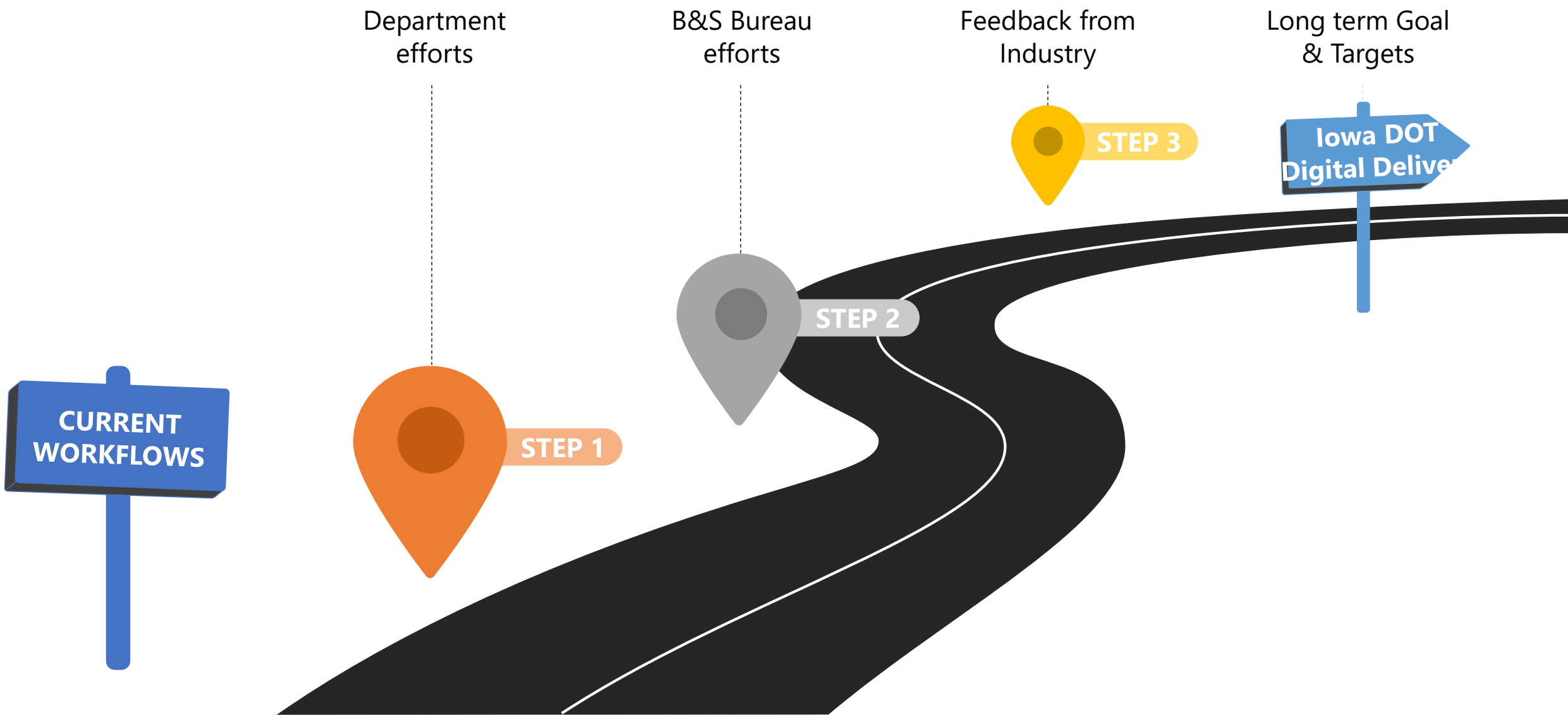
2023 Forum on 3D Design and Digital Delivery for Bridges

Iowa DOT Update

Iowa DOT Progress on Digital Delivery

This is a sample text. Insert your desired text here.



Department Progress

Digital Delivery committee

There is a team identifying process improvement steps related to CAD design, and hand offs of data to contractors and construction staff.

