BIM-CAD-GIS Integration for Civil/Transportation Project Delivery

Session: C1225911

Presenter: **Lance Parve**
Sr Design-Construction Project Engineer, BIM Coordinator
SE Freeways Design-Construction, SE Region, Wisconsin DOT
TRB BIM Subcommittee Co-Chairperson, ABJ95 Committee

Date/Time: **November 14, 2018 08:00-09:00 a.m.**

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Bio:

Lance Parve, MSEng, PG, GISP

Lance works as Senior Project Design-Construction Engineer /BIM Coordinator in SE Freeways/SE Region at WisDOT. His work involves planning, design, and construction of mega/major transportation projects and also provides BIM-CAD-GIS, 3D technologies, LiDAR/integrated survey coordination, and innovation support. Lance has over 27 years of industry experience - 12 public sector transportation/municipal and 15 private sector consulting - involving successful digital project delivery in civil infrastructure planning, design, and construction. Lance serves at TRB as Co-Chairperson of the BIM-CIM-VDC Subcommittee of ABJ95 Committee and also on the Steering Committee of the IICTG-International Intelligent Construction Technologies Group. He has a MS Engineering degree, MS Certificate Urban Planning GIS degree, and a BS Geological Sciences degree from the UW-Milwaukee.

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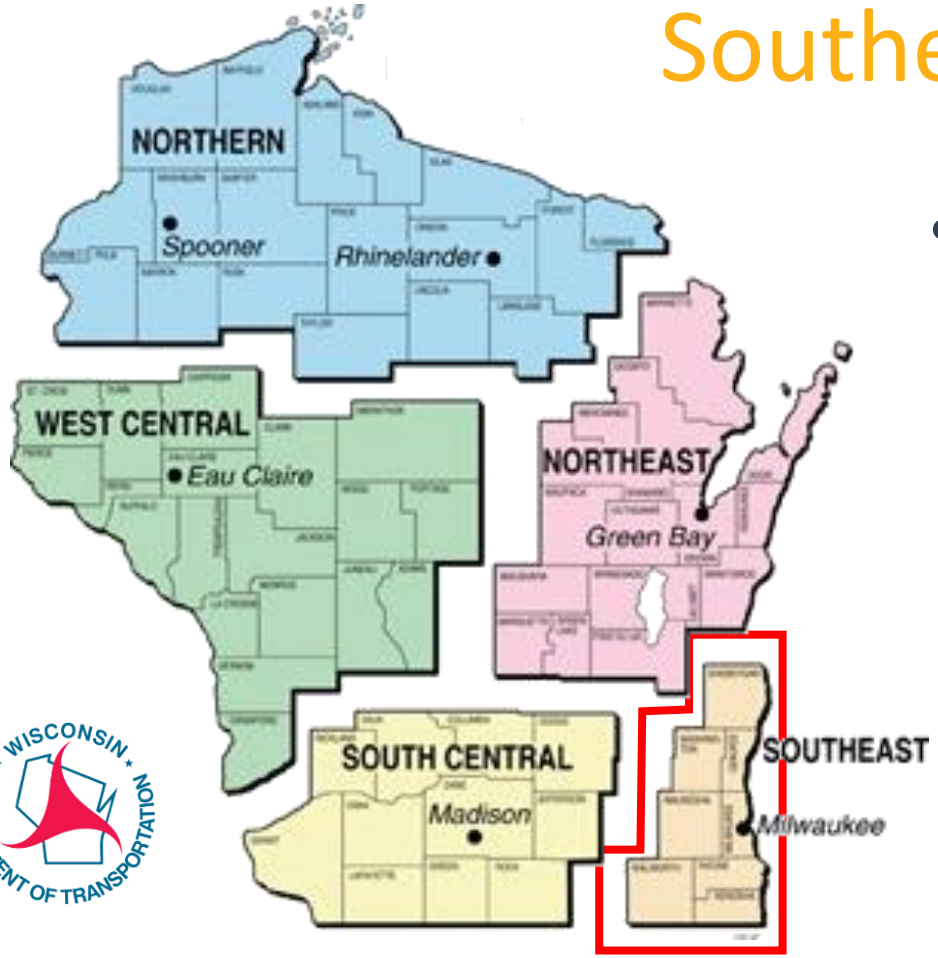
Southeast Region



- Our region:
  - 2,621 Sq. Miles
  - 64 towns
  - 57 villages
  - 32 cities
  - Population: 2 million+
  - 1.7 million vehicle registrations
  - 1,078 bridges
  - 40% of statewide transportation program
  - 42% of the state's senators

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Presentation Agenda

- BIM and Project Delivery at WisDOT SE Freeways
- Technology and Innovation Implementation
- Benefits, Return on Investment and Challenges
- GIS and Asset Management at WisDOT SE Region

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Learning Objectives

- To leverage BIM Technologies for Project Delivery
- To implement Project Execution Plans (PxP) for BIM
- To address Challenges to deploy BIM
- To integrate GIS, BIM and CAD for Asset Management

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BIM for Infrastructure In Digital Project Delivery

FHWA and BIM for Infrastructure

- FHWA promotes use of BIM concepts and other transportation innovations through its Every Day Counts (EDC) initiatives…

  "…proven but underutilized innovations…"

- WisDOT has become a DOT leader in 3D model-based planning-design-construction in digital project delivery and asset management

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BIM for Infrastructure

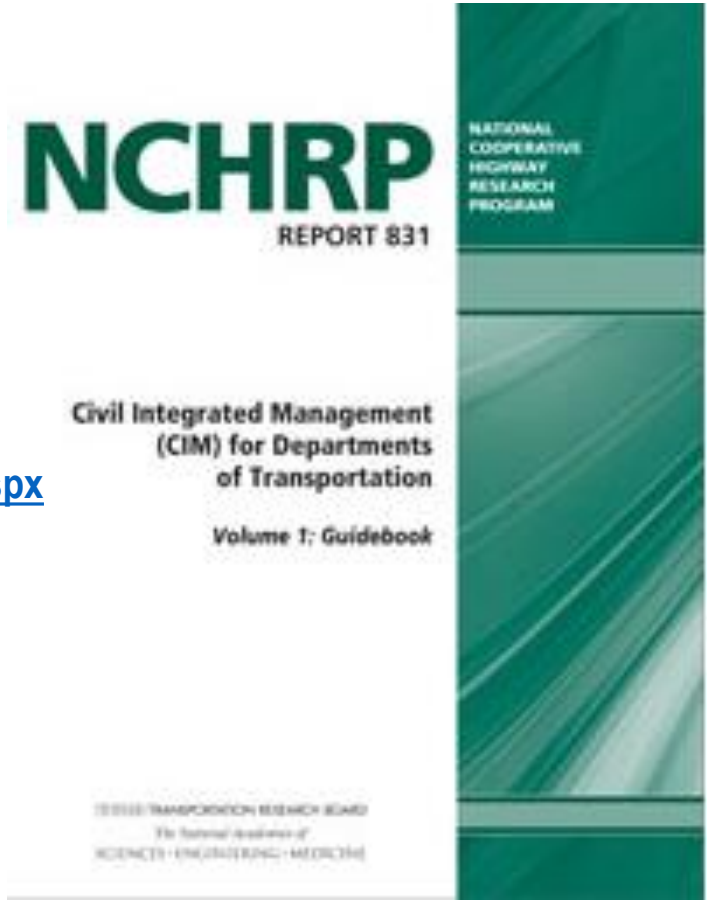
Building Information Modeling *(BIM)* involves the *People, Processes, and Technology Products* generating the digital, integrated, multi-disciplinary, collaborative representation of physical and functional characteristics *(Information Models)* throughout the Lifecycle planning, surveying, engineering, constructing, operating, and maintaining of Transportation Infrastructure Facilities included in *Project Delivery and Asset Management*.

BIM Technologies In Digital Project Delivery

State of the Industry & BIM-CIM

- **NCHRP 20-68A, Scan 13-02 – Advances in CIM Report (2015)**
- **http://onlinepubs.trb.org/onlinepubs/NCHRP20-68A_1002.pdf**

- **NCHRP 10/96, Report 831 – CIM for DOTs (2016)**
- **Guidebook Volume 1 – http://www.trb.org/Main/Blurbs/174318.aspx**
- **Report Volume 2 – http://www.trb.org/Main/blurbs/174321.aspx**



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Cost Savings vs. Cost Avoidance

Cost Savings - reduction in the cost of an item or service compared to the price paid previously or budgeted in the current fiscal year. Savings should generally be tangible. (e.g. elimination of a contract, negotiation of a lower rental fee for facilities/equipment, reduction in construction change order, etc.)

Cost Avoidance - expenses that have not yet been incurred. (e.g. reduction of a proposed price increase from a vendor, preventative maintenance, reduction in design of a future construction issue such as a hard clash, etc.)

SE Freeways: BIM for Infrastructure In Digital Project Delivery

Project Life Cycle

Planning, Programming & Project Initiation

Planning, Survey, Environmental, Design & Construction

Maintenance Operations

Traffic Operations

Source: David Esse, WisDOT, 2015, Graphic Modified

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BIM for Infrastructure In Digital Project Delivery

WisDOT SER-SE Freeways and WisDOT DTSD Projects

WisDOT Investment $18.4B over last 12 yrs

11, 800 mi STH Rds/4,900 Bridges +/-; 110,400 mi Local Rds/8,800 Bridges +/-

- Marquette Interchange (I-43, I-94, I-794)
  (2004 - 2008)
- I-94 N-S/Mitchell Interchange
  (2009 - 2012)
- Hoan Bridge/Lake Freeway (I-794)
  (2013 - 2015)
- Zoo Interchange (I-41, I-94, I-894)
  (2012 - 2018)
- I-94 N-S/Foxconn
  (2018 - 2020)

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Southeast Trust.Passion.Champions.

MARQUETTE INTERCHANGE PROJECT

HOAN I-794 LAKE FREEWAY PROJECT

ZOO Interchange

94 NORTH-SOUTH FREEWAY PROJECT

Historical Background

Marquette Interchange

$750M

- Pockets of Institutional Experience
- Silos of Information

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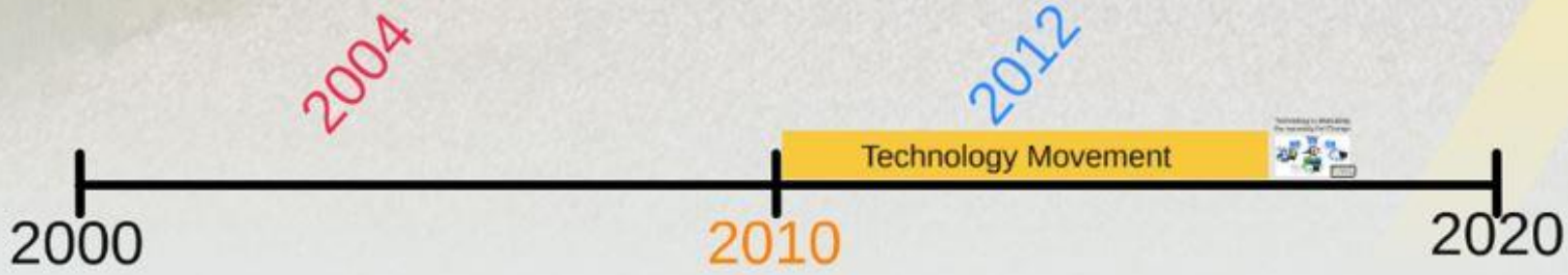
$1.76B

- Scalable
- Industry Buy-in
- Trust Component



I-94NS / Mitchell Interchange

$1.91B

- Cultural Change
- Size / PS&E Process
- Resources / Time Management

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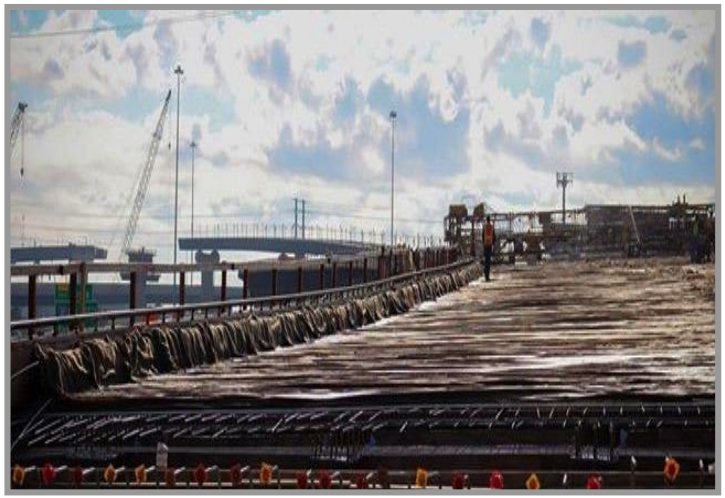
Design-Construction Goals: BIM

- Build On Time
- Build within Budget
- Build with highest Quality
- Build Safely
- Build with Community Involvement
- Build with Traffic Routes for Businesses



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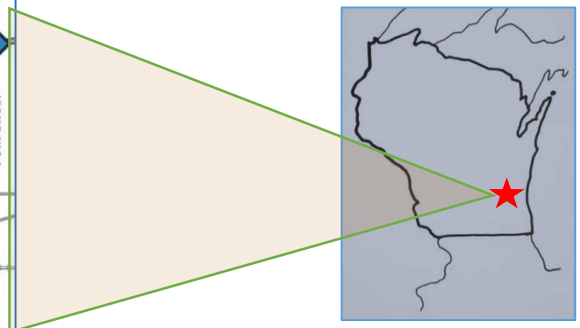
Zoo Interchange 2012-2018

Project Location/Overview



- Adjacent to the Milwaukee County Zoo
- Junction of I-94, I-894 and I-41/US 45
- 350,000 vehicles/day
- 60,000 jobs in the corridor
- $1.7 Billion project
- 3rd Wisconsin Mega Interchange project

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Project Location/Overview

- 50 PS&E Deliverables
  - 9 miles of freeway
  - 12 miles of arterial roadways
- Real Estate - 455 parcels (4 Plats)
- Utility relocations
  - 325+ Permits Issued
  - $100M+ compensable
- Railroad Coordination
- Highlights
  - 73 bridge structures
  - 108 retaining walls
  - 31 noise barriers
  - 115 sign structures
  - 1.94 million CY common excavation
  - 107,000 CY concrete pavement
  - 3D BIM for all Disciplines throughout Zoo IC Design-Construction

zoo
interchange

Design & Reconstruction of the Zoo Interchange

- The Zoo Interchange is the **oldest** and **most heavily traveled** interchange in the state
- Outdated design - results in safety and congestion issues
- Closely spaced service interchanges
- Combination of left- and right-hand entrance and exit ramps
- Weaving across multiple lanes in a short distance

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Existing Zoo Interchange

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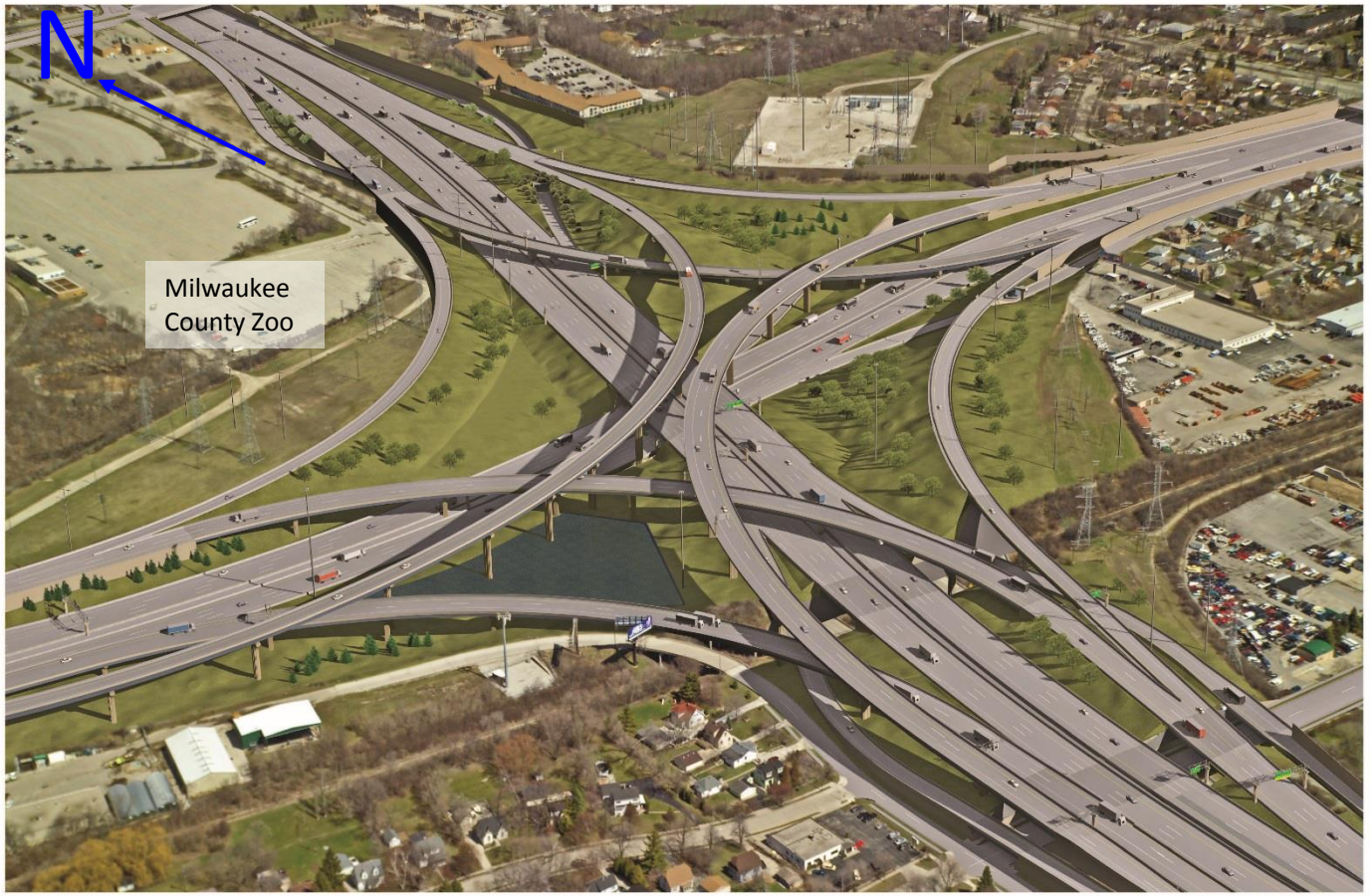
New Zoo Interchange



A 3D view of the planned Zoo Interchange core – looking northeast

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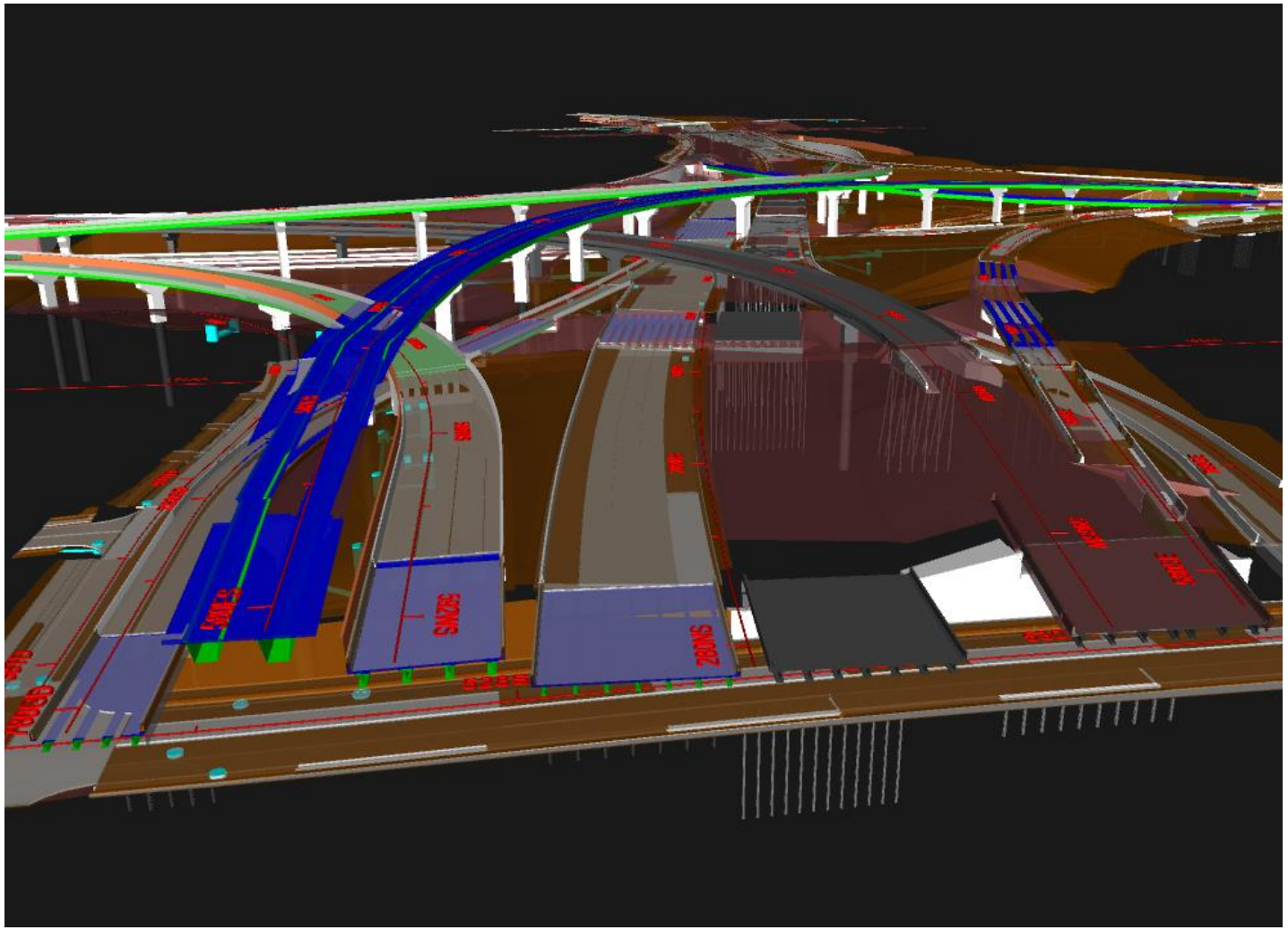
Model-based Data-centric BIM in Project Delivery



