Information Modeling Systems
BIM and Geotechnical Data

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Information Modeling / BIM

- Introduction
- Overview of the Traditional Geotechnical State of Practice
- Including Geotechnical data in BIM workflows
- Conclusion

Geotechnical Data Management and BIM

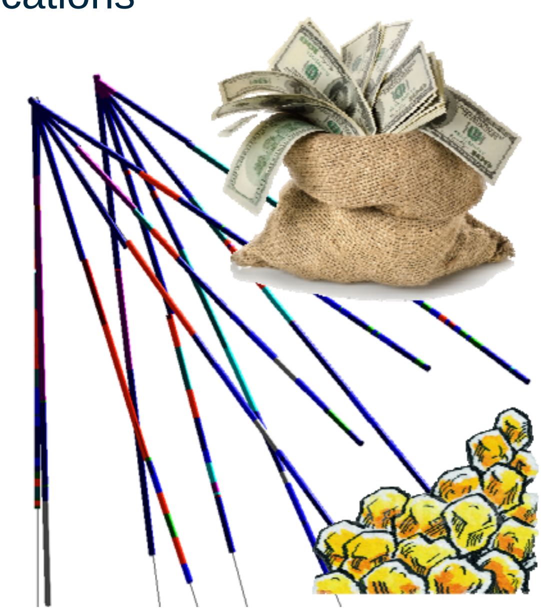
BIM, “Building **Information Modeling** “

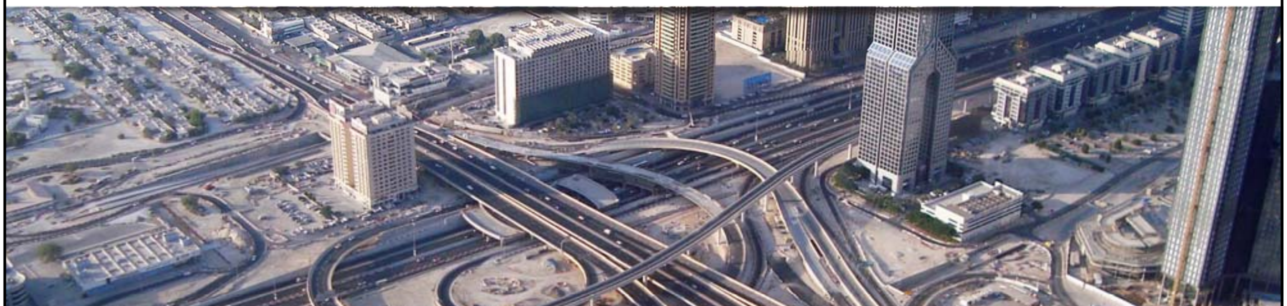
Building Information Modeling insures **sharing** data, it involves a framework that provides **collaboration**, **context** and continuity to the project.

Many organizations that rely on **subsurface** information **fail to integrate** this information in to a BIM model for lack of tools to easily transfer and integrate the data to the model.

BIM in geological and mining applications

- BIM has been around for years
- Borehole data is central
- Better definition is needed
- Interpretation is key





Traditional Geotechnical State of Practice

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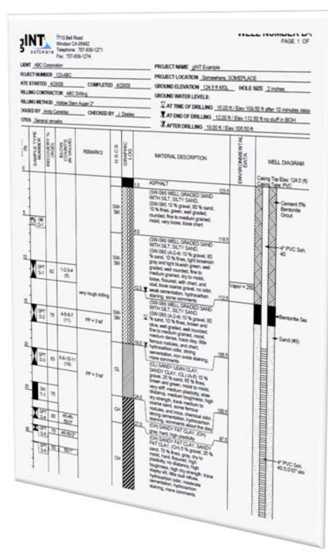
Traditional Geotechnical State of Practice : Report Driven

- Report Driven
  - Paper based
    - (digital paper, PDF)
  - Lag between drilling and report generation
    - (months)
  - Low reusability/manual data re-entry
  - End game is the report delivery



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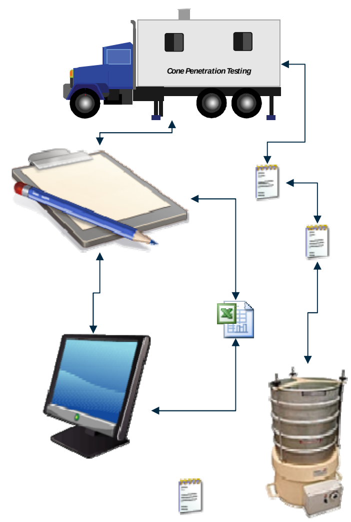
Unmanaged Data Approach

