

# BIM FOR INFRASTRUCTURE PEER EXCHANGE

HOSTED BY NEW YORK STATE DOT

Michael J. Kennerly PE

Director of The Design Bureau

Iowa Department of Transportation

Centralized Design

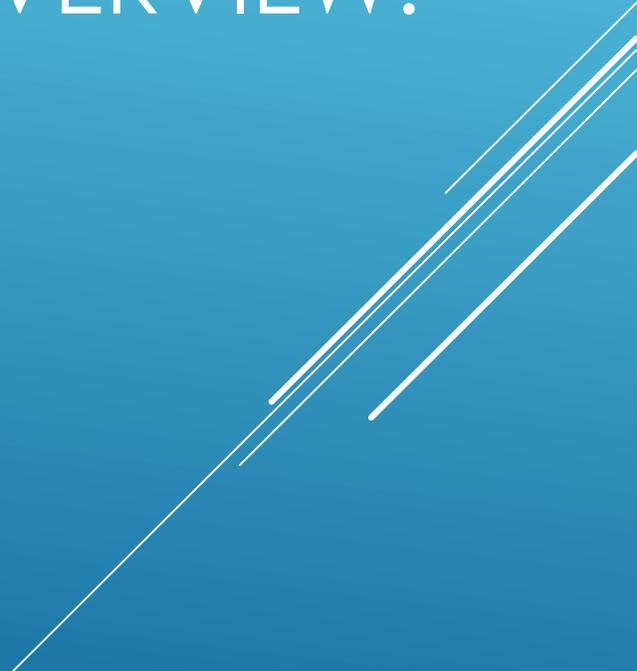
70% In-House-30% Consultant Design for Highway Design

30% In House-70% Consultant Design for Bridge Design

6 Districts: 3R and MP Projects (No bridge design)

Our Annual Program is approximately 1.3 billion, of that approximately \$900 million Annual Highway Improvement Program

## BRIEF OVERVIEW:



- ▶ Design Bureau (Highway Design)
  - ▶ Pre-Design
  - ▶ Preliminary Survey
  - ▶ RTK-GPS Network
  - ▶ Final Design
  - ▶ Methods-Standards Section
  - ▶ Geotechnical Section
  - ▶ Plan Review
  - ▶ Roadside Development
  - ▶ Photogrammetry
  - ▶ CADD Automation Support
  - ▶ Traffic Control (New)
  - ▶ 106 FTE's

## BRIEF OVERVIEW:

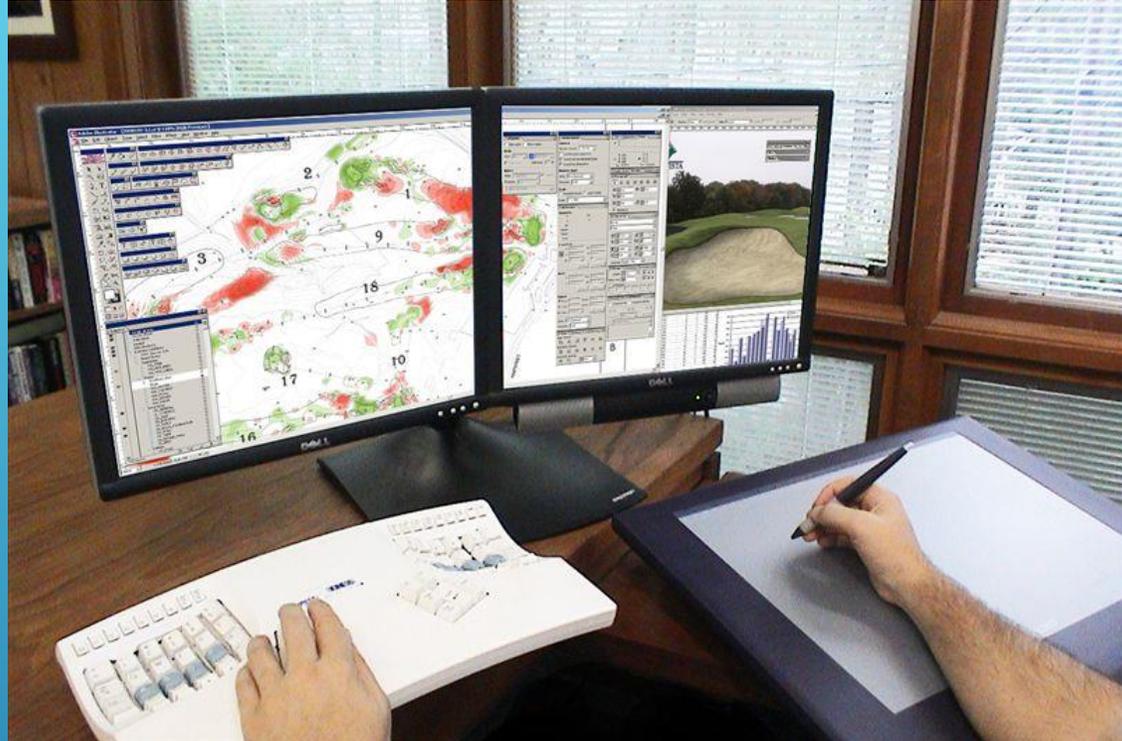


- ▶ State of the Practice: How we got here
- ▶ Overview of our First Pilot with the files of the controlling document
- ▶ Our Vision of BIM and how it relates to CIM
- ▶ Brief Overview of Our Roadmap

## PRESENTATION OVERVIEW



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# STATE OF THE PRACTICE

# STATE OF THE PRACTICE: HOW WE GOT HERE

We began by meeting with the industry, in particular McAninch Corp, who had just won an award from ENR for their work in AMG

We met with Trimble, Caterpillar, and others to understand their needs and where they were going

Our first pilot in 2006 omitted and number of areas we simply could not model. However we made it mandatory for the contractor to use AMG for grading.

