Owner Implementation of New Technology

John Bowen

Digital Implementation Services Manager

John.Bowen@hdrinc.com

402-399-1203

20 Years with HDR

10 Years of Facility Management with Private Firm

Member of National BIM Committees including:

National BIM Standard

National CAD Standard

USACE/Industry BIM Consortium

Agenda

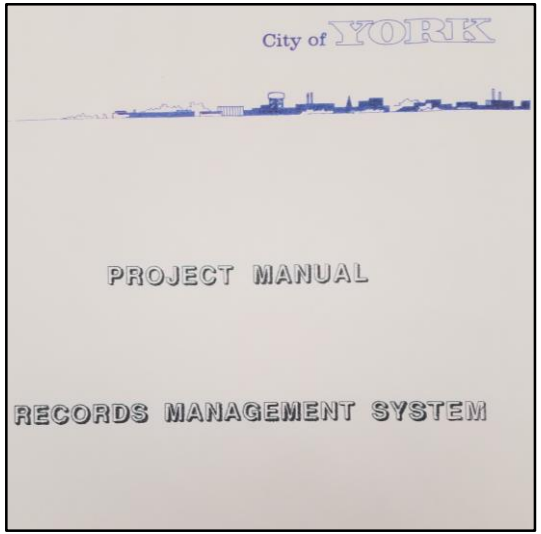
1. History of Technology
2. Current Technology Examples
3. State of the Water/Wastewater Industry
4. Current Workflow Issues
5. Strategic Planning
6. Implementation Planning
7. BIM and Data Standards
8. Contract Language
9. Project Execution
10. Questions

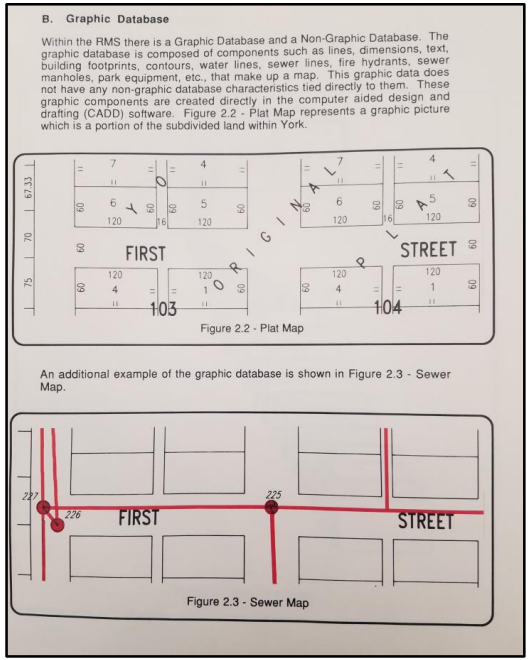
History of Technology

HDR Engineering Office - 1917

Pre-Computer Era

30+ Years Ago…





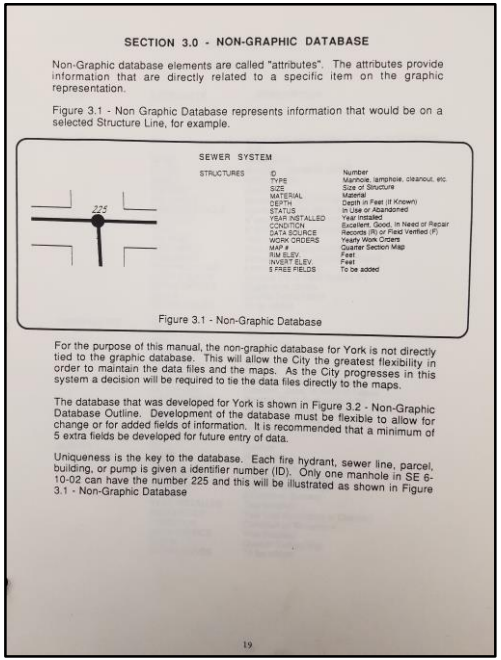
B. Graphic Database

Within the RMS there is a Graphic Database and a Non-Graphic Database. The graphic database is composed of components such as lines, dimensions, text, building footprints, contours, water lines, sewer lines, fire hydrants, sewer manholes, park equipment, etc., that make up a map. This graphic data does not have any non-graphic database characteristics tied directly to them. These graphic components are created directly in the computer aided design and drafting (CADD) software. Figure 2.2 - Plat Map represents a graphic picture which is a portion of the subdivided land within York.

Figure 2.2 - Plat Map

An additional example of the graphic database is shown in Figure 2.3 - Sewer Map.

Figure 2.3 - Sewer Map



SECTION 3.0 - NON-GRAPHIC DATABASE

Non-Graphic database elements are called "attributes". The attributes provide information that are directly related to a specific item on the graphic representation.

Figure 3.1 - Non Graphic Database represents information that would be on a selected Structure Line, for example.

Figure 3.1 - Non-Graphic Database

For the purpose of this manual, the non-graphic database for York is not directly tied to the graphic database. This will allow the City the greatest flexibility in order to maintain the data files and the maps. As the City progresses in this system a decision will be required to tie the data files directly to the maps.

The database that was developed for York is shown in Figure 3.2 - Non-Graphic Database Outline. Development of the database must be flexible to allow for change or for added fields of information. It is recommended that a minimum of 5 extra fields be developed for future entry of data.

Uniqueness is the key to the database. Each fire hydrant, sewer line, parcel, building, or pump is given a identifier number (ID). Only one manhole in SE 6-10-02 can have the number 225 and this will be illustrated as shown in Figure 3.1 - Non-Graphic Database

19

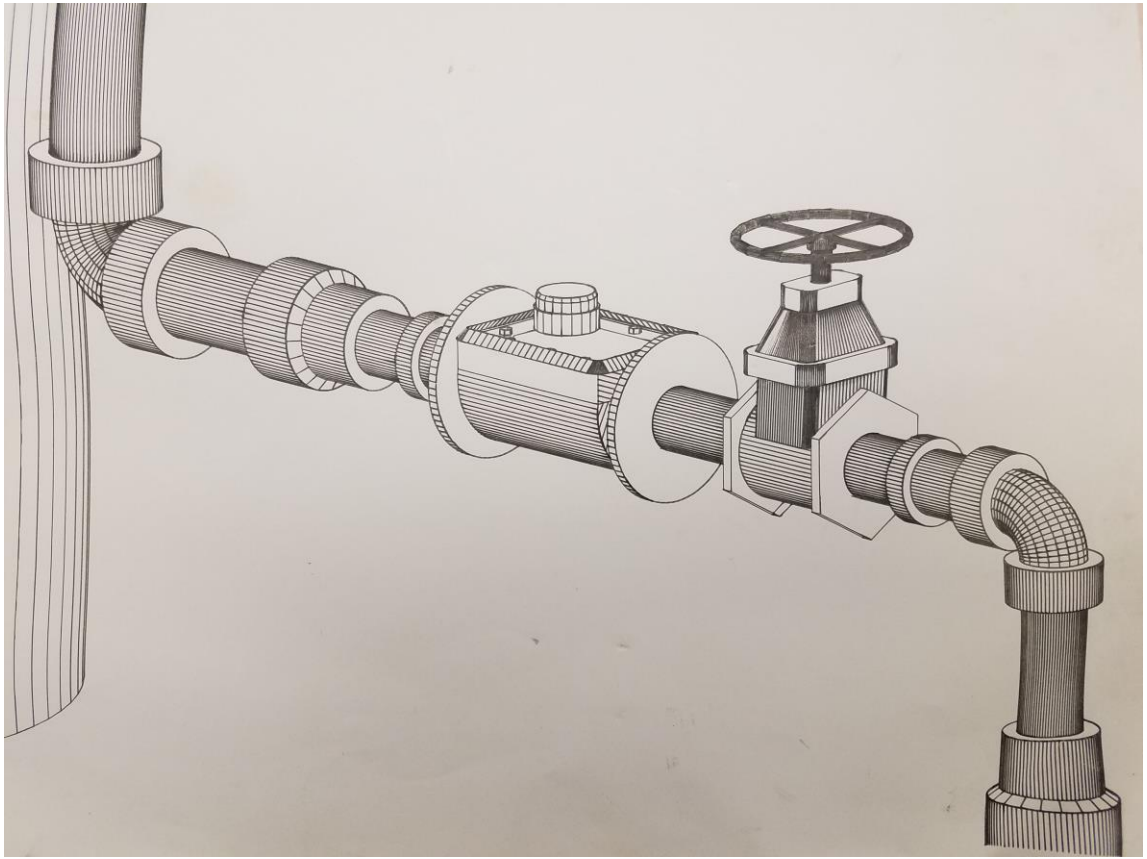
RECORDS MANAGEMENT SYSTEM CREATION
CITY OF YORK, NEBRASKA

30 Years Ago…

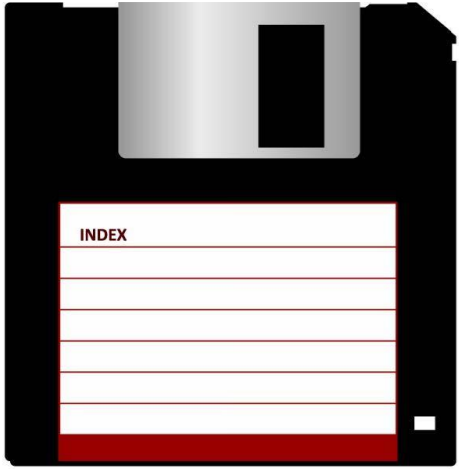
- IBM XT
- 128 KB of RAM
- 286 CPU
- DOS Operating System

- 5-1/4” Floppy Disk
- Original storage of 360 kb
- Grew to 1.2 MB with Dual-Sided version

