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Infrastructure Modeling and Data Management - The Road to Digital Delivery

Jacque Brown, P.E.

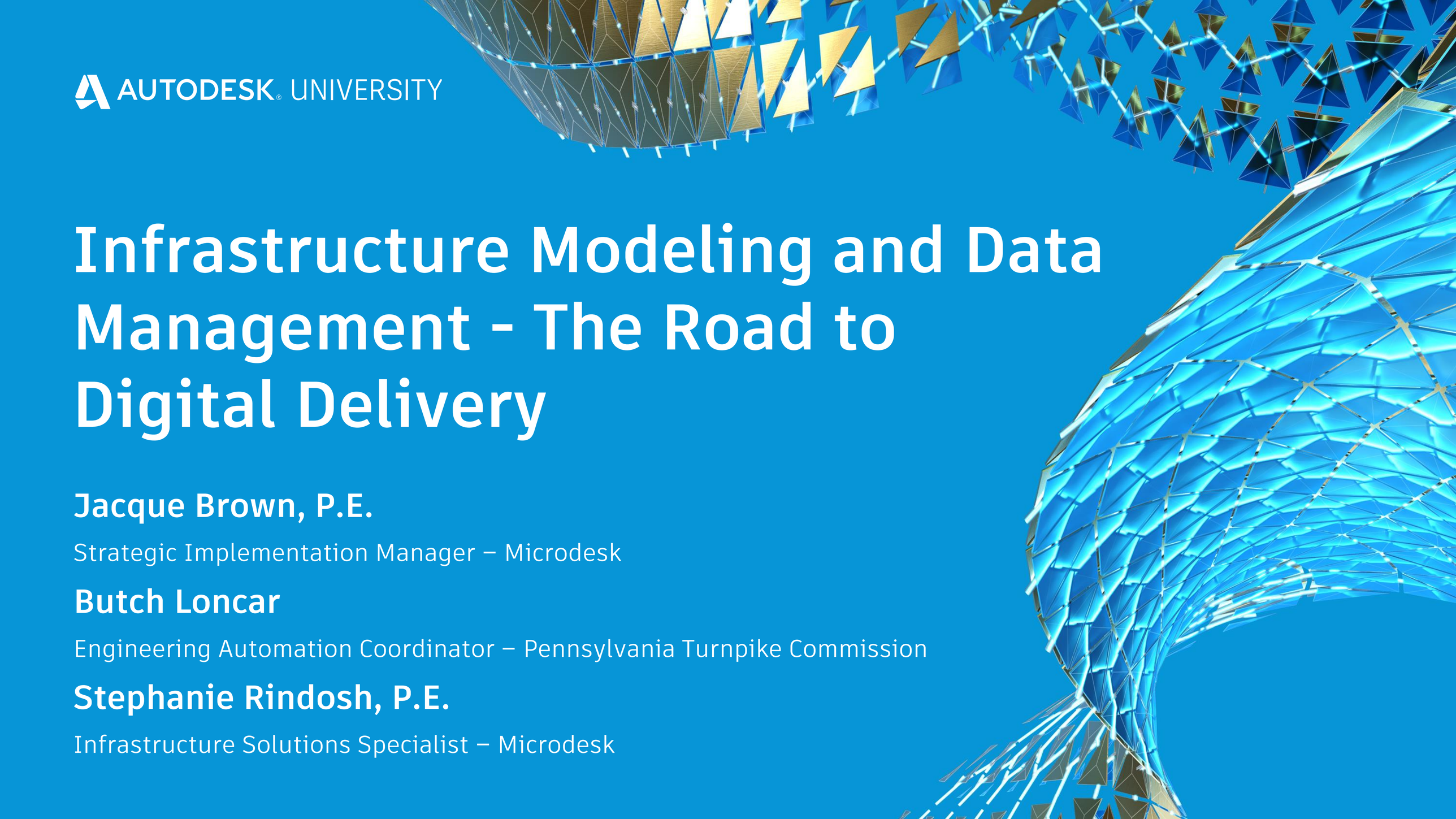
Strategic Implementation Manager – Microdesk

Butch Loncar

Engineering Automation Coordinator – Pennsylvania Turnpike Commission

Stephanie Rindosh, P.E.

Infrastructure Solutions Specialist – Microdesk



About the speaker

Jacque Brown, P.E.

- **B.S.E. Civil Engineering degree from Arizona State University**
- **16+ years in the Infrastructure industry, Microdesk for 7+ years**
- **Manages projects for clientele in the Transportation and Highway, Land Development, Power and Energy, and Port Authority industries**
- **Assists clients, such as PTC, in managing and organizing data, developing and establishing standardized content and procedures, BIM model development and coordination**

About the speaker

Butch Loncar, PTC

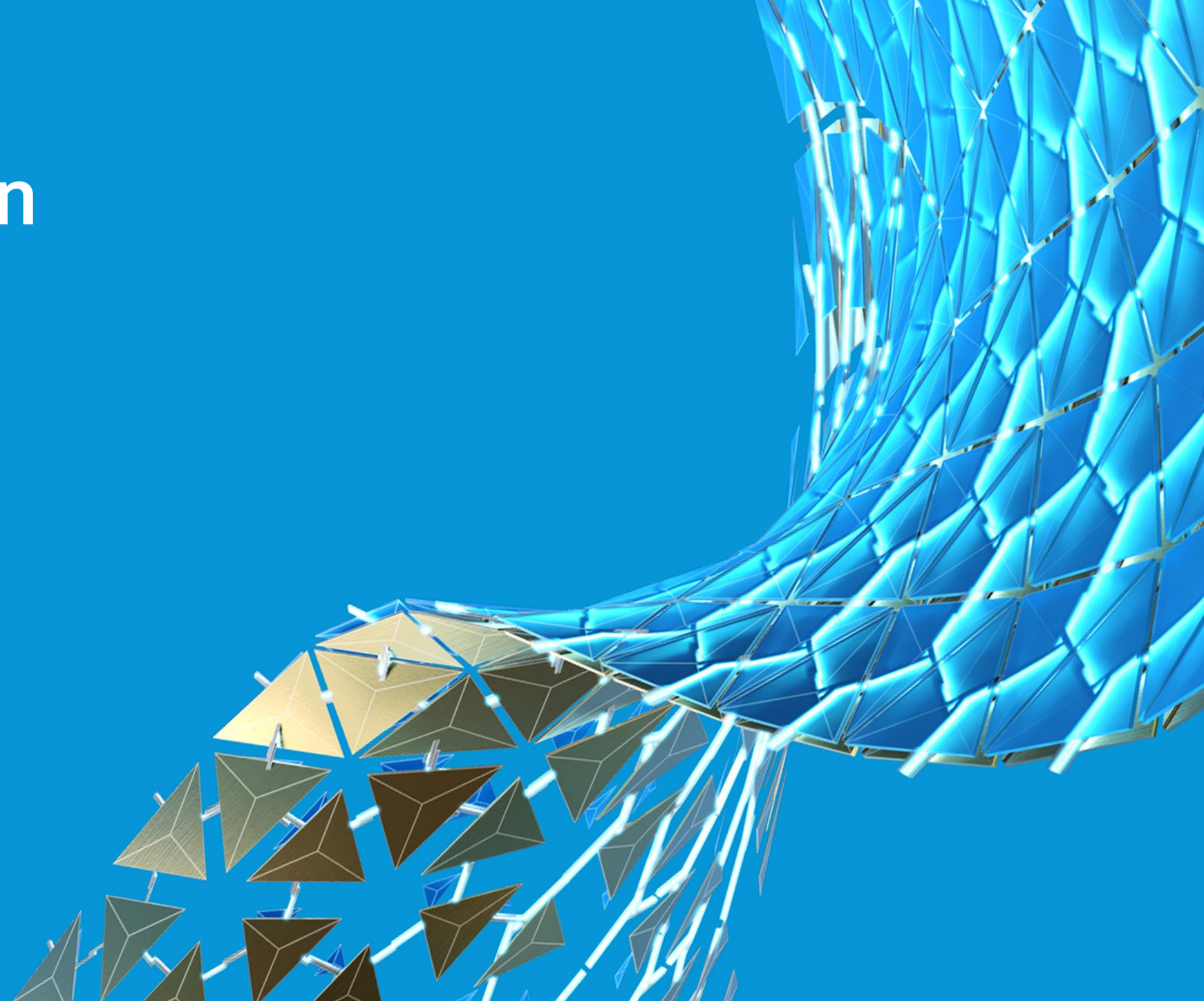
- **Robert "Butch" Loncar is the Engineering Automation Coordinator for the Pennsylvania Turnpike Commission**
- **34+ year employee of the Commission with 28 years within the Engineering Department**
- **For the last 20 years he has been the Engineering Automation Coordinator whose responsibilities are overseeing the development of the Engineering Technology Standards and the operation and maintenance of the CAD and other engineering software and hardware within the Engineering Department**

