

Chapter 9

MAINTENANCE PROGRAMMING

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9.1 Purposes of Maintenance

Maintaining a highway bridge and roads in condition so as to provide safe and uninterrupted traffic flow is the primary function of maintenance. Protection of the investment in the structure facility through well programmed repairs and preventive maintenance is also crucial purpose. To achieve the desired result, it requires constant alertness and thorough inspection procedures.

9.2 Organization for Maintenance

Maintenance organization is to create the conditions and logistical support for the effective implementation of all maintenance activities. The organization should be simple and meet with the specific requirements and resources of Viet Nam, and be accommodated with the existing Vietnamese organizations and budgetary systems for the maintenance of highways. Normally, the organization consists of three organization levels: (a) the central level which establishes national highway plans and budgets, (b) the regional level where maintenance requirements are defined, planning, execution and supervision of maintenance is carried out, and budget control and cost control are implemented, and (c) the district level where the maintenance activities, including monitoring, are carried out under the supervision of maintenance engineers.

9.3 Organization for Budget Procedures and Allocations

9.3.1 Viet Nam Roads Administration (VRA)

The Planning Department of the VRA under the Ministry of Transport (MOT) has responsibility for both annual and long-term plans. The long-term plan is a strategic document, which provides the framework for the more formal five-year expenditure plan. The five-year plan provides the basis of the capital component of the annual plans, but subject to modification as the five-year period proceeds. The approval mechanism for long-term plans is for VRA to pass proposals to MOT for incorporation in the overall transport plan, which is submitted to the Government for approval. The VRA long-term plan for the roads sector deals principally with the national roads but also includes aggregate targets for the provincial roads summarizing the provincial plans drawn up by the Provincial Transport Authorities (PTAs).

9.3.2 Provincial Transport Authorities (PTA)

PTAs are responsible to the MOT for implementing the national annual plan and applying MOT standards or road works and management of national transport assets at the provincial level. On matters of legal standards and the management of national transport assets delegated to the provinces, the PTAs refer to the MOT. With regard to daily operations of the provinces transport infrastructure and services, they are responsible to the Provincial People's Committees (PPCs). This provincial pattern is repeated at the district and sub-district level.

9.3.3 Expenditure and the Annual Plan

For the national roads, proposals or current expenditure originate with the maintenance authorities, i.e. the Regional Road Management Unit (RRMUs) and PTAs. These proposals are reviewed by the Planning Department of Viet Nam Road Administration (VRA) and assembled into the form of a budget request, which is passed up from the VRA to the MOT and then to the Ministry of Planning & Investment (MPI).

The MPI determines the allocation of funds for VRA - the total VRA budget. The VRA translates this back into allocations for the various departments, enterprises and authorities involved, and specifically in regard to road maintenance this implies the RRMUs and the PTAs. The annual maintenance budget for roads covers both small and medium repairs (corresponding to routine and recurring maintenance), but not big repairs (approximating to periodic maintenance), which are classed as capital expenditure.

9.3.4 Capital Expenditure

Road works are considered to be either small, medium, or large. Procedures differ accordingly. Proposals for small and medium works originate with the RRMUs and the PTAs and are reviewed by the Planning Department of the VRA. Small works may be approved by the chief of the VRA; medium works proposals must go up to the MOT. Proposals for large projects are prepared by the VRA and must be submitted through MOT to the Government. Certain large projects, notably those for which foreign finance is sought, come directly under MOT. Execution is the responsibility of the Project Management Units (PMUs).

9.3.5 Provincial Planning & Investment Department (PPIDs)

The majority of finance for Provincial Roads comes from provincial sources and is voted by the PPIDs. PTAs also have the option of submitting

proposals to the MOT for joint financing. This is done through the Local Transport and Communications Department of the MOT. Central finance is most likely to be forthcoming for large projects (especially bridges) and Projects in marginal areas. In total, central finance for provincial roads does not exceed 10 - 20% of total expenditure. Meanwhile, the PTAs operate on both an annual and long-term planning basis in theory, the long-term may be little more than conceptual if no finance is allocated for capital improvements. The annual plan is prepared by the PTA and submitted to the PPID for the allocation of finance. The plan covers all works up to and including reconstruction. As in the case of the national roads, the PTAs' requests tend to be cut substantially in the Committee's allocation. Meanwhile, the PTAs have a dual reporting function - to the PPID and to the MOT, but generally, however, they tend to see their primary responsibility as being to the province.

9.4 Inspection for Road Maintenance

9.4.1 Conditional Inspection

The appraisal on the inspection for road maintenance with quantitative figures is done on the basis of the results of inspections. The inspections are identified into the following groups.

- (1) The carriageway
- (2) The roadside components/elements as well as obstruction to traffic (vegetation, debris, etc.)
- (3) Road sign and furniture
- (4) Road structures (culverts, bridges, small structures, retaining walls etc.)

The inspections for road maintenance should be carried out preferably at least once per year, depending on maintenance procedures and costs.

An example of evaluation with quantitative table is as below:

Point	Damage		General Condition
	Extent	Severity	
1	None existent	None	Good
2	Frequent	Average	Average
3	General	Sever	Poor

These point results will determine the need for a detailed visual inspection.

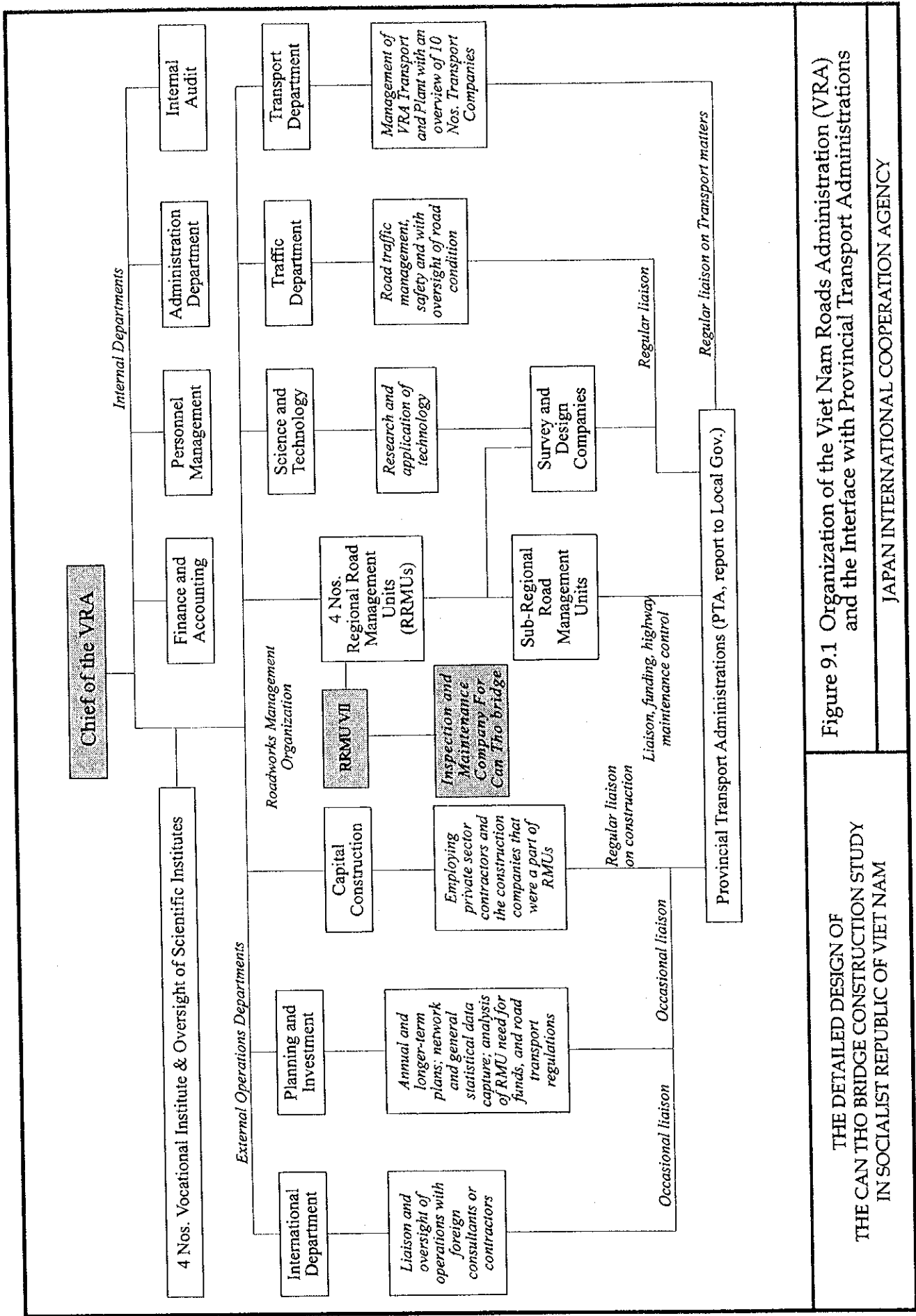


Figure 9.1 Organization of the Viet Nam Roads Administration (VRA) and the Interface with Provincial Transport Administrations

THE DETAILED DESIGN OF THE CAN THO BRIDGE CONSTRUCTION STUDY IN SOCIALIST REPUBLIC OF VIET NAM

JAPAN INTERNATIONAL COOPERATION AGENCY

9.4.2 Detailed Visual Inspection

The purpose of the Detailed Visual Inspection is to investigate type, extent, and severity of damage. It helps the engineer to determine causes of damage and identify the appropriate repair measures. Each detailed visual inspection factor is to be assessed on the point system. Conditions are rated by:

- (1) The extent of the damage, expressed as the percentage of the area and/or
- (2) The severity of the damage

The detailed visual inspection will be carried out on the road surface or carriageway. The factors will be assessed in relation to their influence of vehicle operating costs, traffic speed, and driving safety. The factors to be evaluated for paved roads are:

- Rutting
- Corrugations
- Depressions
- Cracking: Longitudinal, Transverse
- Alligator cracking
- Potholes
- Edge distress
- Stripping/Fretting/Raveling
- Bleeding

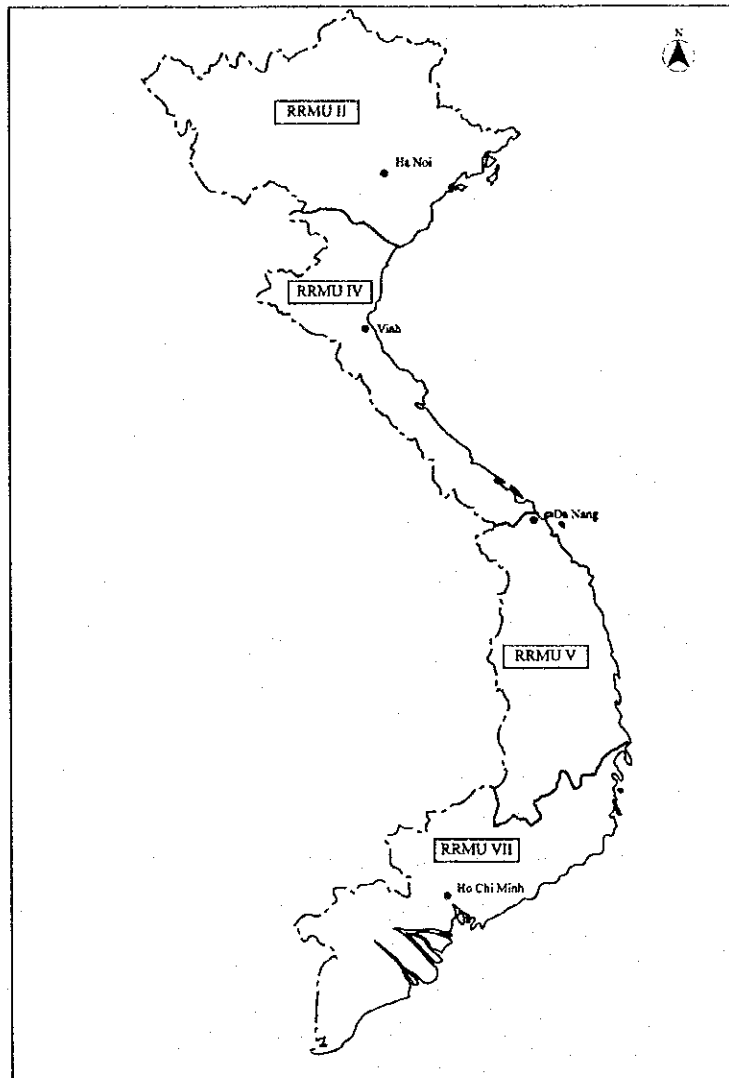


Figure 9.2 Administrative Areas of the RRMUs

9.5 Inspections for Bridge Maintenance

Inspections for bridge structures can be categorized as follows:

(1) Normal Inspection

The inspection to be performed visually in order to detect damage to a bridge at an early stage. It is performed at the same time as daily patrols of the road.

(2) Periodic Inspection

The inspection to be performed periodically in order to maintain the bridge. It is mainly done visually or by using simple inspection equipment.

(3) Special Inspection

The inspection to be performed in order to assure the safety of the bridge after the occurrence of a disaster, such as earthquake, typhoon, localized torrential downpour, or when any abnormal condition has been detected. It is done mainly in order to ensure the safety of the bridge.

(4) Follow-up Inspection

The inspection to be performed repeatedly of a damaged part whose condition of deterioration needs to be known. It is performed visually or by using simple inspection equipment and tools.

(5) Detailed Inspection

The inspection to be performed in order to determine necessity of any repair or reinforcement. It is performed by using inspection equipment and tools.

Damage can be graded into five ranks, each of which shows the steps to be taken considering the condition. Based on the ranking and grade of damage, the necessary maintenance work is carried out (see Table 9.2).

Table 9.2 Criteria for Grade of Damage

Grade	General Conditions
I	Being heavily damaged, affecting or possibly affecting the safety of traffic, or causing or possibly causing trouble to third parties, it is necessary to carry out an emergency repair.
II	Being damaged in a large part, it is necessary to carry out a detailed inspection for studying whether or not any repairs are required.
III	Damaged being found, it is necessary to carry out follow-up inspection.
IV	Damage being found, it is necessary to record the conditions thereof.
V(O.K.)	No damage found as the result of inspection.

