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STAFF APPRAISAL REPORT

KOREA

ROAD IMPROVEMENT PROJECT

APRIL 20, 1989

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

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CURRENCY EQUIVALENTS

Currency Unit - Won (W)

US\$1	=	W 700 (as of November 1, 1988)
US\$1.43	=	W 1,000
US\$1 million	=	W 700 million
US\$1,429	=	W 1 million

FISCAL YEAR

January 1 - December 31

WEIGHTS AND MEASURES

1 meter (M)	=	3.2808 feet (ft)
1 kilometer (km)	=	0.62 mile (mi)
1 square kilometer (km ²)	=	0.3861 square miles (sq mi)
1 hectare (ha) = 0.01 km ²	=	2.4711 acres (ac)
1 kilogram (kg)	=	2.2046 pounds (lbs)
1 metric ton (m ton)	=	2,204.6226 pounds (lbs)
1.1023 short tons (sh tons or 2,000 lbs)	=	0.9842 long tons (lg ton or 2,240 lbs)

ABBREVIATIONS AND ACRONYMS

AADT	-	Annual Average Daily Traffic
BPR	-	Bureau of Public Roads
EPB	-	Economic Planning Board
ERR	-	Economic Rate of Return
GNP	-	Gross National Product
HNMP	-	Highway Network Master Plan
KHC	-	Korea Highway Corporation
KMPA	-	Korea Maritime and Port Administration
KNR	-	Korean National Railroad
MOC	-	Ministry of Construction
MOER	-	Ministry of Energy and Resources
MOHA	-	Ministry of Home Affairs
MOT	-	Ministry of Transportation
RMMS	-	Road Maintenance Management System
VOC	-	vehicle operating costs
VPD	-	vehicles per day

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KOREAROAD IMPROVEMENT PROJECTLoan and Project Summary

Borrower: Republic of Korea

Amount: US\$200 million equivalent

Terms: Repayable in 15 years including 5 years of grace, at the standard variable interest rate

Project Objectives and Description: The project would support three principal road-related Government objectives: enhancing transport efficiency by upgrading existing roads and by improving road maintenance; expanding traffic capacity by widening roads; and increasing traffic safety. The project would include the following components: (a) paving, upgrading and widening of about 270 km of the national road system; (b) establishment of a new road maintenance management system including periodic maintenance of about 700 km of paved roads; (c) implementation of selected aspects of the national road safety program including safety-conscious design of project facilities, modification of design standards and practices and physical improvement of known hazardous road locations, and preparation of road safety guidelines; and (d) the provision of equipment, consultants services, and training and equipment for road sector development.

Benefits and Risks: The main benefits quantified are lower vehicle operating costs in the case of paving existing gravel roads and reduced congestion in the case of road widening. The project also provides benefits associated with the introduction of the modern road maintenance management system and various road safety measures and programs. The project poses no major risks.

<u>Project Cost:</u>	<u>Local</u>	<u>Foreign</u>	<u>Total</u>
	- - - (US\$ million)		- - -
Upgrading & Widening	150.1	127.9	278.0
Road Maintenance	35.2	30.0	65.2
Equipment	1.0	4.0	5.0
Base Cost(10/88 prices)	186.3	161.9	348.2
Contingencies			
Physical	18.0	16.8	34.8
Price	9.1	21.3	30.4
Right-of-way	99.7	0.0	99.7
Total Cost	<u>313.1</u>	<u>200.0</u>	<u>513.1</u>
(of which taxes & duties)	41.3		41.3

<u>Financing Plan:</u>	<u>Local</u>	<u>Foreign</u>	<u>Total</u>
	- - - (US\$ million)		- - -
Government	313.1	-	313.1
Bank		200.0	200.0
Total Finance	<u>313.1</u>	<u>200.0</u>	<u>513.1</u>

Estimated Disbursements:

Bank FY	<u>90</u>	<u>91</u>	<u>92</u>	<u>93</u>	<u>94</u>
	- - - - - (US\$ million) - - - - -				
Annual	24	60	66	38	12
Cumulative	24	84	150	188	200

Economic Rate of Return: 27%

Map: No. IBRD 21309

KOREA

ROAD IMPROVEMENT PROJECT

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This report is based on the findings of an appraisal mission consisting of L.M. Hannah (economist), R. de Silva (country officer), G. Menckhoff (transport specialist), and consultants B. Bjelogrić (highway engineer) and A. Ross (road safety specialist) which visited Korea in October/November 1988.

Annexes

Annex 1: The Road Sector

- Part A - Public Road Network 1967-87
- Part B - Expenditure on Roads (Fifth and Sixth Five Year Plan)
- Part C - Design Standards

Annex 2: Road Safety

- Part A - Road Safety Component Background
- Part B - MOC Road Safety Implementation Program
- Part C - Road Safety Guidelines Terms of Reference
- Part D - Hazardous Location Improvement Program Terms of Reference

Annex 3: Road Maintenance

- Part A - Background to Road Maintenance and Implementation Program
- Part B - Road Maintenance, Survey and Laboratory Equipment

Annex 4: Project Costs and Disbursements

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- Part B - Schedule of Disbursements

Annex 5: Implementation, Training and Project Monitoring

- Part A - Land Acquisition and Compensation Procedures
- Part B - Training
- Part C - Project Monitoring Indices

Annex 6: Selected Documents and Data Available in the Project File

MAP

1. THE TRANSPORT SECTOR

A. Geographic and Economic Setting

1.1 The Republic of Korea has a land area of 99,100 sq km. About 66% of the land area is mountainous and agriculture is confined to about 22,400 sq km, or 23% of the total area, mainly in the river valleys, lower hillsides and coastal plains. The climate is seasonal with very cold dry winters and hot humid summers. Annual rainfall averages 800 mm to 1,400 mm with about 60% falling between June and September. The land mass is drained by a well developed river system with seasonal variations in flow which give rise to frequent flooding. The rugged terrain, extensive river system and severe winter climate make the construction and maintenance of transport facilities, particularly roads, difficult and costly.

1.2 Korea's population is presently estimated at 42 million and growing at an annual rate of 1.2%. Population density is estimated at 424 persons per sq km of total area or 1,875 per sq km of agricultural land. Urban population is estimated to be growing at an annual rate of 5.7% and has increased from 41% of the total in 1970 to 65% in 1987. The increasing urban population has created significant transport demand in the areas around the cities and industrial centers and particularly in the Seoul greater metropolitan area.

1.3 Korea's export-led industrialization has been among the most successful examples of economic development in recent history. During 1962-78, real Gross National Product (GNP) grew by 10% p.a. and per capita income more than tripled in real terms. After a brief but serious recession in 1979-81, the Korean economy recovered its growth momentum, with real GNP increasing by more than 9% in 1983 and 8% in 1984, although it declined to 5% in 1985. Korea returned to a high export and growth trajectory thereafter registering growth rates of 12.5% in 1986, 12.7% in 1987 and 12.2% in 1988.

B. The Transport System

1.4 Korea's increasing urbanization and industrialization have created significant transport demand in the areas around and between the cities and industrial centers. Passenger traffic tripled between 1962 and 1971 and tripled again by 1985; freight traffic increased nine-fold and five-fold, respectively, during the same periods. International trade is served almost exclusively by air for passengers and by sea for freight. Road facilities and transport means could be improved in rural areas, and greater emphasis is now being placed on their development. Better planning and improvement of suburban traffic flows is also being addressed. The further development of port facilities could be concentrated in fewer locations with good scope for future development. There are also opportunities to achieve greater efficiency in railway services and considerable gains in transport productivity by fully exploiting the complementarity between modes.

1.5 Substantial changes in the modal distribution of traffic are illustrated by traffic statistics for the 1966 to 1987 period. 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 between 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 48% and from 10% to 26%, 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 distances and bulk commodities while road transport handled the short distances and more general 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, but also increasingly by private car. About half of all passenger traffic is in urban areas. High taxation of private cars and gasoline has limited motorization to a level significantly below that of other countries with income levels comparable to Korea's but has not deterred rapid growth in road transport. Between 1966 and 1987, the rail share of total passenger-km fell from 43% to 21% while the road share increased from 56% to 73%, an average annual increase in passenger-km of 10%. These proportions are expected to continue with only minor changes through the end of the present Plan, i.e. 1991.

C. Government Objectives for the Sector

1.6 The Government of Korea's primary sectoral objectives in the past have been to increase capacity and modernize the transport system in line with projected traffic growth, to avoid major bottlenecks, and to improve access to the rural population. These objectives have been largely achieved, and the present system is reasonably balanced and traffic is in general allocated economically among the various modes. Another objective of past transport investments has been to pursue broader concerns in Korea's spatial and economic planning. For example, 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 and construction quality has improved with the rapid expansion of the construction industry.

1.7 In the early 1980s, the Government recognized that while the nation's transport system was basically in place, transport investment decisions had become considerably more complex, and although the coordination of investment plans had been vested in the Ministry of Transportation (MOT) through its Transport Coordination Bureau, more comprehensive investment planning and improved coordination among government agencies was required. The need for such improved planning and coordination was confirmed by a Transport Sector Issues Survey completed by the Bank in 1983. Subsequently, the Government has taken action to improve inter-ministerial coordination through MOT in collaboration with the Economic Planning Board (EPB) and the line ministries concerned, and, with Bank assistance, has undertaken several studies of various issues identified by the above-mentioned sector study, including investment planning.

1.8 The Urban Transportation Facilitation Law, enacted in December 1986, provides for MOT, in cooperation with the Ministry of Construction (MOC) and Ministry of Home Affairs (MOHA), to oversee the preparation of transport plans for small and large cities and affected suburban areas throughout the country,

and for the establishment of central as well as provincial-level transport investment coordination committees to supervise implementation plans.

1.9 The Government's basic policy focus in the transport sector during the Sixth Plan (1987-91) is to (a) increase transport efficiency, capacity and quality; (b) provide transport facilities that are balanced regionally; and (c) improve transport administration.

1.10 The Government seeks to achieve the above objectives through a more rational distribution of the means of transport; through efforts to utilize existing facilities to the maximum degree, optimize new investment and energy conservation, and increase private sector participation in transport; and through investments aimed at improving transport in the largest cities and at extending the network of paved roads to improve the accessibility of medium and small cities, and rural areas.

D. Transport Investments

1.11 For more than two decades, Korea's transport system has been strained by the demands of economic growth, requiring large public investments in transport infrastructure to keep abreast of demand. Accordingly, during the period 1967-1977, the Government allocated up to 23% of its total capital budget expenditures to expand and modernize transport infrastructure. This level of investment was reduced to about 15% in the Fourth Plan (1977-81) and to about 10% in the Fifth Plan (1982-86) as demands of the economy as well as investment requirements of other sectors increased. Since major investments in airports, ports and the Seoul subway system were largely completed during the Fifth Plan period, the investment allocations for the transport sector during the current Sixth Plan period (1987-91) have been reduced to about 4% of total public capital investment. However, the budget allocation for national roads has been increased three-fold compared with the outlay on roads in the previous Plan period. Therefore, while total sector investment under the Sixth Plan is currently expected to be about W 7 trillion (US\$10 billion), roads account for about 58% of such planned expenditures.

1.12 Large investments in transport 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 MOC, the Korea Highway Corporation (KHC), and the Korea Maritime and Port Administration (KMFA) have been established or strengthened, in many instances with increasing financial and managerial responsibility. In the private sector, a highly efficient contractor system has evolved for civil works which 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 the past 20 years. There are now some 500 firms capable of handling a broad range of public works. Furthermore, with government encouragement, the major construction firms have successfully expanded their construction activities overseas.

E. Bank Involvement in the Transport Sector

1.13 The Bank's policy dialogue with the Government has been strengthened through the increasing emphasis on sector and subsector work directly linked to transport lending in Korea. This approach was initiated in 1984 with the Highway Sector Project (Loan 2392-KO) which helped to deepen and broaden the Bank's involvement in the road subsector by extending assistance to MOC, MOHA, MOT and the Ministry of Energy and Resources (MOER). That project provided a framework for these agencies to improve their planning and coordination, conserve energy and deregulate land transport. For railways, the Bank has traditionally made sector type loans, financing time slices of KNR's investment plans; the most recent of these, the Seoul/Pusan Corridor Project (Loan 2600-KO), continues this involvement. A Railway Efficiency Sector Report (No. 6692-KO dated June 25, 1987) identified a number of areas, including passenger and freight operations, rolling stock and locomotive maintenance and utilization, and organizational arrangements, where efficiency gains could be achieved through properly targeted investments, which the Bank could assist in financing. For ports, Bank assistance has been directed at the modernization and expansion of facilities to support Korea's export-led development. Containerization was introduced at Pusan under two completed port projects (Loans 917-KO and 1401-KO) and is being developed further under an ongoing project Pusan Port III (Loan 2726-KO), which presented another opportunity for the Bank to support government policy measures aimed at increasing the efficiency of container handling and further strengthening KMPA's progress in institution building, primarily to improve the management and financing of the port subsector.

1.14 Besides these subsector operations, the Bank has been assisting the Government in developing multimodal projects. The first was the Coal and Cement Distribution Project (Loan 2267-KO) approved in 1983, involving railways, ports and inland terminals. The Bank also prepared a Kyonggi Region multimodal transport study which identified ways to meet the very high transport demand in the suburban areas of Seoul where a dense network of facilities is needed. The study mainly recommended additions to the suburban expressway network (a ring road around Seoul) and rail system, and the widening of some major arterials in the Seoul metropolitan area. The ongoing Kyonggi Regional Transport Project (Loan 2905-KO) is addressing these needs. Another multimodal transport study carried out from 1983 to 1985 examined the Seoul-Pusan transport corridor and the feasibility of a high speed rail line between the two cities. This study resulted in the Bank-financed Seoul-Busan Corridor Project (Loan 2600-KO) which represents a first step in increasing capacity. Subsequent steps might include a high-speed train that would run on a separate, dedicated track for which KNR is now undertaking preliminary design work and further road improvements to expand access in the corridors; a second Seoul-Taejon expressway has also been completed.

