Thailand

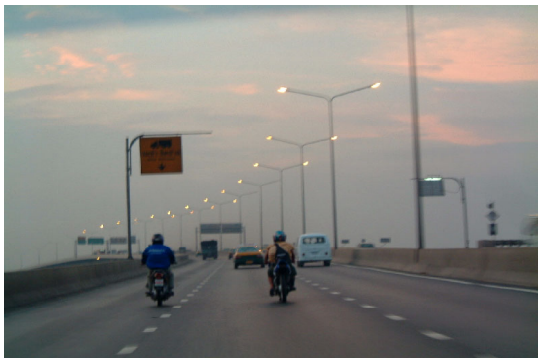
KrungThep Bridge Construction Project

Report Date: January 2003

Field Survey: November 2002

1. Project Profile and Japan's ODA Loan

Site map: Bangkok



New Krung Thep Bridge

1.1 Background

At the time of planning, there was no railway-based means of mass transportation in the city of Bangkok, which depended almost entirely on roads for intra-city transportation. The rapid economic growth and the increase in the number of vehicles in the early 1990s added to the volume of road transportation, making road congestion even more serious.

Traffic congestion was also seen on the bridges that spanned the Chao Phraya River in the city. Particularly, the traffic for the Krung Thep Bridge, which played an important role as part of the Middle-Ring Road, had continued to grow each year, reaching 99,700 vehicles per day in 1991. With economic and population growth, it was predicted that the traffic would increase to about 1.5 times the 1991 level in 2001 and 1.8 times in 2010, and it was feared that traffic congestion would become even more serious. The main reason for traffic congestion around the bridge was that the Middle-Ring Road had six to eight lanes throughout its course while the Krung Thep Bridge had only four lanes and that the bascule bridge had to be lifted two to three times a week on request. In addition, because more than 30 years had elapsed since the bridge was constructed, it was becoming increasingly old, and the traffic of heavy vehicles had been restricted since 1988. This also restricted the role it played as part of the Middle-Ring Road.

Under these circumstances, in order to cope with growing traffic volume, the Thai government decided to build a new six-lane bridge and rehabilitate the Krung Thep Bridge so that it could be utilized efficiently as a bridge exclusively for light vehicles.

1.2 Objectives

To build a new Krung Thep Bridge (hereafter "New Bridge") running in parallel upriver in order to allow the Krung Thep Bridge (hereafter "Old Bridge") to accommodate more traffic and also to rehabilitate the Old Bridge with the aim of efficiently utilizing it as a bridge exclusively for light vehicles.

1.3 Project Scope

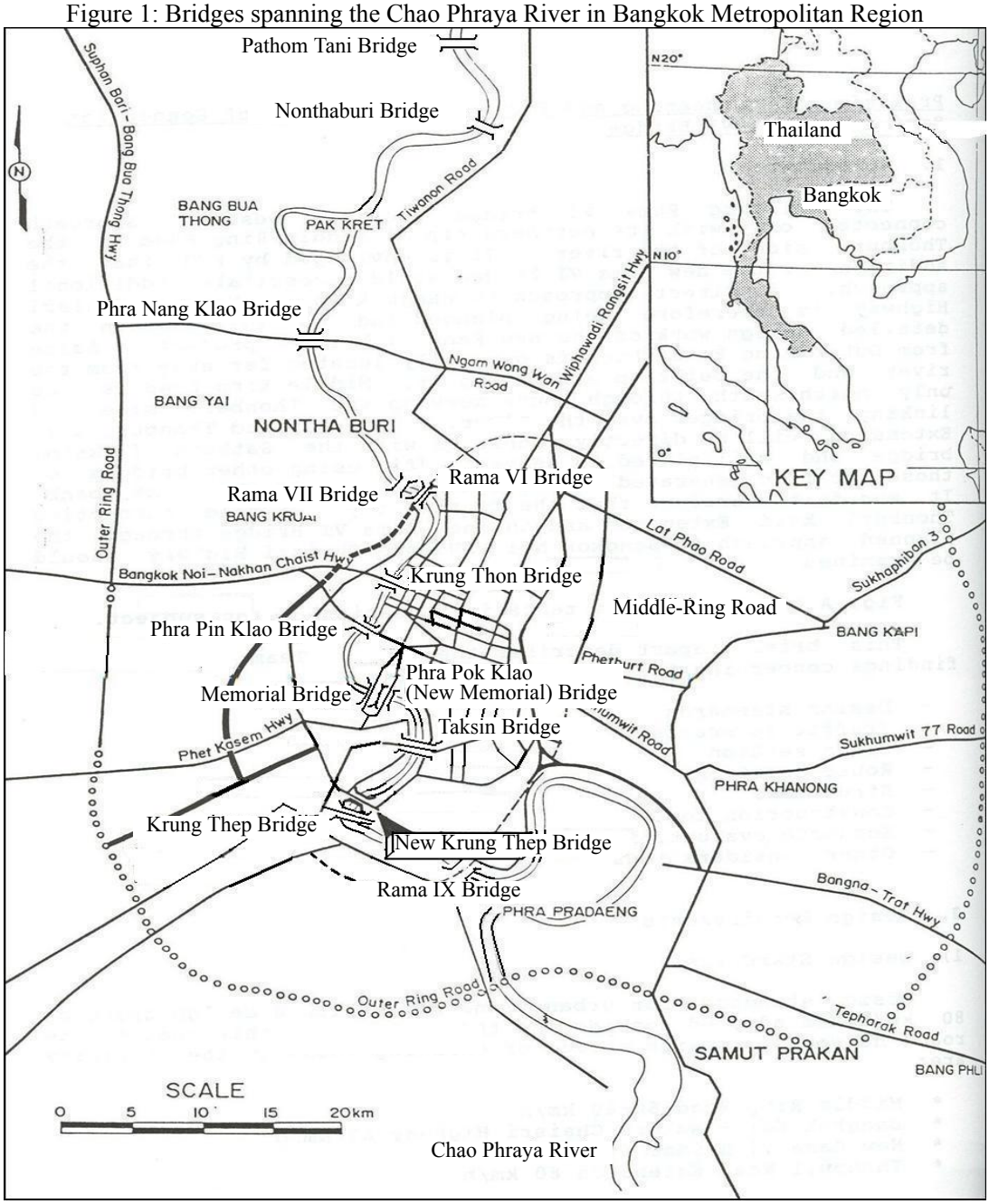
(1) Construction of the New Bridge, a fixed concrete bridge with a center span of 225 meters and a side span of 125 meters at both ends

