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**Report No. 8372**

**PROJECT COMPLETION REPORT**

**KOREA**

**PROVINCIAL AND COUNTRY ROADS PROJECT  
(LOAN 2228-KO)**

**FEBRUARY 16, 1990**

**Infrastructure Operations Division  
Country Department II  
Asia Regional Office**

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**Republic of Korea  
Provincial and County Roads Project**

**CURRENCY EQUIVALENTS**

Currency Unit - Won (W)

US\$1            - W650 (at completion)  
US\$1            - W745 (at appraisal)

**FISCAL YEAR**

January 1 - December 31

**WEIGHTS AND MEASURES**

1 meter (m)	-	39.37 inches (in)
1 square meter (sq m)	-	10.8 square feet (sq ft)
1 cubic meter (cu m)	-	35.3 cubic feet (cu ft)
1 kilometer (km)	-	0.62 mile (mi)
1 square kilometer (sq km)	-	0.386 square mile (sq mi)
1 hectare (ha)	-	10,000 square meters (sq m) or 2.47 acres (ac)

**ABBREVIATIONS AND ACRONYMS**

AC	-	Asphaltic Concrete
BPR	-	Bureau of Public Roads
DBST	-	Double Bituminous Surface Treatment
ICB	-	International Competitive Bidding
IRIPS	-	Integrated Road Investment Planning Study
KHC	-	Korea Highway Corporation
KMPA	-	Korean Maritime and Port Administration
KNR	-	Korean National Railroad
LCB	-	Local Competitive Bidding
MOC	-	Ministry of Construction
MOF	-	Ministry of Finance
MOHA	-	Ministry of Home Affairs
MOT	-	Ministry of Transport
OSROK	-	Office of Supply for the Republic of Korea
ROK	-	Republic of Korea
SAR	-	Staff Appraisal Report
UTS	-	Unscheduled Transport Services

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

Office of Director-General  
Operations Evaluation

February 16, 1990

MEMORANDUM TO THE EXECUTIVE DIRECTORS AND THE PRESIDENT

**SUBJECT: Project Completion Report on Korea Provincial and Country Roads Project (Loan 2228-KO)**

Attached, for information, is a copy of a report entitled "Project Completion Report on Korea - Provincial and Country Roads Project (Loan 2228-KO)" prepared by the Government of Korea, with an overview memorandum prepared by the Asia Regional Office. No audit of this project has been made by the Operations Evaluation Department at this time.

Attachment

A handwritten signature in black ink, appearing to be 'L. P. ...', is located in the lower right quadrant of the page.

PROJECT COMPLETION REPORT

KOREA  
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 (LOAN 2228-KO)

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PROJECT COMPLETION REPORT

KOREA  
PROVINCIAL AND COUNTRY ROADS PROJECT  
(LOAN 2228-KO)

PREFACE

This is the Project Completion Report (PCR) for the Provincial and Country Roads project in Korea for which Loan 2228-KO in the amount of US\$125 million was approved on December 23, 1982. The loan was closed on June 30, 1989, 1 year behind schedule. The final disbursement was made on July 3, 1989 at which time US\$0.674 million was cancelled.

The PCR was jointly prepared by the Infrastructure Operations Division, Country Department II of the Asia Regional Office and the Borrower and is based, inter alia, on the Staff Appraisal Report (SAR); the Loan Agreement; supervision reports; the Borrower's own records; correspondence between the Bank and the Borrower; and internal Bank memoranda.

The draft PCR was sent to the Borrower in July 1989, for comments by the Ministry of Home Affairs and amended in the light of the minor comments received.

PROJECT COMPLETION REPORT

KOREA  
PROVINCIAL AND COUNTRY ROADS PROJECT  
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BASIC DATA SHEET

**KEY PROJECT DATA**

Item	Appraisal Estimate	Actual
Total Project Cost (US\$ million)	259.7	294.9
Loan Amount (US\$ million)	125.0	125.0
Disbursed	-	124.3
Cancelled (7/4/89)	-	0.7
Date Physical Components Completed	12/31/87	06/30/89
Proportion Completed by Original Completion Date (%)	100%	77%
Proportion of Time Overrun (%)	-	32%
Economic Rate of Return	31%	29%

**OTHER PROJECT DATA**

Item	Date		Actual
	Planned	Revised	
Identification	-	-	06/79
Preparation	-	-	10/80-02/82
Appraisal Mission	03/82	05/82	05/82
Loan Negotiations	11/82	11/82	11/82
Board Approval	01/83	03/83	12/23/82
Loan Signature	-	-	12/30/82
Loan Effectiveness	-	-	03/30/83
Project Completion	12/31/87	12/31/88	06/30/89
Loan Closing	06/30/88	06/30/89	07/03/89
Executing Agency			Ministry of Home Affairs
Fiscal Year of Borrower			January 1 - December 31
Follow-on Project			Highway Sector Project
Loan Number			Loan 2392-KO
Amount			US\$230 million
Loan Agreement Date			08/22/84

MISSION DATA

Stage of Project Cycle	Mission Month/Yr	No. of People	Days In Field	Expertise Represented [1]	Overall Performance Rating[2]	Types of Problems [3]
Identification	06/79	1	5	EGR	-	-
Preparation	11/79	1	10	EGR	-	-
Preappraisal I	10/81	4	15	EGRx2/ECN/FNA	-	-
Preappraisal II	02/82	1	7	EGR	-	-
Appraisal	05/82	3	26	EGR/ECN/FNA	-	-
Post-Appraisal I	07/82	1	4	DCH	-	-
Post-Appraisal II	09/82	3	7	EGR/ECN/FNA	-	-
Post-Appraisal III	10/82	1	10	LWR	-	-
Supervision I	01/83	4	8	DCH/ENG/ECN/FNA	1	None
Supervision II	05/83	2	7	EGR/ECN	1	None
Supervision III	07/83	2	5	EGR/ECN	-	-
Supervision IV	10/83	3	7	EGR/ECN/FNA	2	M
Supervision V	01/84	1	7	EGR	1	None
Supervision VI	04/84	3	9	EGRx2/ECN	1	None
Supervision VII	08/84	2	2	ECN/EGR	-	-
Supervision VIII	10/84	3	7	EGRx2/ECN	1	None
Supervision IX	01/85	2	3	ECN/EGR	-	-
Supervision X	05/85	3	8	DCH/EGR/ECN	1	None
Supervision XI	11/85	3	5	DCH/EGRx2	1[4]	-[4]
Supervision XII	03/86	1	4	EGR	-	-
Supervision XIII	10/86	2	7	EGRx2	-	-
Supervision XIV	10/87	3	4	TSP/EGR/ECN	1	-
Supervision XV	05/88	1	4	EGR	1	-
Supervision XVI	11/88	2	4	TSP/EGR	1	-
Supervision XVII	04/89	3	6	TSP/EGR/RSA	-	-

Notes: [1] EGR - Highway Engineer, ECN - Economist, TSP - Transport Specialist, DCH - Division Chief, FNA - Financial Analyst, LWR - Lawyer, RSA - Research Assistant.

[2] 1 - No or minor problems, 2 - Moderate problems.

[3] M - Management.

[4] Rating system changed. Problems no longer specified on Form 590 - Supervision Summary.

STAFF INPUTS  
(staff weeks)

Stage	FY 78	79	80	81	82	83	84	85	86	87	88	89	90	TOTAL
Preparation	0.3	1.5	2.3	3.8	22.8									30.7
Appraisal					16.4	17.5								33.9
Negotiations						3.5								3.5
Supervision						5.5	24.1	12.3	8.7	7.3	9.2	4.5		71.6
Other					3.9	12.9		0.7		2.5		6.7	0.4	27.1
<b>TOTAL</b>	<b>0.3</b>	<b>1.5</b>	<b>2.3</b>	<b>3.8</b>	<b>43.1</b>	<b>39.4</b>	<b>24.1</b>	<b>13.0</b>	<b>8.7</b>	<b>9.8</b>	<b>9.2</b>	<b>11.2</b>	<b>0.4</b>	<b>166.8</b>

**DISBURSEMENT DATA**

**Cumulative Estimated and Actual Disbursements  
(US\$ Million)**

<b>Fiscal Year Ending</b>	<b>Appraisal Estimate</b>	<b>Actual</b>	<b>Actual as % of Estimate</b>	<b>Actual as % of Total</b>
June 30, 1983	3.0	0.13	4.33%	0.10%
June 30, 1984	25.0	21.69	86.76%	17.45%
June 30, 1985	50.0	74.23	148.46%	59.71%
June 30, 1986	90.0	93.40	103.78%	75.13%
June 30, 1987	115.0	96.00	83.48%	77.22%
June 30, 1988	125.0	105.19	84.15%	84.61%
June 30, 1989		123.67	98.94%	99.47%
June 30, 1990		124.33	99.46%	100.00%

Note: The last disbursement was made on July 3, 1989 and the undisbursed loan balance of US\$ 674,417.00 was cancelled effective July 4, 1989.

**Disbursements by Loan Category  
(US\$ Million)**

<b>Category</b>	<b>Loan Allocation At Appraisal</b>	<b>%</b>	<b>Actual Amount Disbursed</b>	<b>%</b>
Civil Works	76.0	60.8%	113.70	91.45%
Road Maintenance Eqpt, Vehicles & Spare Parts	27.0	21.6%	5.04	4.05%
Consultant Services	3.0	2.4%	5.34	4.30%
Overseas Training	0.1	0.1%	0.24	0.20%
Unallocated	18.9	15.1%	0.00	0.00%
<b>Total</b>	<b>125.0</b>	<b>100.0%</b>	<b>124.33</b>	<b>100.00%</b>



PROJECT COMPLETION REPORT

KOREA  
PROVINCIAL AND COUNTY ROADS PROJECT  
(LOAN 2228-KO)

EVALUATION SUMMARY

Objectives

The objective of the Provincial and County Roads Project was to support Government's policy of promoting economic development in rural areas by reducing transport costs through the improvement of the county or tertiary road network (Overview para 2.1). The major components of the project aimed to:

- (a) improve about 1,000 km of provincial and county roads;
- (b) set up and provide equipment for road maintenance organizations at provincial and county level;
- (c) introduce and train all involved in the use of Double Bituminous Surface Treatment (DBST); and
- (d) strengthen the capability of the Ministry of Home Affairs (MOHA) to manage, plan and maintain the roads for which it is responsible and improve traffic safety.

Implementation Experience

The Provincial and County Roads Project was appraised in May 1982 and the loan became effective in March 1983. The Bank Loan (2228-KO) for the project, as signed, was US\$125.0 million; a total of US\$0.674 million was cancelled; the final net loan amounted to US\$124.3 million.

All the civil works contracts progressed well and were completed on schedule (Overview para 4.1), although there were initial problems with quality control as the contractors, all Korean, were not used to working strictly to a specification, and the local consultants were not used to enforcing it. Supervision of construction was progressively strengthened during the project as weak points emerged and the final quality of the work was good.

There was considerable initial resistance to the use of DBST, largely because its capabilities and advantages were not known (Overview para 3.2). Once contractors and consultants became familiar with the technique, DBST became accepted as an economical surfacing for roads with low traffic levels.

Because of the prevailing international contracting situation, low bids were received for the civil works contracts which enabled a further 580 km of roads to be improved (Overview para 4.2). In order to give time for these works to be completed the loan closing date was extended by one year.

There were considerable delays in the procurement of the road maintenance equipment, the scope of which was severely cut back and eventually delivered about 3 years late (Overview para 3.2c and 4.3).

All technical assistance components went well (Overview para 4.5), but the introduction of Unscheduled Transport Services (UTS) was not very successful (Overview paras 4.4 and 4.6d).

### Results

Overall, the project was a success (Overview paras 5.1 and 5.3). From the physical aspect, it more than achieved its objectives and its results had a noticeable impact in the intended areas. A significant proportion of the tertiary road network was improved to all-weather quality, transport costs reduced, maintenance organizations established in every province and preparatory work carried out to improve other aspects of the transport sector in subsequent projects.

The overall economic rate of return, estimated at appraisal to be 31%, based on 1006 km of roads, is now estimated to be 28.8% based on the 1586 km improved (Overview para 5.2).

### Sustainability

With traffic increasing faster than forecast and the introduction of a proper maintenance system for provincial and county roads, it is expected that the project will maintain or even exceed the forecast level of net benefits throughout its economic life (Overview paras 7.1 and 7.2). Its final success 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 roads in good condition.

### Findings and Lessons

The main objectives of the Provincial and County Roads Project were achieved in an efficient and timely fashion.

The Bank learned some valuable lessons (Overview para 7.2) on project preparation and the need to be flexible in the design and during implementation. The Borrower also learned useful lessons (Overview para 8.4) related to future highway planning, the importance of good supervision of civil works and the advantages to be gained from the introduction of unfamiliar techniques.

PROJECT COMPLETION REPORT

KOREA  
PROVINCIAL AND COUNTRY ROADS PROJECT  
(LOAN 2228-KO)

OVERVIEW

1. Background

1.1 For the past two decades, the transport system in the Republic of Korea (ROK) has been strained by the demands of rapid growth and has required massive public sector investments in infrastructure. The Government allocated up to 23% of its total capital expenditure to expand and modernize transport infrastructure from 1967 to 1977, tapering down to about 15% in the Fourth (1977-81) and Fifth Plans (1982-86). The Sixth Plan (1987-91) allocation for transport sector investments is at about the same level. Investments have tended to be concentrated on the Seoul-Busan axis where most industrial development is taking place and in other corridors serving the northeastern and southeastern parts of Korea.

1.2 Substantial changes in the modal distribution of traffic for the period from 1966 to 1985 can be illustrated by traffic statistics. The previously dominant role of the railways (82% of ton-km in 1966) has been replaced by a more balanced distribution of traffic among rail, coastal shipping and road for freight and among road and rail for passenger transport. During this period, for freight traffic, the road and coastal shipping shares of total ton-km increased from 8% to 40% and from 10% to 29%, respectively, while movements by rail, although showing growth in absolute terms, fell to 31% of total ton-km. These changes reflect both the economic advantages of the various modes and the different growth rates of the industries served, as rail and coastal shipping became concentrated on long distance traffic and bulk cargo. For passenger traffic, rapidly expanding personal incomes have generated large increases in personal travel, mainly by public transport such as express trains and buses. About half of all passenger traffic is in urban areas. High taxation of private cars and gasoline has limited car ownership to a level significantly below that of other countries with comparable income levels, but has not deterred rapid growth in road transport. Between 1966 and 1985, the rail share of total passenger-km fell from 43% to 25% while the road share increased from 56% to 73%.

1.3 ROK's basic objective in the past has been to increase and modernize the capacity of the transport system in line with the projected traffic growth and to avoid major bottlenecks. This objective has been largely achieved. The present system is reasonably balanced and traffic is in general allocated economically among the various modes. Another objective of the investments in transport has been to pursue broader concerns in ROK's spatial and economic planning. Considerable efforts have been made to develop new industrial complexes in coastal areas, to take advantage of Korea's natural potential in harbors and to exploit low-cost coastal shipping while avoiding excessive congestion on road and rail. Projects are now better designed, construction quality has improved with the rapid expansion of the construction industry, and maintenance systems have been established for the road network and have been strengthened for the railways.

1.4 In its efforts to ensure that appropriate development priorities were reflected in the allocation of scarce transport resources, the Government has in the past tightly regulated the sector, with a restrictive licensing system for operators in road transport and shipping, and administered pricing for all transport activities. Korea's vehicle fleet has been kept small due to the policy of high taxation of cars and high prices for gasoline.

1.5 The large investments in transportation infrastructure have been complemented by a considerable effort to improve the efficiency of the transport system, through the establishment and strengthening of institutions to plan, construct, maintain and operate the facilities and services. In the public sector, institutions such as the Korean National Railroad (KNR), the Bureau of Public Roads (BPR) in the Ministry of Construction (MOC), the Korea Highway Corporation (KHC), and the Korean Maritime and Port Administration (KMPA) have been established or strengthened in many instances with increasing financial and managerial responsibility as semi-autonomous public corporations. In the private sector, a highly efficient contractor system has evolved for civil works, which system reflects both the policy of competitive bidding in the award of contracts, and the large volume of construction that has been carried out in Korea during more than 20 years. In 1982 there were some 500 firms capable of handling a broad range of public works and the number has increased since then. Furthermore, with Government encouragement, the major construction firms have successfully expanded their construction activities overseas.

1.6 The Bank has played an active role in advising and assisting the Korean authorities in pursuing their transport objectives. Despite considerable efforts, spatial planning of the transportation system was, in 1982, still hindered by generally inadequate interagency coordination, a comparatively limited expertise in planning and economic appraisal techniques, and in the capacity to undertake appropriate longer-term pre-investment studies. Recent projects have improved this situation but there is still some way to go. The Bank has provided, through various projects, active support and finance for technical assistance for a range of feasibility and planning studies relating to national transport development, urban transportation needs and inter-modal alternatives along major traffic axes in addition to more conventional engineering design work for proposed projects.

1.7 Pricing policy and the regulatory framework have been a feature of Bank-Government dialogue for many years. In the 1970s, emphasis was given to supporting Government's efforts to establish agencies such as KNR and KMPA on sound financial bases, with investment planning linked to appropriate tariffs and charges in regard to rail transport and ports. The Bank has also assisted Government in the review of transport and traffic regulation, notably in regard to licensing of common carriers, road vehicle taxation, axle loading and similar issues relating to road transport. The Provincial and County Roads Project (Loan 2228-KO) deepened and broadened the Bank's involvement in the road subsector by extending assistance, for the first time, to MOHA, which deals with the maintenance of provincial roads and the maintenance and improvement of county roads. This new involvement also provided the Bank with an opportunity to improve coordination of road planning between MOC and MOHA, and strengthened the basis for a highway sector loan (Loan 2392-KO), which was approved in 1984.

## **2. Project Objectives and Description**

**2.1 Project Objectives.** Until the early 1980s, most of the investment in highway rehabilitation and maintenance had been directed towards the major routes, the expressways and national highways, with consequent neglect of the provincial and county (gun) roads, which were in a poor condition. The major objective of the project was to support Government's policy of promoting economic development in rural areas by reducing transport costs through the improvement of the county or tertiary road network. The setting up of organizations at central and local levels for the maintenance of provincial and county roads was also seen as an essential step for the long-term protection of the investments being made. The project assisted the Government in carrying out the first phase of MOHA's overall program by promoting improved integration of the planning of the road system by carrying out a review of road investment plans to ensure that county road development was coordinated with the development of the national and provincial road networks. A further objective of the project was to promote the adoption of a low-cost surfacing technique, Double Bituminous Surface Treatment (DBST), which was not then used in Korea, by training local contractors and engineers in its use. MOHA staff were also to be trained under the project in road planning and coordination, transport economics, equipment management, financial management and accounting. The project aimed to help Government to improve road safety and transport services in remote areas.

**2.2 Project Description.** The Project, as appraised, consisted of:

- a. improvement of about 1,000 km of provincial and county roads of which about 820 km were to be paved and the remainder gravel surfaced;
- b. setting up and providing equipment for organizations at central provincial and county administrative levels to implement a road maintenance program;
- c. consultant services for: (i) supervision of county road improvement works; (ii) technical assistance for the provincial and county road maintenance program; (iii) detailed engineering of an additional 1,000 km of county roads; (iv) the implementation of an on-site training program for Korean contractors, consultants and MOHA and MOC staff in the use of DBST; (v) a study for the integrated investment planning of the road system; and (vi) a road safety study; and
- d. provision of overseas fellowships for the training of MOHA staff in road planning and coordination, economic analysis, equipment management, financial management and accounting.

## **3. Project Design and Organization**

**3.1** To address the perceived needs for the improvement of the tertiary roads, a project was identified in June 1979. Preparatory studies were carried out, for provincial roads under the Third Highway Project (Loan 1203-KO), and for county roads under the Fourth Highway Project (Loan 1640-KO). It was intended that these

studies should lead to sector lending projects, but eventually it was seen that project lending was a more appropriate vehicle for the tertiary roads, while sector lending was more appropriate for the improvement of national roads, and this led eventually to the formulation of the Highway Sector Project (Loan 2392-KO). After some delay, the Project Brief for the Provincial and County Roads Project was issued in July 1981, the project was appraised in May 1982, loan negotiations took place in November 1982 and the Board approved the project on December 23, 1982.

3.2 The design of the project directly addressed the needs as defined by the Government and its concepts fitted readily into the plan to develop the capabilities of MOHA. There were three main issues that had to be resolved during project preparation and loan negotiation stages:

- a. There was considerable initial resistance to the use of DBST, largely because its capabilities and advantages were not known. The suspicion of this "new technology" persisted well into the implementation stage. Whereas MOHA's consultants, supported by the Bank, recommended that 70% of the roads should be surfaced with DBST, MOHA wanted less than 20% so treated. A compromise of about 30% was eventually reached.
- b. Associated with the use of DBST, the Bank's view was that the construction standards being applied to the roads were too high in view of the already high cost of road construction in Korea and efforts were made to persuade MOHA to reduce them in order to limit the total project cost. Traditionally the only type of surfacing that was considered to be acceptable in Korea was asphaltic concrete (AC), which contributed to the high costs. The Bank was partially successful in reducing standards on some roads to obtain an acceptable rate of return and thus include these roads in the project.
- c. The maintenance component was also the subject of much discussion, as views on the amount of equipment required for this important task varied widely between the Bank, which wanted more, and MOHA, which wanted less. Eventually a compromise was reached somewhere between the two views with the proposal to set up pilot schemes in three provinces, followed by the establishment of maintenance organizations in all provinces, with adequate equipment to carry out the task.