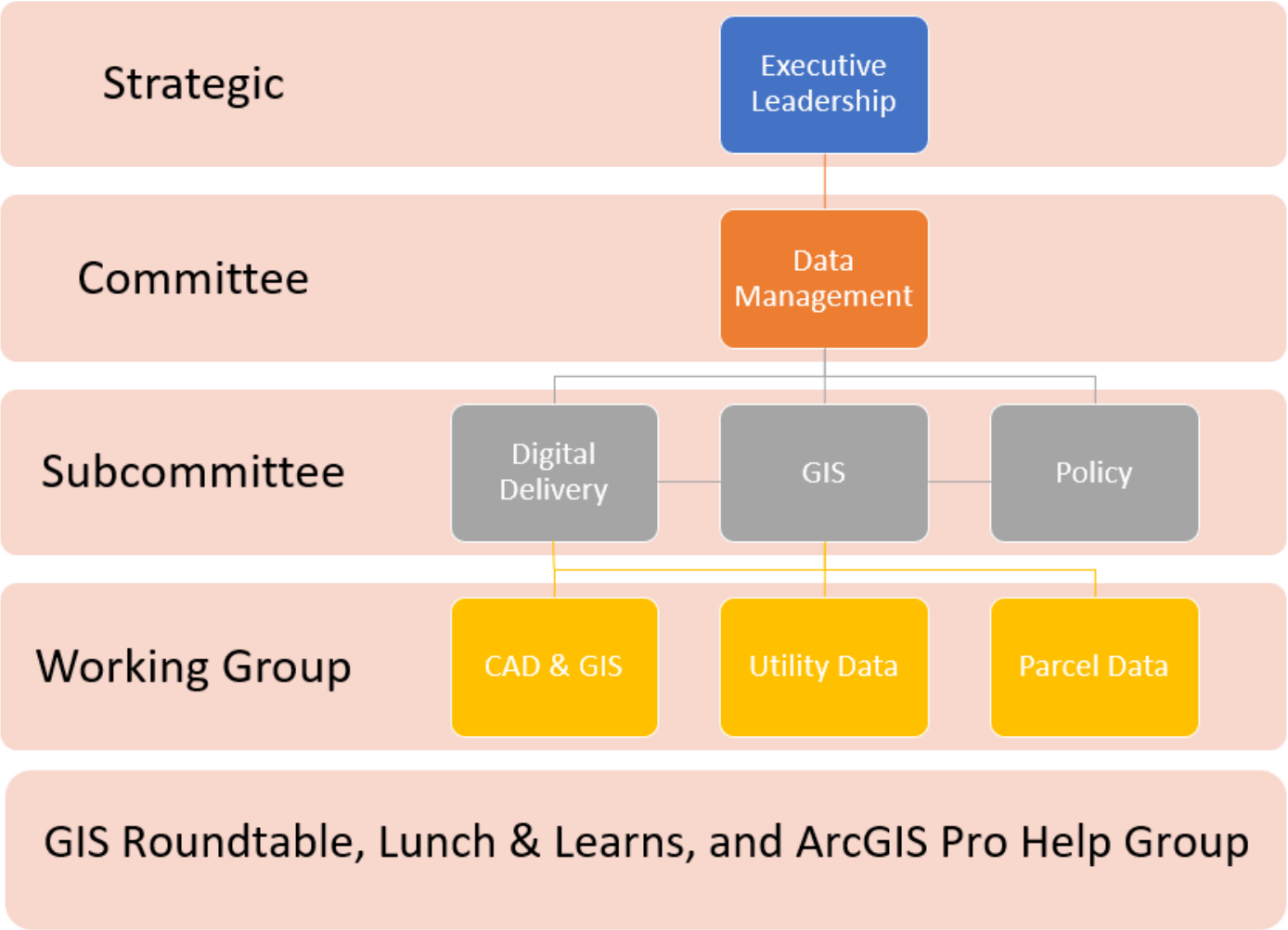
Focus on standardization across offices and process improvement – Projectwise, ORD Feature Elements, etc.

Federal Grants – Looking at innovative technology use

Everyone at the DOT doing Design work will be affected, and we will be looking for feedback from teams along the way

Slow rollout with hybrid approach.

Internal Engagement



AID Grant award

- Applied in 2021 – Received notice during 2023 ADCMS grant prep
- Key objectives for $1.2 million funding include:
- Prepare a detailed digital delivery implementation and deployment plan
- Improve asset management by integration of information beyond digital as-builts and geospatial information
- Deploy and document processes to pilot use cases for digital delivery (digital as-builts, data life-cycle workflows, asset management support)
- Conduct internal and external stakeholder engagement and outreach (throughout steps above)

ADCMS Grant

Applied for the FY 2022/2023 grant

Task One – Business Data Management Solutions (update/create technology/data system architecture diagrams, infographic, standards/requirements/data modeling, roles/responsibilities/data literacy)

Task Two – CAD to GIS Modeling Strategy – Focus on CAD standards/configuration, data handoffs (tools, tech, etc) from Design to Construction to Operations to Asset Management to Design (1-3 assets)

Task Three – Project Design Delivery Solutions – Focus on open source solutions for bridge design and deliverables

ADCMS Grant – Bridge Specific Task 3

Task 3.1 - Configure the modeling software to include pay items attributes (through Bentley CONNECT Item Types) that will enable the automation of quantity takeoffs.

