

Project Management Tools

Selected Project Management Tools
For
Management Of Large Construction Projects
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Introduction

... communication is the key to success ...

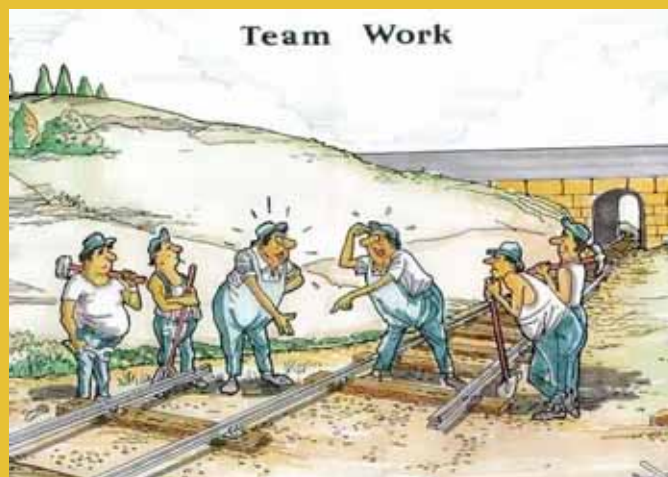


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- ◆ Introduction of the PM (Project Management) tools
 - Use of the Primavera **Expedition** database for document control
 - Use of Primavera Enterprise **P3e/c** for resource management
 - Use of the **Common** and remote **FTP servers** for document depository
 - 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

D 01 12 SK 5 102

Level 1: Program (1)

D – Desert City

Level 4: Work Package/Contract (2)

SK – Skanska

Level 2: Project (2)

01 – Luna Hotel

Level 5: Work Phase (1)

5 – Construction

Level 3: Subproject (2)

12 - Foundations

Level 6: Tasks (3)

102 – Piling

Coding System - CSI

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

03 210 - Reinforcing Steel

050	Basic Concrete Materials & Methods
100	Concrete Forms and Accessories
110	Structural Cast-in-Place Concrete Form
120	Architectural Cast-in-Place Concrete Form
130	Permanent Form
130	Permanent Form
150	Concrete Accessories
200	Concrete Reinforcement
210	Reinforcing Steel
220	Welded Wire Fabric

- 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*

Coding System - Example

Document Code Example

D-01-PE-SB-05-009.02

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

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Coding System - Example

Cost Code

	WBS	CSI	CAT
--	------------	------------	------------

D-00-1-PE-01310-L-001

- ◆ 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)

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Cost Loaded Schedule P3e/c

- ◆ 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 a auxiliary tool only

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Cost Loaded Schedule P3e/c - Inputs

Activity ID	Activity Description	Orig Dur	Perc C	Early Start	Early Finish	TF	Cost to Date	Earned value cost (BCWP)	Budgeted Cost	JAN	FEB	MAR
C.C.02.02.9.03.01	Building											
0202T34522	(Building) F							7,575.41	7,575.41			
0202T34524	(Building) R							12,625.69	12,625.69			
0202T34528	(Building) F							7,575.41	7,575.41			
0202T34529	(Building) F							8,637.98	8,637.98			
0202T34530	(Building) F							5,000.00	5,000.00			
0202T34532	(Building) Concrete/Binding (under Trench slab)	2	100	22FEB05A	13MAR05A		5,050.20	5,050.20	5,050.20			
0202T34533	(Building) Backfill/Compactor (Office Area)	7	82	26FEB05A	31MAR05A	29	7,247.14	7,247.14	8,837.66			
0202T34535	(Building) Rebar - Trench Slab & Interior Wall	8	60	14MAR05A	01APR05	-1	5,000.00	10,100.55	12,025.00			
0202T34534	(Building) Place/Cure/Asphalt							0.00	6,312.65			
0202T34537	(Building) Place - Trench Site							0.00	6,312.65			
0202T3453								0.00	6,312.65			
0202T3453								0.00	12,625.69			
0202T3454								0.00	7,575.41			
0202T3454								0.00	12,625.69			
0202T3454								0.00	0.00			
0202T3454								0.00	21,644.54			
0202T3454								0.00	0.00			
0202T3454								0.00	19,479.64			
C.C.02.02.9								7,575.41	7,575.41			
0202T3454												

