MEKONG-KAMPONG CHAM BRIDGE
ENVIRONMENTAL IMPACT ASSESSMENT CRITICAL REVIEW

PURPOSE

This case study critically evaluates the comprehensiveness and quality of the environmental impact assessment (EIA) completed for the Mekong- Kampong Cham bridge in Cambodia. Course participants will have the opportunity to consider potential environmental impacts of this type of infrastructure project during both the construction and operational phases and to evaluate how EIA findings supported decision making related to the project. Particular attention is given to: (i) the role of monitoring in informing the EIA and follow-up process; (ii) the intention of screening and scoping in determining the coverage of an EIA; (ii) assessing the magnitude and significance of environmental impacts; (iv) adopting appropriate mitigative measures; and (v) deciding what impacts are acceptable.

ETP1 COURSE TOPIC COVERAGE

- ENVIRONMENTAL IMPACT ASSESSMENT (EIA) PROCEDURES
- CHALLENGES IN APPLYING EIA IN THE MRB
- FULL-SCALE EIA
- CUMULATIVE EFFECTS ASSESSMENT (CEA)
- ENVIRONMENTAL SCIENCE IN THE MRB
- ENVIRONMENTAL MONITORING
- ENVIRONMENTAL ECONOMICS
- SOCIO-ECONOMIC IMPACT ASSESSMENT (SIA)

ISSUES

Specific issues highlighted in this case study are:

1. Importance of EIA completeness in anticipating potential environmental impacts in support of the decision-making process for large infrastructure projects
2. Environmental concerns should be considered early in the project planning process to ensure the timely completion of an EIA and the opportunity to respond to recommended mitigation measures in undertaking the project
3. Good science is critical to the credibility of the EIA completed for a project to ensure confidence among all stakeholders and interested parties

LEARNING OBJECTIVES

On completion of this case study, participants will be able to:

- Provide an overview of the EIA process in Cambodia and the responsible agencies
- Compare Cambodian EIA requirements with those of international funding bodies

- Discuss the factors considered in determining the Mekong-Kampong Cham bridge location
- Assess the comprehensiveness of the baseline monitoring program completed as part of the bridge EIA
- Describe the intent and conclusions of the initial environmental examination (IEE) completed for the project
- List and critique the valued environmental components (VEC) identified during the IEE
- Discuss the criteria applied for selecting significant environmental issues (SEI) to be addressed by the EIA
- Describe and critique the EIA's spatial and temporal boundaries
- Comment on the socio-economic issues examined by the EIA and the extent of public participation in project assessment and decision making
- Identify limitations in the cost-benefit analysis completed for the project
- Provide an example of how mitigative measures identified for the project were (or could have been) implemented to avoid or minimize project impacts
- Describe and critique the construction and operational phase monitoring programs
- Consider improvements to the EIA process which could be applied to future infrastructure projects

PROJECT SUMMARY

Introduction and Background

The objectives of the Mekong-Kampong Cham bridge project in Kampong Cham province, 120 km northeast of Phnom Penh, were to:

- Improve road access between Phnom Penh and remote areas in the eastern regions of Mekong River
- Improve the international road network in the Mekong River Basin
- Promote a market-oriented economy
- Promote agricultural development
- Upgrade the living standard in rural communities

In response to a Cambodian government request, the Japanese government provided funding under the Japan International Cooperation Agency (JICA) to conduct a Feasibility Study of the proposed bridge project. This objective of this study was to determine the best location for the bridge crossing among a total of six alternatives in the areas of Neak Leung, Prek Tamak and Kampong Cham. Primary criteria applied in the selection of the recommended bridge location were total project cost, the projected economic internal rate of return (EIRR) and

potential environmental impacts. After taking these critical factors into account, the feasibility study concluded that the Kampong Cham route had significant advantages over the other five alternatives in terms of construction and operating costs and maximizing economic benefits.

Construction is currently underway on the 1,360 m long Mekong-Kampong Cham bridge with completion scheduled for 2002. The estimated project cost is US$79,678,000 of which US$51,003,000 is foreign funded and US$28,675,000 funded by the Cambodian government.

Environmental Impact Assessment Overview

Although the impacts of bridge construction on the environment were considered to be generally minor compared to other large-size infrastructure projects such as roads, railways and dams, a full-scale impact assessment was still considered to be necessary to minimize or even eliminate the adverse impacts caused by implementation of the Mekong-Kampong Cham bridge project.

