BIM-FM: Utopia vs Reality

Saurabh Gangwar

CONNECT & CONSTRUCT SUMMIT

AUTODESK UNIVERSITY

Agenda

- Introduction
- Why?
- What?
- How?
- Who?
- Case Studies
- Recommendations

What are we going to talk about?

https://www.codainsights.com/

Our **construction data** based algorithms partnered with our **building expertise** provide project teams with data based deliverables for **actionable insights**.

AN AFFILIATE OF CLARK CONSTRUCTION GROUP, LLC

Clark Construction Group is one of the most experienced and respected building and civil construction firms in the United States.

About the speaker

Saurabh Gangwar

Senior Manager, Virtual Design and Construction

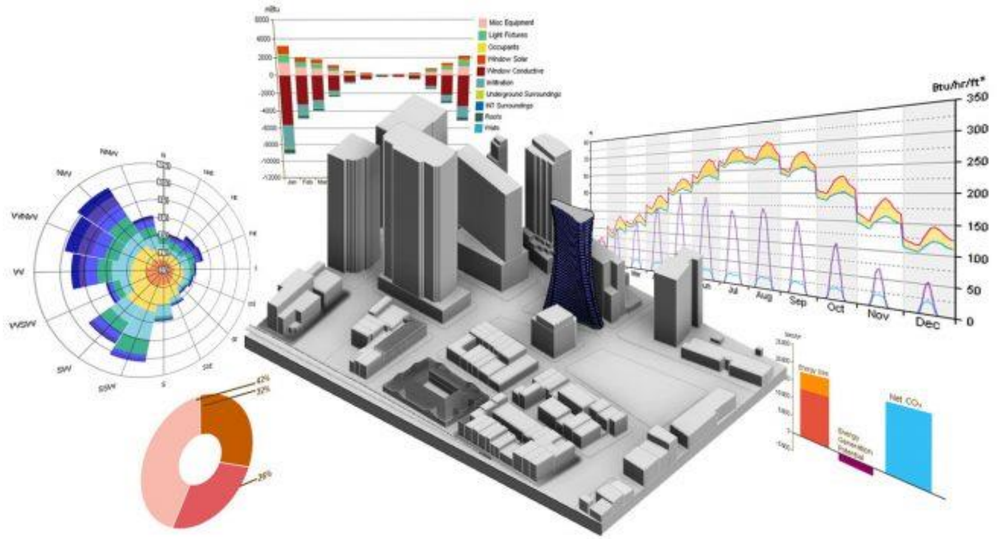
Coda / Clark Construction

- Architect
- Construction Manager
- Technologist
- Green Warrior

Introduction

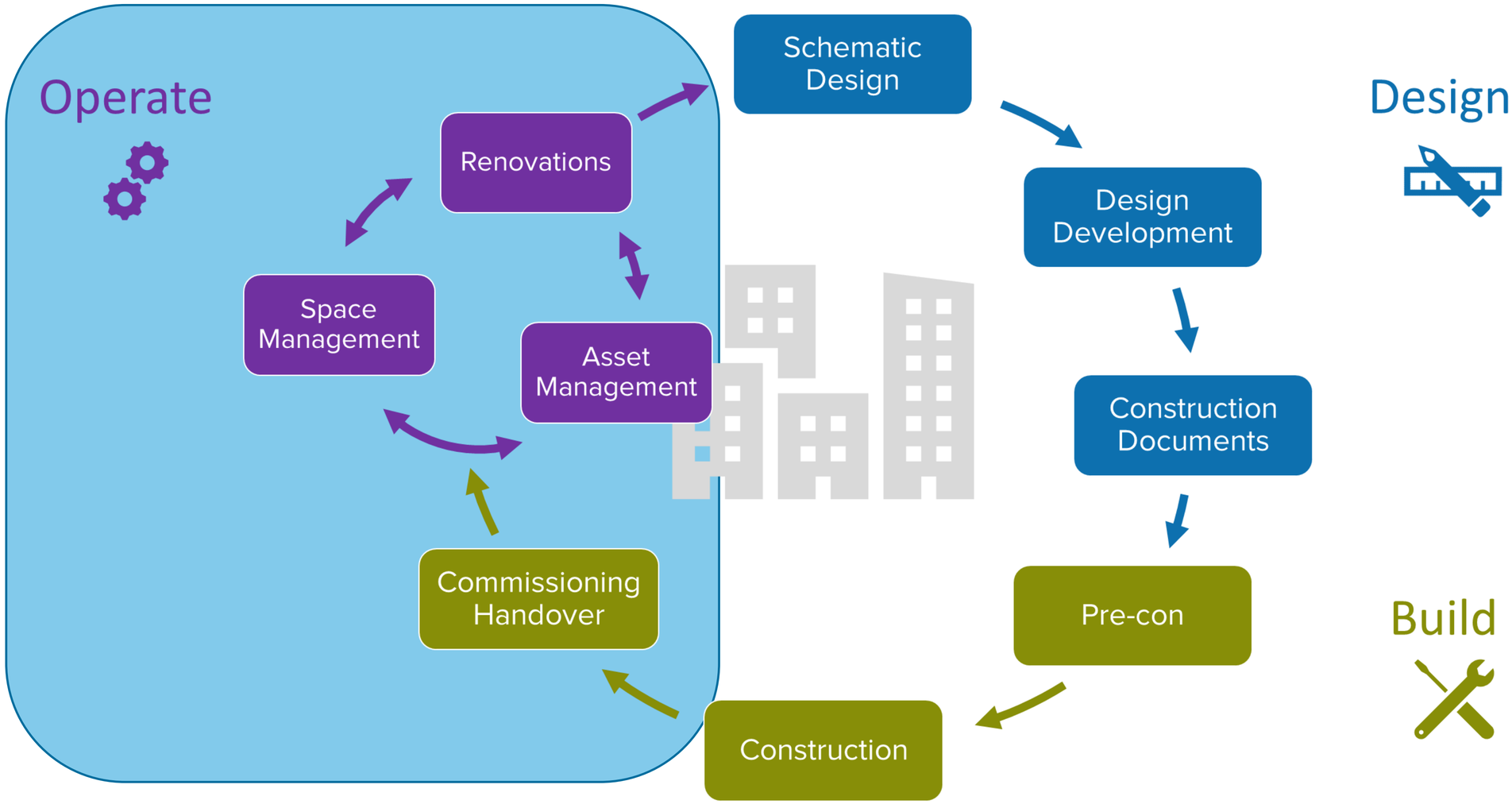
Building Information Modeling (BIM)

“**Building Information Modeling** is a digital representation of physical and functional characteristics of a **facility**. As such it serves as a shared knowledge resource for **information** about a **facility** forming a reliable basis for decisions during its **life cycle** from inception onward.”



