

# The Management of Construction Projects Using Web Sites

**Malcolm MURRAY**  
BSc CEng PrEng  
MICE MSAICE MASCE  
Visiting Associate

Malcolm Murray graduated in Civil Engineering at the University of Manchester, UK. He has gained broad international experience with leading international consultants and contractors and is currently a Visiting Associate at the University of the Witwatersrand as well as being a director of two consultancies.



**Angela LAI**  
BSc (QS)  
Lecturer  
Department of Construction  
Economics and Management,  
University of the Witwatersrand,  
PO Box 777, Gallo Manor, 2052  
Johannesburg , South Africa  
E-mail: murrayim@icon.co.za

Angela Lai graduated in Quantity Surveying at the Department of Construction Economics and Management at Wits University where she currently lectures.



## Summary

The Project Management procedures on a typically sized construction contract are examined and the current use of specific software designed for the construction process is briefly described. Existing software packages dedicated to the construction project management process are then reviewed and the conclusion is reached that, given the ease with which web-sites can be established, instead of using commercially available software, the construction process can be just as easily managed by establishing site-or contract-specific web sites which would primarily be used for horizontal and vertical two-way information dissemination. With the streamlining of information dissemination the construction project team could then devote interaction time to 'soft' management activities such as team motivation and synergy.



**Key words:** web-based construction project management

## **1. Introduction**

The use of project-specific web sites for the management of projects is a relatively new development and is in fact still in the development stage. Specific software, particularly for project planning and resourcing, has been in use for a number of decades and there are a number of web based management packages commercially available to the construction or project manager.

The problem however, in the authors' view, is that these project management (PM) programmes often attempt to be all-embracing but do not in fact attend to the functional needs of users. These often have widely varying requirements: the actual needs of the small contractor and of the large multi-national conglomerate are often very different.

In this paper the authors will attempt to define the size of a typical contract and from there will examine what the needs of the average construction project manager are. They will then define the project management procedures needed to manage the typical contract. Following this, a review will be carried out of software currently used in practice in the construction business. Task specific software generally available on the market will be briefly reviewed, as will commercially available software PM packages.

Finally a PM web-site based system will be proposed, its suitability for a real-life project described and its advantages discussed.

## **2. Web-based PM systems suitable for use in Southern Africa**

Murray and Mavrokefalos <sup>[1]</sup> have recommended that, to deal with the relatively small projects currently being carried out in sub-Saharan Africa, property developers, project managers, consulting engineers and contractors' project and construction managers should be encouraged to develop their electronic PM capabilities by establishing site-specific web sites tailored for each project. They describe the implementation of one such web site which was used for managing a large legal project carried out in Mozambique and showed that cost savings of at least 1,35% were obtained, compared to conventional means, as well as time savings of up to 33%. Part of the cost savings and much of the time savings were due to the use of e-mail.

## **3. The Project Management functions**

Before examining how the PM function may be made more efficient and cost effective by the use of electronic means it may be useful to examine what exactly it involves.

Basically, project management consists of bringing to fruition a specific activity using management disciplines. The activity may be the installation of a new information technology (IT) system within a company, or it may be the design and construction of a civil engineering project or building.

According to 'A Guide to the Project Management Body of Knowledge' (PMBOK) <sup>[2]</sup> the PM disciplines or "knowledge areas" of project management are: integration; scope; time; cost; quality; human resources; communication; risk and procurement. For the management of construction projects the above list may be complemented by the management of health and safety, which could fall under human resources. Procurement could also be amplified by being broken down into the procurement and management of designs and drawings, materials, and plant and equipment. Any modern construction organisation would also add community support and environmental management to the list.

Different to general management, project management entails starting or mobilising a project, executing it and finalising or demobilising it. In the construction business, analogies may be made to military operations, with speed often being of paramount importance.

#### 4. The size of a typical construction contract

A number of large international contractors have developed in-house PM software to control their contracts. Black and Veatch, for example have developed PowrTrak and are developing a next generation IT system, Cygnet, which will link their offices throughout the world for collaborative work processes [3]. Other contractors use commercially available PM packages which are reviewed in item 8 of this paper. To evaluate whether any of these are necessary for the majority of contractors, it would be useful to identify the size of a typical construction contract and, following this, examine the needs of the managers of the average sized contract.