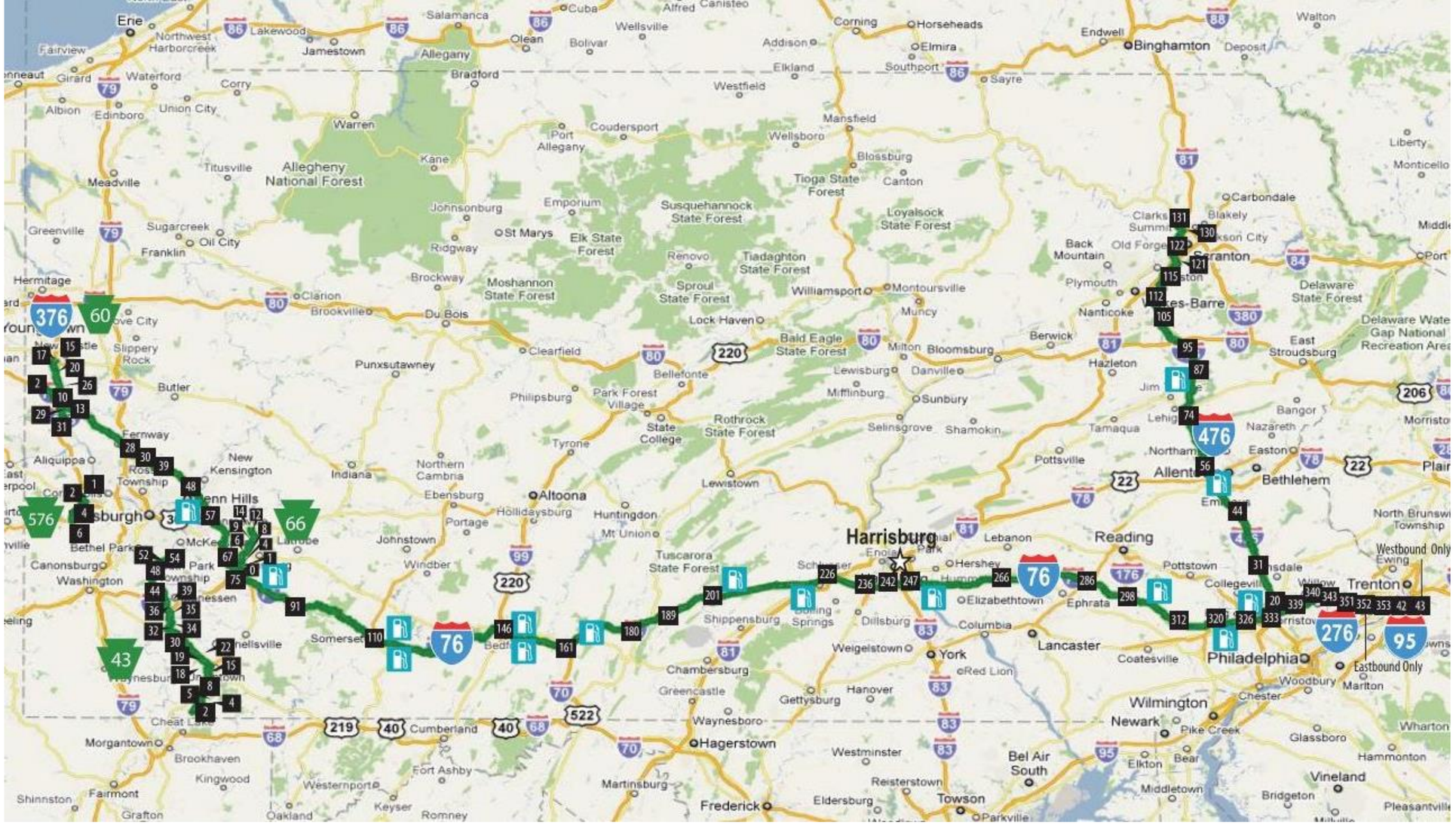
About the speaker

Stephanie Rindosh, P.E.

- **M.S. Civil Engineering degree from Villanova University and B.S. Civil Engineering degree from The College of New Jersey**
- **5+ years of industry experience in major highway design and construction**
- **Provides highly skilled consulting, training and mentoring for engineering firms to ensure the most up-to-date AEC technologies are integrated into their design workflows**

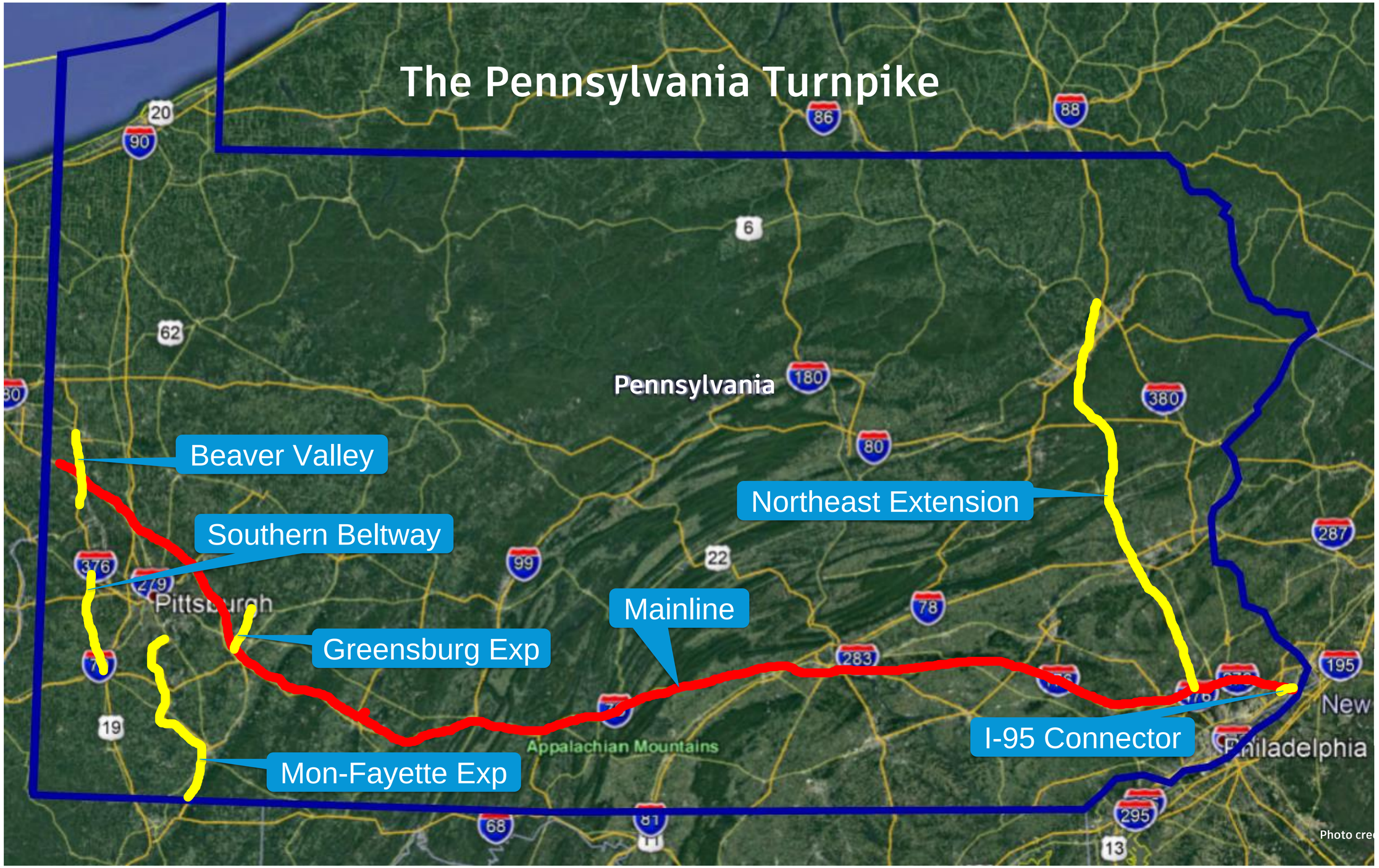
Introduction





Infrastructure Modeling and Data Management - The Road to Digital Delivery

- The Pennsylvania Turnpike Commission is responsible for over 550 miles of highway
- The PTC faces multiple challenges with data management and variations in project deliverables
- Their final goal is to implement digital models as a requirement for project bidding


