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Korea Transport Sector Issues Survey

December 27, 1983

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CURRENCY EQUIVALENTS

Currency Unit = Won

	<u>December 7, 1974</u>	<u>January 15, 1980</u>	<u>September 30, 1983</u>
US\$1	= W 485	= W 580	= 780
W 1,000	= US\$2.06	= US\$1.72	= US\$1.28
US\$1 million	= W 485 million	= W 580 million	= W 780 million
W 1 million	= US\$2,061	= US\$1,724	= US\$1,282

WEIGHTS AND MEASURES

1 meter (m)	= 3.28 feet (ft)
1 square meter (sq m)	= 10.76 square feet (sq ft)
1 cubic meter (cu m)	= 35.29 cubic feet (cu ft)
1 kilometer (km)	= 0.62 mile (mi)
1 kilogram (kg)	= 2.2 pounds (lb)
1 liter (l)	= 1.057 qt (US liquid)
1 metric ton (m ton)	= 2,205 lb
1 revenue tone (rt)	= on average about 600 kg (1,322 lbs)
1 pyeong	= 35.5 sq ft (3.3 sq m)

ABBREVIATIONS AND ACRONYMS

ADB	- Asian Development Bank
BPR	- Bureau of Public Roads
EPB	- Economic Planning Board
FFYP	- Fifth Five-Year Plan
GNP	- Gross National Product
KAL	- Korea Airlines
KHC	- Korea Highway Corporation
KMPA	- Korean Maritime and Port Authority
KNR	- Korean National Railroad
MOC	- Ministry of Construction
MCI	- Ministry of Commerce and Industry
MOER	- Ministry of Energy and Resources
MOF	- Ministry of Finance
MOHA	- Ministry of Home Affairs
MOT	- Ministry of Transportation
SMESRS	- Seoul Metropolitan Electric Suburban Railway System
SET	- Special Excise Tax
TCC	- Transport Coordination Committee
TCO	- Transport Coordination Office
TPO	- Transport Planning Office

FISCAL YEAR: January 1 - December 31

This report is based upon the findings of the Transport Sector Mission which visited the Republic of Korea from March 2 to April 3, 1982. The mission members were:

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Mr. M. Zenick, Senior Loan Officer, joined the mission from March 2 to March 12. Messrs. Ismael Mobarek, Port Engineer, and Jacques Yenny, Senior Transport Economist, contributed to the report based on an advanced mission which visited Korea from February 8 to February 12, 1982. Mr. Hank Yen, Research Assistant, prepared the Statistical Appendix. Ms. Patricia Brereton, Operations Assistant, edited the Report.

Another mission from February 2 to 9, 1983 comprising Messrs. Curt Carnemark, Alain Ballereau, Brendan Kennedy and Manuel Zenick discussed with the Korean Government the main findings of the report as embodied in the Executive Summary. Written comments were prepared mid-July 1983 by Government on the basis of a green cover report issued on April 21, 1983. Further discussions were held in October 1983 with Government and the present final report includes the main comments and responses by Government during that last clarification mission.

KOREA

TRANSPORT SECTOR ISSUES SURVEY

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Executive Summary and Recommendations

1. Despite rapid and substantial progress in the Korean transport sector, many needs remain to be met. The new and more demanding economic environment resulting from the prolonged worldwide recession and increased, temporarily stabilized, fuel costs requires the country to take a more prudent approach than before in developing its basic transport infrastructure so as to optimize the use of scarce investment capital in a very capital-intensive sector. The increasingly complex transport patterns, higher traffic densities, and the growing need to conserve energy and to maintain an expanded system call also for greater efforts than in the past to maximize efficiency of service. In particular, it will be crucial in the years ahead to improve transport planning mechanisms, relax regulation and pricing policies, and streamline agencies' functions to make the sector's development more rational, its operations more efficient and its energy savings substantial.

2. Such an approach appears to be in line with the Fifth 5-Year Plan for 1982-86 which has introduced some fundamental changes in the Government's objectives for national development. Stability, efficiency and balanced regional development are the main new goals. To reach them, the Government intended, and was successful, to fight inflation by putting a lid on its own expenditures and lowering interest rates. It planned to encourage rises in productivity by strengthening economic management and opening up competition. It also intended to decentralize its decision-making process, and thus, to turn away from the past tendency to place almost all government authority at the highest levels. In view of the new perspectives opened by these proposed major changes in direction, it seemed opportune at the start of the new plan to review the status of Korea's transport sector, which plays a critical role in the country's development. This review was to consider, in particular, how Government's new priorities could be supported by further specific policy adjustments and measures that would foster the sector's future evolution.

A. Recent Development of Korea's Transport System

3. Korea's remarkable economic growth over the last two decades has been supported by an impressive development of its transport system. With a GDP of over US\$1,600 per capita, Korea is now-a-days a semi-industrialized country with 56% of its nearly 40 million population living in urban areas and served by a modern transport network. With the exception of recent low growth until 1981, transport demand grew during 1961-78 faster than GNP. Domestic passenger traffic increased thirteen times and freight six times while per capita income more than tripled and real GNP multiplied five-fold.

4. During the past two decades, the former predominant transport role of the railways was replaced by a more balanced distribution of traffic among rail, coastal shipping and road for freight and among road and rail for passenger transport. About half of all passenger traffic is in urban

areas. International trade is served almost exclusively by air for passengers and by sea for freight. Areas for further expansion still remain, however. Road facilities and transport means could be improved in rural areas and near large cities. The development of ports and shipping which was limited to only few areas could be developed further in other areas with good potential. And rail services could further concentrate on the long-distance passenger traffic they can serve best while reducing short-distance traffic that can better be handled by road. Considerable gains in transport productivity could take place in improving complementarity between modes, in particular by providing intermodal terminals.

5. Major transport investments during this period helped to increase and modernize the system's capacity. About 20% to 25% of public capital expenditures were allocated to the sector during four successive 5-Year Plans (1962-81). Large amounts were borrowed from the World Bank and other development agencies to assist in funding public expenditures. Through this assistance, substantial progress was achieved toward a more efficient use of resources. Projects have been better designed, construction quality improved with the rapid expansion of the contracting industry, and maintenance systems have been established for national roads and strengthened for the railways.

6. The Government's development objective in transport was to support economic growth by rapidly expanding the system's capacity. This goal was appropriate for conditions at the time (although it may not in all cases be desirable in the context of current economic constraints). The goal was generally well achieved, and only a few misinvestments occurred. Investments were concentrated on the Seoul-Busan axis where most industrial development has taken place and other corridors serving the northeastern and southwestern parts of Korea. Regional and coastal developments were favored for strategic and economic reasons. Heavy industries relying on sea transport were localized near natural ports. The economic advantages of the various modes were exploited, with rail and coastal shipping increasingly serving long distance traffic and bulk commodities and road transport handling short distance and general cargo.

7. To manage the then limited transport means available, the Government maintained tight regulations most of which are still enforced today. Surprisingly for an increasingly market oriented economy, Korea is still a country where regulatory practice involves rigid operating licensing for road and coastal shipping and administered pricing for all transport modes. The private road vehicle fleet has been kept small through a policy of high taxation on car and gasoline prices. At the same time, the organization and management of the various transport institutions have been either strengthened (for the railways) or established (for the road and port systems). In fact, the railways' efficiency was raised to one of the highest in the world and its tariff system is now being restructured with the objective of making the system financially self-sufficient by 1986.

8. The Bank has assisted Korea in reaching its transport objectives through the provision of technical advice and financing. US\$434 million were invested in seven projects to help modernize and expand rail capacity, and a dialogue was maintained concerning railway investment plans, financial performance and tariff structure. US\$147 million were also invested in two ports projects mainly to introduce containerization in Busan and thus ease the serious, chronic congestion of external trade, and to improve the organization and management of ports. US\$465 million were invested in five road projects and a technical assistance credit to develop and maintain the national road network and, more recently, the provincial and county roads. Policy changes were encouraged that led to more appropriate road standards, weight and vehicle dimensions, and a modified toll system, while institutional improvements strengthened the agencies responsible for project preparation and implementation.

B. Transport Objectives and Programs in the 1980s

9. The Fifth 5-Year Economic and Social Development Plan (1982-86) states Government's objectives and programs for the transport sector that were recommended by a Transport Planning Task Force under the Ministry of Transport (MOT). The main goals are to: (a) selectively increase transport capacity by modernizing equipment and optimizing investments in the sector; (b) enhance transport efficiency by improving intermodal traffic allocation and conserving energy; and (c) strengthen maintenance activities. During the Plan period, GNP is expected to grow at 7.6% p.a. and transport demand is expected to increase by about 47 billion passenger-km and 10 million ton-km, or 50% and 30%, respectively, above actual levels achieved during the Fourth Plan period. Transport investments (both public and private) proposed in the Plan are expected to reach US\$16.3 billion at 1980 prices and exchange rate, or 45% in real terms over outlays under the Fourth Plan. Compared to the Fourth Plan, investments in subways, aviation, road vehicles and ships would be increased significantly, while investment in rail, road and port infrastructure would increase by less than 20%. The Plan proposed major investments to increase transport capacity although its objectives put the emphasis on a more balanced mix of selected capacity increases together with productivity and management improvements.

10. It seems clear now that the original Plan's physical investment targets will not be attained as some substantial cuts were made for rail and port investments at recent semi-annual reviews. A general revision of the Plan was started in July 1983 and will be issued early 1984, reflecting major changes due to budget constraints. These budgetary limitations were already apparent in 1982 and reflected in the Government's intentions, now confirmed, to limit borrowings which has sharply constrained the scope and timing of many investment proposals. Another uncertainty stemmed from the absence of reference in the Plan to the slowdown in economic growth in 1980/81 which had seriously depressed transport demand and was to jeopardize the full realization of the Plan targets as the Plan's base year was over estimated. Although a modest economic recovery was evident late in 1982 (which is followed by more encouraging results in 1983) and very positive signs such as a decline in

inflation and a reduction in the balance of payments deficit, the rapidity of renewed transport growth remains uncertain. In addition, the Transport Plan is really not comprehensive as it excluded major investments for roads by the Ministry of Home Affairs (MOHA) and industrial ports by the Ministry of Construction (MOC) and thus made it doubtful whether the large real increase in funds required to carry out the proposed overall transport investments would be available.

11. In view of the serious funding shortage, Government might have been better off to consider some of the many measures and policies already implied in the Plan to increase productivity in each mode at little cost. In the roads subsector, for example, would it not have been preferable to stretch out the construction of the Olympic Highway and delay the widening of the Daejeon-Chonju expressway or now to consider delaying the further extension of the Chonju-Gwangju expressway in order to ease budgetary pressure? Instead, more urgent projects might be undertaken, such as the construction of expressway sections near Seoul, the improvement of high priority national and provincial roads, and of the county road network, the condition of which constrains rural development. Also, as clearly stated in the Plan objectives, more attention could be placed on road maintenance to preserve the existing network.

12. For the railways, the strategy to give priority to long-distance passenger and bulk freight services which it can serve best is worth being encouraged under the Plan. Suburban services are also worth to be developed in the Seoul Metropolitan Area to provide links with the subway and restrain increased motorization. A more commercial attitude would also be promoted to relieve the growing financial deficit for operations. These objectives all seem sound, but, as with the roads subsector, certain investments to expand capacity seem questionable. Questions have yet to be answered such as whether traffic volume on the Honam line between Iri and Songjeongri, which is now being double tracked, is sufficiently high to merit the large investment being made? Korean National Railways (KNR) made early 1983 some substantial reductions in its investment program which were deemed appropriate to ease its financial difficulties. But KNR could consider other more productive operations such as marketing door-to-door services for container, steel and other bulk products. It is very appropriate in particular concerning the proposed Seoul-Busan high-speed passenger line to find out about its feasibility and timing in the ongoing study.

13. For sea transport, major investments were planned for ships to handle international trade, the mainstay of Korea's export-oriented industrialization policy. But would it be reasonable to maintain 50% of this transport under the national flag, as Government hoped to do, when this would require substantial funding which might otherwise go to more pressing requirements like rural roads? And, although Korean shipping is efficient and a good foreign exchange earner, would it be appropriate to expand capacity at a time of worldwide shipping overcapacity? Port investments are concentrated on few areas but funding shortages have led to postponing construction projects such as the Busan Third Phase container program, giving an opportunity to

streamline cumbersome port clearance procedures and use Incheon Port more fully. But would it be more cost-effective to consolidate the activities of less efficient ports and improve cargo handling whose high costs limit regional development?

14. The problem is similar for aviation which actual traffic growth recorded to date has been less than forecasted. Proposed investments are mainly for the purchase of aircraft to increase capacity, standardize and modernize the fleet, but is this expansion timely in view of the overcapacity and deficits which have hurt Korean Airlines' operations since 1980? The proposed expansion of Kimpo airport, mainly to accommodate the temporary surge in use for the 1988 Olympics, seems unnecessary, as much of this extra capacity will become obsolete when Seoul's new airport is built, probably in the early 1990s.

15. In the same line, large investments undertaken for the subways in Seoul and Busan, though useful, may not have equal priority. Subway construction in Seoul could have been phased so as to first serve high density north-south traffic rather than the long and expensive circular route which was actually started. More attention to design and finances during the initial studies for the subway could also have reduced future operating costs and helped to recover a larger proportion of costs from users.

Major Issues in the Transport Sector

16. Although most of the transport investments proposed under the Fifth Plan pursue development priorities which in our view are right, we believe more could be done to increase the productivity of existing facilities and equipment. In addition to the wide range of measures to encourage efficiency in road maintenance, port management, and railway operations, three main areas deserve specific attention: (a) planning; (b) regulation and pricing; and (c) energy conservation.

C. Institutional Planning Issues

17. Transport planning is generally weak in Korea. The overall plan lacks comprehensiveness, investment proposals are not always consistently treated and appraisal techniques are still somewhat deficient. This weakness has resulted in (a) occasional past misinvestments, (b) the difficulty under the current Development Plan to relate investments to stated development objectives and (c) the exclusion under the Plan of large ongoing and proposed transport investments for local government roads and industrial ports. In the past, the inadequate planning process caused few problems. But, in view of the substantial amounts to be spent, the budgetary constraints, the slower growth of the economy, and the more complicated intermodal transport problems now being faced, planning will be crucial in the future to avoid major misinvestments and to improve the efficiency of investments undertaken. In general, planning has been constrained by four main factors. First, previous Governments have disregarded planning or dealt with it by shortcuts in order to satisfy other, possibly more pressing, political objectives. Second, responsibilities have been fragmented, and this has been exacerbated by a tendency toward bureaucratic isolation. Third, different funding mechanisms

exist, giving relative freedom to revenue-earning agencies compared to those funded from the central budget. And fourth, an effective transport coordinating agency could not be successfully established despite considerable efforts, largely due to the reluctance of agencies to abandon certain practices and institutional privileges. As in other countries, these problems are complex and compounded by vested interests.

18. Suggestions to Strengthen Transport Planning.^{/1} If planning is to be improved, Government should recognize that it is an essential part of government management, and that the decision-making process requires efficient planning at three levels:

- (a) within each agency that must integrate its projects into cost-effective programs;
- (b) between the various agencies responsible for investments in the same mode to ensure consistency and complementarity; and
- (c) among the agencies responsible for investments in different modes to ensure that interdependencies and comparative advantages are reconciled to yield optimal programs.

19. Following from the three primary planning needs are three areas where improvements might be made:

- (a) Improving the quality of planning within transport agencies. There are two fundamental prerequisites for this - a desire to delegate responsibilities and decentralize decision-making (which the current Government now adheres to in principle and increasingly in practice) and - a recognition of the necessity and importance of studies as the key to identifying cost-effective solutions. The high returns gained from studies justify the limited investment required for them and should induce budget reviewers to protect rather than to eliminate them as they now tend to do. Given acceptance of these conditions, a variety of means could be used to improve planning within agencies. Generally, more attention could be directed to master better economic appraisal techniques for pre-investment studies. Also, work could be encouraged on a number of current issues, some of which are identified in this report. Staff skills could be upgraded through appropriate training, and experienced planners, transport economists, intermodal and program analysts, and transport operations specialists could be recruited. And, sector work could be continued through Korean research institutes and local consultants;
- (b) Improving intramodal planning within the road and port subsectors. The problem is confined within each of these two subsectors.

^{/1} In the meantime, parts of these suggestions have been accepted by Government and are embodied in an Action Plan to be implemented under a recently negotiated Highway Sector Loan.

Internal mechanisms, procedures and criteria need to be established to ensure that investments and action programs proposed by the various responsible agencies in each mode are internally fully consistent. While in the past the main planning need was to meet demand, it is now just as important to avoid duplications and gross misadaptation of standards. Institutional mechanisms are required and need to be adapted in each case:

- (i) Road Planning. There is a need first to bring consistency to the road planning done by the various agencies under the Ministry of Construction (MOC) and the planning done by provinces, counties, cities and "special cities" /1 under the Ministry of Home Affairs (MOHA) and by Seoul City. For all agencies, local capabilities to plan and develop the road network could be improved rapidly. As an initial step, a study for integrating national, provincial and county road programs has been agreed under the Bank's recently initiated Provincial and County Roads Project. The study will help to define technical criteria and institutional procedures to be applied in the future. As a second step, studies might be carried out to integrate also city and special cities road programs and to assess whether a unified budget allocation system would be helpful in planning. Would the introduction of such a system facilitate proper intramodal coordination of road development programs by instituting a systematic and equitable allocation of road user charges? Would maintenance recurrent expenditures be given the priority required in budget allocations?
- (ii) Port Planning. There is an urgent need first to ensure consistency and integrate investment plans prepared for general ports under the Korea Maritime and Port Administration (KMPA) and industrial ports under MOC. Later, coordination mechanisms could be introduced to integrate plans prepared for local ports by MOHA and fishing ports by the Ministry of Agriculture (MOA). Many alternative approaches to this problem would be worth considering. One could be to regroup port planning under a high-level body such as the Economic Planning Board (EPB), while the construction and operation of ports could be decentralized in autonomous ports. Another could be to unify all responsibilities including planning and construction under a single ministry while the operation of ports could be decentralized. Another, could be to regroup the planning and construction functions under MOC in a Bureau

/1 The designated special cities under MOHA are Busan, Daegu, and Incheon while Seoul is under the direct jurisdiction of the Government.

of Port Development while the management, operation and maintenance of all ports could be placed under MOT in a reorganized KMPA, the main objectives of this being to maximize the use of port investments and to ensure adequate cost recovery from users. A study is suggested to review alternative institutional arrangements and funding systems for the subsector.

- (c) Improving intermodal planning. There is a need to provide a framework conducive to identifying optimal transport programs. Ideally, all modal plans should be reviewed and integrated to ensure that the most cost-effective transport solutions are adopted, drawing on the complementarity of each mode based on its comparative advantages. Admittedly, very few countries have been able to institutionalize such coordination. If it is to be done, it does not appear, given Korea's institutional framework, that further strengthening of the MOT's planning function should be attempted. Instead, effective coordination in the long run could probably best be organized by the EPB because of its general planning responsibilities and level. The strengthening of EPB's Project Evaluation Bureau, which is already underway, therefore, could result in substantial improvements. In the short term, however, a more direct and practical approach to ensure integrated planning would be to focus on multimodal projects as the means to satisfy transport demand for specific commodities or in specific geographic areas. It was suggested that such multimodal transport projects be developed with the Bank's assistance for the Seoul-Busan Corridor,^{/1} the Seoul Regional Area and the Southeastern Industrial Belt. The institution of ad hoc multidisciplinary groups would put into practice the coordination concept and ultimately would give ideas on how this concept could be institutionalized.

D. Regulation and Pricing Issues

20. Korea's passenger and freight transport services by common carriers are closely controlled by Government through regulations which (a) limit entry into the industry and the provision of services; and (b) set the prices that may be charged. The present system tends to limit competition in commercial road transport and coastal shipping since the restrictions on entering the industry have allowed the existing operators to share the market among themselves. As a result, the still unregulated private sector including individuals and companies transporting their own freight and personnel have become more active, but at a substantial economic cost since the privately-owned vehicles tend normally not to be well utilized. The main justification

^{/1} In the meantime, the Government agreed to this suggestion and had the first two studies started known respectively as the Seoul-Busan Transport Corridor and Highspeed Train Study; and the Kyeonggi Region Multi-Modal Transport Study.

for the present regulation appears to be the average pricing system, imposed on commercial operators, which is uniformly applied for both high-cost or low-cost services. Loss-making services are balanced by surpluses earned on profitable ones. The system can function to the extent that the licensing authority assigns operators a "fair" mix of routes and precludes competition. If competition were allowed, operators would concentrate on the more profitable routes, eroding profit margins and making it impossible for operators servicing unprofitable routes to stay in business. Thus, lifting restrictions on entry cannot be recommended if price controls remain in force and the removal of price controls cannot be recommended unless restrictions on entry are also lifted. Any relaxation in the system would necessarily require a step-by-step program whereby both pricing and entry regulations would be lifted.

21. Road Transport. The Government has embarked on a policy to encourage larger road transport firms that are believed to be more efficient. Existing bus firms are being consolidated into operating units of 300 buses, and further entry into the industry is being restricted. However, the advantage of large units in terms of improved services is not apparent. Further, the pricing of road transport and the present system of road user charges do not permit the system to meet the following commonly-accepted objectives that:

- (a) operators be allowed to charge higher fares for higher-cost services;
- (b) road users pay proportionately for road usage and damage - but in Korea commercial vehicles are virtually untaxed and, in particular, no axle-load tax exists; and
- (c) revenues from fuel taxes be sufficient for expanding the network and ensuring that road transport prices do not distort demand from other modes such as railways or coastal shipping - but in Korea the excise tax on diesel fuel is only 5% of the tax on gasoline.

It would seem clear that road user charges should be revised, and it was suggested that Government sponsor an in-depth study to determine actual road costs, who pays for them, and how the contribution of each road user should be reapportioned to better reflect the damage inflicted on the road by the users. This recommendation has met the agreement of EPB and MOC. Terms of reference have been prepared and the study will be implemented in 1984 under the Highway Sector Loan just negotiated.

22. The present system with all these anomalies is not working to serve Korea's best economic interests. The regulations have not helped to give better service to transport users who increasingly avoid common carriers and the regulated system by operating their own vehicles. Since 1977, the growth of private trucks has been five times higher than for vehicles for hire. If left as it is the system will deteriorate further, leaving commercial oper-

ators with only the more difficult and costly jobs. The option for the authorities is either to prohibit private firms from operating their own vehicles - which is not feasible - or to relax gradually the regulatory and pricing system.

23. Suggestions to liberalize road transport regulations. There are a number of ways to improve the system. It might be desirable to first remove the obligation that commercial operators must serve unprofitable routes by allowing the introduction of other more appropriate forms of transport. Competition could then be opened up on profitable routes by withdrawing licensing and pricing regulations at least for intercity transport. It might be advisable to proceed as follows:

- (a) improve efficiency by relaxing the regulations governing the fleet size of commercial bus and truck operators and the type/size of vehicles that may be used;
- (b) promote earnings of buses by allowing them carrying other freight in addition to accompanying baggage, especially in rural areas;
- (c) remove requirements (and related operating subsidies) for buses in rural areas to operate on unprofitable routes by allowing local people to provide unscheduled transport services with smaller and cheaper vehicles;/1
- (d) reduce peak-hour loads on regular carriers in urban areas and related high capital cost by promoting wider use of informal passenger services (car and van pools, company-owned buses, etc.); and
- (e) adjust the level of the excise tax on diesel fuel relative to the tax on gasoline, with a view to reaching a reasonable level of cost recovery from road users. This would warrant a thorough road user charges study as suggested above.

Government officials in MOT do not entirely concur with the principles set in the above analysis. They have problems with the immediate need to deregulate the road transport industry since it is believed that "a minimum of regulations would help operators to be more efficient and would avoid chaos due to free competition." MOT has stressed the need to proceed with caution to harmonize any relaxation effort with the overriding price stabilization policy and to avoid confrontation with the vested interest of operators. It is thus desirable to study carefully the economic costs associated with the present regulation system in the trucking industry in order to determine the most harmful and unnecessary rules that could be gradually removed through an

/1 An experiment is now about to be conducted by MOHA for a two year period under agreement in the ongoing Provincial and County Roads Project.

implementation program.^{/1} In the meantime, some of the measures suggested above could be introduced before completion of the study.

24. Other transport modes. A few operating restrictions, low tariffs, and uneconomic services are imposed on the railways. To allow them to perform better financially and to realize their full economic benefits, the following measures could be considered:

- (a) all shippers ought to have access to the railways services through any commercial road transport firms, rather than through the one shipping firm now so authorized;
- (b) Government ought to fully compensate the railways for uneconomic services which they are required by Government to perform;
- (c) tariffs for "ordinary" (i.e., short-distance) passenger trains ought to be set so as to cover total operating costs as all other traffic; and
- (d) preferential tariffs could be introduced to attract commuter passengers to off-peak hours, or a surcharge could be imposed to dissuade them from increasing congestion during peak hours.

25. Coastal shipping is more strictly regulated than land transport. Licensing and pricing are controlled to protect small operators. This is a commendable social goal, but it perpetuates inefficiencies in the sector. Subsidies are also given through low port user charges, tax concessions, low interest loans and direct compensation for services to remote islands. The present regulatory system appears to protect inefficient and outmoded operations and to inhibit the introduction of larger and more efficient ships. To avoid regulations which are more likely to serve the interest of shipowners than the public, the following measures could be considered:

- (a) increase port user charges to cover maintenance and operating costs for all ports and to cover part of the capital cost for Busan and Incheon, which could both be established as autonomous ports;
- (b) phase out the rules prohibiting the transport of freight at rates below those established by MOT;
- (c) progressively relax the rules preventing entry of new operators and setting maximum charge in coastal shipping; and

^{/1} The study is to be conducted under MOT in 1984 as part of the Action Plan to be implemented under the Highway Sector Loan just negotiated.

- (d) introduce analytical cost accounting and routinely publish port revenues and expenditures.

26. Aviation is regulated through fares and the opening of new lines. Since air transport costs are not fully covered by users, the following measures could be considered: introduce variable air fares to ensure higher capacity utilization, and routinely publish airport revenues and expenditures.

E. Transport Energy Issues

27. One of the objectives of the current 5-Year Transport Plan is to conserve energy, an objective which is supported by the Bank. As Korea's energy needs grew rapidly from 1962 onward, its dependence on imported oil increased dramatically to 60% of total energy consumption in the early 1980's. Crude oil represents about a third of all imports and costs US\$6.2 billion p.a. or 11% of GNP. Due to its industrial structure, climate, and restrictions on the motorized fleet, the transport sector consumes only about 20% of total petroleum consumption, much less than in most other countries. Road vehicles account for nearly 70% of this consumption and thus have the most potential for achieving savings. A caution is in order, however. Energy is only one of the resources used in transport, accounting for 15-30% of total costs, and the proper aim of energy conservation should be to minimize the cost of transport to the economy not simply to save energy.

28. In 1977 the Government established the Ministry of Energy and Resources (MOER) to develop, with other agencies, policies to cope with the energy needs for sustained economic growth. Focus was put on securing stable energy supplies, substituting less-costly fuels and establishing conservation programs and research for alternative resources. So far, most emphasis has been placed on the supply side. In the Fifth Plan, conservation efforts on the demand side center on the industrial and residential sectors where results could be obtained more rapidly. However, there are few concrete proposals to conserve energy in the transport sector, although studies have been recommended for the establishment of optimum modal travel distances, for the construction of 30 freight terminals, and the introduction of more fuel-efficient automobiles (i.e., 17 km/l compared to 12 km/l at present).

29. Further efforts to promote energy conservation in the transport sector are likely to be less obvious and more difficult to carry out. Transport, however, is one of the areas in which energy consumption is likely to increase very rapidly unless economic measures are introduced to encourage more efficient uses of fuels. It appears that the most effective tool to induce energy conservation in the transport sector would largely rely on market mechanisms, provided that fuel pricing reflects economic costs. At present, prices of petroleum products are controlled at both the producer (ex-refinery) and consumers levels and price deregulation would be required at both levels. Further, the present regulatory environment in the transport industry does not appear to be an ideal framework to encourage competition that would lead to more fuel efficiency in organizing shipments on appropriate

size trucks and avoiding empty back haul; it thus may be desirable to relax certain regulations. In addition, numerous other measures could be considered to strengthen the institutions involved and to alert road transport operators to the availability of fuel conserving devices and methods that may lead to large savings in fuel expenditures - on the order of US\$150 to 200 million p.a.

Suggestions on Fuel Pricing

30. It is suggested first that Government consider approaching the energy problem in transport by putting primary emphasis on charging consumers a price (net of tax) that fully reflects the scarcity value of energy to the economy. It is commonly agreed that the most satisfactory standard for setting relative prices is provided by the actual opportunities for buying goods and services in the world market. At the present time, Korea's domestic ex-refinery prices of gasoline and LPG are not closely geared to international prices and are on average higher, with marked difference between products reflecting past inefficiencies, import controls and past pricing interventions. It is clear also that the production decisions of refiners are affected by Korea's controlled prices (or by certain inequalities in the tax treatment of different fuels which entail substitutions that were not necessarily intended by the Government). Refiners as well as other producers in the country have probably made choices that are not in line with the comparative advantages of Korea. It is thus suggested that fuel prices be gradually geared to the CIF price of imported fuels, i.e., gasoline, diesel oil, and liquefied petroleum gas (LPG). Resolving this problem would require de-controlling petroleum prices, so as to prevent excessive market control over domestic prices by a small group of refiners. This recommendation is in line with the Government's ongoing dialogue with the Bank and a number of measures are being implemented under the Structural Adjustment Loans (SAL I and II).

31. It is suggested, second, that Government consider road infrastructure cost recovery through a blend of user charges on fuels and other vehicle specific fees that relate to actual use of (or damage to) the roads (see para. 21). In most countries, fuel pricing is also set to allow raising revenues to meet the costs of building and maintaining roads and bridges. In a few instances costs are recovered through tolls where users are charged directly, but in most cases, they are recovered indirectly, either through various vehicle licensing fees and/or from user charges added to the cost of fuel, or from general taxes. Low fuel prices that do not recover costs are thus likely to result in inefficient resource allocations, through an uneconomic modal choice favoring artificially cheap road transport against more economical and energy-efficient transport like the railways, for example. Although expenditures on Korea's national roads are to increase only moderately in real terms during the Fifth Plan period, very substantial increases in expenditures on rural and urban roads are projected, requiring substantial increases in total real expenditures in the roads sector. Thus

the level and structure of road user charges would merit close study. While Government has accepted such a study it has indicated that the readjustment of gasoline and diesel prices towards a more economic relationship may be constrained by the possibility of substitution posed by the large volume of low-tax kerosene used by households.

32. Further, fuel pricing, besides meeting economic ex-refinery fuel and roads costs, generally includes a third element - taxes - that are levied on transport users. A tax is a charge that is not related to the cost of resources used by the person who pays the tax, but this is often not recognized and user charges are often misleadingly referred to as taxes. The tax level may of course influence consumer demand, including the demand for automobiles. The Bank does not have a firm view on an optimum rate of motorization for Korea; it has, however, urged the Government to study the costs as well as the benefits of a more rapid motorization than has so far been permitted. Excise taxes beyond the level required for road user charges could also be justified by distributional objectives. However, there are limits to the differential taxation of various fuels if one wants to avoid uneconomic substitutions or even fraud.

Suggestions to Improve Fuel Efficiency in Transport

33. The regulation of the trucking industry strongly affects both the quality of services (para. 22) and the volume of fuel consumed in transport. For example, one third to one half of all truck trips consist of empty back-hauls due to trucking regulations that prohibit private trucks from carrying any cargo other than their own. Deregulating the trucking industry, in line with the Government's new philosophy of leaving more importance to market mechanisms to adjust supply and demand, would next to liberalizing trade in petroleum products, probably be the single most important energy conservation measure in the transport sector. It would, in addition, save a substantial amount of capital, as the utilization and efficiency of the existing vehicle fleet would increase.

34. A correct pricing system and a market orientation of the trucking industry do not exhaust the subject of energy use in transport, nor does this imply that everything can be left to the market. A case in point is the present situation in the domestic automobile industry which enjoys nearly complete protection against foreign competition. At the same time, Korean automobiles are significantly less energy-efficient than present world standards. If it is the policy of the Government to further protect the automobile industry from foreign competition for reasons of industrial policy, i.e., infant industry protection, then more thought needs to be given to the question of how world fuel efficiency standards could be achieved, and what the costs of the present policy are, if world standards are not to be reached rapidly by the domestic vehicle manufacturing industry.

35. A number of measures could also be considered concerning institutional strengthening that will require more planning and time, while other

measures resulting in immediate savings could be implemented very soon. With regard to the institutional framework for energy conservation, the now rather dispersed responsibilities for planning and management could be strengthened in many ways, for example:

- (a) MOER could take the lead in developing an energy management program comprising fuel consumption forecasts in the transport sector. It could fill the coordination function in this area which could be defined and organized through an inter-ministerial agreement. For example, it could direct, schedule and monitor all research, studies, and development efforts and action programs to increase fuel efficiency in the transport sector carried out by other agencies;
- (b) the preparation of short- and long-term transport energy conservation studies, and necessary background studies, could be undertaken under the responsibility of the Ministry of Transport (MOT), while decisions for action programs should be taken jointly by MOER and MOT. Implementation could be organized through the Korea Energy Management Corporation (KEMCO), private operators, trade associations, manufacturers and monitored by MOT, MCI and MOF according to their area of responsibility;
- (c) energy conservation criteria could be developed by MOER and be adopted by all agencies as standard elements of any evaluation procedure in preparing investment plans. Targets for conservation could be reviewed regularly and criteria adjusted as required;
- (d) research and studies should be carried out. In road transport, a study could focus on how to improve fuel efficiency through better truck utilization to avoid the present proliferation of private and small trucks (para. 33). The deregulation of commercial trucking appears to be one of the most needed measures; and
- (e) MOER ought to closely monitor the effect of alternative fuel pricing on consumption levels with a view to encourage savings and maintain neutral taxation. In particular, the rising marginal cost of producing diesel fuel should be closely monitored and be reflected in the pump price to avoid distortions from demand that does not reflect the cost of supply.

36. Many other areas have high potential for immediate energy savings. Policies focusing on operator education and promoting incentives are highly recommended, in particular to:

- (a) promote information campaigns to sensitize the general public, shippers and operators of the energy implications of travel decisions, product distribution and transport grouping;

- (b) disseminate information on conservation devices produced overseas and encourage their local production;
- (c) develop driver training programs emphasizing fuel-efficient operating techniques and introduce driver motivation programs;
- (d) discourage individual utilization of cars and improve rail, bus and car pool alternatives; and
- (e) encourage truck and bus manufacturers to incorporate new engine technologies being developed overseas, or lift import restrictions, and set minimum fuel-efficiency standards for new vehicles.

F. The Bank's Future Role in the Sector

37. The Bank's involvement in Korea's transport sector has been substantial in the past and should remain so in the years to come. As significant progress has been made in project design and implementation, the Bank could now focus its assistance more on institutional and policy improvements, and such an emphasis would justify a continued role by the Bank in the transport sector. In particular, the sector's productivity could be considerably increased with the introduction of more effective policies in the areas discussed above, i.e., investment planning and coordination, regulation and pricing, and energy conservation. Such a shift in emphasis could be achieved by moving away from the past project approach to a sector approach.

38. A sector approach in transport means that a time-slice of a subsector investment program, such as road or maritime transport, could be partly financed by the Bank, contingent upon specific understandings with the Government concerning the development strategy and the broad outlines of the subsector program. In particular, it would require that various agencies implement a number of agreed institutional and policy measures designed to improve efficiency in the subsector. The main objective of the sector approach would be to improve the planning and policy framework to promote better utilization of transport facilities with a view to optimizing their efficiency. A sector approach could, in particular, help to focus on inter- and intra-modal pre-investment studies that are required to improve consistency among plans and to prepare multi-modal projects that ensure complementarity among modes. Also, it could help in introducing more rigorous economic principles in the review of transport policies.

39. The most important objectives that could be pursued in sector lending would be to:

- (a) improve intra-modal transport planning agencies for roads and ports to gear the development of major national facilities to rural and local requirements;

- (b) encourage inter-modal planning coordination and enhance complementarity of modes through the development of multi-modal regional transport projects;
- (c) integrate and coordinate investment programs through a more appropriate institutional framework;
- (d) gradually relax licensing regulations and controls on fares to allow free entry and encourage competition among transport operators to improve the quality of service, keep fares low, and reduce fuel consumption;
- (e) discourage the practice of subsidized services for rail, sea and road transport through the promotion of more cost-effective services;
- (f) adopt more realistic pricing levels by generalizing cost-based fares for the railways;
- (g) adjust user charges for roads and ports to more closely reflect actual use of (or damage to) the facilities;
- (h) adopt more realistic fuel pricing for transport by adjusting tax relationships on diesel, gasoline and LPG to encourage efficient energy use;
- (i) encourage the production of more fuel-efficient vehicles;
- (j) inform transport operators about fuel conservation techniques;
- (k) encourage selective shifts of traffic to more energy-efficient modes; and
- (l) consolidate the institutional functions and responsibilities relative to energy use in the transport sector.

40. Each of these main objectives corresponds to a set of specific measures recommended in the preceding pages. A comprehensive and policy oriented dialogue between the Government and the Bank will help to define how to gradually tackle selected groups of objectives in the course of carrying out the lending program. Some of them are being pursued already through earlier projects or through the Structural Adjustment Loans (SAL). To support the dialogue and delineate how the issues can be dealt with most effectively, a number of studies ought to be undertaken by the Government, with the assistance of consultants and Korean research institutes.

41. The Bank's current transport lending program for Korea includes four proposed projects. They are the Highway Subsector Project scheduled for FY84; a Ports Maritime Subsector Project for FY86, Kyeonggi Multimodal Transport

Project for FY86 or FY87, and a Second Highway Subsector Project for FY87 or FY88. However, only the first project is prepared and about to be presented to the Board; therefore, there is a need to agree with Government on a suitable and timely preparation for the remaining three projects so that the tentative schedule can be met.

42. Further, it is also timely to come to a clearer understanding of the Bank's role in the identification and preparation of future projects through the conduct of necessary studies. In particular, a study to improve transport systems in the Seoul-Busan Corridor has started with financing under the Seventh Railway Project and may lead to substantial investments to increase transport capacity in the corridor. Another study for integrated transport in the Kyeonggi Province around Seoul City is about to start and may lead to important investments in suburban transport facilities comprising road, rail and terminals. A third study is highly recommended to address the transport needs of the Southeastern Coastal Industrial Belt from Pohang to Suncheon where coordinated investments in expressways, roads, railways, and related terminals could minimize total costs. With respect to urban transport, loans are currently planned in FY85 and FY87 or FY88.

43. In the highways subsector, loans would mainly assist in integrating road planning, introducing adequate road user charges and fuel prices, promoting efficient energy use, and liberalizing regulations to improve operators' efficiency (including services in rural areas). Financing could be directed to further improve road maintenance, pave and construct high priority roads, erect multimodal terminals, establish mapping facilities and automate vehicle licensing, etc.

44. In the maritime transport subsector, loans would mainly assist in integrating port planning, further promoting shipping for local bulk transport, liberalizing licensing of routes and pricing, speeding up port clearance and introducing cost-based port charges. Financing could be directed at port investment programs aimed at further developing growth poles in coastal areas, continue port containerization, and strengthen local shipping companies to better manage their fleet.

45. The new multi-modal transport projects are practical ways to deal with the planning and coordination issues, and to address transport needs within specific geographic areas. In addition, other objectives could be pursued such as local deregulation of transport, adequate user charges, utilization of the most energy-efficient modes, etc. Financing could cover broad investment packages, including road/rail/suburban trains/maritime facilities and equipment.

