Campus FM Technology Association

THE OHIO STATE UNIVERSITY

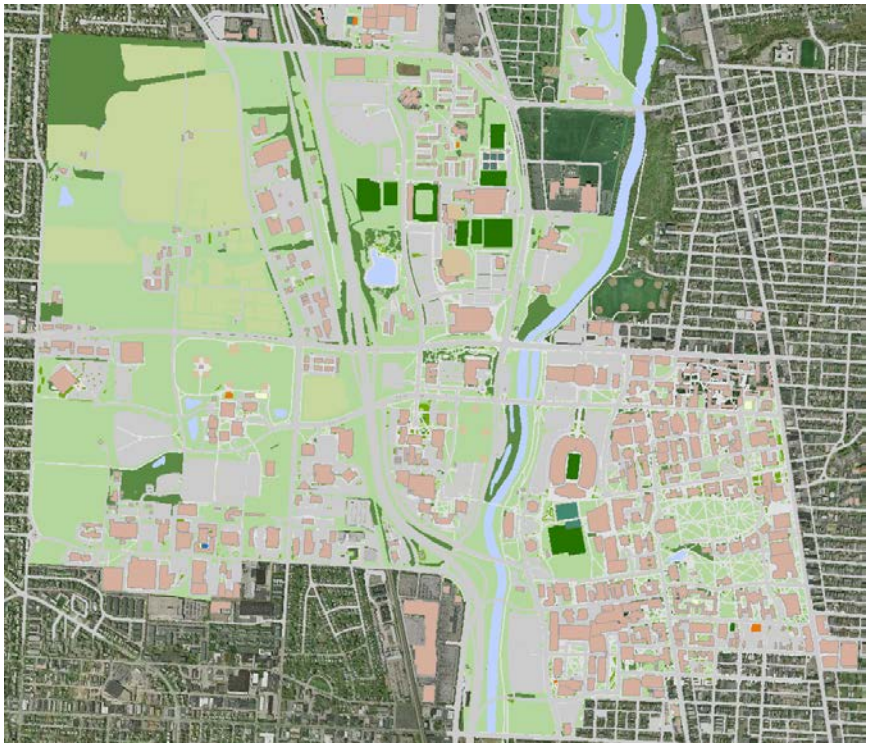
Your Perfect 3D World (BIM and GIS Integrated)

June 2015

Larisa Kruger

Background

- Larisa Kruger- Enterprise GIS Manager
- FITS- Facilities Information Technology Services
- 2 years (GIS for 15)
- 2 FTE, 4 students part time on GIS
- 5 FTE, 6 students on BIM / space data
- 1,350 buildings including regionals
- 34,350,000 GSF
- 1,660 Ac on Columbus campus. 15,056 Ac total



The Ohio State University Enterprise GIS Initiative

To promote, integrate, standardize and advance the utilization of geographic information systems (GIS) for administrative, management, and service-related purposes throughout The Ohio State University.

Asset Management Improved Decision Making/Cost Savings

Link	BldgNumber	GISSTATUS	ComName
http://www.osu.edu/map/linkbuildings/287.jpg	287	VERIFIED	Parking Garage - Neil Avenue (0287)
http://www.osu.edu/map/linkbuildings/067.jpg	67	VERIFIED	Pomerene Hall (0067)
http://www.osu.edu/map/linkbuildings/060.jpg	60	VERIFIED	Orton Hall (0060)
http://www.osu.edu/map/linkbuildings/039.jpg	39	VERIFIED	Hayes Hall (0039)
http://www.osu.edu/map/linkbuildings/066.jpg	66	VERIFIED	Mershon Auditorium (0066)
http://www.osu.edu/map/linkbuildings/078.jpg	78	VERIFIED	Maintenance Building (0078)
http://www.osu.edu/map/linkbuildings/056.jpg	56	VERIFIED	Converse Hall (0056)
http://www.osu.edu/map/linkbuildings/065.jpg	65	VERIFIED	Smith Laboratory (0065)
http://www.osu.edu/map/linkbuildings/090.jpg	90	VERIFIED	Ramseyer Hall (0090)
http://www.osu.edu/map/linkbuildings/148.jpg	148	VERIFIED	Scott Laboratory (0148)
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http://www.osu.edu/map/linkbuildings/359.jpg	359	VERIFIED	Parking Garage - Ninth Ave W (0359)
http://www.osu.edu/map/linkbuildings/379.jpg	379	VERIFIED	Telecommunications Network Center (0379)
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http://www.osu.edu/map/linkbuildings/048.jpg	48	VERIFIED	Pennsylvania Place (0048)	1478 Pennsylvania Ave	Columbus
http://www.osu.edu/map/linkbuildings/348.jpg	348	VERIFIED	Jesse Owens Recreation Center South (0348)	175 W 11th Ave	Columbus
http://www.osu.edu/map/linkbuildings/352.jpg	352	VERIFIED	Parking Garage - Eleventh Ave (0352)	229 W 11th Ave	Columbus
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http://www.osu.edu/map/linkbuildings/847.jpg	847	VERIFIED	William Hall Complex - Scholars House West (	239 W 10th Ave	Columbus
http://www.osu.edu/map/linkbuildings/869.jpg	869	VERIFIED	Pomerene Alumnae Scholarship House (0869)	231 W 10th Ave	Columbus
http://www.osu.edu/map/linkbuildings/864.jpg	864	VERIFIED	Hanley Alumnae Scholarshp House (0864)	225 W 10th Ave	Columbus
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http://www.osu.edu/map/linkbuildings/849.jpg	849	VERIFIED	William Hall Complex - Worthington Building (	203 W 10th Ave	Columbus
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http://www.osu.edu/map/linkbuildings/066.jpg	66	VERIFIED	Plumb Hall (0066)	2027 Coffey Rd	Columbus
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http://www.osu.edu/map/linkbuildings/298.jpg	298	VERIFIED	Agricultural Engineering Building (0298)	590 Woody Hayes Dr	Columbus
http://www.osu.edu/map/linkbuildings/284.jpg	284	VERIFIED	Fawcett Center For Tomorrow (0284)	2400 Olentangy River Rd	Columbus
http://www.osu.edu/map/linkbuildings/243.jpg	2435	VERIFIED	Ackerman Rd, 600	600 Ackerman Rd	Columbus
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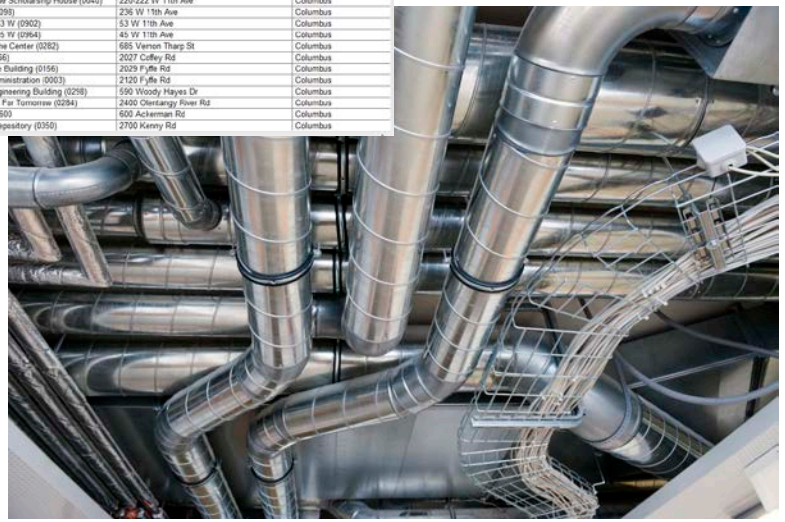
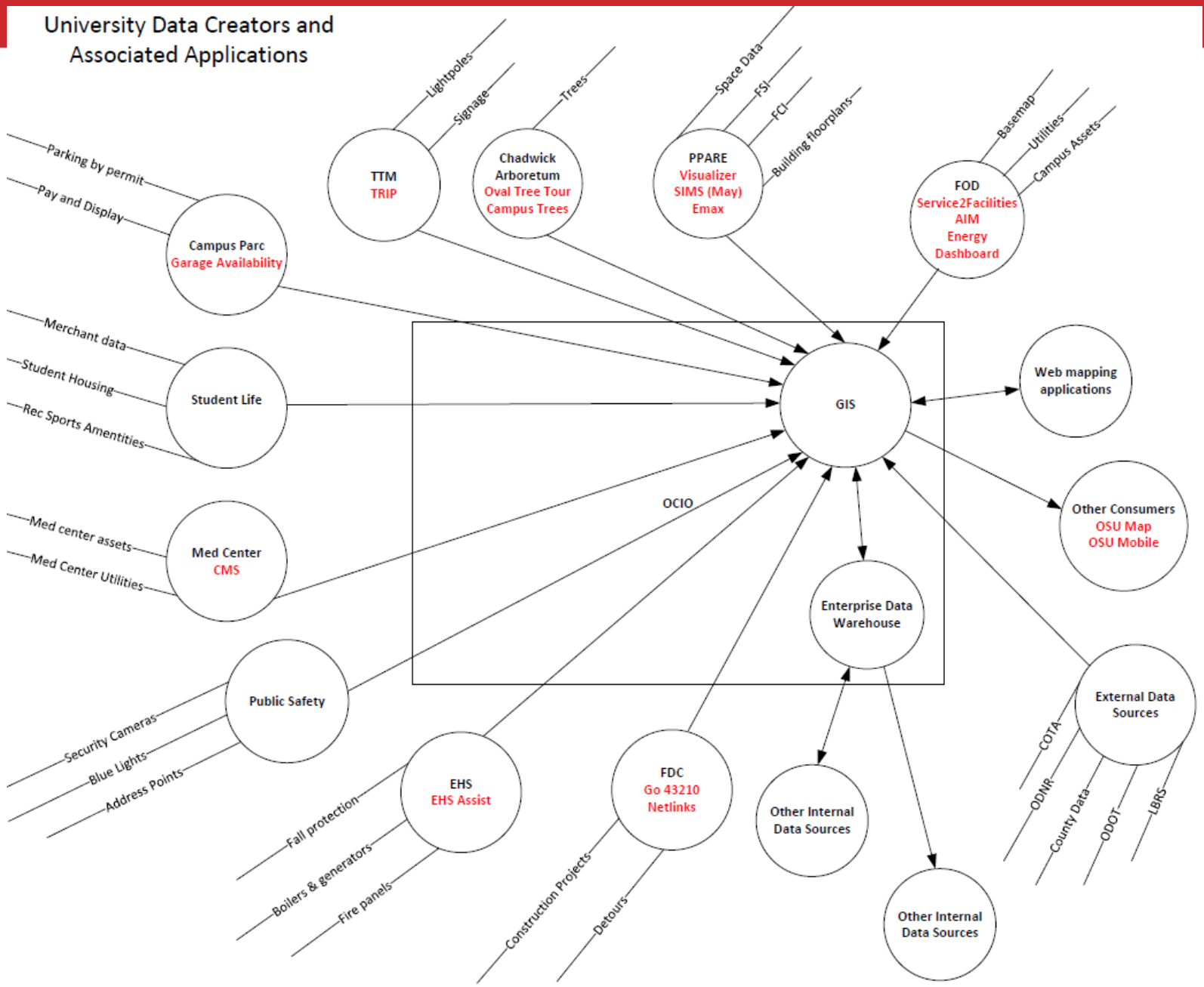
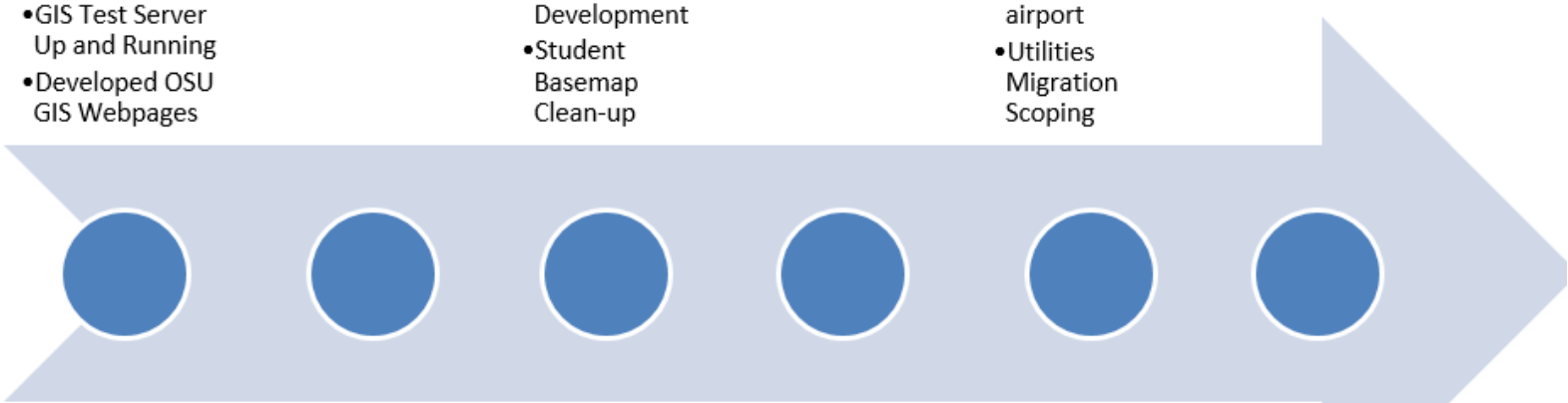


