# Including Geotechnical Data in an OpenRoads Designer Model





# gINT Civil Tools At-A-Glance



# gINT Civil Tools: Standalone Application

- GIS and Mapping
   workflows
- Subsurface interpretation
- Simplified lithology



# Native Read/Write of gINT Projects

- Direct access to any gINT Access
   and SQL Server
- Mapping between gINT schema and gINT Civil Tool
- Settings saved in DGN file and DGN Library, and can be shared

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# Native Read/Write of gINT Projects

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Main Group	Rock Coring	Depth Doc	Field Testing	Monitoring Lab Time	Remarks 🚺	AGS 🚺 Site Maj	p Surfac
Project Ho	ole Samples	Strata Main	Strata Soil	Strata Rock Strata Details	Backfill		
[Ma	in Group]						
Hole I	D Туре	Date Started (dd/mm/yyyy)	Date Completed (dd/mm/yyyy	Local X (m) )	Local Y (m)	Local Z (m)	Final Depth (m)
BH1	RC	12/9/2011	12/9/2011	29563.92	12283.04	334.2633719	10.00
BH2	RC	11/22/1996	11/25/1996	31754.11	12625.37	203.5020308	20.10
BH3	CP	10/6/1996	10/6/1996	31757.99	12642.53	207.7561265	2.80
BH4	RC	11/27/1996	11/29/1996	31757.99	12642.53	207.7561265	30.10
BH5	CP+RC	11/17/1996	11/20/1996	31744.84	12617.09	202.8952942	25.65
BH6	CP	10/6/1996	10/6/1996	31733.05	12635.47	211.3060849	1.64
BH7	RC	11/11/1996	11/14/1996	31733.05	12635.47	211.3060849	
BH8	RC	11/14/1996	11/16/1996	31717.71	12602.48	203.9171226	
BH9	RC	10/29/1996	11/1/1996	31709.33	12623.46	214.3831528	
BH10	RC	11/8/1996	11/13/1996	31687.82	12587.65	207.7122538	
BH11	CP+RC	10/4/1996	10/23/1996	31671.69	12614.08	226.7977796	20.40
BH12	RC	11/4/1996	11/7/1996	31655.64	12575.90	223.0101711	25.20
BH13	RC	10/15/1996	10/17/1996	31645.74	12595.36	229.8863434	12.50
BH14	RC	10/23/1996	10/28/1996	31645.74	12595.36	229.8863434	20.00
BH15	RC	10/30/1996	11/3/1996	31628.77	12566.66	226.8168399	25.50
BH16	CP	10/7/1996	10/7/1996	31614.31	12586.22	234.1574465	2.10
BH17	RC	11/16/1996	11/21/1996	31614.31	12586.22	234.1574465	20.00
BH18	RC	10/22/1996	10/28/1996	31602.95	12561.89	230.2289278	29.85
BH19	CP+RC	10/3/1996	10/20/1996	31593.54	12571.26	236.0963212	25.60
BH20	RC	10/10/1996	10/16/1996	31572.02	12555.91	237.0019073	20.00
BH21	CP+RC	10/4/1996	10/18/1996	31539.99	12518.19	232.2687919	30.10
BH22	RC	10/18/1996	10/20/1996	31510.21	12508.89	241.9942571	20.20

Direct read of gINT Projects minimizes using old data and reduces opportunity for data entry errors



## Subsurface data model : PointID

Hole ID	Туре	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
8H38	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
8H46	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
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BH52	CP+RC	12/4/1996	1/8/1997	30620.23	12392.58	296.3300577	24.65
PU52	CP.PC	9/20/1996	10/11/1996	20522.20	12250.90	292 7624905	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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	Borehole		*
	Name	BH52	
	> Тор	30620.22933000002,12	2392
	Depth	24.650m	
	Diameter	10.000m	
	CustomProperties		
	IsNew	False	
	IsModified	False	