46. The preparation of any of the proposed subsector loans or multi-modal projects will require that essential preinvestment studies be carried out. The timing of project implementation within the 1980s makes it urgent that preparation and detailed engineering studies be agreed upon and carried out in a timely manner. The cost for such studies can easily be recovered

from the identification of least-cost solutions to the benefit of both the Government and users. With a more efficient transport system, Korea would be better poised to continue its remarkable economic development, but this will happen only if supportive institutional measures and policies are implemented.

1. INTRODUCTION

1.01 Over the last two decades, Korea's economy has experienced fundamental changes that in turn have deeply affected the transport sector. Since 1963, the World Bank has assisted the Government in meeting these changing transport needs by providing 15 credits and loans totalling about US\$1.2 billion. These investments have made major contributions to the expansion of transport infrastructure, the development of transport policies and the strengthening of transport institutions. Mutual pride and satisfaction have resulted from this fruitful cooperative effort.

1.02 However, a less favorable worldwide economic environment has evolved which has made the solutions in meeting transport requirements both more costly and complex. The recent recession (1980-81) that slowed Korea's economic growth, reflected basic structural problems in the economy as well as temporary adverse circumstances. To overcome these problems, major adjustments in government development policies were required and implementation is in progress. Improvements in productivity are needed to match high salary and oil price increases; furthermore, increased research and vigorous quality control are necessary to restore Korea's trade growth. In the transport sector, more sophisticated development policies and investment strategies are needed to address the new and major difficulties now emerging which reflect the sector's more advanced stage of development.

1.03 It is in this context that this Transport Sector Issues Survey has been carried out. Its main objectives were to assess the past achievements in the sector and to evaluate the developmental needs that lie ahead. From this analysis of current strengths and weaknesses, the survey defines the issues areas where the Bank could provide Korea with meaningful support in strengthening its institutions and developing its policies. The timing of this survey coincided with the launching of the Fifth Five-Year Economic and Social Development Plan (1982-86), which constituted an appropriate base from which the lessons of past experience could be measured. From there, the perspective to provide a continuing support to the Government's Transport Plan could be outlined as a set of new objectives that would justify the Bank's future lending operations.

1.04 Since the Bank has a fairly good knowledge of Korea's transport sector from previous studies,^{/1} this report does not present a comprehensive review of the sector, but rather focuses on a few important issues. Those issues were identified during discussions with Government, and concern

^{/1} Growth and Prospects of the Korean Economy: Transport, February 23, 1977, Report No. 1489-KO, World Bank.

investment planning, the regulatory system, and the energy efficiency of the sector. More specifically, after reviewing the recent transport developments in Chapter 2, the survey analyzes:

- (a) the government objectives and transport development strategy embodied in the investment program of the next Five-Year Development Plan (Chapter 3);
- (b) the need to strengthen the institutional framework and decision making process in the transport sector to ensure better planned and coordinated policy measures and investment programs (Chapter 4);
- (c) the scope for policy adjustments in the present transport regulatory and pricing systems, particularly those which could better promote intermodal competition, benefit transport users in rural areas, and allow improved cost recovery of public operators (Chapter 5); and
- (d) the present energy efficiency in the transport sector and the scope for conserving energy through pricing and other measures including the future role of different modes under the prevailing conditions of relative fuel scarcity (Chapter 6).

1.05 Through the evaluation of the proposed Development Plan, three main issues are identified and recommendations are made on how the Government might remove existing deficiencies. The first issue identified concerns the Government's approach to transport planning and the institutional limitations on the quality and effectiveness of transport coordination. The second issue concerns policies for deregulation and cost recovery in each mode and relates directly to the Korean transport users' need for lower transport costs and better services. The third issue concerns policies for energy conservation, with the aim of reducing operating costs and limiting the increasing foreign exchange requirement for imported petroleum. Chapter 7 of the report discusses how the Bank might help Government to solve these problems. The future role of the Bank in the transport sector is then redefined, and new projects are proposed for inclusion in the Bank's lending program. The rationale for the Bank's future involvement would no longer be to help Korea in increasing transport capacity, but rather to promote and implement desirable policy and institutional changes.

1.06 While this report can be used as a reference document for future Bank actions, it is principally intended to promote a policy dialogue between the Government of Korea and the Bank. Thus the rationale of some of the transport sector policies advocated by the Bank are explained and substantiated by the necessary analyses. The recommendations presented are geared to practicality and ease of implementation.

2. THE DEVELOPMENT OF KOREA'S TRANSPORT SYSTEM

2.01 The remarkable economic progress made by Korea over the last two decades has been supported by an impressive development of its transport system. At the beginning of the 1960s, Korea was a poor, rural, developing country, dependent on agriculture as its main source of income. The main means of transporting goods and passengers were the railways which were built at the beginning of this century by the Japanese and rehabilitated following the Korean War. Today, with a GDP of over US\$1,600 per capita, Korea is a semi-industrialized, middle-income country with 56% of its 40 million population living in urban areas and served by a modern transport network. The railways have continued to grow in absolute terms but are no longer the primary transport mode. A diversified road network has been developed, and paved national roads have more than tripled during the last decade. The share of coastal goods transport in total traffic has also increased markedly, primarily due to the movement of oil products. The country's export drive and reliance on foreign trade have led since 1970 to a fourfold increase in the volume of port traffic and an over sixfold increase in Korea's international shipping fleet.

A. Size, Growth Trends and Structure

2.02 The transport sector has an important place in the Korean economy. In 1980, nearly 26% of gross domestic capital formation went to transport compared to 24% in 1971, and its contribution to the Gross National Product (GNP) was 7% in 1980 compared to 5% in 1971 (Tables 1.1 and 1.2). Transport demand during the last two decades has generally exceeded the GNP growth rate. During 1961-78, real GNP grew by 10% p.a. and per capita income more than trebled in real terms, while domestic passenger traffic increased thirteen times and freight six times. Specifically, traffic grew very rapidly for road, aviation and express rail passenger traffic and for road and maritime freight transport as shown in the table below.

Table 2.1(T). AVERAGE ANNUAL DOMESTIC TRAFFIC GROWTH (%)

(in pass-km & ton-km)	<u>Road</u>		<u>Rail</u>		<u>Sea</u>		<u>Air</u>	
	<u>Passen- ger</u>	<u>Freight</u>	<u>Passen- ger</u>	<u>Freight</u>	<u>Passen- ger</u>	<u>Freight</u>	<u>Passen- ger</u>	<u>Freight</u>
1962-66	19.9	11.6	10.0	9.3	7.6	36.7	25.0	-
1967-71	14.9	44.7	0.2	7.5	5.5	50.2	41.7	-
1972-76	13.6	13.1	10.3	4.4	(0.6)/a	3.5	(2.6)	(2.5)
1977-81	9.2	9.1	8.5	2.2	14.0	7.5	15.1	26.5

/a Figures in brackets are negative growth rates.

2.03 Since 1979, however, the growth in transport demand has declined due to a general economic recession in the country brought about by a variety of factors including: a transition in political leadership, sharp price increases of imported oil, high interest rates and difficulties in expanding the volume of exported manufactured products. As a consequence, traffic growth generally slowed down, particularly road freight to 9% p.a. during 1977-81 and railway freight to 2% p.a. over the same period. Passenger traffic was also affected on all modes except for sea and air transport. Some encouraging signs of resumed growth are being observed since 1983, particularly with the high sales of automobiles.

2.04 During the period of intense economic growth, the structure of the transport system evolved rapidly and adjusted to the demand shifts among modes. This was made possible by a development strategy that rapidly increased and modernized system capacity through the allocation of large capital budgets in the development plans since 1967 (Table 1.3). As a result, the railway's predominant role in the past was replaced by a more balanced distribution of traffic among rail, roads and coastal shipping. Traffic statistics (Tables 1.4 and 1.5) summarized in the table below illustrate this evolution over the period 1961-81.

Table 2.2(T): EVOLUTION IN DOMESTIC TRAFFIC DISTRIBUTION

	Passenger (pass-km)				Freight (ton-km)			
	Road	Rail	Sea	Air	Road	Rail	Sea	Air
1961	45.5	53.0	1.3	0.2	8.2	88.2	3.6	-
1981	73.9	23.6	0.5	0.6	35.0	37.5	27.5	-

2.05 Nearly half of all road passenger traffic is within urban areas, but this share will be significantly reduced with the opening of the Seoul and Busan subways. International passenger traffic is almost entirely served by air transport and grew at over 30% p.a. during 1962-76, but slowed to 9% in 1977-81; international freight is almost entirely served by sea transport and grew at 18% to 32% p.a. during 1962-76 and 15% in 1977-81 (Table 1.6).

2.06 These structural changes reflect both the economic advantages of the various modes and the different growth rates experienced by the industries served. In general, rail and coastal shipping increasingly are concentrating on long distances and bulk commodities, while road transport handles short distance and more general cargo. Domestic freight by all modes in 1982 amounted to 430 million tons and 30 billion ton-km, compared to 32 million tons and 4 billion ton-km in 1961. Bulk commodities represented over 42% of the tonnage transported. Anthracite and cement with 28 and 20 million tons, respectively, are the main bulk commodities and are

chiefly transported by the railways, which handle 70% and 48% of this traffic, respectively. Oil is the third largest bulk commodity with nearly 19 million tons, 63.3% of which is transported by coastal shipping. Road transport carries mainly grains, fertilizer and lumber over relatively short distances (Table 1.7).

B. Recent Transport Investment Strategy

2.07 The Government's basic strategy in the transport sector has been to increase the system's capacity fast enough to support economic growth and avoid bottlenecks. A large proportion, up to 23%, of planned capital expenditures was allocated to expand and modernize transport infrastructure from 1967 to 1977 when it was tapered to around 15% in the Fourth and Fifth Plans. The investment allocations increased sharply in current prices from W 150 billion in the Second Plan to W 2,800 billion in the Fourth. Actual expenditures were even higher, at least in proportion to overall expenditures, as they ranged from 20% to 27% (Tables 1.8 and 1.9). Investments have been concentrated on the Seoul-Busan axis where most industrial development has taken place and on corridors in the northeastern and southwestern parts of Korea.

Policy Objectives

2.08 The investment strategy aimed at establishing a reasonably balanced system and limiting uneconomic allocation of traffic among the various modes. In addition to transportation objectives, these investments have been linked to broader concerns in Korea's spatial and economic planning. In particular, considerable efforts have been made to develop new industrial complexes in coastal areas to take advantage of Korea's natural potentials in harbors and to exploit low-cost coastal shipping while avoiding excessive congestion on road and rail. Moreover, to ensure that scarce transportation means appropriately meet development priorities, the Government has maintained fairly tight regulations on the sector. Strict licensing of operators in road transport and shipping, and administered pricing for all transport activities were introduced and are still enforced today. Korea discouraged motorization through a policy of high taxation of domestic cars and high prices for gasoline.

2.09 To complement the large investments made to develop a basic transport infrastructure, the Government made a considerable effort to improve the efficiency of institutions responsible to plan, construct, maintain and operate the new facilities and services. In the public sector, institutions such as the Korean National Railroad (KNR) have been strengthened and others established such as the Bureau of Public Roads (BPR) in the Ministry of Construction (MOC), the Korean Highway Corporation (KHC), and the Korean Maritime and Port Authority (KMPA). In many instances, their financial and

managerial responsibilities have been raised to allow them to operate as semi-autonomous public corporations. In the private sector, a highly efficient contractor system has evolved for civil works which reflects both the insistence on competitive bidding in the award of contracts as a matter of policy, and the large volume of construction work 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; in 1981, Korean contractors won overseas contracts valued at US\$13.6 billion.

The Past Investment Plans (1962-81)

2.10 The structural changes in the transport system have been brought about through the implementation of four plans from 1962-81. The First Plan (1962-66) devoted about half of transport investments to modernize and strengthen rail system capacity. Some 275 km of industrial track were built (Tonghae Puku line); the conversion from steam to diesel traction was started with large imports of locomotives and diesel rail cars; the fleet was modernized with large imports of passenger and freight cars while a large number were locally made. The Second Plan (1967-71), in contrast to the First, devoted about 60% of transport investments on highway improvement. Some 655 km of expressways were built (Seoul-Busan, Ulsan-Onyang, Seoul-Incheon and Daejon-Chonju) and the motor vehicles fleet increased by nearly 100,000 units. In the railway sector, 180 km of new tracks were constructed (Kyonggon line), and 50 km doubled-tracked (Honam line); the fleet continued to expand with very large imports of diesel locomotives, passenger and freight cars, while more were built locally and rehabilitated. In the maritime sector, 800,000 GT of ocean-going ships and 130,000 GT of coastal ships were added, while Busan port stevedoring facilities were expanded and Incheon and Ulsan ports were developed to accommodate foreign trade and to establish industrial coastal zones.

2.11 The Third Plan (1972-76) gave priority to the highway and maritime sectors which received 47% and 28%, respectively, of transport investments. Some 490 km of two-lane high-speed highways were built (Chonju-Busan, Wonju-Gangreung), a national road maintenance organization was established and the motor vehicles fleet expanded further by 210,000 units. In the maritime sector, expansion of Busan and Mukho ports was started, while Incheon port was developed further with the help of the Asian Development Bank (ADB); the fleet was increased by some 1.3 million GT. In the railway sector, the line capacity increase continued through electrification of 320 km of heavy traffic industrial lines (Chungang, Taebaek and Yongdong), and about 100 km of the Seoul Metropolitan System (SMESRS); about 90 km of new tracks were laid including 9.5 km of the first subway line in Seoul. In the aviation sector, the international airports of Seoul Kimpo, Busan-Kimhae and Cheju were expanded while ten jet liners were imported.

2.12 The Fourth Plan (1977-81) directed investments at the consolidation of the basic transport infrastructure developed over the previous decade by completing missing links, while also starting to promote better efficiency in the operation of the transport system. The emphasis was placed on expenditures for maintenance and renovations rather than on investments for new facilities, with the major exception being a large-scale subway construction program designed to alleviate urban transport congestion in Seoul City. The basic highway network was completed by widening to 4 lanes the Masan-Busan expressway and constructing the Daegu-Masan 85 km two-lane expressway. A largescale paving program for national roads was also started to bring the paved portion to 68%, a target that was not reached partly due to reclassification. In the railway sector, some 160 km of double tracking were completed (Chungbuk and Gyeongbu lines) while large numbers of electric cars, diesel locomotives, passenger and freight cars and workshops were added. In the maritime sector, the first Busan container port and Mukho coal port were completed; and a second expansion of the Busan container area was started. Incheon expansion, started in 1974, was completed in 1978 with the assistance of ADB, through the addition of 20 deep-water berths, including 5 container berths and 4 breakwaters.

2.13 The past achievements under development plans in the transport sector are very impressive and evidenced by large networks and fleet expansions as well as modernization (Tables 1.10 and 1.11). However, funds expended under the national plans reflect only part of total investments in the transport sector. Local government investments, including those of provinces, counties, cities and special cities, are not included in the plans unless they are funded at least in part by the central budget. Omitting to take them into account would considerably distort the assessment of the real magnitude of Korea's progress. In particular, the four Special Cities (Seoul, Busan, Daegu and Incheon) road investment programs were not shown in the Fourth Transport Plan although with over ₩ 700 billion at current prices (nearly US\$1 billion), 80% of which was in Seoul City, they represented 37% of the country's overall road investment (Table 2.14). In comparison, ₩ 880 billion or 46% were spent on national and express highways and ₩ 328 billion or 14% on provincial, county and city roads.

Performance Assessment

2.14 Broadly, the basic objectives of the transport development plans were met as the network expanded fast enough to accommodate economic growth. The general approach that gave priority to large investments to increase system capacity was the most appropriate. The traffic grew so fast that halfway measures, such as rehabilitation and improvement of the deficient network of the 1960s, would have been insufficient and short-sighted.

2.15 The highway development policy was geared to develop a network of roads to serve the short and medium distance traffic for which they have an economic advantage over the railways. The Road Plan developed in 1968 in consultation with the Bank proposed a very ambitious program consisting of (a) the development through 1986 of a network of about 4,000 km of trunk highways to form a grid of longitudinal and transversal axes linking the four major gate ports of Incheon, Busan, Mogpo and Mukho toward inland centers, and (b) the construction over a 10-year period of a 1,600 km two-lane expressway network designed on separate alignments from the old roads, that could be expanded when traffic volumes would require it. The program was 75% completed and was determinant in localizing industries around Seoul and in most provincial capitals, speeding the urbanization process as the population migrated more easily from rural areas. The voluntary delay in improving the secondary and tertiary networks was well founded in view of the highway requirements of the industrialization policy.

2.16 Similarly, the railway investment policy was directed at strengthening its transport capacity for bulk freight and long distance passenger traffic where the railways have a comparative advantage. Investment in modernization, double tracking and electrification of the most heavily used freight line (14 million tons p.a.) enabled the railway to perform more efficiently and to cope with demand. In particular, it helped increase express train traffic from 1 billion passenger-km in 1971 to 9 million in 1981, to make large profits. However, to keep freight or recover local passenger traffic that would be better handled by road transport, the railway attempted to compete by investing in improvements that were economically not so justified and had to apply a fares policy for ordinary trains that could not cover operating costs. Also the Government forced the railways to invest in infrastructure for other than strictly economic reasons such as double-tracking of the Chung-Buk line.

2.17 Past investments geared to the development of ports, including those of Busan, Incheon and Ulsan, were necessary to cope with large increases of ocean-going freight and to attract heavy industries to coastal areas. Also, the Busan containerization program was effective in reducing handling costs and expediting flows of cargo, although custom clearances still impose lengthy transit delays. However, efforts were too restricted to the major ports. A national port development policy remains to be introduced to shape the future role, number and localization of lesser ports, particularly to support coastal shipping which has scope for much expansion, given the geography and political situation which make Korea a de facto island. Progress in the shipbuilding industry has been very instrumental in modernizing the domestic fleet, which has proven to be a source of foreign exchange earnings. An expansion of air transport was also timely in serving the many foreign and local businessmen who were the artisans of Korea's fantastic exports expansion that increased from 1962 to 1978 at an average rate of 27% p.a.

2.18 Some Misinvestments. The selection of investments was done by each modal agency in a rather independent and isolated manner. It was guided nevertheless by the objectives of the Ten-Year Physical Land Development Plan (1972-81) which called for balanced regional development and incorporated an a priori list of major projects called for by the Blue House. Despite the lack of coordination, very few investments proved to be superfluous or clearly oversized. There were, however, a few misinvestments such as the duplication of cement port facilities at Mukho and Bukpyeong, 10 km apart, which are now underused at Mukho. The oversized container port section of Incheon which is partly idle while Busan is overcrowded, is another.

2.19 In the road sector, the East-West Olympic express-highway between Gwangju and Daegu which was added for political reasons at the end of the Fourth Plan and started in late 1981, is not yet needed. The road crosses a remote mountainous and sparsely populated area that is bypassed by an excellent two-lane expressway via Masan. The funds might have been more effectively used in simply paving the existing road, and providing many other social investments in education, health, and other services to the Gwangju area that was in the past left somewhat behind other regions. Similarly, the double tracking of the Chung-Buk and Honam lines could have been better phased if the Government had only considered economic justifications for this work.

2.20 The standards adopted for some special cities roads are another example of investments that may turn out to be grossly oversized and premature, as evidenced by the low traffic on newly built roads up to 14 lanes-wide in the south Seoul suburbs. The selection of Special Cities' large investments is done separately, and their consistency with other transport projects under the development plans are not checked. It would be useful if the economic justification of such investments were compared to ensure that the overall program was balanced and to avoid excessive diversion of funds from other needs. In particular, such investments appear to be not properly coordinated with the subways and the suburban railway (SMESRS) and other new developments in the area. The accumulation of investments in Seoul City seems to conflict with the recommended strategy in the Ten-Year Plan to organize new development around growth poles in the provinces to compensate for the overwhelming attraction of the capital. The land use plan had recommended control of Seoul's expansion by limiting its growth to 5% p.a. over the plan period and by promoting the transfer of industrial activities from the city to the suburbs or other regional centers.

2.21 All these misinvestments reflect planning deficiencies that are likely to become more numerous in the future as competing transport claims become more complex to resolve and cannot be adequately handled on an

individual basis. Mechanisms, including institutional changes and a new multimodal project approach, are urgently needed to remedy the situation and some suggestions are put forward in Chapter 4.

The Bank's Involvement

2.22 The Bank has played an active role in advising and assisting the Korean authorities in pursuing their transport objectives. Since 1962, the Bank Group has assisted the KNR through eight railway projects amounting to US\$546 million. The first six projects have been satisfactorily completed and a seventh is almost fully disbursed. Bank-supported investments have concentrated on improved rail capacity and service for long distance passenger and bulk cargo transport. The Bank has also maintained an active dialogue on the railway's financial situation, investment plans, level and structure of tariffs. After some deterioration in the 1970s, Government agreed to implement a financial recovery plan for KNR as part of the Seventh Railway Project. Discussions of a revised plan, following the severe downturn of the economy in the early 1980s, are continuing. Meanwhile, the eighth project, a Coal and Cement Distribution Project which was recently approved will strengthen the capacity of the railways, ports and inland terminals to cope with the expected increase in transport demand of these commodities, resulting partly from large coal imports substituting for oil.

2.23 Since 1969, the Bank has financed five highway projects and a preinvestment credit totalling US\$465 million which have had a major impact in assisting Government with the improvement and expansion of the national, provincial and county road networks and with institution-building in the MOC and MOHA. Significant policy changes, relating to the highway subsector, which were effected through these highway projects include the adoption of more appropriate road standards, revisions of regulations governing vehicle weights and dimensions, and a modified government policy on toll roads. The MOC's organization to maintain the national road network was established and strengthened through the provision of technical assistance and road maintenance equipment. Korean consulting firms have benefitted through their association with foreign consultants on the design of road projects.

2.24 Substantial assistance has also been extended for port development. In part related to Korea's export drive, ports are seriously congested, particularly at Busan, the biggest port. Containerization was introduced in Busan with the assistance of the Bank under two port projects totalling US\$147 million; the Saudi Fund for Development participated with the Bank in the financing of the first Busan Port Project. A third port project designed as a subsector loan is now being considered to further improve container handling capacity at Busan and for supporting other maritime plans.

2.25 The Bank has also, through these various projects, provided active support and finance for technical assistance for a range of feasibility and

planning studies relating to national transport development, urban transportation needs, inter-modal alternatives along major traffic axes (such as the Seoul-Busan corridor) in addition to more conventional engineering design work for proposed projects. However, the record of accomplishment is patchy, with experience tending to show a pattern of relatively slow progress, reflecting in part the difficulties of sectoral planning and transport coordination in the Korean context.

2.26 Pricing policy and the regulatory framework have been a feature of Bank-Government dialogue for many years. In the 1970s, emphasis was given to supporting Government's efforts to establish agencies such as KNR and KMPA on a sound financial basis, with investment planning linked to appropriate tariffs and charges in regard to rail transport and ports. The role of the Bank has been quite effective in this regard, although the priority given to reducing inflation in the past two years has led to some reluctance to raise tariffs - for example in rail transportation - in line with changes in costs, although some increases in real terms were achieved. The Bank has also assisted Government in the review of transport and traffic regulation, notably in regard to licensing of common carriers, road vehicle taxation, axle-loading and similar issues relating to road transport.

2.27 It is expected that the Bank's policy dialogue would be strengthened in future years through the increasing emphasis being given to a sector and subsector approach in transport lending to Korea. A Provincial and County Roads Project approved in 1982 has deepened and broadened the Bank's involvement in the road subsector by extending assistance, for the first time, to the Ministry of Home Affairs (MOHA) which deals with the maintenance of provincial roads and the maintenance and improvement of county roads. This new involvement provides the Bank with an opportunity to help improving coordination of road planning between MOC and MOHA, and will strengthen the basis for possible highway subsector loans. Similarly, the recently completed ports study examined broadly which ports should be developed to handle the nation's traffic through the next decade and may lead to a port subsector loan. The Bank's proposed program is discussed in Chapter 7.

2.28 Bank transport projects also contain specific components to promote the local transport consulting industry. A Korean Institute was the consultant responsible for both a Coal and Cement Distribution Study and a Comprehensive National Transport Study. Korean consultants are also closely associated with, and assuming an increasing share of the work and responsibilities for, studies under the Bank's railroad and port projects. The development of a competent consulting industry in the transport sector is likely to lead to significant import substitution and export of such services.

C. The Present Transport Systems

Road Transport

(a) Highway Network and Traffic

2.29 The present highway system is still inadequate to cope with the rapid growth of road transport, despite the Government's effort since 1968 to develop a modern network. As of 1982, only 64% of the national roads, 13% of the provincial roads, and 5% of the county roads were paved, and a high level of investment will continue to be required to provide an adequate level of service. The road network totals about 87,000 km comprising 13,500 km of national roads, 10,000 km of provincial roads, 11,500 km of county roads and 52,400 km of village access roads built by the Saemaul self-help community movement since 1971. In addition there are 11,200 km of city roads, mostly streets, about 7,900 km in the cities of Seoul, Busan, Daegu and Incheon and 3,300 km in the other cities. The national highways include 1,245 km of toll expressways of which 515 km are four-lane divided and 729 km are two-lane (Tables 2.1 and 2.2).

2.30 Despite the remarkable expansion in the road sector, helped through five Bank highway projects and two Asian Development Bank projects, much more remains to be done. The national network requires further improvements, and provincial gravel roads with high traffic volumes have to be paved. County roads urgently need to be improved and effectively maintained through the strengthening of the provincial and county maintenance organization, a task that has started under the Bank's Provincial and County Roads Project approved in 1982. Road density at 0.9 km/sq km is generally sufficient to serve transport needs, since about 70% of the total land area is mountainous. However, the condition of most of the road network is inadequate. In particular, unpaved roads, including some national and provincial roads carrying high traffic and almost all the county roads, are unsafe with no place for pedestrians and in poor to very bad condition that permits driving speeds of only 25 to 35 kph. The paved national road network is generally in adequate condition since maintenance was considerably improved through the establishment of a new, efficient maintenance organization financed by the Bank under the First and Second Highway Projects.

2.31 The planning of highway improvement is based on traffic counts that started in 1965 for the national highways and in 1981 on the provincial roads and are made regularly by MOC. The traffic data available show that annual growth rates of traffic volume were high during the First and Second Plans (1962-71), but fell off in the Third Plan with the first oil price shock (1972-76). Rapid growth of both traffic and fuel consumption resumed in 1976 and peaked in 1979 but decreased again in 1980. Gasoline consumption evolved

like traffic growth and but not a very good indicator of traffic variations due to more fuel efficient vehicles; however, the drop in 1975 fuel consumption which was one-third lower than in 1973 reflected major price increases (Table 2.3).

(b) Motor Vehicles and Motorization

2.32 Korea's motor vehicle fleet is small compared with other countries of similar and even lower income levels. In 1982, the 630,000 four-wheel vehicles registered amounted to only 14 vehicles per 1,000 persons. The ratios are 20 in Thailand, 21 in the Philippines, and 48 in Malaysia, although Korea has a higher per capita income (Tables 2.4 and 2.5). The fleet, comprising 54% of trucks and buses, has been kept small for many reasons: high taxation on ownership and use of private cars, restrictive licensing of commercial vehicles, rather high costs of locally manufactured vehicles and the relatively underdeveloped road network. Only twenty years ago Korea had less than 1,500 km of paved roads.

2.33 The vehicle fleet has, however, been growing rapidly. Including motorcycles, growth averaged 10% p.a. during the First Plan (1962-66), and 19% p.a. during the Second Plan (1967-71). Growth slowed at the beginning of the Third Plan due to the economic stabilization policy in 1971/72 and the oil crisis in 1973/74. Since 1976, the growth accelerated again and averaged 25% p.a. from 1977 to 1981. Of all four-wheel vehicles, cars increased the fastest, doubling since 1977, but growth was irregular, with 31% in 1977 and only 3% in 1980. The small car fleet, which is 74% privately owned but mainly by companies, will probably increase rapidly as occurred in Japan which had only 200,000 cars or 2.8 per 1,000 persons in 1958 but 25 million in 1980 or about 217 per 1,000 inhabitants. The continued slow rate of motorization in Korea will depend upon the willingness or ability of the Government to keep the current high level of taxation in line with increasing incomes. The combined pressure of the public and of car manufacturers reacting to declining exports may force Government to lower the taxation of private cars, leading to rapid motorization (para. 3.15). If not, and as an alternative, the demand may shift to motorcycles, the number of which has increased about 35 times from 1977 to 1982.

2.34 Local production of motor vehicles grew rapidly over the last decade from about 7,500 four-wheel vehicles in 1967 to a peak of 200,000 in 1979. However, it dropped to 120,000 in 1980 and climbed again to 164,000 in 1982 (Table 2.6). This growth was fostered by restrictive import licensing and high customs duties. Except for specialized heavy trucks, all motor vehicles are now locally manufactured or assembled under license from American, Japanese and Italian manufacturers and contain nearly all locally manufactured parts. In 1975, the first 100% Korean car was produced by Hyundai. Exports did not grow as expected and present plans are to develop more efficient models and to boost exports of parts. Forecasts by EPB indicate that production would overtake present capacity of 225,000 vehicles per year in 1983 and reach 625,000 vehicles by 1986, with exports accounting for 20% of production.

Accordingly, large investments are now being considered to expand and re-tool the existing automobile plants.

(c) Road Transport Industry

2.35 Road transport has grown rapidly over the last 15 years, not only in absolute terms but also in relation to other modes, particularly the railways. About 22% of freight traffic in ton-km was carried in 1971 on highways compared to only 8% in 1961. Road freight traffic grew twice as fast as all freight traffic, averaging in ton-km 45% p.a. in 1967-71 and 13.0% p.a. in 1972-76. The share of road freight traffic is expected to continue increasing in the long term although probably more gradually. Passenger traffic on highways also grew rapidly averaging in pass-km 13.1% p.a. in 1972-76, and 9.1% in 1977-81, and amounted in 1981 to over two thirds of the total with one third going by rail, a complete reversal of the situation in 1961. This trend is expected to stabilize as the railways concentrate more on mass transit in urban areas in addition to long distance express services.

2.36 In 1982, there are a total of 1,685 commercial trucking companies operating in Korea; 1,659 under "area" licenses and 26 under "route" licenses.^{/1} Some 735 bus companies operate about 33,000 buses, about 60% in urban areas, and some 1,930 companies operate about 53,000 taxis while another 24,000 are operated by owner-drivers (Table 2.7). Commercial road transport in Korea is restricted through a licensing and tariff system, the merits of which are discussed in Chapter 5. The main problem with this system is that it tends to suppress effective competition in commercial road transport and neglects to serve adequately the needs of the users. Relaxations of regulations were introduced recently but have not gone far enough. This is evidenced by the low growth of the common carrier fleet, which accounted in 1982 for only 63,000 trucks versus 200,000 in the private fleet, while in 1967 with 15,100 trucks, it was almost three times larger (Table 2.5, p. 3). A similar evolution is also noticeable for buses which are operated more and more by private enterprises, schools, and farmers' co-operatives. The limitations on entering particularly the "route" trucking business seem to have worked to the advantage of the existing operators who have shared the market among themselves, protected as they are from outside competition. Since transport users' needs are not fully served by commercial operators (despite subsidies offered by MOT for buses in remote rural areas),

^{/1} An "area" license authorizes service within a limited area, generally the province, and a "route" license authorizes service along a given route between points A and B.

private entities have more and more started to operate their own trucks and buses. MOT is currently reviewing the licensing system. Unfortunately, indications are that the Government may not opt to relax existing regulations further but rather encourage the consolidation of commercial operators, particularly for buses, in larger units which MOT believes are better able to compete with the fast growing private fleets.

2.37 Moreover, the Government, through MOT, is at present implementing a subsidized plan to improve public bus services in the remote rural areas for villages of over 100 households where their availability, frequency and quality are deficient because of poor road conditions and remoteness which make operations of standard buses unprofitable (Table 2.8). By contrast, under the Provincial and County Road Project, the Government is promoting through MOHA, an experiment to introduce unscheduled transport services for the rural population having no access to public road transportation that would operate without subsidy. Such unscheduled and shared transport services are allowed first on an experimental basis in selected areas, and will operate on demand as large taxis. The ownership will not be restricted by minimum fleet requirements and their modalities of operation, including the routes and fares, will be determined by market rules.

2.38 Road Safety. Any country that has a large number of road accidents has a serious problem. Commonly-used figures are sometimes cited in support of a conclusion that the problem is worse in Korea than in many other countries. For example, in 1978, with a vehicle ownership rate of 107 per 10,000 population, there were 129 fatalities per 10,000 vehicles. This compares with 48 fatalities per 10,000 vehicles in other developing countries with an ownership rate of 280 per 10,000 population. What these figures fail to show is the much higher annual mileage run up by Korean cars compared to those in other countries. The average Korean car runs about 30,000 km p.a., about double the world average. When expressed on a mileage instead of a vehicle basis, the Korean figures are probably no worse than other countries. Traffic control is relatively good and driver liability is unusually strict, putting a high premium on avoiding accidents. Despite this corrective to a frequently-held view on accident rates in Korea, there is much room for improvement. The Bank is assisting MOHA under the Provincial and County Roads Project, to improve road traffic safety which is the joint responsibility of three agencies. The Traffic Police, under MOHA, enforce safety-related regulations such as speed limits, etc. and collect and publish traffic accident statistics. The Transportation Safety Promotion Authority under the general control of MOT covers all modes but is responsible for the inspection of motor vehicles, railroad cars, ships, aircraft, rails and cables, from which activity some 90% of its revenues accrue. The Road Traffic Safety Association, a civilian non-profit corporation reporting to MOHA, analyzes traffic accident data, does research and studies on road safety, trains and educates drivers, and prepares and organizes propaganda related to road safety.

Rail Transport

2.39 As a result of the fast expansion of the road network over the last decade, the railways have lost their predominant position in the transport system which has now evolved into a more responsive and complementary multi-modal system. With the modernization of its network, which was assisted by the Bank through seven projects, the Korean National Railroad (KNR) remains the most economic means of land transport for moving bulk traffic over medium and long distance. In addition, KNR operates fast growing and very profitable long distance express passenger trains. It also plays a growing role in providing a self-paying rapid transit service for the Seoul suburban area which is linked with the first subway line.

2.40 In 1980, KNR operates a well maintained 3,100 route-km network of standard gauge including 610 km of double track and 47 km of narrow gauge. 2,368 km of single track industrial lines serving the northeast coal and cement producing areas are electrified, as well as about 100 km of the Seoul Metropolitan Electric Suburban Railway System (SMESRS) linking Incheon and Suweon. Staff comprises 38,000 people, with 33,500 permanent employees. Productivity is high in terms of traffic units (pass-km plus net ton-km), and was 800,000 per staff in 1981 compared to 500,000 for European railways; the dense urban and intercity passenger travel and heavy bulk commodity traffic contribute to this (Table 3.1).

2.41 KNR's fleet and facilities are modern and in good working condition. At the end of 1980, the traction fleet consisted of 425 diesel and 90 electric locomotives, 130 diesel rail cars and 286 electric railcars (for the SMESRS). The rolling stock consisted of 1,900 passenger cars and about 16,700 freight cars (including about 1,700 privately-owned cars). An additional 10 diesel locomotives, 12 diesel railcars, 146 electric railcars (of which 130 for SMESRS), 246 passenger cars and 100 freight cars included in the Seventh Railway Project were procured by end 1982 (Tables 3.2 and 3.3). A plan to improve the maintenance and utilization of locomotives and rolling stock was implemented in consultation with the Bank resulting in improved fleet availability. Main workshops are located in Seoul for electric locomotives, diesel and electric railcars, at Busan for diesel locomotives, and at Daejeon where a new rolling stock workshop has been constructed for freight cars and passenger cars. New freight terminals are being developed in the Seoul region, south at Bugog and west at Susaeg, to relieve existing congested and obsolete stations in the city.

2.42 KNR's freight traffic is substantial and concentrated on a few bulk commodities. In 1981, it carried 48.8 million tons of freight, an 8% increase p.a. since 1966, on a 222 km average distance, amounting to 10.8 billion ton-km compared to 35 billion in Japan or 47 billion in France (Tables 3.4 and 3.5). Freight densities, which averaged 3 million tons net

per route-km in 1981, reached 14 million tons on the heaviest section of the northeast industrial line (Taebaek). The next heaviest used sections, the Jung-Ang line south of Jecheon and the Seoul-Busan line, carry around 4 million tons annually. The main commodities transported include coal with 21.4 million tons which doubled since 1966 and cement with 8.4 million tons, quadrupling since 1966. In addition, other bulk commodities (ore, oil, fertilizer, and grain) accounted for 78% of KNR's total freight ton-km in 1981, up from 66% in 1966.

2.43 KNR's main earnings come from passenger traffic but competition with road transport is severe. In 1981, it carried 471 million passengers on a 94 km average distance, achieving 23.4 billion passenger-km, an 8.6% increase p.a. since 1966 (Table 3.6). Significant changes, however, occurred in the last ten years that deeply affected passenger traffic. The opening of the Seoul-Busan and Daejon-Gwangju expressways in 1970-73 marked the beginning of intense road competition by long-distance bus transport. The rise in personal incomes increased people's mobility, and their demand for greater comfort resulted in a shift to higher class trains. Also, with the opening in 1974 of KNR's electrified suburban lines connected to the first Seoul subway line, a new era of rapid transit started. After a serious decrease in the early 1970s, passenger traffic resumed a steady growth since 1973, reaching a rate of 7% p.a. from 1977 to 1979. The proportion of passengers riding lower class (ordinary) trains has been reduced to 35% while the balance was riding limited express and special express trains which increased over five-fold since 1972. In 1981, 153 million long-distance passengers were transported; passenger traffic on the SMESRS grew rapidly also, exceeding 268 million passengers that year (Table 3.7). These trends are indicative of areas where KNR should increase its services.

2.44 Operating efficiency remains high and in general continues to improve; some examples are given in the following Table. KNR earned positive returns until 1971; its financial situation then deteriorated as inflation increased costs faster than tariffs and required annual government subsidies. Historically, tariffs for freight and ordinary passenger trains were much below costs and were cross-subsidized by the profitable long distance passenger services. However, covenants in successive Bank railway projects emphasized the need to increase freight tariffs in real terms which were raised by 40% between 1975 and 1982 despite rapid inflation. Freight revenues now cover 105% of operating costs and 95% of total costs. The main losses are incurred from ordinary passenger trains which revenues cover less than 40% of operating costs. The SMESRS traffic revenues fully cover total costs, and express passenger train revenues cover 150% of total costs. Since 1978, passenger fares have been raised somewhat over the cost of living, with the exception of fares for ordinary trains which KNR intends to raise gradually to fully cover operating costs in 1985 (Tables 3.8 and 3.19).

Table 2.3(T): SUMMARY OF KNR's OPERATING STATISTICS

	1971	1979	Index 1979 (1971=100)
Average number of passengers per passenger train	358	515	144
Average freight train load (tons)	441	491	111
Traffic units per employee ('000)	379	808	213
Availability (%)			
Diesel locomotives	82.8	89.7	108
Passenger cars	85.0	91.1	107
Freight cars	89.5	94.0	105
Passenger-km per available passenger car ('000)	5,722	11,018	193
Net ton-km per available freight car ('000)	601	727	121

2.45 Further improvements are possible and have been recommended by the Bank in particular through: (a) increasing the length of trains which are limited to 10 cars for passengers and 20 for freight, (b) closing more uneconomic lines, and (c) terminating more rapidly the costly ordinary trains and closing many of the 600 lesser-used stations.