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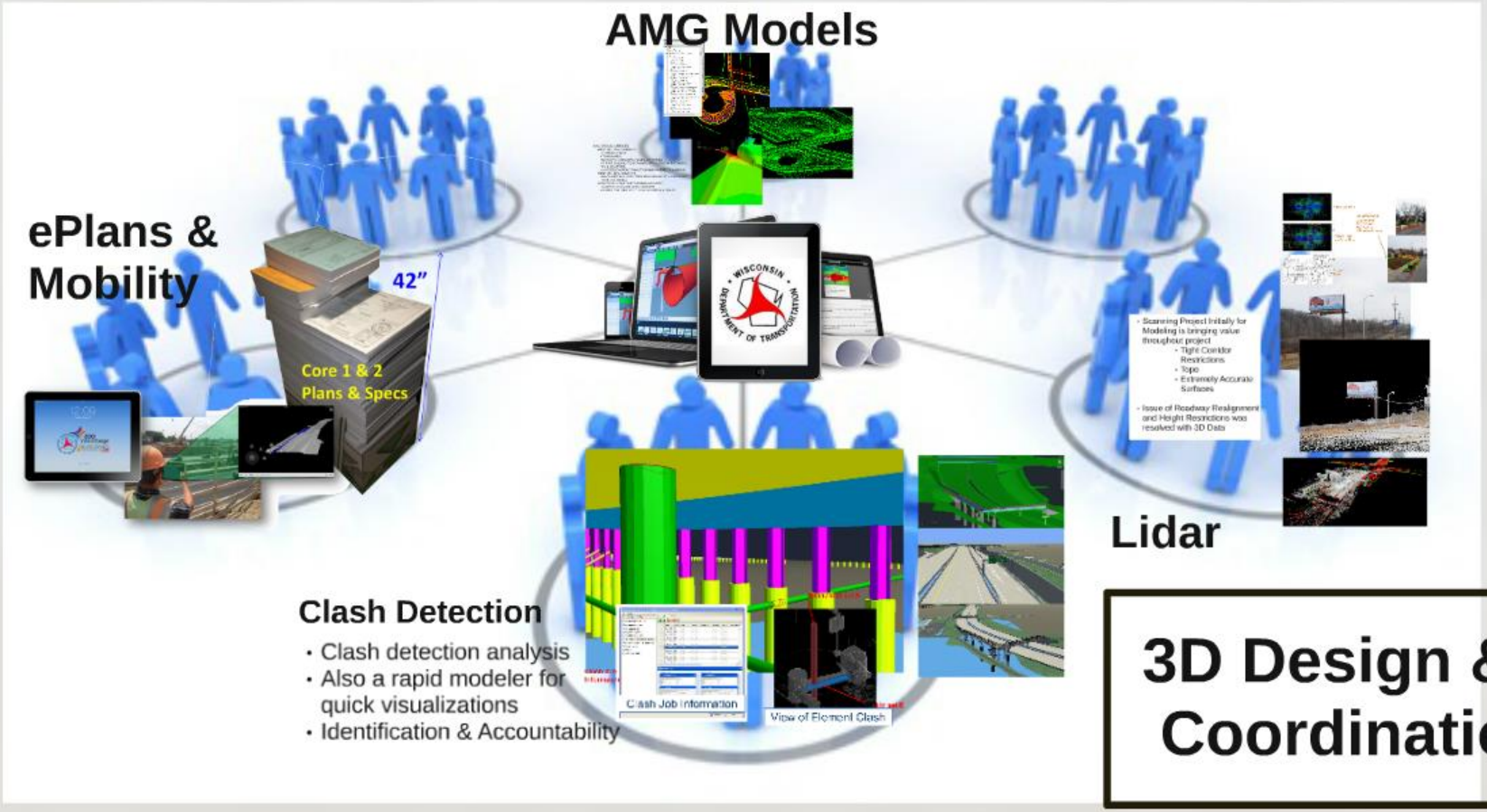
Technology is Motivating the necessity for Change



Q&A

- What are some of the challenges we face as an industry to deploy BIM for Project Delivery?
  - Plan-centric and DBB vs DB vs alternative contracts
  - Technologies Data Interoperability
  - Data centric, IT and Data Storage

- Managing change in delivering projects
  - People
  - Processes-workflows
  - Products-PS&Es, D-C Deliverables, Data

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BIM for Infrastructure In Digital Project Delivery

State of the Industry & BIM for Architecture/BIM for Infrastructure

Traditional-
Plans, Profiles & X-sections

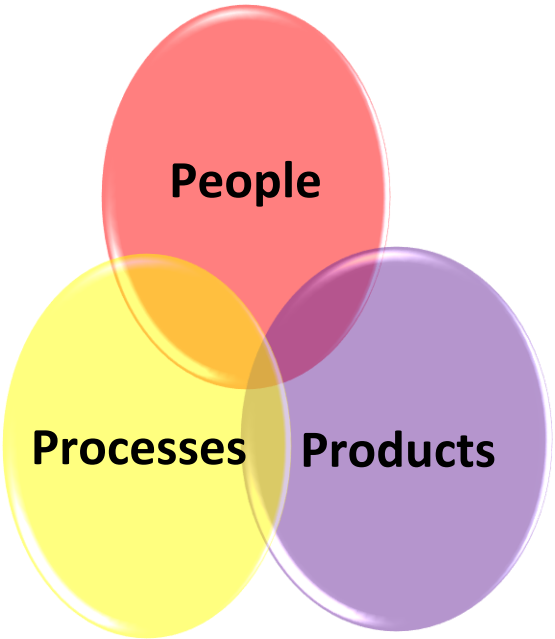
Vertical BIM

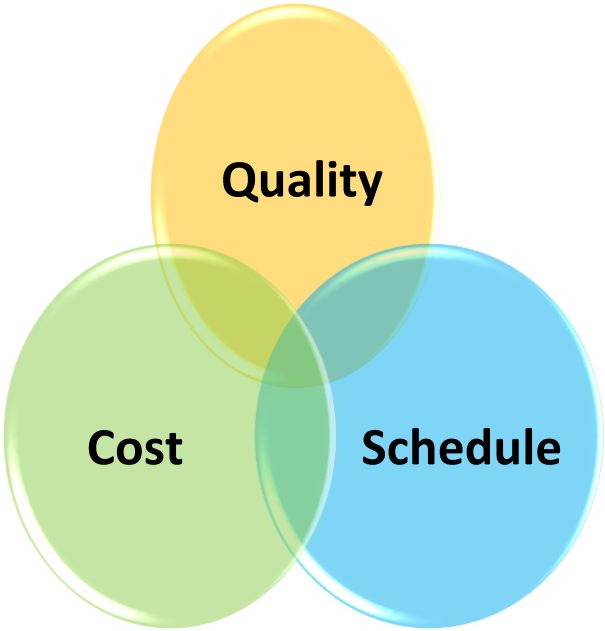
Horizontal BIM

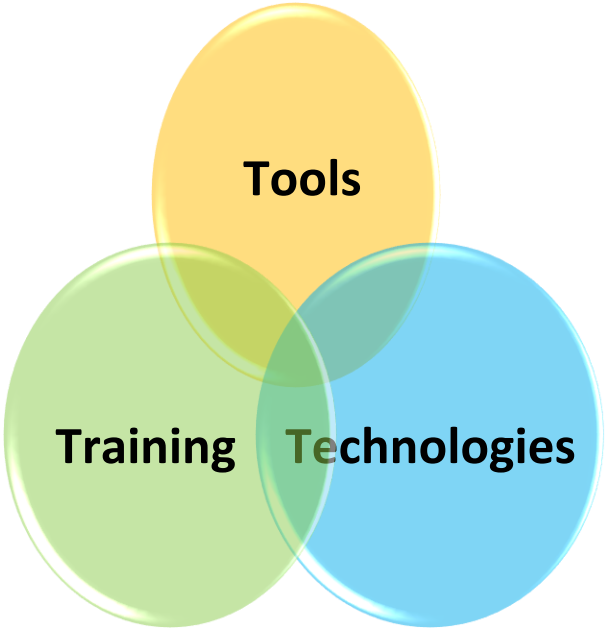
People - AEC + Owner Organizations + Workforces

Processes - Workforces + Tasks-WBS + Workflows + Performance Measures/Plans

Products - PS&Es + Models + Lifecycle Data + Tools/Technologies/Training + ICT







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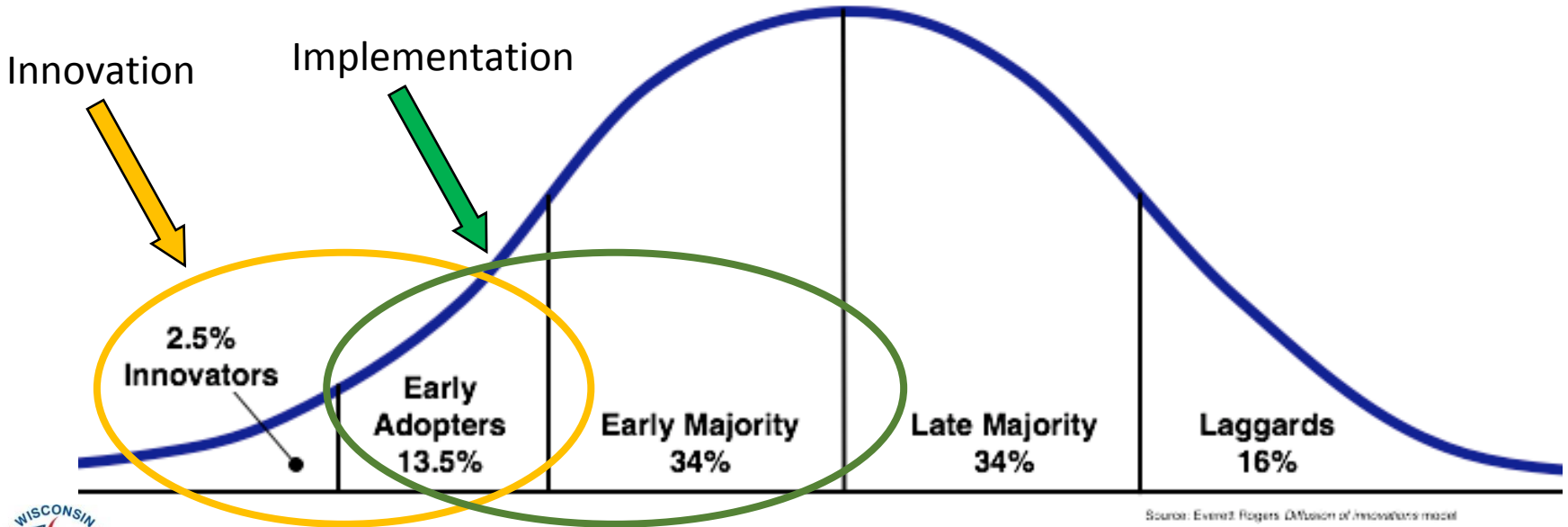
BIM in Digital Project Delivery

Culture: Innovation is all about people



Source: Everett Rogers *Diffusion of Innovations* model

WISCONSIN DEPARTMENT OF TRANSPORTATION

DTSD innovation

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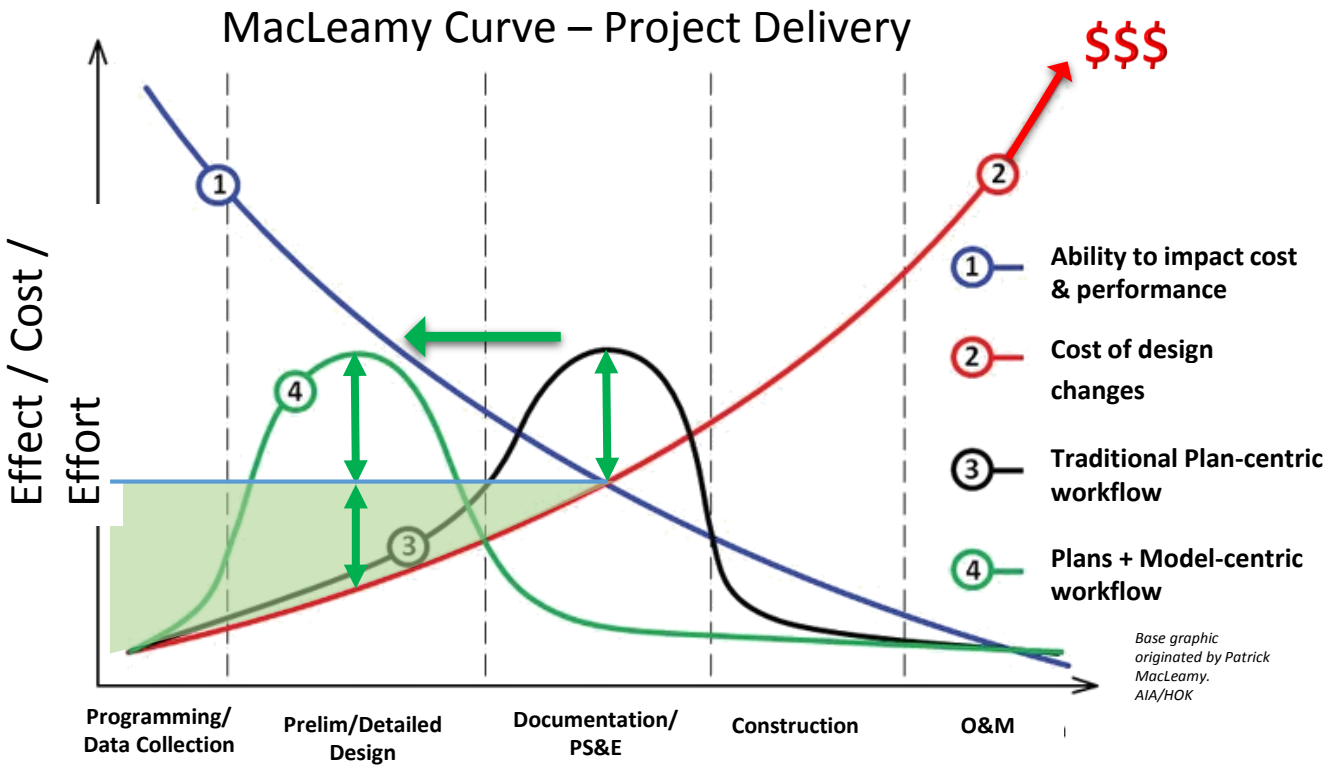
BIM for Infrastructure In Digital Project Delivery



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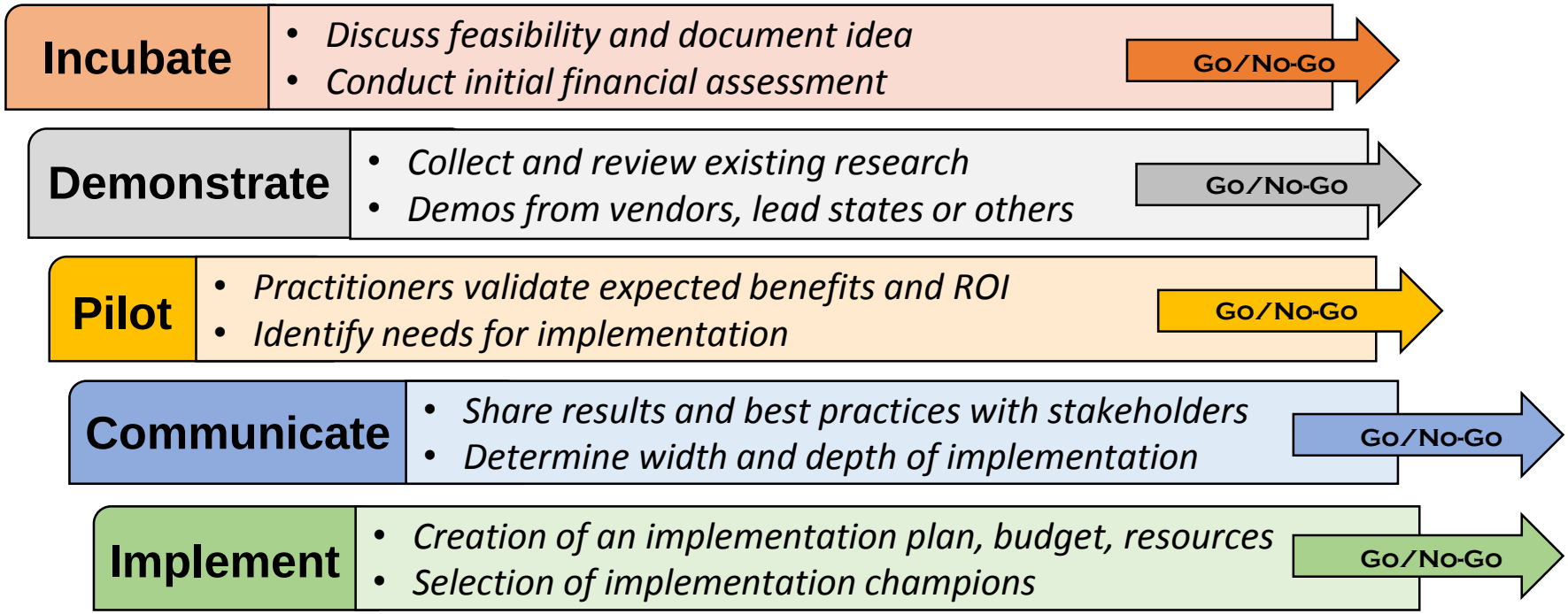
5 Steps to Innovation Deployment



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DTSD innovation

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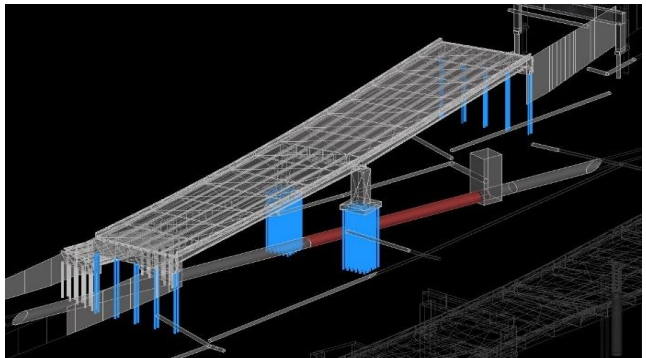
BIM 3D Model-based Design Applications-ROI

- 3D Modeling of All/Many Disciplines-Design (C3D/MS)
- Automated Clash Detection-Design (NVWKS/NAV)
- Visualization for Design Accuracy (BIM 360)
- Design-Construction Plan Reviews (BIM 360/BB)
- Improving the Quality of the Bid Documents (C3D)
- Conceptual Planning (Infraworks-Pilot)
- Automated Quantities-Cost Estimating (QTO/CTK-Pilot)
- Structures (Bentley/Infraworks/Revit-Pilot)
- Utilities (Bentley/C3D/Infraworks-Pilot)



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BIM 3D Model-based Construction Applications-ROI

- Enhanced PS&E Review (BIM 360)
- Dedicated Design Liaison (C3D/MS)
- Visualization for Construction (BIM 360/NVWKS)
- E-Construction (BIM 360/Bluebeam)
- Digital Asbuilts (Bluebeam)
- Project/Issues Tracking (MasterWorks/Raxar-Pilot)
- Asset Management (ArcGIS/C3D/IW-New)

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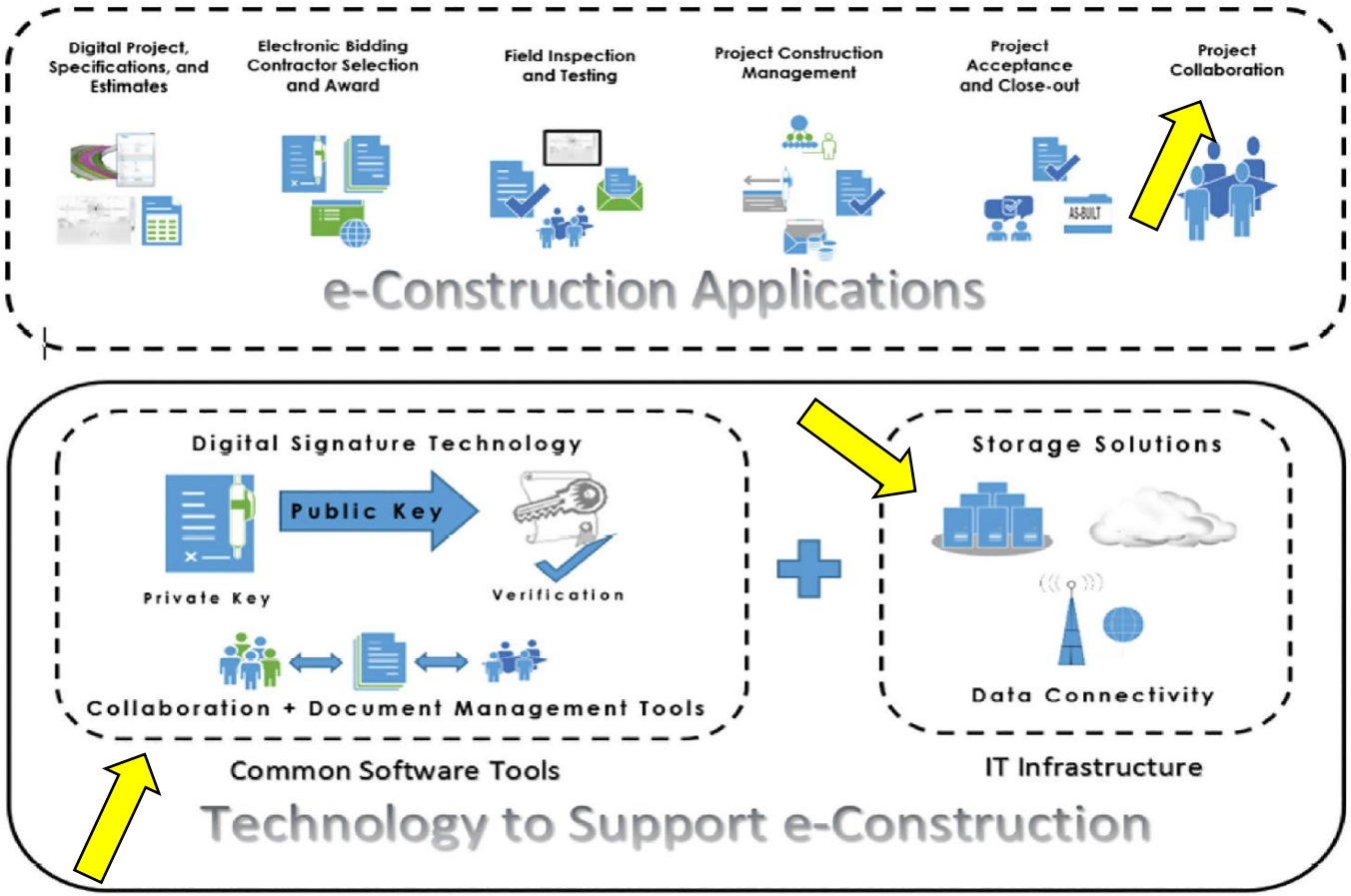
Cloud-based e-Construction-DDE-ROI

FHWA Tech Brief: FHWA-HRT-16-068

"Addressing Challenges and Return on Investment (ROI) for Paperless Project Delivery (e-C… …on)"



- Data Repository-Design-Construction-O&M (Box Enterprise)
- Project Delivery to Life Cycle Facilities Asset Management Approach