University Data Creators and Associated Applications





Summer/Fall 2013

- Campus-wide GIS Assessment
- Compile GIS Listserve
- Document Data Owners/Consumers and Wish-lists
- GIS Test Server Up and Running
- Developed OSU GIS Webpages

Winter 2014

- Advisory Committee Developed
- ESRI Enterprise Advantage Program
- Basemap Ownership migrates to PARE
- CAD database and existing data migrated to LGIM

Spring 2014

- Woolpert Scoping and Analysis
- Revit Model ETL's Developed
- Woolpert Web Application Development
- Student Basemap Clean-up

Summer/Fall 2014

- Web Application build complete
- Students georeference CAD buildings
- Woolpert Systems Architecture Document complete
- Golf Course Basemap delivered

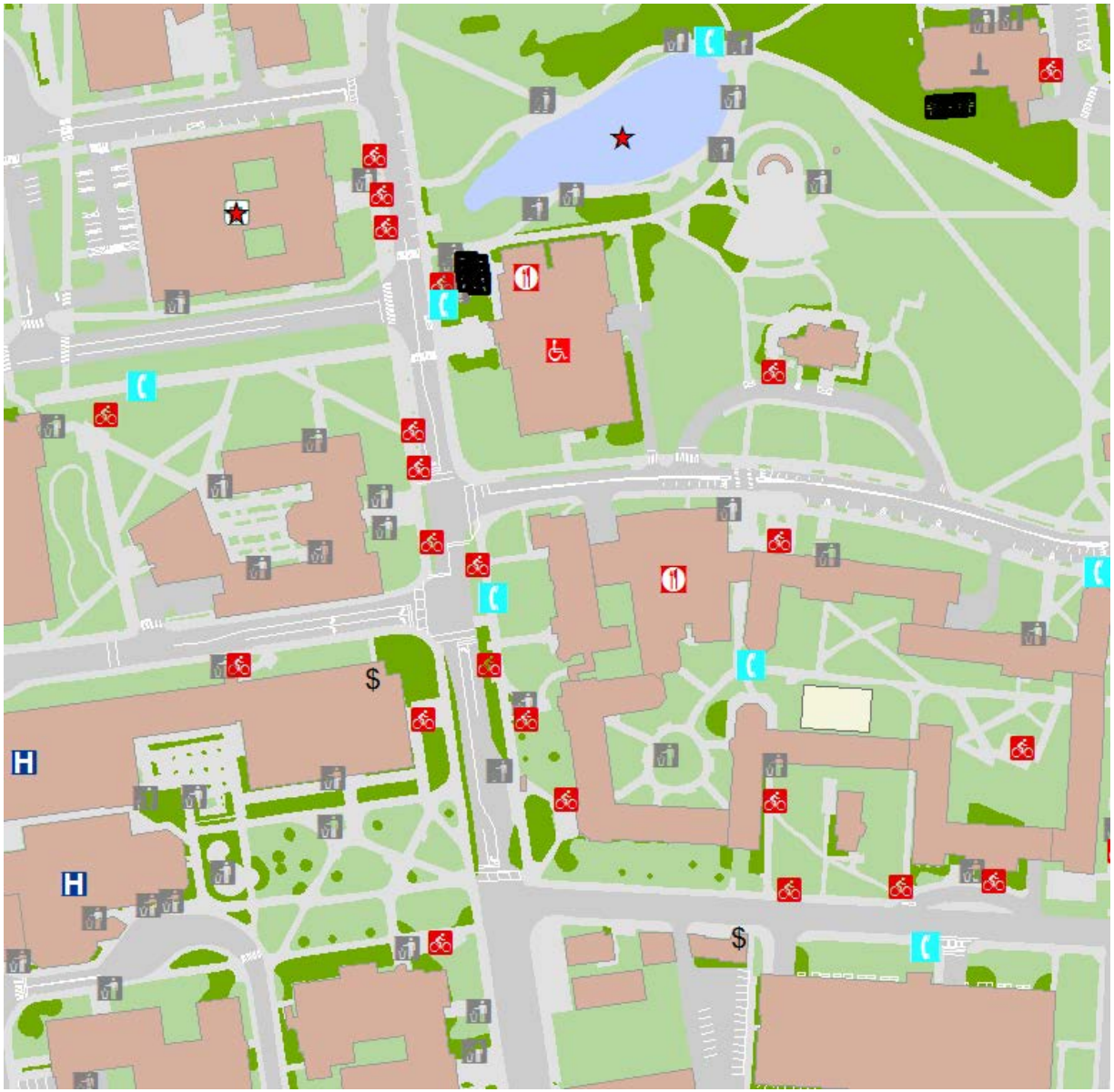
Winter 2015

- OCIO builds out GIS System Architecture
- OCIO helps with GIS Maps 1.0 set-up
- Aerial Photos Flown for Regional Campuses and airport
- Utilities Migration Scoping

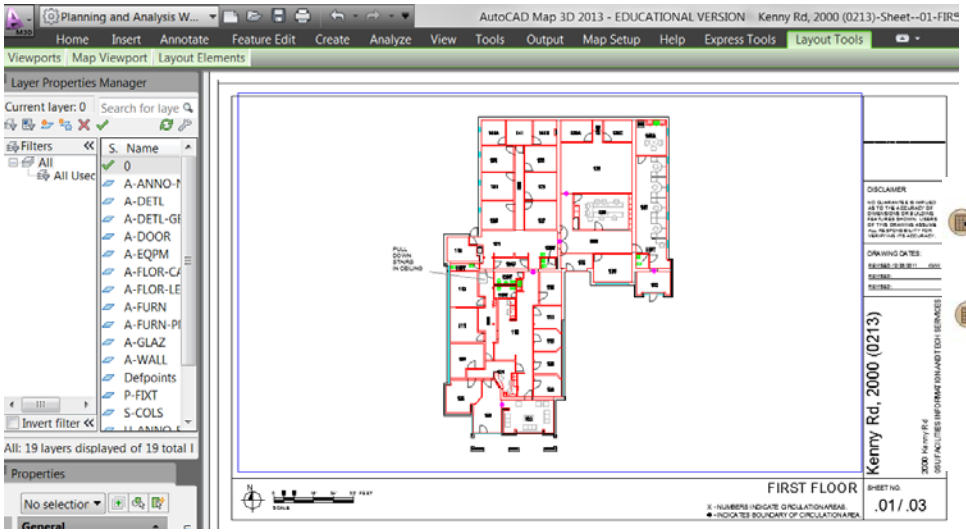
Spring 2015

- Regional Imagery Delivered
- GIS Maps 1.0 soft roll out April 28
- Utilities Migration kicks-off
- Regional basemap begins development

Basemap Migrated from:
PARE's File Geodatabase, FOD Mapping CAD
Smart Feature, FOD Mapping Oracle Spatial
to
Local Government Information Model (LGIM) in SQL SDE
for use in desktop, web apps and ArcGIS Online



CAD to GIS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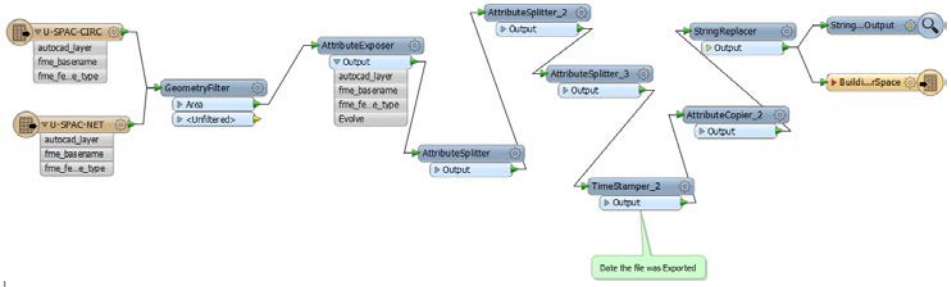
Layer Properties Manager
FIRST FLOOR
Kenny Rd, 2000 (0213)
.01 / .03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U-SPAC-NET
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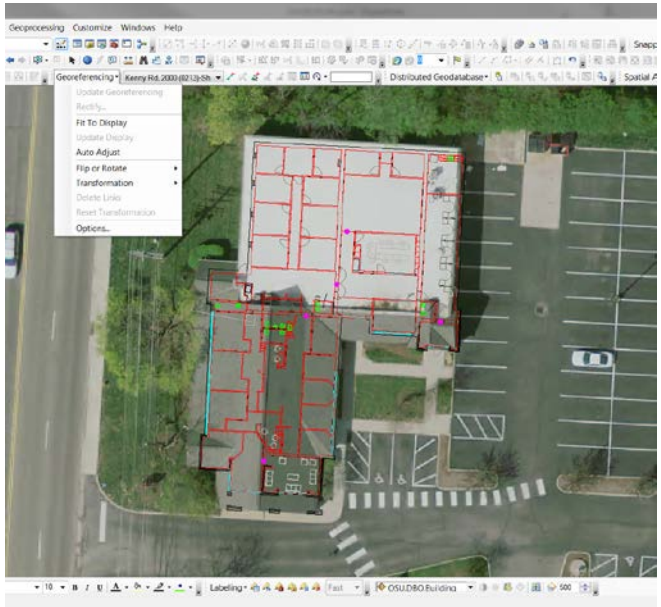
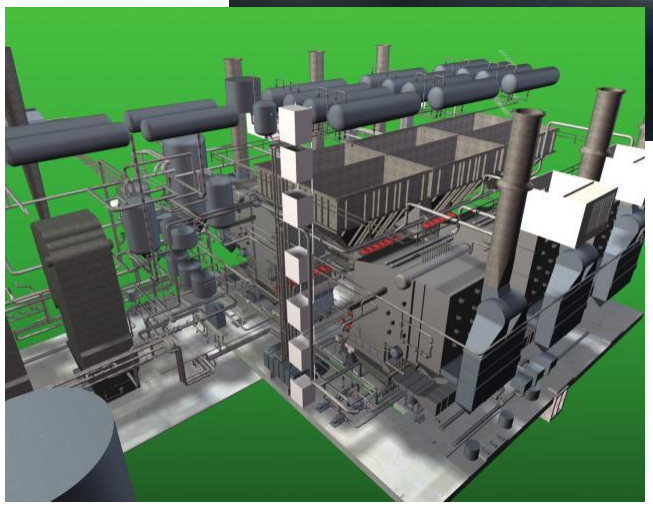
AttributeSplitter_2
AttributeSplitter_3
StringReplacer
AttributeCopier_2
TimeStamper_2
Date the file was Exported


Georeferencing
Update Georeferencing
Rectify...
Fit To Display
Update Display
Auto Adjust
Flip or Rotate
Transformation
Delete Links
Reset Transformation
Options...