2. THE ROAD SECTOR

A. The Network

2.1 Large public expenditures for roads, assisted by external financing, have led to considerable improvement in the extent and condition of the road network. As shown in Annex 1, Part A, the public road network totals about 54,700 km comprising 1,540 km of expressways, 12,252 km of national roads (in addition to the expressways), 10,300 km of provincial roads, 12,900 km of county roads, 17,700 km of urban streets. In addition there about 52,400 km of village access roads. The national expressways are toll roads. These figures represent a doubling of the road network from about 27,000 km in 1962. Road density at 0.56 km/km² is generally sufficient to serve transport needs, particularly as about 70% of the total land area is mountainous, but much of the network of provincial and county roads still needs improvement. Despite heavy investments in road improvements since 1967, about 82% of national roads, 41% of provincial roads, and 21% of county roads were paved as of 1987 and a high level of investment will continue to be required to ensure an adequate level of service for growing traffic volumes and maintenance of existing assets. However, the overall percentage of paved roads has increased from about 5% in 1962 to 57% in 1987. During the same period, roads in rural areas, comprising expressways and national, provincial and county roads, have increased from 16,000 km with 6% paved to almost 37,000 km with about 47% paved.

2.2 Unpaved roads, including some national roads, continue to have poor gravel or earth surfaces, despite some recent improvements. The physical condition of most unpaved roads is such that driving speeds are very low, driving conditions are unsafe and transport costs are high. On some of the more heavily travelled sections of the paved road network, where traffic volumes have increased rapidly, congestion is becoming a problem and road capacity increases are much needed. For example, on the national road network 90% of the roads carry more than 500 vehicles per day (vpd) while 20% carry more than 5,000 vpd. Only 2% of the roads carry less than 200 vpd. Traffic on national roads is estimated to have increased at an annual rate of about 12% over the last decade. Of the 17,700 km of urban roads, about 13,000 km (73%) were paved by 1987. Investments in urban roads in the 57 cities and 5 special cities are being coordinated under the Urban Transport Facilitation Law (para. 1.8). The status of maintenance on national roads is discussed in paragraph 2.39.

B. Road Transport

Traffic

2.3 Road transport has grown rapidly over the last 15 years, not only in absolute terms but also in relation to other modes, particularly railways. Road freight traffic in ton-km grew twice as fast as all freight traffic, averaging 45% p.a. in 1967-71, 13% p.a. in 1972-76 and 15% p.a. in 1977-81. The share of freight traffic by road is expected to continue increasing in the long term, although probably more gradually. Passenger traffic on highways also grew rapidly, at 15% p.a. in passenger-km in 1967-71, 14.1% in 1972-76 and 9.1% in 1977-81. In 1981 it amounted to nearly three-quarters of the total with the

remainder going by rail, a complete reversal of the situation in 1961. Traffic on national roads has been increasing at an average annual rate of 18% during the past five years.

Motor Vehicle Fleet

2.4 While the growth of road traffic has been rapid with increasing incomes, government policy has been to regulate and restrain growth. As a result, the motor vehicle fleet in Korea is still very small compared to other countries at similar levels of per capita income, due mainly to high levels of taxation on private automobiles. Korea had 27 motor vehicles per 1,000 population in 1987 compared with 35 for Thailand (1985), 107 for Malaysia (1985) and 60 for Fiji (1984). The proportion of trucks is high, however. A total of 2.5 million vehicles were registered in Korea in 1987, of which about 1.6 million represent road vehicles with four or more wheels, including 844,000 cars and taxis, 200,000 buses and 567,000 trucks; the remaining 924,000 vehicles are motorcycles. Vehicle registrations have increased at annual rates of 14% and 21%, for motorcycles and other vehicles, respectively. In the Sixth Plan period, the vehicle fleet, excluding motorcycles, is expected to increase to 3.2 million units by 1991, comprising 1.8 million cars, 0.4 million buses and about 1 million trucks, representing an annual average growth rate of 19%. This rapid vehicle fleet growth in the recent past has increasingly burdened the public road system, requiring more road improvement programs. In addition, road congestion is becoming common, selective capacity increases are warranted and road safety has increasingly become a national problem. These phenomena will be exacerbated by the expected vehicle fleet growth during the current Plan period.

Transport Industry and Regulation

2.5 In its efforts to ensure that appropriate development priorities are reflected in the allocation of scarce transport resources, the Government has regulated the sector in the past with a restrictive licensing system and administered pricing for all transport activities, but sector policies are changing. Partly as a result of Bank-supported studies (paras. 2.44, 2.45 - 2.46), many of the regulations constraining the efficiency of the trucking industry, e.g., minimum fleet size and restrictive licensing, have been removed. The MOT is now pursuing an active policy to deregulate the road transport industry. The main recommendations of the two studies with specific regard to the commercial road fleet include measures to reduce minimum fleet size required to qualify for a license; define brokerage functions; abolish area licensing; encourage the use of more efficient trucking equipment; simplify contractual arrangements; establish truck terminals in major areas and a freight information system for commercial truckers. MOT is in the process of reviewing and implementing the various study recommendations. The Government is also reviewing existing road user charges to ensure that heavy vehicles pay their share of costs and generate sufficient revenues.

C. Institutions

2.6 The Economic Planning Board (EPB) approves all transport infrastructure investments proposed by the line ministries, reviews all

government budgets annually and determines priorities, and is concerned with transport pricing such as setting of bus, taxi and subway fares and expressway tolls. EPB has assigned responsibility for detailed transport project appraisal to its Industrial Policy Coordination Bureau, which annually reviews all major transport investment projects for economic feasibility and consistency with the development plan. In addition, a further review is undertaken through an Inter-Agency Coordinating Committee chaired by EPB. Finally, the Budget Bureau routinely coordinates investment plans of the various agencies.

2.7 The Ministry of Construction (MOC) is concerned with all aspects of national physical planning and construction activities in the public sector. It is also exclusively responsible for all public roads through its Bureau of Public Roads, for the design, construction and maintenance of expressways (through the Korea Highway Corporation), and for local roads (through local authorities) and sets standards for urban roads and streets. MOC is also responsible for development of industrial ports.

2.8 The Ministry of Transportation (MOT) has overall responsibility for the planning, development and operations by KNR for railways, by the Korea Maritime and Port Administration (KMPA) for ports (except industrial and fishing ports which are under MOC and the Ministry of Agriculture, respectively), by the Civil Aviation Bureau for aviation and by the Waterways Bureau for inland waterways. MOT is also responsible for regulation of all transport modes.

2.9 The Ministry of Home Affairs (MOHA) has exercised budgetary control over provincial and county roads through the local authorities. The Local Administration Bureau of MOHA monitors provincial and county roads programs which are implemented by the respective local authorities and also assists cities and counties to develop their road networks through budgetary provision.

D. Highway Planning and Financing

Planning

2.10 Transport planning, including planning for roads, is mostly done in the context of five-year national development planning exercises; the current Sixth Plan covers the 1987-91 period. Planning of the national road system, including expressways, has always been done by the Planning Division of the Bureau of Public Roads (BPR) in MOC. BPR's planning capacity was strengthened under the Third Highway Project (Loan 1203-KO) through provision of consultant assistance. MOHA provided budgetary funds for other roads through the provincial, county and city governments. However, it was found that MOHA had little capacity for planning and developing the provincial and county road system, which is largely uncoordinated and implemented on an ad hoc basis resulting in some uneconomic and non-complementary investments. Under the Provincial and County Roads Project (Loan 2228-KO), MOHA's capacity was built up by using investment screening and selection methodologies developed under the Fourth Highway Project (Loan 1640-KO) and by training selected MOHA staff in road development planning and transport economics.

2.11 In order to ensure that future development of the national, provincial and county roads proceeds on a coordinated basis, the road investment

plans of MOC, Korea Highway Corporation (KHC) and MOHA were reviewed by a study under the Provincial and County Roads Project, under the overall management of BPR's Planning Division. Existing and projected traffic flows were analyzed to determine the inter-relationships among the systems, with the objective of reducing the possibility of redundancy and contributing to greater efficiency of road investment. An interagency committee of MOHA, KHC and EPB representatives under overall MOC management directed the study and contributed to institutionalizing balanced road development and bringing consistency to the road planning done by the various agencies. As a result, a system of technical criteria and institutional procedures were defined for future application.

2.12 The Government recognized that although these initiatives had met with some success, road investments needed to be coordinated closely among the concerned agencies and with proposed investments in other modes. Accordingly, the Government decided under the Highway Sector Project to establish a system identified in the above-mentioned study under which all investments in the highway sector are planned on an integrated and sound economic basis, and also, funds appropriated for each road agency support closely the priorities indicated in an integrated highway investment plan. Such a Highway Network Master Plan (HNMP) was prepared in 1986 as the basis for the transport sector plan which was included in the Sixth Development Plan. The HNMP prioritized investments for all types of roads to the year 2001, and together with the Kyonggi Regional Study (para. 1.14), provided a basis for the selection of road links to be constructed or approved under the Sixth Plan.

2.13 The Government also established a system for the annual review of investment proposals and related budget plans for all expressway, national, provincial and county road construction or improvement - whether financed directly from the budget (as for BPR) or otherwise (in the case of KHC and, partly, MOHA) - so that they reflect the integrated Highway Network Master Plan and established economic priorities. Now, all investments in the road sector are planned on an integrated basis; evaluation criteria are applied to all highway investment proposals; and funds appropriated for each road agency closely support the priorities stated in the integrated road investment plan and represent a better balance between the economically justified needs of each agency and the road user charges which are allocated to them. Accordingly, since 1987 the coordination of road investments has been centralized in BPR within MOC to ensure that project timing and scope are consistent, regardless of which agency is implementing them. BPR has also been vested with authority to review plans and specific projects for the improvement of roads proposed by the provinces and counties, and, if they are feasible and consistent with plan requirements, to authorize the release of matching national counterpart funds for their implementation. The HNMP will be subject to periodic review and updating, and consequential revisions will be made to the expressway network plans and investment programs.

2.14 The Government also undertook a staff training program in planning and economic evaluation of transportation investments under the Highway Sector Project to be better able to establish systems and procedures for comparing investment alternatives among transport modes, and to ensure their better coordination.

Financing

2.15. Local funding for the road program comes from various public sources. For the national roads, the general budget is the sole source of funds for development and maintenance; user charges on vehicle purchase and operation, collected through fees and taxes, accrue to the general budget. By contrast, the Korea Highway Corporation (KHC), a government-invested enterprise under MOC, uses its toll revenues to finance construction, maintenance and operating costs of toll expressways. The level of tolls is subject to review and approval by EPB.

2.16 The local governments also have a separate financing system; their own revenues are complemented by a block grant of 13.27% of national revenues allocated annually to MOHA by EPB. For 1987, this allocation was W 1,333.9 billion compared to W 719.0 billion in 1982. Since 1986, a subsidy is also allocated to MOC for provincial and county road construction or improvement in the form of 40%-60% of project costs, upon confirmation by BPR of project priority, timing and appropriateness. EPB, through its Budget Bureau, exercises budgetary control over transport investments proposed by each ministry and has the authority to cut or defer projects if required.

2.17 Budget allocations to MOC for total expenditures on the road program average about 2% of total domestic revenues. The total capital and recurrent expenditures estimated for the Sixth Plan period (1987-91) for national, provincial, county and city roads and expressed in 1986 prices amount to W 3,675 billion or about US\$5.3 billion and are 48% higher than the W 1,770 billion (US\$2.5 billion) spent in 1982-86. The Sixth Plan road investment program appears very reasonable in view of annual forecast traffic increases of 5.7% and 6.8% in freight ton-km and passenger-km, respectively. Such increases in investment imply significant productivity gains in road transport, and will add to the demand for road facilities.

2.18 The proposed road expenditures in the Sixth Plan reflect a policy aiming at more balanced investments between the national roads, for which about 50% of total road expenditures has been earmarked, and the development of the provincial, county, city and special city road networks. This shift occurred during the Fifth Plan period (1982-86). Before 1982, more than 70% of the total road expenditure was spent on national roads including expressways. The share for maintenance of national roads has been increased to 16% of expenditures on these roads, an increase from the 15%, 11% and 6% spent respectively during the Fifth, Fourth and Third Plan periods. In the past, maintenance expenditures by KHC for its highway network have been high but local authorities' allocations for the provincial and county network have been inadequate. The coordination of expenditures levels with the actual needs of the various road networks for greater efficiency of road investment and balanced road development has been assisted by previous Bank-financed projects.

2.19 Total road user charges are in line with road expenditures. In 1985, revenues of W 862 billion covered about 70% of total expenditures of W 1,225 billion. While this is considered satisfactory, it is expected to improve even further in the near future considering the expected rapid expansion of the vehicle fleet. However, it was found that the pricing system involved

considerable cross subsidy among different users with heavy vehicles not paying their share of costs. Road user charges were studied under the Highway Sector Project. The study recommended the gradual adjustment of road user charges from a system that effectively subsidized some larger vehicles towards a more neutral taxation system, mainly through increasing diesel fuel taxes and increasing annual vehicle taxes on trucks and buses so that the Government can come closer to recovering an appropriate portion of the costs incurred in construction and maintenance from the various users of the road network. The recommendations of this study, which involve some complex fiscal, regulatory and administrative relationships, are currently under Government review.

2.20 A proposed law to be considered for enactment by the National Assembly and to become effective in 1989 (initially through 1994) will establish a new financing system through a Special Account for highways. Funds in the Special Account would be available for improvements, including widening, paving and maintenance of national, provincial, county and major city roads. MOC will manage and operate the Special Account which is initially projected to total W 610 billion (US\$871 million), sufficient to cover 60% of expenditure^s for the above needs. The Special Account will be funded from several sources including budget transfers from general revenue; user charges, including special excise taxes on gasoline, diesel and passenger cars; loans from the private sector and external sources; toll revenues; and bond issues.

E. Highway Sector Development Plan (1987-91)

Objectives

2.21 In the context of the Sixth Plan development objectives in the transportation sector (paras 1.11-1.12), priorities in the highway sector plan are to: (a) expand and widen expressways; (b) continue to pave and better maintain national, provincial and county roads; (c) increase and modernize the vehicle fleet while further developing both vehicle and road safety programs; (d) improve the efficiency of the road transport industry through energy conservation by providing more freight terminal and servicing facilities; and (e) expand the road network to improve accessibility to remote farm and fishing villages, creating the potential for rural industrialization.

Scope and Content

2.22. It is anticipated that projected growth rate for the GNP (estimated to average about 7% annually) will generate a similar increase in transport demand. Accordingly, highway passenger transport is estimated to grow from about 80 to 110 billion passenger-km during the Sixth Plan period, with an average trip distance of 7.3 km. Freight transport is expected to grow at a somewhat slower pace from about 8 to 10 billion ton-km during the same period, with an average haul of over 47.5 km. While the estimated growth rate of freight transport is lower than under the previous Plan period, it is consistent with projected economic growth, and the expected increases in passenger transport demand are ensured by the continuing improvements in the road and expressway network. New expressways have been completed between Taegu and Kwangju as well as between Seoul and Taejon. In addition, the rapid increase in motorization, with over 100,000 new vehicles annually in the Seoul

metropolitan area alone, will add to passenger-km growth and dramatic increases in the demand for better road facilities.

