

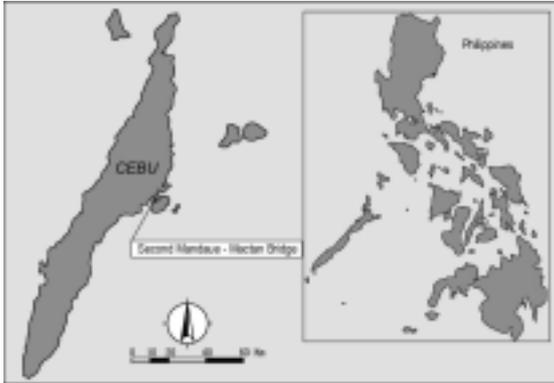
Philippines

Second Mandaue – Mactan Bridge Construction Project

Report Date : September, 2002

Field Survey : June, 2001

1. Project Profile and Japan's ODA Loan



Project Location Map



Second Mandaue-Mactan Bridge

1.1 Background

Metro Cebu, the second largest urban area in the Philippines, functions as an economic, trade and education center for the Central/Southern parts of the country.

Cebu City, located on Cebu Island, is the center of Metro Cebu as well as of the Central Visayas Region. Mactan Island has also become increasingly important since it is viewed as a gateway to Metro Cebu on account of its international airport. The island has also achieved increasing importance as a center for economic activities serving the large-scale industrial estates which are located on the island.

The first Mactan Bridge connects the two islands across the Mactan Channel. This bridge was seriously damaged by a typhoon in 1990 and consequently bridge use by heavy vehicles was restricted to those weighing less than 5 tons. Nevertheless, the bridge was frequently used by vehicles of over 1.5 tons, posing a risk of bridge collapse. Traffic demand on the bridge had been steadily increasing, and anticipated to exceed the traffic capacity by the year 2000.

The construction of a new bridge across the Mactan Channel thus became a high priority matter, in order to support steady economic growth in Metro Cebu area.

1.2 Objectives

The objectives of the project are as follows:

- a. To provide an permanent alternative transport linkage between Mactan Island and mainland Cebu;
- b. To sustain and improve regional economic and social activities in the Cebu area; and
- c. To provide a more reliable and more efficient road network to support socio-economic development.

1.3 Project Scope

The project scope was composed of the following items:

- a. The construction of a new bridge between Mandaue and Mactan islands;
- b. The construction of an access road; and
- c. Detailed design, construction supervision and other necessary consulting services for the above works.

1.4 Borrower/Executing Agency

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

1.5 Outline of Loan Agreement

Loan Amount	6,872 million yen
Loan Disbursed Amount	6,666 million yen
Exchange of Note	August, 1993
Loan Agreement	August, 1993
Terms and Conditions	
Interest Rate	3.0 % p.a.
Repayment Period (Grace Period)	30 years (10 years)
Procurement	General Untied
Final Disbursement Date	December, 2000

2. Results and Evaluation

2.1 Relevance

The rapid population increase in Metro Cebu from the mid 1970s to the 1980s caused various urban problems including traffic congestion and shortages of water, electric power and sewage systems. In order to cope with these problems and simultaneously enhance sound socio-economic activities, the Government of Philippines prepared the Metro Cebu Development Master Plan (MCDMP) in November 1985, which included development plans for various elements of the socio-economic infrastructure such as water supply, power, telecommunications, sewage systems and road networks.

Based on the MCDMP, infrastructure development has been implemented since 1989 as a series of Metro Cebu Projects, including road network development, such as the Cebu North Road, the Plaridel Road, the Mactan Circumferential Road and the South Coastal Road. Second Mandaue-Mactan Bridge (hereinafter “the Bridge”) was identified as a main road development project within the framework of the MCDMP. The Metro Cebu Project is still continuing with financial assistance from JBIC, under the terms of Metro Cebu Development Projects (III).

The objectives of the Bridge were to improve the bottleneck in transport between the two islands, Cebu and Mactan, and to contribute to the mitigation of the traffic congestion in Metro Cebu, both of which were major targets of the Master Plan. Accordingly it can be said that the project was consistent

with the MCDMP at the time of project appraisal and is still relevant today.

