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DrawMGT Overview

Drawing Management System for the Construction Industry

Abstract: This document presents an overview of *DrawMGT*, a web-based drawing management system designed and implemented specifically for the construction industry. *DrawMGT* manages a drawing/document archive, using a powerful document coding and classification system. Support is provided for the construction industry's most commonly used workflow operations, including drawing review and approval, requests for revisions, drawing submittals, technical queries and issue/comment tracking.

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Document Control and Acceptance Certificate

Title	DrawMGT Overview
Synopsis	This document provides an overview of the DrawMGT, a web-based drawing management system designed and implemented specifically for the construction industry.
Version	1.4
Date	25-Mar-2008
File	DrawMGT-Overview-14.doc
Doc ID	SXS-01-000025-5
Site	
Author	Alan Hodgkinson
Project	DrawMGT
Customer	
Approved		
Accepted		

Revision History

Version	Date	Comments
1.0	10-May-2005	Initial version.
1.1	17-May-2005	Review and corrections.
1.2	1-Nov-2006	Updated for DrawMGT version 9.2
1.3	10-Dec-2007	Updated for DrawMGT version 11.0
1.4	25-Mar-2008	Updated for DrawMGT version 11.1

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Drawing Management System
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Construction Industry

1   Introduction

DrawMGT is an Internet-based web application that manages construction drawings, documents and related tasks. DrawMGT was created specifically for the heavy construction and tunnelling industry. It is ideally suited for large projects with participants from multiple organizations, located at multiple sites.

DrawMGT is superior to the content management systems deployed on most projects because it supports design and construction management. In other words, DrawMGT manages the status of your drawings and documents, and makes links to the tasks associated with their production and updating. DrawMGT also helps you coordinate your design tasks and construction tasks. This integration is realized using a comprehensive set of standard and project-specific engineering classification criteria (tags) that can be applied to all your drawings, documents and tasks.

DrawMGT was designed by engineers, for engineers. It is not a generalized content management system that has been 'adapted' for construction. Its native language *is* construction. The procedures DrawMGT supports are the procedures your engineers are probably already using. The goal is to automate accepted industry practices and not to replace them. Thus, DrawMGT will make many tasks more efficient and help ensure that your good engineering does not become a victim of administrative and clerical inefficiencies.

Normal use of DrawMGT, such as searching for and viewing documents, requires no specific training. Creation of new documents is simple and straightforward, making use of the document types familiar to the engineering community.

DrawMGT is an Internet application and to use it all you need is a normal web browser. No special software is required beyond the DrawMGT server. In spite of its powerful features, DrawMGT is efficient. It is usable with older PCs and low-speed Internet connections. Engineers have even productively used DrawMGT from remote job sites with nothing more than a web-enabled cell phone.

2   DrawMGT in Your Organization

DrawMGT's main focus is on assisting the collaboration between all members of a project team, including external partners. You can easily provide access to suppliers, partner companies and the owner's organization. This ensures that all parties are working from the same plans, regardless of their physical location or their place in the project's organization.

During the project set-up emphasis is put on understanding and implementing your project's structure and quality procedures, taking into account the document types and their workflows.

Computer system requirements are kept to a minimum by providing access to DrawMGT over standard web browsers. Access is possible from remote sites using portable browsers. No special client software, such as VPN (virtual private networks) is required. All popular browsers are fully tested and supported.

DrawMGT has been implemented to co-exist with the software you already use. DrawMGT does not mandate the use of any particular document editing or production software. We presume, for example, that you already have your own software for viewing and marking up documents (e.g. Acrobat).

Many document management systems attempt to provide an all-in-one solution, providing for example built-in viewing and redlining. You and your partners are then forced into a rigidly defined software suite, where additional software must be installed for every new user. This is problematic for projects undertaken by multiple organizations, which typically have strict rules governing software installation.

DrawMGT is not intended to replace the systems you have in place for checking out drawings or other documents during daily work. These are typically very dependent on specific programs and your organizational procedures. DrawMGT fits together well with such procedures and provides all the needed capability of tracking drawing production, review and submittal.

