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PROJECT COMPLETION REPORT

KOREA

**KYONGGI REGIONAL TRANSPORT PROJECT
(LOAN 2905-K0)**

AUGUST 5, 1993

MICROGRAPHICS

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Type: PCR

**Infrastructure Operations Division
Country Department I
East Asia and Pacific Region**

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CURRENCY EQUIVALENTS

Currency Unit	=	Won (W)
US\$ 1.00 (SAR)	=	W 800 (as of October 1987)
US\$ 1.00	=	W 778 (as of September 1992)
US\$ 0.001	=	W 1
US\$ 1 million	=	W 778 million
US\$ 1336.9	=	W 1 million

FISCAL YEAR

January 1 - December 31

WEIGHTS AND MEASURES

1 meter (m)	=	3.2808 feet (ft)
1 kilometer (km)	=	0.62 mile (mi)
1 square kilometer (km ²)	=	0.3861 square miles (sq.mi)
1 hectare (ha)	=	0.01 km ² = 2.4711 acres (ac)
1 metric ton (m ton)	=	2.2046226 pounds (lbs)
	=	1.1023 short tons (sh tons or 2,000 lbs)
	=	0.9842 long tons (lg ton or 2,240 lbs)

PRINCIPAL ABBREVIATIONS AND ACRONYMS USED

ADB	- Asian Development Bank
BPW	- Bureau of Public Works of MOC
EIRR	- Economic Internal Rate of Return
GNP	- Gross National Product
GOK	- Government of Korea
KHC	- Korea Highway Corporation
KNR	- Korean National Railroad
KRMTFS	- Korea Regional Multimodal Transport Feasibility Study
MOC	- Ministry of Construction
PCR	- Project Completion Report
MOE	- Ministry of Environment
MOER	- Ministry of Energy and Resources
MOHA	- Ministry of Home Affairs
MOT	- Ministry of Transport
SMESRS	- Seoul Metropolitan Electrified Suburban Railway System
SAR	- Staff Appraisal Report
VOC	- Vehicle Operating Cost

THE WORLD BANK
Washington, D.C. 20433
U.S.A.

Office of Director-General
Operations Evaluation

August 5, 1993

MEMORANDUM TO THE EXECUTIVE DIRECTORS AND THE PRESIDENT

SUBJECT: Project Completion Report on Korea
Kyonggi Regional Transport Project (Loan 2905-KO)

Attached is the "Project Completion Report on Korea - Kyonggi Regional Transport Project (Loan 2905-KO)" prepared by the East Asia and Pacific Region. Part II contains the Borrower's comments.

Loan 2905-KO (US\$116 million equivalent of February 1988) was to help increase the efficiency of transport in the Kyonggi Region, which includes Seoul and Incheon, two of the country's largest urban areas. Accordingly, the Kyonggi Regional Transport Project encompassed civil works and consulting services to improve physical infrastructure in two specific corridors; to support coordinated transport planning in the Region; and to conduct a number of traffic management and other studies.

Except for difficulties with land acquisition, a recurring problem in Korea, implementation was smooth. All physical targets were met in time and within the estimated cost. Although Government preferred to finance out of its own resources all technical assistance and studies associated with the project, the Bank participated fully in the process that led to investment decisions and policy measures.

The comprehensive PCR summarizes adequately the experience gained from project inception to completion. Traffic increased faster than forecast, highway tolls generated substantial revenues, the Korea Highway Corporation became fully competent in expressway construction and management, and environmental issues have been resolved with dispatch, effectiveness and efficiency. Overall the project is rated as satisfactory, its sustainability as likely, and its institutional impact as substantial.

No audit is planned.

Robert Picciotto
by H. Eberhard Köpp

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KOREA

KYONGGI REGIONAL TRANSPORT PROJECT

(LOAN 2905-KO)

PROJECT COMPLETION REPORT

Preface

This is the Project Completion Report (PCR) for the Kyonggi Regional Transport Project in Korea, for which Loan 2905-KO, in the amount of US\$ 116.0 million equivalent was approved on February 2, 1988. The loan closed earlier than the original closing date of December 31, 1992. Disbursements under the loan totalled US\$ 111.86 million, with final disbursement made on April 8, 1992. US\$ 4.14 million was canceled effective June 15, 1992, when the Loan Account was closed.

The PCR was jointly prepared by the Infrastructure Division of the Asia Technical Department (ASTIN), the Infrastructure Operations Division (EAIN) of the East Asia and Pacific Regional Office and the Borrower, and is based, inter alia, on the Staff Appraisal Report (SAR), the Loan Agreement, supervision reports, the Borrowers own records, correspondence between the Bank and the Borrower, and internal Bank memoranda.

KOREA

KYONGGI REGIONAL TRANSPORT PROJECT

(LOAN 2905-KO)

PROJECT COMPLETION REPORT

Evaluation Summary

Objectives

The main objectives were to help increase the efficiency of transport in the Kyonggi Region by; (a) physically improving the transport infrastructure in two specific corridors; (b) supporting the ongoing process of coordination of transport investment planning in the region; (c) supporting the government's commitment to conduct a Traffic Management Study in the secondary cities served by the Bank investment; and (d) supporting the preparation of a comprehensive transport investment program.

Implementation Experience

Overall the project has been a success. All physical targets were met with no significant delays experienced. The only delay occurred with respect to land acquisition, but it did not impact the timely completion of the project. Diligent attention to environmental issues have produced commendable results.

Although the Bank did not finance any of the technical assistance or studies associated with the project, there was nonetheless constant dialogue concerning the studies and regional action plans as well as the decision-making process associated with investment in infrastructure in the area. The Bank was considered a valuable contributor to these discussions and as a result of continued involvement was able to draw attention to issues which otherwise would not have received high priority (specifically those dealing with traffic management and integrated decision-making).

Sustainability

With traffic increasing at rates faster than forecast in the SAR, and tolls bringing in substantial revenue to allow the Korea Highway Corporation (KHC) to finance needed maintenance and operation activities, it is expected that the expressways will maintain and even exceed the forecast level of net benefits throughout their economic life. The only issue of note concerns the expressway's connecting routes, which are outside of the jurisdiction of either the Ministry of Construction (MOC) or the KHC. Careful attention to the impact of the expressways on these roads will continue to be necessary to ensure smooth traffic movement from one level to the other, and to ensure that focus on traffic safety remains a major endeavor for both project roads and the inter-connecting roadways.

Findings and Lessons Learned

The main findings and lessons learned include the following:

- (a) the importance of timely land acquisition to avoid project delays;
- (b) the difficulty of forecasting traffic growth in rapidly expanding economies, resulting in estimates which appear to be too cautious and conservative;
- (c) realization that political decisions also play a part in the design of infrastructure investments, and while technical issues must remain of paramount concern, they must sometimes be looked at in more of a political context than a purely technical one. For example, under this project, the decision to construct the Topyong Interchange at this time was politically motivated;
- (d) co-ordination and co-operation among agencies and levels of government in Korea does not come easily or naturally. For this Project, transport planning and traffic management activities suffered to some extent from this lack of coordination, although project objectives were eventually achieved. These important activities, necessary for project success, should be reflected in both the Bank documents and Loan Agreement and supervised with the same vigor as technical activities;
- (e) in the design of projects, care should be taken to identify those actions which are beyond the control of the implementing agency, because those actions will require more intensive Bank supervision. Such components should also be identified as containing a high degree of risk;
- (f) KHC has now become fully competent in expressway construction and management, with potential for exporting this expertise beyond Korea. The Bank has been instrumental in molding the progress of KHC and should be proud of its achievement.

KOREA

KYONGGI REGIONAL TRANSPORT PROJECT (LOAN 2905-KO)

PROJECT COMPLETION REPORT

PART I. PROJECT REVIEW FROM BANK'S PERSPECTIVE

1. Project Identity

Project Name	:	Kyonggi Regional Transport Project
Loan Number	:	Ln. 2905-KO
RVP Unit	:	East Asia and Pacific Region
Country	:	Korea
Sector	:	Transport
Subsector	:	Highways
		Loan Amount : US\$116.00M
		Canceled Amount : US\$ 4.14M
		Disbursed Amount: US\$111.86M
Approval Date	:	02/02/88
Effective Date	:	05/04/88
Completion Date	:	12/31/91
Loan Account Closing	:	06/15/92
		Staff Appraisal : Oct. 1986
		Amendment Date : None
		Total Project Cost:US\$448.2M
Appraisal ERR	:	31%
		Re-assessed ERR: 22%

2. Background and Sectoral Setting

2.1 In 1988, when the Kyonggi Regional Transport Project was appraised, the population of Korea was about 42 million, with urban population accounting for 65% of the total. High economic growth rates and the changing structure of the economy had resulted in much of the population shifting out of the rural areas. While overall population growth in the 1980's declined to under 1.5% per annum, urban population continued to increase at more than 5% annually. In 1990, although the overall population of Korea had risen only slightly, to 43 million, the proportion of urban dwellers continued to rise, reaching an estimated 72% of Korea's total population.

