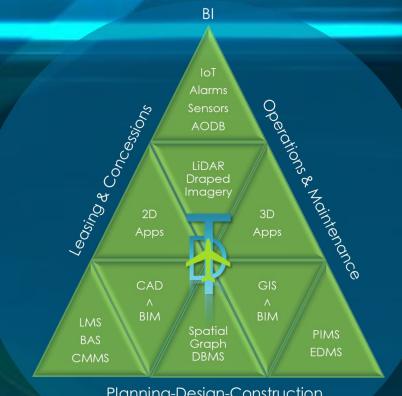
19 JULY 2023

Standardizing & Processing BIM Data Delivered by Airport AEC Projects to Support Digital Twins



Planning-Design-Construction

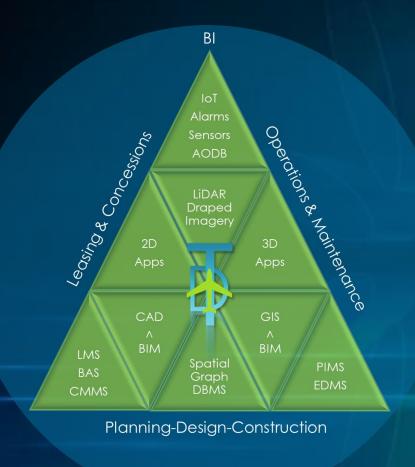
www.AirportDigitalTwin.org Webinar Series

By: David Tamir **Jorge Quiroz** Ed Maghboul **Don Murray & Dave Campanas**

AirportDigitalTwin.org Proprietary Information

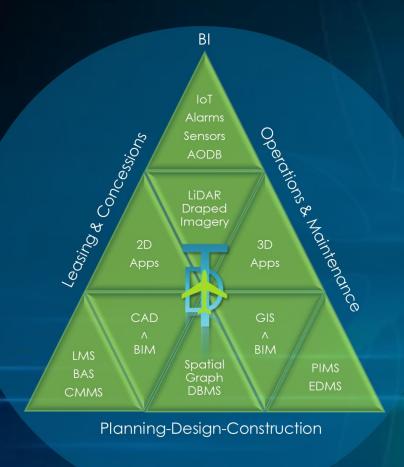


Webinar Series



- Jul 19: BIM Processing
- 2. Jul 26: Information Integration
- 3. Aug 2: Enabling Integrated SMS
- 4. Aug 9: Holistic Business Intelligence
- 5. TBD: Leveraging Video Analytics
- TBD: Predictive Modeling

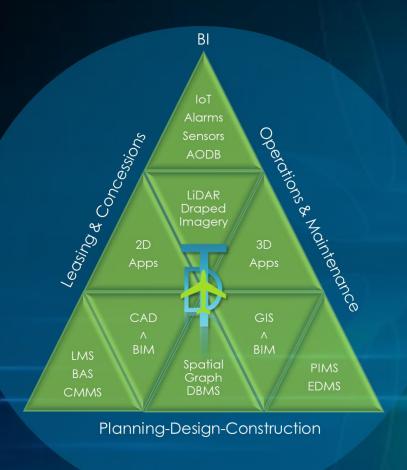
Webinar Outline



1. Jul 19: BIM Processing

- Introductions
- Airport AEC BIM Overview
- Challenges with BIM Deliverables
- BIM Standards to Overcome Challenges
- Auditing BIM Deliverables
- Tools to Process & Use BIM Deliverables

Webinar Outline

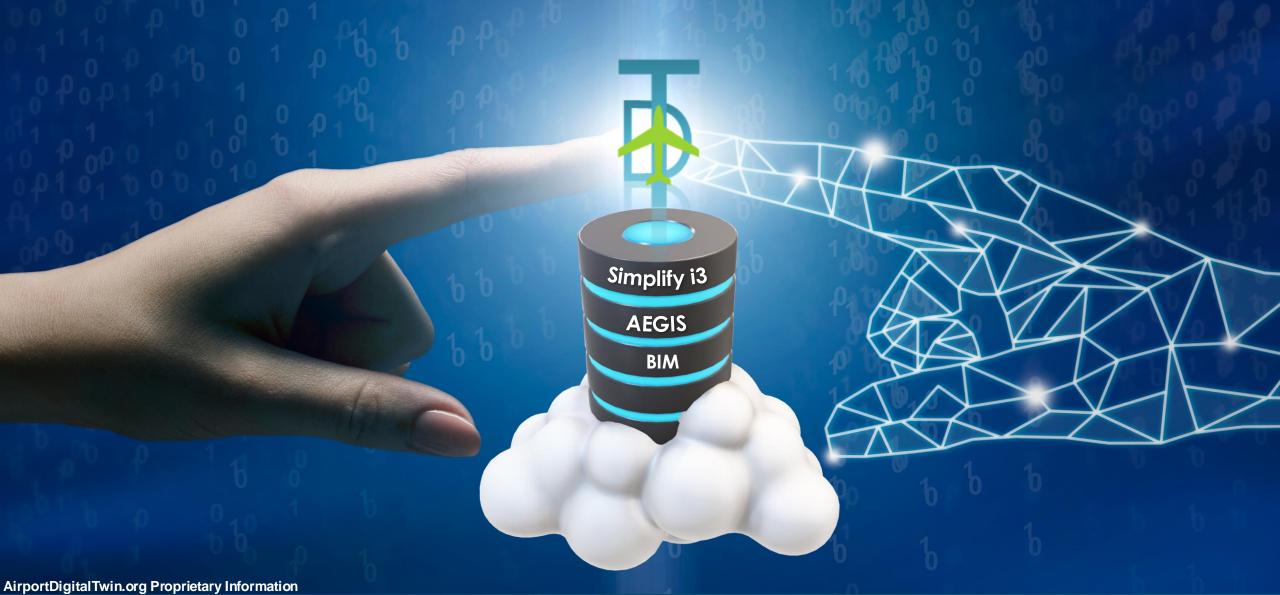


1. Jul 19: BIM Processing

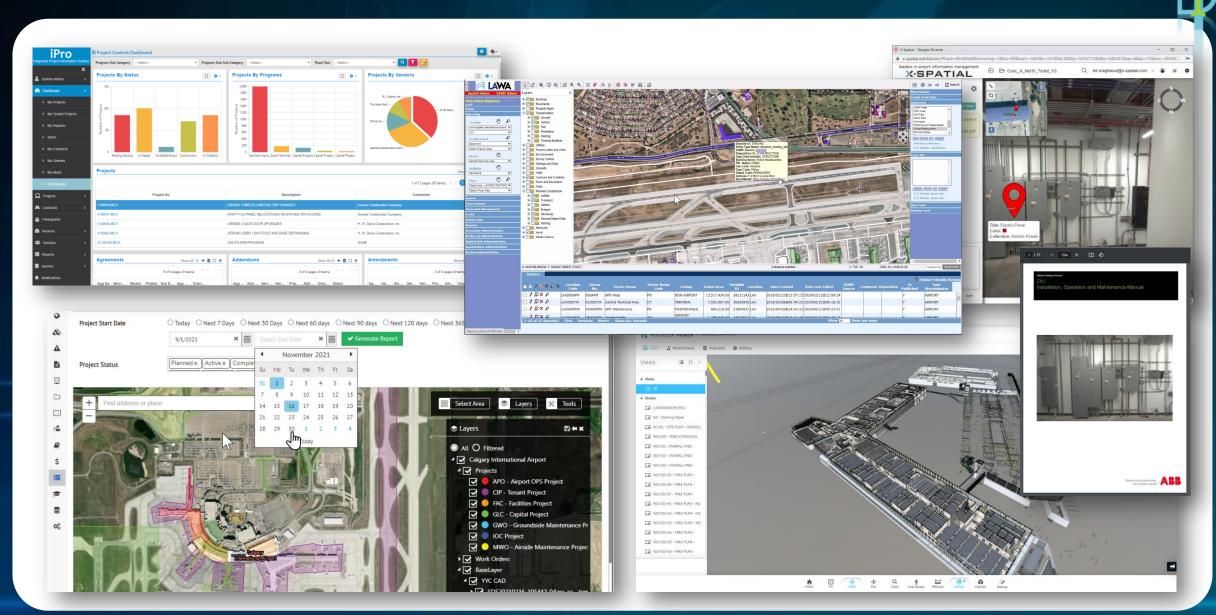
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AirportDigitalTwin.org

Team of Integrated Solution Providers Enabling Airport Owner Digital Twins



Modular Airports Digital Twin Solution



Primary Platform Components





X·SPATIAL

PDBM

Simplify i3

AEGIS

BIM

- Simplify i3 (integrated infrastructure intelligence)
- Airport Enterprise Geospatial Information System (AEGIS)
- → Building Information Modeling (BIM)

Integrating Best of Breed Technologies



















esri

















Qualifications



Service Provider Select

→ Jorge Quiroz (PDBM)



- Brings airport owner's BIM perspective from PANYNJ (15 years serving as BIM Director)
- Led development of BIM standards & best practices for PANYNJ, SEA, MIA, Mexico City...