Maritime Transport

2.46 The export-oriented industrialization policy coupled with the need to import raw materials for which Korea is poorly endowed put heavy pressure on maritime transport. The port infrastructure and the vessel fleet accordingly had to expand rapidly. Now Korea's port network comprises 43 general or commercial ports with 48.0 million tons of stevedoring capacity per year and 12 industrial ports with 40.8 million tons capacity. In addition, there are some 400 fishing ports and 1,400 other wharfs without basic facilities (Tables 4.1 and 4.2).

2.47 The total cargo movement, including seagoing and coastal freight, increased by 11.4% p.a. in the Third Plan (1972-76) and 8.4% in the Fourth Plan (1977-81). Seagoing freight traffic through Korean ports reached over 105 million revenue tons in 1981 compared to 8.5 million tons in 1966, while coastal freight reached 44 million tons compared to 4.6 million tons over the same period, increasing respectively at 18.3% and 16.2% p.a. These increases created serious port congestion (Table 4.3). Both Busan, the biggest port handling 30% of the country's external trade, and Incheon, the port nearest Seoul, required urgent expansion, and a large containerization program started. Industrial development on the southeastern coast prompted the creation of specialized ports at Bukpyeong for cement, Pohang

for steel mill input and output, Ulsan for refineries and petro-chemicals, Onsan for a refinery and nonferrous metal industry, Changweon for industrial machinery and Samil (Yeosu) for fertilizer and petrochemicals.

2.48 In spite of recent development, more efforts are required to further expand port capacities and to improve port handling operations that are costly for some cargo categories at certain ports. In 1981, the ports capacities, measured by the stevedoring throughput of each port, show an aggregate deficit of 10.2 million tons, comprising a 14.2 million ton net deficit for general ports and a 4 million surplus for industrial ports (Tables 4.4 and 4.5). About two thirds of the general ports' capacity shortage is concentrated in Busan. To make up the present deficit, lighter- ing and labor-intensive cargo handling methods are used. The situation will improve with the completion in 1982 of the Busan second phase expansion financed by the Bank under the Second Port Project and with the expansion of Incheon financed by the Asian Development Bank.

2.49 Korea's vessel fleet expanded very fast and is becoming a high foreign exchange earner which the Government wants to develop further. In 1981 with a tonnage of 6.3 million GT, including 0.3 million GT of coastal vessels, the fleet ranks fifteenth in the world. The privately owned fleet increased by 3.3 million GT since 1976, with 1 million GT built in domestic shipyards while the rest was imported. Annual receipts of ocean freight also increased from US\$425 million in 1976 to US\$1.9 billion in 1980 (Table 4.6). Korea's flagships increased their share of ocean cargo from 39% in 1976 to 50% in 1980. In 1981, the coastal shipping fleet numbered 526 ships, totaling 290,000 GT, and varying in size from less than 100 GT to over 10,000 GT (Table 4.7). Except for tankers, ship size and cargo capacity are small; 91% are ships less than 1,000 GT and 78% less than 500 GT. The fleet is quite new with only 10% of the ships over 20 years of age (Table 4.8).

2.50 Coastal shipping has an important role to play as Korea's cheapest domestic transport. Formerly carrying small lots of passengers and goods between ports and small isolated coastal and island communities, it has become a competitor to road and rail for bulk transport. While roads improvement reduced the isolation of coastal villages and their marine dependency, coastal shipping increasingly serves the fast growth of urban and industrial centers located along the coast that have generated large bulk transport. In 1981, it moved 32% of this traffic compared to 10% in 1966. Cargo move- ment grew at 5% p.a. from 4.6 billion ton-km in 1971 to 7.9 in 1981. Coastal shipping expanded with the improvement of ports capacities and the buildup of cargo handling facilities. Coal, cement and oil amounted to about 91% of the traffic in 1981, a slight decrease from 97% in 1971 due to the stagnation of coal transport since 1975, that was balanced partly by increased ores trans- port (Table 4.9).

2.51 Coastal shipping efficiency can be improved by faster and more appropriate vessels. It is operated exclusively by the private sector which is financially independent but is regulated through licensing and tariffs that are established by the Korea Maritime and Port Administration (KMPA). Through the licensing system, KMPA controls renovation of and additions to the fleet and occasionally assists operators requiring loans from financial institutions. The freight tariffs are determined according to the ship size, length of haul and specific type of cargo. This does not encourage rationalization of the fleet but enables traditional operators to remain in business. For coal transport, the Government pays a subsidy amounting to 90% of the average coastal shipping tariff to east coast mines which send 1.6 million of coal p.a. by sea.

Air Transport

2.52 The role of aviation has been essential in supporting Korea's growing international trade. Its role needs to be expanded further, especially for air cargo and promotion of tourism. International passenger traffic is about twice as large as domestic and is growing very fast; it increased 10 times between 1966 and 1981 when 3 million passengers moved in and out of the country. Air freight is still small but growing even faster (Table 1.16). International and domestic traffic are handled at the airports of Seoul-Kimpo, Busan-Kimhae and Cheju Island, a major tourist center; there are in addition eight other local airports. Domestic air passenger traffic grew rapidly in the 1960s at rates 25-40% p.a. from 1962 until 1971, but growth rate decreased somewhat in the 1970s. It still amounts to less than 1% of total passenger-km, and domestic air freight is also negligible (Tables 1.4 and 1.5). There are twelve domestic routes served by the privately-owned Korean Airlines (KAL), which also operates internationally. The most intensely traveled domestic routes are Seoul-Busan with 13 round trips daily, Seoul-Cheju (12 round trips) and Busan-Cheju (7 round trips), all of which are profitable and are cross-subsidizing other loss-producing routes.

3. THE FIFTH TRANSPORT PLAN AND CURRENT ISSUES

3.01 Transport development under the ongoing five-year plan will have to meet more difficult challenges than in the past due to a depressed economic environment. The period of rapid and sustained growth in the Korean economy came to an abrupt close in 1979, following the second major oil price increase, the subsequent worsening of the international economic environment, and political changes within Korea itself. Near economic stagnation, accompanied by severe inflation and balance of payments problems were experienced between 1979 and 1981. A recovery is now in progress, owing to Government's determined efforts to master inflation (which declined from 29% in 1980 and 12% in 1981 to about 5% in 1982), and to a remarkable improvement in the balance of trade (Table 1.12). Nevertheless, the medium-term prospects for a resumption of Korea's former rapid progress remain uncertain. The impact on the transportation sector is two-fold. On one side, the timing of investments needed to sustain further improvements in transport capacity and quality of service will be influenced by growth-induced traffic expansion. On the other side, the capacity of the public sector to finance the necessary upgrading and expansion of transport infrastructure and facilities may be sharply constrained by budgetary limitations. These factors will determine which of the investments proposed in the Transport Plan will be implemented.

A. The Transport Sector Plan Objectives

3.02 The published Fifth Five-Year Economic and Social Development Plan (FFYP) forecast a GNP growth rate of 7.6% p.a. over the period 1982-86 (Table 1.13). In contrast to past transport policy that emphasized expanding capacity during periods of strong economic growth, the Government is now pursuing a recovery policy calling for significant adjustments in the sector. In this line, the Transportation Sector Plan prepared as part of the FFYP document by the Transport Affairs Planning Group gives the following priority objectives: (a) selectively increase transport capacity by modernizing equipment and optimizing investments in the sector; (b) enhance transport efficiency by improving intermodal traffic allocation and conserving energy; and (c) strengthen maintenance activities.

3.03 To meet these objectives, the Plan has earmarked for the transport sector ₩ 9,940 billion or US\$16.3 billion calculated at 1980 prices and exchange rate. This amount represents about 14% of total investment, and is a 45% increase over the ₩ 6,900 billion (US\$11.3 billion) allocated in the Fourth Plan (Table 1.14 and 1.15). About half of the expenditures are to be spent by the public sector for road, rail, sea and air port infrastructure and equipment, and the other half by the private sector for vehicles, ships and aircraft. However, investments in subways and aviation will absorb a

larger fraction of the total as will road vehicles and ships. Hence, real investment in the railway system, road and port infrastructure would increase by less than 20% above the Fourth Plan's outlays as shown in the following Table.

Table 3.1(T): FOURTH AND FIFTH TRANSPORT INVESTMENT PLANS

Transport investment	Fourth plan 1977-81		Fifth plan 1982-86	
	Won billions	%	Won billions	%
Railways	997.2	14.5	1,330.8	13.4
Road transport	3,093.5	44.0	3,718.8	37.4
Roads	1,135.3	(16.4)	1,309.7	(13.2)
Vehicles	1,838.2	(26.6)	2,307.6	(23.2)
Others	66.0	(1.0)	101.5	(1.0)
Sea transport	2,465.4	35.7	2,655.1	26.7
Ships	1,818.6	(26.3)	2,061.4	(20.7)
Ports and facilities	646.8	(9.4)	593.7	(6.0)
Aviation	146.1	2.1	594.5	6.0
Subways	250.5	3.6	1,635.0	16.5
Waterways	4.7	0.1	5.0	-
<u>Total</u>	<u>6,903.3</u>	<u>100.0</u>	<u>9,939.7</u>	<u>100.0</u>
Total capital expenditures	47,189.4		72,100.0	
Total transport investments as % of total capital expenditures	14.6		13.8	

All figures in 1980 prices.

3.04 The size of the investment program appears to respond well to the expected growth in demand which should increase by about 47 billion passenger-km and 10 billion ton-km or 50% and 37%, respectively, above the Fourth Plan period (Tables 1.16 and 1.17). Freight forecasts show some

increase in the relative share of road and coastal transport over the railways, while for passenger traffic an increase in the railways' share (mainly due to suburban traffic) is expected at the expense of road transport. However, it is uncertain whether other aspects of the new intermodal allocation of investment will be accompanied by a changing composition in demand (Table 1.18). In particular, the timeliness and phasing of the very large expenditures for the subways of Seoul and Busan (which are to exceed those for the road network) and the continued large investment for special cities' streets (mostly for Seoul) raise some questions. Proposed investments by subsectors and largest projects are discussed below on the basis of recent forecasts. However, in many cases it is difficult to say clearly whether the proposed investments will meet the planned objectives in the most cost-effective way, because detailed economic and technical studies are not yet available for many projects.

B. Transport Subsector Programs

Road Transport Programs

3.05 Demand for transport is strongly linked to economic development and is expected to grow further as population mobility increases due to higher personal income. The expected expansion of industrial and service activities would also sustain the flow of migration from rural to urban areas. In the road subsector, passenger transport is expected to grow at 6.4% p.a. from 64 to 93 billion passenger-km from 1982 to 1986, with an average trip distance of about 8 passenger-km. Freight transport is expected to grow faster at 7.5% p.a. from 4.9 to 7.5 billion ton-km over the same period, with an average distance of 47 km per ton (Table 2.19). Official growth forecasts appear reasonable, being comparatively much lower than earlier fast growth periods, but they fail to measure the overall growth of traffic as they apply only to common carriers, buses and trucks. If private transport owned by industries, groups and individuals had also been included, the forecasts would have been higher since the private fleet is growing faster than common carriers as noted in para. 2.36 (Table 2.5, p. 2 and 3). Further, the increase in motorization, particularly of cars, as anticipated in EPB's forecasts will add to the demand for road facilities. The registered fleet would double by 1986, reaching 1.2 million vehicles, of which over 50% would be cars (Table 2.10). Production of motor vehicles would increase from 165,000 in 1983 to 416,000 in 1986, with about 20% for export (Table 2.11). Whether these targets can be achieved depends to a large extent on Government's policy for lowering taxes on vehicles and gasoline.

3.06 Supporting the past growth of transport demand, the average traffic on expressways and national highways has increased by 2.1 and 2.3 times, respectively, in the last five years. Traffic congestion is thus anticipated in the future on some sections of this network and the proportion of heavy vehicles is expected to remain very high. The traffic

distribution on national highways indicates high densities for a large proportion of the network. In 1975, an aggregate length of 4,200 km or half of all national highways had an average daily traffic volume of over 500 vehicles per day (vpd); in 1980, this length reached 6,600 km or about 80% of the network. Average traffic density and composition on the national highway system in 1975 and 1980 are shown in the table below:

Table 3.2(T): AVERAGE HIGHWAYS TRAFFIC VOLUMES
(Vehicles/day)

	Expressways			National roads		
	1975	1980	%	1975	1980	%
<u>Total</u>	3,498	7,519	100	949	2,177	100
Cars	607	1,350	(18)	242	573	(26)
Buses	747	1,482	(20)	234	425	(20)
Trucks	2,144	4,687	(62)	473	1,179	(54)

3.07 Discussing priorities, the Plan states rightly that, to provide a consistent level of transportation service, the protection of existing road facilities by providing adequate maintenance is now as important as building and improving new roads. It identifies the two major problems in the sector as insufficient road maintenance and the small size or pettiness of transport firms. It then gives policy directives for road transport emphasizing under the FFYP the need to:

- (a) expand and widen expressways which are near some major urban areas;
- (b) continue improving and paving national and major provincial roads and strengthen maintenance;
- (c) increase and modernize the vehicle fleet and develop safety measures;
- (d) improve the efficiency of road transport operators by expanding terminal facilities and inducing larger-scale transport firms; and
- (e) expand and improve the transportation network in remote areas to reach all villages with 100 or more households.

3.08 The FFYP's overall investment for road transport, comprising public and private programs, amounts to W 3,720 billion (Table 2.12). The

Plan includes expenditures for road works on the national network only, for new vehicles, terminals and warehouses. Total capital and recurrent expenditures planned for the national roads including expressways amount to W 1,285 billion at 1980 prices, or about US\$2.1 billion. Compared to the Fourth Plan, expenditures would be 25% higher than the W 1,030 billion spent in 1977-81 (Tables 2.13 and 2.14). The actual expenditures during the first four plans are given in Table 2.15. As a whole, the FFYP national road investment program appears very reasonable given forecasted traffic increases of 40% and 27% in freight ton-km and passenger-km, respectively, over the period. Such increases imply significant productivity gains in road transport. A comparable increase in capacity was achieved during the Fourth Plan with expenditures that were about 20% higher than those of the Third Plan.

3.09 The maintenance budget for national roads has been increased further and represents 15% of total expenditures on those roads, compared to 11%, 6% and 2% spent, respectively, during the Fourth, Third and Second Plans. This additional provision of funds for maintenance is in line with Government's recognition of the importance of maintenance. Nevertheless, 57% of all maintenance expenditures in 1981 by MOC were spent by KHC on its network of 1,245 km, while the balance was spent on the 12,000 km national road network (Table 2.16). This imbalance can be explained partly by the higher traffic and standard of KHC expressways, but mainly reflects the freedom of KHC to dispose of funds collected through tolls. The problem of coordinating the level of expenditures with the actual needs of the various road networks is discussed in Chapter 4.

3.10 The Transportation Sector Plan does not mention the important road project funded by the Bank to assist MOHA in developing provincial and country roads (para. 3.14) nor construction and improvement programs by other local governments. Massive road investments are programmed in the four Special Cities of Seoul, Busan, Daegu and Incheon. According to MOHA, this program under the FFYP amounts to W 1,220 billion at 1980 prices or US\$2.0 billion, and is about equal to the national highways program (Table 2.17). This is a large increase over the Fourth Plan's W 835 billion at 1980 prices (nearly US\$1.4 billion) spent for road construction by the Special Cities, mainly in Seoul City, which already represented 37% of the country's overall road investments (paras. 2.13 and 2.20). As noted earlier, no planning agency controls the magnitude and concentration of investments in the Special Cities which may not be fully economically justified and may limit funds available for other needs such as rural roads. Road expenditures of W 1,040 billion are proposed by other local governments including provinces, counties and cities and represent a very substantial increase from the W 330 billion (at current prices or W 385 billion at 1980 prices) spent in the Fourth Plan. In 1981, expenditures on the provincial, county and city roads were only 7%, 3%, and 4%, respectively, of the overall investment for roads.

(a) Proposed Road Projects

3.11 The new expressways to be completed include (a) the 175 km East-West Expressway between Daegu and Gwangju, the construction of which started in 1981 and is expected to be completed in 1984 and (b) the 8.2 km of expressway south of Seoul, between Songnam and Pangyo, scheduled for construction during 1985 and 1986 (Table 2.18). A feasibility study on the East-West Expressway done by a local consultant estimated an economic rate of return of 15% and the optimum opening year to be 1991 when only savings in vehicle operating and time costs are considered. It recommended that the opening year could be advanced by more than five years if unquantifiable benefits derived from regional development, increased equity among regions, improved safety and comfort were considered. The study also recommended an open toll system. A Bank review of the study indicates that this investment is premature since the area concerned is presently served by a good national road link (para. 2.19). The construction of the 8.2 km of expressway from Songnam to Pangyo, although not the subject of a feasibility study, is justified to accommodate high growth traffic in the southeastern Seoul suburbs.

3.12 In addition, four expressway sections will be widened, from 4 to 6 lanes between Seoul-Pupyong and Seoul-Suweon, and from 2 to 4 lanes between Daejeon-Jeonju and Masan-Jinju, totalling 172.8 km. The estimated cost is ₩ 114.3 billion and will be funded by KHC from toll revenues. Decisions on widening expressways are based on capacity thresholds that are related to projected traffic volume and traffic mix; no economic or financial evaluation of the investments is available. However, these investments are probably premature given KHC's criteria which are quite low. A capacity limit of 9,000 vpd is used to widen a free flow 2-lane expressway to 4 lanes, and 30,000 vpd to widen from 4 to 6 lanes. Current practices in other countries allow much higher capacities. However, the BPR has undertaken to review the applicability to Korea of the 1965 Highway Capacity Manual's formula that was relevant at the time in the USA for a different mix of much larger cars and larger heavier trucks. The Bank has requested that the findings of this review be applied to the capacity analysis for the expressways proposed for widening.

3.13 Apart from the road lengths and related investments given for expressways and what is termed IBRD 4th and 5th and ADB 5th in Table 2.19, the specific roads to be constructed or improved under the FFYP have not yet been identified. The national and provincial road paving and improvement referred to as IBRD 4th are the balance of the road lengths financed under the Fourth Highway Project, Loan 1640-KO. Completion originally expected by June 1982 has been delayed to end June 1983 because of budget constraints and consequent lack of counterpart funds. The 282.8 km of national and provincial road paving and improvement referred to as IBRD 5th in the table are part of the

1,200 km of roads, studied and designed under the Third Highway Project, Loan 1203-KO. These road sections to be constructed under the FFYP have been selected together with county roads identified from the County Road Development Program prepared by MOHA to form the base of the First Highway Sector Loan just negotiated. The Asian Development Bank (ADB) will assist during the Plan in financing the improvement of 402 km of national roads and construction of some 27 bridges of 8.8 km in total length in the country's southern part. Economic returns for all the selected road sections range from 20% to 60%. A further 765 km of national roads will be paved during the FFYP using domestic funds and are identified for the first two years. No economic evaluation is available, but the road selection will be based on existing and projected traffic volumes. The road paving program follows the FFYP policy directive to increase the paved national road ratio from 56% to 73% (Table 2.20).

3.14 A major investment not shown in the FFYP concerns MOHA's County Road Development Program and its Provincial and County Road Maintenance Program to be implemented during the plan period and already prepared by consultants for the MOHA and appraised by the World Bank. The estimated cost of the capital investment for the programs is about W 194 billion with a foreign exchange requirement of US\$125 million at end 1982 prices. In addition, the recurrent local expenditures for the Provincial and County Road Maintenance Program are likely to be on the order of W 180 billion over the five-year period. These proposed expenditures are not shown in the FFYP since the MOF will not make specific budget allocations for the programs. The expenditures are being funded out of a block grant of domestic revenues which MOF allocates yearly to the MOHA (para 4.19). The FFYP Road Investment Plan also does not include an allocation for the Saemaul roads which capital costs are to be funded by MOHA, although the Plan has a policy directive for improving and developing remote roads in villages of 100 or more households. Since the development is to be done on a year-by-year basis, it must be assumed that no program exists at present.

(b) Other Road Transport Development

(i) Vehicle Fleet Growth and Safety Measures

3.15 The forecasted growth of transport needs will sharply increase the demand for vehicles. Forecasts show a net increase in the vehicle fleet of 567,000 units or by about 100% during the Plan. Some 71,000 vehicles are for commercial use, with about 496,000 for private use (Table 2.10). These increases will be brought about through guidance and encouragement. The Plan says that replacement of old vehicles to ensure safety and improve customer service will be promoted by applying age limits for commercial vehicles: 5 years for taxis, 7 for buses, 13 for trucks, and 10 for pick-ups. There are few if any other countries in the world that have a policy of "force scrapping." The rule is presumably motivated by safety considerations, although it also helps the auto manufacturing industry. One wonders how much needed maintenance is done by owners during the late period of a vehicle's life when he knows it must be scrapped at a certain date. The great drawback of the rule is that it partially restricts the re-allocation of used capital

(older vehicles) to less intensive use as its reliability decreases and its operating costs increase. The obvious alternative method of pursuing safety is to establish an inspection system (Korea already has one), although there are many shortcomings to these and experience has shown them to be less effective than one might expect. It is entirely possible that the best solution is to leave scrapping decisions to market forces, to pursue safety through strict owner liability laws (which Korea has), and to use selective inspections that avoid too elaborate a network and too many temptations to corruption. Further study of this problem seems needed.

3.16 To help administer the ever-increasing vehicle fleet, a computerized management system is recommended in the Plan but too costly to be implemented nationwide at once. Vehicles are now registered by each city and province, and management problems vary with the number involved. Computerization will be introduced in 1982 first for Seoul which manages over 200,000 vehicles, nearly half the country's fleet, and then for Busan, Daegu and Incheon, under the direct control of the central Government. For other cities and provinces, computerization will be introduced gradually and completed by 1986. This should be supported by the Bank.

3.17 To enforce safety standards and thereby prevent traffic accidents, the Plan calls for the provision of vehicle inspection stations with automated equipment. The traditional manual facilities are now inadequate and unreliable with the increasing number and variety of vehicles. To implement the program, responsibilities have been transferred from a civilian agency to the publicly-controlled Transportation Safety Promotion Corporation which will construct large inspection stations in Seoul, Busan, Daegu and Incheon, and will install automated equipment, phased on a yearly basis, in 66 of the country's 77 manual inspection facilities. In addition, under the Bank-financed Provincial and Country Roads Project, a safety promotion study is being carried out to help reduce Korea's high level of traffic accidents (para. 2.38).

(ii) Construction of Freight Terminals and Warehouses

3.18 Freight terminals can contribute greatly to facilitate fast, reliable and low-cost transport of goods. They promote the rational utilization of transport vehicles and equipment and the integrated handling of shipping including multi-modal operation, cargo-handling, storage, packaging, and collection/delivery functions. They act for highway freight as inland ports, stimulating interregional transport while alleviating inner-city traffic congestion. At end 1980, 48 freight terminals nationwide were in operation (18-exclusive use; 30-common use) with a total acreage of 41,000 pyongs, most of them small with inadequate facilities. Under the Plan, modern large-unit freight terminals will be constructed in 34 major cities around the country including Seoul, Busan, Daegu, Incheon, Daejeon and Gwangju, with a total acreage of 370,000 pyongs (see following table). Construction sites will be selected when drawing up specific implementation plans. The Bank should support this efficiency oriented program.

Table 3.3 (T): FREIGHT TERMINAL CONSTRUCTION PLAN

	1982	1983	1984	1985	1986	Total
Number of terminals	(8)	(8)	(9)	(11)		(36)
Lot acreage (pyong)	90,000	100,000	90,000	90,000		270,000
Construction acreage (pyong)	-	13,500	15,000	13,500	13,500	55,500
Funds required (in billion won)	10.00	13.63	15.45	14.18	7.79	61.05

Source: MOT.

3.19 At end 1980, 2,534 warehouse facilities were operated throughout the country, with a total floor space of 270,000 pyongs; most of them are small with decrepit facilities, and are barely profitable, making it difficult to induce new capital investment for improvement. Based on projections of regional warehouse requirements, 135,000 pyongs of additional warehouse space will be constructed under the plan concurrently with the freight terminals (see following table). A report by the Korea Institute of Science and Technology (KIST) on the service industry assumed the required warehouse space as one pyong for every 20 tons of goods.

Table 3.4(T): WAREHOUSE CONSTRUCTION PLAN

	1982	1983	1984	1985	1986	Total
Total volume of goods movement <u>/a</u>	127,000	138,700	150,500	163,300	177,200	757,600
Volume of goods for storage <u>/a</u>	7,674	8,322	9,030	9,798	10,632	45,456
Required warehouse <u>/b</u> space	28.2	32.4	35.4	38.4	41.7	176.1
Warehouse space to be constructed <u>/b</u>	20	25	30	30	30	135
Funds required (in billion won)	6.0	7.5	9.0	9.0	9.0	40.5

/a In thousand tons.

/b In thousand pyongs.

Source: MOT.

3.20 In addition, information regarding freight movements will be provided systematically, punctually and accurately to both freight owners and shipping firms. This will help in better organizing freight dispatching and will reduce empty back hauls and unnecessary vehicles, thus alleviating traffic flows and conserving energy. Further, to improve service to customers, notification will be made of the estimated date of arrival when a consignment is expected, and by the forwarding company when and where the shipment has arrived.

(iii) Encouraging Larger Road Transport Firms

3.21 In order to facilitate the growth of the road transport industry, the Plan prescribes changes in the licensing policy to promote savings in transport costs through better management, fare adjustment and improved services. Bus companies will be encouraged to move toward larger-scale operations to raise the average fleet size to around 300 buses. Trucking companies will be encouraged to consolidate their operations through direct management in 1982, with the objective of converting firms at the rate of 10% a year from the present fleet where 73% of the total is owned and operated by private owners. A "Guideline for Designation of Outstanding

Companies" will be adopted and implemented to provide support to outstanding companies and to develop the transport business into a sound enterprise. Under the Guidelines, outstanding companies will receive preferential consideration in matters such as increasing the number of vehicles, disposition of profits, and administrative and financial support. These measures may not, however, improve services to customers, and require more analysis before implementation as discussed in Chapter 5.

3.22 Also, in order to vitalize the existing road transport trade union, an effort will be made to bring the union and union membership into a closer relationship, and the concerned government agency will set in motion a regulatory mechanism which will demand that the union pursue certain activities designed to facilitate development of road transport trade and to actively promote profits among the fellow businesses in the same trade. The licensing requirement of minimum fleet size for "area" freight companies will gradually be lowered, and a move toward direct management and commercialization will be encouraged. All these measures are peculiar to Korea. The belief that big is better is not necessarily correct, and the Bank has many reservations on this matter.

(iv) Improving Remote-Area and Inter-Regional Passenger Transport Services

3.23 The Plan's objective is to expand the one-day return-trip zones in consolidating the regional transportation system throughout the country. Existing services will be improved including (a) express and inter-city non-stop buses which handle inter-city long-distance demand, (b) intra-district or county buses which serve medium and small cities and (c) new bus lines in remote areas that will be developed progressively each year to reach the 35,500 farming and fishing villages nationwide now without bus services.

3.24 Under the Plan, three types of improvements will be made. First, MOT has a program to introduce new bus services for all villages with 100 or more households. The number of remote-area bus lines will be increased from 804 lines in 1980 to 1,215 lines by 1986, and subsidies to compensate for operating losses of the remote-area bus lines will be increased as a means of preventing cancellations of scheduled runs (Table 2.21). Further, in isolated areas and islands, the use of "saemaul" or cooperative buses and locally-managed buses will be encouraged; in villages (myons), which are without taxi services, taxis will be supplied to take care of emergency patients and other urgent transportation needs. Second, MOT will encourage better inter-city transportation together with expanding road facilities, and will liberalize licensing to offer more variety of buses (express, non-stop, local) to suit the preferences of customers. Comfort inside buses will be improved with heating systems on local buses, air conditioning systems on non-stop buses, and widening the space between seats. Third,

emphasis will also be placed on improving bus-stop facilities through wider enforcement of a standard model bus-stop structure.

Railway Programs

3.25 A very elaborate program was proposed under the FFYP for the railway which was expected to expand further with the growth of the economy. Much has been trimmed in the meantime. Nevertheless, the general objective is to cope with more specialized demands, to meet long distance passenger and bulk freight transport, and to respond to the new demand of suburban commuters in the Seoul Metropolitan Area. The role of the railway which has expanded its operations very substantially in the past will continue to grow. KNR's efficiency is an asset to the country. It was able to satisfy almost five-fold increases in passenger traffic and nearly three-fold in freight over the last 20 years, by raising its staff only by about 20% to the present level of 33,500. Staff productivity is one of the highest in the world. The past traffic growth is summarized in the table below.

Table 3.5(T): RAIL TRAFFIC VOLUMES

	1961	1966	1971	1976	1980	Average annual rate of increase
Passengers (million)	88	138	128	249	444	8.9
Passenger-km (million)	5,372	8,665	8,750	14,305	21,528	7.6
Average distance (km)	60.8	62.7	68.0	83.7	93.0	-
Tonnage (million tons)	15	24	32	44	49	6.4
Ton-km (million)	3,486	5,450	7,841	9,728	10,815	6.1
Average distance (km)	226	226	245	245	220	-

3.26 The magnitude of investments required in the FFYP depends on the demand for more railway services and the need to replace worn-out facilities and equipment to maintain existing levels of service. Contrary to freight, KNR's passenger forecasts have systematically been exceeded by actual traffic, probably due to improved service (Table 1.16). Growth rate estimates used for the Fifth Plan range from 6% to 14% p.a. in passenger volumes and 8% to 14% in passenger-km for intercity and SMESRS traffic respectively, assuming GNP growth at 7.6% p.a. and no change in restriction on ownership and use of private cars. Detailed forecasts by types of service are given in Tables 3.6 and 3.7 and reflect adjustments by the

mission allowing 3.5% growth in intercity passenger traffic and 5.2% in passenger-km. In 1986, intercity passengers would reach 223 million with about 23 billion passenger-km compared to KNR's estimates of 257 million and 27 billion respectively (Table 3.10). In the absence of a comprehensive urban transport study covering the entire metropolitan area, forecasts of Seoul suburban traffic are difficult. KNR's forecast of over 525 million passengers on its suburban lines in 1986 appears reasonable.

3.27 KNR's freight traffic forecasts have generally been too optimistic in the past and the Bank advised using more conservative figures. Forecasts prepared in 1981 for the 1982-86 Five-Year Plan are running in the first year about 9% above actual traffic in tons and 10% in ton-km (Table 1.17). The major shortfall is due to coal, as the ambitious production target set earlier by Government has not been met. More conservative growth estimates, between 3% and 4% p.a. in ton-km, have been assumed by the Bank and agreed with KNR during the appraisal of the Coal and Cement Distribution Project. Detailed forecasts are given in Tables 3.4 and 3.5. Freight traffic would reach 57 million tons and 13 billion ton-km by 1986, with no change in traffic composition, except for container traffic.

3.28 Among the difficulties identified in the Plan to keep up with the demand for railway transport are (a) trunk lines reaching capacity limits; (b) aging of facilities and equipment; (c) backwardness of signal and control systems; and (d) financial deficits in railroad operations. The policy directives for the FFYP emphasize the need to:

- (a) increase trunk lines transport capacity to accommodate long-distance passenger and bulk freight transport by constructing a new line between Seoul and Daejon, by double-tracking a few other lines and by improving existing lines;
- (b) expand the suburban rail system to cope with the demand for speedy, mass transit and integrated transport in the Seoul Metropolitan Area;
- (c) improve the quality of rail services by modernizing and renewing obsolete or worn-out tracks, signals, communications and rolling stock; and
- (d) provide better financial management of the rail system by reducing uneconomic services, adjusting fares, adopting a commercial business-like attitude, and motivating employees to achieve targets.

3.29 The original investment proposed for the railways amounts to W 1,330 billion at 1980 prices or US\$2.2 billion. About 33% is for increased line and station capacity; 28% for new and improved motive power, rolling stock and equipment; 16% for new line construction; 14% for

improvement of tracks and structures, and the balance for telecommunications (4%), electrification (3%) and workshops (9%) (Table 3.11 and 3.12). This tentative distribution of investment is likely to be modified subject to detailed analyses that will be carried out to assess the economic viability of each project. However, the Plan indicates that despite unfavorable economic returns a few projects may be selected for national policy reasons such as balanced regional development. The Bank considers that the most urgent priority is to improve KNR's financial performance. Tariff increases to cover at least operating costs on all traffic should be made without delay; elimination of high-loss ordinary trains and some deferment of new investments will also be required in addition to an increased temporary operating subsidy from Government.

(a) Main Railway Projects

3.30 An analysis of capacity requirements per line carried out by KNR indicates that there is a need for increases in many areas. Many alternatives have been considered either as intermediate measures or more permanent solutions depending on the constraints identified, and an improvement plan has been adopted (Tables 3.13 and 3.14). On a number of lines capacity increases will be achieved by improving signaling, passing loops, curves and gradients to accommodate both longer and a greater number of trains. In fewer cases, largescale expansions are proposed such as double-tracking, electrification, standardization to normal gauge, and new track construction.

3.31 The single largest investment proposed is the construction of a new high-speed line from Seoul to Daejon dedicated to passenger transport. This would be the first link in a future Seoul-Busan line that would accommodate traffic in the next century. The present capacity (133 train runs a day) has been exceeded between Seoul-Suweon, while that of 103 between Suweon-Jochiweon will be exceeded by end-1982 and that of 95 between Jochiweon-Daejon will be reached by end-1984. From 1980 to 1991, the corridor transport demand is expected to increase sharply by 3.6 times for passengers and by 3.7 times for freight. Figures are as follows and do not appear to be realistic, in particular for freight, unless traffic is systematically reassigned from road to rail.

Table 3.6 (T): SEOUL-DAEJON ANNUAL TRANSPORT DEMAND

	in '000	1981	1986	1991	Rate of increase 1991/80	% p.a.
Seoul-Suweon	Passengers	16,080	29,120	55,089	3.4	13
	Freight (tons)	2,981	3,865	4,893	1.6	5
Suweon-Daejon	Passengers	17,840	32,200	60,186	3.4	13
	Freight (tons)	3,685	10,859	13,782	3.7	14

As an interim measure, central train control (CTC) and automatic braking signal (ABS) systems are being considered to increase capacity and safety standards until 1986. However, a long-term solution will be required and a new 160-200 km high-speed line is envisaged. Total investment would be in the order of ₩ 1,050 billion over a construction period from 1986-1989, with ₩ 200 billion spent under the FFYP. The project has merit as a measure to resolve a capacity problem, but mainly as a step to stabilize the growth of Seoul by decentralizing many activities to the Daejon area which would be reached in less than an hour. A preinvestment study of the Seoul-Busan corridor transport needs and a feasibility study of this high-speed line is ongoing with funds provided under the Bank's Seventh Railway Project. The Bank, however, had doubts about the need for the proposed interim measures (CTC and ABS) since they would not be required for freight operations on the old line, and the Government agreed to delay this investment by one year pending the results of the study.

3.32 Three other major projects have been planned: (a) double-tracking of the Honam line from Iri to Songjongri (102 km); (b) improvement of the Cholla line from Iri to Yosu (199 km); and (c) improvement of the Changhang line from Chonan to Changhang (143 km). The first project was started in 1981 and will be completed in 1985 at a cost of ₩ 127 billion. It would increase capacity from 33 to 72 train runs a day, reduce travel time by one hour and have a favorable impact on the regional development of the Gwangju area. The second project would be started in 1985 for completion in 1989 at a cost of ₩ 150 billion, with 18% expended under the FFYP; track capacity is limited by severe curves and inclines, and operating costs are high, but after improvement, distance would be reduced by 23 km and trip time by more than one hour or 25%. The third project would be started in 1986 for completion in 1989 at a cost of ₩ 72 billion with 6% expended under the plan; here also track capacity is limited by the terrain, and after improvement the distance would be reduced by 10 km and travel time by half an hour. The last two lines improvement have been postponed at the 1982 mid-year review by the Government.

(b) Other Projects

3.33 To improve bulk transport of coal and cement from the east to the Seoul area, a Bank project will provide for: (a) electrifying 64 km of the Jung Ang line between Chechon and Yongju; (b) providing CTC on 127 km of the Jechon-Cholan line; (c) widening of 53 km of the Suwon-Incheon line to standard gauge and (d) acquiring 261 coal and 320 cement tank cars. The total investment is estimated at W 90 billion and construction is to start in 1983 for completion in 1986 but delays are possible due to the stabilization of fuel prices. In addition, port investments, including coal terminals and handling equipment are proposed for Incheon and Ulsan.

3.34 To meet the demand for suburban rail transport in the northern Seoul Metropolitan Area, a 13 km double-tracking and electrification project between Songbuk and Euijongbu was started in 1982 for completion in 1984 at a cost of W 23 billion.

3.35 To improve freight movement through faster trains and to handle more container traffic, new freight terminals are being built in the Seoul area, one in the south at Bugog for 10 million tons annual capacity and one in the east at Songbuk for 2 million tons. Costs are estimated at W 50 billion, with 90% to be expended under the FFYP.

3.36 The reinforcement of rolling stock was also a major program of the original FFYP and aimed at the modernization of aging units in the fleet including locomotives, coaches, and freight cars. Some W 374 billion (US\$613 million) would be spent for this purpose, of which US\$247 million would have been for imports. However, the mid-year review also cancelled this program in an effort to consolidate KNR's financial position. Nevertheless, many other measures will be introduced to improve the quality of service in order to keep and attract rail customers. The number of higher class trains such as the limited express will be increased further from 900 in 1980 to 1,670 in 1986. Air conditioned systems will be expanded to raise 50% of limited express trains to express class by 1986. Also, 300 automatic ticket distributors will be imported, and computerized seat reservations will be introduced for all limited express and higher class trains by 1986. KNR's original financial plan (Table 3.15) has accordingly been substantially modified (Table 3.16).

(c) Management Improvements

3.37 To reduce chronic financial deficits, revenue increases and cost reductions will be sought through aggressive business initiatives. Also a concerted effort will be made to develop mid- and long-distance passenger transport, bulk special freight transport and other areas of specialized rail services. The objective is to build a self-supporting railway before 1986. Accordingly, rail fares will be increased gradually to meet costs.

For passengers, a flexible fare system based on rail lines, seasons and days of the week, will be put into effect. For freight, a contractual fare system and express system will be introduced to induce more transport demand.

3.38 To reduce costs, personnel recruitment will be frozen until 1986, certain functions will be consolidated or abolished, and the bureaucratic structure will be reshaped in line with private business organizations. The personnel cost will be reduced by manpower readjustment through automation and by other measures to streamline manpower management. Deficit lines and stations will be phased out gradually. Specifically, seven lines including the Ansong Line will be either abolished or converted for specialized use only, and the frequency on money-losing lines will also be reduced (Table 3.17). All measures will help to eliminate factors contributing to chronic deficits. This approach is highly supported by the Bank.

Maritime Transport Programs

3.39 The continuing expansion of Korea's foreign trade and coastal shipping will require major increases in the vessel fleet, port facilities and trained seamen. Forecasts prepared by KMPA for seagoing traffic assume an 8.9% p.a. growth over the Fifth Plan period, only slightly higher than the 7.6% expected GNP growth. This compares to the 12% to 18% p.a. growth rates recorded in the 1970s. The largest share of the seagoing traffic, about 35%, will transit through Busan and Incheon Ports (Table 4.10). Among major commodities transported, oil movements will remain the most important, followed by coal, containerized and breakbulk cargoes. The impact of the recent economic recession is noticeable on the volumes recorded in 1981 which are less than forecasted for most cargo movements except for grain, iron and steel, and containerized cargo (Table 4.11). As the recession is expected to be temporary, no changes have been made to the 1986 cargo forecast. Growth of petroleum transport is about 5% p.a. compared to 18.6% for coal, and reflects the government strategy to shift from oil to coal. Growth of container traffic forecasted at 11.2% p.a. is modest compared to higher past forecasts that were exceeded by actual movements, largely as more general cargo was containerized. Coastal shipping is expected to grow at 6.7% p.a. in ton-km (Table 4.12).