9.6 Inspection for Cable-stayed Bridge

A cable-stayed bridge is a bridge in which the superstructure is supported by cables, or stays, passing over or attached directly to towers located at the main piers. The superstructure generally consists of an orthotropic deck and continuous girders.

9.6.1 Special Elements

There are several special elements that are unique to cable-stayed bridges, and the bridge inspector should be familiar with those listed below.

(1) Cable System

The inspection of the cable system should include:

- Exterior of the cables (cable wrapping)
- Cable anchorage
- Anchor pipe clearances
- Flange joints
- Sheathing pipe welds (polyethylene or steel)
- Sheathing expansion joints
- Wrap ends near the tower and deck
- Reading the load cells and recording the forces in the cables, noting the loads on the deck at the time of the readings
- Type and amplitude of cable vibrations, noting the direction and speed of wind

(2) Inspect the cable pipes for Cable Piles

- Corrosion
- Splitting
- Cracking
- Excessive bulging

Cable pipes should be inspected carefully. Special concern should be given to the connections with the cable dampers, the tower exists, and anywhere pipes are welded together.

(3) Cable Damper System

The most commonly used cable damper system is a shock absorber type. Inspect this cable damper system for:

- Corrosion
- Tightness in the connection to the cable pipe
- Oil leakage in the shock absorber
- Deformations in the bushings
- Torque in the bolts

(4) Inspect the cable anchorages for Cable Anchorages

- Water tightness of neoprene boots at the upper ends of the guide pipes
- Drainage between the guide pipe and transition pipe
- Corrosion of the anchor system
- Defects, such as splits and tears, in the neoprene boots
- Sufficient clearance between the anchor pipe and cable, noting rub marks and kinks
- Cracks and nut rotation at the socket and bearing plate
- Seepage of grease from the protective hood

9.6.2 Advanced Inspection Techniques

Since visual inspection is often insufficient to detect corrosion and fracture of individual cable wires, advanced inspection techniques may be used. In bridge cables, the greatest problems generally occur due to the corrosion and fracture of individual wires. Visual inspection of unwrapped cables is limited to the outer wires, while visual inspection of wrapped cables is limited to the protective sheathing. Therefore, advanced inspection techniques should be used to achieve a more rigorous and thorough inspection of the cables, including:

- Magnetic induction
- Electrical resistivity
- Dye penetration
- Ultrasonic testing
- Radiographic testing
- Acoustic emission
- Accelerometers
- Strain measurements
- Vibration measurements
- Magnetic flux leakage
- Measurement of loads
- Measurement of stress ranges

9.7 Maintenance for Riverbank and Riverbed

9.7.1 General

Determining an effective solution to a riverbed or river problem is difficult. Settlement of foundations, local scour, bank erosion, and channel degradation are complex problems and cannot be solved by one or two methods. A geologist, hydraulic engineer, and structural engineer are all

needed for consultation prior to undertaking the solution of a serious maintenance problem. In some case, certain remedial work could actually be detrimental to the structure.

Erosion is also caused by the constriction of flow at the bridge site, meander geometry of the stream, the riverbed material, and the bank material as well as the size of the piers.

Severe channel misalignment at a structure, often attributed to improper design, actually may be the result of changes in channel morphology that make the design improper or ineffective at that time. These changes may have resulted from circumstances connected with a particular floodflow that caused a large discharge moving at high velocity to act on the riverbed, carrying away large quantities of material, and thus lowering the elevation of the bottom of the river.

9.7.2 Control and Prevention

(1) Maintenance

Erosion may be controlled by using rock or stone slope protection, grouted rock, interlocking sheet piles, pile retards, tetrahedrons, wire enclosed rock, broken concrete, etc. The type of protection should be compatible with the location and natural roughness of the bank and other site considerations, making use of local material when available. The velocity of flow, site material and direction of the current are critical factor in selecting the materials.

In preventing or limiting scour, the engineer should make a scour analysis to assess the situation prior to undertaking any corrective action. Possibly the damage was caused by a flood well in excess of the design event. In this case, the only remedial action justified may be to return the structure to its original configuration, provided no significant channel modifications have occurred or are anticipated.

(2) Repair

The first step in solving an erosion problem is to determine the cause. A geologic log of the material in which the foundation has been placed is needed to determine the situation. Underpinning is one of several solutions. It may be that a new pier is required, as the original pier has been damaged beyond repair. If further erosion or movement is unlikely and the foundation has retained its capability of supporting the structure, it may be feasible to accept the settlement, modify the

existing pier by extending its shaft and replace the superstructure at its former elevation.

Minor scour conditions can be corrected by the placement of riprap or large stone dumped randomly. Where scour has reached the point where erosion of the footing has occurred or is eminent, the stream flow should be diverted from the scoured area by the construction of a temporary cofferdam.

If measurable erosion has occurred or is progressing, it will now be essential to provide temporary support for the structural members carried on the scoured footing. This can be done by making the cofferdammed area large enough to accommodate timber or steel cribbing on which the members may be temporarily supported.

9.8 Survey Methods of Scouring Depth

To prevent the problems of the riverbed around the abutments and piers of bridge, the following survey methods, mainly, can be conducted for analyzing causes and determining solution.

(1) Radio Control Boat

The equipment consist of radio control boat (RCB) equipped with sonic wave sound and personal computer. By remote control system, the RCB will be moved around the abutment or the pier and measure the water depth. The measured data is collected into the personal computer. The contour map of the riverbed is printed automatically. It is useful output for analysis on the scoured riverbed.

(2) Ultrasonic Sounding

The equipment consist of ultrasonic sensor and personal computer. The riverbed condition and the bridge pier can be represented on the display through imaging sonar.

(3) Magnetic Ring

The equipment consist of measurement pipe with the magnetic ring and magnetic sensor. The measurement can be carried out through the sensor provided inside of pipe which can trace the movement of the magnetic ring.

(4) Electrical Magnet Sensor

The equipment consist of measurement pipe and magnetic pieces provided on the measurement pipe. If the magnetic piece is removed by the river flow from the pipe, the sensor can catch its removal which will tell scouring condition.

Chapter 10

ENVIRONMENTAL IMPACT ASSESSMENT (EIA)

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10.1 General

10.1.1 Background of the EIA Study

The proposed Can Tho Bridge across the Hau Giang branch of Mekong River is a major infrastructure that after being constructed will solve one of the biggest bottlenecks of National Highway No.1, and will trigger the development of the Mekong Delta. However, the construction of the proposed Can Tho Bridge will also raise various impacts on regional natural and socio-economic environment. Assessment of these impacts are considerably important as well as the setting up of the measures for mitigating the adverse impacts, and the environmental monitoring programs, to ensure that the existing environmental values can be protected, and the sustainable development of Mekong Delta can be realized.

10.1.2 Objectives of the EIA Study

Following the environmental impact assessment (EIA) study conducted in the F/S, the EIA Study associated with this Detailed Design aims at reviewing the former EIA Study, making furthermore detailed assessment of the impacts on natural (biophysical) environment and socio-economic environment caused by the construction of the bridge, and proposing the Resettlement Action Plan (RAP), as well as other measures for mitigating the adverse impacts on environment of the project area.

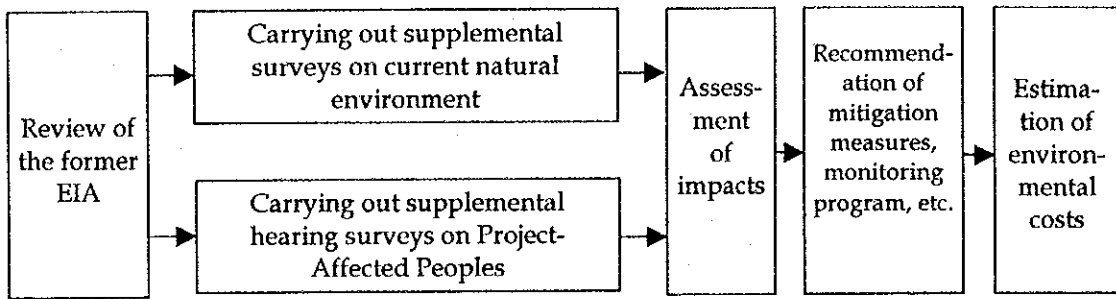
Major objectives of the EIA Study are described as follows:

- (1) Identify and assess all environmental impacts of the Can Tho Bridge Construction Project to the adjacent area, during pre-construction, construction, and operation,
- (2) Set up the Resettlement Action Plan and other recommended measures for mitigating and managing adverse impacts on the environment, and
- (3) Set up the recommended programs for environmental monitoring.

10.1.3 Study Approach

The EIA Study for the Can Tho Bridge Project had been conducted in compliance with the guidelines issued by the Vietnamese Ministry of Science, Technology and Environment, and generally in accordance with the requirements of the JBIC (OECF) Environmental Guidelines and the JICA Environmental Guidelines.

The basic flow-chart of the Study is as follows:



The Environmental Protection Centre (EPC), an organization of the Viet Nam Institute for Tropical Technology and Environmental Protection (VITTEP), was entrusted to carry out the EIA Study. This chapter summarizes the results of the EIA Study carried out by the EPC. The detailed content of the EIA Study is described separately in the following two reports: (1) the Environmental Impact Assessment Report, and (2) the Resettlement Action Plan Report.

10.2 Environmental Consideration to Be Examined in the Detailed Design Stage

10.2.1 Shift of Centerline of the Approach Roads and the Consequences on Environmental Consideration

In the Detailed Design, the location of the main bridge was finally shifted 220m to the downstream side from the location set in the F/S. Consequently, the areas affected by the Project had been changed. The new alignment of the approach roads leads to the reduction in number of project-affected peoples, number of affected temples, tombs, cemeteries, etc. in comparison with the former alignment. However, due to the changes in designed type of the interchanges, one elementary school (in Binh Minh District, Vinh Long Province) and one solid waste disposal site (in Chau Thanh District, Can Tho Province) may come to be affected by the Project.

All of the impacts predicted in the EIA of the F/S, and the ones predicted in the EIA of this Detailed Design, will be described in the following sections.

10.3 Key Environmental Impact Issues

Based on the results of the EIA Studies conducted in the past, the key environmental impact issues caused by the Project can be identified as follows (Table 10.1).

Table 10.1 Key Environmental Issues on Can Tho Bridge Construction Project

Factor	Evaluation	Note
Resettlement	A	A number of residents may have to be relocated to acquire lands for the project implementation.
Economic activities	A	A number of residents have means of livelihood depending on the business activities at the Can Tho Ferry crossing.
Traffic and social facilities	A	The reduction of Can Tho Ferry may cause difficulties in accessibility to residents living near the ferry crossing.
Split of communities	B	Some communities may be split by the new approach roads.
Waste	B	A volume of construction waste may be generated from the bridge construction site.
Soil erosion	C	Exposure of topsoil by land reclamation may cause the water turbidity and affect growth of plants, animals, etc.
Hydrological situation	B	Hydrological regime may be changed by the construction of piers, etc. and by the changes of inflows
Fauna and flora	B	Exhaust gas and noise, and new approach roads may cause the changes of habitats of animals
Landscape	B	Outstanding large scale bridge may give quite changes to existing landscape and raise various impacts to tourism and local people's life.
Air pollution	B	Dust, exhaust gas and toxic gas from earthwork, construction machines and running vehicles may affect health of resident, plants and animals along the roads
Water pollution	B	Disturbance of sediments by construction piers, eroded soil from the road embankment, dust and oil on the road surface, etc. may cause polluted, turbid water and affect the aquatic ecosystem
Soil contamination	C	Dispersion of paving materials, exhaust gas and dust, etc, may cause the contamination of soil.
Noise and vibration	C	A number of residents may be affected by noise and vibration generated by construction machines.
Ground subsidence	B	Newly constructed embankments on soft soil of Mekong Delta may cause subsidence of lands along the approach roads.

Note:

- A : Serious impact is expected
- B : Some impact is expected
- C : Extent of impact is unknown

10.4 Natural Environmental Impact

10.4.1 Current State of the Natural Environment

(1) Physical Environment

The proposed Can Tho Bridge is located in the central part of the Mekong Delta, on the Hau Giang (Hau River) tributary channel, close to the existing Can Tho Ferry. It is influenced by a monsoon climate with heavy rainfall occurring in the rainy season lasting from May to November.

The channels of the Mekong River form a highly braided system with eight main tributary channels across the delta, migrating slowly upstream. The flat terrain is only relieved by the natural levee banks and is generally lower than 1 meter above mean sea level.

The sediment load is high and river sediments are Holocene sandy silts and clays, more than 50 meter-deep, overlying approximately 1,700 meters of Pleistocene sands and gravels. The lowermost recent (finer) sediments are almost certainly initially of marine and near shore origin, laid as the delta advanced following the Holocene postglacial rise in sea level. Mangrove forests would have built up and later diminished as the delta shoreline advanced, making these lower Holocene sediments rich in organic sulfides.

The Mekong Delta may be divided into several main physiographic areas, which are relatively homogeneous in geological formation, topography, soils, and land use.

(2) Biological Environment

The Mekong Rivers create favorable conditions for fish habitats, with more than 250 species of fish, of which about half are of economic importance.

The survey on aquatic organisms at the Project area carried out by the EIA Study Team in June 1999 shown that the diversity of aquatic organisms is high. 73 species of phytoplanktons, 37 species of zooplanktons, and 33 species of benthic animals had been identified by the survey. The species identified by the survey were not different to the species found by other surveys in the Bassac River (see Appendix). No valuable and rare species had been identified.

Some rare endangered birds, such as O Tac (*Eupodotis Bengalensis Blandini*), Seu Co Trui (*Grusantigone Sharpic*), etc., are found existing

in some wetlands in Mekong Delta, especially in Tram Chim area of Dong Thap Muoi Province. However, these species were not found in the Project area during the past surveys.