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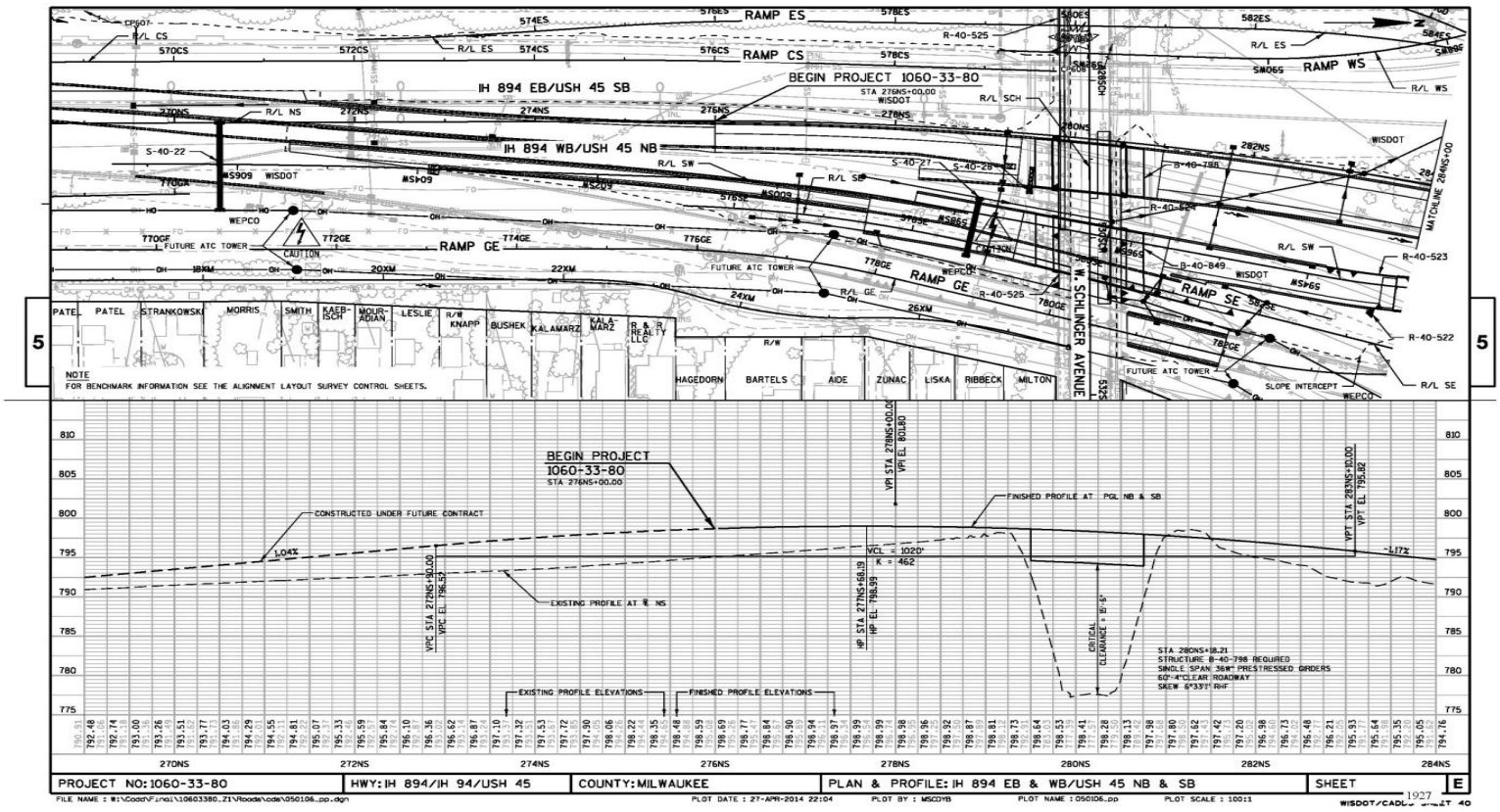
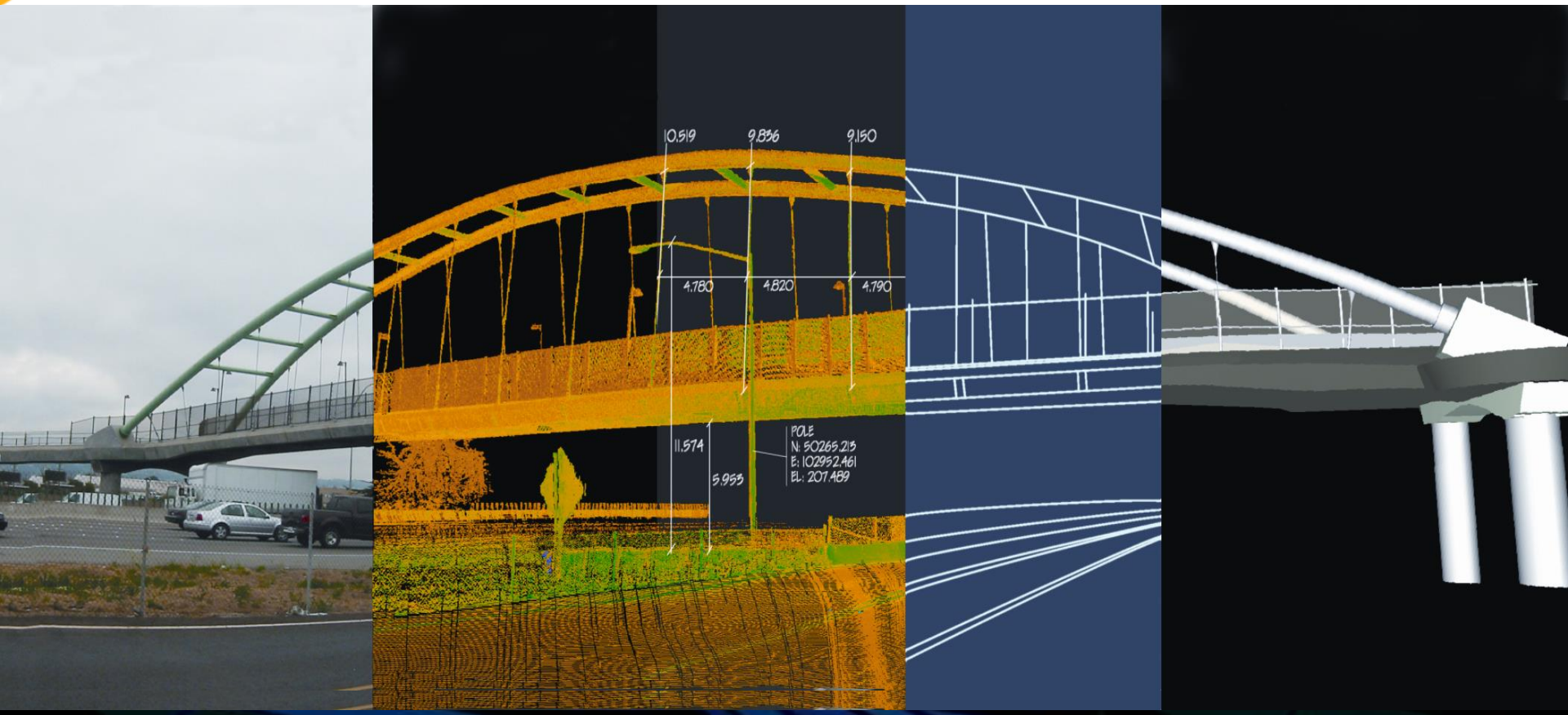
BIM for Infrastructure In Digital Project Delivery

WisDOT Model-based Design & Construction Moving from Analog to Digital 2D/3D Models

Zoo IC: e.g. Core 1 Rev 9 - 4,869 pages; Core 2 – 6,957 pages



BIM for Infrastructure In Digital Project Delivery



Georeferenced

Hi-resolution

Imagery

3D XYZ

LAS Point

Clouds

3D Feature Lines

3D DTMs

X-Sections

3D

BIM

DSMs

BIM for Infrastructure In Digital Project Delivery

SE Freeways: Zoo IC Pre Design-grade Integrated Survey

3D Survey Integrated Mapping using LiDAR-Static/Mobile/Aerial Scanning with Supplemental RTK GPS/Digital Leveling/TS for Existing Conditions

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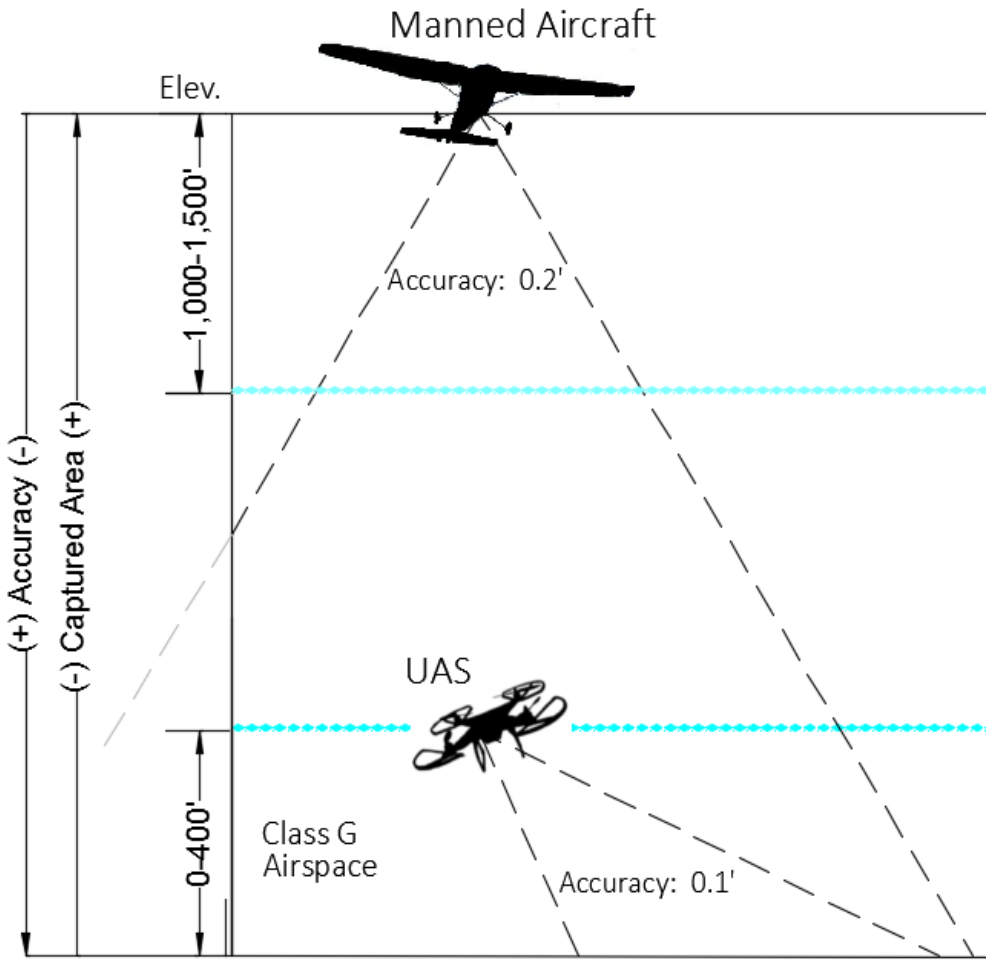
BIM for Infrastructure In Digital Project Delivery

Integrated Survey

Unmanned Aerial Systems can add Value (Consultants vs DOTs)



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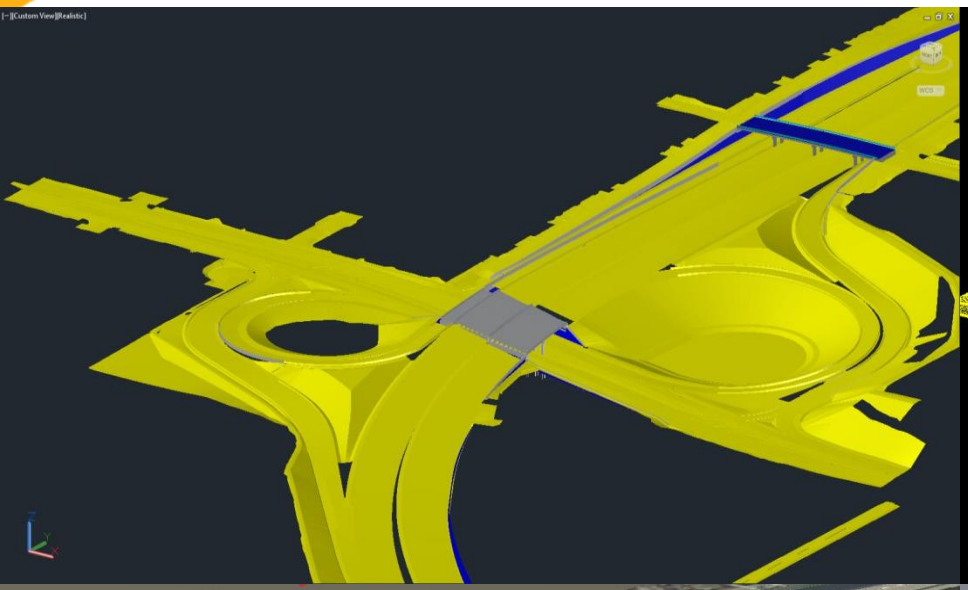
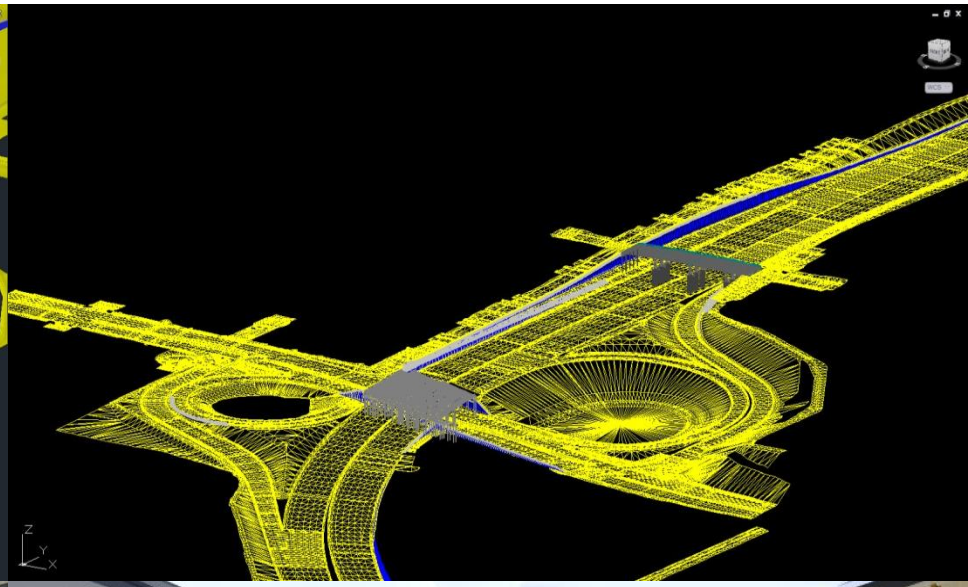
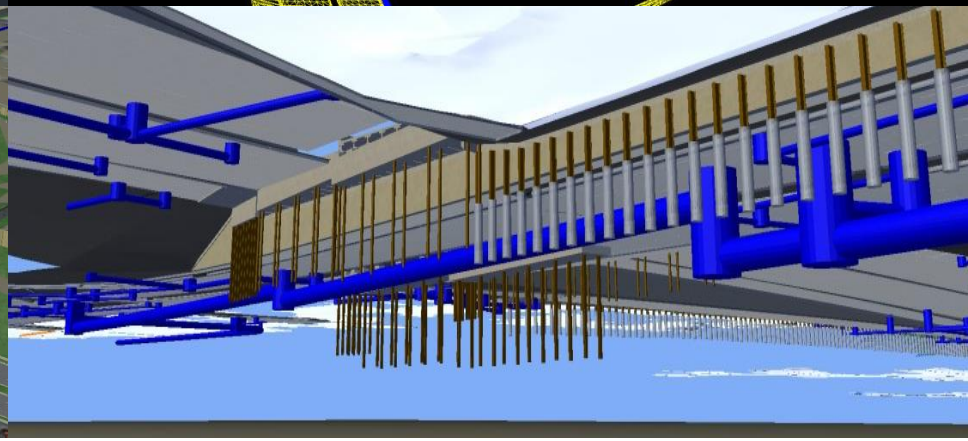
Zoo IC BIM 3D Roads/Drainage/Surfaces







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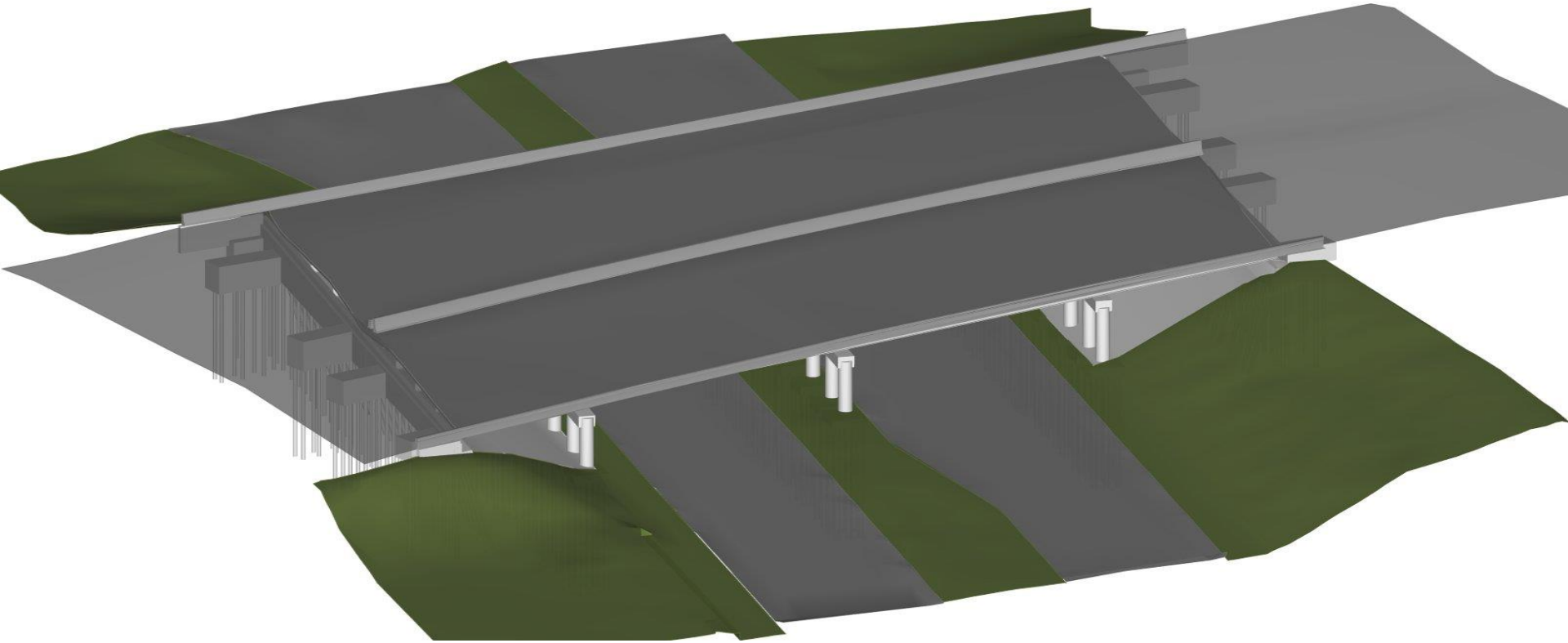
BIM for Infrastructure In Digital Project Delivery

3D Structures: Bridges, Ret Walls, Noise Walls, Tunnels, Sign Bridges, Other



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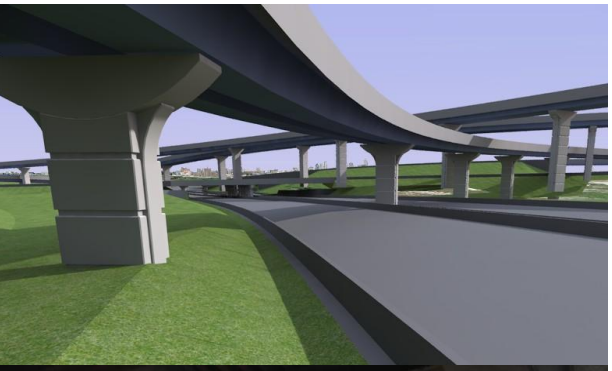
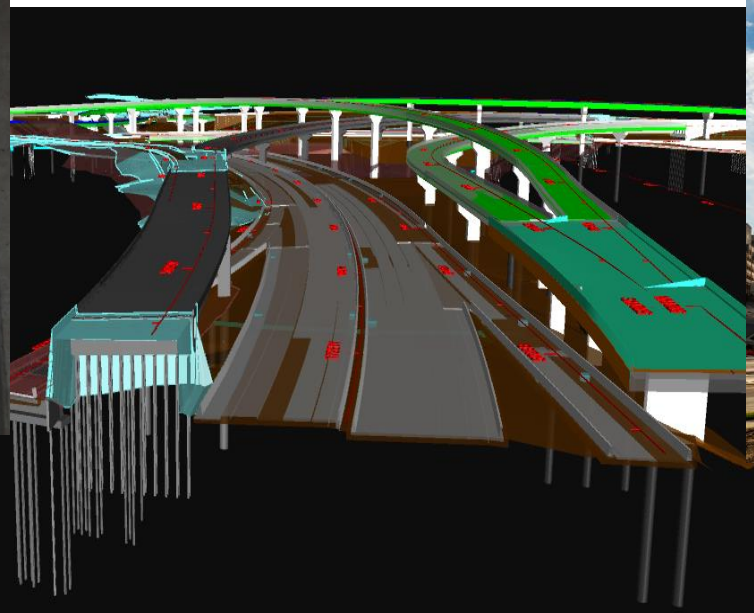
BIM for Infrastructure In Digital Project Delivery

- 68 Bridges
- 108 Retaining Walls
- Community Sensitive Design

3D Structures





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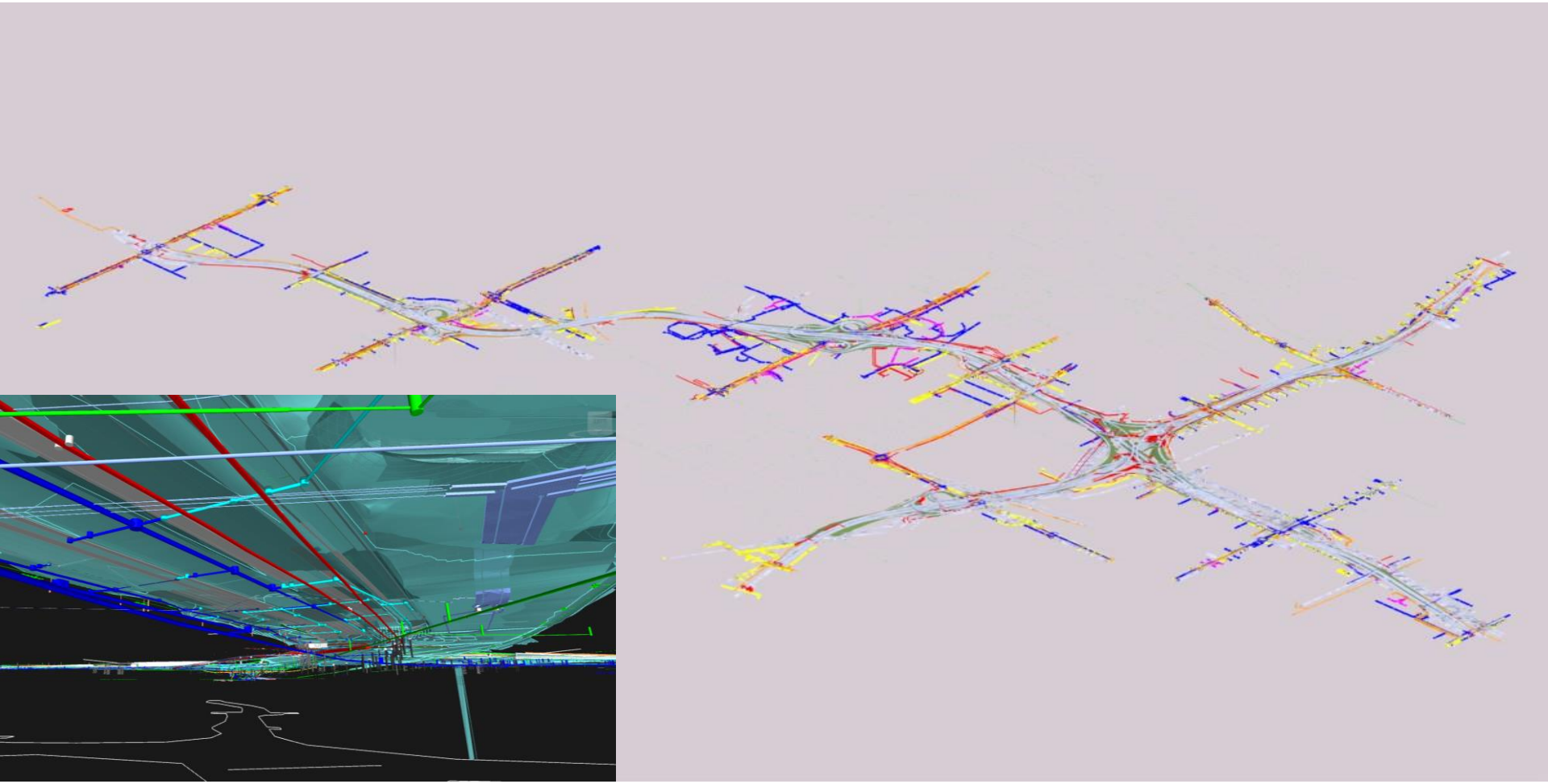
BIM for Infrastructure In Digital Project Delivery