3.3 The project was well designed by MOHA, who used foreign consultants in the lead roles for the various components, with much support from local consultants, thus helping to strengthen this part of the construction industry. Although this was the first Bank project to be executed by MOHA, roles and responsibilities were clearly defined from the outset and MOHA gained the necessary experience very quickly.

3.4 The project, as first envisaged, was very large, having a foreign cost element of \$290 million. As the Bank could only provide \$125 million, the project was put together in as flexible a manner as possible so that components could be dropped if co-financing for \$165 million could not be arranged. Various sources were approached without success and finally the component covering the improvement of

national roads was taken out and included in the Highway Sector Project (Loan 2392-KO), which followed this project.

#### 4. Project Implementation

4.1 Road Construction and Improvement. The project got off to a good start. Since prequalification of contractors had been carried out during project preparation, bids for the construction contracts were invited in February 1983 under International Competitive Bidding (ICB) arrangements and were received in April 1983. Contract awards were made in May/June 1983 and much of the right-of-way had been acquired by July 1983. The necessary consultancy contract for construction supervision was arranged by April 1983. From thereon the contracts progressed well and were completed on schedule, although there were initial problems with quality control as the contractors, all Korean, were not used to working strictly to a specification, and the local consultants were not used to enforcing it. Supervision of construction was progressively strengthened during the project as weak points emerged. There was inadequate laboratory equipment to test the compaction of base and sub-base layers, a vital factor in road construction, but even more so for DBST roads, where the surfacing does not contribute to the strength of the pavement. The DBST itself was often not well laid because of a lack of proper equipment and/or a lack of experience on the part of contractors and consultants. There were some failures of the DBST because it was laid too late in the year and had no time to cure properly before the winter. By the time the original 1006 km of roads were complete, all these deficiencies had been rectified and both supervision and workmanship had improved greatly. This improvement was due not only to thorough training in DBST by the French consultants, but also to the contractors importing the correct equipment and to more laboratory equipment being obtained for the supervising engineers.

4.2 Continuation Project. Because of a downturn in international construction activity, in which Korean firms were heavily engaged, unexpectedly low bids were received for the initial tranche of construction contracts. The bidding was held under ICB and the Korean firms priced their bids in the expectation that some foreign firms would participate because of the international situation, but, in the event, no foreign firm did participate. The resulting low prices, combined with a reduction in the quantity of maintenance equipment procured under the project (para 5.3), resulted in an uncommitted balance of about \$30 million in the loan funds. In January 1987, the Ministry of Finance (MOF) requested the Bank that this balance be used to improve further lengths of road, on the basis that such a move would be fully in accordance with the initial aims of the project and that most of the roads to be included had been previously studied, but had been cut out of the project in order to limit the overall cost. The Bank approved this request in February 1987 and the Loan Agreement was amended in April 1987. MOHA proceeded to invite bids for the improvement of an additional 580 km of road. By 1987 it had become clear that no foreign bidder would bid for a civil works contract in Korea, so the Bank permitted the bids to be invited on the basis of Local Competitive Bidding (LCB). In order to allow these additional contracts to be completed, the loan closing date was extended in April 1987 for one year to December 31, 1988. Some of the improvements consisted of upgrading a few of the roads surfaced with DBST during the first part of the project by applying a layer of AC. The reasons for such instances

varied, but more commonly it was because traffic on the road had increased much more than expected or because the road was in one of the colder areas of the country and the DBST surface was being severely damaged by snow-clearing equipment. One important problem emerged during this work relating to the upgrading of roads from the lowest paved standard, P1, to a higher standard, P2 or P3. The formation width for P1 roads is 6.5 m for a pavement width of 5 m. When upgrading to P2 or P3, which should have formation widths of 7.5 or 7.7 m for pavement widths of 6 or 6.2 m, it is not practicable to inexpensively widen the formation by 0.75 m on each side, so the resulting 6 or 6.2 m pavement was left with virtually no shoulder. This situation is dangerous for traffic and results in an unsatisfactorily supported edge to the roadway construction, and should be corrected in any further upgrading operation by amending the road standard specifications to give P1 roads a formation width of 7.5 m.

4.3 Road Maintenance. Foreign consultants to carry out the maintenance component of the project were appointed in July 1983. Appraisal of this component had been carried out when no provincial maintenance organizations existed. The quantities of equipment that were to be procured under the project reflected this situation. In March 1983, however, provincial organizations were established and equipped with a minimum amount of equipment financed from another source. The scale of equipment provided under the project was accordingly cut back by over 80% from the appraisal quantities. It took MOHA some time to decide on the amount of equipment to be procured and this, combined with delays over the approval of bidding documents, resulted in the award of equipment contracts being almost 3 years late. Funds allocated for maintenance never reached the desirable levels advocated by the Bank because of Government policy that gave a higher priority for the allocation of available funds to road improvement and construction rather than to maintenance.

4.4 Unscheduled Transport Services (UTS). The introduction of UTS in rural areas made a slow start and was eventually made a condition of effectiveness of the Highway Sector Project (Loan 2392-KO). The condition was met, but the number of services that started (nine) was a small fraction of the expected number (at least one hundred) which would have formed a good sample for an assessment of this type of service in Korea. The Bank had hoped to see the inauguration of a widespread service similar to that operating with success in other countries, such as the Philippines, Thailand, Malaysia etc. The full reason behind the lack of response from entrepreneur operators is not clear, but several factors may have been contributory:

- a. initially, no government agency was prepared to take full responsibility for the setting up of the UTS; there were jurisdictional problems between MOHA and the Ministry of Transport (MOT); MOHA did not want to invade the territory of MOT, and MOT did not display much interest;
- b. there was inadequate publicity;
- c. potential operators were given little guidance and were unsure of the financial merits of the scheme;
- d. legal measures to place operators on the same footing as scheduled bus operators were not put in hand; and



- e. the rigors of the Korean climate prevented the use of the relatively cheap open-topped pickup or jeep type vehicle used in warmer countries.

After some delays, a tour of several other countries to see UTS in operation was arranged in 1985. The participants returned with enthusiasm for the scheme and MOT thereupon took a greater part in trying to establish UTS in Korea, but the concept has not yet caught on in a substantial way.

#### 4.5 Studies

- a. A Traffic Safety Study was carried out by a consultant employed by MOHA. It was completed without any problems in April 1984.
- b. An Integrated Road Investment Planning Study (IRIPS) was undertaken by consultants employed by the Ministry of Construction (MOC). It was completed in October 1984. The main issue that arose during the study was a difference of opinion between the consultants and MOC on the most suitable means of obtaining the coordination in planning which was the aim of the study. The implementation proposals put forward in the final report were made part of the Action Plan for the Highway Sector Project (Loan 2392-KO).

4.6 The main variances between planned and actual implementation have been summarized above. The following discusses the principal causes for the variances:

- a. The problems which arose with the construction contracts were all largely foreseen and measures had been incorporated into the project to mitigate them. A DBST training program for contractors, consultants and MOHA staff had been arranged, foreign consultants were employed in order to allow time for the Korean consultants to gain experience in the effective supervision of road works and laboratory equipment was provided. Whereas the unexpectedly large increase in traffic on some routes had not been foreseen, measures had been incorporated into the project by way of IRIPS to mitigate such a situation in the future through the encouragement of integrated highway planning which would help to pinpoint those roads where traffic might be diverted off the national highways. The damage caused by snow-plows to DBST surfaces was a factor that was apparently not foreseen and provides a lesson for the future.
- b. The downturn in international construction activity, which resulted in low bid prices and the consequent surplus in the loan funds, was sudden and unexpected and could not have been foreseen during appraisal, whereas the risks of high prices had been allowed for.
- c. The delays that occurred to the implementation of the maintenance program could not have been foreseen for the following reasons:
  - 1. Although there had been differences of opinion about the scale of the program during project preparation, all parties were finally

in agreement after negotiations. The unexpected provision of some maintenance equipment from the general budget upset the agreed scale of provision and then MOHA took some considerable time to assess what its requirements were. On the other hand, during appraisal it was acknowledged by all parties that funds allocated to road maintenance were insufficient for the roads existing at that time, a situation that would only deteriorate as more roads were upgraded and maintenance became more necessary and costly. Provision was made in the loan agreement to ensure that the Government would progressively increase maintenance funds. The covenant (4.03(b)) covering this matter states that "adequate" funds should be provided. While maintenance funds were progressively increased, the Government's interpretation of "adequate" was at variance with the Bank's interpretation, which expected a higher level of funding.

- ii. In order to create more uniform and internationally acceptable procurement documents, the Bank, at the time of the implementation of this project, tightened up its review systems for bidding documents and issued its standard bidding documents for works and for goods. Procurement procedures and documents, which had previously been accepted by the Bank, came under review and changes were often required. The Office of Supply for the Republic of Korea (OSROK), the Government procurement agency, was asked to make changes to the maintenance equipment bidding documents, which were drafted in a previously accepted format, but no longer conformed to the new, stricter requirements for Bank procurement. This situation provoked a lengthy exchange of views between OSROK and the Bank, and resulted in a delay of some months to the issue of the invitation for bids for the supply of this equipment. This delay could not have been foreseen, but underlines the importance of the Borrower being aware from an early stage of the up-to-date requirements of the Bank in relation to bidding documents.
  
- d. Unscheduled Transport Services (UTS). Although appearing as a covenant (3.07) in the loan agreement, this component does not appear to have been considered in depth during appraisal. It received only a brief mention in the Staff Appraisal Report (SAR), and is not listed in the project description in the SAR. It should have received closer scrutiny during appraisal, in which case more would have come to light on the legal framework and responsibilities for such a service and its implementation would have been on a sounder footing. It is nonetheless surprising that UTS did not achieve a rapid success in Korea, where conditions seemed well suited.

4.7 Several significant decisions were taken which assisted project implementation. These included:

- a. using foreign consultants as the lead firms for construction supervision and for the maintenance component ensured acceptable standards of workmanship and the opportunity for Korean firms to gain valuable experience, to the extent that they became capable of designing and supervising the additional road improvement works without the assistance of foreign consultants;
- b. approval of the use of surplus loan funds for the improvement of a further 580 km of provincial and county roads, hence increasing the physical achievement of the project by over 50%;
- c. the use of ICB for the initial list of road contracts, which contributed towards low bid prices; and
- d. insistence on the production of good quality maintenance equipment bidding documents, which delayed the procurement process somewhat, but paved the way towards a better understanding by OSROK of the Bank's views on fair and acceptable bidding documents.

## 5. Project Results

5.1 Overall, the project has been a success. From the physical aspect, it has more than achieved its objectives and its results have had a noticeable impact in the intended areas. A significant proportion of the tertiary road network was improved to all-weather quality, transport costs reduced, maintenance organizations established in every province and preparatory work carried out to improve other aspects of the transport sector in subsequent projects. The objectives changed during implementation only to the extent that about 50% more roads were improved than originally intended, because of the savings which occurred during the bidding for the original work program and from a cutback in equipment purchases.

5.2 The overall economic rate of return, estimated at appraisal to be 31%, based on 1006 km of roads, is now estimated to be 28.8% based on the 1586 km achieved. It is expected that the final rate of return will be even better, because traffic is increasing faster than forecast. It is, however, interesting to note that the Government's determination to surface only 20%-30% of the roads with DBST, instead of 70% as recommended in the feasibility study, was economically less beneficial, even when the costs of overlaying many of these roads with AC, after only a short period, is taken into consideration. Staged improvement would have yielded a higher economic return, but would have been more disruptive to traffic (Table 5-2 of PCR, page 44).

5.3 The impact that the project has made includes:

- a. strong recommendations to Government for a policy for the integrated planning of highway investment, which was being carried out in an

uncoordinated fashion by at least three separate agencies (MOC, KHC and MOHA);

- b. development of a road traffic safety policy;
- c. further strengthening of the construction industry through the experience gained by consultants in evaluation, design and supervision, and by contractors in carrying out work to a strict specification;
- d. improvement of the physical environment by the paving of roads to reduce the polluting and damaging effects of dust and mud, and the economic costs and discomfort of travelling over rough roads;
- e. development of the technological skills of the construction industry by the introduction of DBST as a low-cost paving method, by the use of modern materials testing equipment and the use of appropriate construction plant;
- f. improvement of access for farmers and rural communities to markets for their products;
- g. introduction of UTS to communities previously without a means of motor transport to nearby towns; and
- h. development of the capability within MOHA at both national and provincial levels to manage projects of this type and to carry out effective maintenance of their road inventories.

## 6. Project Sustainability

6.1 With traffic increasing faster than forecast and the introduction of a proper maintenance system for provincial and county roads, it is expected that the project will maintain or even exceed the forecast level of net benefits throughout its economic life. Its final success 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 roads in good condition.

6.2 There is a decided risk that the maintenance funds would be reduced if there is a downturn in the economy. This issue has been addressed in the most recent highway project<sup>1/</sup>, which includes a major road maintenance component based on a Highway Maintenance Management Study completed in December 1987.

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<sup>1/</sup> Korea - Road Improvement Project, approved on May 16, 1989.

## **7. Bank Performance**

7.1 The overall success of the project can be attributed in part to the good performance by Bank staff during the whole project cycle. The firmness displayed over the introduction of DBST has greatly benefitted the Korean road construction industry, and will continue to do so as it is the ideal surfacing for lightly trafficked rural roads. Although the Bank failed in its attempt to persuade the Government to surface up to 70% of the roads with DBST, the final outcome of the project, although economically less beneficial, was less disruptive in the long run. On many of those roads which the Bank wanted to have a DBST surface, traffic built up at a faster rate than forecast and many more roads would have had to have been overlaid with AC after only a short period. Supervision missions were sent to Korea on a regular basis and the staff changes were kept to a minimum, thus enabling good relationships to be built up over a period of time.

7.2 The main lessons to be learnt by the Bank are:

- a. when deciding upon the growth rate for traffic in a country with a rapidly expanding economy, like Korea's, it is easy to be too modest and to underestimate the rate (para 5.6a);
- b. it is important to insist on a thorough training program when introducing an unfamiliar technology (para 5.1);
- c. in order to obtain the best return on a successful project, flexibility in the design of a project, as well as a readiness to be flexible over enlarging the content of a project, are important ingredients (para 5.2); and
- d. the failure of the UTS to achieve widespread acceptance is probably because of its incorporation into the project without adequate preparation (para 5.6d).

## **8. Borrower Performance**

8.1 The Borrower and its implementing agency, MOHA, performed well during the project. Bearing in mind that this was the first Bank project to be undertaken by MOHA, it learned very fast and improved its performance as the project went on. The initial resistance to the use of DBST was more due to a lack of knowledge of the technique than to an inherent resistance to change, for MOHA demonstrated itself to be flexible and able to adapt to changing circumstances as the project developed.

8.2 MOHA eased the task of project preparation by readily providing the information requested and its performance during implementation improved steadily. At first the provincial offices had difficulty in adequately supervising the contracts and in maintaining the necessary standards of quality control, but as they gained experience, the contract management improved.

8.3 Government staff resources were generally over-stretched and therefore much use was made of consultants, both foreign and Korean. The agencies worked closely

with their consultants and relied heavily on them, generally following their advice, but not always.

**8.4 The main lessons to be learnt by the Borrower are:**

- a. the implementation of the recommendations of IRIPS will have far-reaching benefits on future highway investment planning by more accurately determining from the outset the likely traffic, including that diverted from nearby routes, and the standard to which roads should be improved without the necessity for upgrading them within a short time (para 5.6a);
- b. the upgrading of roads from P1 standard to P2 or P3 is presently difficult because of the width of the formation of a P1 road; consideration should be given to amending the standard for the P1 formation width from 6.5 to 7.5 m to overcome future upgrading problems (para 5.2);
- c. the use of experienced supervisors to implement high standards of quality control, particularly of compaction of the base and sub-base, is an important element in ensuring that a road will not break up during its design life (para 5.1);
- d. the employment of foreign experts should be encouraged when new or unfamiliar techniques are being introduced (Para 5.1); and
- e. it is important that low-cost techniques, such as DBST, are encouraged and used wherever the situation allows, in order that costs are kept to a minimum, with little or no reduction in serviceability (para 4.2).

**9. Project Relationship**

9.1 The excellent relationships that have existed between the staffs of the Borrower and the Bank, during both preparation and implementation phases, has been one of the factors which has contributed towards the success of the project. It created good teamwork, in which each party displayed the flexibility to accede to the other, when necessary, for the good of the end product.

**10. Consulting Services and Contractors**

10.1 On the advice of the Bank, the Borrower employed foreign consultants in the lead roles initially, thus enabling the Korean consultants, who were working with the foreign consultants, to gain experience in designing and supervising road works, so that eventually they successfully carried out these tasks on their own. The consultants all performed satisfactorily.

10.2 Contractors and suppliers also played a major part in the implementation of the project. All the civil works contractors were Korean, even though procurement was by ICB. Initially, while both contractors and local consultants were becoming used to working to a specification under the overall supervision of foreign

consultants, standards of workmanship varied greatly, but as the work progressed, quality control improved so that it was good by the later stages of the project. Suppliers of equipment, who were both Korean and foreign, generally performed satisfactorily.

10.3 This project was good for the Korean consultants and contractors, who learnt much about working to an acceptable international standard of quality control. The introduction of new techniques, notably DBST, were of benefit not only to the firms that took part, but also to the whole construction industry.

## 11. Project Documentation and Data

11.1 The covenants contained in the loan agreement were reasonable and the Borrower had little difficulty complying with them.

11.2 The Staff Appraisal Report provided a useful reference framework during the implementation of the project.

11.3 The information for the completion of the PCR was readily available. MOHA helped greatly in this respect and provided a timely completion report, based on the old format, which forms the main body of the PCR attached.

TABLE 1. Related Bank Loans and/or Credits

Loan/Credit	Purpose	Year of Approval	Status	Comments
Highway Project (LN 769)	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 organisation and purchase of highway maintenance equipment.	1971	Completed	PCR issued; PPAR No. 3045 of June 1980.
Highway II (LN 956)	To assist Government's 1972-76 road construction and paving program and to expand road maintenance organisation. 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.
Highways III (LN 1203)	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. 3024 of April 1984.
Highways IV (LN 1640)	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. 3450 of Feb. 1985.
Highway Sector (LN 2392)	To assist the Borrower to increase economic efficiency in Korea's highway sector through improvements in investment planning, transport regulation and pricing, and energy conservation; and to finance a three-year time-slice (1984-86) of the highway investment program to meet the increasing traffic demand by improving and paving roads, improving highway maintenance, and reducing the traffic accident rate.	1984	Closed 06/30/89	PCR under preparation
Kyonggi Regional Transp. (LN 2905)	To meet road transport demand in two important corridors by constructing two high-capacity toll expressway and support the Government's general objective of increasing the efficiency of transport in the Kyonggi Region.	1988	Ongoing	Became effective 03/04/88.
Road Improvement (LN 3061)	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	In process	Approved 05/16/89



**TABLE 2. Project Implementation**

Component	Implementation Date			
	Appraisal Estimate		Actual	
	Start	Complete	Start	Complete
<b><u>Part A. County Road Improvement</u></b>				
Prequalification of Contractors		12/15/82		12/06/82
Issue Bid Invitation		01/31/83		02/24/83
Receive and Open Bids		03/15/83	04/11/83	04/13/83
Evaluation of Bids and Government Recommendations	03/15/83	05/15/83	04/11/83	04/30/83
Appoint Consultants for Supervision of Works		05/01/83		04/09/83
Construction of County Roads (Original, 109 sections)	05/15/83	12/31/86	05/27/83	12/31/86
Construction of County Roads (Continuation, 57 sections)	-	-	11/01/87	06/30/89
<b><u>Part B. Procurement of Road Maintenance Equipment</u></b>				
Prepare Equipment List, Specifications and Bid Documents and Submit to Bank for Review	-	11/15/82	-	08/15/84
Manufacture and Delivery of Equipment and Spare Parts				
- First Package	05/31/83	11/30/83	09/15/84	07/31/85
- Second Package	05/31/84	11/30/84	04/15/86	10/31/87
<b><u>Part C. Provincial and County Road Pilot Maintenance Program</u></b>				
Establish and Staff Road Maintenance Section	-	04/30/83	-	06/30/83
Establish and Staff the Road Management Division in MOHA	-	12/31/84	-	12/31/84
Appoint Technical Assistance Consultants	-	07/01/83	-	07/01/83
Implementation of Maintenance System in 3 Pilot Provinces	08/01/83	-	07/15/85	-
Implement Maintenance in all Provinces	12/01/84	-	09/01/87	-
<b><u>Part D. Consulting Services</u></b>				
Detailed Engineering for 1000 km of County Roads	05/01/83	04/01/84	07/15/83	07/31/84
Assistance in Implementing DBST Training Program	05/01/83	06/30/83	06/01/83	08/30/83
Study for the Integrated Investment Planning of Roads	05/01/83	12/31/83	02/01/84	10/31/84
Road Safety Study	07/01/83	09/30/83	07/01/83	04/15/84
<b><u>Part E. Overseas Fellowships</u></b>				
Implement Training	09/01/83	12/31/86	09/01/85	06/30/89