(3) Water Quality

A survey on water quality at the location close to the existing ferry and at the proposed bridge construction site have been conducted by RITST in February 1998.

These results show that water of Bassac River in dry season is relatively clean. Suspended solids vary in the range of 50 to 80mg/l. BOD level varies from 2.6 to 3.2 mg/l.

(4) Air Quality and Noise

The survey on air quality carried out by the EIA Study Team in July 1999 showed that dust (particulate matter) is the major air pollutant at the areas along the NH1 in Binh Minh District and Can Tho City. Dust concentrations vary from 0.30 mg/m³ to 0.51 mg/m³ in daytime and evening time (6:00am to 9:00pm), and exceed the permissible level given by the Vietnamese Standard for residential areas. However, concentrations of other air pollutants such as NO₂, Pb, etc., are still lower than the concerned permissible level.

The survey also show that the noises caused by vehicles, motorbikes, etc., reach high level at the residential areas along the NH1. The surveyed average noise levels exceed the Vietnamese Noise Standards for residential areas at all daytime and night time.

(5) Scenic Value / Visual Amenity

The Study area is a part of a flat alluvial terrain of the Mekong Delta, where the common seen landscape is mainly large spreading rice paddy-fields back from the rivers or canals' levees, dryland garden crop trees, and 10~20 meter-high trees such as bamboo, coconut trees (dua trai), nypa palm (dua nuoc), sonneratia caseolaris (ban chua), etc. Scattered on the ground beside is low vegetation such as grasses, water hyacinth, etc.

One can find some beautiful landscape with various kinds of vegetation in the green crop tree gardens at Tan Quoi Ward of Binh Minh District, 2 to 3 km distance upstream from the Study area. But in the area adjacent to the proposed bridge, there is no remarkable beautiful landscape nor any significantly high structure.

(6) Conservation Areas and Nature Conservation Status

The natural ecosystems of the Study area have been extensively modified by agriculture over many centuries. Only rats and domesticated animals such as pig, duck, swan, chicken, goose, etc., are found near the proposed bridge construction site.

However, there are six reserved areas in the provinces of Minh Hai, Dong Thap, Kien Giang, and in the islands of Con Dao, Phu Quoc. But they are at considerable distances from the Study area.

(7) Vegetation Resources

During long period of cultivation in the past, almost all of primitive vegetation in the Project area had been exterminated and replaced by rice paddy fields, tree-croplands and other agricultural ecological systems.

Nam Roi grapefruit, a kind of famous fruit with high economic valuable is a specialty of Binh Minh District. There are many large croplands planting this grapefruit in My Hung Ward, where a proposed approach road is planned to pass through.

10.4.2 Natural Environment Impact Assessment

(1) Impacts on Land and Soil

The construction of the approach roads with total extension of more than 13 km on the soft ground of the Mekong Delta would raise significant impacts on the land and soil of the local area.

The excavation of land would lead to the exposure of potentially acid soils to air, and would generate large quantities of soluble acid substances in the surface water. This would affect the ecosystem of a large area along the approach roads. Dust generated from alluvial sediments and soils which are poorly structured and easily eroded, would be exposed to the air and give significant damage to the physical environment, residents, livestock and vegetation existing at the areas adjacent to the construction sites.

During the rainy season a part of materials utilized for the road embankment and the road surface would be eroded and run off to pollute the water in the existing drainage system.

(2) Impacts on Water Resources and Hydrological System

During construction phase, the earthworks, the stock piling of construction materials, the construction of new drainage facilities, etc., would lead to the change of water flows in the canals along the approach roads, and pollute these water sources.

(3) Impacts on Water Quality

Although the river water in the Mekong Delta is highly polluted (as they are used to dispose of sewage from villages, dwellings along the river banks, and boats, etc.) it is still used as main source of water for washing, irrigation, etc, in the daily life of the local people.

During the construction phase, eroded materials, acidic and turbid water containing suspended solids generated by the construction earth works, and liquid or solid wastes originating from the construction camps, etc., would contaminate the river water, and have adverse impacts on the life of the local people.

Gasoline, engine oil, etc. used by heavy machines and dump trucks during the construction phase may permeate underground or flow into rivers, and contaminate the groundwater and river water.

(4) Impacts on Terrestrial and Aquatic Ecology

In consequence of the exacerbation of water quality and air quality along the approach roads during construction phase, the faunas and floras in the Study area would temporarily suffer significant adverse impacts.

Although there are no specified natural vegetation or habitat within the Study area that may be affected by the Project, caution should be paid to ensure that no excessive amounts of sediment, acidic soil or acidic water or toxic pollutants are released into the river, as they could damage the existing riverine ecosystems and give rise adverse effects on the existing subsistence and commercial fisheries.

(5) Impacts of Noise

There would be temporary noise impacts during construction, especially at the areas where the pile driving works are done. The noise levels at such areas during the construction period may exceed Vietnamese standards.

Two elementary schools located close to the approach road on the Vinh Long side (one close to the river bank, and one close to the existing National Highway No.1) would be significantly affected by noise during construction phase. However, the number of residents who are living along the proposed approach roads and would be affected by excessive noise during the construction phase is small and limited. With the careful choice of working methods, construction equipment, etc., these impacts of excessive noise may be mitigated.

(6) Impacts of Vibration

There is a small number of residents living in the areas close to the construction sites that may be significantly affected by vibration generated from the construction works such as piling, moving of heavy machines, etc.

(7) Impacts on Air Quality

Resident living along the existing National Highway No.1 close to the proposed interchange with the approach road at Dong Binh Ward, Binh Minh District, would suffer significant impacts of air pollution during the construction period. Heavy machinery which are powered by diesel engines would exhaust a significant volume of NO₂, CO and SO₂ and disturb the air quality of the areas adjacent to the construction sites and along the approach roads. Earthworks conducted on embankment, concrete batching, and construction vehicles would stir up dust from exposed soils and construction materials, especially during the dry season.

Dust control methods should be implemented, and further caution should be paid to mitigate adverse impacts on air quality to residents and pupils of the two elementary schools located close to the approach road on Vinh Long side. The concrete batching plants should be constructed and operated in such manner to minimize potential air pollution problems.

(8) Impacts of Excavation and Transportation of Construction Materials

A considerable volume of coarse aggregate, sand, cement, etc., will be required for the construction of approach roads, bridge structure and other facilities. Four sources of aggregate (Bien Hoa, Nui Sap, Vung Tau, An Giang) and three sources of sand (Dong Nai, Long Xuyen, Soc Trang) have been surveyed in selecting the most appropriate sources for procurement of these construction materials. Barges are assumed to

be the most appropriate means of transporting these materials from the sources to the sites.

However, dusts and scattered construction materials generated in the process of excavation and transportation would contaminate and disturb the physical environment on land and in the water at the quarry sites and along the transport routes.

(9) Impacts of Wastes

During the construction phase, numerous kinds of waste such as scattered construction materials, waste water, solid wastes, machine oils, etc. may be generated from the construction sites and from the worker camps. Appropriate planning to control wastes from these sites should be implemented to avoid negative environmental impacts due to the construction.

(10) Impacts on Environmental Health and Safety

Human health and safety, both within the construction workforce and among the local residents should be specifically considered during the construction phase.

At the present time, residents living in the Study area are relatively well nourished by a stable farming system which is able to produce various sources of food for subsistence use and for sale. The existing farming system with extensive use of swamps and ponds for fisheries does not provide favorable places for the propagation of mosquitoes or other disease-transmitted insects.

This stable farming system should be maintained, and all potential toxic substances produced or exposed during the construction phase should be treated by the appropriate methods to ensure that the existing ecosystem will not be damaged.

(11) Impacts of Excavated Soils and Mud for the Construction of the Bridge Foundation

As shown in the Basic Design Report, the Multi-Column with Open Caisson type was recommended as the most appropriate type of foundation for the main bridge. However, it is anticipated that a significant quantity of soils and mud will be excavated from the riverbed during this construction work. These soils, mud, and muddy water generated during this construction work would contaminate the river water, and disturb the riverine ecosystem.

10.4.3 Mitigation Measures for Negative Impacts on Natural Environment

(1) Setting Up of Natural Environmental Preservation Targets

The main target of the natural environmental preservation is to examine the appropriate and reasonable measures to avoid, reduce and mitigate impacts which may be caused by the Project to the natural environment of the Project area.

For natural environment, the sub-target is: all pollutants originated by the activities associated with the Project should be controlled and managed, in order to control the discharge of the pollutants into the surrounding areas so as they will not exceed the permissible level determined by the enacted Vietnamese environmental standards.

(2) Erosion and Sediment Control

The erosion and sediment control plans should be prepared during the Detailed Design phase for each proposed earthwork operation. The cautions, such as the following should be carefully examined during the formulation and the implementation of these plans.

- All construction sites, and facilities should be located as far as possible behind the levee.
- Construction works should be scheduled so that large areas of soil will not be dumped barely during the rainy season.
- The control devices such as silt fences, sediment basins, diversion berms, vegetative buffer areas, channel linings, etc. should be fully used in cases of necessary.
- The road embankment, the disturbed areas, etc, should be revegetated as soon as possible.
- The structural earthwork should be designed with appropriate permanent erosion controls, such as terracing, slope flattening, retaining wall, sodding or grassland establishment, etc.
- The appropriate use of refuse collection traps, settlement basins, etc. to treat the rainwater in the construction areas before discharging into the rivers.

(3) Control of Water Pollution

All wastewater or contaminated rainwater runoff from construction areas, worker camps, etc., should be collected and treated by the appropriate methods before discharging into canals or rivers. Special caution should be paid to avoid accidental spills of oil, grease, fuel, paint, etc.

The concrete batching sites should be located at appropriate areas where the runoff water can be treated easily. Contaminated water should be channeled into a settling pit, so as to collect fine sediment and sediment slurry.

The sewage system in the construction yards should be carefully designed, with the appropriate use of hygienic pit latrines or septic tank system, in order to limit the discharge of untreated wastewater into the rivers.

The solid waste management plans for the construction yards should be carefully prepared by the contractors, in order to collect and dispose of all solid wastes generated in the construction yards in an appropriate manner. The specified solid waste collectors, such as the Urban Environmental Companies in Cai Von City (Binh Minh District), and Can Tho City, may be entrusted for the collection and disposal of solid wastes generated in the construction yards.

(4) Control of Air Pollution

Appropriate measures for mitigating adverse impacts on air environment, such as the following should be implemented at the concrete batching sites, construction areas, and other places where there is a generation of dusts, contaminant gas, etc.

- Concrete mixing plants and asphalt plants should be located far from the concentrated residential areas. Emission control equipment should be installed for the plants where pollutants emitted into the air exceed the permissible level given in the Vietnamese Standards.
- All vehicles used for the transportation of construction materials (sand, clay, cement, stone, etc.) should be covered to prevent dust dispersion. The vehicles, and other construction equipment used in this Project should be checked in their gas exhaustion in conformity with the Vietnamese Standards for gas emission.

- During dry days, the roads and the construction sites should be periodically watered to prevent dust dispersion.
- Waste wood can be burned on-site and away from preserved vegetation, only when applicable permits have been secured. Toxic and polluting materials should not be used to ignite or maintain fires. Burning should be limited and only done when necessary.

In particular, (1) the Nam Roi grapefruit croplands located close to the approach road and the construction yard in My Hung Ward (Binh Minh District), (2) the elementary schools (one in Thuan An Ward, and one in My Hung Ward), and (3) the temple in My Hung Ward, are predicted to suffer significant noise and air pollution caused by the Project, and special caution should be paid to prevent them from these impacts.

(5) Mitigation of Noise Impacts

Appropriate measures should be applied to keep the noise generated from the construction areas below the permissible levels given in the concerned Vietnamese Standards.

All strong noise generated sources, such as concrete batching stations, pile driving facilities, generators, etc., should be located as far as possible from the residential areas and sensitive receptors.

The noise prevention devices, such as wall noise barriers, planting trees, etc. should be used to reduce noise impacts to the affected elementary schools in Thuan An Ward and in My Hung Ward, and the affected temple in My Hung Ward.

(6) Control of Soils, Mud, and Contaminated Water Generated during the Construction of Bridge Foundation

Caution should be paid to prevent the disturbance of riverine ecosystem which may be caused by the soils, mud, and contaminated water generated during the construction of the bridge foundation.

Soils, and mud excavated from the riverbed should be collected and disposed of at the sites specified previously by the Province Peoples' Committees.

In addition, contaminated water should be carefully treated by the appropriate method before discharging into the river.

10.4.4 Monitoring Program for Natural Environment Impacts

Natural environmental monitoring programs should be implemented in three phases: pre-construction phase (to collect background data), construction phase, and operation phase.

(1) Air Quality Monitoring

Based on the requirements made by MOSTE, the following parameters should be monitored with the specified methods.

Table 10.2 Contents of the Air Quality Monitoring

	Pre-construction phase	Construction phase	Operation phase
Parameter	<ul style="list-style-type: none"> - Temperature, humidity, wind direction and velocity - Dust (total particulate matter) - Sulphur dioxide (SO₂), Nitrogen dioxide (NO₂), Carbon monoxide (CO), Lead (Pb) - Volatile organic compounds (VOC) 		
Location	5 selected sites	8 selected sites	5 selected sites
Frequency	1 times/year	Every month	2 times/year
Duration	1 year	5 years	2 years
Estimated cost	2,000 US\$ (2,000 US\$/year)	32,000 US\$ (6,400 US\$/year)	8,000 US\$ (4,000 US\$/year)

(2) Water and Sediment Quality Monitoring

The monitoring equipment and methods for water sampling, storage, analysis, etc. regulated by the Viet Nam NEMS should be applied for monitoring water and sediment quality in the project area during pre-construction phase, construction phase, and operation phase.

Table 10.3 Contents of the Water and Sediment Quality Monitoring

	Pre-construction phase	Construction phase	Operation phase
Parameter	<ul style="list-style-type: none"> - River flow - pH, EC, SS, turbidity, colour, total coliform, BOD - NH₄⁺, NO₃⁻, Total P, Fe, Al - Grease and oil 		
Location	3 points at 5 specified sites		
Frequency	2 times/year, 2 samplings/time		
Duration	1 year	5 years	2 years
Estimated cost	6,000 US\$ (6,000 US\$/year)	30,000 US\$ (6,000 US\$/year)	12,000 US\$ (6,000 US\$/year)

(3) Noise and Vibration Monitoring

Based on the requirements made by MOSTE, the following parameters should be monitored with the specified methods.

