Contractual document process model for document management

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Abstract

Many researchers predicted an increase in the use of electronic document management systems in the construction industry as the cost of computer hardware decreased and the number of proficient users increased. Despite this initial optimism, electronic document management systems have failed to deliver the anticipated increase in the effectiveness of information control. Current research projects demonstrated the advantages gained from conceptualizing knowledge for document management tasks such as information sharing and retrieval. This paper describes a technique for modeling construction contract conditions for the purpose of enhancing document management practices.

Contract conditions describe the rights and obligation of the parties to the contract and describe necessary actions and procedures in order for each party to secure its entitlements under the contract. A detailed understanding of the contract conditions, or lack thereof, will have a major impact on the ability of a party to protect its rights in case of disputes. The contract conditions are therefore a cornerstone of the contract documents that must be consulted throughout the project duration for effective contract administration. The majority of construction contract conditions contain specific document processes required for regulating the progress of the work. Conceptualization of such processes refers to the act of identifying the concepts (actors, document types, time limits, etc.) in addition to the relationships between these concepts dictated by the contract conditions. Specifying these concepts into a model that can be used by the project’s document management system enhances the effectiveness of the document management system not only for the post-document-generation functions, but also in the pre-document-generation tasks. Consistent use over several construction projects will generate a repository of vast amounts of knowledge that can be easily accessed and re-used to solve problems encountered in future projects.

Keywords: document management systems, Contract conditions, modeling

1 Introduction

Construction projects produce vast amounts of documents. Turk et al. (1994) estimate that the construction of a single structure can generate about 10,000 documents. Moreover, numerous types of construction documents are generated and require effective management for successful contract administration: (1) contract documents; (2) correspondences; (3) minutes of meetings; (4) periodic progress reports; (5) quality and safety reports; (6) change order documents; (7) payment requisitions; (8) weather records; (9) material and equipment records; (10) employee time cards; (11) delay records; (12) records of overhead costs; and (13) claim documents (Rubin et al., 1999). The necessity
or reason behind producing and exchanging a document between the parties to a construction contract will be to either satisfy a contractual obligation or secure a contractual entitlement. As such, the origin of the requirement for most of the construction documents mentioned above will be the conditions of the construction contract, which consequently makes the contract conditions an imperative resource for any document management efforts. Moreover, for certain documents (such as change orders, applications for payments, claims, etc.) the contract conditions may define processes that must be followed for generating and exchanging such documents between the parties. The importance of the contract conditions is most notable when the entitlements of one of the parties is hinged upon the precise conformance with a document process specified in the contract, such as in the case of conditions precedent which are regularly encountered in construction standard conditions of contract.

This paper proposes the use of a model developed from the document process requirements in the contract conditions as a guide for managing documents in construction projects. The next section presents a quick review of electronic document management systems (EDMS) in the construction field as well as previous research in the modeling of contract conditions. After that the proposed model is described using the American Institute of Architect’s AIA Document A201-2007, General Conditions of the Contract for Construction, as an example of a standard form of contract. Finally the benefits from applying an EDMS based on the contractual process model for project documents are briefly outlined.

2 Background

Effective contract administration requires thorough documentation and record keeping (Rubin et al., 1999), which are essential for day-to-day project management activities and are vital for proving claims and avoiding/managing disputes (Pena-Mora et al., 2003). Because construction projects produce huge amounts of documents, effective document management systems that can access, search and retrieve the necessary documents depending on the user’s requirements are very important (Rubin et al., 1999). This necessity drives research aimed at developing document management systems for construction projects (Hajjar and AbouRizk, 2000).

The declining cost of computer hardware and the increase in use of computer applications in the construction field prompted a shift from the traditional document management practices (which rely on paper documents) to the use of EDMS’s (El-Tayeh and Gil, 2007; Kangari, 1995). According to Turk et al. (1994), some of the basic functions required of an EDMS include: (1) electronic archiving of documents; (2) creating, modifying and printing documents; (3) getting or referencing external documents; (4) providing document confidentiality and security; (5) management of the relationship between documents; (6) extracting documents or data from documents.

