Selected Project Management Tools
For
Management Of Large Construction Projects
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Introduction

… communication is the key to success …
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  - Project centralized email address

- PM’s usual Scope of Services

- Responsibilities of individual project personnel and project organization chart

- Work Breakdown Structure (WBS)

- Unified document coding system for all documents
  (drawings, contracts, invoices, letters, etc.)

- Common methods for measurement of project progress

- Lessons learned from mistakes on previous projects

What do we manage?

- Documents (Drawings, Invoices, Submittals, RFI’s, Contracts, Reports, Letters, etc.)
  - Primavera Expedition
  - Common Server & FTP Internet Server

- Time
  - Primavera Enterprise P3e/c

- Cost
  - Combination of Expedition and P3e/c
**Why do we manage?**

♦ Usual Scope of Services for PM consultancy on mega projects:

- PM will manage the Master Schedule in the P3e/c
- PM will use Expedition for Document Control
- Client will appoint a Cost Consultant … who will produce Cost Reports
- PM will monitor cost / budget and will identify variances
- PM will develop procedures & coding systems / PMP / GR
- PM will define a method for progress measuring

**Document Coding System**

♦ The document coding system is based on the established WBS structure and on the CSI coding

♦ WBS structure defines a **physical location** of a particular activity (Project P, Building B, Floor F)

♦ CSI (Construction Specification Institute) code defines what kind of activity is performed (Placement of Concrete)
Coding System - WBS

◊ WBS structure defines physical location of the activity

![WBS Structure Diagram]

**Level 1: Program (1)**
D – Desert City

**Level 2: Project (2)**
01 – Luna Hotel

**Level 3: Subproject (2)**
12 - Foundations

**Level 4: Work Package/Contract (2)**
SK – Skansa

**Level 5: Work Phase (1)**
5 – Construction

**Level 6: Tasks (3)**
102 – Piling

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Coding System - CSI

◊ CSI code defines a type of the activity
◊ Original CSI has 16 main divisions
◊ Each division has subdivisions

![CSI Code Chart]

- 01 General Requirements
- 02 Site Construction
- 03 Concrete
- 04 Masonry
- 05 Metals
- 06 Wood and Plastics
- 07 Thermal Protection
- 08 Doors and Windows
- 09 Finishes
- 10 Specialties
- 11 Equipment
- 12 Furnishing
- 13 Special Construction
- 14 Conveying Systems
- 15 Mechanical
- 16 Electrical

- 03 210 - Reinforcing Steel

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**Coding System - Example**

**Document Code Example**

- **Program (Desert City)**
- **Project (Luna Hotel)**
- **Author (Pro Eng)**
- **Nature (Submittal)**
- **Package Number (05)**
- **Document Number (009)**
  - Document Revision (02)

**Cost Code**

- **Program (Desert City)**
- **Project (All)**
- **Phase (1-Management)**
- **Contract (Pro Eng – PM Firm)**
- **CSI (01310 – Project Management)**
- **Cost Category (L-Labor)**
- **Cost line item from budget breakdown (001)**
The schedule is loaded with budgeted cost

All cost loaded activities have cost codes assigned

The actual invoiced amounts are inserted to the schedule monthly. This can be done manually or imported from an Excel sheet. The cost code is the link in between.

Excel is NOT to be used for management of either – Time – Cost – Progress

Excel is to be used as an auxiliary tool only

Cost Loaded Schedule P3e/c - Inputs

Earned Value = PCT × Budget
10,100 = 80% × 12,025

Site manager will approve the monthly progress percentage and by that he is also approving the invoice at the same time. Monthly progress invoice should match the earned value.

5,000
Actual / Invoiced Amount

10,100
Earned Value

12,025
Budget
The colors indicate PHASES or SUBPROJECTS.