Task 3.2 - Coordinate with software vendors and the BIM for Bridges and Structures Pooled Fund to resolve any issues that may arise related to the IFC export process and using the data dictionary.

Task 3.3 - Use the BIM for Bridges and Structures Information Delivery Specification (IDS) to validate IFC files.

Task 3.4 - Document workflows for IFC export and IDS validation, develop and provide training. Document gaps regarding the limits of the current IFC 4.3 standard and any additional data delivery needs to be addressed.

Task 3.5 - Plan, prepare content and facilitate a two-day “Open Standards: Seeing is Believing” peer exchange.

Task 3.6 - Work with stakeholders (i.e., contractors, fabricators, construction software developers) to develop of process for preparing bids using digital data.

Bridges & Strucutures Bureau Progress

Iowa DOT Progress

- Continuation of 3D model design for plan production
  - Working through software complications with designers
  - Testing out plan sheets produced from models looking different
  - Extracting digital information from the model.
- CADD Standards updated for 3D delivery (December 2023)
  - Rebar levels structured around inspection/construction
  - Metadata on elements enhanced to provide more information

3D model pilots for 2023 & 2024

County: Story 223 – HNTB (later presentation)

Project No: IM-035-4(284)103—13-85

Location: At IA 210 Interchange

Letting: 12/19/2023

County: Henry 225 – Consultant Design

Project No: BRFN-218-2(155)—39-44

Location: North Fish Creek 1.1 mi N of Co Rd J20 (NB)

Letting: 07/16/2024

County: Fremont – DOT Final Design

Project No: BRF-002-1(118)—38-36

Location: Stream 3.9 mi E of I-29

Letting: 10/15/2024

County: Wapello 123 – Consultant Design

Project No: BRF-034-7(148)—38-90

Location: South Avery Creek 0.7 mi E of Co Rd T61

Letting: 10/15/2024

Progress from pilots

- Rebar quantities from model
- Schedule created from Model
- Bending information created from model
- Deck Elevations from model.