25 Years Ago…



25 Years Ago…



- IBM PS/2
- 512 KB of RAM
- 386 CPU
- DOS Operating System

- 3-1/2” Floppy Disk
- Storage of 1.44 MB

15 Years Ago…

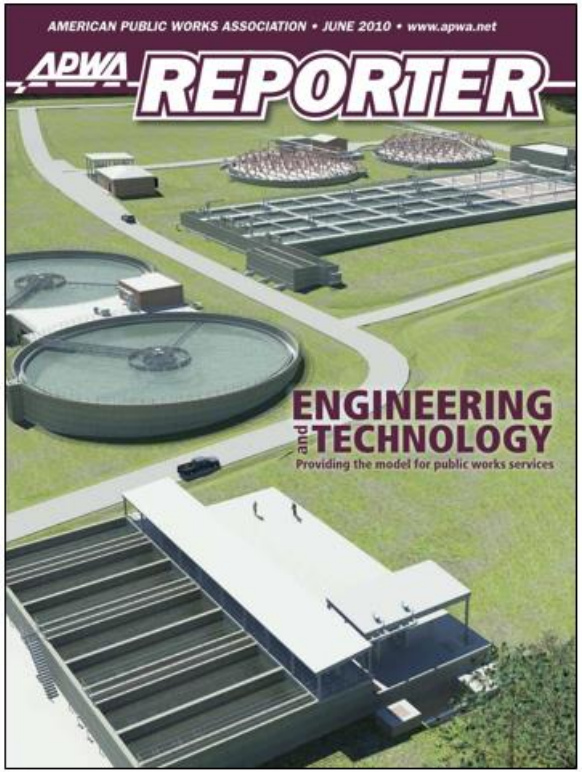

HDR BIM PILOT PROJECT
THERESA STREET NITRIFICATION IMPROVEMENTS
PRIMARY SLUDGE PUMPING STATION AND CLARIFIER
LINCOLN, NEBRASKA

15 Years Ago…

- HP Workstation
- 512 MB of RAM
- Pentium 4 Processor
- Windows Operating System
- 80 GB Hard Drive

- CD ROM
- Storage of 700 MB

9 Years Ago…



BIM (Building Information Modeling)

Intelligent design of public works facilities

John Bowen
National BIM Manager
HDR
Omaha, Nebraska

Introduction

In this industry, we are an acronym-appreciating group, which APWA members can attest to. We deal with LEED APs, EITs, PMs and MEs. Acronyms are used to imply wide acceptance of and add importance to names, processes, certifications and methodologies. So without pushing anyone's acceptance over the brim, I'd like to introduce a fairly new acronym: BIM.

Building Information Modeling

BIM isn't a new acronym in the design world, but it is getting a lot of increased attention. BIM used to be a design option, but now it's become a part of mainstream design culture. It allows an entire project team to create and share knowledge in a single, unified representation. It's truly revolutionizing the way we design and construct facilities.

BIM can be a confusing term, primarily because of its double meaning. You can create a BIM model, but you can also "do BIM" as a process. The Building Information Model is a 3-D model generated and maintained throughout the lifecycle of the facility. Building Information Modeling is the process of generating and managing that model.

BIM the Process

The process combines and integrates the knowledge of a project team—owners, contractors, subcontractors and designers—into one 3-D model. Rather than each team member focusing exclusively on their system, all participants work together to make informed decisions that affect the entire facility. It's common to hear the term Integrated Delivery when discussing BIM the process as both rely heavily on collaboration and combining knowledge.

BIM the Model

In the model sense, BIM combines graphical project data such as 2-D and 3-D drawings with non-graphical information including specifications, cost data and schedules. For example, the specifications for all elements of a door—the type, material, fire rating, configuration, manufacturer, hardware, etc.—can all be contained and accessed through the BIM model. So, while a door represented in a 2-D CAD drawing is just a collection of lines, in BIM it is an intelligent object containing information on its size, cost, manufacturer and more. In its 3-D form, the model itself can be used to communicate design concepts to the owner and calculate cost estimates, as well as detect clashes among building systems. When the model is complete, the contractor will build exactly what he sees.

BIM goes even further by creating a relational database. This means that all information in the BIM is interconnected, and when a change is made to an object in the database, all other affected areas, objects, views and schedules are immediately updated. For example, if a wall is deleted, doors and windows within that wall are also deleted, and all data on the project, views, cost and schedule are instantly adjusted. Furthering the benefits of BIM is its ability to be used as a database throughout the life of a facility. It can be the basis for as-built floor plans and elevations. It can recall finish materials and calculate the square footage of such materials so that when refinishing is required quantities are already known.

BIM provides an unprecedented ability to coordinate the design of multidiscipline teams and to see any clashes between systems as they happen. Fixing these clashes in the virtual world is much more cost effective than catching them during construction.

BIM for Public Works

As BIM is a term used regularly on the architecture front, some may be surprised to know that it's widely used within the engineering industry as well. The same, if not more, benefits from a BIM approach are being realized across the industry. With the complexity of structures and systems used on (you got it, more acronyms) CSOs, WTPs and WWTPs, the benefits have been tremendous.

A key component to BIM's success has been the ability of all parties involved to visualize designs before they are constructed. The instant identification of clashes while designing provides a significant time savings compared to traditional reviews. In addition, multidisciplinary design teams can much more easily coordinate with each others' work. These have greatly reduced RFIs and COs (sorry, had to do it!). Client Review Meetings are held to review the BIM so that the design is much easier to understand compared to traditional 2-D Construction Document reviews.

The Future

BIM is an evolving process and as the process continues to improve so will the quality of all projects utilizing this approach. BIM is the next phase in project delivery for the industry. It capitalizes on involving all parties early in the process, allowing a better project to be designed in a virtual world. The design can be graphically and spatially accurate, represent the end product, and be used in the lifecycle management of the project as time moves forward. It's the ultimate project information tool.

John Bowen is the National Building Information Modeling (BIM) Manager for HDR, located in their Omaha, Nebraska headquarters. He can be reached at (402) 399-1203 or john.bowen@hdrinc.com.

Photographic-quality imaging of models has been a critical factor in the success of BIM in the engineering industry.

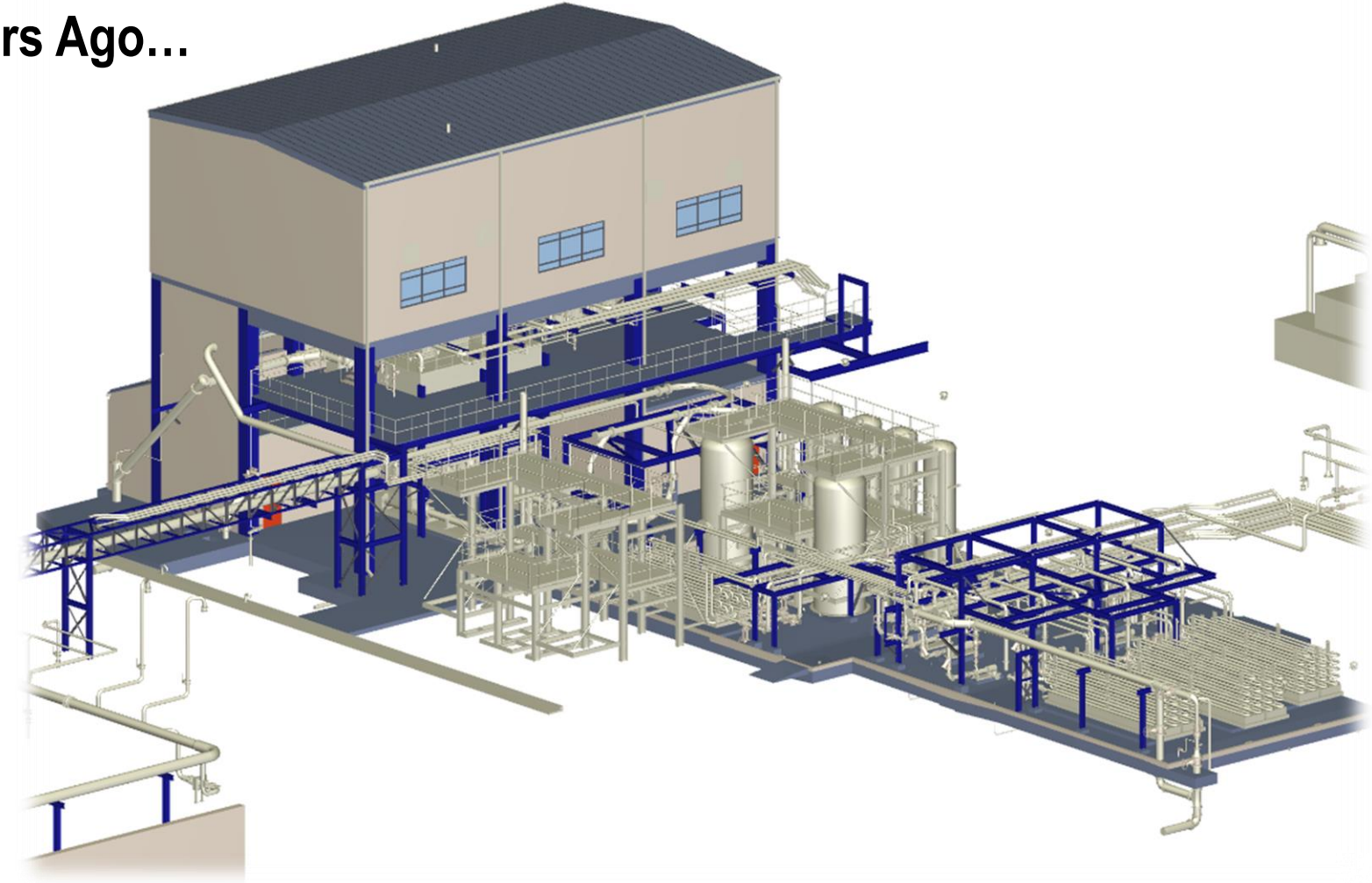
BIM allows all parties involved to easily understand the design.