Major environmental and social concerns raised by the project are air and noise pollution, water quality and aquatic ecology, and human resettlement. Secondary concerns considered were soil erosion and siltation, cultural/historic impacts, environmental aesthetics and traffic-related impacts. Findings of the EIA report and recommended mitigative measures for each of these concerns are summarized below.

Air Quality

Existing air quality monitoring data collected from six stations near the bridge location showed nitrogen oxide levels ranging from 3 to 18 ppm, which was well below both the Japanese and Thai government standards of 290 ug/m^3 and 320 ug/m^3, respectively.

To maintain good existing air quality during the construction phase of the bridge, sprinkling of water and chemicals was considered to be an efficient means to alleviate impacts to area residents. Additional measures proposed to minimize air quality impacts included: (i) completion of concrete mixing at isolated sites away from local communities; (ii) storage of bulk construction materials in closed silos with appropriate dust preventing filters; (ii) enclosing work structures to minimize emissions; and (iv) confining construction vehicles to designated routes only.

Recommended monitoring measures during the construction phase focused on measurement of total suspended particulates in air to ensure that dust levels, which are considered the major disturbance to humans, were closely controlled. Operational monitoring to be carried out at least every five years will include measurement of total suspended particulates and carbon monoxide.

Noise Pollution

Background noise levels were measured for four days at five monitoring locations – four on west bank of the Mekong River and one on the east bank. Monitoring results indicated low noise levels at the eastern station due to the low population (i.e., only four households are located near the construction) and limited existing road access due to the poor condition of the road which is unsuitable for motor vehicles. Slightly higher ambient noise levels were measured at the western stations which are located close to Kampong Cham city centre. Ambient noise levels in decibels (dB) are summarized below.

DATE	A	B	C	D	E
October 20, 1995	64	58	55	68	42
October 25, 1995	65	55	55	65	41
October 26, 1995	67	54	60	67	41
October 27, 1995	65	55	61	67	40

Because anticipated incremental increases in noise levels due to traffic volume following the opening of the bridge in 2002 are expected to be minimal, no mitigation measure were considered necessary during the operational phase. However, temporary sharp increases in noise levels during the construction phase were anticipated and mitigation measures to minimize noise pollution from construction equipment were recommended.

Monitoring of noise levels was to be undertaken during the construction phase to ensure that noise impacts to area residents are acceptable. No monitoring was considered necessary during the operational phase of the project.

Water Quality and Aquatic Ecology

Water samples collected from the center of the river as part of the baseline monitoring program were analyzed for seven parameters at the Pasteur Institute in Phnom Penh: chemical oxygen demand (COD), suspended solids (SS), dissolved oxygen (DO), nitrates, fecal coliforms, pH, and temperature. Analytical results shown below indicate that ambient water quality in the Mekong River at the bridge location is relatively good, with water quality being acceptable for freshwater fish.

COD mg/L	SS mg/L	DO mg/L	NITRATES mg/L	COLIFORM MPN/100ml	PH	TEMP ^{O}C
1.2	25.2	8.5	0.78	1,500	7.8	28.5

Fish resources inhabiting the Mekong River near Kampong Cham were identified by interviewing local fishermen who use a wide variety of fishing gear including lift nets, drift nets, purse seine nets, push nets, set nets, gill nets, traps nets, and conical set nets. Interview results revealed that fish commonly caught in the study area include anchovy, carp, catfish, snakehead, and eel.

Mitigation measures proposed to prevent water quality deterioration during the construction phase included locating machinery maintenance areas and construction camps away from the river. Additional measures to reduce the chance of oil spills from construction equipment and discharge of fecal contaminant from construction camps were the designation of a supervisory agency to monitor construction site practices and the installation of waste containment devices. No effective mitigation measures could be identified to prevent run-off of pollutants from paved surfaces other than proper maintenance of the drainage system. Ongoing monitoring of surface run-off was recommended to confirm proper functioning of the bridge's drainage system.

Socio-Economic Conditions

Bridge construction will require the expropriation of residential land, necessitating relocation of affected inhabitants. As part of the EIA, existing socio-economic conditions in communities situated nearby the Mekong-Kampong Cham bridge were assessed through interviews with local inhabitants. A total of 111 households were interviewed, with households being randomly selected and the interviews conducted using a prepared questionnaire. The survey covered household structure, employment status, occupations, education background, land ownership, and attitudes towards the bridge project. Interview responses are summarized in the following table.

