

## ANALYSIS OF COST OVERRUNS

### A. Introduction

1. The original project costs totaled \$164.6 million (D3,014,396 million equivalent) including allowance for physical and price contingencies and interest during construction.<sup>1</sup> The Phuoc Hoa Water Resources Project was scheduled to be implemented over 6.5 years from 2003 to 2009, but with the bulk of the construction of the Phuoc Hoa barrage and transfer canal to be completed by the end of 2006. However, because of delays in the implementation of the main engineering works involving the construction of the barrage and transfer canal and the main canal serving the Tan Bien irrigation subproject, the project has experienced an escalation in costs and cost overruns necessitating supplementary financing to complete the scope of work. Increased costs can be attributed to several factors, including higher inflation than was initially assumed in cost estimates, implementation delays compounding inflation, and some underestimation of unit rates and quantities for construction in the original feasibility study.

#### 1. Unit costs

2. The cost estimates for engineering works in the original feasibility study were based on the unit rates for various items of construction used in Viet Nam at that time. Each province calculates current construction unit rates that are adjusted to allow for changes in the main input items: steel, cement, labour etc., and updated regularly. The original cost estimates are considered to be representative of prevailing construction rates at that time. However, because of the delays in the award of the contracts for the barrage and head works, transfer canal and the Tan Bien main canal, by the time of awarding these contracts, the unit rates had increased considerably more than was anticipated in the original implementation schedule. Viet Nam experienced high inflation that affected construction costs in 2007 and 2008 that pushed up the unit rates.<sup>2</sup> The international commodity boom also impacted on construction costs (see text box of graph of US steel prices). Table 1 shows a comparison of the unit rates for the main construction items from the time of project appraisal to the award of the head works civil works contract in December 2007, and three packages for the transfer canal in September and October 2008.

**Table 1: Comparison of Construction Unit Costs**  
(D '000)

Item	Unit	Project Appraisal in 2003	Headworks contract December 2007	Transfer canal September and October 2008
Excavation	m <sup>3</sup>	13.50	20.57	
Bulk excavation	m <sup>3</sup>	12.75		16.43
Fill/embankment	m <sup>3</sup>	14.70		16.80
Earthfill damcore	m <sup>3</sup>	21.90	30.49	
Laterite roadbase	m <sup>3</sup>	31.50	43.79	
Concrete lining	m <sup>3</sup>	797.10		1,135.00
Reinforced concrete	m <sup>3</sup>	642.75	811.57	
Steel	kg	6,048	12,710	19,449

Kg = kilogram, m<sup>3</sup> = cubic meter.

Source: Asian Development Bank estimates

<sup>1</sup> ADB. 2003. *Report and Recommendation of the President to the Board of Directors: Proposed Loan to the Socialist Republic of Viet Nam for the Phuoc Hoa Water Resources Project*. Manila (Loan 2025-VIE, for \$90 million, approved on 27 November).

<sup>2</sup> In June 2008, the consumer price index was 27.2% higher than in June 2007.

3. While not all the construction items are directly comparable, with the exception of reinforcing steel, it does indicate the a range in price escalation of between 14.9% for fill and embankment for the transfer canal to 222% for reinforcing steel. Overall the unit rates in the table showed an average increase of 58%, which is directly related to the increase in construction costs for the major contracts. It is of interest that the unit rate for reinforcing steel in the three contracts for the transfer canal signed in September and October 2008 is 53% higher than the unit rate for steel recorded in the contract for the head works and barrage that was signed in December 2007, less than a year earlier.



US Steel Price Index

## 2. Index of construction items

4. The Viet Nam Department of Statistics maintains indices of the main components of construction costs specific to particular provinces. This information is updated regularly and used as the basis for adjusting constructing contracts to account for changes in the unit rates. Table 2 shows the monthly price indices for Tay Ninh province for 2009 compared to an August 2007 base.

**Table 2: Monthly Price Indices for Tay Ninh province**

Period	Consumables (L)	Cement (C)	Steel (S)	Fuel (F)	Rock (M)	Others (M)
Aug-07	100	100	100	100	100	100
Feb-09	129.48	135.26	117.53	124.17	156.72	131.05
Mar-09	129.35	134.78	115.73	119.65	154.08	129.65
Apr-09	129.95	134.97	116.26	116.28	154.08	129.63
May-09	131.55	133.18	122.11	125.28	155.41	128.96
Jun-09	132.73	131.95	119.32	134.68	155.71	128.81
Jul-09	133.63	131.66	118.83	140.7	157.29	128.16
Aug-09	134.21	131.57	119.41	140.88	157.69	128.07
Sep-09	134.54	129.49	120.64	146.51	159.33	128.69
Oct-09	135.35	129.78	120.23	150.15	160.21	129.55
Nov-09	136.5	128.63	117.79	158.91	160.5	130.90
Dec-09	138.11	130.4	119.82	168.02	166.36	132.89
Jan-10	139.31	129.84	123.48	171.68	166.12	133.62

Source: Government of Viet Nam, Department of Statistics

5. The indices show the escalation in the prices of the major inputs relevant to the construction contracts during the period when most of the expenditure for the head works, transfer canal and Tan Bien main canal has occurred. Most items increased by around 30%, while fuel and rock material increased by over 60%, which has had an impact on machinery operating costs. However some commodities, for example cement, have shown a decline in the price index in the more recent period which is an indication of commodity prices coming off the highs of 2008.