→ Ed Maghboul (x-Spatial)



- Brings airport consultant's perspective supporting LAX (30 yrs) and other airports including ONT, VNY, BOS, SFO, SAN, CLT, ...
- Dealing directly with BIM data post processing challenges
- Developed specification for BIM deliverables

Qualifications

Safe Seftware®

29K+

FME Community members

128

countries with FME customers

Don Murray

Dave Campanas

29+

years of solving data challenges

25K+

organizations worldwide

140+

global partners with **FME** services

200K+

users worldwide



Qualifications

Top 5 airports worldwide depend on FME

50+ other airports trust FME for their data integration

25+ others starting their journey

Safe Software®





















David Tamir 38 Years Experience over 30+ Airports

Airport Technology Systems
Business Process Improvement Engineer

- Space Shuttle Program / Rockwell-Boeing 1984 - 1995
- Greater Orlando Aviation Authority1996 2000
- Carter & Burgess / Jacobs2000 2004
- DMJM Aviation / AECOM2005 2012
- TAMIRONICS 2012 - Present

AAAE Digital Twin Working Group Lead

AirportDigitalTwin.org Lead Director





What's an Airport Digital Twin (ARP-DT)

Digital representation of airport campus

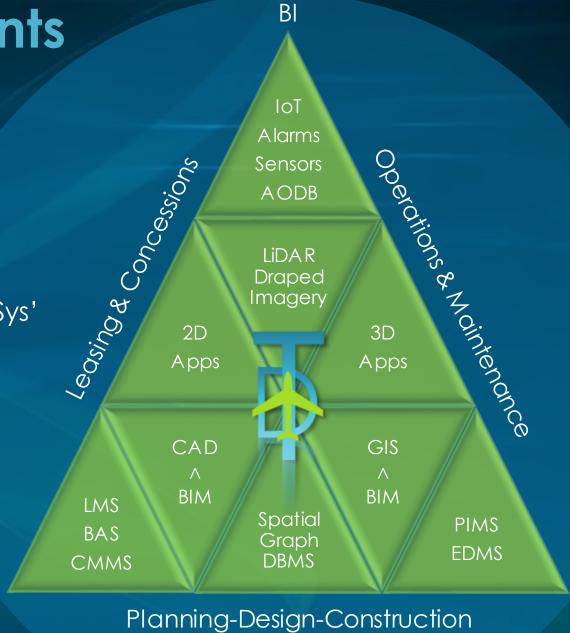


integrating data from disparate systems / sources

- >> to enable safe, secure, and efficient airport functions
- with past, present, and predicted views

Airport ARP-DT Components

- **AODB** Airport Operations Database
- **BAS** Building Automation System
- BI Business Intelligence
- BIM Building Information Modeling
- CAD Computer Aided Design
- CMMS Computerized Maintenance Mgm't Sys'
- DBMS Database Mgm't Systems
- EDMS Electronic Doc's Mgm't System +
- GIS Geospatial Information System
- **IoT** Internet of Things
- LiDAR Light Detection and Ranging +
- LMS Lease Management System
- PIMS Project Info' Mgm't System +





ARP-DT Foundation

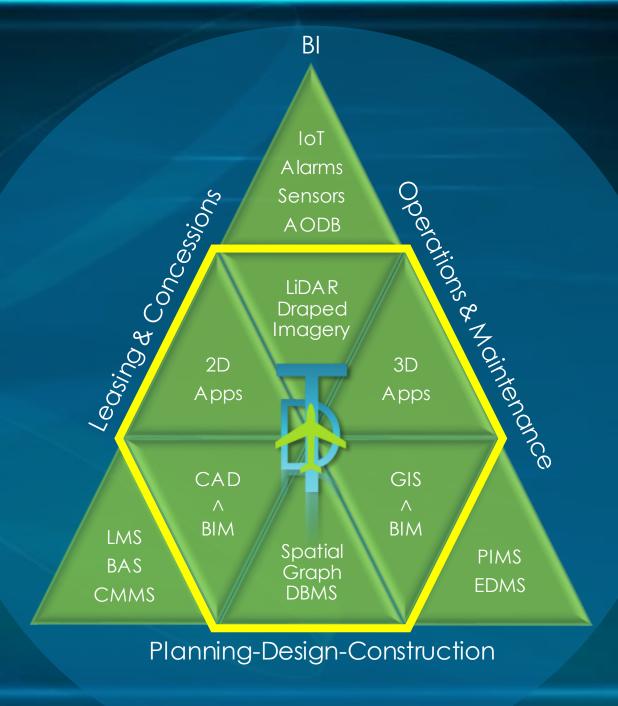
"Skeleton"

correlates DT components together

via common denominator

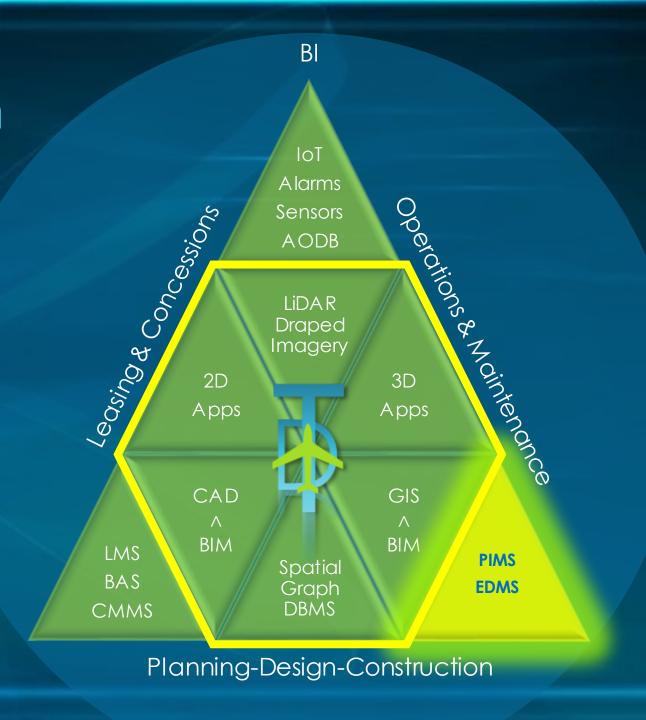
Spatial Database

key to achieving ARP-DT

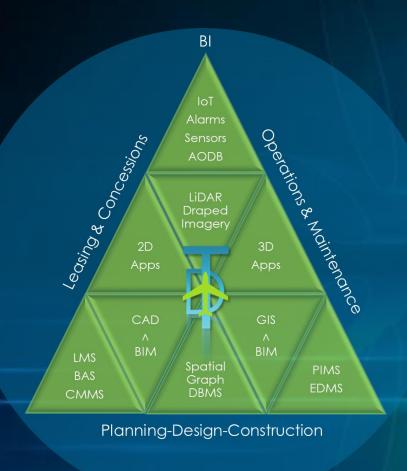


Project Information & Electronic Documentation

- ALP Change Requests / 7460s
- BIM Design & Construction
- Construction Logistics
- Construction Photos w/LiDAR
- Survey Data
- Operational Readiness
 Activation Training (ORAT)
- As-Builts / O&M Manuals



Webinar Outline

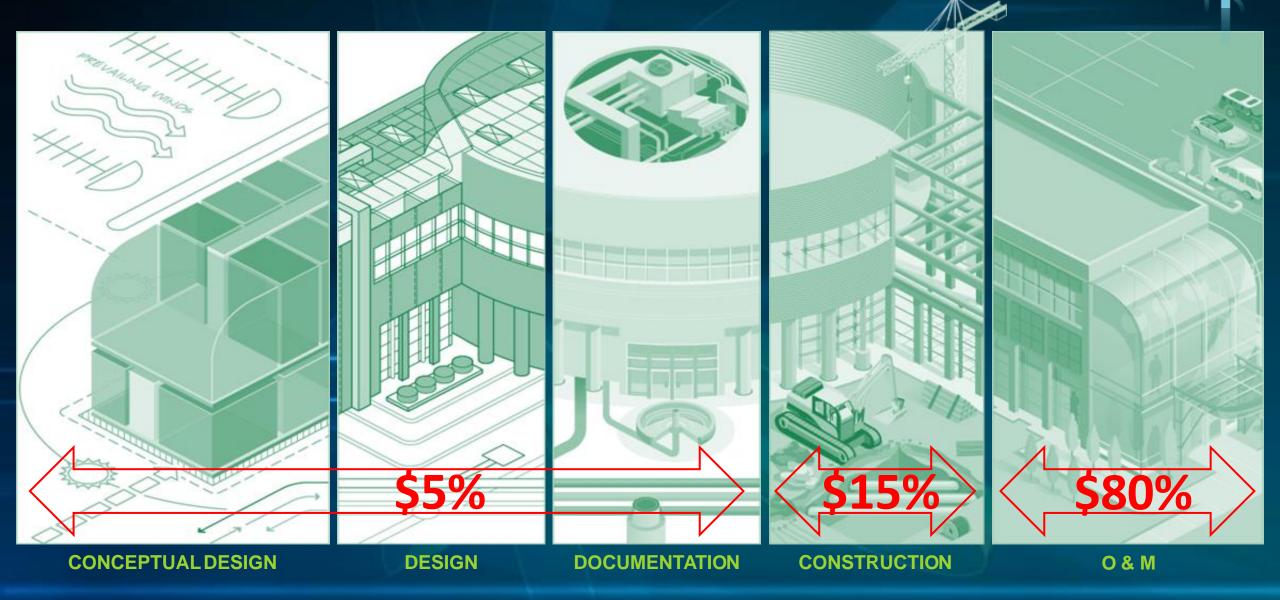


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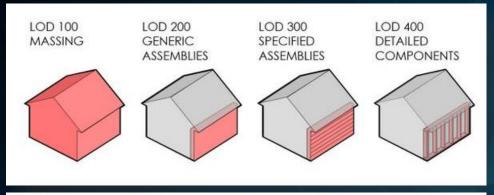
Lowering Facility Lifecycle Costs

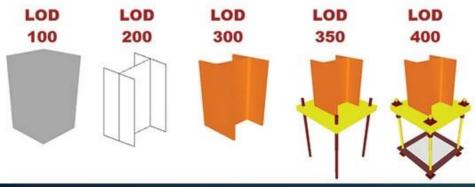




BIM Level of Development (LoD)









- → LOD-100: Programmatic Conceptual Design
- + LOD-200: Approximate Design
- → LOD-300: Precise Design To-Be-Built
- LOD-350: Specified Assemblies
- LOD-400: Fabrication-Assembly-Installation of Detailed Components
- → LOD-500: Laser Scanned As-Built

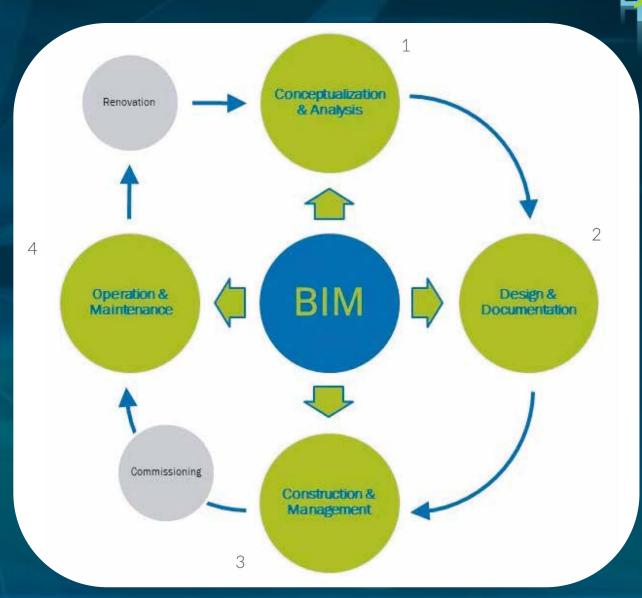
Holistic Lifecycle Applications

PDBM

- 1) Conceptual Design& Analysis Collaboration
- 2) Design Reviews& Documentation
- 3) Construction Management& Project Controls

