The Philippines

Rehabilitation and Maintenance of Bridges Along Arterial Road (I) (II)

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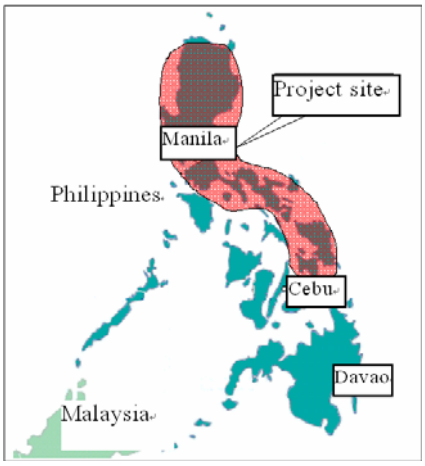
Field Survey: September-November 2005

1. Project Profile and Japan's ODA Loan



Map of project area

Bauang I Bridge

1.1 Background

At the time of appraisal, road transport was the main form of transport in the Republic of the Philippines, comprising 47% of national freight transport, and 78% of passenger transport. The Philippine government also set road sector improvement and expansion as a major policy issue, since it recognized this as a foundation of economic and social activities. In particular, an important role has been played by the Manila North Road and the Philippine-Japan Friendship Highway, which are major arterial roads connecting Luzon Island, pivoting on metropolitan Manila in the north, with the Visayan Islands in the south. These main arterial roads, including bridges, have been rehabilitated and maintained through US financial aid since the 1940s, and through Japan's ODA loans since the second half of the 1960s; however, those rehabilitations and repairs were mainly improvements and widening of pavement and reinforcements of drainage facilities and small bridges. Large bridge rehabilitation was hardly done at all. For these reasons, large bridges have aged and deteriorated remarkably, with worsening traffic safety and efficiency due to damage from natural disasters over many years. It was an urgent task to rehabilitate these bridges in order to restore their functions and ensure the safety and efficiency of these socially and economically important arterial roads.

According to the Feasibility Study by the Japan International Cooperation

Agency (JICA) conducted in 1987, 742 bridges on arterial roads were judged to require repair or rebuilding. Eighty percent of these bridges were built before 1980. Of the 742 bridges, 52 were selected as bridges with a highly urgent need for repairs. Through discussions with the Philippine government, the ODA loan "Rehabilitation and Maintenance of Bridges along Arterial Road" was concluded, and it was decided to carry out rehabilitation on 37 bridges in Phase I, and on 4 bridges in Phase II.

1.2 Objective

The project objective was to ensure smooth road traffic by rehabilitating bridges on the Philippine-Japan Friendship Highway and the Manila North Road, and thereby contribute to the promotion of regional economy of the Philippines and to improvements in the quality of life of local residents.

1.3 Borrower/Executing Agency

Government of the Republic of the Philippines/Department of Public Works and Highways (DPWH)

1.4 Outline of Loan Agreement

	Phase I	Phase II	Total
Loan Amount Disbursed Amount	2,079 million yen 2,020 million yen	2,065 million yen 1,815 million yen	4,144 million yen 3,836 million yen
Exchange of Notes Loan Agreement	October 1989 February 1990	March 1991 July 1991	- -
Terms and Conditions - Interest Rate - Repayment Period - Grace Period - Procurement	 2.7% p.a. 30 years 10 years General Untied (Consultant portion partially untied)	 2.7% p.a. 30 years 10 years General Untied	-
Final Disbursement Date	May 1997	October 1997	-
Main Contractor	Local companies	J.H. Pajara Construction Corp. (Philippines)	-

Consulting Services	Nippon Koei Co., Ltd./Katahira & Engineers Inc. (Japan)	Nippon Koei Co., Ltd. (Japan)	-
Feasibility Study (F/S) etc.	1987 Feasibility Study JICA 1994 Phase III Loan Agreement 1999 Phase IV Loan Agreement		

2. Evaluation Result

2.1 Relevance

2.1.1 Relevance at the time of appraisal

Road network expansion and quality improvement were upheld in the Medium-Term Philippine Development Plan (MTPDP) (1987–1992). In particular, the replacement of provisional fragile bridges by bridges for permanent use was a priority implementation item.