(2) Rehabilitation of the Old Bridge

(3) Consulting services for assistance in bidding and construction work management

Japan's ODA loan covered the entire foreign currency portion and part of the local currency portion of the costs for (1) and (2) above.

Figure 1: Bridges spanning the Chao Phraya River in Bangkok Metropolitan Region



1.4 Borrower/Executing Agency

The Kingdom of Thailand/Public Works Department, Ministry of Interior: PWD
(Current Department of Rural Roads, Ministry of Transport: DOR)

1.5 Outline of Loan Agreement

Loan Amount Loan Disbursed Amount	7,546 million yen 2,660 million yen
Exchange of Notes Loan Agreement	December 1992 January 1993
Terms and Conditions -Interest Rate -Repayment Period (Grace Period) -Procurement	 3.0% 25 years (7 years) General untied
Final Disbursement Date	October 2000

2. Results and Evaluation

2.1 Relevance

In the early 1990s, economic growth in Thailand achieved an annual rate of over 8%[1]. With this growth, the number of motor vehicle registrations in Bangkok increased rapidly, and many trunk roads inside the Middle-Ring Road were faced with the serious traffic congestion problem that vehicles could run only at a speed of 6.5-7.8 km/h during the peak hours[2]. The government included the improvement of infrastructure in Bangkok Metropolitan Region in the priority issues in its Seventh Development Plan (1992-1996) and gave top priority to reducing traffic congestion and improving transport networks in its road sector development plan. This project, with the goal to reduce traffic congestion in Bangkok, was in accord with the policy of the national government and was highly relevant.

At the time of appraisal, there were twelve bridges spanning the Chao Phraya River[3], and these bridges played an important role in connecting the Bangkok side, which is located east of the river, with the Thonburi side, which is located west of the river. The Old Bridge had been expected to not only play such a role but also ensure smooth distribution as part of the Middle-Ring Road. Due to design restrictions such as having only four lanes and being a bascule bridge, however, the Old Bridge bottlenecked traffic, and the government was urged to eliminate traffic congestion on the bridge. As described above, the needs for reduced traffic congestion were high, and the project has

[1] 8.6% in 1991, 8.1% in 1992, 8.2% in 1993, 8.9% in 1994, 8.9% in 1995, 5.9% in 1996, -1.8% in 1997, -10.4% in 1998, 4.1% in 1999, 4.4% in 2000. Source: Statistical Data Bank and Information Dissemination Division

[2] Final Report, Megaprojects Technical Support to Office of the Commission for the Management of Road Traffic (OCMRT), Bangkok Urban Transport Project (1995)

[3] Pathom Tani Bridge (1984), Nonthaburi Bridge (1959), Phra Nang Klao Bridge (1985), Rama VII Bridge (1992), Rama VI Bridge (1926), Krung Thon Bridge (1958), Phra Pin Klao Bridge (1973), Memorial Bridge (1973), Pok Klao Bridge (1984), Taksin Bridge (1982), Krung Thep Bridge (1959), Rama IX Bridge (1987)
As of November 2002, there were 15 bridges in total including New Krung Thep Bridge (1999), Rama VIII Bridge (2002) and Rama V Bridge (2002).

been evaluated as meeting such needs.

In the planning stage, a feasibility study was conducted to examine two plans: removing the Old Bridge and building a new fixed bridge, and building a new movable bridge for which the width could be expanded. From the viewpoint of maintaining traffic on roads around the Old Bridge, the necessity for ensuring ship navigation, and economic losses due to the closure of the bridge during road width expansion work, the project plan, which aimed to build a new fixed bridge and also remodel the Old Bridge and use it as a bridge for light vehicles, was considered more appropriate than the alternative plans, which would have hindered traffic on the Old Bridge and its surrounding areas.

In the future, the Old and New Bridges are expected to serve as a link that connects the northern and western districts of the Thonburi side with Klong Toey Port located in the south of the Bangkok side and Phra Pradaeng, an eastern industrial district. If roads currently under construction[4] are completed, the two bridges will play the role of linking central Bangkok with these roads, and it is expected that they will play an even more important part in the transport networks of the city. For this reason, it is considered that the project will continue to be relevant in the future.

2.2 Efficiency

2.2.1 Project Scope

A project package consisted of construction of the New Bridge and rehabilitation of the Old Bridge, and was implemented in two phases. The first phase involved the construction of a new fixed concrete bridge with six lanes, and the second involved rehabilitation work, including repainting the steel frames, as well as replacing the electric system for the bascule and replacing old expansion joints with new ones. The scope of the project defined at the time of appraisal was not changed, and the project was implemented as scheduled.

