

# **CONTRACT ADMINISTRATION DATABASE FOR POWER PROJECTS - PARSONS BRINCKERHOFF CASE STUDY**

**Zeljko Popovic<sup>1</sup>**

## **ABSTRACT**

Paper briefly introduces principles and common practices of project contract administration, focusing on large power projects. These projects are usually complex, with long durations, involve many stakeholders and require advanced contract administration.

Case study presents contract management plan and contract administration database software that evolved from Parsons Brinckerhoff's practice in the United Arab Emirates. Contract management plan typically describes types and formats of project documents, coding systems, submission and approval procedures, issuing for construction, preparation of as-built drawings, and similar. Database software, compatible with local practice, is used to handle project documentation, with objective to centralize data management, enhance data security, provide facilities for multi-user data access, and utilize user-friendly reporting tools.

Experiences, statistics and lessons learned after two years of intensive usage are briefly summarized. Number of documents in the database reached approximately 150,000, with more than 130 active projects and 150 active users. Efficiency of administration staff was greatly improved, while project engineers valued software tools used to monitor flow of documents, control design and execution of site works, prepare regular progress reports and analyze contractors' claims, following standardized procedures and formats. Ideas and plans for future improvements are outlined at the end of the paper.

## **KEY WORDS**

Construction Project Management, Procurement Management, Contract Administration, Database Systems, Data Mining.

## **INTRODUCTION TO CONTRACT ADMINISTRATION IN CONSTRUCTION**

Procurement in construction is the process of acquiring new services or products and includes contract strategy, contract documentation and contractor selection (Bower et al. 2003). According to Project Management Institute (PMI) project procurement management also includes the contract management processes required to administer contracts. These contract administration processes deal with managing the contract and relationship between buyer and seller, reviewing and documenting performance to establish required corrective actions, and managing contract-related changes (PMI 2004). During the execution of the project contract administration may result in amendments to the contract by mutual consent.

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<sup>1</sup> PhD, Senior Civil Engineer, Parsons Brinckerhoff, Abu Dhabi, PO Box 47445, United Arab Emirates, Phone +971-2-6786060, FAX +971-2-6779772, popovicz@pbworld.com or zelkop@emirates.net.ae

Contract administration leads to orderly contract closure when works are completed in satisfactory manner or early termination of the work in accordance with the contract.

Contract administration may be considered as an open system with specific inputs and outputs. PMI (PMI 2004) defines major **input data** to contract administration as follows: contract documents (general and particular conditions describing scope of work, schedule, period of performance, roles and responsibilities, pricing and payment, acceptance criteria, penalties and incentives, change request handling, dispute resolution mechanism, etc), contract management plan (plan to administer the contract throughout the life of the contract including detailed delivery and performance requirements, programme of administration activities, required documentation, etc), performance information and reports (technical documentation such as design drawings and material proposals, progress measurement reports, invoices, etc), approved change requests (documented and agreed modifications to the conditions of the contract, scope of work, pricing, methods of construction, etc). Input data are processed in line with the contract using appropriate **tools and techniques** (for example: contract change control system, performance review techniques, inspection and audit procedures, claim administration procedures, project database management systems) generating large amounts of output data. **Output data** may include various contract documentation (design review documents, site inspection records, etc), requests for changes to be further processed, recommendations for corrective actions, payment instructions, correspondence and records related to execution of works (such as: warnings of unsatisfactory performance, requests for clarifications, accurate records of written and oral contract communications, etc).

It is clear that contract administration for large construction project involves large amounts of input and output data and specialized procedures. Because of legal implications, contract administration procedures should be well defined and suited to each individual project and supported by adequate project management information system (PMIS). Particular attention should be paid to tailoring the most important part of PMIS – project database system.

## **CONTRACT ADMINISTRATION FOR POWER PROJECTS**

Large power projects are complex and typically include power plants, high voltage substations, overhead transmission lines, underground and submarine cable works, and similar. Such projects require good coordination between different technical disciplines and involve many stakeholders (owners, developers, contractors, government agencies, consultants, etc). Due to their complex nature, power projects are often based on EPC (Engineer, Procure and Construct) type of contract, where major equipment supplier undertakes the whole project, produces design documentation to suit his equipment's requirements and becomes responsible for completion of all construction, installation and commissioning works. Technical supervision of works and contract administration are usually performed by the highly specialized engineering consultant appointed by the owner.