# Subsurface data model : Top-Bottom

Top (m)	Base (m)	Description	Legend
0.00	0.30	TOPSOIL	TOPSOIL
0.30	1.50	Soft to firm yellow and orange brown and grey mottled slightly sandy (fine) silty CLAY with occasional angular fine to medium gravel.	CLAY si sa gr co
1.50	6.50	Very stiff dark brown mottled grey slightly sandy (fine to coarse) silty CLAY with some to much angular to subangular fine to coarse gravel and cobbles of sandstone and quartzite.	CLAY si sa gr co
6.50	7.20	Grey fine and medium grained very thinly to thinly bedded slightly weathered	SANDSTONE
		SANDSTUNE_strong to very strong. Prominent discontinuities: 1) Bedding fractures: subhorizontal (5? to 15?) planar_rough_clean_orange brown stained. 2) Subvertical (70? to	
7.20	8.50	Grey thinly to medium bedded slightly weathered CONGLOMERATE, strong to very strong comprising subangular to subrounded up to coarse gravel sized clasts of quartz with a little to some matrix of fine to coarse grained sandstone. Prominent discontinuities: 1) Bedding	CONGLOMERATE
8.50	9.65	Grey brown fine to medium grained medium bedded slightly weathered SANDSTONE, strong and very strong. Prominent discontinuities: 1) Bedding fractures: 15? to 20?, planar, rough, clean, slightly orange brown stained. 2) Very closely to closely	SANDSTONE
9.65	11.25	Grey thinly to medium bedded slightly weathered CONGLOMERATE.strong to very strong comprising subangular to subrounded up to coarse gravel sized clasts of predominantly quartz with a little to some matrix of fine to coarse grained sandstone. Prominent	CONGLOMERATE
11.25	11.35	Grey slightly weathered SILTSTONE, weak to predominantly moderately weak with very closely to closely spaced randomly orientated and subhorizontal (0? to 20?) planar and irregular, smooth, clean discontinuities.	SILTSTONE
11.35	11.50	AZCL	Unknown
11.50	12.00		SILTSTONE
12.00	13.70	Grey fine to medium grained thinly to thickly bedded slightly weathered SANDSTONE,strong to extremely strong. Prominent discontinuities: 1) Bedding fractures: subhorizontal (S? to 20?) planar and irregular,rough,clean. 2) Subvertical (70? to 80?) irregular,rough,locally	SANDSTONE
13.70	24.65	Grey fine to medium grained thinly to thickly bedded slightly to moderately weathered crystalline LIMESTONE,strong to very strong with occasional sand to coarse gravel sized voids (occasionally infilled with quartz and calcite mineralisation). Locally discoloured brown	LIMESTONE



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	Display Style	(From View Display)							
	Stratum	*							
	Borehole	BH52							
	Material	CLAY							
	⊳ Тор	30620.229330000002,12							
	Depth	5.000m							
	Diameter	10.000m							
	Bearing	0.0°							
	Plunge	-90.0°							
	Raw Data	*							
		)							

# Subsurface data model : Depth Only

Depth (m)	Base (m)	Remark	
2.5		From 2.5m: Samples recovered as angular fine to coarse gravel and cobbles of siltstone and fine grained sandstone with some grey brown mottled silty	
10.5		At 10.50m: recovered as grey silty gravel	
14.22		From 14.22m to 14.52m: 80? to 90? planar,irregular,rough,closed,iron stained joint perpendicular to main joint set	
14.4		From 14.40m to 14.57m: fine to medium grained sandstone with occasional interlaminations of sandy siltstone	
14.57		From 14.57m to 15.00m: with occasional thin sandy laminae	
16.55		From 16.55m to 16.60m: ironstone nodule	
16.8		From 16.80m to 17.00m: weak to moderately weak friable in places	
17.16		From 17.16m to 17.25m; ironstone nodule	Level: Default
17.75		From 17.75m to 18.00m: slightly weathered, clay smearing along bedding fractures	
18.55		From 18.55m to 18.65m: with some coarse gravel size ironstone nodules	
18.82		From 18.82m to 18.85m: with some medium gravel size ironstone nodules	
18.93		From 18.93m to 19.98m: 75? planar,smooth,closed joint	
19.6		From 19.60m to 19.70m: with coarse gravel size ironstone nodules	
20.15		From 20.15m to 20.28m: 45?,planar,rough,closed to slightly open (<1mm) joint with a slight clay smearing in places and slight iron staining	

# Mapping Workflow

- 2D representation of the boreholes; annotation
- Civil projects: import, reference in, ProjectWise integration
- Import / reference CAD and GIS data
- Load raster imagery: from local disk or WMS feed
- Direct Support of BING maps data with Microsoft account
- Projection on the fly: working with multiple coordinate systems and data sources live, no need to import data all in one coordinate system





# **Reporting of Geotechnical Data**

## Loading Boreholes in gINT Civil Tools

- gINT Civil Tools available in
  - OpenRoads Designer Connect Edition (CE)
    - Access from the Geotechnical Workflow
  - gINT Civil Tools Professional Plus
    - Available to all gINT Professional Plus Connect Edition users
- Connecting to a gINT Project
- Loading boreholes and lithology (soil and rock) in 3D context

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- Annotating boreholes and lithology
- Links to gINT reports (boreholes logs)