2.2 Efficiency

(2.2.1) Project Scope

The original scope was to build the Bridge with two lanes. During the engineering study stage, however, it was found that even with the Bridge, traffic demand would exceed the traffic capacity by the early 2000s. As a result, the scope was changed from two lanes to four lanes and the scope of the access roads was also changed in accordance with the change of the bridge width. Taking into account traffic growth during the period from project appraisal to the present, it can be said that the change of the scope was appropriate and effective for achieving the original objectives.

The selection of the bridge type had been included in the scope of the consulting services in order to adopt the most appropriate one based on the various surveys including topographic, geo-technical, hydrological, traffic studies and other social or physical conditions. As a result, an “Extradosed Cable-Stayed” type was adopted in view of the required long span and restrictions on the height of structures in the vicinity of the international airport. This type was implemented in Japan firstly in the world in early 1990’s. This project is the first extradosed cable-stayed type in the Philippines. Its center span of 185 meters between towers is the longest in the world for this type of bridge.

(2.2.2) Implementation Schedule

a. Implementation period

The project was originally scheduled to be implemented during the period from July 1994 to November 1998, while the actual implementation was carried out during the period from November 1994 to October 1999 with eleven months behind the schedule. But this was an indispensable delay considering the drastic changes to the scope of the project at the time of engineering study. As a matter of fact, the actual construction period was 36 months since October 1996, which was almost same duration as originally estimated.

b. Project Implementation

According to the DPWH, the performance of the contractor as well as the consultant were evaluated to be excellent for the following reasons.

- i. The Bridge was awarded Tanaka Prize of the JSCE (Japan Society of Civil Engineering) in fiscal year 2000.
- ii. There were no accidents throughout the construction period, a result of strict safety standards.
- iii. The construction work was smoothly implemented, and therefore the construction period was reduced compared to the rescheduled initial schedule.

(2.2.3) Project Cost

In the original plan subject to JBIC appraisal, the total project cost was estimated to be 9,163 million yen and loan amount was 6,872 million yen (as shown in the above chart in section 1.5).

However, the actual cost was 15,565 million yen. As a result, loan amount is 6,666 million yen under Second Mandaue-Mactan Bridge Construction Project and additional 4,259 million yen has been financed under the separate loan, namely “Second Mandaue-Mactan Bridge (Phase II) and Metro Cebu Road Project”.

As a result of the changes in scope, the project cost exceeded the original cost by a large margin. Because of the expansion of the scope, however, this was an inevitable cost overrun. The main changes are as follows;

- a. Change from 2 lanes to 4 lanes
- b. Change in foundation of the tower from friction pile to composite bored piles cast using the Casting Tube Rotation Method (CTRM)
- c. Construction of a left turn viaduct

2.3 Effectiveness

(2.3.1) Traffic Volume

A traffic volume survey was conducted after the completion of the project. The total traffic volume crossing the Mactan Channel in 1999 was about 46,000 vehicles/day, 50% higher than the volume forecast at the time of project appraisal. Traffic volume on the Bridge was about 40% of the total traffic crossing the Channel at that time, but the current percentage is probably larger, due to the restriction on heavy vehicles on the old bridge has been in effect since last year. The high traffic volume suggests that the implementation of the project was sufficiently effective for achieving the original objectives to mitigate traffic congestion and secure smooth traffic flow between the two important islands, Cebu and Mactan.

Table 1: Traffic Volume (veh/day)

	Traffic Volume on the Old Bridge		Traffic Volume on Second Mandaue-Mactan Bridge		Total Traffic Volume (Old Bridge and Second Mandaue-Mactan Bridge)	
	Original	Actual	Original	Actual	Original	Actual
Year of Appraisal 1992	19,106	-	-	-	19,106	-
1998	29,208	-	-	-	29,208	-
Year of Completion 1999	9,851	27,764	20,817	18,140	30,669	45,904

Source: Annual Target Level (Original) is quoted from JBIC's project appraisal documents.

(2.3.2) Travel Time for Crossing the Bridge

There is no official record on the travel time or running speed for crossing the Mactan Channel.

According to the local government as well as private industry located in the MEPZ (Mactan Export Processing Zone), before the completion of the Bridge, travel time from the city center of Cebu to the airport located in the Mactan Island was more than one hour even in off-peak hours, and sometimes more than two hours driving peak hours. Since the old bridge has only two lanes, when an accident occurred or there was a large vehicles stuck at the slope of the Bridge, it could take several hours to

reach the airport. Many travelers complained that it was impossible to reliably estimate travel time. After the opening of the Bridge, however, travel time has been reduced to less than 30 minutes, even during peak hours.