2.2 Throughout the 1980s the GNP of Korea demonstrated a consistent vigor. Registering a low of about 5% in 1985, it has nonetheless averaged an annual growth rate of about 10% throughout that decade. This has resulted in a tremendous increase in per capita income, which almost tripled between 1983 and 1990, from US\$ 1,914 to US\$ 5,400. Kyonggi Region, which includes Seoul and Inchon, two of the country's largest urban areas, has contributed significantly to this economic growth and includes a large proportion of the higher income earners of the country.

2.3 The rapid economic growth of Korea, coupled with increased levels in disposable income, has strained the transport system. Massive public sector investments were made in transport infrastructure to support this growth, with the Government allocating almost 23% of its total capital expenditure to expand and modernize transport infrastructure between 1967 and 1977, and about 15% during the Fourth (1977-81), Fifth (1982-86) and Sixth Plans (1987-91).

2.4 In the years immediately preceding the Bank project (1966-1985), substantial changes in the modal distribution of traffic had occurred. The previously dominant role of the railways in freight transport (82% of ton-km in 1966) had been replaced by a more balanced split between rail (31%), road (40%) and coastal shipping (29%). In passenger transport, rapidly expanding personal incomes generated large increases in personal travel, mainly by public transport (both rail and road), with the rail share declining from 43% in 1966 to 25% in 1985, and the road share increasing from 56% in 1966 to 73% in 1985.

2.5 The Government of Korea's (GOK) basic objectives in the 1980's, to increase and modernize the capacity of the transport system in line with projected traffic growth and to avoid major bottlenecks, was largely achieved in the period immediately before 1985. The other objective, to develop new industrial complexes outside the Seoul center, and especially in the coastal areas to take advantage of a natural potential in harbors and to exploit coastal shipping, while avoiding excessive congestion on road and rail, has subsequently been largely achieved as well. To ensure that appropriate developmental priorities were reflected in the allocation of scarce transport resources, the GOK also reviewed some of its policy measures during this period. This resulted in a lifting of its restrictive licensing system and a re-assessment of road user charges.

Appraisal Context: The Kyonggi Region

2.6 The Kyonggi Region, located in the northwestern part of the country, had a population of about 15 million in 1985 and 20 million in 1991. The region includes three provincial-level administrative units: (a) Seoul City, the nation's capital, with a population of over 9 million in 1985 and 11 million in 1991; (b) Incheon City, the country's second largest seaport, with a population of 1.4 million in 1985 and 2.0 million in 1991; and (c) Kyonggi-Do Province, which encircles Seoul and Incheon, includes the two busiest transport corridors in Korea, namely the Seoul-Incheon Corridor and the Seoul-Pyongtaek section of the Seoul-Pusan Corridor. There are also a number of other larger cities (with populations ranging from 300,000 to 700,000 inhabitants) including Suwon, (the provincial capital), Songham, Puchon, and Anyang, and another fifteen cities and towns in the province with populations of over 100,000. The population of the Kyonggi Region (exclusive of Seoul but including Incheon) was almost 5 million in 1985 and over 6 million in 1991. The region has been consistent in generating over 40% of the nation's GNP, with Seoul alone accounting for close to 30%.

2.7 The concentration of population and economic activity in the Kyonggi Region has resulted in an explosive demand for transport infrastructure and services. Manufacturing and machinery industries coupled with the service and infrastructure sectors are predominant. The growth of Seoul in particular has created many problems, among which the main issue is transportation. In addition, the growth in other regional cities created serious congestion in the regional network, specifically in those locations (Suwon is an example) where traffic passed through the urban centers. Also, with car ownership rising, 24% annual increase between the years 1983-1988 for the whole nation, and 35% in the Kyonggi Region alone, there was a marked increase in the incidence of traffic accidents. The annual increase in traffic accidents in the country grew by an estimated 17% annually between 1977-88 with the province recording a total 54,000 accidents in 1988 (21,000 serious accidents and over 2,000 deaths). About half of these accidents occurred in the cities under the Kyonggi Regional Transport Project.

Kyonggi Region Transport System

2.8 The transport system of the Kyonggi Region is composed of two main elements; the road network and the subway/railway network. About 15% of the passenger traffic in the Region either originates or is destined for Seoul. In 1983 15.3 million (one-way) passenger trips were recorded per day in Seoul, with about 2.3 million crossing the city boundaries. Of these intercity trips, 64% were taken by bus, 19% by rail and 17% by car and taxi. This represented a 6% annual growth rate over the preceding several years. Also in 1983 about 362,000 freight tons/day moved across Seoul's boundaries, and another 110,000 tons/day moved circumferentially outside the city. About 88% of this traffic moved by road and 12% by rail.

2.9 Seoul's network consists of two ring roads, with a third (beltway) under construction. The Pangyo-Kuri section of the Bank project is a part of this third ring road. The remaining links are under phased construction, with completion of the whole ring road targeted for the year 2001. The Shingal-Ansan section of the Bank project, also part of this third ring road, allows traffic, in particular truck traffic, to by-pass a number of densely populated areas, and connect to the Seoul-Pusan Expressway in the central part of the nation, Inchon on the west, and the Bugok International Container Terminal (ICD) mid-way.

2.10 The rail network in the Kyonggi region is comprised of two components; the Seoul subway system (managed by a public corporation) and Seoul Metropolitan Electrified Suburban Railway System (SMESRS), a rail commuter system managed by the Korean National Railway (KNR). In addition KNR's Kyongbu line runs through the region connecting the northern part of the country with Pusan. Most of the container traffic on this line is either deposited or picked up in Bugok. Most of the connecting traffic generated by Bugok travels by road, and specifically the project's Shingal-Ansan Expressway.

Transport Planning

2.11 To deal with rapid growth in the Kyonggi Region two specific regional development plans were prepared in the early 1980's. The first, referred to as the Comprehensive National Physical Development Plan spans a ten-year period. The Region is presently in its third official Comprehensive National Physical Development Plan (1992-2001). The framework of the second plan (1982-91), under which this Bank project was conceived, focused on relieving congestion in and around Seoul by introducing appropriate traffic management. This objective continues under the Third Plan. The second regional plan which focused on facilitating economic development, is referred to as the Kyonggi Regional Transport Plan (also known as the Seoul Growth Management Plan, the Seoul Re-alignment Plan, and the Kyonggi Multimodal Transport Plan). This Plan, which was prepared between 1985-87, has also been replaced by a Stage Two Plan for the Region. A review and updating of this Plan (which covers the period 1991-2001) is presently in progress, with completion targeted for 1993. The emphasis on construction of satellite cities (under the original plan construction was begun on 5 new towns in Seoul's fringe area including the towns of Bundang, Ilsan, Ponchon, Sanbon and Chundon for a total of 2 million) is expected to continue mainly to relieve population density and traffic congestion in Seoul. Similarly the focus on improving subway and rail transport is expected to continue under this plan, encouraging diversion of passengers from road to rail. A number of improvements envisaged in this plan have already been implemented, including: (a) the construction of the two road sections under Bank financing (1991); (b) a double rail track

between Kuro and Seoul (1991) and a new link between Panwol and Kunpo (1989); and (c) as well as a number of road widenings and pavement improvements along intensely used national and provincial roads in the region. Other projects presently under implementation include: (a) the construction of the Seoul-Sorae section of the new expressway between Seoul and Incheon; (b) the Shihung-Nonggok section of the West expressway; and (c) the Shingal-Munhak expressway. These projects are targeted for completion between 1993 and 1995. In addition the Asian Development Bank's (ADB) most recently financed road improvement project, the construction of the Suweon-Kwangju section (26.2 km) of National Road No.43, was completed in 1991.

2.12 Beginning in 1969 with 24 km, KHC has gradually taken over more and more of Korea's expressway network. Since 1991, KHC has been responsible for the construction and maintenance of all 1600 km of Korea's expressways; all of which are tolled. The Borrower for this Loan, the Republic of Korea, provided the proceeds of the Loan to KHC by means of a Subsidiary Loan Agreement.