The Pennsylvania Turnpike
Beaver Valley
Southern Beltway
Greensburg Exp
Mon-Fayette Exp
Mainline
Northeast Extension
I-95 Connector
Pennsylvania
Pittsburgh
Appalachian Mountains
20
90
86
88
6
62
180
80
380
287
376
279
99
22
78
283
195
19
68
81
295
13
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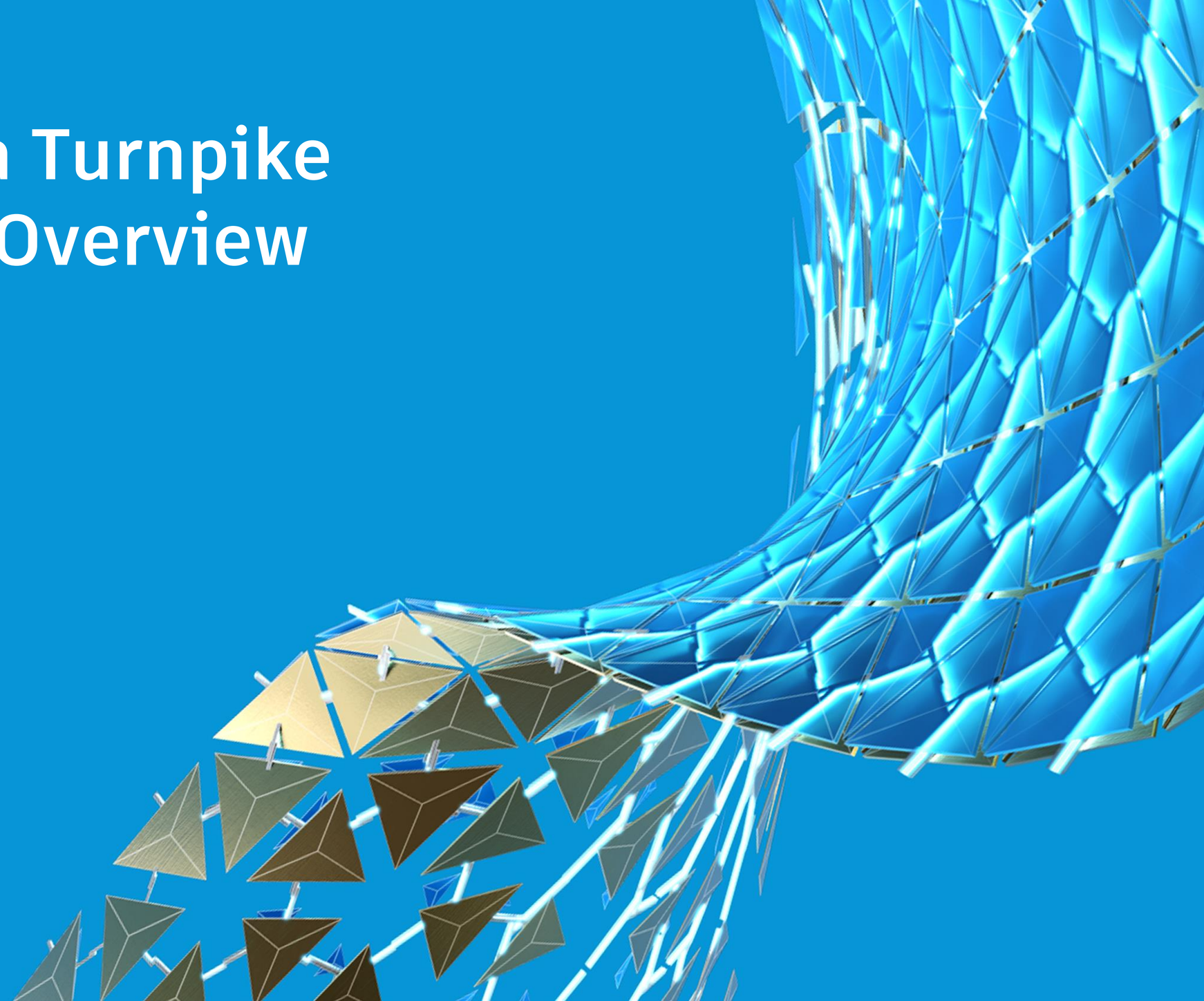
The PTC and Microdesk Partnership

- **Integrate organization standards**
- **Initiate the process of building intelligent 3D models**
- **Solutions included:**
  - Master files of all 550+ miles of highway
  - A cloud-based document management solution
  - Standards for project deliverables
  - Development of BIM models
- **Solutions provided a reduction in rework, easier access to data, and an integrated system between departments**

Pennsylvania Turnpike Commission Overview



OUR VISION

Driving the standard for safety, customer service and mobility.

OUR MISSION

To operate a safe, reliable, customer-valued toll road system that supports national mobility and commerce.

The Pennsylvania Turnpike Commission

What is PTC?

- **Brief History**
  - October 1, 1940 - "America's 1st Superhighway"
    - 2.4 million vehicles in first year opening
    - Average of 6,575 per day
  - October 1, 2020 – 80th Anniversary of Opening
    - 210.3 million vehicles per year (as of 2019)
    - Average of 576,284 vehicles per day
- **Major Projects at PTC**
  - Total Reconstruction Projects of Original System
  - Southern Beltway U.S. Route 22 to I-79
  - Mon-Fayette PA Route 51 to I-376
  - I-95 Interchange