**TABLE 3. Project Costs and Financing**

**A. Project Costs**  
(Won Billion)

	<u>Appraisal Estimate</u>			<u>Actual</u>			Actual as % of Appr. Est.
	Local	Foreign	Total	Local	Foreign	Total	
County Road Improvement	59.09	56.77	115.86	100.65	91.77	192.42	166.1
Equipment	0.00	20.11	20.11	0.00	4.31	4.31	21.4
Consultancy Services							
Supvn of Rd Impr	0.91	1.11	2.02	0.76	1.43	2.19	108.4
Tech Assistance	0.78	0.52	1.30	0.48	0.66	1.14	87.7
Engineering	2.03	0.23	2.26	3.13	1.90	5.03	222.6
Studies	0.04	0.15	0.19	0.02	0.04	0.06	31.6
Contractor Trg	0.10	0.10	0.20	0.00	0.00	0.00	0.0
Subtotal Cons Svcs	<u>3.86</u>	<u>2.11</u>	<u>5.97</u>	<u>4.39</u>	<u>4.03</u>	<u>8.42</u>	141.0
Trg Fellowships	<u>0.02</u>	<u>0.09</u>	<u>0.11</u>	<u>0.00</u>	<u>0.14</u>	<u>0.14</u>	127.3
Total Base Costs	<u>62.97</u>	<u>79.08</u>	<u>142.05</u>	<u>105.04</u>	<u>100.25</u>	<u>205.29</u>	144.5
Phys Contingencies	6.30	7.90	14.20	-	-	-	-
Price Contingencies	<u>11.40</u>	<u>12.91</u>	<u>24.31</u>	-	-	-	-
Subtotal Cont	<u>17.70</u>	<u>20.81</u>	<u>38.51</u>	-	-	-	-
Total Base + Cont	<u>80.67</u>	<u>99.89</u>	<u>180.56</u>	<u>105.04</u>	<u>100.25</u>	<u>205.29</u>	113.7
Right of Way	<u>12.91</u>	0.00	<u>12.91</u>	<u>32.10</u>	-	<u>32.10</u>	248.6
<b>TOTAL PROJECT COSTS</b>	<u>93.58</u>	<u>99.89</u>	<u>193.47</u>	<u>137.14</u>	<u>100.25</u>	<u>237.39</u>	122.7

**B. Project Costs**  
(US\$ Million Equivalent)

	<u>Appraisal Estimate</u>			<u>Actual</u>			Actual as % of Appr. Est.
	Local	Foreign	Total	Local	Foreign	Total	
County Road Improvement	79.32	76.21	155.52	124.73	113.70	238.43	153.3
Equipment	0.00	26.99	26.99	0.00	5.04	5.04	18.7
Consultancy Services							
Supvn of Rd Impr	1.22	1.49	2.71	0.93	1.76	2.69	99.6
Tech Assistance	1.05	0.70	1.75	0.62	0.84	1.46	83.4
Engineering	2.73	0.30	3.03	4.39	2.66	7.05	232.7
Studies	0.05	0.20	0.25	0.02	0.05	0.07	28.0
Contractor Trg	0.13	0.13	0.26	0.00	0.00	0.00	0.0
Subtotal Cons Svcs	5.18	2.82	8.00	5.96	5.31	11.27	141.0
Trg Fellowships	0.03	0.12	0.15	0.00	0.24	0.24	160.0
Total Base Costs	84.53	106.14	190.67	130.69	124.29	254.98	133.7
Phys Contingencies	8.45	10.61	19.06	-	-	-	-
Price Contingencies	15.30	17.33	32.63	-	-	-	-
Subtotal Cont	23.75	27.94	51.69	-	-	-	-
Total Base + Cont	108.28	134.09	242.37	130.69	124.29	254.98	105.2
Right of Way	17.33	0.00	17.33	39.92	-	39.92	229.7
<b>TOTAL PROJECT COSTS</b>	<b>125.61</b>	<b>134.09</b>	<b>259.70</b>	<b>170.61</b>	<b>124.29</b>	<b>294.90</b>	<b>113.6</b>

**C. Project Financing**  
(US\$ Million Equivalent)

Sources	SAR Estimate	%	Actual	%	Comments
Bank Loan	125.0	48.1%	125.0	42.4%	
National Government	53.8	20.7%	0.0	0.0%	
Ministry of Home Affairs	80.9	31.2%	169.9	57.6%	
<b>TOTAL</b>	<b>259.7</b>	<b>100.0%</b>	<b>294.9</b>	<b>100.0%</b>	

**TABLE 4. Equipment for Maintenance Program and Costs**  
(Won million)

Equipment Type	Number	
	Appraisal	Actual
Air Compressor	17	0
Hand Sprayer	17	26
Vibrating Roller 0.9T	15	-
Tired Roller 10T	36	8
Dumper	16	-
Bulldozer	2	-
Wheel Loader	7	2
Motorgrader	67	11
Water Tank Truck	36	9
Dump Truck	146	54
Small Truck	38	14
Crusher/Screening Plant	8	8
Mgmt. Vehicles	38	-
Breaker	-	58
Tamper Compactor	-	28
Plate Compactor	-	28
Asphalt Cold Mixer	-	11
Tandem Roller 2T	-	13
Tandem Roller 8T	-	8
Demountable Water Tank	-	13
Wheeled Excavator	-	6
Base Cost	16,781	4,312
Spare Parts (20%)	<u>3,330</u>	-
Total (Won millions)	<u>20.111</u>	<u>4.312</u>
Total (US\$ thousands)	<u>26.990</u>	<u>5.040</u>

**TABLE 5. Economic Impact**

**A. Appraisal Internal Rate of Return**

Province	Project Length (km)	Internal Rate of Return				
		With Time	With- out Time	Sensitivity		
				1[a]	2[b]	3[c]
Gyeonggi Do	120.2	33	31	28	27	21
Gwangweon Do	86.7	28	25	23	22	17
Chungcheong Bug Do	68.1	23	20	19	18	13
Chungcheong Nam Do	162.9	31	29	27	25	20
Jeonra Bug Do	73.7	28	25	23	22	17
Jeonra Nam Do	122.2	25	23	21	20	15
Gyeongsang Bug Do	192.0	35	31	29	28	21
Gyeongsang Nam Do	174.8	32	29	27	26	20
Jeju Do	5.9	37	34	32	30	23
<b>TOTAL</b>	<b>1006.5</b>	<b>31</b>	<b>28</b>	<b>26</b>	<b>25</b>	<b>19</b>

[a] Basic savings and investment costs increased by 25%.

[b] Savings decreased by 25%, and basic investment cost.

[c] A combination of all preceding tests: basic savings without time, savings decreased by 25% and investment costs increased by 25%.

**B. Actual Internal Rate of Return**

Province	Original Project		Continuation Project			Total	
	Length	IRR	Length	IRR		Length	IRR
				F'cast	Actual		
Gyeonggi Do	128.5	39	84.8	21	24	213.3	32
Gangweon Do	92.8	27	48.7	26	28	141.5	28
Chungcheong Bug Do	73.6	22	33.6	24	29	107.2	24
Chungcheong Nam Do	180.4	32	76.0	22	31	256.4	32
Jeonra Bug Do	85.5	27	28.7	23	22	114.2	25
Jeonra Nam Do	131.9	29	87.5	26	26	219.4	28
Gyeongsang Bug Do	210.8	32	71.1	25	30	281.9	32
Gyeongsang Nam Do	187.5	24	49.9	25	27	237.4	25
Jeju Do	5.9	36	9.2	19	18	15.1	26
<b>TOTAL</b>	<b>1096.9</b>	<b>29</b>	<b>489.5</b>	<b>24</b>	<b>27</b>	<b>1586.4</b>	<b>29</b>

Comments: All IRR are based on basic savings including time saving.

TABLE 6. Studies

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Study	Purpose at Appraisal	Status/Impact
Road Traffic Safety	MOHA in charge. To review traffic accident data, advise on improved data collection, assist in the analysis of data and help to reduce the present high rate of road accidents.	Completed 04/84. 17 point program for traffic safety has been adopted. Study recommendations being incorporated into new projects.
Integrated Road Investment Planning	MOC in charge. In order to ensure future development of the national, provincial and county roads on a coordinated basis, the road investment plans of MOC, KHC and MOHA to be reviewed. Existing and projected traffic flows to be analyzed to determine the inter-relationships among the systems. The study to reduce the possibility of redundancy and contribute to greater efficiency of road investment.	Completed 10/84. The recommendations of the study have been partly adopted by the Government, in that there is now some coordination between MOC, KHC and MOHA when planning highway investments.

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**TABLE 7. Status of Covenants**

<b>Section</b>	<b>Activity</b>	<b>Remarks</b>
3.01(b)	The Borrower to establish by May 1, 1983 and thereafter maintain a committee with representatives from MOC, MOHA, EEC and EPB under the chairmanship of MOC.	Complied with.
3.02	The Borrower to employ (a) by May 1, 1983 or such later agreed date, the consultants required to carry out Parts A, C, D.1 and E.2 of the project; and (b) by July 1, 1983 or such later agreed date, the consultants required to carry out Parts B and E.1 of the project.	Complied with. Part A and D.1 with BCEOM on 04/08/83; Part A with SAMAN and Dong Myeong on 10/19/87; Part B and E.2 with KAMPSAK on 07/15/83; Part C with Ingeroute on 07/15/83 and with SAMAN on 04/14/87; and Part E.1 with Alan Ross on 06/25/83.
3.04(b)	The Borrower to submit timely Progress Reports.	Complied with.
3.04(d)	The Borrower to submit Project Completion Report six months after the closing date.	Complied with.
3.05	The Borrower to acquire all land needed for the project.	Complied with.
3.06	The Borrower to ensure that project conforms to the design standards set forth in Schedule 5 and constructed in accordance with the specifications set forth in Annex 1 to Schedule 2.	Complied with.
3.07	The Borrower shall (a) furnish by June 30, 1983 a plan for the promotion of Unscheduled Transport Services in villages with no regular bus services, including the selection of the pilot area where such plan shall be carried out; (b) commence implementation of such plan by September 30, 1983; and (c) monitor the operation of the services and exchange views with the Bank on the results thereof.	Complied with. Borrower submitted a plan but implementation did not start until March 1984 and this was made a condition of effectiveness of the Highway Sector Project (LW 2392-KO).
3.08	The Borrower to establish within MOHA (a) by April 30, 1983 a Road Maintenance Section; and (b) by June 30, 1985 a Road Management Division, all with powers and functions satisfactory to the Bank.	Complied with.
4.02	The Borrower to have accounts audited and furnish to the Bank not later than six months after the end of each fiscal year.	Complied with.

PROJECT COMPLETION REPORT

KOREA  
PROVINCIAL AND COUNTRY ROADS PROJECT  
(LOAN 2228-KO)

PREAMBLE

The Government of Korea represented by the Ministry of Home Affairs (MOHA) has requested the World Bank assistance in the financing of a program to improve some 1,000Km long Provincial and County Roads network throughout the country. Major component of the project may be summarized as below:

- (a) Improvement of about 1,000Km long provincial and county roads network which have been selected as rating in the priority group of about 2,000Km long roads network out of priority screening studies performed by the MOHA(1979. 9 - 1981. 2), under Loan No. 1640 - KO. A detailed engineering studies have been completed under the above priority screening studies.
- (b) Technical assistance in setting up and providing equipment for organizations of central provincial and county administrative levels to implement a maintenance program.
- (c) Consultant services for (i) supervision of provincial and county roads improvement works, (ii) technical assistance for the provincial and county roads maintenance program, (iii) detailed engineering of the additional 1,000Km long provincial and county roads networks, (iv) assistance in the implementation of technique in the use of double bituminous surface treatment (DBST) and (v) road safety study.
- (d) Assistance in providing overseas training program for the MOHA's staff.

The project has been launched in April 1983 and completed by the end of June 1989. On the occasion of completing the project in whole MOHA, in compliance with Subsection(d), Section 3.04 of the Loan Agreement, intends to furnish to the Bank the Project Completion Report(PCR) hereinafter.



PROJECT COMPLETION REPORT

KOREA  
PROVINCIAL AND COUNTRY ROADS PROJECT  
(LOAN 2228-KO)

I. INTRODUCTION

A. Improvement of provincial and county roads

1.01 The objective of the project is to support Government's policy of promoting economic development in rural area by the reduction of transport costs through the improvement of the provincial and county roads network which have been neglected till the end of the Fourth Five year Economic Development Plan (1977 - 1981). The project aims to better the transport means between the county centers and populated town areas with the primary and secondary road networks, consequently reducing the transport costs of the farm products and promoting off-farm income opportunities for the rural population by providing inexpensive access to secondary urban centers. The project is rated as high priority among Fifth Five year Plan and project roads are located in 80 of the 139 counties distributed throughout all 9 provinces. The proposed improvement standards at the appraisal stage are AC surfacing(600Km), DBST surfacing(260Km) and gravel surfacing(146Km), depending on the configurations of the forecast traffic.

B. Technical Assistance for the Maintenance Program

1.02 In order to solve the problem of the rapidly deteriorating condition of provincial and county roads MOHA, during September 1979 through February 1981, employed consultants(BCEOM, France and Saman, Korea) financed under the Fourth Highway Project, to prepare a five-year maintenance program(1983 - 1987) for the provincial and county roads, basic objective of which is to have effective maintenance organizations in place at central provincial and county levels by 1987. The program has been schemed to be introduced initially on a pilot basis in three provinces, Gangweon, Jeonnam and Gyeongbug, in order to test the new organizational functions, systems and operational techniques. Technical assistance for the maintenance program will include procurement of road maintenance equipment for the program.

C. Consultant Services

1.03 Consultant services have been provided for (i) the supervision of provincial and county roads improvement works, (ii) technical assistance for the implementation fo the provincial and county roads maintenance program, (iii) detailed engineering of the additional 1,000Km long provincial and county roads networks, (iv) assistance in introducing the technique, (v) road safety study and (vi) assistance in providing overseas training program for the MOHA's staff. Consultants services will be discussed separately under appropriate paragraph in the following chapter.

The project has been launched in April 1983 and have been completed by the end of June 1989. Duration of each project component is as follows:

- (a) Supervision of provincial and county roads improvement works (May 1983 - June 1989)
- (b) Technical assistance for the provincial and county roads maintenance program (August 1983 - July 1986)
- (c) Detailed engineering of additional 1,000Km of provincial and county roads (August 1983 - August 1984)
- (d) Road safety studies (June 1983 - April 1984)

## II. PROJECT IDENTIFICATION, PREPARATION AND APPRAISAL

### Improvement of Provincial and County Roads

#### 2.01 Origin, Preparation and Appraisal

In order to support Government Policy of Promoting economic development in rural areas by means of reduction of transport costs through the improvement of the provincial and county roads network, MOHA has undertaken feasibility studies on rural roads aiming to select priority roads network for improvement financed under Fourth Highway Project(1979 - 1981). Through this study approximately 2,000Km provincial and county roads networks have been selected as priority improvement roads. Of these 2,000Km rural roads, a detailed engineering studies for the first 1,000Km rural roads networks have been completed (1981. 9 - 1982. 9) as a part of tasks of the Fourth Highway Project(Loan No. 1640 - KO). MOHA, responsible for preparing the project, employed consultants (BCEOM, France and 12 Local consultant firms) to engage in detailed engineering, where foreign consultants were to play a role of supervising, setting up of design standards, issuing design guidelines and reviewing the engineering works prepared by the local consultants. In performing the engineering works, information and data obtained through the county roads screening study (1979 - 1981), updated wherever necessary. Taking into account the location of roads, traffic and regional condition final engineering out put were classified into three categories of the improvement standards. They were asphalt concrete surfacing(about 600Km), DBST surfacing (about 260Km) and remainder gravel surfacing, totalling 1,006Km in 99 contract sections. With regard to the detailed engineering it is noteworthy to mention that DBST surfacing technique was introduced to the country for the first time. The consultants(BCEOM), therefore, prepared design guidelines based on the data and information made available to them by LCPC(France). As it was well understood between MOHA and the Consultants that personnel of the provincial administrations would be filling the role of supervisory staff, assisted by the supervision consultants, for the improvement works, engineering works were prepared in such details to be fully comprehending by provincial engineers, both in technical and managerial aspects. Further, DBST surfacing improvement method which have been recommended by the Bank was accepted by MOHA on the road sections where traffic was rather low at the design phase, but

envisaging further improvement when traffic might warrant in the future. All in all, project preparation was carried out at normal pace and was completed within the scheduled time-frame. Detailed engineering study started in September 1981 and was completed in September 1982, with the consultants furnishing the MOHA a complete set of tender documents. Appraisal of the project was made by the Bank on the basis of the Bank Loan.

## 2.02 Targets and Goals

The project was the first package of the MOHA's long-term development program for the improvement of provincial and county road networks, with the second package of improvement for 1,000km of provincial and county road networks following immediately, detailed engineering study of which was also included in the project Loan Agreement(para. 2.01). As emphasized before project was rated as priority program of the Fifth Five-year Development Plan of the country for the regional economic promotion and development. The Key assumptions made in the forecasts of the project was traffic volume on the road sections subjected to the improvement, which turned out to be quite realistic in terms of the increase in traffic volume considered due to the road improvement.

### Provincial and County Road Maintenance Program

2.03 Included also in the project is the setting up of organizations at central province and county levels for the maintenance of provincial and county roads. In order to overcome problem of rapidly deteriorating condition of provincial and county roads MOHA, in late 1979, employed consultants(BCEOM, France and Saman, Korea) financed under the Forth Highway Project (Loan No. 1640 - KO), to prepare a five-year maintenance program (1983 - 1987) for the provincial and county roads. MOHA accepting, in general, recommendations of the study has employed consultants(KAMPSAX, Denmark) to provide technical assistance in establishing the organizations, systems and operational techniques of the maintenance program. The maintenance program has been schemed to be introduced initially on a pilot basis for the full program in three out of the nine provinces, namely, Gangweon, Jeonnam and Gyeongbug in order to test the functions, systems and operational techniques of the new organizations to be set up through the technical assistance by the consultants. In line with this task an agreement has been made among the Bank and MOHA that the financing by the Bank will be provider for the technical assistance, procurement of maintenance equipment for the program and overseas training fellowship for MOHA staff while MOHA will provide the recurrent costs of the provincial and county roads maintenance program. Consultants services (1983. 8 - 1986. 7) have started in August 1983 for 24 month-period, to be completed by the end of July 1985. The initial contract have been duly completed at the end of July 1985, as scheduled. However, as agreed on among the Bank and MOHA, the contract have been extended for one full year in order to ensure that the reporting and working procedures developed by the Consultants have been fully implemented in the pilot provinces prior to their introduction for implementation in the remaining provinces. The scope of technical assistance focused on all aspects of

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services are to help MOHA establish effective organizations at central and local levels to efficiently plan, develop and maintain provincial and county roads by (i) assisting in the implementation of provincial and county road maintenance program, (ii) providing MOHA with technical assistance in the fields of road management, and (iii) training central, provincial and county personnel (Ref. Consultants Final Report, July 1986). As to the procurement of road maintenance equipment, actual procurement has fallen short of the original estimates, taking into account the numbers and conditions of the existing equipment in operation. Due to budgetary constraints and delays in procurement of the new equipment, the actual maintenance accomplishments have fallen short of the original targets. Nevertheless, the project has contributed to a significant heightening of the overall maintenance standard on provincial and county road networks in Korea. Physical out put of equipment procurement and maintenance works undertaken in three pilot provinces are given in Annex 1 and 2.

#### Detailed Engineering of Second 1,000Km Roads

2.04 In order to improve the second 1,000Km provincial and county roads which have rated among 2,000Km priority improvement roads resulting by the county roads screening study(1979 - 1981), MOHA employed consultants (Ingeroute, France and Saman, Korea) in order to carry out detailed engineering for the improvement works. The consultant, in compliance with the Terms of Reference prepared by MOHA, subcontracted the major part of the field surveys and engineering studies to 14 local consulting firms, while consultants filling the role of supervising, setting improvement standards, issuing design guidelines and reviewing engineering works prepared by the local consulting firms. The objectives of the consultants services were (i) to carry out feasibility studies in order to select the appropriate road by road improvement standards, (ii) to produce the detailed designs, specifications and tender documents and (iii) finally, to up date the economic and financial analysis. Final engineering out put was 1,033Km provincial and county roads network in 127 road sections (117 contract sections), consisting of asphalt concrete surfacing (745Km), DBST surfacing(263Km) and remainder gravel surfacing (25Km). The consultants services started in late August 1983 and completed in August 1984, with consultants furnishing MOHA all tender documents. The project study was appraied by The World Bank and implemented under Highway Sector Project(Loan No. 2392 - KO), all but eight(8) contract sections which were implement under provincial and county road project(Loan No, 2228 - KO).

2.05 In August 1985, while improvement works of the provincial and county roads financed under Highway sector Loan (Loan No. 2392 - KO) were in progress, it was agreed among MOHA and the Bank that additional works be added to the project but detailed engineering be financed under Loan 2228 - KO. Additional works consisted of extensions to the ongoing project road sections by 89Km(25 road sections) and 30 new road sections (190Km). An additional consultant team was added to the construction supervision consultant in order to carry out the detailed engineering for the improvement. Major part of the field surveys and engineering

studies were subcontracted to eight local consulting firms selected by MOHA. Engineering studies commenced in late August 1985 for four-month period, completing the services in late December 1985, with submission of contract and tender documents (Ref. Consultants Final Report, December 1985).