Despite the importance of effective document management practices in construction projects and despite the expected increase in the use of advanced document management systems, document management practices in the construction industry have been described as inefficient and of limited reliability and cost-effectiveness (Chassiakos and Sakellaropoulos, 2008; Lee et al., 2003), and inadequate and unable to provide the expected impact (Vidogah and Ndekguri, 1998). Some researchers criticized EDMS’s for simply imitating paper-based document management process (Zhu et al., 2007), while others noted that many EDMS’s are only being used for digital storage of documents with minimal search and retrieval capabilities (Fruchter et al., 2003).

The modeling of contract processes has been considered in several research studies. Daskaloglu and Sergot (1995) present an approach that models the drafting of the contract conditions for natural gas supply and purchase contracts. The approach starts with a generic document that is modified according to the user’s input to include specific contract instances from a database of contractual instances. Constraints built in the generic document ensure the soundness of the drafting process. Chieu et al. (2007) developed a web-based electronic contract system that uses a service-oriented
architecture as a guide not just in the drafting but throughout the whole contract lifecycle process: from the initial draft to final signing of the contract. Based on security settings, users from the different parties involved can access the system to perform the various activities in the workflow process. The system also provides a notification capability for sending messages between users.

While the above research projects focus on managing the contract formation process, Krishna et al. (2004) proposed a framework for monitoring the fulfilment of e-contracts by the use of a relational database. The framework employs a business process model that defines the various contract entities, activities, events, etc., and their interrelations based on the conditions of the e-contract. The researchers described the implementation of the system on a composite contract in the textile industry.

Construction contracts are a unique form of contracts because they involve the procurement of goods and services over a specific duration in order to supply a distinctive end-product that will almost never be replicated. Although provisions for construction contracts are not necessarily exclusive to this form of contract, yet, collectively, they form a unique set of contract conditions unlike other standard forms of contract in other fields. In the construction field, various research studies have focused on managing specific document types; for example, construction drawings (Finch et al., 1996), requests for information (Zhu et al., 2007), and claim documents (Al-Sabah et al., 2003). However, a process model that satisfies the contractual requirements of the various types of project documents for the purpose of improving document management has yet to be developed.

3 Contractual process model for document management

In this section, AIA Document A201-2007 is used to illustrate how a document process model based on the contract conditions can be developed. A201 specifies the actions required from the Owner, Contractor and Architect regarding numerous documents generated throughout the project’s duration. Article 7, for example, deals with changes in the work, a very common source of disputes in the construction field. Article 7 specifies the duties of the entities regarding two important documents, Change Order documents and Construction Change Directive documents. According to A201, a Change Order is a change that has been agreed upon on all terms (type of change, cost and time) by the Owner, Contractor and Architect, while a Construction Change Directive is a change required by the Owner and Architect absent an agreement on any one of its terms by the Contractor. Once an agreement is reached, a Construction Change Directive is recorded as a Change Order. The process of the Construction Change Directive is outlined in Figure 1.

![Figure 1. Construction Change Directive process in A201-2007](image-url)
A review of Article 7 for the purpose of document management indicates that the process is initiated by the Architect. This can be represented by the following axiom:

\[
\text{issue(Architect,CCD)}
\]

The following attributes are necessary to accurately model a Change Order or a Construction Change Directive:

- A description of the required change.
- The impact on the contract sum.
- The impact on the contract time.
- The signatures of the relevant entities.
- The date of the requested change.

Accordingly, the following axiom holds:

\[
\forall \text{CCD}(\text{issue(Architect,CCD)} \rightarrow \text{hasA(CCD,Descrip)} \land \text{hasA(CCD,Sum)} \land \text{hasA(CCD,Time)} \land \text{hasA(CCD,Signature)} \land \text{hasA(CCD,Date)})
\]

