



# TECHNICAL PAPER

---

**Title:** The Development, Implementation and Future of the AGS data formats for the transfer of Geotechnical and Geoenvironmental data by Electronic Means

**Authors:** Stephen Walthall – Bechtel Civil  
M. J. Palmer – Halcrow Group

**Date:** 2006

**Publication/Venue:** ASCE Conference  
©2006 Bechtel Corporation. All rights reserved.

# **The development, implementation and future of the AGS data formats for the transfer of Geotechnical and Geoenvironmental data by electronic means**

Walthall S<sup>1</sup> and Palmer M J<sup>2</sup>

<sup>1</sup>Bechtel , Birchwood Park, Warrington UK WA3 6AE, sxwaltha@bechtel.com

<sup>2</sup>Halcrow Group, Burderop Park, Swindon, UK, SN1 4LT, palmermj@halcrow.com

## **Abstract**

The AGS format is a digital data interchange format for the geotechnical community, consisting of a data dictionary, rules and the file format itself. The Association of Geotechnical and Geoenvironmental Specialists (AGS) set up a Working Party in 1991 to reduce the proliferation of data formats and establish a format to transfer of data between systems. The AGS Format is updated and extended in response to industry requirements. AGS3.1 (Dec 2004) includes monitoring and instrumentation data. In future the AGS Format will include new computing techniques and data management. The use of the Format at work has created savings in time and resources.

## **Introduction**

In the UK during the late 1980's the use of computers and in particular spreadsheets was beginning to develop in geotechnical engineering and there was a requirement for data collected by investigation contractors to be submitted to the design engineers in an electronic format. However, each and every user of the data had their own ideas on how the data should be formatted and each producer and receiver had their own software. The result was chaos. This was recognized by the Association of Geotechnical and Geoenvironmental Specialists (AGS) in 1991 and led to the setting up of a Working Party to establish an interchange format which allowed transfer of data between systems with minimal change to the systems themselves. Thus the AGS document entitled "Electronic Transfer of Geotechnical and Geoenvironmental Data" to be known as the AGS Format was born and the first edition AGS.1 was published in 1992. This was first reported in a paper by Threadgold and Hutchinson (1992) at a conference in Paris.

## **Development and History**

The AGS Data Format subcommittee has monitored the use of the format within the industry since its inception and in response to industry's needs the Second and Third Editions were published in 1994 and 1999 respectively containing a series of updates and developments. The third edition was particularly significant as it included the rules for the creation of user defined fields which allowed for the transfer of additional information without the need to revise the format. This incentive has been used to great effect with the publication of AGS-M for monitoring data in 2001, sponsored by CIRIA, and its incorporation into AGS3.1 in 2004. The data format rules laid out in the Third Edition remain unchanged, however in AGS3.1 (AGS, 2004) the data dictionary contains additional fields requested by the geotechnical industry and has been updated to reflect the practicalities of data transfer and enhancements discussed or requested on the web site.

Considerable care was taken at the outset to ensure that the Format facilitated the data input and transfer but should not change the method of working or the requirements of Geotechnical and Geoenvironmental communities following National Codes of Practice or Standards. In the main, however, the requirements for the technical data are common to all nations.

The Format has been successfully adopted by the geotechnical and geoenvironmental industry such that data is available in the format for most investigations carried out in the UK and is specified by most major clients and organizations. It is used by ground investigation contractors and testing houses, consulting engineers, specialist piling and ground treatment contractors, clients and those who hold archives of such data such as the British Geological Survey for the transfer of ground investigation data.

## **The AGS Format**

Development of the AGS format is based on a dictionary of groups and headers defining the data sets, rules and the file format itself.

In order to provide maximum flexibility, the Data Dictionary approach was adopted. To structure the data in a consistent and logical manner it was divided into Data Groups within which a series of Fields are defined. The Data Groups were chosen to relate to specific elements of data which are obtained during an investigation, such as project information, exploratory hole details and strata details. For data of a more complex nature it was necessary to define two or more linked Data Groups. Fields within each Data Group identify specific items such as stratum description, sample depth etc. The fields have been defined as having the status of “key” or “common”. Key Fields are necessary in order to uniquely define the data unambiguously. The Common Data Fields contain the associated data. However, rules are given for the creation of other Fields and Groups, should the need arise to transfer particular data not otherwise covered by the AGS Format.

The format currently contains about 65 Groups and some 800 Fields.

The AGS Format relies on strict adherence to the published ‘RULES’ and the creation of additional Fields or Groups should be considered as a last resort.