2.2.2 Implementation Schedule

At the time of appraisal, plans called for the entire construction period from the conclusion of contracts with the consultants to the completion of construction work to span 53 months from August 1992 to December 1996. Actually, however, the project took 78 months from September 1993 to February 2000. It took 25 months more than initially planned and was completed 39 months later. The reasons for this delay are described below in detail, but the main reason was the delay in acquiring land and selecting contractors.

(1) Delay in contractual procedures

Plans called for consultancy contract (not covered by the ODA loan) to be concluded in August 1992, but it was actually signed in September 1993, delaying the commencement of the project by 13 months.

The bidding and contracting for the main construction work were scheduled for the 12-month

[4] These are the Taksin-Phet Kasem Road (road connecting to the Western Outer Ring Road), Wat Nakhon In Bridge and its connecting Road, Pak Kret-Tiwanon-Rattana Thibet-Phet Kasem Road (road running from south to north inside the Western Outer Ring Road) and the Industrial Ring Road. Three of these roads, excluding the Taksin-Phet Kasem Road, were built using Japan's ODA loan.

period from January to December 1993, but the process actually took 19 months from February 1995 to August 1996, 33 months behind schedule. This was because in addition to the time required for administrative procedures in the contractor bidding and review stage, a lot of time was spent on the handling of objections filed concerning the results of bidding evaluations.

(2) Delay in land acquisition procedures

It was necessary to acquire 31,119 m^2 of land and compensate for the property involved, and these acquisitions were carried out in accordance with the Act on Expropriation of Immovable Property. Thirty-eight lots of land in the Bangkoram district and 43 lots of land in the Thonburi district were acquired with purchase prices totaling 493 million baht. Property compensated for and compensation money paid were (1) 110 million baht for 43 buildings in the Bang Khor Laem district and 21 in the Thonburi district with a total of 64, (2) 146,000 baht for trees, (3) 286,000 baht for relocation expenses and (4) 685,000 baht for other expenses.

Land acquisition was scheduled for 24 months from September 1992 to August 1994 but actually required a longer period from 1995 to 1997. The main reasons for this delay were that it took a long time to relocate the people inhabiting riverside areas where the bridge was to be constructed. 70 of 81 residents eligible for compensation filed complaints against the first appraisal price offered by the condemnation committee, and the subsequent negotiations proceeded with difficulty.

(3) Delay in construction work

The construction period was scheduled for 30 months from January 1994 to June 1996 but actually lasted for 37 months from October 1996 to October 1999, 41 months later than initially planned. The main reason for this delay was the sharp decline in the local currency due to the economic crisis and the steep rise in the prices of materials, which resulted in a lack of funds and meant it took a long time for the contractors to procure materials. In addition, the delay in the relocation of electric wires, telephone lines, cables and water service pipes also affected the implementation schedule. Moreover, the failure to smoothly regulate traffic on the neighboring roads aggravated traffic congestion, and this also delayed the progress of construction work. The executing agency attributes these various problems to lack of techniques, experience and coordinating ability on the part of the contractors.

2.2.3 Project Cost

At the time of appraisal, the total project cost was estimated at 15,091 million yen (2,755 million yen for the foreign currency portion and 12,336 million yen for the local currency portion), and it was planned that 50% of the cost or 7,546 million yen would be covered by Japan's ODA loan and the remaining 50% or 7,545 million yen by the Thai government's budgets. The actual total project cost was 6,757 million yen with approximately 39% or 2,658 million yen (the entire foreign currency portion) covered by Japan's ODA loan. On a Thai baht basis, the actual project cost totaled 1,928 million baht as compared to the 2,980 million baht estimated. The project resulted in a cost underrun of about 55% on a Japanese yen basis and about 35% on a Thai baht basis.

This cost underrun occurred chiefly in the construction work portion of the cost, and the executing agency attributes this to the fact that the highly competitive bidding by ten prospective

contractors kept the contract price low and that the ongoing depreciation of the Thai currency substantially reduced construction costs quoted in foreign currency.

As explained above, although the project cost was substantially reduced, the implementation schedule was prolonged by 25 months, delaying the completion of the project by 39 months. The extended construction period led to the aggravation of traffic congestion on the neighboring roads. If these and all other negative effect are taken into consideration, it is evident that the efficiency of project implementation was not high.

2.3 Effectiveness

2.3.1 Response to Growing Traffic Volumes

The average daily traffic volume for the Old Bridge prior to the implementation of the project was 50,000 vehicles in 1986, 79,845 vehicles in 1988 and 99,734 vehicles in 1991, increasing at an average annual rate of about 16.6% over the six-year period. It is estimated that if the project had not been implemented, the traffic volume during the morning peak hours would have exceeded the Old Bridge's capacity in 1994.

Table 1 indicates the average daily traffic volume for bridges over the Chao Phraya River. The detailed design in 1990 predicted that the average daily traffic volume for the Krung Thep Bridge (Old and New Bridges) would increase to 110,640 vehicles in 2001 and 127,440 in 2011. Actual results, however, show that the traffic volume was 146,708 vehicles in 2000 and 163,606 vehicles in 2001, indicating that it exceeded the initial projections.

One of the possible reasons for the greater figures than planned as described above is underestimates in the projections. Transport demand is forecast taking into consideration population growth rates, income growth rates and other factors. The 1987 feasibility study estimated that income would grow at an average annual rate of 4.6% during the period from 1986 to 1991, but it actually grew at an average annual rate of 10.3%. In addition, the feasibility study forecast transport demand on the assumption that given the fact that some roads had reached saturation in terms of traffic volume, "traffic volume would not necessarily grow in proportion to income growth and there would be a modal shift from cars to mass transit systems." In actuality, however, the number of vehicle registrations steadily increased even after the economic crisis in 1997, and the introduction of the Sky Train mass transit system in 1998 did not effect a major modal shift, allowing traffic volume to continue growing.