The signature of the Contractor, expressing agreement over the terms of the change, differentiates between Change Order and a Construction Change Directive. Disagreement over the terms of the change requires the Contractor to submit itemized data for the cost of performing the changed work, and the Architect to determine the adjustments to the time and cost of the contract, which is represented as follows:

\[
\forall \text{CCD}(\text{reject(Contractor,CCD)} \rightarrow \text{submit(Contractor,CostData)})
\]

\[
\forall \text{CCD}(\text{reject(Contractor,CCD)} \rightarrow \text{determine(Architect,Time)} \land \text{determine(Architect,Cost)})
\]

Finally, it is possible that a Construction Change Directive that is lacking agreement by the parties might become the subject of a claim.

\[
\exists \text{CCD}(\text{reject(Contractor,CCD)} \land \text{submit(Contractor,ClaimNotification)})
\]

The above analysis not only identifies the entities involved in the creation of the documents throughout the process, but also states their duties at the various stages. It is worth noting the number of documents that may result from the process described above: a Construction Change Directive, a Change Order, itemized cost data submissions, claim notification. A claim notification is in fact the beginning of another related process, that of dispute resolution. As such, it can be said that contractual document processes are interlinked, where the initiation of one process may lead to the start of another. A comprehensive document management system must be able to model all document processes specified in the contract conditions.

Another important aspect that must be captured in the document process model is temporal issues specified in the contract conditions for specific documents. The contract conditions may specify certain time limits for the generation of specific documents. The time limits might be subjective; in the above model the Contractor is required to ‘promptly’ advise the Architect of agreement or disagreement on the terms of the change. Or, the time limits might be explicit by stating an exact number of days or weeks in which a party can issue a certain document. A common example for this latter case is the claim process which in AIA Document A201-2007 is the start of the dispute resolution mechanism. Figure 2 presents the timeline for claims assuming the Architect serves in the contract as the claim’s initial decision maker.
The following time limits are noted:

- \( \Delta_1 \): the time limit for submitting a claim. \( \Delta_{1_{\text{max}}} \) value is 21 days from the date of the claim event, or the date the claimant recognizes the claim, whichever is greater.
- \( \Delta_2 \): the time limit for the Architect to request additional supporting data. \( \Delta_{2_{\text{max}}} \) is 10 days from the date of submitting of the claim.
- \( \Delta_3 \): the time limit for complying with the Architect’s request for additional supporting data by the relevant party. \( \Delta_{3_{\text{max}}} \) is 10 days from the date the relevant party receives the Architect’s request.
- The maximum time for the Architect to render a decision is 30 days, measured from the date of submitting of the claim, after which the dispute resolution mechanism can be continued without the requirement for the Architect’s decision.

The claims process not only involves several documents (claim notification, request for supporting data, supporting data, Architect’s decision) produced by different entities, but also puts time constraints of varying durations on the parties required to make the submissions. For example, while theoretically the Architects’ decision can take a maximum of 30 days, the request for supporting data and the time required to prepare such data might minimize this duration to only 10 days. An effective document management system must be able to model the temporal aspects of documents specified in the contract conditions in order to successfully guide the users in the document management process.

4 Conclusion

Because construction projects produce large amounts of documents, document management is essential to be able to easily access the required information. However, a document management system should not be limited to the post-document-generation functions (such as searching and locating the relevant documents) but should also guide the user in the process of generating project documents. In order to identify the rights and obligations of the parties of the contract and in order to regulate the progress of the work, the contract conditions refer to various types of project documents including, inter alia, shop drawings, cost data, claims, various types of requests, submittals, and notifications. In addition, the contract conditions might specify the processes for producing such documents, including who is responsible for preparing the document, what to be included in the document and when to submit the document.

This paper presents a methodology for developing a document process model based on the contract conditions for assisting in the document management tasks of construction projects. The methodology
objectifies the document requirements in the contract conditions to define a template that can be used by an electronic document management system. In the methodology, not only are the attributes of the documents as set out in the contract conditions considered, but also included are the temporal aspects related to the documents. This is especially important since compliance or non-compliance with contractual time limits can produce significant legal ramifications, as in the case of conditions precedent. Finally, it is anticipated that consistent use of a contractual process-centered EDMS over several construction projects will generate a repository of vast amounts of knowledge that can be easily accessed and re-used to solve problems encountered in future projects.

References