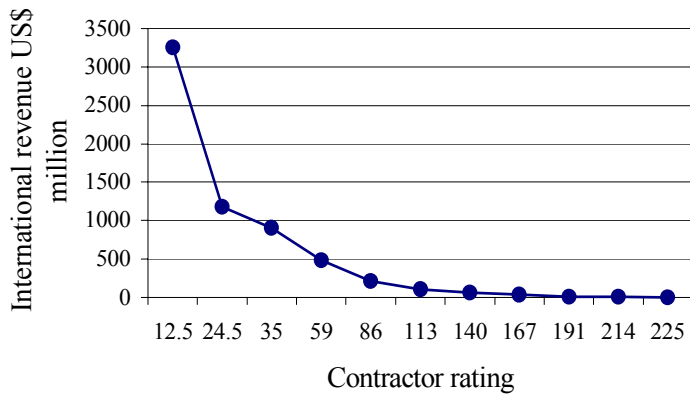


Fig.1 International revenue range of international contractors  
 Source: ENR Top 225 International Contractors, 2000

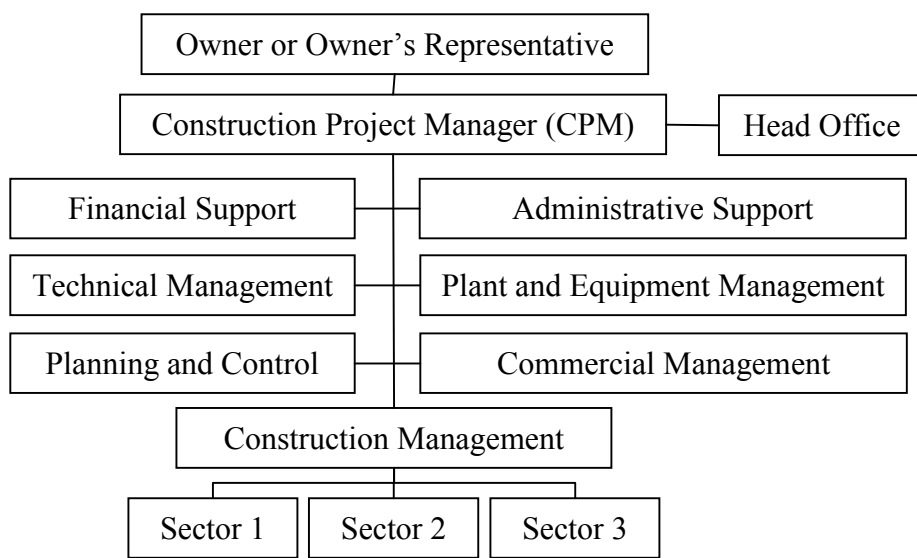
Fig.1 plots the value of the international portion of contracts carried out by the largest 225 international contractors [4]. The dominance of the market by the top 10% of the contractors is evident and has previously been pointed out by Murray and Appiah-Baiden [5]. Eliminating the upper and lower 10% of the range, an average international turnover of US\$ 244 million is calculated.

The value of international contracts carried out by the top 10% is US\$ 74,8 billion and the value of work carried out by the following 80% is US\$ 43,7 billion which proves once again the dominance of the world market by the largest contractors. The top 10% consists of only 23 contractors, while the middle 80% consists of 180 firms. Assuming that each of the 180 average-sized contractors manages 20 overseas contracts, an average annual turnover per contract of US\$ 12,2 million is arrived at. From the lead author's experience a contract of this size would be carried out over a period of about two years, so the average contract size would be US\$ 24.2 millions.

#### 5. The Construction Project Manager's needs

International contractors tend to establish autonomous organisations at remote sites, which are managerially self-sufficient. An organisation chart of a typical contract of a value estimated at US\$ 24 million shown in Fig. 2 provides an indication of the areas of responsibility controlled by a typical Project Construction Manager (PCM). The areas of responsibility are usually organised by divisions. Different companies often vary their organisation charts; the type of project or the personalities of the managers involved may lead to variation in the levels of authority of the managers. The management of plant and equipment, for example, may be subordinated to the construction manager instead of to the PCM on some contracts, as may be the planning and control function, or technical management.

Each division manages specific activities. Administrative support for example could entail managing personnel, warehousing control, travel, IT, functions, etc. purchasing, and stock housing, secretarial



*Figure 2: Typical construction project organisation chart*

## **6. The current use of software in construction**

In the lead author's experience most contractors currently use function-specific software: a planning and control division would use a planning package which, depending on its sophistication, could include resource scheduling and control; the technical manager's division would use a CAD system for designing temporary works and would receive drawings from the client's representative by electronic means.