In order to achieve the MTPDP goals, the Medium-Term Infrastructure Investment Plan (1986-1992) by the Department of Public Works and Highways (DPWH), the project's executing agency, allocated 17.4% of the total infrastructure development investment to roads and bridges. This was the second largest proportion, following the electricity sector. Of the funds for roads and bridges, 52% was allocated for rural and agricultural roads, and 48% was divided amongst key roads and bridges.

Therefore, this was a high priority project, as its rehabilitation of provisional fragile bridges on arterial roads was a priority issue in the Philippines at the time.

2.1.2 Relevance at the time of evaluation

Expansion of the road network and development of safe and efficient roads continued to be upheld in the MTPDP (2004-2010) at the time of evaluation.

To achieve these goals, the DPWH Medium-Term Infrastructure Investment Plan (2005-2010) allocated 69% of the total infrastructure development investment to roads and bridges, of which 81% was allocated for roads and 19% for bridges. The project also has high relevance at time of evaluation, for its aim is to ensure smooth arterial road traffic by rehabilitating bridges on arterial roads.

2.2 Efficiency

2.2.1 Outputs

The planned and actual outputs for Phase I and Phase II of the project are as

follows.

Table 1 Comparison of Planned and Actual Outputs of Bridge Rehabilitation in Phase I & Phase II

Plan		Actual	Plan		Actual
Phase I					
Superstructure and substructure replacement	Labuangan I	Cancelled	REPAIR	Plaridel	Cancelled
	Tagamusing	As planned		Batu	Cancelled
	Santa Cruz	Cancelled		Balasig	Superstructure & substructure replacement
	Santa Maria	Cancelled		Plaridel-Pulilan	As planned
	Indiana	As planned		Guinobatan	Cancelled
	Jiabong	As planned		San Fernando	Cancelled
	Jubasan I	As planned		Pamukid	Cancelled
Superstructure replacement	Marilao	Superstructure & substructure replacement		San Isidro	Cancelled
	Lomboy	Cancelled		Pahoho	Cancelled
	Talaba	As planned		Matias	Cancelled
	Langlangka I	Cancelled		Naubod	Cancelled
	Tipcal	Cancelled		Sook	Cancelled
	Namanparan I	Cancelled		Kanapawan	Cancelled
	Suje	Cancelled		Basiad	Cancelled
	San Gabriel	Cancelled		San Cristobal	Cancelled
	Gumaca	As planned		Hinogbongan	Cancelled
	Tiniguiban	Cancelled		Lagnas II	Cancelled
	Binahaan	Superstructure & substructure replacement			
	Palsabangon	Superstructure & substructure replacement			
	Jubasan II	Superstructure & substructure replacement			
Phase II					
Superstructure and substructure replacement	Bued	As planned			
	Bauang I	Cancelled			
	Bauang II	Cancelled			
	Sulipan	Cancelled			

The plan for Phase I was to rehabilitate a total of 37 bridges, of which 7 were targeted for superstructure and substructure replacement, 13 for superstructure replacement, and 17 for repair. However, in the end, 9 bridge superstructure and substructure reconstructions, 2 bridge superstructure replacements, and 1 bridge repair were implemented. Rehabilitations for 25 bridges were cancelled. Out of the 12 bridge rehabilitations, construction work on 5 bridges was changed from superstructure replacement or repair to superstructure and substructure replacement. The reason for the cancellations and construction work changes was that, although at the time of planning the project was centered on repair and reinforcement, the number of bridges requiring complete reconstruction increased, because as a result of detailed design it was found that it was difficult to reuse the bridge substructures and foundations. This led to the increase in the costs and amounts of work for each bridge; thus the number of bridges that could be rehabilitated within the initial project budget decreased.

The primary cause of increased local man-months (M/M) in consulting service was that due to natural disasters, design details were changed and comprehensive inspections were performed for over 7,000 bridges nationwide, requiring an increase of 1,166.5 M/M. Moreover, the original contract for the Marilao and Plaridel-Pulilan bridges was cancelled due to the contractor's shortage of funds. This resulted in additional work to find a new contractor. The process of redoing the contract also led to the increase in local M/M. For these reasons, the initially planned 773 M/M increased to an actual 2,030 M/M.