Costs

2.23 Overall investment funds for the highway sector allocated in the government budget for the Sixth Plan period amount to W 3,675 billion (US\$5.3 billion), which includes funds for road maintenance but excludes debt servicing. This is nearly 60% of overall transport sector investment during the same period, compared to 17.4% during the previous Fifth Plan, and signifies the prominent role of highways among other transport modes. Budgeted funds will meet the cost of constructing 300 km and widening 240 km of expressways, paving 1,900 km and widening 900 km of national roads, and paving 3,900 km of provincial and county roads. The construction and improvement of the latter roads will be financed by W 528 billion from local government sources. In comparison, during the Fifth Plan period the Government constructed 176 km of expressways, paved 2,656 km of national roads and 2,715 km of provincial roads, partly financed by Bank loans 2228-KO and 2392-KO.

2.24 The sector plan includes provision for the construction and improvement of 2,470 km of city roads, estimated to cost about W 1,500 billion overall during the current Plan period, funded mainly from city budgets. The investments profile for the highway sector during the Sixth Plan appears well planned and reasonable and will provide the funds necessary for the projected 32% and 38% increases in road freight ton-km and passenger-km, respectively. The annual budget for the maintenance of national roads amounting to W 70 billion (US\$100 million) has been increasing at about 15% annually over the last decade and reflects the high priority assigned by the Government to maintaining the road network at an acceptable level. The role of the proposed project in systematizing and making maintenance more cost-effective will assist in the better achievement of these efforts.

Evaluation

2.25 The highway sector plan is based on analyses emerging from two recent transport investment studies: the Highway Network Master Plan and the Bank-financed Kyonggi Region Multimodal Transport Study. The thrust of these studies -- to achieve integrated and coordinated planning as well as economic efficiency -- is well conceived and incorporated in the sector plan. While the sector plan objectives are ambitious and the content substantial, the responsible government agencies, particularly BPR in MOC, are qualified, experienced and able to implement the plan based on previous plan and project performance.

Need for Investment

2.26 The Government's road improvement program is designed to provide better road access between cities, townships and villages and is supported by feasibility studies to establish the economic justification of selected road sections. These national road links have been identified by the Highway Network Master Plan study to have the highest priority in those areas of the country

that are relatively less developed and are, therefore, the focus of the Government's regional development plans.

2.27 The existing roads to be improved have variable geometric characteristics that depend largely on the local topography. Most such road sections have a poorly paved or gravel surface, are generally not wider than 3-5 m, and are unsuitable for the commercial and other heavy traffic expected as the rural economy begins to attract industrial investment. These road sections are also characterized by a lack of shoulders, poor road drainage and intermittently substandard alignments. Given the difficult, hilly and complex topography to be typically traversed in Korea, most roads follow alignments that generally provide both the best option and the only means of access to the areas which they serve. Accordingly, these roads not only serve the function of arterials through their corridors but also collectors for interconnecting provincial and county roads. With increasing urbanization, improving road access to cities and townships through urban arterials is assuming greater importance.

2.28 Given the presently poor road surface and structural condition, the road links to be improved under the sector plan cannot be adequately responsive to the increasing demands of an industrializing and economically progressive economy. In addition, good road access is vital for the creation of off-farm employment opportunities which is a major goal in the Sixth Plan program for the speedy alleviation of regional disparities and depressed rural areas.

2.29 Narrow road widths and rough gravel surfaces slow down vehicles to unreasonably slow speeds, while the excessive wear and tear on vehicles and tires as well as heavy fuel consumption result in very high vehicle operating and transport costs. The extent of justifiable investment on the improvement of specific road sections will be a function of economic activity. For many of the two-lane roads, traffic congestion, resulting low vehicle speeds and high operating costs will demand that these roads be either paved or widened to four-lane paved roads depending on the circumstances. The proposed project will address these investment needs.

F. Design and Construction

2.30 MOC, through BPR, is responsible for design and construction of national roads including new expressways and those provincial roads to be constructed using MOC or external financing. Highway design is based on standards which are adequate for various traffic volumes, types of national highways and topography in Korea (Annex 1, Part C). Consultants are employed for the design of major roads works, with the assistance of seconded BPR staff under a study group system. MOHA has only recently become involved in major road design work in connection with the county road program and employs consultants for design under the same system of study groups used by MOC. Both MOC and MOHA employ mainly domestic consultants for supervision of construction. Korea has a strong well-developed engineering consulting industry, with some 30 firms which are fully competent in all aspects of engineering design but so far have developed only a limited capacity in areas of transport economics and traffic engineering. The proposed project would support the development of local

specialized expertise in these and other areas through the provision of foreign consultants for technology transfer as well as through selected formal training.

2.31 Contracts are awarded through competitive bidding with international competitive bidding (ICB) used for contracts financed by external sources and for specialized construction work. This policy, combined with the large volume of construction works in Korea during the past 15 years, has resulted in the development of a large, efficient and experienced contracting industry capable of carrying out construction of high quality and high cost engineering projects. Because of the strong domestic contracting industry, foreign contractors have not been successful in obtaining work in Korea.

G. Road Safety

2.32 Available data show that Korea has a high road accident rate. According to police statistics, approximately 175,660 traffic accidents occurred on Korean roads in 1987 in which 7,026 persons died and 222,701 persons were injured or crippled. Deaths and injuries resulting from road accidents have been increasing at an annual rate of about 13% during the 1980s. The 1987 Korean road accident fatality rate (when standardized to permit international comparison) of 48 deaths per 10,000 vehicles was very high for a country at Korea's stage of economic and industrial development. Although a developed country in many respects, Korea has a fatality rate which is more typical of a much poorer country. Equivalent European, North American and Japanese rates typically range between 2 to 4 fatalities per 10,000 vehicles. Korea's current rate is therefore around 20 times as high as comparator countries.

2.33 Road safety responsibilities in Korea are currently split among three main ministries: transport policy, licensing, and vehicle testing under MOT; traffic police, regulation and safety publicity under MOHA; road planning, design, construction and maintenance under MOC. The actual implementation of road traffic safety regulations is the responsibility of the Traffic Police, MOT and MOHA. The Traffic Police, under MOHA, enforce some safety-related regulations such as speed limits, etc. and collect, analyze and publish traffic accident statistics.

2.34 In addition, a Transportation Safety Promotion Authority, established in 1979 under the general control of MOT, is responsible for the inspection of motor vehicles, railroad cars, ships, aircraft, rails and cables, from which activity some 90% of its revenues accrue. A Road Traffic Safety Association (RTSA), which was attached to the Traffic Police prior to 1980, was reconstituted under the Road Traffic Law as a civilian nonprofit corporation, reporting to MOHA. Its functions are to analyze traffic accident data, do research and studies on road safety, train and educate drivers, and prepare and organize propaganda related to road safety. The Association has eleven provincial branch offices and one branch each in Seoul and Busan. Its revenue comes mainly from a small portion of driver licensing fees and very small percentage of tire and insurance company profits. While the Association is in theory autonomous, the President is appointed by MOHA, its use of funds must be approved by MOHA and its staff has, for historical reasons, close links with the National Police.

2.35 The need to better coordinate traffic safety measures and tackle the road accident problem has been recognized in Korea for a number of years. The Traffic Safety Law of December 1979 established a potentially powerful structure for those activities by providing for a traffic safety policy committee chaired by the Prime Minister which was to direct an executive committee chaired by the Minister of Transport. Unfortunately, little priority was given to this work, and although some improvement occurred as a result of the law, most of the key ministries with road safety-related responsibilities carried on largely as before. In 1983, as part of a Bank-financed Provincial and County Roads Project, a comprehensive study of road safety was commissioned. The final report, produced in 1984, identified deficiencies in the way in which road safety issues were being handled and made wide ranging recommendations on improvements and activities necessary for the Government to tackle the problem more effectively.

2.36 The growing realization of the scale of the problem and the annual economic losses being sustained eventually convinced the Government to take further measures. As a consequence, the structure of the traffic safety policy committee has recently been revitalized and strengthened and there now seems to be a greatly increased political commitment to act on road safety matters. In early 1987, a Presidential directive established a joint policy group under the Prime Minister's Office (PMO) to develop and implement a comprehensive traffic safety improvement program. In March 1987, 12 ministries were asked to establish safety policies and to prepare road safety improvement plans for areas under their jurisdiction. These were consolidated by the PMO into a comprehensive national road safety plan which the Prime Minister and the policy committee reviewed in August 1987. The ministries and other relevant organizations are now implementing or preparing a variety of road safety improvements included in the National Road Safety Improvement Plan, the implementation with coordination provided by the PMO. A comprehensive and determined national effort is therefore now being made.

2.37 Despite these encouraging developments, some significant institutional and other problems still remain which are inhibiting successful implementation of road safety measures on the national road network in Korea. Some of these issues are already being addressed. A project being financed by the Asian Development Bank, for example, is training MOC road safety staff. The proposed Bank project contributes toward the resolution of both the institutional and technical problems through support for a foreign road safety expert who has been engaged by the Government to develop safety-conscious designs for the project, a hazardous location remedial program and the modification and codification of better safety standards and practices, first for MOC roads, and subsequently for all roads in Korea. These are discussed in more depth in Annex 2.

H. Maintenance

2.38 Responsibility for maintaining the road network is divided among three levels of government agencies: KHC for expressways; MOC for the national road network and local authorities for provincial and county roads. KHC has an effective maintenance organization, well-trained experienced staff, a large

number of maintenance equipment units and adequate funding from tolls. As a result, the expressway network is being maintained to a high standard.

2.39 MOC's road maintenance organization was established in 1972 and strengthened under previous Bank-financed highway projects through the provision of technical assistance and road maintenance equipment. These National Road Maintenance Corporations (NRMCO) in each province are well established, fully staffed and are capable of maintaining the national road network to an adequate standard. However, the planning, programming and budgeting of road maintenance programs are weak and inadequate in view of the magnitude of the network and the growing cost of maintenance. Current practice is to base the annual maintenance work only on visual inspections of existing pavement conditions without the advantages of the modern testing equipment or the sophisticated data analysis recommended in a recent consultant's study discussed below. Therefore, emphasis has been given to routine maintenance and overlays while the need for more varied solutions including pavement strengthening has been neglected. (Annex 3, Part A) As a result, existing pavements of many national roads are inadequate to resist deterioration and cracking under the especially high volume of heavy vehicles. To correct this situation MOC undertook the Highway Maintenance Management Study aimed at: (a) developing a comprehensive road maintenance management system to ensure a systematic approach to decision making within a consistent framework of routine and periodic maintenance including overlay and strengthening needs, and resource requirements on a continuing basis; and (b) establishing a balanced multi-annual improvement and resource need program for 9,000 km of paved national roads.

2.40 The Study was completed by local and foreign consultants in December 1987 and financed under the Highway Sector Project (Loan 2392-KO). As part of the study, which included a detailed survey of about 1,100 km of national roads, a Road Maintenance Management System (RMMS) for Korea was designed. The study recommended the introduction of the RMMS which would permit the condition of the entire network to be rated on the basis of mechanically collected data analyzed with the latest techniques for such purposes. In addition to this sophisticated inventory of the road network, the RMMS would be capable of predicting the need for maintenance in yet visually unidentifiable sections based upon models of pavement deterioration and performance. The heart of the RMMS, a computerized road data bank, would also be used to set maintenance priorities according to economic criteria and to suggest optimal multi-year expenditure programs. MOC accepted the consultant's proposals and decided to implement the newly designed RMMS. Based on study findings and RMMS procedures, road priorities and the design standards have been established and a road maintenance program has been developed which will gradually be extended to the entire network over a three year period. This will necessitate a detailed survey of the remaining 7,057 km of national roads.

2.41 Maintenance of provincial and county roads by the local governments has suffered from a lack of funds, trained staff and proper planning. To address these problems, the Government prepared a five-year (1983-87) maintenance program for provincial and county road networks, which was implemented under the Provincial and County Roads Project (Loan 2228-KO). Although the condition of provincial and county roads has improved, significant

additional benefits could be derived from the adoption of a more systematic approach to planning, programming and monitoring of road maintenance operations.

I. Energy Conservation

2.42 Since virtually all fuel must be imported, energy conservation has long been a major thrust of policy in Korea. Efficient energy use in road transport involves, inter alia, equipment characteristics, fuel pricing, regulation and transport industry efficiency. Studies of trucking regulation and freight transport improvement carried out under the Highway Sector Project and other Bank loans addressed issues of transport energy efficiency and the impact of regulations, for example, on full loads, empty back-hauls and the size and use of equipment.

2.43 Since 1984, MOER has been effectively coordinating, managing and monitoring actions for energy use conservation in the transport sector. These initiatives have resulted in energy conservation policies; the promotion of more energy efficient buses and trucks for the transport industry; energy audits by the Korea Energy Management Corporation of transport companies; conservation programs; and deregulation of the trucking industry, including the abolition of area licensing to enhance truck loads and increase efficiency. MOER has also established training programs in the public sector for greater energy efficiency in transport and works closely with vehicle manufacturers to find ways to improve vehicle efficiency through technology improvements.

J. Previous Bank Involvement in the Highway Subsector

2.44 The Bank has financed seven road projects with loans totalling US\$700 million. Five of the projects have been completed, all with very satisfactory results. The First to the Fourth Highway Project (Loans 769-KO, 956-KO, 1203-KO and 1640-KO) were implemented well; in almost all cases, the re-estimated economic rates of return exceeded appraisal estimates, mainly because of greater than expected traffic growth. The PPAR Nos. for the above four loans are No. 3045 for the first two loans, No. 5024 for Loan 1203-KO and for Loan 1640-KO, the Project Completion Report No. is 5450. The Provincial and County Roads Project (Loan 2228-KO) closed in December 1988; it focussed on rural road improvement schemes, all of which have been successfully carried out. The Highway Sector Project (Loan 2392-KO) is also virtually complete, with more than 90% of the original loan amount disbursed; it is expected to close in June 1989. (para. 1.13) The Kyonggi Regional Transport project (Loan 2905-KO) was signed in 1988; its implementation is proceeding on schedule.

2.45 The first four projects have had major impact in assisting the Government with the improvement and expansion of the national and provincial road networks and with institution building in MOC. Loan 2228-KO assisted MOHA and local authorities in the improvement of about 1,500 km of provincial and county roads, and in setting up and providing equipment for organizations at central, provincial and country administrative levels to implement a maintenance program. In addition, the above projects included numerous studies and policy actions which have had a profound effect on Korea's highway infrastructure and road transport industry. Most recently, primarily in the context of the Highway Sector Project, a detailed Action Plan was implemented which examined (a)

highway investment planning, (b) highway maintenance management; (c) road user charges, (d) trucking industry regulations, (e) freight transport improvements, (f) energy use in the road transport industry, and (g) highway safety.