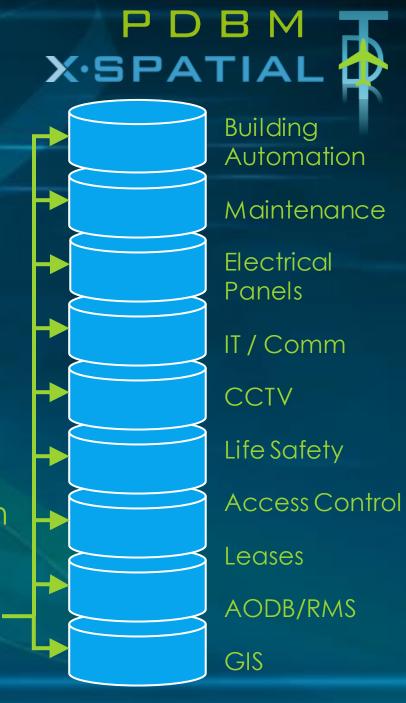
Including Commissioning involving Operational Readiness Activation Training (ORAT)

4) Harvesting & Referencing for O&M and Renovations



Airport Owner Realities

- Revit models are used for airport facility design & construction
- AutoCAD (DWG) drawings are exported from Revit to provide record drawings
- "As-Built" conditions evolve beyond Revit and AutoCAD deliverables as soon as owner and tenants move in and start modifying facility
- Funding to update construction level of detail in Revit & AutoCAD dries-up with project completion
- Airport owners harvest/distill data from Revit
 & AutoCAD to update airport management tools -

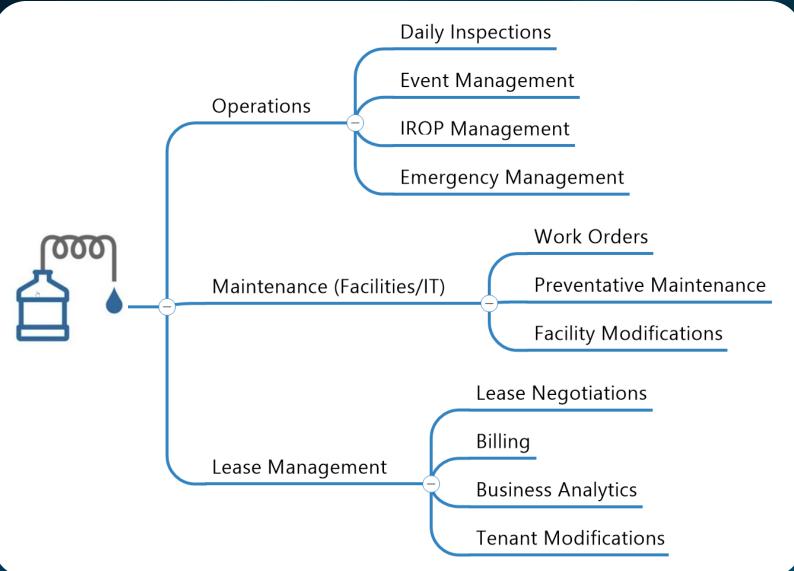


Airport Owner Needs

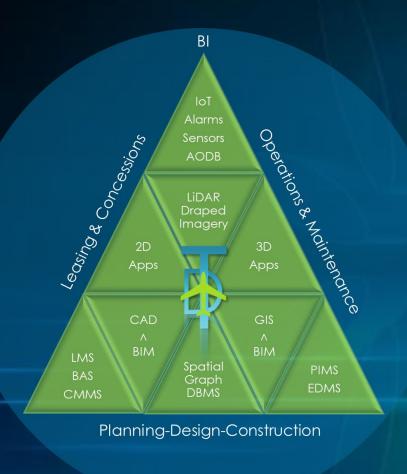


Harvest
& Distill
Project Data
to Support
O&M

Sustain
Only
Business
Essential
Data



Webinar Outline



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Virtual Design & Construction (VDC)



Old-Fashioned Documentation Deliverables





Information Lag Time





When do you normally receive your closeout documentation (O\$M's)?



Information Need



Equipment Failure Potential over 18 Months



Information Inconsistencies







Engineering

Revit (Geometry + Metadata)

ASSET ID	PUMP-01
Classification	Hydronic Pump
Manufacturer	Bell & Gossett
Model Number	e-1510
Flow Rate	240 gpm

Construction

Autodesk Build (Metadata + Photos)

ASSET ID		PUMP01
Manufact	urer	Taco
Model Nu	mber	FI1207D
Serial Nu	mber	123456789
Installer		Miller HVAC
Installation Date		04/30/2022

Commissioning

Autodesk Build (Metadata)

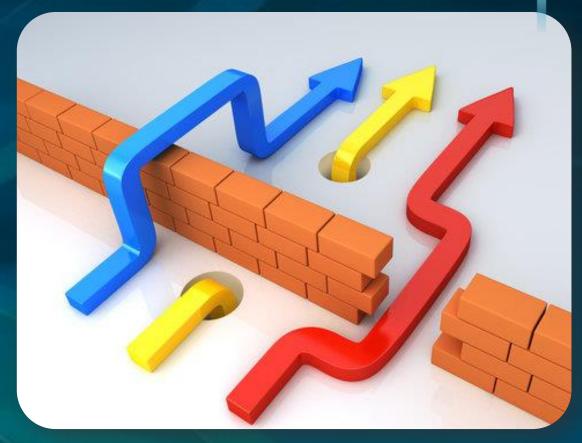
ASSET ID	PUMP1
Commissioning Tech	Joe Smith
Commissioning Date	06/15/2022
Flow Rate Actual	242 gpm
Voltage Actual	220 v
Amps Actual	15 amps

 Many additional actual performance readings

Other Challenges

PDBM X.SPATIAL

- Providing Easy Access & Viewing BIM (Revit) Deliverables
- Harvesting Revit Deliverables
- Simplifying Overly Complex Revit to AutoCAD Construction Details
- Converting AutoCAD to ArcGIS
- Consolidating Redundant
 AutoCAD and ArcGIS Datasets
- Updating CMMS (e.g., Maximo, CityWorks, etc.), LMS (e.g., PROPworks), and other systems with BIM originated asset data