DrawMGT provides considerable flexibility to make use of your existing software. A review of your software configuration can be made during set-up.

3 DrawMGT Key Features

The purpose of the DrawMGT system is to manage the drawings and documents, and related tasks, belonging to a large construction project.

3.1 Document Management Features

- **Version/Revision Management** – Manages multiple revisions of construction drawings and documents. Supports all common revision numbering systems. Superseded versions of documents are clearly marked to reduce the chance of inadvertently using them. Tracks the approval status, reason for issue and requestor for each revision.

- **Design Management** – Allows pre-assignment of drawing numbers, titles, designers, checkers approvers and planned start/complete dates to documents. Tracks the planned and actual complete dates for documents produced internally and documents received from outside suppliers. Manages the tasks associated with document review, revision and distribution.

- **Document Classification** – Classification information can be assigned to all documents (and tasks, see next section), making it easier to locate all documentation and tasks associated with a particular issue or part of the project. Standard engineering classification (e.g. engineering discipline, work type, location. etc.) of documents is supported. Documents can be further classified by document type, project phase, supplier, alignment, chainage, elevation, etc. Much of the classification assignment can be automated.

- **Drawing Coding System** – Supports project-defined drawing numbering systems, including all common revision numbering systems. Correct entry of document numbers is enforced, making it impossible to enter invalid or badly formatted document numbers. Concurrent support for multiple document number types, which is required when documents are received from external suppliers. Additional classification information can be automatically applied to documents based on their actual drawing codes and project specific defaults.

- **Drawing Submittals** – Automatic delivery of drawings approved for construction, based on pre-defined recipient lists. Includes generation of accompanying cover letters and drawing lists.

3.2 Task Management Features

- **Workflow** – Supports common drawing workflows, including drawing review and approval, request for revision, drawing submittals, redlining and technical queries.

- **Design Management** – Support for *to-do* and issue tracking, including assignment and delegation of tasks, tracking of effort expended and effort to go, design review points. Tasks can be classified, and searched for, using the same classification criteria used for documents. Tasks can be linked documents, and documents can be linked to tasks, so that when you view a document you also see the list of tasks associated with it.

- **Construction Management** – Common construction tasks supported (site queries, punch lists, etc.). Reference documents (such as scanned sketches) can be attached to task notes.

3.3 Searching and Reporting Features

- **Indexing and Searching** – Industry standard and project-specific classification criteria are supported.

- **Search Features** – Able to search using partial drawing numbers, engineering classification data, workflow state, as well as via a *Google*-like search interface.

- **Lists and Reporting** – Support for drawing revision lists and schedules, submittal lists and technical query reports. All reports can be displayed in screen or printable formats, and can be sorted by virtually any field. Special reporting requests can be accommodated upon request.

DrawMGT allows users to search for and retrieve electronic drawings using a normal web browser. The documents themselves are downloaded and then viewed and edited using normal PC applications. New and revised drawings can be uploaded onto the DrawMGT server.

3.4 Other Features

- **Web Server Based** – DrawMGT is a server-based system, which requires no client software other than a normal web browser. DrawMGT can be used either over the Internet or in an Intranet environment. Documents are stored in their original format on a centralized web server. A catalog of drawing and document metadata is maintained on the server in a relational database.

- **Secure** – Multiple permission levels (user roles) and a comprehensive audit trail. Includes extensive security features, including role-based user and document access control, which allow administrators fine grained control over who has permissions to view and update documents. This makes it safe to deploy DrawMGT on the Internet. Internet deployment allows remotely located project participants easy access to project documentation.

- **Data Import and Export** – Powerful import and export facilities that ease data migration and allow DrawMGT to co-exist with other systems. All system data can be imported and exported in a variety of formats. This includes the creation of custom reports, which can also be dumped in tab-separated forma for input into other systems. Document and metadata can also be uploaded in bulk to accelerate data migration or allow DrawMGT to be used as an Internet publishing front-end for documentation stored in other systems. Documents can *always* be efficiently imported or exported from DrawMGT, ensuring that your documents are never trapped.

