Introduction in GIS

E-Learning
AMC

AMC Workshop instructor

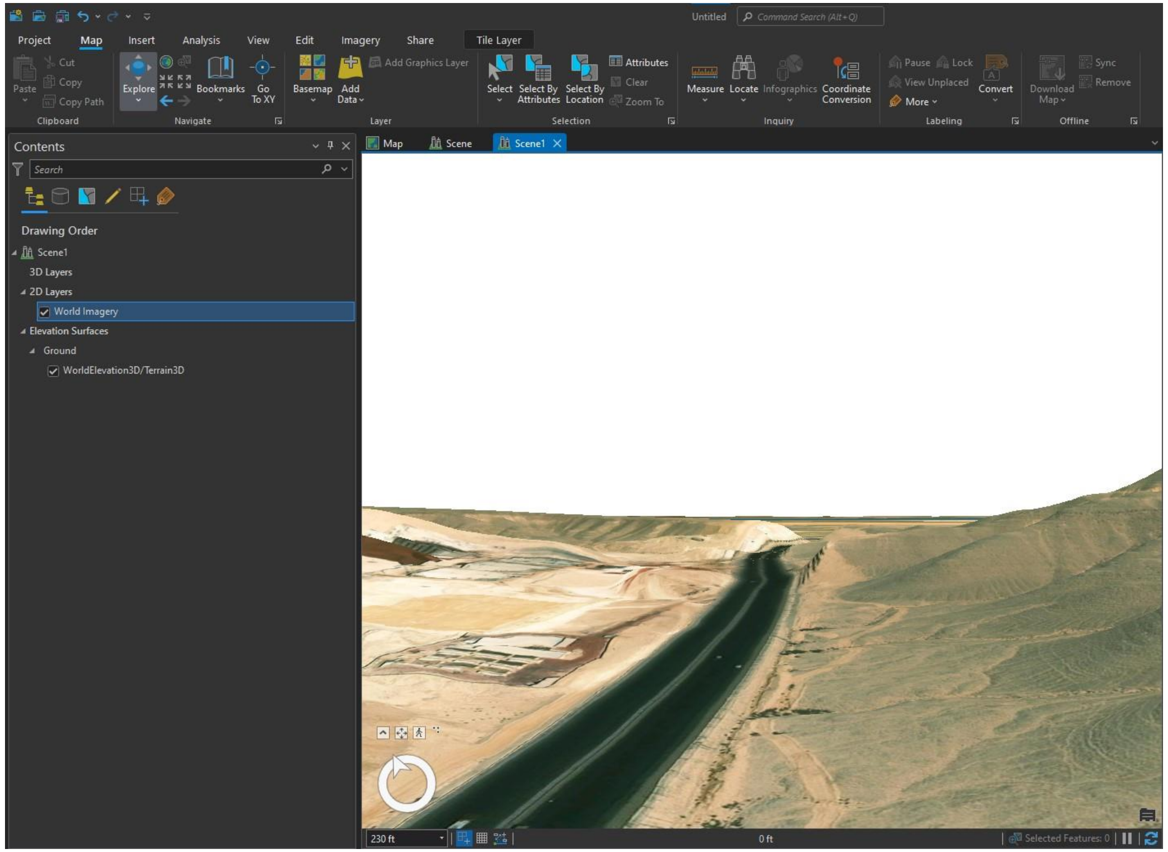
Hashim Mohsen
GIS Specialist

Geographic Information Systems:

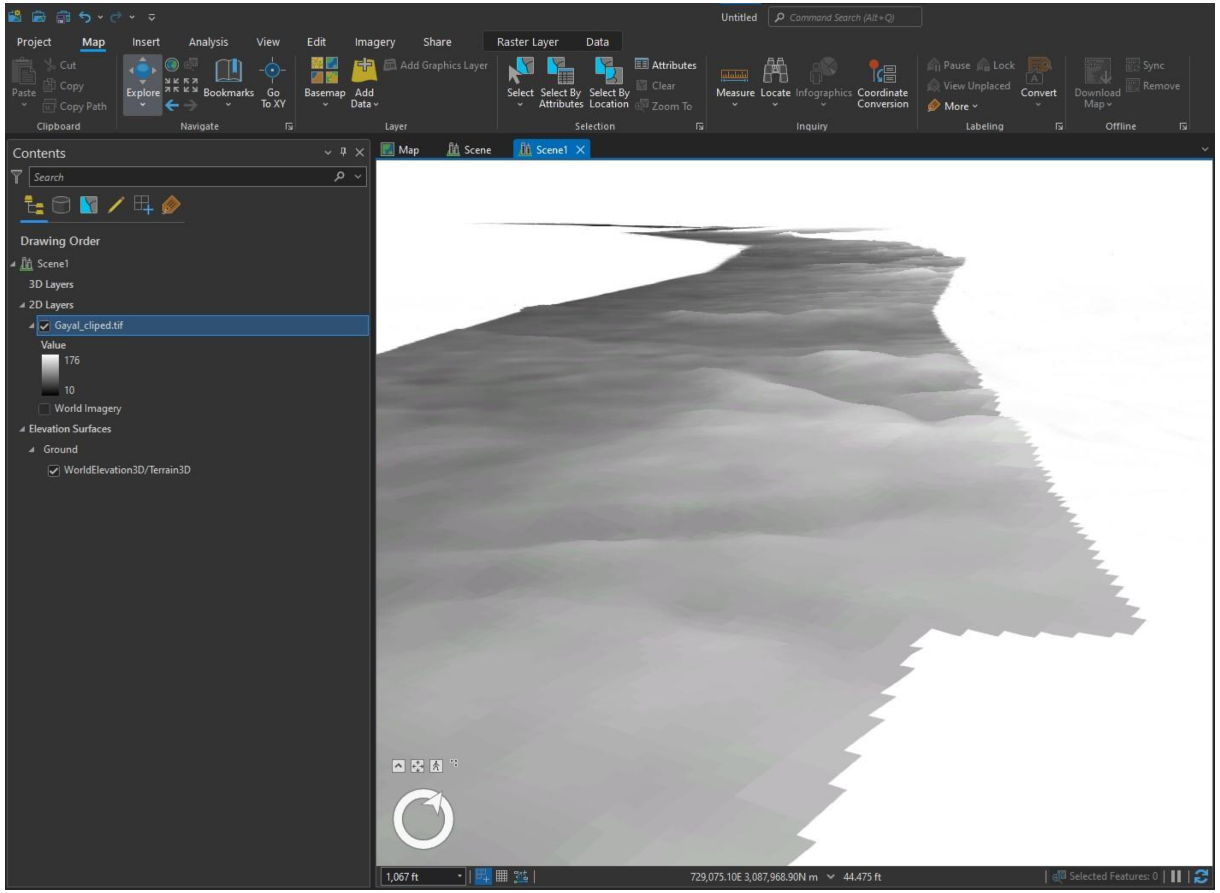
Geographic Information Systems (GIS) **is the science and technology concerned with the collection, input, processing, analysis, visualization, and output of geographic (spatial) and descriptive (attribute) data.**