### 3. Changes in Bill of Quantities

6. The three contracts for construction of the transfer canal that were awarded during the fourth quarter 2008 were analyzed to identify changes in the bill of quantities (BOQ) determined after detailed design compared with the estimates in the original feasibility study, which formed the basis for the project cost estimates and the loan agreement. The original cost estimates for the transfer canal classified quantities into four main categories: excavation, fill, concrete and steel.<sup>3</sup> The physical quantities were able to be compared with the corresponding categories in the construction contracts. A summary is shown in Table 3.

**Table 3: Comparison of Bill of Quantities for Transfer Canal**

Contract & Item	Steel (tonne)	Excavation (m <sup>3</sup> )	Fill & embank- ment (m <sup>3</sup> )	Reinforced Concrete (m <sup>3</sup> )
<b>A. BOQ from Contracts</b>				
<b>Transfer Canal</b>				
Contract 1B	1,079	1,387,315	850,021	45,941
Contract 1C	1,163	2,532,498	232,409	49,879
Contract 1D	780	1,310,764	478,058	33,758
<b>Total</b>	<b>3,022</b>	<b>5,230,577</b>	<b>1,560,488</b>	<b>129,578</b>
<b>Hydraulic structures</b>				
Contract 1B	1,392	284,074	203,738	17,439
Contract 1C	353	96,876	34,270	6,022
Contract 1D	2,747	112,134	176,630	22,597
<b>Total</b>	<b>4,491</b>	<b>493,084</b>	<b>414,638</b>	<b>46,058</b>
<b>Bridges</b>				
Contract 1B	94	11,507	48,207	1,236
Contract 1C	201	19,341	64,991	2,508
Contract 1D	276	23,841	38,597	3,380
<b>Total</b>	<b>572</b>	<b>54,689</b>	<b>151,795</b>	<b>7,124</b>
<b>Total all</b>	<b>8,085</b>	<b>5,778,350</b>	<b>2,126,921</b>	<b>182,760</b>
<b>B. BOQ From 2003 Appraisal</b>				
	<b>6,645</b>	<b>4,931,240</b>	<b>2,893,970</b>	<b>160,460</b>
<b>Change in BOQ after detailed design</b>				
	+22%	+17%	-26%	+14%

BOQ = bill of quantities, Kg = kilogram, m<sup>3</sup> = cubic meter.

Source: ICMB9 construction contracts and ADB Appraisal documents from 2003

7. For three of the categories (steel, excavation, and concrete) the BOQ determined from the detailed design exceeded the original estimates by between 14% and 22%. For one item, "fill and embankment" the original estimates exceeded the BOQ by 26%. All items exceeded the contingency allowance of 10% included in the estimates to allow for underestimation of the physical quantities. Based on the unit costs applied during project appraisal in 2003, this change in quantities for these items would result in an overall increase in cost of 9.2%. Thus, for the transfer canal it can be concluded that a portion of the increased costs are due to this increase in the BOQ determined after detailed design.

### B. Impact of Delay in Implementation

8. The delay in the implementation of the main construction components pushed the contracts into the period when Viet Nam was experiencing abnormally high rates of price

<sup>3</sup> The cost estimates for the barrage and head works during project appraisal in 2003 did not provide this level of comparison as cost estimates were based on lump sums rather than unit rates and quantities.

escalation and international commodity prices were at record levels. Construction only started at the time when it was originally planned that the most of the works would have been completed. The delays resulted in significantly higher expenditure than originally planned for the barrage head works, transfer canal and the Tan Bien main canal.

### **C. Estimating the Financing Shortfall**

9. The total project costs estimated during appraisal in 2003 were \$164.6 million (D3,152,730 million equivalent). Following the cost escalation due to implementation delays and higher inflation and the realization that the project would not have sufficient funds to implement all the proposed works, the scope of work was reduced for phase 1 with deletion of the Binh Long irrigation stem development and the deferment of the Tan Bien irrigation system and the Duc Hoa subproject including the main canal and irrigation network. The total funding required to complete phase 1, which is scheduled to end in March 2011 is estimated to be \$174.6 million (D3,118 billion). Not all the approved ADB funding has been committed and there is a balance of the original funds remaining of around \$23.3 million (D442 billion), which will be utilized for phase 2. Total expenditure for phase 2 is estimated to be \$154.9 million (D2,940 billion), which after allowing for the carry-over funds results in a funding gap of \$131.6 million (D2,498 billion). This is the shortfall that is required to be funded by supplementary loans from ADB and AFD, and increased government commitment.<sup>4</sup> Total project expenditure over phase 1 and phase 2 to complete the anticipated scope of work is now expected to be \$329.5 million (D6,059 billion) including contingencies and interest during implementation.

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<sup>4</sup> Compensation and resettlement costs which are largely borne by government are expected to increase markedly to over D1,683 billion, compared with the original estimate of D370,751 million in the original appraisal documents.