BIM to CAD Export



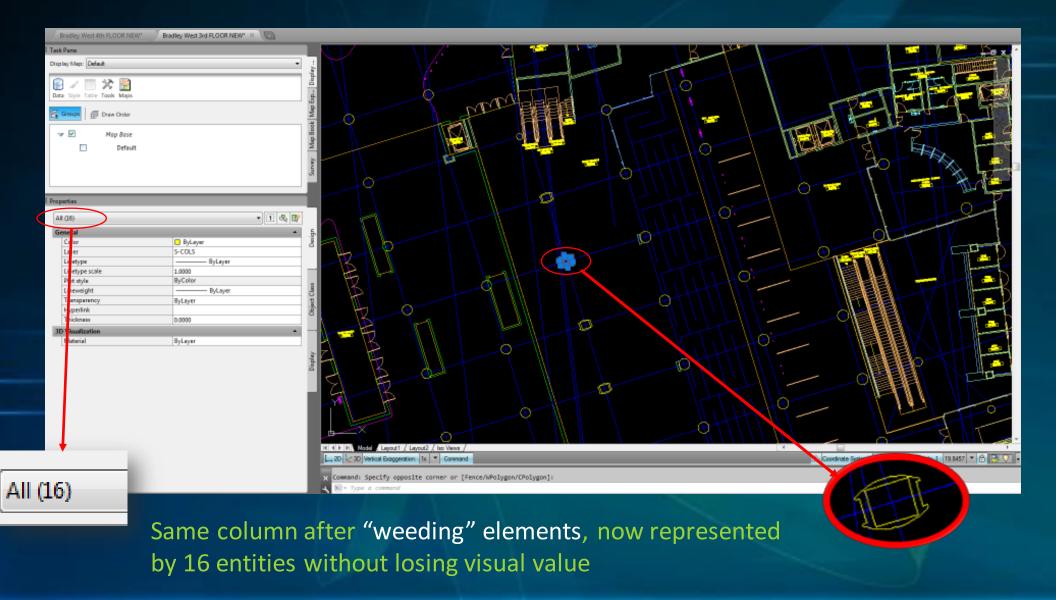




Simplifying Details







BIM to CAD Export



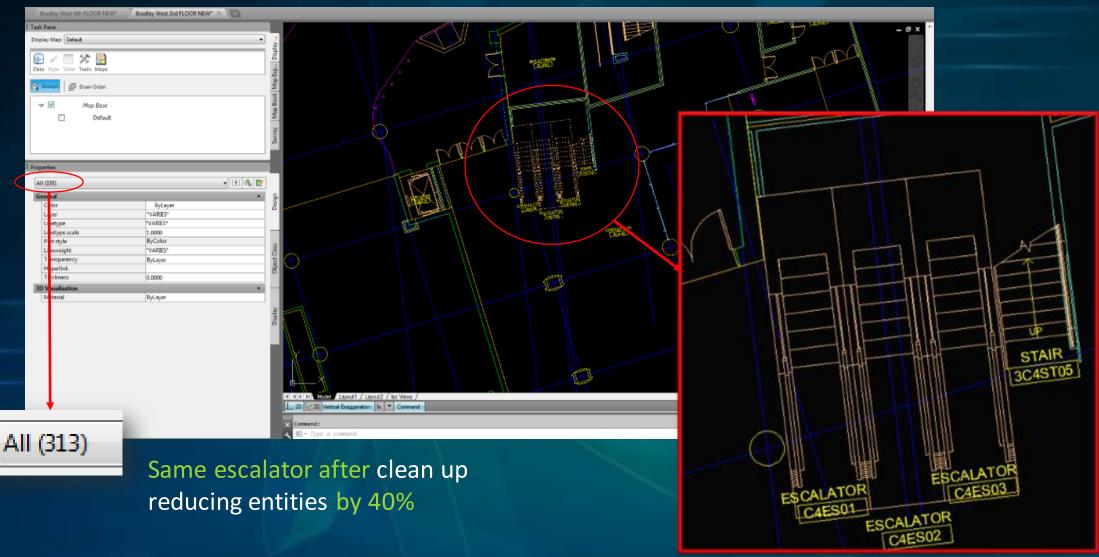




Simplifying Details



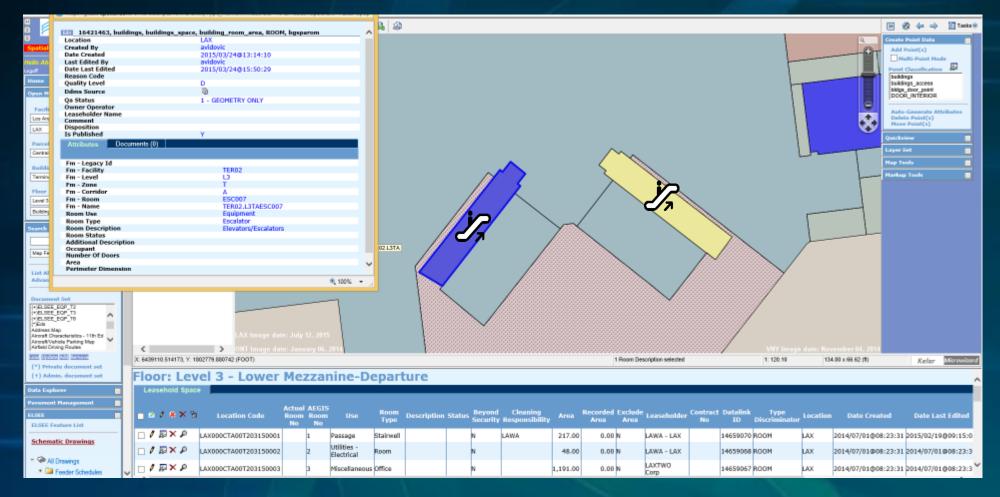




GIS Representation

X·SPATIAL



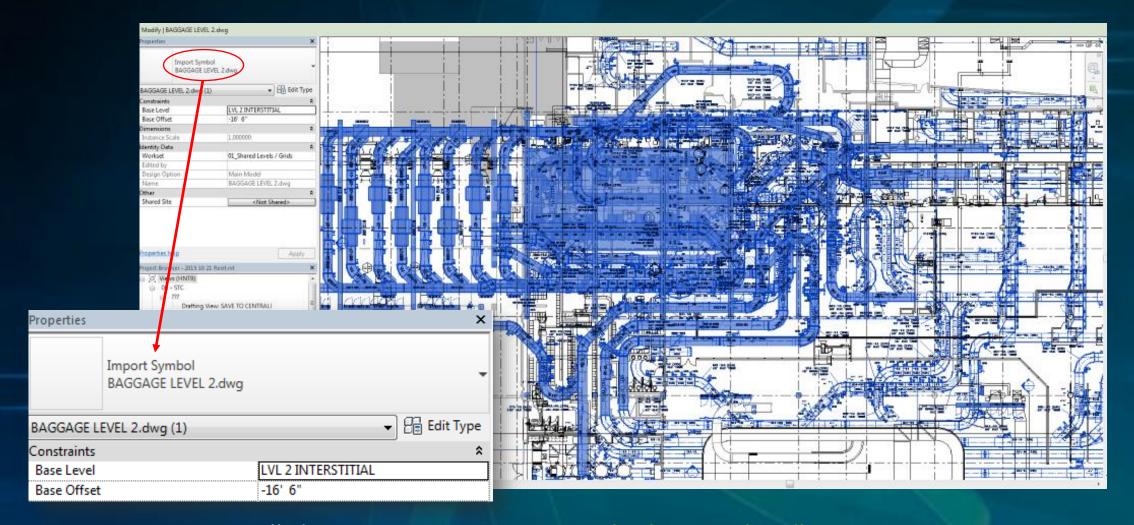


GIS needs bounding polygon and symbology for identification (all attributes are associated with polygon)

Non-Revit 3D Elements

X·SPATIAL



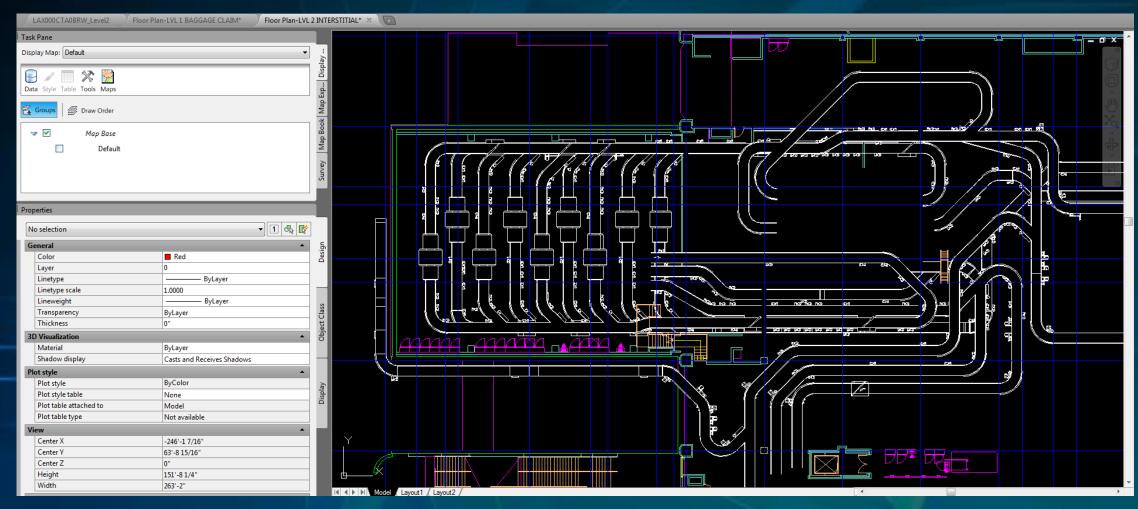


Not all elements in Revit are native: this baggage handling system is 3D AutoCAD drawing linked into Revit model

GIS Representation

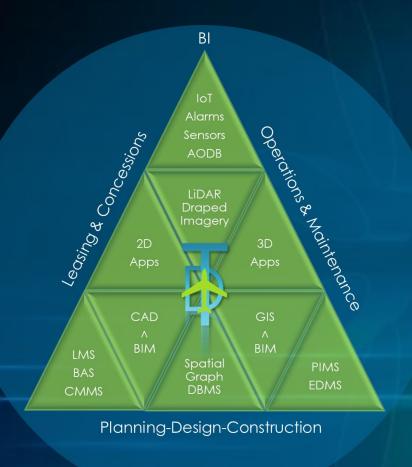






Data simplification sufficient for GIS

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VDC/BIM Standards Roadmap





VDC/BIM Standards = Foundation PDBM

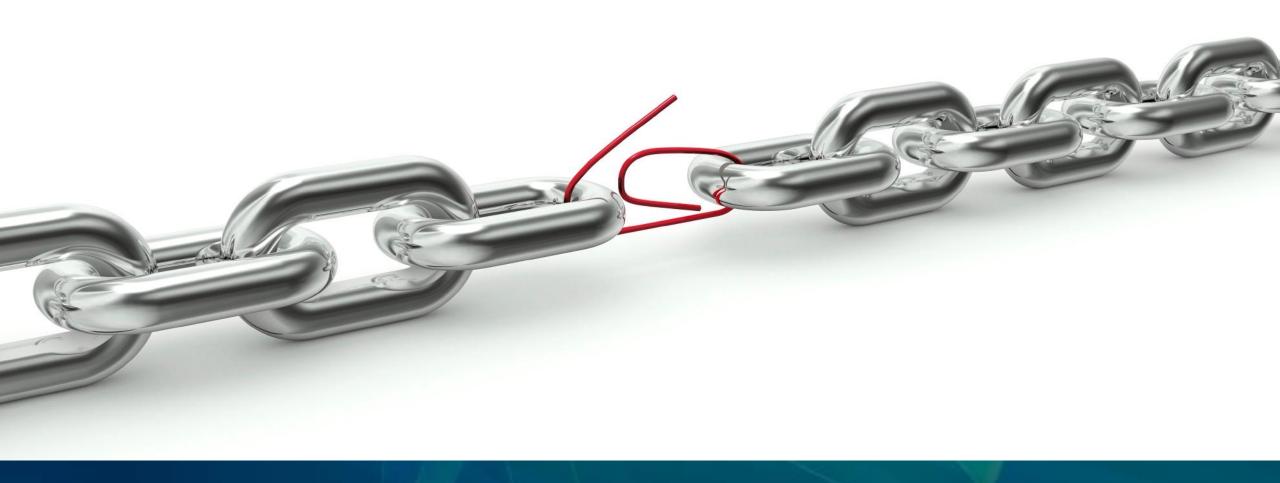






Standards Mitigate Weak Links

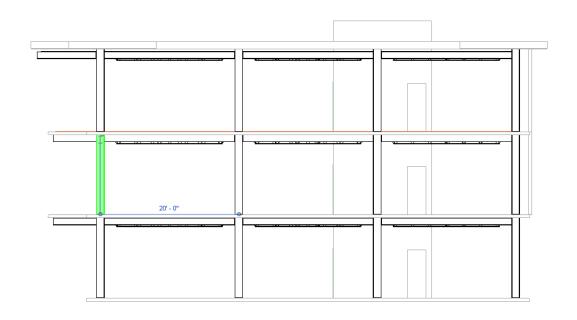




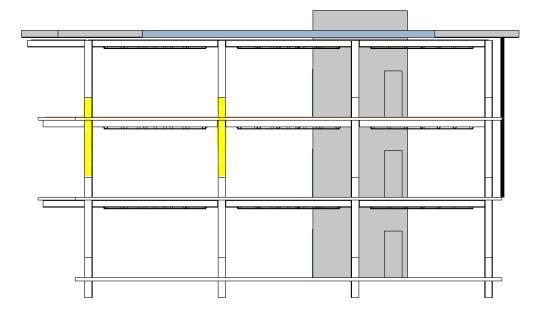
VDC/BIM Standards



Model Types





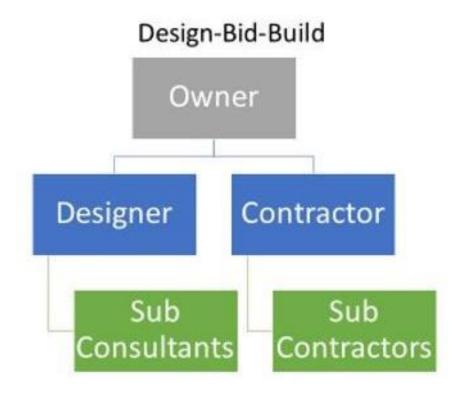


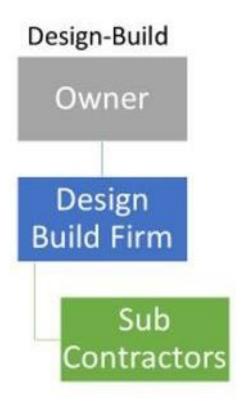
Construction Model

VDC/BIM Standards



Contract Mechanism





VDC/BIM Standards Process



A standardized approach allows owner to produce, release, and receive information in a consistent format during design and construction phases, which eases migration of all project information into enterprise asset management systems.

