PROJECT MAMANGEMENT BY CONSULTANT FOR HAI VAN TUNNEL CONSTRUCTION PROJECT IN VIETNAM

- Application of PMBOK to a Multicultural Project in Developing Country -

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The Hai Van Pass located in coastal Central Vietnam, was the biggest traffic bottleneck, often blocked due to the slope failure during rainy seasons, on the NH1 linking the capital Hanoi with Ho Chi Minh, approximately 20km long with 475m elevation change. The highway tunnel, a 6.3km long with the state-of-the-art electromechanical facilities, construction was started on 1st October 2000 and open to the public on 5 June 2005, on time within the budget; after establishment of Tunnel Operator Company. The tunnel operation, solely by Vietnamese, has been running very well to date. The project was some Two Hundred Million USD scale and the project defect liability expires June 2007. The Consultant has been taking proactive initiative for the project management with appropriate tools like Primavera P3 and PMBOK® Guide.

Key words: highway tunnel, consulting, project management, PMBOK, Vietnam

1 PROJECT BACKGROUND

From the late 1990's, the rapid development of Vietnamese economy has increased the logistic volume through the Hai Van Pass, however, the heavy tracks have been forced to run slowly and fatal traffic accidents increased year by year. In addition, the pass road was often blocked due to the landslide and slope failure during the rainy seasons. Under such circumstances, the Government of Vietnam decided to construct a new highway segment with a tunnel under the Hai Van Pass by the Prime Minister's Decree in March 1994.

2 PROJECT AND TUNNEL OUTLINE

Distinct characteristics of the project are; 1) 6.3km long highway tunnel, 2) 1st NATM (New Austrian Tunneling Method) tunnel in Vietnam, 3) Longitudinal Ventilation System, 4) SCADA (Supervisory Control And Data Acquisition) for Overall System Control, 5) O&M Company required.

1) Project Highway Length: 12,182m
   (Tunnel = 6,280m, Bridges = 1,653m)
2) Traffic Lane (Tunnel): 2 Lanes
   3.75 +1.25 shoulder. Total 10.0m
3) Tunnel Length: Total 14,454m
   6,280m (Main Tunnel, MT),
   6,286m (Evacuation Tunnel, ET)
   1,888m (Ventilation Adit, VA)
4) Tunneling Method: NATM
5) Cross-section: 89m2(MT), 15.5(ET), 36.2(VA)
6) Cross-Passage: 400m interval
7) Ventilation System:
   Longitudinal System,
   23 Jet Fans, 3 EPs, 1 VA