BIM

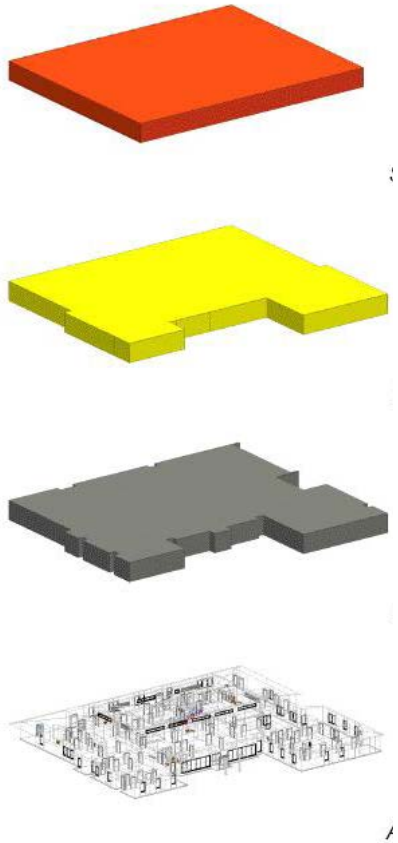
Building Information Modeling (BIM)

- Improved design process
- 3-D visualization for owner (static only)
- Coordination between disciplines
- Interference checking
- Facilitates energy efficiency and LEED
- Automated quantity take offs
- 4-D scheduling
- Improved documentation of design intent
- Potentially used for fabrication



Benefits For Design And Construction

- **Conceptual Model (LOD1)**
  - Spaces, Volumes, approximate shapes
- **Approximate Geometry (LOD2)**
  - Generic elements, materials
  - Specific rooms/spaces
- **Precise Geometry (LOD3)**
  - Specific elements detailed
  - Interference checking
  - Suitable for Construction Documents
- **Fabrication (LOD4)**
  - Contractor/fabricator details
  - As-Built

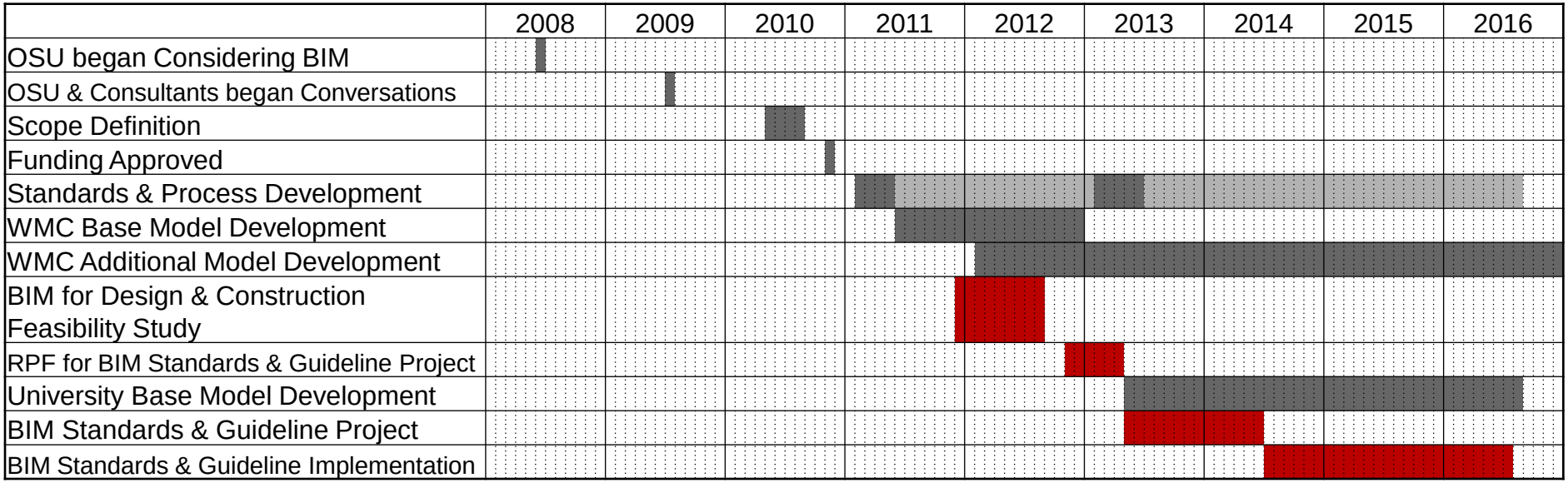


Buckeye BIM Initiative

BIM for Existing Buildings

BIM for Design & Construction

Initiative Timeline



BIM for Existing Buildings

BIM for Design & Construction

THE OHIO STATE UNIVERSITY

Buckeye BIM Initiative

Medical Center- complete

Main Campus- In Progress

Converted 15,525,022 sq ft

Total 34,350,000 sq ft

The Ohio State University

THE BUCKEYE BIM IMPLEMENTATION STATUS

FACILITIES INFORMATION AND TECHNOLOGY SERVICES

Columbus Campus

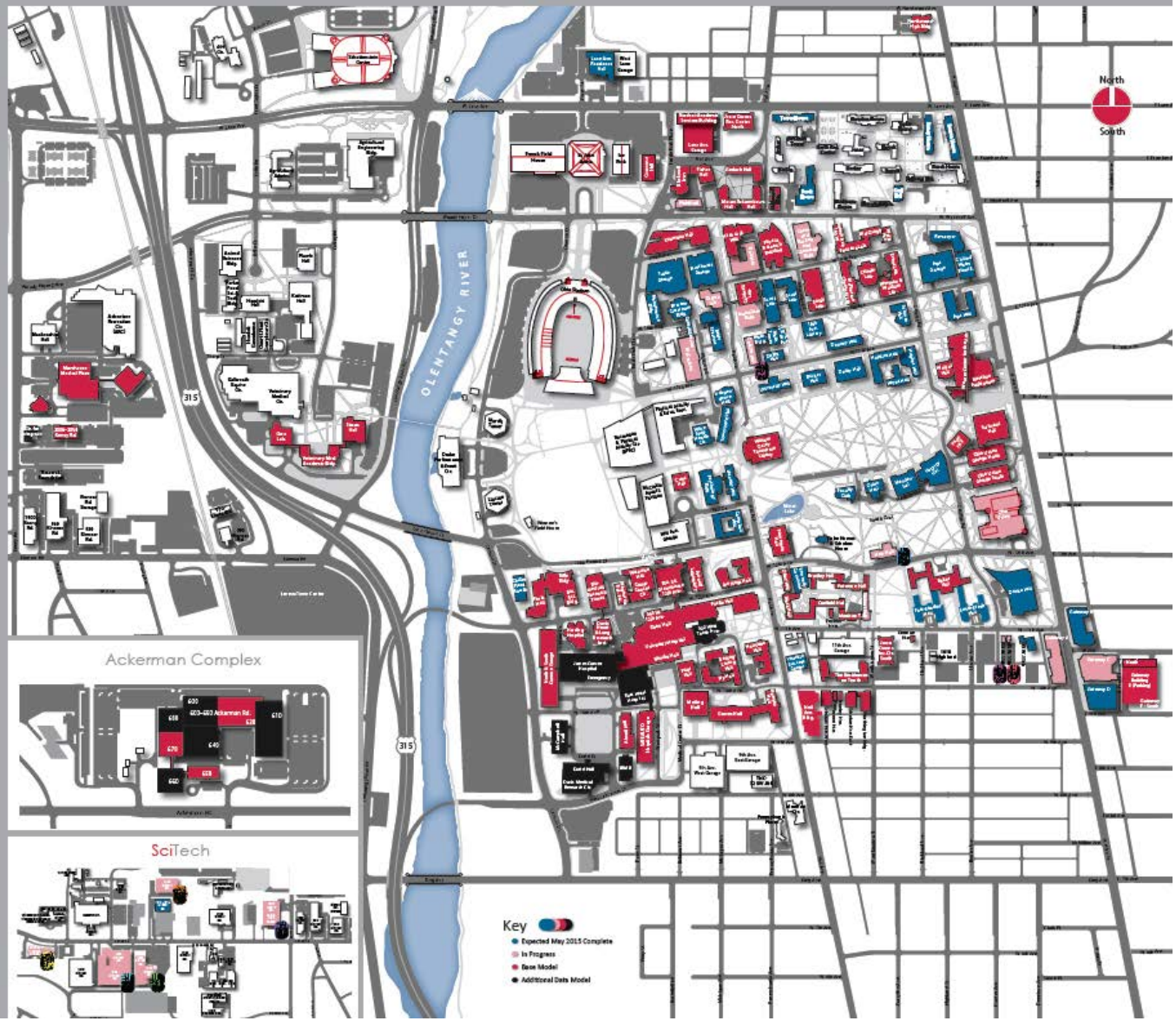
Wexner Medical Center

FITS Team Members

- Joe Porostosky, Director
- Dave Pifher, Architectural Services Manager
- Larisa Kruger, Enterprise GIS Manager
- Tracy Palmer, BIM Coordinator
- Aaron Kidwell, GIS Analyst
- Tim Schacht, Facilities Space Analyst
- Ragni Pahuja, Archive Data Manager

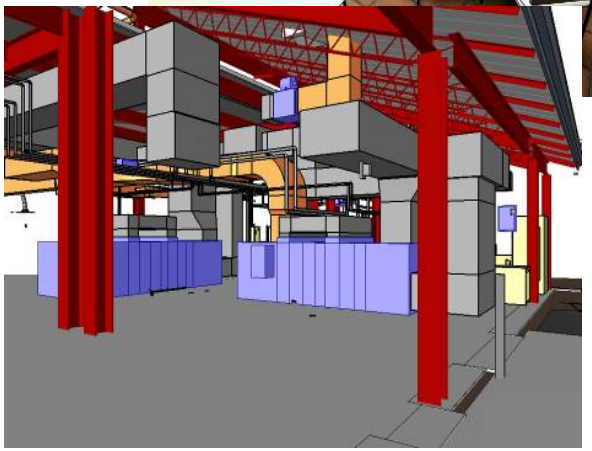
BIM Assistants

- Brooke Somogyi, Interior Design, Solon, OH
- Cassie Gleeson, Landscape Architecture, Ottawa, OH
- Claire Ronan, Architecture, Mooresville, IN
- Daniel Pushpak, Mechanical Engineering, Broadview Heights, OH
- Dominique Raymond, Landscape Architecture, San Bernardino, CA
- Eric Bermudez, Architecture, Rancho Cucamonga, Santa Fe, Arg
- Rachel Ghindes, Architecture, Port Washington, OH
- Timothy McCready, Landscape Architecture, Toledo, OH



BIM To GIS Integration Issues

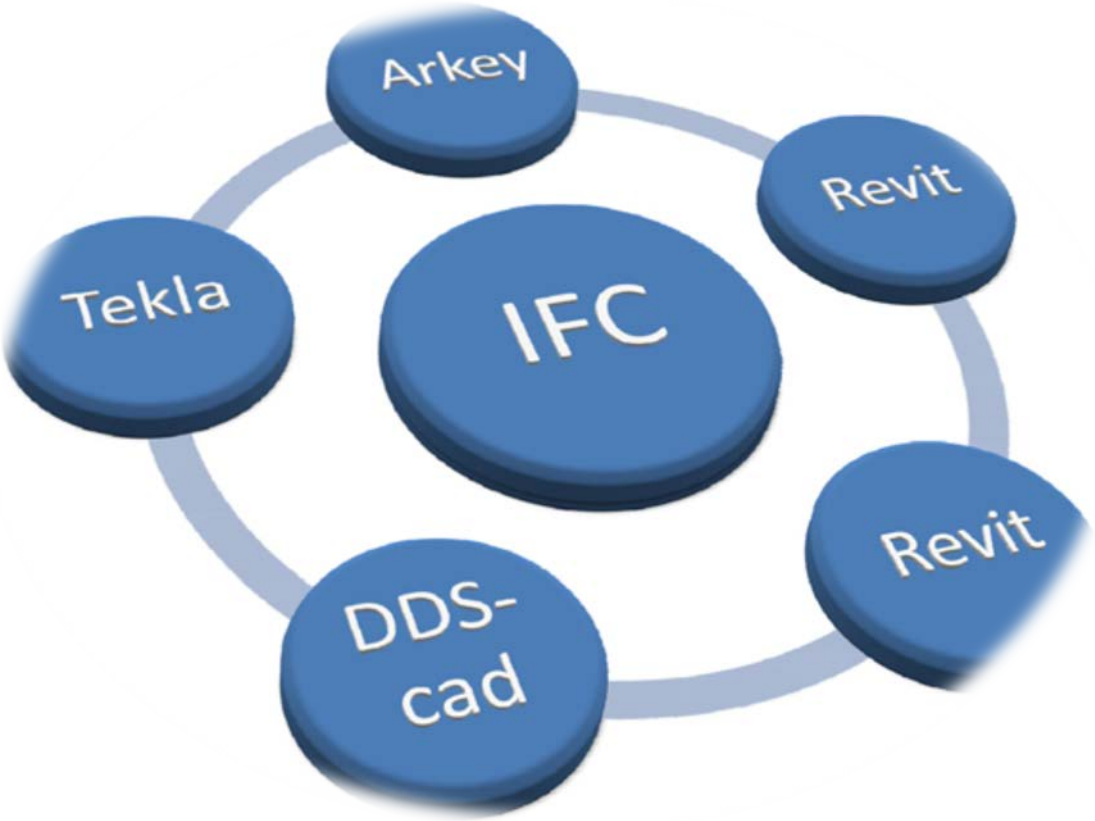
- BIM is MUCH richer in detail than GIS
- GIS has only recently become fully 3-D
- Design BIM contains all the information needed to construct a building, but not to manage it
  - Space polygons
  - Occupant information
  - Asset details (make, model, etc.)
  - Equipment maintenance data
- Missing tabular data can be supplied by Construction Operations Building Information Exchange (COBie)



