7.4.4 Project Evaluation and Required Arrangement

1) Development Effects

Effects from the tourism development project are classified into direct (or primary) economic effects, indirect (or secondary) economic effects and social effects. Economic effects are examined at the end of three stages of development implementation plan, namely 2000 (short-term), 2005 (mid-term), and 2010 (long-term).

(1) Direct economic effect

a) Increase in Foreign Exchange Earnings

Foreign tourists' expenditure contributes to increase in foreign exchange earnings. The total foreign exchange earnings can be estimated for the case of 40% leakage after 2000 as shown in Table 7.4.1.

Table 7.4.1 Expected Increase in Foreign Exchange by Tourist Expenditure

unit: US$1,000

	2000	2005	2010
Central Region	221,417	386,456	661,524
Quang Tri	4,117	10,234	30,098
T.T Hue	137,737	216,551	342,204
QN Danang	77,210	152,495	251,199
Qang Ngai	2,353	7,176	38,022

Source: JICA Study Team

b) Generate Employment

Tourism is a dominant industry which generate large employment since it requires labor-intensive services. Therefore, one of the significant impacts on the economy is considered to be job creation. This study adopts 1.6 employment for high class hotels, 1.0 for mid class ones, and 0.6 for low class ones, considering the wage levels in the region.

Job creation in other tourism industries was estimated at 1.55 times the number of hotel employees, which would be created in other tourism industries. The result is shown in Table 7.4.2.

Table 7.4.2 Expected Direct Job Creation

unit: jobs

	2000	2005	2010
Central Region	3,000	10,300	23,000
Quang Tri	200	500	1,400
T.T Hue	1,900	6,100	12,000
QN Danang	800	3,300	7,800
Qang Ngai	100	400	1,800

Source: JICA Study Team

(2) Indirect economic effect

a) Effect on Income

Indirect economic effects or secondary ripple effects in terms of tourist expenditures is nothing but a multiplier effect in the economy. That is, income increase estimated as shown in Table 6.7.

Table 7.4.3 Indirect Effect on Income Increase

unit: US$1,000

	2000	2005	2010
Central Region	215,134	390,750	658,081
Quang Tri	3,729	8,433	22,709
T.T Hue	118,920	198,039	315,645
QN Danang	90,044	178,067	292,037
Qang Ngai	2,440	6,211	27,690

Source: JICA Study Team

b) Effect on Employment

On the other hand, indirect economic effects or secondary ripple effects on employment is estimated at 195% of the hotel employees. The result is shown in Table 6.8.

Table 7.4.4 Indirect Effect on Job Creation

unit: jobs

	2000	2005	2010
Central Region	3,900	12,900	29,100
Quang Tri	300	600	1,800
T.T Hue	2,400	7,700	15,100
QN Danang	1,000	4,200	9,900
Qang Ngai	200	400	2,300

Source: JICA Study Team

2) Social Effects

This effects include those which are difficult to estimate in monetary terms or those which can not necessarily be justified from the economic point of view, but accepted from the other, so to speak, social purposes.

(1) Increase in the government revenue

Economically speaking, the Government revenues including taxes, tariffs and other charges are just transfer items. However, improvement of the budget allows the Government to spend more funds to other important items such as welfare. It strengthen the confidence of the people in the Government activities and stabilizes the nation.

(2) Improve social infrastructures

The projects include improvement or construction of social infrastructures such as roads, bridges, water supply, sewerage, flood protection, and other facilities. Not only tourists but also the residents can enjoy the benefits from such infrastructure such as convenience, comfort, sanitation, and safety. These facilities improve the life of the area and increase the real income of the people measured in "Utility" (in the usage of theoretical economics). In addition, improvement of infrastructure has an effect to decrease regional economic disparities with a large number of people utilizing those facilities without restrictions.

(3) Other benefits from the facility construction

In addition to infrastructure, many other facilities for tourism are planned to be build up. Some of them have effects to conserve historical assets and to conserve natural environment. Constructing facilities for attracting many tourist to the region can be consistent with keeping "treasuries" of the nation if the tourism development is carried out with a deliberated plan.

(4) Improve reputation in larger people

As the larger number of people come to know the region through tourism, it is expected not only that investments of other sectors are attracted, but that the residents have confidence in their region. Sharing such confidence by the residents is very important for improving the region in the future.

(5) Mitigate opposite effects

Without a well-coordinated plan, tourism development would bring about conflicts between tourists and residents in the region. For example,

- Insolent behavior of tourists in historical and/or religious places, especially through inappropriate dresses
- Illegal trade and exportation of antiques
- Vandalism and graffiti
- Communication problems between tourists and tourism employees
- Commercialization of culture
- Unorganized tourism flows creating overcrowding and spoiling the tranquil atmosphere.

Some of these opposite effects could be mitigated through the development plan, especially preparing tourist information center, and signs as well as training program of employees.

3) Environmental Effect

The initial environmental examination (IEE) for this project (three sub-projects) is carried out. This project mainly consists of road improvement, transport facilities, and tourist facilities. This project will not have the possibilities of significant impacts on environment, because this project is mainly rehabilitation or small-scale one. Therefore, the examination for the necessity of environmental impact assessment will be required at detail design stage. On the other hand, the TPZ project has two TPZs, such as Lang Co TPZ and Hoi An TPZ.

The Lang Co TPZ consists of road construction, golf course and other tourism facilities, and The Hoi An TPZ mainly consists of flood protection and tourism facilities. These TPZs will have the possibilities of significant impacts on waste, hydrological condition, coastal condition, fauna and flora, landscape and water pollution, because these areas are located on the coastal area or along the river. Therefore, this project is required adequate project planning with careful consideration on environment, such as route selection at detail design stage, and the establishment of the regulation of land use in the surrounding areas. The implementation of environmental impact assessment in accordance with Vietnamese laws and regulations on environmental protection is also required.

4) Institutional Arrangement

Due to the characteristics of the tourism products the project involves various kinds and level of governmental agencies. Clear assignment of the implementation agencies and co-ordinating organisation should be realised. In case of the tourism infrastructure improvement projects, road projects for tourist accessibility improvement involve national highways, provincial roads and district roads. The responsible line ministry for road development is MOT but actual construction will be carried out by different administration level in accordance with the road classification. On the other hand, the most of tourism related project such as water supply and sewerage work which is usually managed by local government should be implemented in co-ordination with road project.

In the case of the Lang Co TPZ development project, the project area boundary is clear. Establishment of one impementation organization like "Lang Co Tourism Development Corporation" is desirable. The corporation will carry out all tourism related project in coordination with variouse agencies in concern. Co-operation with local residents and government is important role of the Lang Co Tourism Development Corporation for smooth and effective implementation of the project.

Therefore, one co-ordinating body who can manage the all tourism related project should be established. The newly established body should also be able to implement tourism related administration functions such as tourism resources management, development planning, marketing and promotion.

The study recommends the establishment of this kind of tourism development corporation under the Central Region Development Committee (CRDC). Responsible line ministry in central government level will be the Administration Department of Tourism and/or MPI for tourism development administration. Actual project's implementation will be carried out by organisations who is responsible for operation and management of the activities or facilities. Functional demarcations of project implementation in each sub-project are shown in the following figure.

Figure 7.4.14 Implementing Agencies

SUB-PROJECT NAME	IMPLEMENTATION AGENCIES				
	Line Ministry	CRDC	Local Government	Development Corporation	Private Invester
Tourism Infrastructure Improvement	□	□■	□▨	□	(■▨)
Hoi An TPZ Development	□	□■	□▨	□▨	■▨
Lang Co TPZ Development	□	□■	□	□▨	■▨

LEGEND: □ Coordination/Administration ▨ Operation and Maintenance ■ Construction

NOTE: ( ) shows private investment to a part of tourist facilities such as restaurants and shops.

7.5 HUE-DA NANG INTER-CTIY IIIGHWAY CONSTRUCTION AND SECONDARY ROAD IMPROVEMENT PROJECT (IIDH & SRI)

The goal of the economic analysis is to calculate measures of viability for two road sector priority improvement projects whose development and selection is discussed in Section 4.5. These are construction of a new Hue-Danang Highway, a high-order, two-lane, access-controlled facility; and, upgrading Highways 24, 49 and 14B to Class III (per MoT) standard.

Techniques, methodologies and findings are described in subsequent sections. The discussion is of necessity abridged; the interested reader is therefore urged to consult *Volume 6* of the final report for comprehensive detail regarding economic viability investigations[1].

7.5.1 Methodology Overview

The principal aim of the economic project analysis is to determine the economic viability of implementing two priority projects:

- Construction of a new Hue-Danang Highway ("with" case) as opposed to continued use of existing Highway 1 upgraded in line with on-going IBRD/ADB projects ("without" case); and,
- Improving Highways 24, 49 and 14B to Class III standard ("with" case) as opposed to continued use of existing facilities ("without" case).

The quantified economic benefits which would be realized from implementation of these projects are defined as the savings in vehicle operating costs and time costs when comparing the "with" and "without" project conditions. Resultant benefits catalyzed by the projects are set against the economic project costs to estimate the expected economic return from the resources invested in the projects.

The analysis follows the conventional discounted cash flow methodology in determining the net present value (NPV), internal rate of return (IRR) and benefit cost ratio (B/C). These efficiency measures will indicate the economic viability of the projects and show the sensitivity of the economic viability to changes in costs and benefits.

While these goals are direct, underlying techniques and methodologies are, at times, complex due to a number of considerations.

- The road priority projects represent an essential element of an integrated and coordinated planning approach. Thus, they are directly linked with achievement of regional socio-economic, and macro-economic, targets.
- Projects which satisfy the criteria of economic efficiency are those which, prima facie, exhibit high economic returns. However, a project may not meet strict economic viability criteria but could nevertheless be needed to achieve social or other national objectives, such as improving access to highlands areas (thus catalyzing economic development) or overcoming pronounced physical and psychological obstructions to national unity, such as those posed by Hai Van pass.
- Since the road priority projects are intrinsically linked with, and contribute to, the success of the regions social and macro-economic development framework, it is logical to surmise that some proportion of resulting non-transport benefits are attributable to transport projects. Conversely, failure to provide requisite transport infrastructure will likely prevent (at best impede) the ability of the regions economy to evolve and to meet postulated achievement goals. In a more focused sense,

[1] "Final Report - Volume 6: Road Sector Demand Forecasts, Strategy Formulation, and Priority Project Feasibility Reviews", *The Study on the Integrated Regional Socio-economic Development Master Plan for the Key Area of the Central Region of the Socialist Republic of Viet Nam*, prepared for Development Strategy Institute, Ministry of Planning, by Japan International Cooperation Agency, October, 1996.

additional near-term benefits could also be catalyzed. The projects would, for example, create additional short-term employment in the construction industry and this would have a multiplier effect throughout the study area. Long-term jobs would also be created via staff requirements for road, and in the case of the HDH - toll systems, operation and maintenance. Other long-term opportunities would be created in service areas such as food, fuel and other traveler needs. The improvements are also expected to have a positive effect on industrial development, with increased efficiency in the transportation of goods, benefiting both producers and consumers. Upgraded roads would also have a favorable influence on tourism development by providing faster and more comfortable travel opportunities.

Nevertheless, in order to ensure a conservative approach, economic viability of road sector projects is based only on direct vehicle-related benefits (savings in running cost and passenger time). Indirect transport, or other non-transport benefits previously described, are excluded from the analytical process.

The analysis, as described in subsequent sections, is conducted in economic terms. That is, financial (market) costs with duties, taxes, transfer fees and similar items having been removed. All monetary units are in constant terms, with 1996 serving as a base year for cost derivation purposes[1].

7.5.2 Vehicle Operating Cost

The VOC (vehicle operating cost) of vehicles using the study area road network is influenced by several key variables, among them vehicle type and speed as well as, in the case of Hai Van pass, vertical and horizontal alignment. Thus, for the current study, investigations initially focused on the formulation of modal unit (US cents/kilometer) 1996 VOC under free-flow and smooth road conditions. These are subsequently modified to mirror operating conditions (speed, volume, capacity) simulated via the transport modeling process by using latest available VOC software/techniques sponsored by the IBRD[2].

1) Fleet Costs

A number of previous VOC-related investigative efforts were reviewed as background to the current effort. These include the IBRD Sector Review[3] as well as VOC calculations contained in the Highway 9 corridor improvement project[4], the Highway 18 feasibility study[5] as well as the Hai Van tunnel pre-feasibility report[6]. Each of these appears to feature a similar concern, specifically, that the most-recently available data (2-3 years old) presents an unrealistic fleet profile due to an over-representation of over-age, mostly east European, vehicles and out-of-date taxation structure. It is equally obvious that the fleet profile is rapidly changing, particularly in the case of cars and motorcycles where modern vehicles of (largely) Japanese origin now (since within 1-2 years) dominate. It is expected that this evolution will rapidly accelerate, particularly as the need for bus and truck fleet replacement and expansion intensifies. Thus, it is logical to surmise that VOC appropriate to a 20 (or more) year economic review should not be based upon an out-dated fleet profile and tax structure. Instead, the use of a more representative (vis-à-vis the economic evaluation horizon) fleet structure, based on up-to-date (late 1996) data, augmented by the experience of other Asian nations, is more plausible.

---

[1] Costs and benefits are expressed in terms of US dollars, converted at a rate of 11,000 VD = 1.00 US$.

[2] "Estimating Vehicle Operating Costs", by R.S. Archondo-Callo and A. Faiz, World Bank Technical Paper Number 234, Washington DC. USA. Includes HDM-VOC (Version 4) software.

[3] "Vietnam Transport Sector Review", The World Bank, 1993.

[4] "Subregional Transport Sector Study for the Greater Mekong Subregion", Asian Development Bank, October, 1995.

[5] "Feasibility Study on the Highway No. 18 Improvement in Viet Nam" for Government of Viet Nam, Ministry of Transport, by Japan International Cooperation Agency, March 1996.

[6] "Pre-feasibility Study for Hai Van Pass Tunnel of Highway No. 1", by Express Highway Research Foundation of Japan, for IBRD and Ministry of Transport, Government of Viet Nam, March 1996 (Draft Final Report)

A revised vehicle tax structure was issued during early 1996[1] which contains a graduated scale of import duties and sales taxes. Highest duties are assessed on passenger vehicles not exceeding five seats, lowest on commercial vehicles of five or more ton capacity. The impact in terms of economic pricing can be substantial: some 60 percent of the "on the road" price of a small passenger vehicle consists of duties, taxes and fees; a total which reduces to some 23 percent in the case of largest commercial vehicles. CIF (cost, insurance, freight) vehicle prices were reviewed with industry representatives and fleet operators in order to gain a realistic overview of representative vehicle prices. While differences among various makers do exist, realistic price ranges can nevertheless be defined (Table 7.5.1).

Table 7.5.1 Overview of 1996 Financial and Economic Vehicle Prices

Vehicle Type	Price (US$)	
	Financial[(1)]	Economic[(2)]
Car	72,300	29,300
Van	58,100	27,400
Medium Bus	65,700	45,300
Large Bus	88,800	61,300
Light Truck	26,500	17,400
Medium Truck	49,400	38,200
Heavy Truck	61,800	47,800
Motorcycle	2,200	1,900

(1) Including taxes, duties, commissions and fees.

(2) CIF price; derived from discussions with industry representatives and fleet operators.

2) Passenger and Crew Costs

The costs associated with passenger and crew represent the "human element" of VOC relationships. These items are, however, allocated differently: crew costs represent an actual monetary cost associated with vehicle operation (professional driver and attendant) and are thus an element of actual vehicle running costs. Passenger time, on the other hand, reflects a benefit accruing to motorists in that economically valuable time is shifted from travel to a more productive purpose. Thus, to minimize ambiguity, VOC is developed with passenger time being a separate, time-based, cost.

Accurate study area wage information is virtually non-existent. Interesting previous work, based on a national household survey, provides an overview of 1992 household income and expenditure, as well as a relative income distribution[2]. While relative patterns may still be reasonable accurate, it is unlikely that absolute income data retain validity particularly in light of the on-going and rapid evolution of the doi moi-fueled economy. Circumstantial evidence further suggests that any official income data are unlikely to reflect a true level of respondent "wealth". Reasons for this are varied and include subsidized housing and/or food, participation in the unofficial economy, or simply under-reported income.

The 1996 study area GDP/capita is estimated at near $130 per annum, and is, in real terms, expected to roughly double by year 2005. While relative growth is substantial, absolute totals remain low particularly in light of vehicle prices: roughly $2,000 for a motorcycle, and $70,000 - $80,000 for a passenger car. A frequently-used "rule of thumb" by the banking/lending sector is that annual household income should be slightly higher than the price of the desired vehicle. This, in turn, suggests income per capita of near $400 if a new motorcycle is to be viewed in "affordable" terms by a study area household. This disparity is even more pronounced in the case of passenger cars. It is inconceivable that the value of passenger (both foreign and domestic) time can realistically be approximated by any multiple of

[1] "Amendments and Additions to Import Tariff and Minimum Price List at the Bordergates for the Calculation of Import Duties", issued by the Government of Viet Nam, January 1996.

[2] "Vietnam Living Standards Survey 1992-1993", State Planning Committee - General Statistical Office, 1994.

study area GDP per capita, particularly over the 20 year horizon embedded in the economic review process.

Thus, in the interests of simplicity, a shadow factor of 2.0 is applied to year 2005 GDP capita, which is in turn arrayed against percentile ranges (eight levels) developed by the national household income survey. Car owners are assumed as originating from highest income levels, motorcycle owners from intermediate income levels and bus passengers from moderate income levels . Wages of drivers and attendants are set at the overall average. Adopted passenger time values consequently total $1.10, $0.59 and $0.30 per hour for car, motorcycle and bus users, respectively, with an average driver/attendant wage of $0.34 per hour.

Passenger time savings are conservatively estimated only for trips of economic value, that is, the proportion of occupants undertaking a journey to/from work or for professional business purposes. Recent overseas data[1] suggest that only some 15-30 percent of inter-province trips, depending on mode, are expended on such endeavors. Instead, the dominant trip purpose (near 50 percent of total trips) is personal needs, one of the travel categories typically defined as featuring no significant economic value and/or potential. A similarly low volume of work trips, ranging from 15-35 percent of total trips, was adopted by a previous study conducted in Viet Nam[2]. For purposes of the current study, it is also conservatively postulated that 20-40 percent of passenger time features, depending on mode, economic value.

3) VOC Profile

Vehicle costs, time value and operating parameter are combined to estimate financial and economic VOC. The economic VOC for composite vehicle classes are presented as running costs, both on a distance basis and fixed cost (time) basis, as well as value of passenger time (incurred on a time basis) (Table 7.5.2).

Table 7.5.2 1996 Economic Vehicle Operating Cost

Vehicle Type	VOC (US cents)[4]		
	Running Costs		Time Costs
	Per Kilometer	Per Minute	Per Minute[5]
Motorcycle	2.6	0.1	0.3
Passenger Car (1)	16.1	10.7	1.7
Small/Medium Bus	16.5	6.7	1.9
Large Bus	20.6	8.3	3.8
Pick-Up Truck	12.8	4.5	0.5
Light/Medium Truck (2)	15.8	8.8	0.0
Heavy Truck (3)	25.6	11.0	0.0

(1) Sedans and Vans
(2) Two axle trucks, excluding pick-ups
(3) Trucks with three or more axles, and truck-trailer combinations
(4) VOC applicable to inter-zonal vehicle trips. VOC reflective of free-flow speed and good road conditions
(5) Passenger time with economic value. Crew costs included in vehicle running costs.

These relationship reflect, as indicated previously, free-flow speed and smooth pavement conditions. The computerized modeling process which is sensitive to the interaction of traffic speed, volume and capacity, replicates changes in operating speed as congestion gradually increases on the road network. The capabilities of HDM-VOC[3] were consequently utilized to adjust free-flow VOC to a variety of speed, grade and horizontal curvature conditions. Thus, as speed decreases, and/or vertical grade increases, VOC will correspondingly increase,

[1] 1993/4 national roadside interview conducted in Indonesia.
[2] "Feasibility Study on the Highway No. 18 Improvement in Viet Nam", op. cit.
[3] "Estimating Vehicle Operating Costs", op. cit.

particularly in the case of trucks. VOC is also sensitive to road roughness; that is, a poorly surfaced road will increase VOC due to slower operating speed and higher consumption of vehicle parts.

7.5.3 Improvement Costs

Improvement costs considered in the economic analysis are one-time project implementation costs (construction, contingencies, engineering design, construction supervision, and land), periodic maintenance (overlays every 7-10 years after opening of the facility), and annual maintenance costs. Improvement costs are economic costs; that is, net of taxes and duties.