### Provincial and County Road Continuation Project

2.06 In late October 1986, while the improvement of provincial and county roads under Highway Sector Project was undergoing, an agreement was made among MOHA and the Bank to use balance remaining under Loan 2228 - KO to improve provincial and county roads. Pre-feasibility studies of the additional roads for improvement were carried out by the Consultants (Saman, Korea and Ingeroute, France) from December 1986 to February 1987, selecting about 390Km (57 road sections) for improvement. All these pre-selected roads were ex-ension of the road sections improved previously either under Provincial and County Roads Project (Loan 2228 - KO) or Highway Sector Project (Loan 2392 - KO). In order to carry out detailed engineering for the improvement of the roads, MOHA employed the consultants (Saman, Korea) who were serving as supervision consultants of the Highway Sector Project, and services commenced on April 27, 1987 for four-month period, scheduled to be completed by August 1987. The consultant formed a separate team to carry out engineering studies. In compliance with the Terms of Reference of the consultant contract, basic engineering works were sublet to eight local engineering firms selected by MOHA while the consultant filling the role of supervisory responsibilities, such as setting the improvement standards, issuing design guidelines and reviewing the engineering works prepared by the subcontracted firms. Physical out put of the engineering studies was 377.4Km (57 contract sections) in all, consisting of asphalt concrete pavement (304.4Km) and 73Km gravel roads (Ref. Consultants Final Report, August 1987). The engineering study was completed on August 26, 1987, with consultant submitting to MOHA all contract and tender documents.

### Traffic Safety Study

2.07 The Korea Traffic Safety Study was undertaken for MOHA as part of an IBRD financed Provincial and County Roads Project. The main objectives of the study were (i) to comment upon the improvements necessary in procedures for the collection and analysis of traffic accident statistics and (ii) to prepare an action plan for reducing the high rate of traffic accidents in Korea. The study was undertaken in 3 phases and involved critical examination of present traffic police procedures for the collection, storage and analysis of traffic accident data and a broad ranging appraisal of many other activities related to traffic safety in Korea. Discussions between IBRD and MOHA indicated that specialist traffic safety advice would be required to assist the Korean Government to establish priorities and to prepare and Action plan for the improvement of traffic safety in Korea. The Overseas Unit of the Transport and Road Research Laboratory in England was consulted and on its recommendation, Mr. Alan Ross an independent traffic safety consultant was appointed Traffic Safety Adviser to assist MOHA in undertaking the Korean Traffic Safety Study. The study commenced on 25th June 1988 and has been undertaken during 3 visits of the Traffic safety Adviser to Korea. Consultations were held with numerous organizations and individuals and personal visits were made to all provinces and major cities in order to obtain a thorough understanding

of the present systems. During each visit of the Traffic Safety Adviser, Working Papers were produced to present interim recommendation and suggestions for improvement. In addition Working Papers No.3 was prepared specifically on the subject of Traffic Accident Costs to show the resulting economic loss to Korea. These documents were presented to IBRD, MOHA and Road Traffic Safety Association(RTSA) officials, thus offering opportunities during the course of the study for these organizations to comment on the general direction of the study during its progress. The study was completed in April 1984 (Ref. Consultants Final Report, April 1984).

### III. IMPLEMENTATION

#### A. Construction of Provincial and County Roads

##### Original 1,006Km road

3.01 For the original 1,006Km provincial and county roads improvement construction contracts were made on May 20 through June 1, 1983 over 101 contract sections. The works started timely and proceeded under normal and steady pace. However, in November 1984, about one month before scheduled completion date, an agreement was made among MOHA and the Bank for additional works to 30 of the project road sections. The additional works consisted of extension of road sections by 82Km and the construction of 15 new bridges over 30 project road sections. It was agreed among MOHA and the Bank that construction supervision for the 30 road sections be carried out by the supervision consultants for the Highway Sector Project(Loan 2392 - KO) which was scheduled to commence in March 1985. By the end of the scheduled completion time, therefore, the Certificate of Completion was made to 71 out of 101 contract sections. Furthermore, eight road sections(93.5Km) originally included in the Highway Sector Project were transferred to be implemented under the Provincial and County Road Project(Loan 2228 - KO), making altogether 38 road sections(175.5Km) to be carried over to be worked on in 1985. Of these, 23 road sections were completed in 1985, 15 road sections in 1986 and the remaining two road sections in 1987. The reasons for these changes(for the 30 road sections) were caused entirely by intention to improve more of the roads with the funds made available by under-bidding. Actual Physical outputs of the road improvement for the original 1,006Km road are given in Table 5 by each improvement standard. The Table also gives hypothetic economic rates of return on alternative improvement standards.

##### Continuation Project

3.02 For 57 road sections(para. 2.06), bidding was made on September 30, 1987 throughout the 9 provinces. After evaluation of the bids and agreement by the Bank, construction contracts were made on October 24 through November 1, 1987. The works started immediately and proceeded under normal and steady pace. Of these 57 road sections 52 road sections were completed by the end of December 1988, scheduled completion date, and 5 road sections by end of June 1989. The reasons for the delay in completion date for these 5 road sections was caused by the changes, such as, changes in pavement standards, extension to the road sections, construction of new bridges, which were realized at close to the scheduled completion date.

### Implementation Schedule

3.03 The actual implementation of the project in whole was quite close to the original schedule as set forth at the time of the project appraisal but for the procurement of the maintenance equipment, which was delayed by some 24 month-time. The main reasons for the delay were exceptionally long time involved in deciding the numbers and types of equipment to be procured with the proper considerations given to the numbers and conditions of the existing equipment on hand in operational condition (para. 2.03). Although the implementation schedule for the provincial and county road improvement project was set from May 1983 through December 1986 at appraisal time, the construction contract for the original 1,006Km (101 contract sections) was set December 31, 1984 as the completion date. All 101 contract sections could have been completed within the above contract completion date but for the additional works added to 30 of the project road sections in November 1984, so close to the contract completion date. Be that as it may, 71 contract sections, valued at 77.5% of the total project contract amount, were completed by the contract completion date. Of the remaining 30 road sections where additional works were added and eight road sections transferred from the Highway Sector Project (Loan 2392 - KO) and included in the Project (para. 3.01), 36 road sections valued at 89% of the total contract amount were completed within the given completion date of December 31, 1986. Two road sections which failed to meet the given completion time were due to the further additional works. These two sections were completed in April 1987. All in all the whole project road sections as originally intended and later revised were completed. With due considerations given to these unexpected events, the original time schedule should be deemed quite realistic.

3.04 The actual implementation of the continuation project involving 57 contract sections (para. 2.06) also fell behind the original schedule which was set the end of January 1989. The reason for the delay was caused by the additional works added to some of the project roads in late April 1988. The additional works consisted of about 23Km extensions to 8 of the project road sections and change of the gravel surfaced road to asphalt concrete pavement surfacing in one section. Because of the additional works only 52 out of 57 road sections valued at 96% of the total contract amount were completed within the given contract completion time. The remaining five road sections were completed by the end of June 1989. At end of the provincial and county roads project total works completed were a little over 1,586Km in 166 road sections compared to the original 1,006Km in 101 road sections, over 158% accomplishment.

### Reporting

3.05 Throughout the construction period monthly progress report was prepared stating construction activities, quality control of the works carried out, recommendations issued by the consultants aiming to improve works procedures and financial statement of the relevant month. These reports were extremely beneficial to the supervisory personnel to watch over contractors' working procedures and improving quality of the works.

PROVINCIAL AND COUNTY ROADS PROJECT  
LOAN NO. 2228 - KO

Project Implementation Schedule

<u>Part A. County Road Improvement</u>	<u>Implementation</u>	
	<u>Schedule</u>	<u>Actual</u>
Prequalification of Contractors	Dec. 15, 1982	Dec. 6, 1982
Issue bid invitation to prequalified contractors	Jan. 31, 1983	Feb. 24, 1983
Receive and open bids	May 15, 1983	Apr. 11-13, 1983
Bids Evaluation Report and Government recommendations	May 15, 1983	Apr. 30, 1983
Appoint consultants for supervision of improvement works	May 1, 1983	Apr. 9, 1983
Award construction contracts	May 1, 1983	May 15-Jun. 5 1983
Construction of County Roads (Original, 109 Sections)	May 15, 1983- Dec. 31, 1986	May 27-Jun. 10 1983 - Dec. 31, 1986
Construction of County Roads (continuation, 57 sections)	Nov. 1, 1987 Dec. 31, 1988	Nov. 1, 1987 Jun. 30, 1989
<u>Part B. Procurement of Road Maintenance Equipment</u>		
Prepare equipment list, specifications and bid documents	Nov. 15, 1982	February 1985
Award contracts (by OSROK) for supply of equipment	May 31, 1983 First package Second package	Sep. 1984 Apr. 15, 1986



### Procurement

3.06 All biddings were executed following international competitive bidding procedures, but no foreign contractors participated in bidding. Although international competitive bidding procedures caused some delays in implementing the works because of the time required for the contractors prequalification notice and bid announcement, the procedures helped in reducing the contract costs. For the improvement of provincial and county roads and technical assistance for the maintenance program, consultants were employed. The consultants teams were jointly formed with foreign and local consulting firms, which were formed by mutual agreement among MOHA and the Bank. Foreign consultants were selected on the basis of their experiences in Korea in the similar tasks and remunerations were set on the basis of international levels. Local consultants were selected among leading firms in the country with wide range experience in the similar tasks. It should be mentioned here that only local consultants were employed for the continuation project(57 road sections) for both detailed engineering and construction supervision.

### Costs

3.07 Actual costs of the project roads were closely monitored by means of variation orders which were computed and verified upon occurrence of all variations in the contract amounts, therefore, the costs actually incurred were quite correct. The expected costs of the original 1,006Km roads were estimated at W110,366 million equivalent to US\$148,143 thousand (at US\$1=745) excluding contingencies. However actual costs at final construction time, it turned out to amount W134,994 million equivalent to US\$167,265.9(at US\$1=807.06) because of the additional works (para. 3.01) consisting of extensions of the road sections, bridge structures and other incidental costs. Moreover, eight additional road sections amounting to W13,553 million equivalent to US\$16,793.4 thousand and 57 road sections of the continuation project(para. 3.02) amounting to W43,877 million equivalent to US\$43,877 thousand were added to the project, thus, making the project 1,586Km in 166 contract sections with the final construction costs of W192,424 million equivalent to US\$238,426 thousand(Table 2). As stated above the cost overruns were caused mainly by the increased scope of the project. It should be admitted that there were a slight increase in unit prices by normal price increases over six-year time period; detailed engineering in 1982, 1984 and 1987 wherein the design cost estimates were made for original 1,006Km, 23Km of eight road sections and 377Km of 57 road sections, respectively. The cost overruns for the improvement of the roads were met with underruns by procurement of road maintenance equipment and contingencies. Contingency allowances estimated at appraisal time were adequate to meet the increased costs of the project for foreign component of the cost but fell below for local component of the cost mainly due to the fluctuation of the foreign currency exchange rate.

Project Cost Summary

Project Component	W Million			US \$'000		
	Local	Foreign	Total	Local	Foreign	Total
<b>A. County road improvement</b>						
actual - 1,582Km	100,653.7	91,770.4	192,424.0	124,725.8	113,700.0	238,425.8
(original-1,006Km)	(76,399.7)	(72,159.0)	(148,558.7)	(102,549.9)	(96,857.7)	(199,407.6)
<b>B. Equipment for maintenance program</b>						
actual		4,311.8	4,311.8		5,043.5	5,043.5
(original)		(25,322.1)	(25,322.1)		(33,989.4)	(33,989.4)
<b>C. Consultant Services</b>						
- Supervision of road improvement						
actual - 1,582Km	760.7	1,432.4	2,193.1	935.1	1,760.8	2,695.9
(original-1,006Km)	(999.9)	(1,222.1)	(2,222.0)	(1,342.2)	(1,640.6)	(2,982.8)
- Technical assistance						
actual	480.1	658.4	1,138.5	615.5	844.1	1,459.6
(original)	(858.0)	(572.0)	(1,430.0)	(1,151.7)	(767.8)	(1,919.5)
- Engineering of road improvement						
actual - 1,600Km	3,134.2	1,899.2	5,033.4	4,392.1	2,661.6	7,053.7
(original-1,000Km)	(2,237.4)	(248.6)	(2,486.0)	(3,003.2)	(333.7)	(3,336.9)
- Road safety studies						
actual	18.7	36.4	55.1	23.2	45.2	68.4
(original)	(40.9)	(163.7)	(204.6)	(54.9)	(219.7)	(274.6)
- Contractor training						
actual						
(original)						
<b>D. Training fellowship</b>						
actual		141.0	141.0		240.0	240.0
(original)	(24.2)	(96.8)	(121.0)	(39.6)	(158.5)	(198.1)
<b>Total</b>	<b>105,047.4</b>	<b>100,249.4</b>	<b>205,296.8</b>	<b>130,691.7</b>	<b>124,295.2</b>	<b>254,986.9</b>
	<b>(80,669.8)</b>	<b>(99,894.7)</b>	<b>(180,281.6)</b>	<b>(108,281.6)</b>	<b>(134,086.8)</b>	<b>(242,368.4)</b>
<b>E. Right of way</b>						
actual	32,094.0		32,094.0	39,917.9		39,917.9
(original)	(12,909.0)		(12,909.0)	(17,327.5)		(17,327.5)
<b>Total Project Costs</b>	<b>137,141.4</b>	<b>100,249.4</b>	<b>237,390.8</b>	<b>170,609.6</b>	<b>124,295.2</b>	<b>294,904.8</b>
	<b>(93,578.8)</b>	<b>(99,894.7)</b>	<b>(193,473.5)</b>	<b>(125,609.1)</b>	<b>(134,086.8)</b>	<b>(259,695.9)</b>

Note : (1) Contingencies have been distributed proportionally over all project components.  
(2) Figures in parentheses represent forecast estimates.

### Financial Sources

3.08 Actual expenditures amounted to W205,296.8 millions against the original expectations estimated at W180,281.6 millions including contingencies, exceeding the original estimates by some 13.9% point. The overruns were caused by the improvement of roads, where originally intended 1,006Km had been increased to 1,582Km. Another overruns were incurred by engineering of the roads which were increased to 1,600Km against originally intended 1,000Km. These overruns, when looked at proportionally against original estimates and actual expenditures of the project in whole, the improvement of the provincial and county roads increased from 82.4% to 93.7% and engineering of the provincial and county roads from 1.4% to 2.4%. A summary of project costs and implementation schedule for major components of the project is given in the following tables.

#### B. Training of the Contractors and MOHA's Staff

##### In the Country Training

3.09 In introducing DBST technique into the country a comprehensive training program was prepared (June-July 1983). Training program carried out during February to August 1984 consisted of theoretical seminars, practical demonstrations, trial sections and on-the-job training. In theoretical seminars text in five modules with Supporting slides were used. For trial sections, three provinces were selected, where two adjacent provinces had participated. On-the-job training was carried out all DBST road sections, giving out notices beforehand to all contractors whose DBST sections located nearby Overseas Training.

##### Overseas Training

3.10 A total of nine overseas training for MOHA's staff had been undertaken on separate time periods. Except one occasion of one-year long-term training in England, all the rest of the overseas training was for short-term training of the period ranging from 14 to 15 days in USA and European countries, England, France, Sweden, Switzerland and West Germany. Number of trainees participated were 54 in all throughout 1984 - 1989.

#### IV. INSTITUTIONAL DEVELOPMENT

4.01 MOHA, as agreed on during negotiation of the Loan 2228 - KO, established Road Maintenance Section in MOHA to be responsible for overall management of the maintenance activities over all nine provinces. Further, during 1985 Provincial Road Maintenance Offices had been strengthened in man-power and laboratory equipment. In addition, mobile laboratories mounted on the trucks were provided to all provinces so as to enable to perform on the spot quality tests of the works at the construction sites. All provincial administrations established additional construction sections under road divisions to strengthen construction supervision and management.

#### V. ECONOMIC EVALUATION

5.01 The purpose of the present final evaluation is to determine the economic returns of the project, using actual investment costs and traffic volumes. The road by road evaluation is made through the "with-without" approach as was in the case of original evaluation at appraisal time. The only differences at this final stage would be that the evaluations are made using actual costs and traffic while the original evaluations were made on the basis of estimated costs and traffic. Table 3 shows actual traffic volumes on each road section and original and final estimates of economic rate of return are shown in Table 4.

#### VI. CONCLUSIONS

6.01 As stated previously(para. 2.01) the project was rated as top-priority among the Fifth Five year Plan and the resultant project in the light of Sixth Five year Plan more than justifies the project. Although the scope of the project exceeded the original intention by more than 150%, the size of the project was not overly burdensome to MOHA, considering the project times involved. In conclusion the project was well designed, implemented within the capacity of the provinces. Throughout the duration of the project, Mission from The World Bank made periodic visits to Korea to review the works and management of the project. Number of visits by the Bank ranged between two to four times per year, depending on the work load under progress. The Mission's visits were timely and its reviews of the project was quite helpfull.

PROJECT COMPLETION REPORT  
HIGHWAY PROJECT (LOAN / 2228 - KO)  
Actual and Expected Project Implementation

Project Component	Contractor	Dates of						Percent of the works completed by expected completion date		
		Bid receipt		Contract award		Beginning of work			Completion of work	
		Actual	Expected	Actual	Expected	Actual	Expected		Actual	Expected
	<u>1983 - 1986</u>									
1-1	Sung Won Constr.	'83.4.11	'83.5.15	'83.5.25	'83.5.15	'83.5.30	'83.5.20	'84.12.31	'84.12.31	100
1-2	Dae Hwa Constr.	"	"	"	"	"	"	"	"	100
1-3	You One Constr.	"	"	"	"	"	"	'85.10.30	"	74
1-4	Sam Whan Constr.	"	"	"	"	"	"	'85. 1.20	"	65
1-5	Pung Yang Constr.	"	"	'83.5.25	"	'83.5.28	"	'84.12.31	"	100
1-6	Korea Development	"	"	'83.5.24	"	'83.5.27	"	"	"	100
1-7	Kyong Hyang Constr.	"	"	'83.5.25	"	'83.5.30	"	"	"	100
1-9	Korea Development	"	"	'83.5.24	"	'83.5.27	"	"	"	100
1-11	Kyong Hyang Constr.	"	"	'83.5.25	"	'83.5.30	"	"	"	100
1-12	Sam Poeng Constr.	"	"	"	"	"	"	"	"	100
1-13	Ham Kook Pavement	"	"	"	"	"	"	'85.12.24	"	93
1-14	Yu Sung Constr.	"	"	"	"	"	"	'84.12.31	"	100
1-15	Kong Yung Constr.	"	"	"	"	"	"	"	"	100
1-16	Yu Sung Constr.	"	"	"	"	"	"	'85. 8.31	"	94
1-17	Duck Soo Constr.	"	"	"	"	"	"	'84.12.31	"	100
1-18	Jin Sung Constr.	"	"	"	"	"	"	'85.11.30	"	48
1-19	Tong Yang Constr.	"	"	"	"	"	"	'84.12.31	"	100

PROJECT COMPLETION REPORT  
HIGHWAY PROJECT (LOAN / 2228 - KO)  
Actual and Expected Project Implementation

Project Component	Contractor	Dates of								Percent of the works completed by expected completion date
		Bid receipt		Contract award		Beginning of work		Completion of work		
		Actual	Expected	Actual	Expected	Actual	Expected	Actual	Expected	
2-1	Han Joo Constr.	'83.4.12	'83.5.15	'83.5.26	'83.5.15	'83.5.31	'83.5.20	'84.11.30	'84.12.31	100
2-2	Dong Kuk Constr.	"	"	"	"	"	"	"	"	100
2-3	Sam Ick Corporation	"	"	"	"	"	"	"	"	100
2-4	Tong Yang Constr.	"	"	"	"	"	"	"	"	100
2-5	Sam Do Constr.	"	"	"	"	"	"	'86. 7.10	"	46
2-6	Mi Ryung Constr.	"	"	'83.5.25	"	'83.5.30	"	'84.11.30	"	100
2-7	Poong Lim Constr.	"	"	'83.5.26	"	'83.5.31	"	'84.12.31	"	100
3-6-2	Dae Yang Constr.	"	"	"	"	"	"	'86. 7. 8	"	100
3-1	Lim Kwang Constr.	'83.4.13	"	'83.5.23	"	'83.5.28	"	'84.12.31	"	100
3-2	Nam Yang Him Heung Constr.	"	"	"	"	"	"	"	"	100
3-3	Lim Kwang Constr.	"	"	"	"	"	"	"	"	100
3-4	Poong Chang Constr.	"	"	"	"	"	"	"	"	100
3-5	Lim Kwang Constr.	"	"	"	"	"	"	"	"	100
3-6-1	Han Yang Constr.	"	"	"	"	"	"	'86.12.24	"	37
4-1	Yoo Rim Constr.	'83.4.11	"	'83.5.21	"	'83.5.25	"	'84.12.31	"	100
4-2	Sun Kyong Constr.	"	"	'83.5.26	"	'83.5.31	"	"	"	100
4-3	Sun Kyong Constr.	"	"	"	"	"	"	'85.12.28	"	29







PROJECT COMPLETION REPORT  
HIGHWAY PROJECT (LOAN / 2228 - KO)  
Actual and Expected Project Implementation