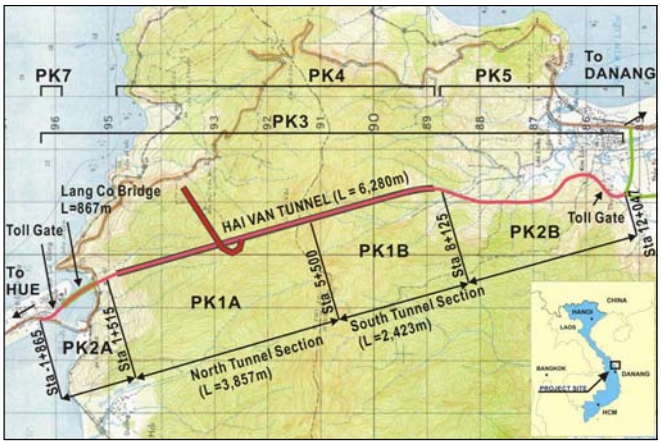

Fig. 1 Project Location Map

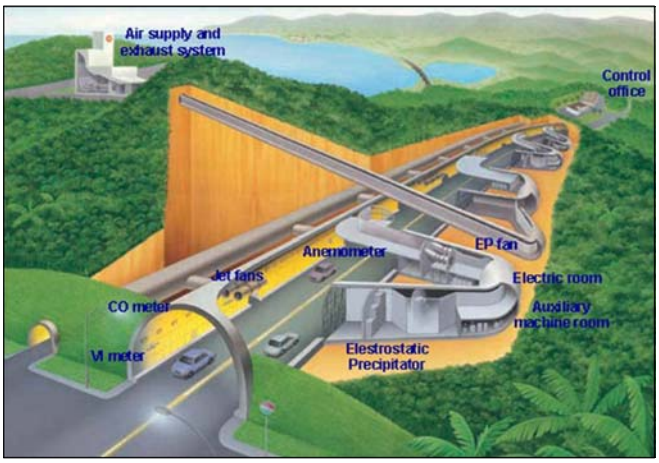

Fig. 2 Tunnel Ventilation System

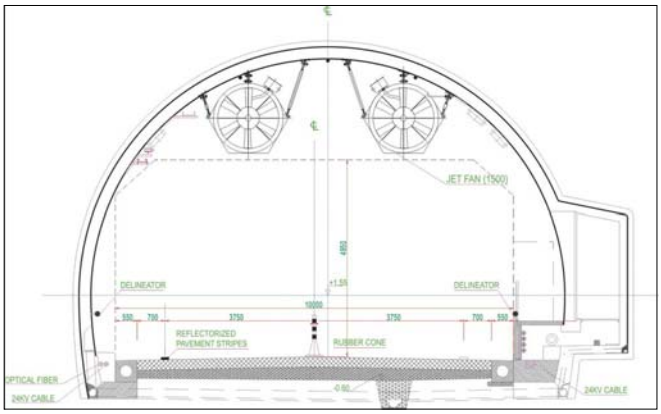

Fig. 3 Typical Cross Section (Tunnel)

3 ORGANIZATION AND CONTRACTS

Project organization and contracts are as shown in Figs.4 and 5.

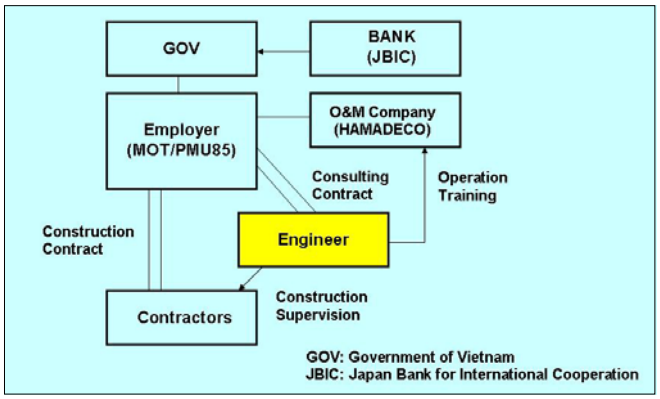

Fig. 4 Project Organization

Table 1 Project Contracts

1) Organization Structure

Organization	Name
Financing Agency	Japan Bank for International Cooperation (JBIC)
	L/A No. VNIV-5, March 26, 1997, Loan Amount: JPY 5.5 billion L/A No. VNVI-5, March 30, 1999, Loan Amount: JPY 10.0 billion L/A No. VNIX-4, March 29, 2002, Loan Amount: JPY 3.359 billion Total 18.859 billion
Executing Agency	Project Management Unit No. 85 (PMU85) under Ministry of Transport and Communications (MOT)
Consultant	Joint Venture of Nippon Koei Co., Ltd., Japan and Louis Berger International Inc., USA in association with Transport Engineering Design Incorporation (TEDI), Vietnam

2) Contract Packages

Contract Packages	Major Works	Sub Packages	Package Title	Total in JPY
Consulting Services				1,968,957,864
Package I	Tunnel Civil Works	Package IA	North Tunnel Section	4,695,769,689
		Package IB	South Tunnel Section	2,863,645,040
Package II	Road and Bridge Works	Package IIA	Lang Co Bridge Section	529,535,426
		Package IIB	Southern Highway Section	447,971,781
Package III	Electrical Works			2,482,310,944
Package IV	Mechanical Works			2,609,984,150
Package V	110/22kV Substation and 110kV Transmission Line			799,411,339
Package VI	Procurement of Maintenance Vehicles			205,347,384
Package VII	Infrastructure Development in the Resettlement Areas			48,576,789
			Total	16,651,510,406

4 CONSULTING SERVICES

4.1 Scope of Services

The consulting service of the project was commenced on January 1998, consisting of 1) Special Survey, 2) Detailed Design, 3) Contract Tendering Assistance, 4) Construction Supervision, and 5) Training and Technology Transfer.

