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Streamlining FIMS/CAIS Data Validation with GIS

Dawn McWha, GIS Manager, Fermi National Accelerator Lab

DOE GIS User Group Meeting, Esri Federal User Conference, Washington, D.C.

29 January 2019

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Today's Topics

- Orientation to Fermilab; GIS program
- Fermilab Infrastructure Database (FID)
- Fermilab Location Data Standards
- Space Utilization and Management (FIMS Reporting)
- FIMS Source Documentation
- Condition Assessments

Thank You

Fermi National Accelerator Laboratory (Fermilab/S

- Structures
  - 460 Properties
    - 402 buildings (367) and trailers (36) (2.4 million sq. ft.)
      - 537 floors
      - 144 tornado shelter designations
    - 54 OSFs
      - Underground enclosures and tunnels (1.1 million sq. ft.)
    - 3 lands
- Land Features
  - 36 miles of roads; 130 acres of parking lots
  - 15 major waterbodies (13.7 million sq. ft.); 16 miles of streams
  - 146 acres of highly sensitive ecological landscape; lots of wildlife
- Utilities
  - 115 miles of electric cable; 2 primary substations; 241 secondary s
  - 27 miles of industrial cooling water; fire protection and science
  - 19 miles of domestic water; 18 miles of natural gas pipeline; 14 mil
- 1,750 + employees; visiting scientists

Fermilab GIS Program

- The Fermilab GIS Program is within the Site Services Department of Facilities Engineering Services Section (FESS) under the Office of the Chief Operating Officer.

- FESS contains the Engineering, Facilities Management, Logistics and Property Control and Site Services Departments (SSV).

- The Data Services group within SSV programmatically assumes all lab-wide Real Property (1), GIS (1) and Application and Data functions (1).

- Our GIS supports all Divisions and Sections with their GIS needs.

Real Property

- Real property includes land and anything permanently affixed to it.
  - Buildings, Trailers, Other Structures and Facilities (OSF's) such as roads and utility systems.
- DOE Order 430.1C Real Property Asset Management order
  - Requires the Department of Energy to keep track of all of their real property assets in a database called the Facilities Information Management System (FIMS).

U.S. Department of Energy

Facilities Information Management System

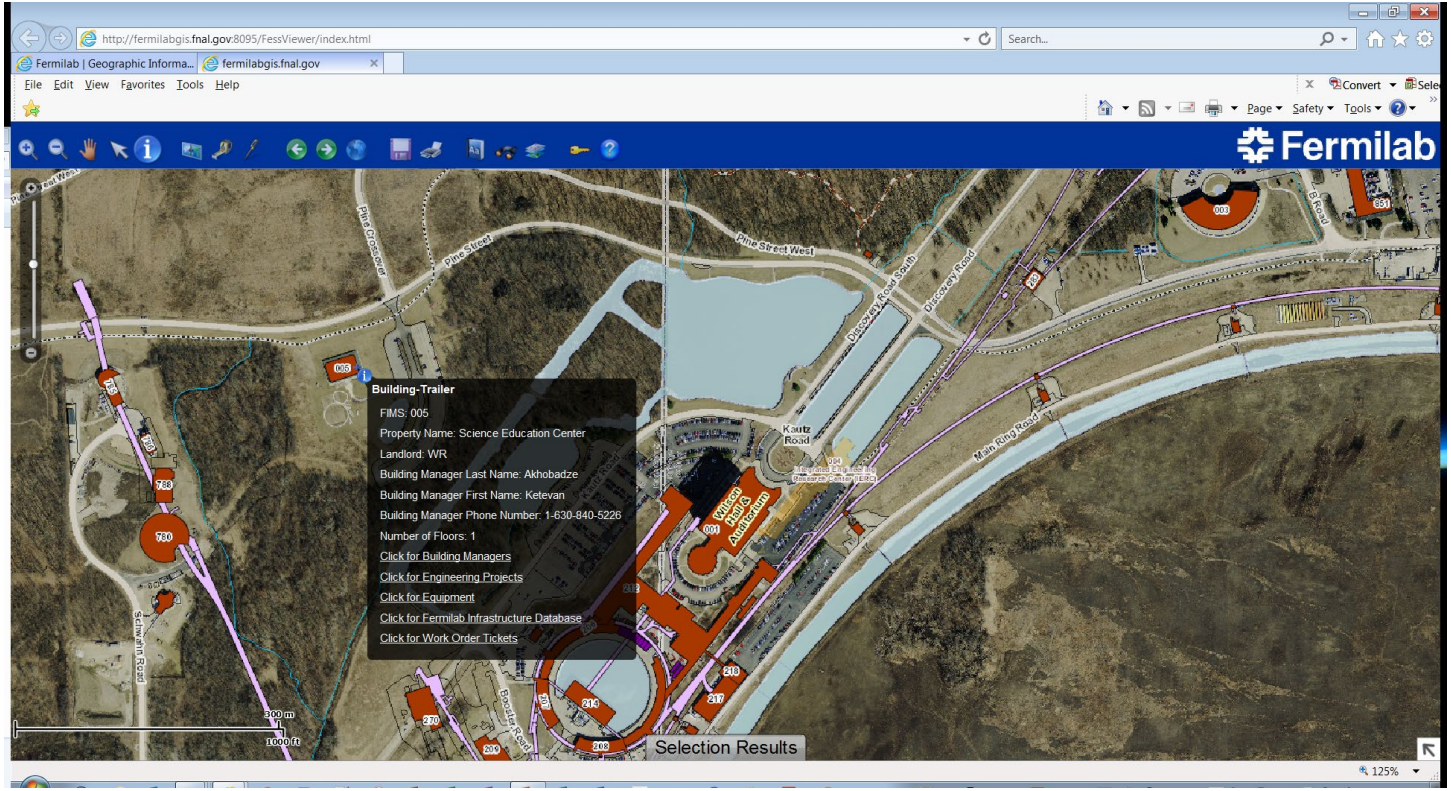
FIMS User's Guide

01/09/2019

Fermilab Infrastructure Database (FID)

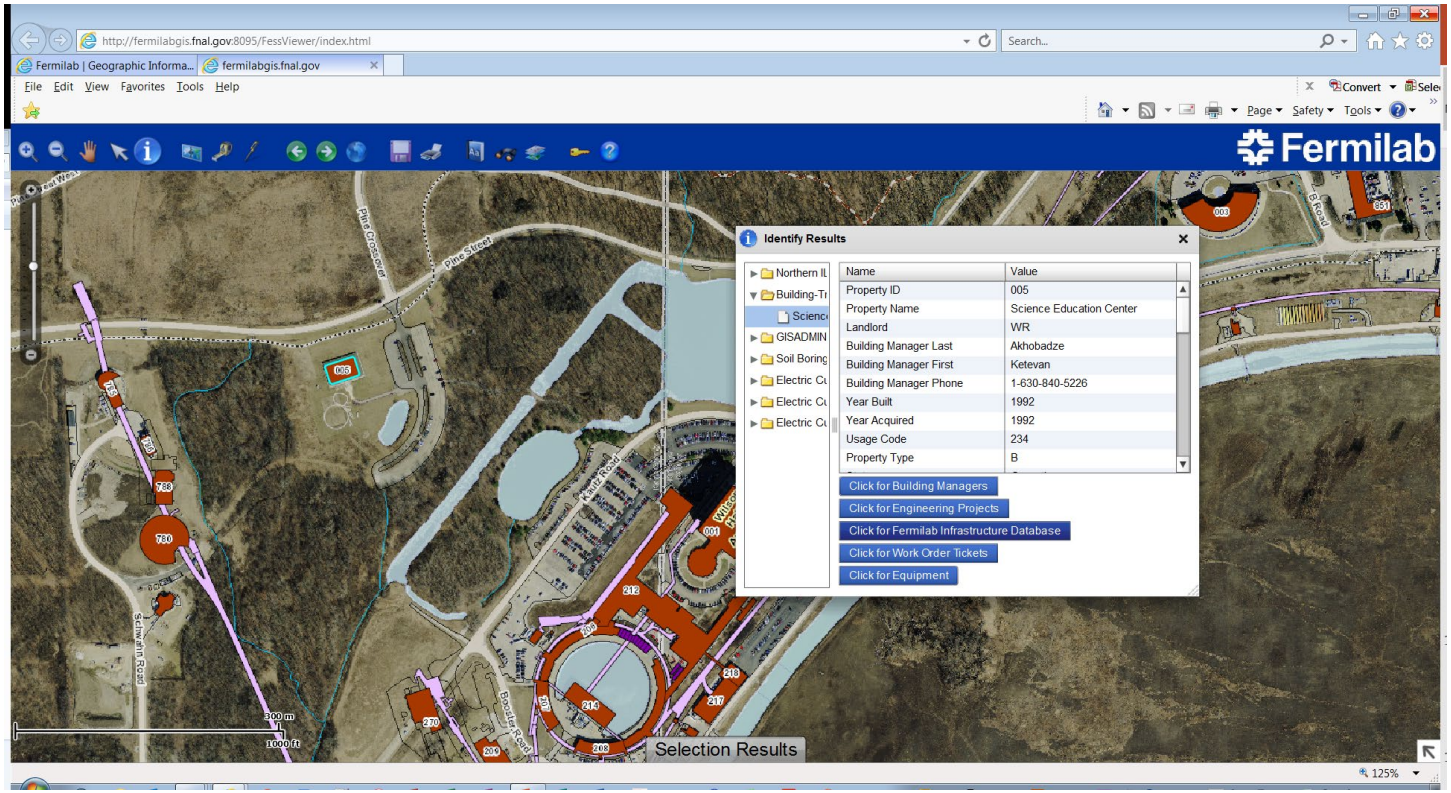
- FID is Fermilab's in-house facility infrastructure database used to manage real property data.
- FID has been in place at Fermilab since 2011 and is continually being enhanced.
- FID …
  - Populates FIMS – data from FID is uploaded into FIMS
  - Provides a single place allowing Property Managers to easily review, access, validate, and export validate data
  - Eliminates redundant, stale data; no more Excel spreadsheets
  - Supports the annual FIMS Validation
  - Declared a "Best Practice" by OAPM
  - Integrates with GIS and other information stores (CMMS, EAM, Engineering)