The owner of power projects in Abu Dhabi Emirate of the United Arab Emirates is Abu Dhabi Water and Electricity Authority (ADWEA), while Parsons Brinckerhoff's Power Division (PB Power) is the major engineering consultant with 30 years of experience in the local power construction market. In terms of contract administration, PB Power's strategy is

to adjust own local procedures to Owner's requirements and improve flow of project documentation and availability of information for local power projects. Such approach resulted in project-tailored contract management plan and contract administration database that are briefly presented in this case study.

## **TYPICAL CONTRACT MANAGEMENT PLAN**

A plan to administer the contract should be prepared based upon the specific buyer-specified items within the contract, and delivery and performance requirements that the buyer and seller must meet (PMI 2004). The plan covers the contract administration activities throughout the life of the contract. Each contract management plan is subset of the project management plan and one of the main inputs to the contract administration process.

Published work on the contract management plan is mostly academic and of limited use to the practitioner. There are few published practical recommendations on how to establish and utilize effective contract administration procedures, such as best-practice procedures collected in "Handbook of Project Management Procedures" (Hamilton 2004). Large companies in construction industry sometimes develop and maintain own guidance for practical contract administration on their projects.

PB Power is a company that recognizes importance of defining the contract management plan in the early project stages. Detailed contract management plans (called "Contract Procedure Manuals" in local terminology) are created as part of contract documents and issued for every power project, tailored to suit both owner's contractual requirements and specific project needs.

Contract procedure manuals tend to describe types and formats of project documents, coding systems, submission and approval procedures, preparation of as-built drawings, and similar. Typical contents of PB Power's contract procedure manual for power project may include:

- An introductory chapter with contract details;
- Names, contact addresses and organisation charts of the main stakeholders;
- General communication requirements (acceptable media and languages for communication; content, frequency and recording of coordination meetings; recommended major forms of general communication documents, such as: contractual correspondence, minutes of meetings, site memos, drawings; etc);
- Performance monitoring procedures (software requirements, presentation forms, approval and updating procedures related to project time and cost plans; content and frequency of monthly progress reports; taking of site photographs; inspection and testing procedures; etc);
- Instructions on preparation of as built documentation (operation and maintenance manuals, as built drawings);
- Instructions on packing, shipping and transportation of materials and equipment (handling and insurance provisions; marking and weather protection; receipt verification; procedures in case of shipment delays, losses or damages; etc);

- Classification and identification system for project documents, usually resulting in each document being identified with alphanumeric code of 15 positions, subdivided into 6 groups (see Figure 1), including detailed lists of available codes;

N	N	N	N	A	A	N	N	N	N	A	N	N	N	A
(1)				(2)		(3)				(4)		(5)		(6)
Where <b>N</b> is a number 0 to 9 and <b>A</b> is an alphabetical capital letter A to Z, excluding O and I														
1.		Project code												
2.		Origin of document												
3.		Subject code												
4.		Type of document												
5.		Document number												
6.		Revision index												

Figure 1: Brief explanation of typical document identification system

- Document distribution schedule, similar to the sample shown on Figure 2;

Document	Engineer		Owner		
	Head Office	Site Office	Head Office	Site Office	Operations Office
Drawings and materials for approval	2	-	2	-	1
Approved drawings	2	1	2	1	2
Drawings for information	2	1	2	1	2
Schedules and specifications	2	1	2	1	2
As built drawings, red marked	-	1	-	1	1
As built drawings, final (prints)	2	-	5	-	2
As built drawings, final (CD ROM)	2	-	2	-	2
Acceptance test procedure for approval	2	-	2	-	1
Approved acceptance test procedure	1	1	2	1	1
Insurance certificates	1	-	2	-	1
Receiving cum damage reports	1	1	2	-	1
Site progress photos	1	1	2	-	1
Monthly progress reports	1	1	2	-	1
Correspondence (general)	1	-	1	-	1
Correspondence (site)	1	1	1	1	1
Payment invoices	6	-	1	-	1

Figure 2: Extract from the document distribution schedule for typical power project

- Procedure for submission and approval of documents, including the following: document submission requirements including forms of Document Transmittal Sheet (DTS) and Material Approval Sheet (MAS) (see sample Figure 3); document review procedure with form of Comment Sheet (CS); official approval categories ("Approved", "Not Approved", "Approved Except As Noted", "Returned", "For Information"); issuing of drawings "for construction", etc;