In Phase II, out of 4 bridges planned for reconstruction, 3 bridges underwent reconstruction. Rehabilitation of Sulipan Bridge was cancelled due to a budget shortage, as it was the least urgent.

This cancellation brought a construction schedule reduction, so consulting service M/M provided by foreign engineers for construction supervision decreased. On the other hand, local M/M increased. This was due to the increased number of local support staff at the Bued Bridge, as it became necessary to change and/or procure materials, which was included among other additional work (excavation, pier replacement, river dike, and current control). Due to this staff increase, the Bued Bridge construction was completed within the schedule planned.

A table comparing principal planned and actual outputs is shown on the last page.

Gumaca Bridge, Rehabilitated in Phase I

Bauang II Bridge, Rehabilitated in Phase II

2.2.2 Project period

The initial plan was to complete Phase I in December 1994, but the project was delayed 29 months and was completed May 1997. The main reason for the delay was that the contractor was changed for the Marilao and Plaridel-Pulilan bridges, and that process took time as mentioned above. Another reason raised is that it was necessary to remove high voltage lines when the Marilao Bridge was replaced, and that work took 283 days.

Also, various additional works was needed on each bridge, plus repairs of damage from natural disasters such as earthquakes and typhoons causing heavy rain and flooding. Material procurement delays also led to delays.

Phase II was initially planned to be completed in December 1996, and was actually completed in August that year. The consultants and contractors cooperated to draw up and implement a schedule to finish the foundation engineering construction work in the dry season, leading to a four-month schedule reduction.

2.2.3 Project cost

For Phase I, the planned cost was 2,772 million yen, but actual project costs increased to 2,896 million yen. This was because the number of bridges requiring complete reconstruction increased, which required more expenses than superstructure replacement or repair. Also, there was additional work and changes during reconstruction.

On the other hand, the planned cost for Phase II was 2,753 million yen, but actual cost was 2,417 million yen. Project costs decreased due to cancellation of the complete reconstruction of Sulipan Bridge that was initially planned.

2.3 Effectiveness

2.3.1 Travel time reduction

The DPWH has not measured the driving time on road sections which contain the bridges targeted by the project.

An individual beneficiary interview survey was carried out in three barangays[1] near the bridges targeted by the project. Out of 59 people, 31 people (valid responses) replied that following the rehabilitation of the bridges, the required travel time from their residences to public facilities such as hospitals, schools, municipal offices, markets, and churches became shorter than before the project. The average reduction in travel time was 12 minutes. The greatest reported reduction was 36 minutes.

Due to the bridge rehabilitations, passage became possible during floods. Bridge widths were expanded, clearing two-way traffic congestion. Moreover, the driving time was reduced since detours that had been used before bridge rehabilitation to avoid risks from disrepair or deterioration during passage were no longer necessary. It can be said that after the project was completed, factors hindering smooth traffic were eliminated, contributing to reduce travel time in residents' daily lives.

2.3.2 Traffic volume

After the project, traffic volume has increased on 11 bridges (see Table 2). The upward trend was seen before project completion year for each bridge, so it is difficult to say that increased traffic volume was solely a result of the project. However, if the project had not been carried out, factors hindering smooth arterial road traffic reported by the beneficiary survey before rehabilitation could have worsened further. The factors include bridge collapse due to deterioration, weight and speed limits, blockages during flooding, congestion caused by narrow bridges, damage to traveling vehicles from damaged bridge paving, and swaying when traveling.

Traffic volume on four of the project's 15 bridges has decreased. The one of the causes of this traffic volume decrease are thought to be delays in surrounding road improvements, and the effects of road construction, etc.

[1] The barangay is the smallest local government administrative unit, following municipalities, cities, and provinces. A barangay is operated and managed by the barangay Captain and Counselors who are selected by election, and has administrative authority, an enforcement institution, and a legislative body.