GIS and FID in Action



Fermilab

GIS and FID in Action



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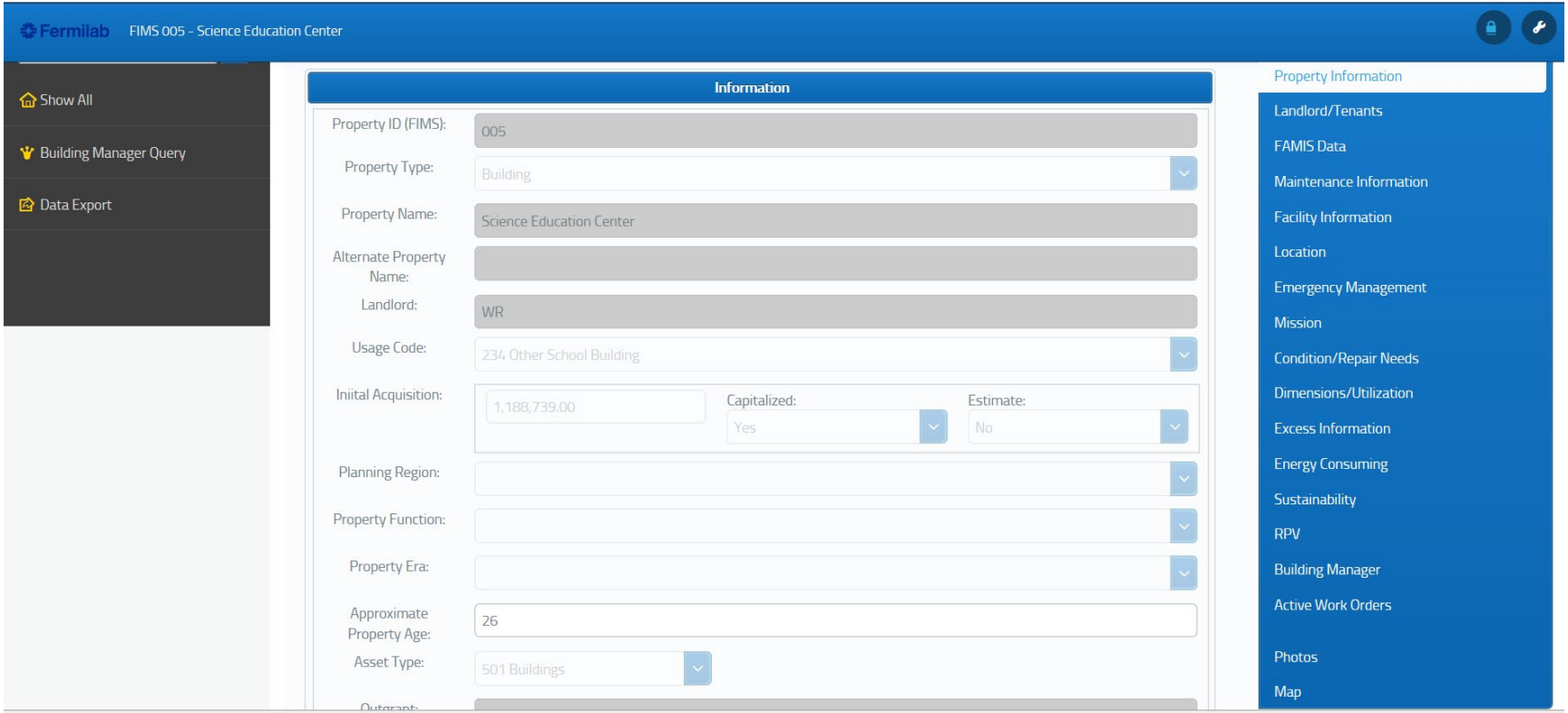
GIS and FID in Action