# Accessing gINT Civil Tools from the Geotechnical Ribbon



# Connecting to a gINT Project



## Loading boreholes and lithology (soil and rock) in 3d in context



# Annotating boreholes and lithology



# Links to gINT reports (boreholes logs)



# Loading Boreholes Demo





# 3D Workflow

- 3D visualization of gINT data
- Thematic symbolization
- Overlay site design plans to provide context view
- QA for boreholes elevation
- Data QA/analysis by combining with other data (existing ground, ...)
- Subsurface creation
- Geological layers creation







# **Reporting of Geotechnical Data**

Cross Sections or Profile along line in Civil Terminology

- Boreholes and lithology loaded
- Loading the bridges and ramps and Cross section lines (saved view)

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- Loading water level
- Create surface for water level
- Create meshes (volumes) for the lithology
- Create a Cross section

## Boreholes and lithology loaded



# Loading water level

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## Create surface for water level



# Create meshes (volumes) for the lithology

![](_page_23_Figure_1.jpeg)

## **Create Section**

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## **Create Section Demo**

![](_page_25_Picture_1.jpeg)

# Reporting of Geotechnical Data

### • Fence Diagrams

- 3d Model with lithology, 3 cross sections
- Create Fence cross sections, one at a time

- Loading Bridge and Ramps
- Review

# 3d Model with lithology, 3 cross sections

![](_page_27_Figure_1.jpeg)

# Create Fence Diagram

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# Loading Bridge and Ramps

![](_page_29_Picture_1.jpeg)

## Review

![](_page_30_Picture_1.jpeg)

## **Reporting of Geotechnical Data Demo**

![](_page_31_Figure_1.jpeg)

# Sharing of Geotechnical Data

## Sharing gINT Civil Tools i-model

- 3D model, link to gINT reports in PDF
- Publishing an i-model
  - One document
  - Embed PDF
  - Push to personal share
- Personal Share, share with people

- Load in navigator, Review
- Review embedded logs

## 3d model, link to gINT reports in PDF

![](_page_33_Figure_1.jpeg)

# Publishing an i-model

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# Personal Share, share with people

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![](_page_36_Figure_1.jpeg)

# Review embedded logs

![](_page_37_Figure_1.jpeg)

## Sharing of Geotechnical Data Demo

![](_page_38_Picture_1.jpeg)

# Geotechnical Modeling and Subsurface Analysis

### Editing Subsurface

- Using a top view and a Cross section view
- Double checking site with Bing maps and aerial photography

Benfleu

- Editing subsurface from cross section
- Updating Surface from cross section
- Visualize result in 3D model

## Using a top view and a Cross section view

![](_page_40_Picture_1.jpeg)

### Double checking site area with Bing Maps and aerial photography

![](_page_41_Picture_1.jpeg)

## Editing subsurface from cross section to update surface

![](_page_42_Picture_1.jpeg)

## Visualize result in 3D model

![](_page_43_Figure_1.jpeg)

# Geotechnical Modeling and Subsurface Analysis Demo

![](_page_44_Picture_1.jpeg)

# **Geotechnical Modeling and Subsurface Analysis**

### Understanding Soil Conditions

- Loading lithology
- Loading samples with N-value calculation
- Activating a display style with N-value gradient
- Loading the fence along with N-values and gradient
- Activating a display style to visualize lithology by coarse/fine soil types
- Loading the bridges

![](_page_45_Picture_9.jpeg)

# Loading Lithology

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## Loading Samples with N-value Calculation

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## Activating a Display Style with N-value Gradient

![](_page_48_Figure_1.jpeg)

## Loading the Fence along with N-values and Gradient

![](_page_49_Figure_1.jpeg)

## Activating a display style to visualize lithology by coarse/fine soil

![](_page_50_Picture_1.jpeg)

# Loading the Bridges

![](_page_51_Figure_1.jpeg)

# Geotechnical Modeling and Subsurface Analysis Demo

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![](_page_52_Picture_2.jpeg)

![](_page_52_Picture_3.jpeg)

# **Additional Information**

- QuickStart using gINT Civil Tools
- <u>http://learn.bentley.com/app/Public/ViewLearningPathWithMasterCourseExpanded?lpId=111600&mcId=102599</u>

- Bentley Communities gINT Forum
- <u>https://communities.bentley.com/products/geotechnical1/f/gint-forum#pi25960=1</u>

![](_page_54_Picture_0.jpeg)

• Have a GREAT conference!

![](_page_54_Picture_2.jpeg)

![](_page_54_Picture_3.jpeg)