4   Document and Task Integration

The DrawMGT system is based on the following central concepts:

- **Classification System** – Supports both industry standard and project specific criteria.
- **Document Register** – All revisions of all drawings and documents.
- **Task Management Register** – To-do items that can be linked to drawings and documents.
- **Workflow Management** – Responsibilities for documents and tasks are assigned and tracked.

Documents and tasks are integrated in two ways: via the classification system and via direct links.

All documents and tasks can be assigned construction-specific classification criteria (engineering discipline, location, work type, chainage, etc.), which makes it easy to find things using familiar engineering and project terminology. The classification system makes it possible to find all documentation and tasks related to a specific engineering issue, regardless of the source or the document numbering system.

Using links, you can directly assign one or more tasks to a drawing or document, or link collections of documents to a task. Each time you view a document, you see a list of the all tasks linked to it, and likewise, when you view a task, you see the list of all the documents linked to it.

4.1   Classification System

Classification codes are similar to document codes, but are not used to identify documents, but rather to categorize them as an aid to searching. Classification codes differ from document codes: document codes are specific to the organization that produced the document, and classification codes are more general. Ideally classification codes are universal. One example of a classification coding system is the KKS system used by the power generation industry.

The use of classification codes for engineering and construction documents is a long-established industry practice that allows positive document tracking and retrieval. It is incomparably superior to storage and retrieval using a file-server or traditional Content Management System, as many organizations have discovered after moving to electronic drawing formats.

The powerful construction-specific classification system is what differentiates DrawMGT from other document management systems.

You can assign the following classification criteria (tags) to documents and tasks:

- Project phase
- Work category
- Contract
- Group
- Engineering Discipline
- Location
- Work Type
- Alignment and Chainage – a single chainage value or a *to/from* range
- Elevation – a single value or a *to/from* range
- Supplier
- KKS process, installation and location
- External key

The classification criteria are defined as well-defined lists and are project specific, allowing you to define a classification system that exactly matches your project. The classification criteria lists can be

changed or extended at any time. Since the classification criteria are based on well-defined lists, mis-filing caused by spelling mistakes or non-standard keywords are eliminated.

Each individual classification criteria is expressed using with a *code* and a *name*:

- *Code* – a code value, often numeric, used in lists and places where space is at a premium
- *Name* – a short description, used in menus and detail screens to explain the meaning of the codes.

Classification criteria can be manually or automatically assigned, based on the document's supplier and drawing code. DrawMGT has a powerful mechanism for automatically assigning classification codes based on document codes, which means that you can easily find documents regardless of the supplier or drawing code.

4.2   Document Register

The DrawMGT document register contains a list of all revisions of all documents, including their classification criteria and any tasks linked to them. Each document is assigned a document type and is further assigned to a contract and group, which determines its workflow and which users are allowed to view it.

The lists of revisions differentiate between the current revisions, superseded revisions and (future) incomplete revisions, all of which are clearly marked.

The document register contains design management tracking information (workflow), which includes the planned and actual completion dates associated with their design, checking, approval and submittal. DrawMGT can manage both project-produced design documentation, and the receipt and approval status of externally produced documents.

4.3   Task Register

Tasks are essentially '*to do*' items, which can have links documents. Each task has workflow information which includes a summary description of the task, the issuer, the creation and due dates, priority, and to whom the task has been assigned.

Users are subscribed to tasks, either based on their responsibilities, or because they elect to subscribe to particular tasks which they consider relevant to their work. At any time users can easily monitor the status of tasks to which they have subscribed.

Just like documents, you can link documents and assign classification criteria to tasks. You can search for tasks and documents using the same classification criteria. Furthermore, the classification criteria can be used to search for all documents related to a particular task.

A complete record of all task discussion is recorded using notes, along with any attached supporting documents. The notes can be marked as question and response to provide a better overview of dialog.

5   Document Management

DrawMGT can manage drawings and documents in virtually any electronic document format. The documents are not limited to construction drawings and can be associated with any project phase.

Every document in DrawMGT is assigned a '*document type*', which together with the contract and group to which it belongs, determines the document's '*workflow*' and the type of document code.

