

## Public Works Engineering - GeoDatabases, the Common Denominator

The release of ArcGIS™ has introduced a new technology, that of GeoDatabases. Two of the prime impacts of the GeoDatabase are (a) the provision of an efficient environment for multi-user and multi-departmental use, and (b) the ability to store multiple data sources in a single database. The former is particularly applicable to Public Works agencies, and consulting engineers that provide services to such agencies, while the latter facilitates the management and maintenance of spatial as well as tabular data.

Typically, the MIS/GIS department of a municipality maintains the municipality's GIS, while the Public Works department relies on the MIS/GIS department to provide pertinent information for planning and design needs. This sometimes can lead to a "tumaround" issue, by which, based upon work load, needed information may be somewhat slow in forthcoming. This is where the GeoDatabase provides a solution. Using the GeoDatabase, Public Works engineers can view, or "check out" GIS information without assistance from MIS or GIS staff, and proceed with the application(s) at hand using the latest available GIS data.

The City of Oklahoma City is one example of a City that has implemented an enterprise ArcGIS solution. In the early 1990's, the City installed several licenses of workstation ArcInfo®, on a Unix based platform, and over the years has built a comprehensive GIS, which is utilized by a variety of departments, the Engineering Division of the Department of Water and Wastewater Utilities being one of them. In building its GIS, the City took the extra effort to ensure that the GIS could be used not only for planning and general information analysis purposes, but also for in-house engineering design applications. To

Database. When the City converted to the ArcGIS environment, the Engineering Division, as well as all of the other departments which utilized GIS data, also had to convert in order to continue using the City's GIS. One of the software packages used by the division is CEDRA-AVland™. This software package provides the City with Civil Engineering design capabilities directly within ArcGIS.

Since the City's GIS is of engineering design precision, the Engineering Division relies heavily upon the use of GIS data. This data include right-of-way, buildings, contours, water lines, wastewater and storm water sewer lines and many other layers of data which comprise the City's base map data. All of this information resides on a server to which the Engineering Division's engineers have access. From a central repository on the server engineers are able to view and/or download information relevant to their work.

To facilitate the map preparation process for use in the City's in-house design projects, the City survey department developed an extensive point and line coding scheme, which when processed with the CEDRA-AVland software produces a complete, annotated, topographic map. Field surveys are conducted in the Oklahoma State Plane coordinate system so that survey information can overlay directly upon the City's GIS data.

As part of the preparation of the topographic map, the City requires that existing feature descriptions (topo notes) appear along, and offset, from the survey base line. This approach leaves the plan sheet area, within the confines of a new design,

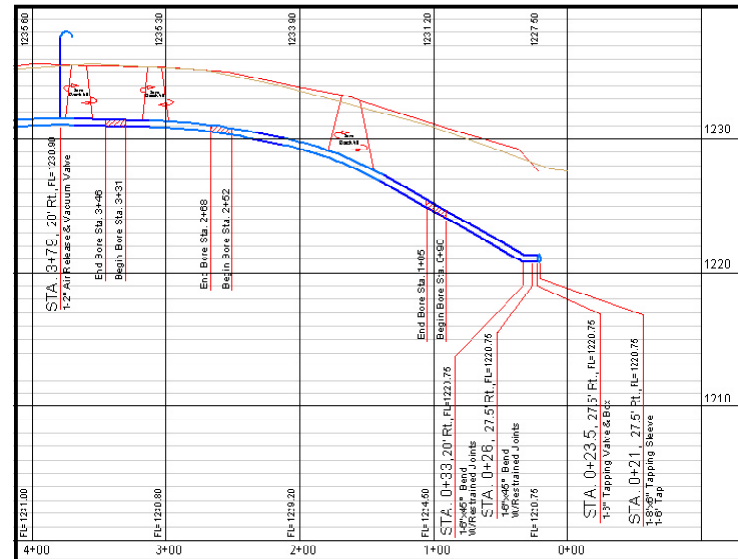
PGD, the software stores the horizontal geometry of the street alignment, its vertical alignment, cross-sections, profiles, and all annotation associated with the street center line. In addition, the information stored in the PGD contains elevation data (Z's). As such, the 3D Analyst™ can be used to display three-dimensional images of the project. Thus, the designer in a single PGD has all of the relevant information

tion, vertical curve tables, and any profile related information.

In addition to the automation of the drafting of design information, CEDRA-AVland provides the ability to carry out general drafting operations, such as typical roadway sections and most any other detail from within ArcMap, and generate drafted plan and profile sheets, as well as

detail sheets for construction purposes. Again, the PGD is used to store individual details with a detail drawing being nothing more than a collection of PGD's.

Although not of direct interest to Public Works agencies, CEDRA-AVland provides engineers who are involved in land development projects (subdivision design) with the ability to introduce local zoning geometric regulations, and automatically subdivide in mass blocks

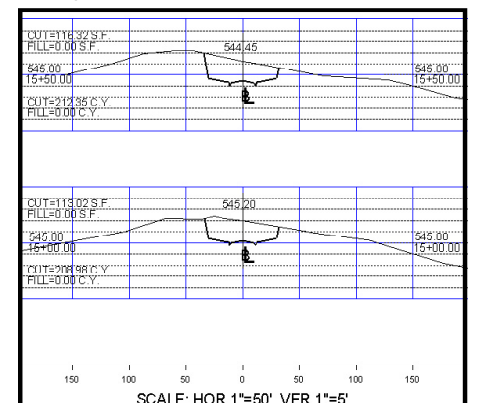


*Profile of new water main design  
(Courtesy of the City of Oklahoma City  
Department of Water and Wastewater Utilities - Engineering Division)*

associated with the street center line with the individual components of the alignment being stored as separate data sets.