3.40 The problem areas identified in the Plan to cope with the expected growth of traffic are: (a) the small size and limited financial capacity of national shipping companies to compete internationally; (b) the relatively limited importance of Korean regular container lines serving only 30% of this traffic; (c) the backlog in expansion of port facilities and equipment and (d) the inefficiencies in port management and fleet operation. Accordingly, the policy directives under the FFYP emphasize the need to:

- (a) increase the fleet size and strengthen Korean shipping businesses to maintain or raise the 50% local transport share of the market for exported goods worth over US\$50 billion;
- (b) intensify cooperation with other major world shipping lines to develop new routes, particularly container service;
- (c) promote coastal shipping to improve access to isolated islands and to increase coastal freight transport;
- (d) modernize and expand port facilities and promote operational efficiency; and
- (e) develop training to raise the quality and availability of seamen.

3.41 To support these objectives, an investment program of W 2,655 billion (US\$4.3 billion) is recommended under the FFYP, including US\$1.6 billion in foreign currency. Some W 2,080 billion or 80% is to be invested by the private sector, primarily for ships, and W 578 billion by the Government, mainly for port construction and improvement, maintenance and dredging, and training institutes (Table 4.13). As ports' capacity will reach their maximum limits at the beginning of the Sixth Five-Year Plan, some W 2.5 billion have been earmarked to prepare a basic plan identifying new port development and assessing port demand traffic that is expected to intensify as trade with mainland China expands in the 1990s.

(a) Vessel Fleet Growth

3.42 An increase in shipping tonnage is the largest component of the program. The target is to accommodate an increase of overseas traffic of about 50 million metric tons from 1982 to 1986, reaching by then about 165 million tons while maintaining the 50% share carried by Korean ships (Table 1.9). The required fleet tonnage will have to rise from 6.3 million gross tons (GT) to 9.4 million GT or a gross increase of 5 million GT, including the replacement of some 2 million tons of aging vessels. The fleet is expected to rise to the tenth rank among shipping nations and should yield receipts of US\$5 billion in 1986. About 1.5 million GT will be produced in Korean shipyards while 3.5 million GT will have to be imported or chartered. This program is very ambitious; the objective of maintaining 50% of overseas shipping under the national flag is questionable as it will require substantial funding which might have better use for more pressing needs such as roll-on/roll-off ships to reach isolated islands or rural roads. Also, the under-utilization of the world fleet might favor the chartering of vessels at lower cost than acquiring new ones. For the coastal fleet, an increase of 142,000 GT to meet an expansion of about 50% of the coastal traffic from 1982 to 1986 appears justified (Table 4.14). There seems to be scope to increase even further the high efficiency of the ocean-going fleet and to rationalize the coastal fleet. Large savings in foreign exchange could be

made in moderating the expansion of the fleet and focusing on management improvement. The Bank should support any effort to raise the fleet's efficiency.

3.43 The opening of new services will follow the tonnage increases. Six new container lines will be opened to supplement the four already in operation, and the number of full container ships will be doubled to 28 units by 1986. Coastal shipping passenger services will be intensified and four additional islands will be linked, assuring regular sea service to 385 of the 577 inhabited islands in the country. Five more car ferries will be added to the three already in operation and six high-speed vessels will be added to the 15 already operating. Coastal freight will be developed further by constructing general storage facilities for 185,000 tons and cement silos for 20,000 tons by 1986. The development of coastal shipping is desirable as one of the most economic transport mode for bulk but also as a tool to promote new decentralized poles of economic activity. Such effort should be supported by the Bank.

(b) Port Expansions

3.44 The overall ports capacity will be increased according to the Plan from 82 million tons in 1980 to about 134 by end 1986 (Table 4.15). Port facilities will be improved in Busan, Incheon, Mokpo, Cheju and Ulsan using some W 380 billion of the W 500 billion allocated for the construction improvement program. However, the concentration of port development in a few areas near Seoul and Busan may be a factor in the over-development of these two megapolises. A more balanced program seeking the improvement of less efficient regional ports might be more cost-effective and a good way to promote regional development.

3.45 In Busan, some W 192 billion, including U\$147 million in foreign cost at 1980 prices, are to be spent during the FFYP to help the port's handling of over 50% of the country's general export-import freight and 90% of the containerized cargo. Some W 49 billion will be invested to complete, by end 1982, the second phase expansion of the container program, including a new pier and equipment. According to the Plan, the berthing capacity will increase from 52 to 70 ships, the stevedoring capacity from 19.6 million MT a year in 1982 to 30 million by 1986 or by 11.5 million revenue tons (Table 4.16). The container capacity will increase in 1982 to a half million Twenty Foot Equivalent Units (TEU). A further third phase expansion is planned in Busan to bring container capacity to nearly 1 million TEU by 1986 or 75% of the national traffic which is expected to nearly double between 1980 and 1986. However, the timing of the W 109 billion investment which includes a 1.6 km long breakwater to develop the outer harbor has been postponed from 1984 to the latter part of the FFYP, due both to a budget shortage and the under-utilization of the container pier at Incheon. The Bank supports a delay by one to two years as it will provide an opportunity

to remove a number of obstacles preventing the full use of Incheon. It will also allow the expedition of lengthy custom procedures at Busan that limit overall capacity. However, a further delay would be detrimental to foreign trade and is not encouraged. W 34 billion were sought from Saudi funds for the construction of a 1 km long breakwater for the development of Kamcheon Bay, just west of Busan.

3.46 The next largest investment proposed is for Incheon port amounting to W 107 billion, including US\$64 million in foreign exchange part to be financed by ADB. The completion of the ongoing second phase expansion for additional piers and lock-gate guidance facilities will require W 52 billion, while W 43 billion are earmarked to construct a coal pier in the south harbor and W 12 billion to build a reserve lock-gate and piers five and six, completing the inner harbor. These investments will raise Incheon stevedoring capacity to 18.7 million tons by 1986, berthing capacity from 29 to 36 ships and increase the maximum ship size to 100,000 DWT. Incheon is expected to handle more container traffic as capacity at Busan will be fully used.

3.47 The investments for Mokpo, Cheju and Ulsan earmarked under the Plan amount respectively to W 11, W 28 and W 32 billion. Stevedoring capacities will increase in these ports to 2.4, 1.3 and 6.7 million tons, respectively, by 1986. In line with government policies to diversify energy sources, piers for coal imports will be built at Mokpo and Ulsan to supply local and industrial users (Table 4.17). A number of small projects amounting to W 27 billion are proposed for construction of breakwaters, piers, terminals, and access roads for Gunsan, Wando and Sokcho while expansion of 16 other ports will amount to W 43 billion. Navigation aid facilities, dredging and maintenance investment worth another W 50 billion are included under the Plan. No economic studies of these investments were carried out and they are required to know whether these investments would yield positive returns.

(c) Management Support for Shipping and Ports

3.48 A number of programs will be developed to improve the financial strength and efficiency of maritime activities. First, the establishment of a Shipping Development Fund is being considered to help shipping companies to expand their fleet. Some W 50 billion should be mobilized by 1985 and W 100 billion by 1990. To secure these funds, the Government intends to attract cofinancing from private sources to supplement public funds and to lay the basis for a shipping bank. Assistance from international organizations including the Bank is expected. Second, port management will be improved through measures to secure more land area around ports, to unify the operation of ground storage facilities, to increase mechanized stevedoring equipment and to improve the labor hiring system. Third, the training of seamen and officers will be systematized to increase the skill and

availability required for a larger and more modern fleet. Training institutes will be expanded to train 4,500 officers during the plan. Short-term training and retraining programs will be organized for 13,000 sailors and 10,600 mechanics and port workers to bring Korean labor at par with international standards. Some 9,700 seamen are expected to find employment as crewmen on foreign ships adding to the 21,000 already employed in 1980 who earned about US\$170 million.

3.49 In addition, industrial ports under the MOC will also be developed under the Plan, but those investments have not been included in the Fifth Plan document. The main capacity expansions planned include Pohang port (13 additional berths), Bukpyong (a coal berth), Changweon (4 new berths) and Kwangyang Bay for a new iron ore port. Apparently there is no coordination between KMPA and MOC concerning the programs for these ports. The investment costs for those works are not known.

Air Transport Programs

3.50 Aviation is essential in supporting the development of Korean overseas trade. Its growth has been fast since the seventies, though in absolute terms it is comparatively small (Table 5.1). Local traffic will remain modest except for a potential large movement of passengers between the capital and Cheju and Busan. International passenger traffic to and from Korea is expected to double by 1986 while freight should triple (Table 1.19). Traffic volumes are as follows:

Table 3.7 (T): FORECAST OF INTERNATIONAL AIR TRAFFIC IN SEOUL (1979-2001)
(in thousands)

	Present capacity	Actual		Forecast			
		1979	1981	1985	1986	1991	2001
Passenger (unit)	4,800	2,518	2,606	5,020	5,642	8,964	19,174
Cargo (tons)	280	156	190	379	447	712	1,537

Source: MOT.

3.51 The problem areas identified in the Plan to cope with future growth are (a) KAL's deficit position since 1980, provoked by a combination of rising operating costs, a low fares policy due to harsh international competition, and a low occupancy ratio (about 40% of seats) resulting from world economic depression and a somewhat excessive acquisition of aircraft; (b) the capacity limitation of airport facilities to handle increasing traffic and (c) imperfect aviation safety systems and a shortage of specialized staff. Accordingly, the policy directives under the FFYP emphasize the need to:

- (a) develop airport facilities in the Seoul Metropolitan Area by expanding the existing airport and by preparing for the development of a new airport;
- (b) improve and expand other airports, principally at Busan and Cheju;
- (c) extend the international routes including a round the world service, while improving the quality of service;
- (d) modernize and standardize the fleet as well as expand its capacity; and
- (e) improve aviation safety facilities through modernization of guidance equipment.

3.52 To meet those objectives, an investment program of W 595 billion (US\$1 billion) including US\$687 million in foreign currency at 1980 prices, is recommended under the FFYP. Some W 431 billion or 72% is to be invested by KAL, primarily for aircraft, and W 164 billion by the Government, about 70% for Seoul airport expansion and the balance for other airports and safety facilities (Table 5.2). Development funds for a new international airport are earmarked under the Plan amounting to W 17 billion or about US\$28 million for a preinvestment study, subsequent detailed engineering and land acquisition. Construction would start under the Sixth Plan.

(a) Aircraft and Routes

3.53 The procurement of new aircraft is the largest investment in the program, although ranked as having third priority after the expansion of airports and development of new routes. KAL's fleet will decrease from 41 planes in 1982 to 39 by 1986, but its seating capacity will increase by 2,000 to 9,800 and air cargo capacity by 420 ton to 800 ton. New acquisitions during the FFYP will include 8 B-747s and 7 unspecified new jet planes for passenger/freight transport. In the meantime, KAL will sell 17 aircraft including B-707s, B-727s, DC-10s, and F-27s to standardize the fleet which will consist by 1986 of 20 B-747s, 8 A-300s and 7 new planes (Tables 5.3). While the objectives of standardization and fuel efficiency have merit, the fleet's capacity net expansion, especially for passenger planes which have a low occupancy ratio, is less justified and some postponement should be advised particularly at a time when KAL is accumulating deficits.

3.54 Opening of New International Air Routes. KAL's world network will be expanded by 12 additional routes to reach 45 routes servicing 32 cities in 19 countries by end 1986. Four new routes will be opened to Japan adding to

the 11 existing routes, and 8 other routes will be opened, 2 each respectively to Southeast Asia, the Middle East and Africa, Europe and America, adding to the 22 existing routes. Aviation agreements and revisions will be made with 9 countries. The opening of the New York-London and Chicago-Rome routes due in 1985 will extend KAL's network around the world (Table 5.4). The timing may not however be very suitable in view of the world's present recession.

(b) Airports and Facilities Expansions

3.55 The largest investment is for the Seoul-Kimpo airport at an overall cost of W 164 billion, with W 97 billion programmed to be spent in 1984-86 (Table 5.3). A second runway will be constructed as an intermediate measure to accommodate traffic between 1985 and 1991 when the new international airport will open. Annual passenger capacity will be nearly doubled to 9 million passengers and air cargo increased by 50% to 180,000 tons p.a. Ground capacity will accommodate up to 70 B-747 size aircraft. But is the time for such investment appropriate when traffic has slackened? Cheju and Busan-Kimhae international airports will also be expanded. The objective for Cheju is to support the government program to develop the island as an international tourist resort. An investment of W 14 billion for a new passenger terminal to open in 1983 will complement a newly built runway and security facilities, increasing annual capacity from 0.6 to 2.6 million passengers. The objective for Busan is to give the largest widebodied aircraft access to this high growth area and to provide an alternative landing port to Seoul in case of bad weather. W 21 billion will be invested to extend the runway and improve facilities.

3.56 Aviation safety facilities and staff training. Remote control systems will be installed in five locations together with improved airport lighting to allow safer air navigation, effective aerial zone control and management and viable flight intelligence. A training institute will be established to provide electronic specialists and technicians to maintain, repair and control the high technology equipment.

Urban Transport Programs

3.57 The past growth of urbanized areas has severely constrained the large-city transport systems. Seoul's residential population grew at 4.4% p.a. in the 1970s, reaching 8.3 million in 1980, while the daily movement of people increased at 8.3% p.a. and was estimated at 13.3 million in 1980. The concentration of the city's functions in the central area has generated excessively heavy traffic at rush hours between the north and south of the Han River which offered the main expansion area given the geographic and strategic situation of the city. High-rise office construction that was not matched with adequate road and parking infrastructure has created serious congestion. Despite a heavy reliance on city bus transport, a high

taxation lid on private motorization, and the multiplication of elevated streets, the downtown areas are clogged with traffic most of the day.

3.58 In 1981, 66% of the people in Seoul used city buses, 7% the subway and suburban rail systems and 27% other modes. Half of the nation's city buses were concentrated in Seoul and about 45% of all taxis. Busan had 20% of the buses and 10% of the taxis of the country. In addition to stop-gap measures which have added over 1,000 nonstop buses in Seoul and 200 in Busan and have encouraged the use of chartered buses, a large program of subway construction was started in 1974. A first 8 km section of line No. 1 was opened in 1976, followed by a 14 km section of line No. 2 in October 1980. Traffic congestion was greatly relieved for residents of Seoul's eastern sector. However, Seoul and Busan continue to grow despite a government policy to stabilize growth by offering better opportunities in secondary cities. In 1981, some 2,100 people moved daily to Seoul City while 1,860 moved out, adding yearly about 90,000 newcomers or about 1%. The Seoul Metropolitan Area is expected to have a population of 15.3 million in 1991 from 13.5 million in 1980. The Seoul City population should increase to 9.6 million from 8.5 million over the same period assuming managed growth, but 11.9 million if the trend is unchecked. Thus, transport problems will worsen as nearly 3 million people move to the Seoul area and 1.8 million to the Busan region even under controlled growth. The outer areas of those cities will grow faster due to (a) the availability of land there and its scarcity in the cities; (b) government incentives to develop outer areas, and (c) superior accessibility that is associated with high speed traffic.

3.59 The transport problems identified in the Plan are: (a) the worsening of downtown traffic congestion caused partly by a lower road ratio of 15% in Seoul and 10% in Busan than current ratios in other larger cities such as New York (35%), London (25%) or Paris (23%), (b) the imperfections of traffic management and signalling, and (c) the operation by private business of city buses resulting in poor services. Accordingly, the policy directives to improve urban transport in the FFYP recommend to:

- (a) expand the subway and suburban rail transport systems as the main passenger transport mode in Seoul and Busan;
- (b) further increase the capacity and quality of city bus services until the completion of the subways and develop systematic linkage points between the systems to ensure their complementarity;
- (c) promote taxis as a semi-mass transport mode by improving the management and operation of company-owned taxis, accelerating the licensing of private taxis and introducing a fare system based on distance and time;

- (d) improve traffic management and expand road and parking capacities; and
- (e) promote urban transport through appropriate measures to be developed from surveys and research for Seoul, Busan, Daegu, Daejon and Gwangju.

3.60 To achieve these objectives, the Plan includes an explicit investment program only for the subway expansion. A total of ₩ 1,635 billion has been earmarked under the FFYP for the completion of Seoul subway lines Nos. 2, 3 and 4, totaling 107 km, and 25 km of line No. 1 in Busan, for which work started in the Fourth Plan. Busan line No. 2, for 21 km, will be started in 1985 for completion in 1989 (Tables 3.18 and 3.19). Upon completion of the program by 1986, some 40% of Seoul traffic will use the subway system and some 17% of Busan traffic will use its line No. 1. As mentioned, KNR in the meantime will further develop the suburban rail system with the electrification of the 13 km Seongbug-Euijonbu north line and the increase of electric power cars from 426 in 1980 to 1,587 in 1986.

3.61 Although the Bank was never directly associated with the subway program a number of remarks can be made concerning the lack of adequate studies, and deficiencies of its financing and cost recovery system. In particular, the location of the lines (route/commuter density), the design of underground stations and lines (at alternatives depths and related gradients), the intersections and transfer stations do not appear to have been analyzed thoroughly as part of a transport system network to define (a) priority routes; (b) linkages with other surface transport; (c) effects on urbanization; (d) trade-offs between investments and operating costs; and (e) economic and financial viability. The studies that were carried out concentrated on detailed engineering for the lines that were selected in an arbitrary manner. In particular, it is doubtful that the Seoul ring line No. 2 should be a top priority since it adds considerable travel distance for most of the likely users who are essentially commuters between the city center and the new suburbs south of the Han River. A direct route such as line No. 3 would probably have a higher occupancy. The funding system which forces motor vehicle owners in Seoul and Busan to help pay for subway construction in those cities by purchasing an interest-bearing bond (₩ 300,000 for private cars, with company cars and commercial vehicles paying only about 10% of this amount) is both practical and sound. Vehicle owners are major contributors to urban congestion and are major beneficiaries of decongestion; it is therefore reasonable to ask them to help pay for the costs they impose on others and the benefits that accrue to themselves.

3.62 The plan gives some details of the proposed measures to improve the management and operation of buses and taxis in larger cities. Other measures such as traffic management facilities and the establishment of passenger-car-restricted-zones in downtown Seoul are mentioned, but no investment figure is given. No particular program is proposed for the city street expansion program for the four special cities. This program, as noted, is very large, reaching ₩ 1,220 billion, about equal to the subway development program (para. 3.10).

C. Evaluation of the Plan's Transport Policies

3.63 The Five-Year Plan is an indicative document. Its approval by the Parliament endorses the Government's priority objectives, but it does not give budgetary authority for the proposed projects and policies. Except for ongoing projects and those for implementation in the earlier Plan years, and for which detailed studies are available, all other Plan components will normally be studied, with few exceptions, before their inclusion in annual budgets. In preparing the Plan, the Transport Planning Task Force had to include projects proposed by the various modal agencies based on studies which varied widely in completeness and quality. Accepting this as inherent to any planning process, the Transport Plan shows a number of strengths and weaknesses. The following detailed analysis of the Plan will help to define areas where the Government should focus its attention in the immediate future.

Strengths of the Plan

3.64 The Transportation Sector Plan clearly analyzes problem areas in each sector. Past development strategies and future traffic demands are generally well documented. Specifically, the Plan identifies capacity bottlenecks due to shortages in facilities and equipment, inefficiencies in operation and management, inadequate tariffs and unavailability of skilled staff. It acknowledges the importance of maintenance and energy conservation. The policy directives defining the objectives for each sector are clear. A balanced emphasis is put on investments for new construction and improvements, on policy measures to improve productivity through better management, and on regulatory changes to ensure adequate service to users. Further, the Plan clearly indicates the financial needs of the public and private sectors and assesses the funds needed from local and foreign sources.

3.65 The policy directives re-emphasize Korea's transport strategy based on comparative modal advantage in terms of economic cost and energy conservation. Rail is given preference for long distance and commuter passenger traffic and for bulk freight; roads are to serve short- and medium-distance inland transport; and coastal shipping is to handle bulk freight. Further, the Transport Plan supports the spatial development strategy proposed in the Ten-Year Second Land Development Plan (1982-91). It seeks the infrastructure expansion necessary to develop secondary cities that are to attract a larger share of the urban migration that would otherwise concentrate in Seoul and Busan. With the mechanization of agriculture, some 10 million people are expected to move over this period from rural to urbanized areas. Disincentives and restrictive measures adopted will help to limit their concentration to some 3 million in the Seoul and Busan metropolitan areas.

Weaknesses and Major Issues

3.66 Several deficiencies in the Plan relative to coordination, regulation, and energy reflect long-standing and new problems that are difficult to resolve. Furthermore, possible budget limitations may result in substantial investment cuts. The first mid-year budget reviews have resulted in large cuts of the railways and ports programs. EPB Budget Bureau and Project Evaluation Bureau have responsibilities to review these investment programs and have among others, taken into consideration the Bank's views to limit capacity increase investments. The budget reviewers control expenditures in relation to government revenues, while the project evaluation officers attempt to minimize foreign borrowings by allowing only high return, foreign exchange earning projects.

3.67 The Plan is unsatisfactory in three areas. First, it is not comprehensive. It does not include major road investment programs by local governments, including special cities, or port investments by industrial complexes and by local governments. These components would increase the public transport investment program by over ₩ 2,000 billion or about 40%. Since little information could be gathered on these investments, it is thus difficult to assess whether they tie in with the Plan's objectives, whether they complement or duplicate each other, are overdesigned or premature. For example, it is proposed to develop the Seoul subway system and a massive road network, yet it is unclear whether these projects will be reviewed between the agencies concerned and in conjunction with other modal agencies' programs. This illustrates a major institutional weakness of the transport sector: investment planning and coordination have remained isolated and fragmented. Each modal agency continues to develop its plan without considering the inter-dependencies of the various modes. The Plan itself suffers from a lack of integration both at the intra- and inter-modal levels. The funding mechanisms, in particular, appear to give various degrees of freedom to agencies such as KHC or the Special Cities which do not seem to imply adequate checks and balances. In addition, the single mode project investment criteria used are not conducive to effective inter-modal analysis. Given the frequency in Korea of investment proposals involving competing modes, it is necessary to develop a better approach for the selection of optimal investments. This issue is discussed and specific recommendations are made in Chapter 4.

3.68 The second problem concerns proposed changes in the regulatory and pricing systems. While the Plan's goals are satisfactory, the actions proposed may not, in some cases, be very effective or may even be counter-productive. Measures seeking to increase the size of transport operators are more likely to result in oligopolies imposing their rules on the market rather than in reducing prices and improving the quality of service. This area is very sensitive due to political and social pressures, and it is understood that solutions are generally compromises that do not fully

reflect sound economic principles. However, as discussed in Chapter 5, the Bank can be instrumental in gradually guiding government policy toward a somewhat less regulated system, providing strong incentives for more efficient operations. The ultimate goal would be to provide the conditions for a dynamic and equitable competition within and between modes that could supply services effectively and adjust promptly to changing transport needs.

3.69 Third, there are apparent inconsistencies between the policy directives and the action programs proposed. Improved maintenance and energy conservation have been rightly identified as priorities. However, the measures proposed are not explicit and in many subsectors are even lacking. Maintenance activities are generally funded by recurrent annual budgets and therefore may not be adequately dealt with in the Plan except when capital expenditures are recommended. This inconsistency is very apparent. On the energy issue where this conservation objective in transport is not properly articulated in action programs of line ministries, some guidance is needed, and this report therefore addresses the problem in Chapter 6 which provides a basis for strengthening the government program. The magnitude of present and future fuel consumption has been analyzed and recommendations are made on conservation measures and potential savings that can be achieved.

4. INSTITUTIONAL PLANNING ISSUES

4.01 The analyses of Korea's recent transport development and of its FFYP in the first chapters have identified several weaknesses in planning. A few misinvestments have occurred, in some instances programs have been developed in parallel by different modal agencies pursuing similar objectives, and often programs have been prepared in each subsector independently without any attempt at integrating them. This approach has caused minimal problems so far but is potentially harmful. Indeed, no major misallocation of resources resulted in the past, mainly because transport demand grew very fast allowing otherwise premature investments to soon be fully used. The Seoul-Busan expressway is such a case where a phased investment might have been preferable, building first a two-lane facility and several years later, an additional two-lanes. But it turned out that high traffic growth on most sections justified four-lanes much earlier.

A. The Need for Improved Planning

4.02 Under present conditions of slow economic growth and budget limitations, coupled with increasingly more complex traffic patterns, there is an urgent need for a rational planning process to improve the transport network. This would allow the identification of projects and programs that are economically sound and avoid a potential waste of resources. To date, Korea has not realized, at least in the transport sector, that planning is an essential step in government management that cannot be disregarded or dealt with by shortcuts for the sake of satisfying other, possibly more pressing, political objectives. The decision-making process requires efficient planning. It has to be worked out through three levels:

- (a) within each transport agency to integrate its projects into meaningful and cost-effective programs;
- (b) between the various agencies responsible for investments in the same mode to ensure that programs are consistent and complementary; and
- (c) among the agencies responsible for investment in different modes to optimize transport programs by organizing interdependences and reducing overall costs.

These three levels of action call for: (a) better unit or agency planning; (b) better intra-modal planning; and (c) better inter-modal planning.

4.03 Thus far, the planning process does not seem to have worked properly for four main reasons. First, little attention has been attached

to planning, which reflects a specific political attitude. Second, responsibilities have been fragmented which is exacerbated by a tendency for bureaucratic domination. Third, different funding mechanisms exist, which give relative freedom to revenue-earning agencies compared to those which receive funds from the central budget. Fourth, no operational coordinating agency exists, largely due to the reluctance of agencies to abandon certain practices or institutional privileges. Before suggesting what can be done, further analysis of the barriers to better planning is necessary.

B. Obstacles Hindering Planning

(a) Planning Limitations

4.04 Under past Korean Governments, strategic decision-making rarely relied on planning at the agency level. The main decisions were taken in a very centralized manner, at the highest level by the Blue House. To some extent the role of the agencies was to dress up those decisions into a rational strategy but mainly to implement the various projects in accordance with prescribed standards and very strict completion dates.

4.05 Accordingly, the planners had little freedom to propose variations to the investments prescribed. This has not been conducive to imaginative efforts by government staff or local consulting firms to find least-cost designs, as standards were applied to the rule. Projects have often been designed with higher standards than necessary, resulting in larger capital expenditures than required and in fewer projects. The Olympic Highway, for example, represents a case of over-investment which is absorbing large resources that were not available for other projects. The use of high design standards for provincial and county roads is another example of over-investment and a precedent that the Bank has tried to discourage by introducing, for example, good but cheaper type pavements such as double bituminous surface treatment (DBST) instead of premixed asphalt concrete (AC).

4.06 As investment decisions were based more on political than economic considerations, there was little desire to carry out economic feasibility studies, the cost effectiveness of which was misunderstood. When studies have been carried out, there was a tendency to alter their results when they were not in line with policy instructions. There were exceptions, however, such as the preinvestment studies that led to projects financed by the World Bank and the Asian Development Bank.

4.07 It is thus not surprising that Korea's civil service has not yet developed a very satisfactory planning capability. By contrast, over the past decade the private sector has demonstrated at home and overseas how a new generation of Korean entrepreneurs, through their dynamism and

ingenuity, managed successfully to undertake civil works for transport projects, and to build transport equipment including motor vehicles and ships. Nevertheless, the exposure of government transport agencies to projects prepared under the Bank's guidance gave them a good grasp of how to carry out preinvestment studies, including feasibility and economic evaluation, detail engineering, contracting documents for international competitive bidding (ICB) and monitoring of project implementation. Large inputs of foreign technical assistance have helped, particularly at the project level, to transfer technology and have succeeded in improving the quality of appraisal techniques. In a few instances such as the KNR and KHC, it even helped to develop in-house project preparation capabilities. In most cases, however, a heavy reliance was placed on consultants, foreign and local, to study projects. The Bureau of Public Roads, the KMPA, and the Transport Coordination Bureau do not have the staff to carry out studies themselves. Their role at best is to commission and supervise studies.

4.08 Although efforts have been made to strengthen capacities and build institutional mechanisms to promote coordination in planning, little came out of this mainly because of a political attitude that perceived such efforts as potentially restricting the freedom of high authorities in making decisions. With the new Government which has increased the delegation of responsibilities, more initiative is left to the modal planning agencies which now have better opportunities to strengthen their capability and may develop new skills to optimize investments. The preparation of the Fifth Transport Plan, which is far superior to any previous plans in quality and depth, is an example of this new determination. The Bank should therefore intensify its assistance to the transport agencies to continue to update their planning techniques, including the training of staff in the required specialties.

(b) Fragmentation of Transport Responsibilities

4.09 A main feature of the institutional organization of the sector is the partitioning of responsibilities which may result in fragmented and inconsistent development of facilities and policies. It is unavoidable and to some extent desirable to have numerous agencies involved, in particular decentralized units that are better suited to respond to local needs. However, it is indispensable to have a coordinating mechanism to adequately plan and develop the transport system. In the absence of such a mechanism, the present setup is likely to yield competing and redundant investments. Also, the financial independence of different agencies may lead to the development of low priority facilities while other urgently needed investments are delayed due to a shortage of budgetary resources. The problem for the road and port subsectors is particularly serious and is analyzed below and suggestions for improvements given in paras. 4.26 to 4.32. For the other transport modes (railways, aviation and inland waterways), the Ministry of Transportation (MOT) is responsible to plan, develop and operate these modes through the KNR, the Civil Aviation Bureau, and the Waterways Bureau, respectively. Intramodal coordination is not a

problem since each of these agencies is fully in charge of its mode; however, the inter-modal coordination of their development plans with others agencies outside MOT is deficient.

4.10 Highways. Responsibility for the administration and development of the road network is shared by three ministries - Construction (MOC), Home Affairs (MOHA) and Transportation (MOT). MOC has responsibility over the expressways through a public corporation, the Korean Highway Corporation (KHC), and for the national roads through its own Bureau of Public Roads (BPR). MOHA is responsible for provincial and county roads. MOT is responsible for the management of land transport, establishing terminals and overall transport coordination. The organizational and functional responsibilities and relationships among agencies are shown in Table 2.8. As a consequence of the present organization, the plans prepared by these agencies are not integrated since no mechanism exists to ensure their consistency and complementarity.

4.11 Under MOC, KHC was established in 1969 as a semi-autonomous, self-accounting corporation. It is active in developing expressways to be funded by its own revenues, and has a capability to design, construct, maintain and operate the expressway system. KHC's planning function is shared with the BPR. The KHC is technically fully competent, and is able to maintain the expressways adequately as it has ample resources of staff, equipment and funds from the tolls collected. BPR is in charge of planning, constructing, maintaining and administering the national roads. The BPR organization has evolved with the aid of technical assistance and training provided by the Bank under four previous highways projects. MOC's present organization is shown in Chart 1 and KHC's in Chart 2.

4.12 Under MOHA, the Local Administration Bureau, through a road section set up in September 1979, is responsible to prepare and monitor programs for provincial and county roads maintenance and to develop the county roads network. With the help of consultants, it prepared a first project approved in 1982 by the Bank, for implementation during 1983-87 and under which the section will be strengthened and upgraded to division level. At the local level, the nine provinces are responsible through provincial road divisions to plan, construct (often with BPR technical help) and maintain the provincial roads. In addition, the Special Cities, the cities and the villages have responsibility under MOHA to develop their own road networks. A Saemaul division in MOHA assists the villages in this task. The present organization of the MOHA is shown in Chart 3.

4.13 While MOT has no authority to build roads, it has a significant responsibility as manager of the road fleet and coordinator of the development of the various transport networks. The Land Transport Bureau (LTB) organizes and controls commercial road transport operators through a

strict regulatory system. Licensing quotas, route permits, pricing of services and vehicle safety are enforced by the provinces' Transport and Commerce Divisions. In theory, MOT is responsible for coordinating all transport investment programs within and among subsectors. This function is supposed to be carried out by the Transport Coordination Bureau (TCB) which was established for this purpose. But, as discussed in para. 4.21, this is facing a lot of resistance and has not been effective so far. Nevertheless, TCB performs a useful role in collecting and analyzing transport statistics, with a particular emphasis on roads, and its efforts appear to merit expansion. MOT's present organization is shown in Chart 4 and KNR's in Chart 5.

4.14 Ports. Responsibility for the administration and development of ports is shared among four ministries - MOT, MOC, MOHA and the Ministry of Agriculture (MOA). Here again, no exchange takes place among these agencies to integrate their plans. As a result, a number of inconsistencies exist, the most disturbing being the tension that arose between KMPA and MOC's Industrial Port Division subsequent to a Bank-recommended reorganization in 1976. MOT's Korea Maritime and Port Administration (KMPA), created in March 1976, is responsible for administering the construction and operation of Korea's 20 first-class commercial ports through ten District Port Authorities. KMPA is also responsible to plan and develop the 23 second-class commercial ports but their operation and maintenance as well as that of numerous other small local ports are handled by provincial governments under MOHA. The Korea Dredging Corporation has been transferred from MOC to MOT, and KMPA controls the dredging of first-class ports. KMPA's organization is shown in Chart 6.

4.15 The planning and construction of "industrial ports," defined as being part of industrial complexes, continue to be the responsibility of MOC, which also handled the commercial ports before the 1976 reorganization. Once built, industrial ports are turned over to KMPA, but only for maintenance and partial operation, since the management and cargo handling generally remains with the administrators of the complex. This division of responsibilities may have appeared reasonable at the time of the reorganization, but it tends in practice to conflict with KMPA's responsibility for overall planning of Korean ports. The Government tried to avoid this conflict by agreeing to establish an Inter-Ministerial Committee under the chairmanship of the Vice-Minister of EPB to review MOC's proposals for industrial port development, and to take action as required. However, this committee has apparently not functioned, and MOC and KMPA programs for port expansions are prepared independently and the new industrial ports are not included under the FFY transport Plan.

4.16 The development, construction and operation of the first- and the third-class fishing ports fall under the jurisdiction of the Office of Fisheries under MOA, but the second-class fishing ports are the responsibility of provincial governors under MOHA. Planned investments for those ports are not included in the Plan either.

(c) Differences in Funding Mechanisms

4.17 The lack of an integrated planning system is also due to the existence of two funding mechanisms - one through the central budget and one through funds that have been earmarked for specific purposes and are used at the discretion of their respective agencies. This means that agencies which rely for funds on the overstretched central budget are at a disadvantage compared to the independently funded agencies.

4.18 Funding of the various modes is organized as follows: for the national roads, main ports and airports, the general budget is the sole source to fund expenditures related to their development and maintenance. User charges on fuels, fleet ownership and utilization of facilities, collected through fees and taxes, accrue to the general budget. By contrast, KHC is financially independent, getting its revenues from tolls collected, and is not required to pay all the capital costs of its roads. The revenues from tolls amounted to W 60 billion in 1981, and two thirds were from the Seoul-Busan Expressway. Nearly 80% were collected from buses and trucks which represented 70% of the traffic (Tables 2.23 and 2.24). About 50% of the toll revenues were spent on maintenance (Table 2.25). The level of toll is subject to review by the Economic Planning Board (EPB) and approval by Government. KMPA for the time being depends on the central budget but in the future will become financially self-supporting. KNR is also a financially independent semi-public corporation receiving its revenues from tariffs. However, a deficit situation since the early 1970s has necessitated substantial subsidies from the central budget.

4.19 The local governments also have a separate financing system for local roads and ports. The county and provincial roads programs are funded through a block grant of 13.3% of local taxes which is allocated yearly by MOF to MOHA which can allocate funds as seen fit. No review is done to adjust these programs to others prepared by BPR or KHC, or with those prepared by the cities.

4.20 The problem inherent in this varied funding system is that all agencies are not treated equally, namely that KHC, KNR, and MOHA's local administrations have a financial independence that is not given to the BPR or, for the time being, to KMPA. It makes the coordination of planning very difficult because the legal framework prevents the budgeting institutions under the EPB from addressing the country's real priorities. The EPB exercises, through its Budget Bureau, a budgetary control on transport investments proposed by each ministry, except by MOHA and the semi-public corporations mentioned above, and has the authority to cut or defer projects due to financial constraints. Also, a Bureau of Project Evaluation, established in 1976 in EPB, reviews the economic justification of individual major investment proposals on a piecemeal basis. It has shown an interest

in transport coordination, spurred by the necessity of cutting back the public sector investment program, and its capability in project analysis is being strengthened under the Bank's 1981 Structural Adjustment Loan.

(d) Deficiencies in the Existing Coordinating Setup

4.21 Planning by different agencies cannot be satisfactory unless their plans are integrated by a coordinating body. Such coordination is necessary both within and between modes. However, both intra- and inter-modal planning coordination are deficient. No mechanism exists between MOC and MOHA to integrate road plans, and the coordinating committee to integrate ports plans prepared by MOT and MOC is not working adequately. The intermodal coordination function, which has by nature to be centralized and is currently the responsibility of MOT, is not carried out. Thus, transport investment alternatives proposed by various modes are not systematically compared before being adopted. The new TCB has only in theory the responsibility to handle this task, with its three divisions: Coordination, Transport Management and Survey/Statistics. Their functions, as evidenced by the list of responsibilities and prerogatives shown in Annex 1, are broad and clearly designed to embrace all aspects of coordination. But it cannot exercise this function effectively not only because it still lacks the resources and staff (although substantial efforts were made recently to train staff), but mainly as the legal framework does not allow such a control function by a ministry over its peers. The transport agencies in charge are too eager to implement their projects and do not easily accept rational challenge except due to funding constraints. In the past, some sort of coordination of investment did take place through the First National Land Development Plan (1972-81), prepared by MOC's Bureau of Physical Planning and embodying directions set at the Blue House. At present, MOC still has a determining role in indicating basic transport infrastructure investments as part of the land use and regional development strategies that are outlined for the future in the Second National Land Development Plan (1982-91) which was prepared with assistance from the Korea Research Institute for Human Settlement (KRIHS).

4.22 Government's past efforts to establish the coordination function started in 1970 when it made MOT responsible for this task, although the Bank had suggested EPB, based on recommendations of a consultants' study financed under an IDA Technical Assistance Transport Credit. Since then, with Bank support, many efforts were deployed to strengthen the Transport Planning Office (TPO) and make it work. Loan agreements under the Bank's First Highway and Third Railway Projects helped to define further its functions. In 1975 the Government established a Transport Coordination Committee (TCC) that consisted of nine directors, representing the ministries most directly concerned, and an implementation body in MOT, the Transport Coordination Office (TCO), that replaced TPO. TCC's responsibilities included the coordination of intermodal transport investments, but was not able to exercise its function effectively, possibly because key decisions were imposed from higher up. The TCO, headed by an assistant minister, was responsible for the review of transport investment

plans and policies, but after being downgraded to the Bureau level in November 1981 as part of an overall government reorganization, became the present TCB.

C. Suggestions to Strengthen Transport Planning

4.23 The problems analyzed above are complex, and vested interests are everywhere. The merits of better planning are, however, obvious and in the best interest of Korea. Our recommendations are to work on three fronts by:

- (a) improving the quality of planning within agencies;
- (b) improving intra-modal planning for roads and ports by introducing new mechanisms and by implementing a few important institutional changes; and
- (c) improving inter-modal planning by limiting coordination efforts to a few multi-modal projects, expecting that a better understanding of the necessity of coordination will later result in institutionalized solutions.