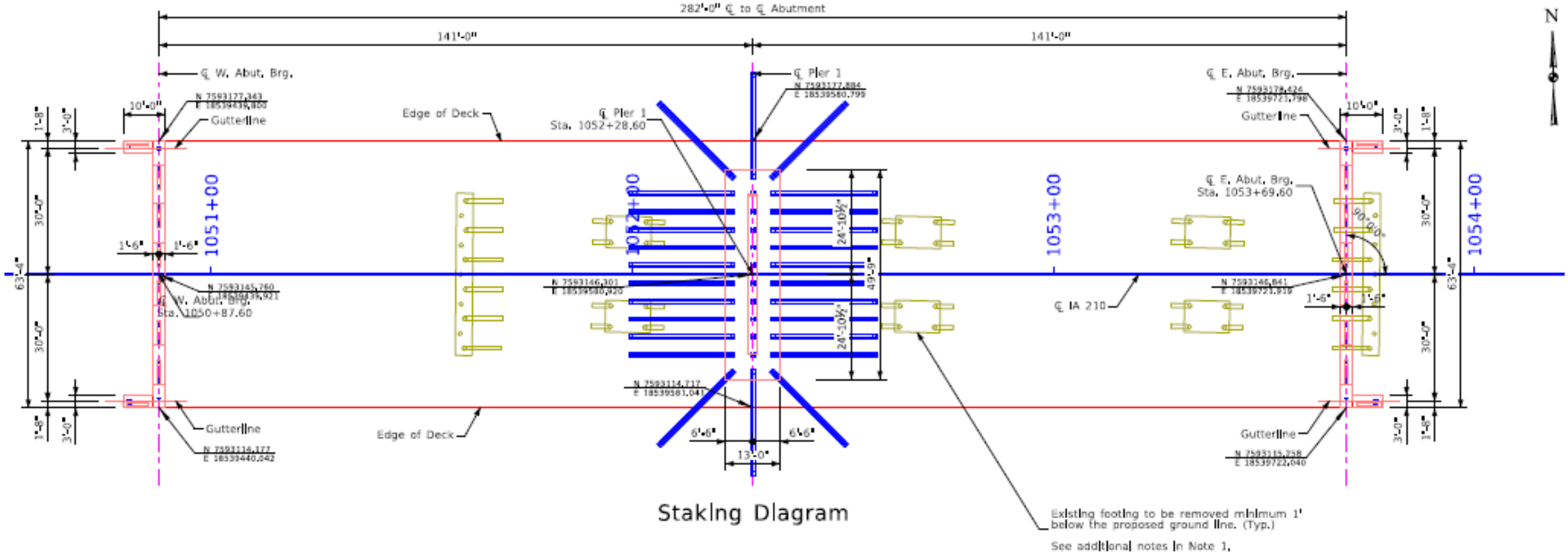
Augmented Reality Piloting

- Acquired AR equipment in late September.
- Field testing in 2024 to determine ROI.
- Anticipated benefits:
  - Quick check of rebar placement
  - Check of subsurface items against anticipated locations.
  - Spot location checks of construction operations.

Deliverables Feed Back

Mentimeter

Testing New Idea



Traditional Table Information

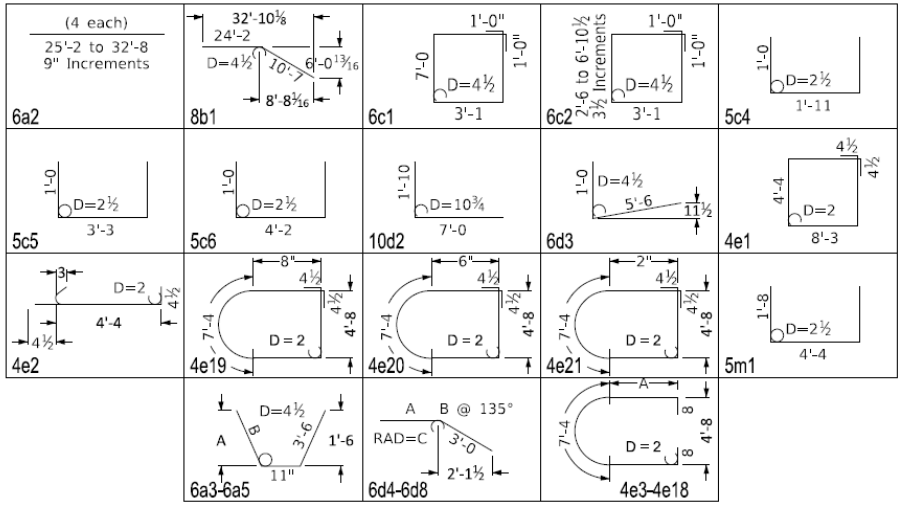
BRIDGE COORDINATES			
Location	W. Abut. Brg.	℄ Pier 1	E. Abut. Brg.
North Edge Of Deck	E=7561677.28 N=18539705.24	E=7561676.79 N=18539851.24	E=7561676.29 N=18540002.24
℄ Approach Roadway	E=7561645.70 N=18539705.14	E=7561645.21 N=18539851.14	E=7561644.70 N=18540002.13
South Edge Of Deck	E=7561614.11 N=18539705.03	E=7561613.63 N=18539851.03	E=7561613.12 N=18540002.03

Note: An electronic file containing the bridge coordinate data is available as part of the e-files supplied with the contract documents. The contractor shall verify these coordinates with the project horizontal control information provided in the road plans.