In 2009 when we migrated to Bentley Corridor Modeler we able to provide more complete files and provided them as part of the letting documents.

Include sections covering the various aspects of 3D Design in our Design Manual.

We would meet annually with the contractors to review our deliverables, go over any concerns and start laying the foundation for the future. The files as the controlling document.

We worked with the Engineering Board on developing a process for applying Digital signatures.

We developed a process for reviewing the electronic files.

We met with the AG prior to our first project where the files were the controlling document.

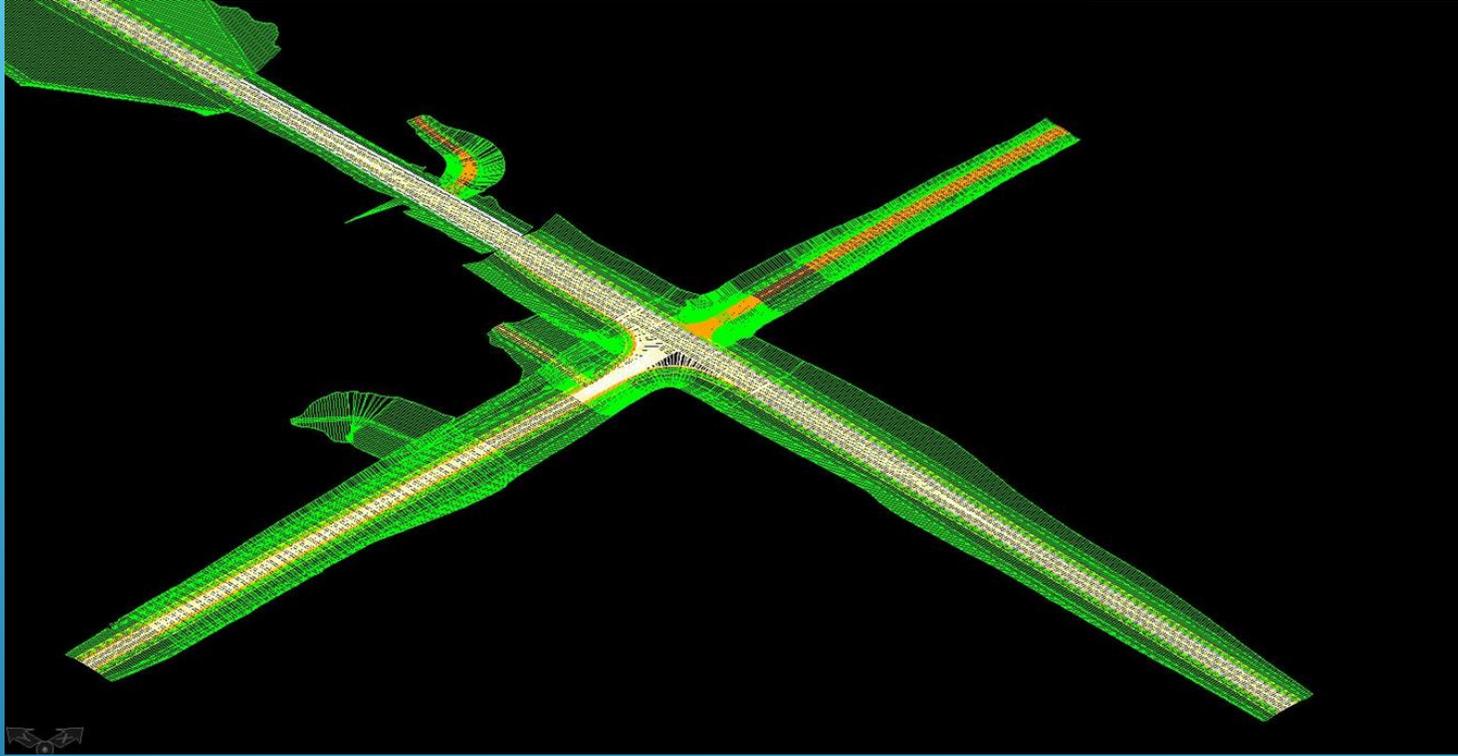
In 2015 we let our first project with the electronic files as the controlling document

In 2016 we let 6 more projects

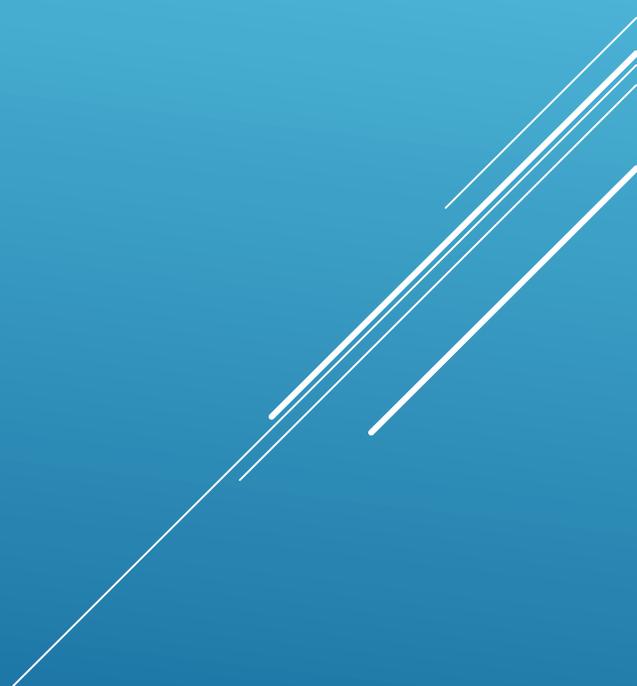
In 2017: For In-house designed grading and paving projects we attach SP150441 Special Provisions for Conformity With and Coordination of Contract Documents” which elevates the electronic files above the plans when a contractor elects to use AMG for either grading or paving.