(a) Improving Planning Within Transport Agencies

4.24 The first condition to be met is a basic change in the Government's attitude in favor of sound planning. The present Government has given clear indications that it attaches great importance to the delegation of responsibilities and the decentralization of the decision-making process. This may augur substantial changes in the quality and depth of planning by the transport agencies concerned. A second condition is that more emphasis be placed on the value of studies. The returns of such activities are generally extremely high and justify the limited investment required. In particular, budget considerations should not systematically eliminate studies as they now tend to do. This approach is in fact counter-productive and very short sighted.

4.25 Given acceptance of these conditions, there are many ways to improve planning within agencies. Work should be encouraged on a number of current issues, some of which are identified in this report. For example, the comparative advantage of modes or the need to improve modal complementarities should be analyzed further to guide future transport development strategy effectively. Bank sector work, which is an attempt to improve this knowledge, should be continued and pursued through Korean research institutes, whose development would also have a major impact on the quality of work of government departments which must rely on the institutes due to the limited number of Civil Service positions under the present Korean administrative system. However, the best staffed institutes such as KRIHS have only a dozen of experts and are overly committed to a fast

increasing number of studies. Hence, the urgent need to upgrade the skills of present government staff and to recruit others with skills that are generally lacking, such as planners, transport economists, intermodal analysts, transport operation specialists, etc.

(b) Improving Intra-modal Planning

4.26 The problem area here is restricted to roads and ports. Internal mechanisms and procedures are required to ensure that the investments proposed by all road or port agencies are internally fully consistent at the subsector level. In the case of ports, there is good reason to reconsider the suitability of the present distribution of responsibilities between MOT and MOC. For its part, the Bank intends to support such an improved intra-modal planning effort through a shift from the past project approach to a subsector approach. Subsector lending includes not only support to investments in a given period, but also to policy and institutional changes that would be in the best interest of the country. Specific recommendations follow on how intra-modal planning can be integrated respectively for the roads and ports subsectors.

4.27 Road Planning. In order to better integrate road plans prepared by MOC (KHC and BPR) and MOHA (Provinces, Counties, Cities and Special Cities), it is first recommended that local capabilities to plan and develop their road network be improved urgently. Second, a mechanism is required to coordinate all road development programs. As an initial practical step, a study for integrating the national, provincial and county road programs is being conducted as a component under the Bank's Provincial and County Roads Project. This provides for a network analysis study to review the FFYP road investment program to ensure its intramodal consistency and to define technical criteria and institutional procedures to be applied in the future. As a second step, another study is recommended to consider whether a unified budget allocation system could be a tool to integrate road funding. Such a system could facilitate proper coordination of the overall road development program by instituting a more systematic and equitable allocation of road user charges. For example, a given proportion of the funds could be allocated, on one hand, to the maintenance of different classes of roads in relation to their traffic volumes while, and on the other hand, funds for improvement, paving and new construction could be appropriated on the basis of proper economic justification. The proposed increase in the diesel fuel tax discussed in Chapter 5 could well be the opportunity to recentralize the funding of road transport (para. 5.14).

/1 Under the recently negotiated Highway Sector Loan, the Government has agreed under the Action Program to establish such annual review function.

4.28 Port Planning. The funding of port maintenance and improvement expenditures could also be rearranged through a unified budget allocation system. This would resolve part of the potentially negative effects of the rather awkward delimitation of responsibilities and lack of coordination between MOC and MOT for port developments. However, such an approach may be too complex at this stage, and it might be easier to consider different ways to rearrange institutional responsibilities.

4.29 There is an urgent need to first ensure consistency and to this end, integrate investment plans already prepared for general ports under the Korea Maritime and Port Administration (KMPA) and industrial ports under MOC. Later, a coordination mechanism could be introduced to integrate future plans and those prepared for local ports by MOHA and fishing ports by the Ministry of Agriculture. Many alternative approaches to this problem would be worth considering. One could be to regroup port planning under a high-level body such as the EPB, while the construction and operation of ports could be decentralized in autonomous ports. Another could be to unify all responsibilities including planning and construction under a single ministry while the operation of ports could be decentralized. The planning and construction functions could also be regrouped under MOC in a Bureau of Port Development while the management, operation and maintenance of all ports could be placed under MOT in a reorganized KMPA, the main objectives of this being to maximize the use of port investments and to ensure adequate cost recovery from users. A study is suggested to review alternative institutional arrangements and funding systems for the subsector.

(c) Improving Inter-modal Planning

4.30 This task is the most difficult and only very few countries have been able to institutionalize such coordination among agencies responsible for various, often competing transport modes. In Korea the problem is that only one agency at EPB's level can realistically fulfill such a function. It seems vain at this stage to recommend any further attempt at strengthening MOT's coordination function. Our recommendation is rather to gradually refine the crude coordinating mechanisms set up in EPB's Project Evaluation Bureau. In particular, as a preliminary measure, it would be desirable to attempt strengthening the Bureau's capability with staff training and a new approach to move from ex-post type evaluation reviews to ex-ante coordination of the plans and programs formulated by the transport agencies concerned.^{/1} The long-term objective would be to integrate the various modal investment plans so that each proposal would be optimized. Such capability would mean, however, a much larger number of staff. An alternative which is already in practice is to rely more on consulting services and research institutes.

^{/1} Under the recently negotiated Highway Sector Loan, the Government has agreed under an Action program to establish by mid-1986 procedures for comparing investment alternatives between modes.

4.31 In the meantime very useful progress can be achieved in this direction by working at the project level to resolve transport needs of either a given commodity or geographic area. An emphasis on what has to be moved would naturally require consideration of all likely modes would require to address not only their comparative advantages. The focus of such a study would seek to optimize services at least cost. Hence, the complementarity of the modes would require to address not only the necessary supporting policies such as freedom of pricing, but also the necessary investments such as intermodal terminals and transit facilities. It is therefore recommended that project preparation be shifted from an isolated approach pre-supposing the need for a given mode to the specificity of the transport demand, and instead of looking at single mode solutions to seek multi-modal integrated solutions.

4.32 The Bank has already advocated such a shift in emphasis and the Government has responded by preparing the first project of this kind: the Coal and Cement Distribution Project. More multi-modal transport projects are recommended in three geographic areas: the Seoul-Busan Corridor, the Kyeonggi Province (Seoul Metropolitan Area) and the Southeastern Industrial Belt. By developing such projects, the coordination process will take place naturally, and will be adapted to the Korean situation. It will later be much easier to learn from such experience how inter-modal planning could be institutionalized.

5. TRANSPORT REGULATION AND PRICING ISSUES

A. Overview

5.01 The Korean society is highly disciplined and regulated, and its transport system is no exception. Carriers are expected to perform the duties assigned to them not because they may be profitable, but to meet legitimate needs identified by the authorities. The need for carriers to be reimbursed is recognized by the Government, but the right to negotiate charges is not. It is for the designated government officials to determine who may, and who may not, enter the industry; the tasks to be performed; and the prices that may be charged.

5.02 Thus, the provision of transport services in Korea is closely controlled by government officials. Even transport operators within the industry need government permission to increase services, or to reduce them. Regulation of this kind tends to introduce inefficiencies, and as a result private commercial and industrial companies that transport their own people and goods and that are still unregulated have become more active. However, it is not easy to devise practical proposals to change the system without upsetting some existing users and operator overly protected by the present system. Nevertheless, several changes should be considered.

Relationship between Pricing and Regulation

5.03 The essential point about pricing regulation in Korea is that it is based on a system of average prices. In many important respects, operators are required to charge the same prices for high-cost as for low-cost services. For example, bus fares in Seoul are the same, irrespective of distance. Passenger fares between cities - by road, rail and air - vary with the distance, but may not vary with other important determinants of costs, such as route density, time of day or day of the week. Inevitably, some services make profits and others losses. Under the present system, land or sea transport operators are required to support loss-making services out of the surpluses earned on profitable ones. Indeed, one of the objectives of the licensing system is to ensure that each operator has a "fair" mix of routes. Such a system can only work in the absence of competition, for competitors would inevitably concentrate their efforts on the more profitable routes, and undermine the efforts of the licensed operators to serve the unprofitable. Therefore the authorities are perfectly logical to restrict competition, and the lifting of restrictions on entry cannot be recommended if the existing price controls are to remain in force. Conversely, the removal of price controls cannot be recommended unless restrictions on entry are also lifted. If it is decided to relax the rules governing transport, it will be necessary to devise a program involving a step by step lifting of both pricing and entry regulations.

5.04 The starting point in all cases might be an examination of the package of services provided by each licensed carrier, with the objective of identifying services considered unprofitable by them. For example, it is reported that many of the services in low-density rural areas are not attractive to the licensed operators, who run them only at the insistence of the licensing authorities and against subsidies (1,062 such unprofitable routes were opened by licensed bus operators from 1976 to 1982). However, such services may well be attractive to local people, particularly those operating just one vehicle either for passengers, goods, or both. If licensed operators were to be allowed to drop services they considered to be unprofitable, it would no longer be necessary to protect their profitable services from competition. It should then be possible to relax all the regulations on entry and, subsequently, the regulations fixing transport tariffs.

5.05 A further general point that should be made is that the licensing authorities appear to work very closely with associations of transporters - whether truckers, bus operators, or coastal shipping operators. When the authorities investigate the need for additional services, the existing operators are consulted and, if a need is established, are generally invited to provide the added services. In practice, the transporters' associations are thus in a position to prevent newcomers from entering the transport market. This cannot be a healthy situation and, indeed, does not seem to be a legal requirement. Even if it were accepted that entry into the transport industries in Korea should be controlled, it does not follow that the control should be exercised by the existing operators.

B. Road Transport

Regulation and Pricing

5.06 The economic regulations governing road transport can be summarized as follows: (a) licenses for all bus operations and trucking "routes"^{/1} are issued only to enterprises having a minimum of 30 vehicles in cities and in rural counties; (b) quotas are imposed on the total number of vehicles in each province as well as service "areas" or "routes"; and (c) rates and fares are regulated for freight and passenger traffic. Some partial relaxations have been introduced subsequent to Agreements under the Bank's Second Highway Project: the number of vehicles needed by an enterprise to obtain "area" trucking and taxi licenses in counties was reduced from 10 to 5; the minimum vehicles requirement can be waived where deemed necessary for particular areas and was removed for pick-up truck services; and the

^{/1} An "area" license authorizes service within a limited area, generally a province, and a "route" license authorizes service along a given route between points A and B.

operation by owner-operators of taxis and "area" trucks was allowed. More details are given in Annex 2./1

5.07 In addition to license and fleet restrictions, there are many other regulations on the industry. For example, on every route exceeding 100 km, bus operators are required to employ attendants to travel in the bus, whose duties are similar to those of flight attendants on commercial air flights. To the outsider, it would seem that the Ministry of Transport has a legitimate interest in the training and working conditions of the bus drivers, whose skills (or weaknesses) directly affect the safety of passengers. But it is difficult to see why it could not be left to the bus companies themselves to decide on the employment of non-drivers.

5.08 Probably the most damaging regulations are those requiring a fleet of 30 vehicles minimum in urban and rural areas for both trucking "routes" and most busing operations. That these regulations serve no useful purpose is illustrated by the fact that, in the Daejeon area, after an exception was made to the law by reducing the minimum required size of intracity bus fleet from 30 to 10, some of the larger fleets split up. The resulting reduction in the size of operating units, which presumably benefited the operators, was also accompanied by an improvement in the service to the public. No evidence has been found that transport services in Korea improve with the size of operating units, and the existing regulations have the additional damaging effect of making it more difficult for newcomers to enter the industry. However, the Plan calls for further consolidation of passenger operating companies, up to 300 buses per unit (para 3.21). It is our view that larger firms should not result from government mandate but rather from the industry's adaptation to market forces. In any case, the entry of new and small companies is necessary to insure, through competition, that best services are offered at most competitive prices./2 Furthermore, there are other regulations that prevent operators from adjusting bus size to actual demand and which result in full-size buses being used in rural areas; this is reflected in the very small number of minibuses seen on the roads. Regulations also do not provide for the use of dual-purpose vehicles for both passengers and goods, a class of vehicle usefully employed in many countries, including Switzerland and Scotland. It is difficult to see any advantages in the regulations governing the sizes of vehicles other than those relating only to considerations of safety, road capacity, etc.

/1 Annex 2 deals with road transport licensing procedures and provides relevant excerpts from the 1961 Road Transport Business Act.

/2 A study on Public Urban Transport Operations, about to start under MOT and financed by the Bank, is to review the desirable extent of Government regulations for urban buses and taxis.

5.09 The pricing of road transport services should be considered in light of the following objectives: (a) to cover the operators' costs in providing the services; (b) to ensure that the costs of using the existing roads are paid for by the road users; (c) to provide revenue for expanding the road system; and (d) to ensure that the costs of road transport do not distort the demand for road use, in relation to the use of competing transport modes, such as railways or coastal shipping.

5.10 The current system of road user charges in Korea (Table 2.26) which is detailed in Annex 3, fulfills none of these objectives. First, the system of cross-subsidization referred to earlier does not allow operators to recover expenditures sustained in high-cost operations, nor to expand their low-cost operations. The second objective, to meet the costs of road use, is generally met in the case of private cars, but not in the case of commercial vehicles, which are virtually untaxed. This is because the Special Excise Tax on diesel oil (exclusive of VAT) is only 23 won a liter (compared to 310 won on a liter of gasoline) and many of the annual licensing fees do not apply to commercial vehicles (Table 1.20). Therefore, objectives (c) and (d) are not met either, and the use of roads for goods transport is stimulated at the expense of rail and coastal shipping.

5.11 Commercial vehicles do, however, pay for the use of toll expressways, though the payment is proportional to vehicle weight rather than to axle load which is regarded as the main factor in damaging road pavements. Thus the present system also encourages goods vehicles to use, and severely damage, the overloaded but untolled national roads, and to avoid the faster and safer expressways.

Does the Present System "Work"?

5.12 Despite the anomalies mentioned above, the present system might be defensible if it were shown to "work." But the evidence is that it is not working; the transport demand, both for people and goods is, to an ever increasing extent met by private groups and firms that avoid the regulations by operating their own vehicles. While the growth in the number of "for hire" vehicles is only 6% per year, the number of privately owned goods trucks has been increasing since 1977 at the rate of 32% per year (para. 2.36). For example, the National Agricultural Cooperative Agency Federation has financed over 2,000 commercial vehicles to enable its members to carry agricultural inputs and produce in rural areas, even though the vehicles cannot be used efficiently because the regulations prohibit them from carrying the goods of non-members. In the case of passenger services, an increasing number of firms buy buses and minibuses to take their employees to and from work.

5.13 If left unchanged, the existing situation may be expected to deteriorate, with more and more traffic - for example, regular consignments on main roads - being taken from the commercial operators, who would be left with the more difficult and costly jobs. Therefore, it would seem that the

options facing the authorities in Korea are either to prohibit private firms from using their own vehicles, which would involve much more regulations, and a reduction in freedom and mobility that would probably be unacceptable, or to relax the regulations and allow more of Korea's transport services to be carried out on the basis of commercial considerations, subject to the appropriate road costs being covered, and to safety and environmental standards being met.

Suggested Changes Towards Deregulation

5.14 There are a number of ways to improve the system by liberalizing road transport regulations and pricing. It might be desirable to first remove the obligation that commercial operators must serve unprofitable routes by allowing introduction of other more appropriate forms of transport. Competition could then be opened up on profitable routes by withdrawing licensing and pricing regulations at least for intercity transport. This process might proceed as follows:

- (a) Relax the regulations governing the sizes of bus and truck fleets and the minimum sizes of vehicles that may be used. This would give road transport operators more freedom in the choice of equipment and organization. Efficiency would probably not be reduced, as operators would still have the freedom to be organized in large units, or to use full-size vehicles should they choose to do so.
- (b) Permit and encourage buses to carry freight in addition to passengers. This could increase the utilization of vehicles, and raise earnings, especially in rural areas where loadings are light.
- (c) Remove licensing requirements for bus transport in rural areas. The carriage of passengers and goods in rural areas is considered to be a high-cost, unprofitable operation which carriers are required to provide as a condition for obtaining licenses for profitable operations. The relaxation of the licensing requirements would allow carriers to confine themselves to profitable routes, and would enable local people to provide local services with appropriate equipment such as unscheduled transport services ^{/1} or cooperative buses owned either by individuals or by associations of farmers. Article 15 of the Road Transport Business Act (Annex 2) already allows qualified owner-drivers to obtain "area" licenses, but limited use seems to be made of this exemption.

^{/1} A first step in this direction is being made by introducing on an experimental basis unscheduled transport services in rural areas under the Provincial and County Roads Project.

- (d) Permit owners or companies of private fleets of trucks and/or buses to purchase licenses directly from existing commercial operators. This would increase the utilization of such private fleets and would facilitate entry into commercial operations.
- (e) Encourage in urban areas further use of "informal" passenger services in peak periods so as to reduce the peakhour loads on the conventional carriers. The provision of peak period transport services is exceptionally costly, because of the need to use equipment and staff that are idle for most of the day. Therefore, any additional capacity that can be used in the peak period will not only ease traveling conditions on trains and conventional buses, but is also likely to reduce their operating costs. The authorities should therefore encourage even more the use of car pools, van pools, company-owned buses and other means of shared travel.
- (f) Introduce an annual axle load tax for heavy trucks and buses to contribute for their actual damages to the road network. This would assist in making fares and tariffs for road services reflect the actual economic cost incurred by the road system which is otherwise paid, not by the direct users, but by the general budget, and constitutes a subsidy to road transport.
- (g) Adjust gradually the level of excise tax on diesel fuel for road transport to the gasoline tax to improve cost recovery from road users. The Special Excise Tax (SET) on diesel fuel (excluding the VAT) was, in 1983, 23 won per liter, resulting in a retail price of 283 won per liter. Regular gasoline, on the other hand, carried a SET of 310 won per liter (US\$1.50 per US gallon) and was sold at 660 won (US\$3.67 per gallon). To the extent that a tax on fuel can be regarded as payment for use of the roads, the tax on diesel oil should be higher than on gasoline because of the superior miles per gallon delivered by diesel engines. There may be a case for taxing personal travel at a higher rate than commercial travel, but it would be more effective to do this by means of duties on vehicles, rather than on fuel. As commercial transport contributes a negligible amount in road use taxation, its use is excessively stimulated at the expense of rail and coastal shipping. Consequently there is a strong case for substantially raising the user-charge element in the pump price of diesel fuel. This charge should not aim at simple equality in the amount of gasoline and diesel user-charges but should reflect the much higher costs which the heavier diesel-powered commercial vehicle fleet imposes on the road system (differences among different types of commercial vehicles can best be recovered through vehicle-specific purchase taxes and/or license fees). If, for instance the tax were equal, users of diesel fuel would still obtain the benefit from its lower production cost and from its higher efficiency in terms of mileage per liter. (see paras. 6.49 to 6.53 for a more detailed discussion of fuel pricing).

5.15 The main objectives pursued by deregulating licensing are (a) to increase the pay load and occupancy ratios of road transport; (b) promote the selection of more efficient size of vehicle; and (c) save substantial amounts of fuel. Large cost savings would accrue that could be passed on to consumers if real competition existed, contributing also to Government's policy of price stabilization. However, fair competition has to be based on a neutral taxation system and appropriate charges for the cost of inputs such as the road infrastructure. Hence, there is a need to ensure that operators pay their fair share of road costs to avoid cross or direct subsidies that distort competition by favoring services which are artificially cheaper as they do not cover economic costs and result in misallocation of resources. It is thus suggested that two separate studies be carried out. One to measure the economic impact of existing regulations on the road transport industry and to implement the phasing out of road transport licensing and administered fares; the other to analyze road costs on the country's networks, the level of user charges that ought to be raised and the taxation system best suited to recover those costs. The Government sees the merits of such a Road Transport Deregulation Study and a Road User Charges Study and has agreed to initiate them in 1984.

Revenue Implications of Raising Diesel Fuel Tax

5.16 Had the SET on diesel oil been the same as on gasoline in 1981 ^{/1} the additional revenue collected could have been about W 1,036 billion, about double the total (W 523.6 billion) actually collected in 1980 in road user charges from all vehicle classes. (The calculation of additional revenue assumes that the increase in the price of diesel oil would raise vehicle operating costs by 20% and reduce diesel oil consumption by 10%.) These additional revenues would have equaled about twice the total amounts spent on the roads in 1981 by government agencies (W 561.5 billion).

5.17 The extra W 1,000 billion generated from fuel taxes could be used in several ways, it could be (a) incorporated in general revenues; (b) spent partly on safeguarding or expanding supplies of petroleum fuels; or (c) allocated partly - say one half - to an "earmarked" fund for the maintenance and/or construction of roads. Such a fund could be the basis for a unified budget allocation system that would allocate funds within the country proportionally to the traffic using the roads, as ascertained from regular traffic counts. Funds could be payable to provincial or county authorities, or indeed to any entity, public or private, that provides public roads. In particular, the KHC could be paid in this manner, in place of its toll collection system. Payment to the KHC out of an earmarked fund on the basis of traffic counts would save the considerable costs of toll collection (about 10% of total revenues) and, more importantly, would improve the

^{/1} The year 1981 is used as it is the latest for which road expenditure figures are available. Use of 1983 data would not affect the proposal.

utilization of the road system by removing the financial penalty for using high-quality, uncongested roads. Allocation of a proportion of highway revenues by a predetermined formula would also ease the work of transport planners and enable them to devote more efforts to non-routine problems. Such a road unified budget allocation system ought to be studied in the proposed road user charges study (para. 5.15).

5.18 Fuel tax revenues increase with vehicle weight and with distance traveled, and can reasonably be used to levy a payment for the cost of maintaining and running the road system, in the same way that the charge for each unit of electricity used by a household is imposed to reflect the cost of providing additional units of electricity. The main disadvantages of fuel taxes as a means of paying for roads are that they are generally too low to reflect the costs imposed under conditions of severe congestion (which can exceed 300 won per vehicle-km), and that, if applied equally on a per liter basis to all fuels, they undercharge vehicles using diesel fuel, compared to those using gasoline, because of the better mileage per liter of diesel. The former disadvantage can be partly overcome by having higher fuel taxes, and vehicle fees, in the Seoul area. The latter could only be overcome by taxing diesel fuel used for road travel at a higher rate than gasoline, but in Korea the situation is now perverse, with diesel fuel being taxed at a much lower rate than gasoline.

5.19 If an earmarked road fund were set up in Korea, it could also receive revenues from annual taxes including a new axle-load tax, on vehicles that impose particularly high costs on the road network, for example, trucks with heavy axle loads. As such vehicles tend to be heavily utilized, annual taxes are not inappropriate to recover from their owners the extra costs they impose on the road system. They would correspond to the periodic 'standing charges' or 'rentals' levied for the use of telephone, electricity and water services and could be distributed in proportion to the incidence of heavy vehicle use over the highway network.

5.20 On transport and environmental grounds, there would seem to be a strong case for improving Korea's road network, as many of its segments are inadequate. Many rural roads have exceedingly poor surfaces, and others are heavily overcrowded. Facilities for pedestrians and cyclists do not exist on many main roads. There are good reasons for improving the road network as soon as possible, to prepare for the higher levels of motorization that are bound to come.

5.21 The Government and the Bank have agreed that the pump price of automotive diesel fuel should be raised to a level two-thirds that of gasoline by 1986. Clearly a number of price adjustments could contribute to this result, e.g. some reduction in the gasoline tax has already occurred, some increase in the diesel tax has also occurred, and some increase in the ex-refinery price of diesel seems likely in the future. Many well-established public and private interests have a stake in how the agreed result is to be achieved. Apart from wanting to see greater recognition of

user-costs in diesel pricing, the Bank has no strong ideas on what solution would be best. It does hope, however, that the Government retains its ad valorem approach to fuel taxation (define to include user-charges), since this system permits easy, automatic adjustments in tax yields in response to changes in the absolute cost elements in the pump price (mainly the ex-refinery price and distribution margins).

C. Other Transport Modes

Railways

5.22 Economic regulations do not constrain the railways in their internal operations. They can carry any commodity and in any quantity. They are however required by Government to comply with tariffs set by the Economic Planning Board, and to keep open some branch lines that they would rather close. They are also reported to be pressured to invest more in expanding high-speed passenger services than they believe to be justified. Government regulations, with the exception noted below, do not seem to inhibit the operations of the railways: they do however force them to provide services that are not commercially justified.

5.23 The main economic regulations affecting the railways are the constraints imposed by Government on road carriers to enter the railway yards. This privilege is confined to one firm - Korea Express Company - for general traffic, and to four firms for container traffic. All other carriers have to transship their goods to the railways through one of the five designated firms.

5.24 Railway tariffs have to be approved by Government. Freight tariffs are kept low, but are high enough to cover the variable costs. As the railways have spare capacity, and as trucks are not required to pay for the road infrastructure (except on the toll expressway) the freight tariffs may be considered reasonable (Table 3.20). However, the spare capacity that justified low tariffs also indicates that some of the proposed investment to expand capacity may be premature. As regards passenger tariffs, the authorities require the railways to charge low rates for the ordinary trains, too low even to cover variable costs. The railways are allowed to charge higher fares for their express services, the costs of which are lower and, as a result, these services cover all costs and earn profits (Table 3.21).

5.25 Mention may also be made of the charges to "commuters" on the Seoul urban railways. Travelers who buy monthly season tickets get their fares commuted to the extent of 30% (hence the name "commuters") and, if they are students, the fares are commuted by 50%. While these concessions are understandable on political grounds, they do not make economic sense: most commuters travel in the peak periods and therefore impose extra costs on the system. If the fares were determined by criteria of efficiency, the concessions would be offered not to peak users, but to off-peak users (Table 3.22).

5.26 It is recommended (a) that the railway terminals be opened to all shippers and commercial transport firms wishing to deliver goods to, or collect goods from, the railways rather than the few firms now so authorized; (b) that the railways should be compensated for operating in a non-commercial manner in compliance with governmental instruction; (c) that the railways should be allowed to raise passenger fares on the "ordinary trains" or (preferably) to close down poorly supported services where buses are available or could be made available; and (d) that the commuters' tariffs be raised in gradual stages, so as to bring them at least to the level of the daily tariffs, and that concessions in the prices of tickets be confined to off-peak services, subject to variable costs being covered at all times.

Coastal Shipping and Ports

5.27 Despite the length of journeys by sea, coastal shipping carries a substantial proportion of Korea's domestic freight transport - 26.8% of total ton/km in 1980. The main items carried are coal, cement, steel and petroleum products. Passenger transport is, however, negligible - less than 1/2% of total passenger-km.

5.28 Coastal shipping regulations are stricter than for land transport. It is generally illegal to carry goods even at less than the charges specified by the Ministry of Transport. The reason given for this is the need to protect small operators from the bankruptcy that could result from price cutting. Entry into the industry is also strictly controlled. Licensing regulations are administered by the Korea Maritime and Port Administration, working closely with the Korea Shipping Association, which represents the coastal shippers.

5.29 With regard to port tariffs, the charges at Busan and Incheon cover maintenance and operating costs but not capital costs. The other ports do not even cover maintenance and operating costs. Statistics on port revenues and costs do not seem to be available. In any event, as coastal shipping comprises only a small fraction of total shipping, the port charges it would pay would have a negligible effect on port finances.

5.30 It is government policy to subsidize coastal shipping by:

- (a) tax concessions;
- (b) low-interest loans; and
- (c) coverage of deficits incurred on services to "remote islands."

Ocean shipping is also subsidized, but in a different way. The existence of different subsidies for different classes of shipping means that (for example) a ship financed for coastal shipping cannot easily be used for ocean shipping, e.g., for trade with Japan.

5.31 A Shipping Association spokesman reported that there was severe over-capacity in coastal shipping and that rates quoted were often 40% below those permitted.

5.32 It is difficult for outsiders to judge the extent to which the industry is encouraged or discouraged by the present combination of subsidies and regulations. The rules that protect the operators of small vessels from competition are also likely to protect the inefficient and the outmoded. The regulation that allows a small vessel (200-ton capacity) to charge more than a large one (800 tons) for similar loads, is likely to inhibit the introduction of larger, more cost-effective vehicles. If there is indeed over-capacity in the industry (and the mission received evidence that some shipowners were adding capacity), the existing regulations are more likely to serve the interests of the shipowners than the public.

5.33 It is suggested that (a) cost-based port tariffs should be applied to cover at least maintenance and operating costs for all ports as well as capital costs for Busan and Incheon, which both could be established as autonomous ports; (b) the rule prohibiting the carriage of goods at less than the MOT rates should be abolished and, in regulating coastal shipping, the authorities should concentrate on safety factors; (c) the rules governing entry and maximum charges in coastal shipping should be progressively relaxed; and (d) analytical cost accounting should be introduced, and information on expenditures and revenues relating to each port should be routinely published.

Air Transport

5.34 Korean Air Lines (KAL) is the only domestic operator in Korea, though it does not appear to have an official monopoly. In view of the small size of the country, air transport accounts for only 0.6% of total passenger-km, and a negligible percentage of domestic freight transport. KAL lost money on its domestic operations in 1980 and 1981, but there were substantial variations in the profitability of different services. Total costs were covered on the Seoul-Busan and Seoul-Cheju routes but losses were incurred on the other sections. KAL pays for landing and air traffic control at the same rate as the other (international) airlines operating in Korea.

5.35 Fares are fixed by Government and are the same for all routes at all times. Planes tend to be full for holiday and weekend travel and less full on weekdays, but KAL is not allowed to vary its fares to take account of differences in demand for air travel. The fares are kept low by government order ("to keep down inflation") and also by competition from other modes. Permission from the Civil Aviation Bureau is needed to start a new route, but the necessary permits are always given when requested by KAL.

5.36 The Seoul-Busan route, a distance of about 400 km (slightly longer than Washington, D.C. - New York) is a significant one, as it is also served by road and by rail. However, as in the case of Washington New York, only air travel enables residents of one city to transact business in the other and return to their homes on the same day. It is therefore to be expected that, as living standards rise, the amount of air travel between Seoul and Busan will increase, both absolutely and in relation to other modes. This factor has an important bearing on the proposed new high-speed Seoul-Busan rail link. The Seoul-Cheju traffic is mainly touristic. It, also, may be expected to increase as incomes rise.

5.37 It is suggested that to better use its capacity, KAL should be encouraged to vary fares to take account of variations in demand, both by route and by day-of-week, season, etc. It is also suggested that the Civil Aviation authorities publish financial accounts relating to airports and air traffic control, to ensure that the full costs of air transport infrastructure are made known and, in general, charged to the users.

6. TRANSPORT ENERGY ISSUES

A. Overview of Current Transport Energy Consumption and Related Policies

Energy Intensity in the Economy and in Transport

6.01 The steep rise in energy prices during the 'seventies' had led the Korean Government, like most others, to give much more attention to energy problems than it had done in the years when energy was cheap. Because of its climate and industrial structure Korea is relatively energy-intensive, and the dramatic growth in the economy during the past two decades has required equally dramatic increases in energy use, especially in the use of petroleum. Between 1966 and 1979 GNP growth averaged 9.8% p.a., total energy use grew at 8.2% p.a., while petroleum use grew 20.8% p.a. Since all petroleum and gas must be imported, the growth of the import bill has been huge. In 1973, crude oil imports cost Korea US\$0.3 billion, or 2.3% of GNP. By 1980 the oil bill had risen to US\$6.2 billion (a twenty-fold increase) and accounted for 10.8% of GNP. As Table 6.1 shows, this was higher than in any of the three comparator countries. By 1981 oil imports were costing about one-third of total exports. While the 1983 declines in world oil prices will mean big savings, no one knows how long these declines will last. It seems extremely unlikely that oil will ever again become cheap enough so that Governments - or private operators - can relax their efforts to economize on its use.

Table 6.1 (T): PETROLEUM IMPORT BILL FOR SELECTED COUNTRIES

	<u>Crude oil imports (billion US\$)</u>				<u>Petroleum imports as % GNP</u>			
	1973	1975	1978	1980	1973	1975	1978	1980
Korea <u>/a</u>	0.3	1.5	2.3	6.2	2.3	6.8	5.1	10.8
Taiwan <u>/b</u>	0.1	0.6	1.6	4.1	1.0	4.3	6.6	10.4
Japan	6.7	19.6	23.4	52.7	1.6	4.2	2.7	5.6
US <u>/a</u>	8.3	26.6	42.9	80.2	0.6	1.7	2.0	3.1

/a Crude oil and petroleum products.

/b Crude oil only.

Source: Data Resources, Inc.

6.02 The proportion of energy used in the transport sector is considerably smaller in Korea than in most other countries of similar income levels. The entire transport sector uses only 18-20% of national petroleum consumption, a figure well below that for most other comparable countries (by contrast, the industrial and electricity sectors consume 38.5% and 27.9%). The main reason for the sector's low consumption is the policy of controlling the growth of private passenger cars, which today account for only 3.3% of total petroleum consumption. This situation is not expected to last, however. Projections of final energy and petroleum demand for 1982-86 indicate that transport use is expected to grow more rapidly than any other sector. Part of the reason for this outlook is that opportunities for substituting nonoil energy sources are far fewer in transport than in other sectors. Another reason is that the Government has so far paid much less attention to energy conservation in transport than in industry, power generation, and buildings. More important than either of these reasons, however, is the prospect of a very large increase in the number of automotive vehicles, particularly passenger cars, which today number about 305,000 compared to 263,000 trucks, 66,000 buses, and 410,000 motorcycles (Table 2.5). The continuing, and probably accelerating, growth of the vehicle fleet means that the sector's energy consumption is bound to increase rapidly. This prospect underlines the importance of energy conservation for the sector. Saving energy is not an absolute goal, however. Governments and private owners should not reduce energy consumption below the point where the benefits exceed the costs. This point can be found only by careful and continuing study.

6.03 It is important to understand the relative importance of energy in the total costs of transport, particularly road transport, which accounts for two-thirds of total transport energy use. Broadly speaking, fuel accounts for 15-30% of the total economic costs of operating an automotive vehicle, with the lower figure being more representative for most types of commercial vehicles. By "economic costs" are meant the costs (including depreciation) of buying the resources needed to provide transport services. This means excluding all tax costs whether on fuel, on vehicle purchase, or annual licensing fees. When costs are taken net of taxes, one finds that fuel costs are of the same general order-of-magnitude as labor and maintenance (all around 20-25% of total resource costs). These are not, of course, the costs experienced by vehicle owners and shippers, for whom taxes are a very important financial cost, often so important that they influence the demand for vehicles, for sizes and types of engines, for types and amounts of fuel, and the choice of mode for passenger or goods transport. The private interest which vehicle owners have in minimizing their transport costs are different from - but re-inforce - the interest Governments have in minimizing the demand which the transport sector puts on a country's fuel requirements. The latter is overwhelmingly a balance of payments concern, although minimizing energy use in transport also influences the number of vehicles needed to provide transport services in the economy and the amount of environmental problems created by fuel emissions and vehicle congestion.

Neither vehicle owners nor the Government should approach the problem of energy use by assuming that they should aim at achieving maximum energy efficiency (defined as minimizing fuel consumption per passenger-km or per ton-km of freight. That would be a purely technical or engineering approach and could lead to heavy investments in infrastructure and vehicle technology that would cost much more than the value of the energy saved. The proper objective must be economic rather than technical and must aim at combining all resources in such proportions that the total cost of providing transport services is held to a minimum. The world's present interest in "energy efficiency" is directed to re-examining how total costs can be reduced after one of its major components, energy, has suddenly become much more expensive. It should not be directed at "minimizing energy use."

Economizing Energy in the Transport Sector /1

6.04 The response of the road transport sector to higher energy prices will depend on the scope which exists for responding; this is limited by what is technically feasible. It depends further on the incentives for using this scope and this is a matter of government policy. Road users, acting on their own, can and will vary the method of operating their vehicles but there are other potential sources of economy which require supplementary action by government, local transport or highway authority, whether by way of changing regulations, altering taxes and duties, controlling congestion, or investing in infrastructure.

6.05 Economical driving and operating methods. Experiments in the USA and Europe show that energy saving of the order of 20% should be attainable by appropriate changes in driving and operating methods. The saving is obtained by keeping engine speed below 2,000 revolutions per minute, maintaining a constant highway speed around 55 miles per hour, minimizing gear shifts, and turning off engines whenever possible. It requires further that engines are maintained through regular air filter changes, competent and timely tuning, and the use of high quality lubricants.

6.06 Reducing traffic congestion. Congestion affects fuel consumption by forcing down the speed of traffic flow and by requiring frequent changes in speed and associated gear changes. Recent research suggests that congestion on freeways in developed countries is capable of raising fuel consumption by as much as 50%. The control of congestion has been pursued with success by a variety of policies: simple lane markings on roads, reserved lanes for buses, zoning combined with pricing, the introduction of parking lots, parking meters, improved traffic light systems, and other measures of traffic management. In Manila, urban traffic speeds rose from 19 to 23 miles per hour in consequence of a traffic management program.

/1 This section is taken, with few changes, from the World Bank publication, Energy and Transport in Developing Countries: Towards Achieving Greater Energy Efficiency (February 22, 1983, 89 pp.)

6.07 Intensifying fleet use. Savings of energy of the order of 5% or more appear possible through measures which raise the load factor of trucks. This tends to occur, for instance, when common carrier services, which have been hampered by the taxation and licensing system of many developing countries, are enabled to take over more traffic from own-account transport. The construction of terminals and the extension of telecommunications can also contribute by permitting improved scheduling. Some of these measures will induce not merely increase in average vehicle loads, but also increases in the size and weights of trucks and buses. Energy is saved by performing a given volume of haulage by larger vehicles because the fuel requirement rises proportionally less than weight.

6.08 Energy-efficient vehicles. Cars of the latest available technology are some 30% more energy-efficient than the vehicles they replace in developed countries. The difference in energy efficiency in trucks is of the order of 10-20% and more progress is expected. The new generation of vehicles saves energy by reductions in weight, better aerodynamics and more efficient engines. The average age of the fleets in most developing countries is greater than in developed countries. The scope for saving energy through fleet renewal is therefore greater.

6.09 Infrastructure improvement. No quantitatively strong relationship has been established between variations in road roughness and fuel consumption. However, the rehabilitation and paving of roads and corrections of road alignment and bends permit driving closer to least-energy speed.

6.10 LPG as an Alternative Automotive Fuel. Liquid Petroleum Gas (LPG) can substitute for both gasoline and diesel fuels with relatively modest costs for vehicle adaptation. Although the present tax structure makes it much cheaper for owners, the fuel is only marginally cheaper for the economy than gasoline and diesel; it is, however, considerably less polluting. The handling and distribution of LPG presently involves more inconvenience than the other fuels, which have well-developed distribution systems; consequently in Korea, LPG use has been confined to taxi fleets that can be fueled at a few central locations. The extension of LPG use to buses deserves investigation on both economic and environmental grounds (a similar study is already being conducted in Bangkok. Significantly, perhaps, Japanese urban buses do not use LPG).

6.11 In conclusion, an improvement of energy efficiency in road transport of the order of 30% over the next five years lies not merely in the range of what is technically feasible but should also be economically feasible in many developing countries, including Korea. The chief sources of improvement will be the use of more energy-efficient vehicles, and adaptations in the methods of driving, maintaining and managing vehicles.

6.12 There are no official statistics on energy consumption by transport mode. However, using reported modal activity levels, estimated vehicle utilization rates, and fuel sales, an approximate breakdown of modal consumption may be obtained. The results are summarized in Table

6.2(T) below. Despite its lack of precision, such a breakdown shows that road transport, as noted, accounts for about two-thirds of all energy consumption in the transport sector. Trucks account for about 29%, buses for 20%, and private cars and taxis for about 18%. The remaining third of sector use is dominated by maritime transport (19%), followed by air (8%) and rail (5%). These proportions are likely to change substantially during the next decade, with road transport - already much the largest component expanding considerably faster than any of the others. For this reason, efforts to increase transport energy efficiency - or, more accurately, to minimize transport costs - should concentrate on road transport.

