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## Project Summary

**Organization**  
AECOM

**Solution**  
Roads

**Location**  
Leeming Bar, North Yorkshire,  
United Kingdom

### Project Objectives

- Design improvements to a 22-kilometer section of A1 from Dishforth to Leeming, North Yorkshire, United Kingdom.
- Consolidate both legacy and current-scheme geological and geotechnical information in one project database.
- Produce geological sections and integrate with general arrangement drawings, cross sections, and profiles for all structures along route.

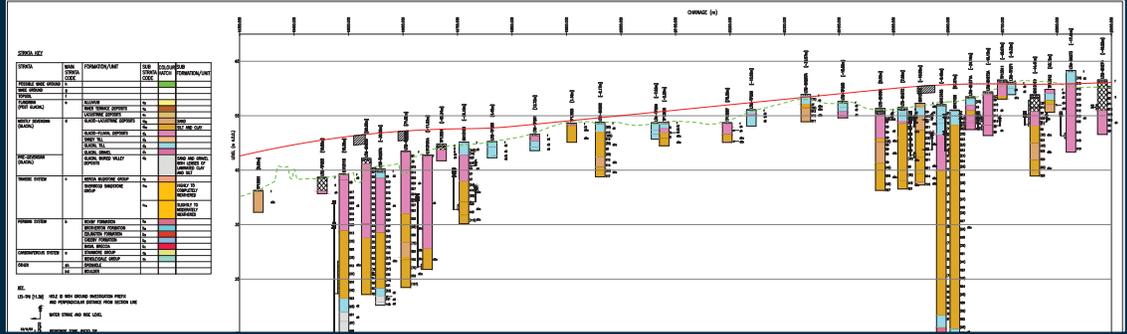
**Products Used**  
gINT, MXROAD

### Fast Facts

- The gINT database stored data from 1,400 exploratory holes dating back to the 1950s.
- Geological sections were generated from gINT data along the full length of the scheme.
- Cross sections were provided for 16 structures, earthwork embankments, and cuttings; 15 balancing ponds; 30 sign gantry structures; and 100+ individual elements.
- Digital terrain models from Bentley MXROAD were integrated with gINT sections to illustrate vertical geometry for proposed highway alignments.

### ROI

- Using gINT to produce geologic sections saved six months or about 800-1,000 man-hours compared to using CAD.
- AECOM was able to use the gINT project database on the next section (A1 Leeming to Barton) to be undertaken.



## gINT Saves AECOM 6 Months of Geotechnical Reporting Time on A1 Improvement Scheme

AECOM Automates Production of Geological Sections for 22 Kilometers of UK Route Using gINT

### Hours Become Seconds

A global provider of professional, technical, and management support services to a broad range of markets, AECOM delivers solutions that create, enhance, and sustain the world's built, natural, and social environments. The *Fortune* 500 company was engaged by the Carillion/Morgan Sindall Joint Venture (CMSJV) to be the lead designer from feasibility through detailed design of the A1 Dishforth to Leeming Improvement Scheme in North Yorkshire, United Kingdom. The USD 460 million scheme upgraded 22 kilometers of the existing A1 trunk road to a dual three-lane motorway with the aim to improve safety, reduce accidents, and provide extra road capacity for future growth. AECOM chose gINT, Bentley's geotechnical and geoenvironmental data management and reporting software, to manage and report all geological and geotechnical information. gINT saved up to six months (800-1,000 man-hours) in manual drafting time by enabling AECOM to produce geological sections in seconds rather than hours.

### 50 Years of Legacy Data

One of the biggest challenges at the start of the project was finding a way to make use of the huge amount of legacy data. Records from the ad hoc improvements made since the A1's opening included short-length roadway upgrades from single to dual carriageway, and roundabout replacements with grade-separated junctions. These projects included 10 different phases of ground investigations carried out by various contractors over the years. Together the legacy data comprised more than 900 exploratory holes – approximately 400 boreholes and 500 trial pits – along with associated laboratory testing data.

AECOM chose gINT to store and manage this historical data due to the easy and flexible way in which the data could be processed. With gINT software, engineers and geo-professionals can gather, manage, present, and report on subsurface data more efficiently and with greater accuracy. Most of the historical data for the A1 was available as hard copy only, so a data entry team was employed to create electronic files from the

paper records. The electronic records were entered into Excel tables compatible with the AGS (Association of Geotechnical and Geoenvironmental Specialists) file structure, which is the standard geotechnical exchange format used in many countries and regions, including the U.K., Ireland, and the Middle East. This allowed easy validation and import into gINT.

Having more than 50 years of ground investigation data together in one readily accessible database proved to be invaluable to the scheme designers. The visualization and analysis of the historic data at an early stage of the project aided in optimizing the requirements of the scheme-specific investigation. Areas with discrepancies or insufficient data were targeted for further investigation.