9 Years Ago…

- HP Workstation
- 4 GB of RAM
- i5 Processor
- Windows Operating System
- 250 GB Hard Drive

- DVD
- Storage of 4.7 GB

5 Years Ago…



5 Years Ago to Present…

- Lenovo ThinkStation
- 32 GB of RAM
- Xeon E5 Processor
- Windows Operating System
- 1 TB Hard Drive

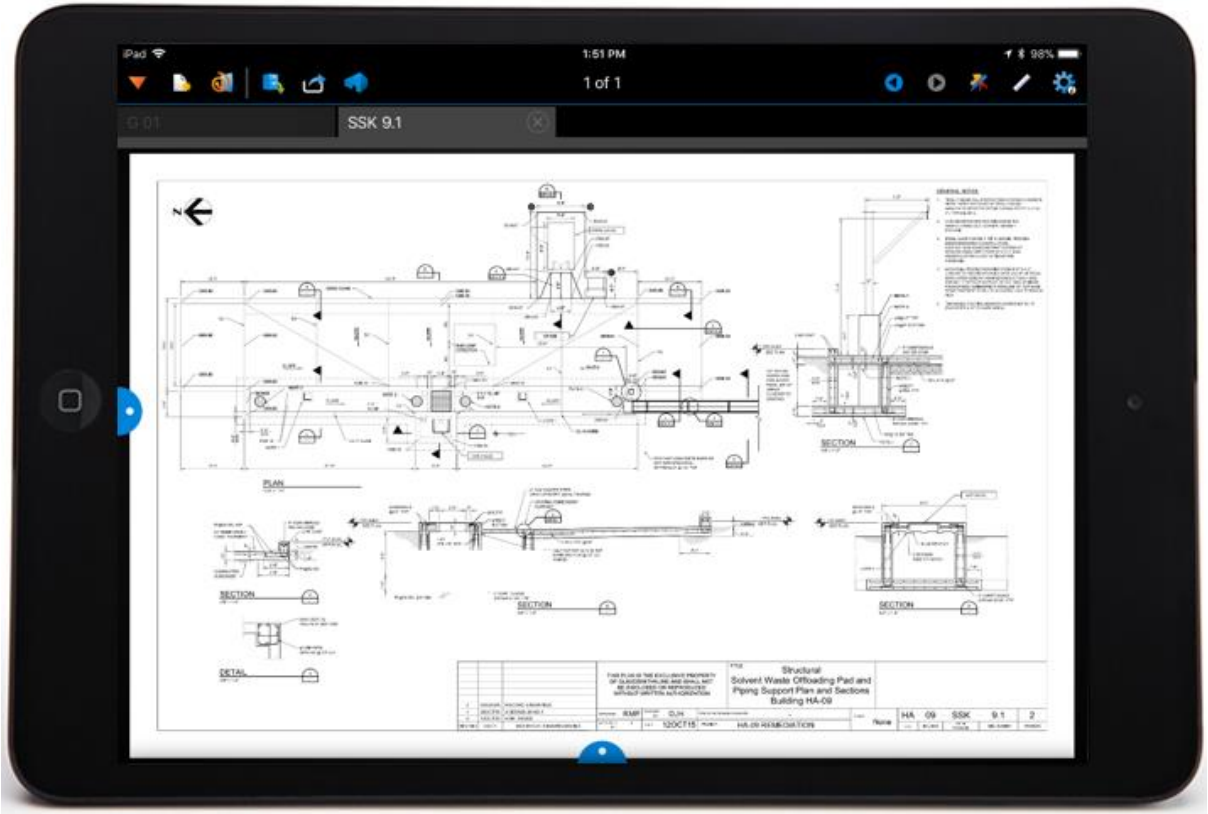
- Flash Drive
- Storage of 1 TB+

Current Technology Examples

Current Technology Examples

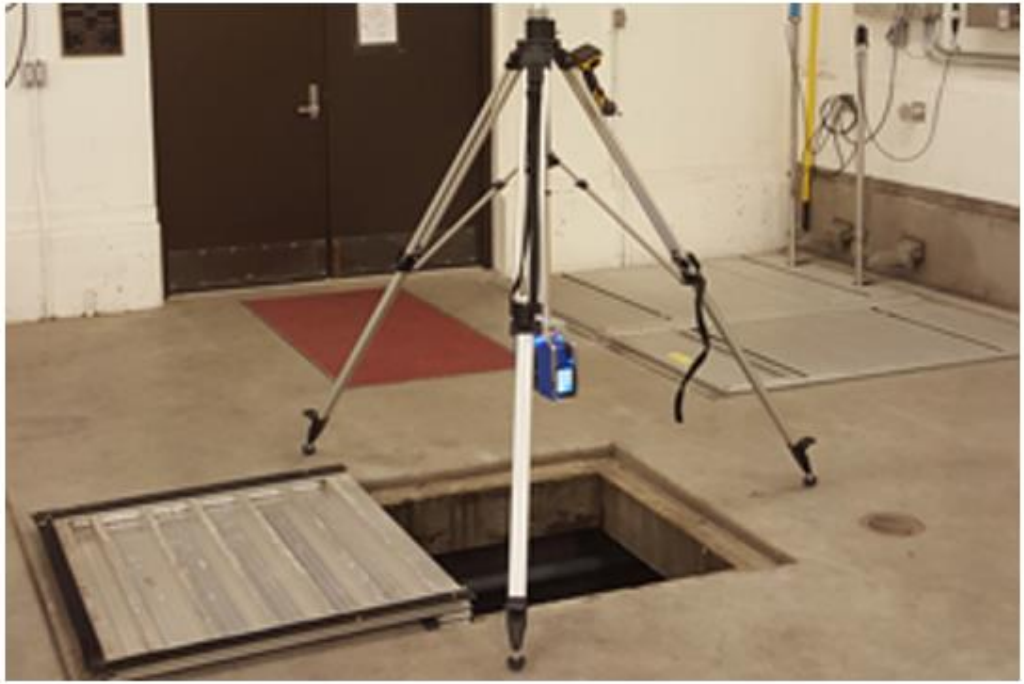
Document Management

Current Technology Examples



Mobile Access to Information

Current Technology Examples



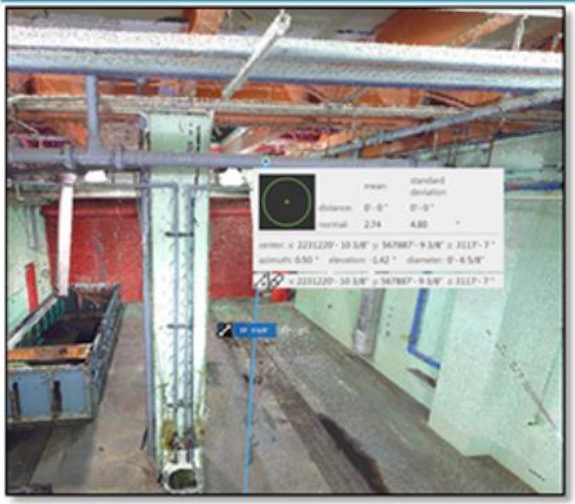
Laser Scanning (LiDAR)

Current Technology Examples

Laser Scanning (LiDAR)

Current Technology Examples

Field Verification



- Buried Electrical Vault – Confined entry training and permit required.

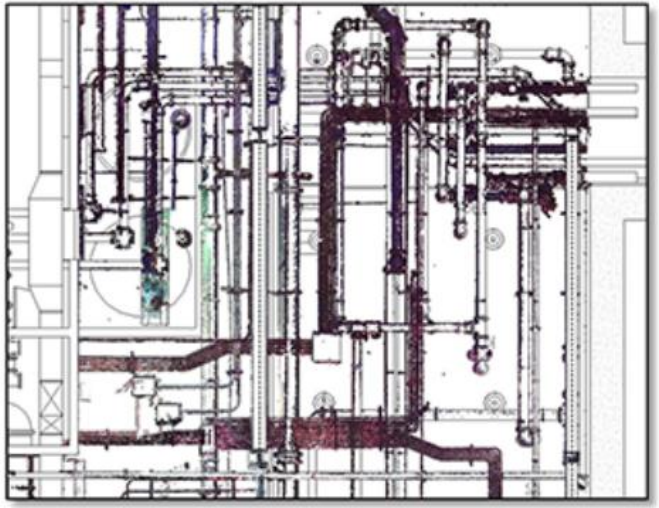
Collect measurements not easily accessible in the field.

- Centerline of pipe 18'- 3/4" off of floor.
- Outside diameter of pipe 6 5/8" – Nominal 6" pipe size

Laser Scanning

Current Technology Examples

Existing Conditions Model Creation



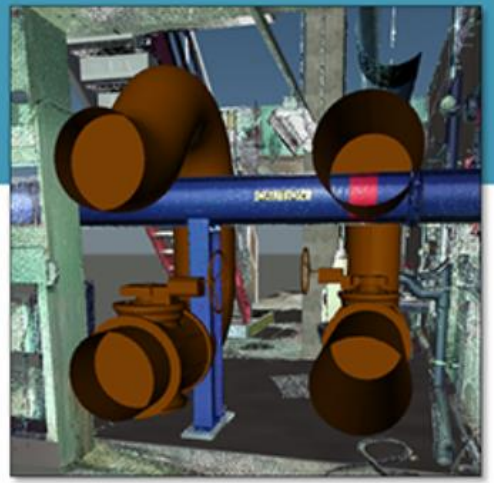
Point cloud linked into design modeling software.

- Tracing the data is faster and more accurate then obtaining data from record drawing or field measurements and notes.