Table 10.4 Contents of the Noise and Vibration Monitoring

Parameter	Pre-construction phase	Construction phase	Operation phase
			- Noise - Vibration
Location		8 selected sites	5 selected sites
Frequency		2 times/year	2 times/year
Duration		5 years	2 years
Estimated cost		8,000 US\$ (1,600 US\$/year)	2,000 US\$ (1,000 US\$/year)

(4) Total Cost for Natural Environmental Monitoring

Table 10.5 Total Cost for Natural Environmental Monitoring

Item	Preconstruction Phase	Construction Phase	Operation Phase	Total
Air quality monitoring	2,000 US\$	32,000 US\$	8,000 US\$	42,000 US\$
Water and sediment quality monitoring	6,000 US\$	30,000 US\$	12,000 US\$	48,000 US\$
Noise and vibration monitoring		8,000 US\$	2,000 US\$	10,000 US\$
Total	8,000 US\$	70,000 US\$	22,000 US\$	100,000 US\$

10.5 Socio-Economic Impact Assessment

10.5.1 Current Socio-Economic Environment

(1) Introduction

With the total extension of more than 13 km, the approach roads of Can Tho Bridge Construction Project will cause direct impacts to a large area including the territories of the following administrative units.

Table 10.6 Administrative Units Affected by the Project

Province	District - City	Ward - Town
1) Vinh Long	1) Binh Minh District	1) Thuan An Ward
		2) Dong Binh Ward
2) Can Tho	2) Can Tho City	3) My Hoa Ward
		4) Hung Phu Ward
	3) Chau Thanh District	5) Hung Thanh Ward
		6) Dong Thanh Ward
		7) Cai Rang Town
		8) Tan Phu Thanh Ward

It is anticipated that a number of residents, communities in Binh Minh District, Can Tho City, and Chau Thanh District would suffer many direct adverse impacts caused by the project. Among them, the most affected peoples may be: (1) the residents who lose their dwellings and cultivated lands for the Project, (2) the shopkeepers, the peddlers, the local transporters, etc., who lose main sources of income due to the reduction of the existing ferry service.

The issues which are concerned the most among these PAPs are likely: (1) the relocation of dwellings and croplands, (2) the insufficient compensation for loss of dwellings and lands, and other issues such as: (3) the decrease in income, (4) the relocation of ancestor tombs, etc. (see Table 10.12).

To prevent any delay of the project implementation caused by local residents' opposition, it is recommended that these issues, especially the issues on compensation and relocation of dwellings and croplands, should be discussed carefully.

In order to collect necessary basic data on PAPs for setting up the Resettlement Action Plan (RAP), the following three hearing surveys had been conducted: (1) Hearing survey in Feasibility Study (conducted by RITST in February 1998); (2) Hearing survey in Detailed Design (conducted by EPC in June and July 1999); and (3) Supplemental hearing survey in Detailed Design (conducted by the JICA Study Team in November 1999). Figure 10.1 shows the locations of the communities subjected to these hearing surveys.

The formulation of the RAP and the setting up of other measures for mitigating impacts on socio-economic environment described in the following sections are based on the results of these surveys.

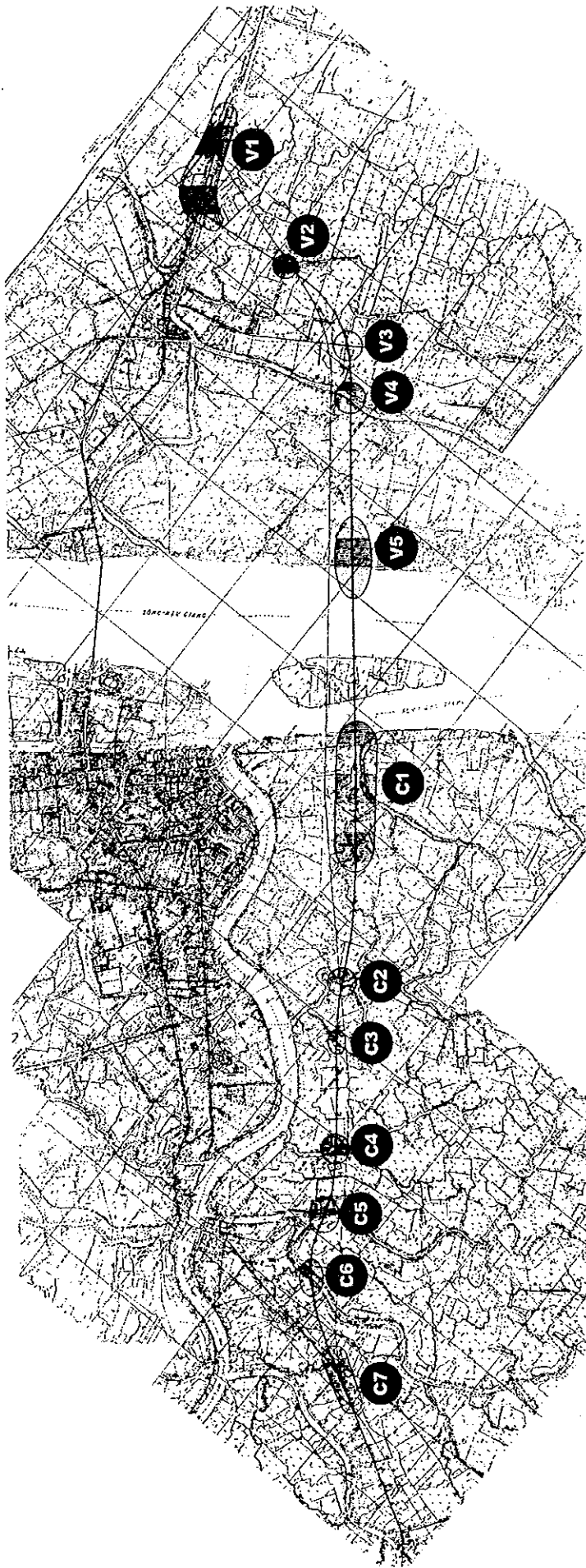


Figure 10.1 Locations of the Communities Subjected to the Hearing Survey in Detailed Design Stage

(2) Current Social Environment

a) Aging Structure of the Interviewed Households

Table 10.7 shows the average household number, and the aging structure of the interviewed households. The average household member in the Project area is 10.6 persons/household. In the communities in Vinh Long Province, the proportion of household's members in schooling age is relatively high (31%~35%). On the contrary, in the communities in Can Tho Province, the proportion of household member in working age, and the proportion of elderly persons in these households are high.

Table 10.7 Average Household Number, and Aging Structure of Interviewed Households

Province Group	Can Tho				Vinh Long			Total
	1	2	3	4	1	2	3	
Number of interviewed household	29	24	17	25	46	27	26	194
Total household member	191	156	87	152	223	145	141	1,095
Average household number (pers/household)	6.6	6.5	5.1	6.1	4.8	5.3	5.4	5.6
Member in schooling age	49 (26%)	49 (31%)	20 (23%)	39 (26%)	78 (35%)	45 (31%)	48 (34%)	328 (30%)
Member in working age	117 (61%)	90 (58%)	57 (66%)	91 (60%)	124 (56%)	87 (60%)	82 (58%)	648 (59%)
Aged member	25 (13%)	17 (11%)	10 (11%)	22 (14%)	21 (9%)	13 (9%)	11 (8%)	119 (11%)

Note:

1. Can Tho 2 includes the Communities C2, C3 and C4 described in Figure 10.1
2. Can Tho 3 includes the Communities C5 and C6 described in Figure 10.1
3. Vinh Long 2 includes the Communities V2, V3 and V4 described in Figure 10.1

Source of data: Result of Hearing Survey on PAPs, conducted by EPC in June and July 1999.

b) Area of Using Lands

Table 10.8 and Figure 10.2 show the percentages of the interviewed household divided by the area of the lands that they are using.

It shows that a majority of peoples in My Hoa Ward (Binh Minh District) have lands with large area. Among 16 households interviewed in My Hoa Ward, 7 households (44%) answered that the total surface area of their using lands is about 2001m²~4000m². In this ward, there are other 2 households (13%) whose lands are

4001m²~6000m² of total area. In Hung Phu Town (Can Tho City), a similar pattern is found. In this town, there are 10 households (21% of total 48 interviewed households) whose lands are 1001m²~2000m² of total area, and other 20 households (42% of the same) whose lands are broader than 2000m².

On another side, there is a big difference in land area among the residents in Hung Thanh Ward (Can Tho City): Besides 15 households (54% of 28 households interviewed in this ward) whose lands' areas are smaller than 200m², there are 7 households (25% of the same) whose lands' total area are broader than 2001m².

Table 10.8 Percentage of Household Divided by the Area of Its Using Lands

(unit: %)

Area of using lands	Binh Minh Dist.			Can Tho City		Chau Thanh Dist			Total	Binh Minh	Can Tho	Chau Thanh
	Thuan An	Dong Binh	My Hoa	Hung Phu	Hung Thanh	Dong Thanh	Cai Rang	Tan P. Thanh				
Smaller than 100m ²	33	6	0	8	29	3	20	8	17	21	16	10
From 101 to 200 m ²	20	15	0	6	25	0	0	0	12	16	13	0
From 201 to 300 m ²	7	4	0	8	11	7	8	4	7	5	9	6
From 301 to 500 m ²	17	6	19	2	4	3	4	8	9	13	3	5
From 501 to 1000 m ²	11	19	19	6	0	3	24	12	12	15	4	13
From 1001 to 2000 m ²	8	33	0	21	7	10	20	16	15	15	16	15
From 2001 to 4000 m ²	2	8	44	19	4	7	8	16	10	8	13	10
From 4001 to 6000 m ²	1	8	13	13	7	0	8	8	6	4	11	5
Broader than 6001 m ²	0	0	6	10	14	13	4	8	5	1	12	9
Others	0	2	0	6	0	53	4	20	8	1	4	28
Total	100	100	100	100	100	100	100	100	100	100	100	100

Source of data: Result of Hearing Survey on PAPs, conducted by the JICA Study Team in November 1999.

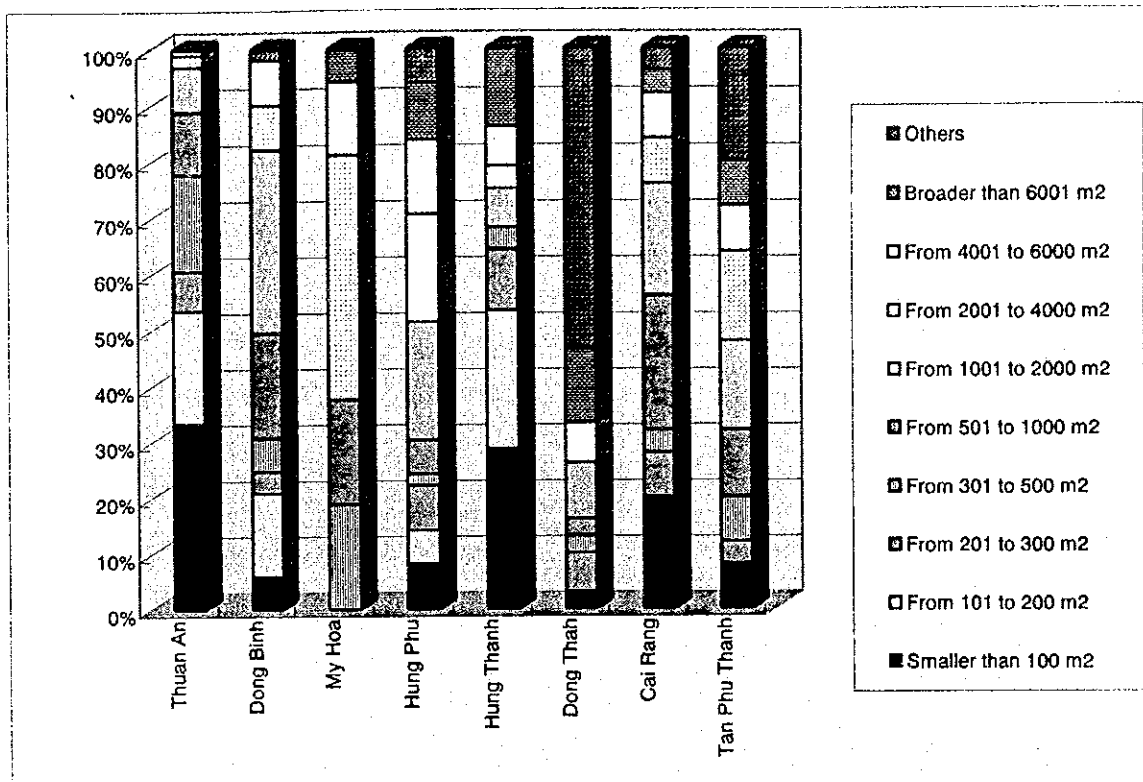


Figure 10.2 Differences in Area of Lands Using by the Residents in Different Administrative Units

(3) Current Economic Environment

a) Annual income

Table 10.9 and Figure 10.3 show the current income status of the interviewed households.

In general, it shows that the residents in Thuan An Ward and My Hoa Ward (Binh Minh District) have relative high income. Nearly 90% of the residents in these two wards have annual income of "more than 9 million VND". Besides, it seems that a great proportion of residents in Tan Phu Thanh Ward (Chau Thanh District) still have low income. In this ward, 28% of interviewed households (7 of total 25 interviewed households) answered that their annual incomes are lower than 5 million VND.