When the scheme-specific ground investigations were undertaken, the number of exploratory holes stored in the database rose to 1,400. The gINT project database allowed users to retrieve data relating to any exploratory hole with a single click. The graphical output from gINT enabled users to visualize the geological data, and quickly and easily generate geological sections to any scale.

### Producing Geologic Sections

Geological long sections (continuous profiles along the road alignment) were generated along the full length of the scheme. Cross sections were also produced to provide detailed information for specific locations, including 16 bridges and retaining structures, earthwork embankments and cuttings, 15 balancing ponds, and motorway communication structures. Geological sections of specific structures were generated in DXF format and integrated with general arrangement drawings, cross sections, and profiles. The sections showed the ground model and highlighted both the existing and proposed road surfaces. They incorporated schematic horizontal and vertical highway geometry produced from the 3D models created in Bentley MXROAD.

AECOM used Bentley MXROAD as an advanced, string-based modeling tool. Rob Addison, AECOM senior consultant,

*“With gINT it’s easy to change a number for your vertical and horizontal scales and re-output with the click of a button.*

*But if you had to do it by hand, then you’d have to redraw the entire drawing.*

*Not only did gINT save man hours, but because it can create or update a new section in a just few seconds, someone doesn’t have to wait for days for a cross section to answer their question.”*

*—Rob Addison, senior consultant, AECOM*

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explained: “The existing topographical ground model was managed in MXROAD, the proposed highway alignments were designed in MXROAD, the cross sections and the long sections were output from MXROAD, and finally the sections, or ‘fences,’ were output from gINT to the same scale via DXF and married up with the gINT section in CAD.”

### Visualizing Subsurface Conditions

These geological sections then assisted engineers and environmental specialists in the visualization and interpretation of ground conditions, formulation of a project ground model, consideration of ground condition constraints, and assessment of geotechnical and geoenvironmental risk.

The easily customized gINT reports enabled a variety of geotechnical parameters to be plotted vs. depth or elevation, and powerful querying tools generated discrete subsets of data to be analyzed. For example, in an area where the route was underlain by soft alluvial soils, cone penetrometer tests (CPT) revealed the exact soil composition and strength. gINT allowed these results to be visualized on profile and cross sections, which the designers used to delineate where improvements had to be made before road embankments could be built.

Addison noted: “I don’t think this would have been possible without gINT. Historically, we would have done the CPT trace profiles in Excel with just a single borehole and a single CPT, but to actually plot it along a specific length of the scheme with all the different CPT traces showing – the cone resistance and the boreholes next to them – it was so much easier to visualize.”

gINT also allowed users to easily export just the data needed for a specific area. “If you wanted to focus on just one balancing pond, you could easily export out the data for the boreholes that related to that pond or structure,”

Addison said. “It was very useful to be able to export out discrete packages of information that are specific and relevant to that structure, pond, or earthwork that you’re working on.” For example, in areas where groundwater monitoring indicated water levels would be above the base of planned retaining ponds, designers were able to base the water level and pond geometries presented in sections and plan the required dewatering.

### Time and Cost Savings

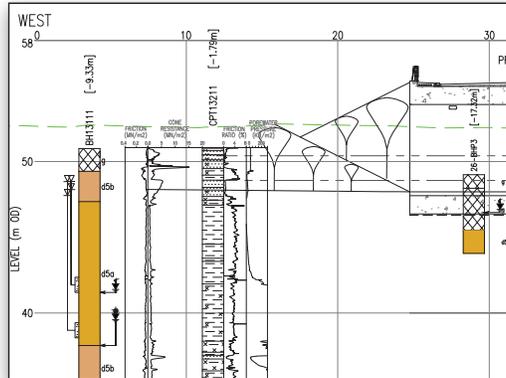
gINT provided access to the legacy and scheme-specific data that informed production of geologic sections for roadways, embankments, ponds, and structures along 22 kilometers.

Rather than draw geological sections manually in AutoCAD, as had been the practice in the past, AECOM was able to output sections from gINT in DXF format at any horizontal and vertical scale. The ability to output sections in seconds provided huge time and cost benefits throughout the project from feasibility through design.

For example, Addison estimated it would take a half-hour to draw each borehole manually in CAD – along with in-situ test results and groundwater data.

To draw one set of long sections for the 1,200 exploratory holes along the route would take around 600 hours or four months elapsed time. In addition, there were at least another 100 cross-sections at key locations such as structures, ponds, and sign gantries that would take another two months to draw manually.

Construction of the A1 Dishforth to Leeming Improvement Scheme began in 2009 and was completed in 2012. The scheme met the needs of motorists as well as the cyclists, equestrians, and pedestrians who use the route. AECOM was later engaged to design the next section of A1 improvements, from Leeming to Barton. The gINT database of historical data was carried over to this next phase of development.



*AECOM used gINT to visualize CPT profiles alongside conventional boreholes in cross sections.*