Laser Scanning

Current Technology Examples

3D Coordination



Clash Identification

Fitting Equipment into Existing Spaces

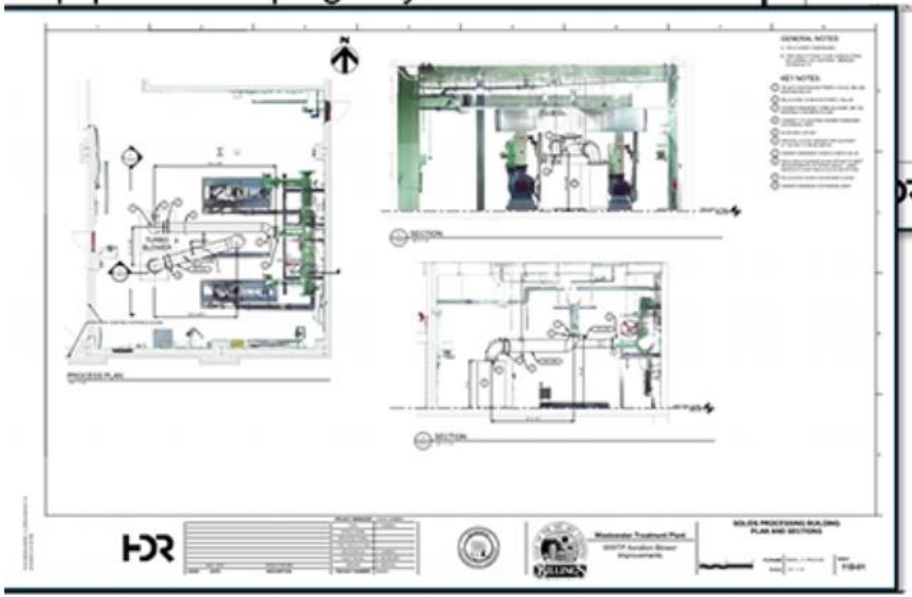
Tie-In Location

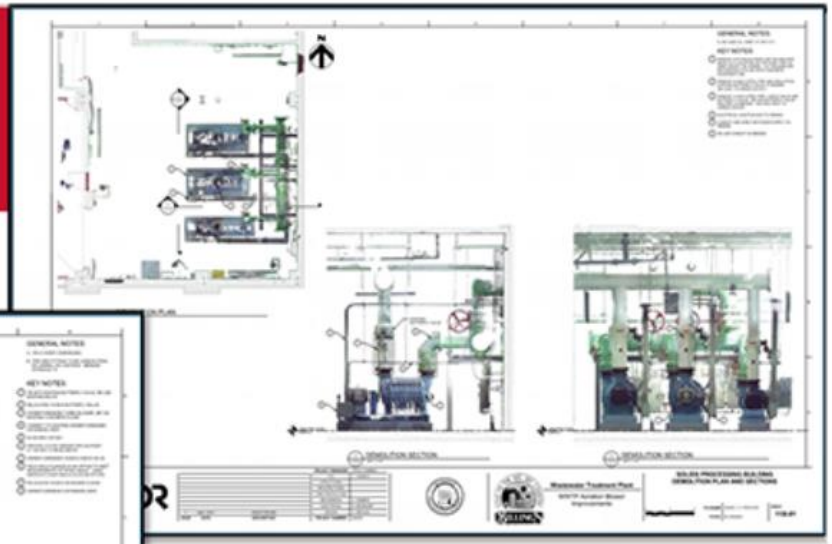
Laser Scanning

Current Technology Examples

Drawing Generation

Equipment / Piping Layout





Demolition Sheet

Laser Scanning

Current Technology Examples

Project Home View Tools

John Bowen

Current Model

600-STRUCTURAL (v1); 600-

Properties Search Advanced Search Collections Dimension Reports Trends

Viewer

Properties

Search:

Name	Value
Facility Name	Pre-Dewatering
Series Number	600
Information	
Assembly Code	
Assembly Description	
Type	Ductile Iron - PE
Insulation	
Insulation Thickness	0
Overall Size	6"
Issued For Bid Drawings	
Drawing Link	http://collaboration/sites/dis/Shared%20Docu...
Issued For Bid Specifications	
Specifications Link	http://collaboration/sites/dis/Shared%20Docu...
Mechanical	
Mechanical - Flow	
Other	
Other(Type)	
Phasing	
Phase Created	New Construction
Photographs	
Photographs Link	http://collaboration/sites/dis/Shared%20Docu...
PIPE SEGMENT QTY	
LENGTH	19.78125
MATERIAL	Ductile Iron
SIZE	6"
SYSTEM	STS

Properties Report Advanced Search Collections

Process completed

Integration of BIM, PMIS, AM, and CMMS

Current Technology Examples

Project Home View Tools

John Bowen

Current Model

600-STRUCTURAL (v1); 600-

Properties Search Advanced Search Collections Dimension Reports Trends

Viewer

Properties

Search:

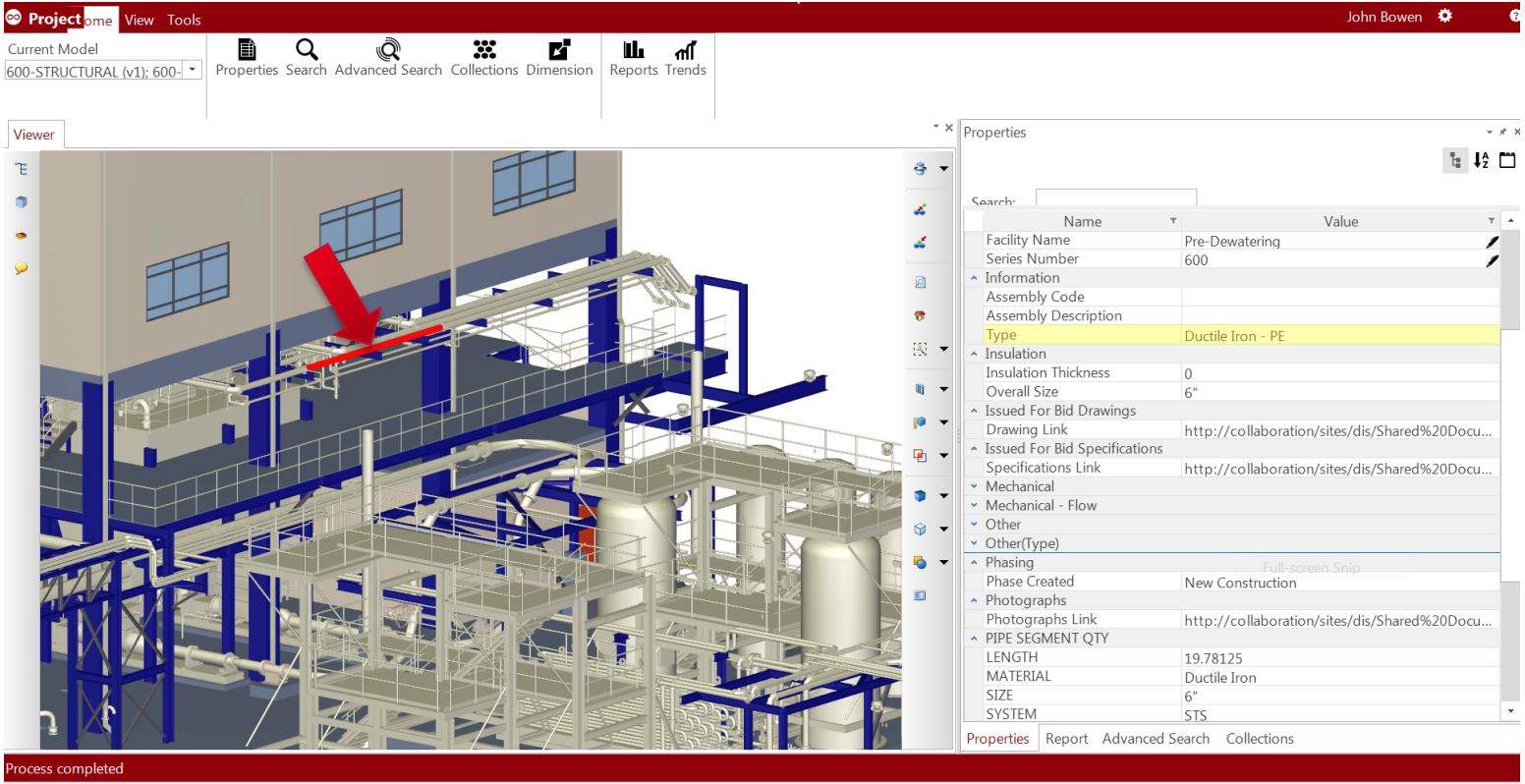
Name	Value
Facility Name	Pre-Dewatering
Series Number	600
Information	
Assembly Code	
Assembly Description	
Type	Ductile Iron - PE
Insulation	
Insulation Thickness	0
Overall Size	6"
Issued For Bid Drawings	
Drawing Link	http://collaboration/sites/dis/Shared%20Docu...
Issued For Bid Specifications	
Specifications Link	http://collaboration/sites/dis/Shared%20Docu...
Mechanical	
Mechanical - Flow	
Other	
Other(Type)	
Phasing	
Phase Created	New Construction
Photographs	
Photographs Link	http://collaboration/sites/dis/Shared%20Docu...
PIPE SEGMENT QTY	
LENGTH	19.78125
MATERIAL	Ductile Iron
SIZE	6"
SYSTEM	STS

Properties Report Advanced Search Collections

Process completed

Integration of BIM, PMIS, AM, and CMMS

Current Technology Examples



Integration of BIM, PMIS, AM, and CMMS

Current Technology Examples

Project Home View Tools

John Bowen

Current Model

600-STRUCTURAL (v1); 600-

Properties Search Advanced Search Collections Dimension Reports Trends

Viewer

Properties

Search:

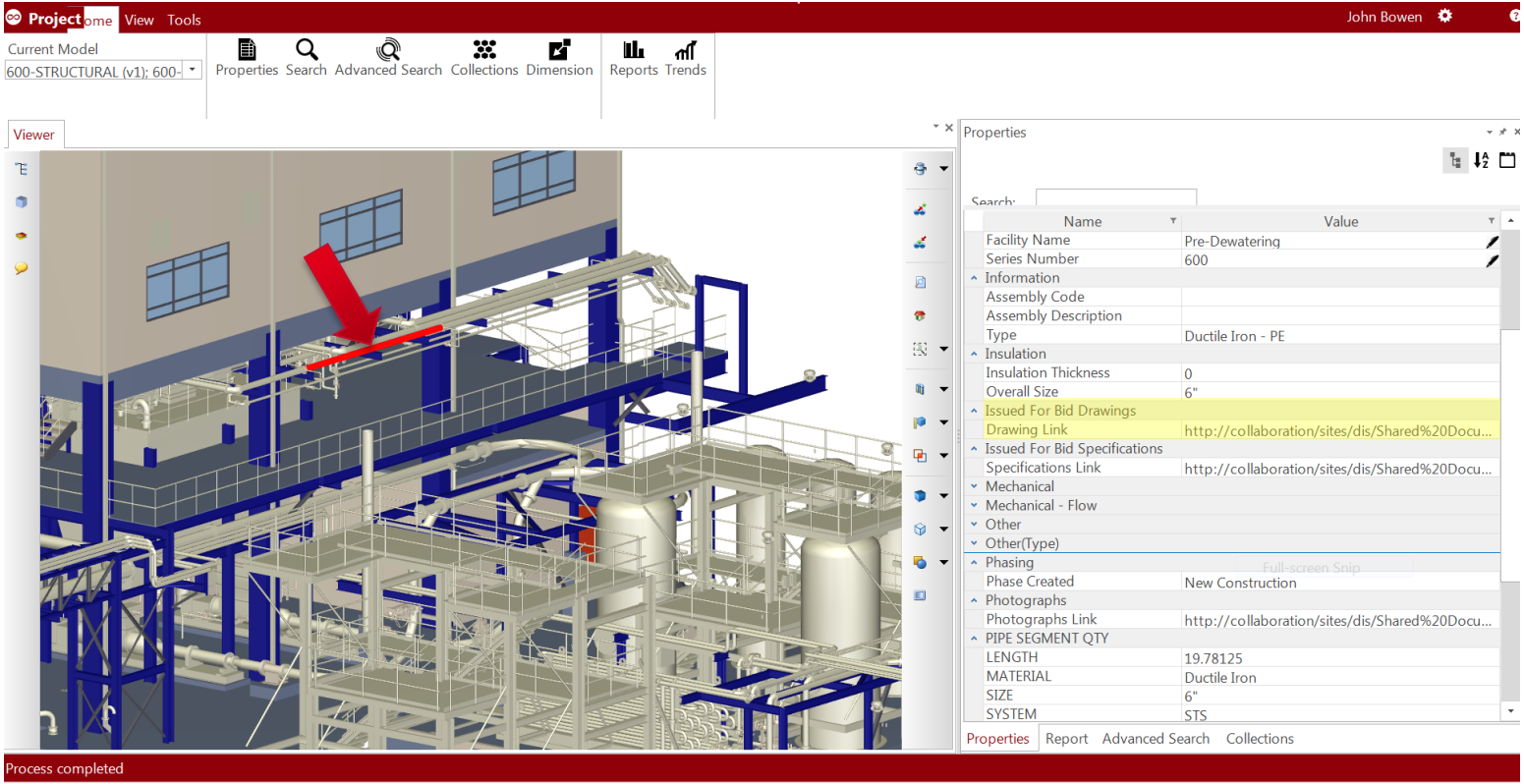
Name	Value
Facility Name	Pre-Dewatering
Series Number	600
Information	
Assembly Code	
Assembly Description	
Type	Ductile Iron - PE
Insulation	
Insulation Thickness	0
Overall Size	6"
Issued For Bid Drawings	
Drawing Link	http://collaboration/sites/dis/Shared%20Docu...
Issued For Bid Specifications	
Specifications Link	http://collaboration/sites/dis/Shared%20Docu...
Mechanical	
Mechanical - Flow	
Other	
Other(Type)	
Phasing	
Phase Created	New Construction
Photographs	
Photographs Link	http://collaboration/sites/dis/Shared%20Docu...
PIPE SEGMENT QTY	
LENGTH	19.78125
MATERIAL	Ductile Iron
SIZE	6"
SYSTEM	STS

Properties Report Advanced Search Collections

Process completed

Integration of BIM, PMIS, AM, and CMMS

Current Technology Examples



Integration of BIM, PMIS, AM, and CMMS

Current Technology Examples

Project Home View Tools

John Bowen

Current Model

600-STRUCTURAL (v1); 600-

Properties Search Advanced Search Collections Dimension Reports Trends

Viewer

Properties

Search:

Name	Value
Facility Name	Pre-Dewatering
Series Number	600
Information	
Assembly Code	
Assembly Description	
Type	Ductile Iron - PE
Insulation	
Insulation Thickness	0
Overall Size	6"
Issued For Bid Drawings	
Drawing Link	http://collaboration/sites/dis/Shared%20Docu...
Issued For Bid Specifications	
Specifications Link	http://collaboration/sites/dis/Shared%20Docu...
Mechanical	
Mechanical - Flow	
Other	
Other(Type)	
Phasing	
Phase Created	New Construction
Photographs	
Photographs Link	http://collaboration/sites/dis/Shared%20Docu...
PIPE SEGMENT QTY	
LENGTH	19.78125
MATERIAL	Ductile Iron
SIZE	6"
SYSTEM	STS

Properties Report Advanced Search Collections

Process completed

Integration of BIM, PMIS, AM, and CMMS

Current Technology Examples

Project Home View Tools

John Bowen

Current Model

600-STRUCTURAL (v1); 600-

Properties Search Advanced Search Collections Dimension Reports Trends

Viewer

Properties

Search:

Name	Value
Facility Name	Pre-Dewatering
Series Number	600
Information	
Assembly Code	
Assembly Description	
Type	Ductile Iron - PE
Insulation	
Insulation Thickness	0
Overall Size	6"
Issued For Bid Drawings	
Drawing Link	http://collaboration/sites/dis/Shared%20Docu...
Issued For Bid Specifications	
Specifications Link	http://collaboration/sites/dis/Shared%20Docu...
Mechanical	
Mechanical - Flow	
Other	
Other(Type)	
Phasing	
Phase Created	New Construction
Photographs	
Photographs Link	http://collaboration/sites/dis/Shared%20Docu...
PIPE SEGMENT QTY	
LENGTH	19.78125
MATERIAL	Ductile Iron
SIZE	6"
SYSTEM	STS

Properties Report Advanced Search Collections

Process completed

Integration of BIM, PMIS, AM, and CMMS

Current Technology Examples

Project Home View Tools

John Bowen

Current Model

600-STRUCTURAL (v1); 600-

Properties Search Advanced Search Collections Dimension Reports Trends

Viewer

Properties

Search:

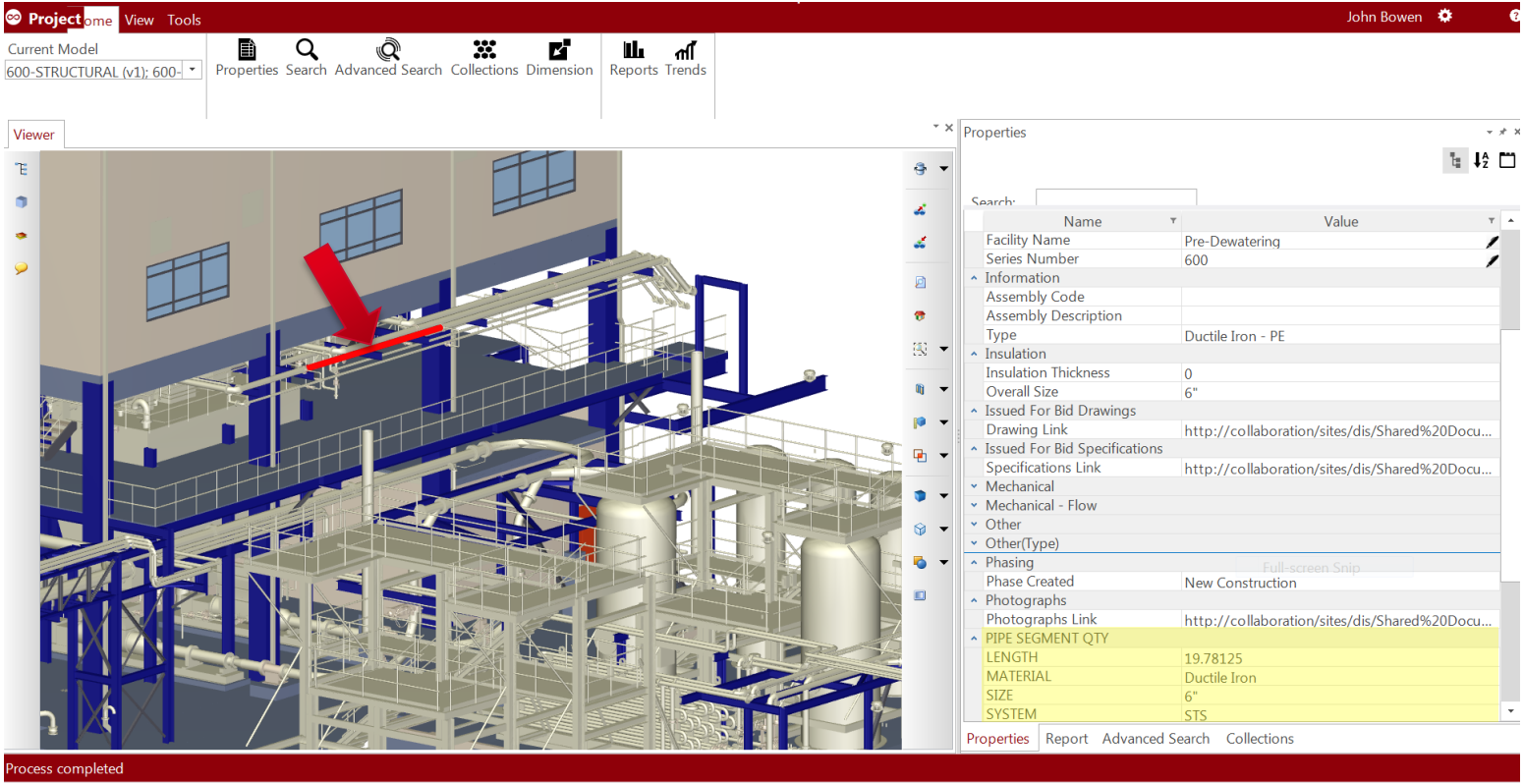
Name	Value
Facility Name	Pre-Dewatering
Series Number	600
Information	
Assembly Code	
Assembly Description	
Type	Ductile Iron - PE
Insulation	
Insulation Thickness	0
Overall Size	6"
Issued For Bid Drawings	
Drawing Link	http://collaboration/sites/dis/Shared%20Docu...
Issued For Bid Specifications	
Specifications Link	http://collaboration/sites/dis/Shared%20Docu...
Mechanical	
Mechanical - Flow	
Other	
Other(Type)	
Phasing	
Phase Created	New Construction
Photographs	
Photographs Link	http://collaboration/sites/dis/Shared%20Docu...
PIPE SEGMENT QTY	
LENGTH	19.78125
MATERIAL	Ductile Iron
SIZE	6"
SYSTEM	STS