PTC Facts and Numbers

553

MILES

553 Miles / 7 Routes

2,442 Total Lane Miles

75

FARE COLLECTION FACILITIES

75 Fare Collection Facilities Using E-ZPass and Toll By Plate

28

MAINTENANCE FACILITIES

23 Maintenance Buildings and 5 Tunnels

576,284

AVERAGE VEHICLES PER DAY

As of 2018, the Average Vehicles Per Fiscal Year is Greater than 210 Million

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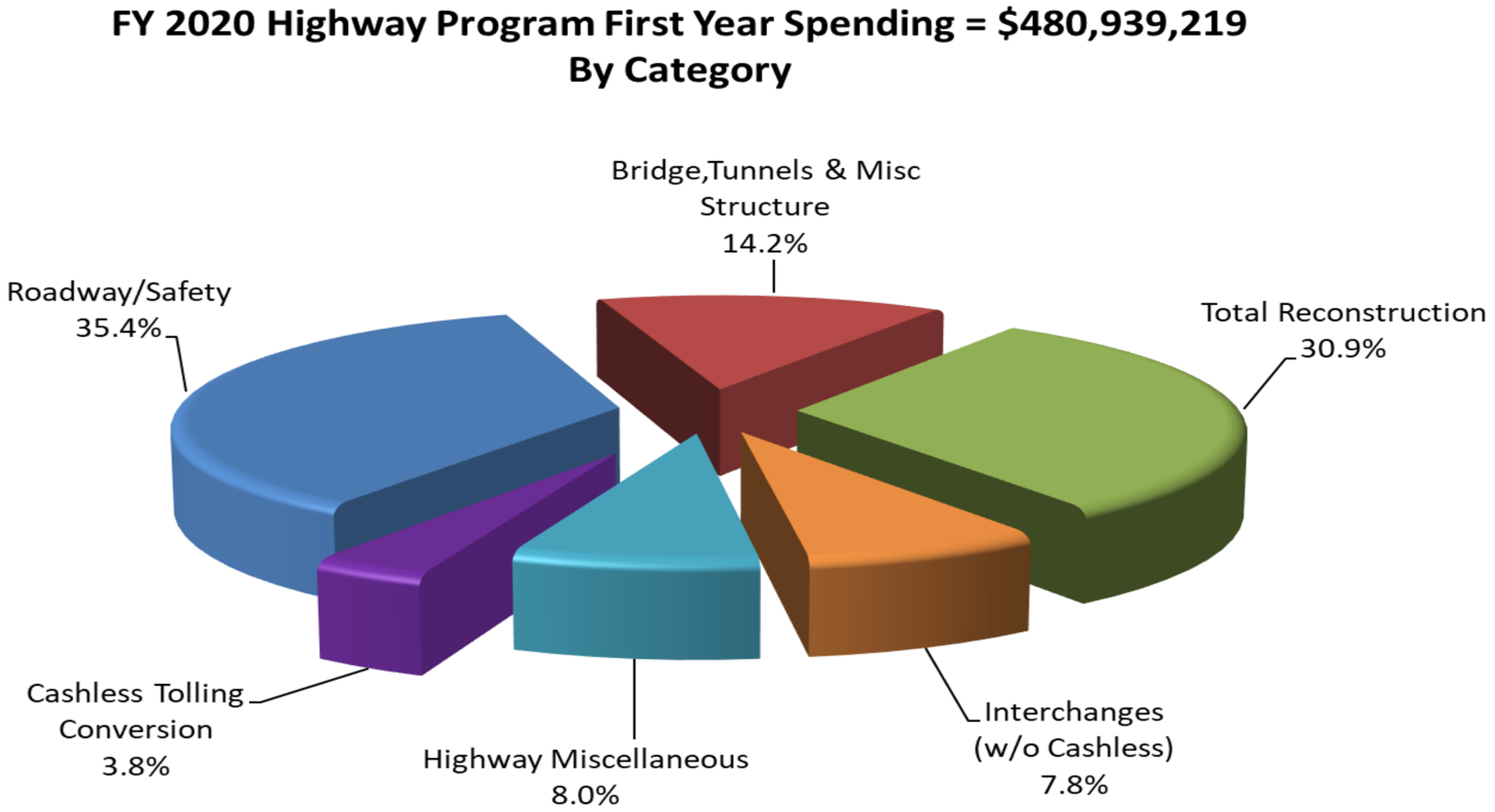
PTC Highway Program