(2.3.3) Internal Rate of Return

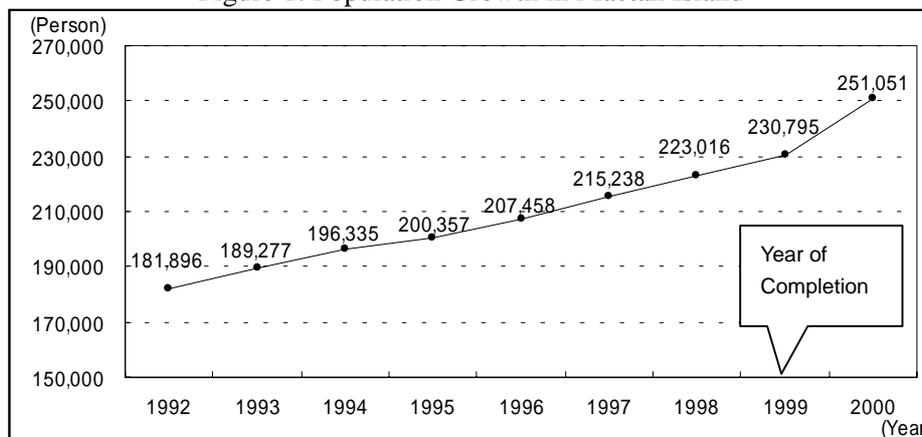
The economic internal rate of return (EIRR) was re-estimated by using the actual project cost and the actual traffic volume of the Bridge. All other conditions are assumed to be the same as in the original calculation at the time of the project appraisal. The re-estimated EIRR is 21.1%. Because of the increase in the project cost based on the scope change, the re-estimated EIRR is a little lower than the original value at the time of the project appraisal (24.5%). However, the project is still judged to be highly feasible.

2.4 Impact

(2.4.1) Socio-Economic Impact

Reflecting the increase in the employment opportunities in MEPZ, the population on Mactan Island has increased during the past several years as shown in Figure 1. The growth rate jumped project completion in 1999, about 9% for 1999 – 2000.

Figure 1: Population Growth in Mactan Island



Source: National Statistic Office Region VII

(2.4.2) Impact on Environment

There were no specific serious negative impacts on the environment during the construction. There is no monitoring station near the project site, but the Bridge is recognized to have contributed to the decrease in air pollution by diverting heavy vehicle traffic from the old bridge, which is located near the urban center, to the Bridge, located outside the urban area.

(2.4.3) Impact on Social Life

a. Construction Stage

As expected at the time of project appraisal, approximately 80 households were affected by the construction of the Bridge. All of these were not squatters but land owners, and appropriate amounts

of land cost and compensation for land costs and property were paid to the affected households. The land acquisition was carried out without trouble.

b. After Completion

There has been a great deal of social impact on the daily life of local communities and residents, particularly for commuters from Cebu City to Mactan Island. There are two MEPZs on Mactan Island, where approximately 150 industries are located. The total number of employees is about 40,000. More than half of the employees are live on the Cebu side and commute to the factories using shuttle bus services. Commuting time has been drastically reduced by the Bridge, since bus routes have been changed from the old to the Bridge.

The main hospitals and schools in the areas are located in Cebu City, and thus residents of Mactan Island have to cross the Mactan Channel in order to receive better medical services and higher education. Accordingly, it is considered that the Bridge has also had an immense impact on these aspects as well.

Another impact is that a recreational park area has been created under the approach bridge at both ends. These park areas have already been transferred into the hands of the local government. The areas are used as a neighborhood amenity zone for the residents. There is a memorial stone in the park which explains that the Bridge was built as a symbol of friendship between Japan and the Philippines together with a description of Japan's ODA.

(2.4.4) Technology Transfer

The Bridge is the first extradosed cable-stayed bridge in the Philippines, and accordingly has drawn the attention of bridge engineers and contractors throughout the country. Transfer of new technology occurred through the following opportunities:

- a. Three engineers from the PMO (Project Management Office) received two weeks training during the design stage.
- b. Engineers from the BOD (Bureau of Design) visited the construction site from almost all regions in the country throughout the construction period.
- c. The director of the local government discussed the project in presentations at several international conferences held in Manila.