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Contractor's logo		Contractor's name, address, telephone and fax number					
<b>DOCUMENT TRANSMITTAL SHEET No. _____</b>							
Document Distribution:							
<input type="checkbox"/> Owner, Head Office						<input type="checkbox"/> 1 Copy	
<input type="checkbox"/> Owner, Site Office						<input type="checkbox"/> 1 Copy	
<input type="checkbox"/> Owner, Operations Office						<input type="checkbox"/> 1 Copy	
<input type="checkbox"/> Engineer, Head Office						<input type="checkbox"/> 1 Original + 1 Copy	
<input type="checkbox"/> Engineer, Site Office						<input type="checkbox"/> 1 Copy	
Your Reference:		Our Reference:				Date:	
<b>CONTRACT NUMBER AND TITLE</b>							
The following Documents are enclosed :							
<input type="checkbox"/> For Information only	<input type="checkbox"/> For approval	<input type="checkbox"/> Approved Documents	<input type="checkbox"/> As Built				
To be filled out by CONTRACTOR				To be filled out by OWNER/ENGINEER			
DOCUMENT TITLE	Document Identification		STATUS			DATE	RET
	Document No.	Rev	AP	AEN	NA		
AP - Approved		AEN - Approved Except as Noted		NA - Not Approved		RET - Returned	
Comments :		See attached Comment Sheet No. _____					
CONTRACTOR		ENGINEER			OWNER		

Figure 3: Form of Document Transmittal Sheet (DTS) used to submit documents for approval

- Sample forms and guidances for preparation of various project documents (site handing over certificate, monthly progress report, contractor's daily report, clearance to energisation, preliminary acceptance certificate, form of snag list, request for inspection of works, site concreting report, test acceptance certificate, receiving cum damage report, commissioning check list, application and approval of shutdown programme, material and equipment shipment monitoring chart, notification of guarantee defect, form of payment certificate, site safety assurance and reporting forms, etc);
- Instructions on preparation and contents of the final project completion report.

### CUSTOM CONTRACT ADMINISTRATION DATABASE

In addition to sample contract administration plan with detailed procedures, PB Power has developed a database application for management of project documentation, with objective to centralize data management, enhance data security, provide facilities for multi-user data access, and utilize user-friendly search and reporting tools. Custom tailored software, compatible with local business practice, was preferred when compared to commercially available solutions. Software title is PB Power's Project Administration Wizard (PB PAW).

## SOFTWARE ARCHITECTURE

All basic data are stored in a relational database centrally and securely located on PB Power's local network server. Database is accessed via compact and easily installed client application, developed using SQL and MS Access Visual Basic for Applications. Clients can log onto the database from any location and work with data. Several users can access database at the same time, even if some of them are editing individual database records.

## DATA SECURITY

Unauthorized persons cannot access database contents. Both centralized database and client application are protected using user-level security mechanism. Implemented security levels are summarized in Table 1.

Table 1: Summary of implemented security levels

Access Rights	User Types				
	Administrators	Full Data Users	Update Data Users	Read-Only Users	Backup Operators
Import data	x				
Read data	x	x	x	x	
Insert new data	x	x			
Update existing data	x	x	x		
Delete data	x	x			
Create document review files	x	x			
Change coding systems	x	x			
Compact/backup data	x				x
Design and administer	x				
<b>Typical users</b>	Database administrators	Data operators	Project managers	Project engineers	Backup operators

Information on users' access rights is stored outside the client software and cannot be changed or corrupted from user's workstation. Every new user is granted a unique user name and adjustable password. A separate custom application is utilized by the administrator to monitor database usage in real time, prevent logging for maintenance purposes and conduct regular backups.

## MAIN FUNCTIONS

The start-up screen, shown on Figure 4, appears after successful log on, offering choice of actions. Users may choose type of project document to work with (drawing submittals, material submittals, correspondence, minutes of meeting, drawings, and technical standards) and desired action. Project contact directory is available at a mouse click, with automatic e-mailing features, generation of mailing lists and similar practical project communication aids. In addition, detailed statistical reports may be generated by the authorized persons, summarizing types and numbers of documents across different projects.



Figure 4: Start-up screen

Depending on the user’s access rights, some actions may be disabled. For example, only authorized data operators are allowed to alter coding systems necessary for data entry and manipulation, such as: valid project codes and titles; areas for basic classification of documents (electrical, civil, mechanical, etc); recognized types of correspondence (letters, faxes, e-mails, etc); available statuses for reviewed documents (“Approved”, “Not Approved”, “Approved Except As Noted”, “Returned”, “For Information”); short and long company names used for correspondence registration; employee initials and names used for distribution of correspondence, etc.

