



# Fermilab Enterprise GIS Standards

Implementation Overview

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## **1.0 Document Purpose**

The purpose of this document is to:

- Provide an overview to internal Fermilab resources who will acquire, consume, maintain and/or report on geospatial data;
- Provide an overview to outside agencies particularly those involved in providing geospatial information to or sharing geospatial information with Fermilab to gain an understanding of the Fermilab GIS environment;
- Provide requirements and parameters for project deliverables.

## **1.1 Contact Information**

Inquiries should be directed to:

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## **1.2 Reference Documents**

The following policies/procedures should be referenced as required:

- CAD Standards
- A/E Consultant Handbook
- FESS Design Document Guide

## **2.0 Fermilab GIS**

### **2.1 Fermilab Enterprise GIS Implementation Overview**

The Fermilab Enterprise GIS implementation is comprised of the following components:

- Operational environment - Primarily Microsoft and iOS Clients; Microsoft Servers; Apache Application Servers.
- Application Development Framework - ArcGIS Javascript API and ArcGIS Flex API.
- Integration – Accomplished via direct and indirect links to external data stores of various constructs.
- GIS data content management – ArcGIS for Desktop Advanced and extensions, Leica and Trimble GPS devices.
- GIS database management repository – Oracle Enterprise versioned ArcSDE enterprise geodatabase using the ST\_Geometry storage type.
- Presentation logic – ArcGIS for Server Enterprise Advanced map and feature services via HTML and ArcGIS Online as well as a small number of standalone solutions using 1-way or checkout replicas.

## 2.2 Fermilab Enterprise GIS Implementation Overview

The Fermilab enterprise geodatabase is hosted onsite at Fermilab, is designed and maintained by the Fermilab GIS team and includes the following characteristics:

Geodatabase capabilities generally include:

- Point, line, polygon, annotation, dimension and multipart vector feature types
- High precision storage (XY resolution and tolerance of 0.0003280833333333 feet)
- M and Z geometry properties (resolutions of 0.0000025 and tolerances of 0.00002 feet)
- Geometric networks
- Network datasets
- Topologies
- Attribute domains
- Subtypes
- Relationship classes
- Versioning

Geodatabase schema is generally adopted from:

- Local Government Information Model (LGIM)
- Facilities Information Spatial Data Model (FISDM)

Geodatabase spatial reference is:

- NAD\_1983\_StatePlane\_Illinois\_East\_FIPS\_1201\_Feet projected coordinate system with the following projection and geographic coordinate system properties:
  - Projection
    - Transverse\_Mercator
    - False\_Easting: 984250.0
    - False\_Northing: 0.0
    - Central\_Meridian: -88.33333333333333
    - Scale\_Factor: 0.999975
    - Latitude\_Of\_Origin: 36.66666666666666
    - Linear Unit: Foot\_US (0.3048006096012192)
  - Geographic Coordinate System
    - GCS\_North\_American\_1983
    - Angular Unit: Degree (0.0174532925199433)
    - Prime Meridian: Greenwich (0.0)
    - Datum: D\_North\_American\_1983
    - Spheroid: GRS\_1980
    - Semimajor Axis: 6378137.0
    - Semiminor Axis: 6356752.314140356
    - Inverse Flattening: 298.257222101

## 2.2 Fermilab GIS Project Deliverables

In general, GIS project deliverables will be determined on a case by case, project by project basis. When GIS data content is involved this approach is desired to provide a seamless data interchange experience with the deliverable provider and Fermilab. This will also serve to facilitate the ability to maintain data integrity, completeness and consistency within the Fermilab GIS environment.

It is highly recommended that initial plans are discussed and reviewed with the Fermilab GIS Team point of contact before investing significant time planning for a particular GIS project deliverable regardless of the original intent of the project. In many cases, GIS is the final resting place for data and information gathered as well as the integration point to back end systems. As well, this will also provide an opportunity to discuss any system implementation requirements including but limited to Esri product software versions.

For project planning purposes, the following deliverable parameters for GIS data content should be considered:

### File geodatabase

- File geodatabase format is the preferred deliverable format for GIS data content. Ensure fields are fully qualified (no truncation based on translation formats such as shapefiles) and domains, relationship classes, joined tables and/or attachments associated with attribute fields are provided as well.

### Shapefiles

- Shapefiles can be provided for simple features and only when the file geodatabase delivery format is not available. While shapefiles are a supported open format, there are limitations that are not suitable for project specifics including precision degradation as well as truncation of attribute field names. Providing shapefiles will also require extra supplemental documentation related but not limited to data field names and use of null values and date fields.

### Delimited files

- Delimited files are acceptable for importing simple x, y coordinate points. The preferred delimiter is a comma (.). The structure of the delimited file will have:
  - a. Header names for each column void of special characters or spaces; variations of Camel case (upper, lower, pascal) is preferred; Limit header names to 30 characters or less.
  - b. No header names or data values containing the delimiter, or other special characters; no spaces at the end of data value rows
  - c. NW Quadrant x and y coordinates in decimal degrees; and
  - d. No end of file marker

### Data Lineage and Integrity

- Fermilab GIS has implemented editor tracking of geometry and content fields. Data lineage including last editor, date of last update, content edit and last date of content edits to be provided as is a description of geometry placement and attribute content source, method and date.

### Data Field Names, Data Types and Probable Content

- Project specific data field names, their data types, and probable content (domains) will be provided with each data delivery.

- All numerics should be stored in integer fields with the highest precision feasible for floating point information, dates in date fields and alphanumeric in string fields with consistent casing throughout the information.
- Limit attribute field names to 30 characters or less.
- Where feasible, Fermilab GIS will provide this information when data is generated for a project.

#### Special Projects

- An assigned Fermilab subject matter expert (SME) will provide at the time of engagement, along with this document, a complete list of information to be delivered associated with any contracted geospatial data acquisition or map information product delivery.

#### CAD datasets

- From time to time, projects require data content to be completed in CAD (AutoCAD; Microstation) and thus the only available deliverable format is a .dwg file. Two main requirements govern GIS data content deliverables coming from CAD.
  - i. The .dwg must be delivered in the Fermilab CAD project Fermi Coordinate system. Please reference the CAD Standards for procedures on how to work with the Fermi Coordinate system.
  - ii. The Fermilab GIS team will provide entity, layer, linetype, text and other document properties for the .dwg file to contain and required for import purposes into the Fermilab GIS.

#### Minimum Metadata to Accompany GIS data content deliveries

- The spatial reference, projection and geographic coordinate information.
- Description of data field names, data types and probable content values.
- Data lineage and data integrity accounts/descriptions.

The Fermilab Enterprise GIS geodatabase is dynamic and updated frequently. If required, the Fermilab GIS team will provide an XML file (schema only) of the enterprise geodatabase prior to any GIS project deliverable creation for GIS data content. This will assist with data field naming, data field type, and content expectations.

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