The Importance of Geographic Information Systems (GIS) in the Engineering Field

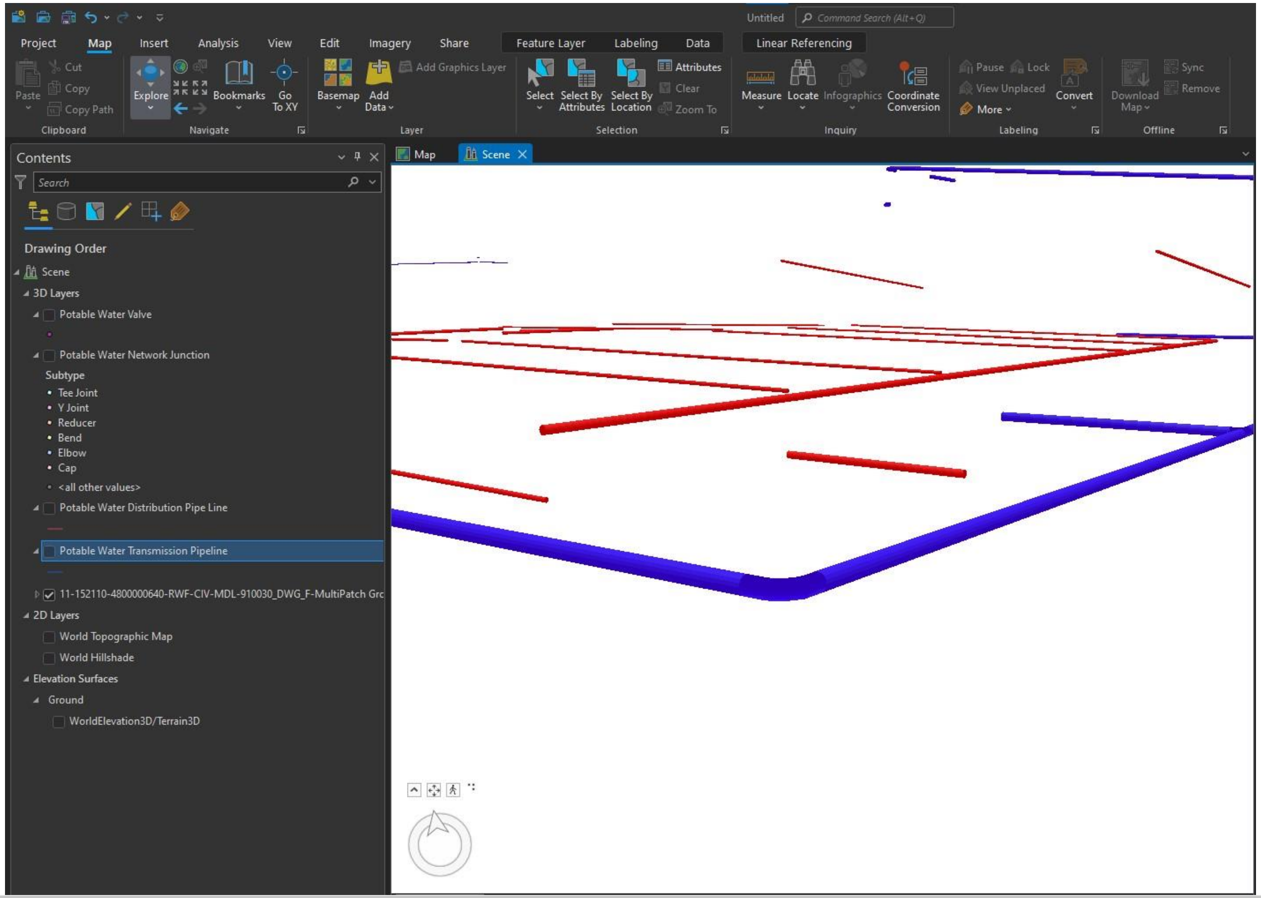
- **Infrastructure Planning and Design:**
  GIS provides accurate spatial data for designing roads, bridges, utilities, and buildings, helping engineers make informed decisions.