- Data is scattered throughout the organization
- Multiple data sources and multiple formats (paper, excel, etc.)
  - Field monitoring data and collection (handheld devices), lab Information, geophysics, environmental, hydrological, and more
- User must perform extensive manual validation
- Data redundancies
  - Entered three different times for three different reports (borehole, section, lab report)
- Lack of interoperability with other software (GIS, Civil, etc.)
- Scalability issue
- “Manageable” as long as the end game is the report



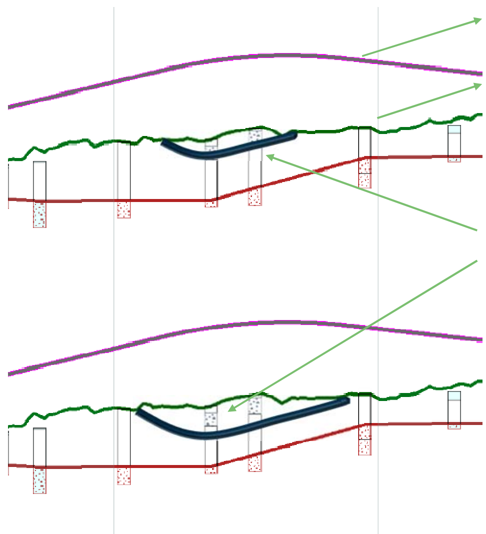
Unmanaged Data Approach : Comments

- “*Some of my geotechnical data is in an user-defined database and some in Excel files, and some even on paper*”.
- “*We use different software for collecting data, another for lab testing and another for reporting*”.
- “*We require different reports: numerical and graphical, for what sometimes we need to reenter data*”.
- ***“I take as few boring jobs as I can as it is tedious to draw logs manually ”.***

Subsurface Interpretation

- Geotechnical Models:

- Created from local point data
- For large areas
- High level of unknown
- Interpretation difficulty depending on geology
- "Partial survey"
- Surprises !

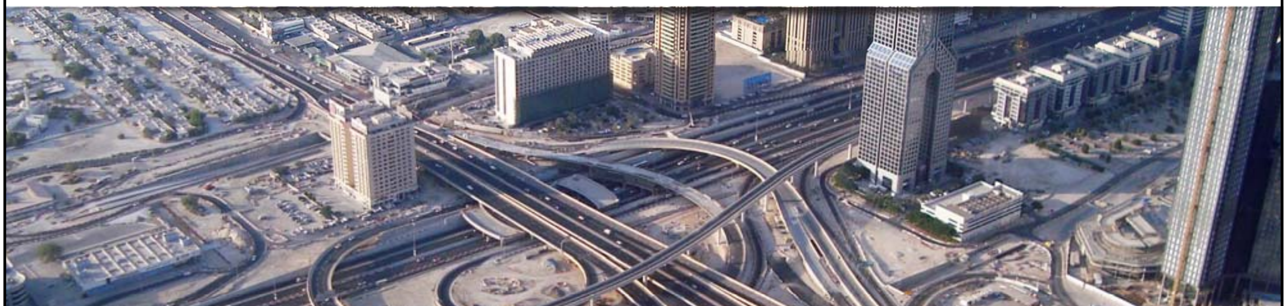


Traditional Geotechnical State of Practice and BIM

- Geotechnical subsurface data stored in "paper format" or multiple sources

- No single source of truth that can be queried by other systems

- Subsurface interpretation



Including Geotechnical Data in to BIM

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Digital Data : Centralized Database

- – For data storage
- – For data validation
- – For data querying
- – For data reporting
- – Data sharing with other programs
- – Can be supported by interoperability standards (DIGGS, AGS4)

- Need for a single source of truth : one data store, many uses

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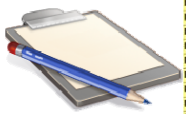
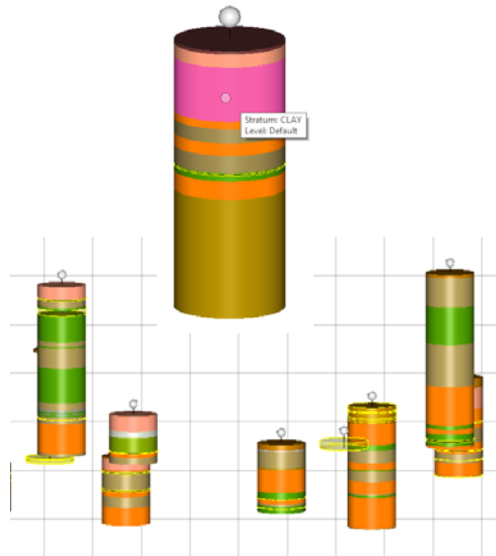
Digital Data: Paper to Database, Database to Models