Economic project costs for the Hai Van pass segment of the HDH are drawn from that projects pre-feasibility study[1]. For remaining sections of the HDH (Hue Bypass, Lang Co-Chan May, Danang Bypass), and for improvement of Highways 14B, 24 and 49, costing specialists were dispatched to the study area to examine each corridor at a pre-feasibility level of detail. Unit costs were derived from recently-completed road design/construction projects, augmented by discussions with representatives of the MoT and province Peoples Committee's. While the computation of engineering-related costs proved to be a relatively straight-forward process, the estimation of land costs was more problematic. Land, in the local context, is not a commercially traded commodity since ownership is restricted. Instead, the value of land is generally measured in terms of its economic production potential. Pending finalization of road priority project design, it is not practical to attempt a detailed land settlement/use analysis of road corridors designated at a Master Plan level of accuracy. Two precedents were accordingly utilized:

- The recently-completed Highway 18 design project[2] developed detailed estimates of land costs based on outlays for land acquisition/compensation (inhabited land along existing road; inhabited land in rural area; cultivated land; and, forest area); crop compensation (rice); resettlement (permanent house; temporary house); and, household relocation assistance. Findings indicate that land costs average near 10 percent of project cost.

- Costing guidelines[3] suggest that, for the type of project considered and likely corridor alignments, land compensation should range from $100 - $150 per hectare per year of use, plus resettlement costs.

The upgrading of Highways 14B, 24 and 49 should incur only few site-specific land costs, with exception of the proposed Highway 49 Bypass near Hue. The HDH, with a suggested 50 meter right-of-way, well incur considerable land costs - on the order of $10 million depending on assumptions of unit cost and land tenure. To maintain a conservative approach, it is deemed prudent to allocate some 15 percent of HDH cost (near $14 million) and 7.5 percent of east-west highways cost (some $6 million) for land rights outlays.

The estimated economic project cost for the new Hue-Danang Highway is some $240 million, near 60 percent thereof being allocated to the Hai Van pass section. Unit cost varies from $527,000 per kilometer (Danang Bypass) to almost $10 million per kilometer for the Hai Van section. In addition, some $25 million is budgeted for improving and/or constructing HDH access roads and/or intersection facilities (Table 7.5.3).

Economic project costs for upgrading east-west highways (considerable portions of which are in mountainous terrain) are expected to total some $85 million. Unit cost is similar for all facilities averaging near $430,000/kilometer (Table 7.5.4).

---

[1] "Pre-feasibility Study of Hai Van Pass Tunnel of Highway No. 1", op. cit.
[2] "Feasibility Study on the Highway No. 18 Improvement in Viet Nam", op. cit.
[3] "Asia Handbook-1994", published by the Bank of Tokyo, Japan, 1995.

Table 7.5.3 Economic 1996 Project Cost for Hue-Da Nang Inter-city Highway

Item	Units	Hue Bypass	Lang Co-Chan May	Hai Van Pass	Da Nang Bypass	Total
Construction	Million $	24.215	34.353	112.158	15.529	186.255
Contingency	@ 10%	2.421	3.435	12.032	1.553	19.442
Engineering/Supervisio	@ 10%	2.664	3.779	12.281	1.708	20.432
Land	@ 15% [1]	4.395	6.235	0.490	2.819	13.939
Total	Million $	33.695	47.803	136.961	21.609	240.068
Length	Km	39.0	32.0	13.9	41.0	125.9
Unit Project Cost	Mill $/Km	0.864	1.494	9.853	0.527	1.907
Access Facilities [2]	Million $	5.400	5.400	4.900	9.500 [3]	25.200
Grand Total [4]	Million %	39.095	53.203	141.861	31.109	265.268

[1] Except Hai Van section.

[2] Upgrading/construction of access roads, flyovers and toll booths.

[3] Includes multi/lane Highway 14B between HDH and Highway 1.

[4] All indicated costs exclude taxes, duties and fees.

Table 7.5.4 Economic 1996 Project Cost Upgrading of East-West Highways

Item	Units	Highway 24[1]	Highway 49	Highway 14B	Total
Construction	Million $	21.269	22.390	21.692	65.351
Contingency	@ 10%	2.127	2.239	2.169	6.535
Engng/Supervision	@ 10%	2.340	2.463	2.386	7.189
Land	@ 7.5%	1.930	2.032	1.969	5.931
Grand Total [2]	Million $	27.666	29.123	28.216	85.005
Length	Km	65.0	70.0	62.9	197.9
Unit Project Cost	Mill $/Km	0.426	0.416	0.449	0.430

[1] Portion of Highway 24 located within the study area.

[2] All indicated costs exclude taxes, duties and fees.

Maintenance costs adopted for the economic analysis total:

- Routine annual maintenance is set at 2,500 1996 US dollars per kilometer per year. This amount exceeds the MoT goal, but is more consistent with the Indonesian Integrated Road Management System (IRMS) which suggests that, to maintain good surface quality on a major, paved road, outlays of $2,000 - $2,500 per kilometer per year are required for facilities carrying up to more than 10,000 vehicles per day.

- Periodic maintenance consisting mainly of minor repairs and overlays applied every seven to 10 years after facility opening, is assigned an economic cost of $60,000 per kilometer per event.

An exception is the Hai Van section which requires complex maintenance procedures due to the presence of three tunnels. The Hai Van per-feasibility study estimates the economic cost at $861,000 per year, or some $62,000 per kilometer per year, averaged over the 13.9 kilometer section.

7.5.4 Economic Viability

The computerized transport models employed in forecasting future demand involve, in summary, the estimation of years 2000, 2005 and 2010 trip matrixes, and their assignment onto future road networks containing alternative types of improvements. These forecast can

essentially be viewed as unconstrained demand, that is, the allocation of a given number of trips between a series of origins and destinations. However, economic analysis algorithms require enhanced sensitivity in that the cost and benefit streams are determined via a comparison of "with improvement" and "without improvement" scenarios. Thus, a narrow (say 6 meter) "without" road will reach saturation capacity earlier than an enhanced (say 7.2 meter) "with" road. Likewise, the HDH improvement will invariably offer vastly higher capacity in the Hue-Danang corridor.

A series of screening steps were therefore instituted which reflect capacity constraints unique to the "with" and "without" scenarios.

- The "without" maximum capacity is, in case of the east-west highways, based on existing facility conditions. In the Hue-Danang corridor, "without" maximum capacity incorporates Highway 1 improvements proposed by on-going IBRD/ADB projects.

- The "with" maximum capacity for east-west highways reflects upgrading to a Class III design standard, while, in the Hue-Danang corridor, the HDH is introduced in the form of a high-order, two-lane, access-controlled facility. The "with" scenario also includes upgraded feeder roads between the HDH and Highway 1, to include multi-laning of Highway 14B.

Results mirror, as expected, conclusions of the sufficiency analysis previously presented in *Chapter 4*. In case of the Hue-Danang corridor, upgrading of Highway 1 in line with IBRD/ADB proposals will be adequate for the near-term future; however, all upgraded corridor sections are expected to saturate in vicinity of year 2005. The introduction of the HDH will suffice for about ten years thereafter before multi-laning of the HDH will be required. Demand growth along the east-west highways will be substantial in a relative sense, although absolute capacity is likely to be sufficient for the foreseeable future.

Economic evaluations include three measures of viability:

- Internal rate of return (IRR), or that rate at which the project net present value is zero. IRR is commonly used as a comparative index of project economic return vis-à-vis some exogenous rate such as societal opportunity cost of capital or financial cost of market capital.

- Net present value (NPV) is the discounted present value of the net project benefit stream (20 year horizon) based on an assumed monetary value (for the current study, 10 percent, 12 percent and 15 percent are used). NPV is considered a more stable indicator of project performance, and that, all things being equal, higher NPV implies superior performance. Negative NPV would suggest, in an economic decision-marking framework, that the project should be rejected.

- Benefit-cost ratio (B/C), that is the relationship of the discounted benefit stream to the discounted initial investment. It must be assumed that, in the case of Viet Nam, investment funds are limited, and that all projects are related through a common budget constraint. In other words, it is likely that the number of projects will, at any given time, exceed the availability of funds for implementation. Thus, it is judged imperative that any review of projects be sensitive to required capital investment. This dimension is provided by the B/C ratio which, unlike IRR and NPV, is directly impacted by the initial investment. B/C ratios were developed for 10 percent, 12 percent and 15 percent discount rates.

1) Hue-Danang Highway

The analysis is structured to reflect a common, four-year construction period, with opening of the entire HDH by year 2004. Results indicate that the HDH, being located in a high-volume, rapidly growing corridor, achieves attractive rates of return. On a composite basis, the HDH IRR is 22.4 percent, at a B/C of 2.03 (12 percent discount rate) (Table 7.5.5).

Table 7.5.5 Measures of Economic Viability for Hue-Da Nang Inter-city Highway

PARAMETER		SEGMENT				
Item	Units	Hue Bypass	Lang Co-Chan May	Hai Van Pass	Da Nang Bypass	Total HDH [4]
IRR [1]	Percent	29.2	25.5	14.5	40.3	22.4
NPV [2]	Million US$ (at 10%)	67.295	70.587	44.048	86.091	268.022
	Million US$ (at 12%)	50.258	51.573	21.120	66.980	189.931
	Million US$ (at 15%)	32.110	31.283	-3.119	46.352	106.626
B/C [3]	Ratio (at 10%)	3.42	2.85	1.41	4.85	2.37
	Ratio (at 12%)	2.92	2.44	1.21	4.19	2.03
	Ratio (at 15%)	2.35	1.96	0.97	3.41	1.63

[1] Economic Internal Rate of Return

[2] Net Present Value discounted at rates of 10, 12 and 15 percent

[3] Ratio of Benefit to Cost stream,, both discounted at rates of 10, 12 and 15 percent.

[4] Based on summed cost and benefit streams calculated for each of four segments.

Hai Van pass is the critical link with an IRR of 14.5 percent, and B/C ratio of 1.21 (12 percent discount rate). This is not surprising given the massive construction cost of the Hai Van tunnels. A sensitivity analysis confirms that while performance of the other three HDH segments remains robust under a wide range of changing cost or benefit scenarios, only a 15 percent decrease in benefits, or 15 percent increase in cost, is sufficient to lower the Hai Van B/C to near unity (Table 7.5.6).

However, in spite of the apparently modest economic yield, the importance of the Hai Van segment should not be overlooked. It is a critical constriction point for the entire Hue-Danang corridor, and a failure to provide an upgraded road facility though this area is expected to negate many of the benefits achieved by flanking sections of the HDH since the amount of traffic flowing across the Thua Thien-Hue and Quang Nam-Danang provinces border would be constrained to the capacity of an upgraded, but mountainous, Highway 1. Thus, the long term (post 2005) economic viability of the entire Hue-Danang corridor might be compromised if a flow constriction is permitted to exist in its midst. Hai Van pass has historically also evolved as a major impediment to full integration of not only the central region, but also northern and southern precincts of the nation. The Government of Viet Nam has confirmed that it places great value on the removal of this impediment.

2) East-West Highways

The analysis is structured to reflect a common, three-year construction period, with completion of work during year 2003. The economic performance of the east-west highways is more modest than that of the HDH. This is not surprising given the reduced traffic volumes and not inconsiderable project cost (considerable portions of the east-west highways are located in mountainous terrain). On a composite basis, the IRR reaches 13.3 percent, and B/C ratio 1.16 (12 percent discount rate) (Table 7.5.7).

Table 7.5.6 IRR and B/C Ratio Sensitivity Analysis for Hue-Da Nang Inter-city Highway

HDH SEGMENT	CHANGE IN COST	INTERNAL RATE OF RETURN (PERCENT) CHANGE IN DEMAND (BENEFITS)					BENEFIT/COST RATIO (12 PERCENT) (1) CHANGE IN DEMAND (BENEFITS)				
		Base	- 15 %	- 30 %	- 45 %	- 60%	Base	- 15 %	- 30 %	- 45 %	- 60%
Hue Bypass	Base	29.2	26.1	22.6	18.6	13.7	2.92	2.48	2.03	1.58	1.14
	15 %	26.5	23.6	20.3	16.4	11.7	2.54	2.15	1.76	1.37	0.98
	30 %	24.3	21.5	18.3	14.6	10.1	2.24	1.89	1.55	1.20	0.86
	45 %	22.4	19.6	16.5	13.0	8.6	2.00	1.69	1.38	1.07	0.77
	60 %	20.7	18.0	15.1	11.6	7.3	1.81	1.53	1.25	0.97	0.69
Lang Co - Chan May	Base	25.5	22.7	19.6	15.9	11.4	2.44	2.07	1.70	1.33	0.96
	15 %	23.1	20.4	17.4	13.9	9.6	2.12	1.80	1.47	1.15	0.83
	30 %	21.1	18.5	15.6	12.2	8.0	1.87	1.59	1.30	1.01	0.73
	45 %	19.3	16.9	14.0	10.7	*	1.67	1.42	1.16	0.91	0.65
	60 %	17.8	15.4	12.7	9.4	*	1.51	1.28	1.05	0.82	0.59
Hai Van Pass	Base	14.5	12.3	9.7	6.6	1.2	1.21	1.02	0.83	0.65	0.46
	15 %	12.6	10.4	7.9	*	*	1.04	0.88	0.72	0.56	0.39
	30 %	10.9	8.8	6.3	*	*	0.92	0.78	0.63	0.49	0.34
	45 %	9.5	7.4	*	*	*	0.82	0.69	0.56	0.43	0.30
	60 %	8.2	6.2	*	*	*	0.74	0.62	0.51	0.39	0.27
Danang Bypass	Base	40.3	36.0	31.3	25.9	19.6	4.19	3.54	2.90	2.26	1.62
	15 %	36.6	32.6	28.1	23.1	17.1	3.63	3.07	2.51	1.95	1.40
	30 %	33.6	29.7	25.5	20.7	15.0	3.20	2.71	2.21	1.72	1.22
	45 %	31.0	27.3	23.3	18.7	13.2	2.86	2.42	1.97	1.53	1.09
	60 %	28.7	25.2	21.3	16.9	11.7	2.58	2.18	1.78	1.38	0.98

(1) Shaded area implies economic non-viability since benefit/cost ratio (discounted at 12 percent) is below unity.

Table 7.5.7 Measures of Economic Viability for East-West Highways

PARAMETER		FACILITY			
Item	Units	Hwy. 24	Hwy. 49	Hwy. 14B	Total [4]
IRR [1]	Percent	12.4	15.0	12.2	13.3
NPV [2]	Million US$ (at 10%)	5.720	16.072	6.019	27.810
	Million US$ (at 12%)	0.732	7.694	0.421	8.847
	Million US$ (at 15%)	-3.740	0.070	-4.487	-8.158
B/C [3]	Ratio (at 10%)	1.30	1.80	1.31	1.48
	Ratio (at 12%)	1.04	1.41	1.02	1.16
	Ratio (at 15%)	0.77	1.00	0.72	0.83

[1] Economic Internal Rate of Return

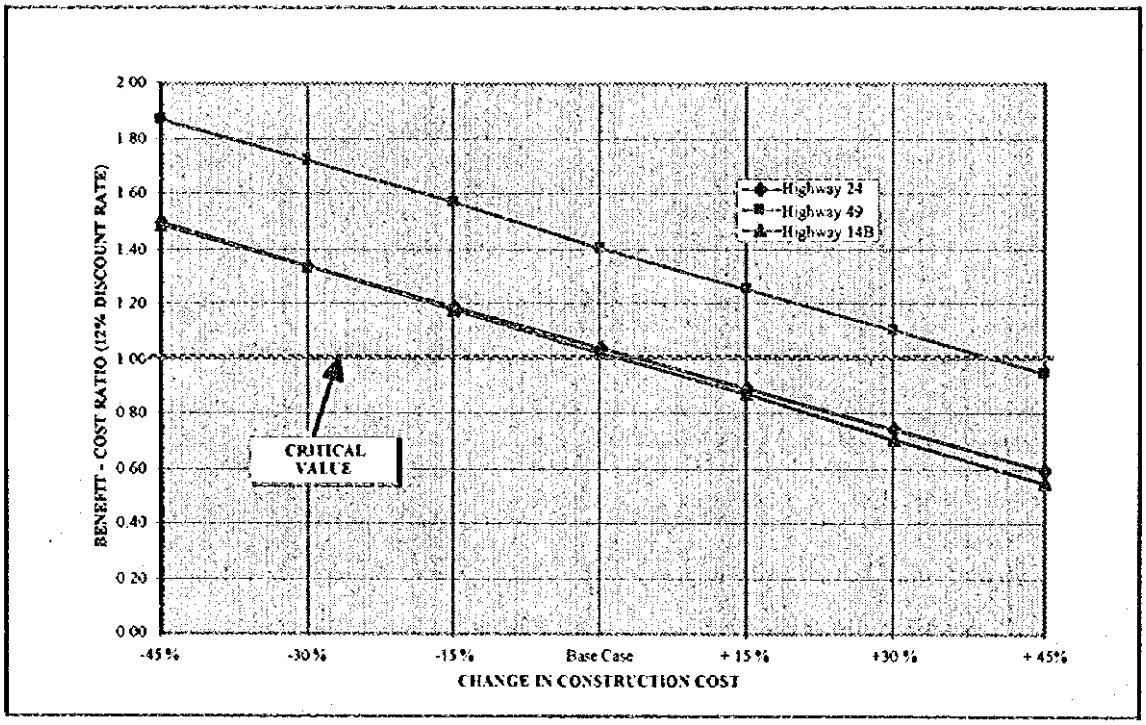
[2] Net Present Value discounted at rates of 10, 12 and 15 percent.

[3] Ratio of Benefit to Cost stream, both discounted at rates of 10, 12 and 15 percent.

[4] Based on summed cost and benefit streams calculated for each of three facilities.

A sensitivity analysis identifies Highway 49 as the most robust element in the east-west highways grouping. Only modest increases in project cost appear, however, to be sufficient to push the B/C ratios for Highway 24 and 14B to below unity (Figure 7.5.1).

Figure 7.5.1 B/C Ratio Sensitivity Analysis for East-West Highways



The economic review process, as indicated in Section 7.5.1, is limited to transport-related benefits catalyzed by savings in VOC and passenger time. No account is taken of indirect transport, or non-transport, benefits spawned by the east-west highways broader function; that is, improve accessibility to the impoverished highlands area[1] and enhance road links between regional and district centers of activity. The importance of roads is undeniable. Recent conclusions of the Viet Nam poverty assessment program[2] are that access to roads:

- Enhances agricultural productivity and is associated with the development of off-farm income opportunities and greater participation in the market economy;
- Appears to affect labor mobility, which is significantly related to economic status;
- Associates with the existence of permanent markets, enterprises, as well as economic diversification; and,
- Contributes positively toward crop and livestock output, crop area and yield as well as fertilizer demand.

The UNDP poverty elimination program[3] concludes that *The need for rural infrastructure, especially roads, is clear. If the type of road is appropriate to its uses, environmentally sound and costs are kept reasonable, it will prove to be economically justified. Rural areas will also have major social impacts, increasing access to health and education. If local people are employed and paid wages for the building, operation and maintenance of such infrastructure, this will in itself be a major anti-poverty activity.*

The Master Plan Team supports these views and urges they be considered as part of any decision-making process related to the upgrading of Highways 24, 49 and 14B.

---

[1] Mountainous parts of the study area have officially been labeled as "difficult to develop" by the D.S.I., largely as a result of inadequate road access.
[2] "Viet Nam Poverty Assessment and Strategy", The World Bank, January 1995.
[3] "Poverty Elimination in Viet Nam", United Nations Development Program in association with United Nations Population Fund (UNFPA) and United Nations Children's Fund (UNICEF), October 1995.

7.5.5 Tollroads and Involvement of the Private Sector

This study has intimated that the Hue-Danang Highway should operate as a tolled facility, with the potential involvement of the private sector via a BOT (build, operate, transfer) or similar arrangement. This is a logical step as the Government of Viet Nam must try to achieve an efficient balance of national investment between the public and private sectors, and then allocate public investment efficiently between competing demands, including highways. The main advantage of involving a private company in the operation of tolled roads is that it will usually manage a project more efficiently. In addition, it will bear the risk, which consists mainly of two elements: first, that the cost of construction may prove greater than expected, which is often the consequence of delays in construction; and secondly, that the revenues from the road may fail to meet expectations.

If a toll road is to be financed and managed by a private company (or a corporation involving joint participation of private and public sector elements), the project must obviously be financially attractive, which implies certain essential conditions. Uncertainties regarding construction, especially land acquisition and feeder road links with the public network, must be minimal. There should be a clear understanding about the scale and timing of other road improvements in the area, as these could affect the traffic using, and resultant revenue of, the toll road. The private company (or corporation) must either have freedom to determine the level of tolls and, preferably, the structure of tolls between different classes of traffic, or be guaranteed a minimum return on its investment. Concerns regarding monetary stability are also likely to arise since HDH investment will invariably be dominated by hard, foreign currencies (Yen or US Dollars) while income (toll revenue) will be in the form of Vietnamese Dong. Any shift in international exchange rates (particularly a devaluation of the Dong) will therefore exert a profound impact on long-term project viability; it is likely that the BOT operator will wish to place mitigating measures against such an eventuality into effect during the project negotiation process.