2.46 Partly as a result of these studies, the Government has redefined responsibilities and procedures in highway planning, maintenance and finance. As described earlier in this chapter, regulations of the road transport industry have been and are being eased, with a general trend away from restrictive licensing of vehicles and companies, toward simple registration. With regard to highway safety, a national safety plan was established (para. 2.35) which is now under implementation. To sum up, the Government, with Bank assistance, has made substantial progress this decade in improving the efficiency of the highway and trucking sector.

3. THE PROJECT

A. Project Objectives and Rationale

Project Objectives

3.1 The proposed project would complete some initiatives begun under previous Bank-assisted projects and would help 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 in corridors with high transport demand; and (c) increasing traffic safety through a number of measures including safety-conscious design of project facilities, modification of design standards and practices where appropriate and physical improvement of known hazardous road locations.

Rationale for Bank Involvement

3.2 Bank lending to Korea has been scaled down considerably but is being continued at a modest level consistent with the country's still large external debt, and the vulnerability of its economy to world market conditions, especially in an increasingly protectionist trade environment and in light of growing fiscal pressures arising from won appreciation, expanding budgetary outlays for accelerated social sector programs, higher wages and increasing production costs. The Government is not taking the current external financial surpluses and Korea's standing in overseas markets for granted.

3.3 Therefore, in the context of a prudent borrowing program, the Government has assigned high priority to continue Bank assistance for road development. Improved transportation infrastructure is important to advance the Government's Sixth Plan policies aimed at the integrated development of small cities and rural areas and reduced regional disparities. The Bank has supported these objectives through a series of projects in the sector (7 projects with financing of over US\$700 million in the FY71-88 period). The road network remains a high priority, with significant benefits to be derived from many roads that are still unpaved or require capacity expansion. The proposed project is

also a continuation of the Bank's previous efforts in the road subsector and builds on specific program initiatives begun earlier, including the improvement of road maintenance and road safety. Both road safety and maintenance systems are areas where Korea's knowledge and experience lag behind the general level of development and where external expertise can be inexpensively and successfully applied to Korean conditions. The serious road safety situation will be measurably improved by the safety conscious designs being employed under the proposed project, the first accident-statistics based safety improvement program for national roads and by the codification and dissemination of improved practices and standards to be prepared as a road safety manual. The introduction of a new road maintenance system under the project is expected to increase both the effectiveness and efficiency of maintenance activities.

B. Project Description

3.4 The project would have four components:

- (a) paving, upgrading and widening of about 270 km of the national road system;
- (b) establishment of a new road maintenance management system including periodic maintenance and rehabilitation of about 700 km of paved national roads;
- (c) implementation of selected aspects of the national road safety program including safety-conscious road design, a hazardous location improvement program and preparation of road safety guidelines; and
- (d) the provision of equipment, consultants' services, and training for road sector development.

Upgrading and Widening of Existing Roads

3.5 In 1987, on the basis of existing data and knowledge MOC identified 47 high priority road sections totalling about 855 km as candidates for improvement during the remaining years of the Sixth Five-Year Development Plan (to 1991). Feasibility studies including preliminary engineering were undertaken which indicated that about 520 km of these roads had a graveled surface with substandard horizontal and vertical alignments, structures and drainage causing high vehicle operating costs and flooding in low-lying areas. The remaining 335 km of two-lane roads had adequate design standards but were congested with heavy traffic volumes ranging from 4,500 annual average daily traffic (AADT) in rural areas and 35,000 AADT in suburban areas, making normal traffic flow impossible. To correct this situation the Government included all these roads in its improvement program. The project would assist the Government in implementing this program by financing the upgrading and widening of the highest priority sections, determined by economic rate of return calculations, totalling about 270 kms of which about 112 kms would be upgraded and the remainder widened.

Road Maintenance

3.6 The Government is preparing to implement the Road Maintenance Management System (RMMS) recently designed by consultants to assist the Government in managing road maintenance on national roads (para. 2.40). This system of identifying, analyzing, prioritizing, budgeting and executing road maintenance operations would be gradually introduced over a four-year period (1988-91) and the present system would be phased out over the same period. Since the computerized road data bank, which is at the core of the RMMS, requires information collected by the new testing and measuring equipment, the timetable for full conversion to the new system depends upon completion of the road inventory, surveys and establishment of a data bank for the entire national road network. Introduction of the new system is expected to result in more efficient and effective road maintenance as well as more economical use of existing resources. These efforts would be supported under the project through the provision of road maintenance, survey, laboratory and other equipment and assistance in the financing of approximately 700 kms of the most urgent periodic road maintenance operations, including strengthening, which would be carried out by contractors.

Road Safety

3.7 The proposed project would promote road safety in three ways. First, a road safety expert with international experience was employed to advise the project feasibility study team on the preparation and design of project road sections. Present MOC highway design standards were also critically reviewed and interim highway and traffic design standards based on safety-conscious design principles were prepared as guidelines for engineering consultants to use during detailed design. The safety expert has also been retained to review the actual detailed designs to assure that modified, safer designs are applied to all civil works undertaken under the project. Second, to build upon this initial effort to improve designs, the project would also include the preparation of road safety guidelines for Korea. The first step toward such guidelines would be the preparation of an MOC road safety handbook which would not only contain new advice and guidance on safety-conscious design and operation of road systems for MOC but would also incorporate, in a single source, related road safety practices from existing manuals of the police and others. The second step would be to review and revise the relevant laws and regulations which determine both practice and jurisdiction. Once institutional responsibilities have been clarified and possibly rationalized, the third step would be the preparation of a comprehensive road safety manual for all users in Korea as a joint exercise of the police and other parties. It is expected that the manual will be used by all roads engineers in Korea in the future so that experience gained from this project can be incorporated in standard procedures for designing new and improved roads. Third, the project would support MOC in establishing a program to correct problems at high accident or hazardous locations. Identified on the basis of police accident data, hazardous location remedial programs have been shown by international experience to be cost-effective in improving road safety. All of the road safety components would be funded directly by the Government.

Consultants Services and Training

3.8 Detailed engineering, construction supervision and other consultants services would be carried out by local consultants selected by MOC in accordance with local procedures and would be financed by the Borrower. Training will comprise of short courses and study tours related to various aspects of road sector development also to be financed by the Borrower. A detailed program was agreed during negotiations. (Annex 5, Part B)

Status of Preparation and Criteria for Selecting Components

3.9 In preparation of the project full feasibility studies were carried out on 47 road sections throughout Korea. These studies, which were completed in September 1988, also include preliminary design in most cases and final engineering in some instances. The Bank has reviewed national highway design standards (Annex 1, Part C), as well as engineering for the project components, and finds them satisfactory.

3.10 Agreed criteria have been used to select the proposed 21 road sections from the 47 studied. In addition to a feasibility study and engineering acceptable to the Bank, the main criteria for a section to be eligible for financing under the project is an economic rate of return of at least 12%. In the event that substitutions or additions to the proposed 21 sections become necessary as the project proceeds, it was agreed that the same criteria would be observed by MOC. During periodic reviews of project progress, conformity with the criteria will be examined in the field and confirmed.

C. Cost Estimates

3.11 The cost of the proposed project, including physical and price contingencies and right-of-way-costs, is estimated at W 359.2 billion or US\$513.1 million equivalent, including an estimated US\$41.3 million equivalent or 10% in taxes and duties for all project items except right-of-way. The proposed Bank loan would cover the project's total foreign exchange cost of US\$200 million, or about 39% of total costs. Costs have been estimated on the basis of October 1988 prices. Physical contingencies are estimated at 10% of the base cost of all project components, and price contingencies are estimated at 2% per annum for local costs throughout the project period (1989-92) and, for foreign costs, 5.3% for 1989 and 1990 and 4.1% thereafter. Price contingencies are equal to 9% of base costs plus physical contingencies. Estimated costs are summarized in Table 3.1 and details of project roads for which feasibility studies have been completed are given in Annex 4, Part A.

Table 3.1: Project Cost Summary

Component	Local	Foreign	Total	Local	Foreign	Total	Percent
	----(Won Billion)-----	-----	-----	---- (US\$ Million)-----	-----	-----	Foreign Cost
1. Upgrading & widening of about 270 km	105.1	89.5	194.6	150.1	127.9	278.0	46%
2. Road Maintenance (overlay and strengthening)	24.6	21.0	45.6	35.2	30.0	65.2	46%
3. Equipment	0.7	2.8	3.5	1.0	4.0	5.0	80%
Base Costs	130.4	113.3	243.7	186.3	161.9	348.2	47%
4. Contingencies							
Physical	12.6	11.8	24.4	18.0	16.8	34.8	
Price	6.4	14.9	21.3	9.1	21.3	30.4	
5. Right of Way	69.8	0.0	69.8	99.7	0.0	99.7	0%
Total Project Cost	219.2	140.0	359.2	313.1	200.0	513.1	39%

Notes: This table includes cost estimates for the 21 candidate sections for funding from the proposed loan only. October 1988 prices. Taxes equivalent to approximately 10% of cost other than right-of-way are included.

3.12 Cost estimates for upgrading and widening of existing roads are based on preliminary engineering prepared by consultants and unit rates for similar works being carried out and financed under the Highway Sector Project (Loan 2392-KO). Compared with ongoing similar projects, the average cost per km of about US\$0.8 million for upgrading and US\$1.4 for widening are considered reasonable and realistic. The cost estimates of US\$0.1 million per km for road maintenance are based on current unit rates for overlays and strengthening and are considered realistic. The cost estimates for road maintenance, survey, laboratory and other equipment (Annex 3, Part B) are based on actual prices for similar equipment recently purchased under Loan 2392-KO.

D. Financing

3.13 The proposed Bank loan of US\$200 million equivalent would cover the full foreign exchange cost or about 39% of project costs. All remaining costs would be financed from the general budget of the central government through MOC. Assurances to this effect were obtained during negotiations.

E. Implementation

3.14 The project would be implemented over approximately a four-year period starting in late 1989 and would be completed by June 30, 1993. MOC would have overall responsibility for project implementation through its BPR which would carry out the upgrading, widening and maintenance of national roads as well as the road safety program. BPR would be responsible for all studies and for the integrated planning of all roads initiated under the project. Preliminary engineering for all project roads has been completed by local consultants. The

preparation of detailed engineering and bidding documents is under way and will be completed by mid-1989. Road upgrading, widening and periodic maintenance works would be carried out by contract and would be supervised by MOC assisted by consultants.

3.15 BPR would introduce the newly designed RMMS. Having gained some experience under the study, BPR has prepared a plan to extend the Highway Maintenance Management Study to cover the remaining part of the national highway network using the methodology developed by the consultants. As shown in the implementation schedule (Annex 3, Part A), BPR is expected to take until approximately the end of 1991 to complete the inventory and survey of the entire network. In the meantime the present system, using only visual inspections for decision making on road maintenance, will be gradually phased out and, as of 1991, the RMMS will be fully implemented. Foreign and local consultants who carried out the study would provide technical assistance to BPR to implement the RMMS and to train staff.

3.16 The consultant who advised on road safety during feasibility studies is presently continuing his tasks with BPR and will be available through the preparation of detailed engineering of roads to be upgraded and widened. Terms of Reference (TOR) for the hazardous location improvement program have been reviewed and found satisfactory. The TOR for the preparation of the MOC road safety handbook was discussed during appraisal and agreed with the Bank. During negotiations a proposal to review the relevant laws and relations to be followed by the preparation of a comprehensive road safety manual was reviewed and agreed.

3.17 Because a portion of the project involves widening of existing roads, the right-of-way requirements call for acquisition of 450 ha of land and the relocation of approximately 609 households. The survey of the land to be acquired has been completed and the acquisition process will begin in early 1989. Budgetary provision for the initial requirements has already been made. The land will be acquired by MOC under the existing Special Law on Acquisition and Compensation of Lands for Public Use under which fair and timely compensation is paid for the property, including, where necessary, provision of alternative housing to minimize hardship to the displaced families. MOC has considerable experience in land acquisition and no major problems are expected in this process. MOC's procedures and plans for land acquisition and compensation are described in Annex 5, Part A.

F. Procurement

3.18 Contracts for major civil works estimated at about US\$296.4 million equivalent, including contingencies, would be procured through international competitive bidding (ICB) in accordance with the Bank Guidelines. This would cover about 70% of all civil works contracts. Small civil works contracts amounting to an aggregate value of about US\$112 million, dispersed throughout the country and each costing up to US\$10.0 million equivalent, which are not attractive for foreign contractors, would be awarded on the basis of local competitive bidding (LCB) under procedures satisfactory to the Bank. Foreign contractors would not, however, be precluded from bidding for those works. The first tender bidding documents for civil works would be reviewed by the Bank and the agreed version would be used for all contract packages for civil works

estimated to cost US\$10.0 million equivalent or more. Road maintenance, survey and laboratory equipment totalling about US\$5.0 million equivalent would be procured through LCB in accordance with the Bank Guidelines. A preference limited to 15% of the c.i.f. price of imported goods or the custom duty, whichever is lower, would be extended to local manufacturers in the evaluation of bids. The procurement documents for the first purchase of equipment would be subject to the Bank's prior review and an agreed standard document used for subsequent purchases. Consultant services for detailed engineering, construction supervision, technical assistance and training would be obtained in accordance with local procedures and would be financed by the Borrower.

Table 3.2: PROCUREMENT SUMMARY
(US\$ million)

Project Element	Procurement Method		Total Cost
	ICB	LCB	
A. CIVIL WORKS			
Widening and Upgrading of national roads	296.4 (141.6)	35.0 (16.6)	331.4 (158.2)
Road maintenance works		77.0 (36.8)	77.0 (36.8)
B. EQUIPMENT			
		5.0 (5.0)	5.0 (5.0)
TOTAL	296.4 (141.6)	117.0 (58.4)	413.4 (200.0)

Notes: 1. Amounts shown for each project element include contingencies.
2. Figures in parenthesis are the respective amounts financed by the Bank loan.
3. Total cost excludes land acquisition.

G. Disbursements

3.19 Disbursements under the loan would be made against the following categories of expenditures:

- (a) 48% of the total cost of road improvement;
- (b) 100% of foreign expenditures for directly imported equipment or 100% of the local expenditures (ex-factory) excluding identifiable taxes and duties, of locally manufactured equipment; and
- (c) 70% of local expenditures for goods procured locally (off-the-shelf).