Average Household Size	6.8 persons
Monthly Household Income	US$886 (average)
Land Price (per m^3)	US$236 (average)
% Land Ownership	98%
Education	4% (elementary) 45% (secondary) 51% (higher)
Attitude Towards Project	99 per cent in favor

The EIA also strongly recommended that a public hearing be held to solicit feedback from all interested parties on the advantages and disadvantages of the project. Although the anticipated impacts of the project were considered minimal, the public hearing was expected to provide responsible authorities with a better understanding of community concerns. A successful public hearing was considered an important step in smooth implementation of the project.

Although the bridge location was carefully selected to minimize resettlement, some relocation of local inhabitants was necessary to accommodate construction of the bridge approach road. A total of 30 houses were affected, 20 on the west bank of

the river and 10 on the east bank. On the west bank, most houses will be affected by construction of bridge approach road, while on the east side houses will be affected by construction of an interchange connecting an approach road to the existing Route 7.

It should be noted that the responsible government agency dealing with resettlement is not the Ministry of Public Work and Transport, but the Kampong Cham authority. Discussions were held between the bridge project Study Team and Kampong Cham officials, headed by the Deputy Governor, in November 1995, to confirm that the local authority will take appropriate actions to compensate affected households.

Recommended mitigation measures to minimize negative socio-economic impacts on local communities focused on compensation of affected households. Realignment of the bridge structure and access roads to bypass the affected areas, although an obvious remedy, was determined not to be viable. Instead, appropriate compensation measures were examined to ensure the provision of sufficient funds or substitute housing in another comparable location to ensure that affected households were able to maintain their living standards.

Measures were also recommended to avoid impacts to the remaining households in the project area. Recognizing the potential for changes in land use and increases in land value, new commercial land industrial development was to be strictly controlled through land use planning by local authorities and responsible government agencies.

Soil Stability and Erosion

Soil conditions were examined as part of the EIA to assess the potential for soil erosion or collapse of the river bank. Geological drilling results revealed that soil characteristics of the study area comprise a combination of Alluvium, Diluvium, Teritary, and Mesozoic formations – although the former two formations are not suitable for bridge foundations the latter two are suitable for this purpose. On the basis of these results, concerns for soil erosion or bank collapse were considered minimal if appropriate engineering design elements were incorporate into the bridge structure.

Mitigation measures recommended to prevent or minimize soil erosion during bridge construction focussed primarily on the establishment of ground cover over earthwork as soon as possible. Additional engineering measures which are known to be very effective included the construction of an embankment to stabilize slopes and the provision of proper drainage system to reduce soil loss.

Beside engineering-type mitigation measures to prevent soil erosion, consideration was also given to planning the construction work to avoid periods of heavy rainfall which is considered the most important factor contributing to soil erosion. Simply refraining from leaving bare soil exposed to strong rains will greatly limit potential

problems. For this reason, it was recommended that major earthworks be avoided during the heavy rain season.

Cultural/Historical Concerns and Environmental Aesthetics

There are believed to be no important cultural and/or historical relics in the immediate vicinity of the bridge project. A historical tower, constructed during the French colonial era, located near the east river bank approximately 150 meters from the center line of the planned bridge approach road was not considered at risk.

Environmental aesthetics values considered by the EIA included concerns about the appearance of the new structures, which may destroy the harmony of the existing scenery or simply block views. No concerns were raised by area residents about obstructions of valued buildings, such as temples, or of scenic views.

No mitigation measures were considered necessary to address concerns relating to cultural, historical or environmental aesthetics since no significant negative impacts were anticipated.

Traffic

The issue of traffic congestion was addressed in the EIA by examining existing and project traffic volumes on the bridge access roads. Traffic in the study area is currently carried by the major highway Route 7, urban type roads on the west bank of the river and rural roads on the east bank. All the roads converge on Route 7 which is presently divided by the Mekong River. With relatively low traffic volumes on the existing road, no significant traffic congestion problems were observed.

The EIA predicted that traffic congestion on completion of the bridge would be confined to the new interchange connecting an approach road and Route 7. The recommended mitigation measure to alleviate this potential problem is construction of an overpass routing east-west. Although no overpass construction is currently proposed, it may be considered in the future if congestion occurs as predicted.