**DATA ENTRY PRINCIPLES**

A typical data entry form, related to the Document Transmittal Sheet (DTS), is shown on Figure 5.

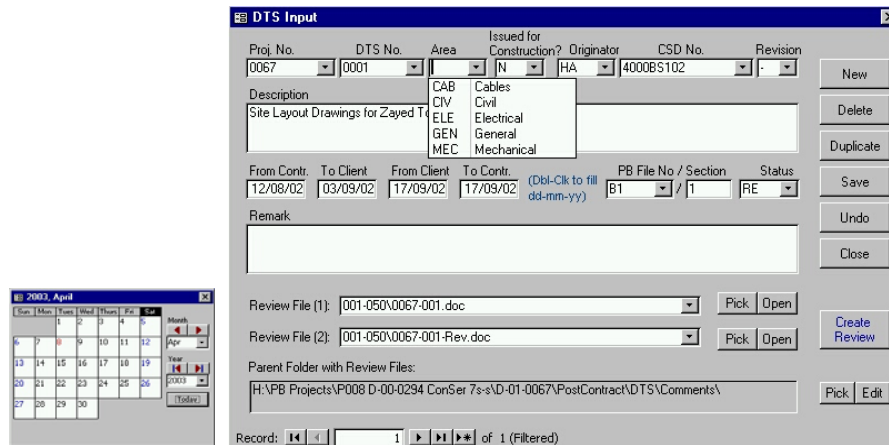


Figure 5: Sample of input form for documents submitted for review and approval

Data entry help is extensive and associative as existing database values are examined, sorted and offered as assistance in many ways. For example, during preparation of outgoing letter assistance will include values extracted from incoming correspondence, sorted in descending order and assuming that recently received letter will be subject of reply. Similarly,

distribution of incoming correspondence may be registered by picking from a list of all employees invoked by double-clicking on the “Distribution” field. Date fields are easily filled by clicking onto small pop-up calendar, and so on.

Project documentation registers are linked to external files containing complete documents. Engineer researching the contractor’s claim may be able to find all documents on specific problem, and than open document review files or linked letters and examine full information needed for problem solving. Database is designed to keep track of parent folder that contains files for a certain project and can automatically reflect changes in the case that files are physically moved to a different location on the computer network.

### SEARCHING AND REPORTING

It is a part of a daily routine for users to search database, drill into details and examine results, often using a combination of reliable search and reporting tools. All of the fields, except the date fields, may be filled partially, using desired key words. Results of specified query can be displayed on screen, displayed and sent to network printer, quickly e-mailed, or just counted.

A simple example on Fig. 6 shows resulting list of DTS submittals, sorted by DTS number, submitted by the contractor between two dates, stored in paper files related to civil works, and containing words “ground floor” in document title. Both tabular and printed reports are shown. Printed report contains header, footer and query specification, suitable for inclusion in various project reports. The view shows that 22 records satisfy the search criteria.