3. Previous Bank Involvement

3.1 The Bank's past involvement in the Korean highway sector has been substantial. Six highway project loans, amounting to US\$690 million have been completed, with one other (US \$200 million) presently on-going. The Bank's emphasis on sector and subsector work was initiated in 1984 with the Highway Sector Project (Ln 2392-KO) which deepened and broadened the Bank's involvement in the roads subsector by extending assistance to the Ministry of Construction (MOC), the Ministry of Home Affairs (MOHA), the Ministry of Transport (MOT) and the Ministry of Energy and Resources (MOER). The above project provided the framework for these agencies to improve their planning and coordination activities, energy conservation policies and land transport deregulation.

3.2 A Project Completion Report (PCR) on the Bank's Highway Sector Project (Ln 2392-KO) was prepared in 1991. Overall the project was considered successful, with only some minor delays in the procurement of road maintenance equipment. The two main lessons identified included the importance of (a) using experienced construction supervisors to implement high standards of quality control, and (b) encouraging inter-agency coordination. The latter issue has plagued most of the Bank's transport projects in Korea including the present one. However, the former lesson, high quality supervision, has been wholly embraced by the GOK in all subsequent highway works. One finding, which has proven to be true of most of the Bank's transport projects, concerns the difficulty of accurately forecasting project traffic growth in a country like Korea, which has had a continuous and very rapid expansion of its economy. Inevitably, estimates in the highway sub-sector (as well as the ports sub-sector), have often proven to be too modest and have in some cases significantly underestimated potential traffic.

3.3 Another PCR, prepared on the Bank's Provincial and Country Roads Project (Ln 2228-KO) articulated similar findings and drew similar lessons.

3.4 The project under review, the Kyonggi Regional Transport Project was based on the findings of the Kyonggi Region Multi-Modal Transport Project Feasibility Study (financed under the Bank's 7th Railway Project, Ln 1836-KO), which identified high priority transport investments for the Region. It provided the basis for the government's Regional Comprehensive Transport Plan. This "Plan" was completed in

1984 and adopted. It called for the following; (a) Road Network: improvement of transport corridors between Seoul and the urban areas in the Kyonggi Region, with construction of secondary roads and by-passes for densely populated areas including arterial and ring roads; and (b) Rail Transport: continuous expansion of an integrated network of subway and electrified rail.

4. Follow-on Initiatives

4.1 There are no projects in the sector presently planned for Bank financing. KHC's expertise in road development is such that KHC is poised for export to other countries. In fact, in a recent poll of Newly Developing Nations (September 1992 issue of the Far Eastern Economic Review) Korea ranked second in their ability to export knowledge and capabilities in the infrastructure sector, second only to Singapore. Although Korea is well versed in civil works lacks exposure in the area of soft services, including infrastructure management, use of computer based information systems, and toll collection technology. They have in fact requested Bank support in these areas, before graduation.

5. The Project

Objectives

5.1 The main objective of the project was to help increase the efficiency of transport in the economically dynamic Kyonggi Region around Seoul by; (a) physically improving the transport infrastructure in two specific corridors; (b) supporting the ongoing process of coordination of transport investment planning in the region; (c) supporting the government's commitment to conduct a Traffic Management Study in the secondary cities served by the Bank investment; and (d) supporting the preparation of a comprehensive transport investment program.

Description

5.2 To assist in the accomplishment of the above objectives, the project included:

- (a) The construction of two four-lane divided, controlled access, toll expressways. The first, the Pangyo-Kuri expressway, constitutes part of a section of the Seoul Outer Ring Road, the whole of which is to be completed in the year 2001. This new 23.8 km expressway with four interchanges and two junctions provides a direct route between the northeastern and southern areas of Kyonggi Region for local traffic and for the traffic using the Seoul-Pusan Expressway. The purpose of the Pangyo-Kuri section was to reduce traffic passing through downtown Seoul, thus alleviating congestion in that area. The second, the Shingal-Panwol Expressway, constitutes a section of the Shingal-Munhak Expressway, the whole of which is to be completed in 1995. This new 23.4 km four-lane expressway with three interchanges and two junctions, joins a national road, recently widened to four lanes, which carries the traffic to Panwol and beyond and links the container terminal at Bugok to the national expressway network. The purpose of the Shingal-Panwol Expressway is to facilitate traffic movement between the eastern and southern part of Kyonggi Region, and the

industrial port city of Incheon, as well as the new industrial and university city of Panwol.

- (b) Consultant's advisory services for the supervision of expressway construction (financed entirely by the Government);
- (c) Regular consultation with the Bank in the ongoing process of coordinating transport planning, and in the preparation of an investment program for transport in the Kyonggi Region; and
- (d) A Government commitment to conduct: a traffic management study in the secondary cities affected by the new expressways (a transportation System Management Program for Seoul was included in the Bank's Seoul Urban transportation Project: Ln 2514-KO).

Design and Organization

5.3 The project was designed as a time-slice investment of the Kyonggi Regional Transport Plan, and specifically a portion of the Seoul Outer Ring Road. Completion date of all of the planned components (including the Bank's portion) remains the year 2001. The origin of the Bank's project name, which suggests greater involvement in transportation planning in the region as a whole, stems from the Bank's original concept to include substantial technical assistance to the sub-sector to assist in the development of an appropriate planning system for the Region including the formulation of a well coordinated process for decision-making, which would include all levels of government concerned with inter-modal transport in the area, including the Ministries of Construction (MOC), and Transport (MOT), the Regional Municipalities and the Provincial Government. The GOK basically refused to borrow funds for such technical assistance, but agreed to continued Bank support in an advisory capacity throughout the planning period. Close Coordination and cooperation was particularly important to address issues concerning traffic management on connecting routes. As a result of Bank-Government dialogue, the Government agreed to prepare a study on Improving Traffic Management in Kuri, Songnam, Anyang and Ansan Cities on the Pankyo-Kuri and Shingal-Ansan Expressways. Both the Bank project and the Study were implemented by KHC in association with MOC. Construction was carried out by KHC's First Construction Department in association with its Planning and Coordination Department.

Revisions and Amendments

5.4 There were no revisions or amendments to the Bank project.

6. Project Implementation

Physical Works

6.1 Implementation of the civil works was carried out on schedule and without any major problems. All construction work was completed as of December 31, 1991, with some of the works completed even before schedule. Total costs of all civil works, including price escalation allowances but excluding land acquisition costs (see para 6.4 below), were W230.741 billion (US\$296.58 million) comparing favorably to appraisal estimates of W248.812 billion (US\$311.01 million). The small difference in appraisal and actual cost is probably due to the fact that SAR estimates were based on completed detail engineering designs. Of

the works included in the Project (46.7 km), the Bank assisted in the financing of all but 4.2 km which was entirely financed by KHC from internal resources at a cost of W48.261 billion (US\$62.0 million).

Action Plans and Studies

6.2 Although Bank finances were not used for any of the Transport Plans or Studies, there was close co-ordination and co-operation between the Bank and the related Korean ministries, departments and agencies. The Bank was particularly concerned that regional transport planning issues peculiar to the area, including inter-modal activities, urban-rural inter-face and prioritization of investments, be addressed within an appropriate planning framework. It was further concerned that the decision-making process include close coordination and cooperation among all the concerned ministries and levels of government, allowing for adequate inter-face between both the highway and railroad sub-sectors. The Bank's concern was that such co-ordination and co-operation was historically unknown in Korea and might prove difficult to implement. Although the GOK strongly objected to use of Bank funds to finance their transport plans and studies it was recognized that Bank input would be a valuable asset to their development. As a result the Bank remained involved throughout the preparation of these activities. The following results have been achieved:

- (a) preparation of a Traffic Management Study for the area of project influence. This Study was prepared by KHC with internal funds, with many of the recommendations already implemented;
- (b) improved coordination and consultation between the central government, the province and municipalities in prioritizing infrastructure investments, including transport planning for the whole of the region; and
- (c) preparation of a Highway Capacity Study and Highway Capacity Manual. This was prepared by the Korean Transport Institute and the Korean Institute for Construction with funds provided by the ADB. The Study was completed in early 1991 with the Highway Capacity Manual completed in October 1991.

Procurement

6.3 Procurement experience under this Project concerned:

(a) Civil Works. The two four-lane divided, controlled access, toll expressways (actual length 46.7 km) which comprised the civil works carried out under the Project were constructed through seven construction contracts, six of which (42.5 km) were tendered and awarded in conformance with the Bank's Guidelines for Procurement through International Competitive Bidding (ICB) and were financed under the Loan. The seventh contract (4.2 km), financed entirely by KHC from their own resources, was tendered and awarded under Local Competitive Bidding (LCB) procedures. All works were satisfactorily completed without significant delays or difficulties despite some early problems related to land acquisition and later difficulties due to lack of coordination between different administrative bodies.