Traditional Bending Details

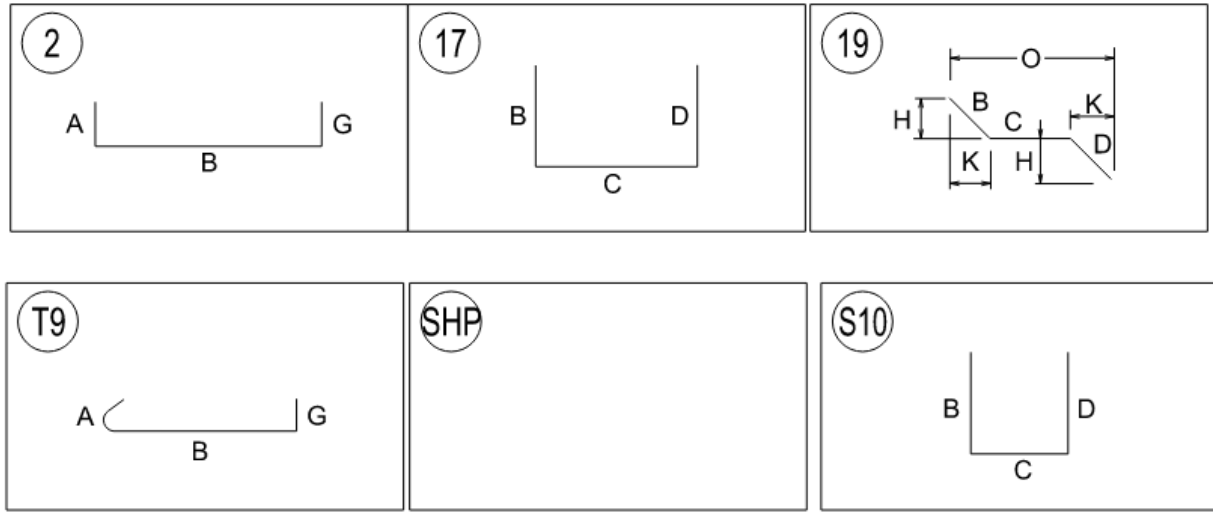
Reinforcing Bar List - Pier

Bar	Location	Shape	No.	Length	Weight
10a1	Cap, Longitudinal, Top		32	35'-1	4,831
6a2	Cap, Longitudinal, Sides		44	Varies	1,912
6a3	Cap, Ends, Top		4	5'-11"	36
6a4	Cap, Ends, Top		4	6'-6"	39
6a5	Cap, Ends, Top		2	6'-8"	20
8b1	Cap, Longitudinal, Bottom		8	34'-9"	743
6c1	Cap, Hoops		106	22'-2"	3,530
6c2	Cap, Hoops, Cantilever (Series)		64	Varies	1,696