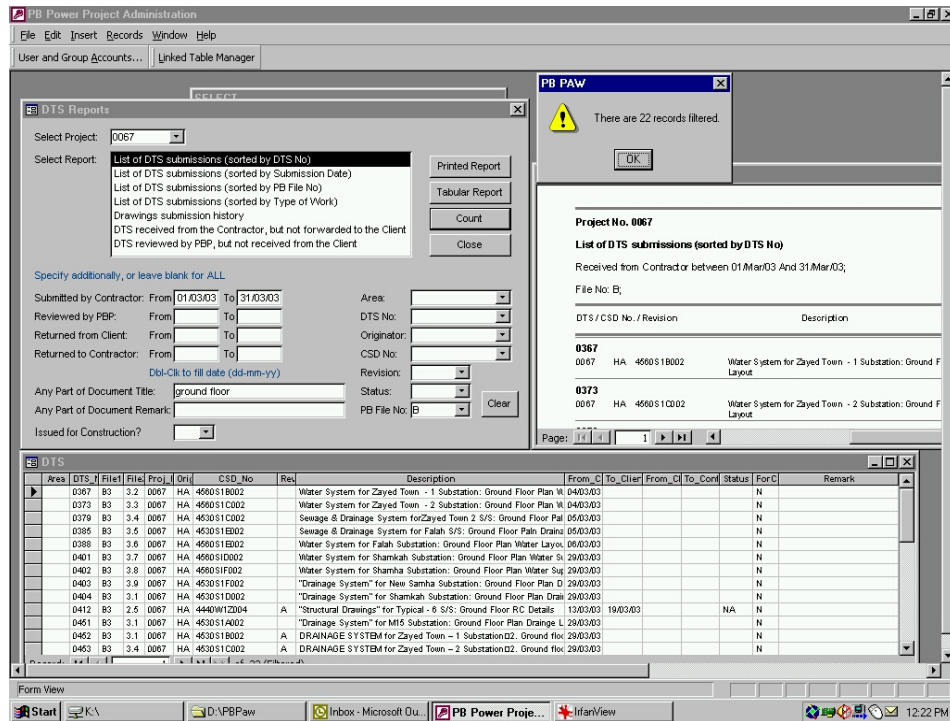


Figure 6: Sample query on DTS documents and resulting lists in tabular and printed form



Details on any retrieved record can be obtained from the tabular report by double-clicking on the small arrow at cursor position. Focus on record details can then be used to change existing data and automatically create or open assigned file with complete document contents.

### AUTOMATIC CREATION OF DOCUMENT REVIEW FILES

Documents submitted for approval are reviewed by the concerned engineers. Document review files (also called “comment sheets”) are based on previously created templates, suiting requirements of each particular project. Review file is automatically created for several documents submitted under the same DTS or MAS cover sheet by displaying submittal number and documents to be included in the review (see Figure 7).

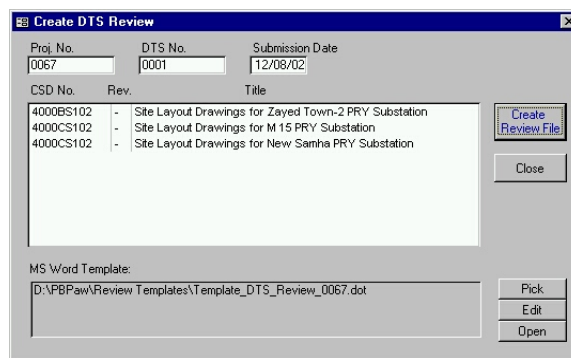


Figure 7: Creation of Word review files based on pre-defined templates

### EFFICIENT USE OF PRE-DEFINED AND ADVANCED REPORTS

Apart from standard pre-defined reports, available for all document types, some specific reports are worth mentioning. For example, a list of submittals (DTS or MAS) received from the contractor, but not forwarded to the client might be useful to assess present workload, or delays in office design review. Similarly, it is possible to obtain list of submittals that were forwarded to, but not received back from the client, which can be used to send reminders and speed up the approval process.

Useful reports are offered for received and dispatched correspondence. For example, a project manager may flag and distribute correspondence that requires reply by a specialist engineer. After certain period of time, project manager may track the responses and produce the list of non-replied letters.

In rare occasions, it may prove that standard reporting capabilities are insufficient for very complex queries. For those cases there are “Advanced Search” options available. For example, a sample advanced query may search for DTS submittals within a certain project, with status different from “Approved”, issued for construction, sorted by DTS number in descending order. This sample query is looking for non-approved documents that were exceptionally allowed for construction. Although such practice is not foreseen in standard contract procedure manuals (only approved documents may be allowed for construction), exceptions are possible on some projects.

Every user may formulate an advanced query and save it as a “Personal Filter”, under freely chosen name. Personal filters are stored locally, which allows users to maintain set of own specific questions and repeat these questions at any given time.

## CONCLUSIONS

Since official implementation of the software in January 2004, number of documents in the database has reached 150,000, with more than 130 active projects and 150 active users.

Software is daily used in PB Power’s Abu Dhabi office by administration staff to register or record status of various types of documents, such as: drawings submitted for review and approval, material approval submittals, project and general correspondence, minutes of meetings, etc. Workload on administration staff was reduced by 50%, allowing for more creative work.

Engineering staff uses the software to monitor flow of documents, control design and execution of site works, prepare regular progress reports and analyze contractors’ claims. Project reporting is done using standardized procedures and formats, with increased accuracy. Project dispute researching became more efficient due to available software tools and response time to contractor’s requests and claims was reduced.

This software has been developed having in mind real world requirements, with carefully linked data across different project administration areas and with possibility to expand data structure and functionality in the future. Expansion would be beneficial at the server side to cater for increased number of users and records, while functionality improvements would go towards Internet publishing and wider availability of data, particularly from distant construction sites. There are also on-going experiments related to implementation of suitable data mining tools to improve graphing of data and discovery of unusual database patterns.

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