3D Utilities-Gas, Steam, Electrical, Comm, Fiber Optic, Tel/Data, CATV/Data, Other



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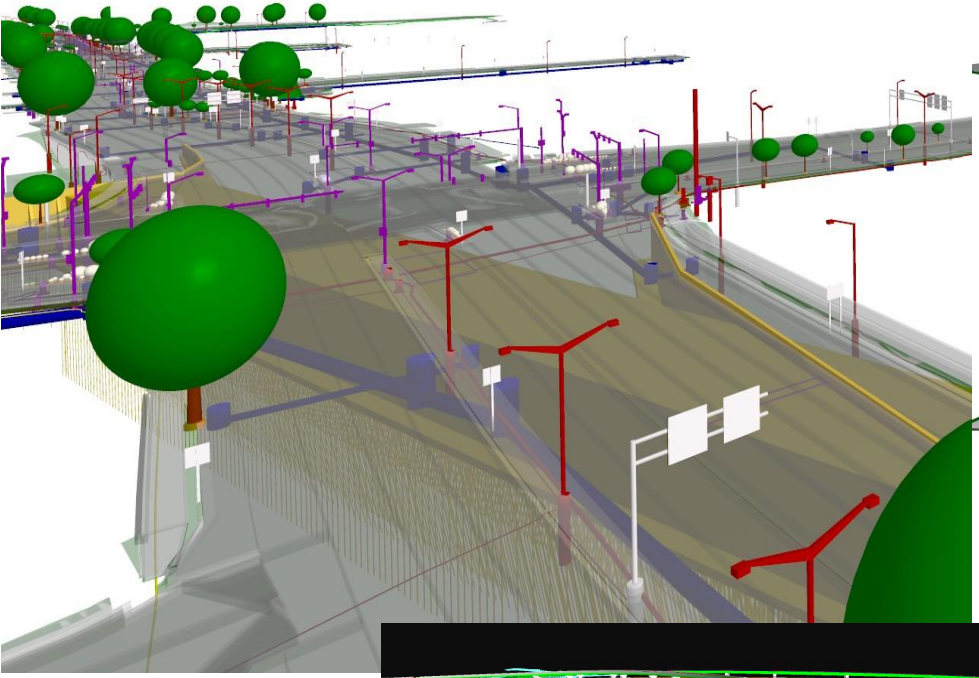
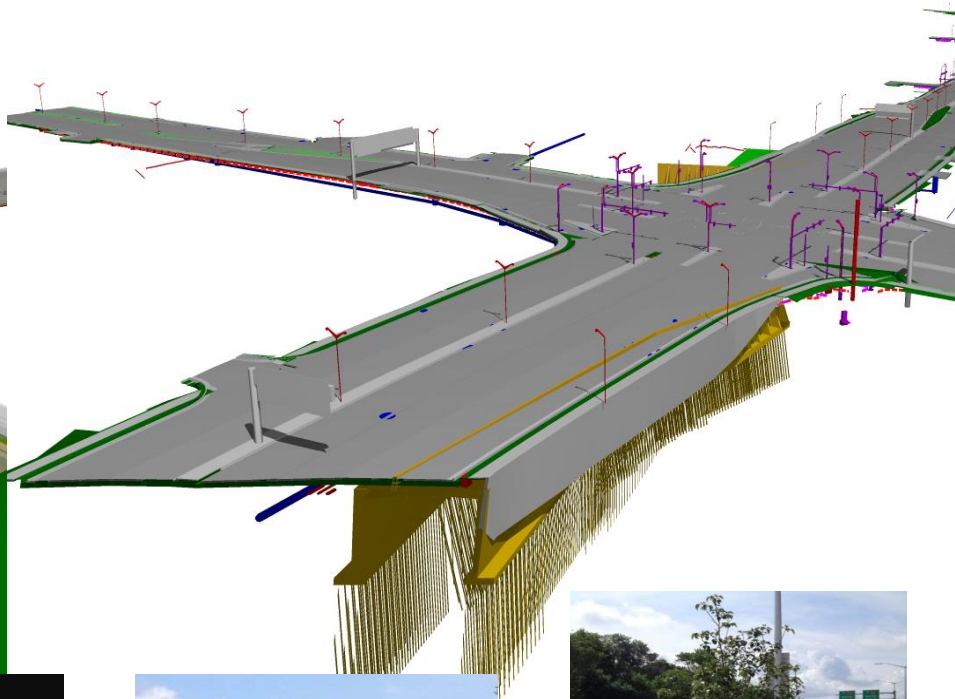
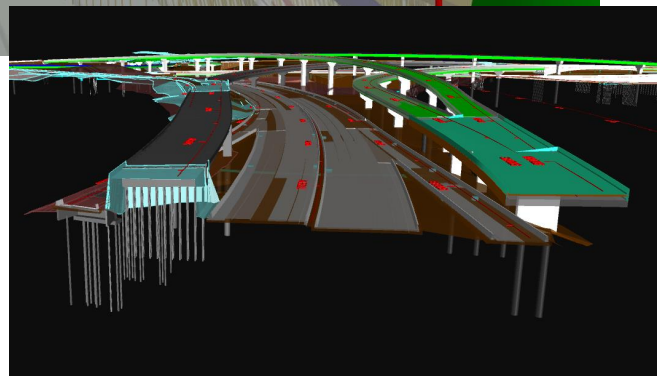
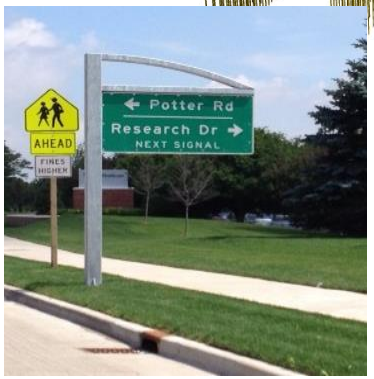
BIM for Infrastructure In Digital Project Delivery

3D ITS/FTMS, Lighting, Signs, Signals, Landscaping, Water, San Sewer, Landscaping, Other









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BIM for Infrastructure In Digital Project Delivery

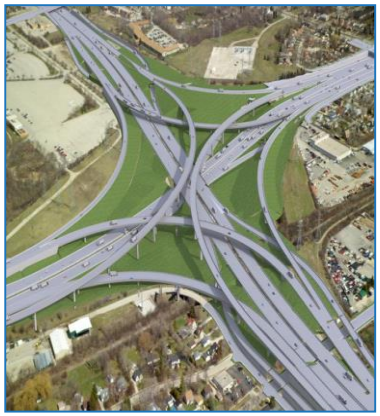
SE Freeways: Zoo IC 12-mi System Interchange Reconstruction

Zoo IC Design-Construction BIM Project Execution Plan (PXP)

Digital Data Exchange (DDE) - 3D + 2D (+ 4D)

for Design Clash Detection-Resolution/Visualization-Inspection/Improved Bids and Construction Survey Stakeout-Verification/Contractor AMG-machine readable

- Pre-Design Data Collection Integrated Existing Conditions 3D Survey incl Mobile/Static LiDAR (future UAS)
- 3D Modeling - Roads
- 3D Modeling - Structures
- 3D Modeling - Utilities
- 3D Modeling - Drainage
- 3D Modeling - Traffic
- 3D Modeling - FTMS, L, S, S
- 3D Modeling - QA/QC
- 3D Modeling - Clash Detection
- 3D Modeling - Temporary /4D Simulations
- In-progress eConstruction RTGNSS Rovers/TS/QA-QC
- Post-Design Data Collection As-built Conditions 3D Survey incl Mobile/Static/Aerial LiDAR (future UAS)
- Life-cycle Use of 2D/3D Models



Discipline	Modeling Approach
Existing Utilities	Network & Drape
Proposed Utilities	Drape
Proposed FTMS	Drape
Proposed Lighting	Drape
Proposed Signals	Drape
Proposed Roadway	Template/Subassembly
Proposed Retaining Walls	Value
Proposed Sign Structures	Individual
Proposed Storm Sewer	Network
Proposed Bridges	Individual

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BIM for Infrastructure In Digital Project Delivery

SE Freeways: Zoo IC 12-mi System Interchange Reconstruction

Zoo IC Design-Construction BIM Project Execution Plan (PXP)

- Pre-Design Existing Conditions 3D Survey
- 3D Modeling - Roads
- 3D Modeling - Structures-Bridges/Ret Walls/Sign Structures
- 3D Modeling - Utilities
- 3D Modeling - Drainage
- 3D Modeling - Traffic
- 3D Modeling - FTMS-ITS, Lighting, Signals, Signs
- 3D Modeling - QA/QC
- 3D Modeling - Clash Detection
- 3D Modeling - Temporary /4D Simulations
- In-progress RT GNSS Rovers/TS/QA-QC
- Post-Design As-built Conditions 3D Survey
- Life-cycle Use of 2D/3D Models

Project Phases

Project Disciplines

	30%/Functional	60%/Preliminary	90%/Final
Existing Ground	X		
Existing Utilities	X		
Existing Structures	X		
Proposed Roadway		X	
Proposed Bridges		X	
Proposed Retaining Walls		X	
Proposed Drainage		X	
Proposed Sign Structures			X
Proposed Lighting			X
Proposed Signals			X
Proposed FTMS			X
Proposed Utilities			X

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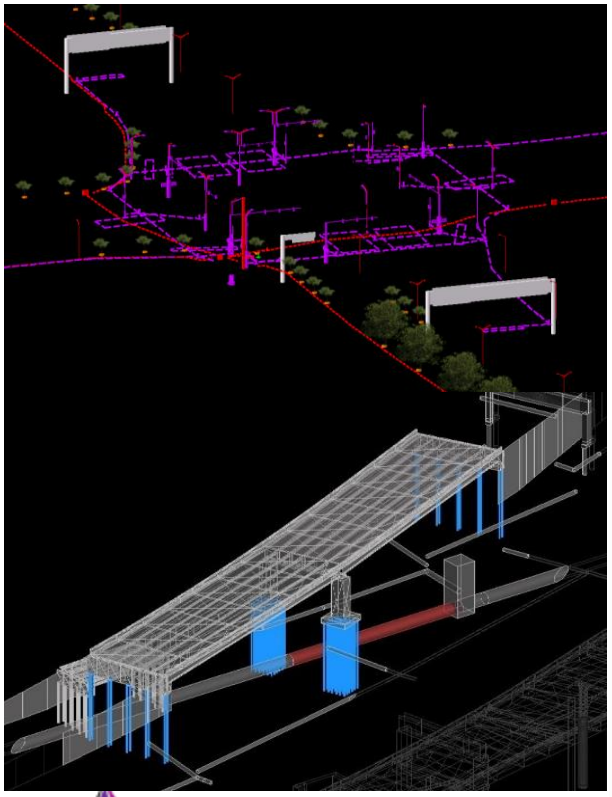
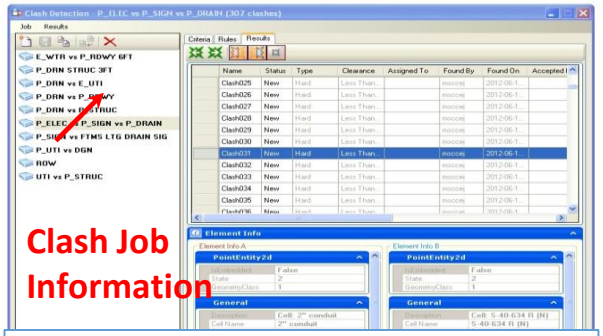
BIM In Digital Project Delivery

BIM 3D Model Clash Detection-Resolution

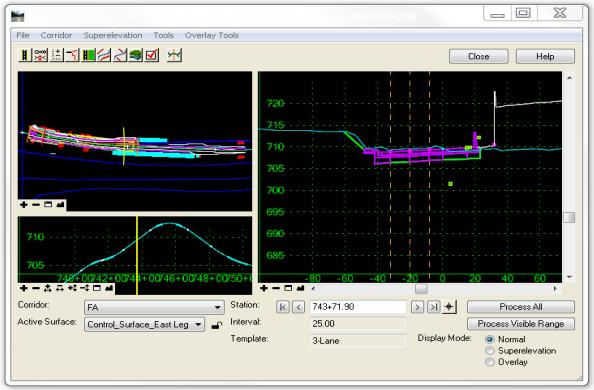
Clash Detection Jobs – Identifying Issues in Design

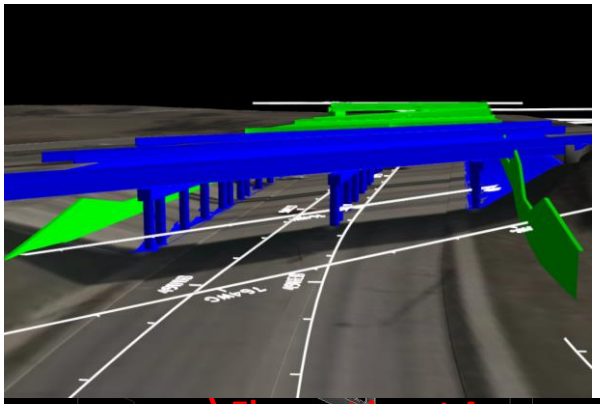
Automated processing of interferences between 3D elements

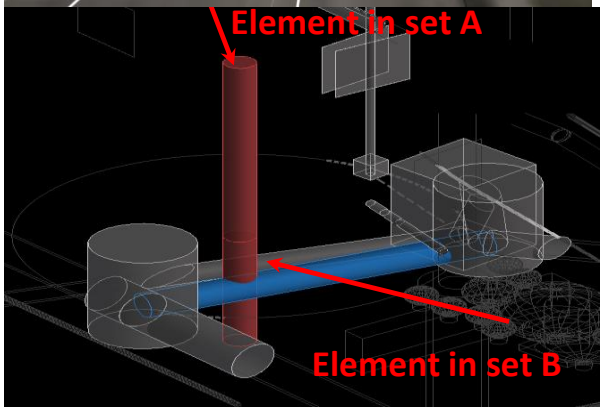




Clash Job Information







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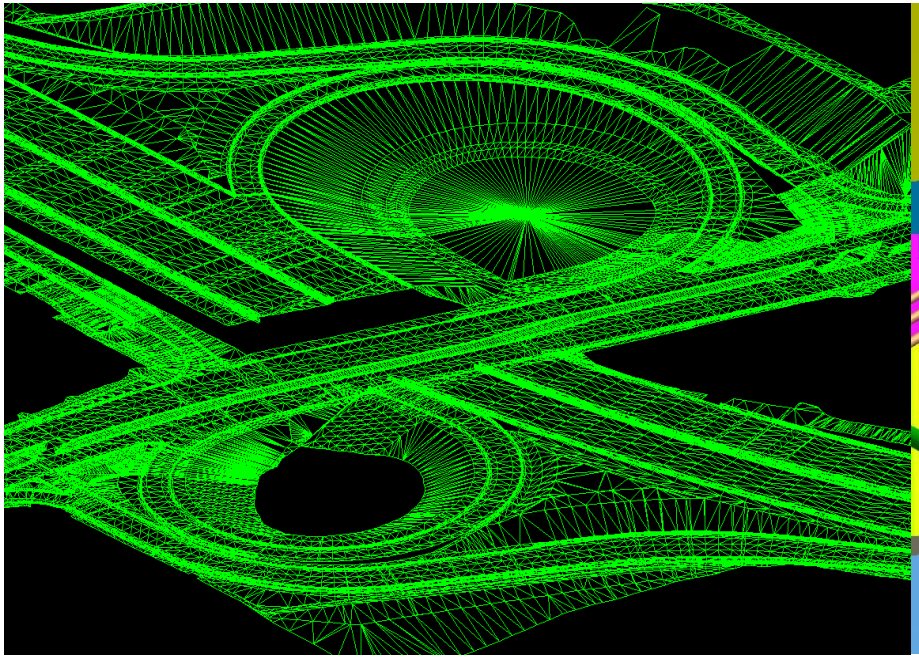
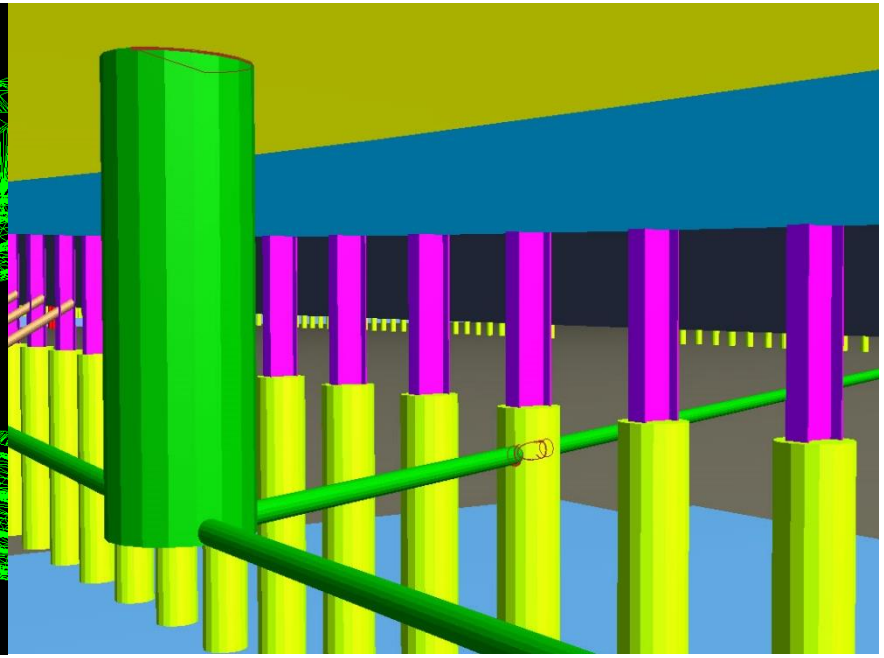
BIM In Digital Project Delivery

BIM 3D Model Clash Detection-Resolution

Clash Detection-North Leg





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BIM for Infrastructure In Digital Project Delivery

BIM 3D Model Clash Detection-Resolution

Clash Detection Jobs – Identifying Issues in Design

Automated processing of interferences between 3D elements

Job Name	Results	Y (RFI)	Y (RDC)	Est. Impact	Comments
P_DRN STRUC 3FT	23	3	3	$ 9,110.00	Used awarded bidder's unit price; 4 structures
P_DRN vs E_UTI	284	90	0	0	Investigation yeilded no conflict or workplans not available
P_DRN vs P_RDWY	37	10	9	$ 55,480.00	Used awarded bidder's unit price; 548 LF pipe
P_DRN vs P_RDWY SUBGRADE	126	57	28	$171,935.00	Used awarded bidder's unit price; 1768 LF pipe and 3 structures
P_DRN vs P_RDWY SUBGRADE EAST	37	16	5	$ 30,703.00	Used awarded bidder's unit price; 18% of similar results (above)
P_RDWY vs P_WALL	245	25	16	???	Unknown impacts to design; resulted in elevation checks on 15 of 22 walls
P_ELEC and P_DRAIN	127	62	47	$ 54,082.00	Used awarded bidder's unit price; 28 conduits, 15 pullboxes, 11 microwave detectors and 6 lightpoles moved
P_RDWY VERT CLR	27	0	0	0	
P_UTI vs P_RDWY	268	0	0	0	
P_DRN vs P_STRUC	59	8	6	$ 11,665.50	Used actual replacement cost from recent construction; 6 anchor slabs
P_STRUC vs P_UTI	23	3	3	?	2 utilities conflicted with C&G and sign bridge footing
P_STRUC vs ABAN	117	0	0	0	
P_STRUC vs E_SS	162	2	0	0	
P_STRUC vs E_SAN	59	0	0	0	
P_STRUC vs E_W	115	31	30	$ 59,400.00	Used awarded bidder's unit price; 198 LF ductile iron
P_STRUC vs E_GAS	132	6	5	???	
P_STRUC vs E_AG	21	0	0	0	
P_STRUC vs E_CONDUIT	224	1	0	0	
P_STRUC vs E_CONDUIT BYOTHERS	379	28	2	?	Electrical coordinated with wall designers
TIEBACK vs UTI 6FT	104	68	67	$ 3,930.00	Used awarded bidder's unit price; 2 tiebacks
P_UTI vs E_DRN	39	1	1	$234,580.00	Used awarded bidder's unit price; 317 LF steel casing with ductile iron
P_SAN-W vs P_DRN	6	6			
	2741	**479**	**269**	**$630,885.50**	

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BIM for Infrastructure In Digital Project Delivery

BIM 3D Model Review-Resolution

Task Lead Representation – Design/Construction

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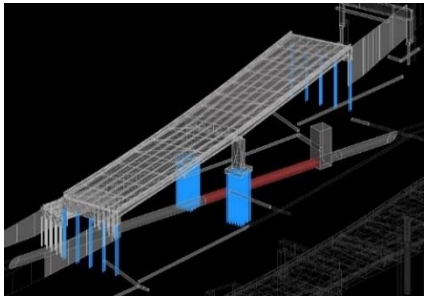
Model-based BIM Design: Keys to Success

- Right-size and Adapt BIM to Project (Mega, Major, RRR, HSP, Local)
- Collect High-Res Reality Capture Integrated Survey (LiDAR, etc)
- Model 3D, 4D, xD All/Majority of Disciplines
- Deploy Automated Clash Detection
- Visualize Data for Design Accuracy
- Conduct Collaborative Design-Construction Plan Reviews
- Improve the Quality of the Bid Documents for Lower Bids
- Track Project Issues
- Integrate BIM-CAD-GIS data



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Model-based BIM Construction: Keys to Success

- Enhance PS&E Review
- Provide Dedicate Design Liaison
- Adopt E-Construction Practices
- Visualize Data for Construction
- Provide Digital Asbuilt Plans/Models
- Reuse Data/Digital Data Exchange
- Deploy Cloud-based Data Repository
- Integrate of CAD-BIM-GIS Data
- Track Project Issues