Experience shows that private companies are prepared to accept BOT conditions, which means that they will accept the right of exploitation for a limited period, after which the toll road becomes public property. A feature of toll road investments is that they will likely take many years to break even, after which profits mount rapidly. Sourcing and pay-back arrangements for long-term financing, short-term bridging loans and equity participation are crucial in this process. The year of transfer to government is also of critical importance to the company; a 20-30 year concessionaire period is not uncommon.

Generally speaking, a tolled HDH can involve two scenarios:

- The road is fully financially viable, that is, can support both construction and annual maintenance/operations costs; or,
- The road is not expected to be financially viable but can still attract private investment if government makes a contribution, e.g. a grant towards the construction cost, or grant of development rights.

The HDH is, as indicated previously, conceived as a tolled facility. Economic viability of the HDH has already been established; this is an important point from a national development point of view since a road should not be contemplated only as a toll road, per se, if it is not economically justifiable as a non-toll road. As transport strategies promulgated within the framework of the current Master Plan Study are adopted and refined, more detailed preliminary design studies must invariably be conducted. It is urged that, as an element of such work, a comprehensive financial feasibility study be conducted for the HDH, to determine whether or not HDH tolls are capable of recovering cost of building and operating/maintaining, or of only operating/maintaining, the road. The Hai Van pre-feasibility study[1] intimates that the latter case may apply for the Hai Van section; that is, the tolled road may not be financially fully self-supporting, but can still attract private sector BOT investment if government makes a contribution most likely in the form of construction cost support.

[1] "Pre-feasibility Study of Hai Van Pass Tunnel of Highway No 1", op. cit.

Pending completion of a financial feasibility study, it is of interest to also examine some outputs of the modeling process conducted within the framework of the current study. The toll diversion analogy embedded in the assignment process is sensitive to travel time saved by using the HDH and aggregate amount of toll incurred. Three composite unit toll rates were tested during the course of the assignment process: 5, 7.5 an 10 cents per kilometer (Table 7.5.8).

- The assignment of year 2000 demand to the future network is for analytical purposes only as the HDH is unlikely to exist until about year 2005. However, for the indicated level of demand, operations along both the HDH and Highway 1 are shown as being at acceptable volume to capacity ratios. Thus, the toll diversion analogy will, by and large, function in a "choice" environment largely free of "forced" diversion catalyzed by congestion. Results suggest a sensitivity of about 0.5; that is, 50 and 33 percent increases in toll rate (from 5 to 7.5 cents, and from 7.5 to 10 cents) catalyze decreases in HDH utilization of 23 and 17 percent, respectively. Net revenue is still shown as increasing, but at a diminishing rate: 17 percent for the 5 to 7.5 cent increase, and 12 percent for the 7.5 to 10 cent increase.
- The application of years 2005 and 2010 demand levels results in increasing congestion as both the HDH and Highway 1 approach and/or exceed their respective capacities. Thus, diversion is increasingly less of a choice as trips are forced onto any facility offering least travel impedance. Revenue forecasts, particularly for year 2010 conditions, should therefore be treated with caution unless use patterns are re-assessed under more realistic operating conditions.

The annual maintenance cost of the Hai Van pass tunnels has, depending on final configuration, been calculated at between US$ 0.8-1.0 million per annum[1]. The estimated revenue catalyzed by the Hai Van subsection of the HDH under year 2000 demand conditions varies, depending on toll, between US$ 0.74 and 0.90 million, while year 2005 revenues range between US$ 2.3-3.9 million. While the year 2005 figures are subject to congestion issues described previously, it would nevertheless appear that routine annual maintenance (to include toll system operations) of the Hai Van subsection can be self-supporting from toll receipts.

7.5.6 Road Maintenance

The current study has identified two key road sector priority projects which call for (a) the provision of a major new highway between Hue and Danang, as well as (b) upgrading Highways 24, 49 and 14B to Class III standard. These proposals have been supported by economic viability reviews, and it is likely that funding for construction will be made available from a variety of domestic and foreign sources. However, a key question remains:

- Once completed, how can these projects be properly maintained given the historic inability of the MoT to maintain roads due to a chronic lack of funding, exacerbated by the absence of a rigorous road maintenance procedure framework?

The timing of road maintenance is critical. Rough pavements increase fuel use, cause excessive wear and tear on vehicles and reduce vehicle productivity due to low travel speeds. Year 1995 maintenance expenditures in Viet Nam totaled some $3,200 per national road kilometer; this includes approximately $800 allocated to routine maintenance, with the remainder being spent on periodic maintenance, emergency repairs and disparate items such as maintaining repair crew quarters. MoT estimates the maintenance budget should increase by a factor of two to three, but funding is unavailable. Yet, as maintenance is delayed, deterioration accelerates quickly; and, if pavements (or non-paved roads) deteriorate too far, they are expensive to restore. Research has shown that actual costs over a 15 year period are roughly three times as high if the road is reconstructed once, as opposed to applying adequate maintenance on an annual basis[2].

---

[1] Ibid.

[2] "Management and Financing of Roads: An Agenda for Reform", SSATP Working Paper No. 8, World Bank, March 1994.

Figure 7.5.8 Impact of Toll Structure on Road Utilization and Revenue for Hue-Da Nang Inter-city Highway Corridor

YEAR	FACILITY	ITEM	UNIT TOLL RATE (US $/KM)			PERCENT CHANGE	
			0.05	0.075	0.10	5 TO 7.5 C	7.5 TO 10 C
2000	Highway 1	Daily Volume (pcu)(1)	36,924	40,939	43,685	10.9%	6.7%
		Daily Volume (Vehicles)(2)	42,127	46,673	49,252	10.8%	5.5%
		Volume/Capacity Ratio (3)	0.42	0.47	0.50	11.9%	6.4%
	HDH	Daily Volume (pcu)	21,107	16,332	13,598	-22.6%	-16.7%
		Diversion Ratio (4)	0.36	0.29	0.24	-21.6%	-16.8%
		Daily Volume (Vehicles)	10,967	8,479	7,050	-22.7%	-16.9%
		Volume/Capacity Ratio	0.15	0.12	0.10	-20.0%	-16.7%
		Toll per Kilometer ($)(5)	0.05	0.075	0.10	50.0%	33.3%
		Potential Revenue (Mill $)(6)	5.631	6.566	7.376	16.6%	12.3%
2005	Highway 1	Daily Volume (pcu)(1)	58,337	62,253	66,005	6.7%	6.0%
		Daily Volume (Vehicles)(2)	85,389	90,690	95,759	6.2%	5.6%
		Volume/Capacity Ratio (3)	0.69	0.73	0.77	5.8%	5.5%
	HDH	Daily Volume (pcu)	73,162	68,722	64,617	-6.1%	-6.0%
		Diversion Ratio (4)	0.56	0.52	0.49	-5.7%	-5.7%
		Daily Volume (Vehicles)	36,804	34,554	32,476	-6.1%	-6.0%
		Volume/Capacity Ratio	0.54	0.51	0.48	-5.6%	-5.9%
		Toll per Kilometer ($)(5)	0.05	0.075	0.10	50.0%	33.3%
		Potential Revenue (Mill $)(6)	19.465	27.51	34.59	41.3%	25.7%
2010	Highway 1	Daily Volume (pcu)(1)	133,611	135,459	135,548	1.4%	0.1%
		Daily Volume (Vehicles)(2)	192,982	195,434	195,791	1.3%	0.2%
		Volume/Capacity Ratio (3)	1.55	1.57	1.57	1.3%	0.0%
	HDH	Daily Volume (pcu)	161,129	158,664	157,879	-1.5%	-0.5%
		Diversion Ratio (4)	0.55	0.54	0.54	-1.3%	-0.3%
		Daily Volume (Vehicles)	77,601	76,404	76,032	-1.5%	-0.5%
		Volume/Capacity Ratio	1.20	1.18	1.18	-1.7%	0.0%
		Toll per Kilometer ($)(5)	0.05	0.075	0.10	50.0%	33.3%
		Potential Revenue (Mill $)(6)	41.440	61.288	81.167	47.9%	32.4%

(1) Summed average pcu's/kilometer (unconstrained demand) for each of four sub-sections (Hue Bypass, Lang Co, Hai Van and Da Nang Bypass). Modes include cars, buses, trucks and motorcycles for Highway 1, and cars, long-distance buses and trucks for HDH.

(2) Summed average vehicles/kilometer (unconstrained demand) for each of four sub-sections (Hue Bypass, Lang Co, Hai Van and Da Nang Bypass). Modes include cars, buses, trucks and motorcycles for Highway 1, and cars, long-distance buses and trucks for HDH.

(3) Ratio of summed pcu's per kilometer to summed assignment capacity.

(4) Ratio of corridor pcu's diverting to HDH. Diversion of cars and trucks considerably higher since motorcycles and (local) buses are not HDH users

(5) Average unit toll of 5, 7.5 and 10 cents per vehicle kilometer as applied to toll diversion model.

(6) Annual HDH revenue derived by multiplying vehicle kilometers, unit toll rate and 340 equivalent days per year.

In case of the nominated road sector priority projects, two diverse conditions apply:

- The HDH is likely to evolve as a tolled road, probably via the participation of the private sector and a BOT arrangement. Thus, annual and periodic maintenance of the HDH is virtually assured as requisite funding would be drawn from toll revenue.

- Highways 14B, 24 and 49 will, on the other hand, be improved under supervision of the MoT who will, in turn, assume responsibility for subsequent (post-improvement) maintenance. The source of adequate maintenance funds therefore emerges as a critical issue.

It is unlikely that a solution can be formed on purely a regional basis; instead, policy changes must likely be instituted at the national level.

In the first instance, it must be recognized which vehicle types are the principal contributors to road deterioration. Pavements wear with the passage of each axle: the heavier the axle, the greater the wear. Moreover, pavements tend to deteriorate exponentially with increasing axle loads. Empirical research has found that a curve based on an exponent of four ($y= x^4$) provides the best fit between increases in axle loads and pavement wear. The "fourth-power rule" is generally used to adjust for different axle loads. This means a doubling of axle load increases the pavement wear 16-fold. Two consequences of the fourth-power rule deserve special mention. First, virtually all pavement damage is caused by trucks. As an example, available data from Viet Nam and abroad suggests that ESA's for two-axle trucks usually range between two and three, for larger trucks up to almost five. In comparison, light vehicles rarely exceed 0.003, and buses 0.2. These data suggest that some 1,500 cars (ESA = 0.002) cause a similar degree of pavement damage than a single truck with an ESA of 3.0.

Secondly, overloading of commercial vehicles dramatically increases ESA's due to the exponential nature of the damage factor. Extreme overloading is a common problem in Viet Nam and important to control since this is the major cause of road deterioration. A survey of axle weights at four sites along Highway 1[1], found 80 percent of the traffic stream consisted of heavy vehicles (albeit with wide variations in the ESA's per vehicle). ESA's per heavy vehicle were higher in the south, partly because trucks and buses are larger but also because of more frequent overloading. The survey also singled out vehicles with axles of 10 tons or more, calculated their ESA's and found that while they represented less than eight percent of the total axles, they accounted for 88 percent of total ESA's . This shows that just a small number of heavy vehicles contributes a disproportionate amount to pavement wear. The Government needs to deal with this problem urgently so that funds for road maintenance and improvements are spent efficiently.

Therefore, as an initial step to improving maintenance, two key national initiatives must be launched:

- The MoT agencies concerned with roads prepare annual and five-year maintenance plans. However, only the yearly plan tends to be reasonably pursued. The reason is that systematic planning for road maintenance has proven largely impossible, mainly because the agencies have to operate on minimal budgets, most of which is spent on emergency repairs. In addition, policies on road maintenance need to be revised because they are based on outdated manuals which do not address the economic dimensions of the problem. Instead, Viet Nam's future road maintenance strategies should be based on the total cost of the roads which includes the cost of operating vehicles on the roads and the (discounted life-cycle) costs of constructing and maintaining roads. Such calculations would enable authorities (who allocate and spend the funds) to gauge the true cost of neglecting road maintenance and design cost-effective strategies to carry it out.

---

[1] "Weigh-In-Motion Surveys, Hanoi-Vinh & Ho Chi Minh City-Can Tho", by C.P. Corne & Associates Ltd., for TESI, April 1991.

- To prevent overloading, explicit axle-load limits must be introduced and enforced impartially, along with the maximum gross weight limits. The existing truck fleet would thus be limited to appropriate loads, instead of regularly being overloaded.

Previous discussions[1] between the IBRD and the Government of Viet Nam confirm that the Government recognizes the need for maintenance, and that this need should be self-supporting from a financial point of view. The Bank, in response, submitted a maintenance funding scheme which relies on two key elements:

- The marginal cost of road use, that is, wear and tear catalyzed by vehicles, should be borne by heavy commercial vehicles. This should be accomplished via a fee which is sensitive to the likely ESA impact of differing truck configurations. The fee should be based on a vehicle's weight and the number of its axles, and designed to recover the weight-related costs and provide an incentive to use less road-damaging models. For example, a 10-ton two-axle truck, the typical heavy vehicle in Viet Nam, would, according to the Bank's 1993 plan, pay a traffic fee one-third higher than the then-existing structure. However, vehicles with more axles (which cause less wear to the road) would benefit because the proposed formula would pass the savings (from less road wear) on to truck owners: for example, adding a third axle and assuming a constant 10-ton vehicle weight, the truck owner would save 70 percent in then-existing fees.

- The basic cost of road maintenance, that is, not related to the volume of traffic, should be borne equally by all road users. For this the Bank recommended a fuel tax to be levied equally on gasoline and diesel fuels which, in 1993, was suggested to total 1,500 VD per liter.

Besides raising revenue, these charges also signal to road users the cost implications of their choice of transport and to transport operators the cost consequences of vehicle choice, notably the axle configuration that spreads the load on the pavement. Raising sufficient revenue is of immediate concern because it is the only way to provide decent roads and maintain them.

The Study Team supports these recommendations, and urges that a legislative framework be enacted at the earliest opportune moment to support the creation of such a highway maintenance funding scheme.

[1] "Viet Nam Transport Sector Review", op. cit.

CHAPTER 8

IMPLEMENTATION PLAN FOR SELECTED PRIORITY PROJECTS AND PROGRAMS

CHAPTER 8 IMPLEMENTATION PLAN FOR SELECTED PRIORITY PROJECTS AND PROGRAMS

8.1 INSTITUTIONAL ARRANGEMENT

8.1.1 Basic Structure

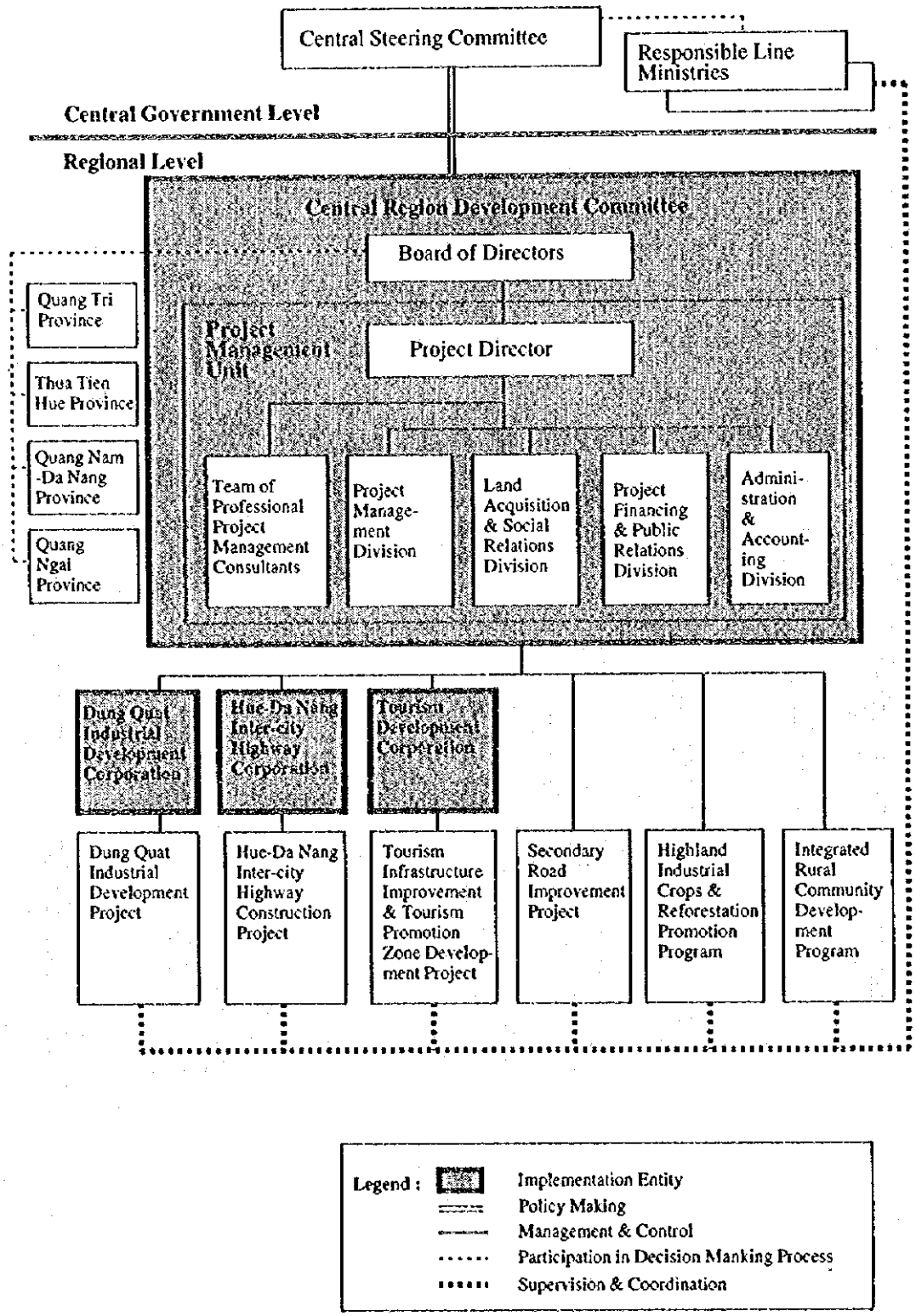
Integrated regional development projects and programs are in principle implemented and maintained by local governments. For the effective implementation and maintenance, local governments need to possess sufficient authority to plan and manage the relevant projects and programs with enough institutional capability and discretionary funds. Local governments led administration systems will bring about merits such as (1) saving enormous costs shouldered by central agencies, (2) encouraging local governments to experience project and program management thus making them sustainable, (3) quickly and properly responding to actual local needs and priorities, and (4) stimulating innovative development planning and management to ensure the life-cycle economy of projects and programs.

In addition to decentralization, coordination is the key to implement integrated regional development projects and programs. Implementation of selected six priority projects and programs require large numbers of organizations with different resources, skills, objectives and procedures. Thus their sustainability depends partly upon the effectiveness of inter-agency as well as inter-provincial coordination. Strengthening linkages among all specialized activities is especially important to cope with the problem of compartmentalization, since regional development plan has to cover a wide scope of issues cutting across organization hierarchy, geographical area, and various sectors. Coordination to be effective, however, need to be strengthened at a level nearer to the target groups and target areas of planning and development.

From this perspective, a necessary condition of the implementation of the selected six priority projects and programs is to establish a new implementation organization tentatively named Central Region Development Committee (CRDC). The basic function of the CRDC is to control and manage collectively and centrally the implementation of those projects and programs that will require inter-provincial coordination and particularly those that will be technically and financially assisted by international agencies. The CRDC will have a Project/Program Management Unit (PMU) organized by responsible representatives from provincial governments, qualified staff from the private sector, and professional management consultants. The CRDC could also have an advisory committee that consists of scholars, consultants, representatives of executing bodies (sectoral agencies), representatives of provincial governments, of the business world, mayors and others. The CRDC will be supervised by a Central Steering Committee (CSC) at the central level, which assumes the function of important policy making.

Thus, a multi-level management system may consists of a Central Steering Committee (CSC), a Central Region Development Committee (CRDC), provincial People's Committees, district and commune People's Committees. For this system to work, provincial governments should take initiative in planning and implementation, and MPI should execute its strong leadership over other ministries and make efforts in inter-regional coordination. In order to overcome the difficulty in inter-departmental and inter-provincial coordination, there is great need for promoting close collaboration between national and provincial governments.

Figure 8.1.1 Implementation Organization for Projects/Programs in the Central Region



8.1.2 Two Types of Institution Building

Selected six projects and programs can be classified as two category according to project financing system.

1) Establishment of a Self-Financed Corporation For Operation and Maintenance

The basic consideration on project financing for those projects that may generate income is that the Government should cover whole or part of the initial capital investment and take the economic return derived from their development, while the recurrent cost for their operation and maintenance should be self-financed with the revenues or charges generated from their operations. Among the selected six priority projects and programs, the following are those falling within this category. An implementation body preferably in the form of a corporation should be established for the implementation of those projects.