ACTUALS

FORECAST

Monthly Actuals

Forecast of Cost At Completion

Cost Loaded Schedule P3e/c - Reports

Cost Loaded Schedule P3e/c - Excel

Cost Code

Bill of Quantities

Activity ID

Budget per Line Item
As per PM’s Scope of Services:
– Develop a method for progress measuring
– The more detail we track the more accurate the overall progress measurement is

How much detail do we want to track?
– Program D 0.01%
– Project P 0.2%
– Building B 1%
– Floor F 10%
– Slab S 60%
  • Formwork Activity 1 100%
  • Rebar Activity 2 90%
  • Concrete pcmnt Activity 3 0%

During construction phase we measure actual progress against the budget which is broken-down as per the BoQ (Bill of Quantities)

Example of one line item from the BoQ:

<table>
<thead>
<tr>
<th>Cost Code</th>
<th>Activity ID</th>
<th>Activity</th>
<th>Unit Cost [USD/m³]</th>
<th>Number Of Units [m³]</th>
</tr>
</thead>
<tbody>
<tr>
<td>D015BE03310</td>
<td>D015MCT07660</td>
<td>Concrete Slab</td>
<td>200</td>
<td>100</td>
</tr>
</tbody>
</table>

Budgeted cost is 20,000USD. Once the Contractor poured 80m³ he earned 80% of the budgeted cost which is 16,000USD. In this case we measured cubic meters.
Measurement of Progress - Responsibility

♦ The physical progress and cost are being reported by the contractor. The schedule (hundreds of activities) is being updated (time & cost) by the contractor.

♦ PM’s construction manager verifies the progress as submitted by the contractor monthly.

♦ Cost Consultant verifies the cost loading.

♦ The schedule is than loaded by PM into the Master Schedule for the program. The schedule & cost reports are submitted to the client.

Organization Chart - typical project

♦ Organization chart for a PM consultancy services (depends on particular scope of services)
All deliverables from consultants / contractors shall be submitted in the following forms:

- Emailed to the Project Manager and to the centralized email address d@example.com.

- Uploaded to the project centralized FTP server under a designated folder for the particular contractor.

- Logged into the Expedition database.

- The key submittals will be also mailed to: Pro Eng, Jankovcova 32, 17000 Praha, Czech Rep.
All documents which were submitted to the PM are kept in the hardcopy file, stored in softcopy at the FTP server, and the status of these submittals is being tracked in the Expedition.

<table>
<thead>
<tr>
<th>Title</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Review of Draft Final Report &amp; CLO Plan</td>
<td></td>
</tr>
</tbody>
</table>

There is a couple of document management platforms available on the market. Perhaps the following two are the leading solutions:

- **Primavera Expedition** (Recently renamed to Primavera Contract Manager)
- **Meridian Prolog** (excluded from this presentation)

The platforms track status of documents including their revisions and allow a collaboration within the team which includes all parties on the project (Owner, PM, Contractors, Engineers, etc.)
Primavera Expedition 10.0

- Expedition is a web-based document control tool
- Expedition is accessible from the Internet via a common web browser with Java support

Primavera Expedition 10.0 - Modules

- Expedition can control the following documents
Following is an example of Expedition use for a control of a Committed Cost and an Actual Cost

- Contract for Pro-Eng’s PM services number D-00-PE-CD-001
- Contract Value 5,000,000.00AED
  D001PE01310L001 (Cost Code)
- Invoices 001 and 002
Invoices

A number of customized reports can be produced and exported into the Excel. The following sample report shows all OPEN items which require attention of the management.
Expedition keeps log of all inquiries from all consultants and tracks their status so that they do not get forgotten. RFI’s are important documents which may lead to cost or time implications on the project.

**Expedition - RFI**

<table>
<thead>
<tr>
<th>Request</th>
<th>Response</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Job No:</td>
<td>Infrastructure (D-90)</td>
<td>Date: 6/20/2006</td>
</tr>
<tr>
<td>Project No: INFRASTRUCTURE (D-90)</td>
<td></td>
<td>Page: 1 of 1</td>
</tr>
<tr>
<td>Type</td>
<td>Tu</td>
<td>Number</td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>RFI</td>
<td>KL</td>
<td>00604</td>
</tr>
</tbody>
</table>

CAN WE GET PROJECT AREA (PROJECT LIMIT) DRAWINGS WITH LATEST PLANNING DETAILS FOR ALL.