Hole ID	Type	Date Started (dd/mm/yyyy)	Date Completed (dd/mm/yyyy)	Local X (m)	Local Y (m)	Local Z (m)	Final Depth (m)
BH37	RC	10/1/1996	10/2/1996	31149.12	12398.80	237.3349670	10.25
BH38	RC	1/23/1997	1/26/1997	31099.25	12422.11	245.0492368	20.00
BH39	RC	1/27/1997	1/29/1997	31023.99	12422.26	262.1024753	25.00
BH40	CP+RC	11/29/1996	12/4/1996	31010.68	12372.64	272.7349314	15.00
BH41	RC	12/5/1996	12/5/1996	30970.56	12373.69	272.9574418	3.31
BH42	RC	12/5/1996	12/12/1996	30970.56	12373.69	272.9574418	15.00
BH43	RC	9/24/1996	9/30/1996	30891.65	12432.63	269.9964031	25.10
BH44	CP	9/24/1996	9/25/1996	30837.01	12436.47	275.1481336	1.30
BH45	CP	9/25/1996	9/25/1996	30837.01	12436.47	275.1481336	3.38
BH46	RC	10/2/1996	10/3/1996	30837.01	12436.47	275.1481336	9.46
BH47	RC	1/15/1997	1/20/1997	30837.01	12436.47	275.1481336	35.00
BH48	CP+RC	9/23/1996	9/26/1996	30869.96	12367.26	297.8937829	15.10
BH49	RC	10/1/1996	10/2/1996	30809.01	12377.77	292.3013887	10.00
BH50	CP+RC	12/9/1996	1/14/1997	30744.12	12412.70	270.4929268	30.35
BH51	CP+RC	12/10/1996	1/11/1997	30708.37	12395.44	264	30.35
BH52	CP+RC	12/4/1996	1/8/1997	30620.23	12392.58	296.3300577	24.65
BH53	CP+RC	9/20/1996	10/11/1996	30532.20	12350.90	292.7634905	11.00
BH54	RC	10/8/1996	10/16/1996	30532.20	12350.90	292.7634905	30.15
BH55	CP+RC	9/20/1996	10/21/1996	30511.81	12345.30	289.4038521	20.80
BH56	CP+RC	9/22/1996	10/14/1996	30471.00	12334.85	293.3918984	35.00
BH57	CP+RC	9/21/1996	10/20/1996	30436.65	12324.26	292.2586770	30.00
BH58	CP+RC	9/26/1996	10/23/1996	30416.30	12332.16	303.3694834	20.31
BH59	RC	10/29/1996	11/2/1996	30385.25	12311.07	301.4364342	25.14



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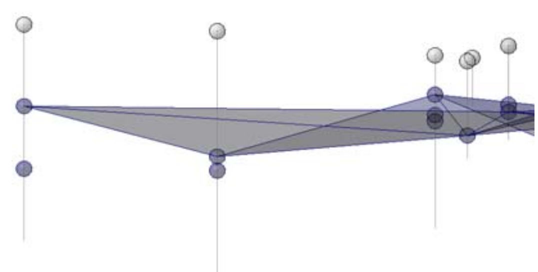
Database to Models :
A geotechnical database is a “geospatial database”

Name	Northing	Easting	Elevation	Depth	Plunge
HB-01	3,969,743.83	230,968.77	44.63	67.00	-90.00
BH-17	3,969,588.34	231,521.37	44.85	67.00	-90.00
BH-04	3,970,151.55	230,894.08	40.62	73.50	-90.00
HB-10	3,971,292.18	231,658.19	38.19	69.90	-90.00

Borehole ID	Reading Event	Date/Time	Hours After	Depth Below Monitoring Point (ft)
BH-01	AD		24	4
BH-02	AD		24	4
BH-03	AD		24	4.2
BH-04	AD		24	4
BH-05	AD		24	4