3.20 To facilitate disbursement, a Special Account for the Bank's funds would be opened in the Korea Exchange Bank, with an initial deposit of US\$12 million equivalent, the estimated average expenditures for a four-month period. Applications for replenishment of the Special Account would be made when funds are down to 50% of the initial deposit or three months of expenditures, whichever comes first.

3.21 A schedule of estimated disbursements is given in Annex 4, Part B which also shows the profile for previous transport projects in Korea. The estimated disbursements generally follow the profile except that disbursements are expected to be completed somewhat earlier since adequate counterpart funding is available and because the road contracts are small compared to the capacity of the construction industry available in Korea. The loan closing date would be December 31, 1993.

3.22 Loan disbursements will be made against contracts for upgrading and widening of national roads. Interim certification of civil works completed and costed at unit rates in the contracts will be done by the supervisory consultants and certified by MOC. Disbursements for minor civil works costing US\$5.0 million or less; and for equipment contracts valued at US\$0.5 million or less each would be made against statement of expenditures based on actual payments made to contractors, suppliers or training institutions.

H. Auditing

3.23 MOC would establish and maintain a separate project account for expenditures under the project. Assurances were obtained during negotiations that MOC would furnish to the Bank, within six months of the end of each fiscal year, audit reports prepared by independent auditors acceptable to the Bank. The audit would contain a separate opinion where statements of expenditure have been used as a basis for disbursement.

I. Progress Reporting and Monitoring

3.24 Agreement was reached with Government during negotiations on the progress reporting requirements for the project. The reports would be submitted to the Bank each quarter commencing December 30, 1989 and would form the basis for reviews of progress. Annex 5, Part C gives the format for Project Monitoring Indices which should be used. Agreement was reached with Government during negotiations on the preparation and submission by MOC of a Project Completion Report no later than six months after the loan closing date.

J. Environmental Aspects

3.25 The proposed road improvements are not expected to cause any noticeable environmental problems. Existing road alignments will be followed to the extent technically and economically feasible. Consequently, the acquisition of land, particularly agricultural land, will be minimized. Road safety will be enhanced by the implementation of the safety program included in the project as well as by road widening and paving and better maintenance. These road improvements will also contribute to the reduction of air pollution in the form of hazardous dust, vehicular noise and also mud during rainy weather. Since the project road sections are mainly in rural areas the urban impact of the project is not significant.

4. ECONOMIC EVALUATION AND PROJECT RISKS

Benefits and Sensitivity Analysis

4.1 The candidate road sections for the project have been subject to cost-benefit analysis and the final ranking for implementation has been made on the basis of the estimated economic rate of return (ERR). The selected components have ERRs ranging from 12% to 54% which is above the opportunity cost of capital for Korea (12%). The weighted average of selected components is 27% and under the most pessimistic sensitivity test applied (10% less benefits and 10% higher cost) the weighted ERR is 24%, still judged acceptable. Details for individual road sections are contained in Annex 4, Part A. Only the road widening and upgrading components have been subject to formal economic analysis. Both road maintenance and safety related activities are expected to produce even greater benefits than the road widening and upgrading components. Based on the experience of similar projects in Korea, periodic maintenance (resealing) is expected to yield economic rates of return of more than 50%.

4.2 The project benefits have been estimated separately for each improvement scheme. They are based on a comparison of vehicle operating costs (VOC) over the road sections in their improved and unimproved forms. The main benefits obtained from the type of road improvements to be made under the proposed project are from the substantial savings in VOC accruing to road users but there are also benefits in the form of reduced travel time which have not been quantified in this analysis. In the case of paving and re-aligning existing gravel roads, the benefits are derived mainly from the much reduced surface roughness, as well as smoother horizontal and vertical alignments. Operating cost parameters for various road alignment types (paved and unpaved) were applied to the specific characteristics obtained from a detailed inventory of all project roads. In the case of widening two-lane to four-lanes, benefits would arise from reduced traffic congestion i.e., higher vehicle speeds. The free flow traffic speeds were determined in surveys made for roads in different gradient categories. Speed variations caused by congestion were estimated from the US Highway Capacity Manual and studies made for Korean conditions.

4.3 Traffic volumes were forecast for the period up to 2012 based on an analysis, at the provincial and county level, of projected population and gross regional product, combined with information on the volumes, origins and distinctions of existing traffic on the roads in question. For the candidate projects in the region surrounding Seoul, where traffic volumes are also affected by the level of congestion on competing routes, results from a more sophisticated network model were utilized to project future volumes. The traffic analysis produced annual growth rates of 8-12% for gravel roads (having an average 1987 traffic of 100 to 600 vehicles per day) and 6-8% for roads to be widened (having an average 1987 traffic of 5,000 to 25,000).

4.4 The economic costs and benefits were estimated for each candidate scheme net of taxes and related to each other over an economic life of 20 years, assuming an implementation period of four years. The 21 schemes tentatively selected for the project are those with the highest ERRs.

4.5 It is difficult to estimate the precise impact of the project on the poverty group since project benefits would accrue to the population at large rather than to any particular income group. However, given the large proportion of buses in the traffic stream in Korea, the poverty impact is expected to be significant.

Risks

4.6 The project poses no major risks. There is a possibility that unforeseen difficulties with land acquisition could result in delays in the timely implementation of the project. However, given MOC's experience, and the fact that the land required is not close to major city centers, any delays are expected to be minimal. A number of people will need to be resettled but previous experience in Korea indicates that the assessment and payment of compensation to the affected people is made in a fair and timely manner and delays are not expected.

5. AGREEMENTS REACHED AND RECOMMENDATION

5.1 During negotiations, the Government confirmed:

- (a) that the road maintenance management system would be carried out as agreed (paras. 3.6 & 3.15);
- (b) that the road safety program would be carried out (paras. 3.7 & 3.16); and,
- (c) the details of the training program (para. 3.8).

5.2 During negotiations, the Government provided assurances that financing would be provided (para. 3.13).

5.3 Subject to the above conditions and agreements, the proposed project would constitute a suitable basis for a Bank loan of US\$200 million equivalent, for a period of 15 years, including a grace period of 5 years, at the standard variable interest rate. The borrower would be the Republic of Korea.

KOREA

ROAD IMPROVEMENT PROJECT

Public Road Network (1967-1987)

(Unit: km)

	National Roads a/			Provincial Roads			County Roads			Special City Roads			City Roads			Total		
	Paved	Gravel	Total	Paved	Gravel	Total	Paved	Gravel	Total	Paved	Gravel	Total	Paved	Gravel	Total	Paved	Gravel	Total
Second FYP																		
1967	1,442	6,744	8,186	52	10,600	10,652	-	-	N.A.	333	1,464	1,817	244	13,900	14,144	2,092	32,708	34,799
1968	1,540	6,626	8,166	74	10,597	10,671	-	-	N.A.	303	1,247	1,650	334	32,294	14,535	2,200	32,750	34,949
1969	2,110	6,461	8,571	134	10,703	10,837	-	-	N.A.	432	2,293	2,744	427	14,590	10,016	2,970	34,199	37,169
1970	2,461	6,197	8,658	292	10,692	10,984	-	-	N.A.	724	4,751	5,476	477	14,739	15,216	3,844	36,681	40,244
1971	2,943	3,843	6,785	254	10,524	10,774	-	-	N.A.	1,934	3,728	5,662	658	29,494	15,413	5,789	34,846	40,635
Third FYP																		
1972	3,319	5,610	8,929	283	10,517	10,800	-	-	N.A.	2,464	4,022	6,487	793	15,949	16,452	6,749	36,099	40,847
1973	3,868	5,419	9,287	503	10,389	10,892	-	-	N.A.	2,633	3,904	6,537	816	16,049	16,865	7,820	33,761	43,581
1974	4,070	5,217	9,287	639	10,250	10,889	-	-	N.A.	2,911	3,698	6,609	1,019	16,372	17,392	8,640	35,538	44,179
1975	4,748	4,612	9,360	719	10,092	10,811	-	-	N.A.	3,377	3,389	6,767	1,153	16,812	17,967	10,000	34,986	44,985
1976	4,876	4,486	9,360	811	10,057	10,868	-	-	N.A.	3,680	3,419	7,291	1,347	16,648	17,995	10,912	34,602	46,514
Fourth FYP																		
1977	5,434	4,008	9,442	922	9,933	10,855	384	12,125	12,509	4,051	3,405	7,456	1,306	4,095	5,401	12,097	33,567	46,664
1978	6,200	3,257	9,457	998	9,821	10,819	442	12,061	12,503	4,537	3,220	7,657	1,468	4,051	5,519	13,544	32,411	45,955
1979	6,224	3,233	9,457	1,169	9,819	10,988	466	12,022	12,488	4,823	3,042	7,865	1,595	3,941	5,536	14,278	32,056	46,333
1980	6,772	2,685	9,457	1,385	9,636	11,021	564	11,948	12,512	5,035	2,903	7,939	1,844	4,179	6,023	15,599	31,352	46,950
1981 b/	8,019	5,473	13,492	1,103	8,910	10,013	532	11,325	11,377	5,854	3,549	9,403	1,672	4,379	6,051	17,179	33,158	50,337
Fifth FYP																		
1982	8,643	4,833	13,476	1,285	8,210	10,005	597	10,848	11,377	6,186	3,296	9,482	2,571	6,956	9,527	19,283	34,653	53,936
1983	9,437	4,037	13,474	1,827	8,214	10,041	708	10,931	11,639	6,337	3,255	9,592	2,970	6,883	9,853	21,279	33,320	54,599
1984	9,848	3,817	13,665	2,404	7,675	10,079	1,244	10,632	11,876	6,844	2,915	9,759	3,224	2,400	5,624	23,644	27,339	51,003
1985	10,433	3,223	13,656	2,967	7,200	10,167	1,843	10,771	12,614	7,133	2,885	10,018	3,696	2,113	5,809	26,072	28,192	52,264
1986	10,865	2,808	13,673	3,833	6,481	10,314	2,445	10,339	12,784	7,759	2,965	10,724	4,169	1,989	6,158	29,071	24,582	53,653
Sixth FYP																		
1987	11,277	2,515	13,792	4,272	6,054	10,328	2,749	10,112	12,861	8,427	2,651	11,078	4,557	2,073	6,630	31,284	23,405	54,689
Composition in 1987																		
	82%	18%	100%	41%	59%	100%	21%	79%	100%	76%	24%	100%	69%	31%	100%	57%	43%	100%

a/ Including expressways under KHC jurisdiction, totalling 1,540 km.

In addition there are village access roads of which 52,444km had been constructed and improved under the Seamaul Movement at the end of 1980.

b/ Road networks were reclassified.

Source: Ministry of Construction

KOREA

ANNEX 1
Part 8

ROAD IMPROVEMENT PROJECT

ROAD DEVELOPMENT PLAN (1987-1991)

.....
(Billion Won at 1988 Price)

Item	FIFTH 5-YEAR PLAN		SIXTH 5-YEAR PLAN b/				Total (W Bil.)
	1982-1986	1987	1988	1989	1990	1991	
Government Expenditures on National Highways a/							
Administration	49.5	15.0	17.2	20.6	21.9	23.4	98.1
Construction	1,555.6	508.8	487.7	1,182.3	1,243.4	1,319.8	4,742.0
Maintenance	154.2	49.5	59.6	80.1	85.7	91.8	366.7

Subtotal	1,759.3	573.3	564.5	1,283.0	1,351.0	1,435.0	5,206.8

Expenditures on Provincial Gun (County), and City Roads							
Administration	97.9	21.2	22.8	45.4	55.0	55.6	200.0
Construction	3,171.4	1,068.3	745.8	1,481.0	1,798.0	1,820.8	6,913.1
Maintenance	209.3	53.2	46.5	92.2	112.0	113.4	417.3

Subtotal	3,478.6	1,142.7	815.1	1,618.6	1,965.0	1,989.8	7,530.4

a/ Included national government's investments to Korea Highway Corporation for its expressway construction.

b/ Estimated based on planned length of these roads.

KOREA

ROAD IMPROVEMENT PROJECT

Highway Design Standards

A. Expressway Standards

Design Speeds and Traffic Volumes
(km/hr)

Topography	Design Traffic Volume (Veh./Day)		
	More than 30,000	30,000-10,000	Less than 10,000
Flat	120-100	100-80	80-60
Mountainous	100-80	80-60	60-50

Typical Geometric Design Standards

	Design Speed (km/hr)			
	120	100	80	60
Radius of curvatures				
Desirable minimum (m)	710	460	280	150
Absolute minimum (m)	570	320	230	120
Maximum grade (%)	2	3	4	5
Length of vertical curve desirable minimum				
Crest (m)	11,000	6,000	3,000	1,400
Sag (m)	4,000	3,000	2,000	1,000
Minimum sight distance (m)	210	160	110	75
Bridge design loading	DB-24	DB-24	DB-24	DB-24

B. Four Lane National Road Standards

Geometric Design Standards	Unit	Terrain		
		Flat	Hilly	Mountainous /a
Traffic Volume Capacity	AADT	51,000	30,000	16,000
Design Speed	km/h	100	80	80
Minimum radius of curvature	m	400	300	200
Maximum gradient	%	5	6	7
Roadway Features (all areas)				
Width of pavement	m	14.8	14.8	14.8
Width of shoulders	m	1.85	1.85	1.35
Width of right-of-way	m	40	30	25
Structural Design Features (all areas)				
Axle load (pavement)	lbs	18,000 /c		
Bridge loading	-	DB-24		
Bridge widths (for new bridges over 100 m long) /d	m	17.5-16.5 (curb to curb)		
Vertical clearance	m	4.8	4.8	4.8

C. Two Lane National Road Standards

Geometric Design Standards	Unit	Terrain		
		Flat	Hilly	Mountainous /a
Design Speed	km/h	80	60	40
Minimum radius of curvature:				
Desirable	m	300	200	100
Minimum	m	230	120	50
Maximum Gradient	%	6	7	9
Desirable	%	4	5	7
Roadway Features (all areas)		Type C	Type B	Type A
	AADT /e	6,500-9,000	4,000-6,500	less than 4,000
Width of pavement	m	7.3	6.8	6.3
Width of shoulders	m	1.85-1.1	1.60-1.10	1.35-0.85
Width of right-of-way/f	m	30	25	25
Structural Design Features (all areas)				
.....				
Axle load (pavement)	lbs	18,000 /c		
Bridge loading	-	DB-18, equivalent to AASHO H20-S16		
Bridge widths (for new bridges) /g				
Rural Areas	m	10.0	9.0	9.0
Urban Areas	m	10.0	9.0	9.0
Vertical Clearance	m	4.80	4.8	4.8

- /a Design speeds and widths may be reduced and gradients increased on section with exceptionally difficult terrain, as appropriate in each case.
- /b Right-of-way width increased to 42 m where designed to accommodate ultimate construction of 4-lane divided highway.
- /c Pavement designed for the projected number of repetitions of "equivalent 18,000 lbs axle loads
- /d Depending on traffic volume
- /e Right-of-way width reduced to 20 m where necessary to minimize demolition of property in urban areas.
- /f Existing bridges retained unless significantly substandard in strength, size or alignment.