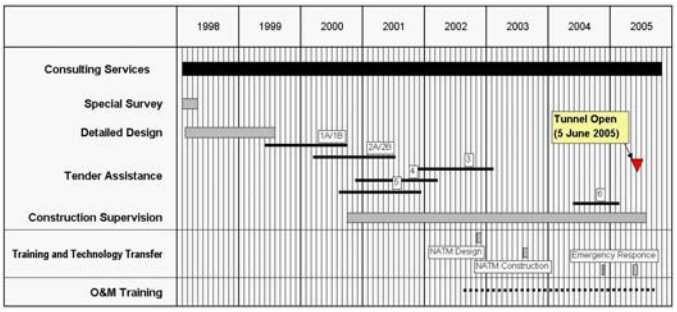

Fig. 5 Progress of Consulting Services

4.2 Tunnel Emergency Response

The Consultant developed SOP (Standard Operation Plan) for the tunnel operation, and executed tunnel operation training for Vietnamese Tunnel Operation Company that established in April 2004. Several times of overall tunnel emergency response on-site drills inside the tunnel was carried out until the fire police persuaded.

Fig. 6 Tunnel Emergency Response Drill

5 CONSTRUCTION PROGRESS

The tunnel construction was started on 1st October 2000; the project had basically progressed very closely to the original contracted schedule, although the tunneling works encountered some unforeseeable geological conditions. The tunnel traffic opening ceremony was nationwide and gracefully celebrated on 5 June 2005.

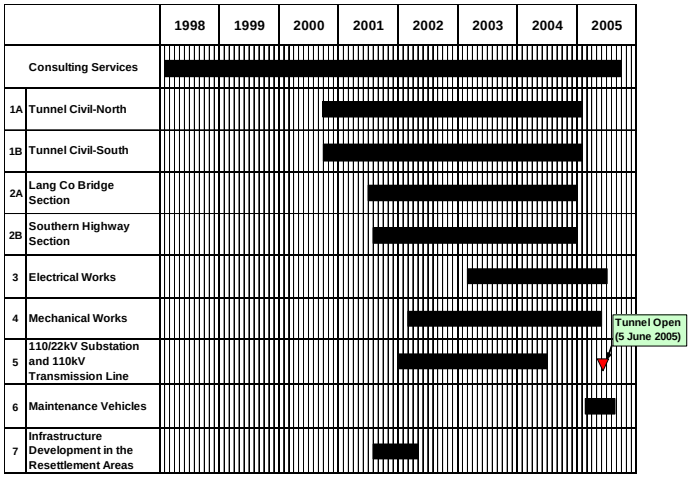

Fig. 7 Progress of Construction Works


Fig. 8 Encountered Unforeseeable Geological Condition

Fig. 9 Tunnel Opening Ceremony (5 June 2005)

6 TUNNEL OPERATION TO DATE

Since the tunnel opening to the public on 5 June 2005, the long highway tunnel has been operated and maintained, by Vietnamese Tunnel Operator, to date without any serious operational problem. As of February 2007, Defect Liability period of all the contract packages have been expired and the Defect Liability Certificates had been issued except the Electrical Works (CP3) and the Mechanical Works which are scheduled to issue in June 2007.

7 PROJECT MANAGEMENT BY CONSULTANT

7.1 FIDIC Based Project

FIDIC (International Federation of Consulting Engineers) is widely used as conditions of contract for international construction contracts. Following FIDIC conditions of the contract were used in the project.