Properties Report Advanced Search Collections

Process completed

Integration of BIM, PMIS, AM, and CMMS

Current Technology Examples

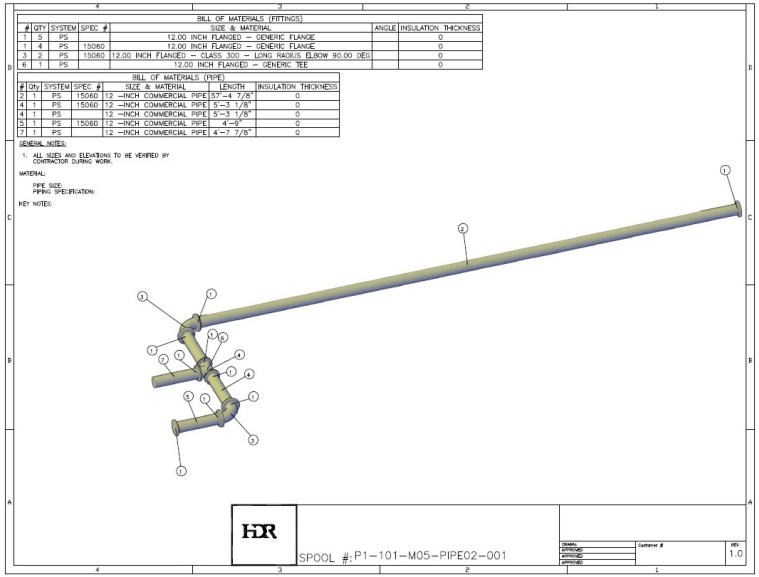


Integration of BIM, PMIS, AM, and CMMS

Current Technology Examples

Drones

Digital Pipe Spool Fabrication



BILL OF MATERIALS (FITTINGS)

#	QTY	SYSTEM	SPEC #	SIZE & MATERIAL	ANGLE	INSULATION THICKNESS
1	5	PS		12.00 INCH FLANGED – GENERIC FLANGE		0
1	4	PS	15060	12.00 INCH FLANGED – GENERIC FLANGE		0
3	2	PS	15060	12.00 INCH FLANGED – CLASS 300 – LONG RADIUS ELBOW 90.00 DEG		0
6	1	PS		12.00 INCH FLANGED – GENERIC TEE		0

BILL OF MATERIALS (PIPE)

#	Qty	SYSTEM	SPEC #	SIZE & MATERIAL	LENGTH	INSULATION THICKNESS
2	1	PS	15060	12 –INCH COMMERCIAL PIPE	57'–4 7/8"	0
4	1	PS	15060	12 –INCH COMMERCIAL PIPE	5'–3 1/8"	0
4	1	PS		12 –INCH COMMERCIAL PIPE	5'–3 1/8"	0
5	1	PS	15060	12 –INCH COMMERCIAL PIPE	4'–0"	0
7	1	PS		12 –INCH COMMERCIAL PIPE	4'–7 7/8"	0

GENERAL NOTES:

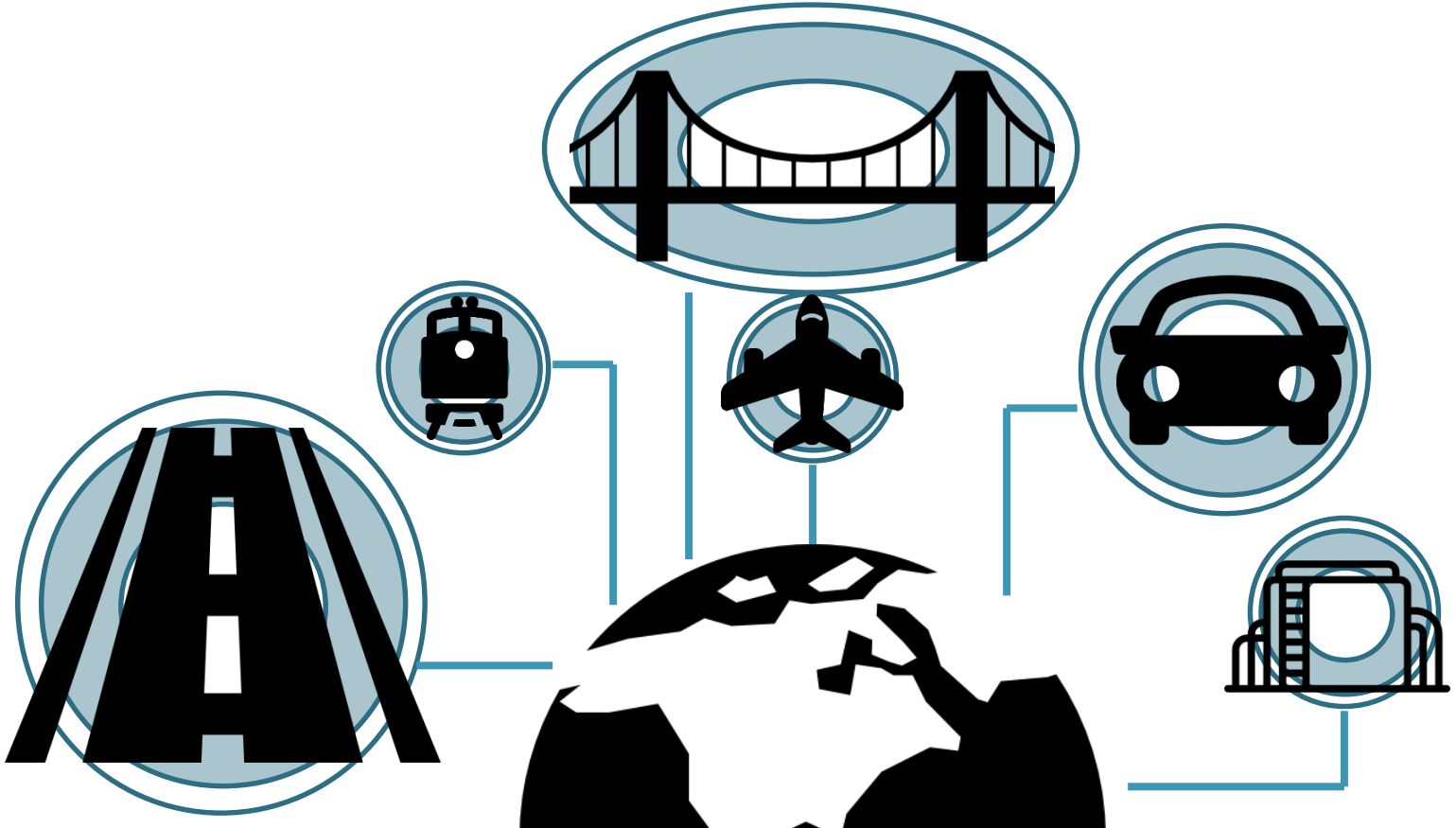
1. ALL SIZES AND ELEVATIONS TO BE VERIFIED BY CONTRACTOR DURING WORK.

MATERIAL:

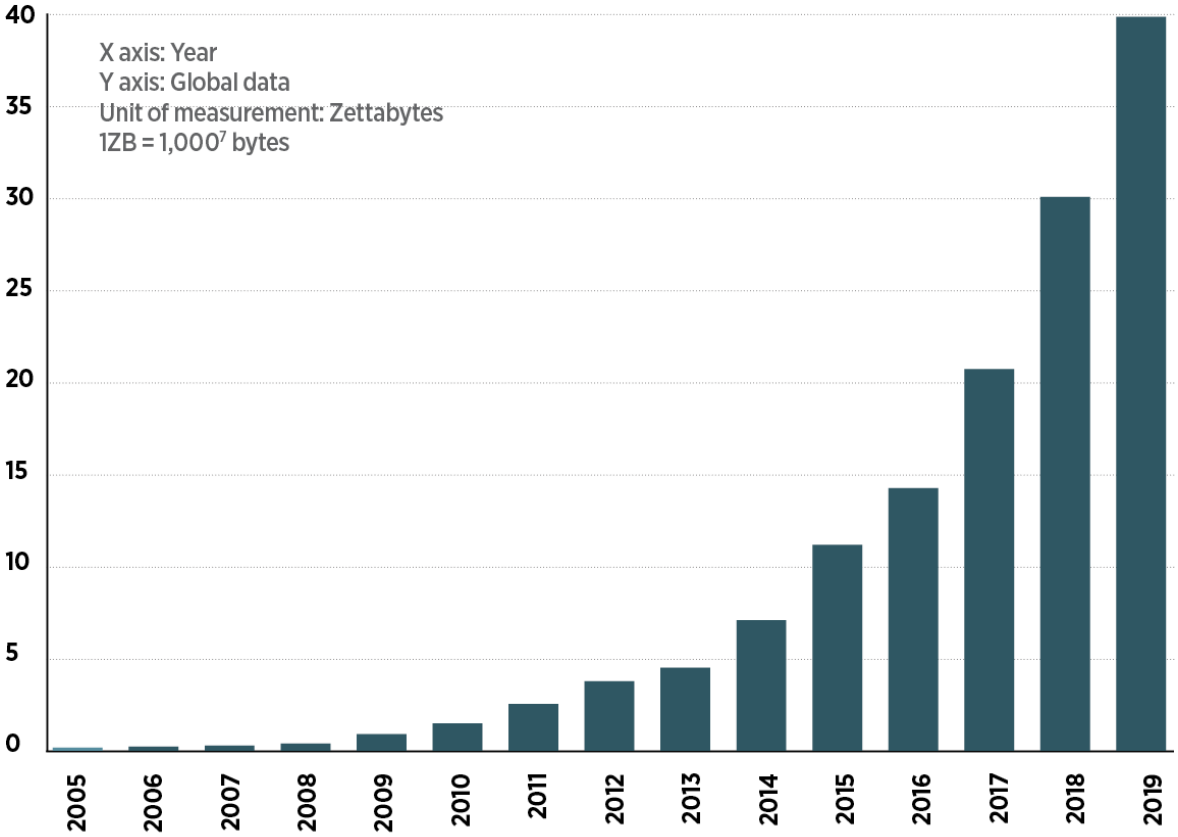
PIPE SIZE:
PIPING SPECIFICATION:

KEY NOTES:

THE INTERNET OF THINGS

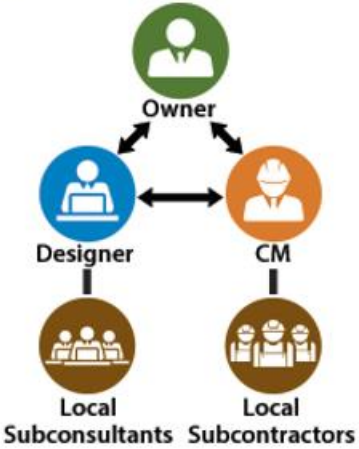


What Does All of This Technology Mean? BIG DATA GROWTH



Note: Post-2013 figures are predicted. Source: UNECE

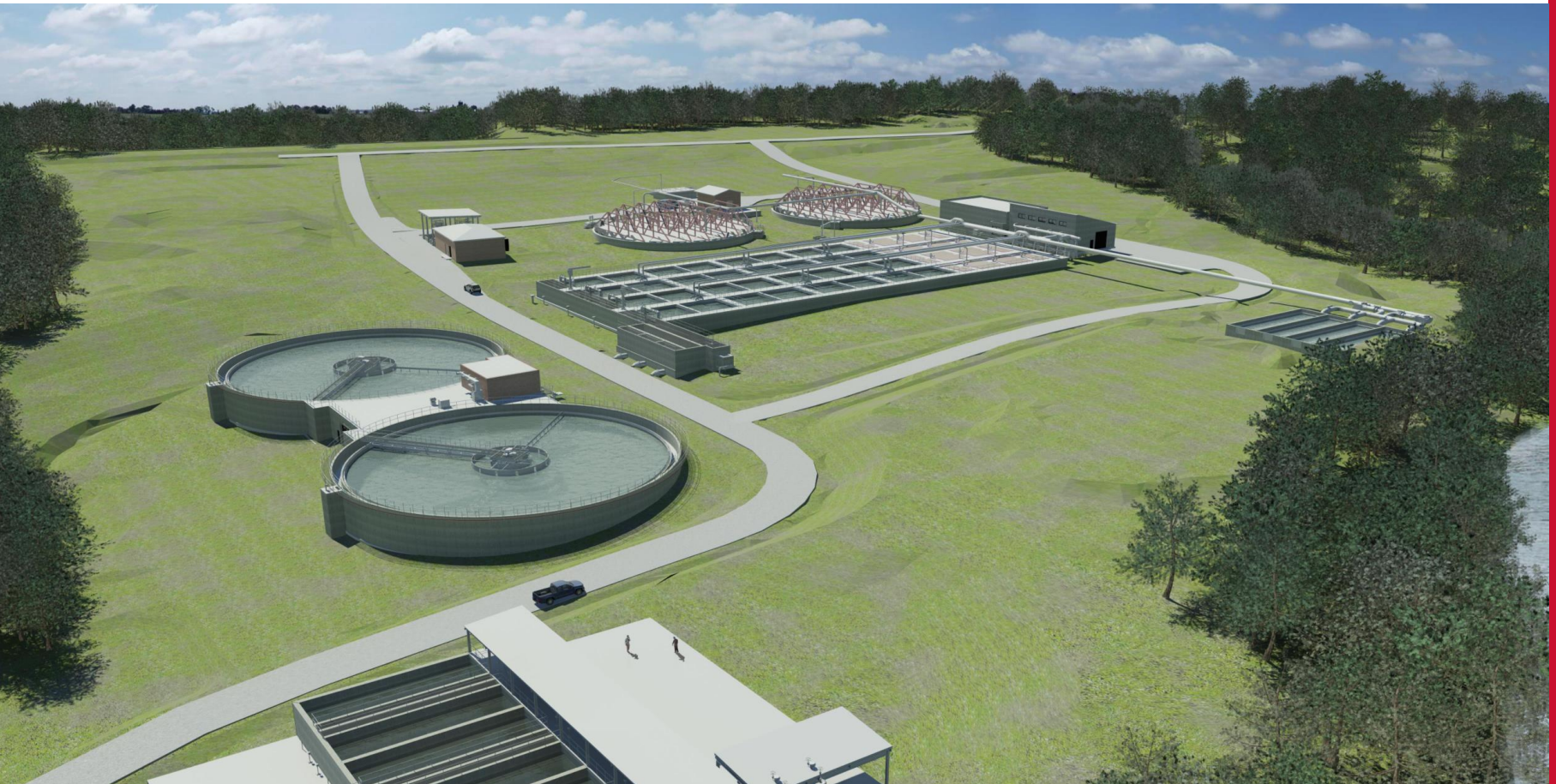
What is Changing



Alternative Delivery Methods

Infrastructure

State of the Water/Wastewater Industry



State of the Water/Wastewater Industry - On Projects

- **Most owners are not requiring the use of BIM**
- **Most Designers/Contractors are using BIM to assist in performing their tasks**
- **Most owners do not have the necessary Contract Language in place including:**
  - RFP Language
  - Contract Requirements
  - Standards
- **Most owners are not receiving models and other useful data during deliverables because simply, they are not asking for it**

State of the Water/Wastewater Industry - In Operations

- **Very few owners are utilizing models and design/construction data for operations**

- **Owners are beginning the process of preparing for this workflow**
  - Focusing on getting documents organized and document management systems in place
  - Performing Strategic Planning initiatives
  - Performing Implementation tasks
  - Updating Contract Language
  - Creating Necessary Standards

- **Have seen a significant uptick in this effort over the past two years**

- **Water/Wastewater owners are at an advantageous starting point due to:**
  - Models being used by Designers/Contractors in the W/WW industry for over a decade
  - Models are typically of high quality

Current Workflow Issues

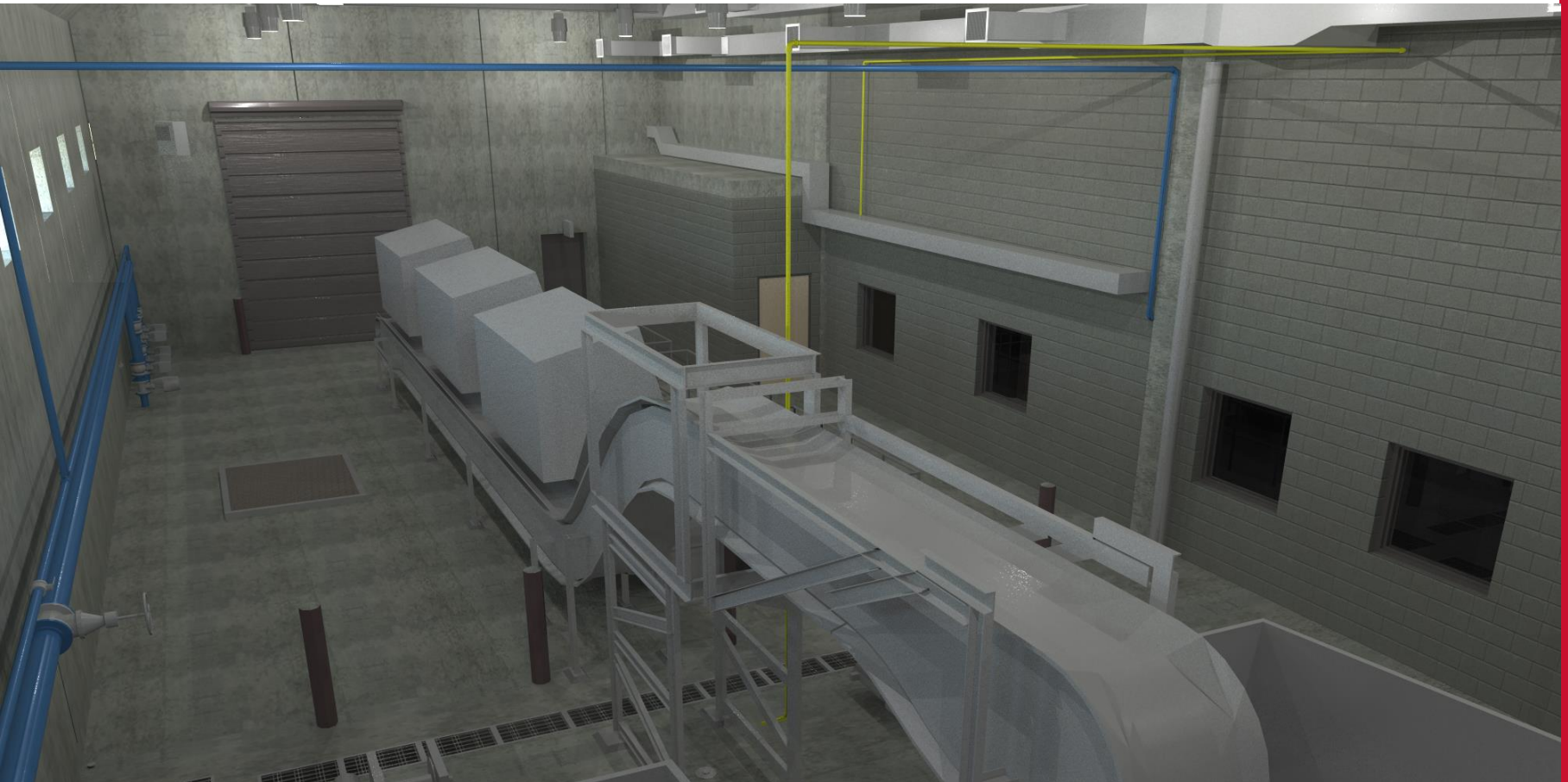
Current Workflow Issues

- **Models are not being developed with O&M in mind:**
  - Not all of the necessary elements are in the model
  - Elements that are included are not always modeled as needed
  - Required Data is not being included
  - Contracts are not asking for models and data correctly (or at all)

- **Data Collection is more difficult than anticipated**
  - Multiple parties are collecting information in various ways (No Consistency)
  - Validation concerns (checking that you are getting what you are asking for)

- **Most Owners do not have the in-house skills related to the new technologies**
  - Not enough experience with the new technologies to know what to ask for
  - What is it's value? The question you should ask is "What problem do I have that these technologies can help me solve?"

