WHITE PAPER

WHY GROUP 4 TIFF/CALS
IS THE
FORMAT OF CHOICE
FOR ELECTRONICALLY DISTRIBUTING
AND ARCHIVING DRAWINGS
USED IN
IN THE CONSTRUCTION INDUSTRY

This paper examines two formats that are often put forward as alternatives for electronically distributing construction drawing documents in applications such as permit approval, bid solicitation and facilities management. The paper discusses Group 4 TIFF/CALS and PDF: their origins and structural characteristics; and presents the file storage requirements of a typical original CAD document converted to each format to provide a frame of reference for the discussion of the relative benefits of each format type.

Introduction

This White Paper discusses the Group 4 TIFF (Tagged Image File Format) or CALS (Continuous Acquisition and Life-cycle Support), and PDF (Portable Document Format) format types for use in distributing drawings in the construction industry for Electronic Bid Solicitations.

The main reason such a choice is necessary is that it is generally accepted that distributing original CAD design documents is impractical due to their proprietary nature, their lack of inherent 'original work' protection for the originator and their typically large file size.

Industry has dealt with this distribution issue in the past mainly by producing paper copies of the documents. However, as the inefficiencies of this method have become increasingly obvious, alternative formats have been put forward as the means of performing such distribution electronically by either converting the original CAD format or by scanning the paper copies and outputting to a particular format.

In examining this subject, it is easy for confusion to arise or misinformation to occur through over-simplification of what is a relatively complex issue. For example Group 4 TIFF is often confused with other variants of the TIFF format, which produce greater file sizes than Group 4. This paper attempts to clarify key issues sufficiently without delving into an overly technical discussion.

Origins and Structures

Group 4 TIFF is an 'open' industry-standard raster* format that was designed by CCITT as general monochromatic format for use in the copying and facsimile industry where compactness and image versatility are primary considerations. Group 4 TIFF is part of the TIFF format, which has several different variants using different compression techniques. Group 4 is widely used in the reprographic industry and employs a very efficient compression capability.

The CALS file format is a US government-accepted variant of the Group 4 TIFF specification specifically developed and supported as an archival standard within the government. CALS is almost identical to Group 4 TIFF except for header information. For purposes of this document these formats are therefore regarded as being virtually the same.

PDF is a proprietary file format controlled by Adobe Systems and in certain situations has license cost implications. It is commonly used to convert disparate word processing and graphic application files into a document format that can only be viewed with the PDF viewer called Acrobat Reader. A PDF document contains one or more pages consisting of text, graphics and images produced directly from applications or from files containing PostScript page descriptions. A PDF document may also contain information in electronic representation only, such as hypertext links.

Unlike Group 4 TIFF which stores information and perform compression in a uniform way PDF can be a composite structure containing multiple format types and compression techniques. To reduce file size, PDF supports multiple compression filters including: JPEG compression of color and grayscale images; CCITT Group 3, CCITT Group 4, LZW and Run Length compression of monochrome; and LZW and Flate compression of text, graphics and indexed image data.

In "automatic" compression mode the PDF creation tool analyses the document structure and then chooses what it deems appropriate.

File Sizes

The first thing to note is that, because of the way each of these file formats work, it is not possible to develop an exact formula or relationship between format types for the specific amount of storage space that will be used for a particular drawing. How much space each format type will take to represent a particular drawing is dependent on: the attributes and complexity of the drawing, the size of the drawing and the resolution level at which you wish to store the document. The ratios applicable to each format type therefore is not consistent from document to document.

To provide a frame of reference, however, the following is an actual example of a typical drawing document:

Original CAD format (DWG)	-	1.62 megabytes (MB)
PDF (using automatic default compression)	-	24.5 KB
Full Resolution (200 dpi) TIFF Group 4 (or CALS)	-	13.3 KB
Preview Resolution TIFF Group 4(or CALS)	-	3.3 KB

Compression Accuracy

Unlike PDF, which uses a variety of compression techniques (as described above) including lossy (which 'throws-away' selected data), the TIFF format uses strictly non-lossy compression algorithms. While PDF complex compression capabilities work well for complex documents, this adds overhead to relatively uniform document structures such as construction drawings. In addition, lossy compression can result in inaccurate reconstruction/scaling of the images which can render them unreliable for scaled printing and for calibration to perform electronic on-screen measurements: an important function in the take-off process needed with bid documents.

Internet Distribution

The ease of access to documents and the options available for their download and use off-line are major areas of consideration when they are being distributed over the Internet.

TIFF/CALS - A technique used to further improve the access speed of raster drawings over the Internet is to provide a lower resolution preview image in addition to the full resolution image for a particular document. Users can browse in preview mode, select the documents they wish to download and then download the full resolution documents in an unattended batch mode at a later time. The ability to selectively view and then download individual TIFF/CALS images from within a structured document is extremely important to users.

PDF – With PDF, multiple pages are stored as one document and cannot be retrieved online individually as with the TIFF example. The extended time needed to download the complete PDF file in order to work with any one part of the document off-line adds substantial overhead and makes the process extremely cumbersome especially with large projects.

Security

Design professionals have long been comfortable with paper distribution for which TIFF or CALS is the electronic equivalent and provides the greatest amount of 'original work' protection. TIFF/CALS cannot be easily imported into a vector format and therefore is well suited for public distribution.

Document Organization & Tools

The organization and presentation of TIFF drawings is performed by an application such as MaxView that was designed to handle TIFF/CALS documents. MaxView is specifically oriented towards construction document handling and its functionality, for both the author and the viewer of these types of documents, is far superior to that of the PDF equivalent (Acrobat).

Acrobat only allows the user to import drawings in a variety of sizes and formats up to and including E-size; and Acrobat makes no provision to support other format types within its organization structure. PDF documents have basic navigation capabilities but have no count and measurement capabilities for takeoff functions.

MaxView organizes all the document of a project into an intuitive tree-structure with folders and files that maintain their original document format. Typically, drawings are stored in TIFF/CALS while specifications are stored in TIFF, Word, Excel or PDF format. MaxView provides the user with a way to calibrate the TIFF

drawing to a specific scale and then to complete takeoffs using the count, distance and area measuring tools intrinsic to the MaxReader application. This functionality coupled with the ability to accurately print any drawing size to scale are major advantages for the use of MaxView in plan review and electronic bid solicitation applications.

Other Considerations

There are a number of other factors that impact the format type to be selected:

-   In many situations, it is necessary to convert legacy documents from a paper source to an electronic format. TIFF images are the standard for scanned drawings.

-   Since TIFF is so widely accepted and used in the reprographics industry, it is very easy for end users to obtain printed paper copies if they desire.

-   Major US government organizations such as USACE and the Air Force have standardized on the CALS format; giving it assurance as a viable long-term archival vehicle.

To summarize; Group 4 TIFF/CALS has a size advantage over PDF and with the use of previews, this advantage is extended. Combining this with better 'original work' protection; its accurate scalability; its ability to work with all forms of document inputs including paper; its 'open' non-proprietary nature and general community acceptance along with a better selection of available tools gives TIFF/CALS a decisive edge as the format of choice for distributing electronic plan pages used in the construction industry.

About the Author: Key Churchill is a document imaging expert who, as a principal of Integrated Imaging Inc, has been involved with many imaging application developments including: design and implementation of the Valley Construction News website in Roanoke, Virginia which has performed electronic plan distribution since 1997 and more recently MaxView's MaxPlans website.