Table 2 FIDIC Applied in the Project

Contract	FIDIC Applied
1A	Conditions of Contract for Works of Civil Engineering Construction, PART I GENERAL CONDITIONS, 4th Edition, 1987 (Red Book)
1B	
2A	
2B	
3	Conditions of Contract for Electrical and Mechanical Works, 3rd Edition, 1987 (Yellow Book)
4	
5	

7.2 Application of PMBOK

The Construction Extent to the Guide to the Project Management Body of Knowledge (PMBOK® Guide) (PMI, 2003) was used as a guideline to project management by the Consultant. Responsibilities of each knowledge area in the PMBOK have been carefully distributed to each team in the Consultant for the successful project management.

7.3 RAM: Responsibility Assignment Matrix

1) Three Objects for Project Management

Project Manager (PMR) of the Consultant team is responsible for management, not only for the Consultant Team but also the overall project. The PMR had been aware that the following three objects are his management targets and had tried to establish good communication atmosphere among the project.

Table 3 Three Objects for Project Management

No.	Management Object
A	Consultant Team
B	Project
B-1	Overall Project
B-2	Each Contract Package

2) RAM for Consultant Team

Consultant Team consists of Core Team (CT), four Resident Teams (RT), Quantity Surveyor Team (QS), Geotechnical Team (GEO), Operation and Maintenance Team (OM), and Administration Team (ADM). Some 70 persons were joined

with the team at the busiest time.
Responsibility Assignment Matrix (RAM) for the Consultant team was set up as follows:

Table 4 Responsibility Assignment Matrix of Consultant Team

Team / Knowledge Area	PMR	CT	RT	GEO	QS	OM	ADM
4. Project Integration Management	●	○					
5. Project Scope Management	●	○					
6. Project Time Management	●	○					
7. Project Cost Management	●						○
8. Project Quality Management	●	○	○	○	○	○	○
9. Project Human Resorce Management	●	○	○	○	○	○	○
10. Project Communication Management	●	○	○	○	○	○	○
11. Project Risk Management	●	○	○				
12. Project Procurment Management	●						○
13. Project Safety Management	●	○	○				
14. Project Environmental Management	●	○	○				○
15. Project Financial Management	●						○
16. Project Claim Management	●	○	○		○		
PMR: Project Manager, CT: Core Team, RT: Resident Team, GEO: Geotechnical Team QS: Quantity Surveyor Team, OM: Operation and Maintenane Team, ADM: Administration Team							
●: Primary Responsibility ○: Secondary Responsibility							

3) RAM for Overall Project and Each Contract Package
Resident Engineer (RE) had much knowledge and experience in each field of the works than the PMR, therefore, responsibility of construction supervision of each contract package was mandated to each RE. This enabled the Project Manager to concentrate his responsibility for the overall project management.

Table 5 Responsibility Assignment Matrix for Project

Team	Overall Project			Each Package		
Knowledge Area	PMR	RE	Other	PMR	RE	Other
4. Project Integration Management	●	○		●	○	
5. Project Scope Management	●	○	QS	○	●	
6. Project Time Management	●	○		○	●	
7. Project Cost Management	●		QS		○	QS
8. Project Quality Management	●				●	GEO
9. Project Human Resorce Management	●	○		●	○	
10. Project Communication Management	●	○	ADM	○	●	ADM
11. Project Risk Management	●	○	QS	○	●	
12. Project Procurment Management	●		ADM	●	○	ADM
13. Project Safety Management	●	○		○	●	
14. Project Environmental Management	●	○		○	●	
15. Project Financial Management	●		QS	●	○	QS
16. Project Claim Management	●		QS	●	○	QS
PMR: Project Manager, RT: Resident Team, GEO: Geotechnical Team QS: Quantity Surveyor Team, ADM: Administration Team						
●: Primary Responsibility ○: Secondary Responsibility						

8 PROJECT TIME MANAGEMENT BY PRIMA VERA P3

8.1 Progressive Detailing of Work Schedule

The Consultant had taken a proactive initiative for work coordination among the contractors because the tunnel civil, electrical and mechanical contractors were required to work simultaneously inside the tunnel in order to shorten the overall construction period. Monthly coordination meetings were held until the tunnel breakthrough, subsequently weekly coordination meetings had been held. Primavera P3 was effectively used, as a scheduling tool, for such meetings and schedule reports to the Client. Following major milestones existed in the project.