STATE OF THE  
PRACTICE:  
HOW WE  
GOT HERE





OVERVIEW OF OUR FIRST PILOT PROJECT  
WITH THE ELECTRONIC FILES AS THE  
CONTROLLING DOCUMENT



- ▶ Change the perception and use of the electronic document. Move from At-risk to Value Added.
- ▶ How do we preserve the integrity of the electronic documents.
- ▶ We needed to find the right project, in this case that was one that had both grading and paving.
- ▶ How would this impact contract administration
- ▶ Industry readiness
- ▶ We needed to learn more about what happens to the files once they leave our hands.
  - ▶ How do you control changes to the model
  - ▶ Can we incorporate some of that into our process

## ISSUES WITH THAT FIRST PILOT:

- ▶ We selected a project that we thought had all of the elements that would give us good feedback and included several disciplines.
- ▶ We added a Special Provision by addendum elevating the electronic files above the paper\pdf plans.
- ▶ We indicated that if any changes needed to be made that the Department would be responsible for making the necessary changes.
- ▶ We made it mandatory for machine guided grading and optional for paving.
- ▶ We did not change our process for this project.

## OUR APPROACH

In case of a discrepancy between contents of the contract documents, the following items listed

by descending order shall prevail:

1. Addendum

2. Proposal Form

3. Special Provision

**4. Digital Contract Files.**

5. Plans

6. Standard Bridge Plans, Standard Culvert Plans, and Standard Road Plans

7. Developmental Specifications

8. Supplemental Specifications

9. General Supplemental Specifications

10. Standard Specifications

11. Materials I.M.

EXCEPTS FROM SP- 120279

SPECIAL PROVISIONS FOR CONFORMITY WITH AND COORDINATION  
OF THE CONTRACT DOCUMENTS

1105.04, D.

Replace the Article:

The Contractor shall not take advantage of any apparent error, omission, or discrepancy in the contract documents. The Engineer will be permitted to make such correction in interpretation as may be deemed necessary for the fulfillment of the intent of the contract documents subject to compensation as provided in Articles 1109.03, 1109.04 and 1109.16. Written notice of changes in the contract documents will be given to the Contractor by the Engineer. **Field adjustment of digital contract files, if necessary, will be completed by the Engineer.**

EXCEPTS FROM SP- 120279

SPECIAL PROVISIONS FOR CONFORMITY WITH AND COORDINATION  
OF THE CONTRACT DOCUMENTS

# IA 196 Grade and Pave Project Details

- ▶ Project Information
  - ▶ Length: **8** miles
  - ▶ Earthwork Quantity: **432,651** Cubic Yards
  - ▶ Paving Quantity **148,618** Square yards
  - ▶ Two Bridge Replacements: Over the Raccoon River and Cedar Creek
  - ▶ Replacement of a Single Box Culvert
- ▶ In conjunction with the completion of the US 20 Corridor in Northwest Iowa

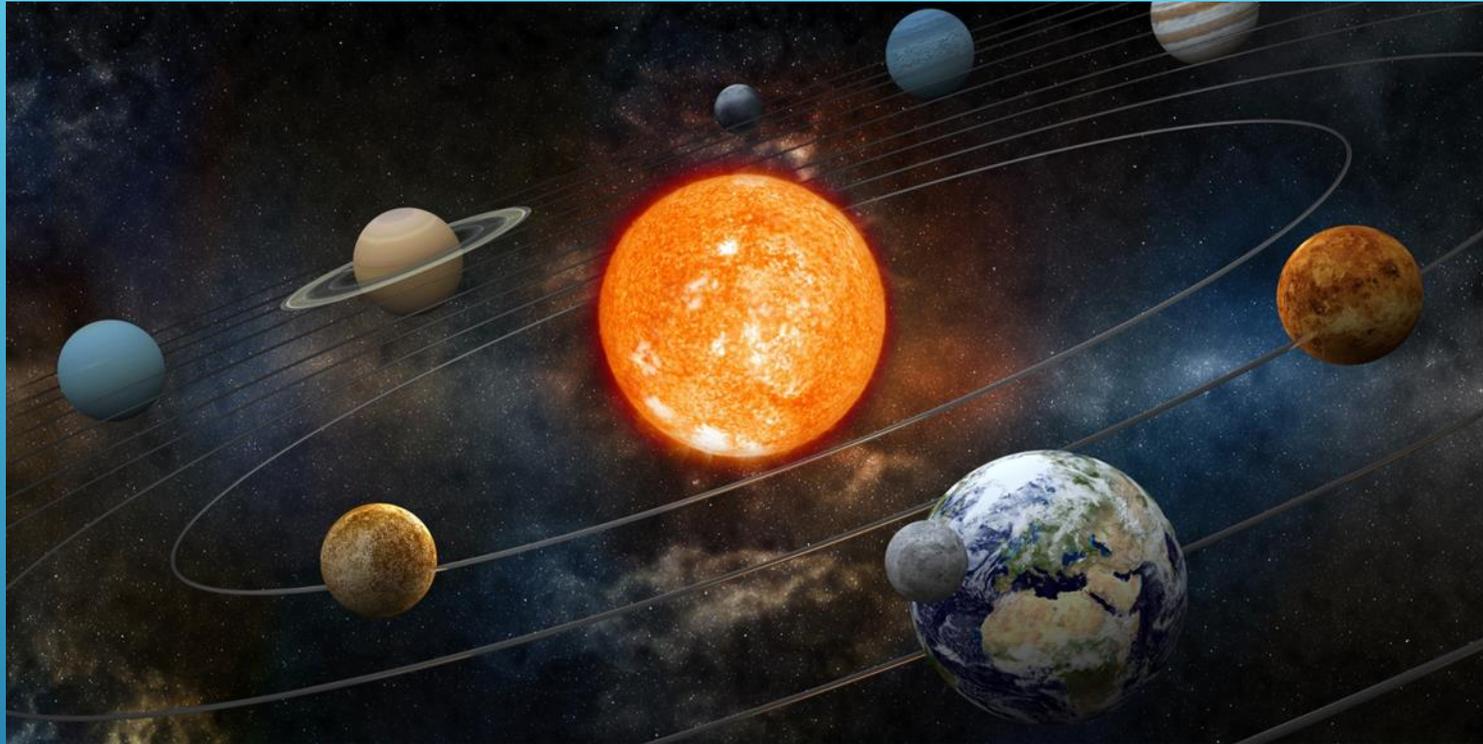
THE PROJECT:

- ▶ The successful low bidder was a joint venture between Peterson Contractors Inc. and Godbersen-Smith. Cedar Valley Corp. was selected as sub for the Paving.
- ▶ Letting Results: (Grade and Pave Project only)
  - ▶ Programmed Amount: \$18,915,000
  - ▶ Awarded Amount: \$18,854,801.68
- ▶ No adjustments in electronic files needed by the contractor
- ▶ Contractor typically transfers risk to the engineering consultant on traditional GPS projects.
- ▶ Reduced costs for contract survey.
- ▶ No difference in their bid, if anything it reduced costs.
- ▶ The contractor preferred this approach. Less risk.
- ▶ No difference or issues for the contract administration staff. Although they had reservations prior to construction they were supportive in the end.

## THE RESULTS

- ▶ Work with your AGC early and often
- ▶ Work with your Consultant Community
- ▶ Consult the AG
- ▶ File size can be an issue
- ▶ How and where you break your project is important
- ▶ Consistent naming conventions is critical
- ▶ Review the files, and then review the files.
- ▶ **This takes time, a critical component is contractor trust.**
- ▶ Choose Projects that allow you to learn
- ▶ Embrace failure as a learning opportunity

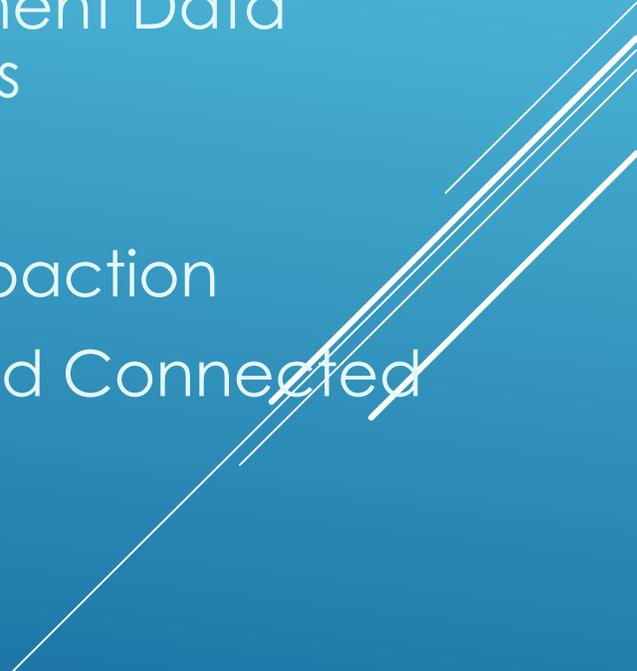
## LESSONS LEARNED



VISION OF BIM\CIM



# BEGINS WITH UNDERSTANDING OUR UNIVERSE IS CHANGING

- ▶ eConstruction
  - ▶ Automated Machine Guidance
  - ▶ LIDAR
  - ▶ Visualization
  - ▶ Animations
  - ▶ 3D Highway Design
  - ▶ 3D Bridge Design
  - ▶ Paperless Business Models
  - ▶ Asset Management Data Collection Efforts
  - ▶ UAV's
  - ▶ Intelligent Compaction
  - ▶ Autonomous and Connected Vehicles
- 