Combined with the engineering classification (e.g. classification by location, work type, chainage, etc.) it is easy to find all the drawings, reports, memos and other information associated with a particular construction issue.

The lists of valid *document types* and *workflow types* are project specific. The lists are defined during system configuration and can be extended and modified as your needs change. The assignment of the workflow type to documents is automated, based on the project configuration.

Defaults can also be assigned for the engineering classification fields based on the document type, contract and work group. This ensures that all documents are classified and that document searches actually produce comprehensive document lists.

The document type, work type and location can be thought of as three axes for 'positioning' and locating documents. The intent is to make it easy to find all documents that have bearing on a particular construction issue, regardless of the type of document and what part of the project it belongs to.

As new revisions are approved and submitted, older versions are marked superseded and displayed in gray to avoid inadvertent use. Documents may also be marked obsolete, and are likewise displayed in gray.

5.1   Drawing and Document Codes

You can configure DrawMGT to understand the meanings of your project's drawing/document codes, and automatically apply classification criteria to drawings/documents based on actual code values.

Drawing codes are alphanumeric values assigned to documents that identify them, and provide clues as to their content and their place within the document hierarchy. For a drawing, the document code is simply the drawing code as it appears on in the drawing's title block. For other documents the document issuer might assign a code, or DrawMGT can automatically assign one. The key point is that each document code has a defined format and allowed range of values, which can often be used to automatically assign the document's classification codes.

- All documents are assigned a document code. It can be user assigned or automatically generated by DrawMGT.
- The complexity of the document numbering system can range from a simple numeric ID to a multi-part alphanumeric code (e.g. *DOC-J-10-405.12-C*), where each component of the document code has a specific allowed range and meaning.
- Document code components can be used to automatically assign document classification codes to documents.
- Multiple document coding systems are supported.
- Each document can also be assigned a second document code, called an '*external key*', which can be used if a document has an alternate document code (useful for documents from external suppliers)
- Drawing search and retrieval can be performed using the document codes. Searches can be performed using complete or partial document codes.
- Project phases including planning, tendering, construction and as-builts are fully supported.

The drawing code systems are defined during system configuration. When a document code system is defined, the allowable range and meaning of the various components of the document coding systems are entered into the DrawMGT system, along with mapping information for automatically setting classification fields. Additional document code systems and extensions to existing document code systems can made at any time after the system is in operation.

For example: given the drawing code *X-10-F-00520-C1*, where *X* represents the contract, *10* the work type (excavation), *F* the location (Adit-2 access tunnel), *00520* the starting chainage, and *C1* the

revision, DrawMGT can automatically assign all classification criteria derivable from the drawing code. Another drawing, from a different supplier, would have a completely different drawing code, and the drawing code *03245-A2-B-0340-1*, might actually be directly related to the previous one, provided you knew that, for this supplier, *A2* means Adit-2, and *B* means excavation. By pre-configuring DrawMGT with information about all drawing codes used in the project, the association between the drawings will automatically be made when they are registered in the system. This means that you need only specify a well-known set of criteria in order to find all documents related to particular issue, regardless of the document's source or drawing code value.

5.2   Document Types

The *document type* records whether the document is a drawing, report, memo, etc.

A partial list of some of the commonly used document types actually used in projects is shown below:

- Construction drawings
- Memos
- Tunnel profiles
- Tunnel inspection photographs

- Design reports
- Inspection reports
- Geological mappings

5.3   Document Workflow

DrawMGT currently supports the following document workflows:

- Construction drawings   Workflow steps: *design, check, approval* and *submittal.*
- Vendor and supplier drawings   Workflow steps: *receipt* and *approval.*
- Controlled documents   Workflow steps: *approval.*
- Uncontrolled documents   Workflow steps: none.

For each workflow type and workflow step, lists of users authorized to perform the step are defined. For each revision of each document, the users that perform workflow steps are recorded, along with the dates on which the steps are performed. DrawMGT also allows you delegate authority to perform workflow steps and records in its audit trail all workflow operations (See *Chapter 9 – Access Control and Security* for a complete description).