2.5 Sustainability

(2.5.1) Organization of Operation and Maintenance

There are four district offices in Cebu Regional Office under DPWH, of which Cebu -1 District office is responsible for the operation and maintenance of the Bridge. The field maintenance engineers in this office have sufficient experience of maintenance work on the 1st Mandaue-Mactan Bridge and therefore the office will be able to adequately handle repair/maintenance activities such as pavement repair/patching, clearing structures, painting, monitoring the structures/parts, but not major repairs of critical sections of the Bridge.

According to the Cebu-1 District Office, they will ask the Central Office Bureau of Maintenance

and the Bureau of Design to send a bridge expert when one is needed to assess any critical condition that would warrant major repairs and temporary closure of the Bridge to traffic.

(2.5.2) Technical Capacity

As an aftercare service, the contractor taught engineers in charge how to maintain this new type of bridge during a period of almost one and a half years and prepared a maintenance manual. A maintenance program will be completed based on the manual. Accordingly there is no specific maintenance problem at present.

However, some anxieties remain: Since the Bridge is still new, daily maintenance is limited to routine inspections. Maintenance should involve a greater variety of inspection method from now on, but there are no well-experienced local engineers.

It is suggested that the local government should seek foreign expert(s) for a short period for the specific purpose of bridge maintenance.

The connecting roads for the Bridge have already been developed into four-lane roads at both ends of the Bridge within the framework of the Metro-Cebu Development Projects, using a JBIC loan.

With regard to the old bridge, the regulation of vehicle weight has been adopted, with the maximum weight limit set at 4.5 tons. The rehabilitation is to be carried out using the Second Phase Project Loan.

(2.5.3) Financial Status

Although the Bridge was opened to traffic in August 1999, maintenance work, including daily inspection of the Bridge, was essentially carried out by the foreign contractor until April 2001 as an aftercare service. Therefore, no maintenance cost has been borne to date by the Cebu-1 district office, responsible for the Bridge.

According to the Regional Director of the DPWH, the maintenance cost for the old bridge is approximately 2.4 million pesos per year. As the Bridge is longer and wider than the old bridge, the maintenance cost for the Bridge will be higher than the old bridge.

There is no maintenance fund allocation yet for the Bridge as it has not yet been accepted and included in the official DPWH list of national roads and bridges qualified to receive regular maintenance funding, because of a delay in the registration procedure. Hence as yet there is no budget, program or expenditure for the Bridge.

It is expected, however that the Bridge will soon be included in the official list of DPWH, since registration for this purpose is now in process. According to the proposed budget for 2001, the total roads and bridges maintenance budget of the Cebu Regional Office is 160 million pesos, of which 14 million pesos will be used for bridge maintenance.

In order to recover maintenance expenses, the introduction of a toll system on the Bridge was planned within the Second Phase Project Loan of JBIC. However, after a number of discussions in the regional assembly, this plan has been suspended, seeing that the Bridge has been used for the daily activities of residents as the main route between Cebu and Mactan.

(2.5.4) Overall Sustainability

The Bridge is a new type for the Philippines, and overall sustainability is not assured at this moment due to the lack of technical capability in the maintenance section and of a sufficient maintenance budget. Therefore, it is important to provide timely assistance and advice to maintain project effectiveness.

3. Lessons Learned

During the engineering study stage, the original design was reviewed and revised taking growing traffic demand into consideration. Such decision of scope change was appropriate and contributed to the original project objectives. It can be said, in the case of a project loan which includes detailed design, that some flexibility in project scope has to be built into the loan agreement for the efficient and effective implementation of the project.

4. Recommendations

It is suggested that the local government should seek foreign expert(s) with sufficient experience and knowledge of this new type of bridge in order to raise the skill level of local engineers to be required for the periodic inspections and maintenance works.