Strategic Planning, Implementation, and Standards



The Steps to Technology Implementation for Owners

	Task Number	Task Description
Strategic Planning	1	Goals Workshop
	2	Strategic Planning Workshop
	3	Strategic Plan Documentation
Implementation Planning	4	Ideal Operating State Workshop
	5	Infrastructure Evaluation (Hardware and Software)
	6	Model Element Breakdown
	7	Level of Detail Specification
	8	Facility Data Requirements
Procurement Planning	9	Team Selection Criteria
	10	Contract Requirements
	11	BIM Project Execution Plan Template Development
Education and Training	12	Training Material Creation
	13	BIM Awareness Sessions (All Staff)
	14	BIM Management Sessions (Deliverable Reviewers and Users)
	15	BIM Technology Sessions (Picks and Clicks)
Project Execution	16	Pilot Project Support
	17	Benchmarking

Strategic Planning

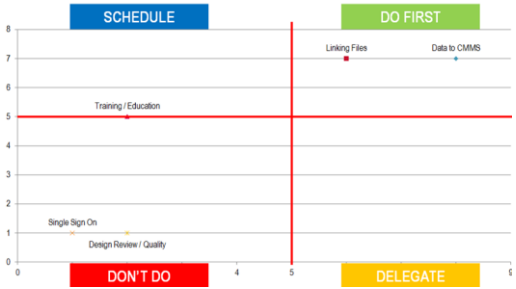
- **Establish an Organizational BIM Champion and Planning Team**
  - Establishes Organizational BIM Goals and Objectives.
  - Provides BIM Awareness and Promotion within the Organization

- **Create a BIM Charter that identifies:**
  - Team Members, Objectives, Duration and Time Commitment, Team Scope, End Result

- **Conduct Organizational BIM Assessment**
  - Establishes Current and Target Levels of Organizational BIM Adoption

- **Establish BIM Goals and Identify BIM Uses Required**
  - Examples: BIM Data to CMMS, Better Design Coordination, Faster Access to Information
  - Industry Standard BIM Uses identified so that BIM Goals can be achieved

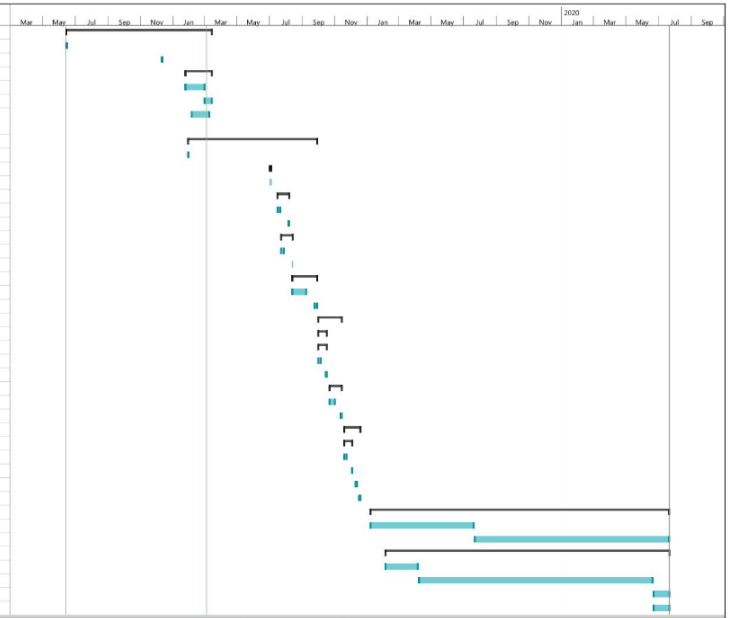
Organizational BIM Assessment Profile			
BIM Planning Element	Current Level	Target Level	Total Possible
Strategy	3	15	25
BIM Uses	1	6	10
Process	0	6	10
Information	0	7	15
Infrastructure	2	9	15
Personnel	0	13	25
Totals	6	56	100



Implementation Planning

- **Infrastructure Evaluation**
  - Includes Hardware and Software
- **Develop an Advancement Strategy (BIM Roadmap)**

ID	Task Name	Duration	Start	Finish
1	**Strategic Planning**	**196 days**	**Wed 6/14/17**	**Wed 3/14/18**
2	**Goals Workshop**	**2 days**	**Wed 6/14/17**	**Thu 6/15/17**
3	**BIM Strategic Planning Workshop**	**1 day**	**Mon 12/11/17**	**Mon 12/11/17**
4	**Strategic Plan Documentation**	**36 days**	**Wed 1/24/18**	**Wed 3/14/18**
5	Draft	26 days	Wed 1/24/18	Wed 2/28/18
6	Final	10 days	Thu 3/1/18	Wed 3/14/18
7	**Review Comments on Draft Standards &Preferences Language**	**25 days**	**Mon 2/5/18**	**Fri 3/9/18**
8	**Implementation Planning**	**175 days**	**Mon 1/29/18**	**Fri 9/28/18**
9	**Ideal Operating State Workshop**	**1 day**	**Mon 1/29/18**	**Mon 1/29/18**
10	**Software Requirements and Budgetary Cost**	**3 days**	**Mon 7/2/18**	**Wed 7/4/18**
11	Final	3 days	Mon 7/2/18	Wed 7/4/18
12	**Model Element Breakdown**	**16 days**	**Mon 7/16/18**	**Mon 8/6/18**
13	Draft	5 days	Mon 7/16/18	Fri 7/20/18
14	Final	1 day	Mon 8/6/18	Mon 8/6/18
15	**Level of Detail Specificiation**	**16 days**	**Mon 7/23/18**	**Mon 8/13/18**
16	Draft	5 days	Mon 7/23/18	Fri 7/27/18
17	Final	1 day	Mon 8/13/18	Mon 8/13/18
18	**Facilty Data Requirements**	**35 days**	**Mon 8/13/18**	**Fri 9/28/18**
19	Draft	20 days	Mon 8/13/18	Fri 9/7/18
20	Final	5 days	Mon 9/24/18	Fri 9/28/18
21	**Procurement Planning**	**32 days**	**Mon 10/1/18**	**Tue 11/13/18**
22	**Contract Requirements**	**12 days**	**Mon 10/1/18**	**Tue 10/16/18**
23	**BIM Design Guidelines**	**12 days**	**Mon 10/1/18**	**Tue 10/16/18**
24	Draft	5 days	Mon 10/1/18	Fri 10/5/18
25	Final	2 days	Mon 10/15/18	Tue 10/16/18
26	**BIM SOP's**	**17 days**	**Mon 10/22/18**	**Tue 11/13/18**
27	Draft	8 days	Mon 10/22/18	Wed 10/31/18
28	Final	2 days	Mon 11/12/18	Tue 11/13/18
29	**Education and Training**	**22 days**	**Mon 11/19/18**	**Tue 12/18/18**
30	**Training Materials**	**11 days**	**Mon 11/19/18**	**Mon 12/3/18**
31	Draft	4 days	Mon 11/19/18	Thu 11/22/18
32	Final	1 day	Mon 12/3/18	Mon 12/3/18
33	**Training Session 1**	**2 days**	**Mon 12/10/18**	**Tue 12/11/18**
34	**Training Session 2**	**2 days**	**Mon 12/17/18**	**Tue 12/18/18**
35	**Project Execution**	**401 days**	**Mon 1/7/19**	**Mon 7/20/20**
36	Deliverable Checking	140 days	Mon 1/7/19	Fri 7/19/19
37	Utilize BIM for Operations	261 days	Mon 7/22/19	Mon 7/20/20
38	**Continuous Improvement**	**382 days**	**Mon 2/4/19**	**Tue 7/21/20**
39	Establish Key Performance Indicators	45 days	Mon 2/4/19	Fri 4/5/19
40	Review Lessons Learned	315 days	Mon 4/8/19	Fri 6/19/20
41	Update Standards and Contract Language	22 days	Mon 6/22/20	Tue 7/21/20
42	Establish Next Two Year Plan	22 days	Mon 6/22/20	Tue 7/21/20



Project: Strategic Plan Roadmap
Date: Mon 3/5/18

Task · Split · Milestone · Summary · Project Summary · Inactive Task · Inactive Milestone · Inactive Summary · Manual Task · Duration-only · Manual Summary Rollup · Manual Summary · Start-only · Finish-only · External Tasks · External Milestone · Deadline · Progress · Manual Progress

BIM and Data Standards

- **Create a Model Element Breakdown**
  - Determines what elements are required to be in the model for O&M
- **Create a Level of Detail Specification**
  - Establishes how much detail each element is modeled to
- **Create Facility Data Requirements**
  - Establishes what attributes and properties should be specified about each element
- **Determine BIM Uses necessary to meet established BIM Goals**
  - Industry Standard BIM Uses identified so that BIM Goals can be achieved

Contract Language

- **Definition of Terms**
- **BIM Project Execution Plan Template**
- **Collaboration requirements, e.g. the sharing of a design model to the contractor**
- **Deliverables**
- **Ownership of the Model and Information**
- **Modeling Standards**
  - Defines specific modeling requirements such as; Model Types, Model Structure, Coordinate Systems, File Naming, Folder Structures, etc.
  - References to Model Element Breakdown, Level of Detail Specification, Facility Data Requirements
- **BIM Requirements for 2D Documents**

Project Execution

- **Verification of Deliverables**
  - The checking of deliverables to make sure you are getting what you asked for
    - Models
    - Facility Data
    - Quality
    - Drawings
- **Project Support**
  - An owner representative who can provide guidance and assistance to project teams
- **Benchmarking**
  - Tracking of Key Performance Indicators (KPI's) to verify progress is occurring

Conclusion

- Technology is evolving faster than ever
- The amount of Data available is more than humans can handle – technology is necessary to manage it
- Software and Hardware are more than capable to achieve success
- Owners need to identify what issues they are having that Technology can help solve, develop a Strategic Plan and implement it
- Owner Contract Language and Standards are needed which match your specific Goals

QUESTIONS