

CAD/BIM/G

Floor Plan Integration at the University of
Washington

IS

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Projects Office

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Goal

Showcase the UW CAD to GIS translation process. Teach others that CAD floor plans can still be maintained for a CAD audience while still meeting the needs of automated GIS translation.

Key points

- Standardization
- Automation
- CAD Focused
Authoring
- Error Checking

In the past....

Not georeferenced

Not standardized

Manual GIS
translation

Current Stats

- 1300+ Floor Plans
- 20+ Million Sq.Ft.
- 1 CAD Drafter

Why CAD *and* GIS?

What about BIM?

The “Holy Grail” for interior space...

Fundamental Differences Between GIS & CAD

➤ Coordinate system

➤ Data Organization (Structure)

-layers

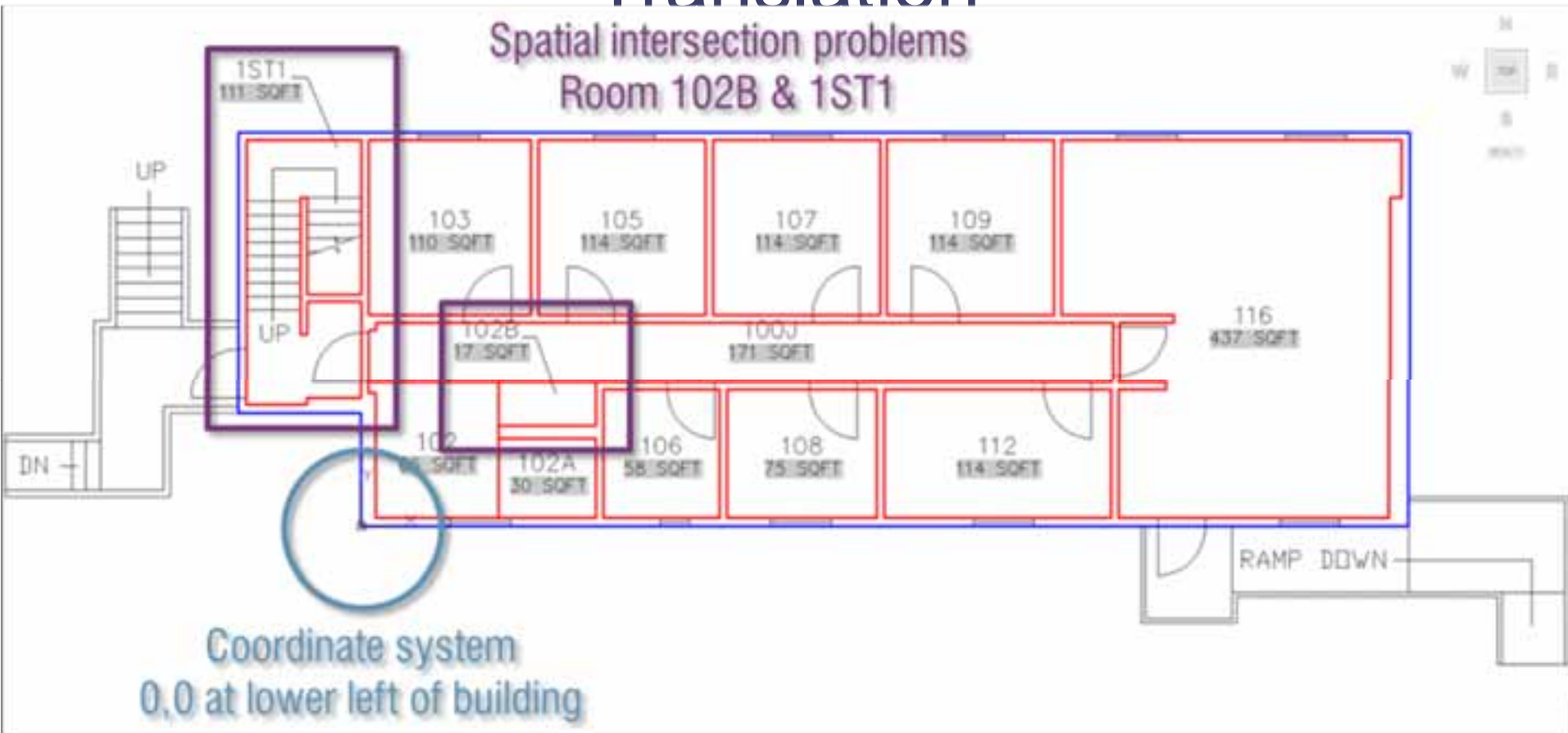
-files vs. database

➤ Data (Information)

Traditional CAD Floor Plan to GIS Translation

- Georeferencing
- Room boundaries as polygons
- Room numbers as annotation
- Spatial Intersection between room boundaries and room numbers

Traditional CAD Floor Plan to GIS Translation



Results from Traditional CAD to GIS Translation

- Errors found in GIS need to be fixed in CAD
 - Cannot be fixed in CAD and must be re-fixed every time the drawing is translated
- Manual editing or verification required