Working entirely within an ArcMap™ document, an engineer is able to interactively transcribe deeds, carry out general coordinate geometry (COGO), design roadway alignments, extract original ground cross sections and profiles along any alignment, design new roadway profiles, introduce typical roadway sections (templates), generate individual or multi-surface (existing and proposed conditions) roadway cross sections, develop existing and proposed roadway contours and merge them to create a new ground model, and compute earthwork quantities. Applications, previously performed in stand-alone or CAD systems, can now be performed within ArcGIS.

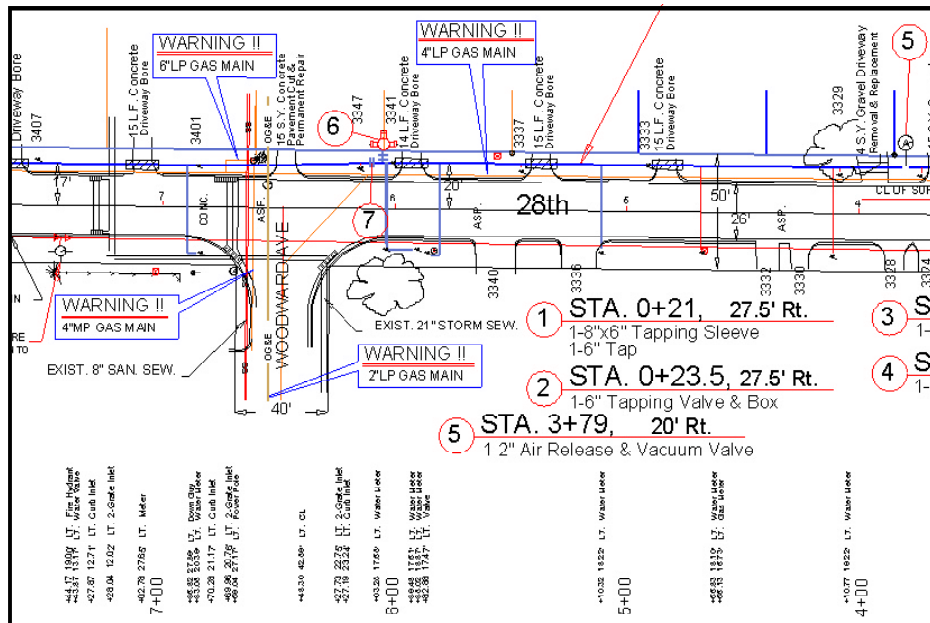
of land into lots in accord with said zoning regulations. In addition, the engineer can introduce house envelopes, and mass annotate lots with their metes and bounds, lot numbers and areas, storing all of this information in a PGD.



*Existing and proposed cross-sections*

Based on the principle that drafting should be a by-product of the design process, a major portion of the drafting of the new roadway design is done by the engineer during the design phase using CEDRA-AVland from within ArcMap.

Utilizing ArcMap and a GeoDatabase approach, in conjunction with CEDRA-AVland, a Civil Engineer now has available a GIS based design tool.

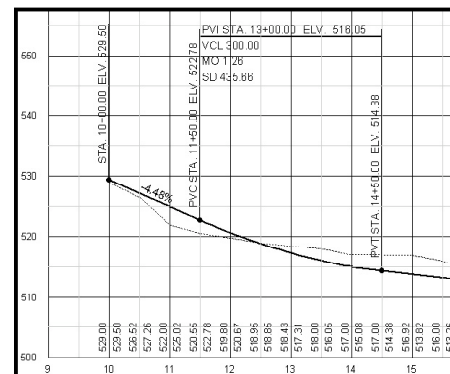


*Plan view of new water main design  
(Courtesy of the City of Oklahoma City  
Department of Water and Wastewater Utilities - Engineering Division)*

accomplish this goal the City had to create a very precise GIS, which at that point of time was a fairly unique approach to take. As a result of taking this approach, the City has created a comprehensive and dynamic database that is used to manage and meet the ever evolving needs of its infrastructure (streets, sewers, water, and other components).

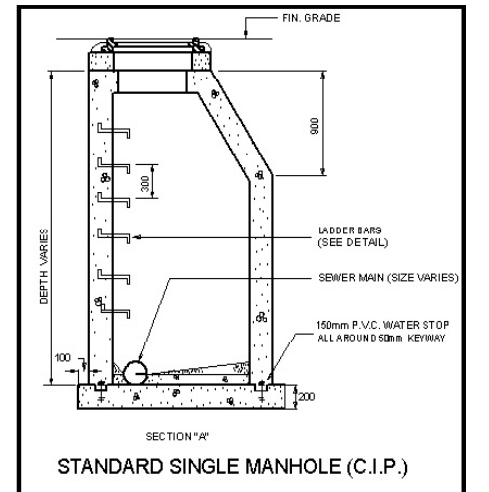
available for construction information. This form of base survey map preparation, as produced by CEDRA-AVland, is common among many engineering design offices.

With the topographic map mass generated, the advantages of the GeoDatabase become apparent during the design process. A typical Engineering Division projects involves a street center line, or as commonly referred to as an alignment. Utilizing the Personal GeoDatabase (PGD), the CEDRA-AVland software creates a PGD for each alignment that is being designed. Within the



*Portion of annotated street profile*

The engineer focuses on the design process, and upon completion produces the desired drawing information. This includes the alignment stationing, horizontal curve and profile annota-



*Detail drafting (manhole)*