- New Hue-Da Nang Inter-city Highway Project (by adopting a toll system)
- Tourism Infrastructure Improvement & Tourism Promotion Zone Development Projects (by collecting tourist charges and/or levying taxes on locators such as hotels and restaurants)
- Dung Quat Industrial Development Project (by leasing the developed land and collecting user charges for port, water, and other utilities/facilities)

For example, Dung Quat Industrial Development Project should be managed by an independent corporation in order to effectively provide an environment conducive to domestic and foreign private investment by concentrating limited resources on the development of essential infrastructure in that area, as well as simplifying the administrative procedures for processing and approving investment application. The mandate of the proposed Dung Quat Industrial Development Corporation may include acquiring, holding and managing land in the IE area; preparing a planning scheme for the development of the land in the IE area; developing or disposing any land in the area or otherwise securing the best use of any such land; encouraging and promoting in investment in the IE area; and providing such infrastructure and carrying out such facilities and services as may be required to attract investment.

Regarding the Lang Co TPZ development project, the establishment of one implementation organization such as Lang Co Tourism Development Corporation under the CRDC is recommended to carry out all tourism related projects by coordinating various agencies concerned as well as cooperating with local residents and governments for smooth and effective implementation of the project. The corporation should be also able to implement tourism related administration functions such as tourism resource management, development planning, marketing and promotion.

2) Public Sector Investment and Finance

The remaining projects and programs should be implemented through the public sector investment and finance. Because of their important nature yet not necessarily financially viable, using as much concessionary loan and/or grant aid as possible will be highly recommended for the public sector investment and finance. Since these projects and programs will be implemented and maintained by local governments, the capability of planning, management and coordination of provincial and district governments and communes should be strengthened. Actions are also needed to improve the resource base and financial management of these local governments.

To this end, a steering committee and a project/program unit should be established for each project and program at relevant levels of governments. The main functions of the project/program unit are to coordinate line agencies and different levels of government involved

in implementing their project or program, monitor its progress, and provide technical and financial assistance to lower levels of governments concerned. The steering committee, on the other hand, should discuss important issues of the project/program concerned and take necessary actions for effective implementation of the project/program.

A special attention should be paid to institution building at the commune level in order to effectively implement Integrated Rural Community Development Program. In general, integrated rural development is the plan to activate poor farmers for the self-reliant pursuit of their own development. One advantage of this approach is the ability to mobilize vast amounts of potential resources at the community level. Poor people could mobilize their own resources for the improvement of their lives, such as the construction and maintenance of community's wells, schools, hospitals, roads, and so forth. Sufficient evidences indicate that people are willing to implement and maintain a project if they think that it is their own project, and see that the project will bring them benefits in the future. This requires, however, active participation of people and local organizations in the decision making process, or identification of local needs and priorities. One of the important role of the commune is to assist the people in developing initiative and capability for self-reliant development. In order for communes to become a viable agent for change, governments at higher levels should provide a viable framework as well as technical and financial assistance to support and activate development movements at the local community level. In the pilot projects, some communes may perform well, while others may not. Through project monitoring and evaluation, an important role of higher levels of government is to find effective ways to promote popular participation for social development, and replicate workable models to other areas. Thus, community development should be based on the learning process of both people and government in which solution to a problem should be found in the process of development activities.

8.1.3 Private Sector Participation

Use of private sector to carry out selected six projects is crucial for efficient implementation of those projects and programs. The profit motive makes the private firms more sensitive to consumer demand, improving prospects for a sustained flow of benefits. Their financial resources, management skills and technical know-how should be fully utilized in order to attain the goals of the projects and programs.

For example, the development of a thermal power plant in the Dung Quat Industrial Development Project would become viable on a build-operate-transfer (BOT) basis. Although it may not be likely in the immediate future, possibility of issuing bonds such as Central Region Infrastructure Fund in the domestic and international markets should be sought to raise capital funds at a reasonable cost.

With respect to incentives for private investment, areas of key importance for the successful transitional economy are (1) legitimate customs regime, (2) credible and efficient banking and finance operations, (3) competitive tax concession packages, (3) streamlined requirements for company formation, and (4) appropriate government guarantees for the exemption, incentives, and concessions granted by the government.

8.1.4 Role of Government in Regional Development

1) Role of Regional Planning

Development cannot be achieved only through unidirectional efforts from higher to lower levels of government, rather, it can only be achieved when people at the grass roots are themselves committed to development. The key role of regional planning is to operationalize the linkage between national development goals and local realities. Thus, administrative system should be developed wherein the disaggregation of the national plan and the aggregation of requirements at the grass roots can be properly linked together and consolidated into regional plans.

National planning is to provides guidelines for harmonious development of the country as a whole in accordance with national values and aspirations. Since local governments are likely to fails to consider fully the interregional dimensions, the central government should assist provincial governments by providing guidelines regarding (1) basic development goals of the country and the framework of the plan, with reference to the role that the region has to play in the total context of national development, (2) the possible assistance and investment the region can expect from the central government, (3) major projects to be carried out in the region under the responsibility of the central government. The problem is how a national plan can be linked to the development plans at lower tiers.

There is no assurance that the day-to-day realities people are faced with are fully understood by planners at the center. Without responding fully to the needs and aspirations of people, the national plan cannot be effective since it is the people who accomplish development. Therefore, there should be a viable mechanism for bringing the message of national planning nearer to the people, and in return getting the feedback from the people to the central government. In this context, regional planning has a special role to play in the whole context of planning and development of a country. It is the linkage between planning at the national level and reality at the grass roots level.

Administrators at lower-tier government levels and the people themselves are fully aware of what needs to be done in their areas. Available literature, including the experience of Asian countries, seems to confirm that the people know best what is to be done and can be done in the area they live. Among many kinds of people in different localities, small and poor farmers constitute the majority. Although they are not very vocal, those farmers represent the potential manpower, the largest latent resource that exists in villages. Thus, an important task of a lower level plan is to find ways to make use of this resource.

One viable way to aggregate requirements at grass roots and consolidate them to regional plans is to start with a modest set of relatively simple projects that are understood and called for by the people themselves. The scope of the projects can be gradually expanded as people's activities gain momentum. The aggregate of such activities will constitute one of the most fundamental ingredients of the total national endeavor for development. Thus, the contents of planning activities to be undertaken at various levels of government are different from each other, not only in terms of scope but in terms of nature itself.

2) Role of Local Government

Thus, planning and coordination functions are bound to expand at various levels of governments, commensurate with the necessarily differentiated authority and responsibility among the levels.

In the context of development in the central region of Viet Nam, special attention needs to given to the role of the government at the lowest tier, commune. Commune is the lowest unit of government, and has direct contact with people and local institutions (e.g., cooperatives and associations). Its geographical size is enough to develop a project that can bring about tangible results in terms of ameliorating the people's livelihood. In other words, communes should be able to elicit the aspirations of people, assist them in identifying projects in order to meet their basic human needs, and implement these projects.

In order to attain one of the most important development goal, poverty alleviation, it is necessary to transform the role of the government at this level from a mere agent for maintaining law and order to one for extending essential services to the people, and for identifying and translating people's needs and aspirations into viable programs and projects. As the activities of people gain momentum, the scope of development projects will be expanded, so that planning for larger geographical areas becomes both necessary and meaningful. Thus, communes should be seen as the basic cell of development in the whole system of multilevel development administration in predominantly rural countries in the region.

One crucial problem is how this kind of activity at the grass roots can be linked to planning at the national level. It is here that the role of provincial government becomes important. Provincial governments should become the focal point of a two-way communication between the bottom and the top, while providing effective back-stopping services to the local development units under its supervision. They should not be an agent which transmits directives from above in a unidirectional fashion. It is at this level that communication in all directions vertically between top and bottom and horizontally among sectors should be channeled. In this process, communication should be selective with strong focus on the needs of the area itself, rather than a simple delivery of messages from the center to local communities.

In order to fulfill these tasks, one of the first things to be done is to strengthen the local government system in which the authority and responsibility relative to planning and implementation at different levels of government should be defined clearly so that each could work in a complementary manner. It should be recognized that it takes some time before the administrative machinery of governments can be fully developed into a viable agent for change. Thus, governments at higher levels should provide a realistic and consistent development framework within which lower level governments can organize their activities to help the people to carry out activities in the spirit of self-reliance. They should also be the one to provide technical and financial support to the lower level.

8.2 INVESTMENT REQUIREMENTS AND BUDGETARY AFFRODABILITY

This section firstly examines capital investments for the selected priority projects and budgetary affordability. Secondly, it describe the environment of project investments in Viet Nam.

The investment cost is estimated for two purpose. One is to evaluate viability of the project. The other is to estimate the magnitude of financial requirements needed for implementation of the plan for confirming affordability by the Governmental budget.

The investment cost and the Governmental budget were estimated with an accuracy for the prefeasibility study in the integrated regional master plan. It has to be noted, therefore, that these estimations are of preliminary nature and that they will have to be reviewed on the basis of more detailed data and information.

8.2.1 Capital Investment

In order to examine the affordability of selected priority projects by the Governmental budget, what are born by the private sector are excluded from the capital investment estimation. Included items are listed as follows:

1. Hue-Da Nang Highway: Hue Bypass, Lang Co-Chan May, Hai Van Pass, Da Nang Bypass, Access/Toll Facilities.
2. Tourism Development: Tourism Infrastructure Improvement, Lang Co TPZ, and Hoi An TPZ
3. Dung Quat Industrial Development: On-site Infrastructure (port, water supply, sanitation plant, and crude oil tank are included), and Off-site Infrastructure (access roads and bridges, and temporary works are included)
4. Secondary Roads Improvement: Highway 24, Highway 49, and Highway 14B
5. Industrial Crop & Reforestation: Facility, Reforestation, and Insurance
6. Rural Community Development: Road, School, Clinic, Electricity, and Water

Capital investment includes construction cost, land acquisition cost, physical contingency, and engineering service fee, but not price contingency. Costs are estimated at 1996 prices. They are summarized in Table 8.2.1.

Table 8.2.1 Capital Investment

(unit: Mil. US$)

	1997 - 2000	2001 - 2005	2006 - 2010	Total
(1) Hue-Da Nang Highway	9.0	280.2	0.0	289.2
(2) Tourism Development	49.2	246.0	98.0	393.2
(3) Dung Quat Industrial Development	227.1	625.4	232.3	1,084.8
(4) Secondary Roads Improvement	0	93.1	0.0	93.1
(5) Industrial Crop & Reforestation	21.0	52.5	0.0	73.5
(6) Rural Community Development	1.9	3.8	0.0	5.7
Total	308.2	1,301.0	330.3	1,939.5

Source: JICA Study Team

8.2.2 Estimation of Governmental Potential Budget for Development

The Government's potential capital expenditure for the target area is estimated with the following steps:

1. Estimate the Government's revenue and development expenditure
2. Allocate the development expenditure in proportion to the population of the target area
3. Multiply by 2.0 the amount calculated in Step 2, taking into consideration the argument that the Government must allocate more budget resources to the target area if this area is to catch up with other economic centers of the country.

Assumptions are as follows:

1. The Vietnamese economy and the target area economy grows as projected;
2. Annual average inflation rate is 5%;
3. Exchange rate VND11,000 = US$1.00 remains constant;
4. There is no essential change in the tax structure;
5. Current expenditures are stabilized at 20% of GDP; and
6. The budget deficit remains at 4% of GDP.

The result at 1996 prices is shown in Table 8.2.2. For the purpose of comparison, cases of 50% and 30% budget allocation for the priority projects are also presented.

Table 8.2.2 The Government's Potential Budget for the Development of the Study Area (at 1996 prices)

(unit: Mil. US$)

	1997 - 2000	2001 - 2005	2006 - 2010	total
Potential Development Budget	1,356.8	2,567.6	3,916.8	7,841.2
50% allocation of the Budget	678.4	1,283.8	1,958.4	3,920.6
30% allocation of the Budget	407.0	770.3	1,175.0	2,352.3

Source: JICA Study Team

8.2.3 Budgetary Affordability of the Investment Cost

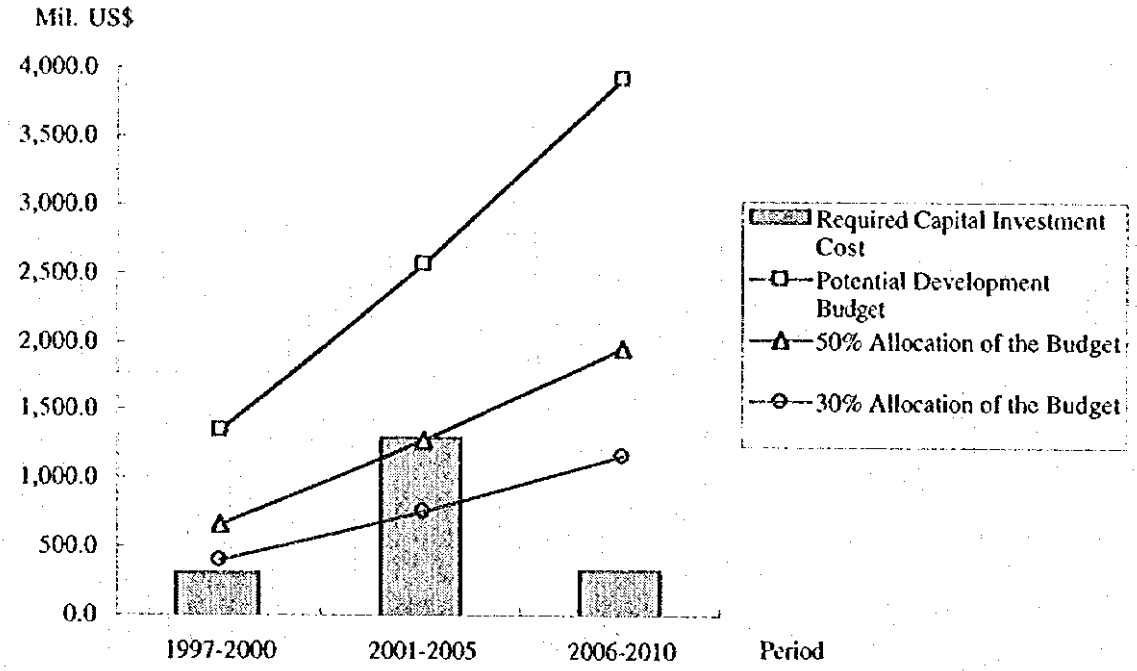
Since other large-scale development projects are expected in the target region as well as the other master plan projects, all the development budget cannot be allocated for the capital investment of the priority projects.

In the case that 50% is allocated, the investment in the 1997 - 2000 period is fully covered by the allocation with some remaining of the budget, and the 2001 - 2005 period is covered by the same period budget and the remaining of the previous period. Furthermore, additional project can be expected in 2006 - 2010 period after affording the period investment.

In the case that 30% is allocated, the investment exceeds the budget in 2001 - 2005 period. However, the total amount of 30% budget allocation in 1997 - 2010 period exceeds the investment of priority projects. Thus, if capital intensive projects are financed by low interest ODA loans, debts on capital intensive projects would be able to fully repaid soon after 2010. Please see Figure 8.2.1.

In either case that the Government cannot allocate the national budget to the target area, in other words multiplier 2.0 cannot be realized, or that less than 30% can be allocated for 1997 - 2010 period, an ODA loan can be considered as a source for the finance of capital intensive projects because the projects have a key roll for the development of the Central Region, and project investments are very efficient at this development stage in Viet Nam as mentioned later in **8.2.4 Environment of Project Investment.**

Figure 8.2.1 Required Investment and Budget for Development



8.2.4 Environment of Project Investment

1) Investment Efficiency

In order to examine an efficiency of invested capital, Incremental Capital Output Ratio (ICOR) is used as an indicator.

ICOR is the ratio between the gross domestic capital formation (I) and the amount of GDP increase (ΔGDP). The smaller ICOR is, the better the investment efficiency is.

By definition,

$$ICOR = \frac{I}{\Delta GDP}$$
$$= \frac{I/GDP}{\Delta GDP/GDP}$$
$$= \frac{I/GDP}{GDP \text{ growth}}$$

Thus, ICOR can be calculated by the percentage of the gross domestic capital formation in GDP divided by GDP growth rate.

Viet Nam's ICOR during the 1989 - 1994 period is shown Table 8.2.3 and other Asian countries' historical ICOR is shown in Table 8.2.4.

Table 8.2.3 Viet Nam's ICOR by Sector 1989 - 1994

Agriculture	1.5 - 2.0
Industry:	2.5 - 3.0
Services and Infrastructure	3.0 - 4.0 or more

Source: "Vietnam's Industrialization, Modernization and Resources," Institute of World Economy, Hanoi, March 1996

Table 8.2.4 ICOR of Asian Countries in 70s and 80s

	in 1970s	in 1980s
China	5.1	4.0
India	6.5	4.0
Indonesia	3.2	5.4
R. of Korea	3.2	3.3
Philippines	4.7	12.9
Thailand	3.9	3.4
Taiwan	3.0	3.0

Source: "Vietnam's Industrialization, Modernization and Resources," Institute of World Economy, Hanoi, March 1996

Viet Nam's ICOR is very low compared with those in other developing countries. According to World Bank experts, reasons are as follows:

- Many major investment projects which began to be implemented during the preceding decade (such as hydroelectric power, oil and gas, cement , etc.) are now working at full capacity;
- The removal of the constraints of the old mechanism and the impact of the new mechanism have caused the potentials to be brought into full play without the need of additional investment; and
- Production branches which are labor-intensive, and not capital-intensive, have enjoyed good growth over the recent years.

Usually, when a country moves from a labor-intensive and capital scant economy to a capital - intensive economy, its ICOR is bound to rise. As Viet Nam is in a stage of structural change, its ICOR will increase at a relatively high rate. According to the report of Institute of World Economy, Viet Nam's ICOR will be 3 in the 1996 - 2000 period and 4 in the 2001 - 2010 period.

2) Inflow of ODA Funds and Disbursement

Per capita ODA receipt is very low, comparing with other developing countries as shown in Table 8.2.5.

Table 8.2.5 ODA Receipts in 1991

	Total (unit: Mil. US$)	Per Capita (unit: US$)
Indonesia	1,854	10.2
Malaysia	289	15.9
Philippines	1,051	16.7
Sri Lanka	814	12.6
Thailand	722	9.0
Vietnam	305	4.5

Source: "Economy and Forecasts" No. 8, 1985, Hanoi, State Planning Committee

According to the study report "Vietnam's Industrialization, Modernization and Resources," Institute of World Economy, Hanoi, March 1996, Viet Nam must, every year, be able to secure US$1.1 billion in ODA, US$2.8 billion in FDI and US$3.9 billion in domestic capital from 1996 to 2000. The report says that it is hoped that after the year 2000, domestic capital would surpass the inflow of foreign capital. The report also describe, "In view of the favorable international situation, we may realistically hope, over the next few years, to acquire about 1 billion USD or more in ODA fund." (p. 66) In addition, the total US$1.1 billion means US$15 per capita. It not so high for such a lower developing country as Viet Nam from the international standards.

ODA funds mainly consist of loans. It should be noted that, though their terms are easy, ODA loans should be repaid and that infrastructural project cannot by itself directly repay loans. Loans can only be repaid through economic and social development.

Forecasting the future receipts of ODA funds is very difficult and this task seems out of the scope of this chapter. However, it can be said that as long as Viet Nam achieves high economic growth, keeps political stability, and expands foreign relations, it can be hoped that Viet Nam has advantages in seeking ODA even after 2000.

In contrast to these ODA inflow estimation, actual disbursements have averaged around a US$480 million from 1991 to 1995. They are much lower than donor commitments, which is by the Consulting Group (CG) meeting US$1.86 billion in 1993, and US$2 billion in 1994. Acceding to the UNDP Report "VIETNAM: Development Co-operation," Hanoi, October 1995, the reasons are:

- The sharp rise in ODA financial commitments has been relatively sudden in response to the country's economic reforms and widening open door policy;
- There are unavoidable time lags between donor financial commitments and project formulation, approval and implementation;
- The Government is facing a variety of different donor procedures and conditions which take time to reconcile with national procedures and practices; and
- The Government's capacity to plan, coordinate, manage and effectively absorb such a sudden jump to ODA needs further strengthening.

Although in the macro level Viet Nam's economy is relatively efficient, but not in the micro level. For successful implementation of sustainable projects/programs requires the effectiveness of the institutional mechanism at multilevel of government and administration.

The decentralization of governmental functions on financial resources towards regional and local levels may allow local governments to allocate resources flexibly for the project and the activities initiated through the project. This provides them with opportunities to strengthen their planning and management capacity. In addition, where a project is identified and planned with active participation of local organizations, it is more likely to reflect the needs of the area. Decentralization would also provide a structure through which stakeholders can participate in mobilization of resources, identification of local needs and priorities. All of these factors will contribute to the sustainability of development projects.