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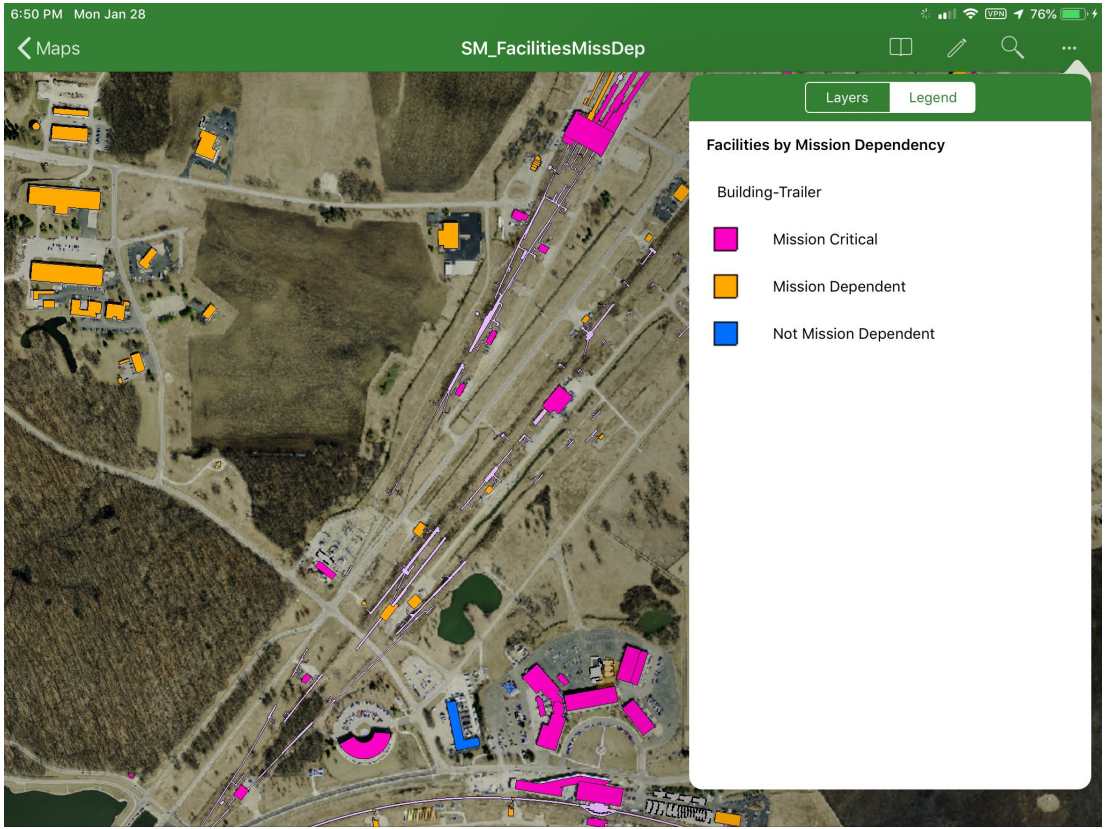
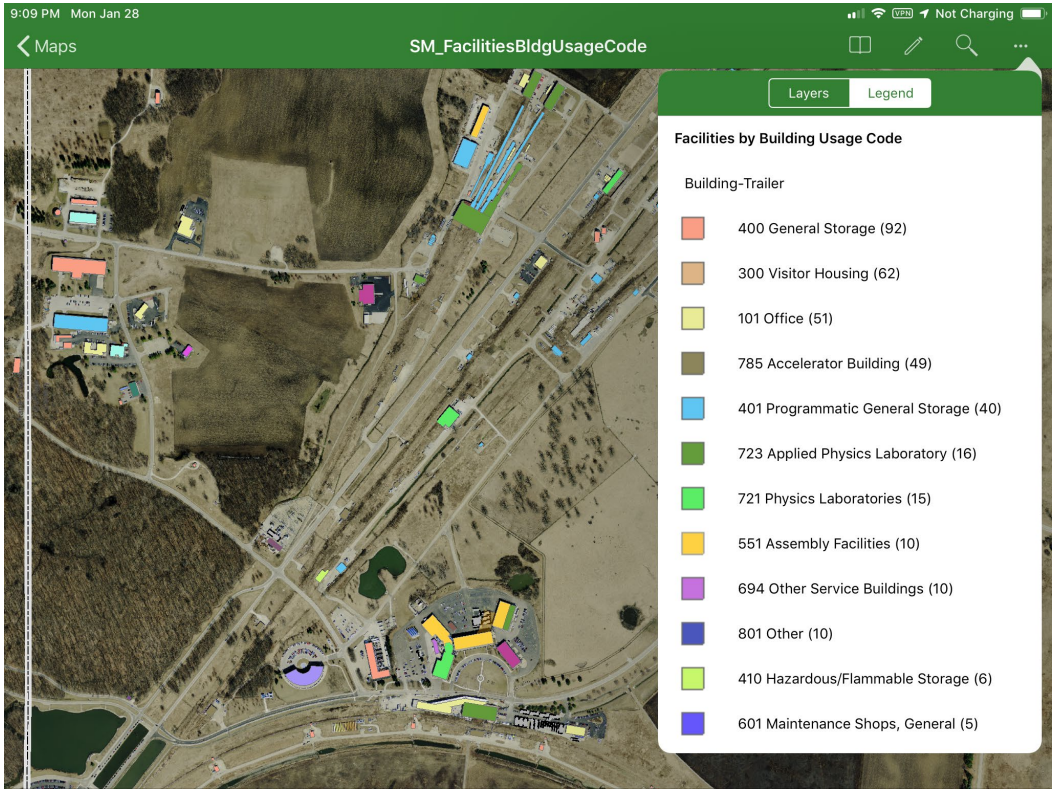
Facility – By Mission Dependency



- Mission Dependency
  - Visualize
  - Query
  - Analyze
- Count
  - Mission Critical (122)
  - Mission Dependent (243)
  - Not Mission Dependent (37)

Facility – By Usage



- Usage Code
  - Visualize
  - Query
  - Analyze
- Fermilab currently has 33 unique Usage Codes

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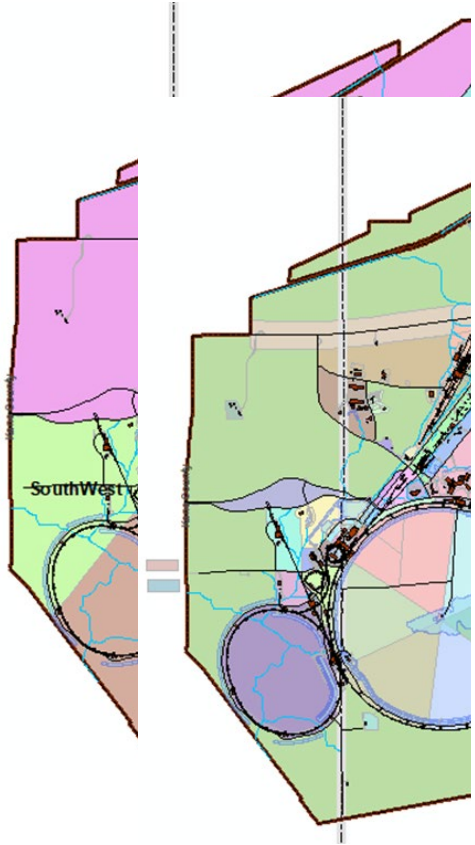
Fermilab Location Data Standards

- 2017 – Location Data Standards Task Force established
  - Establish consistent naming, conventions and definitions for location data
  - Establish rules on their assignment through the Fermilab Facility Lifecycle (early design through operation and decommissioning)
- Location Data – is data content associated with the geographic location of real property (land, building, trailer or other structures and facilities (OSF).
- Location Data Standards – uniform and consistent naming, grouping, nomenclature, definition, terminology and applicability of the Location Data content.
- Applied throughout the lifecycle of all planned and in place real property assets located on and associated with Fermilab.
- GIS is the system of record of all location data; feeds other systems

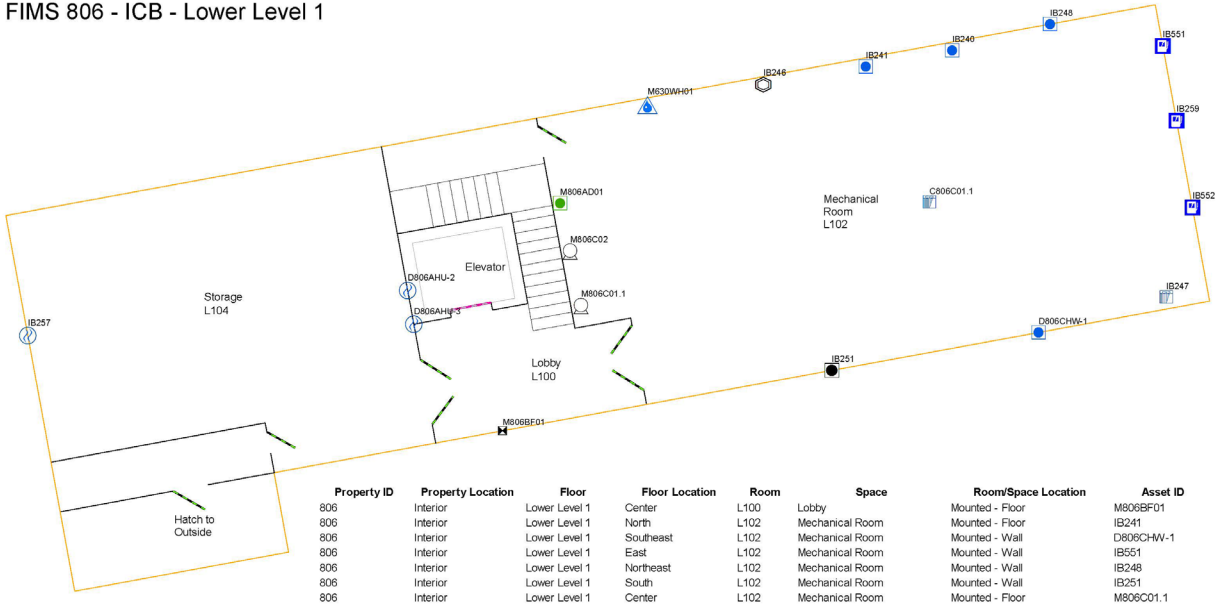
Fermilab Location Data Standards

Group	Location Data Standard	Members/Scope
Political	Country, State, County, Township, Municipality, Zipcode	All Real Property
Agency	Agency, Program, Site, Area	All Real Property
Area	Quadrant, Campus, Complex, Property	All Real Property
Property	Property ID, Property Name, Property Address, Property USNG Coordinate	All Real Property
Facility	Floor and Room	Building, Trailer and Enclosure Real Property
Space	*Unoccupied Space (As Designed)*	*Building, Trailer and Enclosure Real Property*
	Unoccupied Space (In Place)	
	Occupied Space (In Place)	