Dear Mr. [Name]

Please find attached latest area spreadsheet (dated 5/10) and a correspondent drawing (dated 5/20) for your use as requested. As of now we do not expect major changes into it, other than changes in names of tunnel.

Regards,

[Name]

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Expedition treats minutes as a list of issues where each issue is kept alive until it is closed. A particular person is assigned to each item.

**Expedition - Meeting Minutes**

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Status Started</th>
<th>Due</th>
<th>BIC</th>
</tr>
</thead>
<tbody>
<tr>
<td>00010</td>
<td>District Cooling: EM Power is to be approached by [Name] or by a cooling consultant for fact finding and initial discussion. Update 3-Aug-06:</td>
<td>OLD</td>
<td>6/8/2006</td>
<td>DL JM</td>
</tr>
</tbody>
</table>

**BIC (Ball in Court)**

JM – Mr. Jackson Michael
Document Control Responsibilities

♦ **Document controller** – Logs and generates Letters, Meeting Minutes, Transmittals, Submittals, Reports

♦ **Contract & Cost Personnel** – Logs Contracts, RFP, Letter of Intent, Invoices

♦ **Architect** – Logs drawings & specifications, RFI’s and their responses

All personnel has to be able to provide the project director with a **log of documents**, which they produce, indicating their status in the real time, not only once a month for the monthly report.

All documents and logs have to reside on the **commonly accessed servers** as per established procedures.

The commonly accessed server is mirrored to the FTP Internet server by the PC Manager.
FTP Overview

♦ The centralized FTP server serves as a repository of large files (softcopies) from consultants and contractors
♦ The FTP server is not a document management solution
♦ The server has a predefined structure by nature of document
♦ Folder names clearly define content of documents
♦ The access to the server is secured via a unique user id and password with limited accessibility for consultants
♦ The server data shall be backed up on regular basis
♦ The server is serviced with broad bandwidth to enable fast uploads and downloads of documents
♦ Size of attachments is unlimited unlike emails

Common Server

♦ Folder Structure

• The server is structured as per the WBS, by the project and than by the document nature:

  Contract (Big Developer)
  Program (Desert City)
  Project (Luna Hotel)
  Doc. Nature (Reports)

• The server is located at
  Z:\Projects\Big Developer\Desert City\Luna Hotel

• The server is accessible from the site office only.
**FTP Server**

◊ **Folder Structure**

• The FTP server is an exact mirrored image of the Common Server

• The server is located at ftp://ftp.example.com

• All parties have designated folders on the server

• PM has unlimited access to consultants’ folders

• Consultants have restricted access only into their designated folders

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**Lessons Learned**

◊ **Mistakes done on previous jobs**

– Accepting verbal directives from the client and giving verbal directives to contractors

– Not recording meetings

– Trying to track & control too much detail and forgetting the “big picture”

– Doing things which are contractors’ responsibilities

– Not working in a team and not communicating information

– Doing things sloppily in a rush – the project is not a “fast-track” (if applicable)

– Not doing a quality checks of produced documents (Including grammar and spell checks)

– Blindly following system which was used on previous projects

– Not following procedures, especially on large projects
More detailed information on procedures can be found in the **Project Management Plan (PMP)** which is tailored for each particular program or project.

A brief extract from the PMP is in the **General Requirements (GR)** document which is part of each tender package for each contractor. The GR document specifies project standards especially in the following areas:

- Schedule specifications
- Reporting requirements (level of detail, frequency)
- WBS and document / design coding
- Invoicing requirements
- Submittal procedure
- RFI's, claims, and change management
- Site meetings