KOREA

ROAD IMPROVEMENT PROJECT

The Road Sector: Road Safety Component Background

IMPROVED SAFETY THROUGH ROAD DESIGN

1. One of the most cost effective ways of improving road safety in any country is to identify sites on the road network which have abnormally high numbers of accidents (i.e. hazardous location) and to make any necessary improvements to make such sites safer. This approach has been extremely successful in all the countries which have made serious efforts to improve road safety; typical examples of accident reduction by such means are the 61% reduction achieved in Japan and 38% by Sweden. In Korea, experience from the Bank-financed Seoul Urban Transport Project, indicates that accident reductions of around 45% can be achieved at such locations.

2. In 1987, 32.6% of all reported accidents in Korea occurred at 5,233 hazardous locations. Of these hazardous locations, 3,787 (72.4%) were on provincial and city roads and 1,446 (29.6%) were on the national road network. Assuming an average reduction of 45% as achieved under the Seoul Project, up to 25,000 accidents could be prevented each year simply by undertaking effective hazardous location improvement program on national and provincial roads.

3. The cost effectiveness of hazardous location improvements especially where a low-cost countermeasures approach is used can be extremely high, and economic rates of return (ERR) of 200-300% are quite common. For example, HK\$5.3 million "invested" in Hong Kong during 1981 to 1983 to improve 89 "high frequency accident locations" gave an average ERR of 323% through accident savings. Consequently, a properly designed and executed hazardous location improvement program is expected to be an effective part of Korea's effort to improve road safety.

4. Despite its undeniable importance, it is not enough just to undertake hazardous location improvements after accidents occur. It is equally important and necessary to undertake preventive action while planning and designing future roads to ensure that designs incorporate safety considerations and thereby avoid the creation of future hazardous locations. Incorporation of safety features and safety-conscious design principles during planning, design and construction phases can be undertaken at marginal cost and can have a fundamental influence on future road safety in a country. In the early stages of road development, traffic levels are usually low and the primary objective of roads authorities is to provide access to the different parts of the country. As traffic grows, highway authorities become increasingly concerned with providing sufficient capacity to meet the demands and developmental needs of the country. Further increases in traffic in the later stages of development (once the initial primary objectives of access and capacity through new roads have been largely satisfied) normally force roads authorities to recognize that it is not possible to continue increasing capacity indefinitely via road building alone and that operational efficiency also needs to be achieved.

5. As it joins the ranks of the developed nations, Korea has reached this third stage of transport development and MOC and other roads authorities now and in the future must increasingly seek ways to raise the operational efficiency of their road networks both in terms of increasing capacity and in terms of improving road safety.

6. Korean geometric design standards and highway construction practices are broadly compatible with international practice, or can be made so with relative ease, but very significant inadequacies exist in the present highway network design philosophy and the implications arising from it. Until recently, there was little attention paid to the functional design and operational aspects of roads in Korea and, as a consequence, the road networks will have serious traffic and safety problems in 10 to 20 years when traffic levels increase.

7. The areas of greatest inadequacy relate to MOC control over the function, operation and access control of national roads and in its present activities related to identifying, analyzing and improving hazardous locations on national roads. Present Korean traffic engineering design practices result not only in inadequate guidance to drivers at junctions but, in some cases, actually unnecessarily increase the risks to road users, particularly pedestrians, through insensitive traffic engineering design of facilities.

8. Furthermore, the shared responsibility for road signing (with MOC responsible only for direction and information signs and the police responsible for traffic signals, road markings, warning, prohibitory and supplementary signs) means that MOC does not have overall control over operational aspects of its roads and the traffic engineering design of junctions along the national roads. The interface of provincial roads and national roads, in particular, often results in the creation of dangerous conditions. The general absence of safety-conscious design practices in the design of road junctions and the lack of basic traffic engineering expertise to create safer, more efficient road networks at national and local administrative levels leads to unsafe and inefficient operation of roads in Korea.

INSTITUTIONAL RESPONSIBILITIES

9. The present dispersal of responsibilities between MOC and the police over road signs and road markings will require prior agreement of and consultation with the police. This is particularly so with regard to essential and fundamental changes in approach such as the provision of protected refuges at the centers of zebra crossings to enable the pedestrian crossing manoeuvre to be made in two stages and the (by Korean standards) radical changes in type and positioning of junction markings and the adoption of road hierarchy concepts and their implications.

Annex 2. Part A

10. The introduction and acceptance of road hierarchy concepts, for example, automatically leads to the need to have very clearly defined priority for the major road at every junction. This in turn, leads to the need for better design of junctions and the better positioning of motorists to guide them safely and efficiently through the conflict areas of intersections. Yield markings and stop lines pulled forward to the major road edge are a fundamental part of that strategy and the police will have to be consulted as soon as possible on these and other similar traffic engineering issues. Under present legislation, police are responsible for such issues.

11. As soon as possible the present division of responsibilities needs to be reviewed and revised if found necessary. In the short term an enabling mechanism needs to be created to permit MOC more opportunity to influence the traffic engineering aspects of its roads. One of the ways this might be done may be to develop comprehensive guidelines on traffic engineering and safety-related aspects of roads in Korea. (e.g. typical layouts and marking schemes for junctions, channelization, road signing, etc.). Such guidelines could provide a convenient framework and guidelines for consistent and safety-conscious traffic engineering design in Korea.

ROAD SAFETY ON NATIONAL ROADS

12. MOC's actions to improve road safety on the national road network involves two basic components. First, specific existing high-accident locations will be improved, and second, broad measures to improve safety on existing and new roads are under development.

13. A Hazardous Location Program. As part of the Government's interministerial effort to improve road safety, MOC has been entrusted with the specific task of reducing road accidents on the national road network. The worst 500 hazardous locations (places with abnormally high numbers of accidents occurring) on national roads were identified by the police authorities and submitted to MOC for improvement. An additional amount of W 10 billion (US\$14.3 million) has been allocated via MOC's 1989 budget specifically for improvements to be implemented at the worst hazardous locations.

14. MOC efforts to improve road safety in the past (in the absence of information on locations with high accident occurrence) have usually been directed at improving potentially dangerous sections of the network where sight lines, gradients and other substandard geometric standards were considered to pose potential danger to motorists. Now that specific information is available on the actual hazardous locations and an additional budget has been made available, a more concerted effort is to be made at improving hazardous locations on national roads. This hazardous location improvement program will, through joint working with other relevant agencies and specialists, examine the factors causing accidents at each location and seek to devise appropriate countermeasures for improving safety at that location. The measures considered may range from low-cost road marking, warning signs and traffic signals to bypass construction and other higher-cost solutions. In each case the most cost-effective solution will be implemented after in-depth studies have been carried out.

15. A Program to Improve Road Safety on Existing and New Roads. In order to minimize future problems MOC staff will be trained in the latest road safety practices and methods in an overseas program. Operational aspects of existing and planning and design of future national roads will be improved by introducing more safety-conscious design techniques into the planning and design phases of road construction. Road Safety Guidelines will also be developed to provide advice, guidance and a source of reference on road safety and traffic engineering issues for roads engineers and others responsible for planning designing or operating roads in Korea. This effort involves the preparation of an MOC Road Safety Handbook as the initial step. MOC will then propose a thorough review of the laws and regulations governing road safety with a view to rationalizing responsibility for these matters. Once institutional responsibility is reformed MOC intends to propose that a comprehensive full manual on road safety and traffic engineering be prepared jointly by all parties which will become the standard reference text for roads engineers, police etc. in Korea. Such a manual would introduce guidelines and advice on safety-conscious design principles to provide consistency of design and approach in traffic engineering related-matters for all roads and traffic-related agencies.

16. Each of these components is addressed in the MOC road safety program described in Annex 2, Part B.

KOREA

ROAD IMPROVEMENT PROJECT

Road Safety: MOC Road Safety Implementation Program

A. HAZARDOUS LOCATION PROGRAM AT 500 SITES ON NATIONAL ROADS

Appointment of study team to carry out hazardous location improvement program aimed at maximizing accident reduction at minimum cost.	December 1988
Field surveys of hazardous locations by teams.	Jan.-March 1989
Analysis of sites and outline design of selected target sites for improvement.	April - June 1989
Detailed design of improvements of target sites by MOC and related agencies.	July - Sept. 1989
Implementation of improvements.	Sept. 89 - July 91

B. IMPROVING ROAD SAFETY ON EXISTING AND NEW ROADS

(1) Planning/Design of New Roads

Adoption of safety-conscious design principles in detailed design of proposed project roads.	Jan.89 - May 89
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Review of safety aspects of project schemes.	June 1989
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(2) Training on Road Safety Issues (ADB funded)

Introductory course for 6 MOC staff on road safety program design and implementation.	December 1988
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Overseas training and secondments to highway authorities in UK, USA and Japan to develop skills/knowledge about road safety issues and how other countries tackle such problems.	April - May 1989
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In-service course for 30 MOC engineers on hazardous location improvements and countermeasures.	June - July 1989
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(3) Road Safety Guidelines

Bank/MOC agreement on TOR for MOC Road Safety Handbook.	November 1988
Commencement of preparation of MOC Road Safety Handbook by consultants.	December 1988
Review of draft Handbook with IBRD.	December 1989
MOC to propose review of safety aspects of Road Law and Traffic Safety Law by committee under PMO	December 1990
MOC to propose joint preparation of comprehensive and integrated road safety and traffic engineering manual for all relevant agencies.	December 1991

KOREA

ROAD IMPROVEMENT PROJECT

Road Safety

Road Safety Guidelines Terms of Reference

General Background

1. One of the major factors contributing to road safety problems in Korea is the historic fragmentation of institutional responsibility which can result in uncoordinated activities in building and operational management of roads. The present system of separation of responsibility for geometric design and construction from that for traffic engineering facilities can leave gaps in what is designed and implemented and lead to poorly designed junctions which become heavily congested or accident blackspots when traffic levels rise.

2. The main road and traffic related agencies each have their own respective manuals specifying standards (eg. MOC has highway design standards, police have traffic control regulations). Neither of these documents gives practical advice or guidance on how the individual elements of highway design and control devices should be used in combination to provide appropriate guidance for road users. Most of the necessary individual items are included in such manuals although many need updating and amplification to reflect modern developments in traffic engineering and road safety research. Consequently, none of the present documents used by road and traffic related agencies in Korea actually meets the wider needs of those seeking to improve traffic engineering and safety aspects of Korean road networks.

3. Interim advice was provided on such matters as part of this project but the document produced (Interim Advice on Road Safety and Design Standards, April 1988) was not able to cover all the necessary areas and concentrated only upon the areas of greatest urgency with respect to that particular project. A more comprehensive document is now needed to improve the operational efficiency and safety of roads in Korea and to provide a consistent approach and agreed, standardized solutions in terms of junction designs, traffic signals, channelization and road marking/signing which are acceptable to all the concerned agencies. The process of establishing national Guidelines for Road Safety necessarily involves several steps or stages.

MOC Road Safety Handbook

4. The present MOC highway design standard manual was not prepared to explicitly consider the safety related dimensions of those activities under the jurisdiction of MOC. Nor was it prepared in a fashion which sought to emphasise the linkages and interdependencies between MOC responsibilities and those of related agencies such as the police. In view of the urgent need to improve road safety and MOC's internal requirements for guidance on safety conscious design, MOC, in consultation with the Bank decided to proceed with the preparation of a MOC Road Safety Handbook starting late in 1988.

5. The terms of reference for this exercise were reviewed with the Bank and found satisfactory. The emphasis of the work is to provide guidance on the design of facilities where safety is a primary purpose or where safety can be enhanced through better design. Much of the analysis and recommendations are to be derived from the consultants analyzing the experience of other countries and adapting the practices for Korean conditions. Much of the work done in preparing safety designs for this project will be elaborated in this Handbook. Special emphasis is being given to highway safety problems in urbanizing areas, focused on intersections, a particularly relevant problem in Korea at this time. Specific new facilities for safety such as barriers and guard rails will receive special attention. The standards and practices of related agencies, as codified in their respective design manuals, will be incorporated in the handbook but this initial effort will focus on immediate MOC concerns. MOC plans to discuss the draft of this Handbook with the Bank late in 1989.

Review and Revisions of Relevant Laws and Regulations

6. The second step in the process of determining and preparing national road safety guidelines would be to review the relevant laws and regulations with a view to identifying both overlapping as well as missing areas of responsibility. The objective of such an exercise would be not only identification but also rationalization either in the form of revision of existing statutes or drafting of new laws and regulations. For such an exercise to be effective it should be conducted under the auspices of an independent authority and participated in by all agencies. The Committee on Road Traffic Safety Policy under the Prime Minister's Office is such a body and MOC has agreed to put such an exercise on the agenda of that committee later in 1989. The main laws to be reviewed would be the 1979 Traffic Safety Law and the 1979 Road Law.

Comprehensive Road Safety and Traffic Engineering Manual

7. Once the institutional and legal responsibilities are rationalized there is the need for a comprehensive Korean handbook on Traffic Engineering and Road Safety issues related to road planning, design and operation which gives guidance and advice to roads engineers, police and other interested parties in Korea. It would establish consistent and uniform traffic engineering and road safety practices on Korean road networks. Such a manual exists for major developed countries but it would be effective to have a version specifically tailored to Korean conditions and framework and available in the local language.

8. All key ministries and organizations with road and traffic-related responsibilities, such as the police, specialist researchers, traffic experts, consultants, and others, would be involved in a critical review of current practices and standards used by road and traffic related agencies at the national, provincial and city levels to identify areas of inadequacy in present Korean traffic engineering and road safety practices and standards. A review of overseas practices, design guides, manuals and standards in the areas of traffic engineering and road safety with a view to adapting such for application in Korea would augment the earlier work on MOC's own, more restricted handbook.