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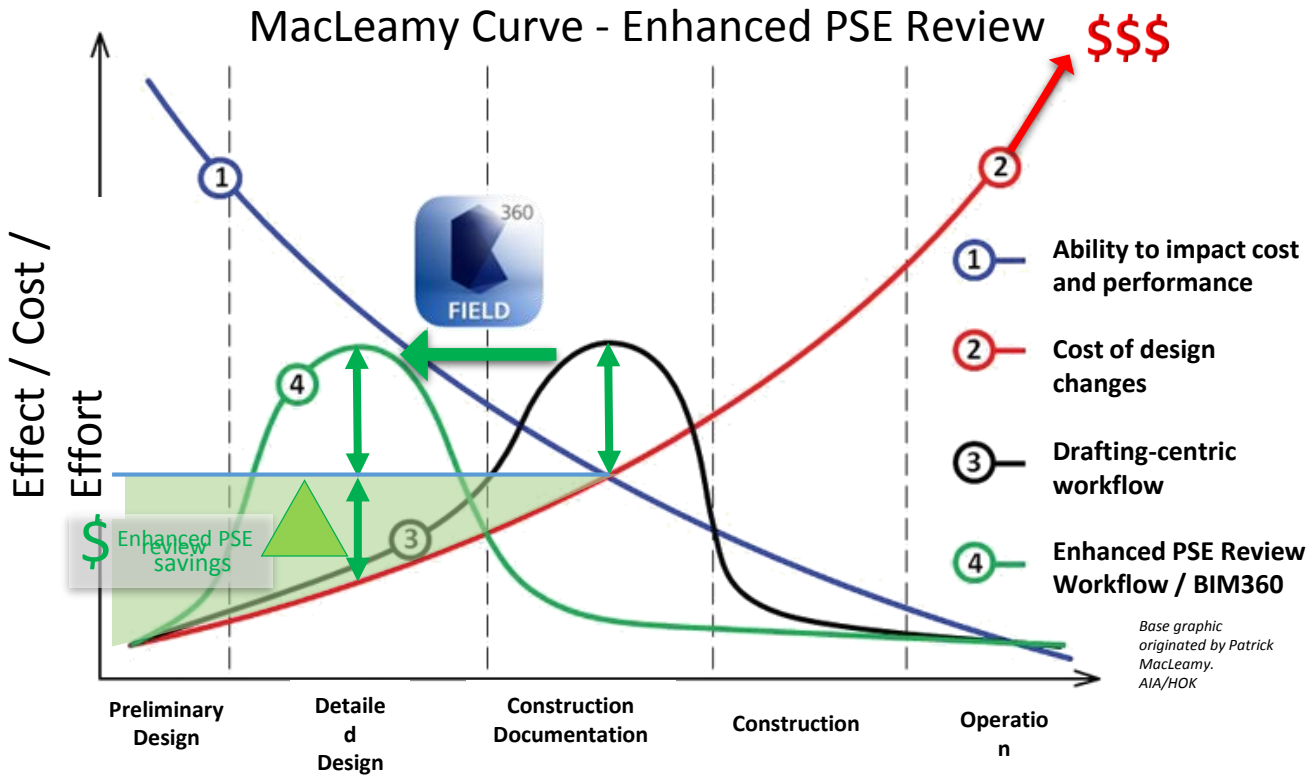
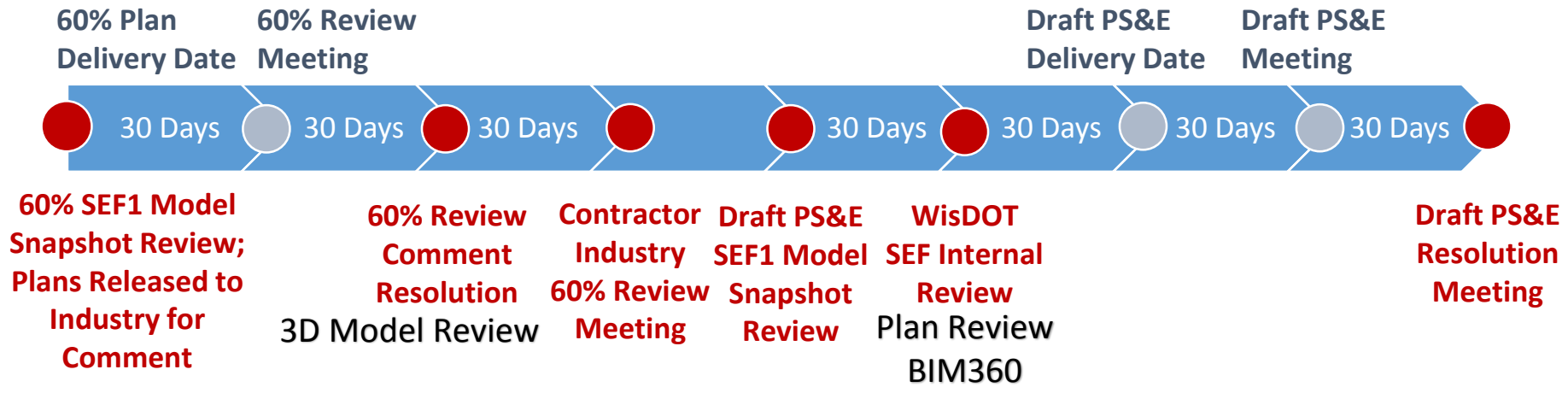
Enhanced Delivery Process



Enhanced PS&E Review

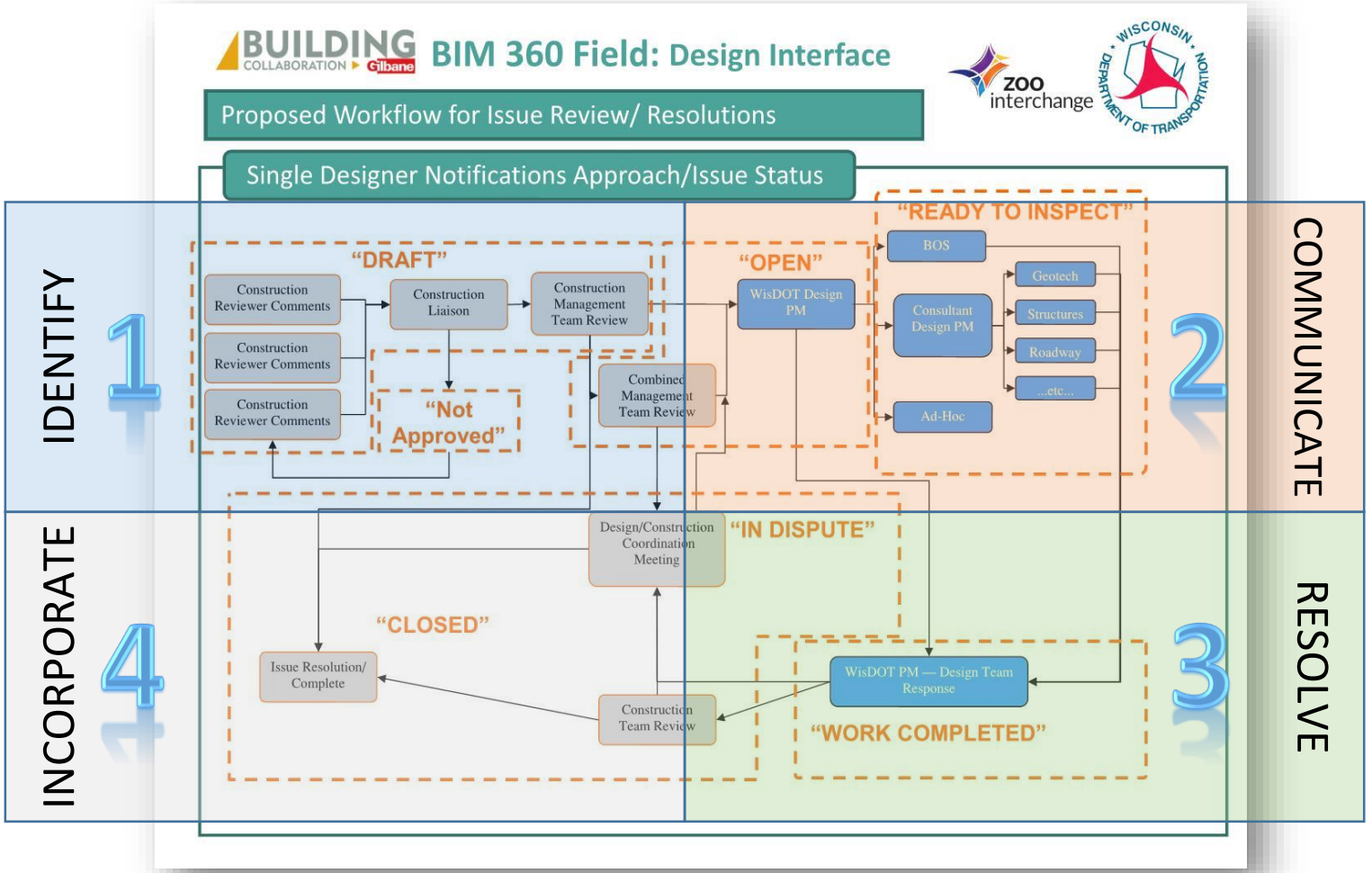
- Integration of Feedback into Traditional Process
- Involve Industry, Ad Hocs, and Construction Early



= Traditional Process

= Feedback Process

Enhanced PS&E Review



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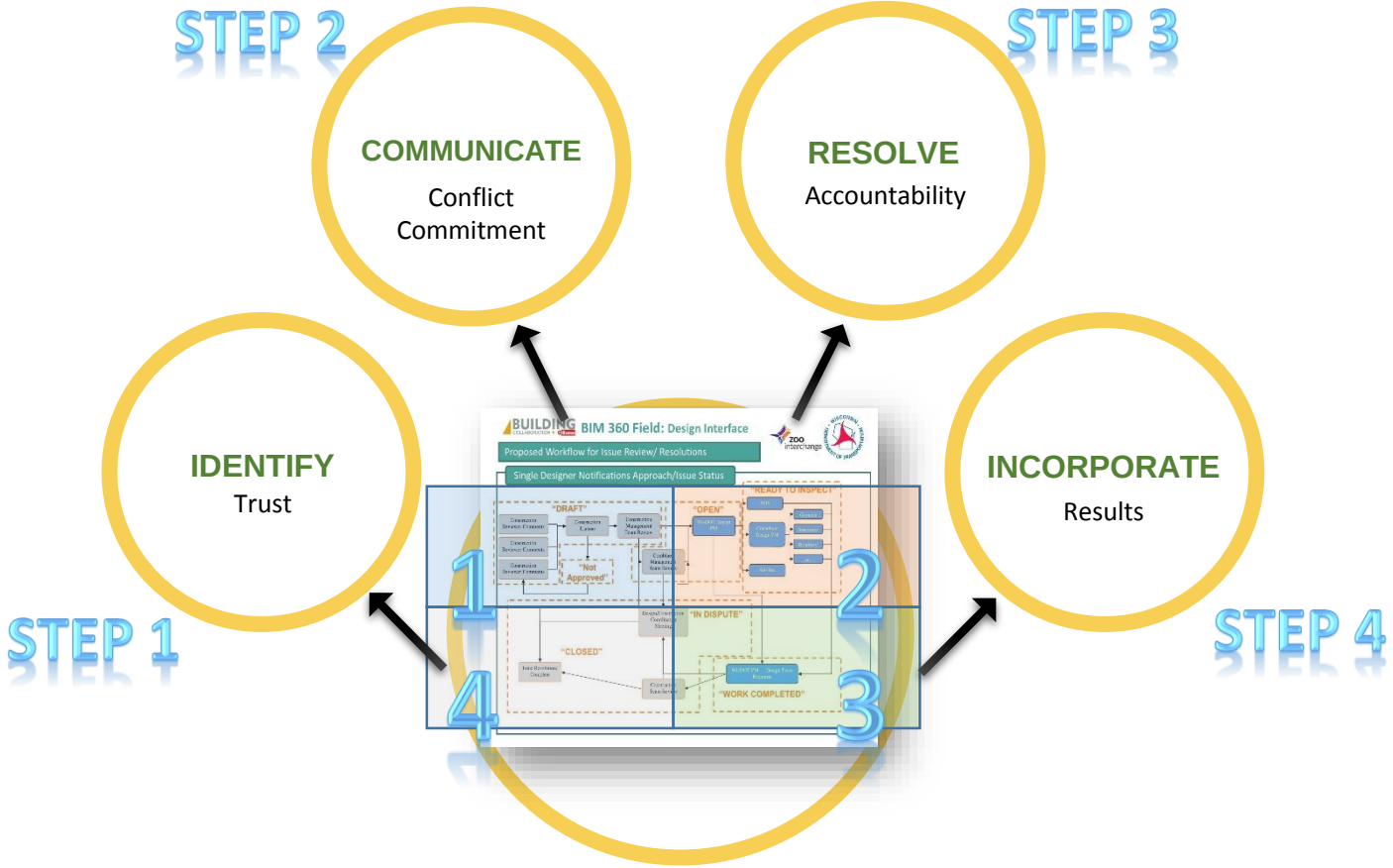
Improving Quality: Bid Documents



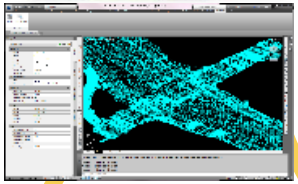
Improving Quality: Bid Documents

IDENTIFY
STEP 1

Transparent Communication

Early Identification:

- Bid-ability
- Risk Management
- Contractor Feedback on design and constructability
- 3D Model & AMG Surfaces for estimating



Internal Communication

Design|Construction Plan Review at

- 30/60/90 Design Streamline Communication
  - Autodesk - BIM 360 Field

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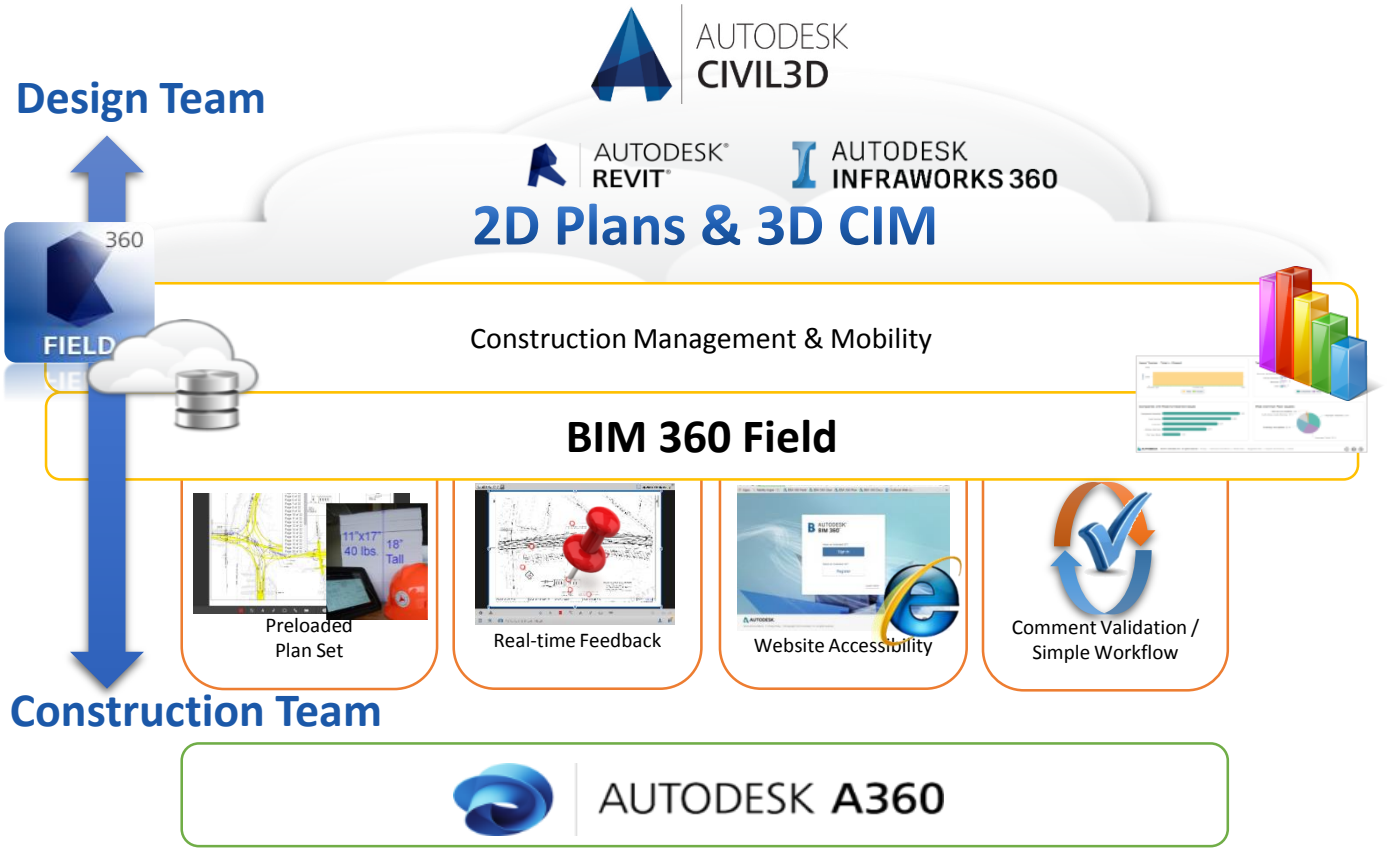
Identify: Enhanced Process

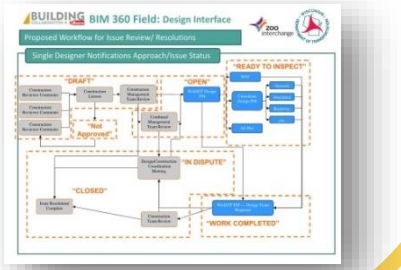


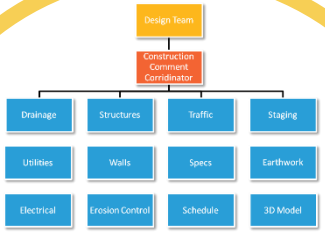
Improving Quality: Bid Documents

COMMUNICATE

STEP 2

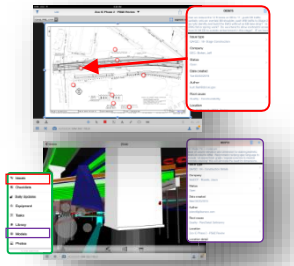
Feedback Workflow





Constructability Review Team Structure

Visualize Issues



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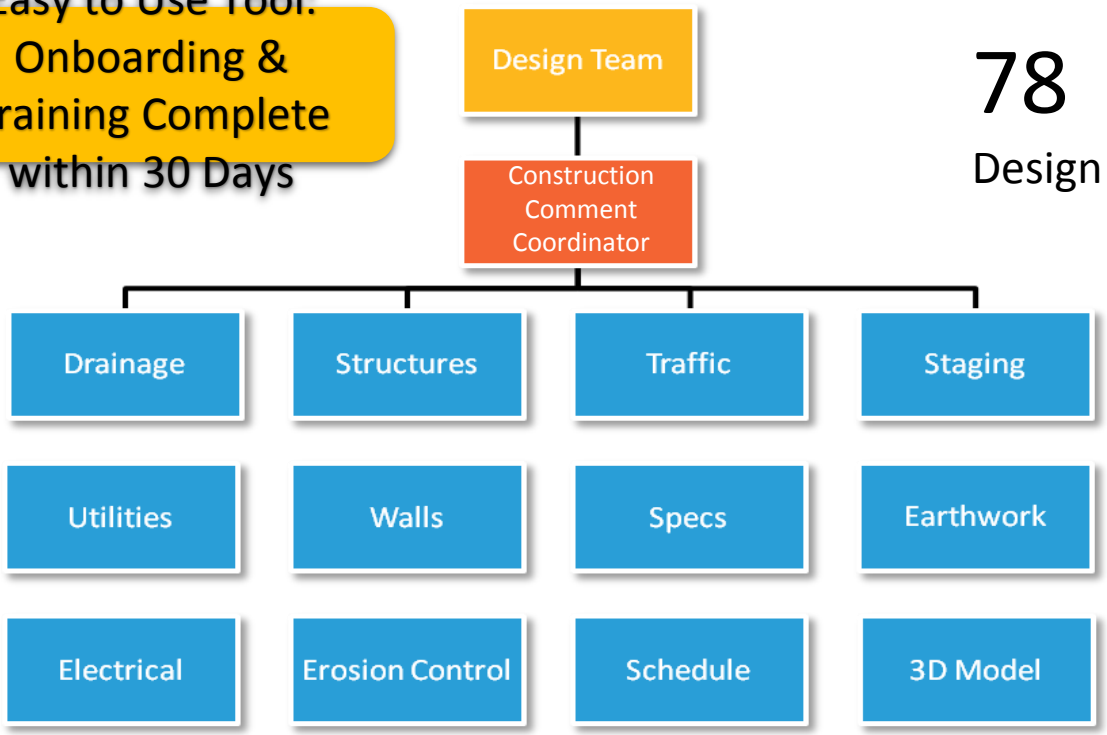
Communicate: Team Structure

Easy to Use Tool: Onboarding & Training Complete within 30 Days



78
Design Engineers

52
Construction Reviewers

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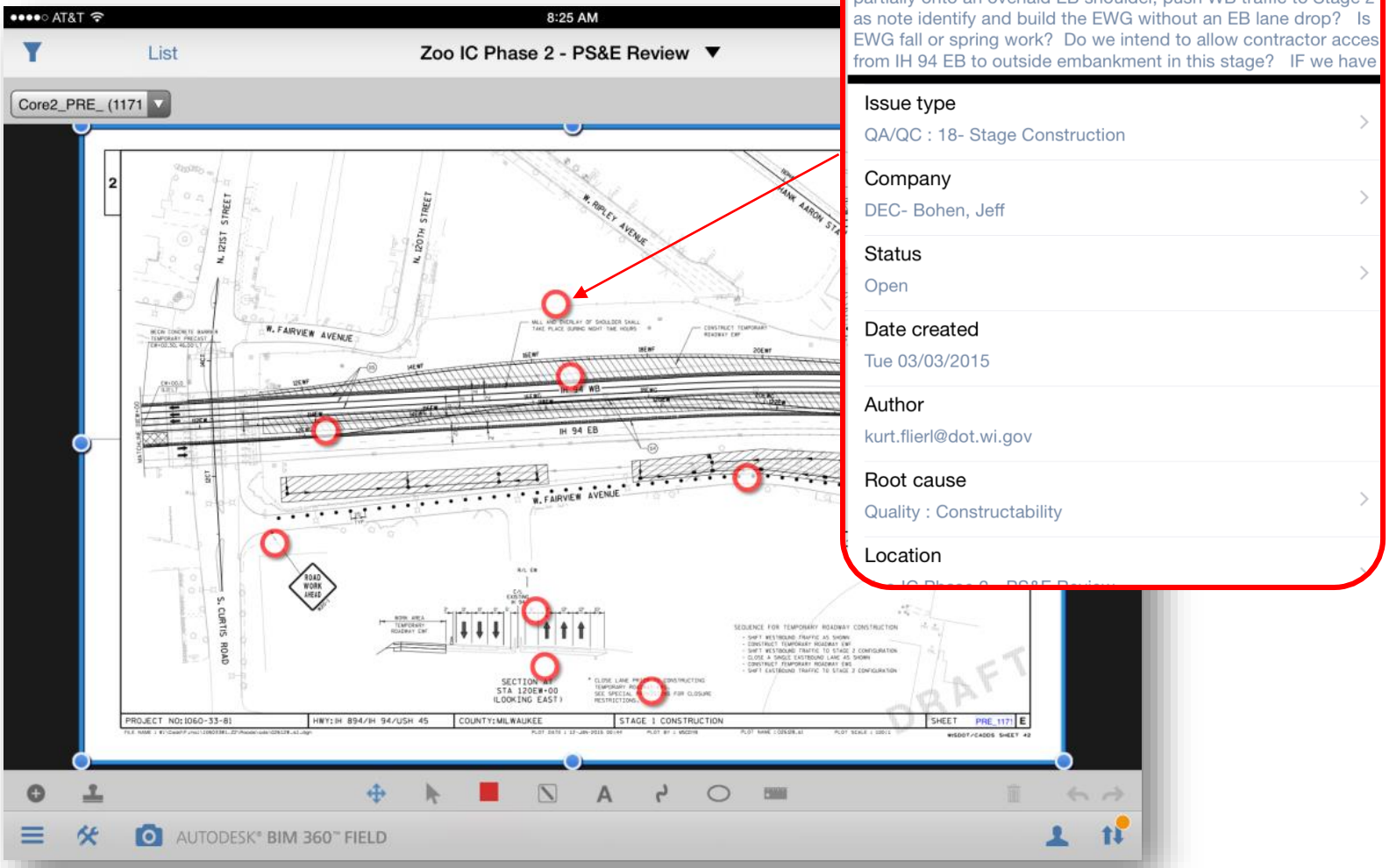
Communicate:

2D Plan Locate of Issue



002675

Can we reduce the 12 ft lanes on EB to 11', push EB traffic partially onto an overlaid EB shoulder, push WB traffic to Stage 2 as note identify and build the EWG without an EB lane drop? Is EWG fall or spring work? Do we intend to allow contractor acces from IH 94 EB to outside embankment in this stage? IF we have