- X, Y, Z (ground) + depth
- Water level depth

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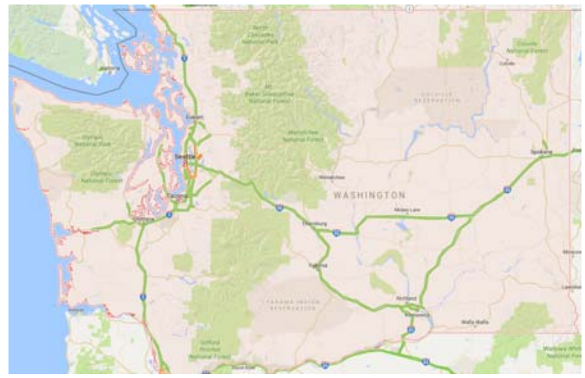
Example of a centralized database

Washington State DOT(WSDOT) consolidated multiple projects into a single database

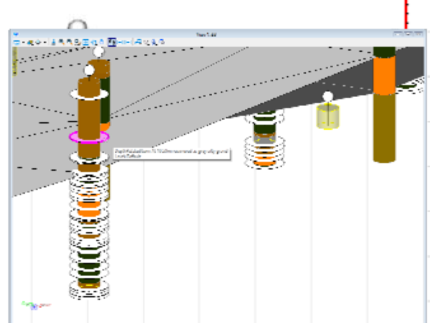
Legacy data available in a Web GIS.

Having all geotechnical data in one database allows for seamless geospatial integration



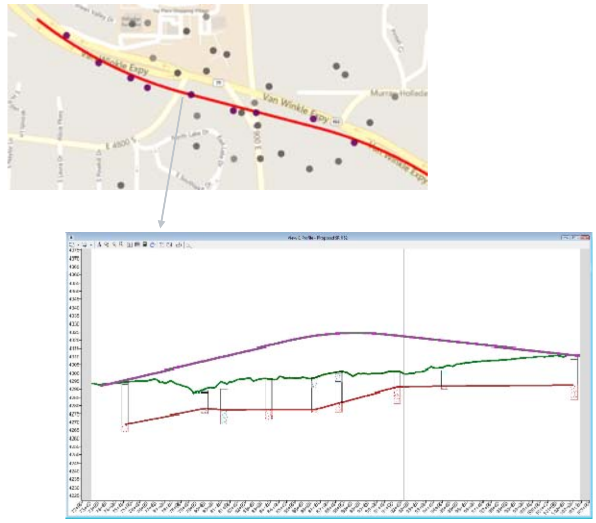
Displaying Geotechnical Models in Context

- Geotechnical database output :
  - 2d plans
  - Profiles
  - 3d models
  - Subsurfaces



Profile Views

- Dynamic profiles
- Borehole visualization plus surfaces
- Civil projects
- Surface interpretation
- “Browsing” tool for subsurface data



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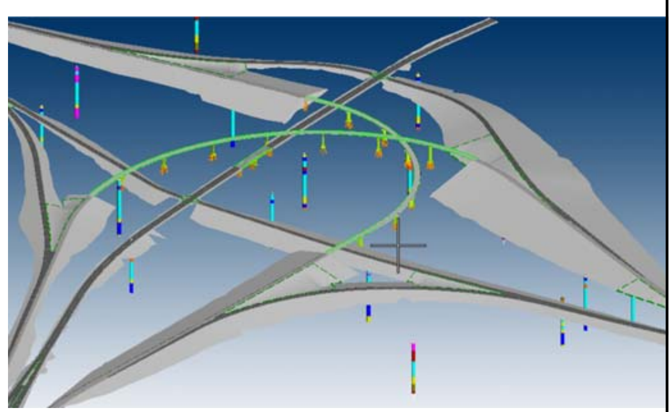
3d Models : Use of geotechnical data in infrastructure projects

- End game is the infrastructure design and construction
- Terrain
- 3D visualization of geotechnical data
- Overlay design plans to provide context view
- Data QA/analysis