This process allows owner to increase efficiency and productivity, along with reducing time and cost.

- Mission & Vision
- Mandate
- → 5-Year Plan
- Contract Language
- Standards Manual
- Support Files
- Criteria for Selection of Projects
- BIM Execution Plan
- Model Development Specification

VDC/BIM Project Criteria



THE PORT AUTHORITY OF NY & NJ

Engineering Department

BIM Criteria





VDC/BIM Contract Language





Building Information Modeling (BIM) Contract Language

Design Phase

PDBM
CONSULTING
PROJECT LIFE CYCLE BIM SERVICES

Building Information Modeling (BIM) Contract Language
Construction Phase

www.pdbmconsulting.com

info@pdbmconsulting.com

VDC/BIM Standards Manual







Miami-Dade Aviation Department
BIM Standards Manual

Developed by:



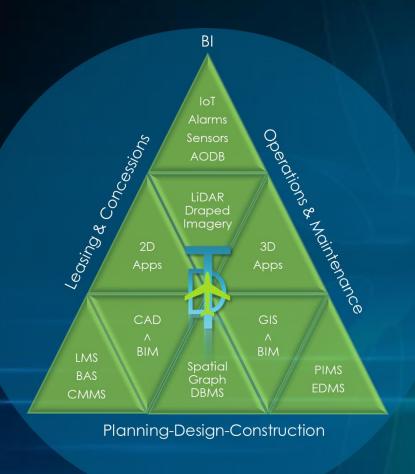
HNTB Corporation
The HNTB Companies
Infrastructure Solutions



www.pdbmconsulting.com info@pdbmconsulting.com

November 2022

Webinar Outline



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BIM Audits

- AEC Self
 QC/QA
- OwnerQC/QA



BIM Standards Review Report

FACILITY	DISCIPLINE
P/C ID NUMBER	DISCIPLINE LEADER
PROJECT TITLE	PROJECT MANAGER
CONTRACT NUMBER	CONSULTANT NAME
REVIEWED BY	DATE SUBMITTED
DATE REVIEWED	PHASE
INITIAL REVIEW DATE	STAGE
DUE DATE	SUBMITTAL %
MODELS REVIWED	

OVERALL SUMMARY PERFORMANCE

□ PASSED □ FAILED

MANDATORY

	Compliance (Yes/No
BIM EXECUTION PLAN	
GENERAL	
Folder Structure	
File Location	
Coordinate System	
AutoCAD Links	
Revit Links	
Model Size	
Links Pinned	
PROJECT SETTINGS	
Units	
Export to AutoCAD layers	
NAMING CONVENTIONS	
Model	
Worksets	
Views	
Families	
Levels and Elevations	

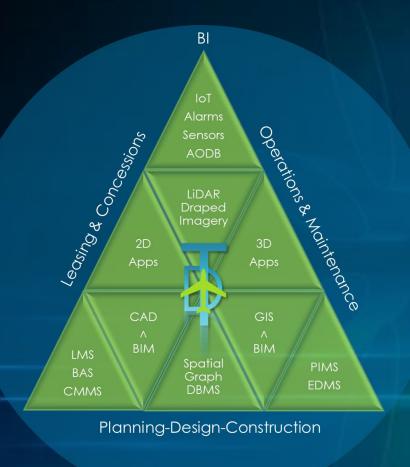






PROJECT BROWSER STRUCTURE	
Discipline / Sub-Group	
View Classification	
PDF SUBMITTALS	
Full Size	
Multi Sheet	
Black and White	
Sheet Order	
CONTENT QUALITY	
Clash Free	
Quantity Takeoffs	
Object Hosting	
Object Alignment	
Object Category	
Parameter Assignment	
Check Systems (Ducts and Pipes)	
Check Services (Cable trays and Conduits)	
Unique Element Identifier	
STYLES	
Object	
Line Weights	
Symbols	
Tags	
Texts	
Dimensions	
Lines	
Regions	
PLAN SET PREPARATION	
Discipline / Sub-Group	
Contract Border	
Project/Contract ID Number	
Facility Name	
P/C ID Number in the CB	
Title Sheet	
Drawing Information	

Webinar Outline



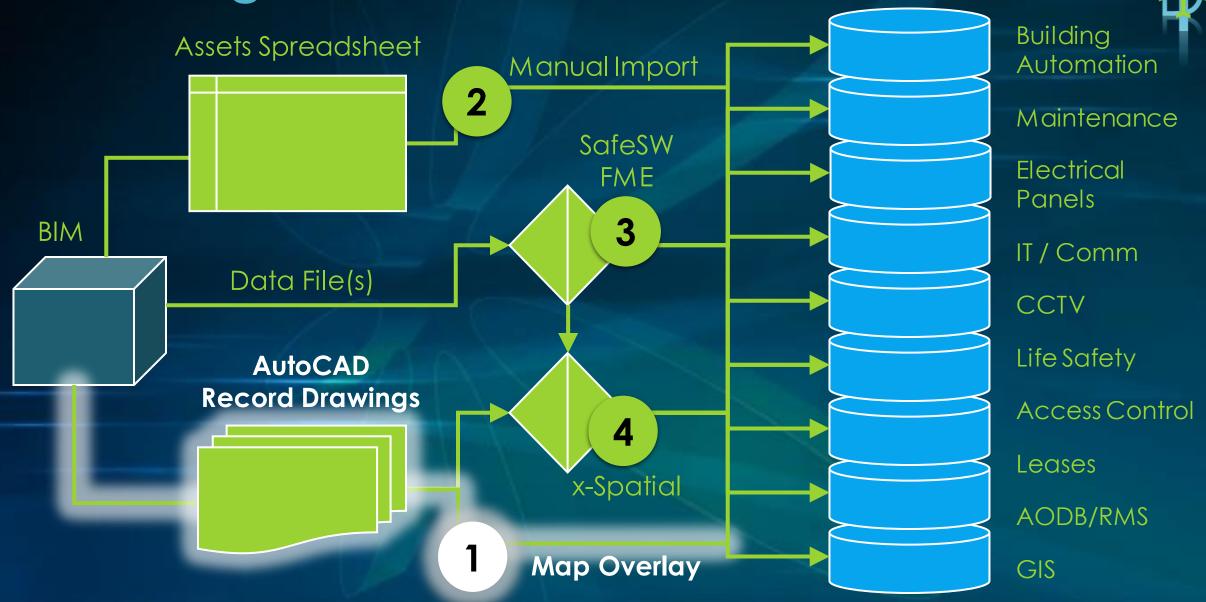
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Harvesting BIM Data Building Assets Spreadsheet Manual Import Automation Maintenance SafeSW Electrical FME Panels 3 BIM IT / Comm Data File(s) **CCTV** Life Safety AutoCAD **Record Drawings** Access Control Leases x-Spatial AODB/RMS Map Overlay GIS

Harvesting BIM Data





Map Overlay



Many systems simply overlay on BIM > CAD generated map (floor plan)

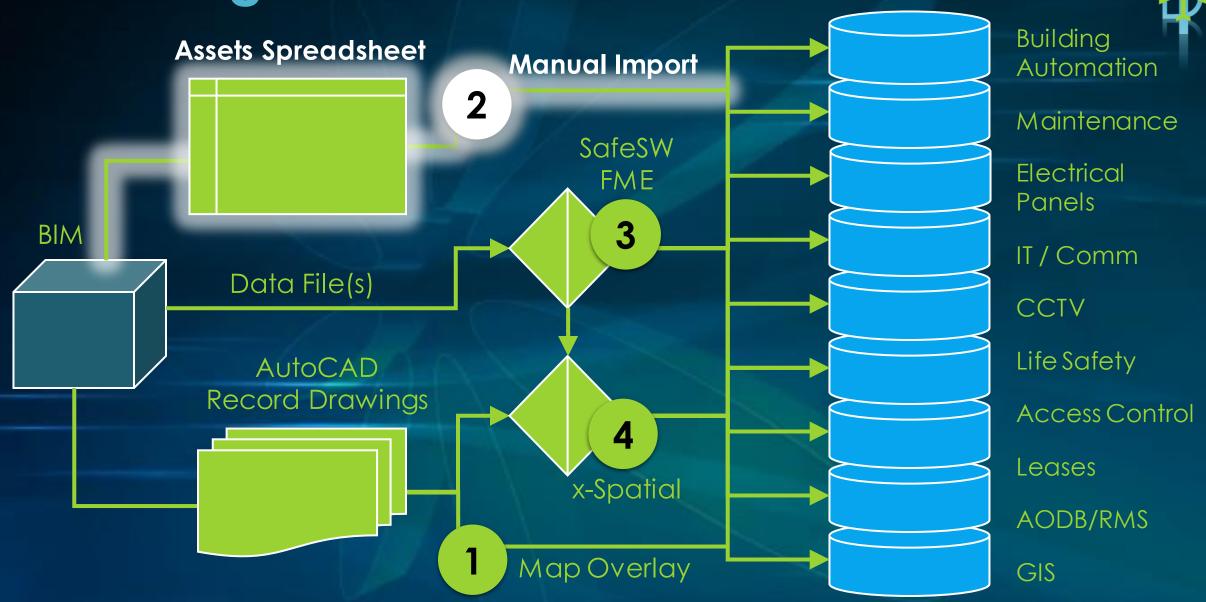
♥ A ♥ B ♥ C ♥ DE

Least Recommended:

- Manual Updates
- **8** Long Lag Time
- Non-Interactive



Harvesting BIM Data



2 BIM to COBie Spreadsheet



Involves Manual Import & Configuration of Assets into Relevant Systems

Not Recommended:

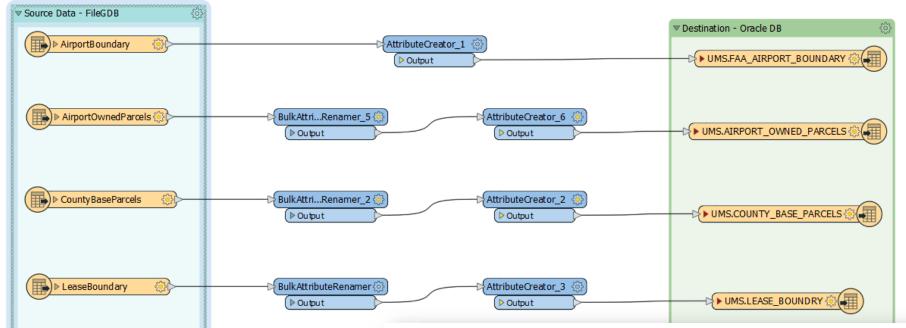
- Manually Intensive
- **Error Prone**
- Non-Spatial
- Long Lag Time

	A	В	С	D	Ε	F	G	Н	- 1	J	K	L	M
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14	SHGCW	Erezi@nol.org	2013-03-16	Requirement	Туре	Window_	0.66	n/a	AU_QUT_N	IfcPropertyS	AU_Win	Whole window	n/a
15	VT	Erezi@nol.org	2013-03-16	Requirement	Туре	Window_	0.69	n/a	AU_QUT_N	IfcPropertyS	AU_Win	Whole window	n/a
16	Air Infiltration	Erezi@nol.org	2013-03-16	Requirement	Туре	Window_	1.15	cfm,	AU_QUT_N	IfcPropertyS	AU_Win	Inflitration	n/a
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19	SHGCw			Requirement		Window_						Solar Heat Gai	
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21	Proprietary suite			Requirement	Туре	Window 1	-	_		IfcPropertyS		****	n/a
22 5	Suite description	Erezi@nol.org	2013-03-16	Requirement	Туре	Window_	n/a	n/a	AU QUT N	IfcProperty5	Au Win	****	n/a
	Frame material ATTRIBUTES 500 ATTRIB	Frezi@nol.org UTES 400 AT	2013-03-16 TRIBUTES 30			Window 1	n/a	_				e.e. Aluminiu	n/a
Ready 🚰 🔲 100% 😑 🗸													

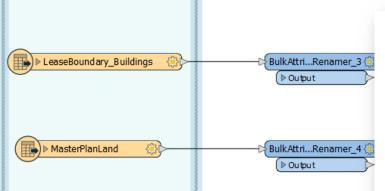
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Extract > Transform > Load (ETL) via FME











Spatial Data Support

Unrivalled support for spatial data with hundreds of connectors and out-of-the-box data transformation tools



No Code

Massive time saving for organizations with capability of building reusable integration and automation workflows without any coding



Scalability

Scalable architecture makes it easy to manage multiple engines for big data processing tasks



Flexibility

A solution for every budget, operating system, and deployment need



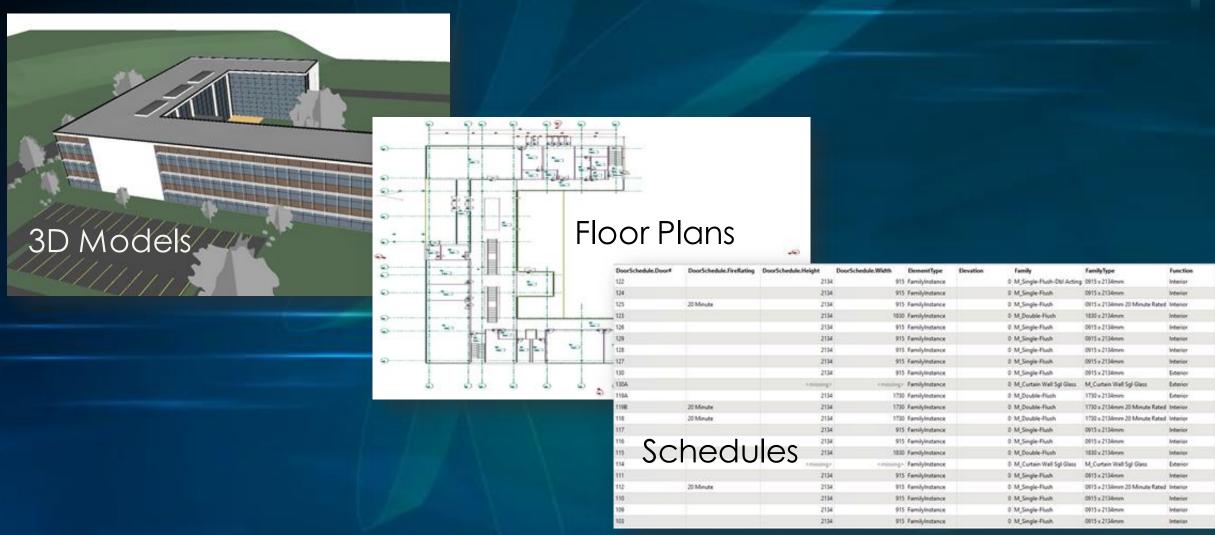
Customer Services

Top-rated customer support, comprehensive knowledge & training resources, and a dedicated community of 16,000+ users 3

Feature Manipulation Engine (FME)

Extracting Revit Data







Feature Manipulation Engine (FME)

Validating Revit Files using Metadata





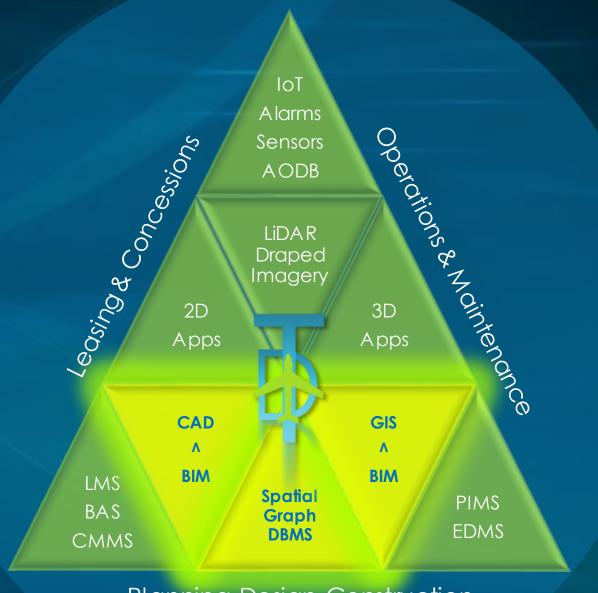
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Detail Items	No	No	Yes	Yes	Brick - UK Standard	D:\PF_Root\8.0\data\Metric\Library\Detail Components\Architectural\	No	Yes
Annotation Symbols	No	No	No	Yes	M_Level Head - No Bubble	D:\PF_Root\8.0\data\Metric\Library\Annotations\	No	Yes
Annotation Symbols	No	No	No	Yes	M_Keynote Tag	Ci\pf_root\dev\Data\Platform\Metric\Library\Annotations\	No	Yes
Annotation Symbols	No	No	No	Yes	M_Material Tag	C/lgf_root\dev\Data\Platform\Metric\Library\Annotations\Architectural\	No	Yes
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Annotation Symbols	No	No	No	Yes	M_Callout Head	C/\pf_root\9.0\Data\Platform\Metric\Library\Annotations\.	No	Yes
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Annotation Symbols	No	No	No	Yes	M_Door Tag	C/pf_root\9.D\Data\Platform\Metric\Library\Annotations\Architectural\	No	Yes
Annotation Symbols	No	No	No	Yes	M_Grid Head - Circle	C/\pf_root\9.0\Data\Platform\Metric\Library\Annotations\	No	Yes
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Annotation Symbols	No	No	No	Yes	M_Level Head - Circle	C/\pf_root\dev\Data\Platform\Metric\Library\Annotations\	No	Yes
Annotation Symbols	No	No	No	Yes	M_North Arrow-2	C:\pf_root\dev\Data\Platform\Metric\Library\Annotations\.	No	Yes
Annotation Symbols	No	No	No	Yes	M_Room Tag	C/\pf_root\9.D\Data\Platform\Metric\Library\Annotations\	No	Yes
Annotation Symbols	No	No	No	Yes	M_Section Head - Filled	C/\pf_root\9.D\Data\Platform\Metric\Library\Annotations\	No	Yes
Annotation Symbols	No	No	No	Yes	M_Section Head - No Arrow	C/\pf_root\9.0\Data\Platform\Metric\Library\Annotations\	No	Yes
Annotation Symbols	No	No	No	Yes	M_Section Head - Open	Cr\pf_root\9.0\Data\Platform\Metric\Library\Annotations\	No	Yes
Annotation Symbols	No	No	No	Yes	M_Section Tail - Filled	C/\pf_root\9.0\Data\Platform\Metric\Library\Annotations\	No	Yes
Annotation Symbols	No	No	No	Yes	M_Section Tail - Filled Horizontal	C/\pf_root\9.0\Data\Platform\Metric\Library\Annotations\	No	Yes
Annotation Symbols	No	No	No	Yes	M_Spot Elevation - Exterior Filled	C/\pf_root\9.0\Data\Platform\Metric\Library\Annotations\	No	Yes
Annotation Symbols	No	No	No	Yes	M_Spot Elevation - Target Filled	C/lpf_root\9.0\Data\Platform\Metric\Library\Annotations\	No	Yes
Annotation Symbols	No	No	No	Yes	M_View Title	C/lpf_root\9.0\Data\Platform\Metric\Library\Annotations\	No	Yes
Annotation Symbols	No	No	No	Yes	M_Wall Tag	C/\pf_root\9.0\Data\Platform\Metric\Library\Annotations\Architectural\	No	Yes
Annotation Symbols	No	No	No	Yes	M_Window Tag	Cr\pf_root\9.0\Data\Platform\Metric\Library\Annotations\Architecturaf\	No	Yes
Columns	No	No	Ves	Yes	M_Rectangular Column	C/\pf_root\9.0\Data\Platform\Metric\Library\Architecturaf\Columns\	No	Yes
Doors	No	Yes	Yes	Yes	M_Single-Flush	C/\pf_root\9.0\Data\Platform\Metric\Library\Architectural\Doors\	No	Yes
Parking	No	No	Yes	Yes	M_Parking Space	C/\pf_root\9.0\Data\Platform\Metric\Library\Site\Parking\	No	Yes

Harvesting BIM Data Building Assets Spreadsheet Manual Import Automation Maintenance **SafeSW** Electrical **FME** Panels 3 BIM IT / Comm Data File(s) **CCTV** Life Safety **AutoCAD Record Drawings** Access Control Leases x-Spatial AODB/RMS Map Overlay GIS

x-Spatial DBMS & Automation

X·SPATIAL

- Assets Breakdown Structure
 (i.e., features & attributes)
- Data Processing
 - BIM ---> CAD Processing
 - CAD ---> GIS Processing
 - BIM ---> GIS Processing
 - BIM ---> BAS/CMMS Processing
- AEC CAD Standards Export
- FAA AGIS/eALP Standards Export



BI

Planning-Design-Construction



x-Spatial DBMS & Automation

X.SPATIAL



x-Spatial Apps











AutoCAD Map







Revit / Tekla



ArcGIS Pro

Auto-Export of Standardized **CAD-GIS Files** (e.g., NCS, ANSI)



AEGIS

DBMS



Seamless Export of Geodatabase Supporting 3rd Party Products & Apps



- ArcGIS Dashboards
- Maximo / Infor / Cityworks
- Simplify i3
- etc...