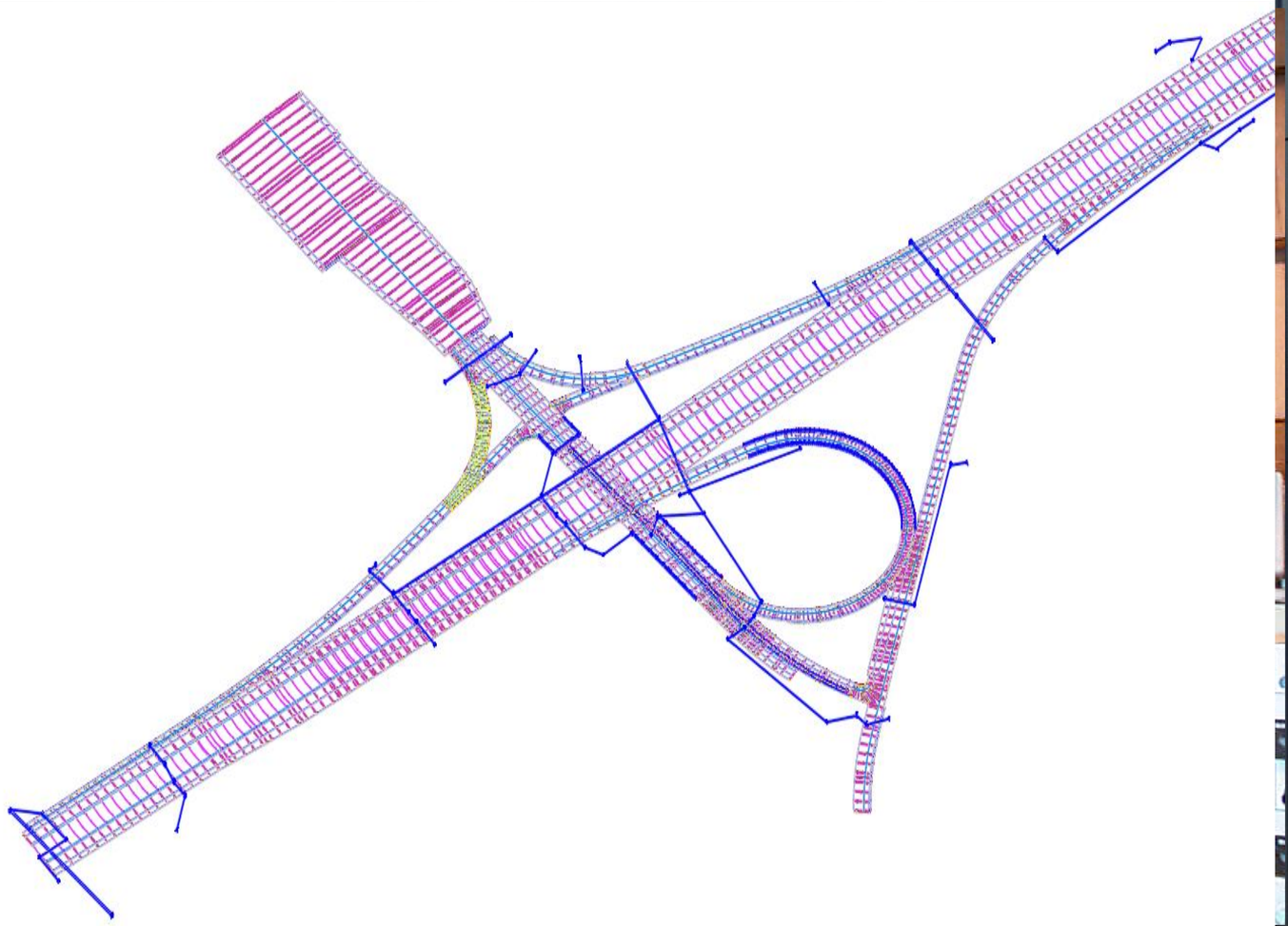


Harrisburg East Toll Plaza and Interchange

Susquehanna River Bridge Construction

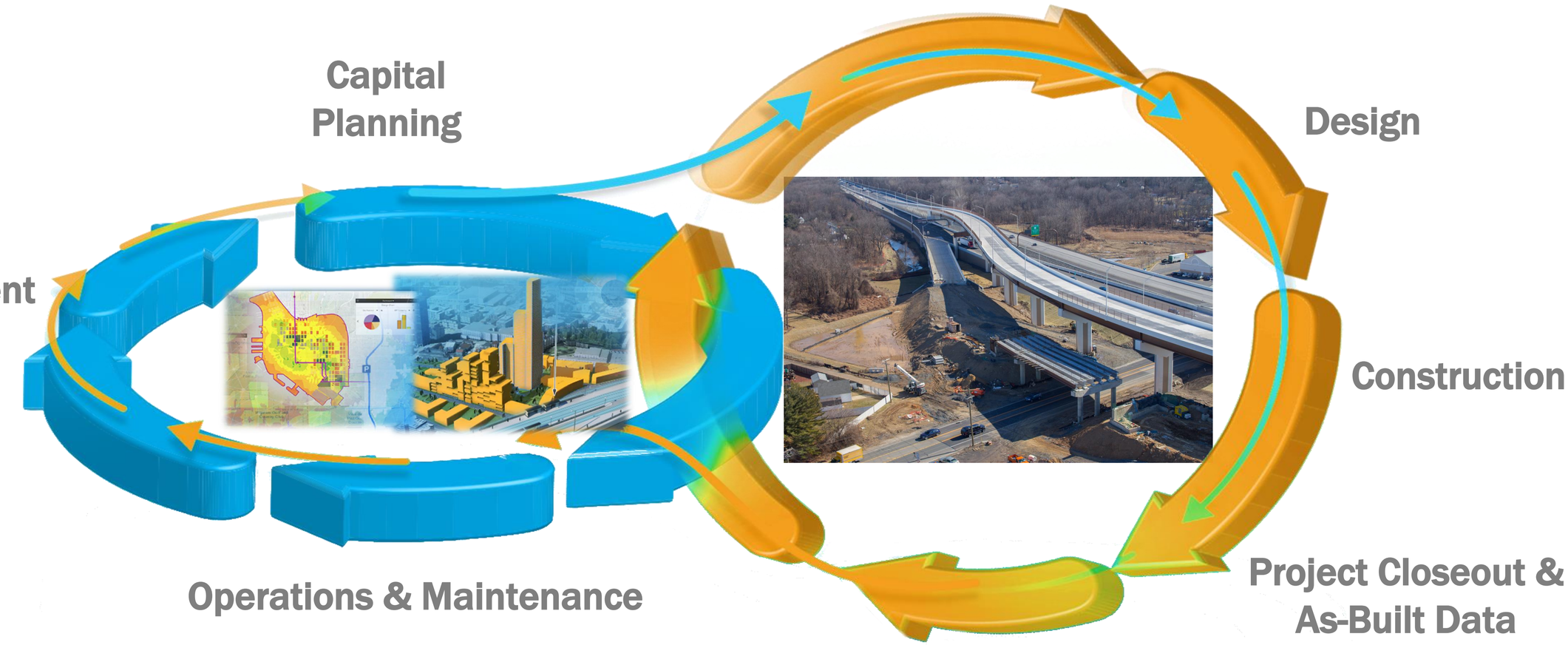
Challenges at PTC

- **Data Management Challenges**
  - 80 years of data done to standards that vary across generations and accuracy
  - No single cohesive view of the entire system
  - Reconciling accuracy differences from 1940 to 2020
- **Project Deliverable Variations and Challenges**
  - Variations in project deliverables and compliance
- **Other Challenges**
  - Creating intelligent models and integration with GIS
  - Creating a “Digital Twin”
  - Collaborating with CAD/Model data vs. pdf plans
  - As-Builts



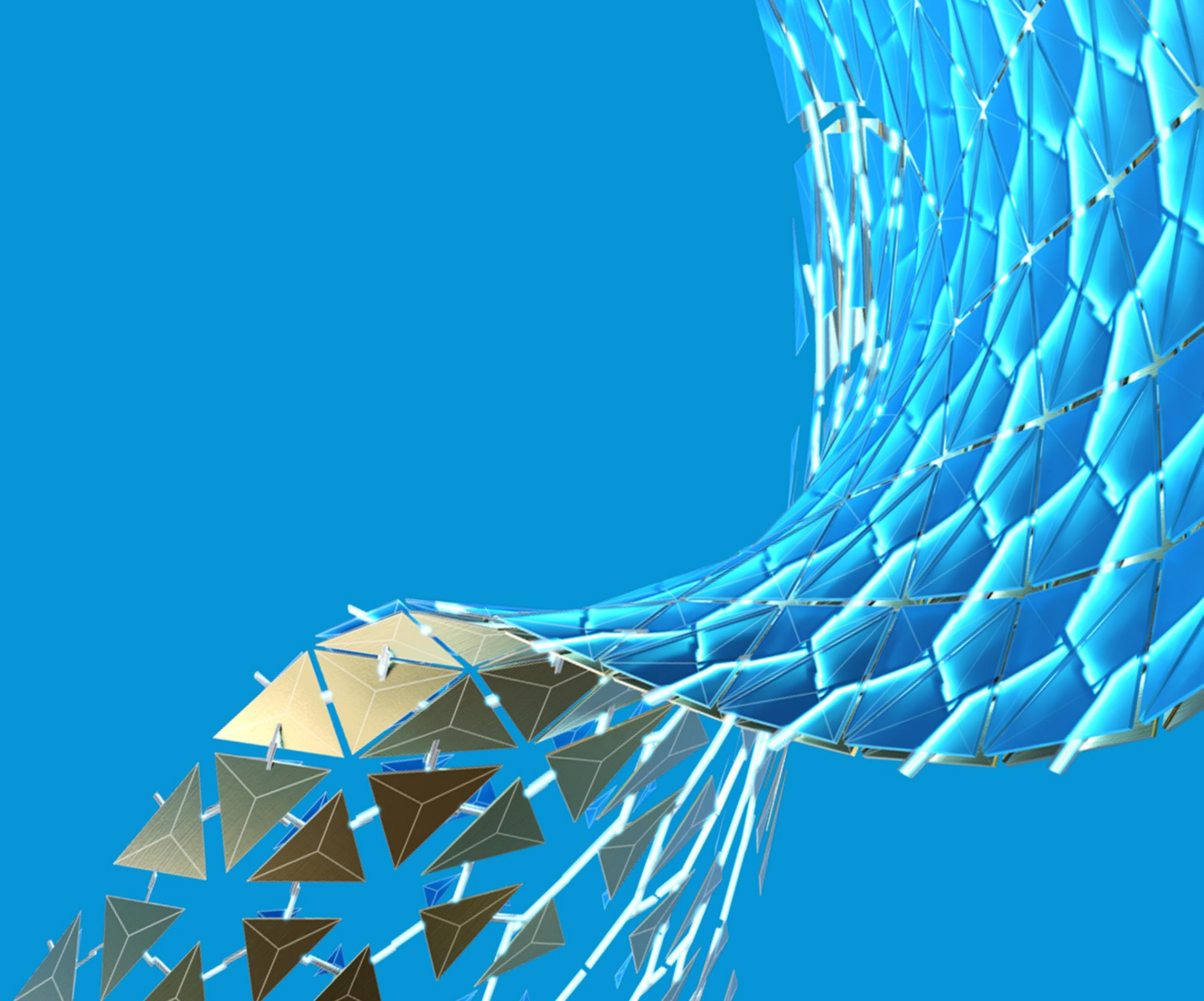
Infrastructure Modeling and Data Management