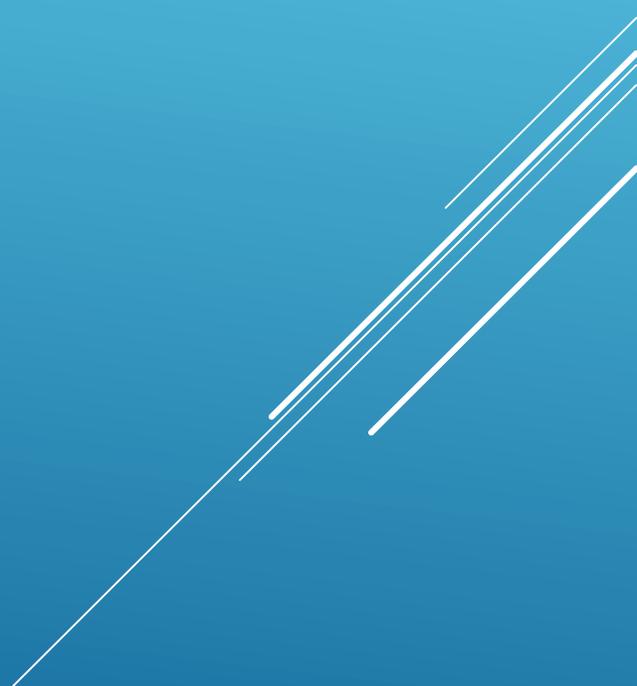
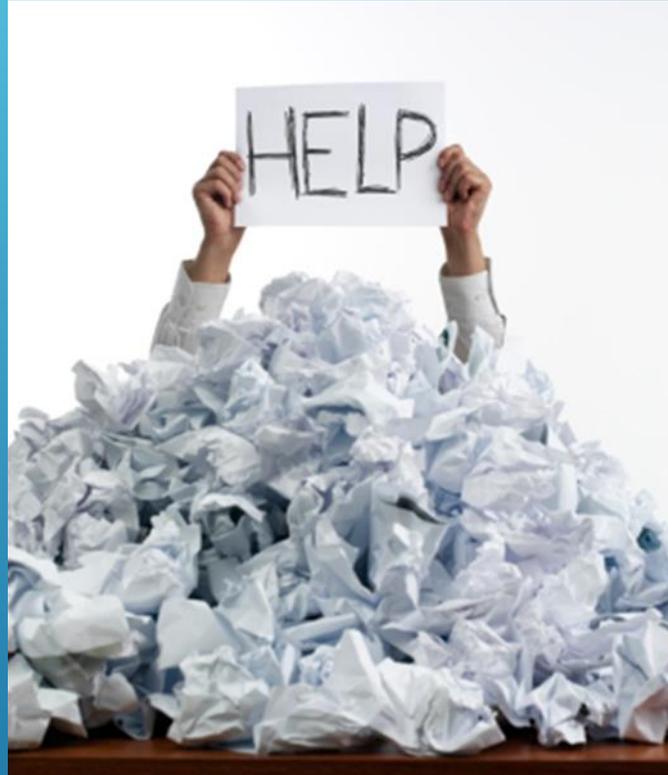
THOSE NEW TECHNOLOGIES PRODUCE TONS OF..





# DIGITAL DATA COMBINED WITH OUR LEGACY DATA

OFTEN RESULTS IN.....



SO HOW DO WE MOVE FROM THIS.....



# TO THIS

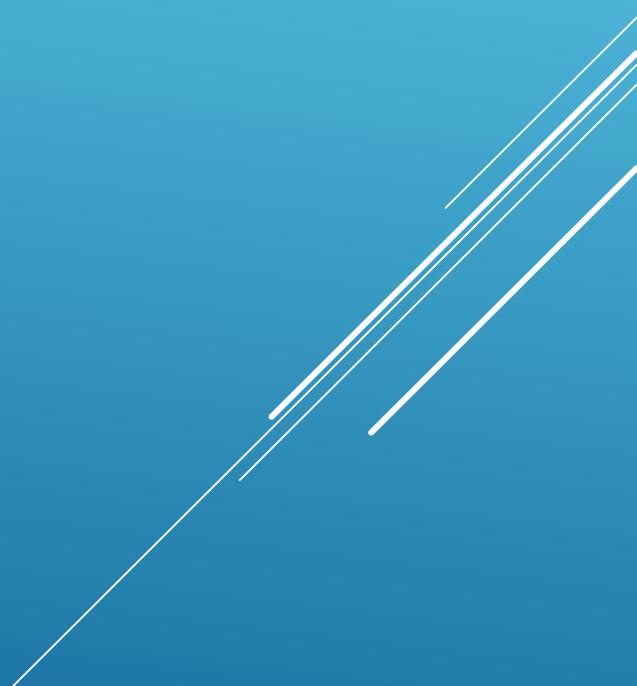


WE WILL DO IT THROUGH.....



# HOW DO WE GET THERE.....

The 2014 Iowa Department of Transportation established the following key initiatives as essential to realizing its Vision of “Smarter, Simpler, Customer Driven”:

- Performance Management
  - **Data Integration**
  - Portfolio and Project Management
  - Organizational Communication
  - Workforce and Knowledge Management
- 

# ENTERPRISE ARCHITECTURE REVIEW:

“The majority of Iowa DOT’s systems were **not** developed in a comprehensive fashion under a singular strategic vision. Some systems are old and support for them challenging, due to their age and possible software obsolescence, or people familiar with the systems. Many of these systems were developed for an individual functional area, *never designed to integrate with any overall planned architecture.*”