APPENDIX

TERMS OF REFERENCE (TOR) / PROJECT PROFILE (PP)

APPENDIX - 1 Water Resources and Agricultural Development Project by Medium and Small Scale Reservoir

Medium and Small Scale Dam Project

Project Profile				
No.: AGRI-02	**Sector:** Agriculture			
Title:	Wate. resources and agricultural development project by medium and small scale r reservoir			
Implementing Agencies:	Ministry of Agriculture and Rural Development People's Committees of the four provinces			
Development Phasing:	~2000	2000~2005	2005~2010	2010~
	X	X		
Location:	All agricultural land distributed in hills and plain areas in the related four provinces. Quang Tri Province; Bao Dai in Vinh Linh, Ai Tu in Trieu Phong, Ben Da in Hai Lang, Thua Thien - Hue Province; Khe Ngang in Huong Tra district, Quang Nam - Da Nang Province; Viet An in Hu Duc Sun, Dong Thien in Thang Binh, Cay Thong and Loc Dai 1 in Que Son, Quang Ngai Province; Nui Ngang in Duc Pho, Cu Va in Son Hinh			
Estimated Cost:	US$ 80,000,000			

Outline of the Project:

Development Goal:

The goal is to harness and stabilize the farm productivity within the key production areas including flat plains as granary of coastal area in four provinces where farm infrastructure has not yet covered properly, and eventually fulfill target rate of food self sufficiency, with a view to eradicating hanger and mitigating miserable poverty by raising living standard within the area.

Background and Justification:

Due to shortage of investment fund, the basic infrastructure for supporting staple food production has lagged behind the public schedule, hence a strong thrust is acutely needed including foreign loan financing resources. As a strategy of implementation, key projects with highest investment efficiency are selected within the framework of infrastructure construction for early implementation, thus maximizing the effect of plunging precious investment funds. Infrastructure to be urgently created includes; medium and small scale dam group with canals and appurtenant structures in order to realize double and multiple cropping of paddy, flood preventive structures for rice bowl areas, farm road consolidation for smooth transport of harvested materials of food processing to processing mills etc..

Objectives:

1. To improve key agricultural base by implementing irrigation / drainage system , strengthening farm infrastructure for crops and animal husbandry as well as agro-forestry.
2. To ameliorate food crop productivity in order to meet increasing demand for food within the area.
3. To contribute sustainable and timely supply of processing materials such as sugarcane to the mills to minimize waste and deterioration of the harvested materials.

Description:

The project will finance the implementation of middle and small scale dams awaited by beneficiary farm population for their better farming efficiency. The project consists of the following components :

- review of feasibility and pre-feasibility studies provided by provincial authorities to draw detailed design ready for implementation.
- major crops to be covered are paddy, rain-fed paddy, industrial and cash crops for marketing etc. also such agro-forestry crops as perennial tree crops, animal feeds and nursery seedlings.
- establish closer link with extension and forestry network to coordinate the project with their participation and cooperation.

Outputs:

1. Incremental benefits from agricultural products as well as from improvement in rural environment
2. Eradication of poverty and hunger within the four provinces.

TERMS OF REFERENCE FOR MASTER PLAN STUDY FOR NEW CHAN MAY INDUSTRIAL CITY DEVELOPMENT PROJECT

1. BACKGROUND OF THE STUDY

Viet Nam attained rapid economic growth ever since the early 1990s, extricating herself from the post-war turmoils. In the wake of joining ASEAN in 1995, Viet Nam is steadily moving towards a new economy, which participates in the framework of global economic liberalization and competition.

Viet Nam will face formidable socio-economic challenges at the turn towards the 21st century, pursuing a more balanced development by overcoming the widening socio-economic disparities among people and regions. In this context, the Central Region, as it is one of the most underdeveloped areas in Viet Nam, should be given due attention for its development. As a matter of fact, the Central Region stands at an early stage of socio-economic development, thus it has tremendous needs for intensive mobilization and integration of resources in order to achieve its accelerated growth, while making appropriate efforts to attain equitable distribution of development effects over the Region.

Associated with Viet Nam's movement towards participation in the international economic framework, sub-regional cooperation will become an important issue, of which the development concept of the "Greater Mekong Sub-region (GMS)" will have a profound impact on the socio-economic development in the Central Region. A new Indochina East-West Trade Corridor, which links Myanmar, Thailand, Laos and Central Viet Nam is an issue to realize the GMS concept. Central Viet Nam is to assume its terminus functions of a transshipment hub and processing trade centre.

As a result of the Central Region Master Development Plan Study, the Chan May area of Thua Thien Hue Province was designated as most suitable to locate such terminus functions, including a deep-sea port to be newly developed. Also, the Master Plan Study confirmed the primary importance of creating an urban agglomeration in the Central Region by integrating two nucleus cities, that is Hue and Da Nang City. Such urban agglomeration is a real need for forming a larger consumer market with moderate-to-high income urban dwellers, to provide adequate and attractive external services for industries coming in, and to assume central functions as a regional nucleus not only within the country, but also in the GMS network. The Chan May development, as it is located just between Hue and Da Nang, will definitely help promoting the urban agglomeration.

The Chan May area is characterized as a coastal sand dune area with low productive farmland and sparsely settled fishery villages along the coast. A comprehensive master plan for urban development is deemed essential for orderly and investment-efficient development, which takes also into account pertaining environmental issues.

2. OBJECTIVES OF THE STUDY

The objectives of the master plan study are to prepare a comprehensive "structure plan" of a new industrial city to be established in the Chan May area. This plan shall serve as a basis for subsequent implementation. The structure plan shall be formulated to realize two principal functions of the new city, which are :

(a) The terminus function of the Indochina East-West Trade Corridor having a transshipment and processing trade centre, and

(b) The function to form a Hue - Da Nang Central Corridor, which will serve as a regional nucleus for all the socio-economic activities in the Central Region.

3. SCOPE OF WORK

Phase One : Identification of Development Issues

3.1 Investigation of site conditions

The present physical and non-physical site conditions shall be investigated thoroughly and an inventory shall be established. The results shall be properly incorporated in the subsequent planning process. Items to be investigated and listed in an inventory are, among others, as follows :

(a) Present land use and its productivity
(b) Geographical and topographical conditions that require special attention
(c) Existence of historical heritages and traditional monuments that may need conservation
(d) Existing social and economic infrastructure
(e) Natural conditions that may require environmental consideration
(f) Records of natural calamities, such as floods, high wave, typhoons and so on, and
(g) Typical life styles of inhabitants.

3.2 Identification of urban development issues

Urban development issues inherent to the Chan May development shall be identified to formulate a master plan, on the basis of which a new city can be established , which has the roles and functions needed for the balanced socio-economic developed in the Central Region. Potential issues are conceived as follows :

(a) Legal and administrative institutions for urban development
(b) Agrarian law and land administration
(c) Housing development policy
(d) Land acquisition and compensation
(e) Resettlement issues
(f) Operation and maintenance of municipal infrastructure
(g) Financial and budgetary systems for urban development, and
(h) Investment incentives to induce foreign direct investment (FDI).

3.3 Review of the requirements for the Indochina E-W Trade Corridor

The concept of the creation of the Indochina East-West Trade Corridor shall be reviewed in terms of its viability and forecast movement of persons and cargoes coming from and going to the inland countries through the Chan May port and Free Trade and Transit Zone (FTTZ). The following are the subjects to be reviewed :

(a) Development of the Chan May Port and its ancillary facilities
(b) Person and cargo traffic generated from and concentrated in the Port and FTTZ
(c) Development concept of the FTTZ
(d) Requirements for external services for the Port and FTTZ, and
(e) Interrelations with the proposed Quang Tri Border Trade Zone (QTBTZ).

Phase Two: Establishment of Development Concept and Framework

3.4 Formulation of development concept and framework

Based on the aforementioned study results, the development concept, which depicts the outline features and characteristics of the new city, shall be formulated, and the development framework, which regulates the dimensions and functions of the new city, shall be established as the basis of the master plan. The items to be covered for that purpose are as follows :

(a) Characterization of the new city
(b) Essential functions to be incorporated in the new city
(c) Development framework, including, among others, spatial, demographic, functional, transport and industrial framework
(d) Development strategy and methodology
(e) Disaster prevention, and
(f) Managerial and administrative systems of the city.

Phase Three: Preparation of Master Development Plan

3.5 Land use zoning

The land use zoning shall be carefully planed with a view to create a city, which is not only functional, but also harmonious with the natural landscape. Due attention shall be given to minimize the transfer of existing productive farmland and settlements. Items to be covered are :

(a) Conservation of existing land use insofar as practical
(b) Location of principal urban functions
(c) Road network and other modes of transport
(d) Comprehensive flood control system, and
(e) Combination with the principal functions such as the Port and FTTZ.

3.6 Transport planning

Transport systems shall be carefully planned, taking into consideration the regional objectives to form a "twin-city concept" linking Hue and Da Nang City (Central Corridor). The items to be covered are :

(a) Linkage with Hue and Da Nang Cities as well as other developments along the Central Corridor
(b) Intra- and inter-city road network
(b) Review of the existing railway functions
(c) Possibility of introducing public transport systems, and
(e) Carparking system.

3.7 Housing development planning

Housing development shall be planned taking into consideration the possibility of involving private sector investors or developers. The potential roles and responsibilities to be shared between the public and private sector shall be examined, if the private sector is to be involved intensively. Items to be covered are :

(a) Spatial layout plan
(b) Necessity of public housing
(c) Housing cluster and neighbourhood development
(d) Involvement of housing developers
(e) Provision of public and community facilities, and
(f) Institutional arrangements.

3.8 Utilities and sanitation planning

Adequate municipal utilities and sanitation systems shall be planned taking into consideration the probable future demand. Particularly, availability of domestic and industrial water is one of the most crucial issue for the new city development. Consideration shall be given to the proposed "Comprehensive Water Resource Management Programme of Huong River Basin", in terms of availing water from the River. The following items shall be covered :

(a) Water supply
(b) Electricity
(c) Gas
(d) Sanitation, and
(e) Solid waste disposal and treatment.

3.9 Landscape planning

The new city of Chan May should be an international city having the functions of international business administration and management, where a considerable number of foreign people may possibly visit, live, work and enjoy their stay. In this context, Chan May should provide a place for quality life of international standards. The following items shall be examined :

(a) Tourist attractions
(b) Distinct urban landscape
(c) Urban amenities, and
(d) Public spaces and parks.

Phase Four: Preparation of Implementation Plan

3.10 Legal and organizational institutions

In consideration of the constraining factors, which would arise from the use of the current legal and institutional systems, recommendations shall be made with regard to the necessity of legal and organizational adjustments, which will be required for the implementation of a large-scale new city development. Also, in light of the international nature of the new city, recommendations will be sought for the establishment of an "international cooperative machinery", particularly within the relevant GMS countries. This is especially essential for the effective and efficient operation and management of the Port and FTTZ.

3.11 Project costing

The implementation cost shall be worked out with reasonably accuracy and breakdown in accordance with the proposed implementation timeframe on a phased basis.

3.12 Project financing scheme

Based on the rationale for the new city development having certain functions of national and regional importance and significance, a project financing scheme shall be recommended, which assigns the funding responsibilities to the central government, provincial governments, municipalities and the private sector. The possibilities for obtaining finance from international lending agencies shall also be examined in a practical manner.

3.13 Implementation Programming and Scheduling

The implementation of the new city development would take a long time, probably over 15 to 20 years until its substantial completion. A phased implementation schedule with appropriate programming of essential infrastructure and facilities shall be prepared taking into consideration the availability of financial sources and other constraining factors.

4. WORK PLAN

The following work plan is tentatively proposed, but it shall be subject to future modification and revision depending upon the possible changes in the scope of work. A preliminary spatial layout plan is attached to this TOR for reference.

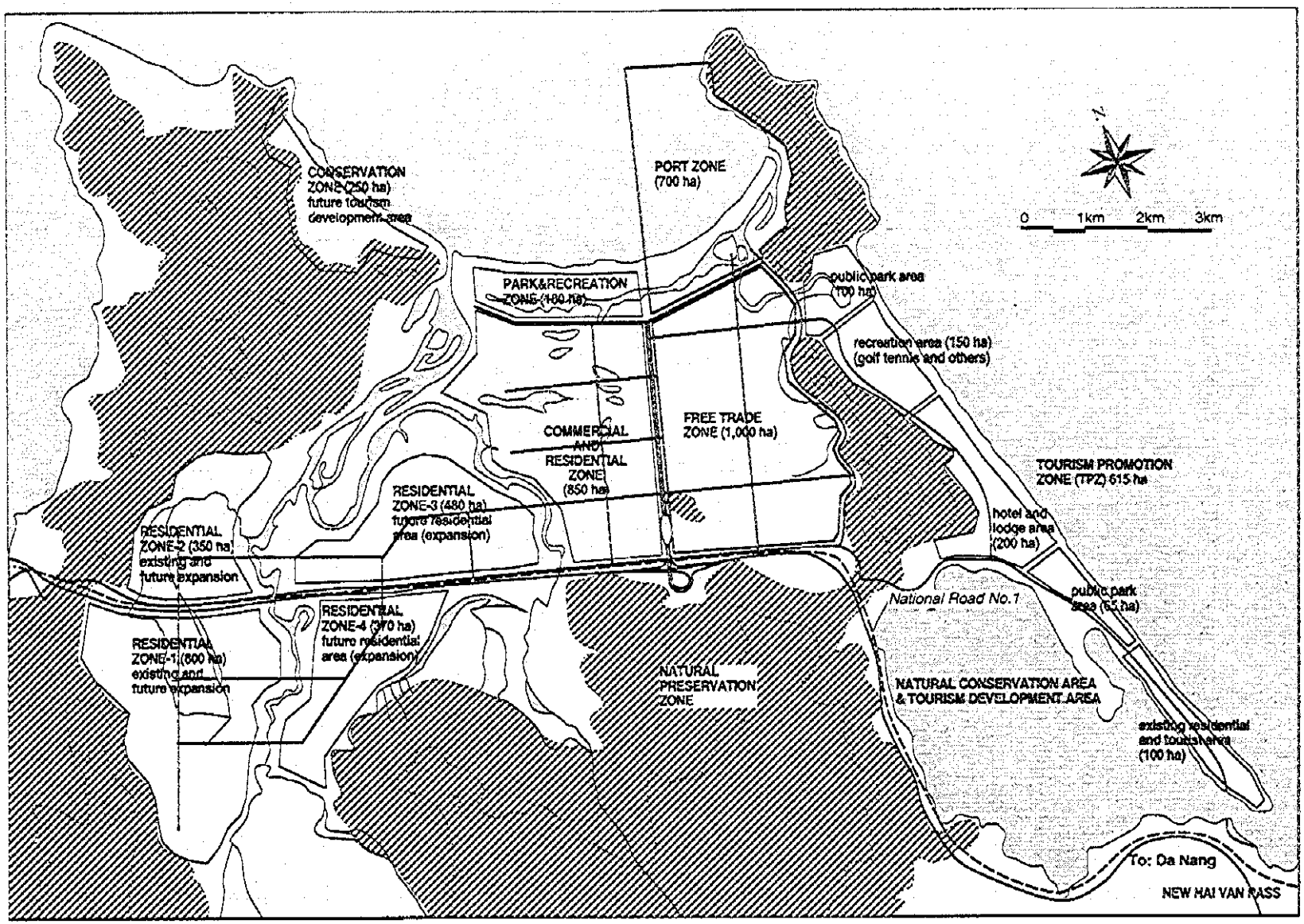
4.1 Estimated staff assignment and man-month input

(a)	Project Manager (Regional and urban planner)	12	man-months
(b)	Urban Planner	12	
(c)	Land use planner	8	
(d)	Transport planner	8	
(e)	Highway Engineer	6	
(f)	Railway Engineer	4	
(g)	Architect	6	
(h)	Electricity Specialist	4	
(i)	Sanitary Engineer	8	
(j)	Social Planner	4	
(k)	Landscape Planner	4	
(l)	Industrial Planner	6	
(m)	Free Trade Zone Specialist	6	
(n)	Drainage Engineer	6	
(o)	Institutional Planner	4	
(p)	Economist	6	
(q)	Cartographer	6	
	Total Man-Months	**110**	**man-months**

4.2 Work Schedule

It is tentatively proposed that completion of the entire master plan study will take 16 months. Implementation of the study should be carried out in four phases as outline below :

Phase One :	**Identification of Development Issues**	**4**	**months**
Phase Two :	**Establishment of Development Concept and Framework**	**4**	**months**
Phase Three:	**Preparation of Master Development Plan**	**4**	**months**
Phase Four :	**Preparation of Implementation Plan**	**4**	**months**



CHAN MAY NEW CITY DEVELOPMENT PLAN

APPENDIX - 3 Integrated Vocational Education and Teacher Training Program

Project Profile				
No: INDUS-03	**Sector:** Education			
Title:	Integrated Vocational Education and Teacher Training Program			
Implementing Agencies:	Ministry of Education and Training/Central Regional Development Committee			
Development Phasing:	~2000	2000~2005	2005~2010	2010~
	X (1997~1999)			
Location:	Da Nang city			
Estimated Cost:	US$80,000,000			

Outline of the Project:

Development Goal:

In order to remedy increasing regional imbalance in social and economic development, a comprehensive development program should be implemented in the Central Region, including those for industrial developments, development of remote areas, poverty alleviation, social welfare programs, spread of education particularly in basic vocational education and so on. Of such programs, enhancement of the quality and quantity of existing vocational education systems is considered to be essential for the sustainable development of the Central Viet Nam in terms of providing improved quality of human resources.

Background and Justification:

Currently, vocational education in Viet Nam is not in line with the prevalent status of the social and economic development in progress in Viet Nam. The rapid growth of her transitional economy resulted in the needs to change the existing industrial structural as well as technical and managerial systems, which inevitably demands increasing supply of skilled workers and quality managerial staff. Also, one continued necessity in the vocational education in the Central Region is to provide more qualified teaching staff for technical and vocational schools.

Objectives:

1. The Project shall take a central role to enhance vocational education at a high school level in the Central Region, covering the fields of (1) Technical Education, (2) Commerce and Business Education, (3) Agriculture (Fishery) and Forestry Education, Tourism and Home Technology Education, and Art and Craft Product Design Education.
2. Also, in order to improve the quality of teaching staff for technical and vocational schools, the Project is to train and educate pre-service and in-service teaching staff.
3. The Project is to provide a center equipped with a variety of educational materials and equipment, and laboratories and experimental firms as well. By using these facilities and technical expertise and know-how, the center is also expected to contribute to social, industrial, and economic development of the Central Region.

Outputs:

The center will be located in the city of Da Nang with the area of approximately 75 hectares, and have adequate building facilities equipped with educational materials and equipment necessary for the above fields of vocational education and teachers training.

APPENDIX - 4 Da Nang International Airport Improvement Project

TERMS OF REFERENCE
FOR
FEASIBILTY STUDY
ON
DA NANG INTERNATIONAL AIRPORT IMPROVEMENT PROJECT

1. BACKGROUND

Da Nang Airport in Central Vietnam is one of the three international airports in Vietnam. The airport currently handles the third largest air traffic volume after Tan Son Nhat Airport in Ho Chi Minh City and Noi Bai Airport in Hanoi. It is an essential facility to provide a fast, reliable, punctual and safe mode of transport and playing a major role for the development of Central Vietnam. In particular, since Central Vietnam is abundant in historic, cultural, artistic, ethnic, scenic and recreational tourism resources, the development of Da Nang Airport is important for effective use of those assets for international tourism development.

Since it was taken over from U.S. army in 1975, Da Nang Airport has been improved by the Civil Aviation Authority of Vietnam (CAAV). However, due to financial constraint, the levels of facilities at the airport are generally poor. Handling capacity of the airport is not sufficient for very rapidly increasing air traffic volume. A master plan for Danag Airport produced by CAAV also require a review by experts with international experience.

Da Nang International Airport Improvement Project is expected to require a considerable size of external funding. Therefore, a comprehensive master plan is needed for evaluating the Project for financing decision.

2. OBJECTIVES

The objective of the Study is to formulate a master plan for Da Nang International Airport up to the year 2020 and to conduct a feasibility study on the first phase development of the Da Nang International Airport Improvement Project.

3. SCOPE OF THE STUDY

A team of consultants/experts (the Study Team) shall be organized for carrying out the Study. The Scope of the Study shall cover the following scope of works:

1) Collection and Analysis of Existing Data, Information and Reports

In order to sort out the framework of the Study, existing data, information and reports related to the Study shall be collected and analyzed. Site reconnaissance and traffic survey shall be conducted to investigate actual conditions of the airport facilities and characteristics of air passengers, cargo and vehicular traffic. A topographic survey and soil investigation shall also be conducted for the latter stage of the Study.

2) Air Traffic Forecasts and Facility Requirements

The number of air passengers, volume of air cargo and number of aircraft movements shall be forecast up to the year 2020. Requirements for airport facilities shall be estimated based on the air traffic forecasts.

3) Evaluation of Existing Airport Facilities

The existing airport facilities shall be evaluated against future requirements and/or normal life span.

4) Master Planning of Da Nang Airport up to the Year 2020

A master plan up to the year 2020 shall be produced for Da Nang Airport. The master plan shall be produced through the review of existing airport master plan, study on phased development, formulation of alternative master plans, cost estimates, initial environmental evaluation (IEE), financial analysis, economic analysis and comprehensive comparison of alternative master plans.