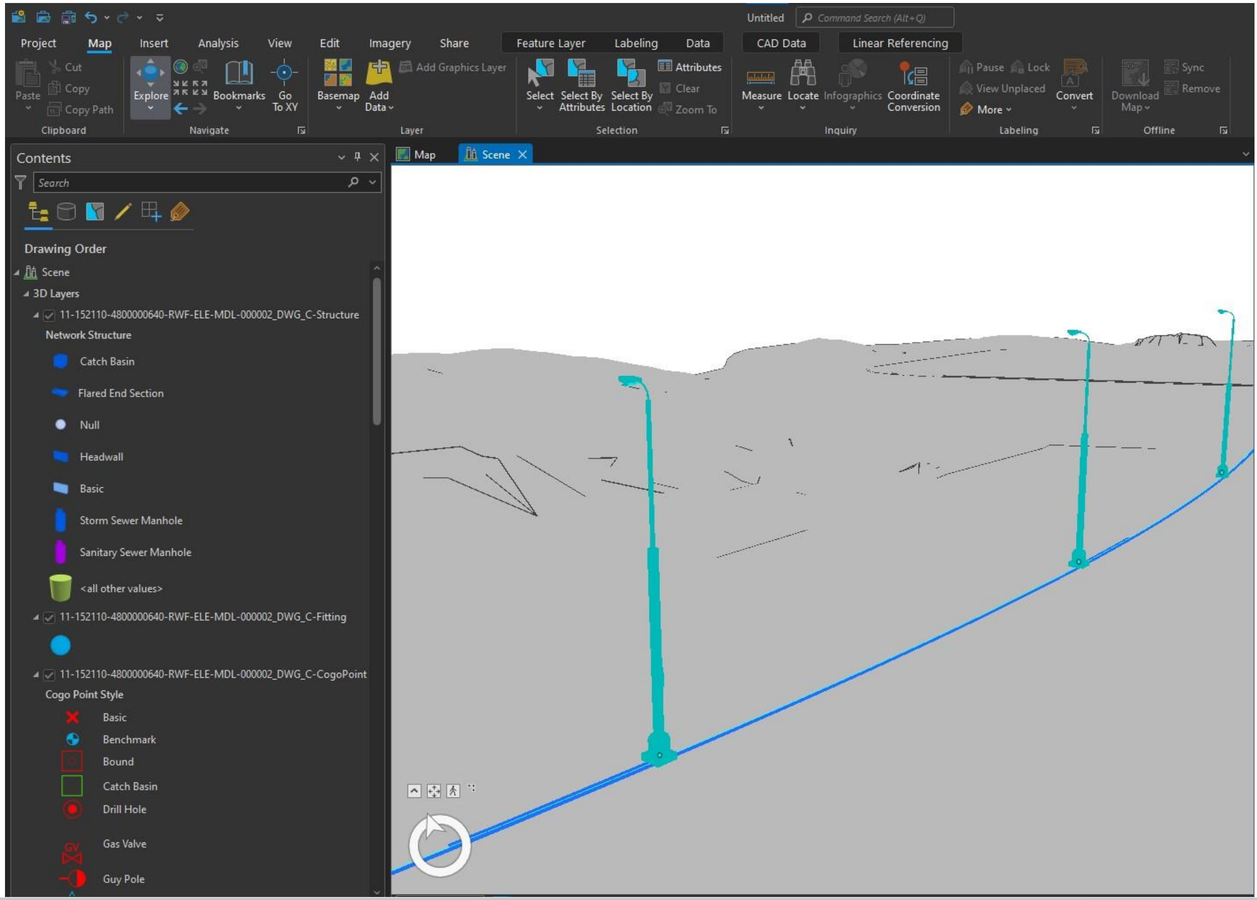


- **Site Selection and Analysis:**
  Engineers use GIS to analyze terrain, soil conditions, land use, and environmental constraints to choose optimal project locations.



- **Utility and Network Management:**
  It supports the planning, monitoring, and maintenance of utility networks such as water, electricity, sewage, and telecommunications.





- **Construction Management:**
  GIS aids in project scheduling, progress tracking, and resource allocation, improving efficiency and reducing costs.

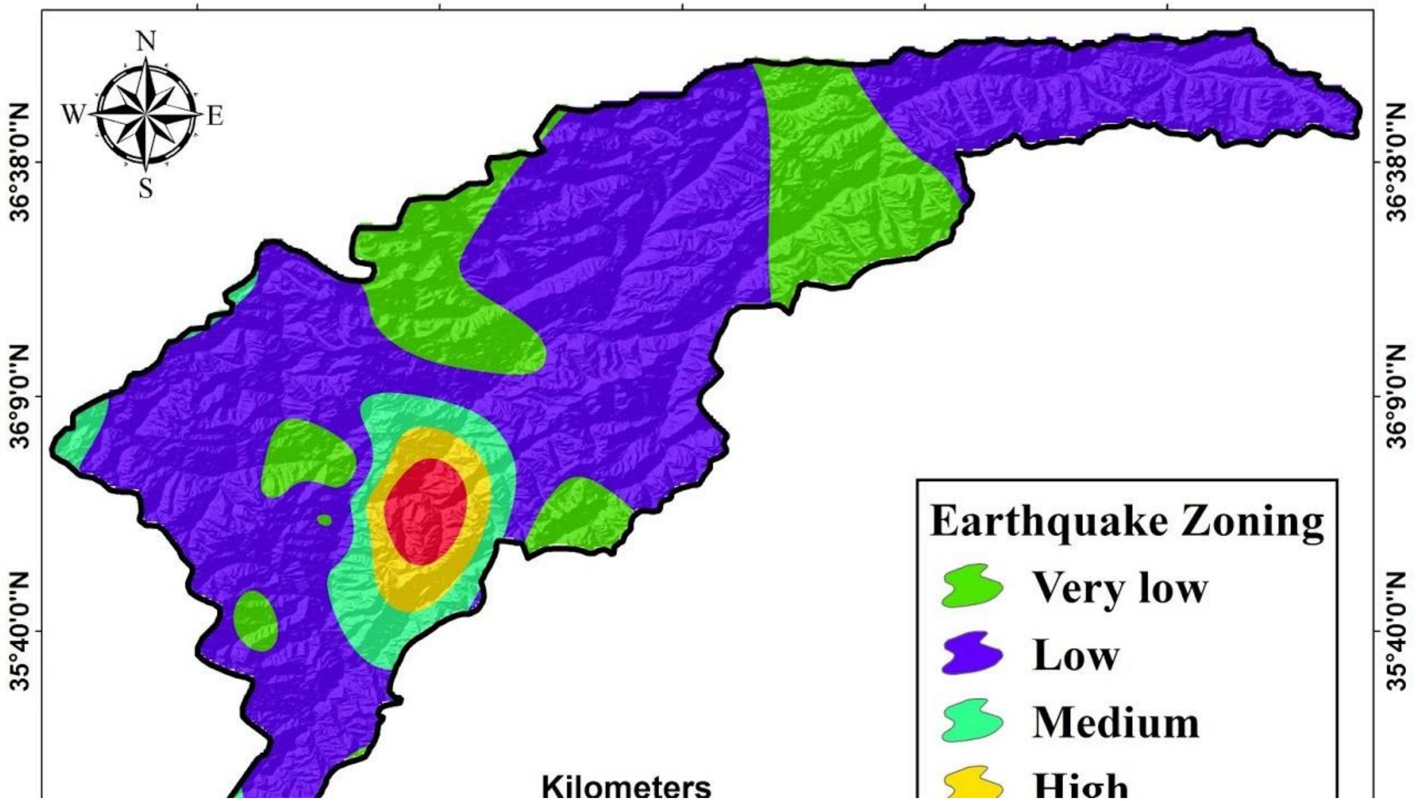
us_sewer_manhole

Field: Add Calculate Selection: Select By Attributes Zoom To Switch Clear Delete Copy