(b) Consulting Services. Construction supervision of civil works was carried out by KHC with the assistance of local consultants entirely financed by KHC, using their own resources, which were obtained

using local procedures. These consultants provided advice and review functions and augmented KHC staff with their own personnel. The performance of both KHC and the consultants in carrying out this work was very satisfactory.

Costs

6.4 There was an 8% decrease in the cost of construction works between appraisal estimates and actual expenditures. This is well within the expected level of accuracy. In terms of consultancy services and land acquisition, however, there were marked differences between appraisal estimates and actual costs. The costs of consultancy services, which were entirely defrayed by KHC from their own resources, amounted to W2.881 billion (US\$3.7 million), compared to the appraisal estimate of W9.35 billion (US\$11.7 million). This large difference is due to the original estimate being based on expatriate instead of local services, which was the actual case. Also, with respect to land acquisition, the appraisal underestimated the cost of land purchase by more than 40%. The original estimate had been made three years before actual construction began and in the interim land prices escalated dramatically. These land costs, which were also defrayed entirely by KHC with its own resources, totaled W140.635 billion (US\$198.4 million) compared to an appraisal estimate of W99.7 billion (US\$124.6 million).

Disbursement

6.5 Disbursement experience was generally good, although there was a slight lag during early implementation. Overall, disbursements represented 21% of total costs, compared to the 26% projected at appraisal. The disbursement percentage for civil works as provided for in the Loan Agreement was 46% of total costs of the civil works financed by the bank, while in reality it amounted to 43.5%. Considering all project civil works (including that not financed by the Bank), actual disbursement represented 34% of total civil works costs. The costs of consultancy services and land acquisition were entirely defrayed by the Borrower.

7. Project Results and Lessons Learned

7.1 Overall, the project has been a success. All physical targets were met and there were no significant delays. The only exception occurred in the early stages of project implementation when delays in land acquisition on some road sections did impact start-up timing. Nonetheless, implementation did proceed without any serious problems resulting in an earlier than planned project completion for the originally included project elements. Construction of the Topyong Interchange, added during the course of project implementation and financed entirely by KHC using its own resources, is still on-going.

Environment

7.2 Diligent attention to environmental impacts during construction (initiated by the Ministry of Environment (MOE)) made this project a model for similar works. MOE visited the project site often to ensure minimum impact of construction on the surrounding areas. Attention to the noise level resulted in the installation of both aluminum and reflective barriers to keep noise levels in populated areas under 65 decibels during the day and 50 at night. As a result of the

attention to noise about double the original length of barriers were installed along the project route. In terms of resettlement, a total of 4 million square meters (400 hectares) was purchased, involving 3979 individual plots of land and 244 dwellings. A total of 360 families (1800 people) were relocated. Finally, in terms of construction accidents there were approximately five accidents per km constructed. This is considered to be somewhat high. The reason for this high number has not been determined, however, it may be that the push to complete construction on or before schedule contributed to this number. Although there is no specific data at this point, it is expected that the previous high number of traffic accidents on the existing roads will decline as a result of the new expressway. However, it has already been noted, expressways themselves are not immune to traffic accidents. During the first 9 months there have been 26 accidents (3 fatalities) on the Pangyo-Kuri section of the Bank's project and 42 (2 fatalities) on the Shingal-Ansam section. Higher speeds permitted by the new facility may be a factor.

Technical Assistance

7.3 The Government's unwillingness to borrow Bank funds for technical assistance, specifically for the Traffic Management Study, did not allow the Bank to be as involved in either the Study progress nor implementation process, as much as may have been warranted. Nonetheless the Study was completed in December 1990 on schedule, with many of the recommendations, specifically those dealing with interchange and intersection improvements, implemented. MOC has already indicated to the Bank that it will follow-up the process to ensure compliance. The Bank has reviewed the Study and the recommendations and is generally in agreement with them, with one exception. This concerns the Topyong Interchange (which is being entirely financed by KHC using its own resources), where the Bank continues to have some reservations about the placement of this interchange as well as its design. However, the regional government has insisted on the construction of the Topyong interchange in the location identified for political reasons, and is unwilling to consider significant changes.

Economic Analysis

7.4 At the time of appraisal, traffic for the Shingal-Panwol Expressway was projected to be 28,000 vehicles per day by the year 1991, the opening year, rising to 49,000 in 2001. For the Pangyo-Kuri Expressway, traffic by 1991 was projected to be 36,000 vehicles per day, rising to 57,000 by 2001. It was expected that the growth rate for both would remain in the region of 5%. In actual fact, in the first year of the project, traffic has averaged about 30,000 to 40,000 vehicles per day on most sections, and is now expected to rise to almost 80,000 by

the year 2001. The growth rate for both roads between 1991 and 1996 is now projected to be about 10%, falling off to about 5% thereafter.

7.5 The economic internal rates of return (EIRR) for the civil works components was estimated at the time of appraisal as 39% for the Shingal-Ansan Expressway and 24% for the Pangyo-Kuri Expressway. The combined EIRR was 31%. Vehicle operating cost (VOC) savings constituted the main benefits. The revised EIRR, which is based on the same methodology as was presented in the SAR, has been calculated as being 25% for the Shingal-Ansan Expressway and 20% for the Pangyo-Kuri Expressway, with a combined and weighted EIRR of 22%. Although this re-appraised EIRR differs from the appraisal estimate it nonetheless mirrors the estimates in the original Korea Regional Multimodal Transport Study (KRMTFS), which estimated an EIRR of 27% for the Shingal-Panwol and 18% for Pangyo-Kuri. It is difficult to determine the reason for the difference in EIRR between appraisal and post-appraisal because of the lack of base information in both the SAR and the Bank files. One possible reason could be the exclusion of land acquisition costs in the appraisal's economic cost estimates and a much smaller operations and maintenance ratio.

Financial Status

7.6 As anticipated at appraisal, tolls were introduced on both expressways financed by the Bank, in December 1990. Furthermore, as discussed in para. 7.4 above, traffic flows have not been affected by the introduction of tolls and are, in fact, even higher than projected.

7.7 Tolls generated by all expressways are retained by KHC in their entirety, and in 1991 were almost double the amount forecast by the appraisal team. This is in part due to the higher traffic volumes as well as a doubling of basic toll rates on the project routes (alone) to ensure adequate user coverage. This has greatly enhanced KHC's financial position and has enabled the corporation to maintain its operating ratio at about 31%. At the time of appraisal it was anticipated that this ratio would be 35%. Although the financial position of KHC appears to be strong allowing it to easily cover its operating costs and adequately service its debt, there is little remaining in the coffer to invest in new construction. As a result KHC is floating bonds to raise sufficient funds for its investment program.

Findings and Lessons learned

7.8 The following outlines the findings and lessons learned from the Bank's involvement in the Kyonggi Regional Transport Project:

- (a) the process of land acquisition should be started as far in advance of project implementation as is possible, and at least a year before, so that there are no undue project delays. Furthermore, to avoid undue delay, alignments should avoid, as much as possible, highly populated areas;
- (b) when determining the appropriate growth rate for traffic in a country with a rapidly expanding economy like Korea, it is easy to be too modest and to underestimate the rate. More attention should be paid to experience in previous projects so that projections more accurately reflect the country situation;

- (c) transport projects are by their very nature political. It is necessary to realize that some decisions are made solely for political reasons, and that these reasons may be as compelling as any others which may exist. The Topyong Interchange is being constructed at this time by KHC (using its own resources) primarily for political reasons, using in the Bank's opinion, a less than optimal design configuration which has been dictated partly by cost considerations and partly by inadequate available land area. While the Bank has made its reservations known, basically the situation has been accepted.
- (d) construction of regional expressways requires coordination and cooperation among a number of ministries and levels of government because it crosses many jurisdictions. However, close coordination and cooperation among agencies does not come easily in the Korean context and was unsatisfactory during the implementation of this Project, causing less than optimal execution of transport planning and traffic management activities, although project objectives were eventually achieved. A provision outlining specific goals and achievements should have been incorporated into the project document and/or loan agreement, with judicious follow-up to ensure success;
- (e) in the design of projects, care should be taken to identify those actions which are beyond the complete control of the implementing agency, because those actions may require more intensive Bank supervision. Such components should also be identified as potentially having a high degree of risk; and
- (f) KHC, with many years of Bank support, has succeeded in graduating to a position where they have become the foremost experts in Korea on the construction of expressways, and have, in fact, reached the stage where they are likely candidates to export this expertise to other developing countries in Asia.

8. Sustainability/Remaining Issues

8.1 With traffic increasing faster than forecast, and KHC well versed in the need for adequate maintenance, it is expected that the expressways will maintain or even exceed the forecast level of net benefits throughout their economic life. The final success of the construction component depends on the continued growth of the Korean economy providing a spur to the growth of traffic and on the timely and adequate provision of maintenance funds to keep the expressways in good condition. With respect to the latter, both expressways are tolled, and all of the revenue collected remains with KHC.