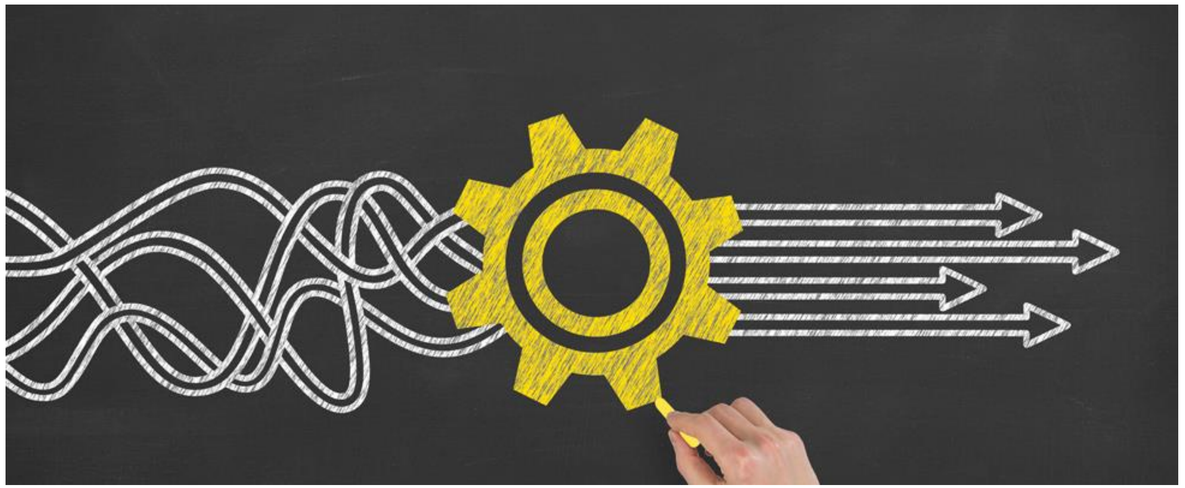
National BIM Standards (NBIMS)

Building Lifecycle



Data Curation

Data curation is the organization and integration of **data collected** from various sources. It involves annotation, publication and presentation of the data such that the value of the data is maintained over time, and the data remains available for reuse and preservation.



Wikipedia

BIM-FM

BIM-FM is the process of data curation from Building Information Models for the purpose of Facilities Management

FM Data Collection: The Traditional Way

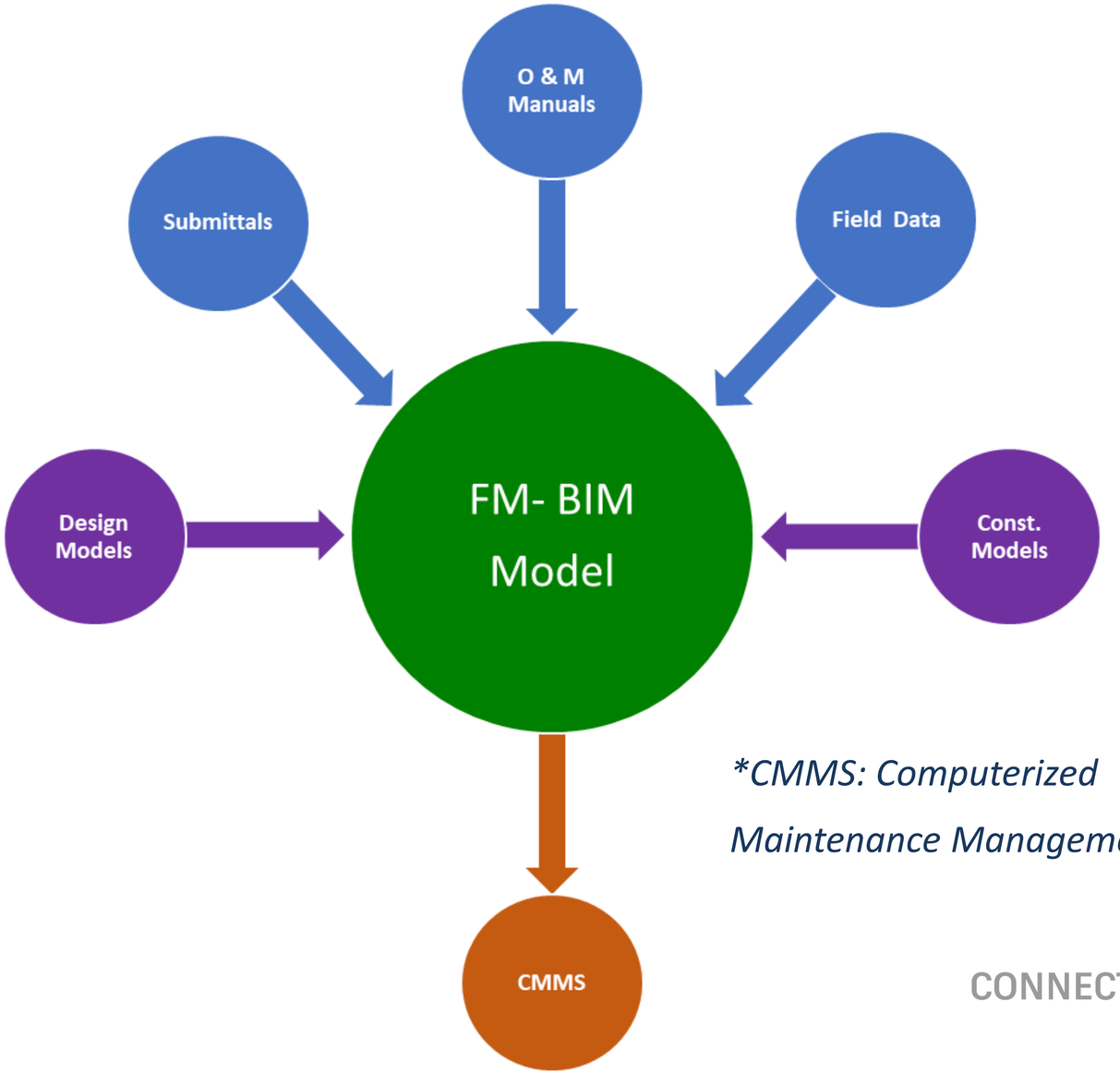
AS BUILT DRAWINGS

- Hard Copy Prints
- PDFs
- 2D CAD

OPERATIONS & MAINTENANCE MANUALS

- Hard Copy Binders
- PDFs

FM Data Collection: The BIM Way (Utopian!)



**CMMS: Computerized*

Maintenance Management System

Utopia Versus Reality!

Life before the digital era

Life after the digital era

What Is The Way Forward?

ANSWER FOUR KEY QUESTIONS

- **Why** do we collect FM data?
- **What** FM data do we collect?
- **How** do we collect FM data?
- **Who** collects FM data?

Why?