Fermilab Location Data Standards – GIS Layers



FIMS 806 - ICB - Lower Level 1



Property ID	Property Location	Floor	Floor Location	Room	Space	Room/Space Location	Asset ID
806	Interior	Lower Level 1	Center	L100	Lobby	Mounted - Floor	M806BF01
806	Interior	Lower Level 1	North	L102	Mechanical Room	Mounted - Floor	IB241
806	Interior	Lower Level 1	Southeast	L102	Mechanical Room	Mounted - Wall	D806CHW-1
806	Interior	Lower Level 1	East	L102	Mechanical Room	Mounted - Wall	IB551
806	Interior	Lower Level 1	Northeast	L102	Mechanical Room	Mounted - Wall	IB248
806	Interior	Lower Level 1	South	L102	Mechanical Room	Mounted - Wall	IB251
806	Interior	Lower Level 1	Center	L102	Mechanical Room	Mounted - Floor	M806C01.1
806	Interior	Lower Level 1	Center	L102	Mechanical Room	Mounted - Floor	M806C02
806	Interior	Lower Level 1	Center	L102	Mechanical Room	Mounted - Floor	C806C01.1
806	Interior	Lower Level 1	Center	L102	Mechanical Room	Mounted - Floor	M806AD01
806	Interior	Lower Level 1	Southeast	L102	Mechanical Room	Mounted - Wall	IB247
806	Interior	Lower Level 1	North	L102	Mechanical Room	Mounted - Floor	M630WH01
806	Interior	Lower Level 1	Northeast	L102	Mechanical Room	Mounted - Floor	IB240
806	Interior	Lower Level 1	East	L102	Mechanical Room	Mounted - Wall	IB259
806	Interior	Lower Level 1	East	L102	Mechanical Room	Mounted - Wall	IB552
806	Interior	Lower Level 1	North	L102	Mechanical Room	Mounted - Floor	IB246
806	Interior	Lower Level 1	Center	L104	Storage Room	Mounted - Wall	D806AHU-2
806	Interior	Lower Level 1	West	L104	Storage Room	Mounted - Floor	IB257
806	Interior	Lower Level 1	West	L104	Storage Room	Mounted - Wall	D806AHU-3

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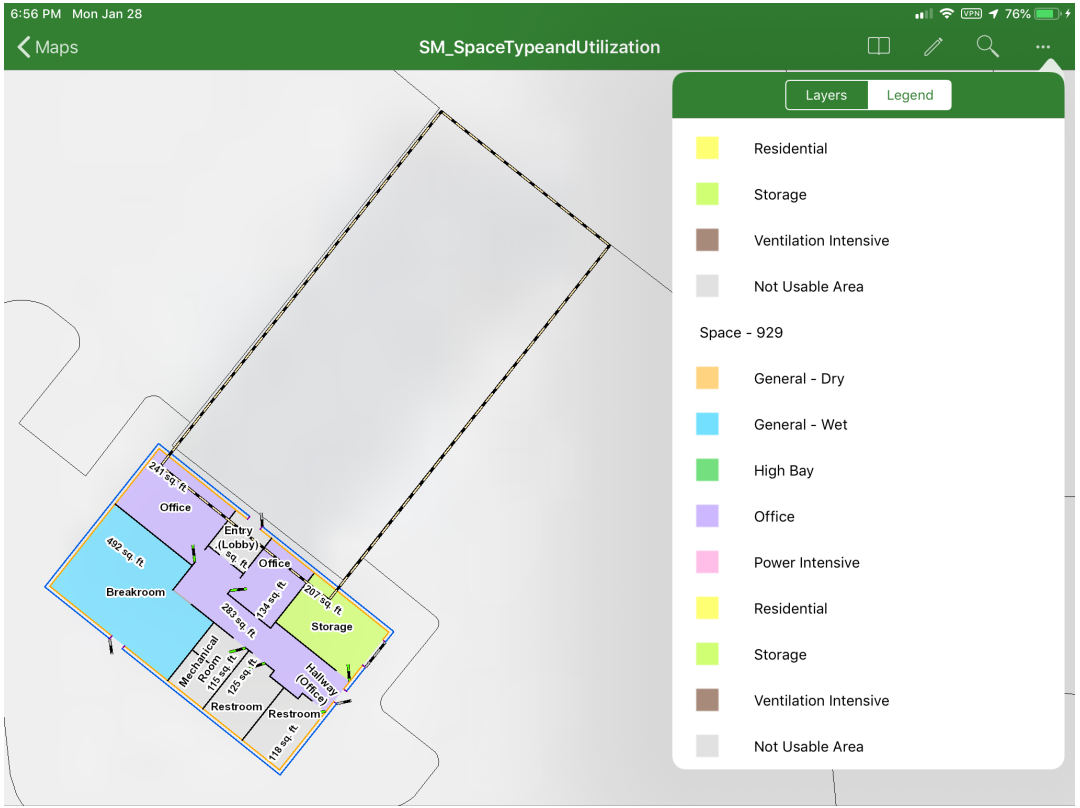
Location Data Standards – Space

- AISLE
- ALCOVE
- ANALOG ROOM
- ATTIC
- BATHROOM
- BEAM
- BEDROOM
- BREAKROOM
- BRIDGE
- CAFÉ
- CATWALK
- CHASE
- CHUTE
- CIRCULATION AREA
- COLUMN
- CLASSROOM (LAB)
- CLASSROOM (LECTURE)
- CLEANROOM
- CLOSET
- COLUMN
- COMMON AREA
- COMMUNICATION ROOM
- COMPUTER ROOM
- CONFERENCE ROOM
- CORRIDOR
- COUNTING ROOM
- DINING AREA
- DINING ROOM
- DISPLAY AREA
- DUMBWAITER
- ELECTRICAL ROOM
- ELEVATOR
- ENTRY (LOBBY)
- ENTRY (VESTIBULE)
- EQUIPMENT ROOM
- ESCALATOR
- GARAGE
- GARDEN
- HALLWAY
- HALLWAY (OFFICE)
- HIGH BAY
- JANITOR ROOM
- KITCHEN
- LAB (MECHANICAL)
- LAB (SCIENCE)
- LAUNDRY
- LIBRARY
- LIVING ROOM
- LOBBY
- LOCKER ROOM
- MATERIAL PROCESSING AREA
- MECHANICAL ROOM
- OFFICE
- OFFICE (HOME)
- PARKING
- PIT
- PLATFORM
- PORCH
- QUIET ROOM
- RECROOM
- RESTROOM
- ROOFOCCU
- ROOFUNOC
- SHAFT
- SHELTER
- SHOP (MACHINE)
- SHOP (METAL)
- SHOP (WOODWORKING)
- SHOP (WORK)
- STAIRWELL
- STORAGE
- STORAGE (OFFICE)
- TECHNICAL AREA
- THEATER
- TRAVELATOR
- TUNNEL
- UTILITY ROOM
- VAULT
- WALKWAY

FIMS Validation Requirement - Facility Dimensions/Space Utilization

- Gross and Usable (Net) Square Footage
- Space (Function) cross-walked to “Space Types”
  - General – Dry
  - General – Wet
  - High Bay
  - Office
  - Power Intensive
  - Ventilation Intensive
  - Storage
- “Office” (2018); “Storage” (2019)



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Source Documentation (Past)

Gross SF: 17117

Usable Sqft: 12113

No of Floors: 3

	% Utilized	Utilization Level
Asset:	100%	Over Utilized
Space Type:	100%	Over Utilized

Space Types	Space Type Usable SF	Space Type Utilization %	Space Type Utilized SF	Space Alternatively Used
High Bay	0	0	0	
Ventilation Intensive	0	0	0	
Power Intensive	0	0	0	
General - Wet	0	0	0	
General - Dry	0	0	0	
Office	3028	100	3,028	
Storage	0	0	0	
Totals:	3,028		3,028	

MB

BUILDING DATA REQUEST FORM
REAL PROPERTY PHYSICAL INVENTORY - 1993

BUILDING/BUILDING MANAGER DATA

BUILDING NO. (RPIS): 036
BUILDING MANAGER: John Barry
BUILDING NAME: 1 SAUK BLVD - ASPEN EAST
DIV/SEC: LS
ALT. BLDG. NAME/ID (1):
MAIL STATION: 322

NET INTERIOR SPACE USAGE AND OCCUPANCY

	NET SQ.FT. (2)	BLDG. USAGE CODE (4)	AREA OCCUPANCY (5)
USABLE OFFICE AREAS	811	101	6 F / O
USABLE LABORATORY AREAS	0	—	0
OTHER USABLE AREAS	6926	301	24
	2188	400	0
	2188	400 *	0
	12,113 (3)		
NON-USABLE AREAS	~~1054~~ 5004 → VERIFIED BY BLDG. MGR.	* JOHN PURCELL	

GROSS BUILDING USAGE AND OCCUPANCY

recalculation 9/4/?