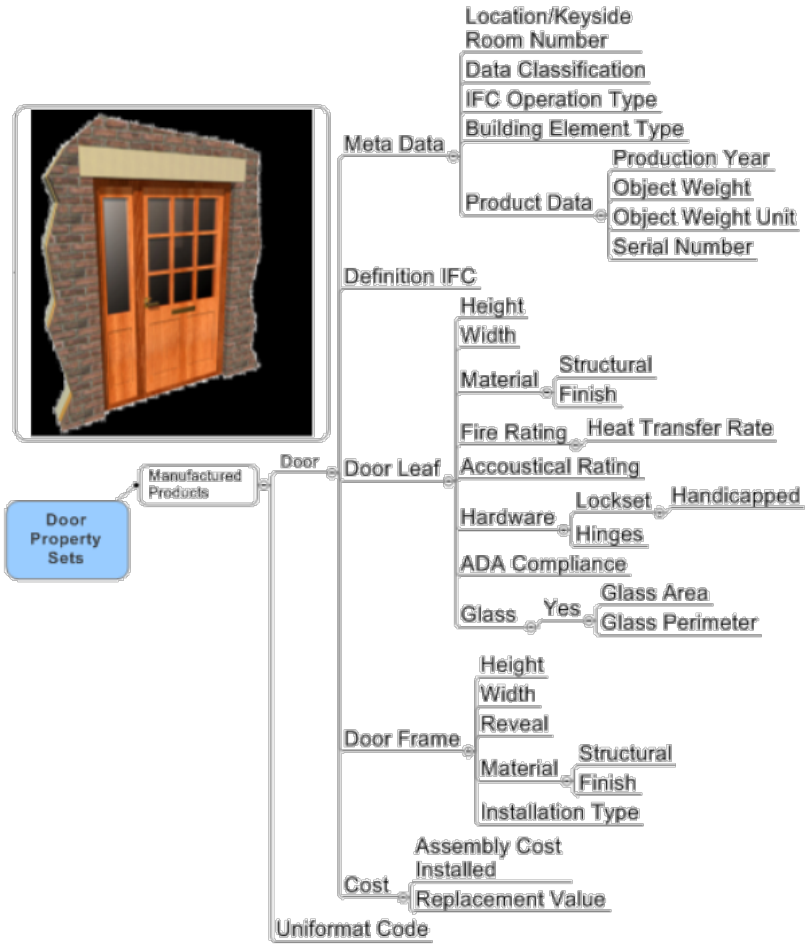
IFC- The international open standard for BIM

'Open' is the key to the real value of our buildingSMART standard. IFC can be used to exchange and share BIM data between applications developed by different software vendors without the software having to support numerous native formats. As an open format, IFC does not belong to a single software vendor; it is neutral and independent of a particular vendor's plans for software development.

IFC



Elements in BIM are Created in Detail



Door Data Property Sets Courtesy AEC Infosystems, Inc.

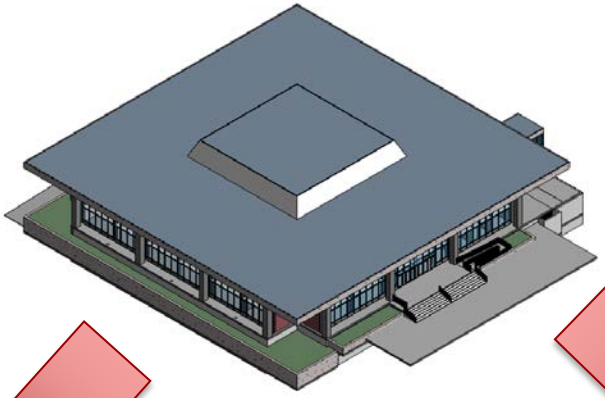
This data is required to convey the information needed to construct the facility.

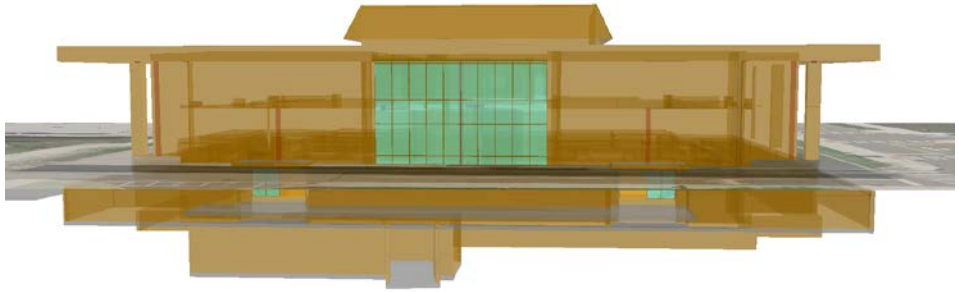
3D Formats

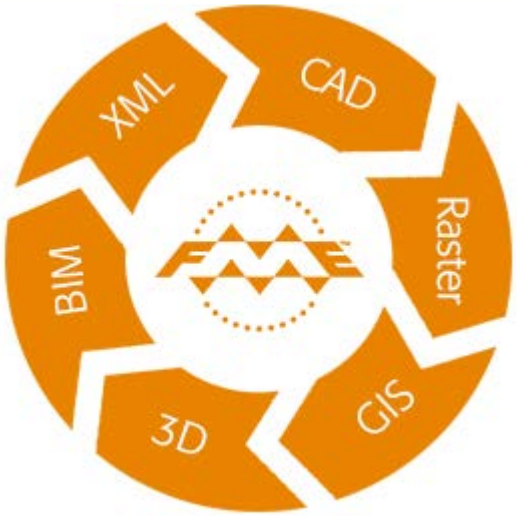
Format	Benefits	Limitations
COLLADA	• Support advanced material handling, asset instancing, and multiple UV sets. • Static Model Import • Shape Import • Open to several software packages	• Machine resource heavy • Light size file
CityGML	• OGC compliance • Not Software driven • Scalable modeling (Exterior and interior) • Indoor Modeling (routing)	• Not a straight forward import • Light size file
3DS		• Old format (not very efficient)
OBJ	• Static Model Import • Shape Import	• No indoor Modeling (routing) • No texture
KML	• Static Model Import • Shape Import	• No indoor Modeling (routing)
Shape/Goedatabase*	• Static Model Import • Shape Import • "Native to the Software"	• No indoor Modeling (routing) • No texture
Autodesk® FBX®	• support advanced material handling, asset instancing, and multiple UV sets	• Some minimal Indoor modeling. • Machine resource heavy • Movie driven • Not supported by FME
OSM	• Free source of data for the base data (2D only)	• Not a 3D dataset