The Road to Digital Delivery

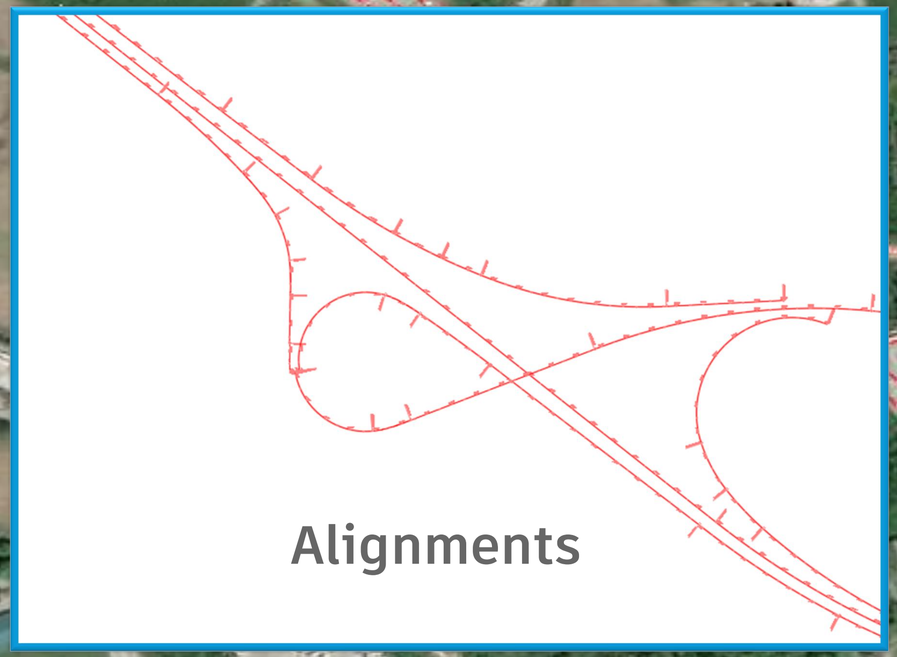


Capital Portfolios **Capital Projects**

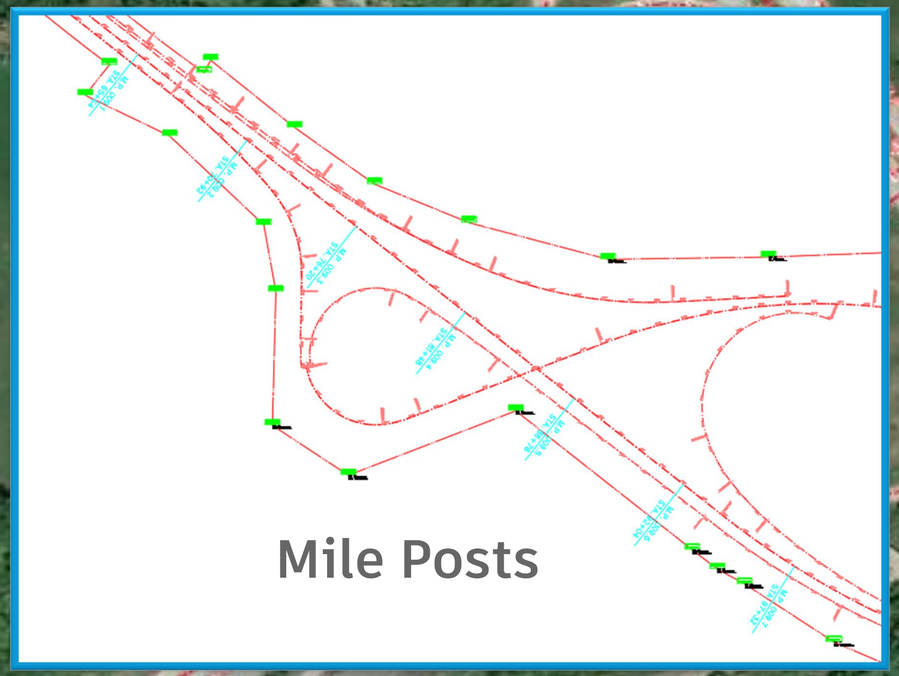
Solutions



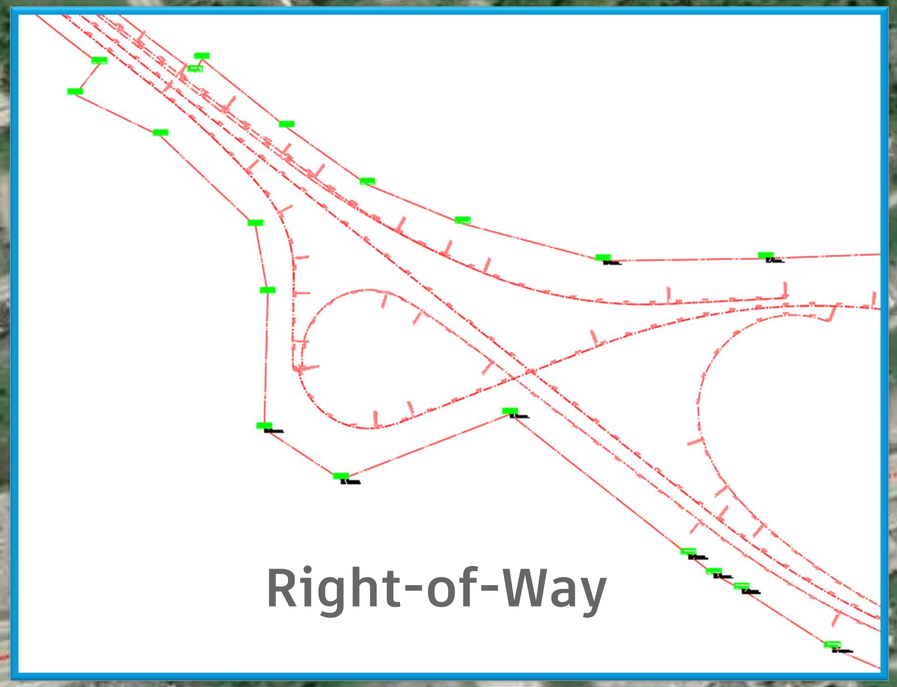
Master LRS and ROW Drawings in Civil 3D



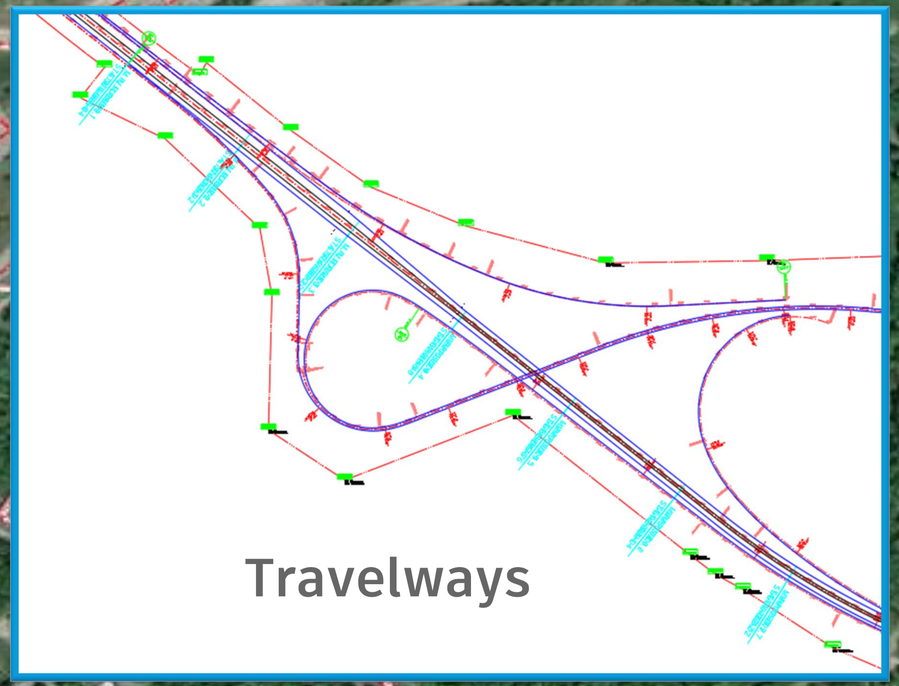
Alignments



Mile Posts



Right-of-Way



Travelways

Master LRS and ROW Statistics

1,671

ALIGNMENTS

Total Alignments Including

92 Primary

1,008 Secondary

272 State Roads

299 Access/Maintenance

6,507,493

LINEAR FEET OF RIGHT-OF-WAY

Total Linear Feet of Right-of-Way Linework

14,776

MILEPOST LABELS

Includes 11,327 Primary and 3,449 Secondary Mileposts

1,419

MILES OF TRAVELWAY

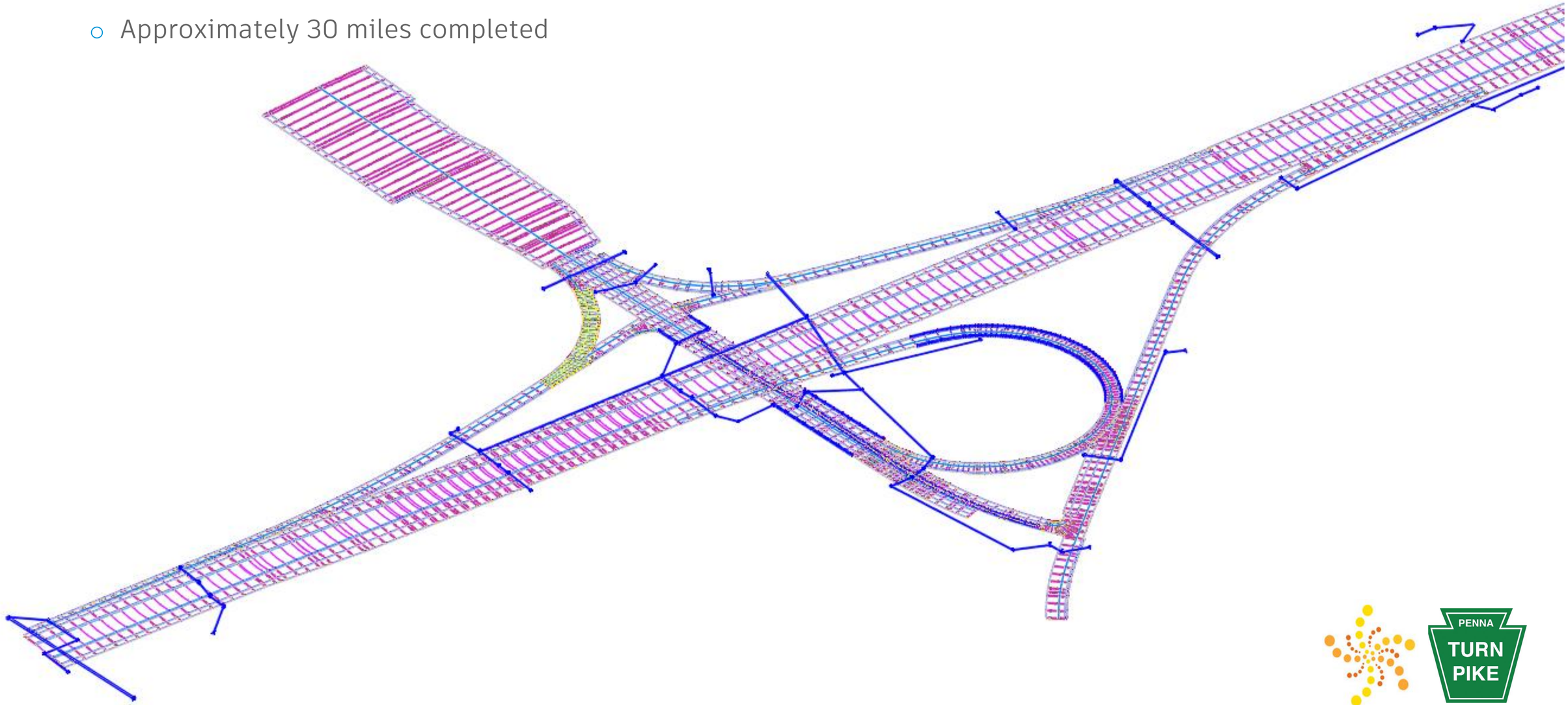
Includes 1,128 Miles of Primary and 291 Miles of Secondary Travelway

Pavement Linework

- **LiDAR Scanning**
  - Process and Convert
    - 5.1 TB of Data
  - Import into Civil 3D
  - Draw Linework
    - Edge of Median
    - Edge of Shoulder
    - Edge of Pavement

BIM/3D Models

- **BIM/3D Models or Roadways and Drainage Networks in Civil 3D**
  - Approximately 30 miles completed



Harrisburg East Interchange

New Castle Interchange (MP 10)

Ramp Name	Station	Alignment Station	ML Station based on Alignment Sta		ML Station		Linear Feet	No. of Lanes	Lane Miles	Notes
Ramp I										**Calculations are on Beaver Valley Exit 26**
Ramp I Spur										**Calculations are on Beaver Valley Exit 27**
T10_RAMP_J	1217+11.50	13+39.89	1217+11.50				200.00	0.5	**0.02**	NB Decel. Taper
NB DECEL to ML	1219+11.50	15+40.25	1219+11.50				700.00	1.0	**0.13**	NB Decel.
			BVE STA 1226+11.50 =							