The UW's Solution

Everything is done in CAD, from a CAD perspective

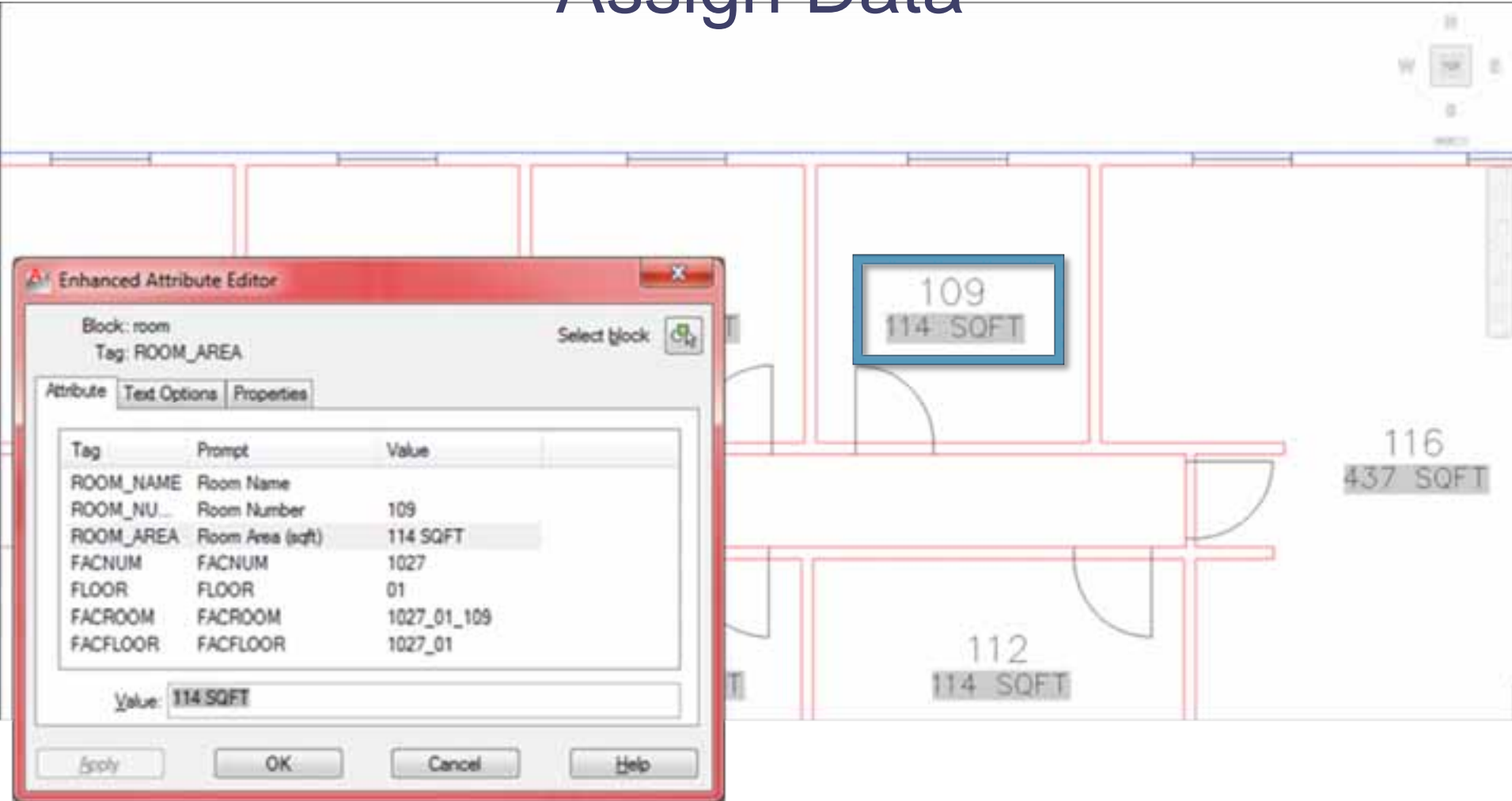
- **Georeferencing while maintaining traditional CAD coordinate system**
- Associate room boundaries and room numbers
- **Data error checking**
- Create GIS feature classes in CAD

World Files

The image displays a screenshot of the AutoCAD interface. The main workspace shows a floor plan with a blue square marker circled in purple. On the left, the Properties palette is open, showing the 'General' and 'Geometric' tabs. The 'Geometric' tab is active, with 'Scale' set to 1.0000 and 'Rotation' set to 0. On the right, the 'Attach External Reference' dialog box is open, showing the 'Scale' section with 'Scale' set to 1.0000 and 'Reference Type' set to 'Point'. At the bottom, the 'AutoCAD Test Window' is open, displaying the following command:

```
Command:
Command:
PROJCS["NAD 1983 StatePlane_washington_North_FIPS_4681_Feet",GEOGCS["GCS North A
merican 1983",DATUM["D North American 1983",SPHEROID["GRS 1980",6378137.0,298.25
7222101]],PRIMEM["Greenwich",0.0],UNIT["Degree",0.0174532925199433]],PROJECTION[
"Lambert Conformal Conic"],PARAMETER["False_Easting",1640416.666666667],PARAME
R["False_Northing",0.0],PARAMETER["Central_Meridian",-120.8333333333333],PARAMET
ER["Standard_Parallel_1",47.5],PARAMETER["Standard_Parallel_2",48.7333333333333
],PARAMETER["Latitude_Of_Origin",47.0],UNIT["Foot_US",0.3048006096012192],AUTHO
RITY["EPSG",2285]]
Command:
```