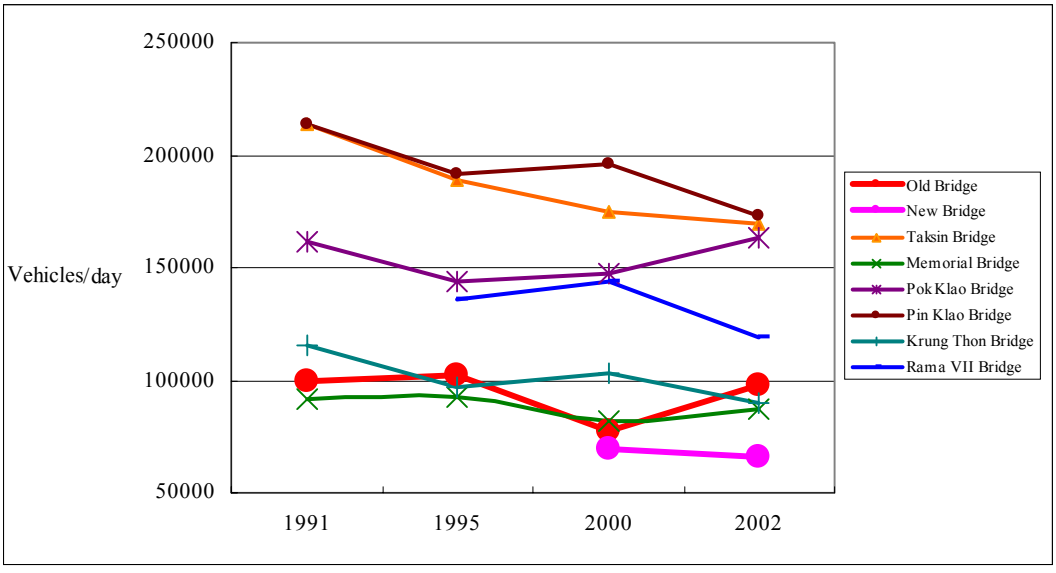
Table 1: Average Daily Traffic Volume

(Unit: vehicles/day both direction)

			1991	1995	1996	1997	1998	1999	2000	2001	2002	2011
Krung Thep Bridge	Old bridge	Plan (1)	-	-	-	-	-	-	-	-	-	37,000
	New bridge		-	-	-	-	-	-	-	-	-	134,000
	Total		-	-	-	-	-	-	-	-	-	171,000
	Old/new	Plan (2)	-	-	-	-	-	-	-	110,640	-	127,440
	Old bridge	Actual	99,734	101,930	68,200	75,364	78,292	-	77,529	-	97,536	-
	New bridge		-	-	-	-	-	-	69,179	-	66,070	-
	Total		99,734	101,930	68,200	75,364	78,292	-	146,708	-	163,606	-
Taksin Bridge		Actual	213,370	189,186	-	-	-	-	175,221	-	169,585	-
Memorial Bridge		Actual	91,462	92,631	-	-	-	-	81,815	-	87,595	-
Pok Klao Bridge		Actual	161,274	144,150	-	-	-	-	146,913	-	163,477	-
Pin Kloa Bridge		Actual	213,314	191,373	-	-	-	-	196,239	-	172,620	-
Krung Thon Bridge		Actual	115,635	97,111	-	-	-	-	103,168	-	89,613	-
Rama VII Bridge		Actual	-	136,061	-	-	-	-	143,586	-	119,097	-

Source: Planned figures (1): Feasibility Study on New Krungthep Bridge Construction and Thonburi Road Extension ('87). Forecasts for the four-lane New Bridge and the two-lane Old Bridge
Planned figures (2): Calculated based on data from 1991 detailed designs in JBIC appraisal documents ()
Actual figures: Traffic Volume Evaluation Project on Chao Phraya River Crossing Bridge, 2543, 2545
Counted during the period from January 25 to March 2, 2000, from June 20 to 29, 2000 and from June 11 to August 1, 2002 for daily averages , DOR

Figure 3: Traffic Volumes for Major Bridges



2.3.2 Making Cross-river Transport during the Peak Hours Efficient

The general degree to which the project purpose has been achieved could be measured by examining how much the time required for crossing the river has been shortened through the implementation of the project, but since this data is not available, the changes in the volume to capacity ratio (V/C) will be considered. V/C is considered "congested" when it ranges from 0.8 to 1.0, "heavily congested" when it is more than 1.0 and "not congested" when it is less than 0.8.

Table 2 shows V/C for the Old and New Bridges as well as the Taksin Bridge during the morning peak hours and the traffic volume for the three bridges during the morning and evening peak hours. V/C for the Bangkok-Thonburi traffic was less than 0.8 at all times of measurement, indicating that there was no congestion. A look at the Thonburi-Bangkok traffic indicates that V/C for the New Bridge was 0.61 in 2000 and 0.77 in 2002, while V/C for the Old Bridge improved from 1.09 (heavily congested) in 1991 to 0.79 (not congested) in 2000 but increased to 1.4 (heavily congested) in 2002, indicating that congestion became more serious. The reasons why congestion was not eliminated is that less traffic shifted to the New Bridge than expected and that more traffic shifted from the Taksin Bridge and other routes to the Old Bridge.