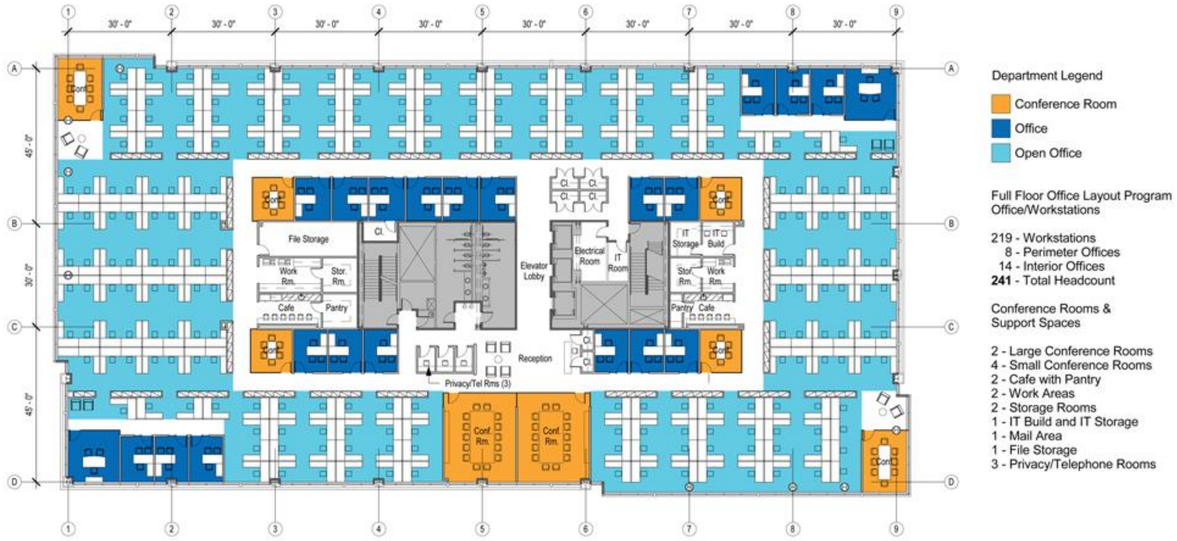
Why Do We Collect FM Data?

FOUR REASONS

- Space Management
- Renovations
- Building Maintenance (Reactive)
- Building Maintenance (Preventive)

1. Space Management

- Area calculations
- Space inventory: occupied vs available
- Control and supervision of the physical spaces
- Space could be a single floor, multiple floors within a building, or multiple floors within multiple buildings



www.arch2o.com

2. Renovation

- Selective demolition
- Addition
- Reconfiguration of space
- Building systems upgrade

3. Building Maintenance (Preventive)

- Equipment management
- Preventive maintenance tasks
- Preventive maintenance schedule
- Safety plans
- Warranty information

4. Building Maintenance (Reactive)

- Building occupant comfort
- Building Automation System (BAS)
- Workorder management
- Spare parts inventory

What?

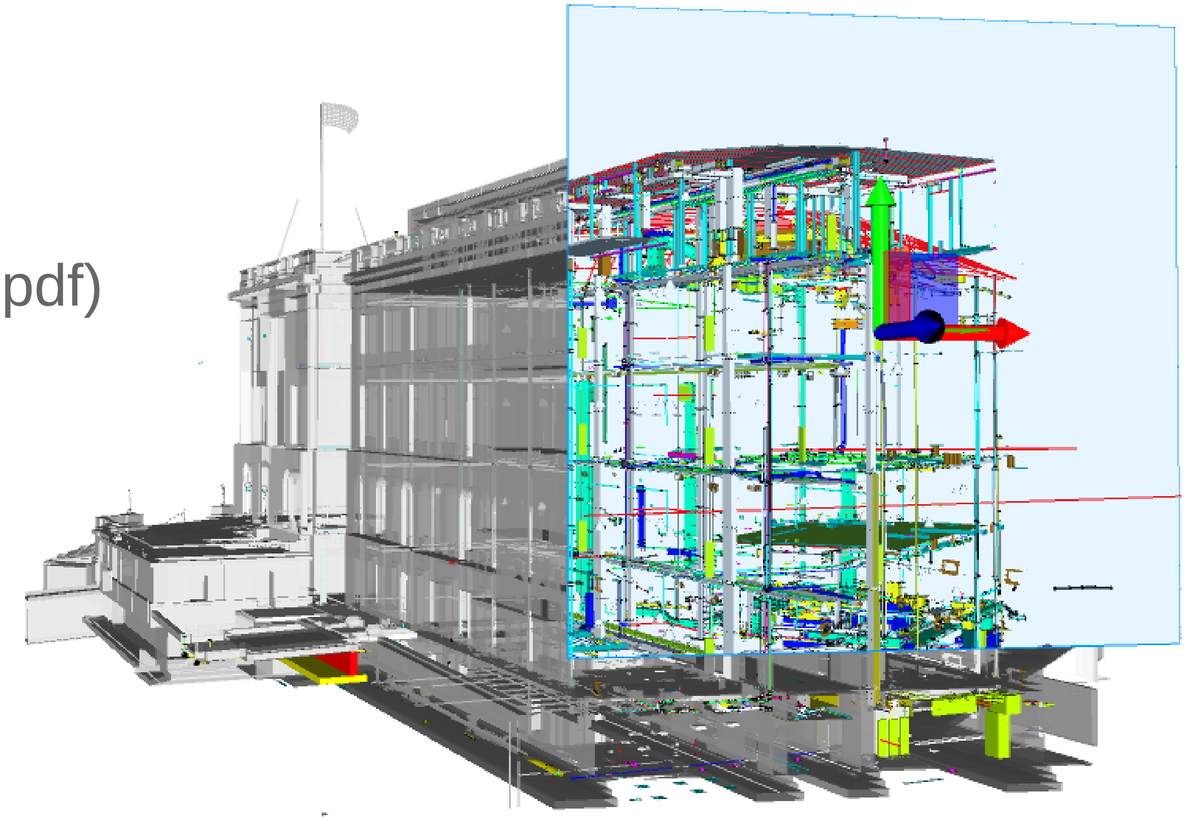
What FM Data Do We Collect?