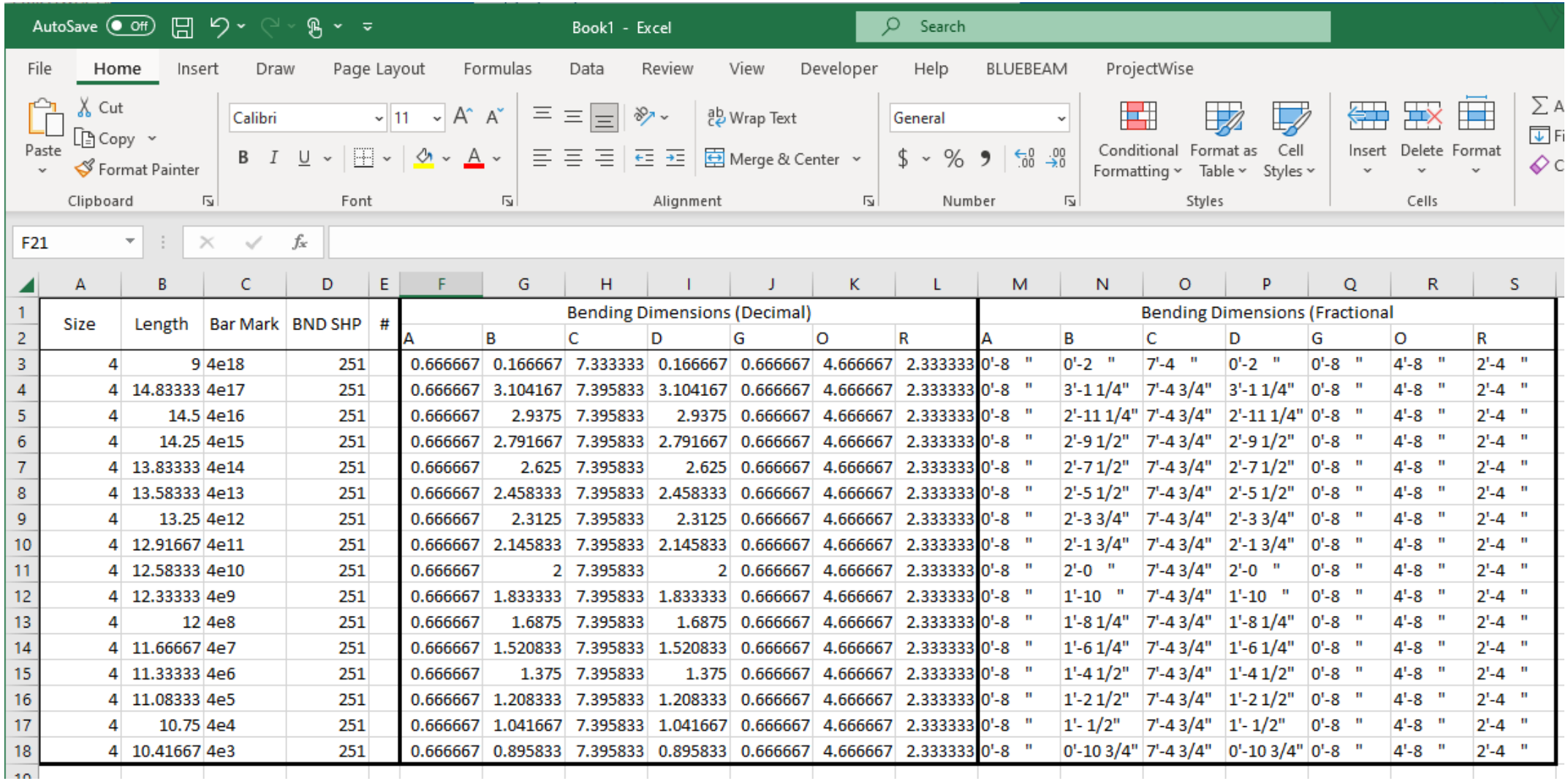


Proposed Bending Details

SIZE	LGTH	BAR MARK	BND SHP	#	Bending Dimensions A	B	C	D	G	O	R
4	9'-0"	4e18	251		0'-8"	0'-2"	7'-4"	0'-2"	0'-8"	4'-8"	2'-4"
4	14'-10"	4e17	251		0'-8"	3'-1¼"	7'-4¾"	3'-1¼"	0'-8"	4'-8"	2'-4"
4	14'-6"	4e16	251		0'-8"	2'-11¼"	7'-4¾"	2'-11¼"	0'-8"	4'-8"	2'-4"
4	14'-3"	4e15	251		0'-8"	2'-9½"	7'-4¾"	2'-9½"	0'-8"	4'-8"	2'-4"
4	13'-10"	4e14	251		0'-8"	2'-7½"	7'-4¾"	2'-7½"	0'-8"	4'-8"	2'-4"
4	13'-7"	4e13	251		0'-8"	2'-5½"	7'-4¾"	2'-5½"	0'-8"	4'-8"	2'-4"
4	13'-3"	4e12	251		0'-8"	2'-3¾"	7'-4¾"	2'-3¾"	0'-8"	4'-8"	2'-4"
4	12'-11"	4e11	251		0'-8"	2'-1¾"	7'-4¾"	2'-1¾"	0'-8"	4'-8"	2'-4"
4	12'-7"	4e10	251		0'-8"	2'-0"	7'-4¾"	2'-0"	0'-8"	4'-8"	2'-4"
4	12'-4"	4e9	251		0'-8"	1'-10"	7'-4¾"	1'-10"	0'-8"	4'-8"	2'-4"
4	12'-0"	4e8	251		0'-8"	1'-8¼"	7'-4¾"	1'-8¼"	0'-8"	4'-8"	2'-4"
4	11'-8"	4e7	251		0'-8"	1'-6¼"	7'-4¾"	1'-6¼"	0'-8"	4'-8"	2'-4"
4	11'-4"	4e6	251		0'-8"	1'-4½"	7'-4¾"	1'-4½"	0'-8"	4'-8"	2'-4"
4	11'-1"	4e5	251		0'-8"	1'-2½"	7'-4¾"	1'-2½"	0'-8"	4'-8"	2'-4"
4	10'-9"	4e4	251		0'-8"	1'-0½"	7'-4¾"	1'-0½"	0'-8"	4'-8"	2'-4"
4	10'-5"	4e3	251		0'-8"	0'-10¾"	7'-4¾"	0'-10¾"	0'-8"	4'-8"	2'-4"