Table 2. Project Bridge Traffic Volumes

(vehicles/day)

Bridge Phase I/Phase II	Year completed	1990 (evaluation in 1989)	1994	1999	2002	2004	2005
Tagamusing	1993	5,511	3,985	1,695	1,797	1,865	1,899
Jubasan I	1993	1,058	1,477	2,105	2,288	2,409	2,470
Jubasan II	1993	1,058	1,477	2,105	2,288	2,409	2,470
Gumaca	1995	1,997	2,101	2,256	2,520	2,696	2,784
Jiabong	1995	672	960	1,393	1,520	1,604	1,646
Marilao	1995	13,638	13,411	13,070	14,592	15,606	16,113
Plaridel-Pulilan	1995	9,531	12,025	15,766	17,280	18,289	18,794
Indiana	1996	1,262	833	188	209	222	229
Balasig	1996	887	1,149	1,542	1,646	1,715	1,749
Talaba	1997	3,285	4,676	6,762	7,530	8,042	8,298
Binahaan	1997	1,373	974	376	419	448	462
Palsabangon	1997	3,613	5,455	8,217	9,061	9,624	9,905
Bued	1994	4,252	5,058	6,266	7,042	7,559	7,817
Bauang I	1996	4,909	3,546	1,502	1,702	1,835	1,901
Bauang II	1996	7,407	8,541	10,243	11,520	12,371	12,797

Source: DPWH

(Note) Only 1999 data is from surveys. Data for other years is calculated based on survey data by the DPWH.

2.3.3 Economic Internal Rate of Return (EIRR)

EIRR was recalculated both at the time of appraisal and evaluation in line with the assumptions used in Phase III, for which ex-post evaluation had been completed[2]. Table 3 shows those results and EIRR of the JICA Feasibility Study (1987). The assumptions for the EIRR calculation at the time of the JICA Feasibility Study and that at for this evaluation were generally the same. However, in this evaluation, EIRR was calculated without considering the impacts of price

[2] Calculation assumptions are as follows.
1. 20-year project life
2. Benefits
   (1) Vehicle Operation Cost Saving
      1) Removal of dangers which make bridges unusable (increased vehicle travel expense from detour use when bridge becomes unusable)
      2) Reduction in the number of days that bridges are impassable due to flooding
      3) Benefits from increased weight that bridges can endure
   (2) Operation and maintenance cost savings
   (3) Scrap value (corresponding to number of years of life after the project life)
3. Costs: (1) Civil works cost, (2) Consulting service fees

increases or taxes on cost.

According to the recalculated results, the EIRR values for the 11 bridges are lower at time of evaluation than at time of appraisal. This is because the project cost increased due to more new bridge replacements, and actual traffic volume turned out to be below projected traffic volume. The high EIRR computed since the time of the Feasibility Study stage was affected by benefits from the bridges as a whole were calculated even for partial repair. This can serve to show a limit to methods for computing the economic effect of projects dealing with partial repair.

Table 3. Economic Internal Rate of Return (EIRR)

(%)

Bridge name (In order of Phase I, Phase II)	JICA Feasibility Study	Recalculation for this evaluation	
		At appraisal time	At evaluation time
Marilao	-	-	49.10
Tagamusing	82.1	56.60	25.95
Plaridel-Pulilan	48.9	73.31	61.09
Indiana	45.9	33.31	4.58
Balasig	47.7	29.31	18.30
Gumaca	88.2	50.57	30.12
Talaba	86.9	55.42	40.71
Binahaan	67.1	54.28	10.46
Palsabangon	65.3	54.28	41.97
Jiabong	30.0	30.20	31.83
Jubasan I	35.4	25.92	62.43
Jubasan II	30.7	45.82	41.58
Bued	22.2	56.55	61.85
Bauang I	46.4	73.96	40.10
Bauang II	61.0	89.28	70.40

2.4 Impact

2.4.1 Regional economic activity

Gross Domestic Regional Product (GDRP) in the project implementation region was as follows.

Table 4. GDRP

(1,000 pesos)

1990		2003	
Region I	20,872,315	Region I	32,259,268
Region II	14,929,743	Region II	22,686,808
Region III	69,437,152	Region III	97,470,120
Region IV	109,431,638	Region IV	140,153,296
Region VIII	17,454,224	Region VIII	24,537,645

Source: National Statistical Office

Comparing GDRP of the project implementation regions before and after project implementation, GDRP has risen in each region. However, it is difficult to judge from statistical data alone whether this GDRP growth is due to the project's impact on regional economic activity.