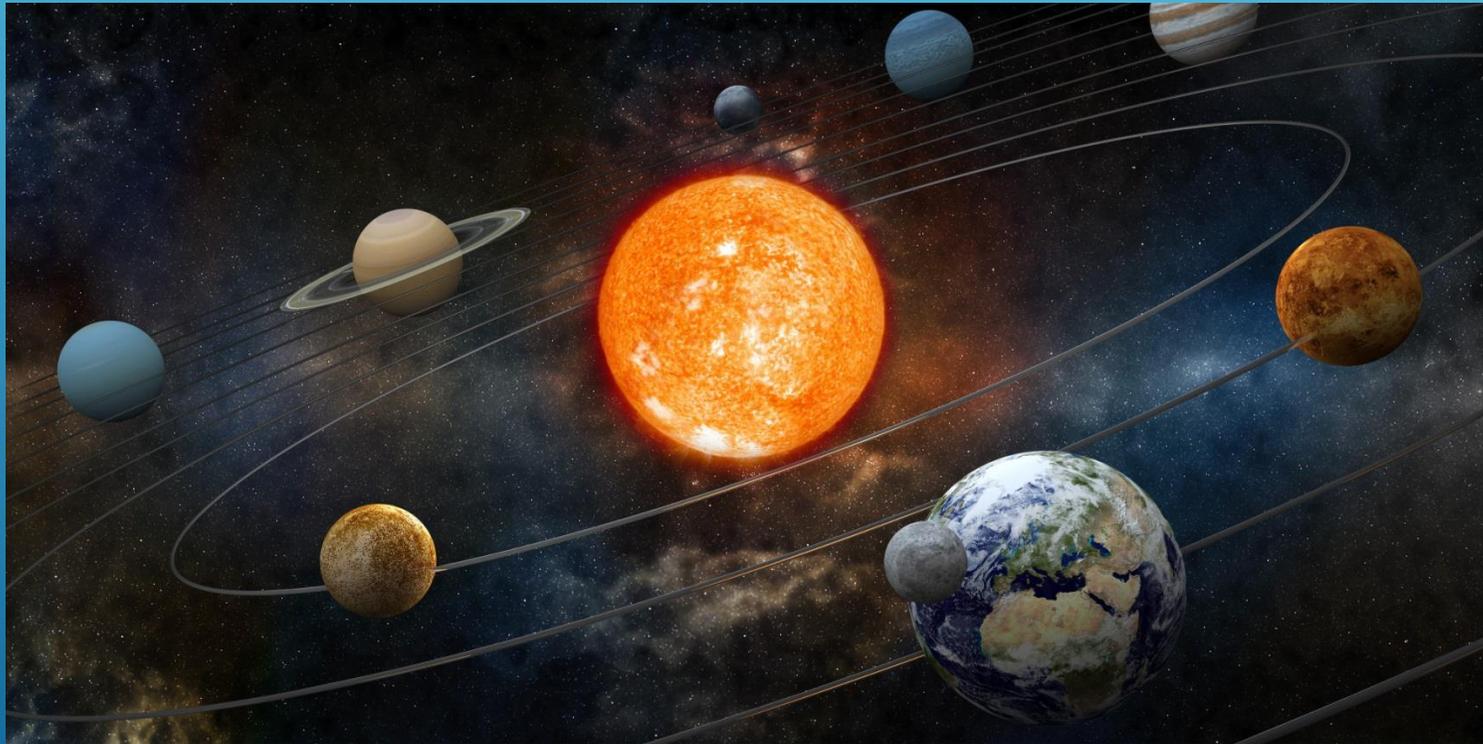
# ENTERPRISE ARCHITECTURE REVIEW:

## The Report Stated the Following:

“As a result, there is limited system and **data integration**, sometimes requiring the same information to be entered into multiple systems across different business units. The current information technology environment limits Iowa DOT’s capacity to realize efficiencies in core areas, such as business process streamlining and systems consolidation. In response to these challenges and opportunities, *Iowa DOT has been taking steps to address this information systems deficit, although many of these efforts are uncoordinated and not following an enterprise-level approach.*”

# CIVIL INTEGRATED MANAGEMENT

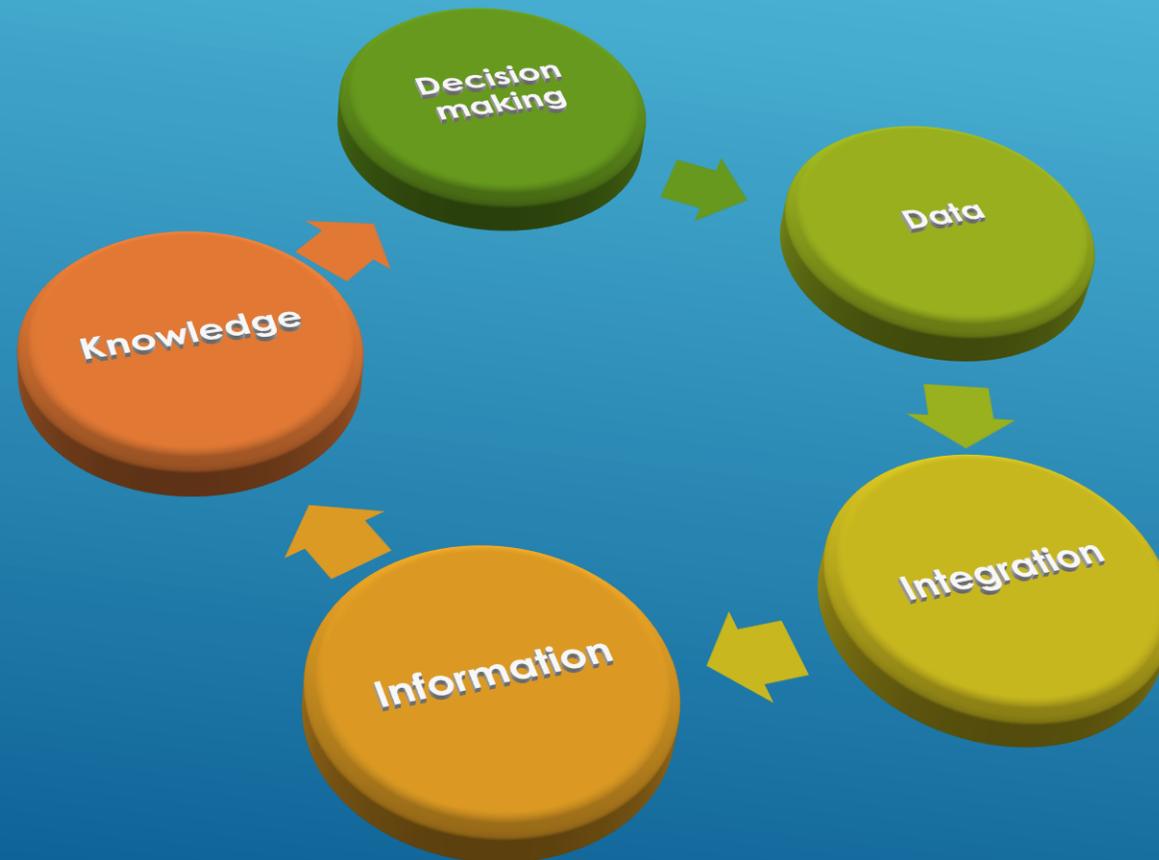
IS ONE TOOL TRANSPORTATION AGENCIES ARE USING TO TAKE THAT ENTERPRISE LEVEL APPROACH BECAUSE AT IT'S CORE CIM IS SIMPLY DATA INTEGRATION