Annex 2. Part C

9. As in the case of the review of laws and regulations, this Manual could only be prepared as a joint exercise among the main agencies with outside sponsorship such as the Prime Minister's Office could provide. A draft terms of reference has been discussed between the Bank and MOC which will be further elaborated as steps 1 and 2 (MOC Handbook and review of laws) are undertaken. Based upon the outcome of the preceding steps and the discussions with outside experts, MOC expects to place the preparation of such a manual on the agenda of the Road Safety Policy Committee and to participate if the exercise is undertaken. The timing of this work is dependent on the successful completion of the review of laws and regulations which is expected to take until late in 1990.

KOREA

ROAD IMPROVEMENT PROJECT

Road Maintenance

Background and Implementation of the New Road Maintenance Management System

1. Since the establishment of a separate road maintenance organization in 1972, Bureau of Public Roads (BPR) of the Ministry of Construction (MOC) has been substantially strengthened and road maintenance has improved. As shown in the following table the Government has been continuously allocating more budget to road maintenance enabling BPR to increase the physical quantity of maintenance each year.

	1984	1985	1986	1987	1988	1989	1990	1991	1992
	<u>(Actual)</u>					<u>(Planned)</u>			
Allocations	25.0	39.0	40.0	49.5	59.6	80.2	85.8	91.8	98.2
Accomplishments (km):									
- routine maintenance	6,895	7,093	7,467	7,971	8,132	8,666	9,200	9,737	10,220
- regravelling	398	1,716	9,400	4,325	2,136	1,602	1,068	534	450
- resealing	96	119	287	576	479	500	500	600	600
- overlay	252	437	367	502	682	650	800	800	800
- strengthening	4	2	8	10	2	60	200	250	250

2. Although the quantity of road maintenance has improved, it is recognized that there is a lack of sophisticated tools for comprehensive planning, programming and budgeting of annual and multi-year road maintenance programs to meet the requirements of rapidly growing present and future traffic. At present, decisions on road maintenance are based on visual inspections without any survey of pavement conditions that utilizes modern testing equipment or analyses that data collected in a sophisticated manner. As shown above, emphases has been given to regravelling, resealing and overlay and while strengthening of pavements has been neglected. As a result, the bearing capacity of many roads is inadequate to resist deterioration and cracking under the high volume of heavy vehicles. To correct this situation, MOC undertook a road management study with the help of consultants under the Highway Sector Project (Loan 2392-KO). The study was completed in December 1987. Based on a detailed survey of about 1,100 km of national roads and using the Highway Design and Maintenance Model (HDM-3), the study consultants developed and recommended the new Road Maintenance Management System (RMMS).

3. Using the newly developed RMMS, BPR prepared a 10-year road maintenance program (1988-97) for the 1,100 km of roads studied by the consultants. The program includes about 996 km of paved roads to be resealed or overlaid and 126 km of roads or about 12% to be strengthened within the first three years (1989-91). Based on these indications, BPR prepared a 4-year program (1989-92) and identified budgetary requirements as shown in the above table. Emphases is now

being given to the strengthening of existing paved roads and accordingly the budgetary allocations are expected to be substantially increased starting in 1989 as compared with the past.

4. MOC has adopted the proposed RMMS which is designed to maximize the efficient use of available resources and to prevent roads from further deterioration. Therefore, MOC has prepared a plan to continue the detailed road inventory, surveys and pavement condition analysis started under the study in order to cover the entire road network, using the same methods and procedures developed by the consultants. Survey and laboratory equipment have been procured under the Highway Sector Project (Loan 2392-KO) and is being delivered. A consultancy agreement is being finalized with local consultants who participated in the study to assist BPR with road survey starting in late 1988.

5. According to the BPR's plan the remaining 7,057 km of national roads (excluding roads passing through urban areas) will be inventoried and surveyed over a three-year period starting in early 1989, with expected completion by the end of 1991, as shown in following implementation schedule:

<u>Activity</u>	<u>Responsible Agency</u>	<u>Target Date</u>	
		<u>Start</u>	<u>Completion</u>
1. Prepare TOR, select and engage consultants for the Korea Highway Maintenance Management Study.	MOC Bank	-	Feb. '87
2. Carry out the study including detailed survey of about 1,100 km of national roads and recommend most appropriate Road Maintenance Management System (RMMS).	Consult BPR	Feb. '87	Dec. '87
3. Review RMMS and make decision on adoption and continuation of detailed survey of the remaining 7,057 km of national rural roads.	GOK MOC BPR Bank	Jan. '88	Apr. '88
4. Prepare the list, specifications, and bidding documents for procurement of survey and laboratory equipment; invite the bids and with the Bank's approval award contracts for delivery of equipment.	BPR Bank Supplier	Jan. '88	Nov. '88
5. Select and appoint consultants to assist BPR and NCL in carrying out detailed survey, of the remaining 7,057 km of national rural roads and to provide on-the-job training.	BPR NCL Consult.	Jan. '88	Nov. '88

<u>Activity</u>	<u>Responsible Agency</u>	<u>Target Date</u>	
		<u>Start</u>	<u>Completion</u>
6. Update inventory of the national road network, carry out detailed survey, including a deflection campaign, establish a highway data bank and, using RMMS, prepare road maintenance program covering four year period:	BPR NCL Consultant		
- 1,000 km		Nov. '88	Aug. '89
- 1,500 km		Jul. '89	May. '90
- 2,500 km		Apr. '90	Feb. '91
- 2,057 km		Feb. '91	Oct. '91
7. Prepare bidding documents, invite the bids, and award contracts for strengthening of the first year maintenance program.	BPR Bank Contractor	Oct. '89	May '90
8. Carry out strengthening of national highways in 1990.	BPR Contractor	May '90	Dec. '90
9. Identify the second and third national highways to be strengthened under the project to be agreed upon:	BPR Consultants		
- for 1991		-	Sep. '90
- for 1992		-	Sep. '91
10. Prepare and issue bidding documents evaluate bids, award contracts and carry out highway strengthening work:	BPR Contractor Consultants		
- for 1991		Oct. '90	Dec. '91
- for 1992		Oct. '91	Dec. '92

KOREA

Annex 3
Part B

ROAD IMPROVEMENT PROJECT

Road Maintenance

List of Road Maintenance and other Equipment

(US\$ Million)

Item Description	No. of Units	Unit Cost	Total Cost	Foreign Percent of Total
1. Weight Scale (hand type)	10	\$22,000	\$220,000	100%
2. Weight Scale (weigh in motion type)	10	\$50,000	\$500,000	100%
3. Tractor-trailer	18	\$80,000	\$1,440,000	80%
4. Crusher	2	\$150,000	\$300,000	80%
5. Self-propelled roller	9	\$50,000	\$450,000	80%
6. Two-way loader	1	\$60,000	\$60,000	80%
7. Self-loader	6	\$70,000	\$420,000	80%
8. Wheel loader	9	\$50,000	\$450,000	80%
9. Motor grader	6	\$90,000	\$540,000	80%
10. Dump truck	1	\$20,000	\$20,000	80%
11. Other equipment			\$600,000	80%
TOTAL EQUIPMENT	72		\$5,000,000	

KOREA
ROAD IMPROVEMENT PROJECT
HOC HIGH PRIORITY PROGRAM AND SELECTED ROADS - DETAILED COST ESTIMATES

Annex 4
Part A

Lot No.	Section Name	Local ----(Won Billion)-----	Foreign -----	Total -----	Local -----(US\$ Million)-----	Foreign -----	Total -----	Economic Rate of Return (ERR)	ROW (Won B.)	Length (km)	Cost per km. (US\$)
I. Upgrading and Widening of National Roads											
GROUP A (upgrading)											
1	Bucheon-Gaehwa *	9.4	8.0	17.4	13.4	11.4	24.8	36%	5.967	14.35	1,728
2	Donghae-Oggye *	1.2	1.0	2.2	1.7	1.4	3.1	13%	0.798	6.85	455
3	Oggye-Gangdong	2.5	2.1	4.6	3.5	3.0	6.5	2%	0.532	9.4	696
4	Gangdong-Gangneung *	3.3	2.8	6.2	4.7	4.0	8.8	12%	1.556	9.55	921
5	Yeoryang-Imgye	7.8	6.7	14.5	11.2	9.5	20.7	9%	1.602	23	898
6	Imgye-Donghae	9.1	7.8	16.9	13.1	11.1	24.2	6%	0.16	21.6	1,119
7	Idong-Wasuri *	5.1	4.3	9.4	7.3	6.2	13.4	14%	1.313	20.78	647
8	Gimhwa-Damogri	5.3	4.5	9.8	7.6	6.4	14.0	5%	0.549	16.5	848
9	Damogri-Sachangri	3.4	2.9	6.2	4.8	4.1	8.9	8%	0.434	13	685
10	Ibjang-Jincheon	3.7	3.2	6.9	5.3	4.5	9.8	11%	0.987	13.83	711
11	Seonghwan-Ibjang *	2.7	2.3	5.0	3.9	3.3	7.2	19%	0.936	12.35	584
12	Chilbo-Sannaee	3.3	2.8	6.1	4.7	4.0	8.7	12%	0.316	11	790
13	Sannaee-Galdam	6.5	5.5	12.1	9.3	7.9	17.2	6%	0.273	11.4	1,512
14	Gwangyang-Oggog *	2.1	1.8	3.8	3.0	2.5	5.5	17%	0.524	11.02	498
15	Jangheung-Hoicheon	2.6	2.2	4.8	3.7	3.1	6.8	10%	0.482	12.77	532
16	Seoggog-Ssangam *	3.7	3.2	6.9	5.4	4.6	9.9	17%	0.562	19.57	507
17	Jangheung-Naju	3.6	3.1	6.7	5.2	4.4	9.6	17%	1.292	19.87	482
18	Gigye-Jugjang	4.8	4.1	9.0	6.9	5.9	12.8	12%	0.588	17.68	723
19	Yeongyang-Jaesan	6.0	5.1	11.1	8.5	7.3	15.8	11%	1.086	30.04	526
20	Jaesan-Hyeondong	3.8	3.2	7.0	5.4	4.6	10.0	9%	0.354	13.76	729
Subtotal for GROUP A		89.9	76.6	166.5	128.4	109.4	237.8		20.311	308.320	771
GROUP B (widening)											
21	Jeongog-Seongdong *	4.8	4.1	8.9	6.9	5.9	12.7	17%	2.42	17.42	731
22	Suseon-Indeogweon *	4.9	4.2	9.2	7.1	6.0	13.1	21%	13.346	10.14	1,291
23	Seonghwan-Pyeongtaeg *	1.7	1.5	3.2	2.5	2.1	4.6	25%	1.006	4.6	1,002
24	Pyeongtaeg-Songtan	6.5	5.5	12.0	9.2	7.9	17.1	17%	2.324	9.3	1,841
25	Gwangju-Seongnam *	6.6	5.6	12.2	9.4	8.0	17.4	54%	3.955	13	1,341
26	Neunggog-Byeogje	8.7	7.4	16.1	12.4	10.6	23.0	15%	3.958	8.45	2,724
27	Byeogje-Euijeongbu	9.2	7.8	17.1	13.2	11.2	24.4	20%	3.081	18.44	1,482
28	Singal-Yongin *	4.7	4.0	8.7	6.7	5.7	12.4	40%	5.25	9.08	1,361
29	Banweol-Gunpo *	1.9	1.6	3.5	2.7	2.3	5.1	29%	1.253	6.52	776
30	Yangchon-Gimpo *	2.5	2.1	4.7	3.6	3.1	6.7	27%	0.645	6.7	993
31	Gimpo-Gaehwa *	3.7	3.1	6.8	5.3	4.5	9.7	44%	3.283	10.3	945
32	Choji Bridge	5.3	4.5	9.9	7.6	6.5	14.1	13%	0.212	3	4,706
33	Samcheong-Donghae *	6.6	5.7	12.3	9.5	8.1	17.6	23%	1.641	16.2	1,084
34	Yangyang-Sogcho *	10.8	9.2	20.0	15.4	13.1	28.5	30%	9.785	17	1,678
35	Sintanjin-Cheongju *	10.4	8.9	19.3	14.9	12.7	27.5	20%	3.202	19.8	1,391
36	Cheonan-Seonghwan *	4.6	3.9	8.5	6.6	5.6	12.1	29%	6.443	12.36	983
37	Hongseong-Yesan	9.7	8.2	17.9	13.8	11.8	25.6	16%	2.55	17.2	1,487
38	Yesan-Sinryeweon	1.1	0.9	2.0	1.5	1.3	2.8	42%	0.48	3.2	873
39	Yeongam-Naju *	10.8	9.2	20.1	15.5	13.2	28.7	25%	2.69	23.6	1,214
40	Songjeong-Bia *	3.4	2.9	6.3	4.9	4.2	9.1	33%	3.197	7.2	1,258
41	Hwasun-Gwangju	5.6	4.8	10.4	8.0	6.8	14.9	14%	2.047	10	1,487
42	Yeongcheon-Gogyeong	5.7	4.9	10.6	8.2	7.0	15.2	17%	2.768	13.6	1,116
43	Gogyeong-Angang	8.1	6.9	15.1	11.6	9.9	21.5	19%	1.275	12.18	1,766
44	Angang-Pohang	7.0	6.0	13.0	10.0	8.5	18.5	18%	1.218	6.72	2,753
45	Chungmu-Sadeung	8.6	7.3	16.0	12.3	10.5	22.8	13%	1.773	18.13	1,257
46	Sadeung-Yeoncho	3.1	2.7	5.8	4.5	3.8	8.3	14%	0.931	10.2	814
47	Yeoncho-Geoje	11.5	9.8	21.3	16.4	14.0	30.4	13%	6.348	11.59	2,619
Subtotal for GROUP B		167.7	142.9	310.6	239.6	204.1	443.7		87.081	313.930	1,413
TOTAL for GROUP A+B		257.6	219.4	477.0	368.0	313.5	681.5		107.39	622.25	1,092

I. Upgrading and Widening of National Roads selected for implementation under the project.

Selected from Group A*	32.3	27.5	59.9	46.2	39.3	85.5	14.08	111.89
Selected from Group B*	72.7	62.0	134.7	103.9	88.5	192.4	55.70	156.50
Selected from Group A+B*	105.0	89.5	194.5	150.1	127.8	277.9	69.77	268.39

KOREA
ROAD IMPROVEMENT PROJECT
Schedule of Disbursements

Annex 4
Part B

Bank Fiscal Year and Quarter ending	Quarterly Disbursements (US\$ Million)	Cumulative Disbursements (US\$ Million)	Percentage of Total (%)	Bank Profile
FY90 -----				
Dec 31, 1989	4.0	4.0	2%	
Mar 31, 1990	10.0	14.0	7%	2%
Jun 30, 1990	10.0	24.0	12%	
FY91 -----				
Sep 30, 1990	15.0	39.0	20%	
Dec 31, 1990	15.0	54.0	27%	
Mar 31, 1991	15.0	69.0	35%	20%
Jun 30, 1991	15.0	84.0	42%	
FY92 -----				
Sep 30, 1991	15.0	99.0	50%	
Dec 31, 1991	15.0	114.0	57%	
Mar 31, 1992	15.0	129.0	65%	56%
Jun 30, 1992	15.0	144.0	72%	
FY93 -----				
Sep 30, 1992	11.0	155.0	78%	
Dec 31, 1992	11.0	166.0	83%	
Mar 31, 1993	11.0	177.0	89%	77%
Jun 30, 1993	11.0	188.0	94%	
FY94 -----				
Sep 30, 1993	6.0	194.0	97%	
Dec 31, 1993	6.0	200.0	100%	
Mar 31, 1994				95%
Jun 30, 1994				
FY95				
				100%

KOREA

ROAD IMPROVEMENT PROJECT

Implementation, Training and Project Monitoring

Land Acquisition and Compensation Procedures

1. The roads to be widened under the project already have the right-of-way (ROW) established. Approximately 14 sections of roads additional ROW of about 4.5 million sq.m. will be required. The survey of the land has been completed and the households affected by the acquisition have been identified.