Leveraging Autodesk Construction Cloud

X·SPATIAL

* 8 6 + / 0 0 0 0 A 4 0 9







Design Collaboration



Aggregated Model Coordination



Automated Clash Detection



Issues **Management**



Document Control

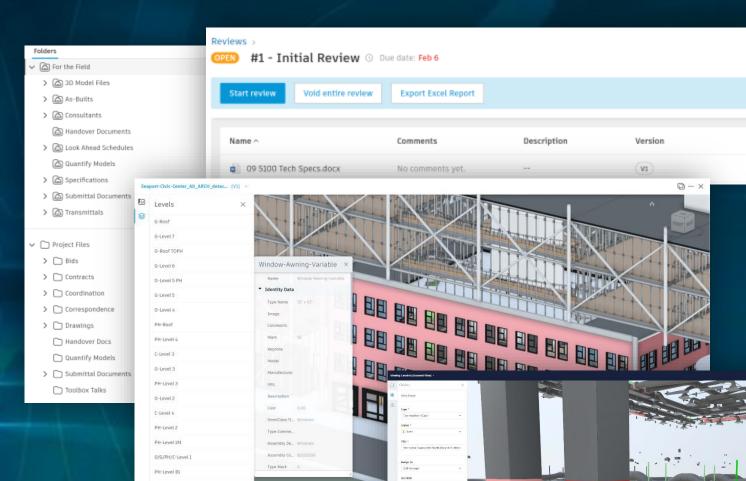


Document Versioning



Document Approvals

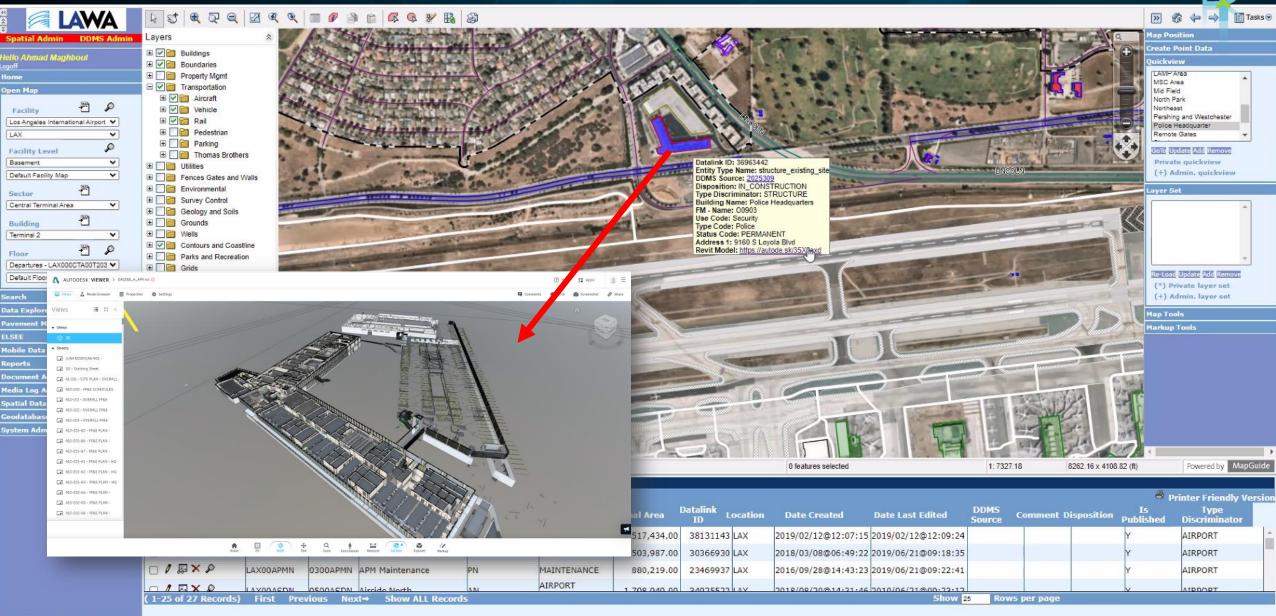






Integrated BIM Records





Web-Enabled BIM Access















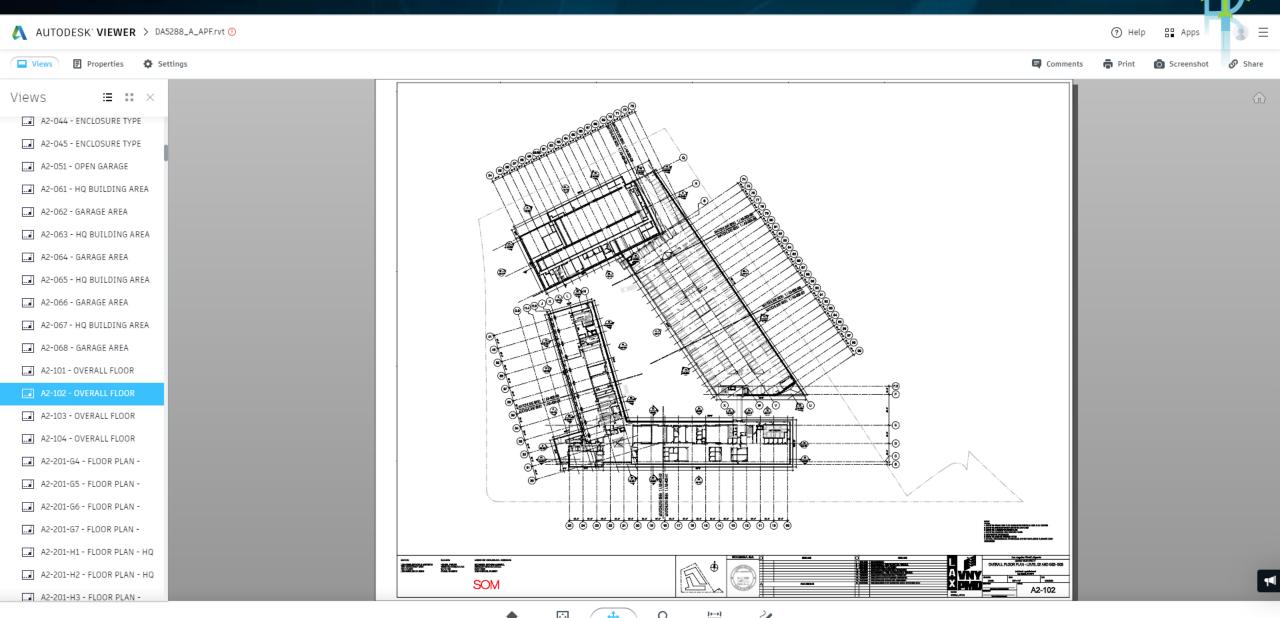




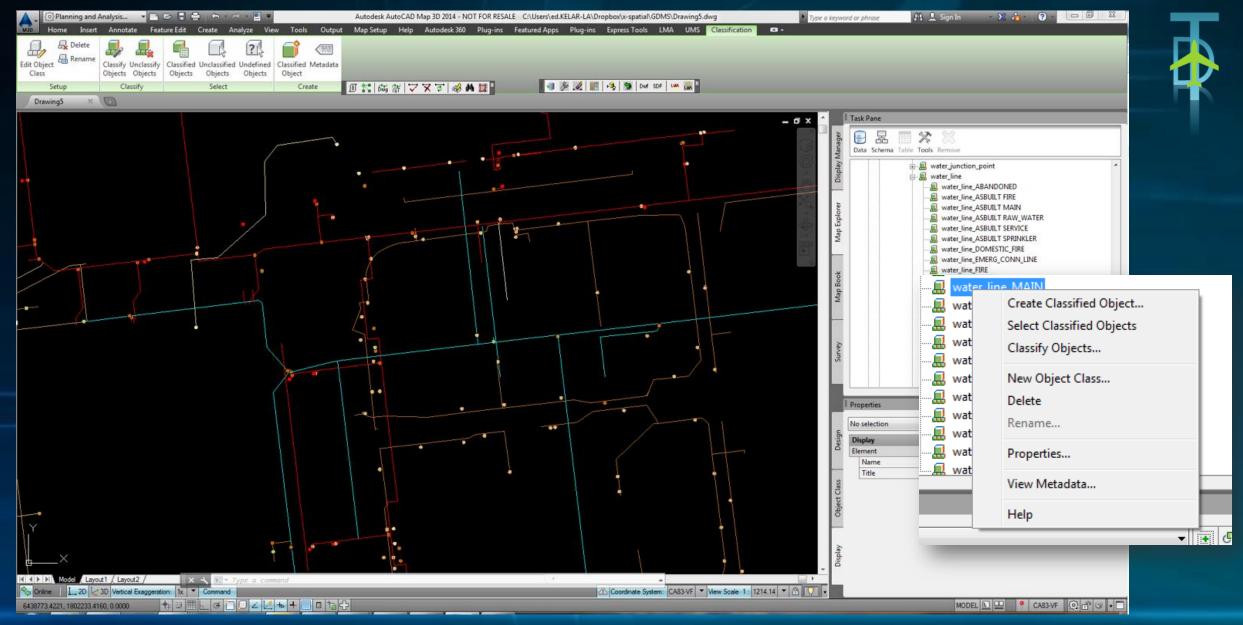


BIM Exported Record Drawings XISPATIAL



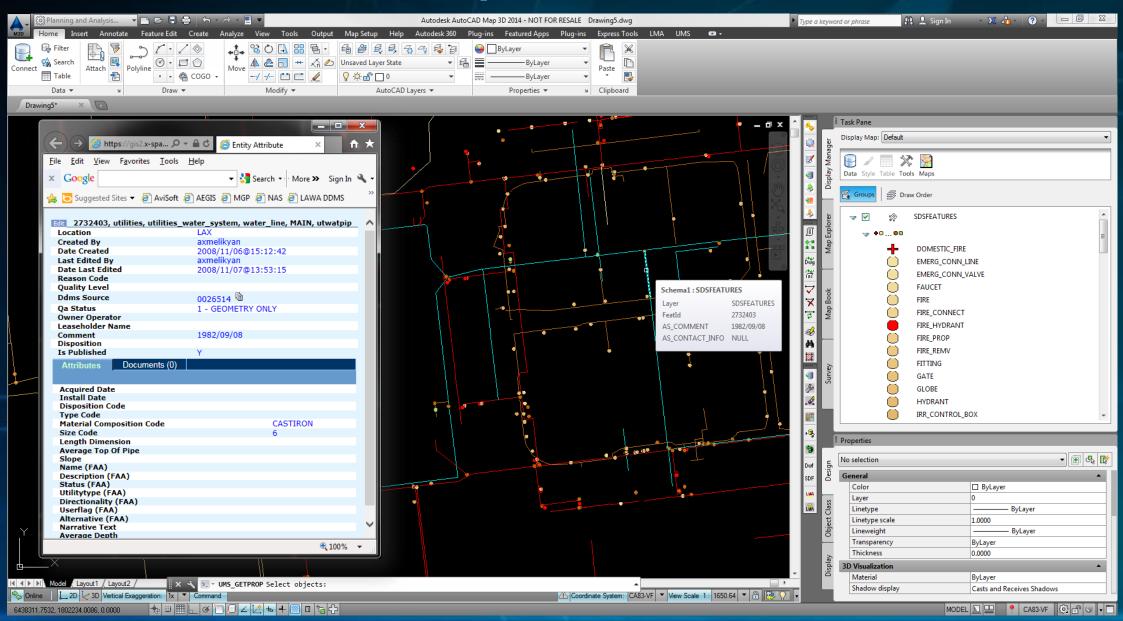


Automation of CAD to GIS Conversion X-SPATIAL



GIS Attribution Tools per Standards

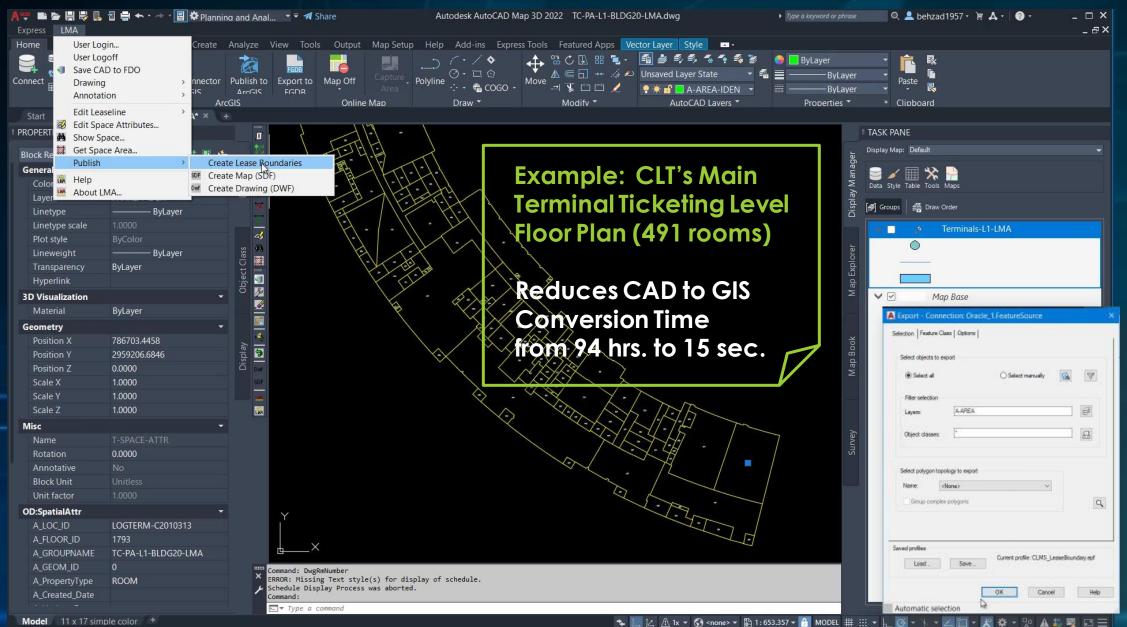
X·SPATIAL





Automation for GIS Floorplan Updates

X·SPATIAL



Keep It Simple & Sustainable (KISS) Principle; simplify data requirements & terminology for airport O&M use cases

- ?
- Standardize data deliverables ("garbage in >< garbage out") include templates for standardizing DWG exports from Revit</p>
- Require AECs to provide cleaned & simplified DWGs from Revit
- x-Spatial tools can automate processing of Revit DWG exports into spatial database serving airport systems & digital twin
- Leverage FME Extract-Transform-Load (ETL) tools
- QC/QA self audit by AEC
 & receiving audit by Owner are essential for efficient post project data processing



Thank You

PDBM X·SPATIAL Safe Seftware

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Solution

Webinars

E 8

INTEGRATED SOLUTION PLATFORM



Simplify i3

Airport Digital Twin Transformation Platform by EPIC Engineering & Consulting Group

Learn more



AEGIS

Airport Enterprise Geospatial Information System by x-Spatial

Learn more



BIM

Building Information Modeling Standardization Harvesting and Integration by PDBM/x-Spatial

Learn more 🕍



В

Building Information Modeling (BIM) is a key layer of our Airport Digital Twin Integrated Platform

PDBM and x-Spatial bring best practices in establishing airport BIM standards and contract compliance language and audit processes, as well as leveraging Autodesk's Construction Cloud (ACC) to serve BIM models linked to our AFGIS and Simility 3 components

foreover, leveraging Safe Software's FME and -Spatial tools, our team enables efficient

Chow Larr



AIRPORT DIGITAL TWIN ENABLING CAPABILITIES



Configuring Airport Owner's BIM Data Warehouse

Our Airport Digital Twin integrated platform includes a BIM data warehouse configured for airport owner iffercycle needs, is Authordex's Construction Cloud (ACC). This integrated BIM/ACC layer supports the upper layers of AEGIs and Simplify 3 to deliver holistic functions spanning Architectures—Engineing-Construction (AEC), commissioning Operational Readiness-Activation Training (ORAT), and Operations and Maintenance (OSM) including these management.

Benefits Spanning Airport Facility's Lifecycle