Table 6.2(T): ESTIMATED ENERGY DEMAND BY MODE /a
(% of total sector use - 1980)

<u>Road</u>			<u>Maritime</u>		18.8
Automobiles	18.6	67.3	Coastal	2.1	
Buses	19.5		Foreign trade	14.3	
Trucks	<u>29.2</u>		Bunkering	<u>2.4</u>	
<u>Railway</u>			<u>Air</u>		
Freight	2.0	5.2	Domestic	6.4	8.4
Passenger	<u>3.2</u>		Foreign	<u>2.0</u>	
<u>Subway</u>		0.3			
			<u>Total</u>		100.0%

/a For more detail, see Table 1.24 in Annex.

6.13 Although purely technical measures of energy efficiency are inconclusive until converted into economic costs, they provide an indispensable starting-point for identifying problem-areas that deserve attention. Energy efficiencies can be estimated on a macro level for each transport mode by constructing ratios of fuel consumption to modal activity. When compared with other countries, these values suggest that Korean transport, especially rail and coastal shipping, is relatively energy efficient (Table 1.25). However, because cross-country comparisons do not control such variables as load factors or the quality of service, and because some estimates are based on macro data while others are based on micro or engineering analyses, they should be interpreted cautiously. For example, on a passenger-km basis, Korean automobiles and buses appear relatively energy efficient, but not on a vehicle-km basis. The passenger-efficiency stems primarily from comparatively high load factors. Technically, the fuel performance of Korean vehicles is less efficient than most other vehicles produced by major world manufacturers. From the viewpoint of fuel economy, vehicle-km is a far better test.

Energy Planning and Management Institutions

6.14 The Korean Government was quick to respond to the "energy crisis" of the 'seventies. It established, in December 1977, a Ministry of Energy and Resources (MOER). It created an energy research institute, the Korea Institute for Energy and Resources. It established the Korea Energy Management Corporation (KEMCO), which has developed effective energy-conservation programs in the industrial and residential and commercial building sectors. A huge effort has been made to convert the electric power industry from its past high dependence on oil to nuclear and coal fuels. The present structure of government agencies with major responsibilities in energy is shown in the diagram next page.

6.15 The MOER is of course the key agency for dealing with the Government's energy problems (Chart 7). It relies on its affiliated research institutes to compile data, identify and develop energy strategies, and conduct technical analyses as inputs to the Ministry's planning and decision-making functions. The resulting plan and programs are then implemented through MOER's affiliated executing agencies. Most of these affiliates focus on the energy supply side, as does most of MOER's recently released Five Year Plan for the Energy and Resources Sector. The electric power industry occupies a particularly prominent role in the Plan and in MOER's activities to date. The Plan's principal demand-side component is conservation, focused heavily on industry and, less so, on commercial and residential buildings.

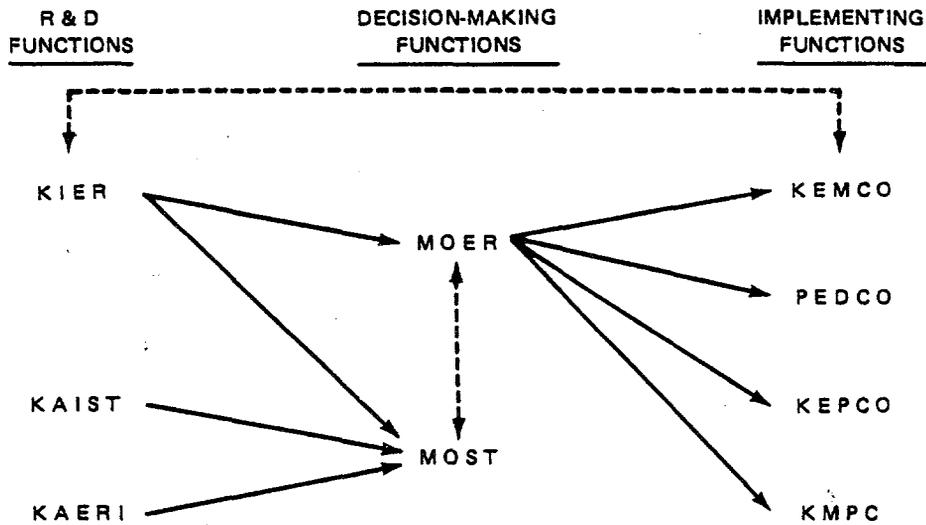
6.16 The amount of attention so far given to conservation in transport has been quite small. The Plan mentions only three actions that might be taken:

- (a) improvements to electric railway substations to reduce losses;
- (b) construction of 36 freight terminals; and
- (c) a study to establish the optimum travel distance for each transport mode.

The first of these is not likely to achieve significant energy savings.^{/1} While the second may save some energy, much of that depends on the layout and operation of the proposed freight terminals and how much current practices can be improved. Likewise, the third item has an unknown energy savings potential. The Plan also recommends the development of automobiles with greater fuel economy (i.e., 17 km/l as compared with the present 12 km/l). This is likely to result in substantial fuel savings. However, MOER appears to be more of an interested observer than an active force in this

^{/1} Because electricity consumption by the railways represents less than 6% of total sectoral consumption, even major efficiency improvements in this area would have a negligible impact on sectoral consumption.

KOREA TRANSPORT SECTOR Internal Linkages Among Government Energy Organizations



————: Strong formal linkages
-----: No or weak linkages

Source: Based on Ho Tak Kim and Atul Wad, *Organizational Issues in Energy Policy and Management*, Proceedings of the South-East Asian Workshop on Energy Policy and Management, October 27–November 1, 1980, World Bank. Updated to reflect recent reorganizations.

Acronyms:

MOER Ministry of Energy and Resources
MOST Ministry of Science and Technology
KIER Korea Institute of Energy and Resources
KAERI Korea Advanced Energy Research Institute
KAIST Korea Advanced Institute of Science and Technology
KEMCO Korea Energy Management Corporation
PEDCO Petroleum Development Corporation
KEPCO Korea Electric Power Company
KMPC Korea Mining Promotion Corporation

program, for which MCI and MOST are the responsible ministries. This may be why automobile fuel economy improvement is not listed as a separate element in the conservation program.

6.17 In addition to the 5-year program, MOER also develops an annual conservation program. For 1982 the principal element in this program was a rationalization of petroleum product distribution. Korea has five refineries, owned by different oil companies, each maintaining their own nationwide terminal and distribution system. By coordinating their distribution systems MOER hopes to reduce transport movement ^{/1} and save about 250 million liters per year or over 3% of the energy consumed by the transport sector.

B. Major Issues and Energy Inefficiencies

6.18 The major energy-related problems in the transport sector involve the following: the dispersion of institutional responsibility for energy planning and management; the high motorization trend projected for the coming decade; inefficiencies in road transport operations and to a lesser extent in rail and maritime services; and the need to rationalize fuel pricing. These issues are discussed below.

Institutional Dispersion of Responsibilities

6.19 There are three major institutional problems which limit the effectiveness of Korean energy planning and management in general and specifically in relation to the transport sector: MOER's loose organizational structure, the dispersion of responsibility among six different ministries, and the weak demand-side orientation.

6.20 MOER. MOER's research and development, decision-making and executing functions are divided among itself and its affiliated research and implementing agencies. Prior to the January 1982 reorganization, MOER had strong organizational linkages with its affiliates, although they had weak or nonexistent linkages with one another.^{/2} While strengthening MOER's control, it made the research institutes increasingly theoretical (by divorcing them from implementation issues) and the executing agencies less aware of current research developments. Counteracting this increased specialization, the reorganization has weakened MOER's linkage with KIER and KAIST and increased MOST's role in energy planning and management. While it is too soon to assess the impact, this new structure obviously requires close coordination between MOER and MOST. At this time, it appears that MOER and MOST are not closely linked.

^{/1} The refinery at Incheon, for example, will deliver products to all terminals in the Seoul area, including those belonging to the oil companies whose refineries are located in the south.

^{/1} There is no evidence that the linkages between KIER and KEMCO, the agencies with primary responsibility for energy conservation, have been strengthened by the reorganization.

6.21 The number of separate agencies within MOER also ensures a certain degree of redundancy. This is particularly disturbing as the field is relatively new and thus there is a limited supply of skilled manpower. When this manpower is distributed across a large bureaucratic structure, expertise tends to become confined to the upper levels with little depth at the working level. The Government recognizes the potential for inefficiency and duplication inherent in the proliferation of special-purpose research institutes, and has adopted a policy of consolidating them. KAIST, for example, was formed by merging the Korea Institute of Science and Technology and the Korea Advanced Institute of Science.

6.22 Inter-ministerial Responsibilities. At least six different ministries (viz., MOT, MOC, MOHA, MCI, MOST and MOER) are involved in improving the energy efficiency of the transport sector. MOER is responsible for defining general policies and strategies, MOST is responsible for the development of advanced technologies for automotive and other applications, and each individual ministry is responsible for actions within its sphere of authority. While there is a coordinating committee composed of the various ministers, major industries and energy producers, it is not clear how active a role the committee plays.

6.23 MOER requested the other ministries to propose their own conservation programs for inclusion in the Five-Year Plan. Although MOT's proposal was extremely limited, MOER had neither the capability nor the authority to develop an alternative program either internally or through its affiliated agencies. Further, as MOER's implementation authority extends only to its executing agencies, it must rely on the cooperation and support of other ministries to implement conservation actions. The ministerial-level coordinating committee does give energy management national prominence, but without working level linkages the conservation proposals that are implemented tend to be done for some other reason which reflects the primary institutional responsibility of the proposing ministry.

6.24 Supply-Side Orientation. MOER's original mandate was largely supply-side activities that were given priority in reducing Korea's energy dependence; MOER then broadened its interest to the demand side, including energy conservation. However, organizational constraints have limited MOER's ability to implement demand-side policies, and the nature of the issues involved are outside of MOER's knowledge. This applies especially to the transport sector where many of the basic analytical techniques and conservation strategies developed for other demand sectors are not adaptable. Thus, much of MOER's expertise in energy conservation is of limited value in developing a transport energy conservation program. Likewise, MOT's experience in transport analysis does not extend to energy aspects, and it has little knowledge of how to improve energy efficiency in the sector.

6.25 This lack of involvement on the demand-side policies applies mainly to the technical know-how of energy conservation. However, pricing,

which is a major policy tool for encouraging conservation has also not been considered to the extent desirable, particularly for heavy vehicles. The role of MOF and EPB may have overshadowed MOER, but it is not too late to move more aggressively in this direction. Some very encouraging steps were taken under the Bank's Structural Adjustment Loans to raise diesel prices pending more in-depth studies (para. 6.52). In this line, a very commendable joint effort under the auspices of EPB is the study issued in December 1982 by KIER on The Improvement of Energy Price Structure in Korea, which provides an excellent backdrop for developing a pricing strategy oriented to conservation in the transport sector. Some suggestions are made on this in paras. 6.49 to 6.53.

Road Vehicle Fuel Inefficiencies

6.26 Automobiles. The Korean motorization rate is far below that in most other countries at comparable levels of income and development (Table 2.4); due to high fees to acquire and operate vehicles and high gasoline prices. This partly reflects the high cost of buying and operating private cars. Nevertheless, as Korean incomes rise the motorization rate is likely to increase dramatically over the next decade (para. 2.34). EPB forecasts indicate that domestic new car sales should grow from 55,000 in 1981 to 355,000 by 1988, an increase of nearly 550%. This increase is a cause for concern, not only as it may result in a substantial increase in energy consumption, but also because it would divert personal savings from investment into vehicle ownership and will put much higher traffic and parking pressure on the streets of high-density urban areas. Energy consumption will depend on average utilization, now approximately 100 km/day (30,000 km/year), which is about double the world average for private cars. As the high fixed cost of owning a private car is reduced, more middle-income persons may be expected to purchase cars. Government planners expect many of these vehicles to sit idle during the day, thereby reducing average utilization. If private car utilization drops to the world average, total motor vehicle energy consumption could be about 1.1 million TOE (tons of oil equivalent) in 1986 (about 23% above 1980 estimates) /1; if utilization remains at current levels, consumption could be 50% higher (1.7 million TOE). The difference, over 570,000 tons, could cost Korea US\$120-130 million p.a. at current prices.

6.27 In order to compete on the world market, Korean automobiles will have to become more fuel efficient. The two most popular models, the Gemini

/1 Based on EPB total registrations of about 1.2 million vehicles, assuming 560,000 trucks and buses and 600,000 cars, a 30% improvement in fuel efficiency and a utilization rate of 15,000 km/year for cars, and 120,000 km/year for taxis. Without fuel economy improvement, consumption would be 2.5 million tons TOE.

and the Pony, now average about 12 km/l (28 mpg) in intercity operation.^{/1} By 1984/85, both Hyundai and Saehan plan to produce cars averaging 17 km/l (40 mpg), i.e., an improvement of 30%. Hyundai has entered into an agreement with Mitsubishi of Japan, to produce this new model. Saehan, its main partner GM, and the Korean Government are also discussing the possibility of assembling the "world car" in Korea. By 1985, this car may have a fuel economy of nearly 21 km/l (50 mpg). It may be argued that the Korean car produced by 1984 could be obsolete when compared with other cars then available on the world market. However, this new vehicle will represent a substantial improvement over currently available vehicles and, even with a more than doubling of the automobile fleet, the growth in demand for gasoline could be negligible compared to that for diesel and heavy fuel.

6.28 Trucks and Buses. At present only one group, Daewoo Heavy Industries, Ltd., produces large 100-285 hp diesel engines under a licensing agreement with MAN of West Germany. These engines are durable and their energy efficiency is acceptable. Daewoo claims that the fuel consumption rate of the 285 hp engines is 1.58 grams per hp per hour, only 5% below the most fuel-efficient diesel engine of that size currently available on the world market (viz., 1.50 grams/hp-hour). Both US and European manufacturers expect to achieve a 10% improvement in the energy efficiency of their large diesel engines by 1984/85.^{/2} If no improvements are made to the locally produced engine, it will be 10-15% less energy efficient than similar engines then available on the world market.

6.29 The Daewoo group maintains a research and development center, but because the group has a monopoly on the large diesel market, it has little incentive to improve its product. Hyundai and Saehan, the two companies producing heavy trucks and buses, are required to use the Daewoo engine. Both they and Daewoo are protected from outside competition by regulations which restrict imports to only those types of vehicles not produced locally. Thus, if the Government does not provide some kind of outside motivation (through regulation, agreement or by easing the restrictions on imports), the trucks and buses produced in 1985 will be little different from those on the road today.

^{/1} It is worth noting that improvements in vehicle fuel consumption that are occurring throughout the world today are considerably stronger for intercity or open-road driving than for city driving. Since more mileage is driven in and around cities than under open-road conditions, Korean vehicle technology may not carry as large a penalty as the open-road figures may suggest.

^{/2} This applies only to the engine. Additional efficiency improvements are likely to be made to the drivetrain, vehicle aerodynamics, tires, etc.

Inefficiencies in Road Transport

6.30 The large and growing fleet of private or own account trucks and the increased use of small trucks are also of concern from an energy standpoint (para. 2.36). Between 1975 and 1980 the private fleet grew at 32% p.a. while the commercial fleet grew by only 6%. The fleet of less than 2 T trucks more than doubled over the 1976-80 period while its utilization rose dramatically (by a factor of 10 based on expressway traffic counts). Small trucks are increasingly being used for long distance transport./1 Both trends have obvious energy implications. A fully loaded small truck with a 1.5 T payload consumes about twice the energy per ton-km of a fully loaded 12 T truck. Likewise, since private trucks are permitted to carry only their own goods, their empty load ratio tends to be much higher than that for commercial trucks, thereby increasing their energy consumption per net ton-km by a comparable margin.

6.31 Trucking companies are keen to reduce operating expenses, but are generally unaware of the existence of fuel-conserving devices which, with the exception of radial tires,/2 are not marketed in Korea (Annex 4 provides a summary of these devices and other techniques). Even turbochargers, now standard equipment on most new trucks sold in developed countries, are rare in Korea. Individual trucking companies, the trucking associations, KEMCO and MOER all want to know more on how to improve truck fuel efficiency and have requested further assistance.

6.32 Trucking companies also tend to be unaware of the energy implications of their current operating procedures. According to several studies carried out during the past decade, commercial trucks seem to be poorly utilized. Their average load factor was only about 50% in 1975 and it appears to have dropped since the 1980 recession. For small trucks less than 2 T the average load factor is only 30%.

6.33 MOT, in association with the local trucking associations, is planning to develop freight terminals in the largest cities to improve vehicle utilization and save energy, among other objectives. However, larger savings may be possible by reducing the size of the private fleet, limiting the use of small trucks for long hauls, and increasing the average load factor of large trucks. The potential for such improvements should be evaluated in the context of a thorough analysis of the existing situation, its underlying causes and energy implications. MOT should be responsible for such a study.

/1 Pickups are also used for passenger travel. The taxes on small trucks, being less than on sedans, give an incentive to purchase these vehicles in lieu of passenger cars.

/2 Since radials provide additional advantages (viz., longer tread life, resistance to puncture, and the ability to be recapped more often) their use may be unrelated to improving fuel economy.

6.34 In the US, Europe and Japan, increasing attention is being directed to the driver's role in energy efficiency. Fuel consumption can vary by as much as 15% between comparably loaded and equipped vehicles traveling over the same route under the same conditions, solely as a result of driving practices. Considerable work has been done in the area of identifying fuel-efficient driving techniques and developing training programs to teach them. MOER, with the assistance of MOT, KEMCO and the trucking associations, should review available material and develop an information and training program using specialized foreign consultants.

6.35 Several trucking companies interviewed during the field visit indicated that they keep a log of fuel use by trip for each vehicle in their fleet. Apparently this information is used primarily to monitor expenses and perhaps to deter pilferage from fuel tanks and siphoning from individual trucks. These firms should be encouraged to use these data for scheduling vehicle maintenance and monitoring driver performance as part of a fuel economy improvement program.

Modal Shares and Other Transport Modes

6.36 Modal Shares. The relative economic cost of a transport mode should be computed on a door-to-door basis, including pickup and delivery. For each transport demand there is a combination of modes which minimizes total cost. However, because the modal choice of travelers and shippers is generally based on such factors as travel time and cost, safety and security and schedule reliability, the mode with the lowest cost to the economy may not be the most attractive alternative to shippers. While the financial attractiveness of economically more efficient modes can be increased by service improvements, a policy developing terminal and transfer points to encourage inter-modal complementarity is at least as effective. It is this approach that the Bank intends to support further.

6.37 On the passenger side, the relatively high efficiency of buses which satisfy over 60% of travel demand indicates that the present modal split is quite good. On the freight side, MOT statistics on traffic volume by commodity type indicate that the existing modal split is reasonably good for most of the reported commodities. The exceptions are containers and steel products where rail carries only 7% and 4% of the traffic, respectively.

6.38 The low level of containerized traffic going by rail is caused by many factors, the most significant being that: (a) only four trucking companies are authorized to handle containers in the railway yards where they have been assigned storage space; (b) KNR deals with neither the customers nor the shipping companies - it only provides the flat cars; and (c) only 30 trucking companies are licenced for inland container transport. These companies have to store inbound containers in special container yards outside Busan port while awaiting customs clearance. When they want to utilize the railway, the containers must be trucked in bond to the railway terminal and trucked again at the destination terminal to the final consignee adding excessive handling costs (Table 3.20).

6.39 There are many ways to improve rail container service. Containers could be moved directly from the port to the railway terminal, then transported to a container yard in the Seoul area where they could await customs clearance. Alternatively, the railway could be permitted to act as a transport company, dealing directly with its customers and subcontracting to trucking companies for pickup and delivery. In any case, MOT should permit all trucking companies to use the railway facilities. Assuming that one third of all containers move between Seoul and Busan (about 150,000 per year) and that the rail share could be increased to 50%, about 11,000 TOE of diesel oil (US\$2-3 million) could be saved each year.

6.40 Several factors also discourage rail shipment of steel. Customers usually must deal with the Korea Express Company, the only trucking company authorized to load or unload freight at the railway stations. Thus, a steel shipment on any other carrier cannot be moved by rail unless the customer specifically indicates a preference for rail. For its part, Korea Express chooses the mode of transport that suits them best. To increase the attractiveness of rail shipment, all trucking companies should be permitted to deal with the railway, and the railway should be permitted to either own its own trucks or subcontract with trucking companies of its choice for pickup and delivery.

6.41 Rail and water transport are fairly energy efficient, but there is scope for improvement. The typical locomotive is a 3,000 hp unit, quite powerful by world standards and possibly underutilized given the average 10-12 car Korean trains. As with trucks and buses, a prime area for efficiency improvement is in operating procedures, particularly train dynamics.^{/1} The coastal shipping fleet is more diverse, with vessel sizes ranging from less than 500 dwt to over 10,000 dwt. Here, potential efficiency improvements (described in detail in Annex 4) include various self-polishing hull coatings to retard the growth of marine organisms, a shift from steam turbines to slow- and medium-speed diesel engines (already the norm in the Korean merchant fleet), and speed reduction.

6.42 As with road transport, programs to improve rail and maritime fuel efficiency require the involvement and cooperation of equipment operators and maintenance personnel. While studies have not quantified the "human factors," US rail and shipping companies and trade associations believe that crew motivation is one of the most promising (and lowest cost) areas for fuel efficiency improvement. MOER (through KEMCO) should work with KMPA, KNR, the trade associations and the individual shipping companies (perhaps with the assistance of foreign consultants) to monitor current practices and develop appropriate conservation programs. Crew motivation and the

^{/1} "Train dynamics" refers to the throttling and braking procedures employed to control the speed of individual locomotives and railcars while the train is in motion. Individual US railroads have reported fuel savings of as much as 13% by maximizing the use of such equipment as dynamic braking and multiple throttle control.

development of a sense of professionalism should be a prime focus of these programs.

Magnitude of Potential Energy Savings

6.43 The magnitude of energy inefficiency and potential savings in the transport sector may be gauged by a few simple calculations. Assuming 1980 activity and consumption levels, current prices and a fairly conservative set of efficiency improvements which could be largely in place by 1985, potential energy savings may be estimated as follows:

Table 6.3 (T): MAGNITUDE OF POTENTIAL FUEL SAVINGS IN TRANSPORT

Measures /a	Annual savings	
	TOE ('000)	million US\$
Raising average new car fuel economy from 12 km/l to 17 km/l (i.e., 20% efficiency improvement)	} 210	45-50
Improving truck and bus fuel economy by 20%	} 400	85-90
Reducing the average utilization of private cars to 15,000 km/year /b	} 250	50-55
Improving driving practices by 10%	300	65-75
Increasing the rail share of Busan-Seoul container traffic to 50%	11	2.5-3

/a Additional measures which offer significant savings potential but which cannot be quantified at this time include: reducing the use of small trucks for long hauls, increasing truck load factors, increasing the rail share of steel traffic, and improving the technical and operating efficiency of rail and maritime transport.

/b Level of savings estimated assumes activity at 1986 level. Reaching this target would involve the promotion of more intensive utilization of cars such as car-pooling, shifting from car to public transport, grouping trip purposes, etc...

Source: Bank's estimates.

The above savings estimates are independent and therefore additive. It would of course take several years to achieve these objectives. Nevertheless, it is clear that the potential reduction in Korea's oil import bill could more than pay for a concerted conservation program focused on such measures. Even if only about half the estimated savings were achieved (say US\$150 million) this would represent about 3% of the country's present oil import bill. That may not seem a large gain. It is, however, two or three times the total cost of maintaining the Government's overseas establishment; about half the

cost of the country's current sugar or pulp and paper imports; and only slightly more than the annual cost of all licensing and royalty fees paid for the use of foreign technology. Thus while the percentage energy savings seem small, the sums themselves are very large. They become very much larger if calculated not on the 1981 vehicle fleet but on the fleet 10 years from now. Then, on what today seem conservative assumptions, Korea is likely to have three times as many trucks, 1.6 times as many buses, and over five times as many cars as it has today. If the 1983 transport sector operates at 1983 standards, the cost to the economy compared with what it might have been with a good conservation program will be very high indeed.

C. Recommended Government Programs and Policies

6.44 Achieving an optimum set of transport services is a never-ending process of problem-identification, policy reviews, technical and program studies, and government and private decisions on matters large and small. While the Government has generally moved very effectively to deal with the country's energy problems, it has given less attention to the energy problems of transport than to those of any other major sector. Since a resumption of upward pressure on energy prices is likely in the years ahead, the Government should strengthen its programs for helping the providers of transport services to use no more energy than serves the national interest. The latter means pushing the whole transport system in the direction of least-cost allocations among modes, the adoption of least-cost technology in each mode, making maximum use of the capital equipment in each mode in order to avoid over-investment, and helping transport operators (from companies to drivers) use their equipment in ways that minimize operating costs. There are some things that can best be done by government, others that can best be left to the decisions and behavior of the countless number of agencies, companies, and individuals who provide the nation's transport services. The most important contribution the Government can make is to create a framework of policies, prices, regulations, and information that will lead private decision-makers to use resources in ways that coincide with the national interest. To the extent Government succeeds in creating the right framework, the providers of transport services will make investment and operating decisions that will push the system towards the least-cost solutions. When this is done, energy use will be reduced to the level appropriate to its weight in the sum of resources that make up the total cost of transport.

6.45 The highest priorities for Government attention in the immediate future should go to revising policies and prices that now seem to be most seriously distorted, in the sense that they are keeping operators from moving towards lowest-resource cost solutions. The areas that are now in greatest need of Government attention are (a) a sharper definition of institutional responsibilities, (b) a relaxation of the regulations which now force nearly half of all truck trips to be made without carrying any freight; (c) adjusting fuel costs so that they better reflect true costs to the economy; (d) technology assessment as a basis for encouraging adoption of cost-saving devices by transport owners; and (e) public education of owners and operators about opportunities for cost savings. Each of these is discussed below.

Streamlining Institutional Responsibilities

6.46 In the five years of its existence MOER has developed strong internal capabilities, supplemented by outside researchers and implementing agencies (e.g. KIER and KEMCO). It has built a generally aggressive conservation program in the industrial and power generation sectors, and is gaining strength in applying conservation to commercial and residential buildings. Little has so far been done for transport, however. Ministry staff are relatively unfamiliar with this area, and institutional linkages have not yet been developed.

6.47 MOER recognizes the gap between its transportation and industrial conservation programs and is eager to narrow it, prompted by recent government directives setting a 1982 conservation goal of over 5% for the sector. While it seems clear that MOER should exercise the same leadership role for energy conservation in transport it has asserted in other sectors, it will need to clarify with at least two other ministries (Transportation, and Science and Technology) where its responsibilities end and theirs begin. There is a need to mount a technology assessment program to evaluate the kinds of energy-saving devices and practices listed in Annex 4; this should be done in one of the research institutes, perhaps one attached to MOST. Once recommended technology has been identified and is ready for recommending to owners, and some of which might find its way into regulations, MOT would seem the appropriate Ministry for transferring such technology into the sector. One question that will have to be settled is what role, if any, KEMCO should be asked to play in the transport sector. At present, neither MOER nor MOT has any group with responsibility or experience in energy conservation in transport. It is possible that MOER might wish to exercise no more than a general planning and monitoring role for energy use in transport, leaving to MOT responsibility for mounting the technology assessments that would underlie an Action Program.

Improving Fuel Efficiency by Lifting Transport Regulations

6.48 The regulation of the trucking industry strongly affects both the quality of services and the volume of fuel consumed in transport. For example, one third to one half of all truck trips consist of empty back-hauls due to trucking regulations that prohibit private trucks from carrying any cargo other than their own (para. 2.36). Deregulating the trucking industry, in line with the Government's new philosophy of leaving more decisions to market forces, would probably be the single most important energy conservation measure in the transport sector, in addition to saving a substantial amount of capital, as the utilization and efficiency of the existing vehicle fleet would increase ^{/1} (para. 5.15). One important change that would follow from liberalizing truck access to the railways would be an increase in Busan-Seoul container traffic, a cost-saving, energy-saving modal shift.

^{/1} Under the Highway Sector Loan just negotiated with the Bank, the Government agreed that a study of the "Economic Impact of Regulation on the Trucking Industry" be carried out in 1984.

Pricing of Transport Fuel

6.49 We have noted earlier that the resource cost of fuel (i.e. net of taxes) rarely comprises more than 20-30% of total costs for road transport; it is somewhat less for rail, and more for both maritime and air. When "taxes" are added on top of the basic resource costs, the fuel-percentage rises, so that it often becomes the largest single cost in providing transport services. Technically and politically, the setting of fuel prices is fraught with difficulties. There are, however, some useful concepts that can help in addressing these problems. One of the most useful is to be clear on the distinction among the basic price (or resource cost) of fuel, the recovery of infrastructure costs from transport users through the various types of user charges (e.g. vehicle purchase taxes, annual licensing fees, or fuel add-ons that appear very much like a "tax"); and a pure tax element, i.e., a charge to the consumer that has no relation to the cost of the resources he is using and which is used for different purposes.

6.50 Resource Pricing. A useful basis for pricing any resource is to charge consumers a (resource) price that reflects the scarcity value of the resource to the economy. In a completely free-trade regime the prices of various energy products would be set, in an energy-importing country like Korea, by the c.i.f. price of imports. Refiners would not be able to set the price of any product higher than the import price because customers would be free to import. In such a pricing regime, the structure of product prices in domestic refineries could not get much out of line with import prices, which might of course fluctuate according to surpluses and shortages in world markets. Korea does not have a pricing regime of this sort. For many years petroleum product prices have been controlled by an administered price regime worked out in close cooperation with the country's five refineries. Generally speaking, all product prices in Korea have been above world levels, i.e., higher than Singapore or Gulf prices even after allowing for transport costs. Two distinctive features of the Korean product-price structure have been (a) a domestic price for Bunker "C" substantially higher than the world price (Bunker "C" amounts to just under half the product produced by Korea's refineries); and (b) a diesel price that has traditionally been relatively low compared to gasoline, measured by differentials commonly found in other countries. The ex-refinery value of a reconstituted barrel of crude has of course been closely related to the world price of crude plus the cost of refining it. One could thus say that Korea, as a country, was paying (even more than the full scarcity value of its imported petroleum energy. But different classes of consumers were being treated very differently: the power-generating industry (the main user of Bunker "C") was paying much more than the import price, while truck and bus operators (the main users of diesel fuel) were paying a much smaller premium. By the test of border prices, all product prices were "distorted" but some were much more distorted than others./1

/1 For a good description of petroleum pricing in Korea see the report, Analysis of Petroleum Product Pricing in the Republic of Korea, by Edward N. Krapels (July 1982, 48 pp.). This was one of several studies financed by the UNDP in connection with the World Bank's first Structural Adjustment Loan (SAL I).

6.51 There are some who believe that the only satisfactory way to eliminate distortions in the structure of petroleum product prices is to de-control them and permit free trade. Although some de-control of fuel prices has recently occurred, it has been limited to minority products where buyers were able to avoid high Korean prices by purchasing abroad whenever they could (this was true for Avgas and solvents, two prices that have recently been de-controlled). Despite these minor changes and despite the trend towards trade liberalization in Korea today, there is considerable doubt that there will be any general de-control of major oil-product prices. The tradition of treating the refining industry as a public utility, with both consumers and producers protected by government-set prices, remains strong. It is of course possible to link domestic product prices to international prices by administrative price-setting rather than by de-controlling the market and opening it to free trade. A movement towards closer linking through administrative action was taken recently, when the price of Bunker "C" was sharply reduced. As the market for Bunker "C" contracts in the face of the power industry's massive shift into coal and nuclear generation, Korean refiners will be under strong pressure to upgrade more of their crude to middle distillates. This will involve higher refining costs, i.e., the resource cost of diesel will rise.

6.52 User Charges. To transport operators, the price of fuel is what they pay at the pump. In most countries, there is a big difference between the resource price of fuel and the pump price. Most people speak of this difference as a "tax;" there may indeed be a tax element in the price, but the greater part of the difference is a "user charge," an add-on to the resource cost designed to raise revenue to meet the costs of building and maintaining roads and bridges. The user charge is in fact a "resource price" to cover the cost of infrastructure resources that are difficult to recover through direct charges. In a few instances, these infrastructure costs are recovered directly through tolls (e.g. KHC's self-financing of expressways); but in most cases, infrastructure costs are recovered indirectly, either through a fuel add-on or from various vehicle licensing fees. Low fuel prices that do not recover full infrastructure costs are thus likely to result in inefficient resource allocations, a common example being artificially cheap road transport that penalizes railways, which are cheaper (and more energy efficient) for certain classes of transport services. The Government has already recognized that trucks and buses have not been paying their share of user costs and, under SAL I, it agreed to substantially raise the pump price of diesel fuel and bring it into a more normal relation to the price of gasoline (measured by the relationship found in other countries). The Government will have to decide how much of this increase in the pump price will be given to the refineries as a "resource cost" and how much to retain for itself as a road-user charge. With substantial increases in road construction and maintenance costs scheduled for the Fifth Plan, there is a pressing need for close study of the level and structure of road-user charges. The Government has agreed on the need for such study but is known to be worried that it may be difficult to impose substantially higher user charges so long as there is a large volume of low-tax kerosene used by households, since kerosene can easily be substituted for, or mixed with, vehicle fuels.

6.53 Taxes. The pump price of fuel, besides meeting the ex-refinery resource cost plus the infrastructure cost, often includes a third element a pure tax - that is levied on transport users. A tax is a charge not related to the cost of resources used by the person who pays the tax; the distinction between user charges and taxes is often not recognized, and many user charges are misleadingly referred to as taxes. A tax element in any consumer price may of course be levied to influence consumer demand (e.g. the demand for automobiles) or to achieve distributional objectives or simply to raise money. The Government has deliberately used very high gasoline prices (through imposition of a stiff tax element) to discourage private car ownership and use, a policy equally supported by high taxes on the purchase and annual licensing of private cars. One of the more important and difficult policy decisions the Government will have to make in the near future is whether or not to hold to its present policy of discouraging private car ownership. This policy will have a stronger influence on future energy consumption in transport than any other decision it can take. The Bank does not have a firm view on an optimum rate of motorization for Korea; the SAL I loan did, however, commit the Government to a study of the costs as well as the benefits of rapid motorization. Such a study was completed in 1982 by the Korea Institute for Economics and Technology (KIET), using a study by a consulting group (Sigma) as an important input. The broad finding of these studies was that continued rapid motorization would not create serious environmental or congestion problems for Korea, at least not for the next several years. The KIET report therefore recommended a reduction in the present high purchase and licensing taxes on passenger cars. The Government has not yet accepted this recommendation, and more analysis and discussion are needed before decisions can be taken on the wisdom of changing the present "mix" of purchase taxes and road-user charges and pure tax now included in the pump price of gasoline and diesel. Today, approximately two-thirds of road-user costs are recovered through fuel taxes (two-thirds of them from gasoline, one-third from diesel, and almost none from LPG), and one-third from purchase taxes and license fees (purchase tax is heavily skewed towards passenger cars even though companies, which own a high proportion of all cars, are exempt from the purchase tax).

Technology Assessments and Research Studies

6.54 The energy crisis of the 'seventies' stimulated much world-wide R&D activity by engineers and transport owners to find ways of reducing costs by saving on fuel consumption. Truck operators have learned to reduce aerodynamic drag by mounting wind deflectors on the cab. Designers have learned to eliminate vertical ribs on truck bodies, to reduce the gap between tractors and trailers, and to streamline frontal designs. Radial tires reduce rolling resistance. Mechanical governors to limit uneconomic engine and road speeds have been installed on many vehicles. Changes in engine and clutch designs have increased power-train efficiency. Railway, marine, and air transport have likewise benefited from design and maintenance changes stimulated by the increase in energy costs. An illustrative list of such technological developments, now widely used in Western vehicles, can be found in Annex 4. MOER and MOT, jointly, should sponsor a program of fuel-saving

technology assessments /1 by Korea's research institutes, working closely with the trucking associations, KNR, KAL, and the shipping industry. The area where most help is likely to be needed is road transport, composed of small operators using Korean-manufactured equipment that may not yet incorporate fuel-saving innovations that have proven cost-effective in other countries. Most fuel-saving changes involve some addition to vehicle capital or maintenance costs; these costs must be weighed against their fuel savings to see which changes are worthwhile.

6.55 Improved technology is not the only way of reducing costs by saving fuel. Other studies, not focussed on technology, are also needed to develop a better understanding of truck utilization and the factors responsible for the growth in the private truck fleet and in the use of small trucks. MOT should be responsible for this study, perhaps with the assistance of the trucking associations, and MOER should work with MOT to develop conservation proposals arising from the study's findings. Such a study would be a part of the proposed road transport deregulation study to be implemented under the Highway Sector Loan. (para. 5.15).

Public Education

6.56 A public education program, aimed primarily at owners and operators of road vehicles, can make an important contribution to fuel conservation. Its aim should be to tell people what they can do if they want to reduce transport costs, provide them with standards for measuring performance, and motivate them. The Bank is not certain whether responsibility for mounting such a program should be placed in MOER or MOT or whether implementation should be assigned to KEMCO or some other agency (KEMCO is an attractive candidate because it has proven its ability in other sectors). A starting-point for a public education program /1 should include the following activities:

- (a) review the literature on public information programs and mount a campaign to inform the general public of the energy implications of their travel decisions and shippers of possible ways to reduce the energy (i.e., cost) of their product distribution;
- (b) work with truck and bus associations to inform members of energy conservation possibilities and to assist them in developing conservation and driver motivation programs;
- (c) disseminate information on conservation devices produced overseas (e.g., air deflectors, fan clutches, governors, etc.) and encourage manufacturers to begin producing this equipment for the local market; and

/1 Under the Highway Sector Loan, the Action Program agreed upon will be a vehicle to implement these components.

- (d) develop a driver training program, perhaps as part of the drivers' licensing process, to teach fuel-efficient operating techniques. Model the program after those now operating elsewhere, but also include training geared specifically to Korean problems (including improper use of vehicle controls).

7. FUTURE ROLE OF THE BANK

7.01 The Bank's involvement in Korea's transport sector has been substantial in the past and should remain so in the coming years. But in view of the country's significant progress in project design and implementation, it is necessary that the Bank's role be refocused on sector policies where weaknesses exist. The country could gain considerable benefits, well in excess of the traditional returns obtained from past projects, through more effective policies in the areas of investment planning and coordination, regulation and pricing, and energy conservation. Such a shift in emphasis, however, would require a major change by the Bank away from its past project approach to a sector approach. The lending program should thus include a growing number of subsector and multi-modal projects. The basis for such operations would be the Government's agreement to implement over a given time period a number of institutional and policy measures designed to improve efficiency in the sector. A continuous dialogue with the Government's numerous ministries and agencies concerned would obviously be necessary to define how specific issues should be tackled.

A. Shift from Project to Sector Lending

7.02 In view of Korea's present stage of development, the resolution of transport needs requires that greater attention be given to a broader sectoral approach than in the past. In particular, the optimal integration of the transport networks could be achieved more easily if the planning and policy frameworks were conducive to such optimization. In shifting to a sector approach, the Bank would assist Korea in adopting such a broader perspective essential to master the skills necessary to carry out inter- and intra-modal investment studies and develop policy objectives more in line with economic principles.

7.03 The task of developing of a more complete transport network makes the identification and selection of new projects increasingly more complex. Often, inter-modal transport solutions appear necessary to provide users with optimal service. This type of project will most likely be increasingly in demand in Korea and will require a broader approach than that used so far for single mode projects. Not only will the physical interdependence and smooth complementarity of the network have to be provided through appropriate

inter-modal transit and terminal facilities, but also the institutional and legal framework would have to ensure that users can fully benefit from the services offered. To this end, licensing and pricing policy restrictions might also have to be relaxed.