Issue type
QA/QC : 18- Stage Construction

Company
DEC- Bohen, Jeff

Status
Open

Date created
Tue 03/03/2015

Author
kurt.flierl@dot.wi.gov

Root cause
Quality : Constructability

Location

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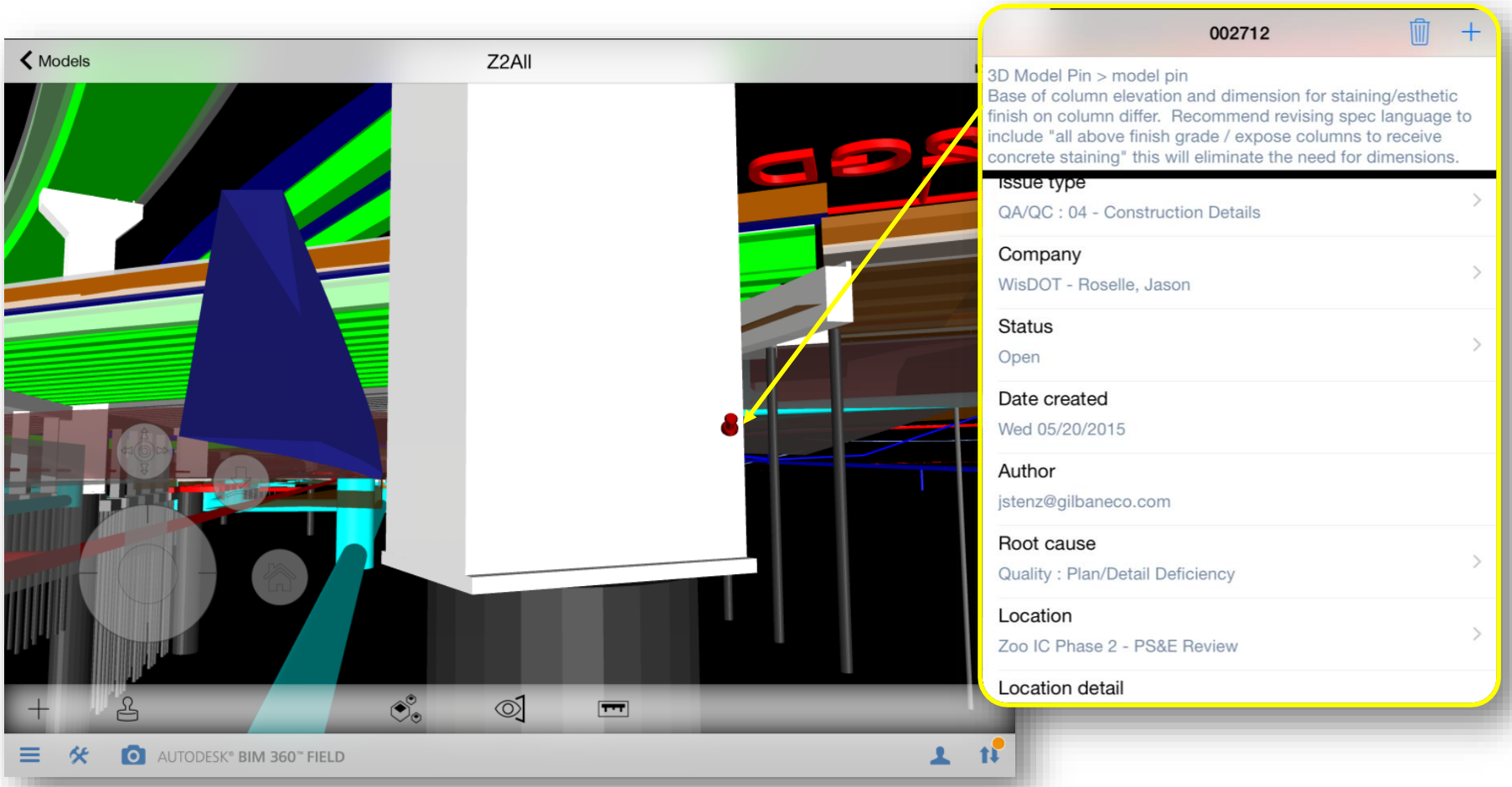
Communicate:

3D Locate of Issue



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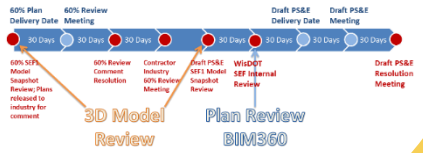
Improving Quality: Bid Documents

RESOLVE
STEP 3

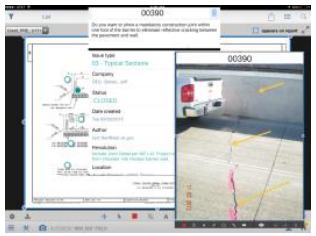
Integration of Feedback into Traditional Process



Functional Breakouts Drive to Resolution

- Staging
- Earthwork
- Drainage
- 3D Model

Transparent Communication



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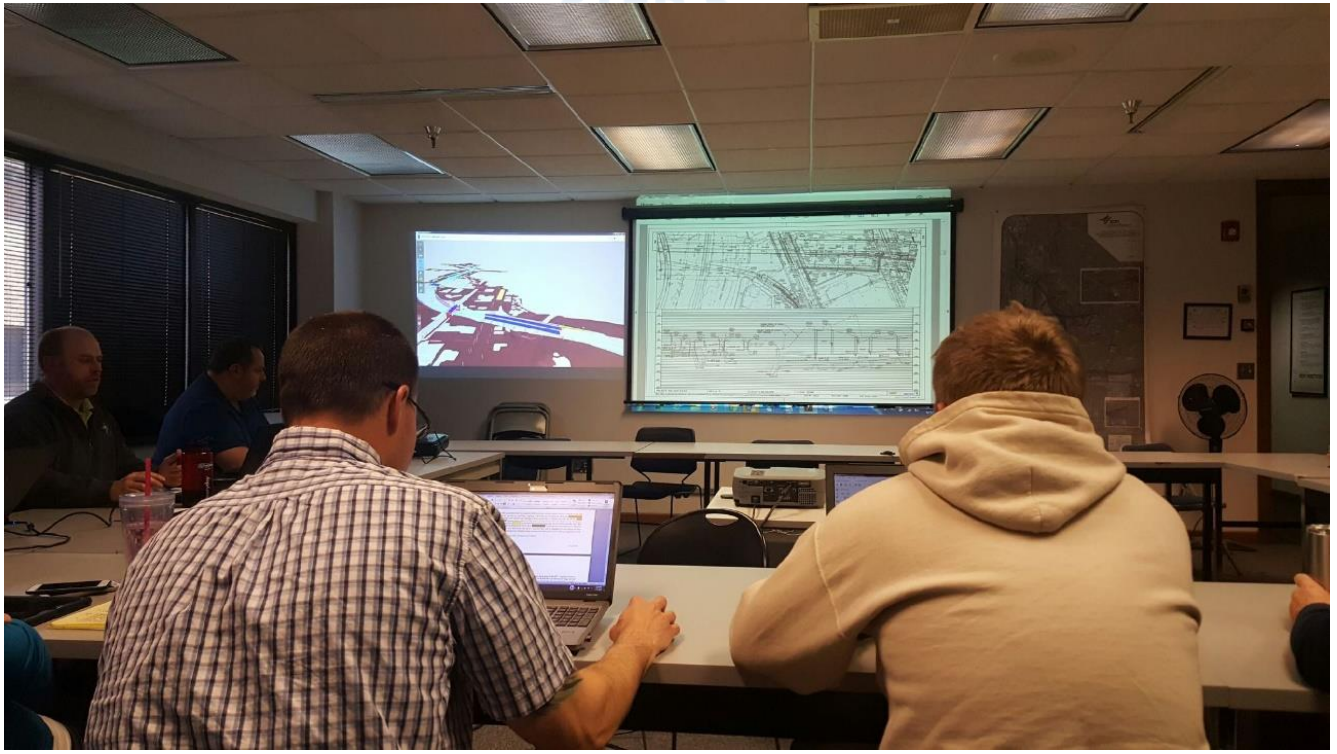
Improving Quality: Bid Documents

RESOLVE

STEP 3



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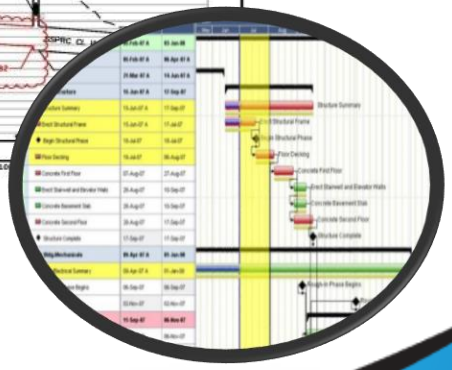
3D BIM Models in Construction-SE Freeways/Region



Real-time Information Collaboration

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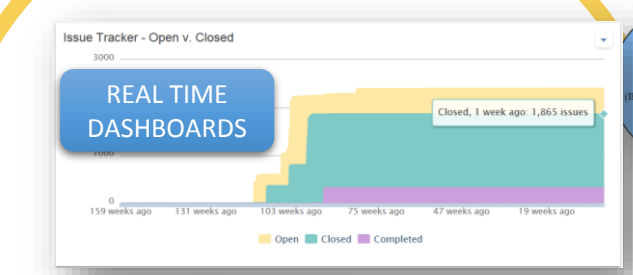
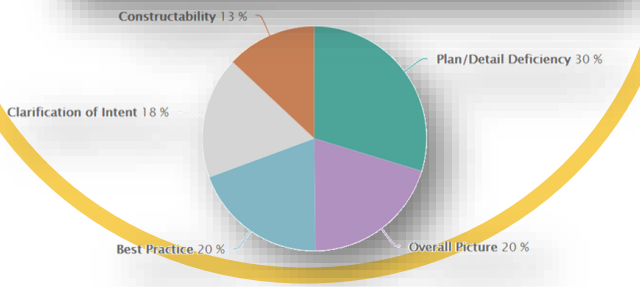
Improving Quality: Bid Documents

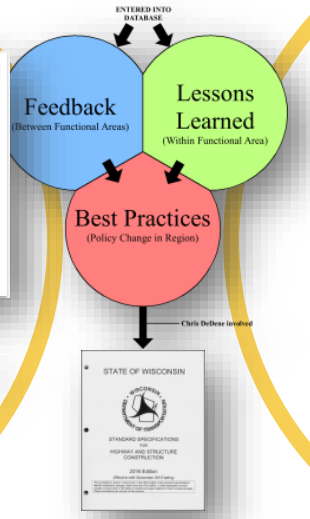
INCORPORATE

STEP 4

Feedback Metrics







Additional Value: Feedback to Design

Leveraging Project Feedback to implement Regional & Statewide Change

- *Currently **70 FBTDs***
- *Southeast Freeways Design Manual **50 FBTDs***
- *Statewide Facilities Development Manual **3 FBTDs***

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INCORPORATE
STEP 4

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Dedicated Design Liaison

- Post-Design Support
- Involved and Engaged throughout Construction
  - Attend Project Meetings
  - Respond to RFIs/DINs
  - Minor Re-Design to Adjust to Field Changes
- Issue Resolution and Timely Decision Making

Transparent Collaboration = **Effective Issue and Risk Mitigation** = **Cost $avings**

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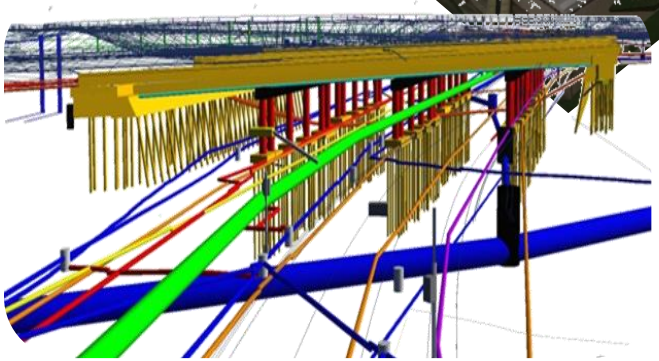
Use of BIM in Construction

- Complexity
  - Unique Construction Elements
  - Staging/Access
  - Traffic Management
- Aggressive Construction Schedule
  - "Burn" Rate = $1.2 million per day
    (Fall 2016)
- 3,711 issues on project to date



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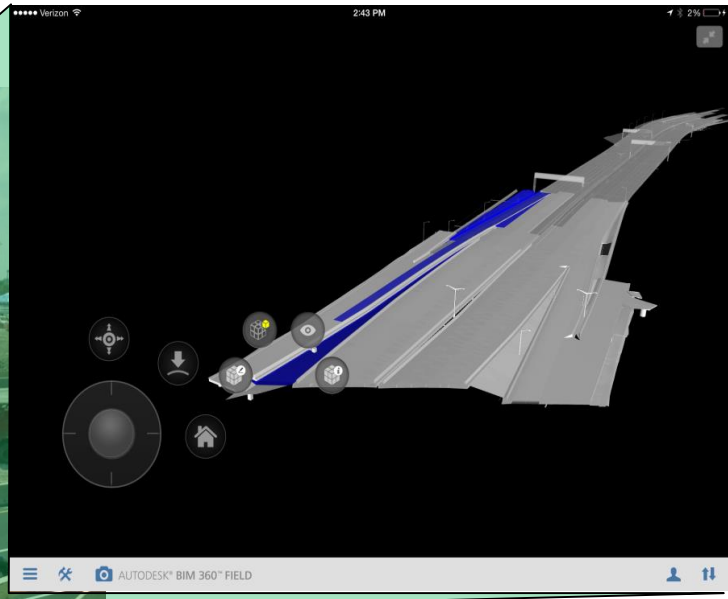
3D Model Visualization

3D Engineered Models in Construction



BIM Used in Field - Issues Tracking

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Use of BIM in Construction

- Automated Machine Guidance (AMG)
  - 2D contract documents
  - 3D model provided for reference
  - Model updates during construction

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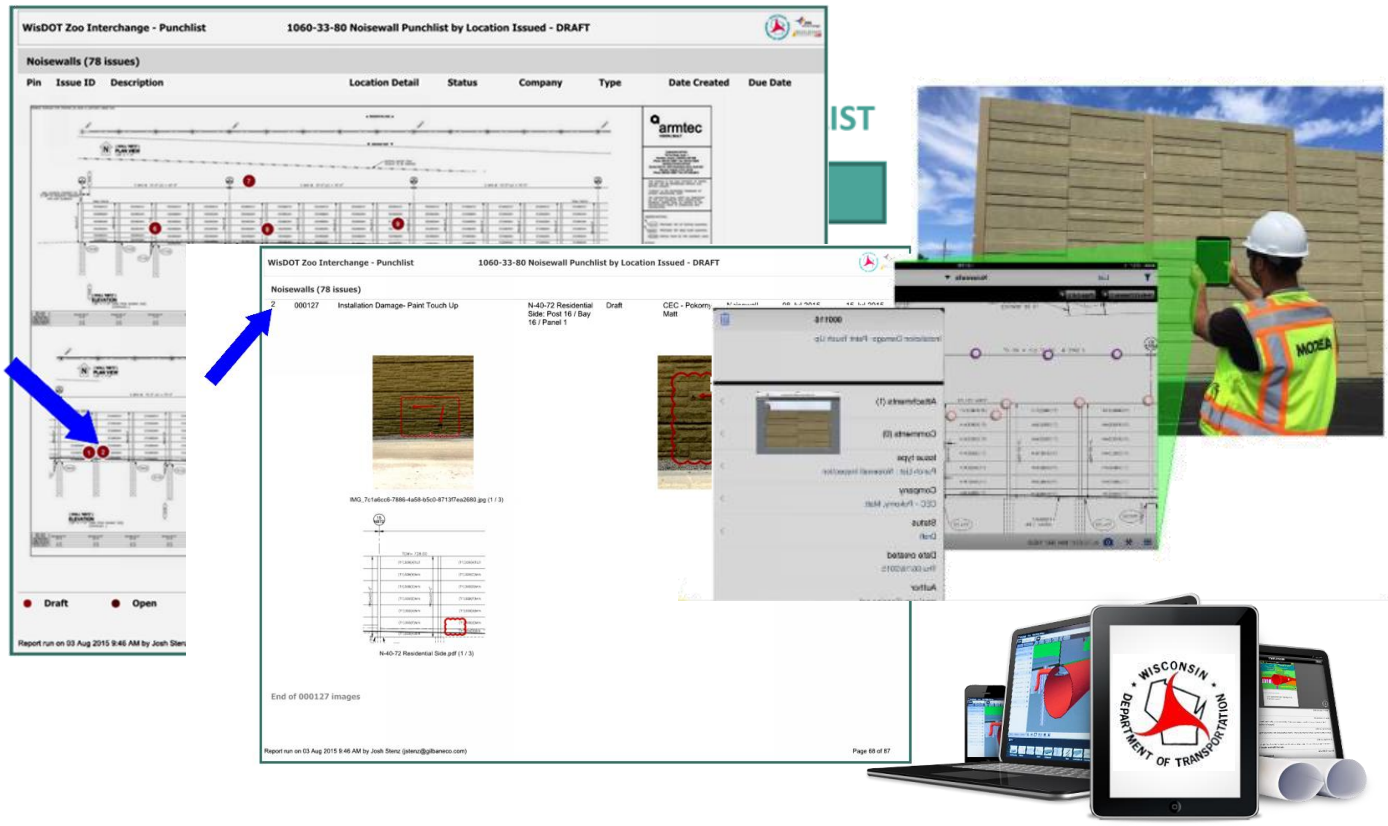
Use of BIM in Construction

Mobile Inspections Software - Punchlist (BIM 360/Bluebeam)



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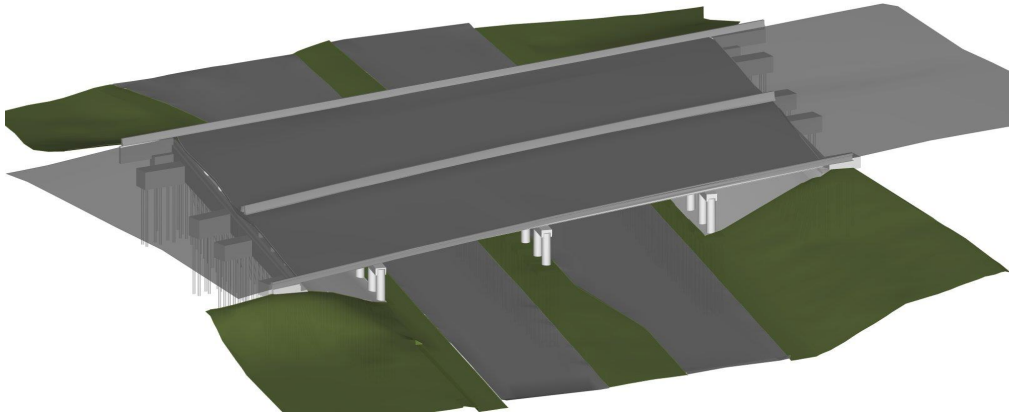
Use of BIM in Construction

- Full time 3D Model Technician on CEC team
  - Staging changes/sequencing
  - Interface with utilities
  - Grading changes/blending slopes
  - EBS
  - Adjusting noise barrier alignments
  - Temporary overhead lighting clearances



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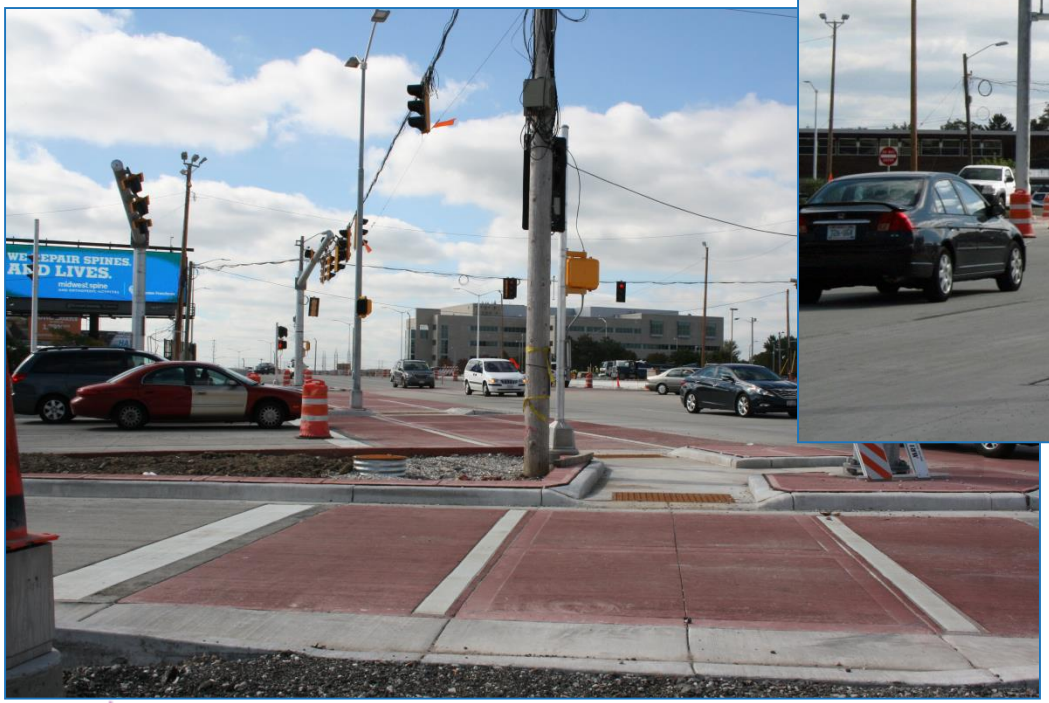
Q&A

- How can our industry become more efficient and manage disruptive transformative change in delivering projects?
  - People
  - Processes
  - Products-PS&Es, D-C Deliverables, Data

- Benefits and Return on Investment

2013 – WIS 100

Final Cost: $36.4M
Changes: 1.17%
Labor: 131,020 hrs



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2013 – Swan Boulevard

Final Cost: $12.3M
Changes: 3.77%
Labor: 36,518 hrs

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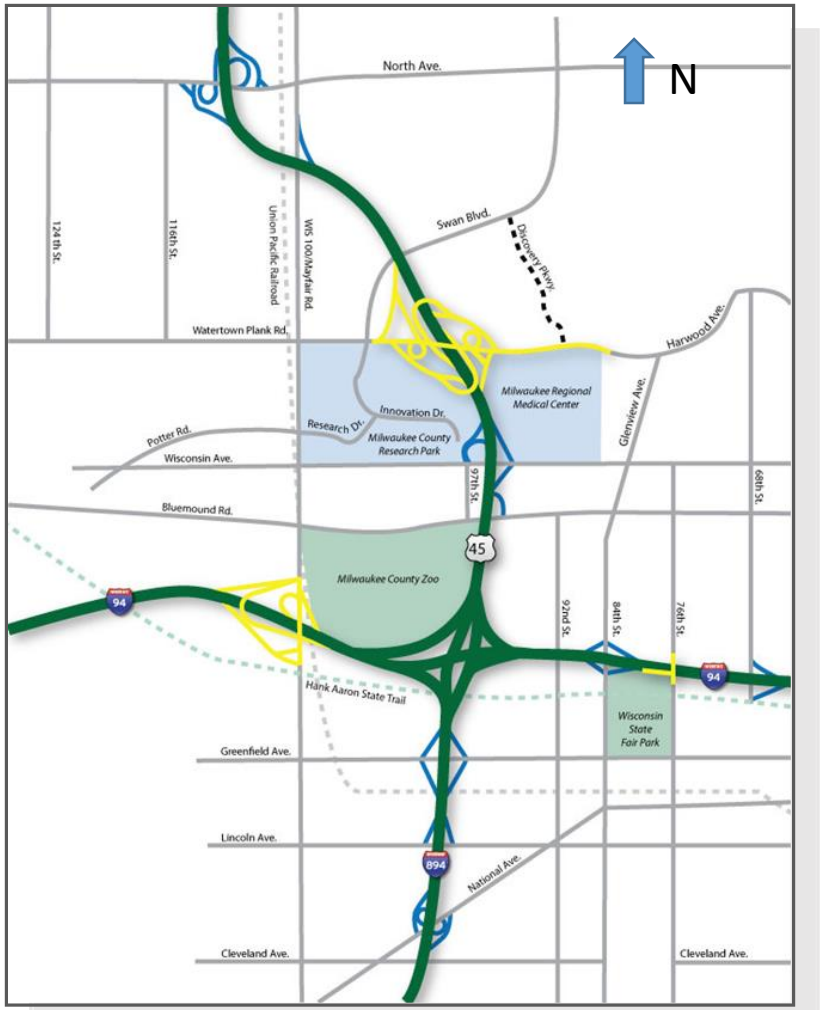
2014 Construction