Earned Value = PCT x Budget
 $10,100 = 80\% \times 12,025$

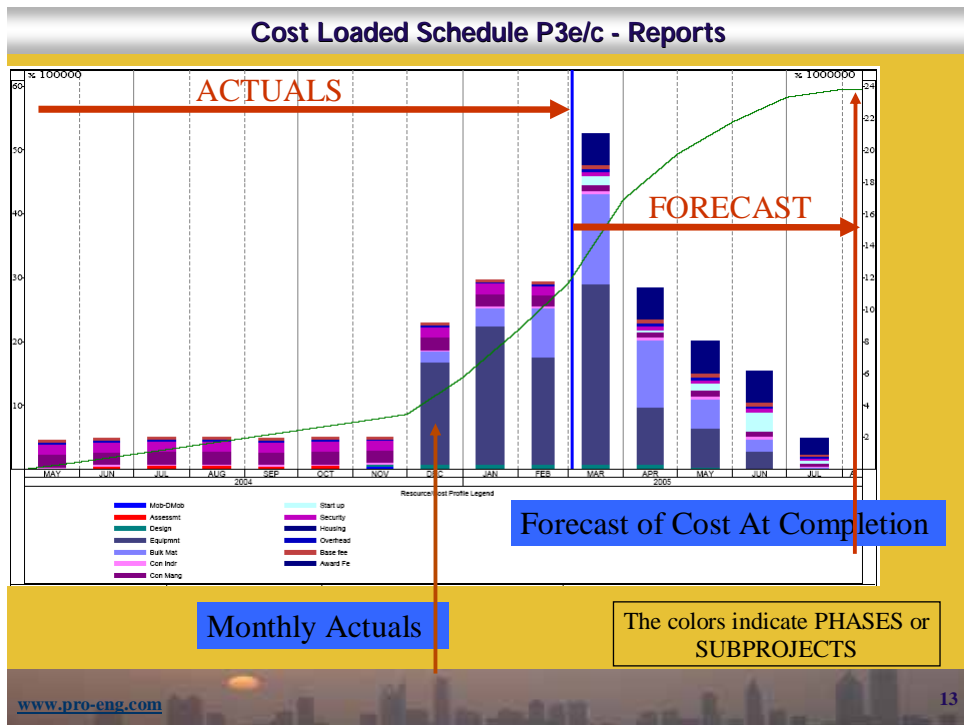
Site manager will approve the monthly progress percentage and by that he is also approving the invoice at the same time. Monthly progress invoice should match the earned value.

5,000
Actual / Invoiced Amount

10,100
Earned Value

12,025
Budget

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Cost Loaded Schedule P3e/c - Excel

A	B	C	D	E	F	G	H	I	J
COST ACCOUNT BASE	ACTIVITY ID BASE	BID ITEM			QTY.	UOM	MATERIAL	LABOR	
		A) MOBILIZATION & DEMOBILIZATION:							
A00100	C15000	Mobilization			1	LS	\$ -	\$ -	
A00200	C15000	Demobilization			1	LS	\$ -	\$ -	
		Subtotal					\$ -	\$ -	
		B) ASSESSMENT & EVALUATION:							
B00100	C25000	Iraq Expatriate Labor				HRS	\$ -	\$ -	
B00200	C25000	Iraq Local Labor				HRS	\$ -	\$ -	
B00300	C25000	Other Direct Costs			1	LS	\$ -	\$ -	
B00400	C25000	Travel & Living			1	LS	\$ -	\$ -	
		Subtotal					\$ -	\$ -	

Cost Code (points to column A)

Activity ID (points to column B)

Bill of Quantities (points to column F)

Budget per Line Item (points to column J)

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Measurement of Progress

- ◆ 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 plcmnt	Activity 3	0%	
- Progress of elements is weighted and rolls up into systems

Measurement of Progress against BoQ

- ◆ 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:

Cost Code	Activity ID	Activity	Unit Cost [USD/m3]	Number Of Units [m3]
D015BE03310	D015MCT07660	Concrete Slab	200	100

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 then loaded by **PM** into the Master Schedule for the program. The schedule & **cost reports** are submitted to the **client**.