BIM to GIS

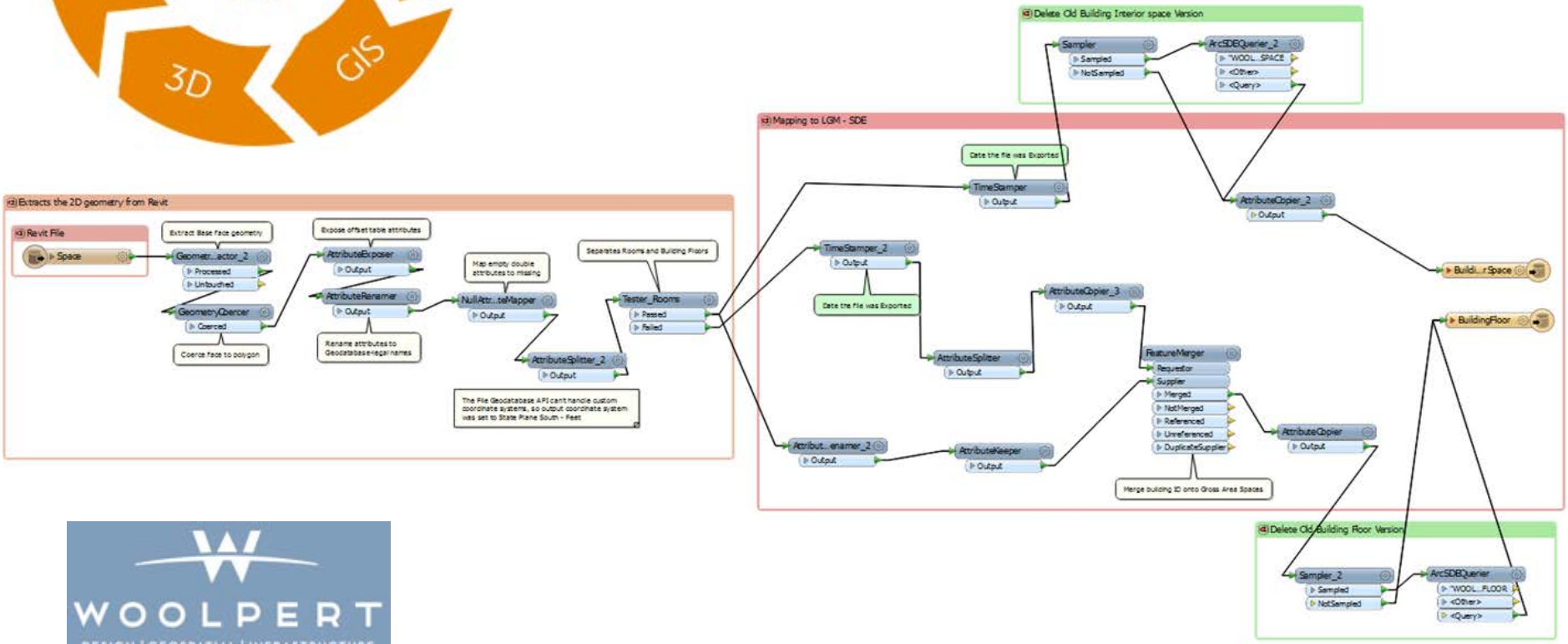
BIM (Autodesk-Revit) to GIS







SAFE SOFTWARE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Sampled
NotSampled
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TimeStamper
Output
AttributeCopier_2
Output
Extracts the 2D geometry from Revit
Revit File
Space
Extract Base face geometry
Geometr...actor_2
Processed
Untouched
Expose offset table attributes
AttributeExposer
Output
AttributeRenamer
Output
Rename attributes to Geodatabase-legal names
GeometryCoercer
Coerced
Coerce face to polygon
Map empty double attributes to missing
NullAttr...teMapper
Output
Separates Rooms and Building Floors
Tester_Rooms
Passed
Failed
AttributeSplitter_2
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The File Geodatabase API can't handle custom coordinate systems, so output coordinate system was set to State Plane South - Feet
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Output
Date the file was Exported
AttributeSplitter
Output
AttributeCopier_3
Output
FeatureMerger
Requestor
Supplier
Merged
NotMerged
Referenced
Unreferenced
DuplicateSupplier
Merge building ID onto Gross Area Spaces
AttributeCopier
Output
Attribut...enamer_2
Output
AttributeKeeper
Output
Buildi...r Space
BuildingFloor
Delete Old Building Floor Version
Sampler_2
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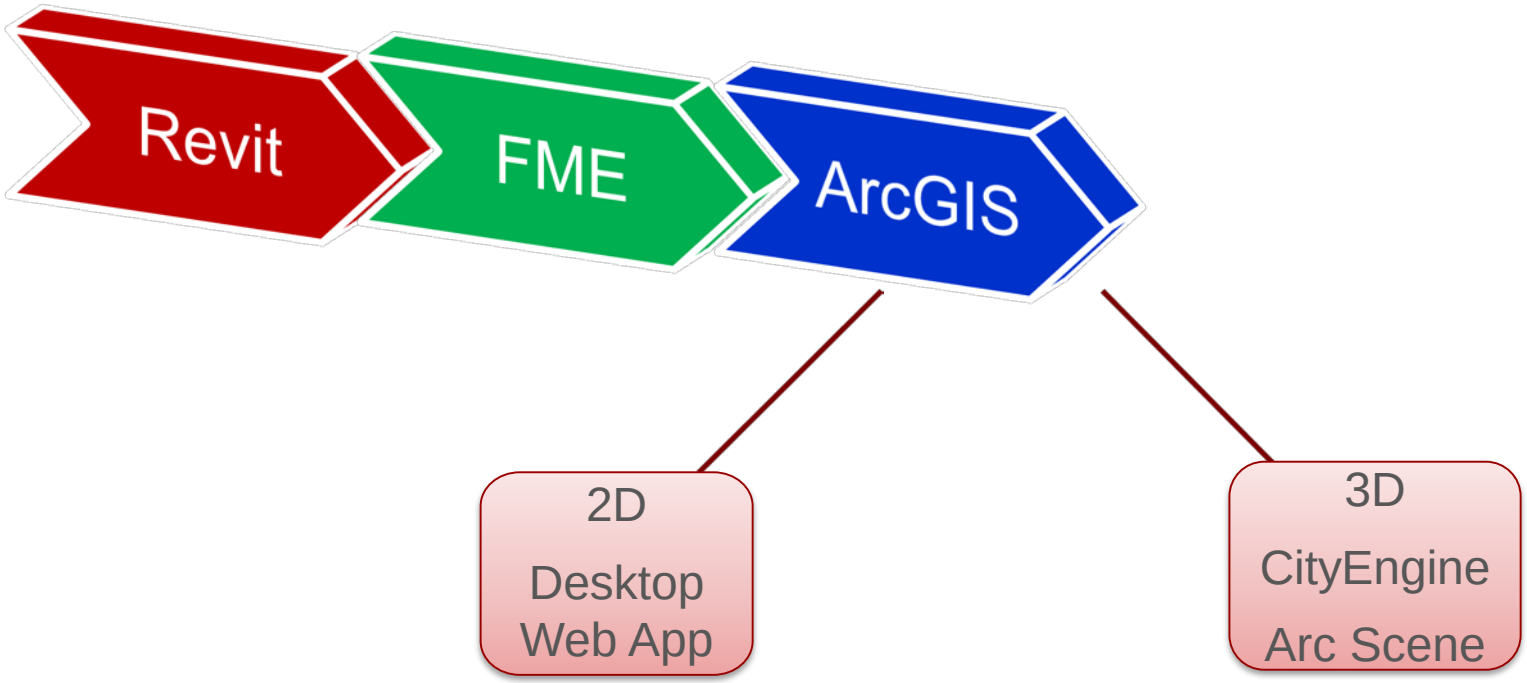
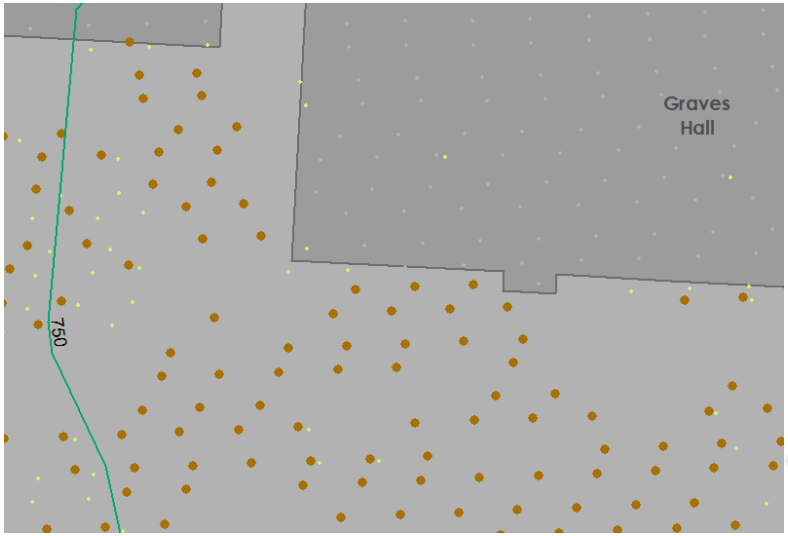
WOOLPERT
DESIGN | GEOSPATIAL | INFRASTRUCTURE