FOUR TYPES

- Geometric Data
- Parametric Data
- Field Data
- Operation and Maintenance Submittal Data

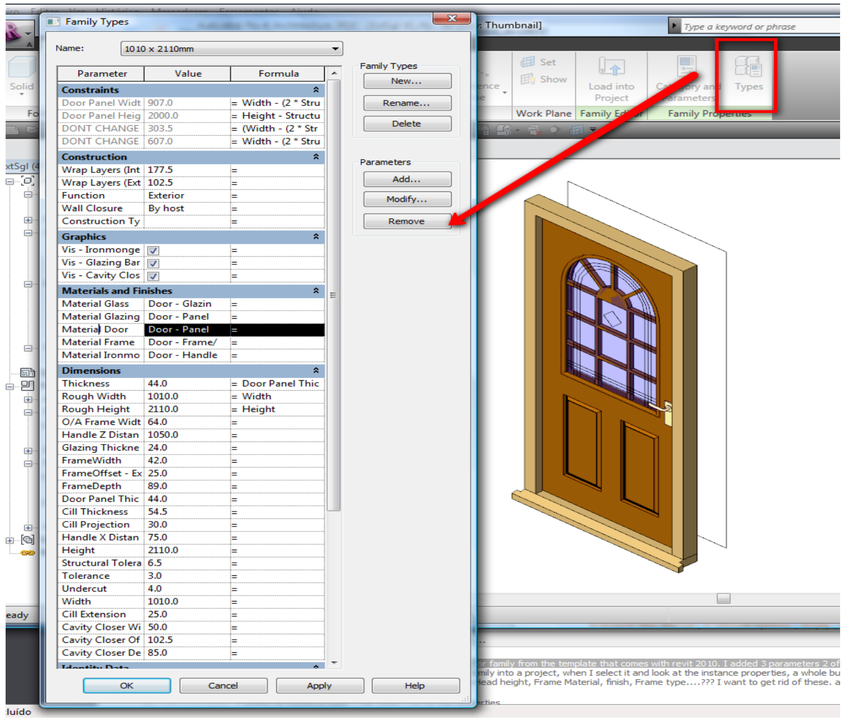
1. Geometric Data

- 2D vs 3D
- File format (native model authoring software/model viewing software/.ifc/.pdf)
- Required for space management and renovation
- As designed vs as built



2. Parametric Data

- Physical attributes (properties)
- Key parameter: location of assets
- Needed for building maintenance (preventive and reactive)
- Classification management
- Nomenclature standards

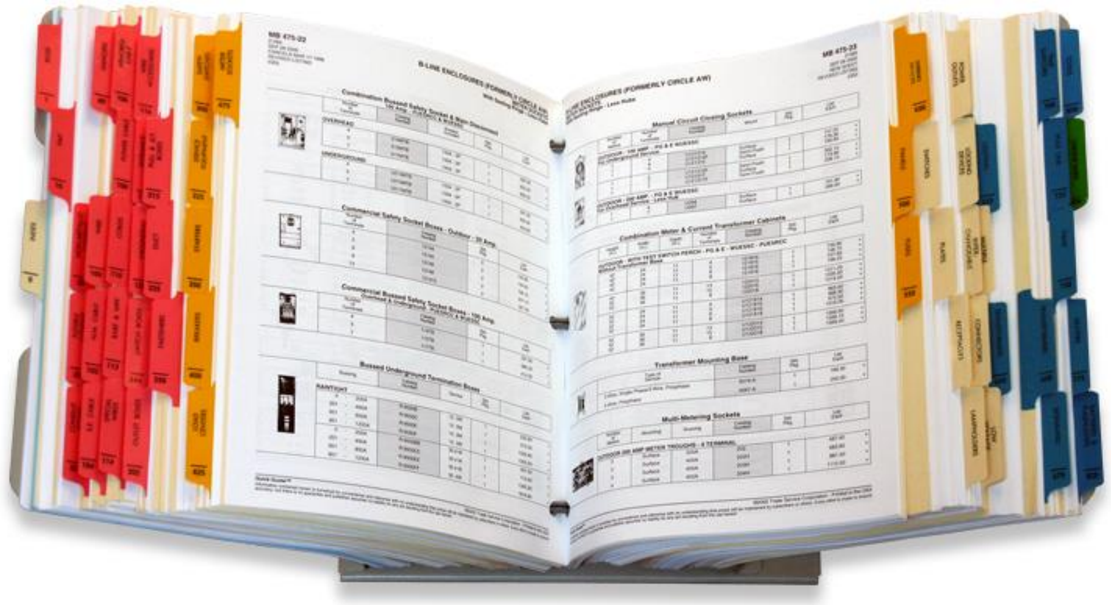


3. Field Data

- Commissioning data
- Barcoding / asset tagging
- Physical location vs virtual location
- Software: consider connectivity in field
- Hardware: consider mobility in field

4. Operations & Maintenance Submittal Data

- Needed for preventive maintenance
- Safety plans
- Warranty information
- Mostly non standard PDFs
- Consider how the data will be populated in the CMMS



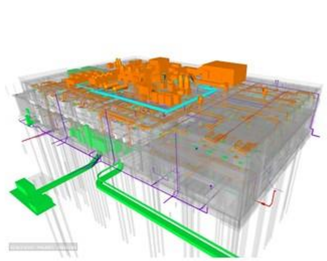
How?

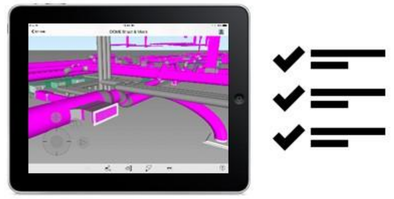
How Do We Collect FM Data?

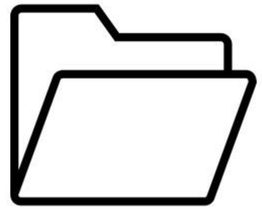
FOUR WAYS

- BIM Authoring Software
- Custom Spreadsheets
- COBie
- FM Cloud Software

Manufacturer	Equipment	ID #	Serial #	Barcode #
Trane	Air-Cooled Chiller	ACC-01	A36587498C	8509051226