Table 10.9 Number of Household Divided by Its Annual Income (unit: household)

Annual income	Binh Minh Dist.			Can Tho City		Chau Thanh Dist.			Total	Binh Minh	Can Tho	Chau Thanh
	Thuan An	Dong Binh	My Hoa	Hung Phu	Hung Thanh	Dong Thanh	Cai Rang	Tan P. Thanh				
Less than 3mil. VND	1	0	0	4	1	2	1	2	11	1	5	5
From 3 to 5 mil. VND	2	3	0	3	3	0	3	5	19	5	6	8
From 5 to 7 mil. VND	2	5	0	8	2	0	2	1	20	7	10	3
From 7 to 9 mil. VND	10	5	2	6	4	6	1	6	40	17	10	13
More than 9 mil. VND	81	39	14	25	18	5	18	10	210	134	43	33
Others	0	0	0	2	0	17	0	1	20	0	2	18
Total	96	52	16	48	28	30	25	25	320	164	76	80

Source of data: Result of Hearing Survey on PAPs, conducted by the JICA Study Team in November 1999.

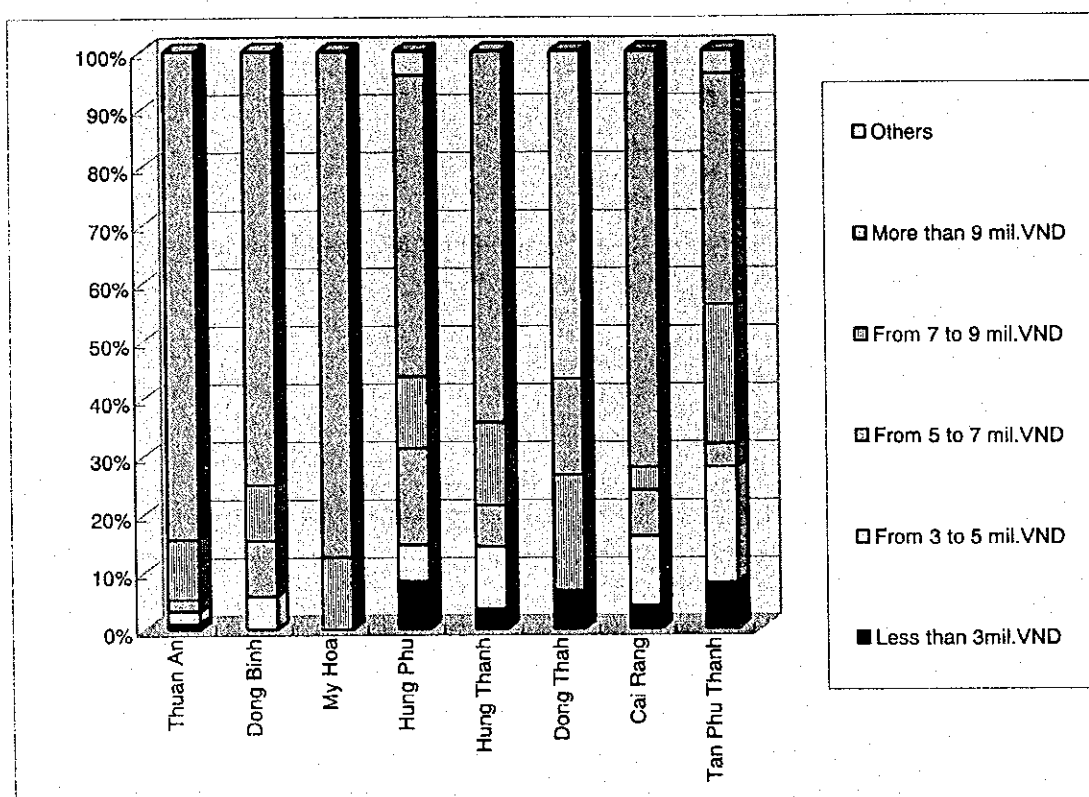


Figure 10.3 Differences in Total Annual Income Among Residents in Different Administrative Units

b) Main source of income

A great part of interviewed residents in Thuan An Ward and My Hoa Ward, whose income are relative high, answered that their main sources of income are business activities and cultivation of croplands, rice paddy fields, etc. (Table 10.10 and Figure 10.4).

Table 10.10 Main Source of Income (unit: household, %)

Main source of income	Binh Minh District			Can Tho City		Chau Thanh District			Total	Binh Minh	Can Tho	Chau Thanh
	Thuan An	Dong Binh	My Hoa	Hung Phu	Hung Thanh	Dong Thanh	Cai Rang	Tan P. Thanh				
Salary, wages	25 (26%)	5 (10%)	1 (6%)	6 (13%)	8 (29%)	5 (17%)	11 (44%)	6 (24%)	67 (21%)	31 (19%)	14 (18%)	22 (28%)
Cultivate croplands, rice paddy fields, etc.	28 (29%)	31 (60%)	13 (81%)	35 (73%)	17 (61%)	7 (23%)	7 (28%)	8 (32%)	146 (46%)	72 (44%)	52 (68%)	22 (28%)
Fishing, stock farming	5 (5%)	6 (12%)	1 (6%)	2 (4%)	0 (0%)	0 (0%)	1 (4%)	3 (12%)	18 (6%)	12 (7%)	2 (3%)	4 (5%)
Business	38 (40%)	8 (15%)	1 (6%)	2 (4%)	3 (11%)	0 (0%)	6 (24%)	4 (16%)	62 (19%)	47 (29%)	5 (7%)	10 (13%)
Other sources	0 (0%)	1 (2%)	0 (0%)	1 (2%)	0 (0%)	0 (0%)	0 (0%)	1 (4%)	3 (1%)	1 (1%)	1 (1%)	1 (1%)
No answer	0 (0%)	1 (2%)	0 (0%)	2 (4%)	0 (0%)	18 (60%)	0 (0%)	3 (12%)	24 (8%)	1 (1%)	2 (3%)	21 (26%)
Total	96 (100%)	52 (100%)	16 (100%)	48 (100%)	28 (100%)	30 (100%)	25 (100%)	25 (100%)	320 (100%)	164 (100%)	76 (100%)	80 (100%)

Source of data: Result of Hearing Survey on PAPs, conducted by the JICA Study Team in November 1999.

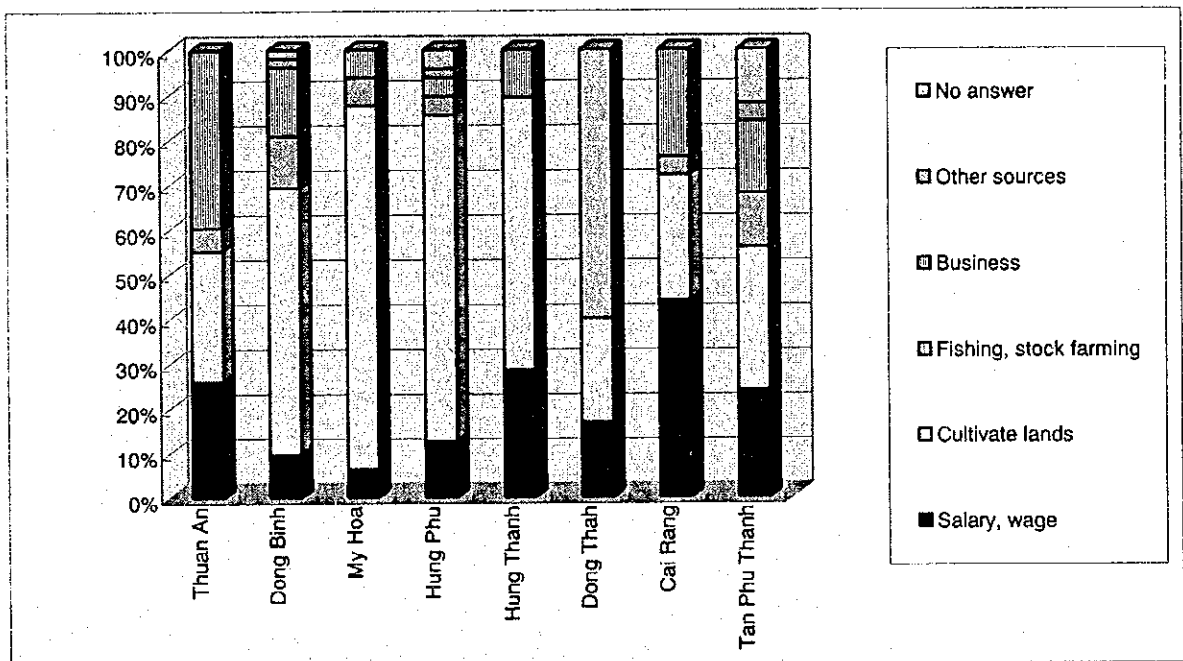


Figure 10.4 Differences in Main Source of Income Among Residents in Different Administrative Units

The residents in Thuan An Ward may earn high income by exploiting their residential lands which are close to National Highway No.1, and are easy to open small shops or run some kinds of business. Also, the residents in My Hoa Ward may be benefited by the geological characteristics of their cultivated lands which are favorable for planting high economic valuable agricultural products such as the Nam Roi grapefruit tree.

(4) Living conditions of the peddlers, the shop-owners, etc., at the ferry crossing

Results of the hearing survey (carried out by RITST in February 1998) to 53 peddlers doing business activities at the existing ferry crossing, show that about 74% of the interviewed peddlers are living in Vinh Long Province, while only 26% are living in Can Tho Province. About 52% of them are less than 20 years-old, and only 26% of them have attended education higher than the junior high schools. Their average daily incomes are about 32,000VND, and based mainly on the sale of goods such as cakes, beverages, tobacco, etc.

In addition, results of other hearing survey carried by the same institute to 200 residents who are owners of the shops or are living close to the existing ferry terminals, show that 59% of these households have annual income of more than 9 million VND. Only 4% of these households have children who use the ferry for going to schools. The existing ferry is more necessary for these residents as a transportation mean for going to the hospitals. 58% of interviewed residents in Binh Minh District answered that they usually use the ferry for going to the hospitals in the Can Tho City.

(5) Community Environmental Concerns

a) Knowledge on the Project

At the time when the hearing survey in June and July 1999 was carried out, 18% of the interviewed residents still answered that they had not known anything about the Project. Other 82% answered that they had known something about the Project, and to them, the most important source of information is 'rumor', instead of massmedia such as news papers or televisions, radios. Another great part of them answered that they had known about the Project by other ways which seem to be the information disseminated by the local authorities or the EIA Study Team through the hearing surveys conducted in the past.

Table 10.11 Knowledge on the Project

Province Group	Can Tho				Vinh Long			Total
	1	2	3	4	1	2	3	
Haven't known on the Project	4 (14%)	6 (25%)	0 (0%)	9 (36%)	14 (30%)	2 (7%)	0 (0%)	35 (18%)
Known by newspapers	2 (7%)	2 (8%)	3 (18%)	0 (0%)	1 (2%)	4 (15%)	7 (27%)	19 (10%)
Known by radio/tivi	2 (7%)	1 (4%)	2 (12%)	5 (20%)	2 (4%)	0 (0%)	2 (8%)	14 (7%)
Known by rumours	11 (38%)	10 (42%)	8 (47%)	7 (28%)	22 (48%)	3 (11%)	4 (15%)	65 (34%)
Known by other ways	10 (34%)	4 (17%)	4 (24%)	4 (16%)	7 (15%)	15 (56%)	12 (46%)	56 (29%)
No answer	0 (0%)	1 (4%)	0 (0%)	0 (0%)	0 (0%)	3 (11%)	1 (4%)	5 (3%)
Total	29 (100%)	24 (100%)	17 (100%)	25 (100%)	46 (100%)	27 (100%)	26 (100%)	194 (100%)

Note:

1. Can Tho 2 includes the Communities C2, C3 and C4 described in Figure 10.1
2. Can Tho 3 includes the Communities C5 and C6 described in Figure 10.1
3. Vinh Long 2 includes the Communities V2, V3 and V4 described in Figure 10.1

Source of data: Result of Hearing Survey on PAPs, conducted by EPC in June and July 1999.

b) Opinion on the Project

A majority (70%) of interviewed residents answered that they are in favor of the Project. Among the interviewed residents living along the existing NH1 in Binh Minh District, 17% are opposed to the Project, and 37% could not clearly express whether they are in favor or opposed to the Project.

c) Environmental issues concerned

The environmental issues which are mostly concerned by the residents living along the existing NH1 in Binh Minh District are the relocation of dwellings and croplands. In general, these issues are also the most concerned issues in other communities in the Project area. Through the hearing survey, 10 typical issues on environment were listed, and one interviewee was allowed to select 3 issues as his/her most concerned ones. The result shows that 171 interviewees (or 88% of total interviewees) had chosen "the relocation of dwellings and croplands" as their most concerned issue. Other major concerned issues are: "the insufficient compensation for restoring livelihoods" (62%), and "the unfair compensation for loss of land and dwelling" (58%).

Table 10.12 Environmental Issues Concerned by the Project-Affected Peoples

Province Group	Can Tho				Vinh Long			Total
	1	2	3	4	1	2	3	
Relocation of dwellings and croplands	28 (97%)	22 (92%)	16 (94%)	23 (92%)	36 (78%)	21 (78%)	25 (96%)	171 (88%)
Removal of ancestor tombs	18 (62%)	14 (58%)	9 (53%)	6 (24%)	12 (26%)	11 (41%)	11 (42%)	81 (42%)
Discontinuation of children schooling	2 (7%)	4 (17%)	5 (29%)	6 (24%)	9 (20%)	4 (15%)	12 (46%)	42 (22%)
Decrease in income	11 (38%)	7 (29%)	10 (59%)	18 (72%)	27 (59%)	10 (37%)	21 (81%)	104 (54%)
Unfair compensation for loss of land and dwelling	17 (59%)	18 (75%)	12 (71%)	11 (44%)	25 (54%)	11 (41%)	19 (73%)	113 (58%)
Natural environmental degrading	1 (3%)	0 (0%)	2 (12%)	1 (4%)	0 (0%)	0 (0%)	0 (0%)	4 (2%)
Pollution caused by the increased traffic volume	2 (7%)	1 (4%)	3 (18%)	2 (8%)	0 (0%)	0 (0%)	0 (0%)	8 (4%)
Increase in traffic accident, and spread of infectious disease	1 (3%)	0 (0%)	1 (6%)	2 (8%)	0 (0%)	0 (0%)	0 (0%)	4 (2%)
Insufficient compensation for restoring livelihoods	22 (76%)	22 (92%)	7 (41%)	11 (44%)	19 (41%)	15 (56%)	24 (92%)	120 (62%)
Difficulty in establishing new neighborhood	14 (48%)	4 (17)	5 (29%)	9 (36%)	23 (50%)	6 (22%)	13 (50%)	74 (38%)
Other reasons	1 (3%)	1 (4%)	0 (0%)	3 (12%)	2 (4%)	2 (7%)	0 (0%)	9 (5%)

Note:

1. Can Tho 2 includes the Communities C2, C3 and C4 described in Figure 10.1
2. Can Tho 3 includes the Communities C5 and C6 described in Figure 10.1
3. Vinh Long 2 includes the Communities V2, V3 and V4 described in Figure 10.1

Source of data: Result of Hearing Survey on PAPs, conducted by EPC in June and July 1999.