5) Feasibility Study on the First Phase Development of Da Nang Airport Master Plan

A feasibility study shall be conducted on the first phase development of the optimum master plan for Da Nang Airport. The feasibility study shall cover preliminary design of required facilities, cost estimates, environmental impact assessment (EIA), construction and implementation schedule, financial analysis, economic analysis and airport operation and management plan.

6) Conclusion of the Study and Recommendations for the Project

Conclusion of the Study and recommendations for the implementation of the first phase development shall be summarized.

4. REPORTS

The following reports shall be submitted in the course of the Study:

1) Inception Report, describing approach, methodology and schedule of the Study

2) Progress Report, describing the study results up to macro environment of the Project and existing conditions of the airport

3) Interim Report, describing the study results up to air traffic forecasts, airport facility requirements evaluation of existing airport facilities and master planning for Da Nang Airport

4) Draft Final Report, describing all the study results

5) Final Report, describing final results of the Study with comments on the Draft Final Report by the Government of Vietnam

5. DURATION OF THE STUDY

The Study shall be completed within ten (10) months from mobilization of the Study Team in Vietnam.

APPENDIX - 5 Rural Communes Health and Child Care Program

Project Profile				
No.: SOCIAL-02	**Sector:** Social Development			
Title:	Rural Communes Health and Child Care Program			
Implementing Agencies:	Ministry of Public Health, Committee for Protection and Care for Children, Ministry of Agriculture, People's Committee of the Quang Tri Province and the Communes, The people of the commune and possibly Women's Union			
Development Phasing:	~2000	2000~2005	2005~2010	2010~
	X	X		
Location:	All districts of four provinces and many communes. Exact names of communes have not been selected. Requests shall come from communes.			
Estimated Cost:	US$ 300,000,000			

Outline of the Project:

Development Goal:

To reduce child-malnutrition presently prevalent in Viet Nam by 10%, accompanied by the improvement of health facilities and health services together with diffusion of family planning.

Background and Justification:

Cases of child malnutrition in Viet Nam is very high. A government source reveals as of 1995 there are still about 44% of malnutrition out of the total number of children under 5 years are mal nourished. The rates in our target provinces are higher than the national average. Also, there are 131 communes without health facilities in four provinces.

A drastic family planning is another key issue of the health sector. A population increase over 2% is too high. Family size in the rural area tends to larger than the urban area. This suggest the family plan should be more thoroughly expanded to the rural area.

Objectives:

1. Mothers learned about balanced diet, and child malnutrition in all communes of four provinces are reduced 10%.
2. People learned the importance of family plan and now apply birth control
3. All the communes in four provinces have permanent type health clinic with basic equipment.

Description:

The program shall be composed of two components:

First component: Child-care and Family Planning

Second component: Construction of health clinics and provision of basic equipment along with a vehicle to

each district of four provinces

- organize teams for campaign - nutritionist, midwife, nurse, volunteers
- preparation of educational materials such as leaflets and audio-visual materials
- open seminar for health-care, balanced diet, child-care, family planning, cooking demonstration, etc.
- provide campaign vehicle to all rural districts

Outputs:

1. The communes are provided with necessary social infrastructure and social services.
2. The all rural districts have vehicles for medical and health campaign.
3. Seminars to provide education to commune people are opened and the people acquired knowledge
4. Demonstration campaign are carried out

APPENDIX - 6 Master Plan Study for Comprehensive Water Resource Management of the Huong River Basin

TERMS OF REFERENCE

FOR MASTER PLAN STUDY FOR COMPREHENSIVE

WATER RESOURCE MANAGEMENT

OF

THE HUONG RIVER BASIN

I. STUDY AREA

(1) The Huong River with three (3) major tributaries of Ta Trach, Huu Trach and Song Bo drains a catchment area of approximately 3,000 km^2 into a large lagoon in the downstream of Hue City and finally flows into the East Sea through the pass of Thuan An. Further, the Truoi, Q Lau and other small rivers neighboring on the Huong River also pour into the same lagoon independently. Therefore, the lagoon drains a total area of approximately 4,000 km^2 with the following breakdown.

Huong River Basin	:	3,000 km^2
Neighboring River Basin	:	800 km^2
Lagoon	:	200 km^2
Total		4,000 km^2

The study area of this project will cover the above total drainage area of approximately 4,000 km^2.

The Study Area is roughly divided into the mountain region and low-lying alluvial plains. The alluvial plains cover the area of approximately 40,000 ha extending to the eastern side of National Highway Route 1. The ground elevation ranges from 0.0 m to 4.0 m, mostly below 1.5 m.

(2) The Study Area is located in the heaviest rainfall region of Vietnam. The average annual rainfall ranges from 2,744 mm at Hue City to 3,490 mm in the Ta Trach River Basin of which 75%-85% concentrates in the rainy season of September to December. Only 20%-25% of the annual rainfall occurs in the dry season of January to August. The average annual evaporation at Hue City is estimated to be 977 mm.

The Study Area is often hit by typhoons with heavy rainfall, causing severe flood damage to the lower plains. Small floods also occur in May and June. On the other hand, the Study Area is affected by serious drought in the dry season, especially in July and August.

(3) The existing population of the Study Area is estimated to be 900,000 in total, of which 300,000 people are inhabited in Hue City with an area of 70 km^2. The remaining 600,000 mostly live in the low-lying alluvial plains of Huong

and the other rivers. The mountainous/hilly areas in the upper reaches of the rivers are sparsely populated.

(4) Agriculture is the largest economic sector followed by tourism, fishery and light industry. Approximately 70% of the working population is engaged in agriculture. However, the Study Area is not self-sufficient in food and 30% of the total consumption is supplied from the other provinces.

In the lagoon of brackish water is, shrimps, crabs and sea weeds are being cultivated for export.

(5) There are many valuable historical and cultural assets attracting foreign tourists in Hue City. The city received 100,000 foreign tourists in addition to the domestic tourists in 1993. Number of the foreign tourists is projected to increase to 600,000 in the year of 2,000.

(3) In the context of the regional development master plan, Chan May has been designated as a future development area as a free trade and industries zone. New urban development along with the port development is also planed. This area is located adjusent to the Huong River Basin water resource management study.

II. NEEDS AND PROBLEMS

The major needs and problems in the comprehensive water resources management of the Huong River Basin are described below.

1. Flood Problems

(1) The low-lying plains extending to the eastern side of the National Highway are habitually flooded every year, causing serious damage to the lives of people, agricultural crops and infrastructures. The entire flood prone area reaches approximately 40,000 ha. In 1983, lives of 237 people were lost.

Even the center of Hue City is frequently flooded. The ground elevation of Hue City is in the range of 1.5 m and 5.0 m, mostly below 3.0 m. On the other hand, the flood water of Huong River at Hue City (Kimlong

Gauging Station) frequently rises higher than 4.0 m. In 1953, the highest water level of 5.5 m was recorded.

(2) There are a number of valuable historical and cultural assets in the old city area of Hue covering 5.0 km^2. They have been recently designated as the World Cultural Heritage by UNESCO. However, these are habitually flooded by Huong River and heavy rainfalls since the ground elevation of this area is also very low.

The study for the preservation of the above historical and cultural asset was conducted by UNESCO in 1993, in which immediate implementation of the flood control and drainage for the old city area was recommended to preserve the above world cultural heritage.

(3) However, the Huong River Basin is provided with no flood control and drainage facilities except small dikes on the limited locations. Full-scale flood control and drainage developments are necessary to cope with the existing serious problems.

2. Water Supply

2.1 Irrigation Requirement

(1) Approximately 27,000 ha of crop irrigation area is distributed over the lower reaches of Huong River. The crops are cultivated twice a year, one is winter-spring crop and the other is summer-autumn crop. The crop area for different crops in different seasons is shown bellow.

	Winter-Spring (ha)	Summer-Autumn (ha)
Paddy	21,000	23,000
Upland Crop	4,000	4,000
Total	25,000	27,000

(2) Several irrigation system including dense irrigated channel network, 4 small storage ponds, 30 large pumping stations and 500 isolated small pumps are provided to irrigate the above crop areas.

However large crop area suffers from drought damage every year due to insufficiency of river water and irrigation facilities. Those damage areas

are 600-5,000 ha in winter-spring crop and 3,500-13,000 ha in summer-autumn crop.

(3) Further developments of the irrigation systems are necessary to satisfy the water requirement of crops and to increase the flood production of the Study Area. For this purpose, the Ministry of Water Resources plans to start the construction of Truoi Dam on the Truoi River in 1995 by local finance.

2.2 Urban Water Requirement

The existing domestic, commercial and industrial water is all supplied from the Huong River. The existing water use is estimated to be approximately 1.0 m^3/s. The water demand will further increase according to the development of the city. Further development of the water source will become necessary in future.

2.3 Water Supply for Chan May New City Area

Chan May area which is adjusent to the Study Area, is designated to new urban development area. This area include free trade zone, industrial zone commercial zone and residensial zone. Lang Co beach is located beside the Chan May area and it will developed as tourists base. Total water demand will increase upto 120,000 ton/day in the yead 2010. which requires development of water resources. As this area dose not have enough water resources of its own, it is necessary to develop and convey water from the Study Area. Source of water will be Truoi River or Trach River.

2.4 Saline Water Intrusion

(1) The lower reach of Huong river is affected by a severe salinity intrusion in dry season, resulting in the damage to the domestic and industrial water supply of Hue City and irrigation water uses every year. Saline water intrudes 25 km from the river mouth at the maximum.

(2) The government of Vietnam constructed the Thao Long Barrage at a distance of 1.5 km from the river mouth to control salinity intrusion in

1978. However, its structure was damaged thereafter and therefore, it is not functioning properly at present.

(3) Control of the saline water intrusion is necessary for the enhancement of the water uses in Huong River.

2.5 Dam and Hydropower Potential

(1) The Huong River Basin is blessed with a considerable amount of hydropower potential. However, almost no hydropower has been developed until present. Effective development of this potential is considered also important to meet the increasing demand of the electric energy of the region.

(2) The flow rate of Huong River is unstable and seasonally much fluctuates. It decreases to the minimum discharge of 12 m^3/s at Hue City in the driest season. On the other hand, it frequently exceeds 5,000 m^3/s at Hue City at the time of big floods. Therefore, regulation of the river flow by dam and reservoir is considered to be the most effective way for the development and management of the water resources of the Basin.

(3) According to the previous studies of the related agencies, the following four (4) major potential dams/reservoirs are identified.

Name of Dam	Ta Trach	Huu Trach	Song Bo	Truoi
Catchment area (km^2)	717	510	680	75
Dam Height	56	80	85	42
Gross Storage Volume (million m^3)	470	400	775	55
Hydropower output (MW)	24	40	45	-
Purpose	Multi	Multi	Multi	Irrigation

Among the above dams and reservoirs, Truoi is in implementation stage. However, the other dams and reservoirs are still in a conceptual stage.

III. STUDY APPROACH

(1) The Study will be divided into two phases as follows

Phase 1: to carry out a master plan study on the comprehensive water resources management of the Basin with the identification of potential priority sub-projects at pre-feasibility level towards the Phase 2 study.

Phase 2 : to undertake the feasibility study on priority sub-projects for immediate implementation. The Study will include various water sectors and the optimization should be made in a complehensive method. Environment conservation point of view is also the one of the most significant point of view.

The water resources development and management of the Basin will include the various water sectors of flood control/drainage, irrigation, urban water supply, salinity intrusion control, hydropower, watershed management, etc.

The master plan will be prepared to optimize the total development and management of the above water sectors. The optimization will be made from the integral view-points of economic development, social well-being and environmental quality conservation.

The master plan will target the year of 2015.

(2) Flood Control:

Flood control and drainage development of the Basin will aim at the protection of two(2) distinct districts: Hue City and downstream rural areas. The most optimum flood control and drainage systems will be applied to the two districts respectively in due consideration of the social and economical importance and topographic and hydraulic characteristics of the districts.

In planning the flood control and drainage systems of the Basin, attention should be paid to the following factors in addition to mitigation of the existing flood damage.

(i) Preservation of the historical/cultural assets, promotion of tourism development and future expansion of urban area of Hue City.

(ii) Future land use enhancement of the downstream rural areas

An integrated flood control and drainage system including structural and non-structural measures will be necessary to attain a satisfactory solution of the flood problems in the Basin. The principal measures to be studied will include:

(i) Flood flow regulation by dam/reservoir

(ii) River channel improvement such as construction of dikes/plodders, diversion channel and dredging

(iii) Improvement of drainage system of low-land

(iv) Non-structural measures such as flood forecasting/warning and flood plain management.

(3) Water supply:

Water demand is form the sectors of irrigation, existing urban areas and newly developed areas. A long term water supply planning should be carried out, and long-term implementation plan should be formulated. For example, the on-going Truoi Dam and Irrigation Project will be incorporated into the proposed long-term development plan in a well coordinated manner. A part of storage water of Truoi Dam could be allocated for Chan May new urban and industrial city.

(4) Prevention of Saline Water Intrusion

Increase of the available river water in the dry season by dam and reservoir and by salinity intrusion control is considered essential to achieve the full irrigation development. The most effective control plan of the saline water intrusion of Huong River will be proposed through the comparison of various alternatives. Those alternative measures will include:

(i) Reconstruction of Thao Long Barrage

(ii) Construction of a new barrage

(iii) Flushing of saline water by dam/reservoir

(iv) Relocation of the existing water intake to upstream

These alternatives will be compared from the integral aspects of finance, economy and environment.

(5) Dam and Reservoir:

Control of the river flow by dam and reservoir is considered as the most essential to attain the full scale development of the water resources of the basin. The dam and reservoir will contribute to the development of many sectors such as flood control, irrigation, urban water supply, hydropower, salinity intrusion control, sediment run-off control, recreation, etc.

The dam and reservoir will be designed for multiple uses as far as possible to maximize the beneficial effects of the limited water resources and potential dam sites.

However large dam and reservoir project may require a large amount of construction cost during a short period, resulting in difficulty of smooth implementation of the project. Therefore, a combination of small and medium scale dams and reservoirs will be studied as alternative so that stage wise implementation of dam and reservoir can be achieved. For this purpose, potential dam and reservoir sites shall be identified as many as possible.

(6) Environmental Consideration:

Construction of dam and reservoir may cause significant natural and social adverse impacts on the Basin. The major environmental issues to be studied are as follows;

(i) Fauna and flora to be submerged

(ii) Change of river water and morphology in the downstream

(iii) Resettlement of people

An excessive amount of river water intake in dry season may change the salinity concentration of the lagoon and as a result, it may cause damages on the existing shrimp cultivation. Such adverse impact will also be studied.

Beautification of the riverine and cleaning of the canals in Hue City will be planned for preservation of the historical area and for promotion of tourism development in relation to flood control/drainage project.

(7) Mathematical Simulation:

Detailed mathematical simulations will be necessary to obtain a satisfactory solution of the existing and potential water problems. The major phenomena that may require a detailed mathematical simulation will include:

(i) Flood run-off of Huong River

(ii) Saline water intrusion in Huong River

(iii) Water quality change of the lagoon

IV. SCOPE OF WORK

In order to achieve the objective of the Study, the consultants shall prepare all the necessary technical studies and field investigation including but not limited to following works.

Phase 1 : Master Plan Study

1. Data collection and Review

(1) Previous report
(2) Socio-economy and land use
(3) Topography and geology
(4) Hydrology and water quality
(5) Rivers and floods
(6) Agriculture and irrigation
(7) Domestic and other water uses
(8) Saline water intrusion
(9) Hydropower
(10) Watershed management(including satellite photograph)
(11) Environments
(12) Regional Development Project

2. Field Survey and Investigation

(1) Topographical Survey including

- Longitudinal and cross-sectional survey of rivers, dam/reservoir sites and other sites
- Aerophoto mapping of potential dam/reservoir areas

(2) Geological Survey

- Geological survey including drilling and seismic test for dam, barrage and other specific sites
- Survey for dam embankment materials and river bed materials

(3) Hydrological and Water Quality Observation

- Installation of hydrological observation station
- Observation of river flow, river/lagoon water quality, sediment loads

3. Sectoral Study

(1) Socio-economy and Land Use Study

- Assessment and projection of existing and future socio-economy including population, GDP, public services, industrial production, regional budget and institution, etc.
- Study on regional development policies including agricultural, tourism and fishery developments
- Assessment/projection of existing/future land development

(2) Hydrological and Water Quality Study

- Assessment of temperature, evaporation, rainfall, river flow, river and lagoon water level, river, lagoon water quality, sediment loads.
- Simulation of flood run-off and saline water intrusion
- Simulation of lagoon water quality

(3) Flood Control and Drainage System

- Survey of existing river conditions including flow capacity, siltation and erosion, flood prevention and drainage works, etc.
- Survey of inundation area and flood damage
- Study of inundation area by satellite photographs
- Study on design flood discharge including flood flow regulation by dam/reservoir
- Planning, preliminary design and cost estimation for flood control and drainage facilities including flood forecasting and warning system.
- Planning of non-structural flood control measures

(4) Agriculture and Irrigation Study

- Survey for land use and capacity
- Study of existing/proposed cropping pattern and crop production
- Assessment of drought and salinity damage
- Inventory survey of existing irrigation system/facilities
- Estimate of irrigation water requirement
- Planning, preliminary design and cost estimate for rehabilitation and new construction of irrigation facilities
- Study of irrigation water management system

(5) Urban and Other Water Use Study

- Inventory survey of existing urban water supply system/facilities
- Assessment/projection of existing/future urban water demand
- Assessment of salinity damage
- Planning, preliminary design and cost estimate for urban water intake
- Survey for existing inland fishery and navigation

(6) Hydropower Study

- Study of existing electric power distribution system in region
- Assessment of hydropower development potential
- Planning, preliminary design and cost estimate for hydropower development facilities

(7) Dam/Reservoir and Salinity Barrage Study

- Identification of potential dam sites including topographic and geological evaluation
- Assessment of storage capacity of reservoir
- Study on reservoir operation including flushing of saline water
- Planning, preliminary design and cost estimate of dam and salinity barrage

(8) Watershed and River Management Study

- Study of the watershed by remote sensing technique
- Identification of devastated mountain areas
- Study on watershed management including erosion control and afforestation
- Study on river management including riverine beautification and canal cleaning

(9) River Morphological Study

- Study of the history of morphological change in Huong River System including Tam Giang Lagoon
- Qualitative assessment of the effects of the upstream development on the morphology of the lower reach of the Huong River and Tam Giang Lagoon

(10) Environmental Study

- Survey/assessment of fauna and flora to be submerged by dam/reservoir
- Study for resettlement of people to be affected by dam/reservoir
- Study of change of river water quality and river morphology by dam/reservoir development
- Initial environmental examination (IEE) of dam/ reservoir, salinity barrage and others major works

4. Formulation of Master Plan

(1) Integration of Sectoral Development Plans

(2) Preparation of Implementation Program

(3) Evaluation of Master Plan

Phase 2 : Feasibility Study

The general scope of works for feasibility study is described below.

1. Supplementary Data Collection
2. Supplementary and Detailed Field Survey and Investigation
   (1) Detailed Topographic Survey for the structures
   (2) Detailed Geological Survey for Project Site
   (3) Supplementary Hydrological and Water Quality Observation
3. Preparation of Definite Plan of Projects
4. Structural Design of the projects
5. Cost Estimate of Project
6. Preparation of Implementation Program of Project
7. Project Evaluation
   (1) Economical Evaluation
   (2) Financial Evaluation
   (3) Environmental Assessment

V. IMPLEMENTATION PROGRAM

1. Organization

The Ministry of Agricultur and Rural Development will be responsible for the administration and management of this Study. For smooth implementation of the Study a technical committee or a coordination committee consisting of the members representing the related agencies of central and local governments, and a study team will be established.

2. Implementation Schedule

The Study will be completed within 36 months through two (2) study phases: master plan study and feasibility study and during the course of the Study, the following reports will be submitted by the consultants to the government of Vietnam in English. A tentative implementation schedule is shown in Fig (3).

Phase 1: Master Plan Study

(1) Inception Report (30 copies) within one (1) month after commencement of the Phase 1 Study

(2) Interim Report (30 copies) within 10 months after commencement of the phase 1 Study. The report will include the results on field survey and investigation and basic sectoral studies.

(3) Draft Final Report (50 copies) within 16 months after commencement of the phase 1 Study. The report will include the results of field survey and investigation and basic sectoral studies.

(4) Final Report (50 copies) including Executive Summary Report (100 copies) within 18 months after commencement of the Phase 1 Study.

Phase 2: Feasibility Study

(1) Inception Report (30 copies) within one (1) month after commencement of the Phase 2 Study.

(2) Interim Report (30 copies) within 10 months after commencement of the Phase 2 Study. The report will include the results of field survey/investigation and definitive plan of the objective project

(3) Draft Final Report (50 copies) within 16 months after commencement of the Phase 2 Study. The report will include all the results of the feasibility study.