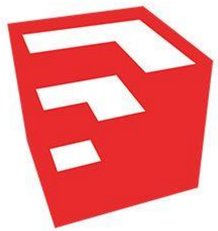


1. BIM Authoring Software

AUTODESK® REVIT®

Trimble Tekla®

GRAPHISOFT® ArchiCAD®



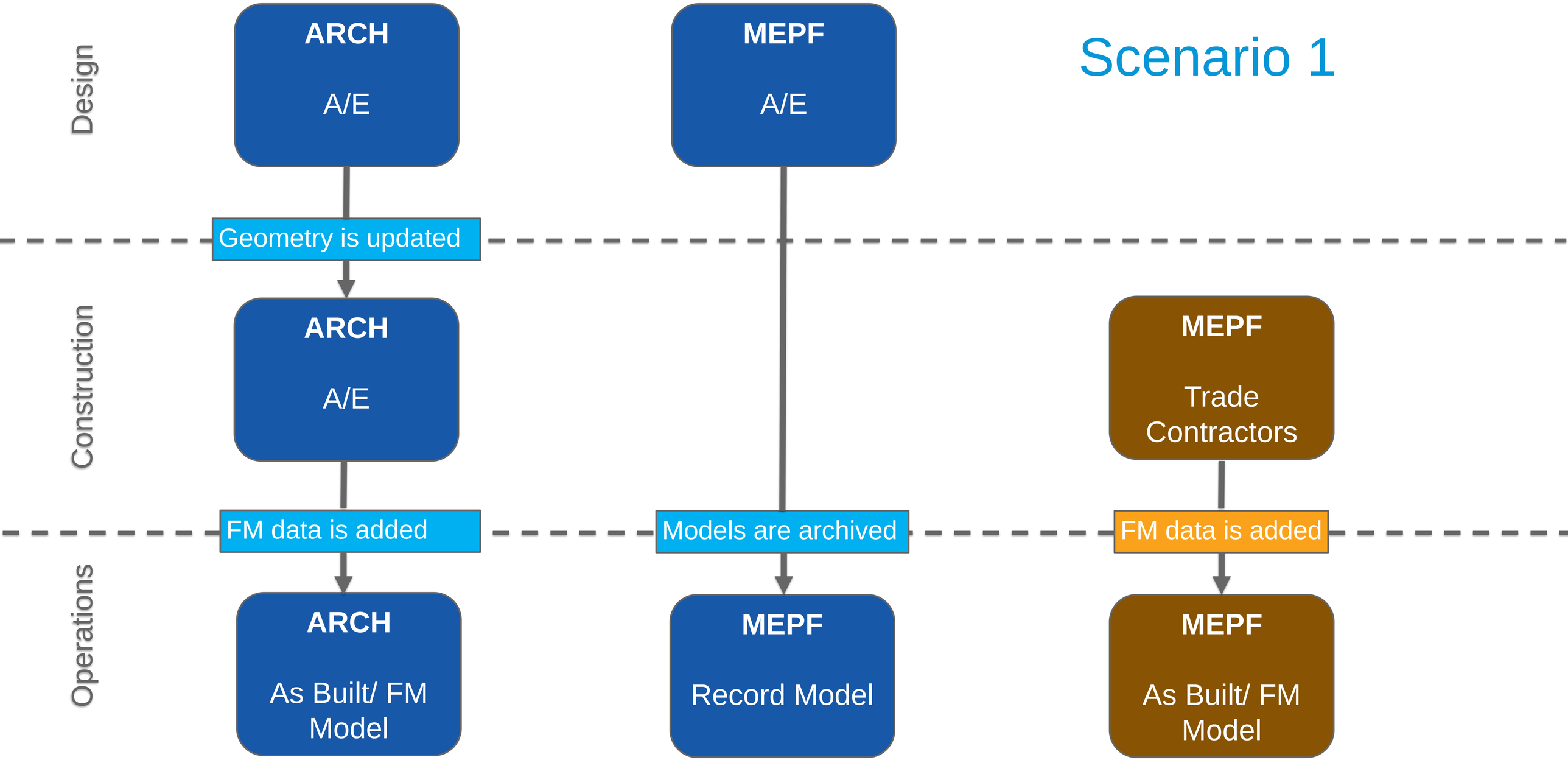
CATIA

BIM Authoring Software: Efficiency

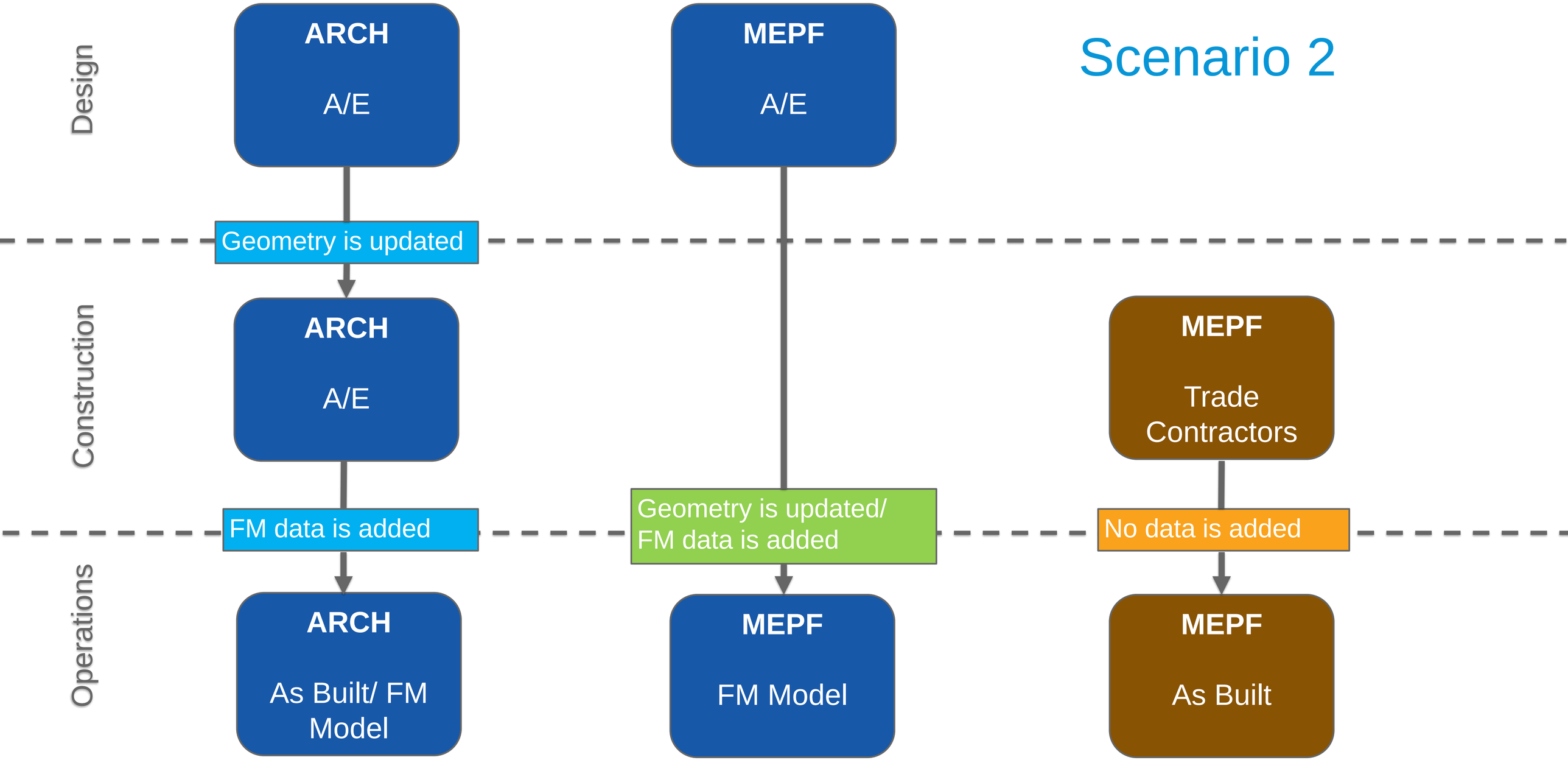
MANAGEMENT OF DIFFERENT DATA TYPES

- Great for geometric data
- Good for parametric data
- OK for field data
- Not so good for submittal data