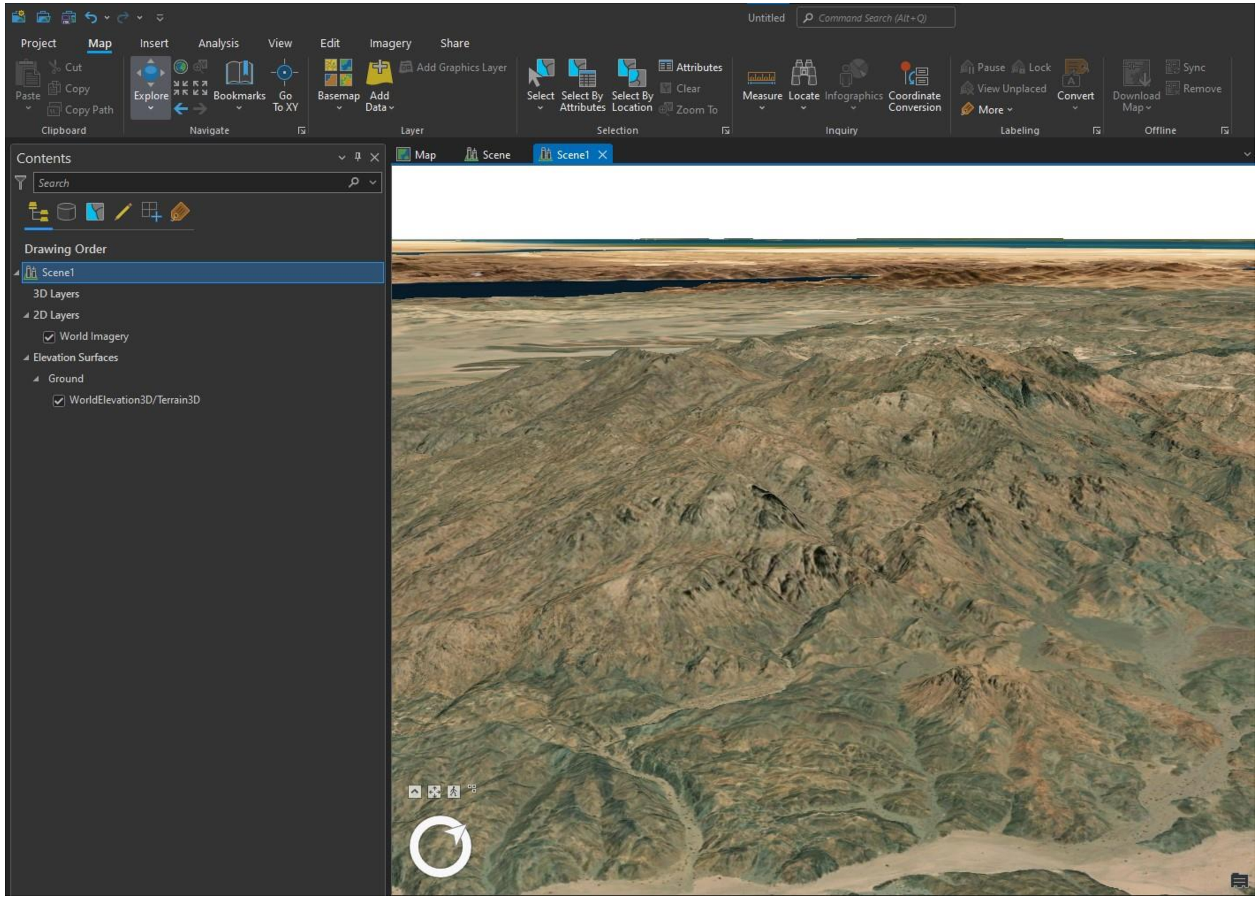
	comments	in_service_date	out_service_date	in_out_service_id	manhole_type_shape_id	manhole_cover_type_id	manhole_cover_material_type_id	acud_asse
1	مطبق صرف صحي دائري	1/4/2021	<Null>	In	Circular	Circular	dci	<Null>
2	مطبق صرف صحي دائري	1/4/2021	<Null>	In	Circular	Circular	dci	<Null>
3	مطبق صرف صحي دائري	1/4/2021	<Null>	In	Circular	Circular	dci	<Null>
4	مطبق صرف صحي دائري	1/4/2021	<Null>	In	Circular	Circular	dci	<Null>
5	مطبق صرف صحي دائري	1/4/2021	<Null>	In	Circular	Circular	dci	<Null>
6	مطبق صرف صحي دائري	1/4/2021	<Null>	In	Circular	Circular	dci	<Null>
7	مطبق صرف صحي دائري	1/4/2021	<Null>	In	Circular	Circular	dci	<Null>
8	مطبق صرف صحي دائري	1/4/2021	<Null>	In	Circular	Circular	dci	<Null>
9	مطبق صرف صحي دائري	1/4/2021	<Null>	In	Circular	Circular	dci	<Null>
10	مطبق صرف صحي دائري	1/4/2021	<Null>	In	Circular	Circular	dci	<Null>
11	مطبق صرف صحي دائري	1/4/2021	<Null>	In	Circular	Circular	dci	<Null>
12	مطبق صرف صحي دائري	1/4/2021	<Null>	In	Circular	Circular	dci	<Null>
13	مطبق صرف صحي دائري	1/4/2021	<Null>	In	Circular	Circular	dci	<Null>
14	مطبق صرف صحي دائري	1/4/2021	<Null>	In	Circular	Circular	dci	<Null>
15	مطبق صرف صحي دائري	1/4/2021	<Null>	In	Circular	Circular	dci	<Null>
16	مطبق صرف صحي دائري	1/4/2021	<Null>	In	Circular	Circular	dci	<Null>
17	مطبق صرف صحي دائري	1/4/2021	<Null>	In	Circular	Circular	dci	<Null>
18	مطبق صرف صحي دائري	1/4/2021	<Null>	In	Circular	Circular	dci	<Null>
19	مطبق صرف صحي دائري	1/4/2021	<Null>	In	Circular	Circular	dci	<Null>

- **Environmental Impact Assessment:**
  Engineers use GIS to study and minimize the environmental effects of construction and infrastructure projects.

- **Disaster Risk Reduction in Engineering Projects:**
  By analyzing natural hazards (like floods or earthquakes), GIS helps design safer structures and infrastructure.



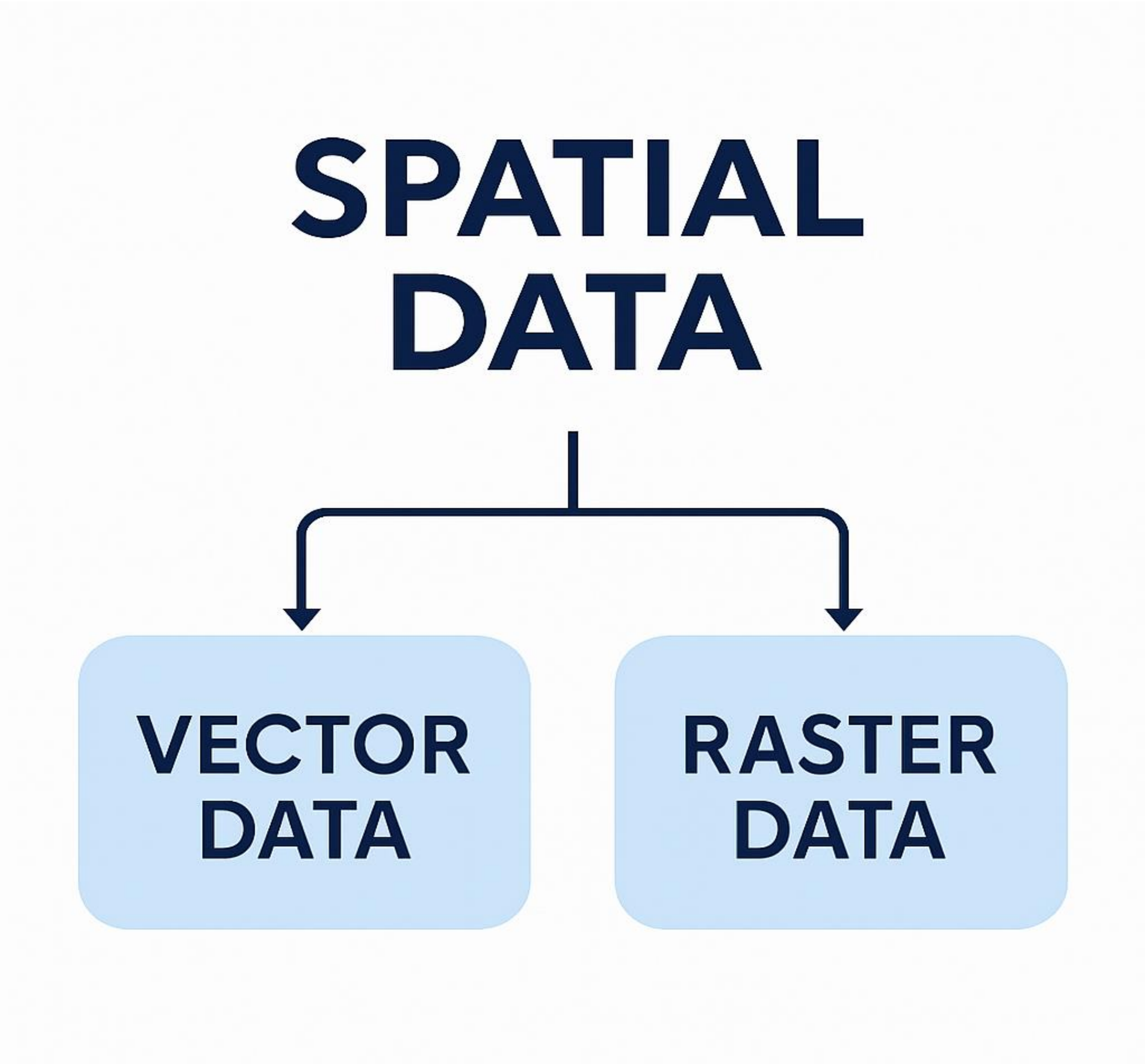
- **3D Modeling and Visualization:**
  GIS enables the creation of 3D terrain and infrastructure models, enhancing understanding and communication among stakeholders.