Because the software used is specific to each division's functions, the flow of information horizontally between the divisions, up to site management and downwards to site supervisors, entails the production of much paper and the need for frequent formal and informal meetings.

## **7. A brief overview of task-specific software**

After an examination of the tasks normally carried out by the divisions shown in Fig 2 <sup>[6]</sup> it is concluded that there is a variety of software packages available on the market which can streamline activities as diverse as surveying and sub contract payments. Essentially, for the majority of tasks normally carried out in the divisions as shown, there is usually suitable software available on the market for the tasks to be carried out electronically.

## **8. Overview of Project Management software**

The Project Management Institute's Project Management Software Survey <sup>[7]</sup> reviews in depth PM software suitable for use in a wide range of industries and processes. The book starts by reviewing PM software suites, which are defined as groups of tools designed to work concurrently to bring together all information necessary to manage a project. The products are mainly designed for, and targeted to, large organizations. The study states that enterprise PM is the current wave in PM trends and that there is a breadth and depth of software items available that far exceeds what was available two years previously.

PM Software specifically designed for the construction process fall into one of two categories: the first attempts to provide a full CPM service on-line. Web-sites that offer this service include Buzzsaw <sup>[8]</sup>, Viecon <sup>[9]</sup> and Hard-Dollar <sup>[10]</sup>. Other packages that purport to also offer the whole software package include Meridian <sup>[11]</sup>, Project Integrator <sup>[12]</sup>, Citadon <sup>[13]</sup> and Constructware <sup>[14]</sup>.

Primavera <sup>[15]</sup>, on the other hand, provides a comprehensive family of PM software solutions with the construction-oriented software package, Concentric Products, which encompasses the following: Enterprise Suite, Project Planner, Expedition and Expedition Analyse, Expedition Express and Sure Track Project Manager.

Other companies that offer products which cover some of the PM functions include Timberline <sup>[16]</sup> and Build-net <sup>[17]</sup> which is directed at the residential building industry. Other products include Emerging Solutions, Software Dimension, MC<sup>2</sup>, Computer Guidance Ironspire, Trakware and Heavy Construction Systems Specialists. Detailed reviews of CPM software have been made by Engineering

News Record [18,19,20]. A California State University Study has also compared project web-site services [21,22].

It is concluded that there is an overwhelming choice of PM software on the market, both of variable quality and capability. It is believed however that there are simpler electronic PM solutions available to the managers of a medium-sized contract.

## 9. Web-based Project Management

It is generally known that whereas specialists, who are often younger people, dominate information technology, generalists, i.e. managers, who tend to be older, are often reluctant IT users. It follows that any IT based PM system intended for construction site use should be simple and user-friendly. One such system involves the use of web sites for construction PM.

It is suggested that web-based PM be established on a project by project basis. The web sites could be easily, quickly and inexpensively set up, and would be flexible; updating could be carried out in a matter of hours. The website pages would correspond to the contract organisation chart and information would be systematically supplied by the project's divisions and uploaded onto the site by the project's web-master. The website layout would be tailored to each project's requirements and the management of the web-site would be carried out by the project's managers.

The advantage of this system is that all site team members would have instantaneous and continuous access to information from their peers, thus eliminating wasteful paper flow and reducing the number of lengthy and inefficient meetings. Head office personnel and the client's representatives could also access the website for information, again on an instantaneous basis, economising on communication costs. An example of a typical web page provided with links to other divisions is given in Fig 3.

Each division's web page could receive data from appropriate software packages: most sites would have a word processing and a spreadsheet package and these would be supplemented by specialised programmes. The financial support division would probably have, for example, one of the off-the-shelf accounting packages at its disposal.

The advantage of this procedure is that each project's website would be tailored to its needs, the divisions would choose and use software with which they would be comfortable, there would be no clutter and the website would be simple and user-friendly. The website would be designed by the site managers specifically for their project, would be managed by them and would focus on aspects of importance to the specific contract. It is not impossible of course that, as commercial PM web-based suites are developed, different off-the shelf programmes or portals could be offered in the future, tailored to the needs of large, medium and small contractors respectively.