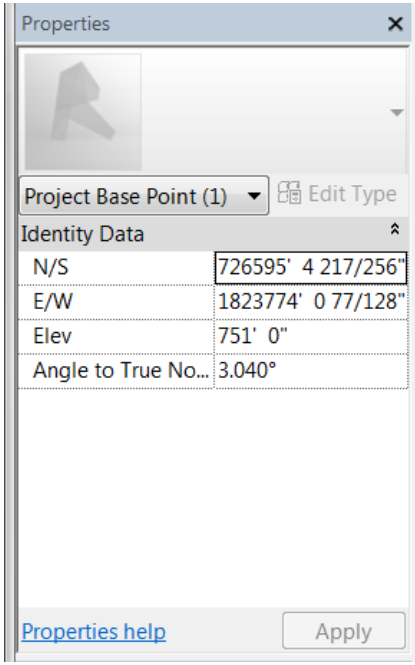
Data Conversion Workflow

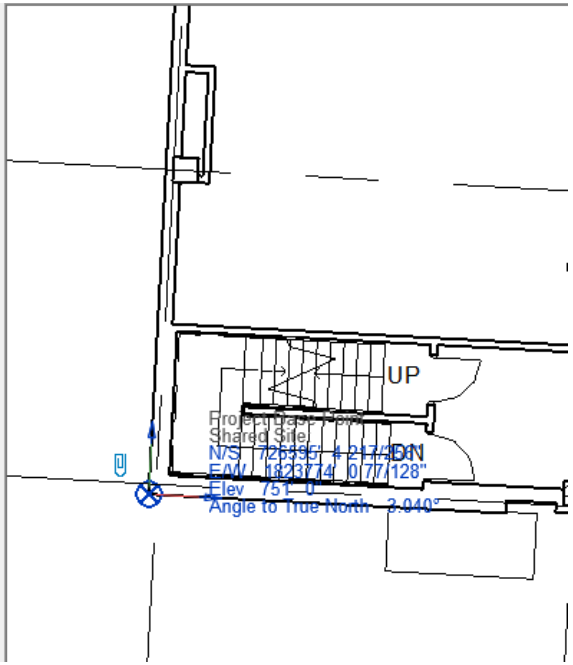


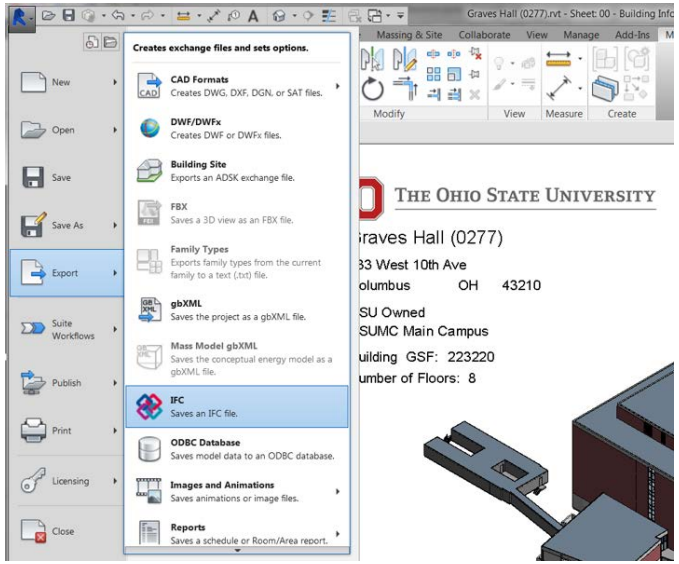


Coordinates and Elevation from ArcMap

Enter Coordinates in Revit

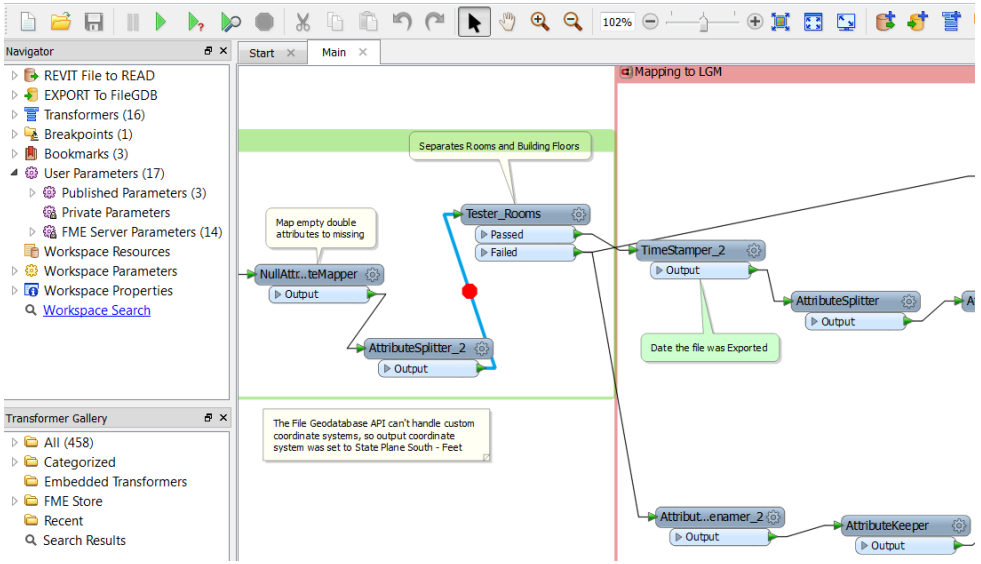






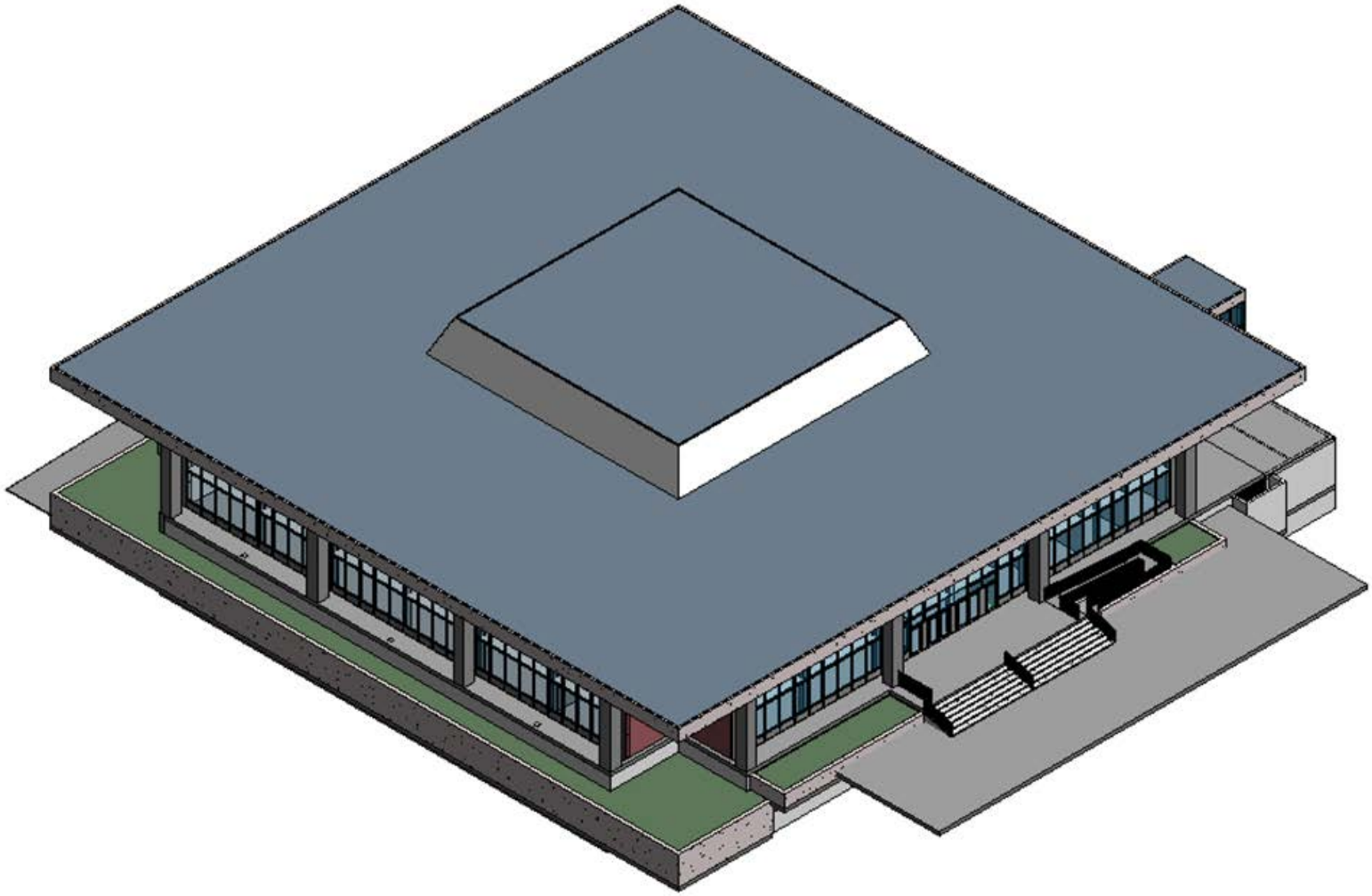
Export to IFC

Run FME Models

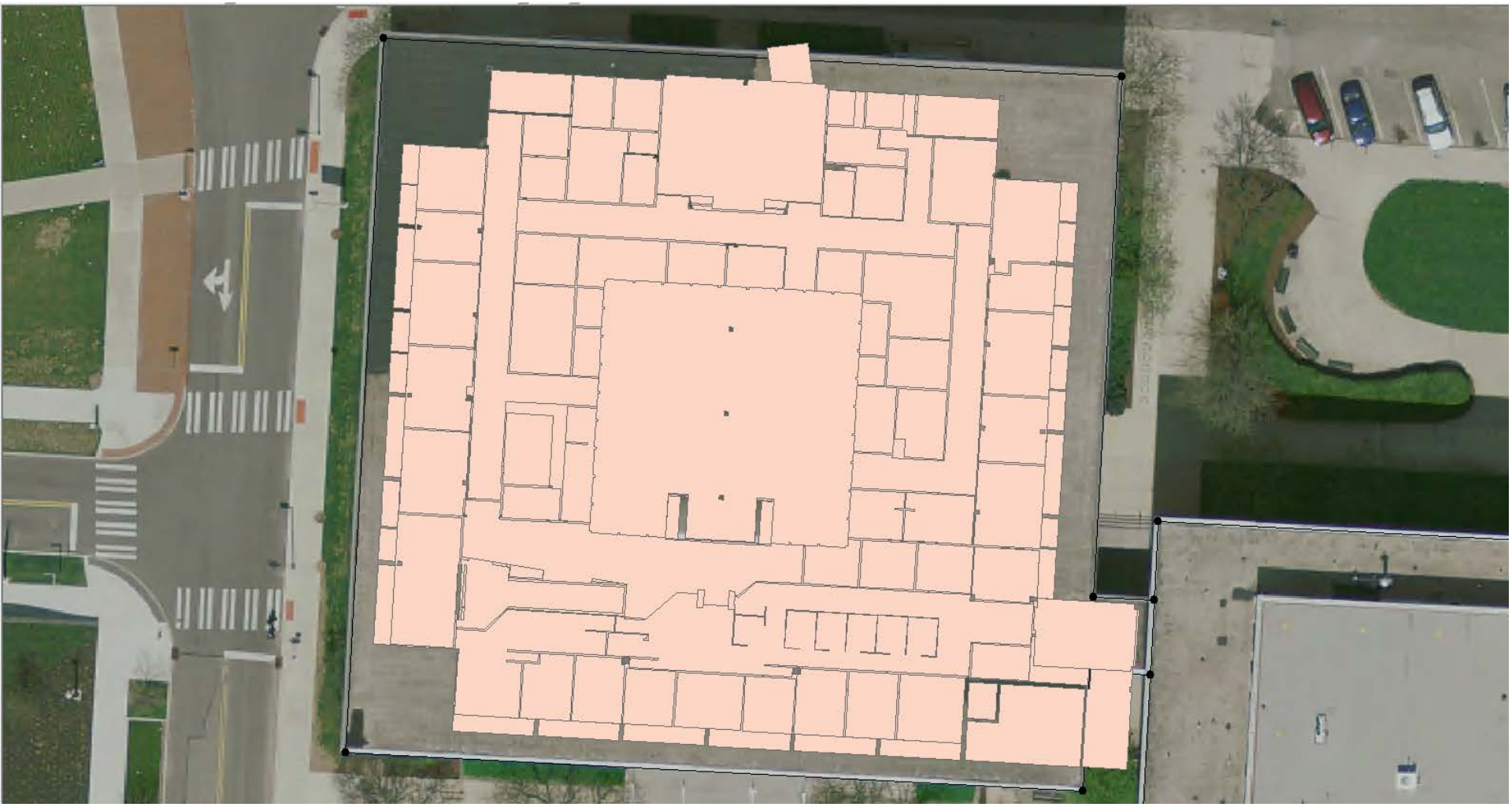


Challenges- Conversion

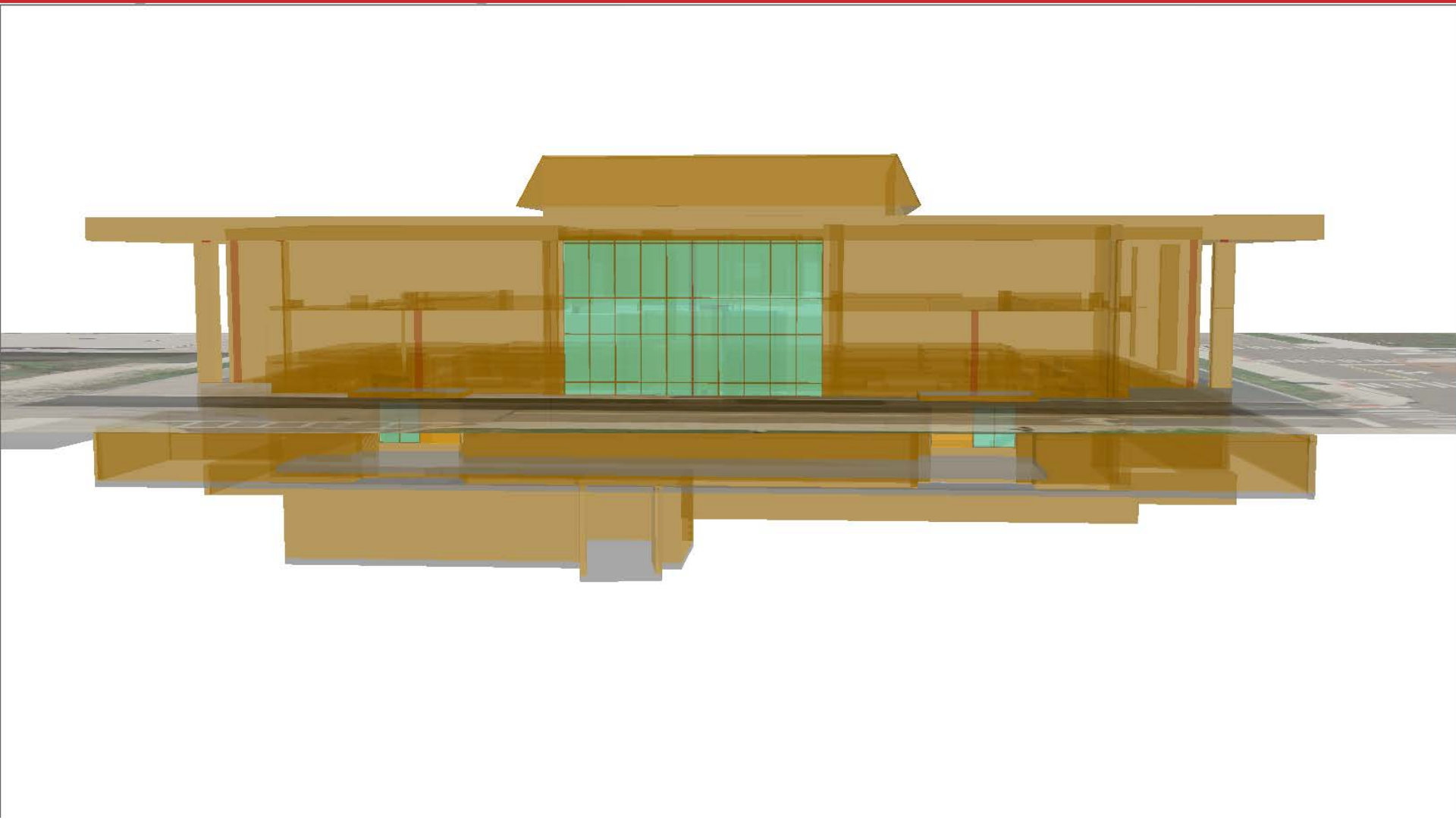
- IFC handling of the columns
- Custom Attributes (Room ID) in Revit
- Coordinate System