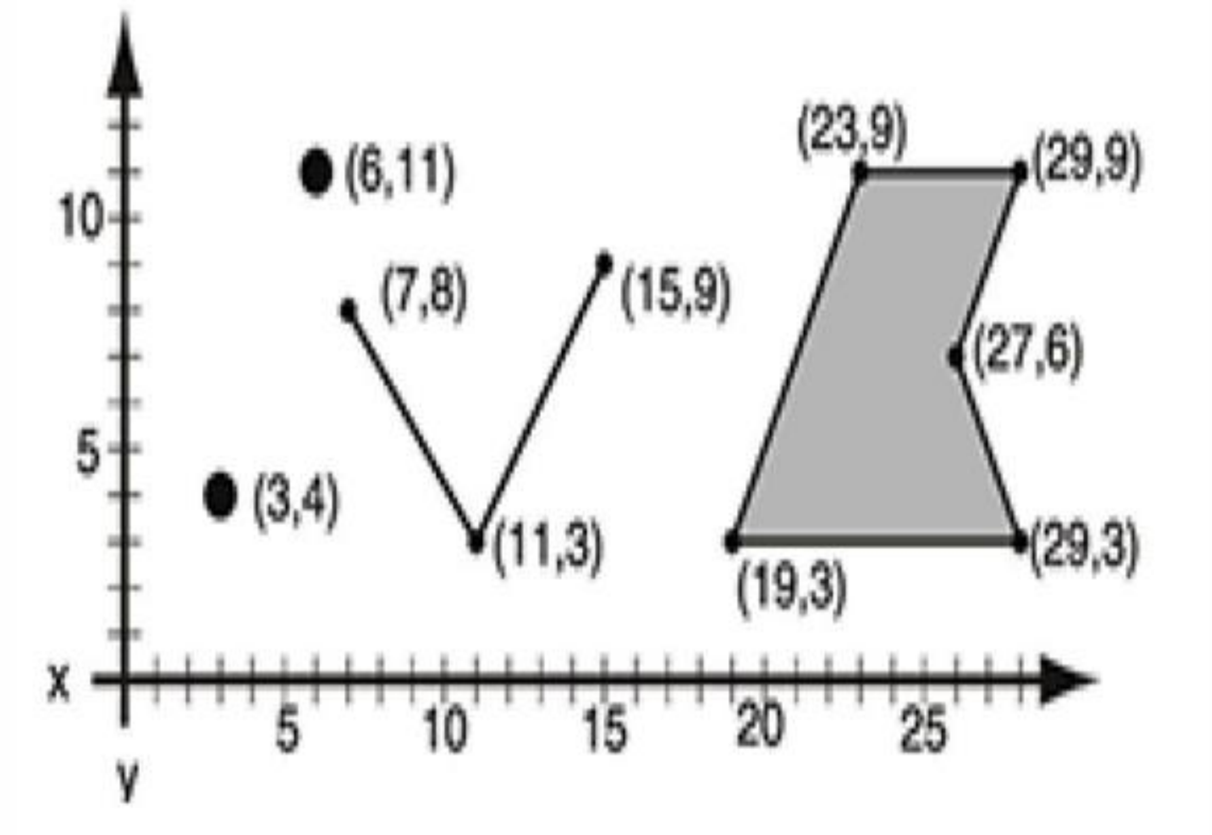
Types of Geographic Data

Spatial Data (Geographic Data)

This refers to data that has a geographic or spatial component, such as coordinates, shapes, and locations on the Earth's surface.