Regarding passenger and freight activity, beneficiary survey[3] responses indicate that access from every barangay to neighboring local cities and metropolitan Manila was improved in terms of travel time, safety, and comfort compared to before the project. It was also reported that weight and speed limits eased due to increased design load, which resulted in smother road traffic flow and increased efficiency in moving people and goods. There were reports from members of farmers' organizations that transport of 50-75 tons daily became possible due to the increased transport capacity per truck realized by increasing the design load of the bridges. It was also reported that reduced grinder height created sufficient room under girder, and this enabled for motorboats to pass under bridge so that water transport of marine and agricultural products became possible, which was impossible before the project.

From a macro viewpoint, it is difficult to show how much the changes in the society and economy were results of the project. However, as understood from the beneficiary surveys, it is believed that the realization of year-round traffic, smoother traffic with alleviated weight and speed limits, and increased efficiency in moving people and goods bring some benefits for the regional economy.

[3] In 12 barangays in the vicinity of the bridges, focus group discussions with a total 130 people, and individual interviews with 59 people were carried out.

Large Truck Traffic at Indiana Bridge

Plaridel-Pulilan Bridge

2.4.2 Improvement in quality of life for local residents

According to the beneficiary survey, residents in the project implementation areas were faced with physical injuries from traffic accidents, vehicle collision accidents, and congestion problems due to narrow bridge width before the project implementation. Even though they felt uneasiness and danger from problems like bridge cracks and swaying during transit, they had to use the bridge or roundabout detours.

It is clear from the beneficiary survey that due to the extended bridge widths after project implementation, it became possible for large trucks to pass each other, and congestion from two-way traffic and the risk of collision accidents between cars was avoided. Safety aspects improved, with the number of pedestrians injured by traffic accident reduced through the installation of footpaths. Also, local people in all barangays surveyed reported reduced travel time from their residences to public facilities like hospitals, schools, municipal offices, markets, and churches, as well as improved safety and comfort[4]. In particular, they could use the bridges for quick access to the closest medical facilities in emergencies.

The previous bridges which remain are used as drying areas for corn and rice and as children's playgrounds. Over 90% of residents[5] in the beneficiary survey recognize that these improvements in road traffic access, convenience and safety are due to the project's bridge rehabilitations.

2.4.3 Environmental and social impact

[4] According to results from 46 responses out of 59 individual interviews conducted in 3 barangays, and a total 130 people in focus group discussions conducted in nine barangays.

[5] According to results from 56 responses out of 59 individual interviews, and a total of 130 people in focus group discussions.

In both Phase I and Phase II, there were no particular problems with the land acquisition, and no relocation of residents took place[6].

Beneficiary Survey Focus Group Discussion Near Balasig Bridge

Beneficiary Survey Focus Group Discussion Near Talaba Bridge

2.5 Sustainability

2.5.1 Executing agency

2.5.1.1 Technical capacity

Operation and maintenance is managed based on DPWH Philippine road maintenance system manuals. DPWH arranged bridge repair and rehabilitation seminars and workshops, provided training for domestic engineers by foreign consultants at construction sites, and distributed operation and maintenance related documents. Also, district office operation and maintenance staff participated in seminars on bridge operation and maintenance conducted under JICA technical cooperation. Participating operation and maintenance department staff reported that participation in these kinds of seminars and distribution of manuals on inspection and repair technology were useful for ascertaining the fundamentals of operation and maintenance technology, and for retaining and upgrading skills. There were no particular problems.

2.5.1.2 Operation and Maintenance System

[6] On the other hand, residents in the vicinity of one of the 15 bridges surveyed are facing problems from new traffic congestion and noise. This was due to the increased bridge height, enabling large trucks and jeepneys to pass under the bridge. Also, squatters (people occupying land without legal authorization) living under the bridge increased, becoming a matter of concern for nearby residents in two barangays. There is room to debate whether the project should be linked to the increased number of squatters, but it is possible that increased bridge quality created a better living environment below the bridge, compared with before the project.