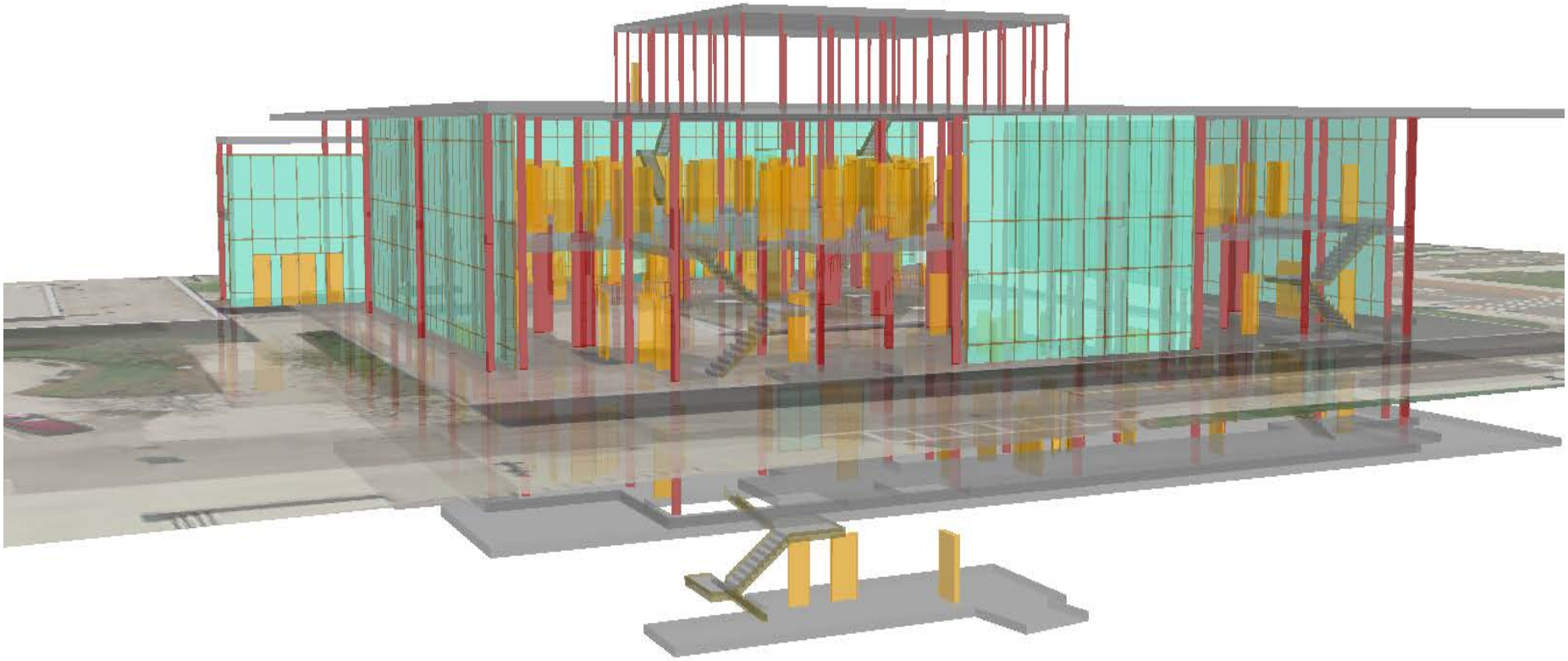
Revit File



2D geodatabase



3D Shapefile



3D Shapefile

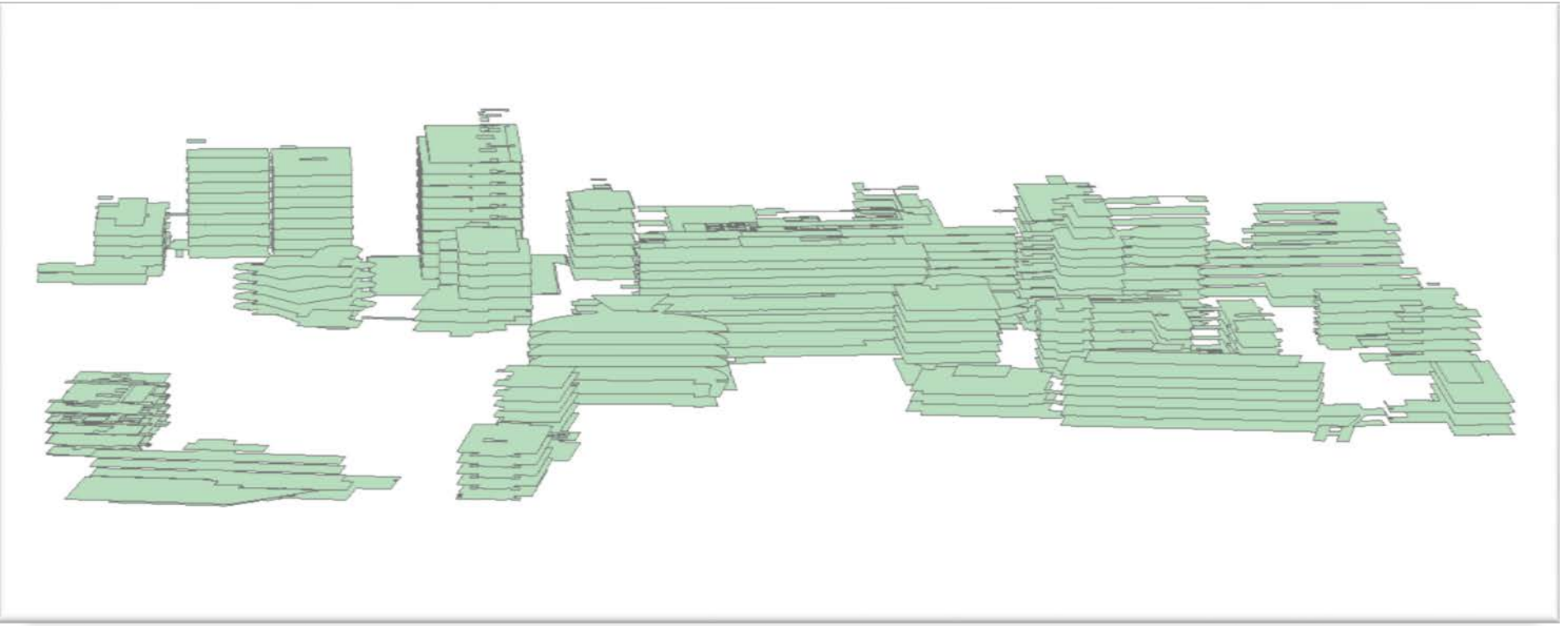
ESRI Interior Space Data Model

BuildingFloor		BuildingFloor
FLOORID	String	FLOORID
BUILDINGKEY	String	BUILDINGKEY
FLOOR	String	FLOOR
DESCRIP	String	DESCRIP
BASEELEV	Double	BASEELEV
FLOORHEIGHT	Double	FLOORHEIGHT
VERTORDER	Integer	VERTORDER
ACCESSTYPE	String	ACCESSTYPE
LASTUPDATE	Date	LASTUPDATE
LASTEDITOR	String	LASTEDITOR

BuildingInteriorSpace		BuildingInteriorSpace
SPACEID	String	SPACEID
FLOORKEY	String	FLOORKEY
SECTIONKEY	String	SECTIONKEY
BUILDING	String	BUILDING
FLOOR	String	FLOOR
SHORTNAME	String	SHORTNAME
LONGNAME	String	LONGNAME
DESCRIP	String	DESCRIP
SPACETYPE	String	SPACETYPE
ACCESSTYPE	String	ACCESSTYPE
CEILINGHEIGHT	Double	CEILINGHEIGHT
BASEELEV	Double	BASEELEV
FLOORAREA	Double	FLOORAREA
CAPACITY	Integer	CAPACITY
SPACEFORM	String	SPACEFORM
SPACEFUNC	String	SPACEFUNC
SPACEUSE	String	SPACEUSE
LASTUPDATE	Date	LASTUPDATE
LASTEDITOR	String	LASTEDITOR

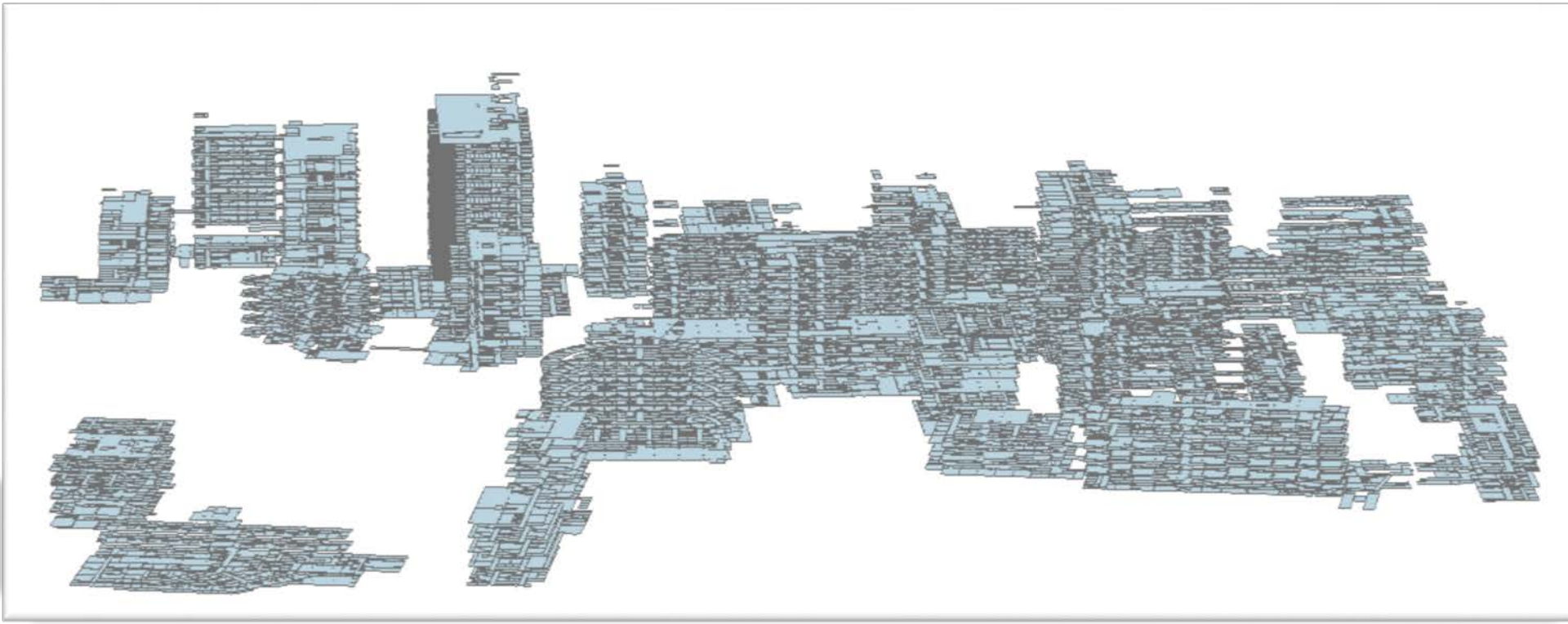
Interior Space Data Model

BuildingFloor



Interior Space Data Model

BuildingInteriorSpace



GIS Maps

GIS Maps Application

GISMaps is an enterprise GIS web application developed to provide students, staff, and faculty the view into useful information about the campus as a whole.

Provides basic information:

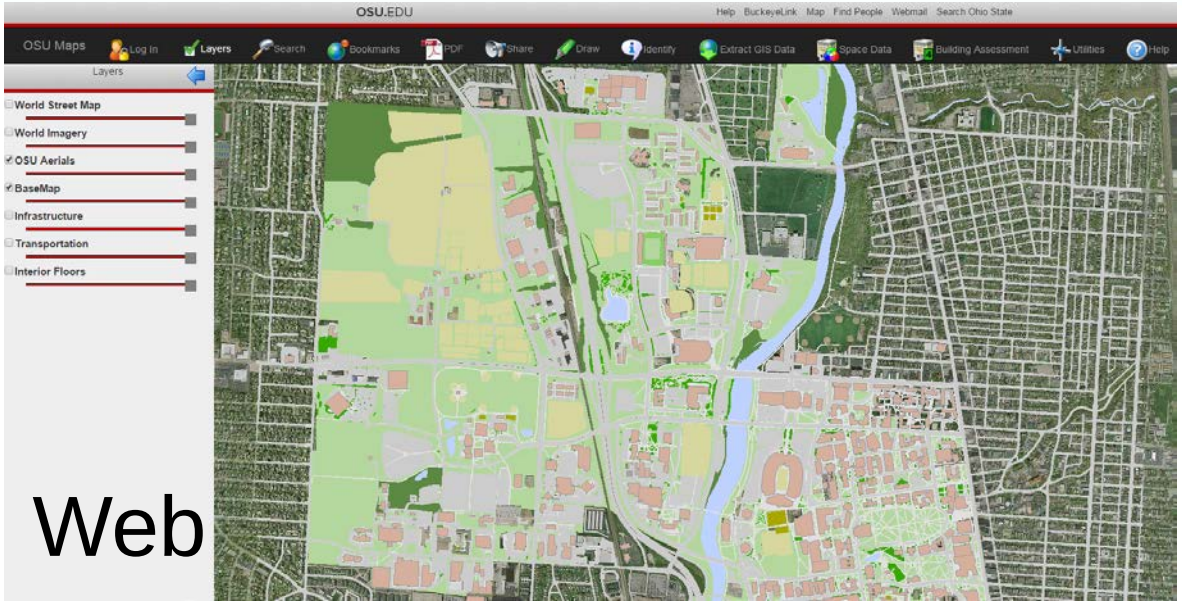
- GIS data
- Building information
- Parking locations
- Public transportation
- Directions

Advanced functionality:

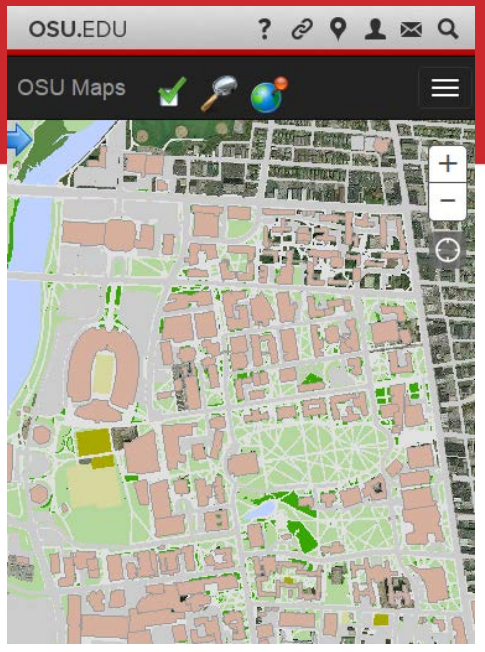
- Display energy usage
- Information about interior space
- Building assessment data
- Utility locations

The application uses modern responsive design that makes it accessible on desktops, tablets, and smartphones alike.

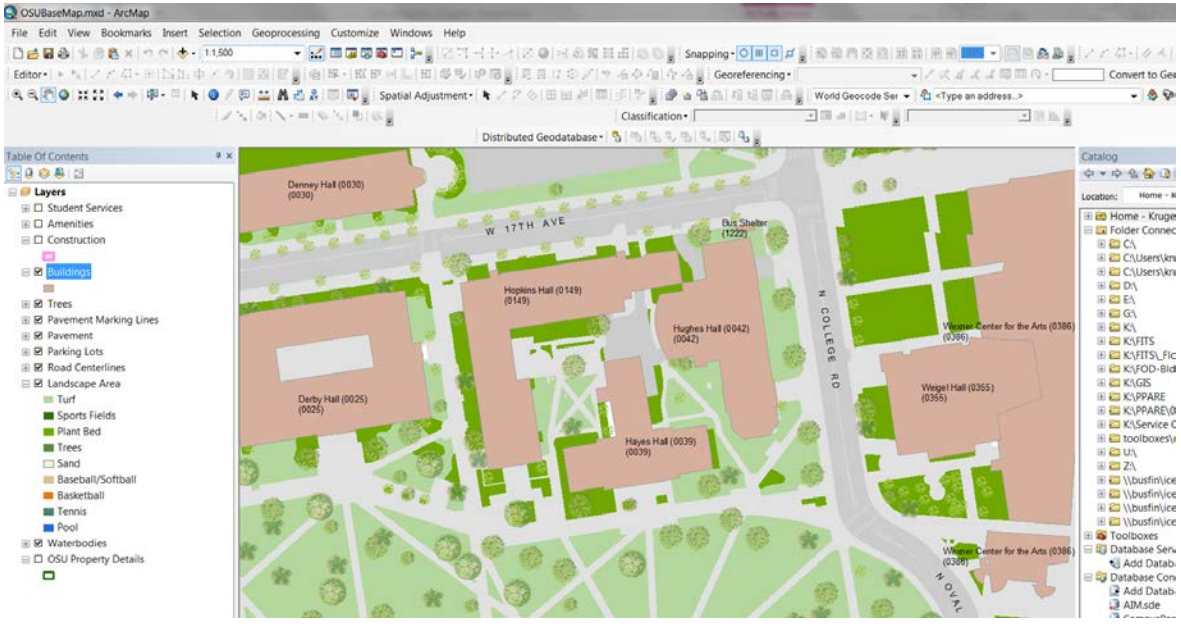
THE OHIO STATE UNIVERSITY



Web



Mobile Device



Desktop

GIS Links to Various Databases

- Display floors around campus
- Find detailed information about a room
  - Organization
  - Department
  - College
  - Room Type
  - Function
  - Sub Room Type
  - Capacity
  - Room Number/Space ID
- Display building assessments
  - Interior Finishes
  - Exterior
  - Life Safety
  - Accessibility
  - Plumbing
  - HVAC
  - Electrical