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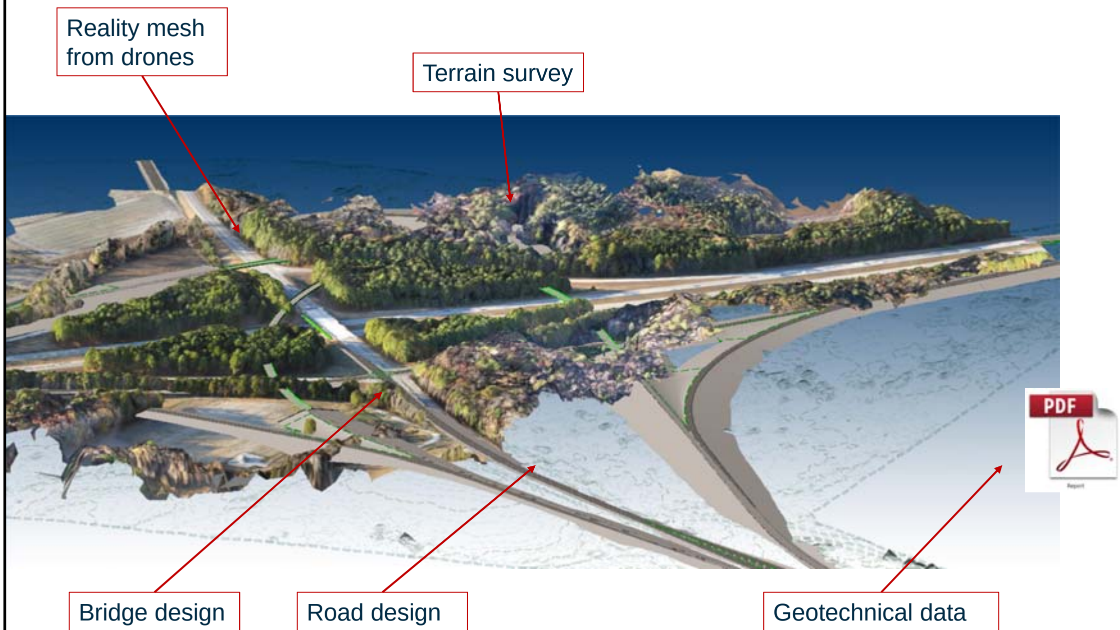

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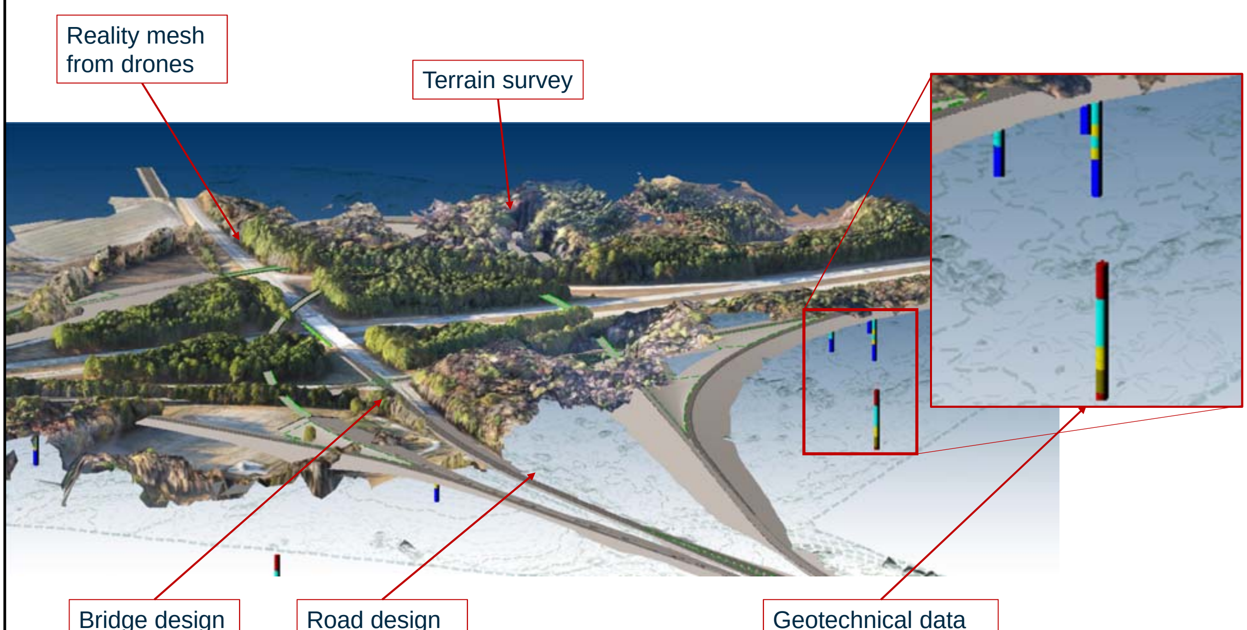