10.5.2 Projected Socio-Economic Impacts

(1) Major Impacts on Socio-Economic Environment

Figure 10.5 summarized the key impacts which may be caused by the construction of the Can Tho Bridge on the socio-economic environment of the Study area.

Before and during the construction phases, these impacts may be described as follows:

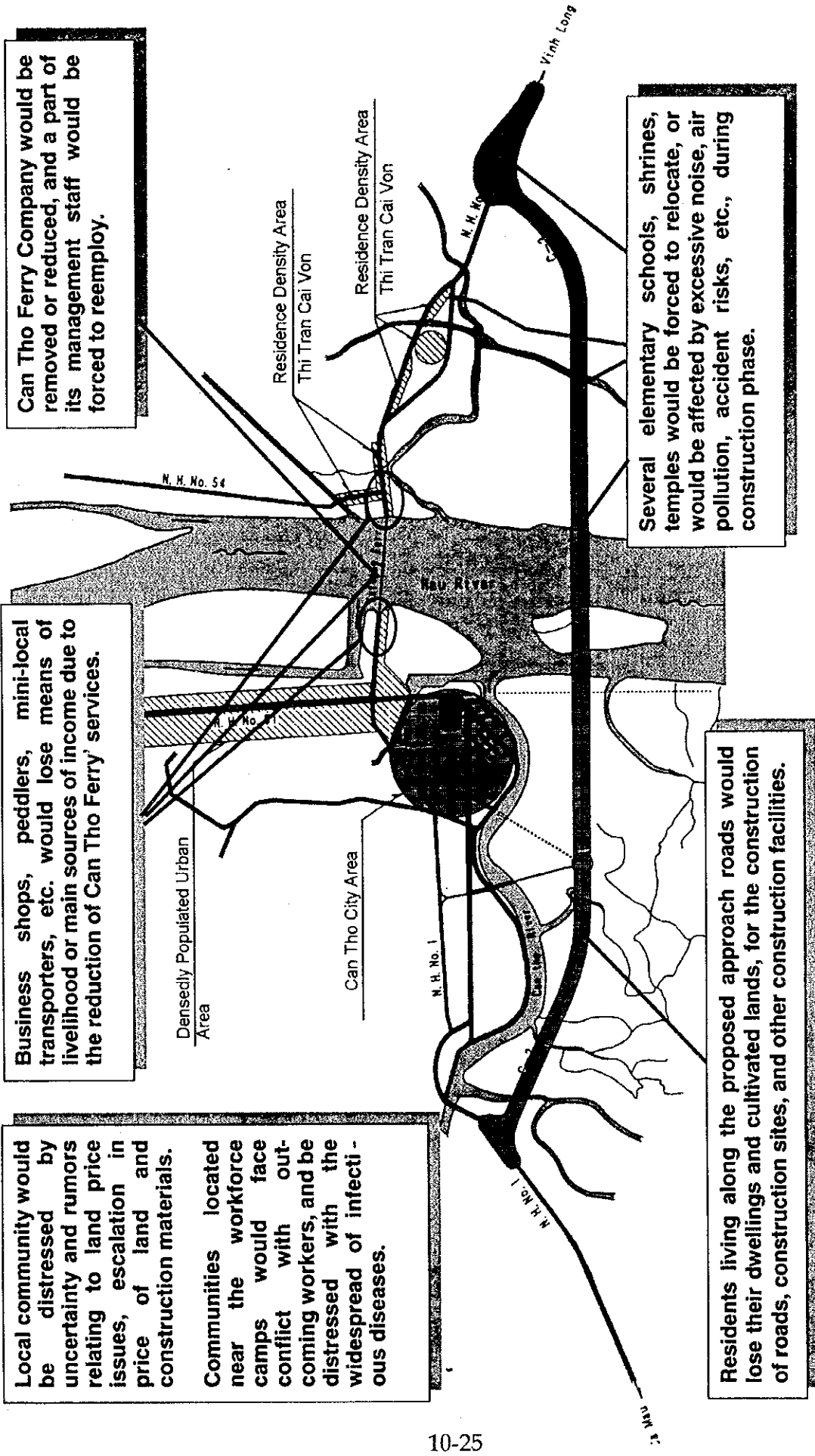
- A number of residents would lose their dwellings or cultivated lands and would be forced to resettle (hereinafter refer to as the Project-Affected People, or PAP) to acquire lands for the Project,
- The local community would be distressed by rumors relating to land price issues, and would be affected by the escalation in the price of land and construction materials,

Local community would be distressed by uncertainty and rumors relating to land price issues, escalation in price of land and construction materials.

Communities located near the workforce camps would face conflict with outcoming workers, and be distressed with the widespread of infectious diseases.

Business shops, peddlers, mini-local transporters, etc. would lose means of livelihood or main sources of income due to the reduction of Can Tho Ferry' services.

Can Tho Ferry Company would be removed or reduced, and a part of its management staff would be forced to reemploy.



Residents living along the proposed approach roads would lose their dwellings and cultivated lands, for the construction of roads, construction sites, and other construction facilities.

Several elementary schools, shrines, temples would be forced to relocate, or would be affected by excessive noise, air pollution, accident risks, etc., during construction phase.

Figure 10.5 Major Impacts of the Can Tho Bridge Construction Project on Socio-Economic Environment

- A conflict between local residents and the construction workers, who come from other provinces, would be unavoidable,
- There would be a widespread of infectious diseases in the local community,
- One elementary schools, and one solid waste disposal site would be affected, and would need to be relocated,
- Several schools, shrines/temples would suffer significant impacts of noise, air pollution, accident risks, etc.

(2) Impacts of Land Acquisition and Resettlement

a) Quantity of likely affected lands

Table 10.13 shows the areas of the lands to be acquired by the Project, which were estimated based on the 1:500 scale maps. About 265.8 ha of land was estimated to be acquired for the Project, including 194.0 ha for the approach roads, 62.2 ha for the construction yards, and 9.6 ha for the resettlement sites. The lands for the approach roads and the resettlement sites will be eternally acquired, while the lands for the construction of the resettlement sites will be temporarily acquired and will be handed back to the land users after the completion of the Project in principle.

Table 10.13 Areas of Lands to be Acquired by the Project (unit: m²)

	Vinh Long Province	Can Tho Province	Total
1. Lands for approach roads	940,852	999,122	1,939,974
a) Annual crop lands	537,268	380,039	917,307
b) Perennial crop lands	351,984	547,683	899,667
c) Residential lands	51,600	71,400	123,000
2. Lands for construction yards	352,500	270,000	622,500
a) Annual crop lands	144,500	79,500	224,000
b) Perennial crop lands	196,000	183,500	379,500
c) Residential lands	12,000	7,000	19,000
3. Lands for resettlement sites	64,000	32,000	96,000
a) Annual crop lands	55,000	25,000	80,000
b) Perennial crop lands	6,000	6,000	12,000
c) Residential lands	3,000	1,000	4,000
Total lands for the Project	1,357,352	1,301,122	2,658,474
a) Annual crop lands	736,768	584,539	1,221,307
b) Perennial crop lands	553,984	737,183	1,291,167
c) Residential lands	66,600	79,400	146,000

b) Number of likely affected dwellings

Although the proposed approach roads are planned to be located at the areas which consist of mainly rice paddy and crop lands, there are a number of residents whose dwellings and residential lands may be acquired to make space for the construction of approach roads, service areas, construction sites, resettlement sites, and other relevant facilities.

Table 10.14 shows the estimated number of likely affected dwellings.

Table 10.14 Estimated Number of Likely Affected Dwellings

House classification	Vinh Long Province		Can Tho Province		Total	
	Quantity	Area (m ²)	Quantity	Area (m ²)	Quantity	Area (m ²)
House of Class I	2	300	4	600	6	900
Permanent house (class II)	7	700	15	800	22	1500
Semi permanent house (class III)	61	4,270	75	5,250	136	9,520
Temporary house (class IV)	184	11,040	205	12,300	389	23,340
Total	254	16,310	299	18,950	553	35,260

(3) Affected Schools and Other Public Facilities

It is anticipated that a part of land of the following public facilities would be acquired to make place for the Project:

- a) The elementary school 'Thuan An B', located in Thuan An Ward, Binh Minh District, whose a part of land and school facility would be acquired for make land to construct the Interchange No.1, connecting the existing NH1 to the proposed approach road (see Figure 10.6);
- b) The solid waste disposal site, located in Tan Phu Thanh Ward, Chau Thanh District, whose a part of land would be acquired to make land to construct the Interchange No.4, connecting the existing NH1 to the approach road in the south of the Project;
- c) About 27 poles of high voltage electric power, and 150 poles of low voltage electric power along the approach roads.

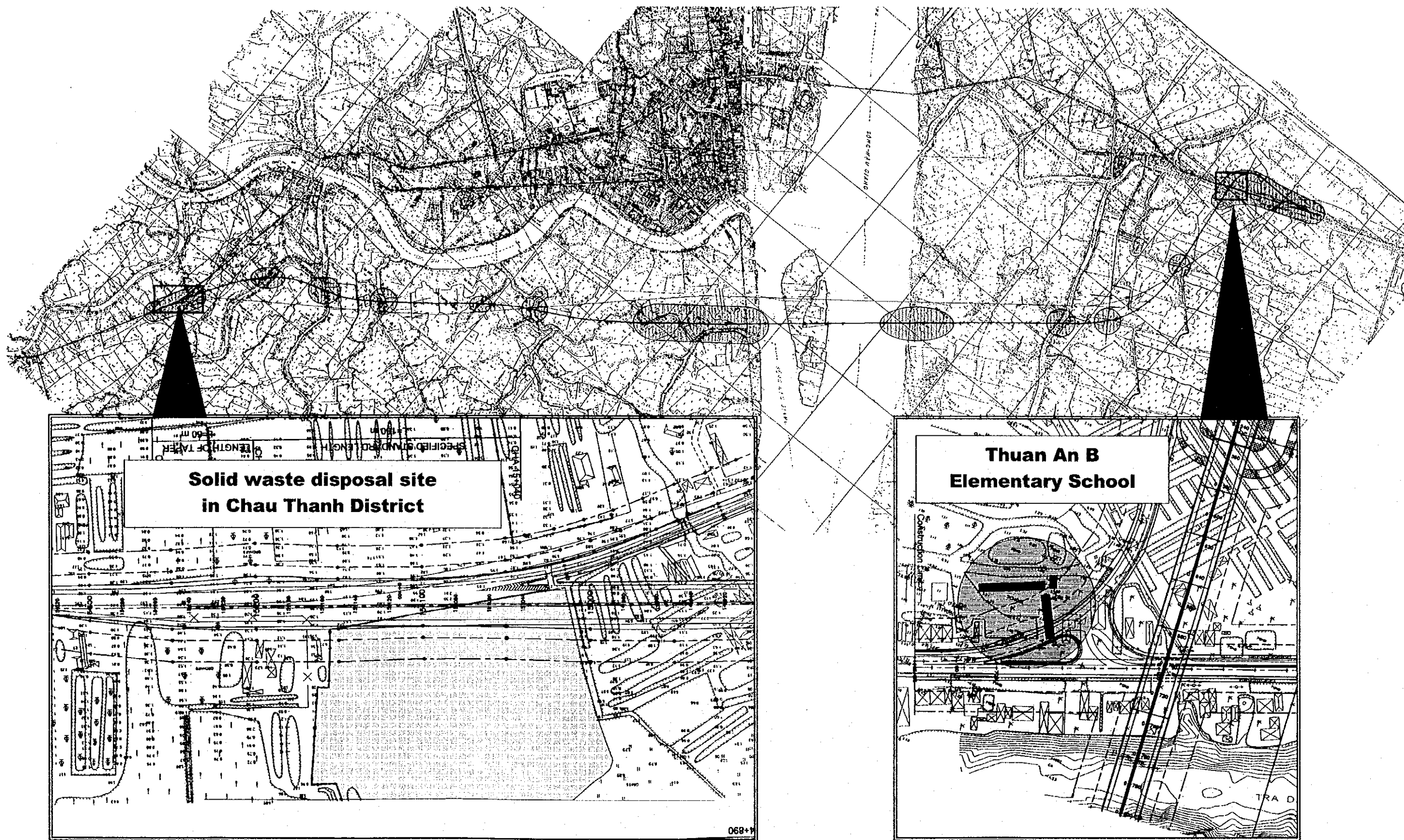


Figure 10.6 Location of the Affected Elementary School and the Solid Waste Disposal Site

(4) Increase in Prices of Land and Construction Materials

News about the plan to implement the Can Tho Bridge Construction Project has been widespread nationwide, and during the long time period of the pre-construction phase, the residents in the provinces of Vinh Long and Can Tho are being distressed by the uncertainty caused by the rumors about the construction of the Can Tho Bridge. The land price at the areas surrounding the proposed bridge site seems to be increasing, and this phenomenon would continue to occur in the future.

The price of construction materials would escalate if it appears there is a need to provide houses to workers who come from other provinces.