2. Acquisition. Acquisition of land for public purposes is governed by the "Special Law on Acquisition and Compensation of Lands for Public Use" in force since December 31, 1975. Under this law, MOC, as the implementing agency, makes the initial surveys and investigations of the land required, including the number of families to be displaced, and estimates the value of compensation payable for the property, relocation and other expenses. As soon as possible thereafter, MOC retains two or more licenced land evaluators to make an assessment of the appropriate compensation to be paid to the displaced persons. These independent valuations are made in accordance with the guidelines framed under the Law and are based on the evaluator's professional judgement after considering both market prices and book values based on periodic government surveys. The average of the independent evaluators assessments forms the basis for final negotiations with the affected persons. In the majority of cases, the affected persons will accept the assessments made by the independent evaluators. Where no agreement is reached, the affected parties are entitled to a hearing by a committee set up under the Law in MOC. The Minister of Construction acts as Chairman of the Committee. The general experience is that no more than 10% of the affected people take their cases to this committee, mainly to ask for a reassessment of property values based on anticipated appreciation due to the improvement for which the acquisition is being made. In the rare event of the committee's findings being unacceptable to the parties concerned, recourse is possible to the courts. These proceedings, which take from 6 to 9 months to complete, are seen as fair and reasonable by the general public.

3. Compensation. As explained above, compensation valuations are determined by independent professional assessments based on market and book value. Compensation is payable for both movable and immovable property affected as well as for loss of crops and other amenities, loss of livelihood (on average up to three months of estimated lost earnings), loss of rental deposits and relocation expenses. Compensation is paid to both owners and affected renters.

4. Relocation. MOC not only provides compensation to facilitate relocation but in cases where the number of units to be acquired exceeds 30 within an administrative unit (myeon), undertakes to build alternative housing through local authorities.

5. MOC has developed a realistic and satisfactory plan to accomplish the land acquisition, compensation and relocation affecting some 609 families due to the scheduled work under the project. These costs have been included in project costs and in the analysis of the economic justification of the project. MOC also has the organizational capacity and experience to successfully acquire the land without causing undue hardship and social problems while implementing these important public projects.

Annex 5
Part B

KOREA
ROAD IMPROVEMENT PROJECT

Proposed Overseas Training Program

Training Field	No. of Trainees	Training Period (Months)	Agency of Trainee (For Each)	Estimated Total Cost (US\$)
Long Term Training				
Transportation Engineering, Road Safety & Maintenance	1	3	BPR/RCO	10,000
Highway Capacity Analysis	1	3	BPR/RCO NIHMO	10,000
Pavement Design	1	3	BPR/RCO NIHMO	10,000
Design & Operation of Traffic Facilities	1	3	BPR/RCO NIHMO	10,000
Short Term Training				
Road Safety (Traffic Accident Analysis, Design, Construct. & Operation of Traffic Safety Facilities)	8	1	BPR/RCO NIHMO	48,000
Road Maintenance & Management System, & Bridge Maintenance Techniques	6	1	BPR/RCO NIHMO	34,000
Noise Attenuation	2	1	BPR/RCO NIHMO	12,000
Design of Intersection and Interchange	2	1	BPR/RCO NIHMO	12,000
Road Inventory and Database	2	1	BPR/RCO NIHMO	12,000
Highway Adminis. (Organization and Finance)	2	1	BPR/RCO NIHMO	12,000
Expatriat Trainer for Road Safety				30,000
				200,000

KOREA

ROAD IMPROVEMENT PROJECT

Monitoring Indices

Lot No.	Section Name	Appraisal Estimate		Contract Amount		Work Certified		Share Completed (%)
		Bil.Won	Mil.US\$	Bil.Won	Mil.US\$	Bil.Won	Mil.US\$	
GROUP A (upgrading)								
*	1	Bucheon-Gaehwa	17.4	24.8				
*	2	Donghae-Oggye	2.2	3.1				
	3	Oggye-Gangdong	4.6	6.5				
*	4	Gangdong-Gangneung	6.2	8.8				
	5	Yeoryang-Ingye	14.5	20.7				
	6	Ingye-Donghae	16.9	24.2				
*	7	Idong-Wasuri	9.4	13.4				
	8	Gimhwa-Damogri	9.8	14.0				
	9	Damogri-Sachangri	6.2	8.9				
	10	Ibjang-Jincheon	6.9	9.8				
*	11	Seonghwan-Ibjang	5.0	7.2				
	12	Chilbo-Sanna	6.1	8.7				
	13	Sanna-Galdam	12.1	17.2				
*	14	Gwangyang-Oggog	3.8	5.5				
	15	Jangheung-Hoicheon	4.8	6.8				
*	16	Seoggog-Ssangam	6.9	9.9				
	17	Jangheung-Naju	6.7	9.6				
	18	Gigye-Jugjang	9.0	12.8				
	19	Yeongyang-Jaesan	11.1	15.8				
	20	Jaesan-Hyeondong	7.0	10.0				
GROUP B (widening)								
*	21	Jeongog-Seongdong	8.9	12.7				
*	22	Suwon-Indeogwon	9.2	13.1				
*	23	Seonghwan-Pyeongtaeg	3.2	4.6				
	24	Pyeongtaeg-Songtan	12.0	17.1				
*	25	Gwangju-Seongnam	12.2	17.4				
	26	Neunggog-Byeogje	16.1	23.0				
	27	Byeogje-Euijeongbu	17.1	24.4				
*	28	Singal-Yongin	8.7	12.4				
*	29	Barweol-Gunpo	3.5	5.1				
*	30	Yangchon-Gimpo	4.7	6.7				
*	31	Gimpo-Gaehwa	6.8	9.7				
	32	Choji Bridge	9.9	14.1				
*	33	Sascheg-Donghae	12.3	17.6				
*	34	Yangyang-Sogcho	20.0	28.5				
*	35	Sintanjin-Cheongju	19.3	27.5				
*	36	Cheonan-Seonghwan	8.5	12.1				
	37	Hongseong-Yesan	17.9	25.6				
	38	Yesan-Sinryewon	2.0	2.8				

*	39 Yeongan-Naju	20.1	28.7
*	40 Songjeong-Bia	6.3	9.1
	41 Hwasun-Gwangju	10.4	14.9
	42 Yeongcheon-Gogyeong	10.6	15.2
	43 Gogyeong-Angang	15.1	21.5
	44 Angang-Pohang	13.0	18.5
	45 Chungmu-Sadeung	16.0	22.8
	46 Sadeung-Yeoncho	5.8	8.3
	47 Yeoncho-Geoje	21.3	30.4

477.0 681.5

Selected from Group A	59.9	85.5
Selected from Group B	134.7	192.4
Selected from Group A+B	194.5	277.9

*	39 Yeongam-Naju	20.1	28.7
*	40 Songjeong-Bia	6.3	9.1
	41 Hwasun-Gwangju	10.4	14.9
	42 Yeongcheon-Gogyeong	10.6	15.2
	43 Gogyeong-Angang	15.1	21.5
	44 Angang-Pohang	13.0	18.5
	45 Chungmu-Sadeung	16.0	22.8
	46 Sadeung-Yeoncho	5.8	8.3
	47 Yeoncho-Geoje	21.3	30.4

477.0 681.5

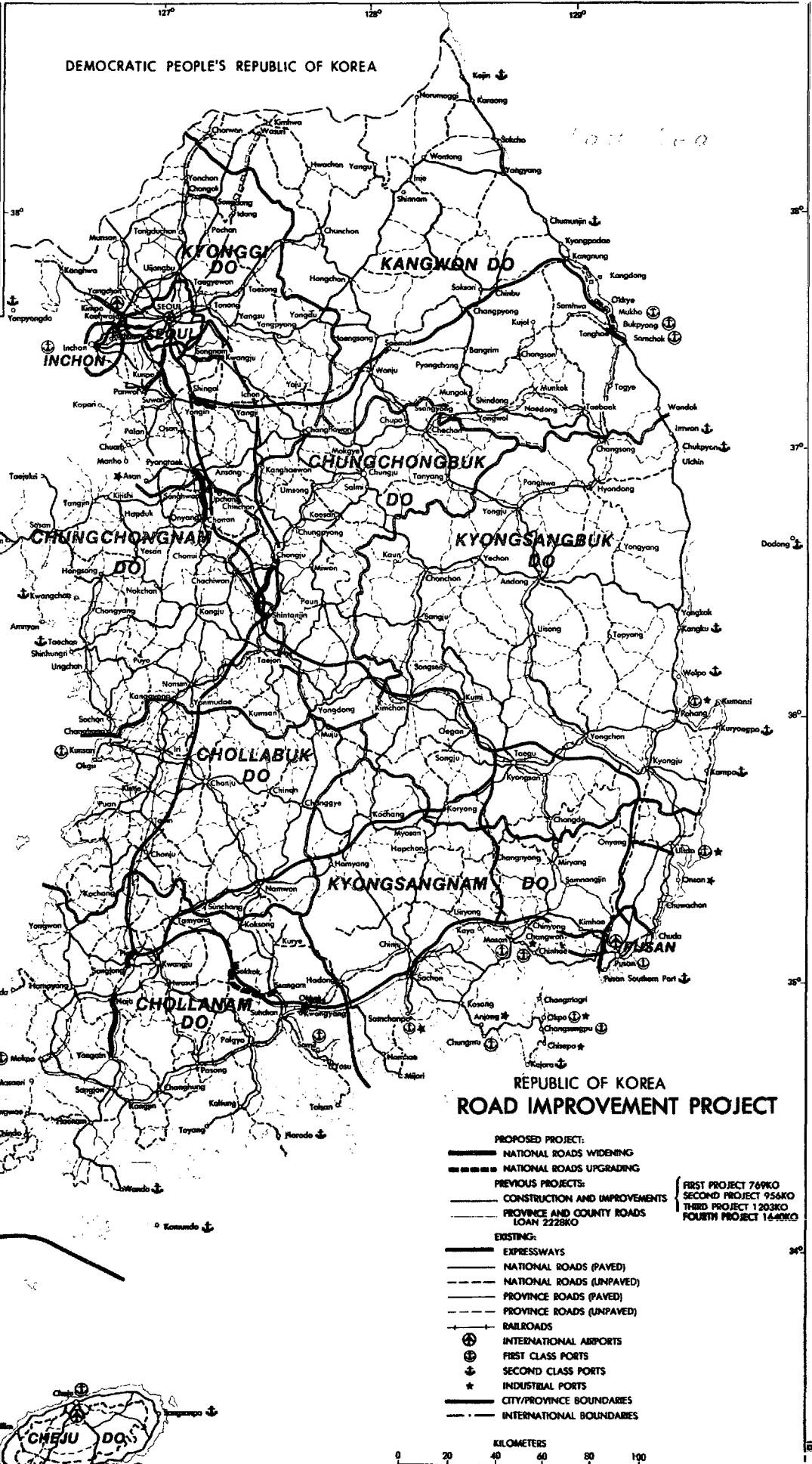
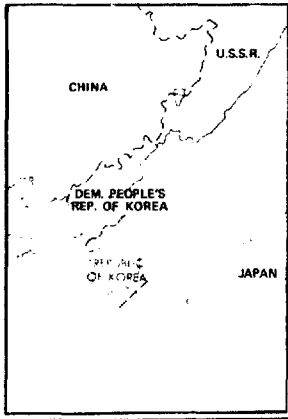
	Selected from Group A	59.9	85.5
	Selected from Group B	134.7	192.4
	Selected from Group A+B	194.5	277.9

KOREA

ROAD IMPROVEMENT PROJECT

Selected Documents and Data Available in the Project File

1. Feasibility Study Report for the IBRD Sixth Road Improvement Project, Korea Consultants International for the Ministry of Construction of the Republic of Korea, September 1988.
 - Volume One General Report
 - Volume Two Sub-project Group A Feasibility Studies
 - Volume Three Sub-project Group B Feasibility Studies
 - Volume Four Appendices
 - Volume Five Drawings
2. Korea Highway Maintenance Management Study - Final Report, Samwoo Engineering/BCEOM-LCPC-KCI for the Ministry of Construction, Republic of Korea, December 1987
3. Road Safety and Design Standards, Ross Silcock Partnership, April 1988
4. National Road Safety Plan, The Prime Minister's Office of the Republic of Korea, original in Korean, unofficial translation in English.
5. Various mission papers and data.



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Yellow Sea

REPUBLIC OF KOREA ROAD IMPROVEMENT PROJECT

- PROPOSED PROJECT:
 - NATIONAL ROADS WIDENING
 - NATIONAL ROADS UPGRADING
- PREVIOUS PROJECTS:
 - CONSTRUCTION AND IMPROVEMENTS
 - PROVINCE AND COUNTY ROADS
 - LOAN 2228KO
- EXISTING:
 - EXPRESSWAYS
 - NATIONAL ROADS (PAVED)
 - NATIONAL ROADS (UNPAVED)
 - PROVINCE ROADS (PAVED)
 - PROVINCE ROADS (UNPAVED)
 - RAILROADS
 - INTERNATIONAL AIRPORTS
 - FIRST CLASS PORTS
 - SECOND CLASS PORTS
 - INDUSTRIAL PORTS
 - CITY/PROVINCE BOUNDARIES
 - INTERNATIONAL BOUNDARIES

FIRST PROJECT 769KO
SECOND PROJECT 956KO
THIRD PROJECT 1203KO
FOURTH PROJECT 1640KO