	GROSS SQ. FT. (6)	PREDOMINANT USAGE (7)	TOTAL OCCUPANCY (8)
TOTAL	~~13167~~ 17,117	301	30

INSTRUCTIONS TO BUILDING MANAGER

Please fill out information on the building using definitions and usage codes listed on opposite page and attachment. Return completed form to Dennis Theriot, M.S. 105 by June 1, 1993.

NOTES AND DEFINITIONS

(1) Indicate any alternate building name or number associated with indicated building. Examples are the operation numbers on experimental area service buildings.

(2) Net usable square feet is the occupied area less corridors, stairways, elevator shafts, lobbies, bathrooms, equipment rooms, janitor rooms, utility shafts and closets, atrium areas and exterior wall, for each area usage recorded.

(3) Corridors, stairways, elevator shafts, etc. indicated in (2) above comprise "Non-usable" remaining building area.

(4) Select appropriate building usage code from list on reverse side.

(5) Indicate number of personnel who occupy the preceding area and usage code. (F - indicates Fermilab employees and O - indicates Others.) Area occupancy shall be personnel with assigned offices or work stations within the specified area.

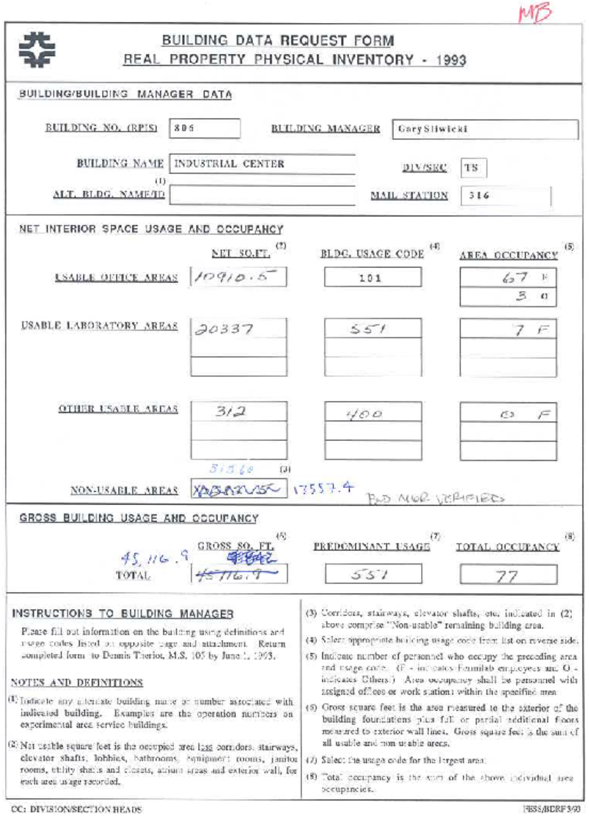
(6) Gross square feet is the area measured to the exterior of the building foundations plus full or partial additional floors measured to exterior wall lines. Gross square feet is the sum of all usable and non-usable areas.

(7) Select the usage code for the largest area.

(8) Total occupancy is the sum of the above individual area occupancies.

CC: DIVISION/SECTION HEADS

Source Documentation (Past)



MB

BUILDING DATA REQUEST FORM
REAL PROPERTY PHYSICAL INVENTORY - 1993

BUILDING/BUILDING MANAGER DATA

BUILDING NO. (RPIS): 806 — BUILDING MANAGER: Gary Sliwicki

BUILDING NAME: INDUSTRIAL CENTER — DIV/SEC: TS

ALT. BLDG. NAME/ID (1): — MAIL STATION: 316

NET INTERIOR SPACE USAGE AND OCCUPANCY

	NET SQ.FT. (2)	BLDG. USAGE CODE (4)	AREA OCCUPANCY (5)
USABLE OFFICE AREAS	10910.5	101	67 F / 3 O
USABLE LABORATORY AREAS	20337	551	7 F
OTHER USABLE AREAS	312	400	0 F
	31560 (3)		
NON-USABLE AREAS	17557.4	BLD MGR VERIFIED	

GROSS BUILDING USAGE AND OCCUPANCY

	GROSS SQ. FT. (6)	PREDOMINANT USAGE (7)	TOTAL OCCUPANCY (8)
TOTAL	45,116.9	551	77

INSTRUCTIONS TO BUILDING MANAGER

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NOTES AND DEFINITIONS

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(3) Corridors, stairways, elevator shafts, etc. indicated in (2) above comprise "Non-usable" remaining building area.

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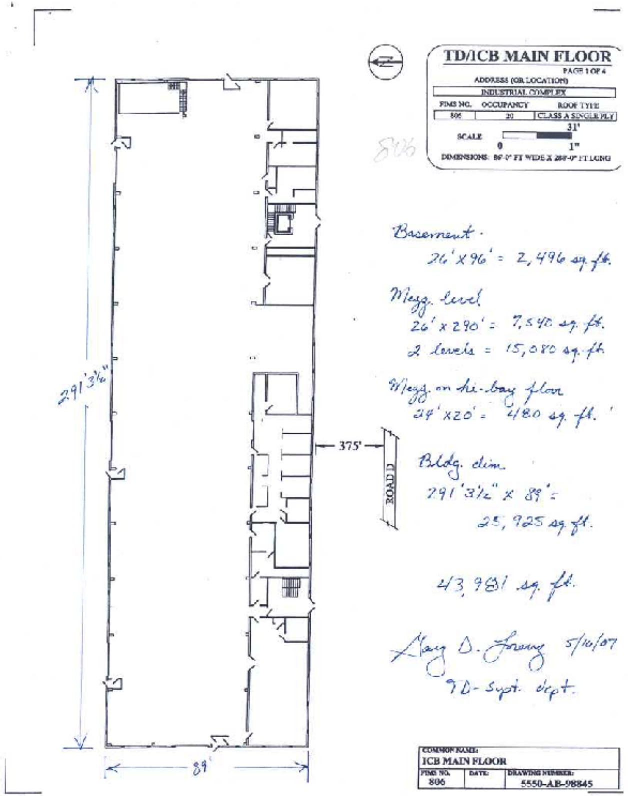
(6) Gross square feet is the area measured to the exterior of the building foundations plus full or partial additional floors measured to exterior wall lines. Gross square feet is the sum of all usable and non usable areas.

(7) Select the usage code for the largest area.

(8) Total occupancy is the sum of the above individual area occupancies.

CC: DIVISION/SECTION HEADS — FESS/BDRF3/93



Gross SF: 43981

Usable Sqft: 31560

No of Floors: 4

	% Utilized	Utilization Level
Asset:	100%	Over Utilized
Space Type:	100%	Over Utilized

Space Types	Space Type Usable SF	Space Type Utilization %	Space Type Utilized SF	Space Alternatively Used
High Bay	16560	100	16,560	
Ventilation Intensive	0	0	0	
Power Intensive	0	0	0	
General - Wet	0	0	0	
General - Dry	0	0	0	
Office	15000	100	15,000	
Storage	0	0	0	
Totals:	31,560		31,560	

General – Dry

- CONFERENCE ROOM
- COUNTING ROOM
- CROWS NEST
- DISPLAY AREA
- SHELTER
- SHOP
- TECHNICAL AREA
- THEATER

General – Wet

- ALCOVE
- BREAKROOM
- CAFÉ
- CLASSROOM
- DINING
- KITCHEN
- LAB (SCIENCE)
- LAUNDRY
- MATERIALS PROC AREA
- PIT
- QUIET ROOM
- RECROOM

Power - Intensive

- COMMUNICATION ROOM
- COMPUTER ROOM
- LAB (MECHANICAL)

Ventilation - Intensive

- CIRCULATION AREA
- CLEANROOM

Storage

- GARAGE
- LIBRARY
- LOCKER ROOM
- PLATFORM
- STORAGE

High Bay

- HIGH BAY

Office

- AISLE
- HALLWAY (OFFICE)
- OFFICE
- STORAGE (OFFICE)