Scenario 1

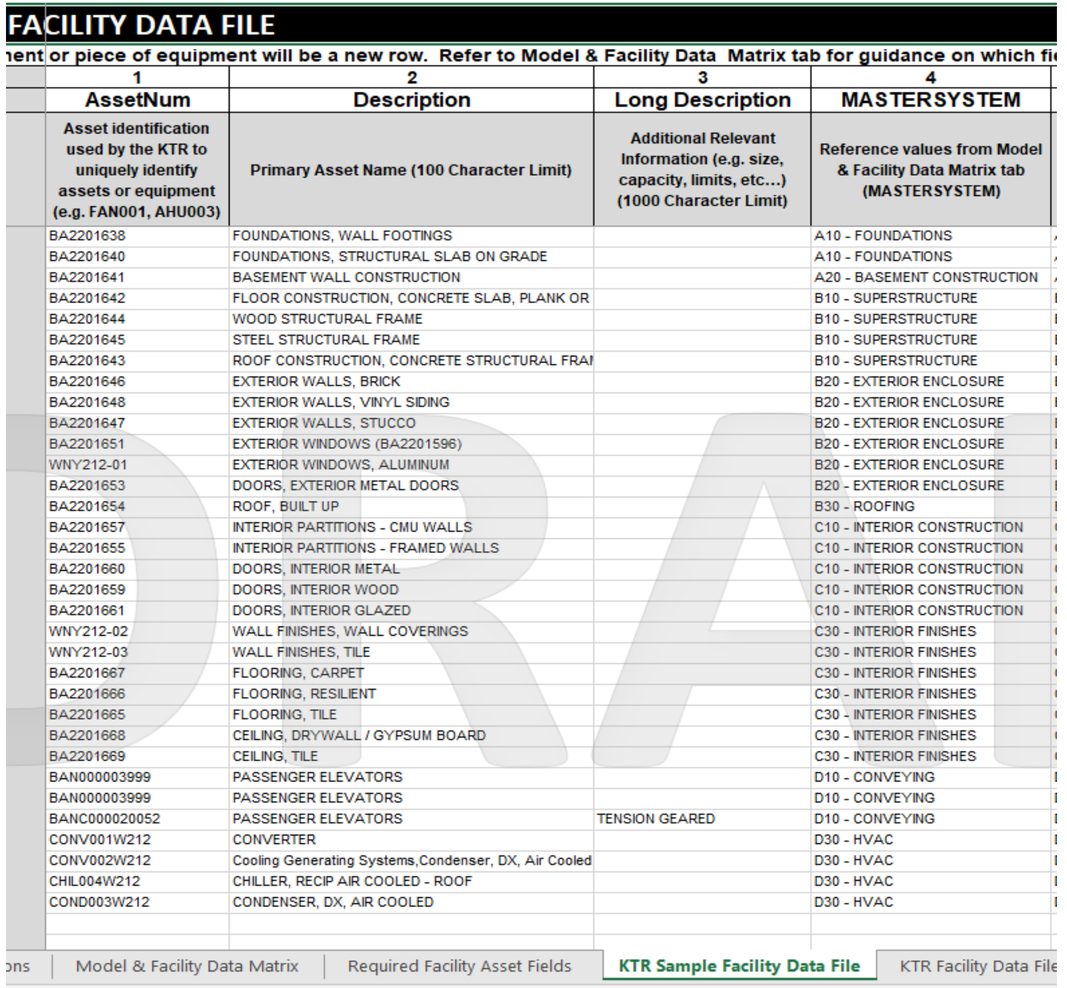

Design
Construction
Operations
ARCH
A/E
MEPF
A/E
Geometry is updated
ARCH
A/E
FM data is added
Models are archived
MEPF
Trade Contractors
FM data is added
ARCH
As Built/ FM Model
MEPF
Record Model
MEPF
As Built/ FM Model

Scenario 2


Design
Construction
Operations
ARCH
A/E
MEPF
A/E
Geometry is updated
ARCH
A/E
MEPF
Trade Contractors
FM data is added
Geometry is updated/
FM data is added
No data is added
ARCH
As Built/ FM Model
MEPF
FM Model
MEPF
As Built

2. Custom Spreadsheets

- Example: eOMSI
- **Electronic Operation and Maintenance Support Information (eOMSI)** is an FM deliverable instituted by NAVFAC to streamline the flow of building information.



FACILITY DATA FILE

nent or piece of equipment will be a new row. Refer to Model & Facility Data Matrix tab for guidance on which fi

	1	2	3	4
	AssetNum	Description	Long Description	MASTERSYSTEM
	Asset identification used by the KTR to uniquely identify assets or equipment (e.g. FAN001, AHU003)	Primary Asset Name (100 Character Limit)	Additional Relevant Information (e.g. size, capacity, limits, etc…) (1000 Character Limit)	Reference values from Model & Facility Data Matrix tab (MASTERSYSTEM)
	BA2201638	FOUNDATIONS, WALL FOOTINGS		A10 - FOUNDATIONS
	BA2201640	FOUNDATIONS, STRUCTURAL SLAB ON GRADE		A10 - FOUNDATIONS
	BA2201641	BASEMENT WALL CONSTRUCTION		A20 - BASEMENT CONSTRUCTION
	BA2201642	FLOOR CONSTRUCTION, CONCRETE SLAB, PLANK OR		B10 - SUPERSTRUCTURE
	BA2201644	WOOD STRUCTURAL FRAME		B10 - SUPERSTRUCTURE
	BA2201645	STEEL STRUCTURAL FRAME		B10 - SUPERSTRUCTURE
	BA2201643	ROOF CONSTRUCTION, CONCRETE STRUCTURAL FRAI		B10 - SUPERSTRUCTURE
	BA2201646	EXTERIOR WALLS, BRICK		B20 - EXTERIOR ENCLOSURE
	BA2201648	EXTERIOR WALLS, VINYL SIDING		B20 - EXTERIOR ENCLOSURE
	BA2201647	EXTERIOR WALLS, STUCCO		B20 - EXTERIOR ENCLOSURE
	BA2201651	EXTERIOR WINDOWS (BA2201596)		B20 - EXTERIOR ENCLOSURE
	WNY212-01	EXTERIOR WINDOWS, ALUMINUM		B20 - EXTERIOR ENCLOSURE
	BA2201653	DOORS, EXTERIOR METAL DOORS		B20 - EXTERIOR ENCLOSURE
	BA2201654	ROOF, BUILT UP		B30 - ROOFING
	BA2201657	INTERIOR PARTITIONS - CMU WALLS		C10 - INTERIOR CONSTRUCTION
	BA2201655	INTERIOR PARTITIONS - FRAMED WALLS		C10 - INTERIOR CONSTRUCTION
	BA2201660	DOORS, INTERIOR METAL		C10 - INTERIOR CONSTRUCTION
	BA2201659	DOORS, INTERIOR WOOD		C10 - INTERIOR CONSTRUCTION
	BA2201661	DOORS, INTERIOR GLAZED		C10 - INTERIOR CONSTRUCTION
	WNY212-02	WALL FINISHES, WALL COVERINGS		C30 - INTERIOR FINISHES
	WNY212-03	WALL FINISHES, TILE		C30 - INTERIOR FINISHES
	BA2201667	FLOORING, CARPET		C30 - INTERIOR FINISHES
	BA2201666	FLOORING, RESILIENT		C30 - INTERIOR FINISHES
	BA2201665	FLOORING, TILE		C30 - INTERIOR FINISHES
	BA2201668	CEILING, DRYWALL / GYPSUM BOARD		C30 - INTERIOR FINISHES
	BA2201669	CEILING, TILE		C30 - INTERIOR FINISHES
	BAN000003999	PASSENGER ELEVATORS		D10 - CONVEYING
	BAN000003999	PASSENGER ELEVATORS		D10 - CONVEYING
	BANC000020052	PASSENGER ELEVATORS	TENSION GEARED	D10 - CONVEYING
	CONV001W212	CONVERTER		D30 - HVAC
	CONV002W212	Cooling Generating Systems,Condenser, DX, Air Cooled		D30 - HVAC
	CHIL004W212	CHILLER, RECIP AIR COOLED - ROOF		D30 - HVAC
	COND003W212	CONDENSER, DX, AIR COOLED		D30 - HVAC