Digital Bending Details



Size	Length	Bar Mark	BND SHP	#	Bending Dimensions (Decimal)							Bending Dimensions (Fractional						
					A	B	C	D	G	O	R	A	B	C	D	G	O	R
4	9	4e18	251		0.666667	0.166667	7.333333	0.166667	0.666667	4.666667	2.333333	0'-8 "	0'-2 "	7'-4 "	0'-2 "	0'-8 "	4'-8 "	2'-4 "
4	14.83333	4e17	251		0.666667	3.104167	7.395833	3.104167	0.666667	4.666667	2.333333	0'-8 "	3'-1 1/4"	7'-4 3/4"	3'-1 1/4"	0'-8 "	4'-8 "	2'-4 "
4	14.5	4e16	251		0.666667	2.9375	7.395833	2.9375	0.666667	4.666667	2.333333	0'-8 "	2'-11 1/4"	7'-4 3/4"	2'-11 1/4"	0'-8 "	4'-8 "	2'-4 "
4	14.25	4e15	251		0.666667	2.791667	7.395833	2.791667	0.666667	4.666667	2.333333	0'-8 "	2'-9 1/2"	7'-4 3/4"	2'-9 1/2"	0'-8 "	4'-8 "	2'-4 "
4	13.83333	4e14	251		0.666667	2.625	7.395833	2.625	0.666667	4.666667	2.333333	0'-8 "	2'-7 1/2"	7'-4 3/4"	2'-7 1/2"	0'-8 "	4'-8 "	2'-4 "
4	13.58333	4e13	251		0.666667	2.458333	7.395833	2.458333	0.666667	4.666667	2.333333	0'-8 "	2'-5 1/2"	7'-4 3/4"	2'-5 1/2"	0'-8 "	4'-8 "	2'-4 "
4	13.25	4e12	251		0.666667	2.3125	7.395833	2.3125	0.666667	4.666667	2.333333	0'-8 "	2'-3 3/4"	7'-4 3/4"	2'-3 3/4"	0'-8 "	4'-8 "	2'-4 "
4	12.91667	4e11	251		0.666667	2.145833	7.395833	2.145833	0.666667	4.666667	2.333333	0'-8 "	2'-1 3/4"	7'-4 3/4"	2'-1 3/4"	0'-8 "	4'-8 "	2'-4 "
4	12.58333	4e10	251		0.666667	2	7.395833	2	0.666667	4.666667	2.333333	0'-8 "	2'-0 "	7'-4 3/4"	2'-0 "	0'-8 "	4'-8 "	2'-4 "
4	12.33333	4e9	251		0.666667	1.833333	7.395833	1.833333	0.666667	4.666667	2.333333	0'-8 "	1'-10 "	7'-4 3/4"	1'-10 "	0'-8 "	4'-8 "	2'-4 "
4	12	4e8	251		0.666667	1.6875	7.395833	1.6875	0.666667	4.666667	2.333333	0'-8 "	1'-8 1/4"	7'-4 3/4"	1'-8 1/4"	0'-8 "	4'-8 "	2'-4 "
4	11.66667	4e7	251		0.666667	1.520833	7.395833	1.520833	0.666667	4.666667	2.333333	0'-8 "	1'-6 1/4"	7'-4 3/4"	1'-6 1/4"	0'-8 "	4'-8 "	2'-4 "
4	11.33333	4e6	251		0.666667	1.375	7.395833	1.375	0.666667	4.666667	2.333333	0'-8 "	1'-4 1/2"	7'-4 3/4"	1'-4 1/2"	0'-8 "	4'-8 "	2'-4 "
4	11.08333	4e5	251		0.666667	1.208333	7.395833	1.208333	0.666667	4.666667	2.333333	0'-8 "	1'-2 1/2"	7'-4 3/4"	1'-2 1/2"	0'-8 "	4'-8 "	2'-4 "
4	10.75	4e4	251		0.666667	1.041667	7.395833	1.041667	0.666667	4.666667	2.333333	0'-8 "	1'- 1/2"	7'-4 3/4"	1'- 1/2"	0'-8 "	4'-8 "	2'-4 "
4	10.41667	4e3	251		0.666667	0.895833	7.395833	0.895833	0.666667	4.666667	2.333333	0'-8 "	0'-10 3/4"	7'-4 3/4"	0'-10 3/4"	0'-8 "	4'-8 "	2'-4 "

Spring “Field” Demonstration

- Demonstration of Digital Delivery data set on a fictious bridge on DOT Campus
- Bridge digital delivery hands on experience.
- Augmented Reality hands-on experience.
- Time and Date to be determined.

Iowa DOT Long Term Goals

Current goals

- Continue to build on 3D modeling details one project at a time to as we build confidence in the new workflow/format to create a single source of truth for bridge project delivery.
- Work with industry partners to build confidence in models and the benefits of digital information.
- Develop long term strategy for down stream users of design data to ensure information is readily accessible/available when needed.
- Break free from the “how we’ve always done it” mentality.