Residential / Not Usable Area Legend

Green – Could transform to Usable

Purple – Not Usable by FIMS definition

Blue – Like Purple; would never be Usable

Shaded – "Fermilab' Space Type

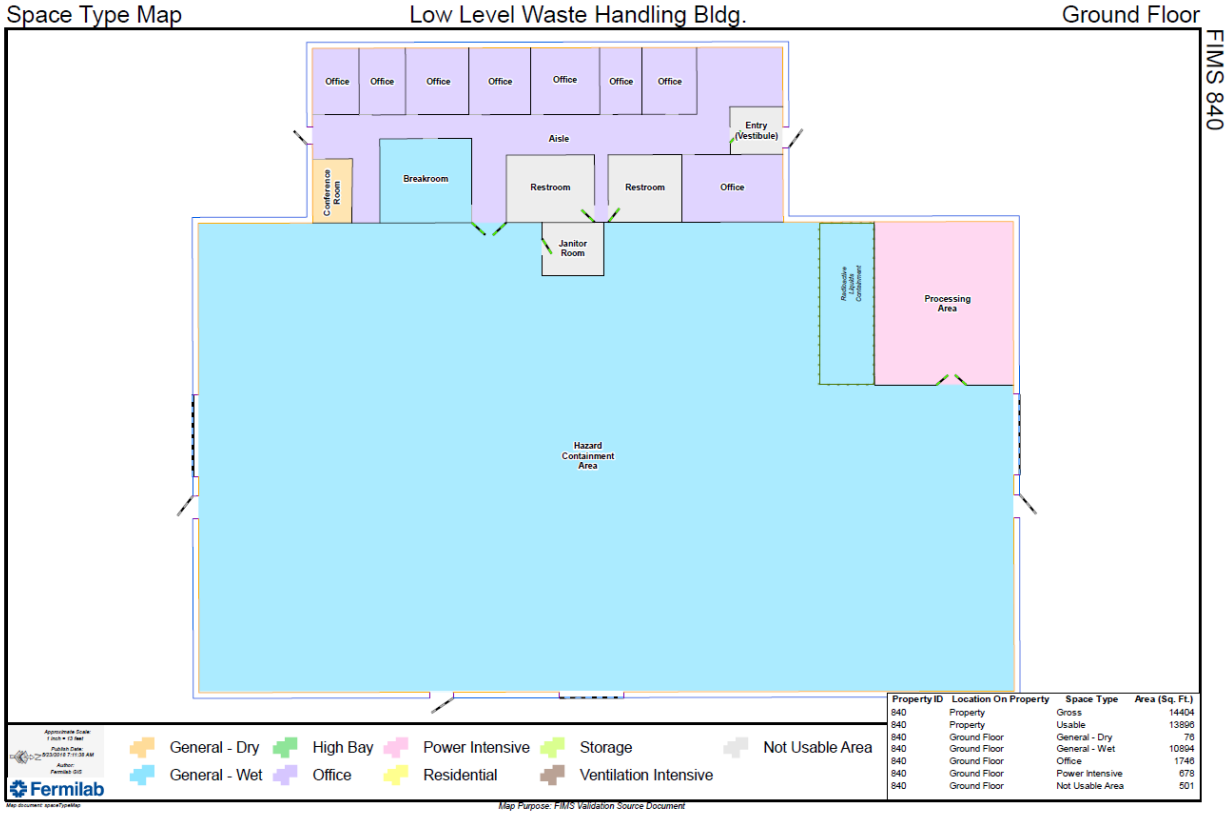
Not Usable Area

- ANALOG ROOM
- ATTIC
- BATHROOM
- BEAM
- BRIDGE
- CATWALK
- CHASE
- CHUTE
- COLUMN
- CLOSET
- CORRIDOR
- DUMBWAITER
- ELECTRICAL ROOM
- ELEVATOR
- ENTRY (VESTIBULE)
- EQUIPMENT ROOM
- ESCALATOR
- GARDEN
- JANITOR ROOM
- LIVING ROOM
- ENTRY (LOBBY)
- MECHANICAL ROOM
- PARKING
- PORCH
- RESTROOM
- ROOFOCCU
- ROOFUNOC
- SHAFT
- STAIRWELL
- TRAVELATOR
- TUNNEL
- UTILITY ROOM
- VAULT

Residential

- BEDROOM
- LIVING ROOM
- DINING ROOM
- OFFICE (HOME)

Source Documentation – Low Level Waste Handling Building



Property ID	Location On Property	Space Type	Area (Sq. Ft.)
840	Property	Gross	14404
840	Property	Usable	13898
840	Ground Floor	General - Dry	76
840	Ground Floor	General - Wet	10894
840	Ground Floor	Office	1746
840	Ground Floor	Power Intensive	678
840	Ground Floor	Not Usable Area	501

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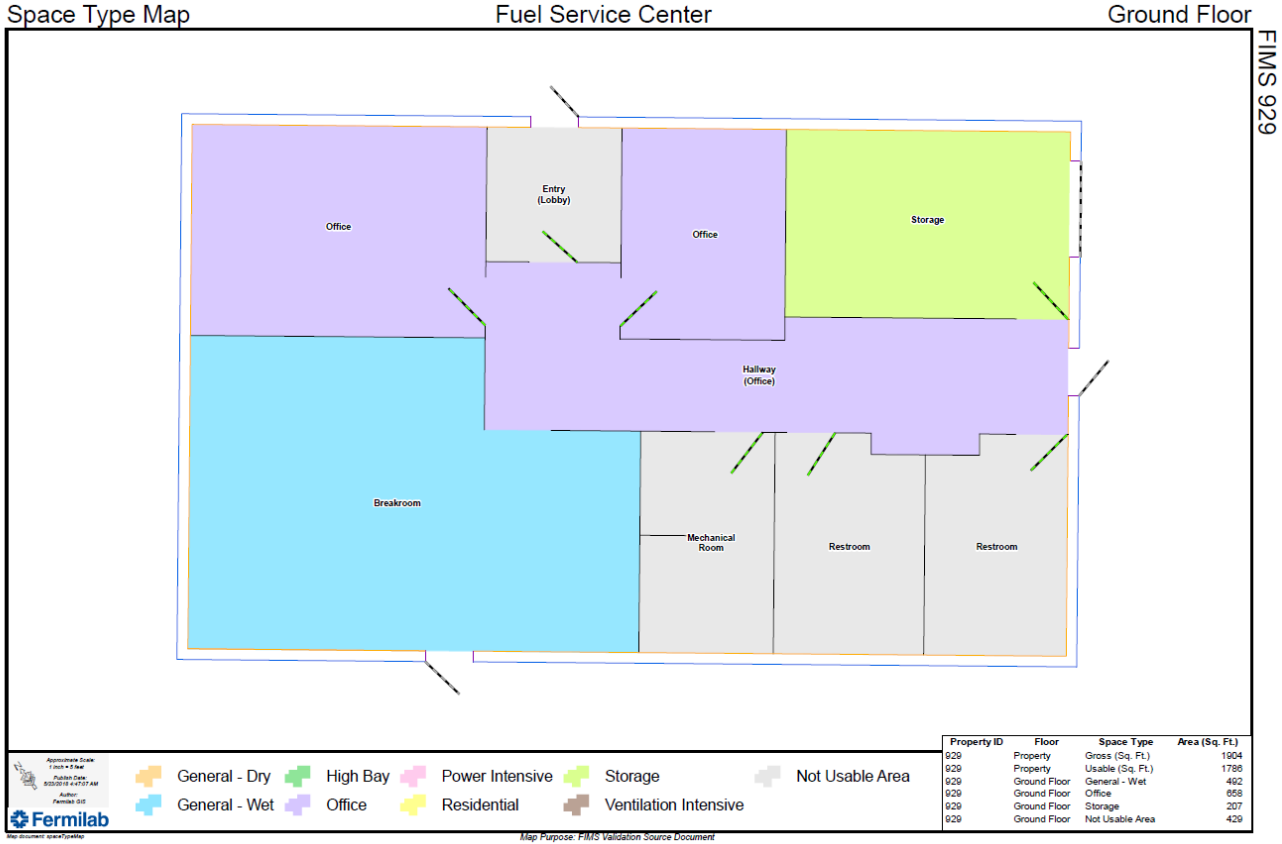
Source Documentation – Fuel Service Center