Table 2: V/C for the Morning Peak Hours (8:00-9:00)

Bridge	Direction	1991	2000	2002
Old	Bangkok → Thonburi	0.69	0.58	0.41
	Thonburi → Bangkok	1.09	0.79	1.4
New	Bangkok → Thonburi	-	0.26	0.22
	Thonburi → Bangkok	-	0.61	0.77
Taksin	Bangkok → Thonburi	0.41	0.56	0.39
	Thonburi → Bangkok	1.03	0.77	0.69

Source: Calculated based on DOR materials

Actual Traffic Volumes for the Peak Hours

(Unit: vehicles/hour, Both direction)

Bridge	Time	1991	1995	2000	2002
Old	8:00-9:00	7,187	5,476	6,656	8,795
	17:00-18:00	7,219	6,622	5,754	6,346
New	8:00-9:00	-	-	4,678	5,280
	17:00-18:00	-	-	4,982	3,969
Taksin	8:00-9:00	13,637	10,204	13,784	12,034
	17:00-18:00	17,637	12,116	10,617	8,469

Source: DOR

2.3.3 Economic Internal Rate of Return (EIRR)

The economic internal rate of return (EIRR) for the project was recalculated with the project life at 20 years, and the result was 8.92%. EIRR at the time of appraisal was 20.1%, but the two results cannot be compared with each other because the initial calculation and recalculation were based on different preconditions for benefits[5].

In recalculating EIRR, costs for construction, consulting services and operation/maintenance which were submitted by the executing agency were used as costs, and valued savings in the travel time and costs by driving on the New Bridge were used as benefits. Generally benefits are economically assessed using the transport demand forecast, but since the executing agency did not have that data and it was impossible to forecast transport demand in this survey, a simple method

[5] The preconditions at appraisal referred to the benefits for the entire road network in central Bangkok, but in the recalculations, benefits were limited to those for vehicles using the Old and New Bridges.

was used instead. In order to calculate the effects of reduced driving time, the reduced time was set at 4.284 minutes (derived by assuming that driving speed was 5 km/h before the project and 20 km/h after the project), and the time value was set at 62.4 baht per vehicle per hour (based on assessment of vehicle types using the New Bridge and the time value for each type of vehicle as obtained in the feasibility study). The effect of travel cost savings was calculated by assuming the difference in travel cost between the "case in which the project was implemented" and the "case in which the project was not implemented" as 0.5 baht per vehicle.

As described above, the traffic volume for the combined Old and New Bridges increased, but the effects vary depending on the bridge and the direction of traffic. For the New Bridge, the transport demand for the Bangkok-Thonburi traffic went below the forecasts and traffic was smooth in both directions, while for the Old Bridge, the transport demand in both directions was greater than that forecast and the congestion in the Thonburi-Bangkok traffic during the morning peak hours has not been improved.

One possible reason the volume for the Bangkok-Thonburi traffic on the New Bridge went below the planned figures is that the bridge played a smaller role as a medium-distance transport road than initially expected. For example, road users seem to believe that for traveling a medium distance, using other routes saves more time (using, for example, the Rama IX Bridge-Rama II Road route when moving from central Bangkok to southern Thailand, and the Pin Klao Bridge-Pin Klao Road route when heading for western Thailand).

One possible reason the traffic volume for the Old Bridge exceeded demand forecasts is that the transport demand for the Charoen Nakhon and Charoen Krung Roads was high in the current transport network, prompting traffic to concentrate on the Old Bridge, which provides easy access to these roads. One of the possible reasons the congestion of the Thonburi-Bangkok traffic at the Old Bridge during the morning peak hours has not been eliminated is that although efforts were made to develop the Thonburi district in order to distribute economic activities and prevent the concentration of people and goods in Bangkok, they did not make much progress. For the locations of roads and bridges, refer to Figure 4.

2.4 Impact

2.4.1 Reduction in Traffic Congestion in the City of Bangkok

(1) Reduction in Traffic Congestion on Other Bridges

A look at the number of new vehicle registrations per day nationwide from 2000 indicates that the number increased each year, from 702 vehicles in 2000 to 820 vehicles in 2001 to 1,148 vehicles in 2002. It is believed that the traffic volume in the city of Bangkok grew similarly, but the average daily traffic volume for major bridges over the Chao Phraya River, excluding the Krung Thep, Memorial and Pok Klao Bridges, declined in 2002 as shown in Table 1. One of the possible reasons is that in addition to the completion of the project, the completion of the Wat Nakhon In and Rama VIII Bridges in 2002 increased the overall traffic capacity of bridges that link Bangkok with Thonburi, thus distributing traffic.

According to the survey conducted by the Bangkok Metropolitan Administration (BMA), meanwhile, the average driving speed for the Thonburi-Bangkok traffic during the morning peak

hours in 2002 rose for all bridges as compared to 2001: up by 10.3% for the Rama VII Bridge, 12% for the Krung Thon Bridge, 2.9% for the Pin Klao Bridge, 3.4% for the Memorial Bridge, 0.4% for the Pok Klao Bridge and 2.7% for the Taksin Bridge. The average driving speed for the Bangkok-Thonburi traffic also climbed (except for the Memorial Bridge, which saw a 5.2% decrease) up by 13.3% for the Rama VII Bridge, 14.6% for the Krung Thon Bridge, 7.7% for the Pin Klao Bridge, 12.5% for the Pok Klao Bridge and 31.2% for the Taksin Bridge. From this, it is evident that traffic congestion has been reduced for both directions.

(2) Reduction in Traffic Congestion in Surrounding Roads

According to BMA data, the traffic volumes for intersections on surrounding roads are as shown in Table 4. A look at the change between 1999 and 2001 indicates that the traffic volumes for the Bukkalo Intersection (P1) and the Thanon Tok Intersection (P4) along the Ratchadapisek Road, which runs through the Old Bridge, grew by 89% and 289%, respectively. Meanwhile, the traffic volume for the intersection (P5) along the road, which runs through the Taksin Bridge, only increased by 15% during the same period. Those for the Mahaisawan Intersection (P2) and the Tapa Intersection (P3) of the road, which runs through the Old Bridge, continued to rise while that for the intersection (P6) along the road, which runs through the Taksin Bridge, continued to fall. This is considered to result from Taksin Bridge users having shifted to the project route.