Comparison of Original and Actual Scope

Item	Plan	Actual
Project Scope Construction of Second Mandaue-Mactan Bridge Construction of Access Road Consulting Service	L = 998m, W=10.5m L = 1,200m <ul style="list-style-type: none"> • Geo-technical and Soils Survey • Comparative Study and Selection of Bridge Type • Detailed Design of the Bridge and Approach Road • Preparation of Tender Documents 	L = 1,237m W = 14.5m L = 2,657m <ul style="list-style-type: none"> • D/D • Assistance for Tendering • Supervision of Construction • Geo-technical Survey • Comparative Study of Bridge type
Implementation Schedule Consulting Service - Detailed Design - Supervision Selection of Contractor Construction - Substructure & Foundation - Superstructure - Access Road	Jul. 1994 to Sep. 1995 Dec. 1995 to Nov. 1998 Dec.1994 to Feb. 1996 Dec. 1995 to Mar. 1998 Dec. 1996 to Nov.1998 Dec. 1997 to Nov.1998	Nov. 1994 to May 1996 Aug. 1996 to Oct. 1999 Aug. 1995 to Aug. 1996 } Oct. 1996 to Oct. 1999 Aug. 1996 to Aug 1999
Project Cost Foreign currency Local currency Total ODA Loan Portion Exchange Rate	5,368 million yen 3,795 million yen 9,163 million yen 6,872 million yen 1 peso = 5.00 yen	12,751 million yen 585.05 million peso 15,565 million yen 6,666 million yen*) 1 peso = 4.81 yen

NOTE *): The excess amount of project cost was financed by an additional JBIC loan in the Second State Project.

Independent Evaluator's Opinion on Second Mandaue – Mactan Bridge Construction Project

Wilfredo B. Carada
Professor of Development Management and Governance,
University of the Philippines Los Banos

1. Relevance

The project remains relevant from the time it was appraised up to the time of its completion. The objective of the project, to provide a permanent alternative transport linkage between Mactan Island and the mainland Cebu in order to sustain and improve regional economic and social activities, remains relevant today, for the government, for Region 7 and for the people in the area.

The Medium-Term Philippine Development Plan for 2001-2004 continues to support road investments leading to regional growth centers, key tourism development areas and economically lagging regions, all of which are the service areas of the Second Bridge Project.

The project remained relevant although its design and scope was changed. In fact, the modification/redesign of the bridge enabled the project to be more effective and generate more impact.

2. Impact

The overall goal of the project was achieved (mitigating traffic congestion and ensuring smooth traffic flow between the islands of Cebu and Mactan).

The project generated positive impact as (1) contribution to the generation of employment opportunities in the Mactan Island; (2) decreased air pollution; (3) improved access to services and (4) technology transfer (in bridge design, construction, operation and maintenance).

Commuting time to Mactan Island, where about 150 industries are located, from Cebu decreased. Access to job/economic opportunities increased. Moreover, access to health and educational services also improved. Air pollution which was formerly concentrated in the old bridge located in the urban area decreased as heavy traffic is diverted to the new bridge, located outside the urban area.

The project promoted transfer of technology in designing, constructing and operating an extradosed cable-stayed type, first of its kind in the Philippines. Local engineers and students were exposed to this undertaking.

3. Efficiency

The technology used by the project, which is the extradosed cable stayed type, has been technically effective for the topographic, geo-technical, hydrological, traffic and other social and physical conditions of the area. The change in project scope (2 lanes to 4; change in foundation and construction of left turn viaduct) resulted to big additional project costs and caused eleven (11) months delay in project completion.

4. Effectiveness

The second Mactan-Mandaue Bridge has been very effective in mitigating traffic congestion and ensuring smooth traffic flow between the islands of Cebu and Mactan. In 1999, the bridge accommodated 40% of the total volume of traffic (about 46,000 vehicles/day) crossing them Mandaue Mactan channel. Now, due to the restrictions on heavy vehicles on the old bridge, traffic volume is even bigger. A substantial reduction of more than 50% in travel time due to this project, was also noted.

5. Sustainability

The District Office of the Dept. of Public Works and Highways is responsible for the operation and maintenance of the project. The Central Office Bureau of Maintenance and Bureau of Design could be mobilized when assistance is needed. Technical capacity building for one and a half year had been provided by the contractor. Maintenance and improvement of connecting road sections and the old bridge were also undertaken to further ensure the sustainability of the second bridge. Funds for the maintenance work of the bridge has no existing allocation since maintenance until April 2001 was still part of the contractor's aftercare service.

6. Lessons Learned

The project offers some lessons

Inappropriate design undertaken during the planning phase delays and increases project cost, inappropriate project design and scope (erroneous development hypothesis) could still generate greater project effectiveness and impact with proper redesigning/modification.

Institutional development is a key to project sustainability, even in an infrastructure project like a bridge, thus must be included as a project component.

7. Recommendations

This project is highly relevant and effective, To ensure its sustainability and create more impact, these are needed: (1) budget for the maintenance of the bridge should be allocated and (2) as the first bridge of this type in the country, a periodic visit of an expert to coach local engineers on proper maintenance work should be ensured.

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