# DEFINITION OF CIVIL INTEGRATED MANAGEMENT

- ▶ CIM includes leveraging data and information from various sections of a highway agency and making use of that data throughout an asset's life cycle. CIM may be used by all affected parties for a wide range of purposes, including planning, environmental assessment, surveying, design, construction, maintenance, asset management, and risk assessment. CIM aims to serve all project stakeholders and consistently provide appropriate, accurate, and reliable information.

# THE GOAL OF CIM: BETTER DECISION MAKING THROUGHOUT THE LIFECYCLE OF AN INFRASTRUCTURE ASSET



# HOW DO WE GET THERE....

**The Aha Moment:** While the use of 3D Design and electronic files will be a source they fall well short of being the answer:

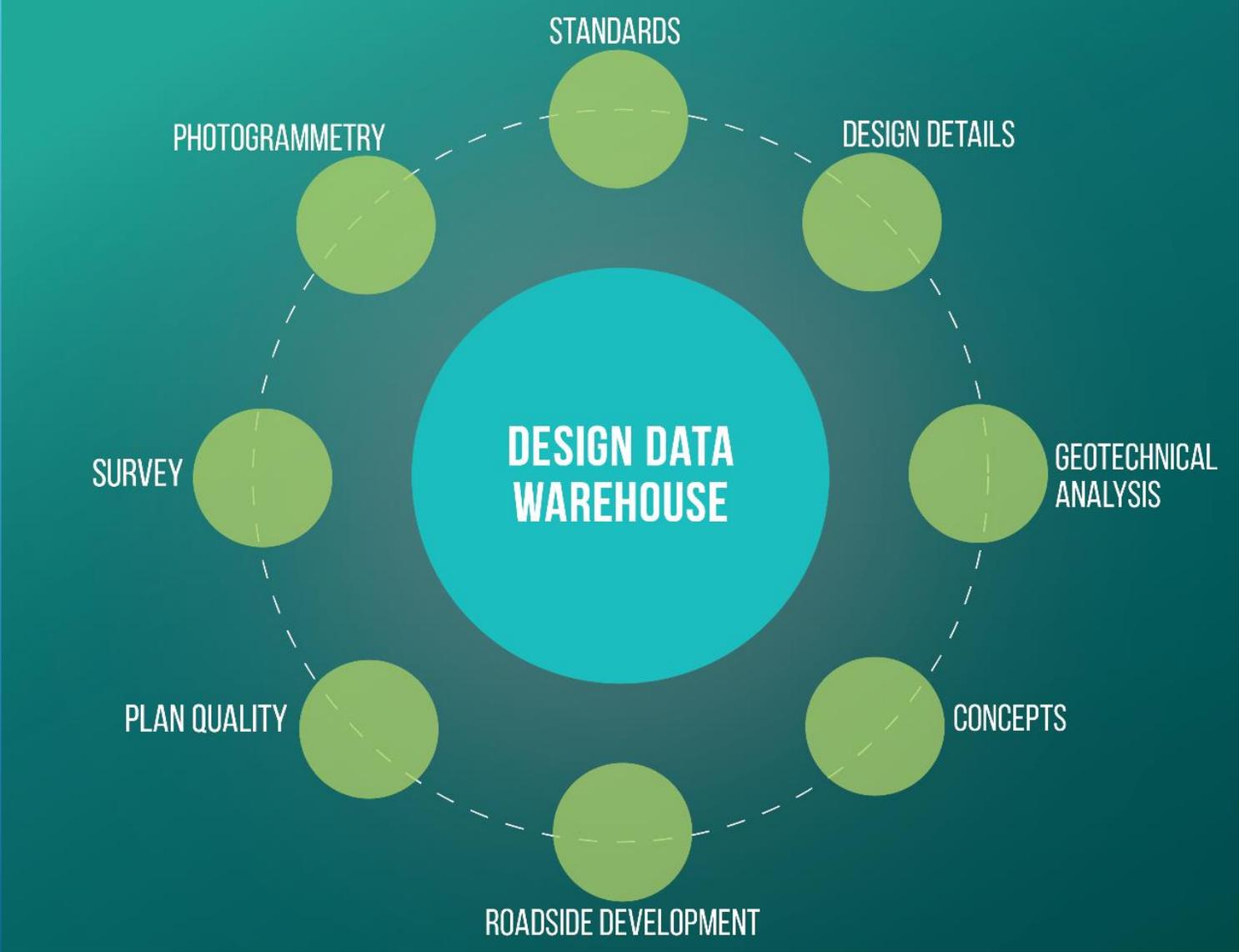
- ▶ Total Miles of Interstate and Highway rehabilitation identified in the 2017 to 2021 5-Year Program: Approximately **890** miles.
- ▶ Miles of interstate and highway the Department maintains approximately **9403** including ramp mileage.
- ▶ That is 9.5% of our system in a Building Information Model (BIM)
- ▶ How do we address the rest of the system?