Assign Data



Assign Data

```
(setq alldatafields (list "FACNAM" "FLOOR" "ROOM_NUMBER" "FACFLOOR" "FACROOM" "ROOM_AREA"))
(repeat datablocklength
  (setq data_values nil)
  (setq block (entnext (ssname datablocks datablockcnt)))
  ;;create a list of attribute tag name / value combinations for each block
  (while (/= "SEQEND" (cdr (assoc 0 (setq d (entget block)))))

    ;; if the tag is OBJECT, store this entity name as that is what provides the link back to the asset
    (if (or (eq "ROOM_ARFA" (strcase (cdr (assoc 2 d)))) (eq "OBJECT" (strcase (cdr (assoc 2 d)))))
      ;true, trim off SQFT and just store the number and save the assetID as link
      (progn
        (setq assetID block)
        (setq data_values (cons (cons (cdr (assoc 2 d)) (substr (cdr (assoc 1 d)) 1 (vl-string-search " " (cdr (assoc 1 d))))) data_values))
      )
      ;not true, just store the whole value
      (setq data_values (cons (cons (cdr (assoc 2 d)) (cdr (assoc 1 d))) data_values))
    )
    (setq block (entnext block))
  )
  (reverse data_values))

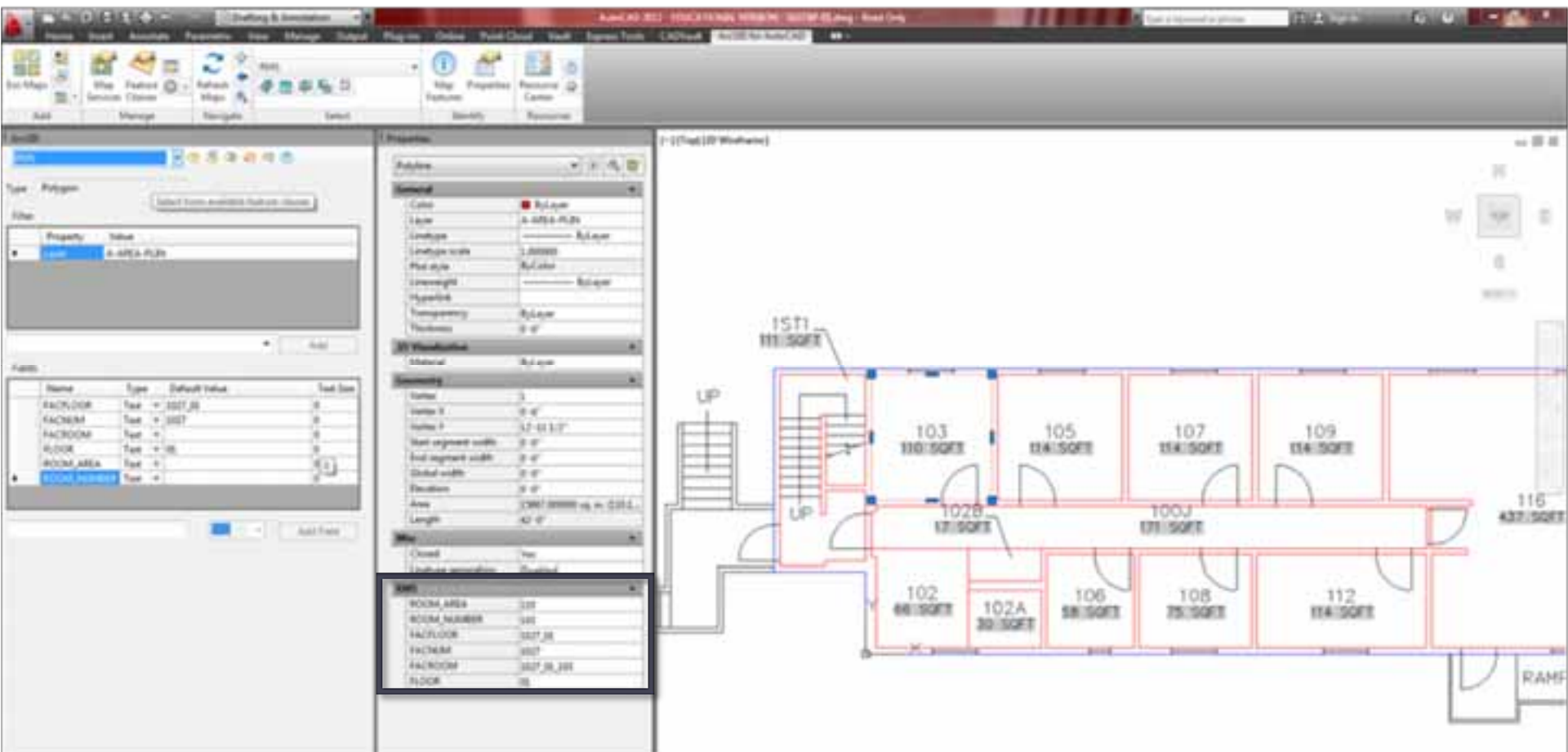
;; convert the listed values to the field text code which includes the object id for the asset
(setq fieldcode (fieldtotext assetID))

(if (and fieldcode (vl-string-search "ObjId" fieldcode))
  (progn
    (setq objid (substr fieldcode (+ 7 (vl-string-search "ObjId" fieldcode))
      (- (- (vl-string-search ">|" fieldcode)(vl-string-search "ObjId" fieldcode)) 6 )))
    pline (vla-objectidtoobject (vla-get-activedocument (vlax-get-Acad-Object)) objid);convert the object id to an object
    pline_ename (vla-object->ename pline);get the entity name of the pline object
  )

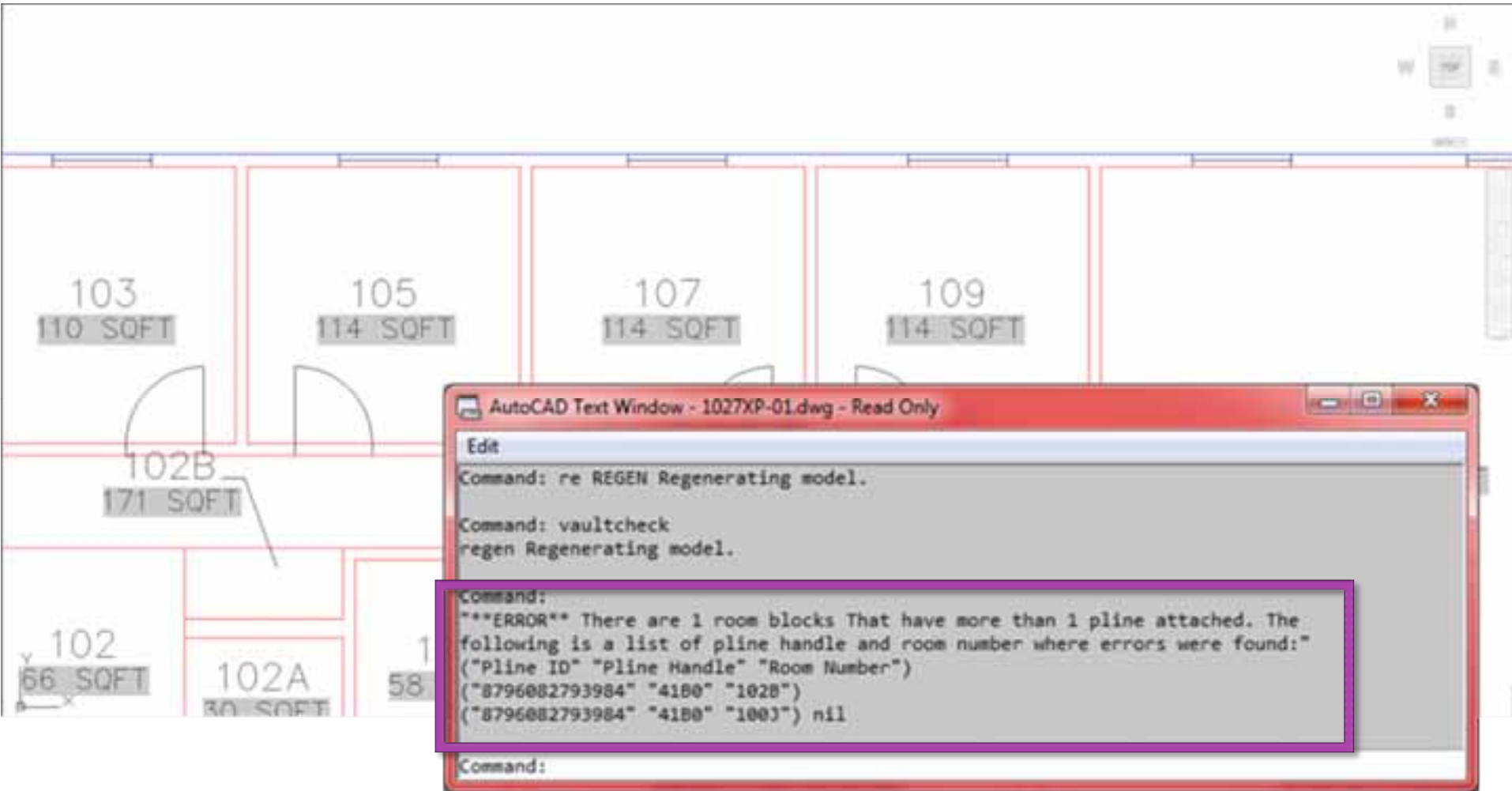
  ;;(setq field (car alldatafields))
  ;;(entget pline_ename)
  ;; (esri_getattribute pline_ename field)
  ;;: for each field of data assign the value to the asset per feature class field
  (foreach field alldatafields
    ;SET: AddAttribute pline objid field /APP: 1 /ADD: /SET: Field data value)))
```