Project Component	Contractor	Dates of						Percent of the works completed by expected completion date		
		Bid receipt		Contract award		Beginning of work			Completion of work	
		Actual	Expected	Actual	Expected	Actual	Expected		Actual	Expected
7-7	Jung Woo Constr.	'83.4.12	'84.5.15	'83.5.26	'83.5.15	'83.6.1	'83.5.20	'85.12.26	'84.11.30	62
7-8	Yeong Nam Constr.	"	"	"	"	"	"	'84. 6.30	'84. 6.30	100
7-9	Han Bo Constr.	"	"	"	"	"	"	'84.12.10	'84.12.10	100
7-10	Jin Duk Constr.	"	"	"	"	"	"	'85.12.23	'84.12.31	51
7-12	Young Jin Constr.	"	"	"	"	"	"	'84. 5.31	'84. 5.31	100
7-13	Suh Kwang Constr.	"	"	"	"	"	"	'85. 9.28	'84.11.30	100
7-14	Kwang Myung Constr.	"	"	"	"	"	"	'84.12.31	'84.12.31	100
7-15	Kuk Dong Constr.	"	"	"	"	"	"	'87. 4.30	'84.12.31	73
7-16	Sam Ryung Constr.	"	"	"	"	"	"	'84.11.30	'84.11.30	100
7-17	Nam Kwang Constr.	"	"	"	"	"	"	'84.12.31	'84.12.31	100
7-19	Hwa Sung Constr.	"	"	"	"	"	"	'85. 4.29	'84. 9.30	91
7-20	Seo Ha Constr.	"	"	"	"	"	"	'85. 7.26	'84.12.31	90
7-21	Han Il Constr.	"	"	"	"	"	"	'84.12.31	"	100
8-1	Dong San Constr.	'83.4.13	"	'83.5.26	"	'83.5.31	"	'85.12.26	"	57
8-2	Sung Jee Constr.	"	"	"	"	"	"	'84. 9.29	'84. 4.30	100
8-3	Sung Jee Constr.	"	"	"	"	"	"	'84. 9.29	'84. 6.30	100
8-4	Kuk Je City	"	"	"	"	"	"	'84. 4.30	'84. 3.31	100
8-5	Dae Woo Constr.	"	"	"	"	"	"	'84. 5.23	'84. 5.24	100

PROJECT COMPLETION REPORT

HIGHWAY PROJECT (LOAN / 2228 - KO)

Actual and Expected Project Implementation

Project Component	Contractor	Dates of								Percent of the works completed by expected completion date
		Bid receipt		Contract award		Beginning of work		Completion of work		
		Actual	Expected	Actual	Expected	Actual	Expected	Actual	Expected	
8-6	Korea Shipping	'83.4.13	'83.5.1	'83.5.26	'83.5.15	'83.5.31	'83.5.20	'84.12.20	'84.12.20	100
8-7	Woo Chang Constr.	"	"	"	"	"	"	"	"	100
8-9	Seo Il Constr.	"	"	"	"	"	"	'84.12.18	'84.10.20	100
8-10	Seo Il Constr.	"	"	'83.7.14	"	'83.7.19	"	'84. 4. 3	'84. 2.22	100
8-11	Sam Sung Constr.	"	"	'83.5.26	"	'83.5.31	"	'84.12.20	'84.12.31	100
8-12	Chia Hung Constr.	"	"	"	"	"	"	'84.10.31	'84.12.31	100
8-14	Sam Sung Constr.	"	"	"	"	"	"	'85.12.23	"	42
8-15	Dae Lim Constr.	"	"	"	"	"	"	'85. 5.31	"	86
8-16	Mee Sung Constr.	"	"	"	"	"	"	'84. 5.24	"	100
8-17	Tae Young Constr.	"	"	'83.5.25	"	'83.5.30	"	'84. 8.21	"	100
8-18	Tae Young Constr.	"	"	"	"	"	"	'84.12.19	"	100
8-19	Sam Han Constr.	"	"	'83.5.26	"	'83.5.31	"	'84.12.20	"	100
8-20	Kolon Constr.	"	"	"	"	"	"	"	"	100
9-1	Nam Yang Jin Heung Constr.	"	"	"	"	"	"	'84.12.31	'84.12.31	100

PROJECT COMPLETION REPORT

HIGHWAY PROJECT (LOAN / 2228 - KO)

Actual and Expected Project Implementation

Project Component	Contractor	Dates of						Percent of the works completed by expected completion date		
		Bid receipt		Contract award		Beginning of work			Completion of work	
		Actual	Expected	Actual	Expected	Actual	Expected		Actual	Expected
<u>1984 - 1986</u>										
1-P2	Sung Won Constr.	'84.9.18	'84.8.20	'84.11.29	'84.11.15	'84.11.30	'84.11.20	'86.12.13	'86.12.13	100
1-P7	Han Il Develop.	"	"	'84.11.29	"	'84.11.30	"	'86.8.26	'86.8.26	100
1-P11/G2	Lotte Constr.	"	"	'84.11.29	"	'84.11.30	"	'86.9.6	'86.9.6	100
1-G4	Han Il Develop.	"	"	'84.11.29	"	'84.11.30	"	'86.11.29	'86.11.29	100
2-G2	Ssang Yong Develop.	"	"	'84.11.25	"	'84.11.26	"	'86.10.18	'86.6.30	89
4-P1	Duk Soo Develop.	'84.9.20	"	'84.11.25	"	'84.11.28	"	'86.9.8	'86.6.30	92
4-P4	Mi Do Pa Constr.	"	"	'84.11.25	"	'84.11.26	"	'86.9.4	'86.12.31	100
4-P6	Sam Hwan Corp.	"	"	'84.12.7	"	'84.12.7	"	'86.12.30	'86.12.30	100
<u>1987 - 1989</u>										
1-E1	Central Constr.	'87.9.30	'87.9.25	'87.10.22	'87.10.20	'87.10.24	'87.10.22	'89.6.10	'88.9.17	100
1-E2	Nam Yang Jin Hwang	"	"	'87.10.21	"	'87.10.23	"	'88.11.24	'88.9.18	7
1-E3	Mun Hwa Constr.	"	"	'87.10.26	"	'87.10.28	"	'88.12.22	'88.9.21	100
1-E4	Mun Hwa Constr.	"	"	'87.10.26	"	'87.10.28	"	'88.10.31	'88.6.23	100
2-E1	A Jin Constr.	"	"	'87.10.22	"	'87.10.24	"	'89.5.30	'88.12.10	82
2-E2	Yoo Seong Constr.	"	"	'87.9.27	"	'87.9.29	"	'88.6.28	'88.6.30	100
2-E3	Central Constr.	"	"	'87.9.22	"	'87.9.24	"	'88.12.20	'88.12.10	100
2-E4	Sam Do Constr.	"	"	'87.10.24	"	'87.10.26	"	'88.12.8	'88.12.10	100
2-E5	Poong Chang	"	"	'87.10.23	"	'87.10.25	"	'88.6.30	'88.6.20	100

PROJECT COMPLETION REPORT  
HIGHWAY PROJECT (LOAN / 2229 - KO)  
Actual and Expected Project Implamentation

Project Component	Contractor	Dates of						Percent of the works completed by expected completion date		
		Bid receipt		Contract award		Beginning of work			Completion of work	
		Actual	Expected	Actual	Expected	Actual	Expected		Actual	Expected
3-E1	Dong Shin Constr.	'87.9.30	'87.9.25	'87.10.22	'87.10.20	'87.10.24	'87.10.22	'88.12. 5	'88. 9.15	100
3-E2	Shin Woo Constr.	"	"	'87.10.21	"	'87.10.23	"	'88.12. 8	'88.12.31	100
3-E3	Han Shin Constr.	"	"	'87.10.21	"	'87.10.23	"	'87.12.28	'87.12.31	100
3-E4	Saang Yong Constr.	"	"	'87.10.31	"	'87.11.1	"	'88.12. 8	'88. 9.25	100
3-E5	Dong Shin Constr.	"	"	'87.10.22	"	'87.10.24	"	'88.10. 4	'88. 9.15	100
3-E6	Lim Kwang Constr.	"	"	'87.10.22	"	'87.10.24	"	'88.12. 2	'88.12.10	100
3-E7	Dae Woo Develop.	"	"	'87.10.20	"	'87.10.22	"	'88. 9.19	'88. 9.15	100
4-E1	Sun Kyeong Constr.	"	"	'87.10.21	"	'87.10.23	"	'88.11.12	'88.12.10	100
4-E2	Kye Ryong Constr.	"	"	'87.10.18	"	'87.10.20	"	'89. 6.30	"	83
4-E3	Kye Ryong Constr.	"	"	'87.10.19	"	'87.10.21	"	'88. 9.30	"	100
4-E4	Sam An Constr.	"	"	'87.10.21	"	'87.10.23	"	'88.12.10	"	100
4-E5	Mi Do Pa Constr.	"	"	'87.10.18	"	'87.10.20	"	'89. 6.30	"	95
5-E1	Kyong Hyang Constr.	"	"	'87.10.22	"	'87.10.24	"	'88.10. 7	'88. 9.27	100
5-E2	Sung Won Constr.	"	"	'87.10.24	"	'87.10.26	"	'88.12. 8	'88.12. 7	100
5-E3	Sam Do Constr.	"	"	'87.10.22	"	'87.10.24	"	'88.11. 8	'88.12.10	100
5-E4	Sam Ick Constr.	"	"	'87.10.24	"	'87.10.26	"	'88. 9.30	'88. 9.30	100
5-E5	Shin Dong A Constr.	"	"	'87.11.26	"	'87.10.28	"	'88.11. 5	'88. 9. 6	100

PROJECT COMPLETION REPORT  
HIGHWAY PROJECT (LOAN / 2228 - KO)  
Actual and Expected Project Implementation

Project Component	Contractor	Dates of						Percent of the works completed by expected completion date		
		Bid receipt		Contract award		Beginning of work			Completion of work	
		Actual	Expected	Actual	Expected	Actual	Expected		Actual	Expected
6-E1	Dae Dong Constr.	'87.9.30	'87.9.25	'87.10.25	'87.10.20	'87.10.27	'87.10.22	'88. 5.10	'88. 6.27	100
6-E2	Han Bo Constr.	"	"	"	"	"	"	'88. 6.16	'88. 6.27	100
6-E3	Nam Yang Constr.	"	"	"	"	"	"	'88.12.23	'88.11.26	100
6-E4	Nam Hwa Constr.	"	"	"	"	"	"	'88. 9.22	'88.11.27	100
6-E5	Nam Hwa Constr.	"	"	"	"	"	"	'88.10. 8	'88.11.27	100
6-E6	Dae Ju Constr.	"	"	"	"	"	"	'88.11.25	"	100
6-E7	Il Woo Constr.	"	"	"	"	"	"	'88.12.17	"	100
6-E8	Nam Jin Constr.	"	"	"	"	"	"	'88. 9.16	'88.11.26	100
6-E9	Han Kuk Constr.	"	"	"	"	"	"	'88.12.22	'88.11.27	100
6-E10	Dae Dong Constr.	"	"	"	"	"	"	'88.11.10	"	100
7-E1	Suh Kwang Constr.	"	"	'87.10.22	"	'87.10.24	"	'88.10.10	'88.11.23	100
7-E2	Chin Hung Indust.	"	"	"	"	"	"	'88.11.18	'88.11.24	100
7-E3	Dae Myung Constr.	"	"	"	"	"	"	'88.11.22	'88.11.23	100
7-E4	Yong Jin Constr.	"	"	"	"	"	"	'88. 6.30	"	100
7-E5	Kuk Dong Constr.	"	"	'87.10.20	"	'87.10.22	"	'88.11.12	'88.11.21	100
7-E6	Kyung Il Constr.	"	"	'87.10.24	"	'87.10.26	"	'88. 6.19	'88.11.18	100
7-E7	Han Il Develop.	"	"	'87.10.22	"	'87.10.24	"	'87.12.21	'88. 4.20	100
7-E8	Korea Indu. Develop.	"	"	"	"	"	"	'88.11.17	'88.11.21	100

PROJECT COMPLETION REPORT  
HIGHWAY PROJECT (LOAN / 2228 - KO)  
Actual and Expected Project Implementation

Project Component	Contractor	Dates of						Percent of the works completed by expected completion date		
		Bid receipt		Contract award		Beginning of work			Completion of work	
		Actual	Expected	Actual	Expected	Actual	Expected		Actual	Expected
7-E9	Daer Myung Constr.	'87.9.30	'87.9.25	'87.10.22	'87.10.20	'87.10.24	'87.10.22	'88. 8.16	'88. 4.23	100
7-E10	Hwa Sung Constr.	"	"	'87.10.23	"	'87.10.25	"	'88. 6.18	'88. 4.24	100
7-E11	Kuk Dong Constr.	"	"	'87.10.20	"	'87.10.22	"	'88. 7. 7	'88.11.21	100
7-E12	Han II Develop.	"	"	'87.10.22	"	'87.10.24	"	'87.12. 4	'88. 4.20	100
7-E13	Young Nam Constr.	"	"	"	"	"	"	'87.12.22	"	100
8-E1	Dong Shin Constr.	"	"	'87.10.23	"	'87.10.25	"	'88.12. 5	'88.12.10	100
8-E2	International Constr.	"	"	"	"	"	"	'89. 5.31	"	67
8-E3	Korea Indu. Develop.	"	"	"	"	"	"	'88. 5.19	"	100
8-E4	Lotte Constr.	"	"	"	"	"	"	'88.12.10	"	100
8-E5	Il Shin Constr.	"	"	"	"	"	"	'88. 8.22	"	100
8-E6	Sam Sung Constr.	"	"	"	"	"	"	'88.12. 8	"	100
9-E1	Hwa Sung Constr.	"	"	'87.10.22	"	'87.10.24	"	'88.11.30	'88.12.31	100
9-E2	Daer Chang Constr.	"	"	"	"	"	"	'88. 8.18	"	100

Source : Consultants Final Reports (1984, 1986, 1989)

**PROJECT COMPLETION REPORT**  
**HIGHWAY PROJECT (LOAN/ 2228 - RO )**  
**Actual and Forecast Estimates of Project Cost**

Unit : US\$/M='000

Project Component	Length(Km)		Standard/a	Actual cost			Contract amount	Forecast estimate of cost			Actual cost as a proportion of	
	Original	Final		Local Country currency	Foreign US\$	Total US\$ equivalent		Local Country currency	Foreign US\$	Total US\$ equivalent	Forecast estimate of cost(%)	Contract amount
<b>1983.4 - 1986.12</b>												
1-1	6.0	6.0	P.2	387.3	353.2	740.5	483,956	371.1	357.5	735.6	100.7	123.5
1-2	2.6	2.6	P.1	109.2	99.5	208.7	199,100	171.0	166.3	342.3	61	84.6
1-3	12.5 (2.0) (10.5)	16.0	P.2	1,333.4	1,216.1	2,549.5	1,700,046	1,715.7	1,149.4	2,363.1	167.8	121.0
1-4	9.0	9.0	G.2	693.9	632.8	1,326.7	693,076	509.8	482.0	991.9	133.7	154.4
1-5	10.0 (3.6) (6.4)		P.2 G.2	365.0	332.8	697.8	514,739	491.2	464.4	955.7	73.0	100.9
1-6	6.6 (3.2) (3.4)	6.6	P.1	613.6	559.6	1,173.2	822,000	722.3	550.5	1,132.8	103.5	106.3
1-7	6.3	6.3	P.3	690.1	629.4	1,319.5	1,123,890	789.3	746.3	1,535.6	85.9	94.7
1-9	11.1 (5.1) (6.0)	11.1	P.1	695.5	634.4	1,329.9	943,000	658.2	622.3	1,280.5	103.8	113.8
1-11	6.5 (2.3) (4.2)	6.5	P.3 P.1	576.7	526.0	1,102.7	745,340	623.7	589.7	1,213.4	90.8	119.4
1-12	3.8	3.8	P.3	312.0	284.6	596.6	468,045	429.8	406.4	836.2	71.3	94.9
1-13	4.8 (2.4) (2.4)	4.2	P.3	256.8	234.2	491.0	651,887	595.5	562.9	1,158.4	42.4	60.8
1-14	5.3	5.3	P.2	291.8	266.1	557.9	528,076	511.9	484.0	995.9	56.2	85.3
1-15	7.4	7.4	P.2	817.6	745.7	1,563.3	1,286,123	892.1	843.5	1,735.6	90.1	98.1
1-16	5.4	5.4	P.2	231.3	210.9	442.2	601,305	603.7	570.8	1,174.5	37.7	59.3
1-17	9.2 (3.7) (5.5)	9.2	P.2	483.1	440.5	923.6	688,000	845.2	799.1	1,644.3	56.2	108.3
1-18	5.0	10.2	P.2	684.3	624.2	1,308.5	447,010	347.7	328.8	676.5	193.4	236.2
1-19	8.9	8.9	P.3	586.6	535.0	1,121.6	869,300	632.7	598.1	1,230.8	91.1	104.1
<b>Subtotal</b>	<b>120.2</b>	<b>128.5</b>		<b>9,128.2</b>	<b>8,325.3</b>	<b>17,453.5</b>	<b>12,764,893</b>	<b>10,282.7</b>	<b>9,722.6</b>	<b>20,005.3</b>	<b>87.2</b>	<b>110.3</b>
2-1	11.4	11.4	G.2	888.3	810.3	1,698.6	1,064,980	735.5	695.4	1,430.9	118.7	128.7
2-2	9.9	9.9	P.1	601.7	548.8	1,150.5	819,500	825.2	780.2	1,605.4	71.7	113.3
2-3	12.4 (2.3) (3.2) (3.8) (2.3) (0.7)	12.4	P.2 P.1 P.1 P.2 P.2	911.4	831.2	1,742.6	1,181,446	708.6	669.9	1,378.5	126.4	119.0
2-4	14.3 (8.1) (6.2)	14.3	P.2	860.5	784.8	1,645.3	1,095,800	1,414.4	1,337.3	2,751.7	59.8	121.2
2-5	9.9 (2.4) (7.5)	16.0	P.1	1,300.2	1,185.8	2,486.0	713,040	606.4	573.4	1,179.8	210.7	281.4
2-6	11.9 (8.4) (3.5)	11.9	P.1	1,297.3	1,183.1	2,480.4	1,725,793	1,199.8	1,134.4	2,334.2	106.2	115.9
2-7	16.9 (4.4) (10.8) (1.7)	16.9	P.2	1,846.2	1,683.9	3,530.1	2,378,424	1,708.9	1,615.9	3,324.8	106.2	119.7
<b>Subtotal</b>	<b>86.7</b>	<b>92.8</b>		<b>7,705.7</b>	<b>7,027.9</b>	<b>14,733.6</b>	<b>8,978,983</b>	<b>7,198.7</b>	<b>6,806.6</b>	<b>14,005.3</b>	<b>105.2</b>	<b>132.4</b>

**PROJECT COMPLETION REPORT**  
**HIGHWAY PROJECT (LOAN/ 2228 - KO)**  
**Actual and Forecast Estimates of Project Cost**

Project Component	Length(Km)		Stand-ard/a	Actual cost			Contract amount	Forecast estimate of cost			Actual cost	
	Original	Final		Local Country currency	Foreign US\$	Total US\$ equivalent		Local Country currency	Foreign US\$	Total US\$ equivalent	Forecast estimate of cost(%)	Contract amount
3-1	7.7	7.7	P.1	831.7	758.5	1,590.2	950,296	651.3	615.8	1,267.1	125.5	135.0
3-2	14.5	14.5	G.2	893.7	815.1	1,708.8	1,173,000	792.7	749.6	1,542.3	110.7	117.5
3-3	7.1	7.1	P.1	535.5	488.4	1,023.9	707,900	492.6	465.8	958.4	106.8	116.7
3-4	12.6	12.6	G.2	809.6	738.3	1,547.9	891,560	607.1	574.1	1,181.2	131.0	140.1
3-5	14.6	14.6										
	(6.2)		P.1	968.7	883.5	1,652.2	1,189,000	909.3	859.8	1,769.1	104.7	125.7
	(8.4)		G.2									
3-6	11.5	17.1	P.1	2,429.5	2,215.8	4,645.3	1,445,978	992.8	938.7	1,931.5	240.5	239.3
Subtotal	68.1	73.6		6,468.7	5,899.6	12,368.3	6,357,734	4,445.9	4,203.7	8,649.6	142.9	144.9
4-1	5.7	5.7	P.1	470.1	428.7	898.8	632,000	400.9	379.0	779.9	115.2	114.7
4-2	8.0	8.0	P.1	631.5	575.9	1,207.4	920,000	508.5	556.4	1,144.9	105.4	105.9
4-3	8.7	9.9										
	(6.0)		P.1									
	(2.7)		P.2	2,085.2	1,901.9	3,987.1	869,000	529.2	500.3	1,029.5	387.3	370.3
4-4	7.3	7.3										
	(1.0)		P.3									
	(6.3)		P.2	538.1	490.7	1,028.8	778,930	481.6	455.3	936.9	109.8	106.5
4-5	11.3	17.4										
	(1.1)		P.3									
	(10.3)		P.1	1,483.9	1,353.4	2,837.3	1,274,000	858.3	811.5	1,669.8	169.9	179.7
4-6	10.5	10.5	G.2	451.2	411.5	862.7	533,800	499.5	472.3	971.8	88.7	130.4
4-7	12.7	12.7	P.2									
	(4.0)											
	(8.7)			727.8	663.9	1,391.7	997,200	1,091.5	1,032.0	2,123.5	65.5	112.6
4-8	5.3	12.6	P.1	1,044.3	952.5	1,996.8	482,900	395.3	373.8	769.1	259.6	333.6
4-9	15.5	15.5	P.1									
	(10.9)											
	(4.6)			627.2	572.0	1,199.2	940,500	1,081.9	1,022.8	2,104.7	56.9	102.9
4-10	13.1	13.1	G.2	304.5	277.8	582.3	490,390	594.1	561.6	1,155.7	50.4	95.8
4-11	8.3	8.3										
	(8.1)		P.2									
	(0.2)		G.2	535.0	487.9	1,022.9	706,150	856.9	810.2	1,667.1	61.4	116.8
4-12	8.3	8.3	G.2	335.8	306.3	642.1	327,200	331.2	313.1	644.3	99.6	158.3
4-13	14.8	14.8	P.3									
	(8.1)											
	(6.7)			1,142.3	1,041.7	2,184.0	1,576,000	1,467.5	1,387.5	2,855.0	76.5	103.2
4-14	6.6	6.6	G.2	473.2	431.5	904.7	418,488	338.1	319.6	657.7	137.5	174.4
4-15	7.2	10.2	P.1	784	715.1	1,499.1	571,865	474.7	449.8	923.5	162.3	211.5
4-16	19.5	19.5	P.2									
	(8.4)			2,023.1	1,845.1	3,868.2	2,698,000	1,884.2	1,781.6	3,665.8	105.5	115.7
	(11.1)											
Subtotal	162.9	180.4		13,657.4	12,456.1	26,113.4	14,216,423	11,873.0	11,226.3	23,099.3	113.0	136.8
5-1	13.8	13.8										
	(6.2)		P.2	978.4	892.4	1,870.8	1,157,041	1,005.9	951.1	1,957.0	95.6	130.4
	(7.6)		P.1									
5-2	15.4	27.1	P.2									
	(10.4)			2,483.5	2,265.1	4,748.6	2,469,254	1,684.8	1,593.0	3,277.8	144.9	155.2
	(4.9)											
5-3	10.3	10.3	G.2	477.7	435.6	913.3	592,731	520.9	492.5	1,013.4	90.1	133.3
5-4	14.0	14.0	P.1									
	(11.9)											
	(2.1)			643.7	587.1	1,230.8	811,919	879.7	831.7	1,711.4	71.9	122.3
5-5	11.5		G.2									
	(7.7)											
	(3.8)	11.6		676.3	616.8	1,293.1	885,418	848.6	802.4	1,651.0	78.3	117.8
5-6	8.7	8.7	P.2	697.9	636.5	1,334.4	943,337	574.0	542.8	1,116.8	119.5	114.2
Subtotal	73.7	85.5		5,957.5	5,433.6	11,391.1	6,819,700	5,514.0	5,213.5	10,727.5	106.1	134.7