It is possible to search for documents based on their workflow state, for example, that search results only contain *approved* documents. Additionally the system can be configured so that, by default, search results only contain *approved* or *submitted* documents.

Outdated revisions of a document (e.g. revisions that have been superseded by a subsequent revision) are marked as *superseded* and are, by default, excluded from search results. You can still however search for superseded revisions of documents. When superseded documents are displayed they are highlighted and marked as such, in order to ensure that they are not mistakenly assumed to be the currently valid revision. Documents can also be marked as obsolete and, by default, are excluded from search results.

The workflow steps record not only the dates upon which the steps are performed, but also their *planned* date, allowing you to manage lists of planned deliverables and identify upcoming document deliveries or late documents.

Review, Approve, Submit processing represents the traditional mechanism whereby a document is created, reviewed, approved and released:

- Review (checking) is *role*-based, which means that any DrawMGT user configured with the appropriate *review* role for the given contract / group can check the document.

- Approvals are *role*-based, which means that any DrawMGT user configured with the appropriate *approval* role for the given contract / group can approve the document.

- *Submittals* are supported by the system. These are formal deliveries of sets of drawings and/or documents to DrawMGT users or other third parties. This includes automatic generation of a cover letters and e-mail notification of document delivery. Note that the system maintains an audit trail and locks all delivered documents so that you have an accurate record of all delivered documents.

Review and approval steps can be assigned to groups and individual tasks can be assigned 'planned' completion dates. DrawMGT tracks the planned dates and can provide reminders of upcoming tasks. You can also display the 'completed' dates vs. the 'planned' dates to track the efficiency of your organization and help revise your project schedules.

5.4 Source and Publish Files

DrawMGT is able to manage documents both in their native type (original 'source' format) as well as in a separate 'publish' format. For example, you might use DrawMGT to manage a series of AutoCAD drawings, but publish (or transmit) the drawings as PDF files. Most users would be allowed to access only the published PDF versions, but a selected set of users, restricted to your design staff, would be have access to the original AutoCAD versions.

While DrawMGT recognizes many document types, it has only a rudimentary awareness of the actual document structure or content. This means that in most cases documents must be created, viewed and edited using external applications. That said, helper applications for the most common document types (PDF, MS Word, Excel, etc.) are well integrated with most web browsers.

Mark up of drawings is supported using external applications (such as Acrobat Writer, which can be used for PDF mark up) utilizing an organization's established software infrastructure.

6 Task Management

Tasks are essentially '*to do*' items which can be attached to one or more documents. They record who issued the task, the creation and due dates, priority, and to whom the task has been assigned (and delegated to). A complete record of all discussion is also recorded along with any supporting documents.

By default the types of tasks supported by DrawMGT include:

- Drawing comment
- Request for new drawing revision
- Punch list item
- Design review issue
- Technical query
- Request for comment
- Redlining of drawings

You can change and extend this list to fit your project's needs.

Task processing allows users to provide feedback and ask questions about documents.

- All tasks are assigned a *type*, such as *technical query, document revision request,* or *punch list item.*
- Tasks can be assigned to users as *to do* items with due dates.
- Schedules of deadlines and individual *to do* lists can be generated.
- Tasks can automatically be forwarded via e-mail to responsible engineers and to staff for review.
- A complete task history is maintained and can be viewed.

Tasks can be assigned classification codes just like documents, so that you can search for tasks in the same way you search for documents. When you view the details of a document, links to all the tasks associated with that document are also provided.

6.1   Task Workflow

To open a new task it is only necessary to provide a summary title of the task and to assign the task to the responsible person. The priority (e.g. *Urgent*) and a due date are typically also entered. Additional information and supporting documentation, as it becomes available, can be added as notes and attachments.

The person assigned to the task is advised of the task either by using DrawMGT to review pending tasks or by an e-mail reminder. Acknowledgment of the task is typically made by changing the status from *New* to *Pending*. Responsibility for the task may be delegated to another person. Additional information, such as relevant drawings or documents, may also be linked to the task. Requests may be made for additional information by entering a new note.

After sufficient information is available, the person responsible for the task enters a concluding note and marks this as a *Response*. A completion date is entered and the status is changed to *Answered*.