	22+40.25	22+40.25	1226+11.50				1695.15	1.0	**0.32**	NB Decel.
			Ramp J STA 39+35.40 = Ramp O STA 68+48.50							
Ramp K										**Calculations are on Beaver Valley Exit 27**
T10_RAMP_K_SPUR			**Ramp K STA 9+72.37 = Ramp K Spur STA 9+72.37**							
	9+72.37	9+72.37			8+72.37	8+72.37	100.00	0.5	**0.01**	SB Decel. Spur Taper (Assumed)
	8+72.37	8+72.37			5+69.88	5+69.88	302.49	1.0	**0.06**	SB Decel. Spur
			Ramp K Spur STA 5+69.88 = Ra			**STA 59+95.12**				
	59+95.12	5+69.88	59+95.12		55+50.00	1+24.76	50.00	445.12	1.0	**0.08**
	55+50.00	1+24.76	55+50.00		54+25.34	0+00.00	.34	124.66	1.0	**0.02**
			Ramp K SPUR STA 0+00.00 = Ramp K			**STA 50+00.00**				
	55+50.00	50+00.00	54+25.34		52+50.00	48+24.52	52+	300.00	0.5	**0.03** Taper
Ramp L										**Calculations are on Beaver Valley Exit 27**
T10_RAMP_**M**	113+05.58	19+14.49	113+05.58	to	111+05.58	21+14.85	111+05.58	200.00	0.5	**0.02** WB Decel. Taper
WB DECEL	111+05.58	21+14.85	111+05.58	to	104+05.58	28+06.41	104+05.58	700.00	1.0	**0.13** WB Decel.
			ML STA 104+05.58 = Ramp M STA 28+06.41							
	28+06.41	28+06.41		to	47+14.06			1907.65	1.0	**0.36** WB Decel.
			Ramp N STA 47+14.06 = Ramp O STA 47+14.06							
T10_RAMP_N					**TA 17+98.10**					Add/Drop
EB DECEL	17+98.10				26+84.01				**17**	EB Decel.
					STA 26+84.01					
	26+84.01				47				**38**	Dual Ramp
	47+14.06				49				**18**	Dual Ramp Taper From 2 lanes to 6
	49+56.75				55+92.42				**72**	
	55+92.42				59+59.44				**28**	Dual Ramp Taper From 6 lanes to 2
	59+59.44				73+33.28				**26**	Intersection with Ramp L
T10_RAMP_N_SPUR	71+62.75			to	72+25.76				**0.01**	
EB DECEL to RMP L	72+25.76			to				314.36	1.0	**0.06** Length Calculated from CADD