- 76th Street Bridge
- Box Culvert crossing at I-94 and 84th Street
- WIS 100 Interchange / UPRR Bridge
- Watertown Plank Road Interchange



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2014 – 76th Street Bridge/Honey Creek Box Culvert

Final Cost: $33.0M

Changes: 1.35%

Labor: 170,086 hrs

- 84th Street ramps closure for Honey Creek Box Culvert Work
- 84th Street lane restrictions winter 2013-14
- Kearney closed nine months
- Temporary 76th Street ramp
- 76th Street bridge closed for six months
- Detours to use 68th/70th Interchange

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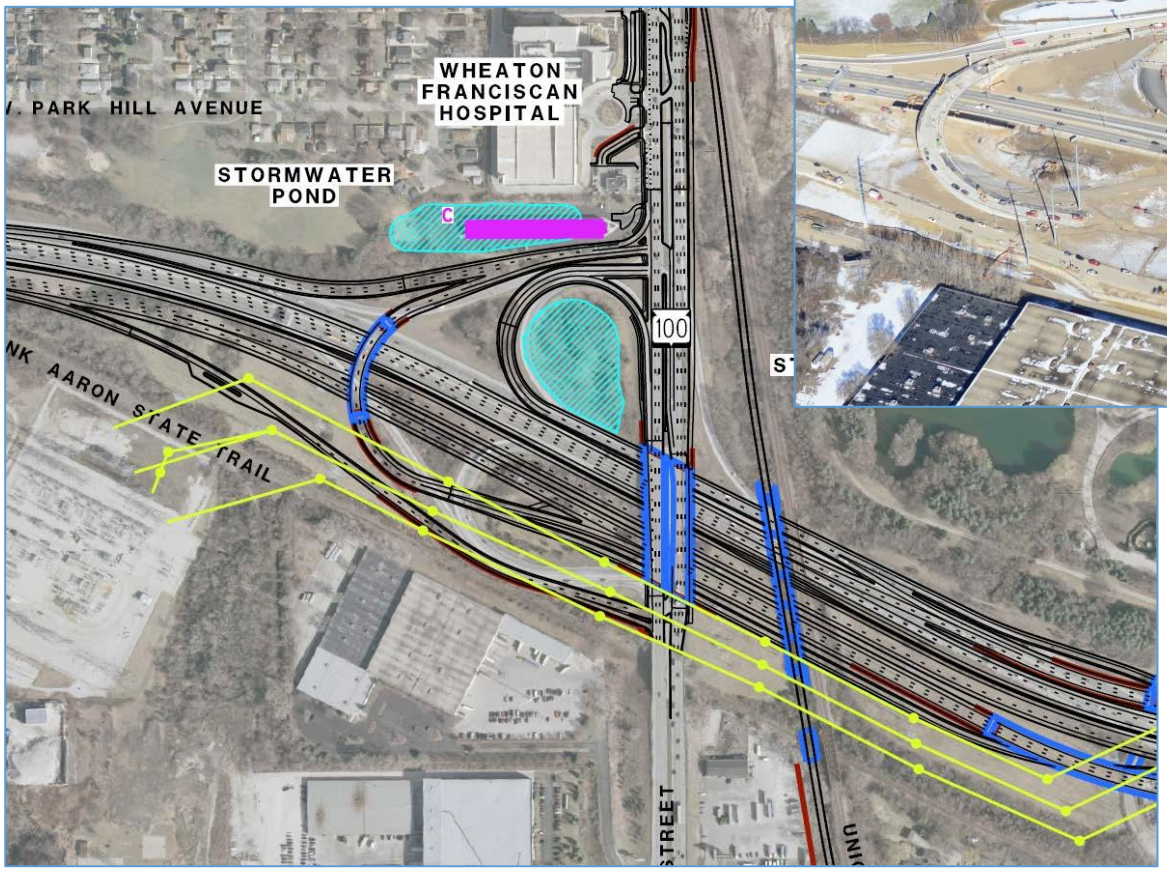
2014 – WIS 100 Interchange



Final Cost: $75.7M
Changes: 3.23%
Labor: 238,334 hrs

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New Union Pacific Railroad Bridge over I-94

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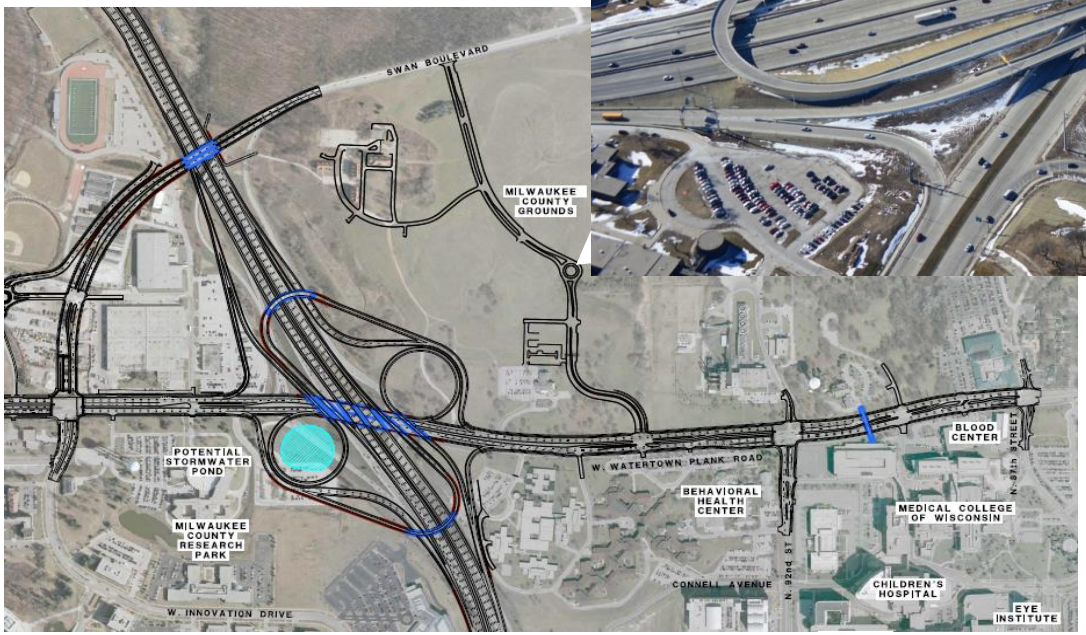
2014 – Watertown Plank Road



Final Cost: $68.1M
Changes: 1.97%
Labor: 316,402 hrs

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Watertown Plank Road
U-Ramp tub girders being set

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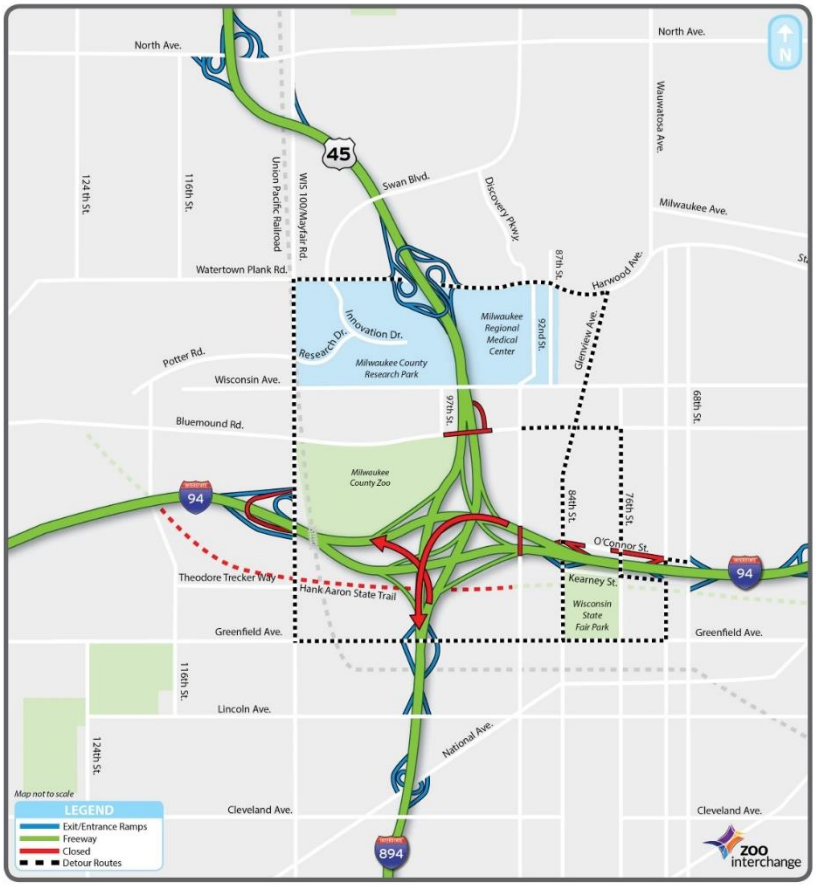
Core 1: Fall 2014 – Spring 2016

- LET = $198M
- Wisconsin Constructors II
  - Michels
  - Lunda
  - Edgerton



Final Cost: $206.2M
Changes: 3.75%
Labor: 772,864 hrs

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Core 1 – May 2015

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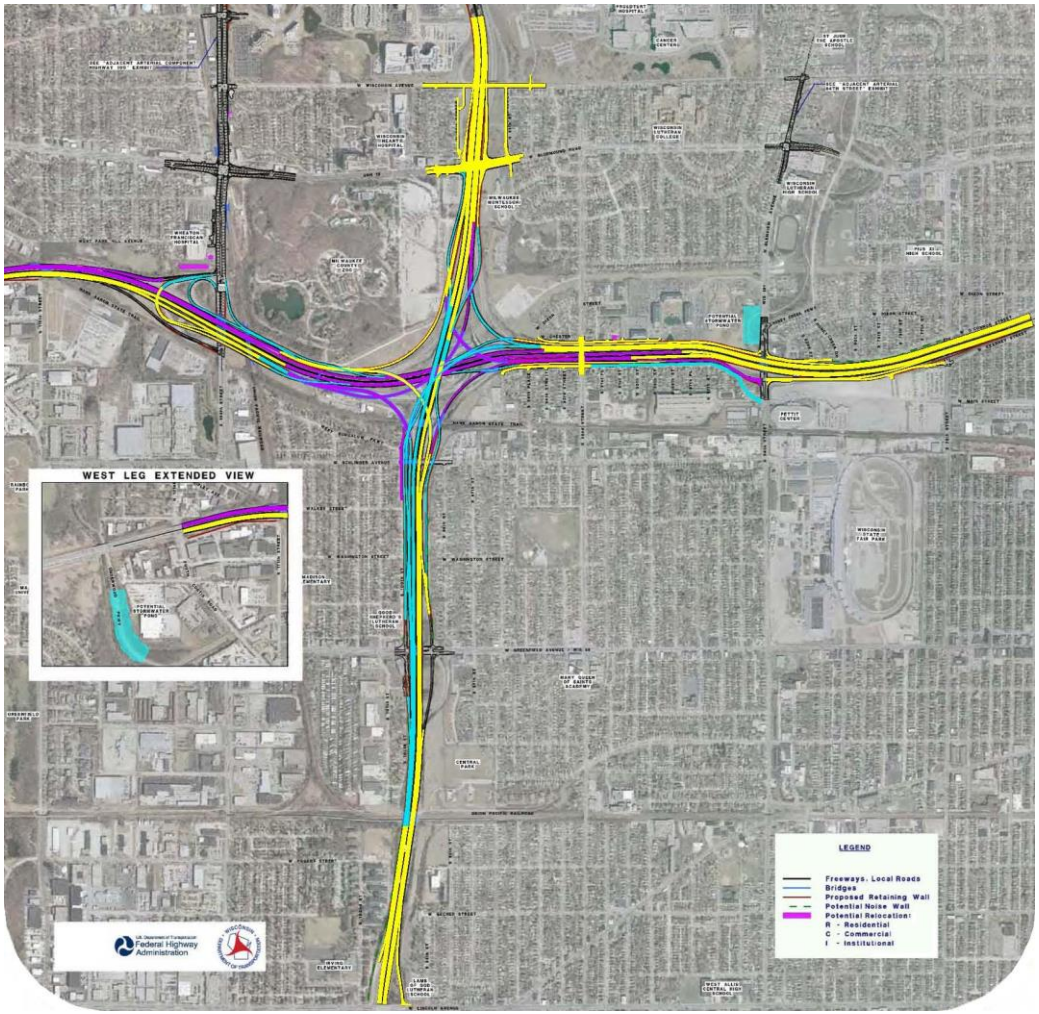
Core 2: Fall 2015 – Summer 2018



- LET = $302.2M
- Walsh Construction
- Changes = 4.05%

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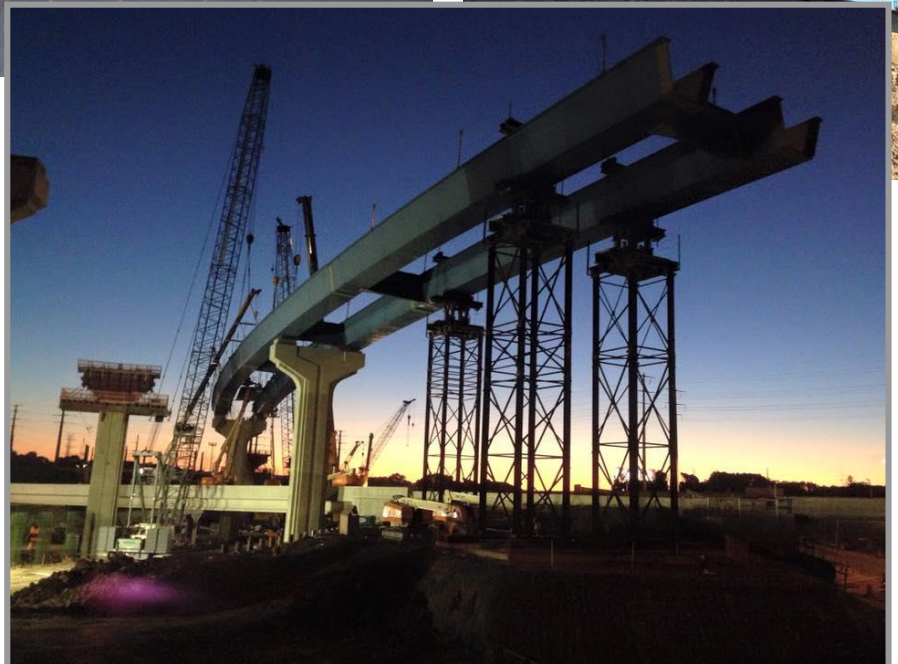
Core 2: 2015 – 2018



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Core 2 – 96” Storm Sewer

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Core 2: 2015 – 2018

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Core 2: Fall 2015 – 2018

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SE Freeways: Conclusions on ROI-BIM

- Earlier Clash Detection/ Resolution of Construction Discipline Interface Conflicts, Multi-disciplinary Collaboration
- Improved Existing Conditions Accuracies with 3D Integrated LiDAR Surveys
- Visualization, Simulation, 3D-4D Staging, AR/VR-Pilot
- Improved Quality of Design Plan Sets/Bid Docs / Enhanced PS&E Review
- e-Construction Real-time Field Construction Management (GPS Hand-helds/Rovers)
- Verification with 3D Models 3D to 4D Schedules-Pilot
- Contract Modification Costs significantly reduced by using BIM

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SE Freeways: Summary on ROI-CIM
(Zoo IC CBA-ROI Final Report in 12/2018)

- I-94 N-S Program Changes (4.5%) vs ($26.93m / $806.85m) Zoo IC Program Changes 3.43%
- Complex Project Changes (e.g I-94 N-S) typically range from 5%-9% (+/-)
- Zoo IC Core 1 Contract is complex and Changes are 3.75% ($7.45m / $198.77m)
- Zoo IC Core 2 Contract is complex and Changes are 4.05% ($10.42m / $302.20m) and 1.62% excluding a $5.52M Cost

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SE Freeways: Summary on ROI-CIM

(Zoo IC CBA-ROI Final Report in 01/2019)

Zoo IC Project	Contract $	CO $	CO %
• Core 1 System IC	206.2m	7.5m	3.75%
• Core 2 System IC	305.8m	10.4m	4.05/1.62%
• Mayfair Rd (STH 100)	36.4m	0.4m	1.17%
• Watertown Plank IC	68.1m	1.3m	1.97%
• Swan Blvd-Bridge	12.3m	0.5m	3.77%
• UP RR-STH 100 Bridge	75.7m	2.4m	3.23%
• Bridges (6)	62.5m	0.9m	1.47%
• Total (includes next slide)	822.3m	25.3m	3.43%

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SE Freeways: Summary on ROI-CIM
(Zoo IC CBA-ROI Final Report in 01/2019)

Zoo IC Project	Contract $	CO $	CO %
• I-94/I-894 Aux Lanes	16.3m	0.7m	4.05%
• Local Roads/Other	11.0m	-.01m	-0.07%
• Adj Facilities	12.6m	1.0m	8.10%
• Traffic Mitigation/TMP	15.4m	0.2m	1.53%
• Total (includes prev slide)	822.3m	25.3m	3.43%
• Adj Streets-Bridges (9)	26.8m	1.4m	5.46%

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Q&A

- How can we reuse CAD and BIM data for asset management?

- How can we integrate BIM-CAD-GIS data?
  - ArcGIS
  - AGO
  - SDE
  - ArcGIS Connector (New)
  - Smart Cities, Smart Transportation Corridors

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Asset Management (GIS) Deliverables

- 2,818 miles of highway
- 125+ GB of data analyzed
  - SERGIS: 6 GB
- 33,000+ files
- 50+ layer files
- 100+ scripts
- 32 map templates
  - 4 sizes
  - 7 counties plus Region
- ArcGIS Online

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Asset Management (GIS) Data Layers

SERGIS Data Layer Tracking

Interdependent Data | Meta-Manager Data | External Data | Data Steward | Empty Supporting documents

Index ID	Layer/Datasets Used/Needed	Data Type	Data_Dictio	Data_Proce	R = Region C = County R&C	Spatial Feature Name	Layer File Name	Assigned Consultant	Deliverable Tier (Target Date) 1 = 1/19/2018 2 = March 2018 3 = June 2018	Assignment (who is responible for completing immediate next steps of data layer)	Status (Active, Not Active, Complete, On Hold)	Next Steps (Completed steps and history of next steps is being stored in the comments)
19	Construction Map Data	Line	X	X	R			GRAEF	3	WisDOT	Not Active	Investigating data source. Construction map data is derived from an application. Data and outputs stored on the network. Determining if data is dervided from improvement project data or if we will ne create a new feature class to house the data.
20	Zoning	Polygon	X	X	C	MKE_Parcels_with_Property_Information_20171011; RacineParcel_download_20171003	MILWAUKEE_ZONING.lyr; RACINE_ZONING.lyr	GRAEF	1	WisDOT	On Hold	Data Dictionary updated with DOT field names - only Racine and Milwaukee county had zoning dat available. Layer files were created for these two counties No data dictionary and process Investigation of Zoning data, data layer exist from Statewide parcel initiative but does not cover all a This may change in the future. In the interim counties my be the best reliable source for consistenc
21	PLSS Section/Qsec (SEWRPC)	Line	X	X	R	PLSS_QTR_SECT_SEWRPC_POLY; PLSS_SECT_SEWRPC_POLY	SEWRPC_QTR_SECT_POLY.lyr;	GRAEF	1	Consultant	Complete	Data Dictionary updated with DOT Field Names
22	Section Corners (SEWRPC)	Point	X	X	R	PLSS_SECT_CNR_SEWRPC_PT		GRAEF		Consultant	Complete	Data Dictionary updated with DOT Field Names
23	Wetlands - ADID (SEWRPC)		X	X	R	various names		DAAR	1	Consultant	Complete	Empty Data Dictionary
24	Land use (SEWRPC)	Polygon	X	X	R	LDU_2010_SEWRPC_POLY	LAND_USE_2010.lyr	GRAEF	2	Consultant	Complete	
25	Land use (Future) (SEWRPC)	Polygon	X	X	R	LDU_2035_SEWRPC_POLY; LDU_2050_SEWRPC_POLY	LAND_USE_2035.lyr; LAND_USE_2050.lyr	GRAEF	2	Consultant	Complete	
26	Existing & Proposed Trails (SEWRPC)		X	X	R			DAAR	1	Consultant	Complete	We will utilize SEWRPC trail file that was assembled for Vision 2050. This data has both current and trails. The definition of the file are off street (this does not inlcude on street accomodations).
27	Environmental Corridors (SEWRPC)		X	X	R			DAAR	1	Consultant	Complete	Data Dictionary updated with DOT Field Names, Aliases & Descriptions
28	Topo/DTM	Polygon	X	X	C	TOPO_DTM_WDOT_POLY		GRAEF	2	Consultant	Active	Data Dictionary updated with DOT Field Names, Aliases & Descriptions
29	Historical Sites (NRHP)		X	X	R			GRAEF	2	WisDOT	Not Active	Data comes as is. SHPO was contacted, data needs to be purchased - DOT not pursuing at this tin
30	Floodplain (FEMA) streaming		X	X	R			DAAR	1	Consultant	Complete	Utilizing streaming service from FEMA we will create regional layer files from regional views.
30.1	DFIRM - Digital Flood Insurance Rate Map				R&C	DFIRM_FEMA_POLY		GRAEF	1	Consultant	Complete	Using DFIRM downloaded from FEMA we will create county and Regional feature classes to be use business area workflows.
31	Surface Water (DNR)	Polygon	X	X	R		SURFACE_WATER_VIEWER.lyr	GRAEF	1	Consultant	Complete	Surface water feature class from DNR. This feature will only be a regional data layer.
31.1	Hydro Area and Line				R&C	HYDRO_CNTY_POLY; HYDRO_CNTY_LINE		GRAEF	1	Consultant	Complete	Second, is hydro area and line sourced from the counties. This feature class will be produced at bo county and regional level.
32	Wetlands - DNR (WWI)	Polygon	X	X	R		WWI.lyr	GRAEF	1	Consultant	Complete	Empty Data Dictionary
33	Soils (USDA)	Polygon	X	X	R	SOIL_USDA_POLY	SOILS.lyr	GRAEF	1	Consultant	Complete	Merge Script Completed & Data Dictionary updated with DOT field names **Process document - merge MD_Soil_Join and MD_SOIL_USDA_POLY. Both doc pertain to the creation of one feature. Add a break between documents so the re can understand where one process ends and the other begins.**
34	Soils Management (Cuts & Fills)	Google KMZ	X	X	R			DAAR	2	WisDOT		Soils quantites data is new data that is just starting to be collected. This data set will be a supplemer that we will incorporate into SERGIS structure. The base spatial feature will be either the improveme project or construction map feature class. (see Current improvement programs (LET) and Construc row items above.) The data will be manually entered into a spreadsheet for now. We will create a fe table based on data from the spreadsheet to be joined to the features listed previously. Develop da structure for geodatabase table. Evaluate table with data. determine how best to store data. We will us the current data that we have available. We will use \DT_RDWY_NPROJ_LINE and \DT_PPROJ_FOR_GIS both located in the SDELayers\Region\geodatabase folder to create a generic project line work. After we make this join join the spreadsheet with cut and fills and symbolize appropriately.
35	Contours (County)	Line	X	X	C	TOPG_LINE		GRAEF	2	WisDOT	Complete	Data Dictionary updated with DOT field names
36	Utility Permits	Database	X	X	C			DAAR				Data Dictionary is filled out for base spatial feature. Data steward managed kmz file on google earth needs to be converted an actual feature class. User also maintains three spreadsheets for tracking purposes. We will want to look at how the user can maintain some of his work flows but merge the ta join the data to the spatial feature. Longer term development of the data layer will include linking ac