Note: This does not include approximately 1125 miles of 3R work over the same 5 year period.

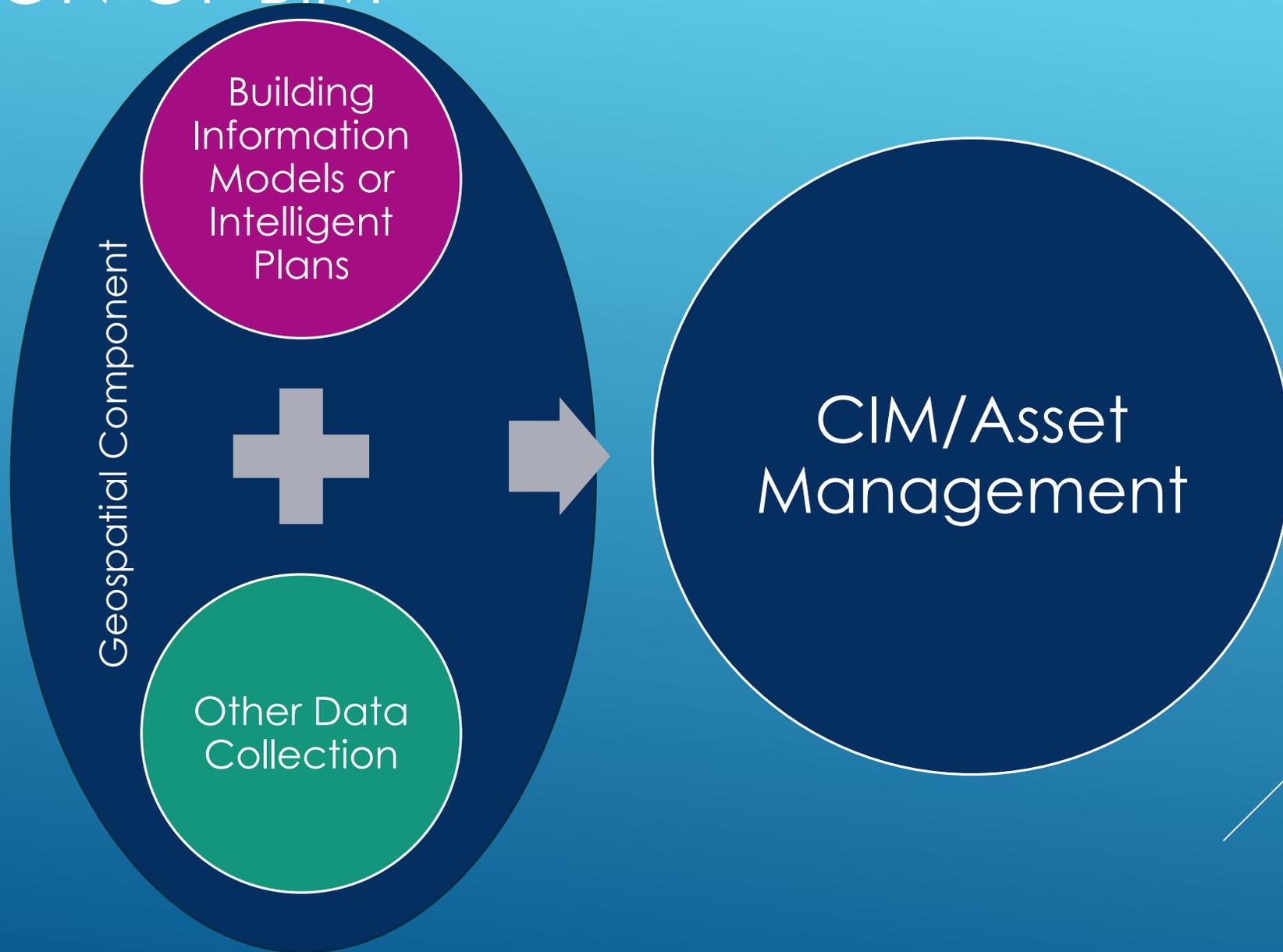
# CIM: AT THE IOWA DOT



# CIM: AT THE IOWA DOT



# VISION OF BIM



- ▶ They say the journey of a thousand miles begins with one step. However; the first step requires that we know where we want the journey to end. In the case of a Road Map for an Intelligent Plan (or Building Information Model (BIM)) when we reach the end of our journey we will have an interactive electronic model of the project that will serve as both the traditional plan set and contract document. It will have the ability to be updated with changes throughout construction, thus allowing it to also serve as an electronic as-built. However, the most important aspect will be the ability to harvest or upload that data into an agency wide asset management system to further our agencies ability to manage its assets throughout their lifecycle.
- ▶ “The RoadMap: AKA “The Journey of a Thousand Miles””

## VISION FOR BIM: THE ROADMAP

- ▶ Development of a Level of Development (LOD) Specification
- ▶ Development a specification or guidance on Level of Accuracy
- ▶ Work with each discipline on what data we want to capture and for their use and asset management.
- ▶ Coordinate with our eConstruction effort
- ▶ Coordinate with Maintenance
- ▶ Leverage Data Governance effort
- ▶ Leverage and involve GIS effort
- ▶ Involve IT all along the way
- ▶ Develop a Process to Review the Model (20B-72)
- ▶ How will this work with 3R, MP, MB type projects. (Remember its all about asset management and data collection)
- ▶ Develop a process for Digital Signatures
- ▶ Digital Sealing the model to restrict or track changes
- ▶ How will Contractors review the files (Estimators and Field staff)
- ▶ Defining post letting responsibilities for Consultants

## THE STEPS INCLUDE:

QUESTIONS?