The person who issued the task performs the final review of the task (which could also be delegated), and if satisfied, changes the task's status to *Closed*.

6.2   Task Notes

Task Notes are textual notes that can be attached to tasks. They are used with tasks to record the dialog and exchange of information between those involved in accomplishing tasks. In order to provide a structure to notes, important notes can be marked as *Question, Answer, Alert,* or *Response.* Important notes are highlighted when displayed.

An unlimited number of notes may be added to a task. To better display tasks, a short form may be used, which only displays the important notes (e.g. notes types: *Question, Answer, Alert,* and *Response*).

6.3   Attachments

Electronic files can be attached to notes, such as sketches or photos showing task details. If the document is already on DrawMGT, a link can be made associating the document with the task.

6.4   Subscriptions

Users are subscribed to tasks, either based on their responsibilities or because they elect to subscribe to particular tasks which they consider relevant to their work. At any time users can easily monitor the status of tasks to which they have subscribed.

7 Search

Efficient search for documents and tasks is a key feature of DrawMGT. Both text search (*Google*-like search) and searching based on classification criteria are supported.

Text searching is implemented to include not only titles and descriptions, but also the classification criteria entered for the document or task, making text searching with DrawMGT both efficient and powerful.

While many users will find text search sufficient for their needs, searching based on engineering classification criteria (e.g. location, work type) provides more precise results. DrawMGT makes it very easy to restrict search using classification criteria. Industry standard and project-specific classification criteria are supported.

For more advanced search, DrawMGT supports search using complete (or partial) drawing numbers, document or task creators (e.g. designer or author), workflow state as wells as by date. Documents and tasks can be searched for using one or more of the following criteria:

- Document or task code, partial code.
- Location and work type classification.
- Document or task title.
- Document creator (e.g. Designer or Author), Task Issuer
- Dates (including documents recently reviewed, approved or distributed).
- Document or Task type.
- Alignment, chainage, elevation, etc.
- Key word and standard industry classifications (e.g. KKS).
- Workflow state (designed, reviewed, approved, etc. for documents; status for tasks).

The search result is a list of candidate documents or tasks, which includes links to view the documents, and 'drill-down' to display additional details about the documents and tasks.

Documents found by searching (including 'drill-down' links) can be placed in a document or task *basket*, allowing the use of repeated searches to build up a list of documents or tasks. The lists can be further sorted by various classification criteria using the different views.

By default DrawMGT only lists the currently valid (excluding *superseded* and *obsolete*) documents. Superseded and obsolete documents displayed in lists are highlighted to prevent their being mistakenly assumed to be the currently valid revisions.

8 Reporting

Reports can be generated by DrawMGT in many ways:

- Document or task details can be reported using the *Print* feature (using button in top menu). The resulting web page can be printed or used to generate a PDF document.
- Document or task lists (e.g. search results or basket) can be viewed in a number of ways, depending on the users needs (e.g. status report, design/check). Reports can be generated using the *Print* feature with optional input of report titles and page breaks. Custom list views can be provided if required.
- Document submittals include a cover letter and document list based on project templates.
- Summaries of documents and tasks registered in DrawMGT are provided for each contract as well as over the entire project. Custom summaries can be provided if required.

Examples of reports are:

- Drawing lists.
- Lists of documents matching user defined criteria (e.g. document search results).
- Lists of documents delivered to clients.
- Lists of pending tasks.
- 'To do' lists and upcoming deadlines (e.g. for document review and approval).
- Schedules of planned tasks.
- Document revision histories.
- Lists of review comments and queries associated with documents (and their status/deadlines).

The document and task lists can be displayed using different *Views*, without having to search again. This is useful when checking classification data or workflow status for particular types of documents. Additional custom reports (Views) can be provided upon request.

Document lists can also be exported in tab-separated format, suitable for further processing in Excel or other programs, should you need to create a special report not immediately available from DrawMGT.

Reports saved in PDF format can be filed on DrawMGT as document revisions (e.g. Drawing lists or Task lists which are generated on say a monthly basis), making it very easy to maintain a project history.

