Mid-South Engineering Company

Issue No 9 Working Together First Quarter, 2004

How suitable is GIS for engineering projects?

If properly planned, organized, and prepared, GIS (geographic information systems) provides powerful, user-friendly tools for infrastructure management and facility operations that were only dreamed of a few years ago. Once created, a GIS database readily answers such questions as, How many feet of 6-inch cast-iron pipe over 50 years old do we have? How many breaks have occurred on this pipe during the last two years? A quick printout of the required information assists in reports and field use.

A well-designed GIS is built upon the foundation of an accurate base map, a line or photo map that indicates the planimetric or physical ground features of the area, such as roads, railroads, bodies of water, and treelines. This graphical data can be linked to detailed databases to provide a powerful information management tool.

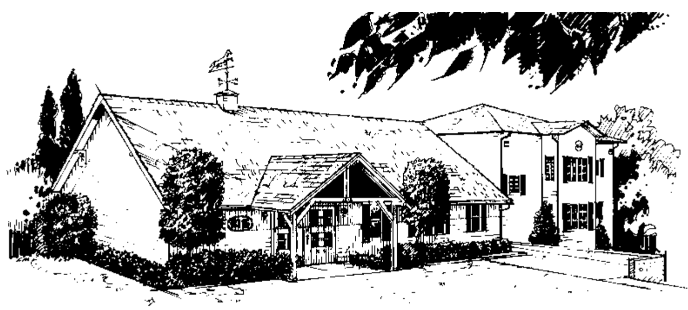
If developed with sufficient detail and accuracy, GIS can contribute significantly to the engineering design process. The first stage of all design projects is information gathering. The engineer must ascertain such parameters as length and distance, elevation, size, condition, material, capacity, and depth before proceeding with detailed design. Historically technicians or survey crews have gathered this information in the field, often a time-consuming process. Much information required for infrastructure design can be obtained from previous field reports and existing maps and drawings embedded within GIS for nearly instantaneous recovery, potentially saving considerable time and money.

Design information from even the most comprehensive GIS, however, will not eliminate the necessary field visits. Many projects require very specific data regarding soils and subsurface conditions, which can be obtained only by borings, probings, or test pits. The amount and depth of additional field work depend upon the accuracy of the base mapping and associated data.

If an engineer uses GIS information to produce engineering drawings, the base mapping must be prepared from accurate topography of appropriate scale. Base mapping developed from enlarged USGS mapping may be perfectly suitable for planning purposes, but grossly inaccurate when converted into engineering drawings. A 5-foot base map contour interval, for example, is usually suitable for planning purposes, but 2-foot or less base map contour intervals are typically required for site and drainage work. If information on the drawings is inaccurate or missing, the cost of construction-contract change orders can greatly exceed the cost of preparing adequate plans. At a minimum, an engineer must field check data on the existing topography and facilities prior to issuing documents for bid or construction.

Using GIS for engineering applications is a new field with powerful potential. To maximize the return on investment, projects must carefully plan for appropriate base mapping and data input during the needs assessment phase of GIS development.

At present, Mid-South offers GIS Services such as spatial analysis and custom property maps. These custom maps show a variety of layers such as roads, lakes, rivers, and population statistics, along with countless other forms of spatial data. Ownership boundaries can be digitized and over laid onto topographical maps or digital infrared aerial photographs to produce a property map, which can be printed to any specified size. In the near future, we are planning to expand our GIS Services even further.



"The Barn" built in the 1930's to house Welsh ponies, serves as Mid-South's offices.

NEC Working Clearances

The National Electrical Code mandates minimum clearance requirements around electrical equipment based on voltage levels. While trying to comply with these requirements, it is important to understand what we are trying to accomplish. The basis for these clearances is to provide adequate workspace for those servicing electrical equipment. This workspace is required and must be maintained about all electrical equipment where parts of an energized system may be serviced.

See below for the NEC table 110.26(A)(1) for requirements relating to the *depth* of working space in the direction of live parts for equipment operating up to 600 volts to ground and NEC table 110.34(A) where voltage to ground exceeds 600 volts. All distances are measured from live parts if exposed, and from the enclosure front or opening if enclosed. For example, the distance from a 480-volt motor control center (MCC) to another MCC cannot be less than 4 ft. The distance from a 480-volt MCC to a wall or any other grounded object can be no less than 3-1/2 ft.

For equipment operating at less than 600 volts to ground, the *width* of working space is required to be the width of the equipment or 30 inches whichever is greater. For equipment operating over 600 volts to ground the width can be no less than 3 feet. In all cases the ability to open equipment doors or hinged panels at least 90 degrees is mandatory.

The work space height or minimum headroom of working spaces about service equipment, switchboards, panelboards, distribution boards and motor control centers operating at less than 600 volts to ground is required to be 6-1/2 feet or the height of the equipment, whichever is greater. For equipment operating over 600 volts to ground the height can be no less than 6-1/2 feet.

In general, working space is not required in the back of equipment such as dead front switchboards where there are no renewable or adjustable parts on the back and where all connections are accessible from locations other than the back.

In addition to the above, there are specific requirements regarding the number and locations of entrances to working spaces containing electrical equipment.

The various requirements described above are sometimes ignored when making in-plant modifications. Mill personnel unfamiliar with these rules may install electrical equipment in violation of the code, thereby seriously compromising worker safety.

Table 110.26(A)(1) Working Spaces

	Minimum Clear Distance		
Nominal Voltage to Ground	**Condition 1**	**Condition 2**	**Condition 3**
0-150	900 mm (3 ft)	900 mm (3 ft)	900 mm (3 ft)
151-600	900 mm (3 ft)	1 m (3-1/2 ft)	1.2 m (4 ft)

Table 110.34(A) Minimum Depth of Clear Working Space at Electrical Equipment

	Minimum Clear Distance		
Nominal Voltage to Ground	**Condition 1**	**Condition 2**	**Condition 3**
601-2500 V	900 mm (3 ft)	1.2 m (4 ft)	1.5 m (5 ft)
2501-9000 V	1.2 m (4 ft)	1.5 m (5 ft)	1.8 m (6 ft)
9001-25,000 V	1.5 m (5 ft)	1.8 m (6 ft)	2.8 m (9 ft)
25,001V-75 kV	1.8 m (6 ft)	2.5 m (8 ft)	3.0 m (10 ft)
Above 75 kV	2.5 m (8 ft)	3.0 m (10 ft)	3.7 m (12 ft)

Note: Where the conditions are as follows:
Condition 1 - Exposed live parts on one side and no live or grounded parts on the other side of the working space, or exposed live parts on both sides effectively guarded by suitable wood or other insulating materials. Insulated wire or insulated busbars operating at not over 300 volts to ground shall not be considered live parts.
Condition 2 - Exposed live parts on one side and grounded parts on the other side. Concrete, brick, or tile walls shall be considered as grounded.
Condition 3 - Exposed live parts on both sides of the work space (not guarded as provided in Condition 1) with the operator between.

Mid-South Engineering Company

1658 Malvern Ave (71901) P.O. Box 1399
Hot Springs, Arkansas 71902
Telephone: 501-321-BARN (2276)
Contact: **Mark Culpepper** mculpepper@mseco.com

Web Site: www.mseco.com