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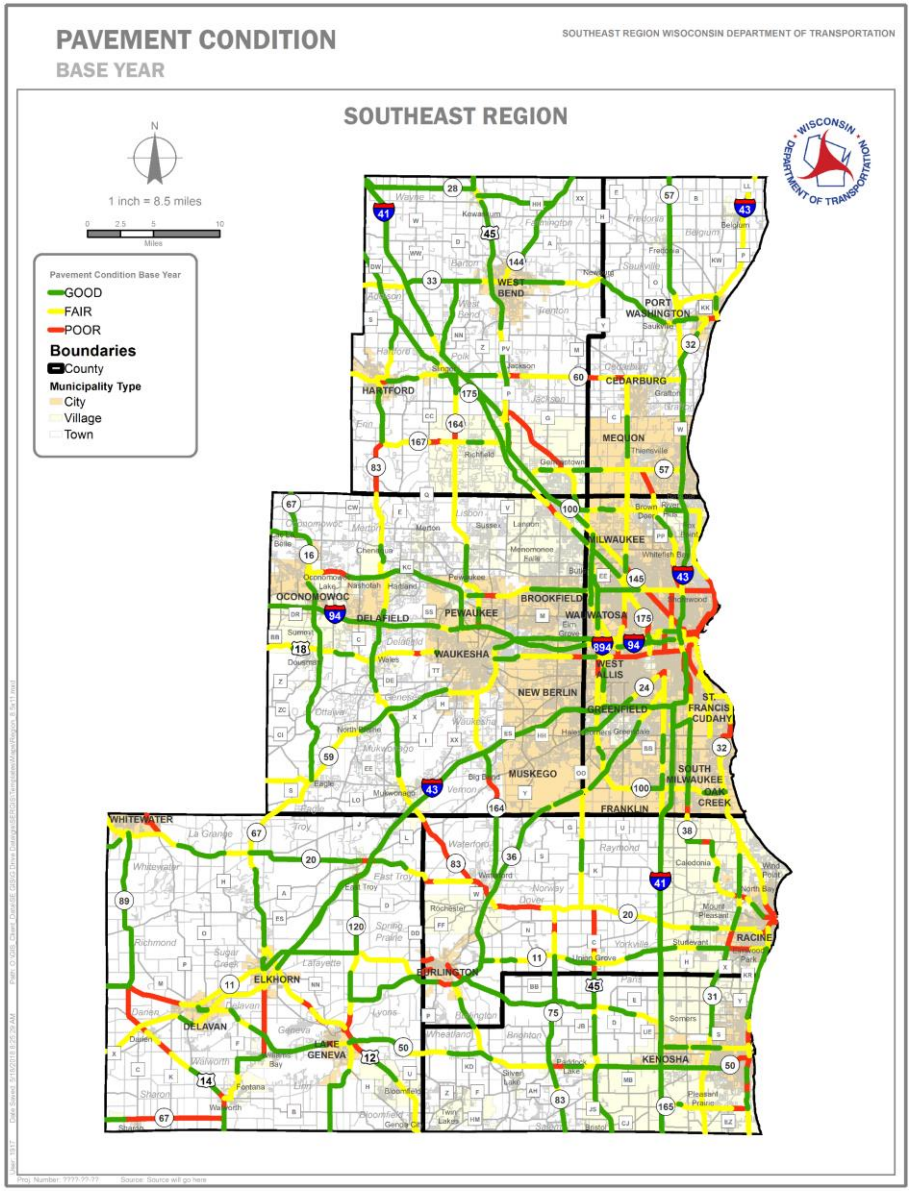
Asset Management (GIS)



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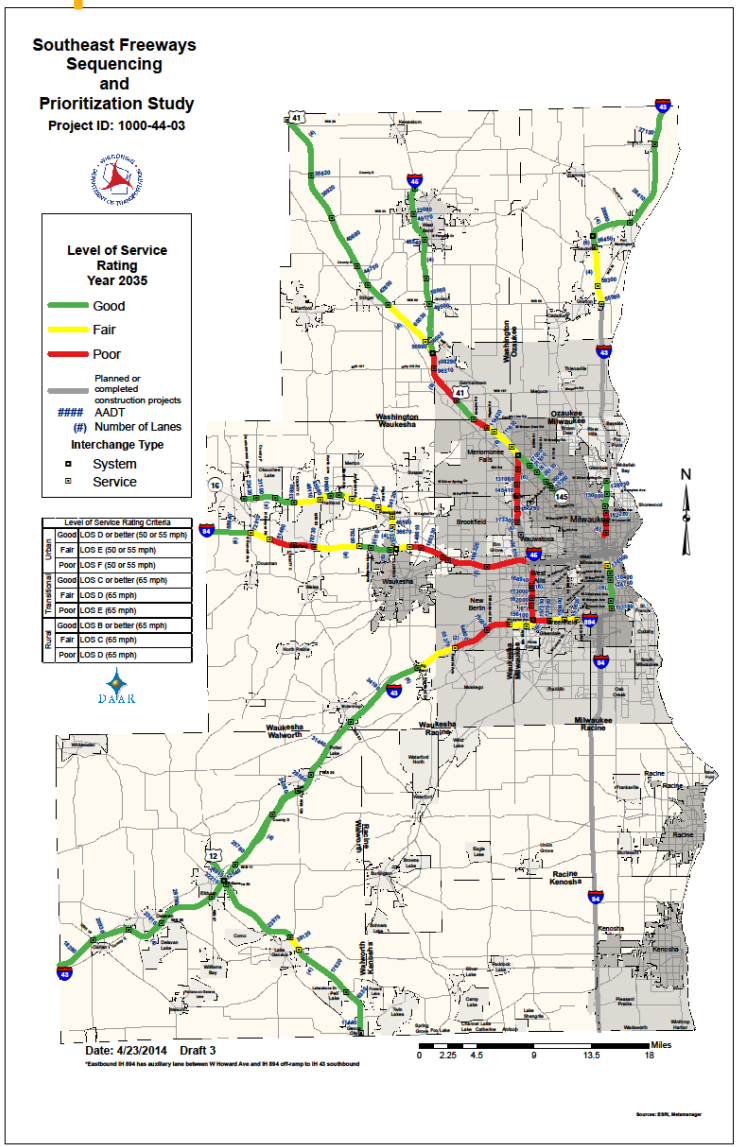
Asset Management (GIS)
SER System Maps

1) LOS (2013, 2035, 2050)
2) Crashes
3) Bridge Condition
4) Pavement Condition (2013, 2019)

Segment Classifications

- Urban
- Transitional
- Rural



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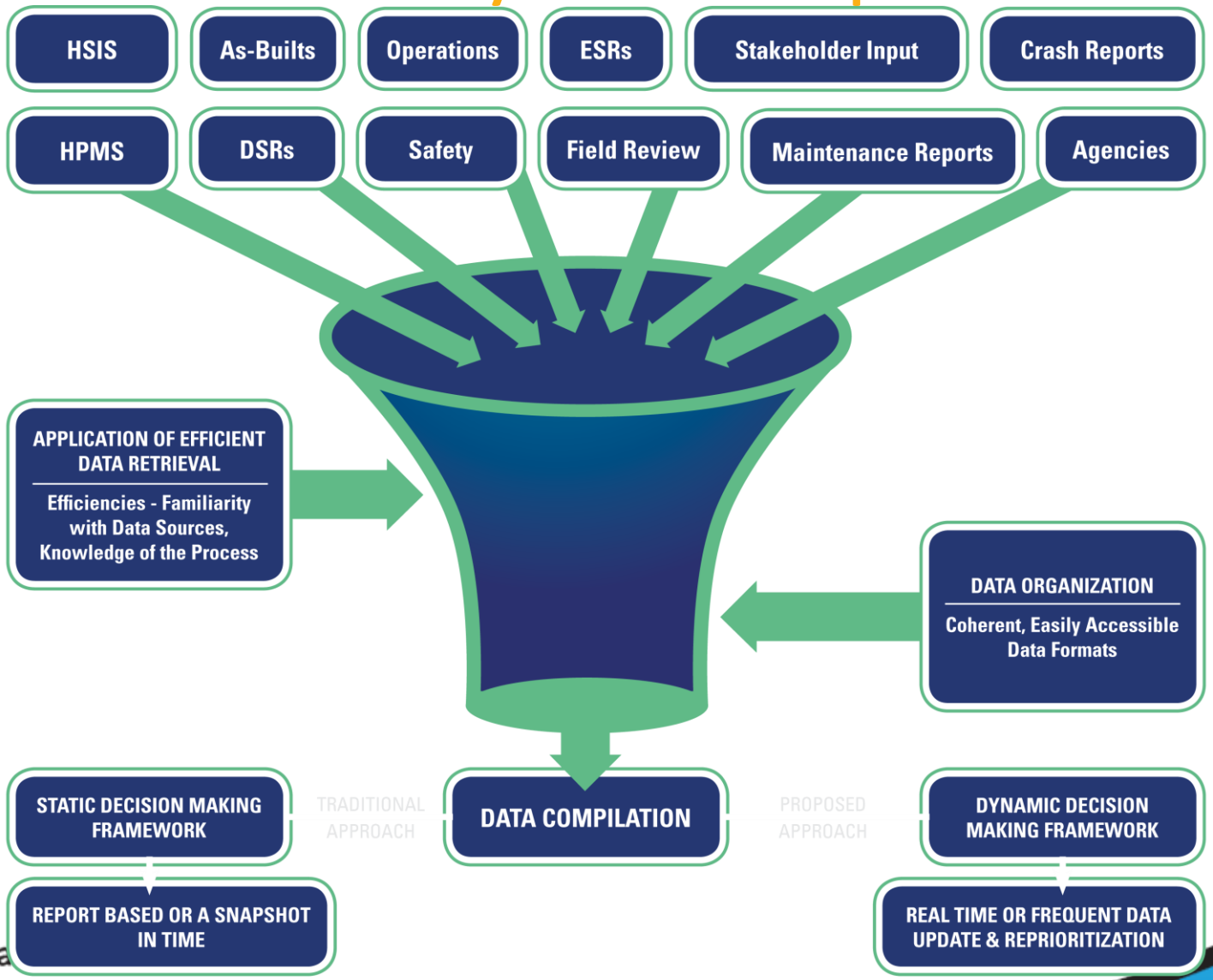
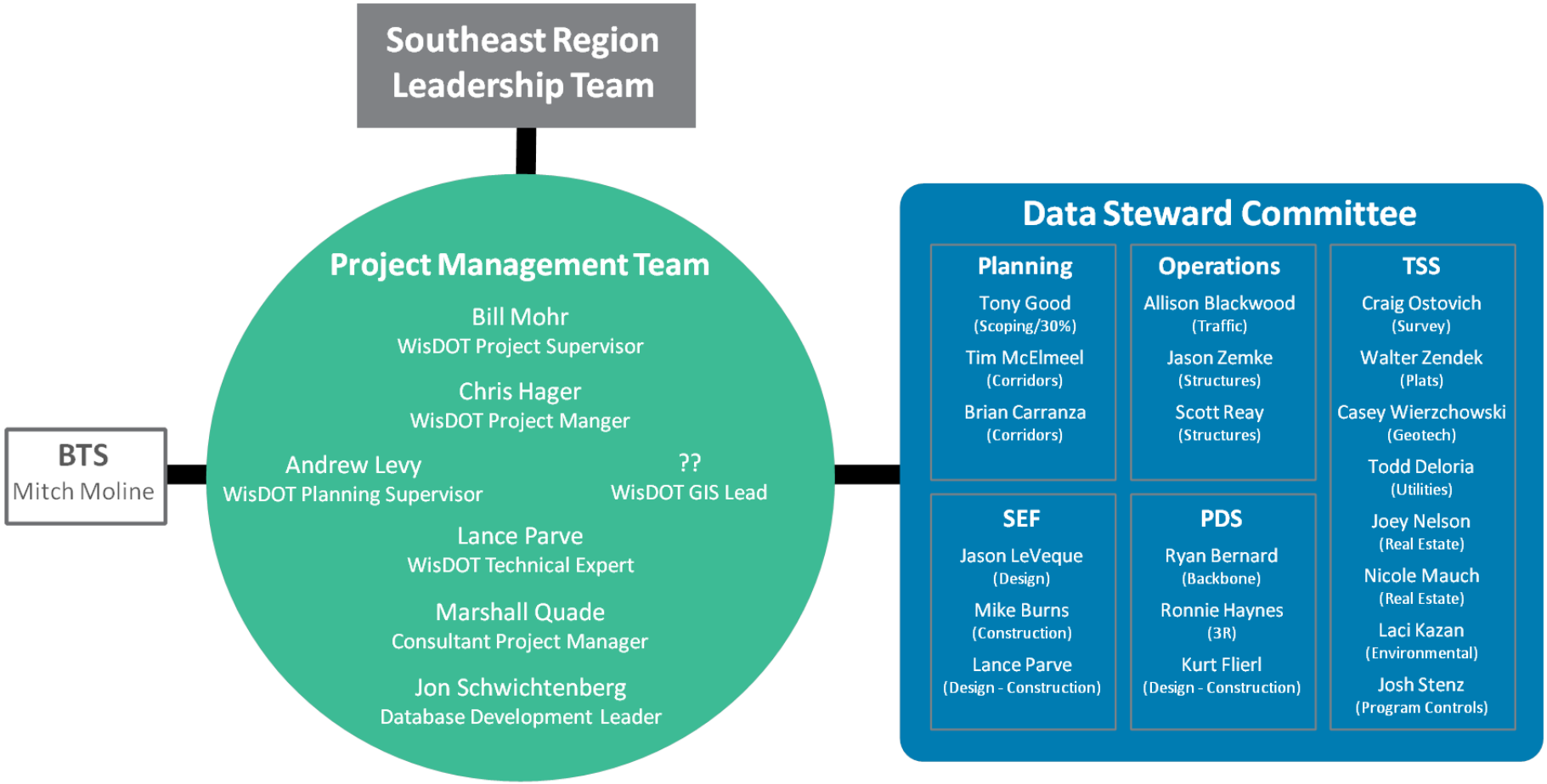
Asset Management (GIS)
SER System Maps



Asset Management (GIS) SER Team Organization



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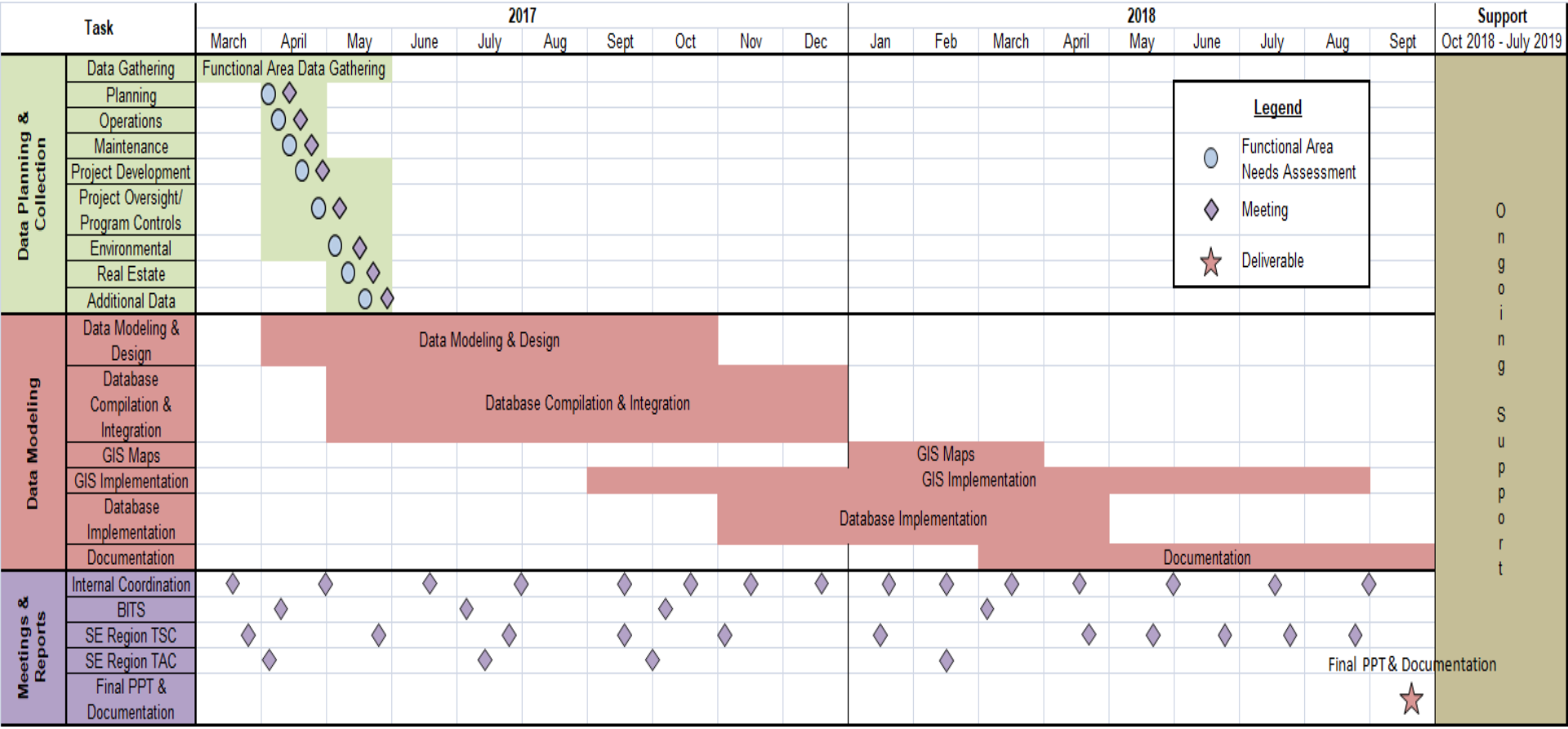
Asset Management (GIS) Project Schedule



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Asset Management (GIS) Project Delivery Approach

- Needs Assessment
- Universe of Needs & Wants
- Prioritization
- Tiered Delivery of Data Layers
- Close Coordination with Project Management Team & Data Stewards

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Asset Management (GIS) Documentation

- Needs Assessments
- Data Dictionaries
- Process Workflow Diagrams
- Metadata Documentation
- Layer Tracking Spreadsheet
- Naming Convention
- File Structure
- SharePoint/Box Enterprise

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Asset Management (GIS)
SER Needs Assessment Findings

- Findings
  - Siloed data storage
  - Disparate data formats
  - Redundant data & processes
  - Unique, individual workflows
  - Need for more access to data
    - Accurate
    - Current
  - Need for more efficient workflows
    - Timely creation of data/maps
  - Need for useable outputs

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Asset Management (GIS) Challenges & Lessons Learned

- Data
  - Where is it?
  - What should we start with?
  - How good is it?
  - How complete is it?
- Access
  - Where should data be stored?
  - Who should have access to what?
- Maintenance
  - Who's responsible?

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Asset Management (GIS): Keys to Success

- Champion
- Point Person
- Define Roles
- Prioritize Data
- Internal Department Coordination
- IT Coordination
- Documentation
- Standardization with Flexibility

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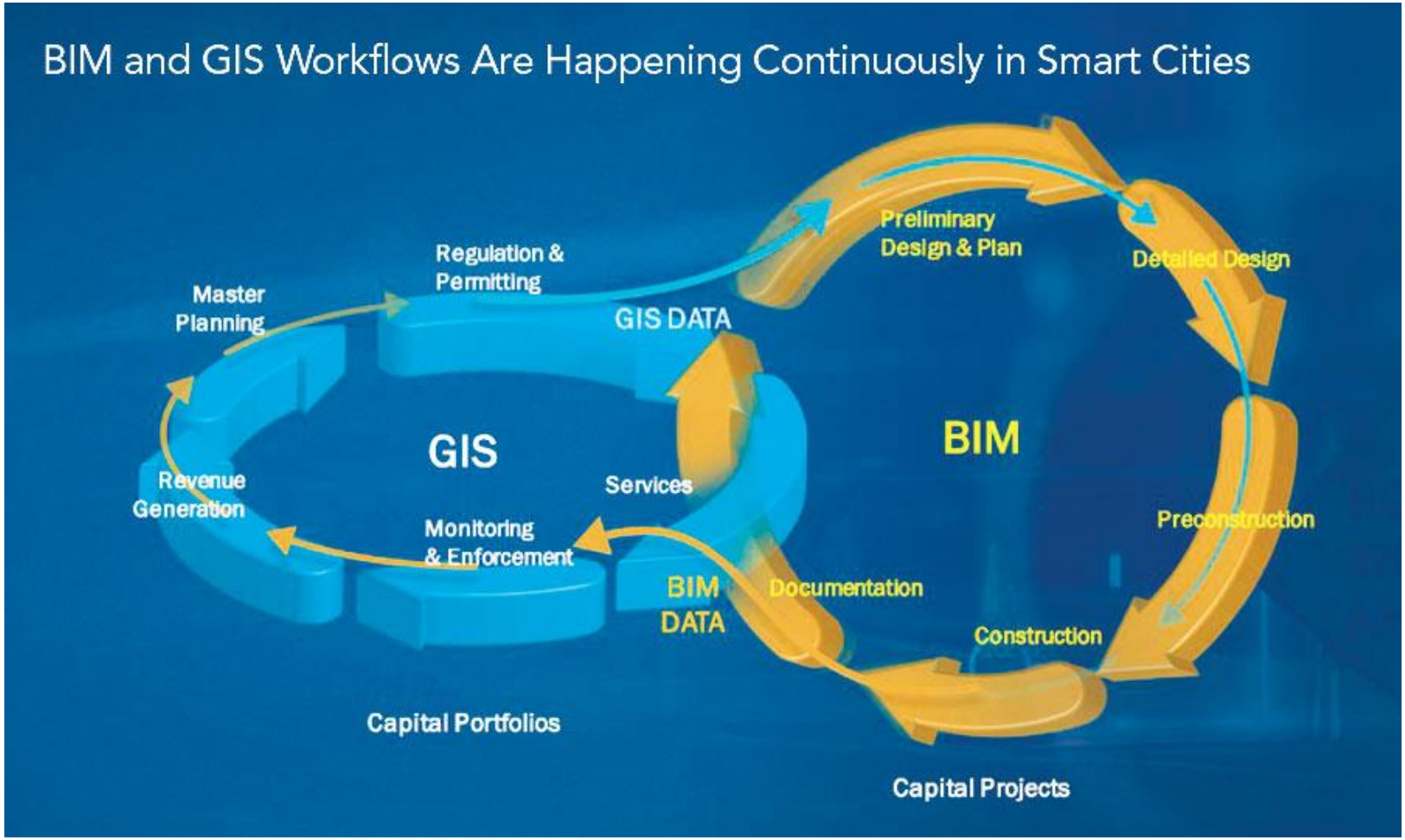
BIM - CAD - GIS



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Q&A?

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