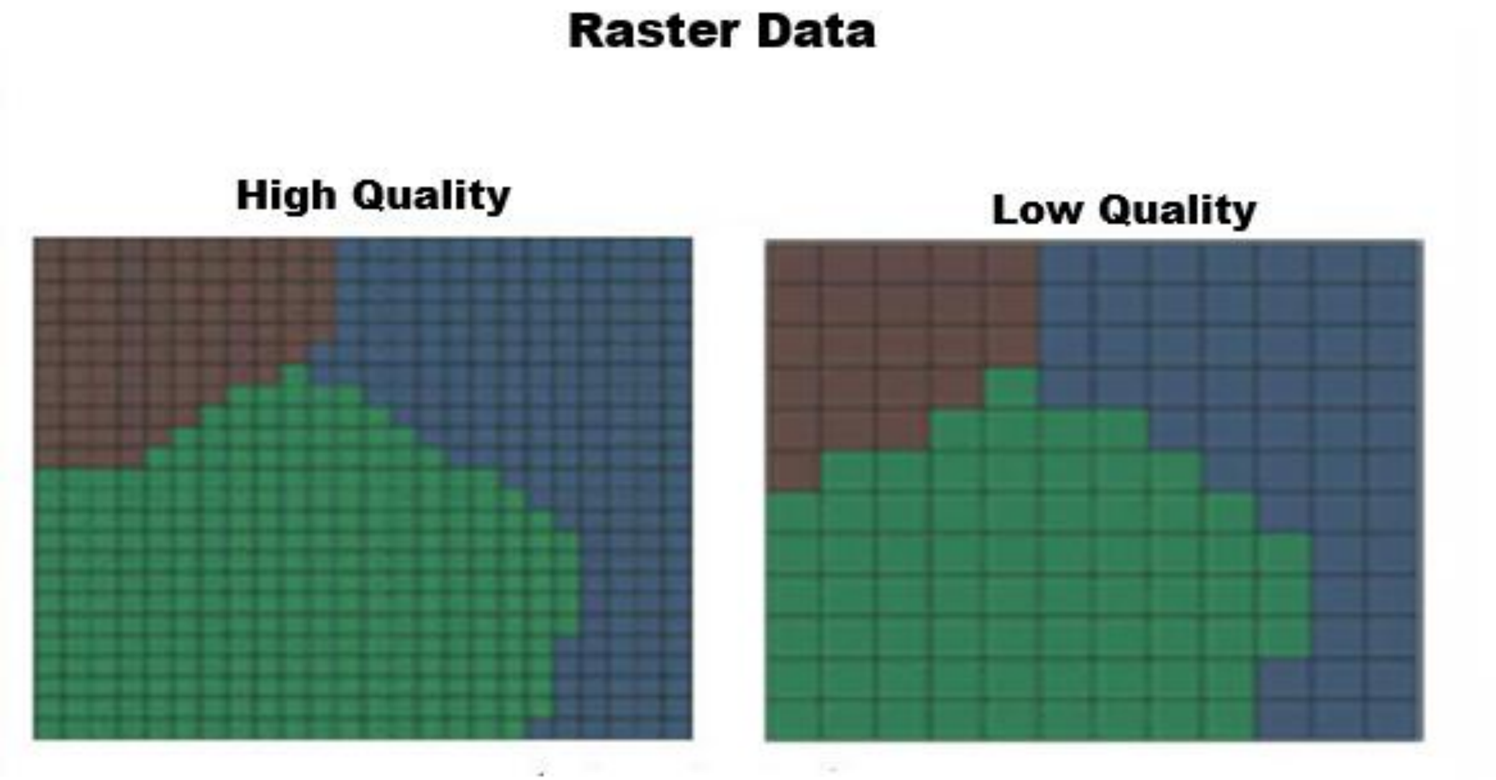

SPATIAL
DATA
VECTOR
DATA
RASTER
DATA

1. **Vector data:**
   Vector data represents spatial information using fundamental spatial elements known as features, which include points, lines, and polygons.



2. Raster data:

It refers to geographic data represented on a grid or a two-dimensional matrix of cells, each known as a pixel.



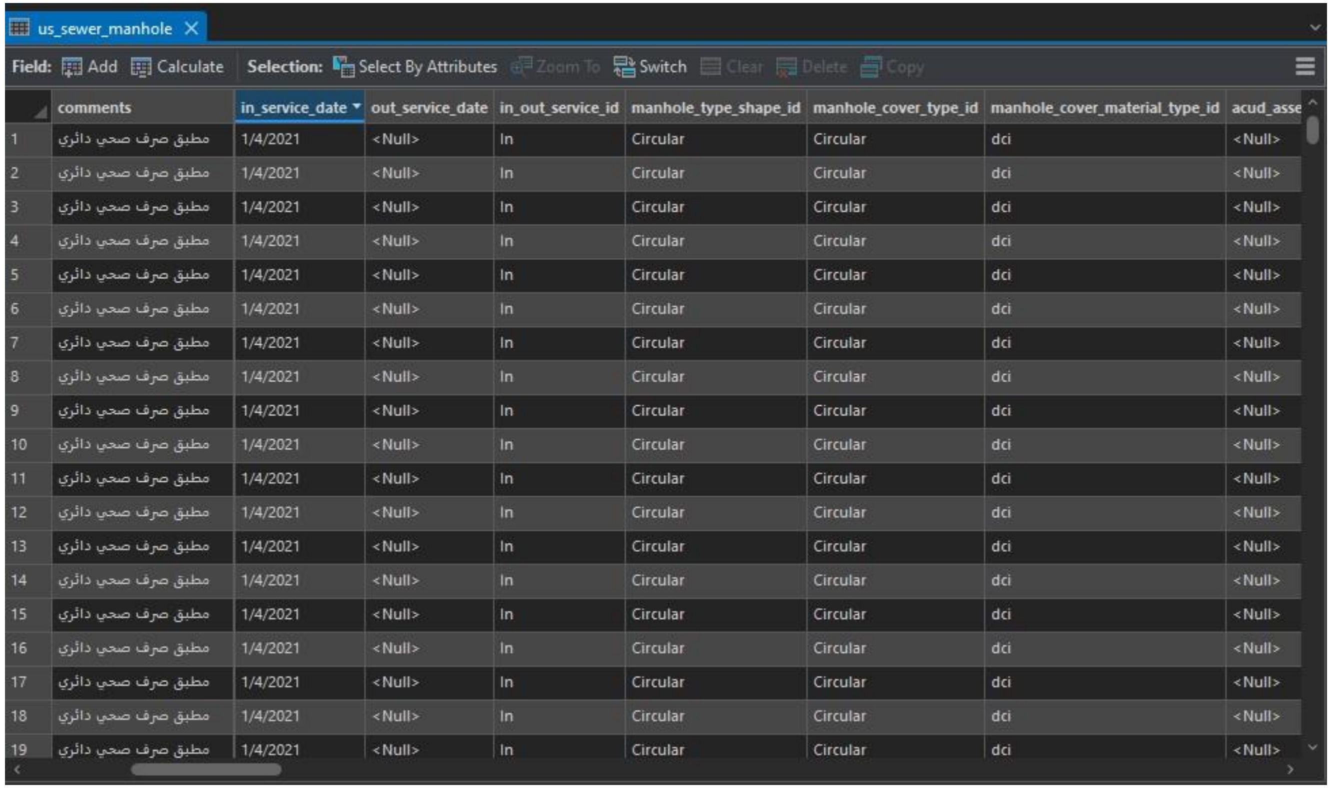
Professional Comparison: Vector vs. Raster Data

Aspect	Vector Data	Raster Data
Data Structure	Uses points, lines, and polygons	Uses a grid of cells (pixels)
Representation	Best for discrete features (e.g., roads, boundaries)	Best for continuous data (e.g., elevation, temperature)
File Size	Generally smaller and more efficient	Can be large, especially at high resolution
Resolution	Not fixed; based on geometry	Depends on pixel size
Data Accuracy	High spatial accuracy for feature boundaries	Accuracy depends on cell size
Attribute Data	Rich attribute tables linked to features	Usually limited to one value per pixel
Editing and Analysis	Easier to edit individual features	More suitable for complex spatial analysis
Examples	Roads, buildings, property parcels	Satellite imagery, land cover, elevation models
Common Formats	Shapefile (.shp), GeoJSON, GDB	GeoTIFF, IMG, GRID

- ## Attribute Data:

This data provides descriptive information about spatial features, such as characteristics, measurements, or classifications.