9 Administrative Functions

Administration responsibilities for DrawMGT are divided between those handled by SoftXS (e.g. initial system configuration and changes) and those handled by the local site administrators (using configuration features built into DrawMGT).

Local site administrators are able to configure the following items:

User configuration:

- Create new users and assign/modify their roles
- Set/reset user passwords and mark departed users as *Disabled*

System configuration:

- Create new contracts and groups
- Add work types, locations, alignments, companies

Local site administrators are also able to monitor who has been using the system recently (e.g. display lists of which users and which IP addresses have accessed the system).

Administrator privileges can be assigned independently for each contract.

SoftXS administers the following system configuration items:

- Document types
- Comment types
- Contract/group based defaults and restrictions for comments, documents, revisions
- Document code types
- Work flow types
- Submittal templates
- Various other classification items such as file types, project phases, work categories

System configuration is performed by SoftXS as part of the customer's maintenance agreement.

10 Access Control and Security

10.1 Users Groups and Roles

In order to access the DrawMGT system a user ID is required. The user ID forms the basis for controlling access to the various system transactions and documents stored on the system. A key point is that DrawMGT separates its '*user permissions*' from your '*project authorities*'. This means that roles for performing operations can be delegated and that trusted users can perform workflow steps on behalf of other users. A practical example is that deputies to project and lead engineers (or, if you policies allow it, personal assistants) can approve or issue documents in the name of the engineer. Note that the actual user who performed the operation is always recorded in the system's audit trail.

The most basic access controls are at the project, contract and group levels. This means that only users with explicitly granted access rights are able to access the documents associated within a specific contract. Simply stated this means that you can safely partition your projects into *contracts* and assign access rights for users within the contracts, without exposing all your other documents.

The actual mechanism by which this is achieved is to assign each user to one or more groups, which are, in turn, members of contracts. Within each group, a user can be assigned one or more *roles*, which determine which system functions can be performed on the documents assigned to that group.

The user *roles* can be thought of as the roles you commonly perform in your daily business, e.g. project-manager, engineer, document reviewer, secretary, librarian, etc. As in real life, you commonly have more than one role. For example, you might be a project-manager for sub-project *A1* associated with client *A*, and a document approver for sub-project *A2*, additionally you might be a document recipient for newly approved documents from project *B*.

As stated above, it is possible to delegate your roles to others on a permanent or temporary basis. For example, your secretary can be empowered to perform certain duties on the system on your behalf, or you might have another engineer take over all your duties while you are on vacation.

While many content management systems perform workflow steps based only on the actual user performing the operation and the current date, DrawMGT allows users to perform operations and assign dates on behalf of others (providing they have been assigned the appropriate roles). This means that common tasks can be delegated to others or be performed after the fact.

10.2 Audit Trails

A log of all operations performed on the DrawMGT system is recorded and forms the basis for the system's audit trail. The information includes the date and time, the document identifier, the operation performed and the user that performed it. While workflow steps can be performed on behalf of someone else and can be recorded in DrawMGT after the fact, the *actual* user and date/time that a workflow step is performed is recorded in the system's audit trail.

Additionally, the history of each document, comment and query can be summarized, which includes the dates and details associated with each new version of the document, its updates and all the workflow steps performed on it.

The audit trail data can also be used to:

- Provide a complete and accurate record of all official document approvals, deliveries and submittals.
- Investigate your project's workflow and target your organization's training needs.
- Investigate problems associated with the use of incorrect or obsolete documents.

11 Language Support

DrawMGT has been designed for the international market and versions in English and German are currently available. A French language version is planned for an upcoming release.

DrawMGT fully supports the ISO-8859-1 Western European character set. This means that DrawMGT understands the accented, umlauted and other national characters of all Western European languages.

DrawMGT's configuration data (the list of project locations, work types, contract names, document types, classification information, etc.) can be in any language, or even a mix of languages. For example you might want to have most of your project in one language, and then use other languages in those contracts, which have international suppliers.