(4) Final Report (100 copies) within 18 months after commencement of the phase 2 Study.

Fig. (3) Time Schedule

Month	0	6	12	18	24	30	36
Phase 1 (Master Plan Study)							
1. Data Collection and Review							
2. Field Survey and Investigation							
3. Sectoral Study							
4. Formulation of Master Plan							
5. Preparation of TOR for FS Study							
Phase 2 (Feasibility Study)							
1. Supplementary Data Collection							
2. Field Survey and Investigation							
3. Preparation of Definite Plan							
4. Structural Design of Project							
5. Cost Estimate of Project							
6. Implementation of Project Program							
7. Project Evaluation							
8. Report							

VI. EXPERTISE REQUIREMENT

To complete the Phase 1 Study (master plan study), the following 18 experts with a total assignment of 150 man-months will be required.

(1) Team Leader

(2) Water Resources Planning Expert

(3) Hydrologist

(4) River Engineer

(5) Flood Control/Drainage Engineer

(6) Agricultural Expert

(7) Irrigation Engineer

(8) Dam/Hydropower Engineer

(9) Structural Engineer

(10) Construction Planning/Cost Estimate Expert

(11) Socio-Economist

(12) Land Use Planner

(13) Watershed Management Expert

(14) Simulation Expert

(15) Environmental Expert

(16) Geologist

(17) River Morphologist

(18) Geodesic Engineer

The required experts and assignment man-months for the Phase 2 Study (feasibility study) will be proposed in the final stage of the Phase1 Study (master plan study).

APPENDIX - 7 Hue Citadel Drainage and Sewerage Improvement Project

1. BACKGROUND

The Hue Royal Citadel is located at the center of Hue City of Thua-Thien Hue Province in the Central Viet Nam. Hue City used to be the Capital of Viet Nam under the Nguyen Dynasty over some 140 years till 1945 and the Royal Citadel is encompassed by the earthen wall with about 2.2 km-square, i.e. some 480 ha including water surface and some 6 m in height. Out of some 270,000 people in Hue City, some 60,000 people equivalent to 22 % are living in the Royal Citadel, being accompanied with commerce, public service institutions and industries. Due to its old and distinguished history, the Royal Citadel still boasts a plentiful historical relics, architectural structures and precious antiquity, of which many vestiges are designated as the " World's Cultural Heritage" in 1993. From such advantageous historical features, Hue City, especially the Royal Citadel area is expected as the most promising zone for the tourism development in Central Vietnam Region.

However, Hue City has frequently suffered from flood due to its adverse natural conditions during the rainy season every year. Especially, the Royal Citadel, where is located adjacently to the north side of the Huong River already silted to the high level, has periodically tormented by long-lasting inundation for even one (1) week, due to the lower land elevation and poor storm water drainage. In such situation, many cultural structures are decaying quickly owing to protracted submersion and high humidity by frequent inundation.

In addition, the deterioration on sanitary situation caused by untreated sewage, that is, waste water generated from households, commerce, industries and others in the Royal Citadel have already reached the worst grade with exposing polluted surface water in rivers, lakes and ponds. The ground water in the area is reported to have contaminated by ammonia derived from infiltrated human excrement not so to meet potable water standards. This is because all of waste water including human night soil are discharged to water courses or ground without any proper treatment. To be worse, periodical and frequent inundation, as mentioned above, contributes to disperse such ill sanitary situation to the wide extent over the Royal Citadel with high-risk of the prevalence on water-born diseases.

At the present, due to the submersion caused by flood and inundation, the Royal Citadel is facing at the critical occasion that it may lose many historical vestiges. Besides, ill sanitary atmosphere may force it to lose the advantageous position for the tourism center. In such, the Royal Citadel urgently need proper abatement measures for ill sanitation and inundation.

2. OBJECTIVES

It has been concluded in this study that Hue City is expected to grow as a core urban center in the Central Region of Viet Nam with the high potentiality for tourism development due to the endowment of its historical heritage. In the relationship with the socio-economic development in the Central Viet Nam Region, the objectives of the Hue Royal Citadel urban environment improvement project are defined as follows:

(1) Betterment of the human health and living environment by means of:

(a) to develop a sewage disposal facilitates equipped with a sewage collection system and a biological sewage treatment system, (b) to reinforce drainage capacity inside the Royal Citadel

by rehabilitation of present drainage, dredging of water ways and new construction of storm water pumping station and drainage ways.

(2) Preservation of qualified tourism resources, namely:

The preservation of historical vestiges by the betterment of urban sanitation so as to establish the Hue Royal Ciradel's position as a attractive tourism center in the Central Viet Nam.

In the whole area of Hue City not limited to the Hue Royal Citadel, the flood and inundation also tend to occur with the direct influence of the Huong River. Therefore, it is deemed that a substantial and comprehensive water shed control measure*1 on the Huong River basin is essential to mitigate against the flood and inundation in this area. Thus, while the flood proof inside the Hue Royal Citadel is selected as one component measure of this urban environment improvement project, it should be noted that this is proposed as an urgent and tentative scheme to avoid the worst case of inundation.

3. GENERAL CONDITIONS

3.1 Socio-Economic Frameworks

The Royal Citadel is comparted by four (4) administrative wards with the land area of a total of 488 ha by: (1) Thuan Thanh of 148 ha, (2) Thuan Hoa of 105 ha, (3) Tay Loc of 98 ha, and (4) Thuan Loc of 137 ha.

The Citadel, which accommodates some 60,000 people at present, is projected to have the living population growth with average 2.4 % annually and the tourist number growth with average some 13 % annually over 15 years toward 2010 as shown Table 1.

Table 1 Socio-Economic Development Framework in the Royal Citadel

Items \ Phase		1995 (present)	2010	Remarks
Living Population	(number)	60,100	85,276	average annual groth ratio 2.4%
Tourist				
International	(number/year)	190,000	950,000	average annual groth ratio 14.7%
Domestic	(number/year)	143,220	875,490	average annual groth ratio 12.8%
Total	(number/year)	333,220	1,825,490	average annual groth ratio 12.1%

Source : JICA Study Team

3.2 Urban Environment Issues

In the Citadel, while there are pipes and ditches with even quite limited length to discharge mainly storm water, large parts of them are out of order due to damage and clogging. Besides, no waste water treatment apparatus is existing in this area except for very simple and unreliable septic tanks in many cases. It is also reported that many of household, especially the lower income level household, are not equipped with a toilet. Consequently, all of waste water generated in the Royal Citadel from household, public services, commerces, industries and others are lead to rain water pipes/ditches mentioned above, otherwise infiltrated into underground directly.

While there are few reliable data on the environment sanitation situation in the Royal Citadel, it is undoubtedly deemed that the essential lack of waste water mitigation is causing serious pollution of water in rivers, moats and ponds in and around the Royal Citadel. Besides this,

*1 : The comprehensive water shed control project is precisely proposed by the Water Resources Sector in other section of this study.

such ill sanitation spreads to the whole area of the Citadel by the occurrence of frequent inundation. It is said by Hue City that waste water generated in the Royal Citadel is resulting in the anxieties like:

- High prevalence of water-born diseases due to the use of contaminated underground water and surface water in pond and river, and
- Deterioration in the qualities as a tourism zone due to smelling, damaged landscape and scenery.

3.3 Hydrological Features of the Royal Citadel

Storm water in the Royal Citadel is discharged into the Ngu Ha River, which is flowing through the inside the Royal Citadel, and then is lead to the Huong River via the Dong Ba River and the Ke Van River encompassing the Citadel. The land elevation in the Royal Citadel is relatively low ranging from 1.8 m to 2.7 m with the following distribution in each Ward:

- Thuan Thanh Ward : Elevation level 2.3 to 2.7 m
- Thuan Hoa Ward : Elevation level 2.1 to 2.6 m
- Tay Loc Ward : Elevation level 1.9 to 2.3 m, and
- Thuan Loc Ward : Elevation level 1.8 to 2.2 m.

The water level of the Huong River directly influences to the inundation occurrence in the Royal Citadel. The lower area in the Royal Citadel, especially the lower area than 2 m, is destined to be so often inundated, since the occurrence provability of the higher water level than 2 m in the Huong River is roughly estimated as high as some 7 %.

Actually, the Royal Citadel has suffered from more often damage of submersion caused by deteriorated drainage capacity inside the Royal Citadel resulting from: (1) filling up of the Ngu Ha River, (2) decrease in the river breadth due to the illegal usage for cultivation, and (3) the shortage and damage of drainage ditches/pipes.

4. DESIGN POLICY

4.1 Sewage Disposal Facilities

4.1.1 Sewage Collection and Treatment scheme

All of waste water generated in the Royal Citadel from household, commerce, industries, public services and others should be properly collected and then purified prior to discharge into water courses in order to protect human health and secure environment amenity. Together, to attain the efficient and prompt betterment on both, the sanitation standard and the retrieval of water quality in the Royal Citadel, the introduction of the "Separated-Sewage Collection System" is recommended*1. Therefore, the sewage collection pipes separated from the storm water drain ditches/pipes are equipped in the whole of the service area along with a sewage treatment plant and necessary appurtenances.

---

*1 : The " Separated-Sewage Collection Type" sewage facilities does not collect rain water. Unlike the separated type sewage disposal facilities, in the combined type facilities some portions of pollutant is inevitably discharged to the water courses at the beginning stage of rainfall. Thus, the separated type sewerage is recommended in this section.

4.1.2 Sewage Inflow and Design Capacity

The service coverage of sewage disposal facilities is targeted to reach 100 % in 2010 in terms of both the population and the area within the Royal Citadel. The projected population in 2010 is based on the socio-economic development framework set forth before. The sewage discharges from each sewage sources are projected in total to be 37,260 cu-m per day in the daily maximum base and 2,170 cu-m per hour in the hourly maximum base in the target year of 2010 as shown in Table 2, including infiltrated ground water.

Table 2 Design Sewage Discharge in the Royal Citadel

Categories	Sewage Discharge (Unit)		Descriptions
Household	17,060	(cu-m/d)	unit water consumtion 200lit/cap.d, population coverage 100%
Public and private services	5,118	(cu-m/d)	30 % of household waste water
Industries	1,120	(cu-m/d)	10 % of 11,220 cu-m/d for the whole Hue City
A day's tourists	395	(cu-m/d)	1.6 mill people a year, peak factor 3.0, unit water consumption 30lit/cap.d
Overnight tourists	1,230	(cu-m/d)	0.2 mill people a year, peak factor 3.0, unit water consumtion 250 lit/cap.d, average 3 days stay
Sub-total	24,923	(cu-m/d)	
Ground water infiltration	3,738	(cu-m/d)	15 % of sub-total
Total(daily average discharge)	28,660	(cu-m/d)	
Daily maximum discharge	37,260	(cu-m/d)	Peak factor 1.3
Hourly maximum discharge	2,170	(cu-m/h)	Peak factor 1.4

Source : JICA Study Team

The characteristics of sewage inflow is estimated to be 220 mg/l of BOD, 190 mg/l of SS, etc. based on the pollutant discharging rate of each sewage source as referred in Table 3. While sewage contains a certain concentration of such eutrophication components as T-N (Total-Nitrogen) and T-P (Total-Phosphorous), these components are regarded to be handled in the sewage treatment plant in the future.

Table 3 Characteristics of Inflow Sewage

Pollutants / Categories	BOD		SS		Total nitrogen (T-N)		Total phosphorous (T-P)	
	(kg/d)	(mg/l)	(kg/d)	(mg/l)	(kg/d)	(mg/l)	(kg/d)	(mg/l)
Household	4,260	250	3,411	200	850	50	85	5
Public and private services	1,280	250	1,280	250	256	50	26	5
Industries	336	300	336	300	-	-	-	-
A day's tourists	79	200	59	150	16	40	2	4
Overnight tourists	308	250	246	200	62	50	6	5
Sub-total	6,262	-	5,332	-	1,183	-	118	-
Infiltrated ground water	0	0	0	0	0	0	0	0
Sewage inflow	6,262	218	5,332	186	1,183	41	118	4

Notes :
(1) Per capita discharge of BOD, SS, T-N and T-P are assumed 50, 40, 10 and 1 gram/day, respectively.
(2) Water qualities of other categories are assumed based on relevant standards in Japan.
Source : JICA Study Team

4.1.3 Treated Sewage Quality Standards

The serious pollution have already extended on both, the surface water and the bottom mud of water courses such as the Ngu Ha River, moats and ponds scattered in the Royal Citadel, due to waste water discharge over the long period. Also, the ground water is, reportedly, deteriorated indicating high-concentration of ammonia, since living waste water has infiltrated excessively beyond self-purification function. In order to restore normal natural environment promptly, the more strict effluent standards under 30 mg/l of BOD for treated sewerage than that specified by MOSTE is recommended to be applied to this project as shown in Table 4.

Table 4 Effluent Standard of Treated Sewage

Constituents	Unit	Water Qualities	
		Applied Effluent Standard	Specified by MOSTE (class-I)
1. pH		5-8	5-8
2. Suspended solids(SS)	mg/l	50	50
3. Biochemical oxygen demand(BOD)	mg/l	30	80
4. Chemical oxygen demand(COD by Cr)	mg/l	120	160
5. Oil and grease(mineral)	mg/l	1	1
7. Total nitrogen(T-N)	mg/l	50	-
8. Total phophorous(T-P)	mg/l	5	-
9. E-colifrom	MPN/100ml	5,000	5,000

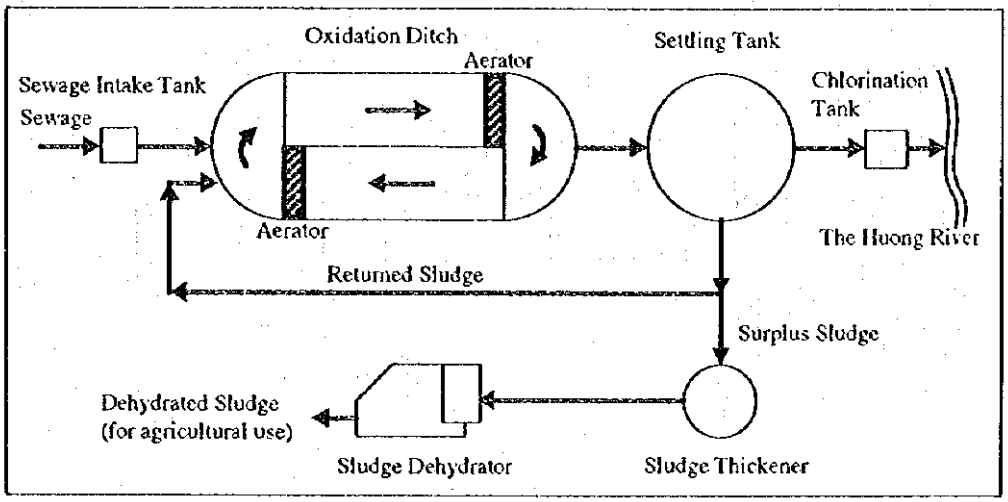
Source : JICA Study Team

4.1.4 Applied Treatment Process

The "Oxidation Ditch Process" as shown in Figure 1, which employs an aerobic biological purification principle, is recommended behind the reasons: (1) strong durability against low temperature in January to March in this region, (2) lower construction cost including land acquisition, and (3) easier operation and maintenance.

While a certain volume of surplus sludge will be generated in sewage treatment plant as a result of sewage decomposition, this can be used as a fertilizer for agricultural use due to the containment of organic substances.

Figure 1 Conceptual Flow Diagram of Sewage Disposal Facilities



Source : JICA Study Team

4.2 Flood Control and Drainage

4.2.1 Flood Control Scheme

The land elevation of the Royal Citadel is ranging from the lowest 1.8 m in Tay Loc Ward to the highest 2.7 m in Thuan Thanh Ward. On the other hand, the water stage of the Huong River as referred in Table 5[*1], to which storm water in the Royal Citadel is drained out through

[*1] : The water stage data of the Huong River is based on the measurement record of the water level at Kim Long Gauging Station located adjacent to the Royal Citadel.

the Ngu Ha River via the Dong Ba River and the Ke Van River, is varied widely with the maximum over 5 m with reflecting the rainfall amount in its catchment basin. It is estimated based on the occurrence provability that the water from the Huong River may intrude into the Royal Citadel with inundation risk as many as some 30 days annually in the lower land*1.

Table 5 Record on the Water Level of the Huong River

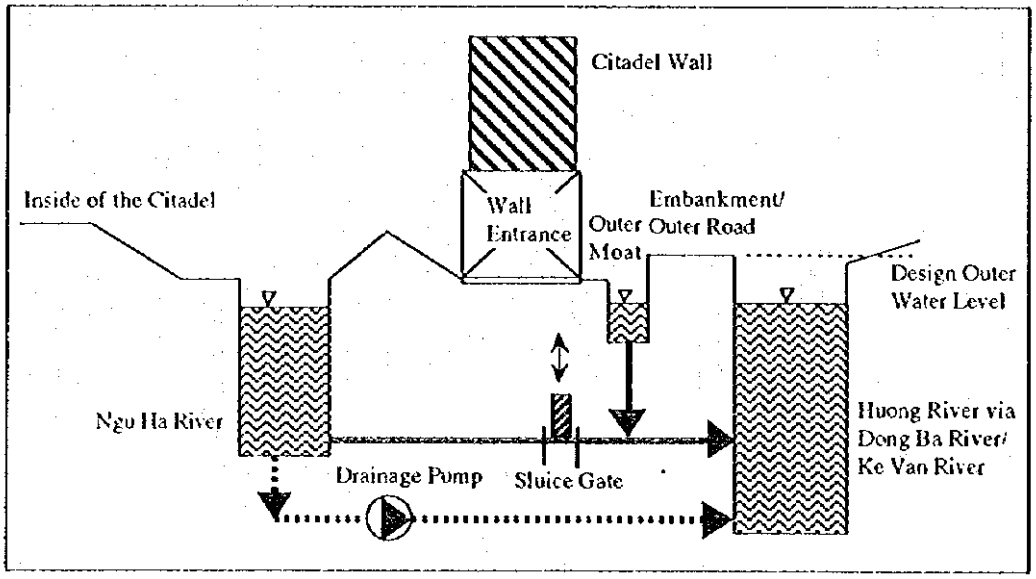
Water Level	over 5m	4 - 5m	3 - 4m	2 - 3m	1.5 - 2m
Number of Days with Each Water Level	2	7	25	83	178
Cumulative Number of Days	2	9	34	117	295

Notes : The data are based on the daily average records at Kim Long Gauging Station during 11 years from 1983 to 1993.
Source : JICA Study Team

The major proposed mitigation for flood and inundation is to construct sluice gates and discharge pumping stations for rain water discharge at the end of the Ngu Ha River, as shown Figure 2, so to prevent from the water inflow from the Hunog River to the inside of the Royal Citadel when the high-water in the Huong River occurs. The functions of these devices are described as follows:

- Sluice gates: The sluice gates are shut to prevent from the water inflow from the Huong River, in case the water stage of the Huong River reach the alarm level for inundation.
- Drainage pumping stations: When the sluice gates are shut, all storm water flows into the Ngu Ha River through the drainage ditches/pipes. In this case, the pumping stations, which is of capacity enough to discharge the rainwater volume in the Royal Citadel, works to transfer storm water from the Ngu Ha River to the Don Ba River and the Ke Van River located outside the Royal Citadel.

Figure 2 Conceptual Configuration of Flood Control in the Royal Citadel



Source : JICA Study Team

*1 : The flood frequency in this report is based on "daily measurement record." It is anticipated to be more frequent flood if based on " hourly measurement record."

In this scheme, the design water level is of 2.5 m for flooding equal to the top end of the Don Ba River and the Ke Van River, and, by means of this countermeasure, the occurrence probability of inundation in the Royal Citadel can be reduced to 2.5 % equivalent to around 10 days annually from present 30 days.

The storm water drainage pumps will be designed based on : (1) daily 240 mm of rainfall for five (5) year probability, and (2) one (1) day of discharge time.

Another countermeasure for the inundation control is to rehabilitate the existing ditches/pipes broken and clogged at the present and to newly construct the drainage courses for conveyance of storm water, where required in the Royal Citadel. The dredging works of the Ngu Ha River and surrounding moats will also take place in order to restore their flow capacity.

4.2.2 Storm Water Discharge

The open channels and/or pipes for drainage will be constructed newly in the Royal Citadel and some of ditches/pipes will be rehabilitated, in order to prevent from submersion in occasion of raining. The following equation in five (5) year-probability established based on the rainfall intensity graph used in Hue City will be applicable to the calculation of design rainfall:

- Rainfall intensity to be applied:

$$I = 22{,}305/(t + 48.7)$$

where, I : Rainfall intensity(mm/h)

t : Duration(min)

The discharge pumps will be designed based on the daily maximum rainfall of 240 mm in five (5)*1 year-probability.

4.3 Special Remarks on Project Implementation

As mentioned before, the Royal Citadel accommodates many valuable vestiges such as historical relics and architectural structures. Special attention should be paid to the preservation for such valuable assets and their surrounding landscapes through the planning, design and construction works. In this respect, this project implementation essentially needs for close attendance of specialists engaged in the culture conservation in the subject area.