8.2 The only remaining issue concerns the roads at the end of the interchanges, which are outside the jurisdiction of either MOC or KHC. Although the Traffic Management Study has been completed, implementation is left wholly up to the municipalities concerned, including the financing of any of the recommendations. Given the constrained budgets of these municipalities, they may not be able to implement the recommendations in a timely manner. MOC has indicated that it has sent copies of the report's findings to each of the concerned municipalities and plans to follow this up with a formal letter, strongly encouraging them to implement the study's recommendations in order to realize the full potential of the expressway benefits.

8.3 The other outstanding issue, which concerns Korean roads more generally is the issue of traffic safety. MOT figures show that in 1991 there were 13,429 fatalities on roads in South Korea, or nearly 37 people per day. The nation's accident rate is third highest in the world after South Africa and Portugal. South Korea's roads and traffic management systems have become inadequate for the recent explosion in car ownership with about 540 new cars per day registered in Seoul alone in 1991, and with new registrations nationally running at nearly 2,100 per day, adding to the 5 million vehicles presently on the roads. There is an obvious need to address the issue from a national perspective, with a comprehensive review of all measures, from driver testing to road use itself, warranted.

9. Bank Performance

9.1 Bank performance was very good throughout the project cycle. However, this must be tempered by the fact that KHC has become a sophisticated agency, implementing high caliber works, responsive to Bank suggestions and willing to engage in dialogue with concerned agencies. The Bank did provide a continuity of involvement, with a minimum of staff change. Supervision was regular and staffed with appropriate expertise.

10. Borrower Performance

10.1 The Borrower and its implementing agency, in this case KHC, performed well during the project. They eased the task of project preparation by readily providing the information requested and their performance during project implementation was very good.

11. Project Relationships

11.1 The excellent relationship that has existed between the staffs of the Borrower and the Bank goes back many years. During the preparation and implementation of this project, this relationship developed even further and became one of the key factors which contributed towards the success of the project. It created good teamwork, in which each party displayed flexibility to allow for successful achievement of the goals.

12. Project Documentation and Data

12.1 The covenants contained in the Loan Agreement were reasonable and the Borrower complied with them. In addition, the staff appraisal report provided a useful reference framework during project implementation.

12.2 KHC has kept excellent records of the project, and these have been well organized and accessible to the Bank. This has enabled the Bank to review the project easily and prepare the project completion report without any complication.

PART II. PROJECT REVIEW FROM THE BORROWER'S PERSPECTIVE

A. Conditions Leading to the Project

In 1983, during discussions on transport sector development with the GOK, a consensus emerged on the importance of coordinating and integrating the different modal transport plans for the Kyonggi Region. Recent government spatial policies had emphasized the high priority given to the dispersal of the large population of Seoul by promoting urban growth centers to the south and east of the city. Emphasis was also being given to the location of major new highways and rail lines to influence future settlement patterns as well as provide improved access to the city. The results of these discussions led to the formulation of the first Kyonggi Multimodal Transport Plan (also known as the Regional Transport Plan) which identified a number of priority investments to the year 1995, and of which the present Bank project under review, the Kyonggi Regional Transport Project, is an integral part (para. 2.11).

The main purpose of the project, from the Borrower's perspective, was to facilitate traffic flow by inter-connecting the main urban roads as well as the Kyungbu and Central Expressways, and ease traffic circulation in the metropolitan areas in the Kyonggi Region.

B. Main Findings and Lessons Learned

The following includes the findings and lessons which were identified by KHC:

- (a) Since 1970 KHC has received much technological assistance from the Bank, in addition to the financial assistance. This has enabled them to enhance their skills;
- (b) The Bank has significantly influenced the development of the traffic management plans for the Kyonggi Region, and has been instrumental in helping the government focus on the need for the preparation of these plans in a timely fashion; and
- (c) The Bank has also been instrumental in assisting in coordinating activities between the various agencies. It influenced inter-actions between some nine agencies involved in the project, by encouraging coordination.

C. Summary of Bank Role and Performance

The Bank promptly responded to all problems which arose and adopted a flexible approach in its administration of the project; for example, approval of local contracts. Since the Executing Agency was experienced in the implementation of similar projects, the flexible approach adopted by the Bank enabled smooth implementation of each component. The overall success of the project can be, therefore, attributed, in part, to the good performance by Bank staff during the whole project cycle. During implementation supervision missions were sent to Korea on a regular basis, about once per year, with the final project review carried out by the PCR mission in September/October 1992. These review missions aptly highlighted the issues and recommended solutions to the various difficulties affecting implementation. Staff changes were kept to a minimum, thus enabling good relationships to be built up over the project period. Disbursement of the loan proceeds were prompt, with the contractors receiving their payments in a timely

manner. The Bank's performance throughout the preparation and implementation phases of the project was very satisfactory.

D. Evaluation of Borrower's Own Performance

The performance of the Borrower (the Korean Government) and the Executing Agency (KHC) in implementing the project was generally satisfactory. The Executing Agency, with experience in other similar projects, contributed significantly to the efficient implementation of the project. The management of the project was also efficient and the staff assigned to it were both qualified and competent. The required facilities and equipment were provided in good condition and on time.

Difficulties were encountered with one important aspect of project implementation, that is acquisition of the right-of-way. With rising land costs and increased legal action on the part of the land owners, land acquisition posed some problems during the early stages of project implementation. However, KHC vigorously pursued purchase with the result that all necessary land was acquired without incident.

E. Remaining Issues

Financing from government sources has been steadily diminishing, thus KHC has sought external funds to implement their projects (they have floated bonds). Although KHC is quite confident in its abilities to construct civil works, it is less confident in its ability to implement management systems, computerize its operations (introduction of MIS/OIS), and carry out adequate maintenance functions. In these specific areas it requires external assistance, and would appreciate continued assistance from the World Bank.

PART III. STATISTICAL INFORMATION

Table 1: RELATED BANK LOANS AND/OR CREDITS

Loan/Credit	Purpose	Year of Approval	Status	Comments
Highway Project (Loan 769-KO)	To construct 372 km of national highways between Chonju and Pusan: feasibility studies and detailed engineering of 1,400 km and 1,100 km, respectively; a highway maintenance study and establishment of a pilot maintenance organization and purchase of highway maintenance equipment.	1971	Completed	PCR issued: PPAR No. 3045 of June 1980
Highway II (Loan 956-KO)	To assist Government's 1972-76 road construction and paving program and to expand road maintenance organization. To construct national highways from Saemal to Gangreung (97 km) and Gangreung to Mukho (33 km); pave and improve 634 km of national highways: procure maintenance equipment and carry out feasibility studies and detailed engineering of 1,000 km of national and provincial roads.	1974	Completed	PCR issued: PPAR No. 3045 of June 1980
Highway III (Loan 1203-KO)	To cater for growing traffic on the highway system by extending the network of all weather paved highways (800 km) between the main centers of population and carry out feasibility studies and detailed engineering (1,200 km) to prepare future projects.	1976	Completed	PCR issued: PPAR No. 5024 of April 1984
Highway IV (Loan 1640-KO)	To assist in improving the highway system by extending the network of paved highways by some 1,230 km and by preparing a program for improving the maintenance and development of the provincial and county (gun) road system.	1979	Completed	PCR issued: PPAR No. 5450 of February 1985
Provincial and County Roads (Loan 2228)	To assist the Borrower to improve some 1,000 km of county (gun) or tertiary network roads throughout the country and to establish and equip appropriate maintenance organizations for the provincial and county road networks.	1982	Completed	PCR issued PPAR No. 8372 of February 1990
Highway Sector Project (Loan 2392-KO)	To assist the Government in increasing efficiency in its highway sector through improvement in investment planning, transport regulation and pricing, and energy conservation.	1984	Completed	PCR issued PPAR No. 9243 of December 1990
Road Improvement (Loan 3061-PH)	To increase transport capacity during the Sixth Plan period (1987-91) by supporting three principal road-related Government objectives: (a) enhancing transport efficiency by upgrading the surface and alignment of existing roads and by improving road maintenance and operations; (b) expanding traffic capacity by widening roads and (c) increasing traffic safety.	1989	Ongoing	Approved May 16, 1989

Table 2: BANK RESOURCES

A. Staff Input

Stage of Project Cycle	Number of Staffweeks
Through Appraisal	48.2
Appraisal through Board Approval	66.8
Board Approval through Effectiveness	20.2
Supervision	11.8
Project Completion Report	6.0
Total	153.0 SW

B. Missions

Month/year	No. of persons	Days in field	Specialization	Performance rating	Type of problems
<u>Preparation</u>					
July 1985	4	7	HE/LO/TS/EC	n.a.	
November 1985	4	7	HE/LO/TS/EC	n.a.	
March 1986	1	1	EC	n.a.	
<u>Appraisal</u>					
October 1986	5	15	HE/LO/TS/EC/TE	n.a.	
<u>Post Appraisal</u>					
March 1987	3	10	HE/TS/EC	n.a.	
May 1987	3	10	TS/LO/EC	n.a.	
June 1987	1	3	EC	n.a.	
August 1987	2	10	TS/EC	n.a.	
<u>Supervision</u>					
October 1988	2	3	HE/TS	1	
April 1989	4	7	TS/OA/TE/HE	1	Development Impact, rated 2
November 1989	2	2	TS/EC	1	Improvement in Development Impact shown
February 1991	2	2	TS/EC	1	
September 1991	2	7	HE/FA	1	
<u>PCR</u>					
October 1992	3	4	HE/EC/OA	n.a.	