12 Data Import and Export

DrawMGT has been designed as an Open System with respect to the data it accepts and shares with your other automated systems. A primary DrawMGT design goal is that co-exists with your existing systems without disrupting your current working methods. Your documents and their classification data is never 'trapped' in DrawMGT and can always be exported.

12.1 Data Import

Most document metadata can be uploaded in bulk. This enables:

- Data migration.
- Co-existence with other document management systems.

Document and classification data can also be uploaded to allow DrawMGT to be used as an Internet 'publishing' front-end for other systems.

12.2 Data Export

All data and documents in the DrawMGT system can be exported in electronic formats for use by other systems. This includes all reports generated by the system and all documents and document metadata.

All system data can be exported in a variety of formats. This includes the creation of custom reports, which can be dumped in comma and tab-separated formats for input into other external systems.

12.3 Data Migration Services

SoftXS offers data migration services and is willing to help you migrate your document archives into and out of DrawMGT. This includes:

- Assistance in bulk data transfers to and from DrawMGT's internal relational database server

- Preparation of DrawMGT data for loading into external systems
- Preparation of as-built document archives, suitable for delivery to project owners, which can be accessed without the DrawMGT server

13 Example Uses of DrawMGT

Although DrawMGT has been designed to be the complete repository of all construction project documents and drawing, you can also use DrawMGT in smaller environments. This chapter demonstrates some example uses.

13.1 Construction Project Management Tool

DrawMGT is used for all project phases, and project drawings and documents.

The commenting/query system is used to manage project *to do* items, including items associated with document production, design review, correspondence, site queries, as-built documentation, etc.

This case simply the sum of the uses described in the following sections.

13.2 Drawing Production and Vendor Drawing Tracking

This is the most typical use of DrawMGT. DrawMGT is used to manage the workflow associated with drawing production: design, checking, approval and issue. In addition DrawMGT is used to track drawings supplied by outside entities (vendors, suppliers, etc.), including the tracking of their due dates, actual date of receipt and their approval status.

The commenting and query system is used to manage:

- Requests for new drawing revisions
- Design issues
- Design review '*to do*' items

13.3 Technical and Site Query Management

The DrawMGT system is used to record the formal requests and responses to technical and site queries. The commenting and query sub-system is used to record the requests, all technical and other discussion, and a final official response.

The due dates and priorities can be used to identify items requiring an immediate response.

13.4 Standard Detail and Template Library

The DrawMGT system is used as a library of standard design details and document/drawing templates, classified by engineering discipline and work type. The individual drawings could be created especially for the library or imported from past projects. The goal is that all engineers in a design office have access, and can contribute, to a common pool of standardized drawings and documents.

The library could contain also example contracts, documentation describing standards, specifications, etc.

13.5 Tunnel Inspection Records

Tunnel inspection reports are scanned and registered as documents. Each report is classified by alignment and to/from chainage.

Inspection requests may be used to manage the inspection schedule. The chainage to be inspected is recorded as classification information and any particular issues associated with the upcoming (or completed) inspections are record as an additional notes associated with the query.

In addition, actual inspection photographs of the excavation and critical reinforcement details (that will later be covered) can be stored in the system and become part of the project's permanent record.

13.6 Tunnel Profile Management

Tunnel profiles are registered in the DrawMGT system and classified by alignment, chainage and the inspection phase (rough excavation, after remedial work, after final lining, etc.).

The commenting/query system can be used to record requests for inspections, additional lining and rework.

13.7 Correspondence Tracking

The DrawMGT system is used to record and manage all official project correspondence.

Documents (letters, reports, emails) and either scanned or electronic versions are registered in the system and classified according to project specific criteria (contract, location, work type, alignment, supplier, etc.).

Correspondence related to do items are recorded as comments, assigned priorities, due dates, etc. and assigned/delegated to appropriate individuals. Open items can be tracked by searching by due date and priority.

It is planned that future versions of DrawMGT will be able to accept and automatically register incoming email as correspondence.

13.8 As-Built Project Archive

At project completion a special DrawMGT system is created containing all the as-built drawings and any other documents and reports that might be useful for later operation and maintenance. Upon request SoftXS can also create static CD and DVD based systems that can be used without the DrawMGT server.