BIM benefits, via the airport owner's Digital Twin, reduce costs throughput the lifecycle of airport facilities, especially during the O&M phase, when 80% of the total facility costs take place.



Efficient BIM Data Interoperability is Key

In order to support the full lifecycle of the airport owner's facilities with a Digital Twin, BIM deliverables and data nonenclature need to be standardized for efficient interoperability. Our teams specializes in developing BIM standards, contractual language requirements, and auditin



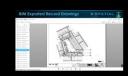
Distilling BIM Details for Airport Owner Use Cases

BIM data is extremely detailed to support manufacturing and assembly of building components. This level of detail is not recipied and overwhelming for airport management use cases. Hence, BIM details need to be distilled down through post processing and import automation into AEGIs, in support of Digital Twin use cases including maintenance management, lease management, etc.



Viewing 3D BIM Data via Easy Web User Interface

BIM deliverables are extremely large and complex files, requiring powerful engineering vontation computers to lower wit where rather software, such as Autodeck's Revit. Moreover, opening such native files may take long processing films, which is not practical or alipsort owners reading to quickly research BIM data. Our Digital Twin solution enables the airport women to quickly access and view such BiM data; vio aur efficient integration with ACC and It's built-in, web-enabled, user-friendly, BIM viewer.



Easy Access to BIM Design & Construction Records

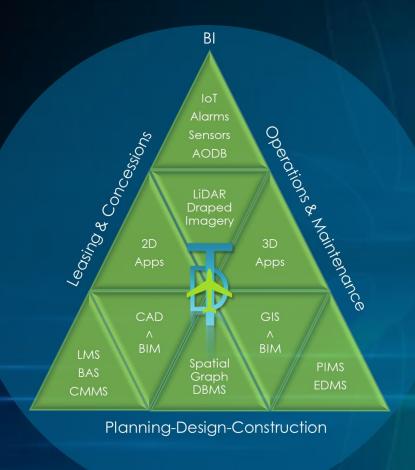
BIM models, delivered into the airport owner's BIM data warehouse (via ACC), are linked to project location/boundaries and corresponding assets managed in our Digital Twin solution. This enables easy access to the "asbuilt" record information, for future use; such as research of interstitial layers, not easily accessible, and component specifications for renewal an replacement.



Easy 2D Viewing of Record Drawings

In addition to the above easy viewing of the 3D BIM models, enabled by ou integrated Digital Twin solution, the airport owner can also easily access the 2D record drawings, which were generated from the BIM models. This is very valuable, as most airport use cases require 2D data.

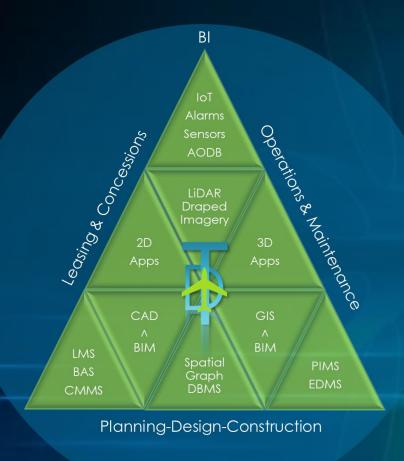
Webinar Series



- 1. Jul 19: BIM Processing
- 2. Jul 26: Information Integration
- 3. Aug 2: Enabling Integrated SMS
- 4. Aug 9: Holistic Business Intelligence
- 5. TBD: Leveraging Video Analytics
- TBD: Predictive Modeling

AirportDigitalTwin.org

Webinar Outline



2. Jul 26: Information Integration

- Disparate Information Correlation via Spatial Common Denominator
- Multi-Dimensional Information Association
 - → BIM-CAD-GIS-LiDAR with Draped Imagery
 - IoT Devices-Sensors-Alarms...
 - Documents-Files-Photos-Videos...
 - Process Workflows-Communications-Tasks...
- Business Intelligence (BI) Rollup

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