In such, the following criteria, but not limited to, are suggested for the preservation of cultural structures and landscape, at the moment:

- To plan and design all sanitation facilities not so to contact cultural structures and to restore by using original materials and original technologies, if not avoidable
- To site and/or mitigate so to conceal the relevant facilities to this project from the tourists' view. For example, to construct discharge pumping stations with lower height, encompassing green trees and to site sewage the treatment plant outside of the Royal Citadel, and
- To repair in the original shape broken structures such as embankments of surrounding moats and bridges, which directly affects to drainage capacity.

5. APPLICABLE STANDARDS AND CRITERIA

The following basic standards and criteria will be applicable to the planning, design and installation of the proposed sewage disposal facilities and storm water drainage:

---

*1 : The daily maximum rainfall is based on the record at the Phu Bai Meteorological Observatory.

5.1 Sewage Disposal Facilities

- Design discharge bases
  - Sewage collection pipes/ditches : Hourly maximum discharge
  - Sewage relay pumps : Hourly maximum discharge
  - Sewage Treatment plant : Daily maximum discharge
- Sewage collection pipes
  - Material : High density centrifugal concrete pipe, socket joint type
  - Minimum size of pipe : 200 mmdia
  - Minimum gradient of pipe : 2 per mm
  - Critical velocity : Minimum 0.6 m/sec; Maximum 3.0 m/sec
  - Earth covering : Minimum 1.3 m; Maximum 6.0 m
  - Location of manhole :

    Located where changing of flow direction, pipe gradient, and originating points of sewage pipes and junctions of pipes.
  - Maximum interval of manhole : 50 m, less than 300 mmdia; 75 m, less than 600 mmdia; 100 m, less than 1,000 mmdia
- Sewage relay pumps
  - Location : Constructed where the earth coverage is beyond 6.0 m
  - Type : Centrifugal submersible pump
- Hydraulic design

  The hydraulic design of sewage pipes are based on the "Manning's formula" defined by:

  $Q = A \times V$

  $V = (1/n) \times R^{2/3} \times I^{1/2}$

  where, Q = Hourly maximum discharge, m^3/sec
  A = Sectional area of pipe, m^2
  V = Velocity, m/sec
  n = Roughness coefficient, 0.013
  R = Hydraulic radius, m
  I = hydraulic gradient, -

5.2 Storm Water Drainage

- Design discharge

  The design storm water discharge will be computed by the following "Rational Equation":

$$Q = (1/360) \times C \times I \times A$$

where, C = Run-off coefficient, 0.9

I = Average rainfall in rainfall duration, mm/hr

A = Drainage area, ha

Q = Storm water discharge, m^3/sec

- Storm water ditches/pipes

- Material	:	High density centrifugal concrete pipe, socket joint type or, reinforced-concrete open channel	
- Minimum size of pipes	:	200 mmdia	
- Minimum gradient of ditches/pipes	:	2 per mm	
- Critical velocity of pipes	:	Minimum	0.6 m/sec
		Maximum	3.0 m/sec

- Hydraulic design

  The same criteria to the sewage disposal facilities will be applicable.

6. OUTLINE OF THE PROPOSED FACILITIES

The proposed urban sanitation facilities will basically consist of the sewage disposal facilities and the storm water drainage. The sewage disposal facilities will include: (1) sewage collection system, and (2) sewage treatment system. The sewage treatment system accommodating a biological treatment plant will be located at Hung Vin District, some 300 m north of the Royal Citadel, since the area inside the Royal Citadel is not available for the facilities construction. Thus, sewage collected from the inside of the Royal Citadel will be conveyed to the site of the sewage treatment system through carbon steel pipes with being pressurized by pumps.

The storm water drainage will include: (1) discharge pumps, (2) water gates, and (3) drainage ditches/pipes. Apart from the construction works of the storm water drainage, the dredging work for the Ngu Ha River and the moats encompassing the Royal Citadel will take place. The main specifications of each facilities are referred in Table 6.

7. IMPLEMENTATION COST

The estimated cost for the construction works on the proposed facilities are summarized in Table 7.

The following conditions are applied to the cost estimation:

- Direct construction cost covers preparatory works, purchase of equipment and material, shop manufacturing, ocean and inland transportation, site installation works and startup operation.
- Equipment and material necessary for construction works are purchased in local market in Viet Nam, if reliable and competitive one are available. Otherwise, they are imported from foreign countries.
- Indirect construction cost covers expense for engineering services and land acquisition, and price and physical contingency. Any taxation such as import tax, V.A.T(Value Added Tax) and I.D.C(Interest During Construction) are exempted from construction cost.
- All prices of equipment and material are on the basis of " as of 1996."

Table 6 Outline of the Proposed Urban Sanitation Facilities in the Royal Citadel

Work items	Quantities		Descriptions
1. Sewage disposal facilities			
1.1 Sewage collection system			
Trunk pipes	5.3	km	concrete pipe, 600 t0 800mmDia
Main pipes	22	km	concrete pipe, 300 to 500mmDia
Branch pipes	37	km	PVC pipe, 200mmDia
Transfer pipes	3.4	km	carbon steel pipe, 500mmDia
Sewage relay pump	5	sets	centrifugal
Appurtenances	1	lot	manhole
			connection sump
1.2 Sewage treatment facilities			
Treatment process	4	units	biological oxidation ditch type
Capacity			9400cu-m/d x 4units, total 37,600cu-m/d
Component equipment			
- Grit chamber	2	units	15sq-m with sewage intake pumps
- Oxidation ditch	4	units	9,400cu-m with aeration rotor
- Settling basin	4	units	620sq-m with with sludge collecter
- Chlorination tank	1	unit	400cu-m with chlorinater
- Sludge thickener	1	unit	100sq-m with sludge collecter
- Sludge dehydrator	3	units	belt-press type with 1.5mWidth
Appurtenances			operation room, laboratory, electrical room, workshop, storage room, sludge dehydration room
Site area			230mWidth x 360mLength (8.4ha)
2. Storm water drainage			
2.1 Storm water discharge pump			
2.1.1 For Thuy Quan mouth			
Pump main	3	units	including 1 standby, centrifugal
Capacity			1.8cu-m/sec x 150kw,
Appurtenance			grit chamber, diesel engine, pump room
2.1.2 For Thanh Long mouth			
Pump main	3	units	including 1 standby, centrifugal
Capacity			1.8cu-m/sec x 150kw,
Appurtenance			grit chamber,diesel engine, pump room
2.2 Water gate			
For Thuy Quan mouth	1	unit	sluice gate type, carbon steel 8.5mWidth x 7.5mHeight
For Thanh Long mouth	1	unit	sluice gate type, carbon steel 5.0mWidth x 7.5mHeight
For Mang Ca mouth	1	unit	sluice gate type, carbon steel 5.0mWidth x 3.0mHeight
2.3 Drainage pipe and ditch			
Pipes	10.5	km	concrete pipe, 1,000 to 1,200mmDia
Pipes	7.5	km	concrete pipe, 600 to 800mmDia
Ditches	7.0	km	concrete ditch, 400 to 600mmWidth
Rehabilitation works	1	lot	existing pipes and ditches
2.4 Dredging works			
Dredging of the Ngu Ha River	270,000	cu-m	40 to 50mWidth x 3.4kmLength x 2.0mDigging
Dredging of moats	320,000	cu-m	10 to 15mWidth x 11.2kmLength x 2.0mDigging

Notes : The Quantities and the capacities in this table is at the final construction stage.
Source : JICA Study Team

Table 7 Implementation Cost of the Urban Environment Improvement Project

Items	Quantities	Unit Cost (1000USD)	Cumulative cost (1000USD)
1. Sewage disposal facilities			
1.1 Sewage collection system			
Trunk pipes	5.3 km	300	1,590
Main pipes	22 km	200	4,400
Branch pipes	37 km	70	2,590
Transfer pipes	3.4 km	300	1,020
Sewage relay pump	5 sets	30	150
1.2 Sewage treatment facilities	4 units	3,300	13,200
Sub-total			22,950
2. Storm water drainage			
2.1 Storm water discharge pump			
For Thuy Quan mouth	3 units	900	2,700
For Thanh Long mouth	3 units	900	2,700
2.2 Water gate			
For Thuy Quan mouth	1 unit	450	450
For Thanh Long mouth	1 unit	260	260
For Mang Ca mouth	1 unit	110	110
2.3 Drainage pipe and ditch			
Pipes	10.5 km	600	6,300
Pipes	7.5 km	250	1,875
Ditches	7.0 km	130	910
Rehabilitation works	1 lot	(L.S)	300
2.4 Dredging works			
Dredging of the Ngu Ha River	270,000 cu-m	0.020	5,400
Dredging of moats	320,000 cu-m	0.010	3,200
Sub-total			24,205
Total(Direct Cost)			47,155
Engineering service	8.0 %		3,772
Price contingency	10.0 %		4,716
Physical contingency	5.0 %		2,358
Land acquisition	9.0 ha	50	450
Grand-total(Construction cost)			58,451

Notes: The above operation cost includes the man-hour expense for management, operation and maintenance staff, utilities expense, and repair expense.
Source: JICA Study Team

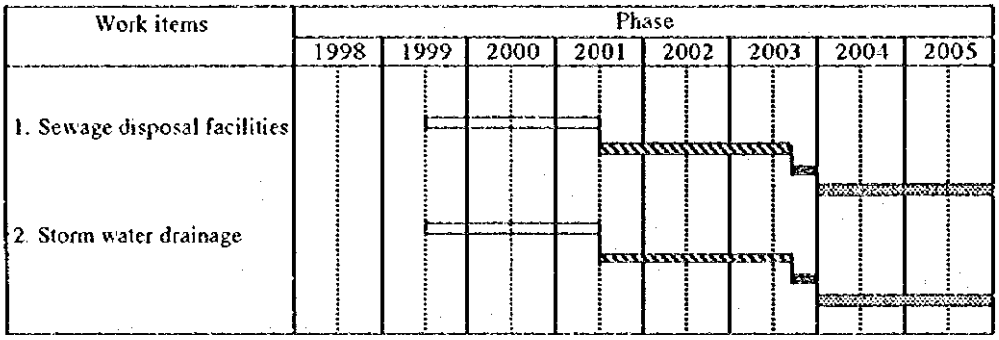
8. IMPLEMENTATION SCHEDULE

As seen before, while the flood control over the whole of Hue City is the subject to a long-term plan, the environment improvement for the inside of the Royal Citadel is the urgent matter, which calls for the project enforcement immediately. Therefore, the project implementation schedule is proposed to be completed up to the end of 2003 as shown in Figure 3.

9. IMPLEMENTATION AGENCY

The Peoples' Committee of Hue City will be responsible for the implementation of this urban environment improvement project.

Figure 3 Implementation Schedule on the Environment Improvement Project



Notes : The bar chart shows the duration necessary for:
: Site investigation, detail design, place of purchase order
: Shop manufacturing, site construction
: Commissioning
: Operation

Source : JICA Study Team

10. MANAGEMENT AND OPERATION/MAINTENANCE

After completion of the construction work, the Peoples' Committee of Hue City will be responsible for the management and operation/maintenance of the facilities. Based on the principle of " Users' Payment," all users will be obligated to pay for the discharge of sewage according to the used volume of supplied water.

Figure 4 Schematic Layout on the Sewage Treatment Plant

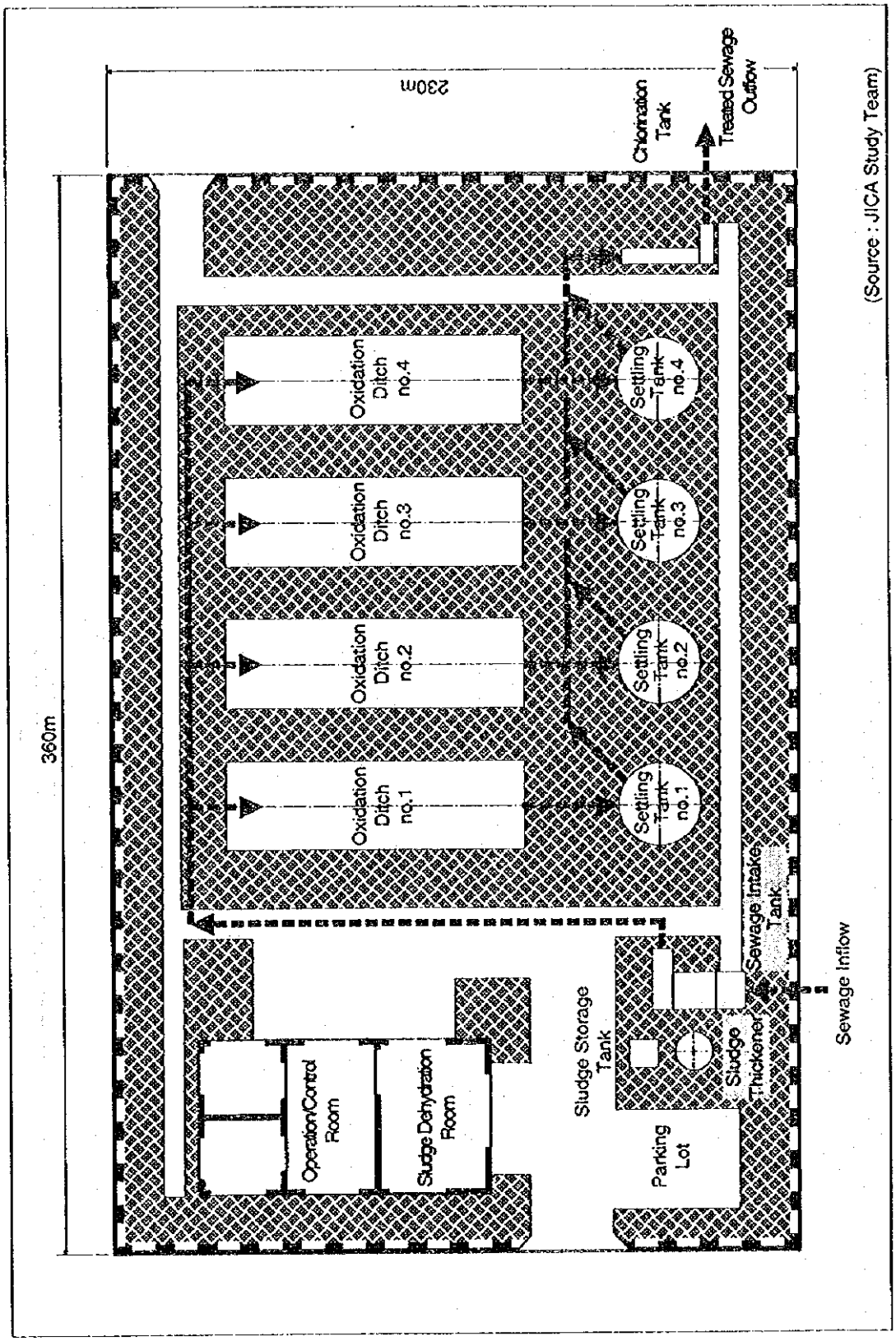
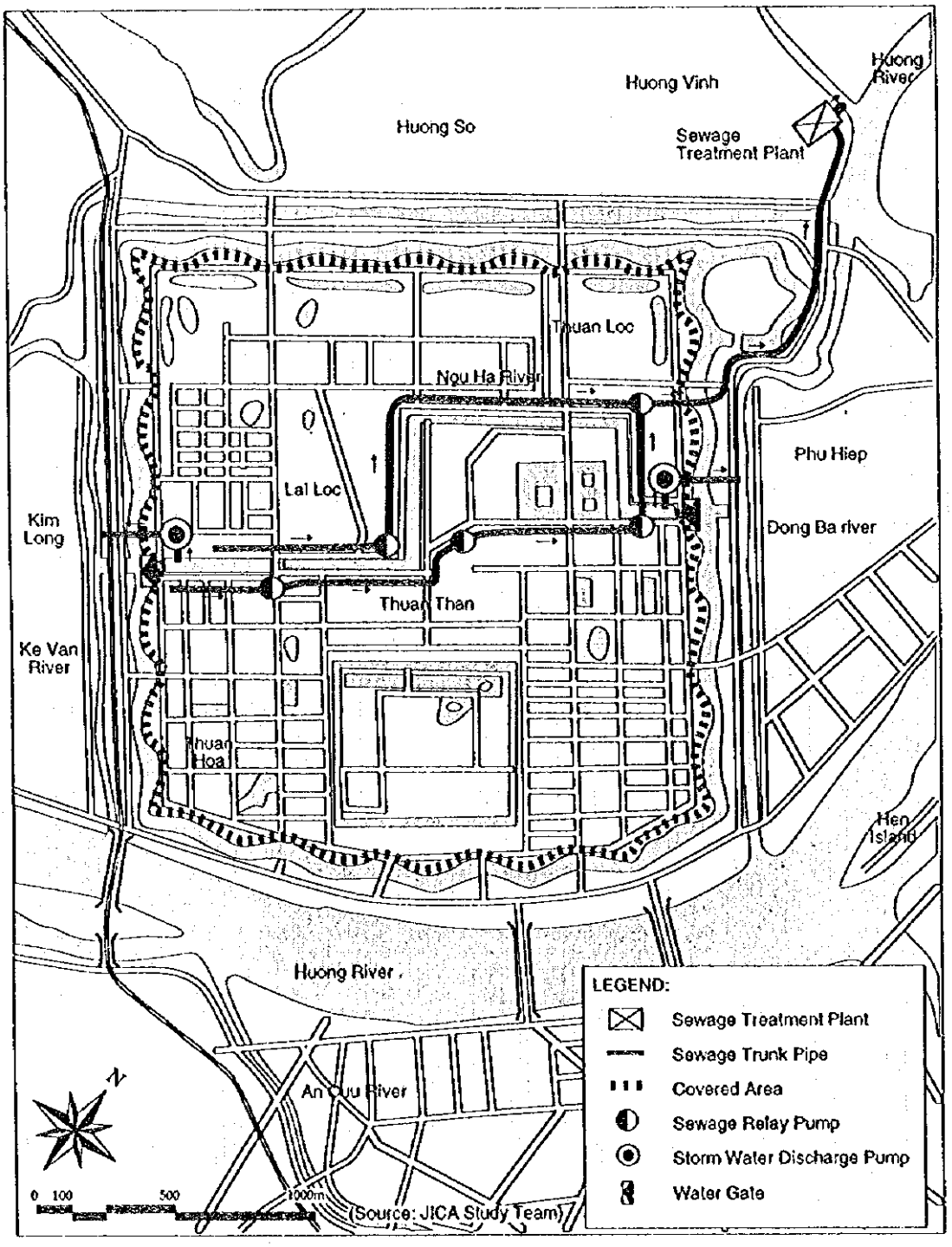


Figure 5 Overall Layout Plan on the Urban Sanitation Facilities in the Hue Royal Citadel



APPENDIX - 8 Central Region Environmental Management Center Project

Project Profile				
No.: ENV-01	Sector: Environmental management and protection			
Title:	Central Region Environmental Management Center (EMC) Project			
Implementing Agencies:	Ministry of Science, Technology and Environment Quang Nam - Da Nang People's Committee			
Development Phasing:	~2000	2000~2005	2005~2010	2010~
		X		
Location:	Da Nang City in Quang Nam - Da Nang Province			
Estimated Cost:	Experimental Facilities(1,500,000), Equipment(3,500,000) Grand Total: US$ 5,000,000			

Outline of the Project:

Development Goal:

The goal is to fundamentally to strengthen the capability of the local government on environmental management.

Background and Justification:

The environmental problems in Central Region will be occurred in the near future, because the social and economic structure will start changing by way of the urbanization and the industrialization. It is urgently necessary for the realization of effective and efficient environmental protection that the technical officials should be trained to get the improved skill of survey and analysis, and also administrative officials to obtain expertise to integrate environmental policies into other development policies at their planning stage. For these purposes, it seems to be the best way to establish a environmental training center, where the necessary knowledge, experiences and techniques should be systematically transferred to each trainee.

Objectives:

- To the capability of the environmental management through environmental research and monitoring activities and the information, and environmental training for human resource development
- To develop environmental policies and strategies
- To undertake research projects on environment
- To strengthen the institutional capacity
- To improve the quality of environment
- To improve the control on environmental standards
- To improve the pollution control management system
- To improve the environmental impact assessment system
- To increase of public awareness to environmental problems
- Development of appropriate pollution control technologies

Description:

1. Organization

   Training Division, Research Division, Administrative Section, Information Section

2. Functions:
   - Environmental Monitoring Program
   - Environmental Training Programs (Technical Training, Administrative Training, Environmental Impact Assessment Training, Environmental Data Processing Training, Environmental Education Training, Environmental Research Programs, Environmental Information System Programs)
   - Seminars and Workshops

Outputs:

1. Development of an education and training program, and the collection of a comprehensive set of reference materials
2. Establishment and function of EMC in Da Nang