7.04 Similarly, a balanced regional development strategy makes it more important to ensure adequate intra-modal investment programs. Specifically roads and ports programs developed by the agencies concerned should be coordinated and fully integrated. This would ensure proper balance between investments which designs would be closely related to their respective functions. In addition, policies for road and port user charges and taxation should be compatible and neutral to avoid demand distortion and misallocation of resources. For all these reasons, the Bank's future role ought to be directed toward a sector lending approach which best could assist the Government in developing appropriate transport policies.

B. Policy Objectives in Sector Lending

7.05 The most important objectives that could be pursued in sector lending to Korea would be to:

- (a) improve intra-modal transport planning agencies for roads and ports to harmonize the development of major facilities with rural and local requirements;
- (b) encourage ad hoc inter-modal planning coordination and enhance the complementarity of modes through the development of multi-modal regional transport projects;
- (c) integrate and coordinate investment programs through a more appropriate institutional framework;
- (d) gradually relax licensing regulations and controls on fares to allow freer entry in the transportation industry and encourage competition among operators to improve the quality of service, keep fares low and reduce fuel consumption;
- (e) discourage the practice of subsidized services for rail, sea and road transport through the promotion of more cost-effective alternative services;

- (f) adopt more realistic pricing levels by generalizing cost-based fares for the railways;
- (g) adjust user charges for roads and ports more closely to actual use of (or damage to) the facilities;
- (h) adopt more realistic fuel pricing for transport by adjusting tax relationships on diesel, gasoline and LPG to encourage efficient energy use;
- (i) encourage the production of more fuel-efficient vehicles;
- (j) inform transport operators about fuel conservation techniques;
- (k) encourage selective shifts of traffic to more energy-efficient modes; and
- (l) consolidate the institutional functions and responsibilities relative to energy use in the transport sector.

7.06 Specific action packages under each objective remain to be defined based on detailed recommendations made throughout the report. Others will require specific studies by the Government through the services of consultants and Korean research institutes. Such studies are suggested in Annex 5. The problems relative to each objective have been discussed in detail in this report and should serve as a basis for the Bank's dialogue with Government. It is intended to gradually tackle selected groups of objectives through future transport projects that could be prepared jointly. Broader objectives such as (i), (j) and (l) can be dealt with under the ongoing transport sector dialogue.

C. Project Possibilities in Transport

7.07 The projects through which the above policy objectives could be addressed might be selected from those discussed below. It is expected that substantial amount of cofinancing from other sources than the World Bank would be required in addition to what the Bank may contribute, in particular with respect to the multi-modal projects. The role of foreign commercial banks and other development agencies and funds may need to be very substantial. In addition to two projects approved in FY83, and one pending in FY84, new projects recommended for consideration from FY84 to FY90 comprise two road and two maritime transport subsector projects and three multimodal projects including substantial rail components.

Roads Subsector

7.08 The Provincial and County Roads Project signed in FY83 with the Bank was the first operation with MOHA and the fifth of the conventional road projects. The continuing involvement of the Bank should be assured through a first highway subsector loan in FY84. One of the main justifications is to make considerable headway toward objective (a) above (para. 7.05) concerning integration of road planning. Another justification is that the subsector loan would be an excellent basis to move forward with objectives (g) and (h) concerning proper road user charges and fuel pricing. It would also be an appropriate vehicle to deal with objectives (d) and (e) on operators' efficiency and as a follow-up to the introduction of the unscheduled transport services scheme to be monitored under the Provincial and County Road Project.

7.09 On project grounds, the Bank's involvement would be still required to assist in further developing the road maintenance system that has just been initiated for MOHA's network and also to strengthen the maintenance of city and village roads. The improvement of the network through paving and new construction is still a major objective since in 1982 only 36% of the country's roads are paved. A large proportion of provincial and county roads and many high priority national roads still need paving. The development of much needed secondary cities will depend on an appropriate road infrastructure. A number of other objectives should also be pursued such as multi-modal terminals and depots, capital and institutional assistance to the private road transport industry, better road safety measures and inspection facilities, automation of vehicle licensing, improved mapping facilities and more effective quality control.

7.10 Sector lending would be an appropriate vehicle to deal with such an investment package. Project preparation can be effectively arranged through the existing government agencies. Part of the program referring to private road transport could possibly be channeled through the Korean Development Bank (KDB). Bank appraisal would be based on a tranche of the overall investment program for roads and road transport, and loan agreements would be worked out separately with each agency concerned. In view of the large investment program proposed by Korea and the urgent need to deal with the policy issues outlined above, the Bank should consider several substantial lending operations of the order of \$200-250 million. As the policy objectives assigned to the highway subsector are broad-based, involving major institutional changes and important policy measures that will

substantially affect Korea's road/motorization development strategy, consideration for another highway subsector project most likely will be warranted in 3-4 years time.

Maritime Subsector

7.11 The Bank's role in ports has in the past been primarily concentrated on development of the Busan container facilities. This emphasis has neglected important aspects of the national port and shipping development strategy that are of major concern to the Government. In order to move toward a more integrated approach to satisfy the needs of lesser ports, coastal and overseas shipping, the Bank should also shift to subsector lending.

7.12 A maritime subsector project might be considered for FY85 or FY86 to assist the overall ports development program including the Busan third phase expansion, other secondary ports as well as major institutional improvements and policy measures. The Bank's rationale would be primarily to pursue objective (a) above concerning the integration of port planning through appropriate institutional changes and as a follow-up to actions under the Coal and Cement Project as indicated below (para. 7.15). Subsector lending would also be ideally suited to deal with objective (c) concerning the complementarity of shipping versus other modes. Emphasis would be put on deregulation and reduction in red tape clearance at entry ports to allow shippers more freedom in selecting routings for their cargoes. It would also provide an excellent perspective to deal with objective (g) to adjust port charges and liberalize ship pricing and with objective (k) to move toward improved fuel efficiency offered by maritime transport.

7.13 On project grounds, the Bank's involvement would be justified to promote the Government's effort to develop growth poles in coastal areas that would benefit from cheaper sea transport and help in implementing further the decentralization/regionalization strategy adopted by Korea. The Port Development Study recommended under the Plan would provide the Bank with an opportunity to offer its assistance (para. 3.41). The objective of developing local shipping companies and helping them to improve the management of their fleet to maintain a fair proportion of international trade traffic would also be desirable during a moderate growth period to avoid increase in foreign exchange costs. Other possible project components include (1) establishment of a well-managed shipping bank that could attract cofinanciers and (2) the development of the coastal fleet with more efficient ships.

7.14 The basis for a maritime subsector project would be the preparatory work done for the Busan third expansion and related studies for immediate ports improvement. Components could be easily finalized by port districts. As for highways, the maritime project would comprise a tranche of investments, including maintenance expenditures. Each major component would be specified, based on detailed analyses to be carried out before loan funds could be disbursed. A number of measures would be implemented during project execution in accordance with explicit action and monitoring programs. In view of the possibility of obtaining funds from other cofinancing sources and given the limitation of counterparts funds, a loan for such maritime subsector project could amount to about US\$200 million. To fully carry out the institutional and policy objectives recommended, a follow-on second maritime subsector project by FY89 is likely to merit consideration.

Railways Subsector

7.15 Traditionally the Bank has lent to the railway based on a subsector approach. Compared to the general sectoral lending proposed for road and maritime transport, the future development of the railways should be more focused on specific functions where they have a comparative advantage. Investments in railways could thus be large components of multi-modal transport projects where the specificity of rail could be developed (see paras. 7.16 to 7.20). The Coal and Cement Distribution Project agreed in FY83 is an innovation along this line and is also the first of a possible new series of integrated inter-modal projects meeting objective (b) above. Therefore, it includes a number of features which address important policy objectives. Specifically, it will be instrumental in resolving objectives (c) and (f) above concerning inter-modal coordination and cost-based tariffs. It will provide an excellent basis to continue the work done to reach objective (e) to limit and eventually close uneconomic services and subsidized operations. It will achieve objective (k) for fuel efficiency.

Integrated Multi-modal Projects

7.16 The increasing complexity of transport problems facing Korea in the 1980s requires a new integrated multi-modal approach. In many instances, solutions cannot be properly identified and implemented by any single modal agency. The risk of misinvestment that could occur given independent funding resources, makes it important that a practical and operational approach be used to deal with specific regional needs. Otherwise, uncoordinated planning would probably result in unnecessarily costly and wasteful investments due to the likely construction of competing and duplicating facilities in many of high growth areas where high traffic densities and many modes are present.

7.17 Although it is expected that Korea will make rapid progress to improve its institutional planning mechanisms defined as objective (c) above, the surest way to achieve integrated planning is to approach it at the project level. This recognizes the practical limitations of institutional planning and the actuality of bureaucratic isolation. Therefore, the Bank could well assist Korea in this new approach that may eventually lead to a clearer perception of how to organize and institutionally structure transport coordination, a task, it was noted, addressed over the last ten years without success. Three operations are recommended for consideration. They would focus on Korea transport planning and coordination in three major transport concentrations: (a) the Seoul-Busan Corridor, (b) the Kyeonggi (Seoul suburbs) Regional Area and (c) the Southeastern Coast Industrial Belt. The related study program and status is shown in Annex 5.

7.18 The Seoul-Busan Transport Corridor. The Bank's objective in supporting a study in this area is to put into practice the concept of integrated planning at the project level. The corridor is served by road and rail, and connected at both ends by air and sea transport. Over 60% of the country's economic activity is located in this area. High traffic and complex transport requirements justify the existence and expansion of each mode. However, there are alternatives that could optimize the transport services while minimizing costs to the users. A Bank-financed study is now ongoing that is reviewing and comparing investments alternatives and combinations in order to define what type of complementarity offers the most attractive investment/improvement/management/financial package. The end-product will identify inter alia the merits of a high speed rail line between Seoul and Daejeon and a number of related road/rail investments. This package might be considered as the basis for a first multi-modal project by the end of the decade. Policy objectives (d), (e) and (k) would be pursued.

7.19 The Kyeonggi Region Transport Area. The Bank's objective would be also to support integrated project planning in the Seoul suburban area, but mainly to assist the Government's objective to deconcentrate Seoul City and develop optimal links with its main satellite cities. Specifically, rail, for concentric mass passenger movement, and road, for freight and peripheric passenger transport, have complementary roles to play. A study discussed and agreed with the Government is now expected to start in FY84 and could be the basis for a suburban rail/road multi-modal project for FY86 or FY87. Policy objectives (c), (d) and (f) would be pursued.

7.20 The Southeastern Coast Industrial Belt. The Bank's objective would be to support the country's industrial dispersion strategy and to meet the fast growing transport needs in this area. It stretches from Suncheon to the west to Pohang to the east via Masan/Changweon, Busan and Ulsan. This area has the country's highest concentration of heavy industries including steel and metal product complexes, shipbuilding and machinery industries, petrochemicals and others. For strategic and economic reasons, these complexes, which require heavy imported raw materials, have been located on the coast. Linkages among them to supply intermediate products and with other consumer centers require better integrated transport networks including terminals to speed up exchanges. Rail, road and coastal transport have each an important role to play and their complementarity needs to be strengthened. A study should be undertaken about in FY85 to identify the needs to upgrade their related network and improve traffic allocation. A multi-modal project for rail/road/sea transport could subsequently be considered possibly by FY90. Policy objectives such as (c), (d), (f), (g) and (k) would be pursued.

7.21 The need to undertake the studies was discussed with Government and agreement for the first two was reached gradually, the last should be considered in 1984. The returns in undertaking this one too would be high. While the Government is quite rightly making an effort to trim capital and recurrent expenditures in a period of budgetary constraints, it is the Bank's role to re-emphasize the cost-effectiveness of preinvestment studies. The multimodal projects discussed above have in common the objective of seeking leastcost solutions in terms of both investment and operating costs. Optimization is attainable only if rigorous studies are carried out. The costs will be paid many times by the savings made possible by well thought-out solutions.

7.22 The approach recommended for project development in transport combines, as presented, past strengths acquired by Korea with new challenges that can be met through a continuing intense cooperation between the Government and the Bank. Problems are more complex, but the proposed approach recommended by the Bank to deal with the various issues is expected to strengthen efficiency in the sector and should be instrumental for further progress in the best interest of transport services and the people of Korea.

KOREA

TRANSPORT SECTOR ISSUES SURVEY

MOT - Division of Responsibilities and Powers

The following is a summary of the responsibilities of two main bureaus in MOT in charge of transport coordination and land transport. In practice, only a fraction of these functions are effectively carried out, which reduce considerably the powers of MOT. The main weaknesses, however, are in the Bureau of Transport Coordination which has failed so far, for various reasons including the lack of qualification of staff of its three divisions trained as public administrators, to impose its views about planning on the other main transport agencies. The Land Transport Bureau which is responsible of the management of commercial road transport has been more successful in administering its functions. However, many questions can be raised as to the overall usefulness of its regulating activity which is discussed in Chapter 4 of the Survey.

Bureau of Transport Coordination (TCB)

(a) Coordination Division:

(i) Management Section

- a. Personnel Management of the Bureau (all divisions);
- b. The Bureau's basic operation plan and postevaluation of the performance;
- c. Preparation of budget proposal for the Bureau and follow-up;
- d. Action plan for recovery of transport facilities from damages due to flood or other causes;
- e. Short-term transport plan for all modes and investment coordination; and
- f. Other matters of common interest of the Bureau's divisions not specifically dealt with by any other single division.

(ii) Development Section

- a. Medium and long term transport demand forecast;
- b. Medium and long term transport policy and investment plan;

- c. Long term transport system development based on forecast movement of major commodities between the production and consumption points; and
- d. Modal assignment of transport and modal coordination.

(iii) Coordination Section

- a. Extraordinary transport measures for passengers and freights (i.e. national holidays such as new year and chuseog);
- b. Analyses of user charges and transport costs of each mode and coordination of rates and fares;
- d. Cooperation with other ministries and agencies with regard to the foregoing;
- d. Control on supply of transport equipment;
- e. Preparation of documents for the economic minister's conference (of which Minister of Transport is a member); and
- f. Various other matters relating to transport regulation.

(b) Transport Management Division

(i) Railroad Section

- a. Control over KNR and its performance;
- b. Policies/plans for construction of new lines;
- c. Formulation of standards for licensing small-sized railroad-related transport operators (companies) and their tariff rates; and
- d. Licensing private railroads for business or for own use.

(ii) Maritime Section

- a. Control and supervision of maritime transport;
- b. Control and supervision of ports operation;
- c. Monitoring and formulating positions of MOT concerning policy issues in the sector of shipping industry and on major investment projects in the sector; and

- d. Study on proposed affiliation with UN Convention on International Multimodal Transport of Goods.

(iii) Economic Cooperation Section

- a. Foreign capital inducement (loan, joint-venture etc) and management; and
- b. International cooperation.

(c) Survey and Statistics Division

(i) Survey Section

- a. Studies oriented to technological development of transport and rationalization in transport operations;
- b. Data collection and analyses on transport performance; and
- c. Management of the Ministry's library;

(ii) Statistics Section

- a. Compilation and publication of transport statistics,
- b. Studies oriented to improving statistics; and
- c. Arrangements for use of computer services by other bureaus of MOT.

(iii) Complaints Treatment Section

- a. Dealing with letters from complaining transport users (receiving letters, distributing them to agencies/officials and/or transport operators in charge, requesting from them appropriate actions to be taken, and replying the letter writers, etc.)
- b. Analysing trends in the nature of complaints; and
- c. Recommending on institutional improvements with regard to complaints reported by users.

Bureau of Land Transport (BLT)

(a) Transportation Policy Division

(i) Management Section

- a. General and personnel affairs of the Bureau;
- b. Basic operation plan and post-evaluation of the Bureau's performance;
- c. Preparation of budget proposal and follow-up;
- d. Management of the vehicle(s) assigned to the Bureau; and
- e. Matters not specifically assigned to any other division of the Bureau.

(ii) Survey Section

- a. Traffic survey and determination of traffic levels for new licenses to be issued by each province;
- b. Road transport statistics; and
- c. Long term road transport plan and studies oriented to institutional improvements.

(iii) Promotion Section

- a. Road transport tariff rates;
- b. Road transport taxes;
- c. Basic plan for land transport promotion; and
- d. Subsidies (rewards) for developing services for remote areas.

(b) Transport Operation Division

(i) Inter-City Bus Section

- a. Formulation of criteria for licensing inter-city and charter bus operation and studies for institutional improvements;
- b. Control and supervision over provincial/city government in their transport regulation operations for inter-city bus services;

- c. Policies regarding expansion of private bus ownerships and utilization; and
- d. Policies regarding bus stops for private buses in downtown areas.

(ii) Express-Bus Section

- a. Licensing express buses and express buses operation;
- b. Policies regarding express bus terminals;
- c. Institutional improvement of express buses operation; and
- d. Control and supervision of local governments over their use of power delegated by MOT related to express buses business operations.

(iii) Trucking Section

- a. Formulation of criteria for licensing trucking operations;
- b. Policies related to truck terminals and warehouses;
- c. Measures to check private trucks from being involved in business operations;
- d. Control and supervision of provincial/city governments over their use of power delegated by MOT with respect to trucking business operations.

(c) Urban Transport Division

(i) Planning Section

- a. Urban transport overall planning;
- b. Urban and area transport demand projection and transport planning; and
- c. Consultant services management for studies in urban transportation.

(ii) Intra-City Bus Section

- a. Criteria for licensing;
- b. Institutional improvement for intra-city bus transport services; and

- c. Control and supervision of local governments over their use of powers delegated by MOT.

(iii) Taxi Section

- a. Criteria for licensing taxis;
- b. Criteria for licensing rent cars;
- c. Institutional improvements for taxi services; and
- d. Supervision over provinces and cities with regard to deligated authorities.

(iv) Subway Section

- a. Criteria for licensing subway operation and designation of routes;
- b. Technical and technological advices and controls over subway construction and subway trains; and
- c. Review and recommendation, for consideration by Minister, of proposed subway construction projects.

(d) Guidance Division

(i) Guidance Section

- a. Control and supervision of road transport business associations;
- b. Review and approval of budgets of the associations and the elected board of executives;
- c. Guidance in transport safety policies; and
- d. Guidance on transport business operations.

(ii) Compensation Section

- a. Policies concerning automobile insurances;
- b. Licensing transport operators' mutual relief cooperatives and control and supervision of the cooperative operations; and
- c. Studies and actions for improving transport insurance systems.

(iii) Training Section

- a. Policies regarding training of workers in transport sector;
- b. Transport sector employment policies; and
- c. Measures for services improvements.

(iv) Registration Section

- a. Policies regarding vehicles registration and mortgage handling of vehicles;
- b. Policies concerning sales handlings or scrapping of used vehicles; and
- c. Policies concerning the construction of automobile chassis and engines.

(v) Maintenance Section

- a. Criteria for licensing garage services for automobiles;
- b. Policies regarding training of technicians for maintenance garages;
- c. Policies concerning mechanical aspects of road transport safety; and
- d. Control and supervision of cable car business operations.

(vi) Inspection Section

- a. Criteria for mechanical automobile safety inspection;
- b. Guidance and supervision of inspection mechanics;
- c. Selection or designation of types for inspection equipment and instruments;
- d. Criteria for automobile structures; and
- e. Policies concerning renewal of old vehicles.

KOREA

TRANSPORT SECTOR ISSUES SURVEY

Road Transport Licensing Procedures and Regulations

A. The Procedure

The attached excerpts in sections B and C from the Road Transport Business Act and the Rules of Implementation provide legal reference to the licensing procedure.

It can be summarized as follows:

1. The eligible applicant to any of the seven categories of transport services must apply by completing an application form giving all informations required by law and supplement it by other documents required under Articles 10 to 15 of the Rules of Implementation.
2. The applicant submits his application to the Transport Division (through General Affairs Division) of the provincial or special city government office (Art. 16).
3. The provincial or special city Transport Division reviews the application to see whether:
 - (a) the applicant is legally qualified (Art. 5 of Act);
 - (b) the application meets the licencing criteria (Art. 6 of Act);
 - (c) the proposed services would find demands as assessed by MOT through its traffic survey and analyses (Art. 9 of Rules);
 - (d) the applicant's business operation plan provides all information regarding organization, vehicle fleet, facilities, etc. (Art. 12 and 13 of Rules).
4. If the application passes the review, the provincial or special city Transport Division prepares comments and recommendations for licensing which will be approved by the governor or mayor and submitted to MOT (Art. 14 and 16 of Rules).
5. In the Ministry of Transportation (MOT) the application and comments by the province or special city are further reviewed by the Transport Division of the Land Transport Bureau. If the comments are acceptable, MOT sends to the applicant a notice advising of the date when MOT and provincial or special city officials will visit the applicant to check and confirm that all informations provided in the application are true and correct (Art. 14 of Rules).

6. After all these steps are followed, a license will be awarded to the applicant in accordance with Article 4 of the Act.

7. The procedure described above applies specifically to a new comer to the market. However, MOT's licensing power has been delegated to the provincial governors or special city mayors who are now responsible to handle licenses insofar as the transport services are expansions of existing operations which should however not extend across the provincial or special city boundary line. Part of the licensing power is delegated further by the province to cities or towns.

8. According to provincial sources, the whole licensing procedure when it falls in the domain of compliance of provincial governors, is supposed to take a maximum of 15 days from reception of the application to issuance of a license.

9. The applicant must pay for "official revenue stamps." The stamp costs W 14,000 per application and W 2,000 per additional vehicle to the proposed fleet.

B. The Road Transport Business Act

Law No. 916, dated December 30, 1961 amended by Law No. 2867, December 31, 1976.

(a) Types of Licenses (Art. 3)

- (i) Route bus services
- (ii) Charter bus services
- (iii) Taxi services
- (iv) Route trucking services
- (v) Area trucking services
- (vi) Special vehicles transport services (passenger or freight)
- (vii) Funeral bus services

(b) Licensing (Art. 4)

- (i) License is required from MOT before anyone can start commercial services of any type of seven categories of services above;
- (ii) License defines area or routes to which the operator must limit his services;

- (iii) License can also limit the users or types of the services (types of goods or of passengers);
 - (iv) License can be for a certain limited period of time if the services are to meet certain temporary demands.
- (c) Applicants not qualified for licensing (Art. 5)
- (i) Convicts serving a prison term;
 - (ii) One who lost his license by cancellation by MOT during the last two years;
 - (iii) A company having, as one of its members of board of directors, such a person as indicated in (a) and (b) above.
- (d) Criteria for Licensing (Art. 6)
- (i) Applicant's plan of operation (proposed services) must match the estimated transport demand on the proposed route(s) or area of services;
 - (ii) The plan of operation to be prepared by the applicant must be a long-term operation plan;
 - (iii) The applicant needs to be assessed to possess the ability to run the business;
 - (iv) The proposed operation needs to be judged to serve the public interest as a result of evaluation by MOT.
- (e) Schedule of Charges (Art. 8 and 10). The transport operator shall prepare a schedule of charges for his services for approval by MOT (Art. 8). The approved schedule of charges should be made known to the users of the services by way of showing it on a bulletin-board (Art. 10).

C. Rules of Implementation of the Road Transport Business Act

MOT Decree No. 357, dated November 25, 1969, amended by
MOT Decree No. 716, dated October 8, 1981.

Art. 9: Criteria for Supplying Commercial Vehicles

1. Determination of whether the existing licensed transport services on a given route or in a given area are responding to the demand, is to be based on the supply criteria which MOT will set up as a result of demand and supply surveys carried out at least once a year.

2. How to set up the supply criteria shall be defined separately from these rules by the Ministry of Transportation.

Art. 10: Application for License

1. Application for a road transport business license must be submitted to MOT, through provincial government (See Art. 64 below). The application shall include the following information:

- (a) Name and address of applicant;
- (b) Type of transport services being applied for;
- (c) Proposed route(s) or area of services;
- (d) Size of fleet proposed;
- (e) Statements describing how the proposed services will serve the public interest;
- (f) Types of passengers or goods to be transported or the scope of services (only in case of a limited license as defined in Art. 4-3 of the Act);
- (g) Proposed time period of services (only in case of a temporary license as defined in Art. 4-4 of the Act).

2. The application also shall be supplemented by the following documents:

- (a) Plan of operation;
- (b) Paper proving the total value and an itemized description of fixed assets devoted to the proposed business operation;
- (c) Financial plan;
- (d) Route and station map (for route licenses);
- (e) Papers specially required if the applicant is an existing company:
 - (i) Articles of the company and the company's copy of registration;
 - (ii) Personal data of members of the board of trustees;
 - (iii) Agreement by the board of trustees of the license application.

- (f) Papers required from a new company:
 - (i) Articles of company notarized;
 - (ii) List of names and personal data of the company organizers (members of board of trustees);
 - (iii) Schedule of offer for stocks subscription.
- (g) Papers required from private applicants:
 - (i) List of assets;
 - (ii) Personal identification;
 - (iii) Career statement of the applicant.
- (h) Paper certifying that the applicant is not disqualified for the applied license (Art. 5 of the Act).

3. When an existing operator wants to expand or reduce the scope of services only in a given (or licensed) type of services, his application needs not accompany papers listed in 5 or 6 above.

Art. 11: License for Route Service

Applications for route services shall provide in addition the following information:

- (a) End points of route (names of villages, etc.);
- (b) Distance in Km;
- (c) Route map showing:
 - (i) Station and stops
 - (ii) Class of road (expressway, national, provincial, and/or gun road, paved or gravel surfaced, etc.);
 - (iii) Major facilities located alongside of the route (school, factory, railroad crossing, etc.).

Art. 12: Operational Plan

The following information should be provided:

- (a) Vehicle fleet (types, assignment by route etc.);

- (b) Facilities required (parking, garage, stations, etc.);
- (c) Operation time table.

Art. 13: Minimum Fleet and Facilities Requirements

1. Minimum fleet required for licensing
(amended by MOT Decree October 8, 1981)

	<u>Seoul and Busan city</u>	<u>City</u>	<u>Gun</u>
Express bus	30	30	30
Intercity bus	30	30	30
Intracity bus	30	30	30
Route trucking	30	30	30
Area trucking (<8 ton)	20	10	5
Area " (8 ton)	20	5	5
Pick-up local delivery	No limit	No limit	No limit
Chartered bus	20	10	10
Taxi	20	10	5
Special vehicle	No limit	No limit	No limit
Funeral bus	No limit	No limit	No limit
Car leasing	30	30	30

2. Minimum required garage area
(MOT Decree May 20, 1980)

Express bus	36 sq m
Ordinary/Charter bus	32 sq m (large size)
"	23 sq m (small size)
Taxi	10 sq m
Trucking (large over 10 tons)	36 sq m
" (medium 5 to 10 tons)	26 sq m
" (small up to 5 tons)	13 sq m
Pick-up local delivery 1 ton	7 sq m
Funeral bus	32 sq m
Special vehicle	26 sq m
Renting vehicles	10 sq m (12 seats or larger: 13 sq m)

Art. 14: License Approval

1. Upon receiving an application for license, the MOT first reviews the documents to check whether they comply with Article 10 of the Rules. The application being complete, MOT then notify the applicant the dates when MOT will send its officials to check his facilities.

2. License will be issued when the applicant has passed the two steps of the reviewing of documents and the checking of facilities.

Art. 15: Licensing - Exceptional Cases

Taxi owner-driver or area truck licensing can be considered in the following cases:

1. For a driver employed within the last 4 years in commercial vehicle operation without driving accident during 3 years.
2. For a driver employed within the last 7 years in noncommercial vehicle operation without driving accident during 6 years.

Art. 64: Application to be Submitted through Provincial Government

The licensing application must be submitted to the provincial government. Provincial governor should attach his comments to the application before forwarding it to the MOT, with respect to the following points:

- The applicant's financial capability;
- Transport demand;
- Proposed facilities;
- Prospects on proposed business;
- Influence on market;
- Information on other applicants, if any; and
- Other qualification requirements.

March 1982

KOREA

TRANSPORT SECTOR ISSUES SURVEY

Taxation, Tariffs, Vehicle Standards and Other Regulations

A. Motor vehicles Taxation

Through a sophisticated tax and pricing regime, the Korean government has been highly successful in discouraging private automobile ownership. The deterrent effect of present rules can be measured by the fact that for example, private cars cannot be purchased with bank credit, or that gasoline tax almost triples its price from the refinery to pump, or even that Korean taxes on automobile ownership are very high, pushing the acquisition costs to 50-60% above ex-factory prices when taking into account compulsory purchase of Public Bonds. Rates for commercial use vehicles are much lower. Overall motor vehicles taxes including purchase and gasoline taxes and other user fees account for 8 to 10% of total national revenues. The table below gives a synthetic illustration of the incidence of taxes on few popular car models.

PURCHASE, REGISTRATION AND OPERATING TAXES
ON PRIVATE AUTOMOBILE OWNERSHIP /a
(Won) /b

	Pony-II (1,400 cc) Hyundai	Maepsi-II (1,500 cc) Saehan	Rekord (Saehan)
Ex-factory price	3,458,785	3,002,041	5,722,198
Special tax	363,173	315,214	801,107
Defense tax	108,952	94,465	240,332
Value added tax (selling price)	393,090 (4,324,000)	341,181 (4,013,000)	676,363 (7,740,000)
Registration tax	216,200	200,650	387,000
Acquisition tax (acquisition cost)	86,480 (4,626,680)	80,260 (4,293,910)	154,800 (8,281,800)
Annual operating taxes	252,000	252,000	401,400
First year capital cost	4,878,680	4,545,910	8,683,200
Overall taxes weight as percentage of ex-factory price (%)	41.1	51.4	51.7

/a Excludes Public Bond.

/b As of April, 1982; Exchange Rate: US\$1 = 720 Won.

The tax system on motor vehicle ownership and usage can be divided into two main categories:

The National Taxes including the: (i) Value Added; (ii) Special Excise; (iii) Defense Taxes and the Local Taxes including: (a) For Provinces the (i) Acquisition; (ii) Registration; and (iii) License Taxes. (b) For Cities (Si) and Counties (Gun) the (i) Automobile Tax; and (c) For Special Cities (Seoul, Busan, Daegu and Incheon) the (i) Acquisition; (ii) Registration; (iii) License; and (iv) Automobile Taxes.

The National Taxes Rates:/1

(a) Value Added Tax (VAT):/2 Present rate 13%.

(b) Special Excise Tax:
Depends on engine displacement.

- (i) 1,500 cc or less and three wheel vehicles 15%
- (ii) over 1,500 cc but less than 2,000 cc and four wheel jeep type vehicles 20%
- (iii) six-cylinder, 2,000 cc or less 30%
- (iv) more than 2,000 cc 40%

(c) Defense Tax:/3

Applies to passenger cars for nonbusiness purpose (excluding official cars) and, amount to a surcharge percentage of the Special excise tax 30%

The Local Taxes Rates:

(a) Acquisition Tax based on value of purchase 2%

(b) Registration Tax:

	<u>Tax base</u>	<u>Rates</u>
New Record & Transfer	Value	5%
Creation of a lien	Value	3%
Other record	Per Case	5,000 (Won)

/1 Korea Taxation 1980, Ministry of Finance, Korea.

/2 The VAT is a flexible rate that can range between 10% and 16% depending on changes in economic situation; the normal rate is 10%.

/3 The defense tax is a temporary tax due to expire in the year of 1980 but it was extended until end-1985.

(c) License Tax:

Vehicle class	Cities with 500,000 inhabitants or more	Other cities	Counties (guns)
1	W 27,000	W 18,000	W 10,800
2	W 21,600	W 13,500	W 7,200
3	W 16,200	W 9,000	W 4,800
4	W 10,800	W 6,000	W 3,600
5	W 7,200	W 3,000	W 1,800
6	W 3,600	W 1,500	W 600

(d) Automobile Tax: (Annual Tax Amount per Vehicle)

(i) Automobiles (more than 4-Cylinder)

Wheel base	Business use	Nonbusiness use	
		Less than 8-cylinder	8-cylinder or more
275 cm or more	W 84,000	W 1,683,000	W 1,980,000
less than 275 cm	W 40,000	W 816,000	W 960,000

(ii) Small-size automobiles (4-Cylinder and less)

Discharge	Business use	Nonbusiness use
More than 1,500 cc	W 30,400	W 374,400
More than 1,000 cc	W 26,000	W 225,000
1,000 cc or less	W 21,200	W 125,000

(iii) Other small-size automobiles

	Business use	Nonbusiness use
Per vehicle	W 16,800	W 67,000

(iv) Buses

Type	Business use	Nonbusiness use
Express bus	W 82,000	-
Large-size chartered bus	W 50,000	-
Small-size chartered bus	W 41,000	-
Other large-size bus	W 35,000	W 77,000
Other small-size	W 21,000	W 44,000

(v) Trucks

Class	Cargo capacity	Business use	Nonbusiness use
1	1,000 kg or less	W 4,400	W 19,000
2	2,000 kg or less	W 6,400	W 23,000
3	3,000 kg or less	W 9,000	W 32,000
4	4,000 kg or less	W 12,000	W 42,000
5	5,000 kg or less	W 15,000	W 53,000
6	8,000 kg or less	W 24,000	W 87,000
7	10,000 kg or less	W 30,000	W 105,000
8	More than 10,000	W 36,000	W 126,000

(vi) Special cars

Class	Category	Business use	Nonbusiness use
1	Large-size special car	W 24,000	W 105,000
2	Small-size special car	W 9,000	W 39,000

(vii) Cars with 3-wheel or less

Class	Category	Business use	Nonbusiness use
1	3-wheel car	W 3,100	W 11,500
2	Small-size special car	W 2,200	W 12,000

B. Tariffs and Fares.

The government controls all transport tariffs and fares, which are as follows:

KOREA: TARIFFS AND FARES FOR TRANSPORT
(Won)

Mode	Type of service	Effective date							
		02/04/74	05/01/75	07/01/78	05/01/79	12/19/79	08/01/80	12/21/80	06/10/81
Highway									
Taxi/a	Basic fare (2 km)	160.00	200.00	250.00	300.00	400.00	500.00	550.00	600.00
	Additional (per 500 m)	30.00	30.00						
	Additional (per 400 m)			30.00	40.00	40.00	50.00	50.00	50.00
	Waiting (per 10 min.)	150.00	150.00		220.00	250.00	300.00	300.00	300.00
Microbus	Single fare							300.00	350.00
Urban bus (intracity)	Additional:								
Ordinary	Adults	25.00	30.00				90.00	90.00	110.00/c
	Student, military, police	15.00	20.00				65.0	65.0	60.00/d
Special	Adults	30.00	35.00	50.00	60.00	80.00			
	Student, military, police	20.00	25.00	35.00	50.00	55.00			
Suburban bus (intercity)	Minimum freight rate (8 km)	40.00	45.00		80.00				
Ordinary	Minimum freight rate (10 km)					100.00	100.00	120.00	130.00
	Additional:								
	Paved (person/km)	4.45	5.18	6.73	8.78	10.31	11.32	12.95	14.27
	Unpaved (person/km)	4.98	5.79		9.83	11.55	12.68	14.51	16.00
	Seoul to Incheon (person/km)	3.17	3.68						
Express	Paved (person/km)			8.47	9.31	10.94	12.01	13.73	15.13
	Unpaved (person/km)				10.42	12.24	13.43	15.36	16.93
Highway bus									
Express	1 - 200 km (person/km)	4.39	5.27	6.00	7.71	9.75	10.52	11.84	12.79
	201 - 400 km (person/km)	4.39	4.83	5.50	7.07	8.94	9.63	10.83	11.69
	Over 401 km (person/km)	4.39	4.39	5.00	6.43	8.13	8.76	9.85	10.63
Ordinary	1 - 200 km (person/km)	3.95	4.74		6.93	8.77	9.45	10.63	11.48
	201-400 km (person/km)	3.95	4.34		6.35	8.03	8.65	9.73	10.51
District freight/b (Sectoral local area)									
By distance	One way (ton/km)	35.11	41.64						
	Round trip (ton/km)	22.50	26.69						
By time	Day (8 hours) (ton/km)	2,553.57	3,000.00						
	Overtime (per hour) (ton/km)	360.48	400.00						
Waiting	1st hour no charge (per 1/2 hour)	96.28	100.00						
Line freight (route)	Per 10 kg/10 km	3.28	3.89		5.76	6.86	7.79	8.73	9.31
	Per ton/km	32.00	38.90	49.35	57.73	68.81	78.16	87.53	93.36
Local small delivery (pickup, small truck)	Basic fare (8 km)	700.00							
	Basic fare (5 km)		700.00		1,000.00	1,300.00	1,600.00	1,600.00	1,800.00
	Additional (800 m)	60.00							
	Additional (500 m)		40.00		60.00	80.00	100.00	100.00	120.00
	Waiting (per 5 min.)	60.00	80.00		120.00	160.00	190.00	190.00	210.00
Charter bus									
By distance	Basic fare (40 km)	7,300.00	8,500.00	11,050.00	13,260.00	15,580.00	17,100.00	19,560.00	21,570.00
	Additional (per 1 km)	92.85	108.00	140.00	170.00	200.00	219.00	250.00	275.00
By time	First one hour	1,731.07	2,000.00						
	Additional (per 1/2 hour)	787.03	900.00		2,400.00	2,820.00	3,090.00	3,530.00	3,890.00
Waiting	Lodging/trip (per 1/2 hour)	351.48	400.00		620.00	720.00	790.00	900.00	990.00
	One-day trip (per 1/2 hour)	351.48	400.00		1,800.00	2,110.00	2,310.00	2,640.00	2,910.00
Funeral service	Basic fare (30 km)	15,000.00	17,500.00						44,420.00
	Additional (per 1 km)	163.85	190.00						470.00
	Waiting (per 1 hour)	1,000.00	1,000.00						2,540.00

KOREA: TARIFFS AND FARES FOR TRANSPORT (cont'd)
(Won)

Mode	Type of service	Effective date										
		02/04/74	05/01/75	07/01/78	05/01/79	12/19/79	08/01/80	12/21/80	06/10/81	12/15/81/1	07/15/82	12/15/82
Railway												
Passenger												
Ordinary /k	Saemaul Express (person/km)			11.76	15.88				27.75	29.14		32.13
	U-Deong Express (person/km)			8.53	11.09				16.25	17.06		18.81
	Express (person/km)			5.84	7.30				11.67	12.25		13.50
	Ordinary express (person/km)			4.40	4.84				8.02	8.42		-
	Common (person/km)			2.94	3.24				5.83	6.12		6.75
	Subway (per 8 km)			50.00	60.00			90.00	100.00	110.00		-
	Electric train (per 1 km) /m			4.21	4.63			6.38	7.45	7.82	8.31	8.62
Commuters	Students; up to 21 km, (person/km) /n								2.92	3.06		3.375
	Nonstudents up to 21 km, (person/km) /f									4.28		4.725
Freight												
Commodities /h	Carload rates (per ton/50 km) /g											
	Class 1 (ton/50 km)							593.00	652.00	717.00	753.00	806.00
	2 (ton/50 km)							539.00	626.00	689.00	723.00	774.00
	3 (ton/50 km)			297.00	327.00			490.00	573.00	630.00	662.00	708.00
	4 (ton/50 km)							450.00	540.00	594.00	624.00	668.00
	Special Anthracite coal										730.00	774.00
Baggage	Minimum charge, up to 5 kg											
	1 - 100 km							150.00	170.00	190.00	200.00	210.00
	101 - 200 km							130.00	170.00	190.00	200.00	210.00
	201 - 300 km							150.00	170.00	190.00	200.00	210.00
	301 - 400 km							150.00	170.00	190.00	200.00	210.00
	Over 400 km							150.00	170.00	190.00	200.00	210.00
	For each additional 5 kg											
	1 - 100 km							43.00	49.00	54.00	57.00	61.00
	101 - 200 km							65.00	75.00	83.00	87.00	93.00
	201 - 300 km							73.00	84.00	92.00	97.00	104.00
301 - 400 km							80.00	92.00	101.00	106.00	113.00	
Over 400 km							88.00	101.00	111.00	117.00	125.00	
Miscellaneous	Switching (per movement/per km)								4,244.00			5,235.00
	Demurrage (per ton/6 hours) /i								279.00			331.00
	Storage (per ton/24 hours) /j								1,107.00			1,392.00
Coastal Shipping												
Passenger												
	Person/nautical mile		16.13	18.89	22.19	26.48	29.56	33.30				
Freight												
Small-sized (200 ton)	Ton/nautical mile		18.70	23.47	28.68	33.66	39.02	43.35				
	Large-sized (800 ton)	Ton/nautical mile		13.09	14.86	16.73	20.59	24.28	27.15			
Aviation (domestic)												
Passenger												
	2nd class (person/km)		25.487	28.049		45.13	54.28	61.04				
Freight												
	Per kg/km		0.457	0.503				0.83				

/a The basic fare for taxi is adjustable according to regional circumstances within the limit of 200 won.