(5) Impacts on Public Health and Others

If a significant number of construction workers come from other regions, the threat to public health and hygiene caused by the spread of AIDS/HIV and other sexually transmitted diseases as a result of an increase in prostitution will become a reality. The conflict between local residents and outside workers would also be another threat to the stability of the local communities.

Water pollution, air pollution, excessive noise, vibration caused by construction works would disturb the physical environment and create adverse affects to the health of residents living close to the construction sites. Pupils of two elementary schools located close to the proposed approach roads, and the construction yards would suffer significant impacts on their health if their schools are not relocated.

(6) Adverse Impacts on Local Economic Activities

There are about 90 small business shops located along the access roads close to the terminals of the existing Can Tho Ferry (65 shops at the Vinh Long terminal, and 25 shops at the Can Tho terminal). In addition, there are about 150 peddlers and local transporters, etc., who have some sources of income depending on the business activities on the ferries or at the ferry terminals. These shopkeepers, peddlers, transporters, etc., would lose their means of livelihood or main sources of income due to the reduction of the Can Tho Ferry's services after the construction of the Can Tho Bridge.

Almost all of interviewed peoples who are running the shops at the ferry terminals said that their business is their main source of income. Therefore, a decrease in number of ferry passengers caused by the

reduction of the Can Tho Ferry's services after the completion of the bridge would significantly affect their livelihoods.

In addition, a part of the Can Tho Ferry Company's management staff would be forced to re-employ or move to other regions due to the restructuring of the company after the construction of the bridge. After the completion of the bridge, depending on the number of local people employed on the construction site, there would be a sudden increase in unemployment in the local communities.

(7) Hazards and Risk

The risks of traffic accident along the approach roads would grow higher, as a result of the increase in traffic volume and vehicle velocity.

10.5.3 Measures for Mitigating the Adverse Impacts on Socio-Economic Environment

(1) Setting Up of Socio-Economic Environmental Preservation Targets

The main target of the environmental preservation is to examine the appropriate and reasonable measures to avoid, reduce, and mitigate impacts which may be caused by the Project to the environment of the Project area.

The sub-target for socio-economic environmental preservation is to ensure that all project-affected peoples will be able to restore the livelihood and the living standard, soon after the commencement of the Project. For mitigating the adverse impacts on socio-economic environment, the Compensation Program and the Resettlement Plan would be formulated and implemented in a fair and impartial manner, and facilitate the smooth implementation of land acquisition without any severe residents' resistance.

(2) Resettlement Action Plan

The Resettlement Action Plan (RAP) consists of two major parts: (1) the Compensation Program, and (2) the Resettlement Plan. The main objective of the RAP is to improve or at least to restore the former living standards, as well as the income earning capacity and the production levels of the residents, whose cultivated lands or dwellings or properties are affected by the Project.

The contents of this RAP are described in detail in the document titled "Resettlement Action Plan for the Can Tho Bridge Construction

Project", prepared by the EPC in December 1999. The summary of this document is described as follows.

a) Setting up of the principles of the Resettlement Action Plan

The principles of the RAP are set up in order to meet the following requirements, and to achieve the target mentioned above.

- The requirements stipulated in the decrees or regulations enacted by the concerned Vietnamese authorities, relating to the compensation in cases of lands are acquired for the public projects;
- The requirements made by JICA and JBIC, which aim at the mitigation of adverse impacts caused by the project on socio-economic environment;
- The wishes of the likely-affected residents, and the comments of the persons in charge in the local authorities, collected through the hearing surveys conducted in the stages of Feasibility Study and Detailed Design.

b) Principles of the Resettlement Action Plan

- Avoid and reduce the loss of lands and properties, where ever it is possible. In order to achieve this objective, the alignment of the approach roads, the allocation of the construction yards and other facilities associated with the Project, should be carefully undertaken, taking into consideration the comments of the persons in charge in local agencies.
- The data collected through the detailed household surveys conducted by the local resettlement committees, will be used as the formal data for calculation the compensation amount to be paid to the PAPs.
- The principles set up for the Resettlement Action Plan will be applied for both Vinh Long Province and Can Tho Province. The compensation rates will be determined by the Province Peoples' Committees, based on the land price unit, house price unit, etc., being enacted in the provinces.
- The PAPs should all be entitled to receive the compensations and allowances, including: (1) compensations for all parts of

acquired land; (2) compensation for all properties, assets, structures, and other additional works which are built on, or installed in the acquired lands; (3) allowances for relocation, subsistence allowances, compensation for lost business, incomes and wages; (4) rehabilitation assistance including vocational training, employment assistance, for those who have to seek new means of livelihood (in line of the Article 4 of Decree No.22/1998/ND-CP).

- The rates of compensations and other allowances should be determined in a fair, impartial, and reasonable manner, so as it is proportionate to the losses that the PAPs have to suffer in actuality. The subsistence allowance, the compensation for lost business, incomes and wages provided to the PAPs should be extended during the whole time span that is long enough for the PAPs to build their new houses and rehabilitate their production facilities.
- The lost lands should be compensated by lands of similar surface area and classification. If a PAP lost a piece of cultivated land, he/she should be compensated by cultivated land of similar surface area and similar category. In case that there is no suitable land for compensation by land, the PAPs may be compensated by cash, with appropriate compensation rate determined in line of Article 8 of Decree 22/1998/ND-CP.
- The following cases should be appropriately considered: (1) the PAP who would lose main sources of income based on the acquired lands (e.g. cultivated lands, stockfarming lands, land-based production, etc.); and (2) the PAP who has low income and is difficult to change his/her livelihood. These PAPs should have priority to obtain vocational training, soft loans, and other necessary assistances to seek new cultivated lands or new jobs for regaining their livelihoods.
- The PAP who would lose his/her residential lands and dwellings, and whose remained lands are not available to resettle, should be provided sufficient compensations, assistances, guidances, etc., to seek the new residential lands close to the former resident, in order to avoid the difficulty in establishing new neighborhood, and avoid the discontinuation of children' schooling. The PAP who can not seek new residential land close to his/her former resident,

should be entitled to have a plot of land in the designed Resettlement Site which is closest to his/her former resident.

- The houses and assets, including the temporary houses, the huts, and other additional works which are built on the acquired lands should be compensated by the cost required for rebuilding the same things at the new resident, with the actual market price.
- The determination of compensation rate for the loss of perennial crop trees should be based on the real value of these trees. The Province Peoples' Committees should determine the compensation rate for each kind of crop tree, taking into consideration the actual productivity and the economic value of these trees.
- Community and PAP participation should be actively encouraged and ensured.
- The impacts of the Project on socio-economic environment of the Project area, as well as the progress of the implementation of the RAP should be monitored by PMU My Thuan (as a internal monitoring agency), and by an independent agency (as an external monitoring agency). Specified monitoring reports should be prepared and submitted to MOT and JBIC at a certain time interval, during the pre-construction phase, the construction phase, and the operation phase.

c) Compensation items

The following compensation items are considered in the Compensation Program:

- The loss of lands, including the residential lands, the cultivated lands, etc.;
- The loss of dwellings and other properties such as the ponds, the gardens, etc., laying on the lost lands;
- The relocation of the tombs, the garden trees, etc;
- The loss of lands associated with the religious or cultural facilities, such as temples, churches, etc., and the structures or assets built on these lands;

- The relocation of the public facilities, transportation facilities, urban infrastructure, etc.

d) Other subsidies and allowances

In addition to these compensation items, the following subsidies and allowances are also proposed in the Compensation Program in order to mitigate the impacts to the PAPs.

- Subsidies for stabilizing the production activities, including the subsidies for re-employment, the subsidies for the discontinuation of production activity, etc;
- Subsidies for the dismantling and relocation of the properties;
- Subsidies for the PAPs who voluntarily resettle by their own efforts without the involvement of the relevant agencies;
- Rewards for the PAPs who promptly resettle, and clear their lands before the time limit.

e) Resettlement Plan

Three Resettlement Sites (RSs) being designed for the PAPs who would lose their dwellings, and have no other appropriate land for relocation.

The locations of these RSs are shown in Figure 10.7. The technical specifications of these RSs are summarized in Table 10.15.

Table 10.15 Outlines of the Resettlement Sites

	Resettlement Site in Binh Minh	Resettlement Site in Hung Phu	Resettlement Site in Chau Thanh
Location	- Dong Binh Ward, Binh Minh District, Vinh Long Province (beside NH54, close to the Interchange 2)	- Xom Chai, Hung Phu Town, Can Tho City, Can Tho Province (in the new residential zone planned by the Can Tho City)	- Tan Phu Thanh Ward, Chau Thanh District, Can Tho Province (beside NH1, close to the Interchange 4)
Total surface area	- 60,645 m ²	- 10,815 m ²	- 21,250 m ²
Number of lots	- 149 lots	- 22 lots	- 57 lots
Average lot area	- 250 m ²	- 126 m ²	- 200 m ²
Planning ground level	- 2.5m	- 2.5m	- 2.5 m
Accessibility	- Both Nation Highway No.54, and Tra On River can be used to access to the Cai Von City located about 2 km in the north of the RS.	- A road of 400m extension is planned to link the Resettlement Site with the proposed approach road, at the location close to the toll gate.	- Both Nation Highway No.1, and Ba Lang River can be used to access to the Can Tho City located about 8 km in the north-east of the RS.
Infrastructure	<ul style="list-style-type: none"> - Internal road system, with lighting system, planting trees along the sidewalks. - Water supply system. - Electric power supply system. - Drainage system (designed for both sewage and storm water drainage). - Necessary facilities for the appropriate management of solid waste. 		
Public facilities	- Public toilets - Water treatment plant and elevated tank	- Public facilities to be built as parts of the new residential zone are also available to the RS residents.	- Public toilets-Water treatment plant and elevated tank

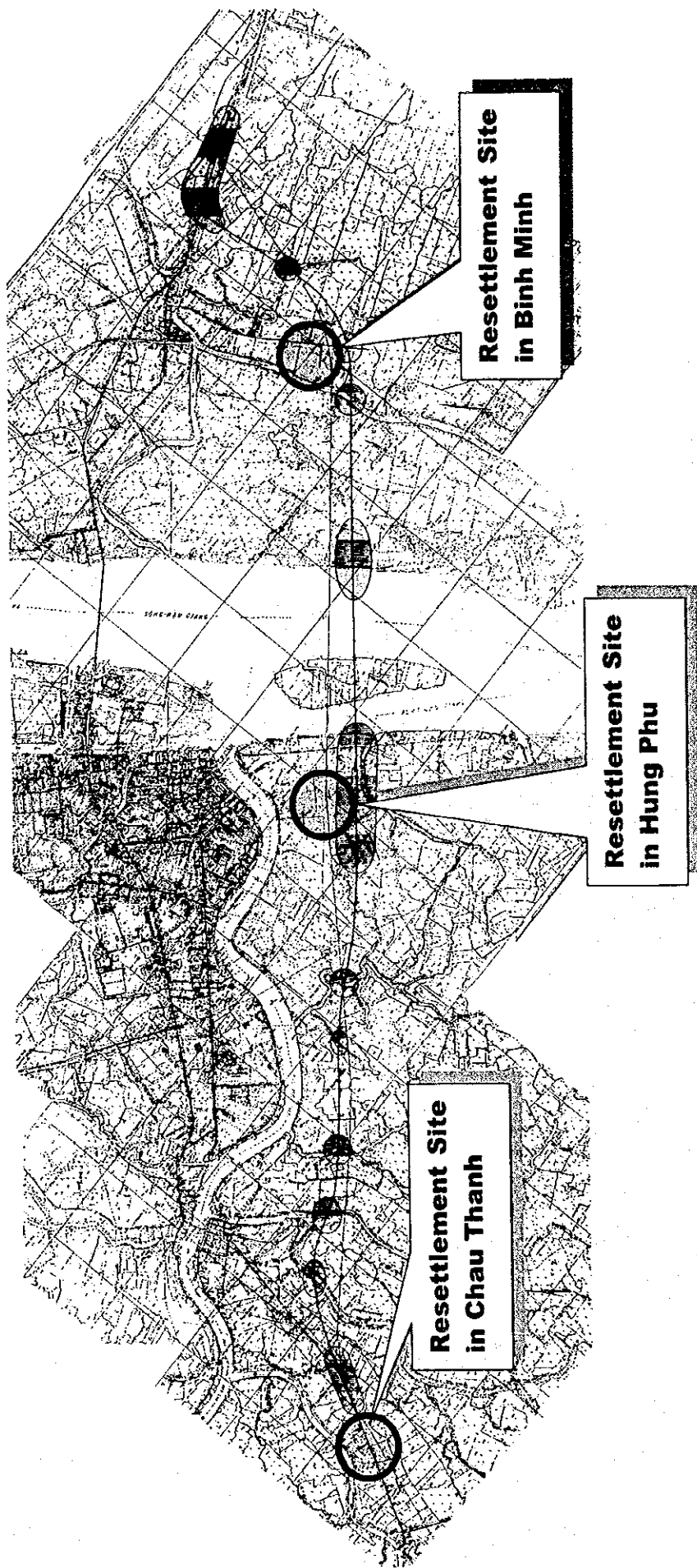


Figure 10.7 Locations of the Resettlement Sites designed for the Can Tho Bridge Construction Project

f) Public Information

The Public Information Campaign and the PAP Consultation Program were prepared as parts of the RAP, in order to reduce the potential for conflicts, and minimize the risk of project delays.