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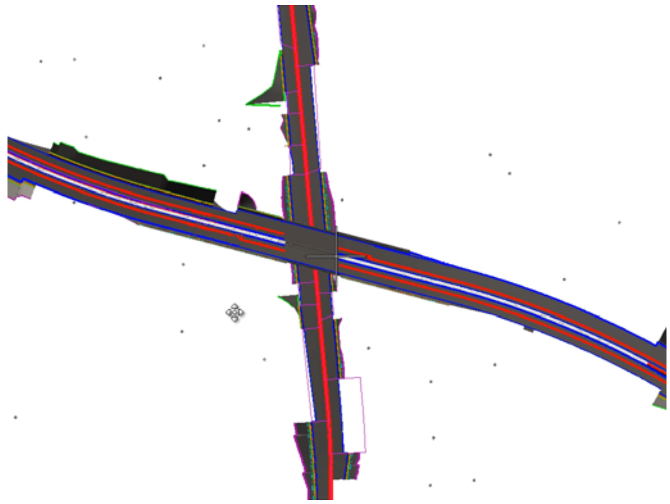
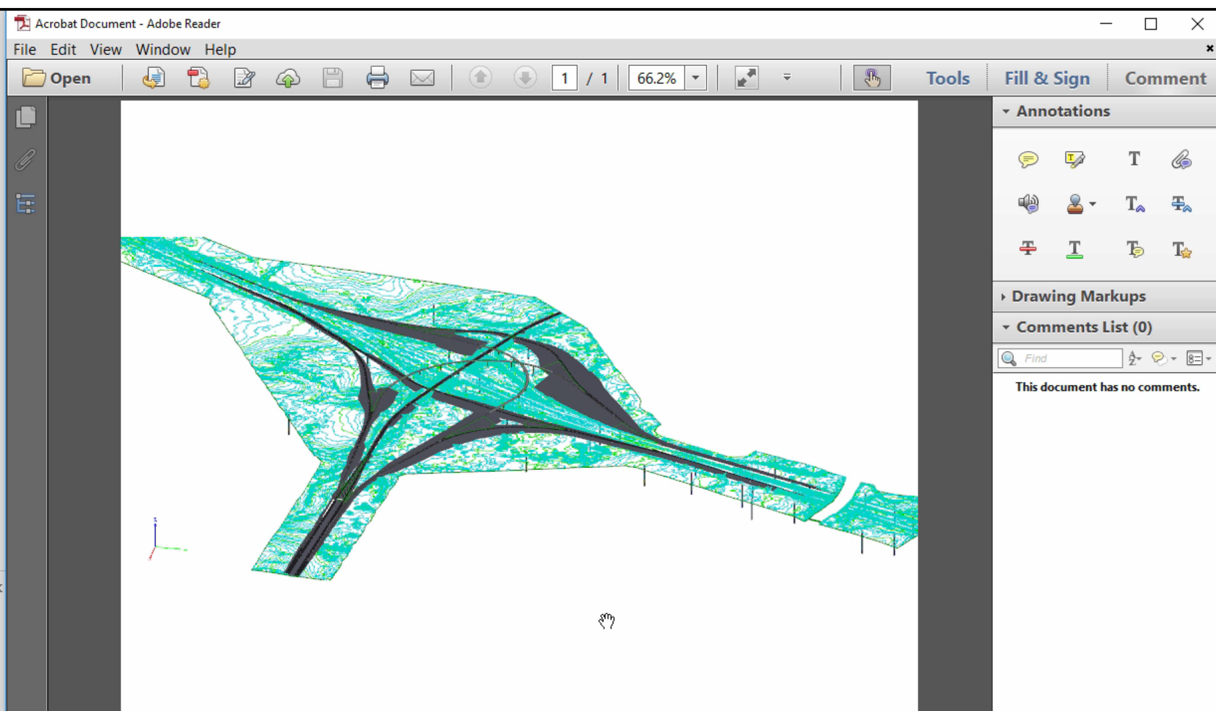
Subsurface : Layer Creation for BIM

- Sub surfaces needed for civil projects
- Gradual process
- “Imperfect interpretation” or “paper logs”





Conclusion

- 3D modeling/BIM is not an ‘if’ question but a ‘when’
- Geotechnical data must be stored in systems that are open for multiple uses rather than “just” the generation of a paper based reports.
- Using a single source of truth will address 2 of the 3 issues identified in the traditional geotechnical state of practice : **report driven** and **unmanaged data**.
- The liability/surprise aspect of the subsurface generation/interpretation remains in order to fully deploy BIM workflows; It can be managed

Thank You

Questions ?

Going Digital….