ArcGIS for AutoCAD

Room Featureclass



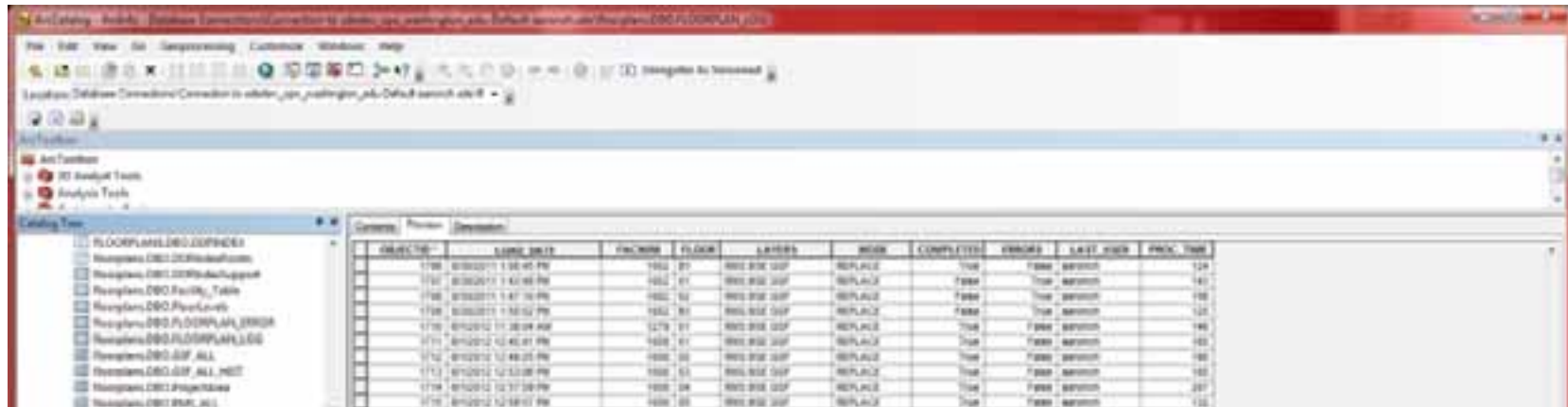
CAD Error Checking



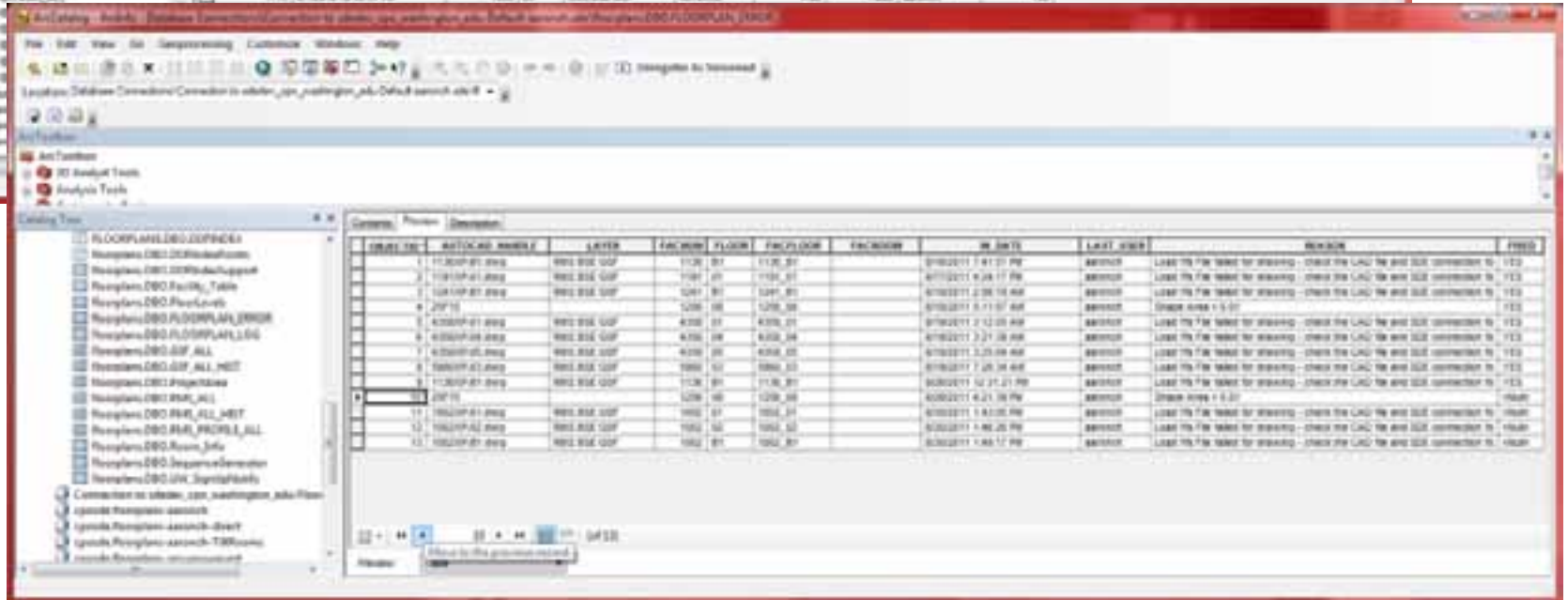
The image shows a CAD floor plan with several rooms labeled with numbers and square footages. The rooms are: 103 (110 SQFT), 105 (114 SQFT), 107 (114 SQFT), 109 (114 SQFT), 102B (171 SQFT), 102 (66 SQFT), 102A (30 SQFT), and 58. An AutoCAD Text Window is open, displaying the following commands and error message:

```
AutoCAD Text Window - 1027XP-01.dwg - Read Only
Edit
Command: re REGEN Regenerating model.
Command: vaultcheck
regen Regenerating model.
Command:
***ERROR** There are 1 room blocks That have more than 1 pline attached. The
following is a list of pline handle and room number where errors were found:"
("Pline ID" "Pline Handle" "Room Number")
("8796082793984" "4180" "102B")
("8796082793984" "4180" "1003") nil
Command:
```