Examples: Valve Material, land use type, Pressure Rating, and Diameter.



	comments	in_service_date	out_service_date	in_out_service_id	manhole_type_shape_id	manhole_cover_type_id	manhole_cover_material_type_id	acud_asse
1	مطبق صرف صحي دائري	1/4/2021	<Null>	In	Circular	Circular	dci	<Null>
2	مطبق صرف صحي دائري	1/4/2021	<Null>	In	Circular	Circular	dci	<Null>
3	مطبق صرف صحي دائري	1/4/2021	<Null>	In	Circular	Circular	dci	<Null>
4	مطبق صرف صحي دائري	1/4/2021	<Null>	In	Circular	Circular	dci	<Null>
5	مطبق صرف صحي دائري	1/4/2021	<Null>	In	Circular	Circular	dci	<Null>
6	مطبق صرف صحي دائري	1/4/2021	<Null>	In	Circular	Circular	dci	<Null>
7	مطبق صرف صحي دائري	1/4/2021	<Null>	In	Circular	Circular	dci	<Null>
8	مطبق صرف صحي دائري	1/4/2021	<Null>	In	Circular	Circular	dci	<Null>
9	مطبق صرف صحي دائري	1/4/2021	<Null>	In	Circular	Circular	dci	<Null>
10	مطبق صرف صحي دائري	1/4/2021	<Null>	In	Circular	Circular	dci	<Null>
11	مطبق صرف صحي دائري	1/4/2021	<Null>	In	Circular	Circular	dci	<Null>
12	مطبق صرف صحي دائري	1/4/2021	<Null>	In	Circular	Circular	dci	<Null>
13	مطبق صرف صحي دائري	1/4/2021	<Null>	In	Circular	Circular	dci	<Null>
14	مطبق صرف صحي دائري	1/4/2021	<Null>	In	Circular	Circular	dci	<Null>
15	مطبق صرف صحي دائري	1/4/2021	<Null>	In	Circular	Circular	dci	<Null>
16	مطبق صرف صحي دائري	1/4/2021	<Null>	In	Circular	Circular	dci	<Null>
17	مطبق صرف صحي دائري	1/4/2021	<Null>	In	Circular	Circular	dci	<Null>
18	مطبق صرف صحي دائري	1/4/2021	<Null>	In	Circular	Circular	dci	<Null>
19	مطبق صرف صحي دائري	1/4/2021	<Null>	In	Circular	Circular	dci	<Null>

GIS Software Overview

ArcGIS Pro (Desktop / Enterprise)
Comprehensive analysis, data management, mapping tools

QGIS (Desktop / Open-Source)
Open-source, extensible, plugin support, data management

Google Earth Pro (Desktop / Open-Source)
Cloud-based environmental analysis, remote sensing

MapInfo Professional (Desktop)
Data analysis, mapping, and geospatial tools for business use

Global Mapper (Desktop)
Supports many data formats, terrain analysis, powerful tools, user-friendly UI

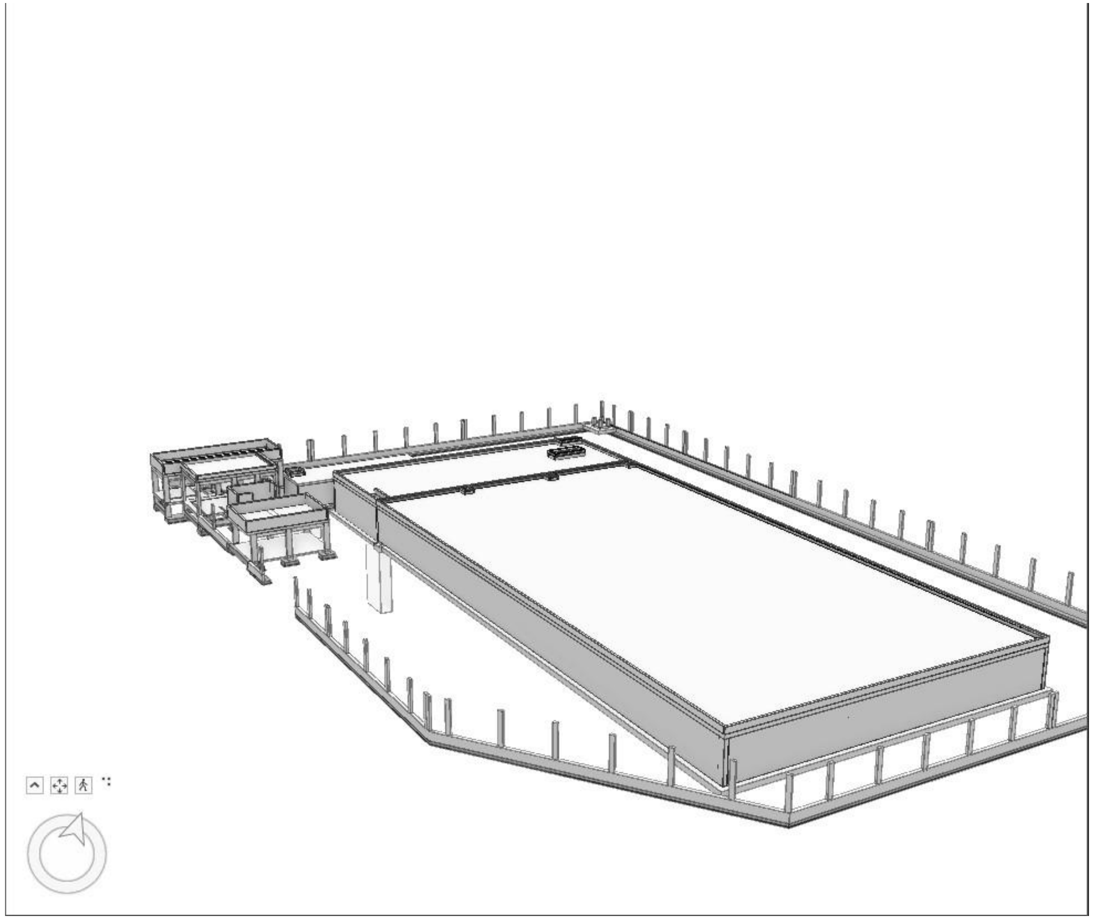
Integration GIS AND BIM

Integration of GIS and BIM refers to the process of combining the capabilities of GIS and BIM to enhance data sharing, improve spatial accuracy, and streamline project planning, design, and construction processes. While GIS typically deals with geographic data and spatial analysis, BIM focuses on detailed modeling of a building or infrastructure. When integrated, these systems can provide a more comprehensive, accurate, and efficient way of managing construction and infrastructure projects.