This project helped reduce traffic congestion on surrounding roads, and this is evidenced in the results of the recently conducted mobility access survey as well (refer to the section “Social and Environmental Impacts” below). The majority of users surveyed used the roads for the purpose of commuting, and their major destinations were areas near Sathupradit, Phetcha Kasem, Charoen Nakhon and Tapa Intersections. Asked about the change between the pre- and post-project periods, 86% of users replied that traffic congestion had been reduced and 91% replied that the required travel time had been shortened, confirming that the project had brought excellent results.

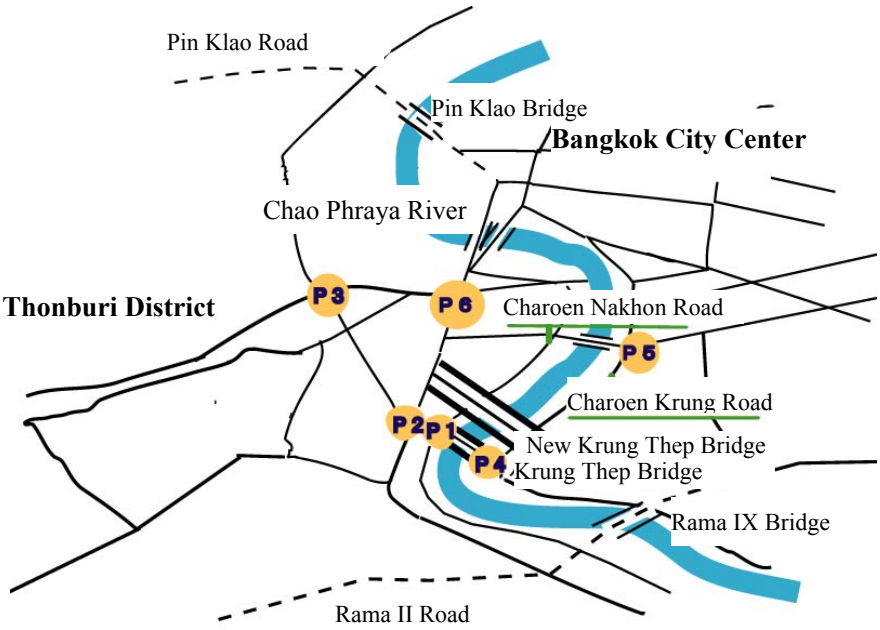
Table 4: Average Daily Traffic Volumes for Intersections along Surrounding Roads in the Project Area

(Unit: vehicles/day)

		1996	1997	1998	1999	2000	2001
1	Bukkalo Intersection (P1)	100,513	-	-	36,213	-	68,437
2	Mahaisawan Intersection (P2)	-	-	77,862	66,399	76,577	-
3	Tapa Intersection (P3)	-	70,307	77,311	92,630	103,684	101,861
4	Thanon Tok Intersection (P4)	-	52,417	-	13,225	-	51,517
5	Sathorn-Charoen Krung Intersection (P5)	-	33,315	-	25,159	27,459	28,883
6	Krung Thonburi-Taksin Intersection (P6)	-	72,082	-	-	69,809	-
7	GDP growth rate (%)	5.9	-1.8	-10.4	4.1	4.4	1.8
8	Population growth rate in Bangkok (%)	0.26	0.35	0.77	0.26	0.32	0.81
9	Rate of increase in vehicle registrations nationwide (%)	14.2	9.8	6.8	6.6	3.7	8.4

Source: (No.1-6) BMA, (No.7) NESDB, (No.8) Ministry of Interior, (No.9) Ministry of Transport and Communication

Figure 4: Map of Roads around the Krung Thep Bridge



2.4.2 Social and Environmental Impacts

A questionnaire survey was conducted along the Middle-Ring Road and those surrounding areas[6] on which the project is believed to have had direct impact, concerning the changes in socioeconomic conditions, the environment and safety between the pre- and post-project periods. The survey targeted (1) New Bridge and Old Bridge users (157 samples), (2) residents around the bridges (64 samples), (3) business operators and employers around the bridges (75 samples) and (4) bus drivers (19 samples).

The results of the survey are as summarized below. The project contributed greatly to reducing the commuting time to work and school, thus achieving greater efficiency in the daily lives or work of users, while it had slightly negative effects on the local economy and the environment of local residents.

(1) Improved Mobility and Access

Referring to the ripple effects of improved mobility and access, 89% of those surveyed replied that transportation had improved, allowing ampler time and making business more efficient, and 39% of business operators replied that sales had grown after the project. Bus companies that serve the Old Bridge and New Bridge routes reported that they had seen substantial cost saving effects, such as reductions in vehicle operation and maintenance costs of about 21% and time savings of about 36%. There are no clear tendencies in the changes in land use and the population on both Bangkok and Thonburi sides, but business operators and residents in the areas around the bridges on the Thonburi side pointed out several changes. One change is that since transportation improved, more people flowed into Bangkok, reducing the number of people shopping locally.

(2) Environmental Impact

The project was expected to bring the secondary effect of reducing air pollution through the elimination of traffic congestion, but since the executing agency has not carried out environmental monitoring, quantitative assessment of the impact on the atmospheric air cannot be conducted.