**PROJECT COMPLETION REPORT**  
**HIGHWAY PROJECT (LOAN/ 2228 - KO)**  
**Actual and Forecast Estimates of Project Cost**

Project Component	Length(Km)		Standard/a	Actual cost			Contract amount	Forecast estimate of cost			Actual cost as a proportion of		
	Original	Final		Local Country currency	Foreign US\$	Total US\$ equivalent		Local Country currency	Foreign US\$	Total US\$ equivalent	Forecast estimate of cost (%)	Contract amount	
6-1	21.6 (10.1) (7.3) (4.3)	21.6	P.1 P.2 P.2										
6-2	10.1 (2.0) (8.1)	10.1	P.3 P.2	1,516.9	1,383.5	2,900.4	2,101,596	1,711.0	1,617.8	3,328.8	87.1	111.4	
6-3	15.2 (5.6) (5.5) (4.2)	15.2	P.3 P.2 P.3	645.5	588.8	1,234.3	895,414	945.9	894.3	1,840.2	67.1	111.2	
6-4	11.3	16.5	P.1	1,183.8	1,079.7	2,263.5	1,840,394	1,413.3	1,337.0	2,750.3	82.3	99.2	
6-5	15.9 (5.9) (7.6) (2.4)	15.9	P.1	1,143.2	1,042.6	2,185.8	979,271	857.6	810.8	1,668.4	131.0	180.1	
6-6	11.4	11.9	G.2	789.4	719.9	1,509.3	1,047,805	901.1	851.9	1,753.0	86.1	116.2	
6-7	9.2	9.2	G.2	838.2	764.5	1,602.7	1,116,000	781.0	738.5	1,519.5	105.4	115.8	
6-8	9.7	9.7	P.1	577.1	526.4	1,103.5	881,166	685.1	647.7	1,332.8	82.7	101.1	
6-9	8.3	8.3	P.1	840.6	766.7	1,607.3	1,042,260	734.1	694.0	1,428.1	112.5	124.4	
6-10	9.4 (5.5) (3.9)	13.5	P.1	880.0	802.6	1,682.6	1,065,000	706.5	667.9	1,374.4	122.4	127.4	
Subtotal	122.2	131.9		1,069.1	975.0	2,044.1	1,232,142	743.7	703.2	1,446.9	141.2	133.8	
7-1	16.4 (1.5) (8.2) (6.7)	16.4	P.2 P.1 P.2	9,483.8	8,649.7	18,133.5	12,201,048	9,479.7	8,963.2	18,442.9	98.3	119.9	
7-2	7.7	7.8	P.1	1,271.8	1,159.9	2,431.7	1,660,000	1,226.7	1,159.8	2,386.5	101.9	118.2	
7-3	7.7	7.7	G.2	857.5	782.0	1,639.5	850,000	547.1	517.3	1,064.4	154.0	155.6	
7-4	15.2 (4.2) (5.9) (5.1)	15.2	P.1 P.1 P.1	189.2	172.6	361.8	299,900	357.4	337.9	695.3	52.0	97.3	
7-6	16.7	16.7	G.2	853.2	778.2	1,631.4	1,100,000	749.3	708.4	1,457.7	111.9	119.6	
7-7	10.8	16.1	P.3	1,899.6	1,732.5	3,632.1	2,139,000	1,469.6	1,389.4	2,859.0	127.0	126.5	
7-8	3.0	3.0	P.1	1,037.3	946.0	1,983.3	836,000	552.7	522.5	1,075.2	184.4	191.4	
7-9	9.9	9.9	P.1	217.1	198.0	415.1	285,956	194.6	183.9	378.5	109.6	117.1	
7-10	8.3 (1.5) (6.8)	14.9	P.1 P.2 G.2	525.6	479.4	1,005.0	632,100	585.0	553.2	1,138.2	88.3	128.3	
7-12	3.1	3.1	P.3	1,798.1	1,640.0	3,438.1	1,285,000	823.1	778.2	1,601.3	214.7	215.9	
7-13	7.5 (5.2) (2.3)	7.5	P.3 P.3	250.4	228.4	478.8	351,000	245.0	231.5	476.5	100.4	110.0	
7-14	9.4	9.4	P.1	620.6	566.1	1,186.7	889,000	605.8	572.7	1,178.5	100.6	107.7	
7-15	16.6 (10.1) (6.6)	23.1	P.2	602.8	549.8	1,152.6	832,000	617.5	583.8	1,201.3	95.9	111.7	
7-16	8.0	8.1	G.2	3,453.1	3,149.4	6,602.5	3,755,900	2,430.0	2,297.5	4,727.5	139.6	141.8	
7-17	13.8 (7.6) (6.2)	13.8	P.1	294.9	269.0	563.9	431,200	284.3	268.7	553.0	101.9	105.5	
7-19	10.1	10.3	G.2	1,372.2	1,251.6	2,623.8	2,015,280	1,153.6	1,090.7	2,244.3	116.9	105.1	
7-20	12.1	12.1	P.1	575.4	524.8	1,100.2	611,100	486.4	459.9	946.3	116.2	145.2	
7-21	15.7 (7.4) (6.5) (1.8)	15.7	P.1 P.1 P.3	888.3	810.2	1,698.5	1,125,000	763.1	721.4	1,484.5	114.4	121.8	
Subtotal	192.0	210.8		1,413.0	1,288.7	2,701.7	2,123,000	1,177.7	1,113.5	2,291.2	117.9	102.6	
Subtotal	192.0	210.8		18,120.2	16,526.5	34,646.7	21,221,436	14,268.5	13,491.2	27,759.7	124.8	131.7	

**PROJECT COMPLETION REPORT**

**HIGHWAY PROJECT (LOAN/ 2228 - KO)**

**Actual and Forecast Estimates of Project Cost**

Project Component	Length(Km)		Standard/a	Actual cost			Contract amount	Forecast estimate of cost			Actual cost of project	
	Original	Final		Local Country currency	Foreign US\$	Total US\$ equivalent		Local Country currency	Foreign US\$	Total US\$ equivalent	Forecast estimate of cost(%)	Contract amount
8-1	14.3 (7.5) (4.1) (2.7)	18.4	P.2 P.2 P.1	1,978.9	1,804.8	3,783.7	1,692,000	1,025.2	969.4	1,994.6	189.6	180.4
8-2	2.9	2.9	P.1	176.1	160.6	336.7	209,950	142.1	134.4	276.5	121.7	129.4
8-3	2.6	2.6	P.1	137.2	125.2	262.4	182,000	129.1	121.9	251.0	104.5	116.3
8-4	2.2	2.2	P.3	228.4	208.4	436.8	342,000	238.8	225.6	466.4	94.0	103.1
8-5	4.1	4.1	P.3	210.4	191.8	402.2	266,428	285.6	270.1	555.7	72.4	121.8
8-6	14.3 (7.0) (7.3)	14.3	P.2	1,577.7	1,439.0	3,016.7	2,335,625	1,455.1	1,375.7	2,830.8	106.5	104.2
8-7	17.0 (5.8) (11.2)	17.0	P.2	1,718.5	1,567.4	3,285.9	2,288,027	1,609.0	1,521.2	3,130.2	104.9	115.8
8-9	8.9 (5.4) (3.5)	8.9	P.1 P.2	684.4	624.2	1,308.6	921,000	642.3	607.3	1,249.6	104.7	114.6
8-10	3.1	3.1	P.3	152.9	139.5	292.4	236,000	187.7	177.4	365.1	80.1	99.9
8-11	10.7 (7.3) (3.4)	10.7	P.1	1,010.2	921.4	1,931.6	1,233,147	821.0	776.3	1,597.3	120.9	126.4
8-12	12.5 (4.9) (7.6)	12.5	P.1	1,237.3	1,128.5	2,365.8	1,164,582	767.2	725.4	1,492.6	158.5	163.9
8-14	11.1 (0.3) (8.1) (2.7)	19.7	P.3 P.1 P.2	1,916.6	1,848.0	3,664.6	1,115,524	772.7	730.6	1,503.3	243.7	265.1
8-15	8.0 (0.8) (7.2)	8.0	P.2 P.1	574.8	524.2	1,099.0	629,000	449.2	424.6	873.8	125.7	141.0
8-16	6.0	6.0	P.3	552.2	503.7	1,055.9	711,000	481.6	455.3	936.9	122.7	119.8
8-17	8.1 (4.1) (4.0)	8.1	P.2 P.1	751.0	684.9	1,435.9	872,330	576.8	545.3	1,122.1	127.9	132.8
8-18	12.1	12.1	P.3	671.9	612.8	1,284.7	855,000	735.5	695.3	1,430.8	89.8	121.2
8-19	21.0	21.0	P.1	1,737.2	1,584.4	3,321.6	2,115,000	1,211.0	1,146.0	2,357.0	140.9	
8-20	15.9 (3.5) (3.2) (2.7) (6.5)	15.9	P.1	1,189.3	1,084.7	2,274.0	1,609,458	1,150.9	1,088.2	2,239.1	101.5	114.0
<b>Subtotal</b>	<b>174.8</b>	<b>187.5</b>		<b>16,505.0</b>	<b>15,053.4</b>	<b>31,558.4</b>	<b>18,778,071</b>	<b>12,680.9</b>	<b>11,990.2</b>	<b>24,671.1</b>	<b>127.9</b>	<b>135.6</b>
9-1	5.9	5.9	P.1	453.7	413.7	867.4	540,000	373.9	353.6	727.5	119.2	129.6
<b>Subtotal</b>	<b>5.9</b>	<b>5.9</b>		<b>453.7</b>	<b>413.7</b>	<b>867.4</b>	<b>540,000</b>	<b>373.9</b>	<b>353.6</b>	<b>727.5</b>	<b>119.2</b>	<b>129.6</b>
<b>TOTAL</b>	<b>1,006.5</b>	<b>1,096.9</b>		<b>87,480.1</b>	<b>79,785.8</b>	<b>167,265.9</b>	<b>101,878,288</b>	<b>76,117.5</b>	<b>71,971.1</b>	<b>148,088.6</b>	<b>113.0</b>	<b>132.5</b>

PROJECT COMPLETION REPORT

HIGHWAY PROJECT (LOAN/ 2228 - KO)

Actual and Forecast Estimates of Project Cost

Project Component	Length(Km)		Stand-ard/a	Actual cost			Contract amount	Forecast estimate of cost			Actual cost as a proportion of	
	Original	Final		Local Country currency	Foreign US\$	Total US\$ equivalent		Local Country currency	Foreign US\$	Total US\$ equivalent	Forecast estimate of cost (%)	Contract amount
<b>1984 - 1987</b>												
1-P2	9.8	9.8	P2	1,405.1	1,272.2	2,677.3	1,414,400	1,079.8	1,020.9	2,100.7	114.4	126.5
1-P7	10.1	10.1	P2	616.0	557.5	1,173.5	806,100	904.5	855.2	1,759.7	59.8	97.3
1-P11/G2	15.8	15.8	P2	1,302.8	1,180.9	2,483.7	1,191,600	1,340.6	1,267.5	2,608.1	85.4	139.3
1-G4	13.1	13.1	P2	1,376.6	1,255.5	2,632.1	1,527,000	1,575.1	1,489.3	3,064.4	85.9	139.1
2-G2	12.3	14.0	P1	1,173.1	1,062.1	2,235.2	1,259,000	904.5	855.2	1,759.7	118.7	114.0
4-P1	5.0	5.0	P3	438.6	397.1	835.7	498,400	491.9	465.1	957.0	78.3	112.1
4-P4	8.5	8.5	P2	854.1	773.2	1,627.3	1,043,000	1,028.0	972.0	2,000.0	73.0	104.3
4-P6	14.7	17.2	P2	1,642.0	1,486.6	3,128.6	1,245,500	905.9	856.5	1,762.4	159.3	167.9
<b>Total (8 Roads)</b>	<b>89.3</b>	<b>93.5</b>		<b>8,808.3</b>	<b>7,985.1</b>	<b>16,793.4</b>	<b>8,985,000</b>	<b>8,230.3</b>	<b>7,781.7</b>	<b>16,012.0</b>	<b>104.9</b>	<b>150.8</b>
<b>1987 - 1989</b>												
1-E1	9.3	12.3	P3	1,087.7	992.1	2,079.8	1,150,000	1,285.4	1,215.4	2,500.8	83.2	134.7
1-E2	12.7	12.7	P2	1,145.3	1,044.5	2,189.8	1,767,150	1,284.0	1,214.1	2,498.1	87.7	100
1-E3	7.2	7.2	P3	577.4	526.7	1,104.1	891,000	877.9	830.0	1,707.9	64.6	100
1-E4	3.8	3.8	P2	332.5	303.2	635.7	431,200	425.3	402.1	827.4	76.8	109.8
<b>Subtotal</b>	<b>33.0</b>	<b>36.0</b>		<b>3,142.9</b>	<b>2,866.5</b>	<b>6,009.4</b>	<b>4,239,350</b>	<b>3,872.6</b>	<b>3,661.6</b>	<b>7,534.2</b>	<b>79.8</b>	<b>114.4</b>
2-E1	7.0	10.3	P2	1,595.6	1,455.3	3,050.9	2,049,600	1,521.3	1,438.4	2,959.7	103.1	110.9
2-E2	1.7	1.6	P2	211.5	192.9	404.4	340,233	234.7	221.9	456.6	88.6	88.6
2-E3	10.8	10.8	P2	665.2	606.7	1,271.9	996,000	1,107.0	1,046.6	2,153.6	59.1	95.1
2-E4	9.6	9.6	G3	564	514.5	1,078.5	644,400	708.5	669.9	1,378.4	78.2	124.7
2-E5	2.4	2.4	P2	289.9	264.4	554.3	433,650	315.9	298.6	614.5	90.2	95.2
<b>Subtotal</b>	<b>31.5</b>	<b>34.7</b>		<b>3,326.3</b>	<b>3,033.7</b>	<b>6,360.0</b>	<b>4,463,883</b>	<b>3,887.3</b>	<b>3,675.5</b>	<b>7,562.8</b>	<b>84.1</b>	<b>106.2</b>
3-E1	2.6	2.6	P2	273.4	249.4	522.8	404,880	295.5	279.5	575.0	90.9	96.2
3-E2	0.4	0.4	P*1	67.9	62.0	129.9	102,900	9.8	135.8	145.6	89.2	94.1
3-E3	3.9	3.9	P2	53.1	48.3	101.4	81,792	87.7	82.8	170.5	59.4	100
3-E4	7.3	7.3	P*1	566.8	516.9	1,083.7	827,500	824.4	779.5	1,603.9	67.6	97.6
3-E5	7.8	7.8	G3	362.9	330.9	693.8	629,900	621.0	587.1	1,208.1	57.4	82.1
3-E6	4.8	4.8	G3	296.0	270.0	566.0	415,800	302.8	286.3	589.1	96.1	109.8
3-E7	6.8	6.8	G3	654.2	596.7	1,250.9	847,000	615.4	581.9	1,197.3	104.5	110.0
<b>Subtotal</b>	<b>33.6</b>	<b>33.6</b>		<b>2,274.3</b>	<b>2,074.2</b>	<b>4,348.5</b>	<b>3,309,772</b>	<b>2,821.6</b>	<b>2,667.9</b>	<b>5,489.5</b>	<b>79.2</b>	<b>106.0</b>
4-E1	7.3	7.3	P*1	402.5	367.2	769.7	601,650	570.8	539.8	1,110.6	69.3	95.3
4-E2	15.5	15.5	P*1	799.8	729.4	1,529.2	1,190,175	859.9	813.1	1,673.0	91.4	103.7
4-E3	2.8	2.8	P2	226.0	206.2	432.2	338,520	359.3	339.8	699.1	61.8	95.1
4-E4	9.6	9.6	P*1	705.5	643.5	1,349.0	1,057,000	758.5	717.2	1,475.7	91.4	95.1
4-E5	10.0	10.1	P2	1,364.8	1,244.6	2,609.4	1,921,500	1,390.9	1,315.1	2,706.0	96.4	101.2
<b>Subtotal</b>	<b>45.2</b>	<b>45.3</b>		<b>3,498.6</b>	<b>3,190.9</b>	<b>6,689.5</b>	<b>5,108,845</b>	<b>3,939.4</b>	<b>3,725.0</b>	<b>7,664.4</b>	<b>87.3</b>	<b>105.7</b>

**PROJECT COMPLETION REPORT**  
**HIGHWAY PROJECT (LOAN/ 2228 - KO)**  
**Actual and Forecast Estimates of Project Cost**