GIS Error Checking/Logs



OBJECT ID	OBJECT NAME	LAYER	FACID	FLOOR	STATUS	COMPLETE	ERROR	LAST MOD	PROJ. TAG
170	0102011 1:30:45 PM	0102 01	000 010 000	REPLACE	True	False	None	0102011 1:30:45 PM	124
171	0102011 1:42:46 PM	0102 01	000 010 000	REPLACE	True	True	None	0102011 1:42:46 PM	141
172	0102011 1:47:16 PM	0102 01	000 010 000	REPLACE	True	True	None	0102011 1:47:16 PM	140
173	0102011 1:50:52 PM	0102 01	000 010 000	REPLACE	True	True	None	0102011 1:50:52 PM	141
174	0102012 11:28:04 AM	1278 01	000 010 000	REPLACE	True	False	None	0102012 11:28:04 AM	124
175	0102012 12:45:01 PM	1438 01	000 010 000	REPLACE	True	False	None	0102012 12:45:01 PM	141
176	0102012 12:48:25 PM	1438 01	000 010 000	REPLACE	True	False	None	0102012 12:48:25 PM	140
177	0102012 12:53:08 PM	1438 01	000 010 000	REPLACE	True	False	None	0102012 12:53:08 PM	141
178	0102012 12:57:09 PM	1438 01	000 010 000	REPLACE	True	False	None	0102012 12:57:09 PM	140
179	0102012 12:58:07 PM	1438 01	000 010 000	REPLACE	True	False	None	0102012 12:58:07 PM	141



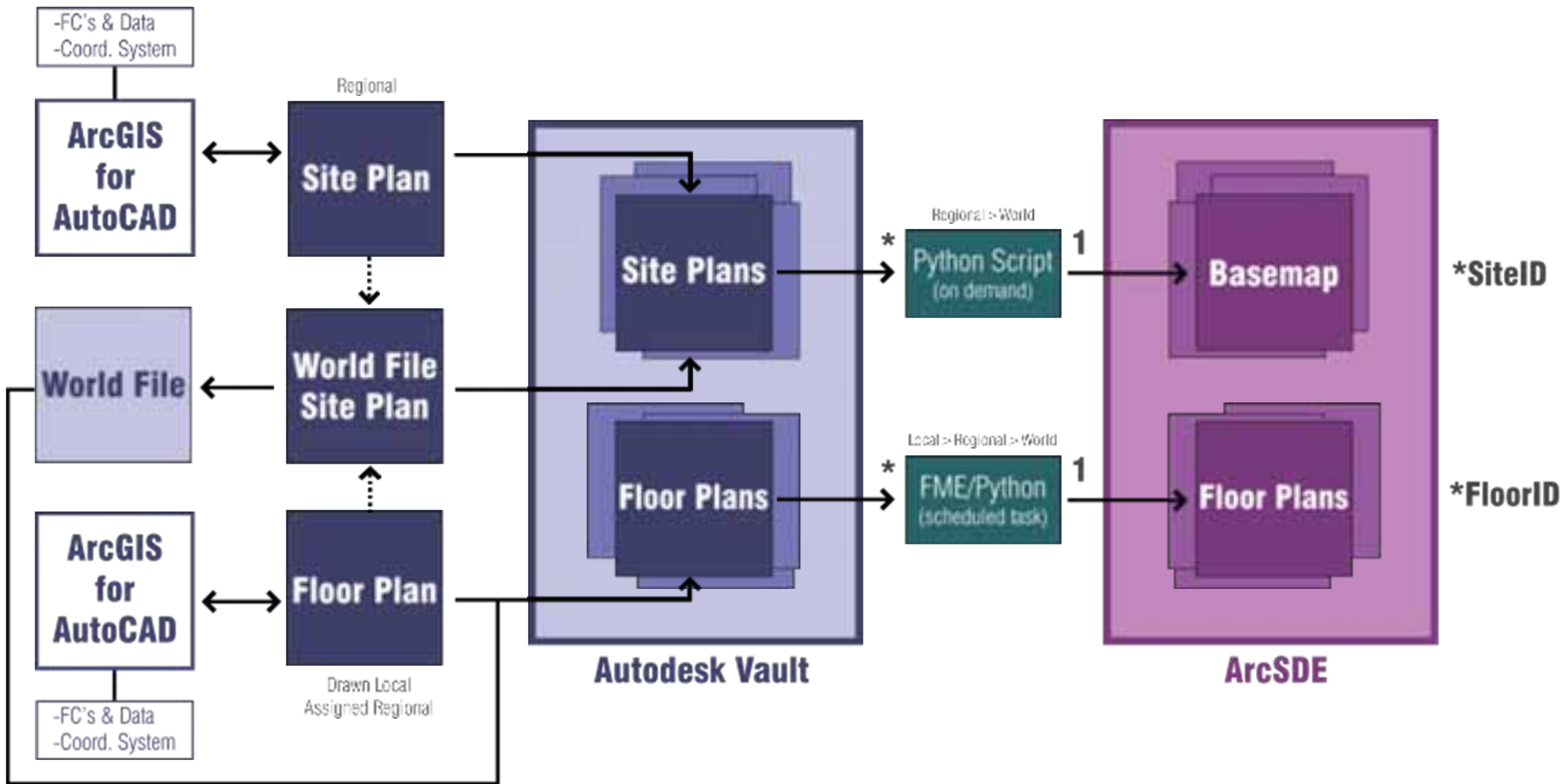
OBJECT ID	OBJECT NAME	LAYER	FACID	FLOOR	FAC/FLOOR	FAC/ROOM	IN DATE	LAST MOD	MESSAGE	PROJ.
1	11020101.dwg	000 010 000	1136 01	1136 01			0102011 9:11:21 PM	0102011 9:11:21 PM	LOAD THE FILE BEFORE RE-LOADING...CHECK THE LAYER THE BENT SUCCESS CONNECTION TO	1136
2	11020101.dwg	000 010 000	1136 01	1136 01			0102011 9:28:17 PM	0102011 9:28:17 PM	LOAD THE FILE BEFORE RE-LOADING...CHECK THE LAYER THE BENT SUCCESS CONNECTION TO	1136
3	11020101.dwg	000 010 000	1241 01	1241 01			0102011 2:28:16 AM	0102011 2:28:16 AM	LOAD THE FILE BEFORE RE-LOADING...CHECK THE LAYER THE BENT SUCCESS CONNECTION TO	1136