Iowa Timeline

2018
First MALD Bridge Project (I-80/380)

2022
First Connect software pilot model (Bridge + Pier Rebar)

2023
Continuation in piloting 3D Bridge, Rebar Modeled for Pier & Abutments

2024
Field testing of AR equipment for inspection for ROI

2026
IFC MALD deliverable project along side traditional delivery

2027
Digital Twin of structure with As-built metadata added to model

2030
Target for Full standards of 3D modeling & digital delivery

Iowa DOT Bridge BIM Roadmap

1-year goals

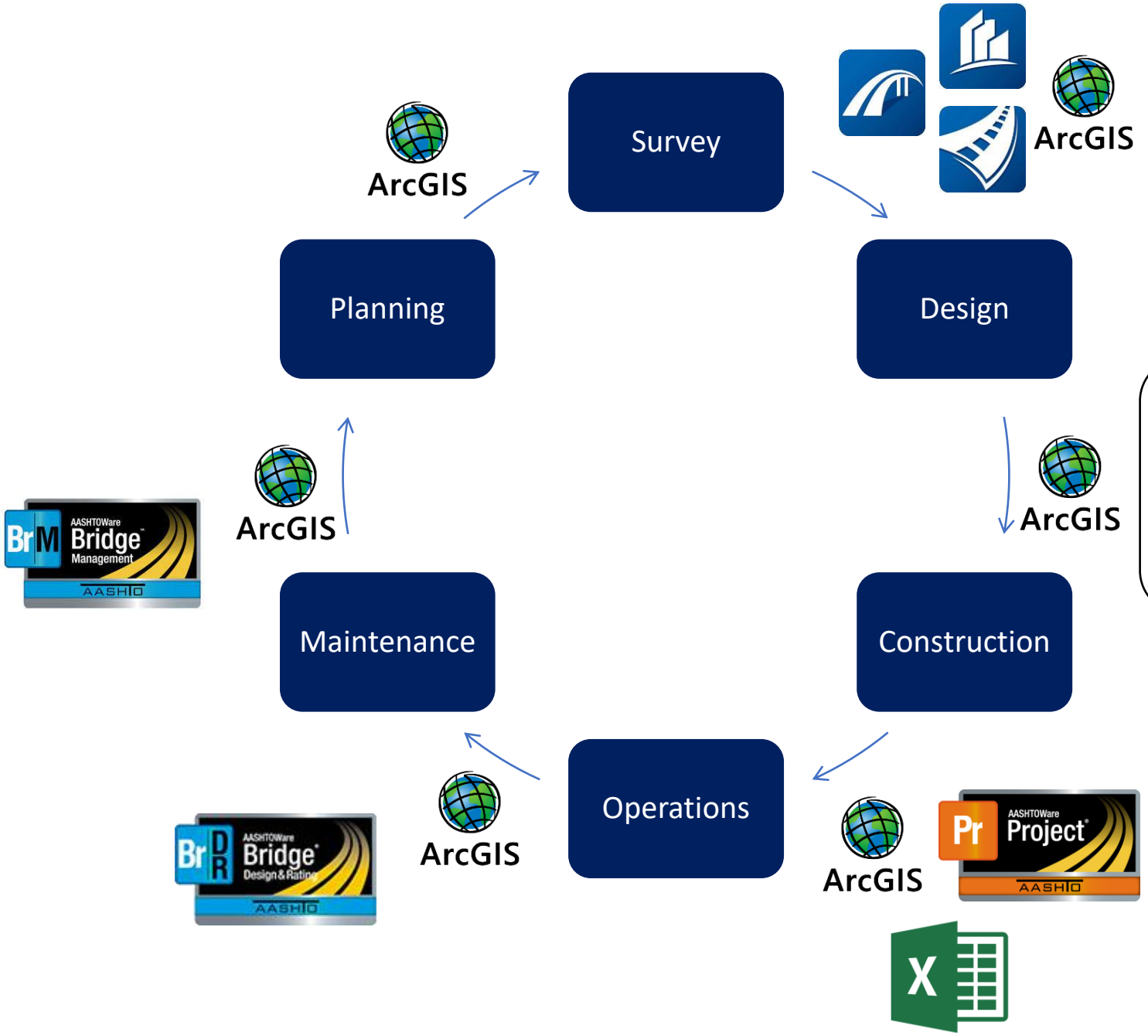
- Simple model-based quantities

5-year goals

- Software agnostic model-based delivery that can deliver:
  - Quantity take-offs
  - Individual element metadata
  - Dimensioned views from the model
  - Single source of truth
  - Produce As-Built IFC file to go back to asset management software

10-year goals

- Ability to augment data of model to produce complete Digital As-built
  - Shop Drawings, Materials e-tickets, Mill Tests, etc.
  - Monitoring devices
  - Reality capture model of constructed structure



Digital Delivery is not a single item.

Thank you for your attention

Thomas Hamski

Thomas.Hamski@iowadot.us