Property ID	Floor	Space Type	Area (Sq. Ft.)
929	Property	Gross (Sq. Ft.)	1904
929	Property	Usable (Sq. Ft.)	1786
929	Ground Floor	General - Wet	492
929	Ground Floor	Office	658
929	Ground Floor	Storage	207
929	Ground Floor	Not Usable Area	429

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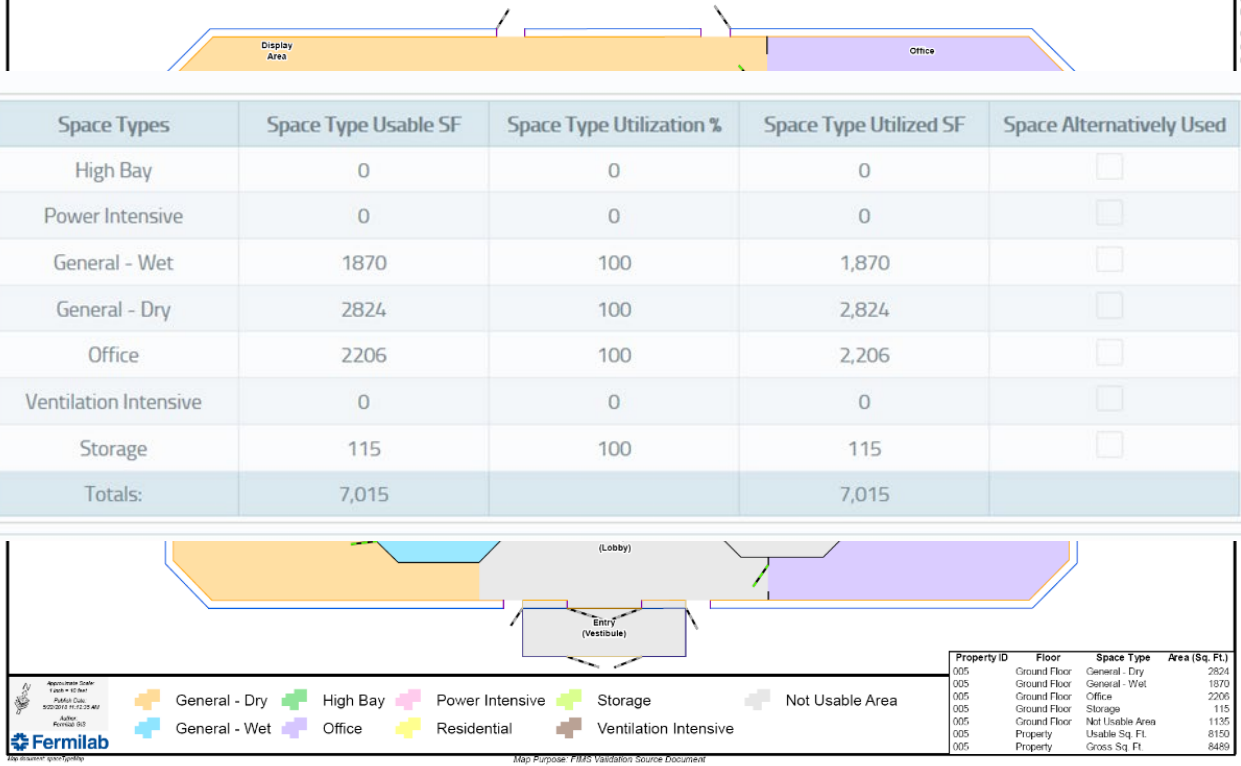
Source Documentation – Science Education Center

Space Type Map — Science Education Center — Ground Floor

FIMS 005



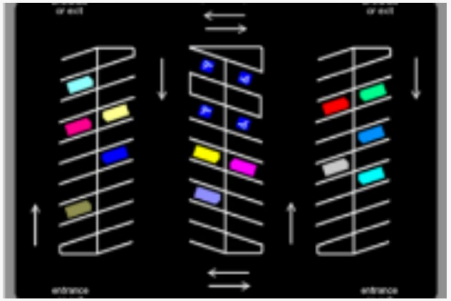
Space Types	Space Type Usable SF	Space Type Utilization %	Space Type Utilized SF	Space Alternatively Used
High Bay	0	0	0	
Power Intensive	0	0	0	
General - Wet	1870	100	1,870	
General - Dry	2824	100	2,824	
Office	2206	100	2,206	
Ventilation Intensive	0	0	0	
Storage	115	100	115	
Totals:	7,015		7,015	

Property ID	Floor	Space Type	Area (Sq. Ft.)
005	Ground Floor	General - Dry	2824
005	Ground Floor	General - Wet	1870
005	Ground Floor	Office	2206
005	Ground Floor	Storage	115
005	Ground Floor	Not Usable Area	1135
005	Property	Usable Sq. Ft.	8150
005	Property	Gross Sq. Ft.	8489

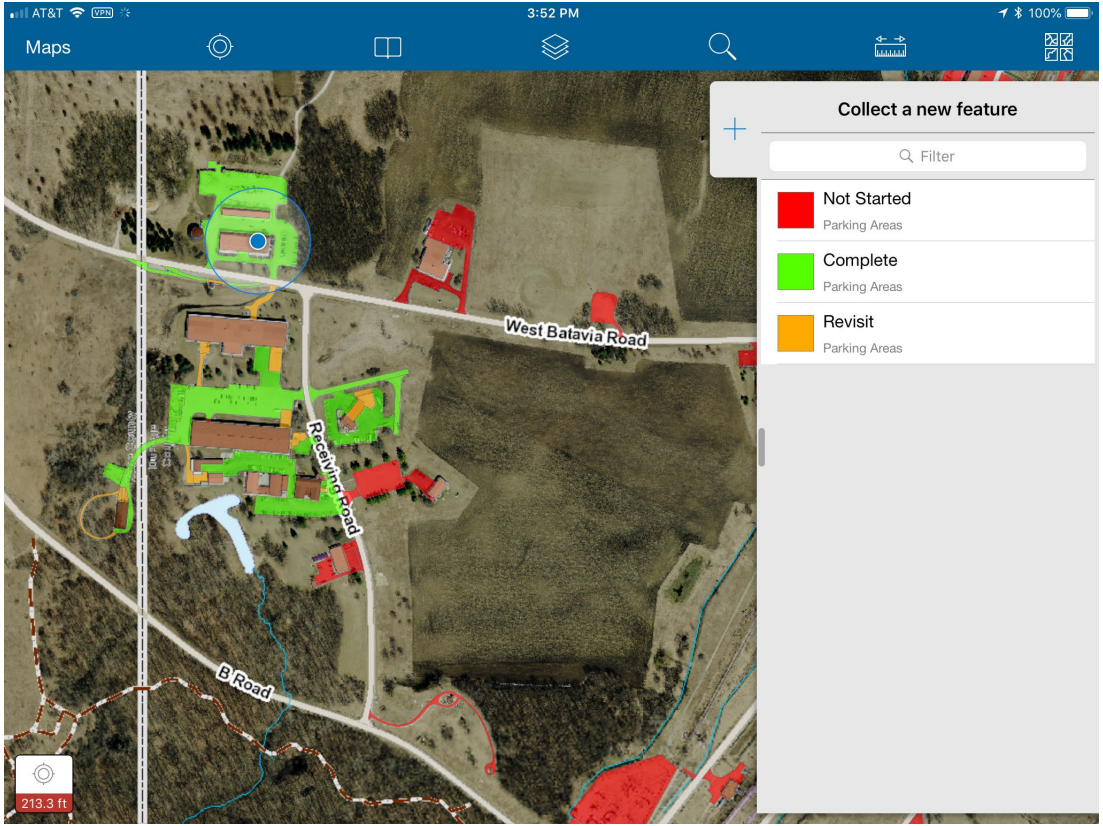
Map Purpose: FIMS Validation Source Document

Mobile GIS - Condition Assessments

- Using GIS in the field has been valuable for completing in field updates and inventories such as tank locations, guard rails, waste receptacles, sampling locations, utility pole inventory, seed collections, invasive plants, asset tagging
- Mobile GIS applications are used to perform condition assessments for Parking Areas, Cross-Drains to determine asset condition.
- Asset Condition required for annual FIMS reporting
  - Adequate, Inadequate, Substandard