HE - Highway Engineer
 FA - Financial Analyst
 EC - Economist

LO - Loan Officer
 OA - Operations Assistant
 TE - Traffic Engineer
 TS - Transport Specialist

Table 3: STATUS OF LEGAL COVENANTS

Agreement Section No.	Description of Covenant	Status	Comments
3.01(a)	Provide KHC with funds, facilities services and other resources	Compliance	
3.01(b)	Relend proceeds of loan to KHC under Subsidiary Loan Agreement	Compliance	
3.04(i)	Furnish the Bank with draft of transport elements to be included in the Capital Region Implementation Program for 1988/96.	Compliance	Discussion between Bank and MOC held during PCR preparation meeting.
3.04(ii)	Review with the Bank yearly progress in the execution of transport elements of the Program.	Compliance	
3.05	Carry out study on improvement of traffic systems in Songnam, Suwon, Kuri and Anyang	Compliance	
3.05	Implement recommendations of the study	See notes	Traffic management measures within the Secondary Cities are not likely to be implemented unless MOC takes the necessary actions.
4.01	Submit audit reports including Statement of Expenditure	Compliance	

Table 4: CUMULATIVE ESTIMATED AND ACTUAL DISBURSEMENT
(US\$ million)

Semester Ending	Appraisal Estimate	Actual	Actual as % of Estimate
December 31, 1987	-	-	-
June 30, 1988	10.0	10.0	100.0
December 31, 1988	18.0	10.0	55.6
June 30, 1989	26.0	28.5	109.6
December 31, 1989	38.0	34.0	89.5
June 30, 1990	64.0	52.8	82.5
December 31, 1990	88.0	81.0	92.0
June 30, 1991	96.0	96.1	100.1
December 31, 1991	103.0	186.7	103.6
June 30, 1992	110.0	111.9	101.7
December 31, 1992	116.0	-	-

Date of final disbursement: April 8, 1992

Table 5: FINANCING PLAN
(US\$ million)

	SAR Plan			Actual Funding		
	Bank	Gov't	Total	Bank	Gov't	Total
Expressway construction						
Pangyo-Tongbu (Shinjang)	51.1	60.3	111.4	41.9	54.5	96.4
Hail (Kodok) - Kuri	-	54.0	54.0	-	64.8	64.8
Shingal - Panwol	56.4	66.5	122.9	54.4	70.8	125.2
Supervision of construction	-	11.7	11.7	-	3.7	3.7
Contingencies/Escalation						
Pangyo-Tongbu (Shinjang)	4.0	4.8	8.8	6.6	8.7	15.3
Hail (Kodok) - Kuri	-	4.2	4.2	-	3.2	3.2
Shingal - Panwol	4.5	5.2	9.7	8.9	11.5	20.4
Supervision of construction	-	0.9	0.9	-	0.6	0.6
Right-of-way acquisition	-	124.6	124.6	-	198.4	198.4
Total	116.0	332.2	448.2	111.9	417.2	529.0

Table 6: PROJECT COST
(Won million)

	SAR Estimate			Actual		
	Local	Foreign	Total	Local	Foreign	Total
Pangyo-Kuri (23.5 km)	67,230	65,110	132,340	75,892	38,428	114,320
Lot 1 (5.6 km)				14,197	7,189	21,386
Lot 2 (7.9 km)				15,648	7,924	23,572
Lot 3 (5.8 km)				15,535	7,866	23,401
Lot 4 (4.2 km)				30,512	15,449	45,961
Shingal-Ansan (23.2 km)	49,940	48,360	98,300	58,943	29,846	88,789
Lot 5 (7.2 km)				22,016	11,148	33,164
Lot 6 (9.3 km)				25,341	12,832	38,173
Lot 7 (6.7 km)				11,586	5,866	17,452
Contingencies/Escalation/Change Orders						
Physical	6,330	5,670	12,000	8,604	6,759	15,363
Price	3,630	3,260	6,890	8,023	4,246	12,269
Right-of-Way Acquisition	99,700	-	99,700	140,635	-	140,635
Supervision of Construction	9,350	-	9,350	2,881	-	2,881
Grand Total	236,180	122,400	358,580	294,978	79,279	374,257

Table 7: DETAILED PROJECT COST

PANGYO-KURI AND SHINGAL-ANSAN EXPRESSWAYS PROJECT (LOAN NO. 2905-KO)

Project Component	Length (km)	Contract	Design Agency	Design started	Design completed	Completion Date			Cost (million USD)				Payment (million USD)				Disbursement (USD)		Financing (%)	R. ratio
						Contract	Reported	Actual or Reported	Appr. Est.	Contract Price	Reported Contract Price	Actual or Reported	Appr. Est.	Actual Paid	Total	Actual Paid	Appr. (W/o sub)	Disburse (W/o sub)		
Civil Work										₩	₩	₩								
Lot 1	5.6	Sang Yong	KHC/KBOC	'88-2.12	'88-2.16	'91-12.7	-	'91-12.7	)	21,386	(25,813)	(25,813)	25,813	-	25,813	25,813	11,240	11,240	100.0	
Lot 2	7.9	Dong Ah	"	"	"	"	"	"	)	99,100	(26,346)	(26,346)	26,346	-	26,346	26,346	11,471	11,471	100.0	
Lot 3	5.8	Yoo Oun	"	"	"	"	"	"	)	23,401	(27,079)	(27,079)	27,079	-	27,079	27,079	11,791	11,791	100.0	
Lot 4	4.2	Doo Lim	"	'88-1.30	'88-2.1	"	"	"	)	43,241	(48,261)	(48,261)	48,261	-	48,261	48,261	-	-	100.0	
Lot 5	7.2	Doo Woo	"	'88-2.12	'88-2.16	"	"	"	)	33,864	(41,124)	(41,124)	41,124	-	41,124	41,124	17,626	17,626	100.0	
Lot 6	0.5	Sun Sang	"	"	"	"	"	"	)	28,173	(42,877)	(42,877)	42,877	-	42,877	42,877	12,306	12,306	100.0	
Lot 7	0.7	Hwa Yong	"	"	"	"	"	"	)	17,432	(19,241)	(19,241)	19,241	-	19,241	19,241	9,345	9,345	100.0	
Subtotal	46.7									230,642	(203,189)	(230,741)	230,741	-	230,741	230,741	79,279	79,279	100.0	
Other Works (Landscaping, electrical works, construction, etc.)																				
Contingency																				
Physical Price										18,880		15,363	15,363							
Subtotal											27,632	27,632								
Construction cost										249,532	203,189	230,741	230,741		230,741	230,741	79,279	79,279	100.0	
Land acquisition										99,760	-	-	140,635		140,635	140,635	140,635	140,635	100.0	
Contingency reserve																				
Supervision		KBOC	KHC	'88-3.2	'88-3.2	'91-12.31	-	'91-12.31	9,330	9,330	3,301	2,881	2,881		2,881	2,881	-	-	100.0	
Grand Total (Project Cost)										339,392		374,257	374,257		374,257	374,257	79,279	79,279	100.0	

$f_b, f_c = f_a + f_d$

Table 8: PROJECT IMPLEMENTATION SCHEDULE

	Start	Complete
General Procurement		06/15/87
	09/03/87	
Issue prequalification (PQ) documents for contractors and get responses		10/31/87
Evaluate PQ submissions, including Bank review	11/01/87	12/23/87
Terms of reference for supervision consultants	07/01/87	11/11/87
<u>Pangyo-Tongbu (Shinjang) and Shingai-Panwol Expressways</u>	07/01/87	01/04/88
Bidding documents, including Bank review	07/01/87	01/04/88
Bid period	12/26/87	02/23/88
Evaluation of bids, including Bank review of evaluation report and KHC recommendations	01/25/88	02/03/88
Request proposals for supervision consultancies and select consultants, including Bank review	12/15/87	02/22/88
Construction of expressway	02/01/88	12/07/91
<u>Hail (Kodok)-Kuri Expressway Section</u> (funded by Government)		
Engineering documents	03/02/88	12/31/91
Construction of expressway	02/01/88	12/07/91