Floorplans Link to Space Data (SIMS)

Select Layer: 01

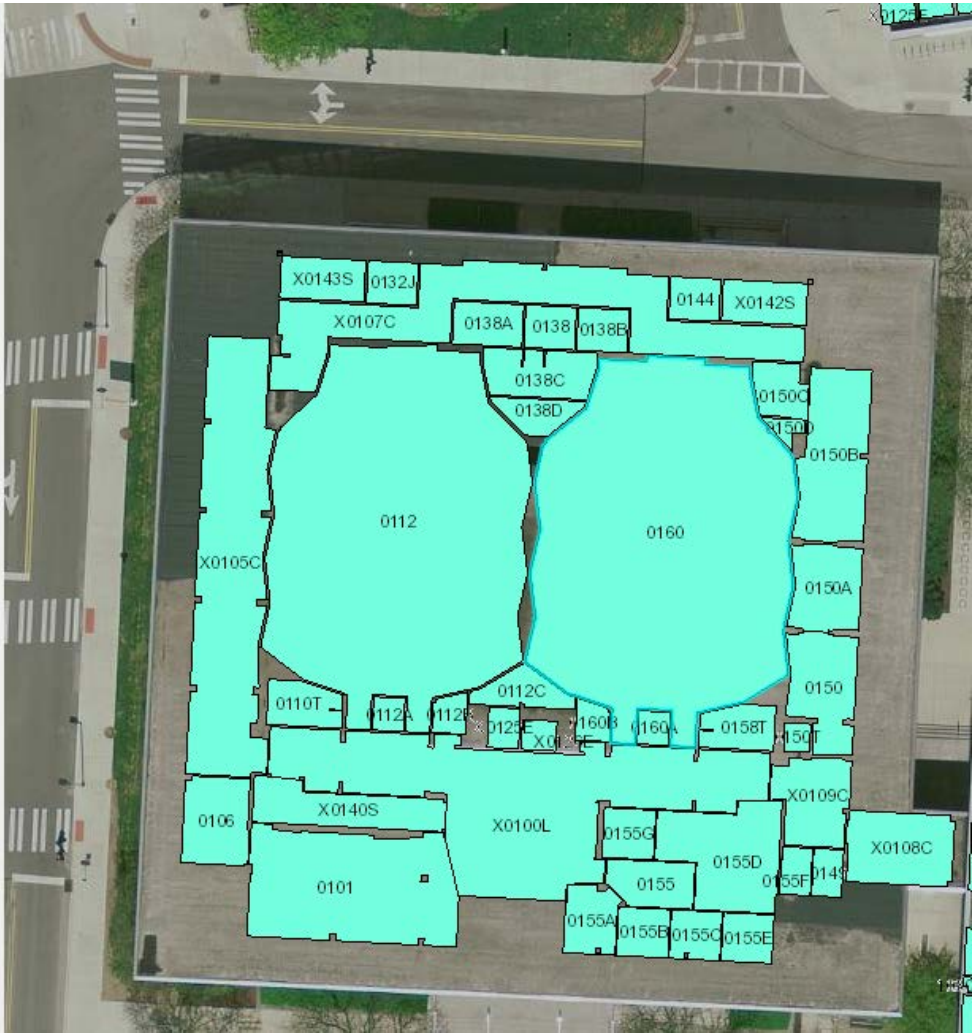
You can choose from the above drop-down if multiple items are selected.

Clear Selection

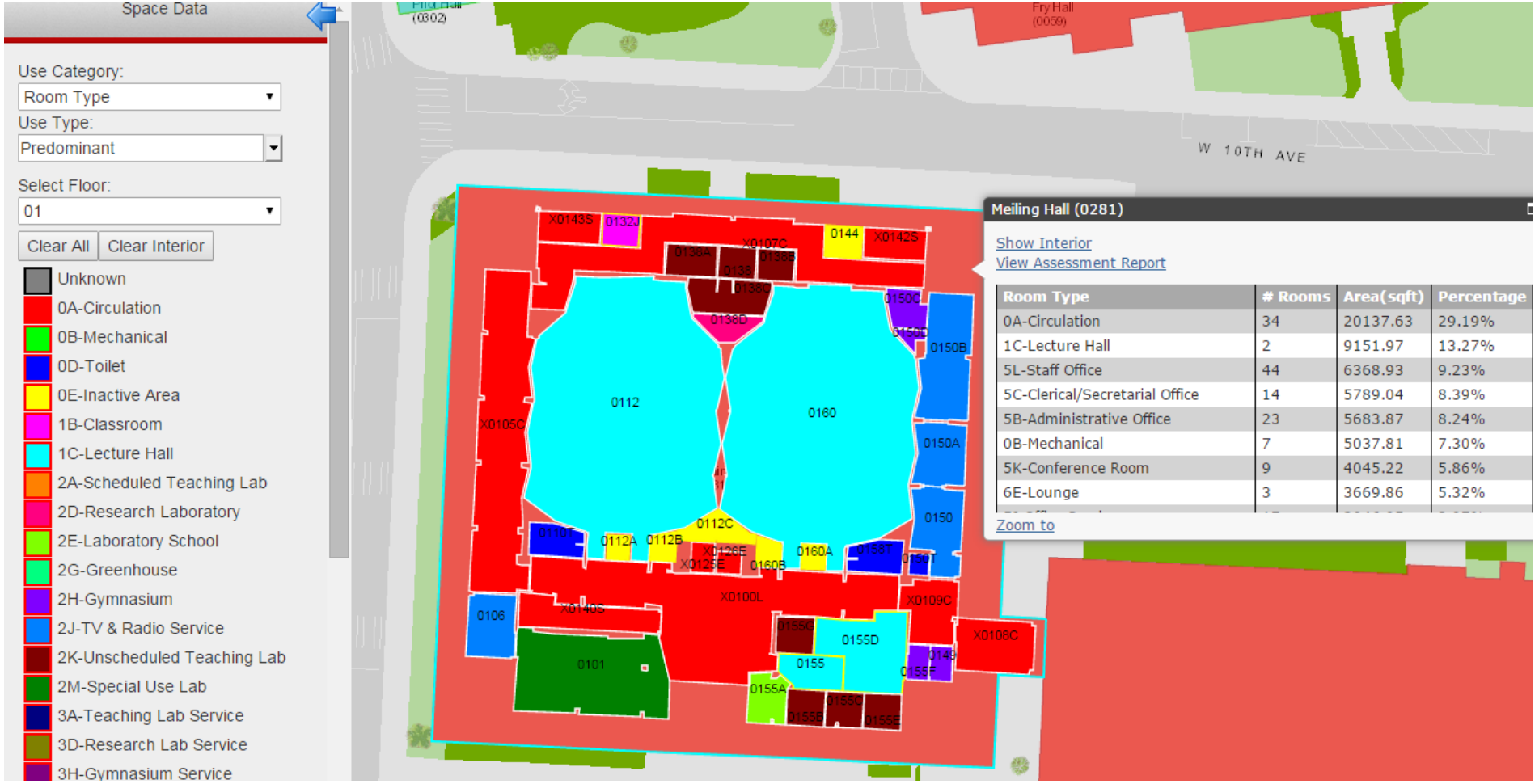
SPACEID: 281-01-0160

Room Number: 0160
Room Type: 1C-Lecture Hall
Sub Room Type: null
Area: 4575.49
Organization: ADM-Medicine Administration (100%)
Function: A-Instruction and Instruction Support
Capacity: 75
Comment: null

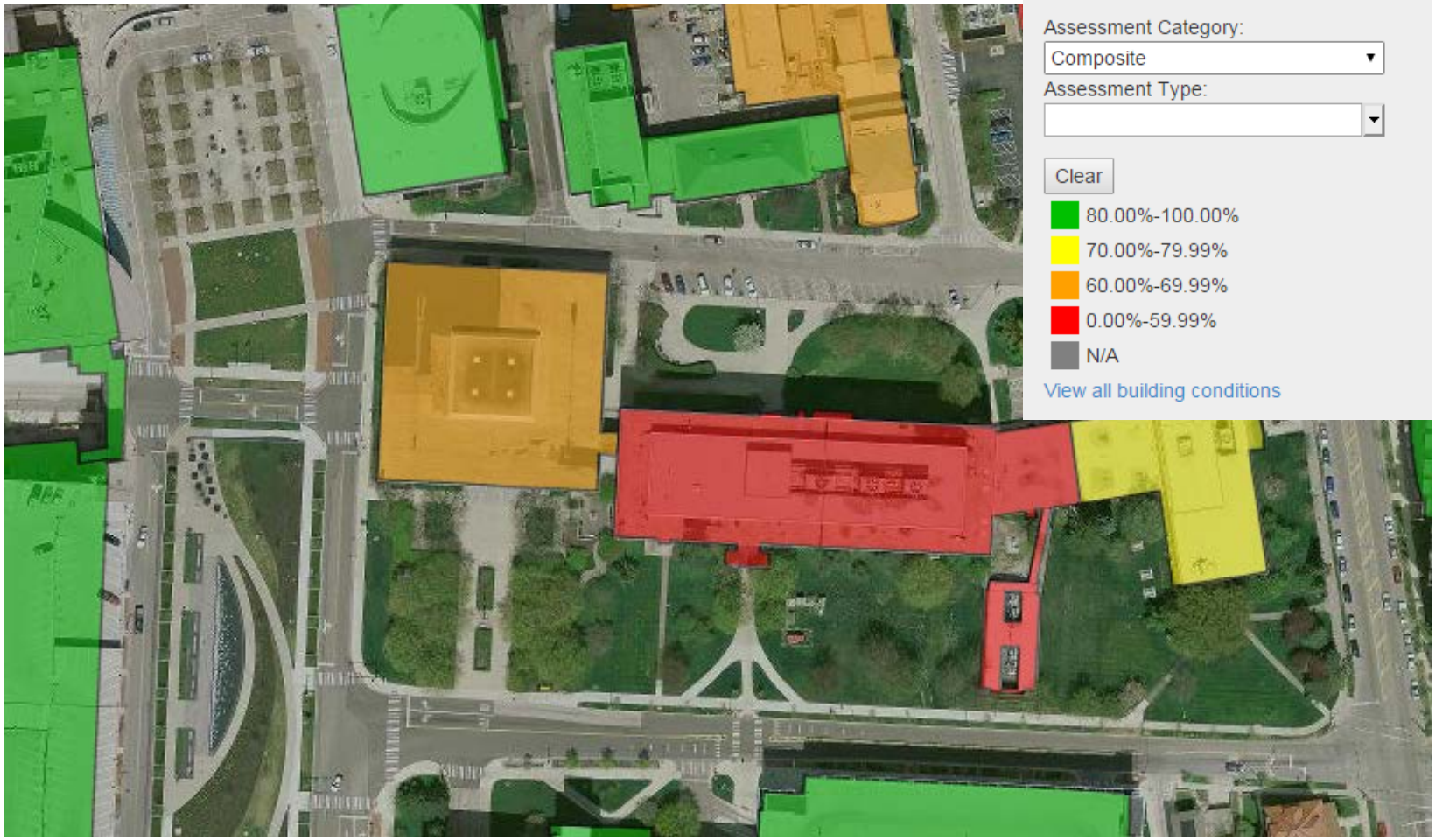
Room Number: 0160
Room Type: 1C-Lecture Hall
Sub Room Type: null
Area: 4575.49
Organization: ADM-Medicine Administration (100%)
Function: A-Instruction and Instruction Support
Capacity: 75
Comment: null



Categorization and Query of Space Utilization



Buildings Link to Building Assessment Database



ESRI City Engine

Demo

Questions?