The transfer file itself is a text file with the data surrounded by quotes and separated by commas. All fields are text.

The AGS Format is owned by the AGS and is maintained by a subcommittee of the AGS which contains representatives of all aspects of the industry, consultants, ground investigation contractors and testing houses, clients, software houses and national bodies. It is therefore completely open and independent and able to respond rapidly to the needs of the industry. Recently the AGS data format committee has been involved in liaison and discussions with other bodies in the United States and Europe about cooperation on the next phase of the development of the format by the use of XML.

## **Implementation of the AGS format into the work environment**

### ***Launch of the AGS and the early days***

The AGS format was launched to potential users through an introductory seminar to promote the document and to provide a forum for feedback. The format was adopted immediately from the launch, a reflection of the recognized need for such a format and the involvement of the industry in developing the format.

End users of the format started to make the provision of data a requirement in ground investigation specifications. Those contractors who were not already able to produce data in this format had to quickly get on board. During the early years a common complaint from the end users was with data and software correctness. However, as software improved and feedback was provided from the data receivers, these problems have generally been resolved by the main data providers. Software for checking that files are compliant with the Format have improved the quality of the data and are freely available from software houses.

The introduction of the AGS format and its acceptance by all components of the industry as being appropriate to data preparation, analysis, transfer and storage in electronic format has enabled the industry to progress. Whilst providing benefit in relation to data transfer, the AGS Format allowed both producers and receivers to continue to use their own familiar forms and facilities and hence aid the implementation of quality assurance procedures. Storage, access and use of ground investigation data were rendered far more efficient.

Clearly, the transfer of data by electronic means to the receivers systems without the need for a printed interface helped to minimize costs, time and the potential for error. It also encouraged greater and better use of the data.

### ***Software***

With the standardization of an industry format, software houses and in-house software departments have invested in the development of routines for the creation, handling, transfer and use of the ground investigation data.

Software companies have played an important role in the development of the AGS format. They have aided the development by providing cost effective methods of managing the data, data and format checking, integration with laboratory systems and report production. In addition training courses are run to develop the understanding of the format and use of software. Multinational and international software has adopted the use of the format and most new systems for data recording and analysis now embody the AGS Format from inception.

### ***User meetings and discussion sites***

In addition to regular meetings of the working group to address questions and continued development in response to requests from the industry user group meetings have been held, typically following the launch of new editions to discuss the documents but also to obtain further feedback and opinion from the wider industry.

The AGS website ([www.ags.org.uk](http://www.ags.org.uk)) contains a complete historical record of the data dictionary. The website also has a discussion page where questions, comments and requests can be provided. All threads are reviewed by the working group and following consideration of all comments a definitive answer can be provided where appropriate.

### ***Handling ground investigation data***

Producers of geotechnical data have adopted database systems that not only allow provision of AGS format data but also the efficient preparation and presentation of reports in printed formats and the tracking of laboratory samples within their laboratories.

Receivers of the data have been able to interrogate, analyze and produce interpretative reports far more efficiently than in the past and in particular for large projects (Nicholls *et al.* 1995, Nichols and Pycroft 1996, Ramcharan *et al.* 1997).

Storage and access to the data is rendered far more efficient and the establishment of data banks by producers, receivers and national bodies is facilitated. The British Geological Survey (BGS) holds a national archive of geological and geotechnical information. Statutory regulations require information from some investigations to be routinely provided and data can also be submitted voluntarily. This information is available for retrieval and plays an important part in preliminary desk studies. The BGS now accepts this data in AGS format which means it can be supplied in this format also.

### ***Pick Lists***

Pick lists are used within the AGS format in a number of fields to allow users to have common abbreviations for standard items, of these hole type and sample are fairly obvious, the CNMT names for chemicals has developed over the life time of the AGS Format and the most recent pick lists include a standard numerical list of legend codes and the BGS lexicon for the rock type names. All of these are available on the web site.

### ***User Defined Fields***

User defined fields are permitted within the AGS Format for the inclusion of items of data which are specific to that project. These can also be used to develop the Format into new areas. For example in 2002 monitoring data was included in AGS-M as user defined fields which are fully compliant with the rules in AGS3 and made available to the industry at large (Soudain, 2002). It has now been incorporated into AGS3.1. In a similar manner the QA data required by environmental chemists is being developed for the CNMT table and a North American version of the geology table to suit soils and rocks which are described in accordance with ASTM.