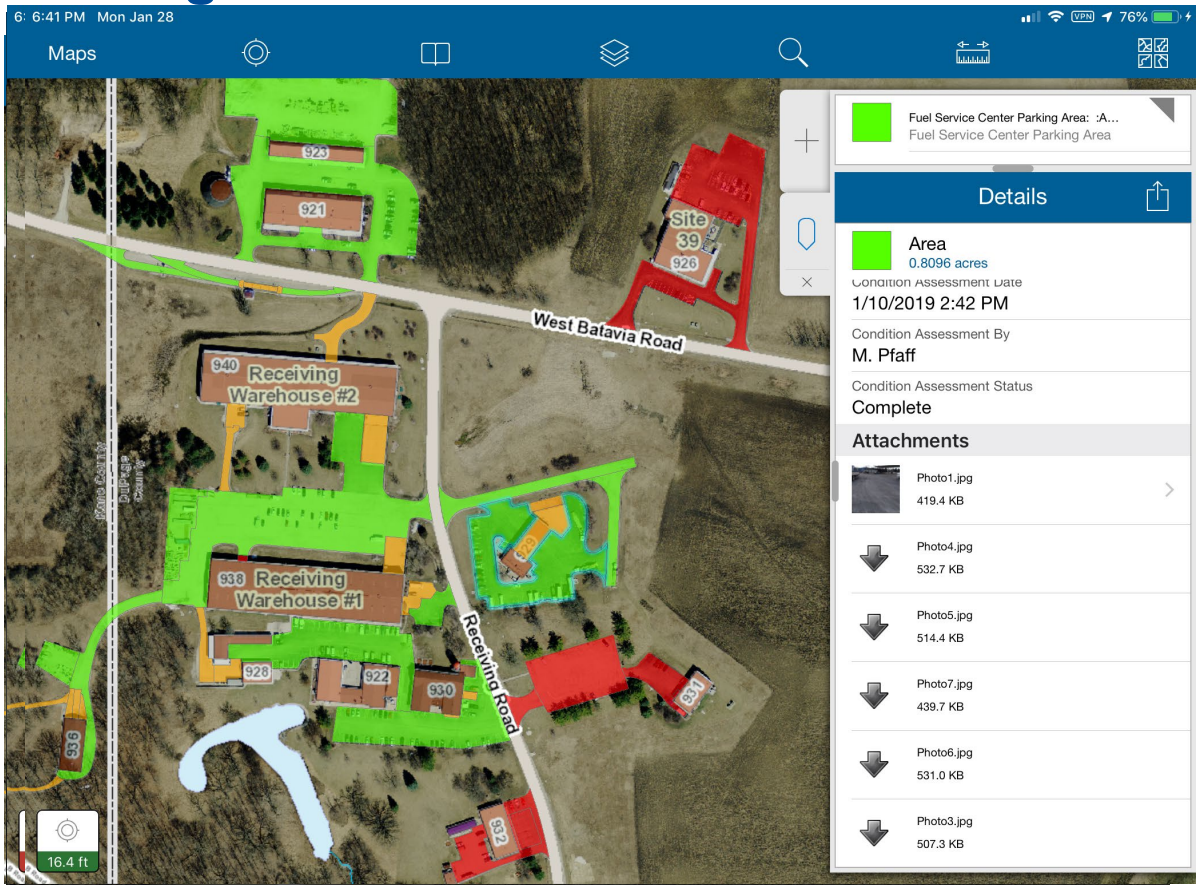


Parking Areas Condition Assessment



- Assessment is completed in the field
- Collector for ArcGIS (iPad)
- Status of Progress

Parking Areas Condition Assessment



- Condition Assessment includes questions on
  - Striping
  - Surface
  - Base/binder
  - Subsurface
  - Curbing & Bumpers
- Date, Name & Status
- Photos

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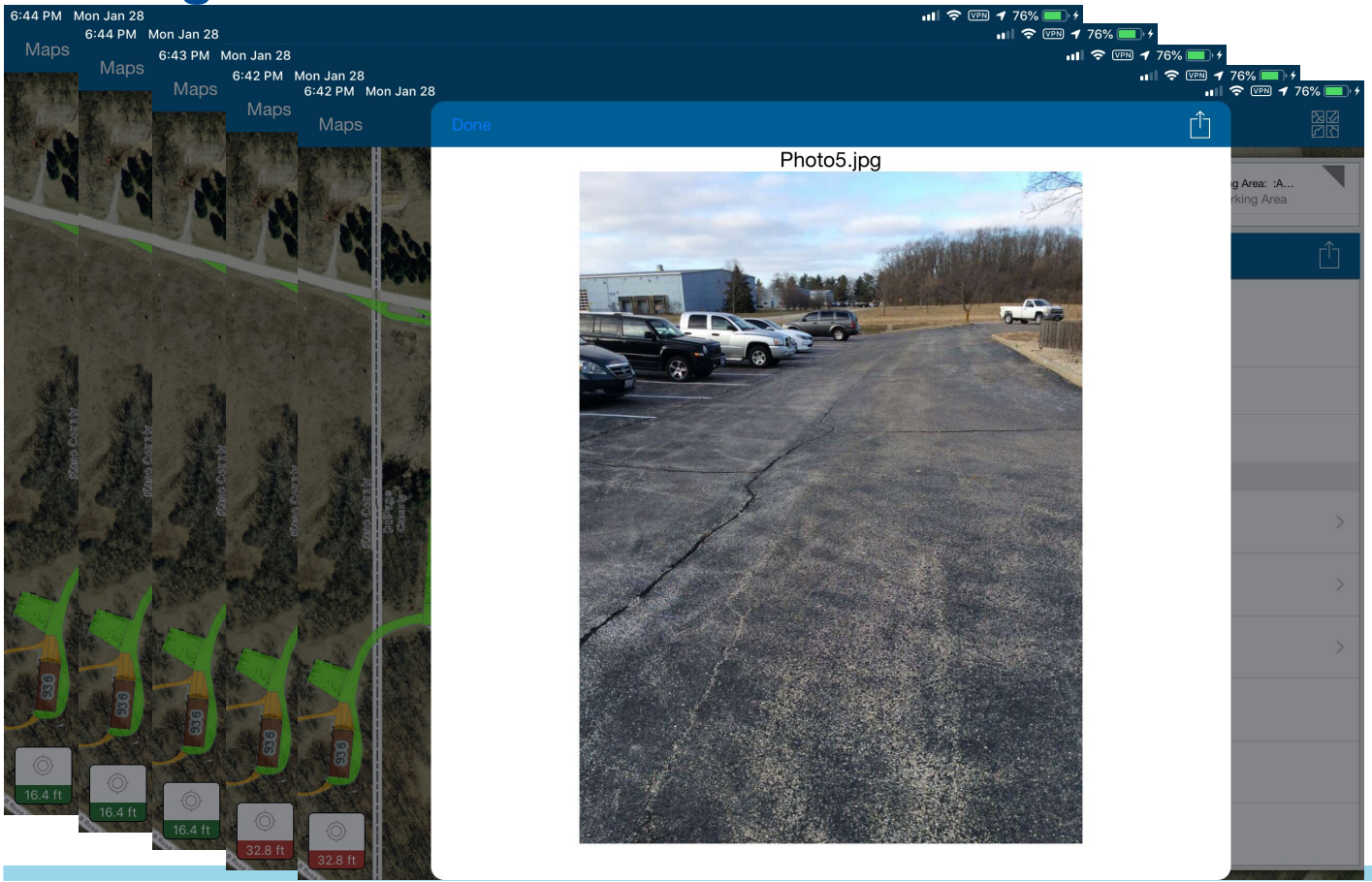
Parking Areas Condition Assessment



- Provide a critical historical record of condition

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Parking Areas Condition Assessment

- Once complete, the information will be scored to determine an overall Asset Condition.
- Asset Conditions will be migrated to respective condition assessment information data stores and reports.
- The information is also used and analyzed to support budget decisions for work repairs, replacements.
- In field assessments capture accurate, in place information; provide a historical record for a sustainable, repeatable, and maintainable practice.

What's Next?

- Fermilab Location Data Standards; rollout and implementation
- Refine, publish and rollout space to space type cross walk standards
- Continue to enhance our FIMS Validation Source Documentation practice
- Continue to enhance and building out GIS integration links to other core systems
- Empower property managers to assess assets; maintain (update, change) assets; condition assessments
- Enhance our capabilities to provide common operating pictures and increase situational awareness across lab functions utilizing our geospatial investments
- Evangelize, collaborate with and continue outreach on our approaches on Location Data Standards and other practices to other DOE Labs

Thank You

- Questions

- Comments