Summary of EIA Report Findings, Conclusions and Recommendations

Potential environmental impacts caused by construction of the Mekong-Kampong Cham bridge were studied at two different stages: Initial Environmental examination (IEE) and Environmental Impact Assessment (EIA).

The IEE identified probable environmental parameters which will be affected by project implementation and evaluated the likely magnitude of impacts on the identified parameters, including air and noise pollution, water quality and aquatic ecology, human resettlement, soil erosion and siltation, cultural/historical aspects, environmental aesthetics, and transportation. The IEE also reviewed the environmental ranking of original six candidate bridge locations and compared the environmental impacts of the Kampong Cham location with the alternatives.

The full-scale EIA involved in-depth analysis of baseline environmental conditions and predicted impacts on major environmental parameters. The magnitude of likely impacts was assessed and recommendations made for feasible mitigation measures and monitoring programs.

Findings of the EIA report indicate that some limited but significant environmental impacts will occur. For example, expropriation of land to construct the bridge approach roads will cause human relocation problems. In addition, environmental health will be adversely affected to a certain extent by project implementation. While impacts to both human and environmental parameters cannot be avoided it is expected that the majority can be minimized through implementation of recommended mitigation measures and monitoring programs. The report concluded that the overall environmental impacts resulting from bridge construction and operation will be minimal if all the proposed mitigation measures and monitoring programs are properly implemented. Recognizing the importance of the mitigation measures, the EIA report strongly recommended that mitigation measures be clearly specified in construction contracts and that qualified environmental inspectors be hired to oversee implementation of the mitigation measures during construction with their reports to be submitted regularly to the responsible authorities.

Predicted environmental impacts should be compared with the benefits of the bridge project in deciding whether the project should proceed or not. Benefits of the project identified in the EIA report included enhanced economic development through the provision of an efficient and time-saving transport system. Findings of the economic evaluation of the project as provided in the EIA report concluded that the bridge construction project is economically viable.

SITE VISIT METHODOLOGY

Course participants will visit the Mekong-Kampong Cham bridge to observe the completed project and learn more about the project's economic benefits, environmental impacts and the effectiveness of mitigation measures. The group will be accompanied by resource persons from the Cambodian Ministry of Environment and community representatives knowledgeable about EIA completed for the project and the local environmental and socio-economic conditions.
The expected duration of the site visit is one day. The overall objective of the site visit will be for the class to critique the EIA which was completed for the bridge and to evaluate whether existing environmental protection measures are adequate.

Participants will be organized into small groups for the site visit with each group being assigned a specific task as summarized in the following table.

SUBJECT	FOCUS
Air Quality and Noise	Baseline conditions Characterization of air and noise emissions Impact assessment Mitigation measures Monitoring and measurement
Traffic	Baseline conditions Predicted and actual traffic volumes Road accidents Dangerous goods transport and emergency response Mitigation measures Monitoring and assessment
Water Quality and Aquatic Habitat	Environmental receptors at risk Impact assessment Effectiveness of mitigation measures Baseline and follow-up monitoring
Socio-Economics	Economic benefits Demographic and social changes Compensation and mitigation measures Community support for project
Your Own EIA for this Project	Your group has been asked to do the EIA for the project. Describe how your EIA would be different from the existing EIA.

On completion of the site visit, small groups will be asked to present their findings to the class with emphasis on the practical lessons learned by course participants which reinforce EIA theory taught in the course.

TAKE HOME MESSAGES

Anticipated lessons learned by course participants in completing the case study and site visit might include:

1. The importance of undertaking comprehensive EIA's for all projects even if the EIA is just a formality for projects which will almost certainly proceed for economic reasons. EIA findings are valuable in guiding site selection, alternatives means to implementing the project and selection of appropriate mitigation measures.
2. Proper baseline monitoring is essential in informing EIA screening, IEE, scoping, and impact assessment. In the absence of adequate understanding of environmental receptors at risk and knowledge of how receptors respond to stressors, potentially significant environmental impacts are likely to be overlooked and mitigation measures prove not to be appropriate or effective.
3. Audit and evaluation of mitigation measures and operational monitoring programs is important to validate impact predictions and to assess the effectiveness of mitigation measures. Parties responsible for EIA follow-up must have the resources and capability to complete monitoring activities and the authority to enforce environmental regulations.

REFERENCE READING

JICA. 1996. Feasibility Study on Construction of Mekong Bridge in Kingdom of Cambodia. Japan International Cooperation Agency. Selected Chapters from Main Report.

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