4	2010		1256 01	1256 01			0102011 5:11:57 AM	0102011 5:11:57 AM	CHECK AREA = 5.01	1136
5	4020101.dwg	000 010 000	4020 01	4020 01			0102011 2:12:28 AM	0102011 2:12:28 AM	LOAD THE FILE BEFORE RE-LOADING...CHECK THE LAYER THE BENT SUCCESS CONNECTION TO	1136
6	4020101.dwg	000 010 000	4020 01	4020 01			0102011 2:25:08 AM	0102011 2:25:08 AM	LOAD THE FILE BEFORE RE-LOADING...CHECK THE LAYER THE BENT SUCCESS CONNECTION TO	1136
7	4020101.dwg	000 010 000	4020 01	4020 01			0102011 2:25:08 AM	0102011 2:25:08 AM	LOAD THE FILE BEFORE RE-LOADING...CHECK THE LAYER THE BENT SUCCESS CONNECTION TO	1136
8	4020101.dwg	000 010 000	4020 01	4020 01			0102011 2:25:08 AM	0102011 2:25:08 AM	LOAD THE FILE BEFORE RE-LOADING...CHECK THE LAYER THE BENT SUCCESS CONNECTION TO	1136
9	11020101.dwg	000 010 000	1136 01	1136 01			0102011 12:21:21 PM	0102011 12:21:21 PM	LOAD THE FILE BEFORE RE-LOADING...CHECK THE LAYER THE BENT SUCCESS CONNECTION TO	1136
10	2010		1256 01	1256 01			0102011 4:21:16 PM	0102011 4:21:16 PM	CHECK AREA = 5.01	1136
11	11020101.dwg	000 010 000	1136 01	1136 01			0102011 1:42:00 PM	0102011 1:42:00 PM	LOAD THE FILE BEFORE RE-LOADING...CHECK THE LAYER THE BENT SUCCESS CONNECTION TO	1136
12	11020101.dwg	000 010 000	1136 01	1136 01			0102011 1:46:20 PM	0102011 1:46:20 PM	LOAD THE FILE BEFORE RE-LOADING...CHECK THE LAYER THE BENT SUCCESS CONNECTION TO	1136
13	11020101.dwg	000 010 000	1136 01	1136 01			0102011 1:46:17 PM	0102011 1:46:17 PM	LOAD THE FILE BEFORE RE-LOADING...CHECK THE LAYER THE BENT SUCCESS CONNECTION TO	1136