Residents as well as business operators and employers in the areas around the bridges were asked about the condition of the air, noise and litter observed before the project, during the construction work and after the completion of the project. Adverse effects on the environment were rarely pointed out, but some of the people living beneath the New Bridge complained that they sometimes suffered from filthy water because rainwater from the New Bridge was not drained appropriately, and others complained that they could not sleep due to noise from the New Bridge.

(3) Safety

Questions were asked on the changes in the safety of driving on the Old Bridge. 54% replied that safety has improved, far exceeding the 16.5% who responded “no change”. Asked about the

[6] Rama III Road, Taksin Road, Charoen Nakhon Road, Charoen Krung Road, Charan Sanit Wong Road, Phet Kasem Road, Chakkrawat Road, Ratchada-Tapa Road

frequency of traffic accidents before the rehabilitation, 49.8% replied “frequently” or “very frequently”, and 34.1% replied “not very frequently” or “rarely”. Meanwhile, regarding the post-rehabilitation, 17.6% replied “frequently” or “very frequently”, and 69.6% replied “not very frequently” or “rarely”, evidencing that safety has improved after rehabilitation.

By contrast, on safety of the New Bridge, “sharp inclination”, “low protective walls”, “sharp curve for the ramp”, “darkness at night”, etc. were pointed out as concerns.

2.5 Sustainability

The on-site inspection alone did not raise any problems regarding the condition of bridge facilities. The restriction on vehicle weight for the Old Bridge is accomplished by traffic signs and police control, and it was appropriately managed as a road exclusively for light vehicles. For the New Bridge, it was also confirmed that its use by heavy vehicles was limited to the off-peak hours between 10:00 a.m. and 4:00 p.m. As mentioned earlier, opinions expressing concern about the safety of the New Bridge have been received, and therefore, the executing agency needs to look into these concerns in more detail.

Analyses of the possibility of project sustainability made from various viewpoints are as described below, but broadly speaking, it is considered that due to weak organizational capability, there is room for improvement in terms of sustainability.

2.5.1 Organizational System

At the time of appraisal, the executing agency for the project was the Ministry of the Interior’s Public Works Department (PWD), which consisted of 2,097 staff members in 18 divisions and four offices and was responsible for the overall administration of bridges and regional roads in the Bangkok metropolitan area, including planning, development and operations/maintenance. On October 3, 2002, the ministries and agencies of the Thai government was reorganized into one office, 19 ministries and 162 departments and agencies. With its urban development unit left to the Ministry of the Interior, PWD, together with the Ministry’s Office of Accelerated Rural Development (ARD), was transferred to the Department of Rural Roads (DOR), a new unit established under the Ministry of Transport. Currently, PWD has 1,904 staff members in ten sections (approximately 700 from the former PWD and 1,200 from the former ARD).

The operations and maintenance for the project are undertaken by the bridge maintenance section at the Bureau of Maintenance and Road Safety, Department of Rural Roads, Ministry of Transport. The section has five engineers who manage the overall operations and six assistants and is responsible for the operation and maintenance of bridges in the Bangkok Metropolitan Region and about 2,900 bridges in rural areas nationwide.

2.5.2 Technical Capacity

For the management of bridges in the city, mobile groups consisting of five engineers are responsible for inspection planning, budget compilation, monitoring and supervision, and their respective responsibilities are clarified with certain bridges assigned to each engineer.

Ten-year inspection plans are formed to implement a combination of routine, periodic and special inspections. Routine inspections are conducted once every month and involve the cleaning of

drain ditches and pipes, replacement of electric bulbs, street cleaning and other kinds of work. Twelve workers are used for each bridge, but 14 are especially assigned to the Old Bridge because it is a bascule bridge. Periodic inspections deal with six items, including pavements and painting, and are carried out on about two items once every four years. The inspection of the bascule bridge requires a high level of technical skill, but operations and maintenance manuals are not available, and training and evaluation systems for managing technical levels have not been established. The fact is that the inspection of the bascule bridge counts on the inspectors' working experience, which amounts to over ten years. In order to improve the quality and reliability of maintenance work, it is necessary to create an environment for maintaining and improving the technical level of engineers, but there is no specific improvement plan at this moment.

2.5.3 Financial Status

According to the executing agency, about 5-10% of PWD budgets have been appropriated to cover operations and maintenance expenses. Budges have continued to be cut since the economic crisis in 1997, and in fiscal 2002, they were reduced by about 49% as compared to fiscal 1997, and by about 9% as compared to fiscal 2001. The budget for fiscal 2003 is about 27% smaller than for the previous year and less than half the fiscal 1997 level. The executing agency does not indicate maintenance problems arising from reduced budgets. Since PWD was incorporated into the Ministry of Transport in 2002, future budgetary allocations are unknown.

3. Feedback

3.1 Lessons Learned

In order to minimize the factors which may affect the effectiveness of the project, it is essential that executing agency itself keep track related data and information.

Some local residents pointed out environmental problems that were caused during and after the implementation of the project. Since this project was not deemed to cause crucial environmental impact, it was dispensed from the Environmental Impact Assessment and consequently any environmental counteraction was not taken. That satisfied not only the Thai government's rules but also JBIC's guidelines. For future appraisal of comparable projects, however, in order to minimize the negative effectiveness caused by the project, a clear and proper understanding of the situation may enables the executing agency to monitor and take measures for preventing negative

In order to ensure effective project management, it is necessary to bolster the organization of the executing agency and improve its management capabilities.

In order to ensure effective project management, it is necessary to bolster the organization of the executing agency. Aiming at providing support for enhanced sustainability, human resources development plans should be implemented concurrently, through consulting services that include improvement of the executing agency's management capabilities.

3.2 Recommendations

(To the executing agency)

(1) Problems related to the safety of the New Bridge are pointed out by users, and problems related

to the drained water and noise are pointed out by some of the local residents. The executing agency is required to conduct full investigations and then take measures as necessary.