ons | Model & Facility Data Matrix | Required Facility Asset Fields | KTR Sample Facility Data File | KTR Facility Data File

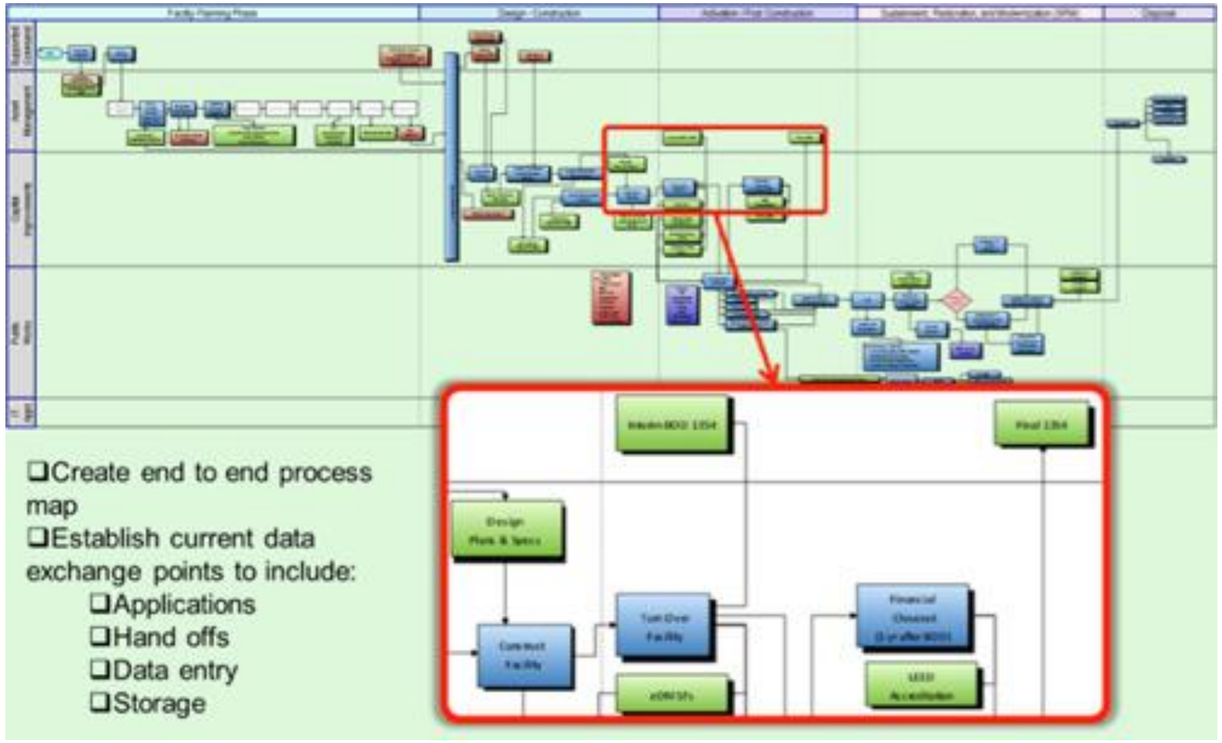
Custom Spreadsheets: Efficiency

MANAGEMENT OF DIFFERENT DATA TYPES

- Not so good for geometric data
- Great for parametric data
- Good for field data
- OK for submittal data

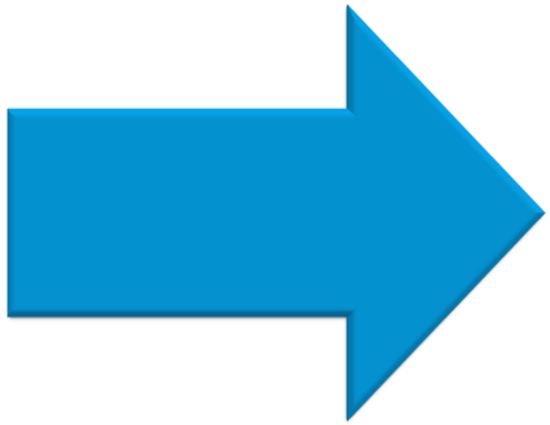
Custom Spreadsheets: Considerations

- Customization versus standardization
- Responsibilities and data integrity



wbdg.org

3. COBie



COBie Standard (NBIMS)

The **Construction to Operations Building information exchange (COBie)** leverages the free open COBie standard for the transfer of building information between Virtual Design and Construction software and owners' existing facility databases.