Table 9: PROJECT MONITORING INDICES

Project Component	Estimated quantities	Actual
<u>Pangyo-Kuri Expressway</u>		
<u>Lot 1</u>		
Earthworks (m ³)	2,506,000	2,884,464
Paving (m ²)	147,000	151,857
Culverts (no.)	36	49
Bridges (no.)	17	16
Final cost (W bln)	50	26
<u>Lot 2</u>		
Earthworks (m ³)	2,437,000	2,027,908
Paving (m ²)	173,000	124,513
Culverts (no.)	44	39
Bridges (no.)	11	11
Final cost (W bln)	65	26
<u>Lot 3</u>		
Earthworks (m ³)	2,097,000	2,090,981
Paving (m ²)	150,000	108,927
Culverts (no.)	72	55
Bridges (no.)	11	13
Final cost (W bln)	48	27
<u>Lot 4</u>		
Earthworks (m ³)	1,026,700	1,108,776
Paving (m ²)	62,000	45,547
Culverts (no.)	19	22
Bridges (no.)	2	4
Final cost (W bln)	56	42
<u>Shingal-Panwol Expressway</u>		
<u>Lot 1</u>		
Earthworks (m ³)	3,644,000	4,037,383
Paving (m ²)	232,000	219,513
Culverts (no.)	62	66
Bridges (no.)	12	13
Final cost (W bln)	47	41
<u>Lot 2</u>		
Earthworks (m ³)	4,612,000	4,564,605
Paving (m ²)	206,000	179,907
Culverts (no.)	46	50
Bridges (no.)	14	15
Final cost (W bln)	55	43
<u>Lot 3</u>		
Earthworks (m ³)	3,054,000	3,031,525
Paving (m ²)	159,000	147,607
Culverts (no.)	62	49
Bridges (no.)	6	6
Final cost (W bln)	37	19

Table 10: STUDIES

Studies	Purpose as Defined at Appraisal	Status
Traffic Management Study in Secondary Cities around Seoul	The proposed expressways would directly affect the traffic patterns in several satellite cities around Seoul, especially Anyang, Kuri, Songnam and Suwon. These secondary cities are expanding rapidly into commercial and industrial centers, and traffic systems management will be needed to avoid congestion and transport related pollution.	Completed December 1990.
Highway Capacity Study	The growth of traffic is beginning to cause unacceptable levels of congestion and delays on many parts of the Korean highway network which is expected to become particularly severe in the Kyonggi region. The geometric design of the highways has been based on the U.S. Highway Capacity Manual, but it became increasingly evident that U.S. traffic flow relationships are not directly applicable to Korean conditions because of the high proportion of trucks in the traffic stream and major differences in vehicle performance and driving characteristics. Ministry of Construction thus intends to conduct a study leading to the development of a Korean Highway Capacity Manual.	Completed with assistance from ADB.

Table 11: TRAFFIC VOLUME, 1991/92

Route	Section	Total		Car		Bus		Truck	
		Volume	%	Volume	%	Volume	%	Volume	%
Pangyo-Kuri Expressway	Pangyo - Seongnam	24,322	100	13,149	54.1	2,183	9.0	8,990	36.9
	Seongnam - Songpa	29,529	100	16,711	56.6	2,410	8.2	10,408	35.2
	Songpa - Seohanam	40,058	100	21,720	54.2	3,654	9.1	14,684	36.7
	Hail - Kuri	36,687	100	19,518	53.2	3,090	8.4	14,079	38.4
Shingal - Ansan Expressway	Shingal - Dongsuweon	55,927	100	27,061	48.4	6,119	10.9	22,747	40.7
	Dongsuweon - Busksuweon	49,267	100	13,642	48.0	5,271	10.7	20,354	41.3
	Buksuweon - Bugok	40,408	100	19,180	47.5	4,503	11.1	16,725	41.4
	Bugok - Banweol	38,507	100	18,564	48.2	4,375	11.4	15,568	40.4
	Banweol - Ansan	32,034	100	15,713	49.1	3,706	11.6	12,615	39.4

Table 12: KHC-MANAGED NETWORK, 1991

Route	Length (km)	Width (m)	No. of lanes	Design speed (kph)	Date of completion
Seoul-Inchon	24.0	20.4/36.0	4/8	80-120	Dec 1968
Seoul-Pusan	428.0	22.4	4/8	80-120	Jul 1970
Eonyang-Ulsan	14.3	22.4	4	80-120	Dec 1969
Taejon-Jonju	79.5	23.4	4	80-120	Dec 1970
Shingal-Saemal	104.0	13.2	2	80-120	Nov 1971
Jonju-Sunchon	172.3	13.2/23.4	2/4	70-120	Nov 1975
Sunchon-Pusan	176.5	13.2/23.4	2/4	70-120	Nov 1975
Saemal-Kangnung	97.0	10.7	2	50-120	Sep 1975
Kangnung-Tonghae	41.7	10.7/13.2	2	50-120	Sep 1975
Taegu-Masan	86.3	13.2/23.4	2/4	70-120	Dec 1977
Pusan-Masan	20.6	23.4	4	80-120	Sep 1981
Taegu-Kwangju	182.9	13.2	2	80-120	Jun 1984
Hail-Nami	123.6	23.4	4	100-	Dec 1987
Pangyo-Kuri	123.5	23.4	4	120	Dec 1991
Shingal-Ansan	23.2	23.4	4	100	Dec 1991
Total	1,597.4				

Table 13: TOLL RATES AND USER BENEFITS

Vehicles class	Benefit (won/km)	Basic rate (won/km)	% of Benefit
Passenger cars, trucks < 2.5 t	180.1	27	15.0
Buses	212.2	46	21.7
Trucks < 10 t	270.8	30	11.1
Trucks > 10 t	376.5	60	15.9

Table 14: KOREA HIGHWAY CORPORATION: INCOME STATEMENT (1987-91)
(Won million)

	1987		1988		1989		1990		1991	
	SAR	Actual	SAR	Actual	SAR	Actual	SAR	Actual	SAR	Actual
Toll	172,460	182,472	196,100	218,496	225,644	271,152	250,690	323,772	276,555	406,990
Others /a	23,213	36,206	34,203	25,226	8,982	19,299	9,291	31,924	9,610	56,774
Total Revenue	195,673	18,678	230,303	243,722	234,626	290,451	259,981	355,696	286,165	463,770
Expenditures										
Operating Expenditures										
Operation and maintenance	60,819	58,815	73,560	69,074	78,710	79,777	84,000	86,343	89,800	99,855
Administration and management	6,917	6,941	8,366	8,939	8,950	11,885	9,050	14,666	10,210	18,742
Others /a	22,098	28,201	26,282	14,585	840	2,561	950	10,966	990	24,438
Subtotal	89,834	93,957	108,208	92,598	88,500	94,223	94,000	111,975	101,000	143,035
Nonoperating Expenditures										
Interest	762	1,215	8,500	7,703	7,100	2,175	14,400	3,937	22,400	3,046
Others	2,901	19,025	3,500	4,548	3,550	7,301	3,600	9,904	3,620	107,852
Subtotal	3,663	20,240	12,000	12,251	10,650	9,476	18,000	13,841	26,020	110,898
Total Expenditures	93,497	114,197	120,208	104,849	99,150	103,699	112,000	125,816	127,020	253,933
Income Before Taxes	102,176	104,481	110,095	138,873	135,476	186,752	147,981	229,880	159,145	209,837
Taxes	6,447	4,477	7,730	5,813	8,940	15,376	9,760	25,171	10,500	44,444
After-Tax Income	95,729	100,004	102,365	133,060	126,536	171,376	138,221	204,709	148,645	165,393
Highway cost recovery	92,793	97,348	99,290	129,041	122,740	163,807	134,080	1,084	144,185	152,456
Net Income	2,936	2,656	3,075	4,019	3,796	7,569	4,141	10,625	4,460	12,937
/a Includes special Government allocation of W 160,176 million for Chung-bu Expressway in 1985-88, and equal amount for construction expenditure.										