DPWH district offices conduct operation and maintenance of the bridges under their jurisdiction, under management and supervision of the DPWH Bureau of Maintenance. The number of personnel for operation and maintenance seems somewhat scant considering the number of bridges managed by a single district office, and the fact that they also manage roads. For example, there are district offices managing 52 bridges with 12 people, and 75 bridges with 13 people. The district offices make use of Road Maintenance Crews (RMCs), consisting of barangay residents in the vicinity of the bridges hired on a day-by-day basis to perform regular operation and maintenance of roads and bridges. Two kilometers are allocated to each person, who is commissioned to perform work such as cleaning and painting. They also use Maintenance By Contract (MBC), wherein the private sector is employed for operation and maintenance such as bridge repair. Residents and private work forces in the vicinity of bridges are used to carry out operation and maintenance. RMC is also conducive to promoting participation in operation and maintenance work among the residents of nearby barangays and to creating temporary employment (124 people were employed by RMC in the Quezon 4th Engineering District in 2005).

2.5.1.3 Financial status

The operation and maintenance budget is allocated from DPWH to each district office based on the equivalent maintenance kilometers (EMK)[7], and each district office determines the budget allocation for the bridges under their jurisdiction. The operation and maintenance budget for national roads and bridges managed by DPWH (Table 5) shows that the amount allocated for their maintenance is increasing.

[7] Philippine national road and bridge operation and maintenance costs are calculated based on the EMK system as follows.
O&M Cost = Basic Cost x EMK
Basic Cost: Cost required to operate and maintain one kilometer of road for one year. Determined each year by the Bureau of Maintenance, considering the inflation rate of each cost item. It was 36,788 pesos/EMK in 2005.
EMK: Index determined by pavement type, road width, and traffic volume.
EMK = {road length (km) x EMK index (differing by road type and width) x EMK index (differing by road type and traffic volume)} + {bridge length (m) x EMK index (differing by bridge type)}.

Table 5. National Roads & Bridges Maintenance Budget

2000	4,093,667	2004	5,900,000
2001	4,093,667	2005	5,741,208
2002	4,093,667	2006	5,960,592
2003	4,846,710		(1,000 pesos)

Source: DPWH

At the same time, the budget allocations for each bridge vary greatly from year to year. For example, for Indiana Bridge 3,520 pesos were allocated each year from 2002-2004 and 27,979 pesos in 2005, and for Marilao Bridge 64,000 pesos were allocated in 2006 compared to 3,000 pesos in 2005. In years with a large budget allocation, costs for material and equipment, paint, and management of guardrails and signs needed for operation and maintenance are included. However, in low budget years (i.e. the 3,000 pesos for Marilao Bridge in 2005), there is no budget allocated for those items, hindering any immediate response even when there is an urgent need for repairs. According to interviews with operation and maintenance staff, one bridge requires roughly 90,000 pesos for operation and maintenance each year (depending upon the condition of the bridge), yet the amount allocated falls below the required amount. As a result, some of the bridges under the jurisdiction of the district offices (not targeted for the project) were left unattended, despite the urgent need for rehabilitation or repairs. Due to budget constraints, these bridges cannot be either rehabilitated or repaired and are alternately handled only through temporary fixes such as lining with thick plates.

While the amount of the budget allocated to national roads and bridges is increasing, the budget allocation for each bridge is low. It is believed that reasons for this may be that more funds are allocated for the operation and maintenance of national roads, or the possibility that even though the total amount computed based on EMK is on an increasing trend, it is not commensurate with the actual needs for operation and maintenance of the roads and bridges.

2.5.2 Operation and Maintenance Status

Inspections of bridges are performed regularly every two weeks or at the most every six months depending on the condition of the bridge. The results of bridge inspections are recorded on forms prescribed by the DPWH and stored.

Since not very much time has passed since the rehabilitation, operation and maintenance work consists primarily of repainting (every four months or every

three years at the maximum interval) and regular cleaning. According to the field survey of 15 bridges, the bridges were generally well maintained. However, there are also calls from the beneficiary survey for repairs of damaged bridge sections, cleaning, and further widening. Damaged portions were noticed on one bridge out of 15; later, it was confirmed that these had been repaired. Roughly 20% of all bridges had no weight or speed limit indication. In such circumstances, large buses and trucks cross at quite high speeds, making bridge deterioration a concern. Urgent measures are called for, such as the installation of vehicle weight and speed limit signs.