Organization Chart – typical project

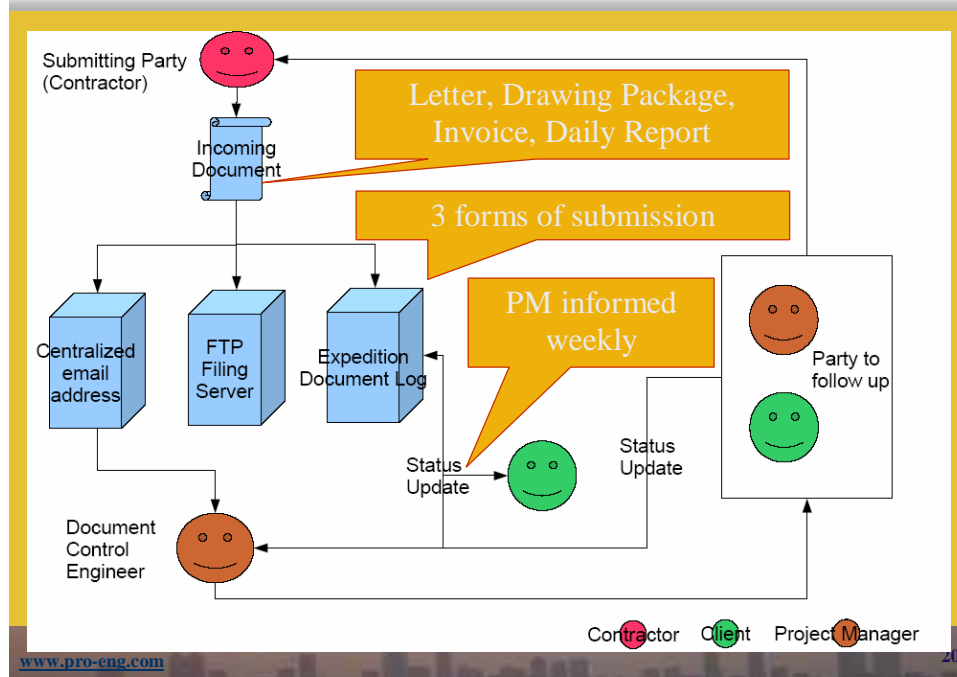


- ◆ Organization chart for a PM consultancy services (depends on particular scope of services)

Deliverables

- ◆ 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.

Document Flow



Document Control System

- ◆ 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.

Title	Status
Review of Draft Final Report & Plan	CLO

Expedition Document Log

Filename

- TR_0073.00 - 21 May 06 - Themed Consultancy Services Fee Proposal
- TR_0074.00 - 22 May 06 - Minutes of Meeting 22-May-06
- TR_0075.00 - 24 May 06 - Luxa Hot Design Brief (RFP)
- TR_0076.00 - 25 May 06 - Draft Plot Development Profiles Plots 1 to 45.1
- TR_0078.00 - 27 May 06 - Desert 245 Towers Proposal
- TR_0079.00 - 27 May 06 - Minutes of Meeting 25-May-06
- TR_0083.00 - 28 May 06 - Schedules
- TR_0085.00 - 29 May 06 - PM Consultancy Services
- TR_0086.00 - 29 May 06 - Review of RTKL Final Draft Report
- TR_0087.00 - 30 May 06 - MEP for
- TR_0088.00 - 30 May 06 - Pell Clarke Contract Document
- TR_0089.00 - 31 May 06 - Draft RPP for Cost Consultancy
- TR_0090.00 - 31 May 06 - Minutes of Meeting 30-May-06

FTP Filing Server

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Document Control

- ◆ 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.)

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Primavera Expedition 10.0

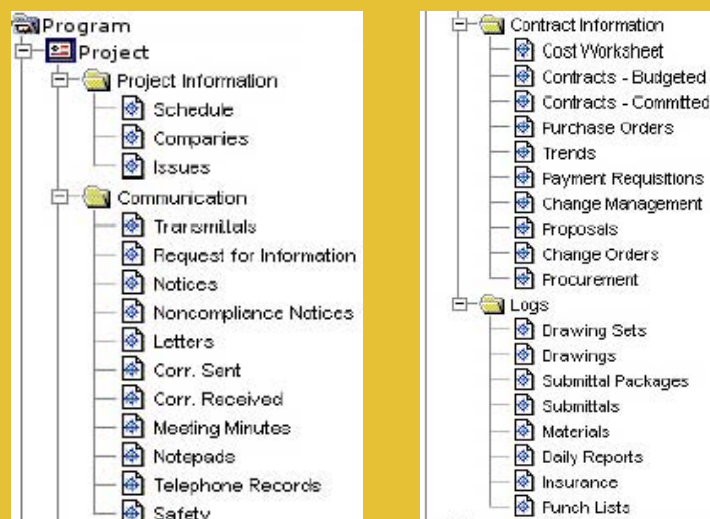
- ◆ Expedition is a web-based document control tool