GIS Translation



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System Diagram

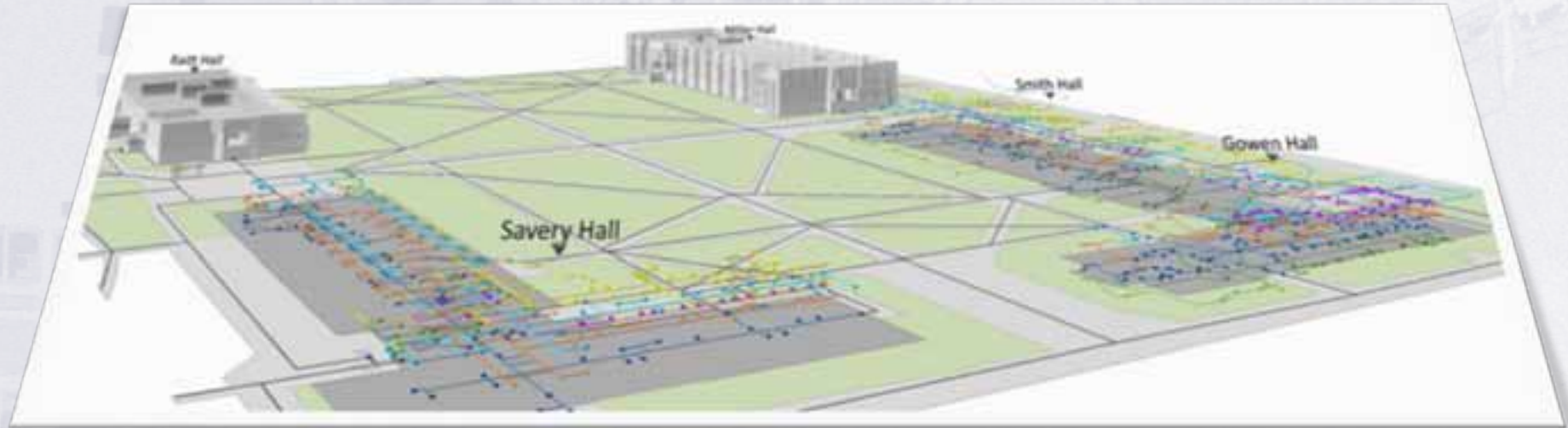


Conclusion

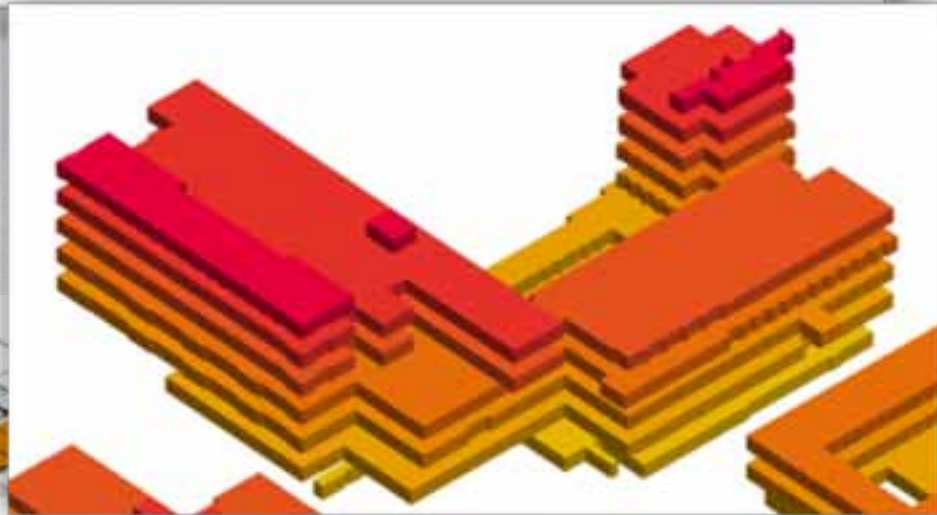
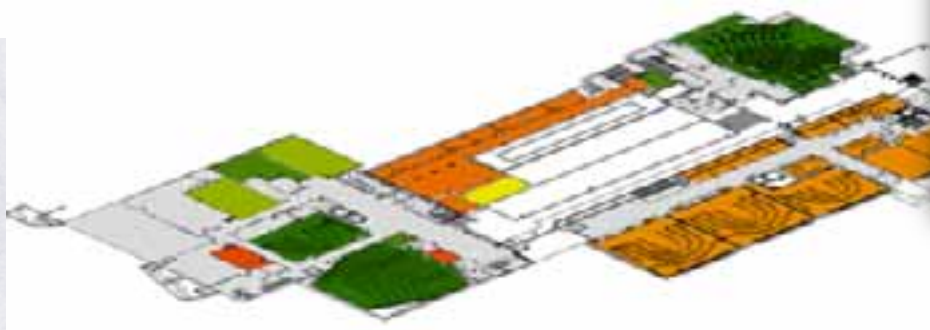
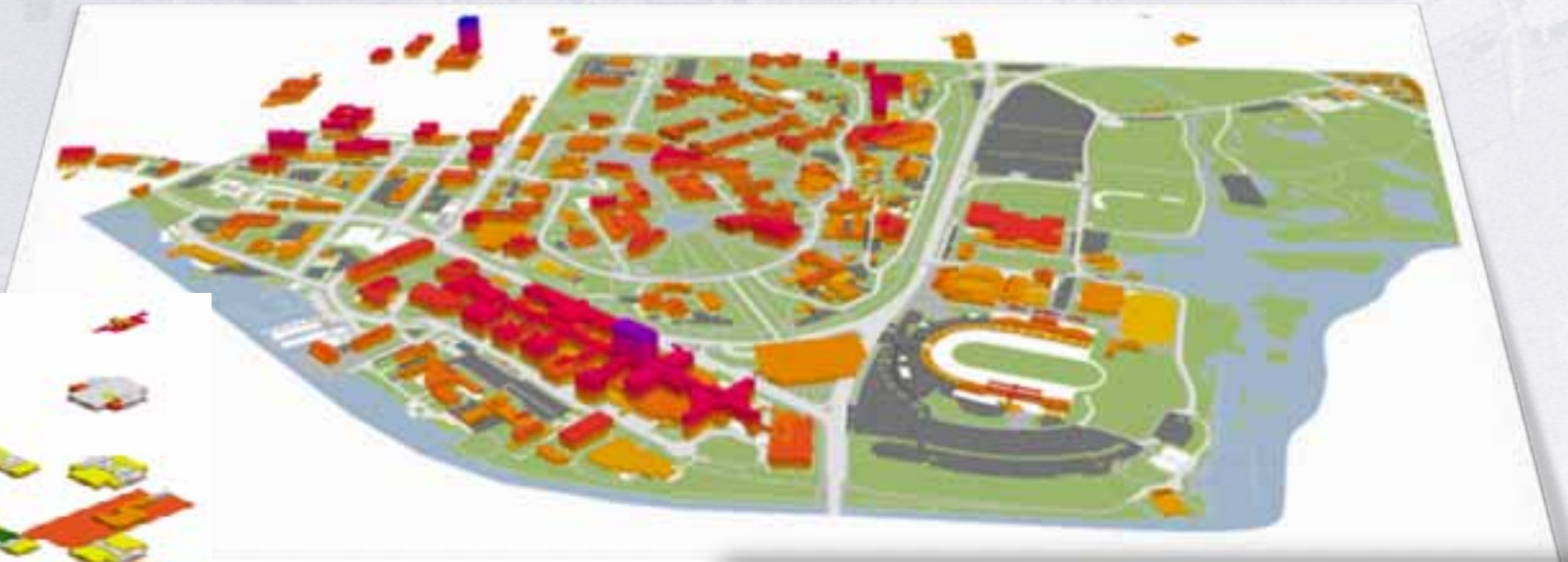
Features

- Data Driven Pages for printing floor plans in GIS
- 2D and schematic 3D floor plans
- Link to any data containing room ID
- Foundation for other systems to build on
 - Space Inventory
 - Asset Management
 - Way-Finding
 - Life Safety

Way-Finding



2D & Schematic 3D



Web Apps & Data Driven Pages