Project Component	Length(Km)		Standard/a	Actual cost			Contract amount	Forecast estimate of cost			Actual cost as a proportion of	
	Original	Final		Local Country currency	Foreign US\$	Total US\$ equivalent		Local Country currency	Foreign US\$	Total US\$ equivalent	Forecast estimate of cost(%)	Contract amount
5-E1	5.5	5.5	P2	570.3	520.2	1,090.5	955,500	729.5	689.8	1,419.3	76.8	85.0
5-E2	4.6	6.9	G3	425.9	388.5	814.4	320,950	355.7	336.4	692.1	117.7	204.8
5-E3	7.2	7.2	P2	882.0	804.4	1,686.4	1,160,000	1,315.6	1,243.9	2,559.5	65.9	108.4
5-E4	5.6	5.6	P2	721.3	657.9	1,379.2	1,118,000	842.5	796.6	1,639.1	84.1	91.9
5-E5	2.0	3.5	P2	394.7	359.9	754.6	341,500	257.2	243.2	500.4	150.8	178.3
<b>Subtotal</b>	<b>24.9</b>	<b>28.7</b>		<b>2,994.2</b>	<b>2,730.9</b>	<b>5,725.1</b>	<b>3,895,950</b>	<b>3,500.5</b>	<b>3,309.9</b>	<b>6,810.4</b>	<b>84.1</b>	<b>118.6</b>
6-E1	16.5	16.5	P*1	302.6	275.9	578.5	478,800	352.8	333.6	686.4	84.3	90.0
6-E2	15.9	15.8	P*1	260.7	237.8	498.5	418,900	313.7	296.6	610.3	81.7	88.7
6-E3	8.0	10.7	P*1	751.8	685.6	1,437.4	702,700	523.5	494.9	1,018.4	141.1	165.1
6-E4	8.3	8.2	P*1	371.2	338.6	709.8	541,590	396.3	374.7	771.0	92.1	97.6
6-E5	0.8	0.8	Br	292.6	266.9	559.5	462,000	332.5	314.5	647.0	86.5	90.2
6-E6	4.2	4.2	P2	525.4	479.1	1,004.5	555,500	410.8	388.4	799.2	125.7	145.9
6-E7	9.3	9.2	P3	578.1	527.3	1,105.4	855,750	854.1	807.6	1,661.7	66.5	104.2
6-E8	3.2	3.3	P2	293.3	267.6	560.9	452,500	336.2	317.8	654.0	85.8	92.3
6-E9	8.4	8.3	P2	357.7	326.3	684.0	503,000	543.3	513.7	1,057.0	64.7	101.3
6-E10	10.5	10.5	P2	601.5	548.5	1,150.0	901,950	664.4	628.2	1,292.6	88.9	102.9
<b>Subtotal</b>	<b>85.1</b>	<b>87.5</b>		<b>4,334.9</b>	<b>3,953.6</b>	<b>8,288.5</b>	<b>5,872,690</b>	<b>4,727.6</b>	<b>4,470.0</b>	<b>9,197.6</b>	<b>90.1</b>	<b>113.9</b>
7-E1	5.2	5.2	P*1	469.6	428.2	897.8	730,000	525.3	496.6	1,021.9	87.8	99.2
7-E2	6.9	6.9	P2	722.1	658.6	1,380.7	1,067,000	775.8	733.6	1,509.4	91.5	96.4
7-E3	8.2	8.2	P*1	530.1	483.5	1,013.6	771,540	569.4	538.3	1,107.7	91.5	106.0
7-E4	4.2	4.2	P2	231.4	211.0	442.4	354,900	252.9	239.1	492.0	89.9	92.9
7-E5	8.6	8.6	G3	716.3	653.3	1,369.6	1,092,000	801.6	758.0	1,559.6	87.8	93.4
7-E6	6.4	6.4	P*1	283.0	258.1	541.1	446,000	324.2	306.5	630.7	85.8	90.4
7-E7	8.1	8.1	P*1	122.2	111.4	233.6	188,530	137.0	129.5	266.5	87.7	92.3
7-E8	2.7	2.7	P2	259.3	236.4	495.7	400,000	334.6	316.5	651.1	76.1	100
7-E9	(45m)	(45m)	Br.	199.4	181.8	381.2	289,380	208.0	196.6	404.6	94.2	98.1
7-E10	(48m)	(48m)	Br.	85.7	78.2	163.9	132,300	97.0	91.8	188.8	86.8	99.9
7-E11	5.4	5.4	P2	319.8	291.7	611.5	472,500	547.7	517.8	1,065.5	57.4	96.4
7-E12	9.6	9.6	P*1	140.4	128.1	268.5	216,700	160.1	151.4	311.5	86.2	92.3
7-E13	5.8	5.8	P*1	86.1	78.6	164.7	132,930	94.9	89.8	184.7	89.2	92.3
<b>Subtotal</b>	<b>71.1</b>	<b>71.1</b>		<b>4,165.4</b>	<b>3,798.9</b>	<b>7,964.3</b>	<b>6,293,780</b>	<b>4,828.5</b>	<b>4,565.5</b>	<b>9,394.0</b>	<b>84.8</b>	<b>102.1</b>
8-E1	9.3	9.7	P2	694.8	633.7	1,328.5	901,880	928.7	878.1	1,806.8	73.5	118.9
8-E2	13.3	15.1	G3	1,262.5	1,151.4	2,413.9	1,200,000	1,114.1	1,053.5	2,167.6	111.4	162.3
8-E3	7.3	7.3	P2	576.1	525.4	1,101.5	669,470	736.8	696.6	1,433.4	76.8	132.8
8-E4	6.5	8.5	P2	559.3	510.1	1,069.4	770,660	857.7	811.0	1,668.7	64.1	111.9
8-E5	2.1	2.1	P*1	253.2	230.9	484.1	410,400	298.5	282.2	580.7	95.2	95.2
8-E6	5.1	7.2	P2	736.7	672.0	1,408.7	900,900	675.2	638.4	1,313.6	107.2	126.2
<b>Subtotal</b>	<b>43.6</b>	<b>49.9</b>		<b>4,082.6</b>	<b>3,723.5</b>	<b>7,806.0</b>	<b>4,853,310</b>	<b>4,611.0</b>	<b>4,359.8</b>	<b>8,970.8</b>	<b>87.0</b>	<b>129.8</b>

**PROJECT COMPLETION REPORT**  
**HIGHWAY PROJECT (LOAN/ 2228 - KO)**  
**Actual and Forecast Estimates of Project Cost**

Project Component	Length(Km)		Stand-ard/a	Actual cost			Contract amount	Forecast estimate of cost			Actual cost as a proportion of	
	Original	Final		Local Country currency	Foreign US\$	Total US\$ equivalent		Local Country currency	Foreign US\$	Total US\$ equivalent	Forecast estimate of cost(%)	Contract amount
9-E1	3.6	3.6	P2	353.2	322.1	675.3	428,960	308.6	291.8	600.4	112.5	117.3
9-E2	5.6	5.6	P2	261.4	238.5	499.9	406,980	295.5	279.3	575.0	86.9	99.1
Subtotal	9.2	9.2		614.6	560.6	1,175.2	835,940	604.1	571.3	1,175.4	100	113.5
Total (57 Roads)	377.2	396.0		28,433.7	25,932.8	54,366.5	38,873,520	32,792.6	31,006.5	63,799.1	85.2	112.8
GRAND TOTAL	1,473.0	1,586.4		124,722.2	113,703.7	238,425.8	149,736,808	117,140.4	110,759.3	227,899.7	104.6	118.6

Note : Contingency allowances have been distributed over all Project components for the forecast estimates of costs.

1/ All costs are in US dollars except original contract amounts which are in Won currency.

2/ Exchange rate of US\$1=W745 for forecast estimate of costs and US\$1=W807.06 for actual costs.

Source : Bank Appraisal Report

Consultants Final Reports (1984, 1987, 1989)

PROJECT COMPLETION REPORT  
HIGHWAY PROJECT (LOAN / 2228 - KO)

Actual and Forecast Traffic,(1985 - 89 )

Section	Base year 1985						Latest year 1988					
	Vehicle type 1		Vehicle type 2		Total		Vehicle type 1		Vehicle type 2		Total	
	Actual	Forecast	Actual	Forecast	Actual	Forecast	Actual	Forecast	Actual	Forecast	Actual	Forecast
	<u>1983 - 1986</u>											
1 - 1	770	714	193	178	963	892	824	764	208	192	1,072	956
1 - 2	262	245	87	82	349	326	283	265	93	88	376	353
1 - 3	522	484	348	322	870	806	559	518	376	348	935	866
1 - 4	170	161	73	69	243	230	182	172	79	75	261	247
1 - 5	604	360	151	90	755	450	652	389	163	97	815	486
1 - 6	213	200	174	164	387	365	228	215	186	176	414	391
1 - 7	414	376	276	251	690	627	451	410	301	273	752	683
1 - 9	135	126	90	84	225	210	145	135	96	90	241	225
1 - 11	552	511	368	341	920	852	590	547	394	365	984	912
1 - 12	870	791	373	339	1,243	1,130	957	870	410	373	1,367	1,243
1 - 13	696	633	174	158	870	791	766	696	191	174	957	870
1 - 14	632	585	158	146	790	731	682	632	171	158	853	790
1 - 15	652	604	434	402	1,086	1,006	704	652	469	434	1,173	1,086
1 - 16	421	397	421	397	842	794	446	421	447	421	893	842
1 - 17	362	341	241	228	603	569	387	365	258	244	645	609
1 - 18	446	413	111	103	557	516	482	446	120	111	602	557
1 - 19	942	888	235	222	1,177	1,110	998	942	250	235	1,248	1,177
2 - 1	184	173	61	58	245	231	200	189	67	63	267	252
2 - 2	338	313	182	168	520	481	365	338	197	182	562	520
2 - 3	188	175	80	75	268	250	201	188	86	80	287	268
2 - 4	272	252	117	108	389	360	294	273	126	117	420	390
2 - 5	387	361	208	195	595	556	414	387	223	208	637	595
2 - 6	277	257	185	171	462	428	299	277	200	185	499	462
2 - 7	323	305	215	203	538	508	346	326	230	218	576	544
3-6-2	104	97	103	96	207	193	111	104	111	103	222	207
3 - 1	219	203	94	87	313	290	237	219	101	94	338	313
3 - 2	105	99	56	53	161	152	114	108	62	58	176	166
3 - 3	214	200	54	50	268	250	230	214	57	54	287	268
3 - 4	83	78	36	34	119	112	91	85	39	37	130	122
3 - 5	168	155	42	39	210	194	182	168	45	42	227	210
3-6-1	104	97	103	96	207	193	112	104	111	104	223	208
4 - 1	288	265	236	216	524	481	314	288	257	236	571	524
4 - 2	289	267	155	144	444	411	312	289	168	155	480	444
4 - 3	508	470	217	201	725	671	548	507	235	218	783	725
4 - 4	356	326	152	140	508	466	388	356	166	152	554	508
4 - 5	415	384	276	256	691	640	448	415	298	276	746	691

PROJECT COMPLETION REPORT  
HIGHWAY PROJECT (LOAN / 2228 - KO)

Actual and Forecast Traffic, (1985 89 )

Section	Base year 1985						Latest year 1988					
	Vehicle type 1		Vehicle type 2		Total		Vehicle type 1		Vehicle type 2		Total	
	Actual	Forecast	Actual	Forecast	Actual	Forecast	Actual	Forecast	Actual	Forecast	Actual	Forecast
4 - 6	221	205	74	68	295	273	239	221	80	74	319	295
4 - 7	612	562	263	241	875	803	668	612	286	263	954	875
4 - 8	277	261	92	87	369	348	299	282	100	94	399	376
4 - 9	388	356	166	152	554	508	423	388	181	166	604	554
4 - 10	146	137	78	74	224	211	159	149	85	81	244	230
4 - 11	240	220	360	330	600	550	327	300	327	300	654	600
4 - 12	108	100	108	100	216	200	128	119	105	97	233	216
4 - 13	202	185	472	433	674	618	294	270	441	404	735	674
4 - 14	129	122	32	30	161	152	139	131	35	33	174	164
4 - 15	173	163	43	41	216	204	190	179	48	45	238	224
4 - 16	521	482	173	161	694	643	559	521	187	174	746	695
5 - 1	413	378	276	252	689	630	451	412	300	275	751	687
5 - 2	406	376	271	251	677	627	439	406	292	271	731	677
5 - 3	149	141	81	76	230	217	161	152	87	82	248	234
5 - 4	278	262	93	88	371	350	298	281	99	94	397	375
5 - 5	263	246	66	61	329	307	282	263	70	66	352	329
5 - 6	610	565	153	141	763	706	659	610	165	153	824	763
6 - 1	353	327	118	109	471	436	382	353	127	118	509	471
6-1-1	439	407	147	136	586	543	475	439	158	147	633	586
6 - 2	333	305	332	305	665	610	399	366	326	299	725	665
6 - 3	429	401	184	172	613	573	459	429	197	184	656	613
6 - 4	238	221	159	147	397	368	257	239	172	159	429	398
6 - 5	111	104	60	56	171	160	119	111	64	60	183	171
6 - 6	173	160	43	40	216	200	186	173	47	43	233	216
6 - 7	114	106	29	26	143	132	124	114	31	29	155	143
6 - 8	175	162	174	161	349	323	207	192	170	157	377	349
6 - 9	275	254	91	85	366	339	296	274	99	92	395	366
6 - 10	231	216	99	92	330	308	247	231	106	99	353	330
7 - 1	329	302	178	163	507	465	359	329	194	178	553	507
7 - 2	157	146	52	49	209	195	168	157	56	52	224	209
7 - 3	173	162	58	54	231	216	185	173	62	58	247	231
7 - 4	262	245	87	81	349	326	280	262	93	87	373	349
7 - 6	482	443	260	238	742	681	526	482	283	260	809	742
7 - 7	293	272	98	90	391	362	316	293	106	98	422	391
7 - 8	224	211	96	91	320	302	239	226	103	97	342	323
7 - 9	188	174	63	58	251	232	203	188	68	63	271	251
7 - 10	380	352	254	235	634	587	411	380	274	254	685	634
7 - 12		551			101		727	661				1.101

**PROJECT COMPLETION REPORT**  
**HIGHWAY PROJECT (LOAN / 2228 - KO)**

**Actual and Forecast Traffic, (1985 - 89)**

Section	Base year 1985						Latest year 1988					
	Vehicle type 1		Vehicle type 2		Total		Vehicle type 1		Vehicle type 2		Total	
	Actual	Forecast	Actual	Forecast	Actual	Forecast	Actual	Forecast	Actual	Forecast	Actual	Forecast
7 - 13	694	630	373	340	1,067	970	763	694	411	374	1,174	1,068
7 - 14	234	221	100	94	334	315	250	236	107	101	357	337
7 - 15	201	188	301	281	502	469	269	251	268	251	537	502
7 - 16	199	188	85	80	284	268	213	201	91	86	304	287
7 - 17	341	322	85	80	426	402	368	347	92	87	460	434
7 - 19	155	146	51	48	206	194	165	156	55	52	220	208
7 - 20	236	220	127	119	363	339	252	236	136	127	388	363
7 - 21	560	514	240	220	800	734	610	559	262	240	872	799
8 - 1	357	331	119	110	476	441	385	358	129	119	514	477
8 - 2	207	196	112	105	319	301	222	209	119	113	341	322
8 - 3	212	200	114	108	326	308	227	214	122	116	349	330
8 - 4	530	482	177	161	707	642	583	529	195	177	778	706
8 - 5	206	189	88	81	294	270	225	206	96	88	321	294
8 - 6	425	398	142	132	567	530	455	425	152	142	607	567
8 - 7	375	344	202	185	577	529	409	375	220	202	629	577
8 - 9	205	192	111	103	316	295	220	206	118	111	338	317
8 - 10	275	255	148	137	423	392	297	276	160	149	457	425
8 - 11	221	209	95	89	316	298	239	225	102	97	341	322
8 - 12	302	282	75	70	377	352	322	302	81	75	403	377
8 - 14	318	294	80	74	398	368	344	318	86	80	430	398
8 - 15	284	263	189	175	473	438	306	284	205	189	511	473
8 - 16	413	379	177	162	590	541	450	413	193	177	643	590
8 - 17	278	257	227	211	505	468	328	304	218	202	546	506
8 - 18	473	437	157	146	630	583	511	472	170	158	681	630
8 - 19	344	318	114	106	458	424	371	343	124	115	495	458
8 - 20	263	246	142	132	405	378	281	263	152	141	433	404
9 - 1	114	106	139	130	253	236	136	127	135	126	271	253
<b>1985 - 1986</b>												
1 - P2	245	231	200	189	445	420	252	238	206	195	458	433
1 - P7	353	280	151	120	504	400	365	289	156	124	521	413
1-P11/G2	123	98	123	97	246	195	140	111	114	91	254	202
1 - G4	277	220	416	330	693	550	358	284	358	284	716	568
2 - G2	132	105	57	45	189	150	136	108	59	47	195	155
4 - P1	309	245	132	105	441	350	319	255	137	107	456	362



PROJECT COMPLETION REPORT  
HIGHWAY PROJECT (LOAN / 2228 - KO)

Actual and Forecast Traffic, (1985 - 89)

Section	Base year 1985						Latest year 1988					
	Vehicle type 1		Vehicle type 2		Total		Vehicle type 1		Vehicle type 2		Total	
	Actual	Forecast	Actual	Forecast	Actual	Forecast	Actual	Forecast	Actual	Forecast	Actual	Forecast
4 - P4	410	325	220	175	630	500	423	336	228	181	651	517
4 - P6	369	285	246	190	615	475	388	299	258	200	646	499
	<u>1987 - 1989</u>											
1 - E1	581	601	387	401	968	1,002						
1 - E2	564	555	141	139	705	694						
1 - E3	862	829	258	248	1,120	1,077						
1 - E4	221	196	180	161	401	357						
2 - E1	228	214	152	142	380	356						
2 - E2	143	135	77	73	220	208						
2 - E3	276	267	49	47	325	314						
2 - E4	131	137	70	73	201	210						
2 - E5	270	262	195	189	465	451						
3 - E1	373	369	201	198	574	567						
3 - E2	494	416	55	46	549	462						
3 - E3	251	228	587	532	838	760						
3 - E4	193	189	104	101	297	290						
3 - E5	233	246	125	132	358	378						
3 - E6	172	168	93	91	265	259						
3 - E7	311	285	104	95	415	380						
4 - E1	459	455	306	303	765	758						
4 - E2	509	404	339	269	848	673						
4 - E3	239	212	102	91	341	303						
4 - E4	375	298	202	160	577	458						
4 - E5	478	409	257	221	735	630						
5 - E1	217	186	145	124	362	310						
5 - E2	338	295	199	174	537	469						
5 - E3	235	202	59	50	294	252						
5 - E4	517	443	344	295	861	738						
5 - E5	1,264	1,084	422	362	1,686	1,446						
6 - E1	323	282	159	139	482	421						
6 - E2	268	238	109	97	377	335						
6 - E3	308	259	77	65	385	324						
6 - E4	259	226	78	68	337	294						
6 - E5	264	213	47	37	311	250						
6 - E6	257	218	178	152	435	370						

PROJECT COMPLETION REPORT  
HIGHWAY PROJECT (LOAN / 2228 - KO)

Actual and Forecast Traffic, (1985 - 89)

Section	Base year 1989						Latest year					
	Vehicle type 1		Vehicle type 2		Total		Vehicle type 1		Vehicle type 2		Total	
	Actual	Forecast	Actual	Forecast	Actual	Forecast	Actual	Forecast	Actual	Forecast	Actual	Forecast
6 - E7	271	237	174	152	445	389						
6 - E8	220	189	147	126	367	315						
6 - E9	558	490	372	327	930	817						
6 - E10	478	425	160	142	638	567						
7 - E1	238	205	129	110	367	315						
7 - E2	492	414	123	104	615	518						
7 - E3	488	426	262	229	750	655						
7 - E4	200	172	134	114	334	286						
7 - E5	252	224	333	296	585	520						
7 - E6	511	438	170	146	681	584						
7 - E7	321	276	243	208	564	484						
7 - E8	305	266	130	114	435	380						
7 - E9	312	263	104	87	416	350						
7 - E10	309	265	132	113	441	378						
7 - E11	245	210	163	140	408	350						
7 - E12	267	243	115	104	382	347						
7 - E13	385	340	90	80	475	420						
8 - E1	931	798	399	342	1,330	1,140						
8 - E2	210	183	90	78	300	261						
8 - E3	269	231	116	99	385	330						
8 - E4	342	293	120	103	462	396						
8 - E5	342	310	120	109	462	419						
8 - E6	353	312	62	55	415	367						
9 - E1	246	223	87	79	333	302						
9 - E2	143	123	61	52	204	175						

Source : Consultants Final Reports (1984, 1987, 1989)

PROJECT COMPLETION REPORT  
HIGHWAY PROJECT (LOAN / 2228 - KO)

Ex-post and Original Estimates of Economic Rates of Return

Unit : 1,000Won

Project components	Proportion of total investment		Rate of return (%)	
	<u>Total Cost</u>	<u>Proportion(%)</u>	Ex-post estimate	Original estimate
<b>1983 - 1986</b>				
1 - 1	597,587	0.3	39.6	46.5
1 - 2	168,410	0.1	31.7	20.9
1 - 3	3,057,454	1.0	45.4	33.3
1 - 4	1,070,651	0.5	33.9	35.3
1 - 5	563,115	0.3	36.7	30.0
1 - 6	946,800	0.5	32.1	29.9
1 - 7	1,064,799	0.6	33.9	45.4
1 - 9	1,073,300	0.6	23.2	22.6
1 - 11	889,900	0.5	47.0	34.5
1 - 12	481,475	0.2	44.4	37.4
1 - 13	396,270	0.2	49.2	42.6
1 - 14	450,211	0.2	35.3	20.1
1 - 15	1,261,650	0.7	44.2	33.5
1 - 16	356,847	0.2	44.2	22.4
1 - 17	745,332	0.4	47.4	26.0
1 - 18	1,055,964	0.5	31.7	28.0
1 - 19	905,170	0.5	45.0	34.7
<b>Subtotal</b>	<b>14,084,935</b>	<b>7.3</b>	<b>39.0</b>	<b>33.2</b>
2 - 1	1,370,801	0.7	27.0	28.5
2 - 2	928,422	0.5	31.8	45.7
2 - 3	1,406,310	0.7	44.8	32.8
2 - 4	1,327,800	0.7	46.6	20.9
2 - 5	2,006,230	1.1	21.7	16.8
2 - 6	2,001,673	1.0	19.4	28.7
2 - 7	2,848,796	1.5	16.1	22.4
<b>Subtotal</b>	<b>11,890,032</b>	<b>6.2</b>	<b>27.4</b>	<b>27.6</b>

PROJECT COMPLETION REPORT  
HIGHWAY PROJECT (LOAN / 2228 - KO)

Ex-post and Original Estimates of Economic Rates of Return

Project components	Proportion of total investment		Rate of return (%)	
	<u>Total Cost</u>	<u>Proportion(%)</u>	Ex-post estimate	Original estimate
3 - 1	1,283,277	0.7	24.9	22.0
3 - 2	1,379,031	0.7	16.5	16.8
3 - 3	826,311	0.4	30.5	19.5
3 - 4	1,249,150	0.6	19.4	17.8
3 - 5	1,494,703	0.8	25.7	27.3
3 - 6	3,748,791	2.0	21.8	27.0
Subtotal	9,981,269	5.2	22.6	22.6
4 - 1	725,340	0.4	32.7	36.1
4 - 2	974,400	0.5	22.5	24.5
4 - 3	3,217,620	1.7	22.4	25.8
4 - 4	830,251	0.4	25.1	33.6
4 - 5	2,289,710	1.2	32.6	34.2
4 - 6	696,170	0.4	37.1	32.8
4 - 7	1,123,142	0.6	44.3	43.4
4 - 8	1,611,452	0.8	19.8	15.5
4 - 9	967,750	0.5	44.5	28.6
4 - 10	469,940	0.2	34.3	23.2
4 - 11	825,500	0.4	49.0	51.5
4 - 12	518,210	0.3	36.9	41.9
4 - 13	1,762,500	0.9	43.3	32.8
4 - 14	730,107	0.4	16.3	19.9
4 - 15	1,209,780	0.6	20.3	19.2
4 - 16	3,121,650	1.6	35.4	19.0
Subtotal	21,073,522	10.9	31.9	31.4
5 - 1	1,509,750	0.8	47.0	30.9
5 - 2	3,832,132	2.0	30.9	24.6