Intelligent Civil 3D Data

GIS Systems

Pavement Asset Management Systems

GIS and Pavement Asset Management Systems

Data with intelligence used to feed GIS and Pavement Asset Management

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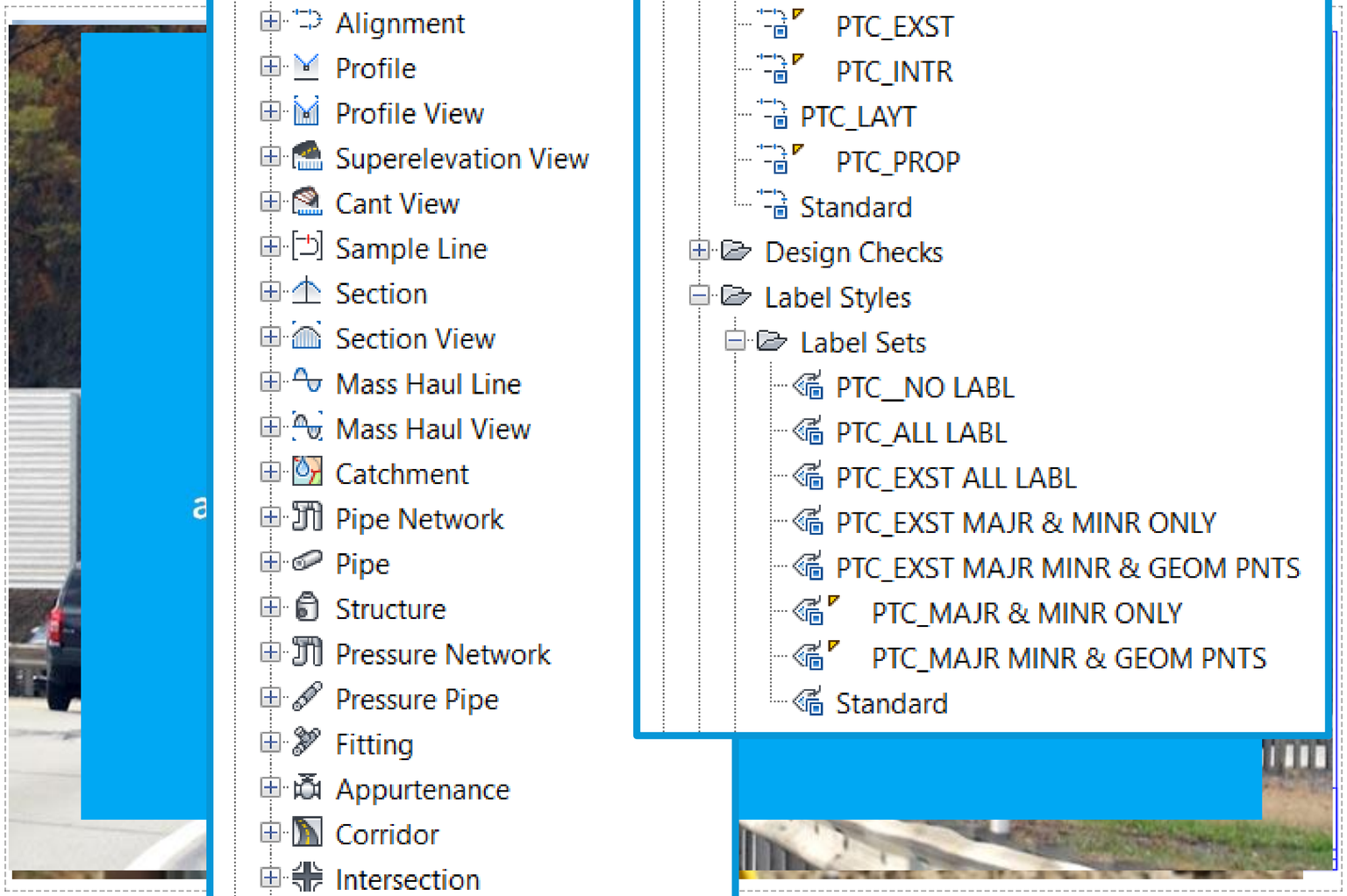
Engineering Technology Standards Development

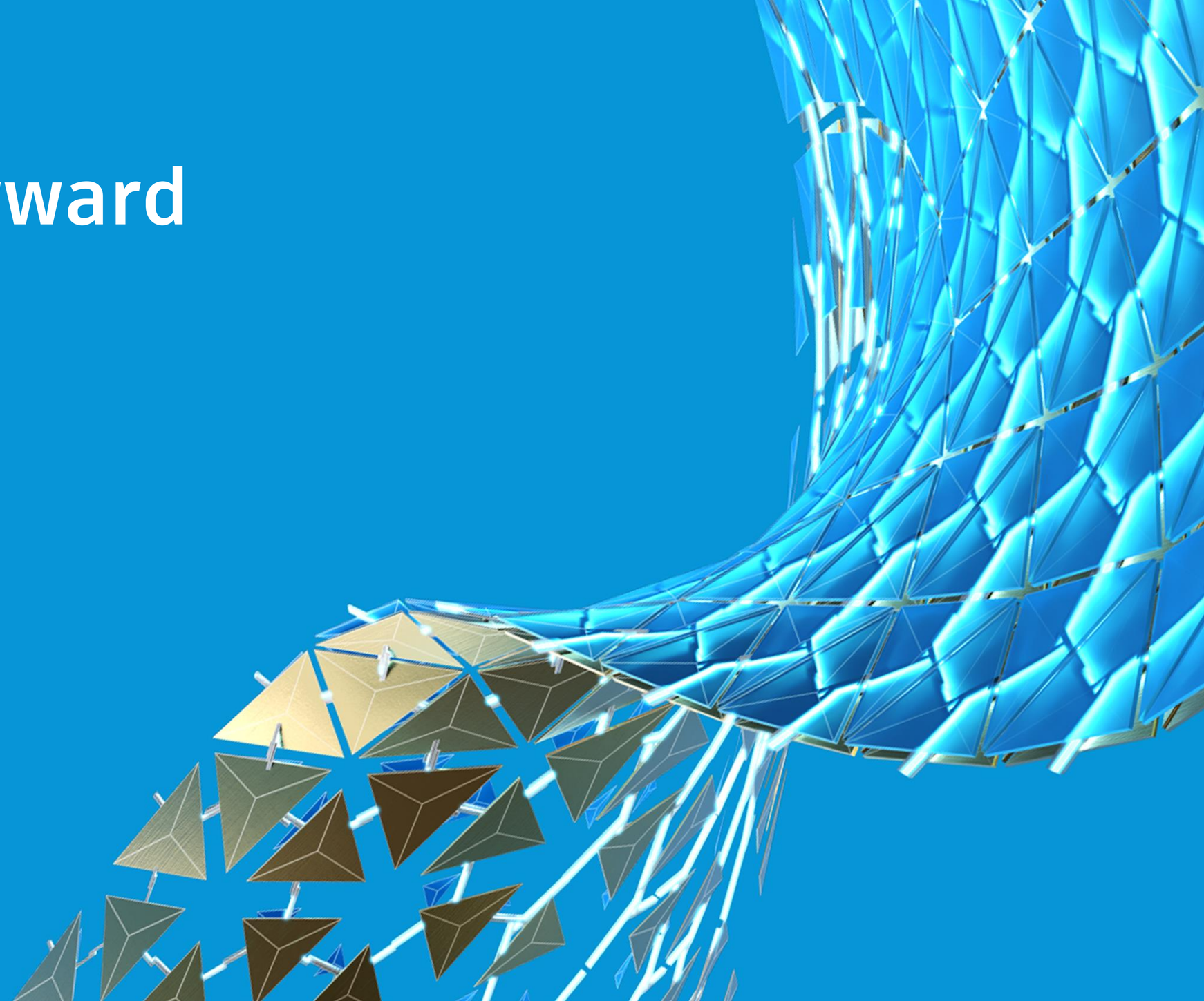
- Documentation
- AutoCAD and Civil 3D Templates
- Bentley MicroStation and OpenRoads Templates
- Sheet Templates
- Compliance Checking

Future Standards Development

- Survey and As-Built Standards
- BIM/3D Modeling Standards



Looking Forward



Do More
Do Better
With Less

Inspired by Autodesk CEO Andrew Anagnost

Autodesk University November 2017

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Digital Delivery by 2023

- **3D Intelligent Model is the primary source document**
  - All information extracted from 3D Models
- **3D Model Benefits**
  - Better visualization
  - Reduce project errors
  - Reduce project costs
  - Provide more information with greater accuracy
  - Stronger communication
  - Future planning
  - And many more!

3D Model Development of Entire Turnpike

PENNA TURN PIKE

Compilation and Organization of Data
File Management

**"I am not disorganized — I know *exactly* where everything is!
The newer stuff is on top and the older stuff is on the bottom."**

Project Evolution

2015-2017

INITIAL RESEARCH

- Review Current PTC Workflows & Research Technology Solutions
- CAD Standard Document
- C3D Master Centerline Alignment Files

2017-2019

C3D INTEROPERABILITY

- C3D Master Right-of-Way Files
- CAD Linear Reference System
- GIS Integration
- GIS Workflow Interoperability between multiple stakeholders

2019-2021

BIM MODEL DEVELOPMENT

- LiDAR Scans & C3D Master Pavement Data
- Development of Corridor and Drainage Models
- BIM Technology Standards & Compliance Checking
- Research & Workflow of Data File Management System

2021-2023

DIGITAL DELIVERY

- Continue development of Corridor and Drainage Models
- Integration of Data File Management System
- Develop efficient digital review procedures
- Project Pilot and Review
- Implementation of Digital Delivery

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Future of the PTC and Microdesk Partnership

Valley Forge Interchange 1954

Valley Forge Interchange 2015

Pennsylvania Turnpike Commission

LEADING FUTURE HIGHWAY DESIGN

PTC Bridge Demolition