(2) The executing agency should establish a system that enables it to take over the portion of its operations that is supported by the experiences of maintenance personnel. In the midst of the ongoing budget cuts, it should strengthen its operations and maintenance system and improve its quality and efficiency.

Comparison of Original and Actual Scope

Item	Plan	Actual
1. Project Scope		
1. Construction of new bridges		
(1) Major roads		As left
Center span	226m	
Side span	125m	
Overall length	476m	
Type	Monolithic construction, box girders	
(2) Foundation		
Concrete spikes	22	
Span	1.50m	
(3) Clearance		
Width	68m	
Height	32m	
(4) Elevated bridge for the ramp	16.5-meter-wide, 174-meter-long road connecting to the Taksin Road on the Thonburi side and the bridge connecting to the Charoen Krung Road on the Bangkok side	
(5) Pier structure	Reinforced concrete slab	
2. Rehabilitation of the Old Bridge	Repair and painting of the steel and concrete structures Replacement of elastic joints for the bridge deck Replacement of the electric system for the bascule bridge Replacement of street lights	
3. Consulting services	Assistance in bidding Construction work management	
2. Implementation Schedule	Aug. 1992 – Dec. 1996 (53months)	Sep. 1993 – Feb. 2000 (78months)
Consultant contract	Aug. 1992	Sep. 1993
Land acquisition	Sep. 1992 – Aug. 1994	1995 – 1997
Bidding/contract	Jan. 1993 – Dec. 1993	Feb. 1995 – Aug. 1996
Construction of the New Bridge	Jan. 1994 – Jun. 1996	Oct. 1996 – Oct. 1999
Rehabilitation of the Old Bridge	Jul. 1996 – Dec. 1996	Oct. 1999 – Feb. 2000
3. Project Cost		
Foreign currency	2,755 million yen	2,658 million yen
Local currency	12,336 million yen (Local currency: baht)	4,099 million yen (Local currency: baht)
Total	15,091 million yen	6,757 million yen
ODA loan portion	7,546 million yen	2,660 million yen
Exchange rate	1 baht = 5.1 yen	1 baht = 3.5 yen

Third Party Evaluator's Opinion on
KrungThep Bridge Construction Project

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Relevance

This project (the New Krung Thep Bridge) was implemented in accordance with the Development Plan and also in conjunction with the National Development Policy. It aims to rectify the congested bottleneck problem caused by the unbalance between the four existing lanes on the old bridge and the connecting roads of 6 lanes on both ends of the bridge. This is not to mention the low rise bridge structure which requires a portion of bridge to be lifted up for ship navigation a few times a week. Ultimately, the project intends to improve traffic conditions along the Ratchadapisek or Middle Ring Road, one of the significant roads serving traffic around and inside the inner area of Bangkok. It is expected that this project can help alleviate the severe congestion along several main roads connecting to the nearby roads inside Bangkok 's inner area. The key feature of this new bridge is that it was designed to be constructed as a long elevated structure crossing over Charoen Krung Road, Charoen Nakhon Road and Somdet Phra Chao Taksin Road which can clearly helps improve traffic condition along the Ratchadapisek Road and the surrounding main roads. At present, the Ratchadapisek Road is connected to the Taksin-Phetkasem Road (at the location approximately 3 km from this project) which is the more convenient route for traveling between the western part of Thonburi and Bangkok. Furthermore, in the future this project can increase its role in providing higher accessibility to the southern and western areas of the country due to the connection of the Taksin-Phetkasem Road to the Outer-Ring Road. Presently, other two similar projects are also implemented: the Rama VIII Bridge which was opened to traffic since 2002 and the Rama V Bridge (opened in 2002). The Rama VIII Bridge aims to relieve the heavy traffic demands on the Phra Pinklao Bridge and facilitate higher accessibility to the western part of the country. On the other hand, the Rama V Bridge intends to handle traffic and provide higher mobility along both sides of the Chao Phraya River in Nonthaburi.

Impact

Since its implementation, this project helps improve traffic conditions along the surrounding roads even though traffic flows are increased. It was known that along the Middle Ring Road within the vicinity of this project, average travel speed was observed to be 20-25 kph (in 2000-2002) compared to the previous travel speed of only 15-20 kph. In fact, the surrounding main roads such as Somdet Phra Chao Taksin Road, one of the main arterials in Thonburi which often face with severe congestion problem, has the normal travel speed of 10-15 kph. However, after the completion of this project, it can be observed that average travel speed along this road has improved to be 20-25 kph. Additionally, according to the questionnaire survey conducted along the Middle Ring Road and surrounding areas, results of the survey indicate that 86% of users interviewed expressed that traffic congestion has been reduced and 91% stated that travel time also decreased. On the other hand, impact of this project on land development is not clear due to the fact that this project is only a bridge construction, unlike new road construction that has high impact on land development from such project. Results of this study only report that there exists some evidence that trips in the city are increasing due to the higher accessibility but has little effect on the local economy. Regarding environmental impact, it is expected that air quality should be improved due to better traffic conditions. However there is no clear evident to support this statement. On the contrary, results of the questionnaire survey reveal that those who live beneath this bridge complained about the poorly treated drainage system and excessive noise level. With respect to safety issue as expressed by commuters, negative comments such as "sharp inclination", "low protective walls", "sharp curve for the ramp", and "darkness at night" are evident. In the meantime, factors that had effects on the implementation schedule of this project are the country 's economic crisis (resulting in high construction costs); delay in land acquisition; delay in obtain an approval for traffic management plan during construction. All these factors were not anticipated during the planning stage of this project.