8.2 Diagram Type for Scheduling

The Consultant had developed the overall construction schedule in different diagram types in accordance with depth of scope of works, with progressive detailing.

Table 6 Project Milestone

Table 7 Diagram Type of Overall Construction Schedule

8.3 Conventional Diagram

Time:Chainage Program had been used at the initial stage of construction until the tunnel breakthrough, October 2003. This expression is good to understand overall work relation, however, difficult to express the critical works(see Figure 12).
Figure 12 – Conventional Time: Chainage Program

8.4 Critical Path Method (CPM) Scheduling by Primavera P3

WBS (Work Breakdown Structure) was developed for the tunnel civil works, the electrical works and the mechanical works in order to establish a Critical Path Method (CPM) scheduling with tracking of the works running of the critical path (see Figure 13). WBS had updated when required. Configuration change management was executed to keep consistency in the time management.
Figure 13 - WBS for Electrical Works
On the basis of the WBS of each contractor, the Consultant developed a baseline schedule by Primavera P3. All interfaces had studied carefully and necessary linkages were made in the program (see Figure 14).
Figure 14 - Progress Tracking (Partial, by Primavera P3)

8.5 Monthly Progress Tracking Report

Since April 2004, the Consultant had issued a "Monthly Progress Tracking Report" to the Employer, copied to the Contractors, informing of 1) Change of WBS and work linkage during the previous month, 2) Overall progress of the project (summary), 3) Critical works (TF < 30 days), 4) Site Hand-over and Energization Forecast, 5) Detailed output as of the end of month. The report was also presented at URL:http://haivan.cadp.jp/05_progresstodate/work.htm.

9 CONCLUSION; KEYS TO SUCCESSFUL PROJECT MANAGEMENT

9.1 Communication Management with Clear RAM

As emphasized in the PMBOK, the communication management is the most important management area for the successful project implementation.
RAM (Responsibility Assignment Matrix) should be carefull y established and disclosed in the project. Disclosure of RA M could reduce unnecessary communication barrier among people in the project, especially project in the developing co untries where different cultural discipline usually exists. All the stakeholders should respect difference of culture of each staff in the project, however, should respect disclosed RAM at the same time, and it surely makes him/her to contribute t o the project success.

9.2 Time Management with WBS

Time is the most important target in the construction pr oject in which multiple contractors are involved in. Effe ctive monitoring unit should be established for overall

work coordination. The PMBOK recommends a unit eq uivalent to about 80 working hours; however, physical working areas for 80 hours are usually very much diffe rent in civil works and electrical and mechanical works. It is requested to establish acceptable work units for e ach contractor, and such agreed unit should be used in the process of WBS development.

Milestone in the project, especially hand-over and hand-back between the contractors, should be clearly indicate d in the WBS and the monitoring schedule. Progressive detailing of the schedule can be made when a milesto ne is realized, however, such configuration changes sho uld be kept traceable in the project to avoid unnecessar y EOT claim.

9.3 Utilization of Web, as Communication Tool, in PM O

Ishimoto (2001, 2002) reported that there exist four obj ects for IT management in the Project Management Off ice (PMO); 1) Office Infrastructure, 2) Work Tools, 3) Data Management, and 4) Web, and he has been report ing the innovative application of the Web technology fo r the project management.

Ishimoto (2003) proposed standardized contents of Proje ct Office WEBsite (POWEB), including modules of pub lic, project-consultant, project-coordination, company, etc. That practice is disclosed at URL: http://haivan.cadp.jp (see Figure 15).

Figure 15 – Project Office Website (Hai Van Tunnel C onstruction Project)

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