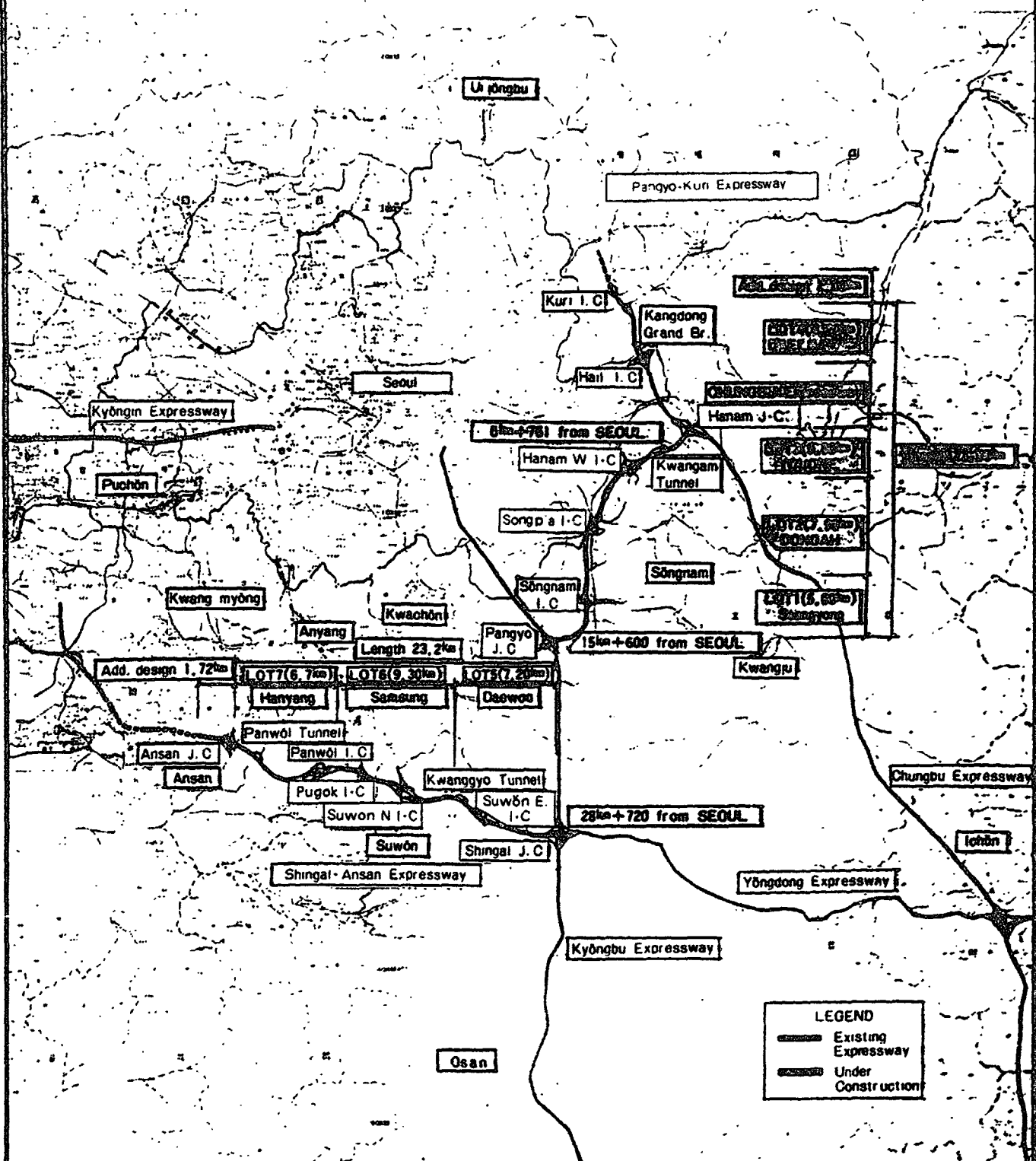
Table 15: KOREA HIGHWAY CORPORATION: SOURCES AND APPLICATIONS OF FUNDS (1987-91)
(Won million)

	1987		1988		1989		1990		1991	
	SAR	Actual	SAR	Actual	SAR	Actual	SAR	Actual	SAR	Actual
Sources										
Internal Cash Generation										
Income	95,729	100,004	102,365	133,060	126,536	171,376	138,221	204,709	148,645	165,393
Plus depreciation, etc.	13,248	23,980	16,700	17,400	17,100	32,535	17,100	29,534	19,300	137,621
Subtotal cash generation	108,977	123,984	119,065	150,460	143,636	203,911	143,636	234,243	167,945	303,014
Government contribution	90,000	90,000	200,000	45,000	100,000	80,000	100,000	84,100	200,000	240,650
IBRD loan	-	30,000	34,000	27,814	27,200	50,000	27,200	116,697	15,300	464,412
Total Sources	198,977	243,984	353,065	223,274	270,836	333,911	270,836	435,040	383,245	1,008,076
Applications										
Investments										
Highways widening and construction	221,645	213,596	201,400	164,888	240,400	256,199	240,400	353,971	246,900	1,070,713
Kyonggi Region /a	6,100	1,273	127,200	95,842	122,700	139,246	122,700	165,916	71,600	544,589
Others	215,545	212,323	74,200	69,046	117,700	116,953	117,700	187,455	175,300	526,124
Highway improvement	21,847	24,905	36,300	612	77,100	48,993	77,100	61,100	52,300	82,802
Other capital expenditure	19,571	13,634	23,300	22,312	10,600	24,951	10,600	40,618	29,100	63,182
Subtotal investments	263,063	252,135	261,000	225,812	328,100	330,143	328,100	455,089	328,300	1,216,697
Other expenditure	6,227	7,493	-	-	-	5,019	-	81,639	-	7,509
Debt service (non-IBRD)	1,993	2,133	2,000	7,977	2,000	37,317	2,000	11,254	2,000	18,012
Change in noncash working capital	(72,306)	(17,777)	90,065	(11,313)	(59,264)	(38,568)	(59,264)	(112,942)	52,945	(234,142)
Total Applications	198,977	243,984	353,065	223,274	270,836	333,911	270,836	435,040	383,245	1,008,076
/a Including debt service for IBRD loan.										

Table 16: KOREA HIGHWAY CORPORATION: BALANCE SHEET (1987-91)
(Won million)

	1987		1988		1989		1990		1991	
	SAR	Actual	SAR	Actual	SAR	Actual	SAR	Actual	SAR	Actual
Assets										
Current Assets										
Quick assets	482	12,343	20,000	6,798	20,000	75,200	20,000	94,141	20,000	275,696
Inventories	4,479	2,622	4,000	1,736	4,000	2,208	4,000	3,701	4,000	4,998
Other current assets /a	26,232	17,150	3,000	3,097	3,000	1,603	3,000	2,059	3,000	1,599
Total Current Assets	31,193	32,115	27,000	11,631	27,000	79,011	27,000	99,901	27,000	282,293
Less: Current Liabilities										
Payables and accrued liabilities	123,111	69,365	28,846	54,405	88,110	130,957	169,489	29,249	169,489	700,493
Current portion at long-term debt	1,993	2,132	2,000	7,921	2,000	37,318	2,000	10,858	2,000	18,148
Total Current Liabilities	125,104	71,497	30,846	62,326	90,110	168,275	171,489	302,107	171,489	718,641
Net Working Capital	(93,911)	(39,382)	(3,846)	(50,695)	(63,110)	(89,264)	(144,489)	(202,206)	(144,489)	(436,348)
Fixed Assets										
Highways (at cost)	995,016	973,462	1,196,416	1,293,211	1,436,816	1,598,596	1,694,316	2,093,664	1,941,216	3,245,398
Other (net)	62,177	64,522	51,777	84,722	99,477	102,218	149,677	130,536	178,077	173,050
Total Fixed Assets	1,057,193	1,037,984	1,248,193	1,377,933	1,536,293	1,700,814	1,843,993	2,224,200	2,119,293	3,418,448
Total Assets	963,282	998,602	1,244,347	1,327,238	1,473,183	1,611,550	1,699,504	2,021,994	2,027,749	2,982,100
Liabilities and Equity										
Long-term debt: IBRD	-	34,000	3,303	61,200	9,089	83,200	25,300	98,500	59,032	76,649
Other	46,531	39,813	44,531	68,563	42,531	89,258	40,531	115,525	38,531	745,160
Equity	916,751	926,736	1,165,816	1,228,891	1,369,452	1,470,725	1,575,773	1,760,305	1,575,773	2,160,291
Total Liabilities and Equity	963,282	998,602	1,244,347	1,327,238	1,473,183	1,611,550	1,699,504	2,021,994	2,027,749	2,982,100
/a Including work-in-progress for Chung-bu Expressway.										

EXPRESSWAY ROUTES



LEGEND	
	Existing Expressway
	Under Construction