### ***Current practices and other uses***

Current practice includes the recording of borehole data directly at the site of the borehole in to AGS format using hand held palm tops by the drillers and engineers. This data can then be transferred electronically from the field to the office. Data is only recorded once; sample details are transferred directly through the laboratory system and into the final report.

The AGS format data has been used for more than just ground investigation data but also for the transfer laboratory testing schedules and instructions. Measurement and bills of quantities are also assessed from the data.

The format has also been used for concrete attack investigations (Floyd and Wimpenny, 2002). Earthwork construction and tunnel construction data has been collected and subsequently interpreted using the AGS format. The inclusion of monitoring in the format has been adapted for the monitoring of buildings during tunnel advancement, settlement of port container terminals and seepage through embankment dams. Real time monitoring of dewatering and settlements have been recorded in AGS format, uploaded by satellite for viewing over the internet (Richards *et al.* 2003).

### ***Specifying the format***

The Format document is available for free download from the Internet ([www.ags.org.uk](http://www.ags.org.uk)) and can be used by all. Specification of the AGS format is included in UK standard contracts and in other contracts; a simple contact specification is also included in the format documents.

### ***Use in other countries.***

The AGS format has been adopted by organizations in other countries, in particular for example in Hong Kong and has also been used as an example for data transfer in Greece, China, North America, Singapore, Gulf States, Malaysia and the Netherlands.

### **The Future of the AGS Format**

The AGS format continues to be kept up to date. In the latest version a significant initiative was to involve the Chemists and Environmental scientist where additional fields were required to provide the quality control information specified in these investigations. These modifications were carried out within the “Rules” and the result is fully compliant with the Format whilst providing a well supported format for the transfer of specialist data.

Currently the development of an XML format for the AGS format is being pursued (see paper by Chandler *et al.* 2006, this conference on AGSML). In all these the basic rules and the data dictionary are jealously guarded to protect the integrity of the format and the interest of the users.

The working group also serves to encourage the use of data in the electronic format, not only in site investigation but also in the design, bidding and construction phases of the project.

### **Conclusions**

The AGS Format has provided a sound basis for the development of the geotechnical and geoenvironmental industry to use electronic data processing; it has facilitated the development of software and is being used to populate national data bases and archives. It satisfies the golden rules of data management in that “you only enter the data once” and with the production of the AGSML version it will continue into the future. With support it can become fully international. It is acknowledged by the AGS format committee that writing the format was the easy bit, getting it implemented and maintaining it has needed considerable effort and dedication. With thirteen years of experience it is well established and is now entering its teenage years which for software is a long time.

### **Acknowledgements**

We wish to thank the AGS data Format committee members, both past and present who have spent many hours ensuring that the format was compliant with its own rules, without them it would not have succeeded.

### **References**

- AGS, (2004). “Electronic Transfer of Geotechnical and Geoenvironmental Data (Edition 3.1)” ISBN 0-9539846-2-1, Published by Association of Geotechnical and Geoenvironmental Specialists
- Chandler R.J., Beaumont A., Evans D., Toll D. and Quinn P. (2006). “Combining the power of AGS and XML - A data format for the future” *this conference*.
- Floyd M. and Wimpenny D. E. (2002). “Procedures for Assessing Thaumassite Sulfate Attack and Adjacent Ground Conditions at Buried Concrete Structures.” *1st International Conference for Thaumassite in Cementitious Materials at BRE Watford, pp19-21*.
- Nicholls R. A., Pycroft A. S., Palmer M. J. and Frame J. A. (1995). “From Paper to Silicon Chip - the Growing Art of Computerised Data Management.” *International Conference on Advances in Site Investigation Practices, ICE*.
- Nicholls R. A. and Pycroft A. S. (1996). “Plots of Numbers, description of the geotechnical data management system developed by Halcrow.” *Ground Engineering, November*.
- Ramcharan P., Walthall S. and Zytynski M. (1997). “The use of a geotechnical data base on a large civil engineering project.” *Ground Engineering, August*.
- Richards D. J., Chandler R. J. and Lock A. C. (2003). “Electronic data transfer systems for field monitoring” *Proceedings of the Institute of Civil Engineers, Geotechnical Engineering vol156, issue 1 pp47-55*.
- Soudain M. (2002) “Very model of a modern module.” *Ground Engineering, March p41*.
- Threadgold L. and Hutchison R. (1992) "The Electronic Transfer of Geotechnical Data from Ground Investigations" *Geotechnique et Informatique, Paris*.