The instantaneous access to project knowledge would eliminate information transmission lags and the system would lead to economies spent in time spent in meetings and in printing and distributing paper.

<b>General Links</b>	<b>Technical Management Division</b>
<i>Head Office</i>	* Drawing register
<i>Construction PM</i>	* Specifications
<i>Financial Support</i>	* Drawings
<i>Administrative Support</i>	- Permanent
<i>Technical Management</i>	- Temporary
<i>Planning and Control</i>	* As - built
<i>Plant and Equipment</i>	* Quality Assurance procedures
<i>Management</i>	* Environmental management procedures
<i>Commercial Management</i>	* Weather register and forecast
<i>Construction Management</i>	* Technical library

Figure 3: A typical web page layout for a technical management division

## 10. "Soft" Project Management

It is well known that PM consists of much more than the organisation, planning and control of a contract. For projects to function effectively the "soft" side of the PM discipline should often be brought into play: this consists of melding and motivating the team by the use of skilled communication.

It is considered that the use of web-based project management would facilitate the flow of information on the project between the project team and would release meeting time for synergy-generating activities such as brain-storming and team interaction, instead of the meetings being merely a vehicle for the transmission and understanding of information. Team members could arrive at meetings prepared, having already absorbed information from the project web-site.

## 11. Conclusions

The conclusion reached is that, while there is adequate software available commercially for specific construction-related tasks, the available PM software packages are not sufficiently flexible and are too unwieldy for use on the average sized contract. Given the ease with which websites can be designed and set up, it is recommended that site-specific websites be established for the management of construction projects on a project-by-project or site- by-site basis.

Information generated by specialised construction software packages could then be accessed from the appropriate web pages, which could also contain links to download specific software if so required.

This system would have the advantages of being tailor-made for the project and would have simplicity, low cost, user-friendliness and speed.

## 12. Recommendations

Future research could examine the experience gained by contractors in using electronic PM systems and determine their attitude towards it. New commercial packages on the market could be analysed, taking into consideration the average contractor's point of view and case studies could describe the use of web-based PM in construction and in other sectors of industry.

## References

1. Murray M, Mavrokefalos D., The Use of E-mail and Dedicated Web-sites in the Management of Engineering Projects, 22<sup>nd</sup> *Symposium on Computers in Engineering*. September 2000. South African Institution of Civil Engineering.
2. *A Guide to the Project Management Body of Knowledge*. 1999 Project Management Institute. [www.pmi.org](http://www.pmi.org)
3. Award of Excellence. *Engineering News Record*. April 26,1999.
4. 2000 ENR Top 225 International Contractors: [www.enr.com](http://www.enr.com)
5. Murray M, Appiah-Baiden J, Difficulties Facing Contractors from Developing Countries: Problems and Solutions *Proceedings of the 2<sup>nd</sup> International Conference of the CIB Task Group 29 on Construction in Developing Countries* Nov 2000, p.277-286.
6. Murray M, The Integrated Use of Information Technology in the Construction Industry. *CIB 78 Conference: IT in Construction in Africa, Pretoria, South Africa, May 2001* (paper in preparation)
7. *Project Management Software Survey*. Project Management Institute, 1999.
8. [www.buzzsaw.com](http://www.buzzsaw.com)
9. [www.Viecon.com](http://www.Viecon.com)
10. [www.harddollar.com](http://www.harddollar.com)
11. [www.meridian.com](http://www.meridian.com)

12. [www.ProjectIntegrator.com](http://www.ProjectIntegrator.com)
13. [www.citadon.com](http://www.citadon.com)
14. [www.Constructware.com](http://www.Constructware.com)
15. [www.Primavera.com](http://www.Primavera.com)
16. [www.Timberline.com](http://www.Timberline.com)
17. [www.Buildnet.com](http://www.Buildnet.com)
18. Firms Jockey for the Lead in the Race to Go Online. *Engineering News Record* (ENR) Sept 25<sup>th</sup> 2000, p50-66
19. Web Sets Direction for Vendors *ENR* June 7<sup>th</sup> 1999 p. 12-13
20. Connection Crescendo *ENR* May 17<sup>th</sup> 1999 p.22-26
21. Doherty, P. Site Seeing. *Civil Engineering*, American Society of Civil Engineers May 1999 p. 38-41
22. *California State University Report* 1999 [www.integrated-aec.com](http://www.integrated-aec.com)