Key Benefits of GIS and BIM Integration

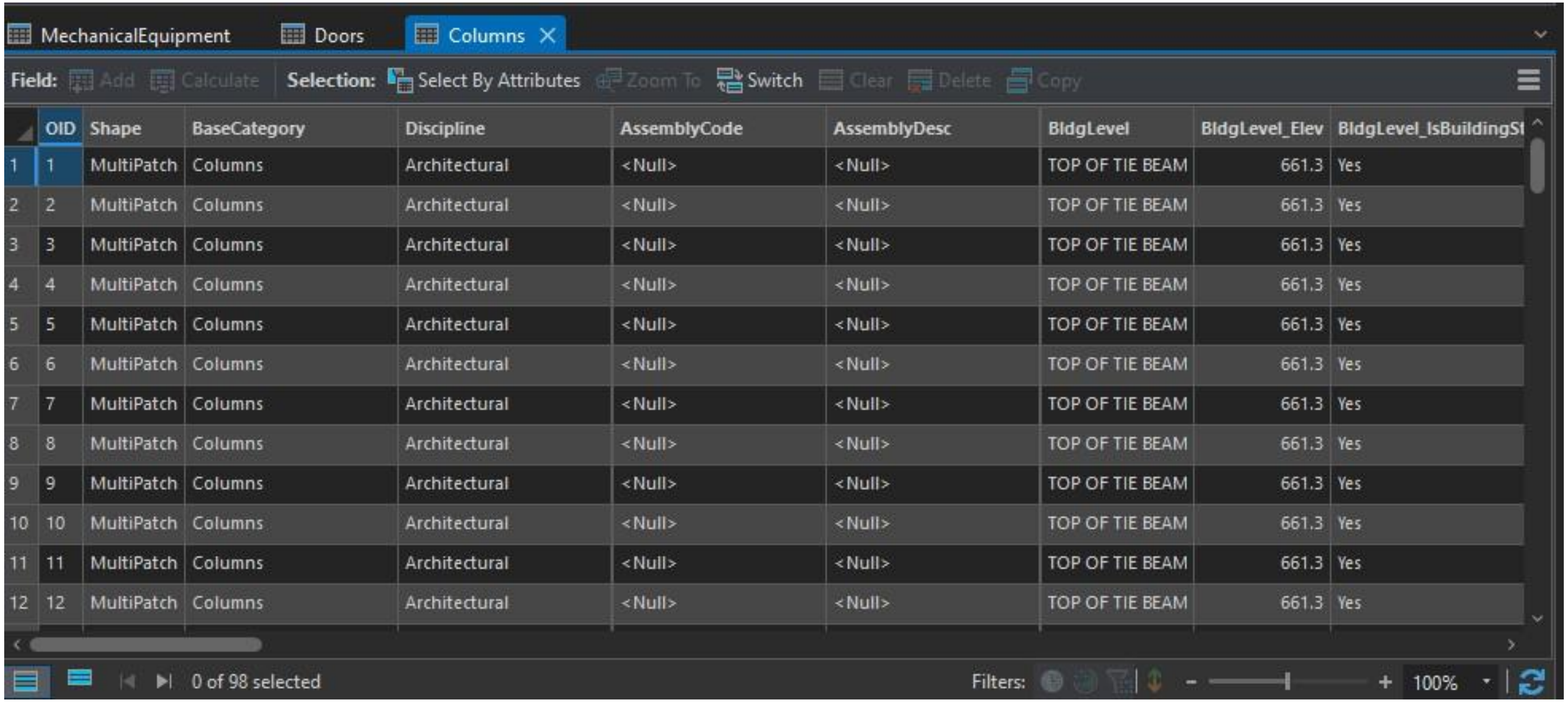
1. Enhanced Data Visualization:

GIS provides geospatial context (location, topography, environmental factors) while BIM offers detailed information about physical assets (design, materials, systems). Together, they create a more complete and visual understanding of the project.



2. Improved Collaboration:

Both disciplines typically involve multiple stakeholders. Integrating GIS and BIM allows all involved parties planners, architects, engineers, and contractors to work with the same accurate data, improving collaboration and reducing errors.



	OID	Shape	BaseCategory	Discipline	AssemblyCode	AssemblyDesc	BldgLevel	BldgLevel_Elev	BldgLevel_IsBuildingSt
1	1	MultiPatch	Columns	Architectural	<Null>	<Null>	TOP OF TIE BEAM	661.3	Yes
2	2	MultiPatch	Columns	Architectural	<Null>	<Null>	TOP OF TIE BEAM	661.3	Yes
3	3	MultiPatch	Columns	Architectural	<Null>	<Null>	TOP OF TIE BEAM	661.3	Yes
4	4	MultiPatch	Columns	Architectural	<Null>	<Null>	TOP OF TIE BEAM	661.3	Yes
5	5	MultiPatch	Columns	Architectural	<Null>	<Null>	TOP OF TIE BEAM	661.3	Yes
6	6	MultiPatch	Columns	Architectural	<Null>	<Null>	TOP OF TIE BEAM	661.3	Yes
7	7	MultiPatch	Columns	Architectural	<Null>	<Null>	TOP OF TIE BEAM	661.3	Yes
8	8	MultiPatch	Columns	Architectural	<Null>	<Null>	TOP OF TIE BEAM	661.3	Yes
9	9	MultiPatch	Columns	Architectural	<Null>	<Null>	TOP OF TIE BEAM	661.3	Yes
10	10	MultiPatch	Columns	Architectural	<Null>	<Null>	TOP OF TIE BEAM	661.3	Yes
11	11	MultiPatch	Columns	Architectural	<Null>	<Null>	TOP OF TIE BEAM	661.3	Yes
12	12	MultiPatch	Columns	Architectural	<Null>	<Null>	TOP OF TIE BEAM	661.3	Yes

3. Better Decision-Making:

The integration allows stakeholders to analyze the impact of design decisions on the environment, site conditions, and other spatial factors, helping to make informed decisions early in the project lifecycle.

4. Lifecycle Management:

GIS helps manage the broader environmental and spatial context of the project, while BIM focuses on the building or infrastructure's details. Integrating both systems supports better asset management, maintenance, and upgrades after construction, offering a holistic view of a project throughout its lifecycle.

5. Optimized Project Planning:

GIS can help in the early planning stages by analyzing environmental impacts, terrain, and surrounding infrastructure. BIM can be used to model the design in detail. Combined, they help in optimizing construction schedules, budgets, and resources.

6. Improved Infrastructure Management:

Post-construction, integrating GIS and BIM can help manage and maintain infrastructure, as BIM can track details like material specifications and asset conditions, while GIS provides context for monitoring the asset’s location and its interaction with other infrastructures (e.g., transportation, utilities).

AMC E-Learning

THANK YOU