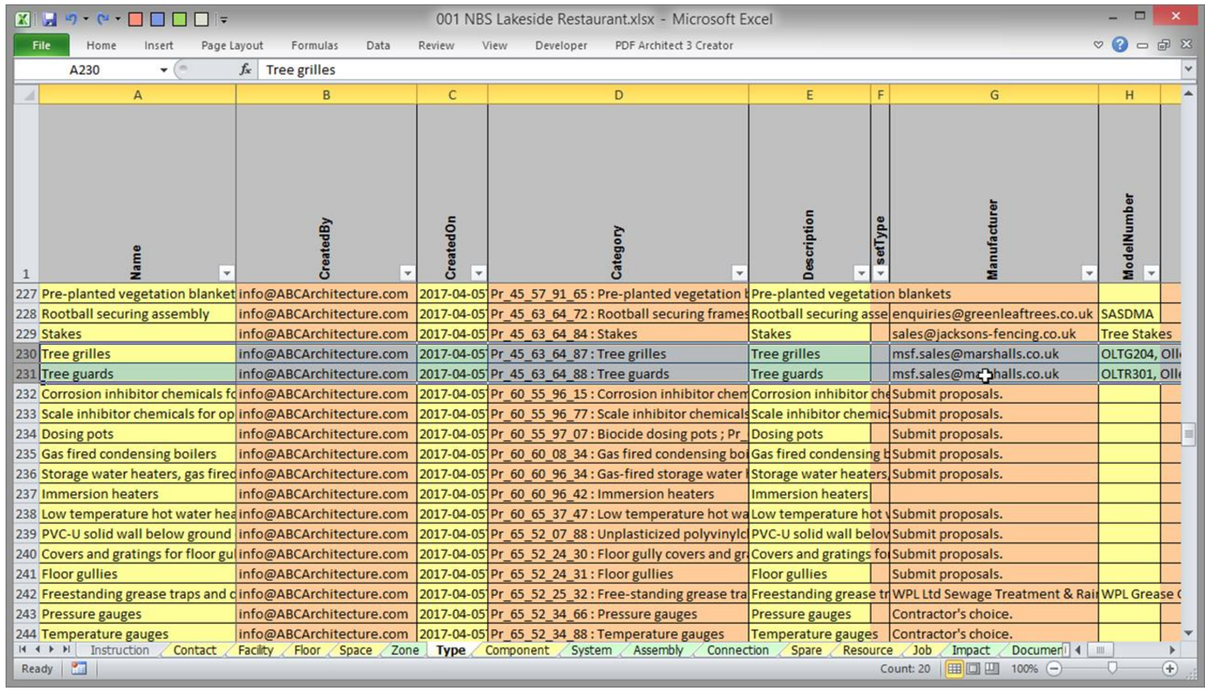
COBie: Efficiency

MANAGEMENT OF DIFFERENT DATA TYPES

- Not so good for geometric data
- Great for parametric data
- Good for field data
- OK for submittal data

3. COBie: Considerations

- Industry standard so not much customization possible
- Many software can import/export COBie directly (with proper data formatting)
- COBie is becoming the norm for FM data curation



	A	B	C	D	E	F	G	H
1	Name	CreatedBy	CreatedOn	Category	Description	setType	Manufacturer	ModelNumber
227	Pre-planted vegetation blanket	info@ABCArchitecture.com	2017-04-05	Pr_45_57_91_65 : Pre-planted vegetation	Pre-planted vegetation blankets			
228	Rootball securing assembly	info@ABCArchitecture.com	2017-04-05	Pr_45_63_64_72 : Rootball securing frames	Rootball securing asse		enquiries@greenleaftrees.co.uk	SASDMA
229	Stakes	info@ABCArchitecture.com	2017-04-05	Pr_45_63_64_84 : Stakes	Stakes		sales@jacksons-fencing.co.uk	Tree Stakes
230	Tree grilles	info@ABCArchitecture.com	2017-04-05	Pr_45_63_64_87 : Tree grilles	Tree grilles		msf.sales@marshalls.co.uk	OLTG204, Oll
231	Tree guards	info@ABCArchitecture.com	2017-04-05	Pr_45_63_64_88 : Tree guards	Tree guards		msf.sales@marshalls.co.uk	OLTR301, Oll
232	Corrosion inhibitor chemicals fo	info@ABCArchitecture.com	2017-04-05	Pr_60_55_96_15 : Corrosion inhibitor chem	Corrosion inhibitor che		Submit proposals.	
233	Scale inhibitor chemicals for op	info@ABCArchitecture.com	2017-04-05	Pr_60_55_96_77 : Scale inhibitor chemicals	Scale inhibitor chemic		Submit proposals.	
234	Dosing pots	info@ABCArchitecture.com	2017-04-05	Pr_60_55_97_07 : Biocide dosing pots ; Pr_	Dosing pots		Submit proposals.	
235	Gas fired condensing boilers	info@ABCArchitecture.com	2017-04-05	Pr_60_60_08_34 : Gas fired condensing bo	Gas fired condensing b		Submit proposals.	
236	Storage water heaters, gas fired	info@ABCArchitecture.com	2017-04-05	Pr_60_60_96_34 : Gas-fired storage water	Storage water heaters,		Submit proposals.	
237	Immersion heaters	info@ABCArchitecture.com	2017-04-05	Pr_60_60_96_42 : Immersion heaters	Immersion heaters			
238	Low temperature hot water hea	info@ABCArchitecture.com	2017-04-05	Pr_60_65_37_47 : Low temperature hot wa	Low temperature hot v		Submit proposals.	
239	PVC-U solid wall below ground	info@ABCArchitecture.com	2017-04-05	Pr_65_52_07_88 : Unplasticized polyvinylc	PVC-U solid wall below		Submit proposals.	
240	Covers and gratings for floor gu	info@ABCArchitecture.com	2017-04-05	Pr_65_52_24_30 : Floor gully covers and gr	Covers and gratings fo		Submit proposals.	
241	Floor gullies	info@ABCArchitecture.com	2017-04-05	Pr_65_52_24_31 : Floor gullies	Floor gullies		Submit proposals.	
242	Freestanding grease traps and c	info@ABCArchitecture.com	2017-04-05	Pr_65_52_25_32 : Free-standing grease tra	Freestanding grease tr		WPL Ltd Sewage Treatment & Rai	WPL Grease
243	Pressure gauges	info@ABCArchitecture.com	2017-04-05	Pr_65_52_34_66 : Pressure gauges	Pressure gauges		Contractor's choice.	
244	Temperature gauges	info@ABCArchitecture.com	2017-04-05	Pr_65_52_34_88 : Temperature gauges	Temperature gauges		Contractor's choice.	

4. FM Cloud Software

AUTODESK® BIM 360™

ecodomus

KTrack

ONUMA SYSTEM

dRofus
A NEMETSCHEK COMPANY

FM Cloud Software: Efficiency

MANAGEMENT OF DIFFERENT DATA TYPES

- OK for geometric data
- Good for parametric data
- Great for field data
- OK for submittal data

FM Cloud Software: Other Considerations

- Software cost
- Software interoperability
- Data encryption
- Overlapping functionality with other project management software

FM Data Collection: Summary

	Geometric Data	Parametric Data	Field Data	Submittal Data
BIM Authoring Software	★★★	★★	★	⊘
Custom Spreadsheet	⊘	★★★	★★	★
COBie	⊘	★★★	★★	★
FM Cloud Software	★	★★	★★★	★

Who?

Stakeholders

- Designers
- Contractors
- Subcontractors
- Consultants

Case Study: Kansas City International Airport, Missouri

- 1.5 B $, 2023 completion
- Organization vs project BIM standards
- Construction Models to FM Models
- Geometric and parametric data from BIM authoring software
- Field data from FM cloud software
- COBie requirements

Case Study: East County Detention Center, Indio, CA

- 275 M $, 2019 completion
- Construction Models to FM Models
- Parametric and O&M data linked in model viewing software
- Field data from FM cloud software
- Custom spreadsheets

Recommendations

- Clearly define deliverables early
- Clearly define assets and attributes early
- Establish LOD definitions for all required assets early
- Define roles and responsibilities of various stakeholders

Recommendations Contd.

- Data deliverable requirements dictate data collection workflows
- Start with the end in mind
- Consider software interoperability (or lack thereof!)
- Do not wait till the end for data collection

Thanks!

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