Weight Limit Sign Installed at Talaba Bridge

3. Feedback

3.1 Lessons learned

In Phase I of the project, the project cost was increased due to considerable changes in design. It is advisable to consider the ODA loan scheme for the project like this not to specify the project targets so as to enable to adapt flexibly for changes without specifying the targets in the project implementation stage.

Moreover, contractors and consultants should combine their efforts in confirming the appropriateness of construction timing, taking wet and dry seasons into consideration in order to keep damage from natural disasters to a minimum. As was the case in Phase II, such effort can shorten the work period and keep the effects from natural disasters on project implementation to a minimum.

Moreover, in this evaluation the EIRR was calculated following the computation methods for project benefits employed by the JICA feasibility study to keep consistency with the time of appraisal. The sunk costs due to time passage were not taken into consideration in the assumptions used for calculating the EIRR in this evaluation. Due to this and other factors, some bridges had excessively high figures.

In particular, for the computation of cost and benefits used as assumptions for further calculations, it is necessary to perform a second validation of the Feasibility Study at the time of appraisal.

3.2 Recommendations

Regarding the changes in environment following the rehabilitation of bridges, there were reports from the beneficiary survey of new congestion and noise problems due to increased traffic volume, as well as of increased traffic accidents caused by the increased traffic speed. Safety measures for the rehabilitated bridges are called for by the DPWH, such as installation of signs for weight and speed limits. Moreover, it is recommended that the DPWH continue with the effective use of RMC and MBC. By encouraging the participation of nearby residents in regular operation and maintenance activities, RMC is expected to lead to job creation, raise the sense of ownership for operation and maintenance of the bridge in the community, and be effective for sustainable operation and maintenance requiring only a few personnel.

Comparison of Original and Actual Scope

Item	Plan	Actual
(1) Outputs	(1) Outputs	
Phase I	Phase I	Phase I
1)Superstructure and substructure replacement	7 bridges	9 bridges
2)Superstructure replacement	13 bridges	2 bridges
3)Repairs	17 bridges	1 bridge
Total	37 bridges	12 bridges
Consulting services	Consulting services	Consulting services
Foreign	99 M/M	112 M/M
Local	773 M/M	2,030 M/M
Phase II	Phase II	Phase II
Superstructure and substructure replacement	4 bridges	3 bridges
Total	4 bridges	3 bridges
Consulting services	Consulting services	Consulting services
Foreign	41 M/M	25 M/M
Local	117 M/M	479 M/M
(2) Project Period		
Phase I	Phase I	Phase I
Loan Agreement	February 1990	February 1990
Selection of consultant	August 1989-September 1990	August 1989-July 1990
Detailed design	October 1990-March 1992	February 1991-July 1992
Prequalification & tender	October 1991-December 1992	December 1991-November 1995
Civil works	January 1993-December 1994	April 1992-June 1997
Consulting services	January 1993-December 1994	April 1992-May 1997
Phase II	Phase II	Phase II
Loan Agreement	July 1991	July 1991
Selection of consultant	July 1991-July 1992	December 1991-March 1992
Land acquisition	July 1992-December 1994	February 1993-October 1995
Prequalification & tender	July 1992-December 1994	March 1992-July 1994
Civil works	January 1994-December 1996	July 1992-August 1996
Consulting services	July 1992-December 1996	March 1992-September 1996
(3) Project Cost		
Phase I	Phase I	Phase I
Foreign currency	1,556 million yen	2,020 million yen
Local currency	1,215 million yen (196 million pesos)	876 million yen (204 million pesos)

Total	2,772 million yen	2,896 million pesos
ODA Loan Portion	2,079 million yen	2,020 million pesos
Exchange rate	1 peso = 6.2 yen (1989)	1 peso = 4.3 yen
Phase II	Phase II	Phase II
Foreign currency	1,678 million yen	1,815 million yen
Local currency	1,075 million yen	602 million yen
	(158.10 million pesos)	(140 million pesos)
Total	2,753 million yen	2,417 million yen
ODA Loan Portion	2,065 million yen	1,815 million yen
Exchange rate	1 peso = 6.8 yen (1990)	1 peso = 4.3 yen