The PAPs will have an avenue to redress their grievances. If any PAP is aggrieved by the decision of the District Compensation Committee, regarding any aspect of the compensation or other benefit due to him/her, he/she can prefer an appeal to the Provincial Resettlement Committee, or to the civil court.

g) Procedure and Institutional Arrangement

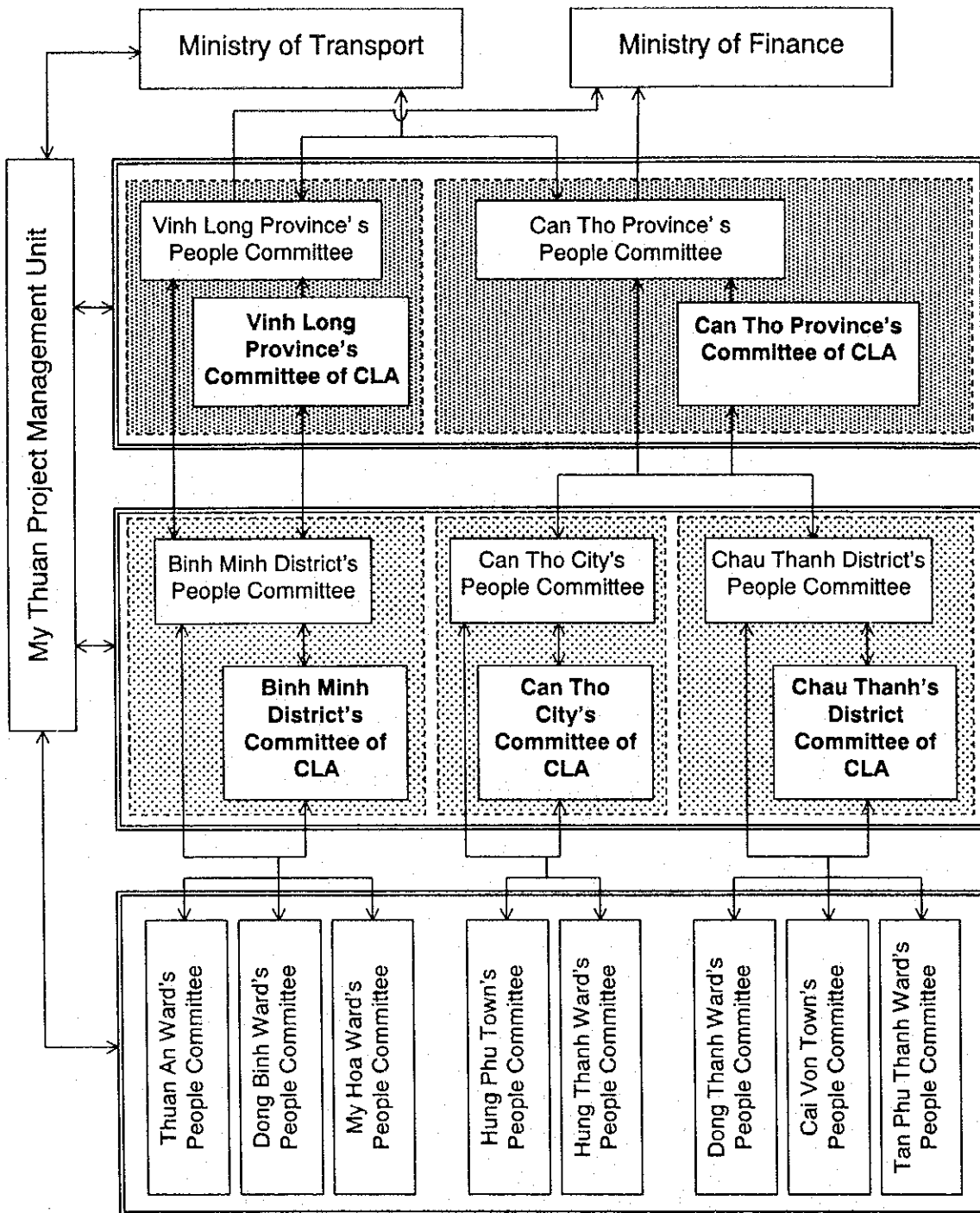
Figure 10.8 describes the procedure and the agencies in charge of carrying out the land acquisition, and the implementation of the RAP. Beside the ordinary agencies which are under direct control of the People's Committees, there are five special organizations which were established and are playing the important roles in implementing the RAP. These are:

At the provincial level:

- (1) the Vinh Long Province's Committee of Compensation for Land Acquisition (*Ban Giai Phong Mat Bang Tinh Vinh Long*);
- (2) the Can Tho Province's Committee of Compensation for Land Acquisition (*Hoi Dong Den Bu Thiet Hai Giai Phong Mat Bang Tinh Vinh Long*);

At the district level:

- (3) the Binh Minh District's Committee of Compensation for Land Acquisition (*Hoi Dong Den Bu Thiet Hai Giai Phong Mat Bang Huyen Binh Minh*);
- (4) the Can Tho City's Committee of Compensation for Land Acquisition (*Ban Den Bu Thiet Hai Giai Phong Mat Bang Tinh Can Tho*);
- (5) the Chau Thanh District's Committee of Compensation for Land Acquisition (*Ban Den Bu Thiet Hai Giai Phong Mat Bang Huyen Chau Thanh*);



* Note) Committee of CLA: Committee of Compensation for Land Acquisition
(Hoi Dong Den Bu Thiet Hai Giai Phong Mat Bang, or Ban Den Bu Thiet Hai
Giai Phong Mat Bang)

Figure 10.8 Organizations and Procedure for the Resettlement Action Plan Implementation

h) Proposed time schedule for land acquisition

Figure 10.9 shows the tentative time schedule for carrying out the land acquisition, the compensation program, and the resettlement plan.

According to this proposed time schedule, the PMU My Thuan should prepare a detailed Resettlement Action Plan, and submit this RAP to the MOT by the end of July 2000. To ensure that the construction works can be commenced in August 2001, the components proposed in the RAP, such as the announcement on land acquisition to public, the relevant negotiation with PAPs, payment of compensation, resettlement, etc., should be completed in a 8-month period, if it is accepted by the Ministry of Finance, and the MOT at the end of August 2000.

Figure 10.9 Tentative Working Schedule for Carrying Out the Land Acquisition

(3) Assistance to Those Who Lost their Livelihood at the Ferry Crossing

Appropriate measures should be implemented to help the PAPs, whose livelihoods are depending on the business or service activities on the existing ferries or at the ferry terminals.

Two service areas at two sides of the proposed bridge are designed to provide these PAPs with places to continue their former businesses. The project-affected shopkeepers, the peddlers at the existing ferry terminals can have priority to move into one of these two service areas and carry out substitute businesses to maintain their livelihood.

Beside the construction of these two service areas, other measures such as the following are proposed to mitigate the adverse impacts caused by the Project to the residents whose livelihood is depending on the existing ferry:

- Training on some viable forms of food processing which could be undertaken at the households level.
- Establishment of some forms of soft loans, to help affected residents, especially the peddlers, who intent to carry out new business plan, but do not have sufficient finance.

(4) Other Mitigatory Measures on Socio-Economic Adverse Impacts

Other measures, such as the following are also considered to be necessary for mitigating the adverse impacts caused by the Project on socio-economic environment:

- The provincial Departments of Labor, Disabled Soldiers and Social Welfare, and/or the local branches of the Labor Union should be entrusted to establish an employment register of local people with relevant skills interested in obtaining works related to the bridge construction project.
- The staff members of the Can Tho Ferry Company, who would lose their current jobs due to the reduction of their company after the completion of the bridge, should be given priority to be employed at the companies to be entrusted to undertake the bridge operation/maintenance works.
- The plan to establish the gardening-tourism areas in the southern part of the Binh Minh District and in the Con Au Island should be pushed forward, to create new jobs for local residents, especially for the peddlers, the local transporters who would lose main

source of income due to the reduction of the Can Tho Ferry. Such tourism areas may also serve as places to absorb unemployed workers after the completion of the bridge.

- The relocation of the elementary schools in the Binh Minh District, and the solid waste disposal site in the Chau Thanh District affected by the Project should be carefully examined. The relevant relocation plans should be prepared and included in the detailed RAP to be submitted to the MOT.
- Assistance should be provided for the establishment and upgrading of the local clinics on either sides of the river, to help construction workers and local residents in medical examining and treating of minor illnesses. Some of these local clinics may be entrusted to monitor the socio-economic impacts (by collecting data on residents' health condition), with a reasonable financial support.
- Consideration should be given to help dislocated families who need to remove their ancestor tombs. Usually, the removal of these tombs would have to be done by a professional on a determined day and at time set by an astrologist.

10.5.4 Monitoring Program for the Socio-Economic Impacts

Regular monitoring of the implementation of the RAP and other measures for mitigating the adverse impacts on socio-economic environment should be conducted both by PMU-My Thuan (internal monitoring), and by an independent external monitoring agency.

(1) Internal Monitoring

PMU-My Thuan will be solely responsible for the internal monitoring of all aspects relating to the implementation of the RAP and other measures for mitigating the adverse impacts on socio-economic environment.

The indicators to be monitored should include the following:

- Payment of compensation amounts, subsidies, allowances to the PAPs;
- Implementation of public information and consultation procedures;
- Grievance procedures;
- Design and construction of the Resettlement Sites, its lot

- allocation, operation, etc.;
- Restoration of public facilities and infrastructure affected by the Project;
- Job inventory;
- Provision of soft loans, training, and other kinds of assistance.

Every month, the staff of the PMU-My Thuan should collect the relevant information, and update the database which will be built up to store and compile these information.

The monitoring reports should be prepared by the PMU-My Thuan and submitted to the MOT and the JBIC at intervals of 3 months.

(2) External Monitoring

An independent monitoring agency should be entrusted by the PMU My Thuan, to undertake the monitoring of changes in socio-economic environment of the project area. This monitoring agency should conduct the surveys necessary for the assessment on living standard, income, etc., of the PAPs, during the pre-construction phase, the construction phase, and the first six months of the operation phase.

The indicators to be monitored and assessed include the following:

- Payment of compensation amounts, subsidies and other allowances;
- Progress of the construction of the Resettlement Sites, and the implementation of the RAP, as well as the land clearance;
- Restoration of public facilities (such as the elementary schools, the solid waste disposal site, the electric power poles, etc.);
- Lot allocation and house construction at the Resettlement Sites;
- Implementation of Public Information Campaign, PAP Consultation Program;
- PAPs' living standards;
- PAPs' income levels;
- Level of PAPs' satisfaction;
- Addressed PAPs' grievances, and the efficiency of the grievance redress system;
- Procurement and market price of the construction materials;
- Employment opportunities, and relevant endeavors to help the PAPs to regain/improve their income status (such as new job creation program, vocational program, provision of soft loan, etc.)
- Productivity of PAPs who are farmers, gardeners, stockfarmers, home-based producers, etc.;

- Community health, widespread of infectious diseases, etc.

The monitoring agency should successively collect the relevant information, and update the database which stores these information every month.

The monitoring reports should be prepared and submitted to the PMU-My Thuan at the intervals of 3 months. In cases of necessary, meetings should be held with the attendance of the persons in charge of PMU My Thuan and the monitoring agency, to discuss about the problems identified, the solutions, and the need of carrying out the follow-up surveys or actions.

The roughly estimated cost for external monitoring is US\$110,000 for 2 ~ 6 local experts, working during about 6 years of the pre-construction phase, construction phase, and operation phase.

10.6 Cost Estimate for Environmental Measures and Monitoring

10.6.1 Cost for Land Acquisition and Mitigating Impacts on Socio-Economic Environment

(1) Compensation Cost for the Loss of Lands

Item	Unit	Quantity	Unit Price (×1000VND)	Cost (×1000VND)
Residential land	m ²	146,200	150	21,900,000
Annual cropland	m ²	1,221,307	5	6,106,535
Perennial cropland	m ²	1,291,167	19	24,532,173
Total		2,676,674		53,538,708

(2) Compensation Cost for the Loss of Dwellings and Other Assets

Item	Unit	Quantity	Unit Price (×1000VND)	Cost (×1000VND)
House of class I	m ²	900	1,300	1,170,000
Permanent house (class II)	m ²	1,500	950	1,425,000
Semi permanent house (class III)	m ²	9,520	650	6,188,000
Temporary house (class IV)	m ²	23,340	300	7,002,000
Other assets				5,000,000
Total				20,785,000

(3) Other Costs and Allowances

Item	Unit	Quantity	Unit Price (×1000VND)	Cost (×1000VND)
Compensation for loss of harvest				12,000,000
Subsidy for house relocation	Family	500	2,000	1,000,000
Subsidy for stabilization of living	Person	2,500	900	2,250,000
Subsidy for low income PAP		500	1,000	500,000
Vocational training		150	2,000	300,000
Award for prompt relocation	Family	500	1,000	500,000
Subsidy for self-resettlement	Family	50	20,000	1,000,000
Total				17,550,000

(4) Costs for Construction of the Resettlement Sites

Item	Unit	Quantity	Unit Price (×1000VND)	Cost (×1000VND)
RS at Binh Minh District	site	1		
RS at Can Tho City	site	1		
RS at Chau Thanh District	site	1		
Total				30,000,000

(5) Operation Costs for the Resettlement Committees and others

Item	Unit	Quantity	Unit Price (×1000VND)	Cost (×1000VND)
Setting up the pegs for acquired land				600,000
Making the land acquisition map				800,000
Resettlement committees' operation cost				3,000,000
Conducting internal monitoring				500,000
Removal and restoration of the public facilities, infrastructure				2,500,000
Total				7,400,000

(6) Total Costs for Land Acquisition and Mitigating Impacts on Socio-economic Environment

a)	Compensation cost for the loss of lands	52,538.7 million VND
b)	Compensation cost for the loss of dwellings and other assets	20,785.0 million VND
c)	Other subsidies and allowances	17,550.0 million VND
d)	Cost for construction of the Resettlement Sites	30,000.0 million VND
e)	Operation cost for the Resettlement Committees and others	7,400.0 million VND
	Subtotal	128,273.7 million VND
f)	Contingencies (10% of subtotal)	12,827.4 million VND
	Grand total	141,101.1 million VND
	(or 10,114,773 US\$, in case that 1US\$=13,950VND)	

10.6.2 Cost for Implementing Environmental Monitoring Programs

a)	Natural environmental monitoring (see Section 10.4.4)	100,000 US\$
b)	Socio-economic environmental monitoring (see Section 5.5.3)	110,000 US\$
	Total monitoring cost	210,000 US\$

10.6.3 Total Environmental Cost

a)	Cost for land acquisition and mitigating impacts on socio-economic environment	10,114,773 US\$
b)	Cost for implementing environmental monitoring programs	210,000 US\$
	Total environmental cost	10,324,773 US\$