- ◆ 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



Expedition - Example

- ◆ 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

Expedition - Contract

◆ **Contract**

Big Developer PO BOX 3456 Dubai, DUBAI, UAE		Phone: Fax:	CONTRACT No. D00PECD001				
TO: Pro Eng Jankovcova 32 17000 Praha Czech Republic	DATE: 4/27/2006		PROJECT: Desert City				
ATTN: Jan Hlavacek	COMPLETED: 12/31/2007		JOB:				
WORK AT	BILL TO						
	Big Developer PO BOX 3456 Dubai, DUBAI, UAE						
TERMS:	SHIP VIA:						
Item	Quantity	Units	Stock Number/Description	Unit Price	Tax Rate	Tax Amount	Net Amount
00001	1.00		Project Management Services	\$35,000,000.00	0.00%	\$0.00	\$35,000,000.00

Expedition - Invoice

◆ Invoices

Big Developer PO BOX 3456 Dubai, DUBAI, UAE		INVOICES FOR CONTRACT NoD00PECD001
		Phone: Fax:
PROJECT:	JOB:	
ORIGINAL SUM: \$35,000,000.00	TO: Pro Eng	
APPROVED CHANGES: \$0.00	FROM: Big Developer	
REVISED SUM: \$35,000,000.00	DATED: 4/27/2006	
INVOICED TO DATE: \$1,257,620.00	ORIGINAL COMPLETION DATE: 12/31/2007	
BALANCE: \$33,742,380.00	REVISED COMPLETION DATE:	

Number	Date	Amount	Payment Date	Check Number	Amount Paid	Status
D00PEIN001 <small>Dec-05 to Feb-06</small>	6/6/2006	\$912,420.00			\$0.00	NEW
D00PEIN002 <small>March-06</small>	6/31/2006	\$345,200.00			\$0.00	NEW

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Expedition - Correspondence

◆ 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.

Initiator of the document

Party to follow up

Correspondence Sent (Open Items)

Job Number: Desert City (D-01)				Luna Hotel D-01		
Project Number: PROJECTWIDE (D-00)				8/27/2006		
Date Sent	Doc.Number	Subject	Status	To	BIC Contact	From
Herman Fernando						
26-Jul-06	D-00-HL-TA-LT-050	RTKL Invoice No.50-99	Open	Big Developer	George Michael	Pro Eng
26-Jul-06	D-00-HL-TA-LT-049	RTKL Invoice # 5430	Open			
17-Aug-06	D-00-HL-TA-LT-064	RTKL Invoice # 50-54	Open			
15-Aug-06	D-00-HL-TA-LT-063	MEP for Appoint. of Master Planners	Open			
29-Jul-06	D-00-HL-TA-LT-034	RTKL Invoice # 50-54	Open			
Jan Hlavacek						
10-Aug-06	D-00-HL-TA-LT-059	Affection Plan Delay	Open	Skanska	Jahfar	Pro Eng
12-Aug-06	EL 060812	Site Plan CAD Format	Open	Big Developer	Arlene	

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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

Document Control Responsibilities

- ◆ 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



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Common Server

◆ Folder Structure

- The server is structured as per the WBS, by the project and then 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.

- [01 - Contact list]
- [03 - Contracts - PO - LOI - RFP]
- [06 - Correspondence]
- [07 - Reports&Presentations]
- [08 - Organization&WBS]
- [09 - Procedures&Manuals]
- [10 - Photos Logos Maps]
- [11 - Cost&Quantity]
- [12 - Procurements & Invoices]
- [13 - Quality Control]
- [14 - Submittals]
- [15 - Transmittals]
- [16 - Logistics]
- [17 - Request for Information (RFI)]
- [18 - Change Orders (CO)]
- [19 - Schedules]
- [20 - Minutes of Meeting]
- [21 - Drawings & Specifications]
 - [21.04-Title Block]
 - [21.05-Specifications]
 - [21.06-Design Guidelines]
 - [21.09-List of Architects]
- [26 - Manpower]

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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

- [01 - Contact list]
- [03 - Contracts - PO - LOI - RFP]
- [06 - Correspondence]
- [07 - Reports&Presentations]
- [08 - Organization&WBS]
- [09 - Procedures&Manuals]
- [10 - Photos Logos Maps]
- [11 - Cost&Quantity]
- [12 - Procurements & Invoices]
- [13 - Quality Control]
- [14 - Submittals]
- [15 - Transmittals]
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 - [21.05-Specifications]
 - [21.06-Design Guidelines]
 - [21.09-List of Architects]
- [26 - Manpower]

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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

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Information sources

- ◆ 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