PROJECT COMPLETION REPORT  
HIGHWAY PROJECT (LOAN / 2228 - KO)

Ex-post and Original Estimates of Economic Rates of Return

Project components	Proportion of total investment		Rate of return (%)	
	Total Cost	Proportion(%)	Ex-post estimate	Original estimate
5 - 3	737,016	0.4	18.3	23.3
5 - 4	993,287	0.5	22.7	17.9
5 - 5	1,043,515	0.5	38.1	33.6
5 - 6	1,076,900	0.6	36.9	38.7
Subtotal	9,192,605	4.8	26.5	27.7
6 - 1	2,340,652	1.2	39.2	32.1
6 - 2	996,080	0.5	42.4	25.7
6 - 3	1,826,631	1.0	36.6	29.6
6 - 4	1,763,942	0.9	22.6	20.5
6 - 5	1,218,007	0.6	23.3	21.7
6 - 6	1,293,351	0.7	24.0	17.4
6 - 7	890,542	0.5	33.7	15.1
6 - 8	1,297,077	0.7	36.3	21.4
6 - 9	1,357,880	0.7	23.4	27.4
6 - 10	1,649,575	0.8	23.9	18.4
Subtotal	14,633,737	7.6	28.9	24.9
7 - 1	1,962,450	1.0	31.8	39.0
7 - 2	1,323,037	0.7	19.9	22.2
7 - 3	292,000	0.2	22.6	23.3
7 - 4	1,316,500	0.7	41.7	39.2
7 - 6	2,931,075	1.5	25.4	31.2
7 - 7	1,600,515	0.8	45.0	35.7
7 - 8	334,950	0.2	36.7	40.5
7 - 9	811,000	0.4	29.4	26.0
7 - 10	2,774,520	1.4	39.9	30.3
7 - 12	386,400	0.2	33.7	35.9
7 - 13	957,684	0.5	43.6	45.5

PROJECT COMPLETION REPORT  
HIGHWAY PROJECT (LOAN / 2228 - KO)

Ex-post and Original Estimates of Economic Rates of Return

Project components	Proportion of total investment		Rate of return (%)	
	<u>Total Cost</u>	<u>Proportion(%)</u>	Ex-post estimate	Original estimate
7 - 14	930,185	0.5	28.5	31.9
7 - 15	5,328,230	2.8	31.6	34.8
7 - 16	455,070	0.2	42.4	45.8
7 - 17	2,117,430	1.1	21.3	23.4
7 - 19	887,859	0.5	27.3	34.4
7 - 20	1,370,680	0.7	20.5	32.5
7 - 21	2,180,300	1.1	41.7	45.2
<b>Subtotal</b>	<b>27,959,885</b>	<b>14.5</b>	<b>31.9</b>	<b>34.5</b>
8 - 1	3,053,474	1.6	30.3	39.6
8 - 2	271,700	0.1	17.6	21.4
8 - 3	211,785	0.1	23.7	26.5
8 - 4	352,500	0.2	30.9	34.0
8 - 5	324,555	0.2	29.4	43.6
8 - 6	2,434,400	1.3	23.1	29.4
8 - 7	2,651,700	1.4	32.0	34.8
8 - 9	1,056,050	0.5	16.4	28.0
8 - 10	236,000	0.1	23.8	24.3
8 - 11	1,558,769	0.8	14.7	21.7
8 - 12	1,909,204	1.0	15.4	28.5
8 - 14	2,957,346	1.5	19.8	24.6
8 - 15	886,872	0.5	21.0	40.9
8 - 16	852,100	0.4	31.0	42.4
8 - 17	1,158,780	0.6	26.1	29.3
8 - 18	1,036,770	0.5	27.1	35.9
8 - 19	2,680,500	1.4	26.3	34.5
8 - 20	1,835,085	1.0	24.7	21.6
<b>Subtotal</b>	<b>25,467,590</b>	<b>13.2</b>	<b>24.1</b>	<b>31.7</b>

PROJECT COMPLETION REPORT

HIGHWAY PROJECT (LOAN / 2228 - KO)

Ex-post and Original Estimates of Economic Rates of Return

Project components	Proportion of total investment		Rate of return (%)	
	Total Cost	Proportion(%)	Ex-post estimate	Original estimate
9 - 1	700,000	0.4	35.7	37.4
Subtotal	700,000	0.4	35.7	37.4
Total	134,983,575	70.1	29.4	30.5
<u>1984 - 1987</u>				
1 - P2	2,149,410	1.0	16.2	13.9
1 - P7	1,942,120	1.0	25.5	19.4
1-P11/G2	1,993,950	1.0	14.8	14.4
1 - G4	2,120,210	1.0	20.4	16.1
2 - G2	1,794,480	0.9	22.6	24.0
4 - P1	670,910	0.2	24.0	26.2
4 - P4	1,306,450	0.7	19.8	20.3
4 - P6	2,599,530	1.3	37.6	13.4
Subtotal	13,577,060	7.1	23.3	17.6
<u>1987 - 1989</u>				
1 - E1	1,678,397	0.9	45.6	28.4
1 - E2	1,790,450	0.9	33.7	33.8
1 - E3	947,184	0.5	25.6	27.2
1 - E4	513,004	0.3	23.6	23.3
Subtotal	4,929,035	2.6	33.0	29.3
2 - E1	2,462,100	1.3	29.2	28.5
2 - E2	326,374	0.2	18.9	18.6
2 - E3	1,026,400	0.5	32.9	26.7
2 - E4	870,370	0.5	33.2	27.3
2 - E5	447,300	0.2	26.4	25.7
Subtotal	5,132,544	2.7	29.6	26.7

PROJECT COMPLETION REPORT  
HIGHWAY PROJECT (LOAN / 2228 - KO)

Ex-post and Original Estimates of Economic Rates of Return

Project components	Proportion of total investment		Rate of return (%)	
	<u>Total Cost</u>	<u>Proportion(%)</u>	Ex-post estimate	Original estimate
3 - E1	421,890	0.2	24.1	23.2
3 - E2	104,811	0.1	32.8	28.0
3 - E3	81,792	-	36.5	38.8
3 - E4	874,560	0.5	24.7	22.6
3 - E5	559,881	0.3	33.8	25.7
3 - E6	448,350	0.2	26.0	24.3
3 - E7	1,009,470	0.5	23.1	22.4
<b>Subtotal</b>	<b>3,500,754</b>	<b>1.8</b>	<b>28.8</b>	<b>24.4</b>
4 - E1	621,180	0.3	32.1	26.7
4 - E2	1,195,299	0.6	39.8	33.4
4 - E3	348,759	0.2	22.4	16.6
4 - E4	1,088,676	0.6	21.3	18.2
4 - E5	2,105,790	1.1	29.2	29.9
<b>Subtotal</b>	<b>5,359,704</b>	<b>2.8</b>	<b>32.3</b>	<b>26.7</b>
5 - E1	880,000	0.5	21.1	19.2
5 - E2	609,900	0.3	19.2	18.4
5 - E3	1,360,900	0.7	16.0	21.0
5 - E4	1,113,000	0.6	30.2	27.3
5 - E5	609,000	0.3	28.1	28.4
<b>Subtotal</b>	<b>4,572,800</b>	<b>2.4</b>	<b>22.2</b>	<b>22.5</b>
6 - E1	466,830	0.2	32.5	31.5
6 - E2	402,255	0.2	34.0	32.0
6 - E3	1,231,500	0.7	19.8	28.4
6 - E4	572,775	0.3	21.8	22.4
6 - E5	451,500	0.2	16.2	15.1
6 - E6	790,650	0.4	27.7	26.0



PROJECT COMPLETION REPORT  
HIGHWAY PROJECT (LOAN / 2228 - KO)

Ex-post and Original Estimates of Economic Rates of Return

Project components	Proportion of total investment		Rate of return (%)	
	<u>Total Cost</u>	<u>Proportion(%)</u>	Ex-post estimate	Original estimate
6 - E7	945,420	0.5	31.6	27.2
6 - E8	452,655	0.2	28.1	28.4
6 - E9	551,990	0.3	27.2	25.4
6 - E10	926,580	0.5	24.5	24.1
Subtotal	6,792,155	3.5	26.4	26.1
7 - E1	724,500	0.4	26.6	26.0
7 - E2	1,114,200	0.6	21.7	21.8
7 - E3	810,000	0.4	23.5	22.9
7 - E4	357,000	0.2	26.5	26.4
7 - E5	1,105,230	0.6	26.8	28.2
7 - E6	436,700	0.2	26.7	25.6
7 - E7	188,530	0.1	37.2	34.6
7 - E8	393,225	0.2	20.8	22.4
7 - E9	307,650	0.1	27.0	26.2
7 - E10	132,300	0.1	33.4	38.2
7 - E11	493,452	0.2	24.1	19.3
7 - E12	216,700	0.1	34.9	35.5
7 - E13	132,930	0.1	39.6	35.6
Subtotal	6,412,417	3.3	30.3	25.3
8 - E1	1,077,110	0.5	40.6	37.9
8 - E2	1,948,000	1.0	23.1	21.3
8 - E3	813,120	0.4	24.3	22.0
8 - E4	863,000	0.5	33.6	24.6
8 - E5	390,700	0.2	18.6	16.4
8 - E6	1,123,655	0.6	20.1	17.5
Subtotal	6,215,585	3.2	27.4	24.5

PROJECT COMPLETION REPORT

HIGHWAY PROJECT (LOAN / 2228 - KO)

Ex-post and Original Estimates of Economic Rates of Return

Project components	Proportion of total investment		Rate of return (%)	
	<u>Total Cost</u>	<u>Proportion(%)</u>	Ex-post estimate	Original estimate
9 - E1	544,961	0.3	14.4	15.4
9 - E2	403,410	0.2	24.3	22.4
Subtotal	948,371	0.5	18.2	18.7
Total	57,440,425	29.9	28.8	25.6
Grand Total	192,424,000	100	28.8	28.1

IMPROVEMENT STANDARD  
Actual and Forecast

Table 5 - 1

Standard	AC Pavement		DBST		Gravel		Total	
	Actual	Forecast	Actual	Forecast	Actual	Forecast	Actual	Forecast
Sections and length (Km)								
Number of Road sections	54	50	28	31	19	20	101	101
Length (Km)	618.8	545.5	300.6	281.4	178.5	180.6	1,096.9	1,006.5

Note : Table 5 - 1 is in connection with original 1,006Km road improvement

RATE OF RETURN (%)  
Improvement Alternatives  
(Hypothetic)

Table 5 - 2

Improvement Alternatives	Direct Cost W Million	Right of Way W Million	Economic Cost W Million	IRR (%)
1 Improvement to gravel road	545	87	768	34.9
2 Improvement from gravel to DBST road	576 (31)	87	807	39.6
3 Improvement from DBST to AC paved road	822 (246)	87	1,115	32.6
4 Improvement to AC paved road from the start	756	87	1,032	32.0

Note :

- 1/ Sample road is section 1-4 of Provincial and County Road Project(2228-K0) which actually had undergone Alternatives 1 and 2.
- 2/ Figures in parentheses represent additional costs relevant to alternative
- 3/ Opening year of Alternatives 1,2,4 is 1985.
- 4/ Alternative 4 was opened to traffic in 1985 as DBST road and was improved to AC in 1987 with additional cost at 1987 price.
- 5/ All basic cost is at 1982 price.
- 6/ Economic costs are derived from 1.25 times direct costs plus ROW.

EQUIPMENT PROCURED UNDER LOAN

A. Major Equipment

<u>No.</u>	<u>Equipment</u>	<u>Capacity</u>	<u>Quantities in unit</u>
1	Engine Breaker	20 Kg	40
2	Tamper Compactor	80 Kg	19
3	Plate Compactor	150 Kg	19
4	A/P Heater/Hand Sprayer	200 l	17
5	A/P Cold Mixer	200 l	8
6	Dump Truck	8 Ton	54
7	Motor Grader	12 f	11
8	Wheel Loader	2.3 m <sup>3</sup>	2
9	Tandem Roller	2 Ton	13
10	Tandem Roller	8 Ton	8
11	Tired Roller	10 Ton	8
12	Water Tank Truck	5,500l	9
13	Demountable Water Tank	5,500l	13
14	Truck, Double Cab	2.5 Ton	14
15	Wheeled Excavator	0.4 m <sup>3</sup>	6
16	Screening Plant	120 tph	8
17	Crushing Plant	40 tph	8

B. Minor Equipment for the pilot provinces

<u>No.</u>	<u>Description</u>	<u>Capacity</u>	<u>Number given to each pilot province</u>
1	Engine/Breaker	28.4Kg	3
2	Ditto	25 Kg	3
3	Tamper/Compactor	80 Kg	3
4	Vibrating Plate Compactor	161Kg	3
5	Asphalt Heater/ Hand sprayer	200 l	3
6	Asphalt Cold Mixer	200 l	1

Total Amount

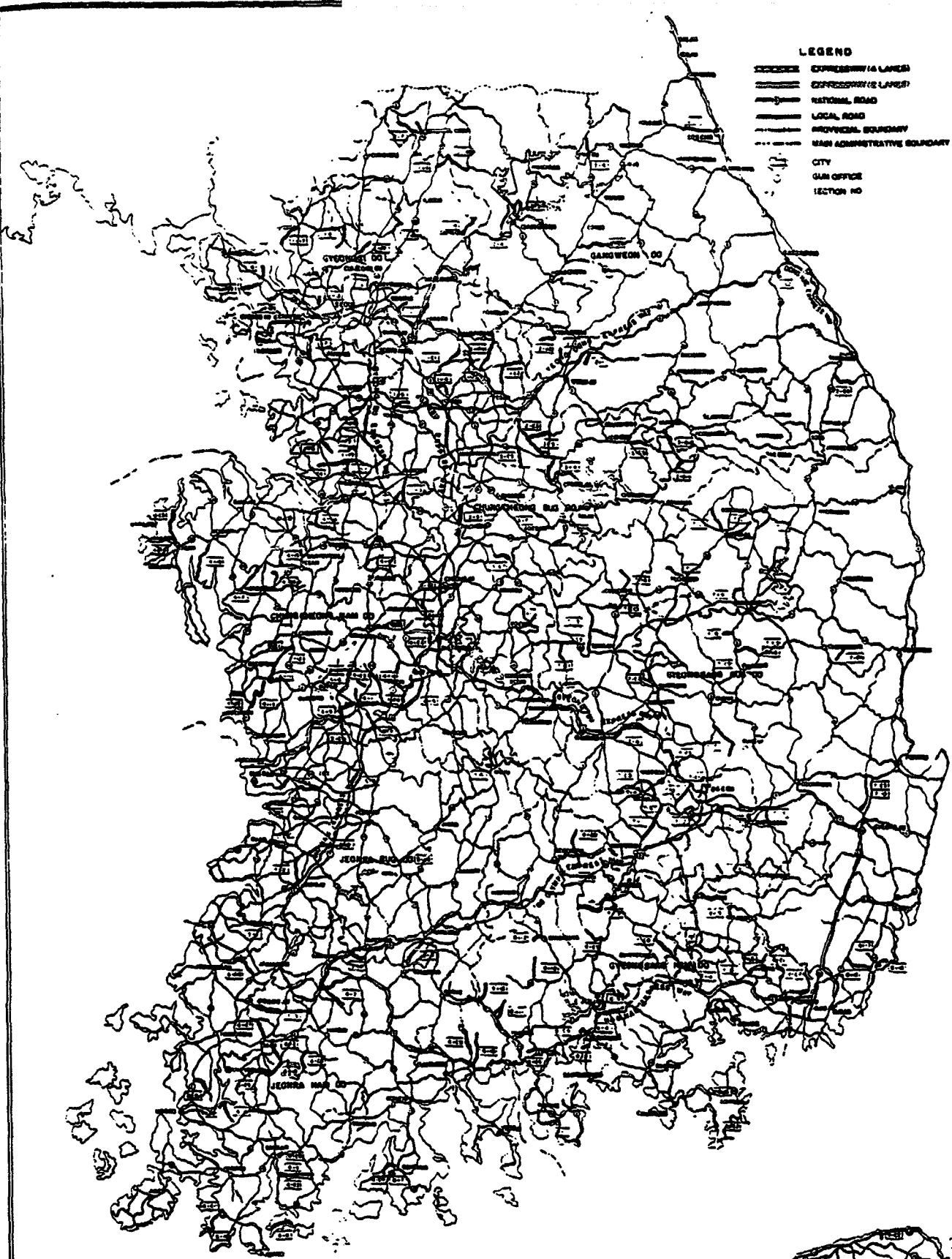
US\$5,026,985.32  
(W4,311,808,500)

Actual Physical Output of Maintenance Works  
on Pilot Provinces  
(1983 and 1984)

ANNEX 2

Unit : M Million

Description	Total Work Load 1983 - 1984	Total 1983 - 1984	1983						1984							
			Work Load	Contract			Force Account			Work Load	Contract			Force Account		
				Total	Prov. Road	County Road	Total	Prov. Road	County Road		Total	Prov. Road	County Road	Total	Prov. Road	County Road
<b>A. Paved roads</b>																
- Surface treatment																
. In whole	1,208 a									1,208 a				38.8	38.8	
. Partial	414.7a									414.7 <sup>m</sup>	3.3	1.3	2.0	21.8	21.8	
- Patching	315.1a		170 a	53.0	53.0	12.0	32.0			145.1 <sup>m</sup>	24.7	14.3	10.4	62.0	62.0	
- Overlay	5,329 a		2,428.5a	950.3	618.3	332.0	443.0			2,900.5 <sup>m</sup>	1,012.0	219.9	792.0	445.1	445.1	
- Lane marking	366 Km		259 Km	108.2	29.5	78.7				77.8Km	61.0		61.0	51.1	51.1	
- Shoulder regravelling	Km		Km							Km						
- Others	2									2	45.8		45.8	60.0	60.0	
<b>Subtotal</b>				1,111.5	647.8	463.7	475.0	475.0			1,146.8	235.5	911.3	678.8	678.8	
<b>B. Gravel roads</b>																
- Regravelling																
. Screened gravel	158.3Km									158.3Km	2,357.0	1,977.0	380.0	45.0	45.0	
. Unscreened gravel	5,129.9 <sup>m</sup>		3,429.8 <sup>m</sup>	708.0	708.0		1,002.4	867.7	134.7	1,700.1 <sup>m</sup>	223.4	152.2	71.2	188.4	14.8	173.6
- Regrading	2,402 "		866 "				289.0	289.0		1,536 "				287.9	287.9	
- Others	2									2	132.3	65.0	67.3	111.0	111.0	
<b>Subtotal</b>				708.0	708.0		1,291.4	1,156.7	134.7		2,712.7	2,194.2	518.5	632.3	458.7	173.6
<b>C. Structures</b>																
- Bridge																
. Repair	2/20		2/20	16.0	16.0											
. New and/or widening	27/1.134 <sup>m</sup>		16/467 "	373.0	206.0	167.0				11/667 "	233.0	81.0	152.0			
- Retaining wall																
. Concrete	32/4.443 <sup>m</sup>		47/2.112 <sup>m</sup>	289.1	239.1	50.0				35/2.331 <sup>m</sup>	494.0	462.0	31.9			
. Stone	58/4.026 <sup>m</sup>		Loc./m	32.1	32.1					35/3.650 <sup>m</sup>	253.6	196.6	57.0			
- Guard post	17/2.505 <sup>m</sup>		"	31.7	31.7					9/772 "	263.9	18.6	245.3			
- Culverts(box and pipe)	813/10.430		"	473.9	269.4	204.5				556/7.639 "	511.6	286.8	224.9			
- Others	Loc./m															
<b>Subtotal</b>				1,215.8	794.3	421.5					1,756.1	1,045.0	711.1			
<b>D. Miscellaneous</b>																
- Side ditch	3/24.500		4/11.300	6.9	6.9					4/13.200	10.6	10.2	0.4			
- Shoulder and side slope	Loc./m <sup>2</sup>		Loc./m <sup>2</sup>							Loc./m <sup>2</sup>						
- Road sign	602 ea <sub>1</sub>		221 ea <sub>1</sub>	94.8	63.0	31.8				381 ea <sub>3</sub>	153.1	107.7	45.4			
- Anti-skid sand spreading																
- Blackspot counter measure	41/32.890		34/11.168	550.0	550.0					27/21.721	1,285.8	1,140.2	145.6			
- Emergency repair	88 Loc./m		21 Loc./m	244.6	156.6	88.0				67 Loc./m	687.0	589.0	98.0			
- Labor man-power	1,085man		691 man	139.0	97.0	42.0	631.8	124.9	556.9	394 man				616.2	93.2	523.0
- Others	24		22	226.6	213.6	13.0				2				2.1	0.3	1.9
<b>Subtotal</b>				1,526.2	1,351.4	174.8	681.8	124.9	556.9		2,136.5	1,838.1	289.4	618.4	93.5	524.9
<b>Total</b>		16,691.3		4,561.5	3,501.5	1,060.0	2,448.2	1,756.6	691.6		7,752.1	5,312.8	2,430.3	1,929.5	1,231.0	698.5



**LEGEND**

- CONCRETE LANE
- ASPHALT LANE
- NATIONAL ROAD
- LOCAL ROAD
- PROVINCIAL BOUNDARY
- MAIN ADMINISTRATIVE BOUNDARY
- CITY
- TOWN OFFICE
- SECTION NO

PROVINCIAL AND COUNTY ROAD PROJECT  
 LOAN NO. 2228 - KO