/b (1) Freight (district, line, local small delivery): adjustment as of May 1, 1975; Others (taxi, urban, suburban, highway, charter, funeral): adjustment as of July 1, 1975.

/c W 10 surcharge when adult rides without tokens.

/d W 10 surcharge when student rides without the student coupon.

/e One month: 50 times. Minimum charge W 3,500.

/f One month: 60 times. Minimum charge W 3,800.

/g Mini-charge by type of freight cars: 30 ton (W 35,640), 40 ton (W 47,520), 50 ton (W 59,400).

/h A. Car-load rates: Class 1: Cattle, textiles, furniture, meat, sugar, cotton, plywood, hard board, tobacco, gasoline and dangerous goods. Class 2: Cement, diesel, bunker oil, fruits, vegetables. Class 3: Lumber, rice, grains, salt, fertilizer, limestone, ores, pulp, asphalt, bricks. Class 4: Sand, scraw.

B. Minimum charges by type of freight cars:

Type of car	Minimum charges
30 ton	40,080
40 ton	53,440
50 ton	66,800

/i Including first 6 hours.

/j Car-load basis.

/k In addition: (a) Special room charges

(b) Sleeper charges

(c) Minimum charges

	Up to 200 km			Up to 400 km			Over 401 km			Common	140 (up to 21 km)	
	Express	U-Deong Express	Saemaul Express	Express	U-Deong Express	Saemaul Express	Upper berth	Lower berth	Express			U-Deong Express
	1,200.00	1,600.00	2,000.00	2,000.00	2,300.00	2,900.00	2,700.00	3,000.00	4,000.00	7,900.00	10,700.00	1,900 (up to 103 km)
												3,500 (up to 110 km)

/l Date of the current railroad tariffs and fares.

/m Minimum charge (up to 8 km): W 110.

Source: Government of Korea

C. Vehicle Standards and Inspection

1. Maximum Vehicle standards in Korea compared to other countries are as follows:

LIMITS OF VEHICLE SIZES AND WEIGHTS

		DIMENSIONS (m)				AXLE LOAD (t)			GROSS WEIGHT (t)	
		Width	Height	Length		Combin.	Single	Tandem	Unit	Combin.
				Tractor	Unit					
Korea		2.50	3.50	12.00	15.00	18.00	10.0	16.0	20.0	35.0
USA	Maximum	2.74	4.27	16.78	19.81	21.35	10.9	18.4	29.5	40.8
	Minimum	2.44	3.81	10.67	15.24	15.24	8.2	14.5	16.3	24.3
UK		2.50	4.57	11.00	13.00	18.00	(2)	(2)	22.4	32.5
France		2.50	-	12.00	15.00	8.00	13.0	21.0	26.0	35.0
West Germany		2.50	4.00	12.00	15.00	18.00	10.0	16.0	22.0	28.0
Taiwan		2.50	3.80	11.00	14.00	-	8.0	11.0	14.0	20.0
Japan		2.50	3.50	12.00	24.00	24.00	10.0	20.0	20.0	40.0
Geneva	Convention	2.50	3.80	11.00	14.00	18.00	8.0	14.5	(1)	(1)
AASHO	Policy	2.59	4.12	12.40	16.78	19.81	9.1	14.5	(2)	32.6

Sources: Road Transportation Vehicle Law No. 962, January 10, 1962, revised January 16, 1967, and MOT Ordinance No. 111, March 29, 1962, revised April 20, 1967, MOT Decrees, April 4, 1968; August 8, 1969; July 1, 1970; and November 27, 1970.

Other data = "Limits of Motor Vehicle, Sizes and Weights", International Road Federation.

Notes: (1) Gross weight = $11.25 + 1.25 a$ (a= distance between outer axles in meters)

(2) Depends on axle spacing and type of vehicle.

2. There are two kinds of motor vehicle inspections designated by law:

(a) Daily inspection:

Object: all registered, operating motor vehicles
Inspector: driver
Time: every day before operating
Format: Daily inspection report

(b) Periodic inspection:

Object: all registered, operating motor vehicles except the
2-wheel small-size motors.

Inspector: (i) Class-A motor vehicles must be inspected by the
1st Class inspection shop.

(ii) Class B motor vehicles must be inspected by the
1st or 2nd Class inspection shop.

Time: Interval between inspections:

(i) Commercial motor vehicles:
2nd Class every 3 months
1st Class every 6 months

(ii) Non-Commercial motor vehicle
2nd Class every 6 months
1st Class every 12 months

(iii) Exceptions:

- a. No 2nd class inspection is required for new vehicles within 1 year for commercial use and within 2 years for noncommercial use.
- b. 1st class inspection is required only every 12 months for new vehicles for commercial and 2nd class inspection only every 6 months.
- c. For tractor - trailers the 2nd class inspection is required only every 6 months and the 1st class inspection only every 12 months.

Format: Only Certified Inspectors can sign the inspection report./1

/1 A Certified Inspector must obtain the National Auto Mechanic License from the Government.

D. Operating Permits /1

(a) The driver's license may be obtained from four sources, either

- (i) the Mayor of Seoul or
- (ii) the Mayor of Busan or
- (iii) the Mayor of Daegu (since 1981) or
- (iv) Provincial governors

(b) The driver's licenses are classified into two types - unlimited and noncommercial as follows:

(i) Type-I (unlimited)

- a. license for large size (all types of road vehicles);
- b. license for ordinary size (as above, except for buses with more than 16 seats and trucks transporting explosives or high-pressure gas over 60% of payload); and
- c. license for small size (auto-tricycles, motorcycles, etc.);
- d. special license (limited to any particular type of vehicle).

(ii) Type-II (limited to noncommercial vehicle)

- a. license for ordinary size (cars, minibuses of less than 9 seats, trucks of 4-ton payload or less, motor powered tricycles and bicycles, etc.);
- b. license for small size (motorcycles);
- c. special license (limited any particular type of the above vehicles); and
- d. license for motor-installed bicycles.

/1 Road Traffic Act, Law No. 941, Promulgated on December 31, 1961, amended by Five additional laws, No. 1112, 1300, 2236, 2382 and 2591 from 1962 to 1973. Laws of the Rep. of Korea, 3rd Edition, June 1975, The Korean Legal Center, Seoul, Korea (pp. 86-107).

- (c) The transport business license. (See Road Transport Licensing Procedure Annex 2).

The government licenses private firms that operate services for hire on Korea's road transport systems. Road transport licenses are issued for scheduled bus and truck services along established routes and for nonscheduled taxi and truck operations in defined areas. There are no special commodity carrier license for trucks, but special licenses are issued for truck trailers, tank trucks, and container trailers. To operate a road transport business, the operator must meet minimum fleet standards and minimum garage-area requirements.

The minimum fleet requirement for road transport does not mean that the licensee must own the requisite number of vehicles. Vehicles are frequently individually owned, but may be licensed as an entity for business purposes.

For road transport, licensing authorities attempt to match licensed capacity to demand. Annual surveys are conducted to determine the number of passengers carried daily by taxis and buses and the numbers of kilometers traveled daily by trucks. If the average use factor exceeds a set daily standard, i.e. 29 persons for buses, and 170 kilometers for trucks, additional capacity is licensed. This system is based on fairly uniform vehicle size and makes no allowance for improvements in productivity, whether through acquisition of larger vehicles or better use of existing vehicles.

Licensing authorities also control the number of daily runs by each bus on a particular route, although the exact time of each run is determined by the operator and is reported to the government. New routes are authorized when demand has been demonstrated.

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TRANSPORT SECTOR ISSUES SURVEY

Factors Affecting Fuel Consumption of Road and Rail Transport and Potential Fuel Savings by Selected Conservation Devices and Techniques

Factors affecting fuel consumption	Applicable devices and/or techniques	Potential fuel savings (%) /a
A. Road Transport		
<u>Aerodynamic Drag</u>		
The air resistance encountered by a moving vehicle.	1. Wind deflectors mounted on top of the truck cab. 2. Eliminating exterior vertical ribs on trailers. 3. Reducing the gap between tractor and trailer. 4. New truck frontal designs.	4-8
<u>Rolling Resistance</u>		
The energy required to flex the tire tread and sidewall, and push the tire over various road surfaces.	Radial tires	3-10
<u>Powertrain Efficiency</u>		
1. Fuel consumption per hp/hr of the bare engine	1. Turbocharged engines /b "Fuel economy" engines /c	2-10
2. The "match" between engine, transmission and axles	2. Tag axles /d	
3. Horsepower of the engine and power train	3. Reduction of excess hp /e	
4. Horsepower load of engine accessories (i.e., cooling fan, air compressor, air conditioner, power steering)	4. Fan clutches /f	
<u>Speed Control</u>		
1. Engine speed (rpm)	1. Engine governors /g	4-20
2. Road speed (km/hr)	2. Road speed governors /g Tachographs /h	
<u>Vehicle Maintenance</u>		
Preventive maintenance helps in fuel economy and lengthens tune-up intervals.	1. Regular inspection and replacement of air cleaners and filters. 2. Regular tire inflation checks.	1-5
<u>Driving Practices</u>		
	1. Observe speed limits. 2. Keep engine speed (rpm) down. 3. Avoid excessive speed changes. 4. Shut off engine when possible. /i 5. Shift gears only when necessary. 6. Skip shift gears when possible.	1-10
<u>Miscellaneous</u>		
	1. Avoid overfilling fuel tanks. 2. Fuel additives, synthetic lubricants	1-3
B. Railways		
<u>Aerodynamic Drag</u>		
The air resistance encountered by a moving vehicle.	1. Aerodynamically efficient grouping of mixed trains. /j 2. Eliminate cabooses.	1-2
<u>Rolling Resistance</u>		
The energy required to push the wheels over the rail.	1. Increase track rigidity. 2. Improve roadbeds to reduce friction. 3. Improve roller bearings/seal sets on wheel trucks. /k	3-5
<u>Powertrain Efficiency</u>		
1. Empty weight of locomotive	1. Substitute lighter weight, high strength iron and steel components.	6-10
2. Fuel consumption per hp/hr of the bare engine.	2. Turbocharging /b	
3. Horsepower load of engine accessories (i.e., air compressor, radiator cooling system and auxiliary generators).	3. Wayside energy storage /l Clutching mechanism to disengage accessory when not needed.	
<u>Maintenance</u>		
Improper operation of engine and fuel system components.	Regular inspection and replacement of air filters, fuel injectors, injection pumps, turbochargers, governors and engine blowers.	1-5
<u>Operating Procedures</u>		
	1. Shut down extra power units when not needed. 2. Reduce speed to the lowest level consistent with required performance. 3. Shut down engine if locomotive will be idling more than one hour and ambient temperature is not expected to drop below 13°C. 4. Use minimum hp/trailing gross ton ratio consistent with required performance level. 5. Use low idle when engine is idling and shut down is impractical. 6. Use most efficient braking and throttle modulation procedure. 7. Increase car loading.	1-5 3-10

Footnotes see page 2.

Sources: Joint Industry-Government Voluntary Truck and Bus Fuel Economy Program, How to Save Truck Fuel; and US General Accounting Office, The Federal Government Should More Actively Promote Energy Conservation by Heavy Trucks, March 1980.

C.L. Saricks and K.M. Bertram, Summary of Rail Fuel Conservation Measures, Argonne National Laboratory, unpublished draft 1982. H.C. Eck, et al., Fuel Conservation in Train Operation, Association of American Railroads, December 1981.

FOOTNOTES FOR ANNEX 4

- /a Fuel savings of devices/techniques are only partially additive as each additional measure diminishes the base of fuel consumption that can be reduced further. The ranges shown correspond to results obtained in the US under typical operating conditions. Savings achieved elsewhere will depend on local conditions.
- /b Turbochargers are fans driven by exhaust gases that force more air into the combustion chamber, thereby increasing pressure and combustion efficiency.
- /c These are turbocharged engines with direct injection of fuel into the combustion chamber, high torque (i.e., force delivered to the driveshaft) at low engine speeds (i.e., 1,600 rpm and below), engine governors to keep engine speed within the most fuel efficient range (i.e., generally below 2,000 rpm), and low numerical axle ratios (i.e., fewer driveshaft rotations per drive wheel rotation).
- /d Tandem axle arrangements in which one of the axles is "dead" (i.e., not driving wheel rotation).
- /e Selecting the lowest hp engine with the performance characteristics needed.
- /f Fans that operate only when needed to reduce engine temperature (generally less than 5% of engine running time).
- /g Devices that limit maximum engine or road speed (i.e., rpm or km/hr) by limiting fuel flow.
- /h Devices that continuously record engine speed (rpm) versus time.
- /i Devices now on the market will shut the engine down automatically after a specified time delay.
- /j A mix train is composed of different car types (e.g., hoppers, tank cars, boxcars, flatcars, etc.) An aerodynamically efficient grouping minimizes the number of surfaces exposed to the greatest air resistance.
- /k Wheel trucks are the wheels and associated swiveling assemblies connecting them to the rail car body. Improved bearings and seals minimize friction losses.
- /l Large flywheel housed in underground structure near grade summit electronically recovers braking energy transmitted from train on down grade and transmits it to following train for use on upgrade.

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List of Follow-up Studies

1. Many of the recommended government actions and policy measures are of sufficient complexity and technical sophistication as to benefit from some measure of Bank involvement. As explained in this Survey, often more analyses are required to prepare such action programs (para. 4.25). The main objective is generally to increase efficiency in the transport sector by promoting the right incentives. Sometimes, organizational changes might be relevant. In particular, as the transport energy issue is a relatively new area, it is to be expected that institutional arrangements are not yet well defined and that most professional staff in Government are only little familiar with current developments in the field. Thus, future Bank involvement could focus on providing technical assistance with the objective of strengthening the institutional structure of MOER, and of organizing its relationship with MOT, MCI and other ministries involved, to deal with the required research and build-up of a comprehensive action program.

2. The Bank would be willing to finance a number of recommended studies as part of future projects (e.g., the Highway Sector Project or Maritime Sector Project). Also, it is strongly advised that a number of detailed follow-up studies of particular system anomalies be financed directly by Government and be carried out by the increasingly active Korean research institutes dealing with transportation. At this time, urgent attention should be given to the following specific studies which complexity seems to require special expertise and may warrant the Bank's assistance:

- (a) A study for improving the efficiency of trucking industry. With a view to provide direction in defining a more competitive and stimulating regulatory framework, it would cover (i) own-account trucking, the factors responsible for its rapid development, its operating characteristics, and the energy and investment consequences of its continued growth; and (ii) commercial trucking, the factors responsible for its apparent stagnation, its operating characteristics, and its energy efficiency vis-a-vis private truck and rail (para. 5.15).
- (b) A study for appropriating road infrastructure costs to users. With a view to promote a fairer basis for competition among transport modes through the introduction of a neutral taxation system, the study would analyze road costs on the country's networks, the level of user charges that ought to be raised and the taxation system best suited to recover those costs (para. 5.15).

- (c) Two separate studies for improving institutional structures for coordination and planning, namely for:
 - (i) funding and apportioning budget for road investment programs, in particular through new mechanisms such as a unified budgeting system (para. 4.27); and
 - (ii) restructuring institutional responsibilities for ports programs (para. 4.29).

3. Among other studies that ought to be carried out by Government research institutes are:

- (a) an assessment of the impact in Korea of the energy conservation energy technics and devices recommended in Annex 4 (para. 6.54);
- (b) the definition of an energy management program, with fuel consumption forecast in the transport sector, and a close monitoring system (para. 6.47);
- (c) the development of standard energy-conservation criteria for use in project evaluation similar to Bank's project analysis methods or other recognized techniques, and that could be systematically adopted by all investment planning agencies (para. 6.09);
- (d) the periodic revision of MOER forecasts for transport energy demand and supply requirements to reflect anticipated savings from the conservation program, to avoid overcapacity and premature investment in energy supply facilities (para. 6.22); and
- (e) analyze systematically the energy implications of the Government's investment program in transportation under the Five-Year Plan.

4. With respect to the preparation of future intermodal transport projects, the objectives and status of the three recommended studies (the first started in March 1983, the second will start early in 1984) are given below:

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Multimodal Transport Feasibility Studies (As of Dec. 1983)

Title	Study objective	Lead agency	Source of funds	Cost (\$)	TORs status	Short-list	Invite proposals	Receive proposals	Select consultants	Sign contract	Duration (mos.)	Comments and current status
<u>Multimodal Transport Feasibility Studies /a</u>												
Review of Long-Term Transport Investment Needs in the Seoul-Busan Corridor and Feasibility Study of Rail Capacity Expansion Between Seoul and Daejeon	See title.	Transport Coordination Bureau - MOT	7th Railway Loan	1,500,000	final	Completed	Yes 07/82	Yes 08/82	Yes	Yes	14	Study started March 1983. Funds have been provided under budget. Timetable for project preparation was agreed upon in March 1982. Steering Committee was established before start of study. Study would be basis for a multimodal transport project earmarked for FY87 or FY88.
Kyeonggi Region Integrated Transport Study (Seoul Suburban)	Study land transport requirements (rail/road) and to conduct feasibility studies on proposed new links to determine the most cost-effective transport system for the region. <u>Phase I</u> . Prepare Investment Plan. <u>Phase II</u> . Feasibility Study.	Bureau of Public Roads (BPR) - MOC	7th Railway Loan and Coal and Cement Project	1,500,000 600,000	final	Completed	Yes 08/83	Yes 10/83	Yes	Yes	12	Government has agreed to carry out study under MOC which has specific responsibility for planning in Seoul Region. TOR was finalized after interim report of Seoul City Transport was issued to ensure smooth continuity. Study is expected to start early 1984 and be basis for Regional Transport Project scheduled for FY86 or FY87.
Busan Industrial Belt Transportation Study	See Kyeonggi Region; but Coastal shipping, port terminals, and port facilities requirements would be considered in addition to rail and road needs.	MOC or MOT	Proposed Highway Sector Loan	1,500,000	No	No	No	No	No	No	12	Government has deferred decision on preparatory steps for this study which could be financed under a proposed future project. Study should start in 1985, or 1986 for an FY89 project.

/a Each resulting project will require in addition full detailed engineering studies to be funded from other sources.

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Gross Domestic Capital Formation (1971-80)
(Unit: Billion Won)

	1971 /a	1976 /b	1980 /b
Gross domestic capital formation (%)	748.8 (100.0)	3,112.4 (100.0)	4,660.6 (100.0)
Agriculture, forestry and fishery (%)	55.8 (7.5)	273.4 (8.8)	340.8 (7.3)
Mining and manufacturing (%)	136.8 (18.3)	719.2 (23.1)	982.4 (21.1)
Social overhead capital (%)	247.1 (32.9)	1,019.7 (32.7)	1,877.4 (40.3)
Transportation, storage and communication (%)	(177.8) (23.7)	(701.3) (22.5)	(1,205.5) (25.9)
Other services (%)	240.9 (32.2)	906.1 (29.2)	1,775.9 (38.1)
Increase in stocks (%)	68.2 (9.1)	193.9 (6.2)	-315.8 (-6.8)

/a At 1970 constant market price.

/b At 1975 constant market price.

Sources: (1) Statistical Yearbook of Transportation - 1977, MOT, Korea, p.3.

(2) Statistical Yearbook of Transportation - 1982, MOT, Korea, p. 5.

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Gross National Product by Sectors (1971-86)
(Unit: Billion Won)

	Actual /a			Forecast /b		Average annual increase (%) (1982-86)
	1971	1976	1980	1982	1986	
GNP (%)	6,962.5 (100.0)	11,275.5 (100.0)	13,842.8 (100.0)	40,193.3 (100.0)	53,676.9 (100.0)	7.6
Agriculture, forestry and fishery (%)	2,005.4 (28.8)	2,702.7 (24.0)	2,207.5 (15.9)	7,206.8 (17.9)	7,955.0 (18.4)	2.6
Mining and manufacturing (%)	1,455.3 (20.9)	3,328.3 (29.5)	4,935.5 (35.6)	12,569.5 (31.3)	18,766.3 (35.0)	10.8
Social overhead capital (%)	769.4 (11.1)	1,420.7 (12.6)	2,306.5 (16.7)	7,142.4 (17.8)	10,004.3 (18.6)	8.9
Transportation and storage (%)	(316.1) (4.5)	(590.7) (5.2)	(948.2) (6.8)	(1,776.5) (4.4)	(2,032.9) (3.8)	3.4
Other services (%)	2,732.4 (39.2)	3,823.8 (33.9)	4,393.3 (31.8)	13,274.6 (33.0)	16,951.4 (31.6)	6.4

/a At 1975 constant market prices.

/b At 1980 constant market prices.

- Sources: (1) Statistical Yearbook of Transportation - 1979, MOT, Korea, p. 3.
 (2) Statistical Yearbook of Transportation - 1982, MOT, Korea, p. 5.
 (3) "Draft" for Preparation of Fifth Five-Year Social and Economic Plan - Transportation Sector, August 1981, MOT, Korea, pp. 10, 64-67.

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TRANSPORT SECTORAllocation of Investment Plans by Sectors (1967-86)
(Billion won)

	Second five-year plan (1967-71) /a		Third five-year plan (1972-76) /b		Fourth five-year plan (1977-81) /c		Fifth five-year plan (1982-86) /d	
	Amount	%	Amount	%	Amount	%	Amount	%
Agriculture, forestry and fishery	160 (1,251)	16.3	649 (3,472)	13.6	1,979 (4,453)	10.4	6,300	8.7
Mining	17 (133)	1.7	67 (358)	1.4	303 (682)	1.6	500	0.7
Manufacturing	284 (2,221)	29.0	1,246 (6,666)	26.1	5,088 (11,448)	26.7	16,200	22.5
Electricity	79 (618)	8.1	252 (1,348)	5.3	2,479 (5,578)	13.0	4,700	6.5
Communications	59 (461)	6.0	149 (797)	3.1	750 (1,688)	3.9	6,960	9.4
Transportation	150 (1,173)	15.3	1,076 (5,757)	22.5	2,784 (6,264)	14.6	9,940	14.1
Housing	75 (587)	7.7	383 (2,049)	8.0	2,641 (5,942)	13.9	14,400	20.0
Education	25 (196)	2.6	179 (958)	3.7	749 (1,685)	3.9	3,600	5.0
Other services /e	131 (1,024)	13.3	777 (4,157)	16.3	2,255 (5,074)	12.0	9,500	13.1
<u>Total</u>	<u>980</u> <u>(7,664)</u>	<u>100.0</u>	<u>4,778</u> <u>(25,562)</u>	<u>100.0</u>	<u>19,028</u> <u>(42,813)</u>	<u>100.0</u>	<u>72,100</u>	<u>100.0</u>

Note: Figures in parentheses indicate the 1980 prices.

/a The Second Five-Year Economic Development Plan (1967-71). Government of the Republic of Korea, 1966, pp. 210-211 (1965 prices).

/b The Third Five-Year Economic Development Plan (1972-76). Government of the Republic of Korea, 1971, pp. 178-179 (1970 prices).

/c The Fourth Five-Year Economic Development Plan (1977-81). Government of the Republic of Korea, 1976, pp. 140-163 (1975 prices).

/d The Fifth Five-Year Economic Development Plan (1982-86). Government of the Republic of Korea, 1982, p. 173 (1980 prices).

/e Included public works and other construction, manpower development, health, science and technology, and others.

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Growth Trend of Domestic Passenger Traffic (1961-82)
(Units: 1,000 Passengers; million pass-km)

	1961		1966		1962-66 % in- crease	1971		1967-71 % in- crease	1976		1972-76 % in- crease	1981		1977-81 % in- crease	1982	
	Traffic volume	% share	Traffic volume	% share		Traffic volume	% share									
Passenger																
Railways																
Rail intercity	88,291	13.0	138,299	8.3	9.4	128,159	4.1	(1.5)	148,562	2.8	3.0	268,364	2.9	13.1	282,022	2.9
Seoul suburban	N.A.	-	N.A.	-	-	N.A.	-	-	100,107	1.9	-	172,765	1.9	10.7	161,548	1.6
Subtotal	<u>88,291</u>	<u>13.0</u>	<u>138,299</u>	<u>8.3</u>	<u>9.4</u>	<u>128,159</u>	<u>4.1</u>	<u>(1.5)</u>	<u>248,699</u>	<u>4.7</u>	<u>14.2</u>	<u>441,129</u>	<u>4.8</u>	<u>12.2</u>	<u>443,570</u>	<u>4.5</u>
Subway	-	-	-	-	-	-	-	-	33,914	0.6	-	88,326	1.0	21.1	89,298	0.9
Highways																
Intercity	N.A.	-	277,078	16.7	-	339,886	10.7	4.2	651,624	12.2	13.9	910,657	9.9	7.0	978,402	10.0
Urban	N.A.	-	1,234,480	74.6	-	2,684,343	85.0	16.8	4,399,359	82.4	10.4	7,772,473	84.2	12.0	8,280,850	84.5
Subtotal	<u>586,864</u>	<u>86.4</u>	<u>1,511,558</u>	<u>91.3</u>	<u>20.8</u>	<u>3,024,229</u>	<u>95.7</u>	<u>14.9</u>	<u>5,050,983</u>	<u>94.6</u>	<u>10.8</u>	<u>8,683,130</u>	<u>94.1</u>	<u>11.4</u>	<u>9,259,252</u>	<u>94.5</u>
Maritime	3,743	0.6	5,909	0.4	9.6	6,371	0.2	1.5	5,994	0.1	(1.2)	9,230	0.1	9.0	9,602	0.1
Aviation	62	-	192	-	25.4	1,105	-	44.8	795	-	(6.8)	1,555	-	14.4	1,844	-
Total	<u>678,960</u>	<u>100.0</u>	<u>1,655,958</u>	<u>100.0</u>	<u>19.5</u>	<u>3,159,864</u>	<u>100.0</u>	<u>13.8</u>	<u>5,340,385</u>	<u>100.0</u>	<u>11.1</u>	<u>9,223,370</u>	<u>100.0</u>	<u>11.5</u>	<u>9,803,566</u>	<u>100.0</u>
Pass-km																
Railways																
Rail intercity	5,372	53.0	8,665	42.5	10.0	8,750	27.1	0.2	12,440	21.2	7.3	16,552	18.2	5.8	15,838	16.5
Seoul suburban	N.A.	-	N.A.	-	-	N.A.	-	-	1,865	3.2	-	4,976	5.4	21.7	5,196	5.5
Subtotal	<u>5,372</u>	<u>53.0</u>	<u>8,665</u>	<u>42.5</u>	<u>10.0</u>	<u>8,750</u>	<u>27.1</u>	<u>0.2</u>	<u>14,305</u>	<u>24.4</u>	<u>10.3</u>	<u>21,528</u>	<u>23.6</u>	<u>8.5</u>	<u>21,034</u>	<u>22.0</u>
Subway	-	-	-	-	-	-	-	-	388	0.7	-	1,258	1.4	26.5	1,309	1.4
Highways																
Intercity	N.A.	-	N.A.	-	-	11,936	37.0	-	25,030	42.7	16.0	35,559	39.0	7.3	38,211	39.9
Urban	N.A.	-	N.A.	-	-	10,981	34.1	-	18,369	31.3	10.8	31,756	34.9	11.6	33,899	35.4
Subtotal	<u>4,618</u>	<u>45.5</u>	<u>11,464</u>	<u>56.2</u>	<u>19.9</u>	<u>22,917</u>	<u>71.1</u>	<u>14.9</u>	<u>43,399</u>	<u>74.0</u>	<u>13.6</u>	<u>67,315</u>	<u>73.9</u>	<u>9.2</u>	<u>72,110</u>	<u>75.3</u>
Maritime	136	1.3	196	1.0	7.6	256	0.8	5.5	249	0.4	(0.6)	480	0.5	14.0	610	0.6
Aviation	18	0.2	55	0.3	25.0	314	1.0	41.7	276	0.5	(2.6)	557	0.6	15.1	654	0.7
Total	<u>10,144</u>	<u>100.0</u>	<u>20,380</u>	<u>100.0</u>	<u>15.0</u>	<u>32,237</u>	<u>100.0</u>	<u>9.6</u>	<u>58,617</u>	<u>100.0</u>	<u>12.7</u>	<u>91,138</u>	<u>100.0</u>	<u>9.2</u>	<u>95,717</u>	<u>100.0</u>

Sources: (1) Fifth Five-Year Economic and Social Development Plan, Transportation Sector Plan - (1982-86), December 1981, Transportation Sector Planning Task Force, MOT, Korea, pp. 2-3.

(2) Statistical Yearbook of Transportation - 1981, MOT, Korea, pp. 16-17, pp. 60-63, pp. 110-113.

(3) Statistical Yearbook of Transportation - 1973, MOT, Korea, pp. 76-77.

(4) Statistical Yearbook of Transportation - 1982, MOT, Korea, pp. 8-9.

(5) Mission to Korea.

KOREA

TRANSPORT SECTOR

Growth Trend of Domestic Freight Traffic (1961-82)
(Units: 1,000 tons; million tons-km)

	1961		1966		1962-66	1971		1967-71	1976		1972-76	1981		1977-81	1982	
	Traffic volume	% share	Traffic volume	% share	% in- crease	Traffic volume	% share									
Tonnage																
Railways	15,373	47.9	24,064	46.9	9.4	31,955	25.1	5.8	43,629	17.8	6.4	48,761	12.1	2.2	47,437	11.0
Highways																
Commercial	N.A.	-	N.A.	-	-	73,934	58.0	-	93,751	38.2	4.9	104,256	26.0	2.1	108,576	25.2
Private & gov't.	N.A.	-	N.A.	-	-	10,320	8.1	-	94,439	38.4	55.7	226,547	56.4	19.1	247,675	57.6
Subtotal	<u>15,299</u>	<u>47.6</u>	<u>24,528</u>	<u>47.8</u>	<u>9.9</u>	<u>84,254</u>	<u>66.1</u>	<u>28.0</u>	<u>188,190</u>	<u>76.6</u>	<u>17.4</u>	<u>330,803</u>	<u>82.4</u>	<u>(11.9)</u>	<u>356,251</u>	<u>82.8</u>
Maritime	1,442	4.5	2,686	5.3	13.2	11,263	8.8	33.2	13,829	5.6	4.2	22,206	5.5	9.9	26,454	6.2
Aviation	-	-	-	-	-	7	-	49.1	5	-	(5.7)	18	-	28.5	30	-
Total	<u>32,114</u>	<u>100.0</u>	<u>51,278</u>	<u>100.0</u>	<u>9.8</u>	<u>127,479</u>	<u>100.0</u>	<u>20.0</u>	<u>245,653</u>	<u>100.0</u>	<u>5.2</u>	<u>401,788</u>	<u>100.0</u>	<u>10.3</u>	<u>430,172</u>	<u>100.0</u>
Tons-km																
Railways	3,486	88.2	5,450	81.6	9.3	7,841	48.9	7.5	9,728	44.6	4.4	10,815	37.5	2.2	10,892	36.9
Highways																
Commercial	N.A.	-	N.A.	-	-	3,302	20.6	-	4,374	20.0	5.8	4,868	16.9	2.2	5,097	17.2
Private & gov't.	N.A.	-	N.A.	-	-	237	1.5	-	2,172	10.0	55.7	5,217	18.1	19.2	5,674	19.2
Subtotal	<u>323</u>	<u>8.2</u>	<u>558</u>	<u>8.4</u>	<u>11.6</u>	<u>3,539</u>	<u>22.1</u>	<u>44.7</u>	<u>6,546</u>	<u>30.0</u>	<u>13.1</u>	<u>10,085</u>	<u>35.0</u>	<u>9.1</u>	<u>10,771</u>	<u>36.4</u>
Maritime	141	3.6	672	10.0	36.7	4,653	29.0	50.2	5,533	25.4	3.5	7,927	27.5	7.5	7,881	26.7
Aviation	-	-	-	-	-	2	-	-	2	-	(2.5)	7	-	26.5	11	-
Total	<u>3,950</u>	<u>100.0</u>	<u>6,680</u>	<u>100.0</u>	<u>11.1</u>	<u>16,026</u>	<u>100.0</u>	<u>19.1</u>	<u>21,809</u>	<u>100.0</u>	<u>6.4</u>	<u>24,834</u>	<u>100.0</u>	<u>5.8</u>	<u>29,555</u>	<u>100.0</u>

- Sources: (1) Fifth Five-Year Economic and Social Development Plan, Transportation Sector Plan - (1982-86), December 1981, Transportation Sector Planning Task Force, MOT, Korea, pp. 2-3.
(2) Statistical Yearbook of Transportation - 1981, MOT, Korea, pp. 111, 113, 155, 157.
(3) Statistical Yearbook of Transportation - 1973, MOT, Korea, pp. 76-77, 101.
(4) Statistical Yearbook of Transportation - 1982, MOT, Korea, pp. 10-11, 159, 161.
(5) Mission to Korea.

KOREA
TRANSPORT SECTOR

Growth Trend of International Traffic (1961-82)
(Units: 1,000 Passengers; million tons)

	1961		1966		1962-66 % in- crease	1971		1967-71 % in- crease	1976		1972-76 % in- crease	1981		1977-81 % in- crease	1982	
	Traffic volume	% share	Traffic volume	% share		Traffic volume	% share									
<u>Passenger Total</u>	<u>31</u>	<u>100.0</u>	<u>143</u>	<u>100.0</u>	<u>35.8</u>	<u>553</u>	<u>100.0</u>	<u>31.1</u>	<u>2,077</u>	<u>100.0</u>	<u>30.3</u>	<u>3,280</u>	<u>100.0</u>	<u>8.5</u>	<u>3,558</u>	<u>100.0</u>
Maritime	-	-	12	8.4	-	38	7.0	25.9	63	3.0	10.6	51	1.6	(7.4)	57	1.6
Aviation	31	100.0	131	91.6	33.4	515	93.0	31.5	2,014	97.0	31.4	3,229	98.4	8.9	3,501	98.4
<u>Freight Total</u>	<u>3,416</u>	<u>100.0</u>	<u>8,442</u>	<u>100.0</u>	<u>19.8</u>	<u>28,478</u>	<u>100.0</u>	<u>27.5</u>	<u>55,862</u>	<u>100.0</u>	<u>14.4</u>	<u>105,530</u>	<u>100.0</u>	<u>12.8</u>	<u>108,742</u>	<u>100.0</u>
Maritime	3,413	99.9	8,435	99.9	19.8	28,449	99.9	27.5	55,757	99.8	14.4	105,321	99.8	12.8	108,507	99.8
Aviation	3	0.1	7	0.1	18.5	29	0.1	32.9	105	0.2	29.3	209	0.2	15.0	235	0.2

Source: (1) Fifth Five-Year Economic and Social Development Plan - Transportation Sector Plan (1982-86), December 1981, Transportation Sector Planning Task Force, MOT, Korea, pp. 10-11.

(2) Mission to Korea.

KOREA
TRANSPORT SECTOR

Freight Movement by Main Commodities in 1980
(Units: 1,000 tons; million tons-km)

	Anth- racite	Cement	Grains	Ferti- lizer	Oil product	Minerals	Lumber	Other	Total
<u>Tonnage Total</u>	25,093	21,217	8,986	5,632	17,566	7,246	5,617	81,420	172,777
Railways	18,588	9,837	984	1,705	3,903	3,348	665	9,978	49,008
(%)	(74.1)	(46.4)	(11.0)	(30.3)	(22.2)	(46.2)	(11.8)	(12.3)	(28.4)
Highways	4,871	8,349	7,928	3,821	3,234	2,664	4,899	68,760	104,526
(%)	(19.4)	(39.4)	(88.2)	(67.8)	(18.4)	(36.8)	(87.2)	(84.4)	(60.5)
Maritime	1,634	3,031	74	106	10,429	1,234	53	2,669	19,230
(%)	(6.5)	(14.3)	(0.8)	(1.9)	(59.4)	(17.0)	(1.0)	(3.3)	(11.1)
Aviation	-	-	-	-	-	-	-	13.0	13.0
(%)	-	-	-	-	-	-	-	-	-
<u>Tons-km Total</u>	4,628	3,252	607	629	6,362	1,071	384	6,253	23,186
Railways	3,943	2,018	310	461	833	798	120	2,315	10,798
(%)	(85.2)	(62.1)	(51.1)	(73.3)	(13.1)	(74.5)	(31.2)	(37.0)	(46.6)
Highways	141	252	289	125	96	140	258	3,619	4,920
(%)	(3.0)	(7.7)	(47.6)	(19.9)	(1.5)	(13.1)	(67.2)	(57.9)	(21.2)
Maritime	544	982	8	43	5,433	133	6	314	7,463
(%)	(11.8)	(30.2)	(1.3)	(6.8)	(85.4)	(12.4)	(1.6)	(5.0)	(32.2)
Aviation	-	-	-	-	-	-	-	5.0	5.0
(%)	-	-	-	-	-	-	-	(0.1)	-

Note: Figures in () indicate per-means share, in percentage.

Source: (1) Fifth Five-Year Economic and Social Development Plan - Transportation Sector Plan (1982-86), December 1981, Transportation Sector Planning Task Force, MOT, Korea, pp. 10-11, 179, 188.
(2) Mission to Korea.

KOREA
TRANSPORT SECTOR

Freight Movement by Main Commodities in 1982
(Units: '000 tons; million ton-km)

	Anthracite	Cement	Grains	Fertilizer	Oil product	Minerals	Lumber	Other	Total
<u>Tonnage Total</u>	<u>28,039</u>	<u>19,884</u>	<u>8,051</u>	<u>6,115</u>	<u>19,404</u>	<u>8,459</u>	<u>5,798</u>	<u>86,273</u>	<u>182,023</u>
Railways	19,574	9,519	651	1,829	2,877	3,876	629	8,482	47,437
(%)	(69.8)	(47.9)	(8.1)	(29.9)	(14.8)	(45.8)	(10.8)	(9.8)	(26.1)
Highways	6,768	7,013	7,337	4,145	4,243	3,343	5,119	70,607	108,575
(%)	(24.1)	(35.3)	(91.1)	(67.8)	(21.9)	(39.5)	(88.3)	(81.9)	(59.7)
Maritime	1,697	3,352	63	141	12,284	1,240	50	7,154	25,981
(%)	(6.1)	(16.8)	(0.8)	(2.3)	(63.3)	(14.7)	(0.9)	(8.3)	(14.2)
Aviation	-	-	-	-	-	-	-	30	30
(%)	-	-	-	-	-	-	-	-	-
<u>Ton-km Total</u>	<u>4,959</u>	<u>3,574</u>	<u>512</u>	<u>671</u>	<u>5,246</u>	<u>1,316</u>	<u>394</u>	<u>7,120</u>	<u>23,792</u>
Railways	4,221	2,053	215	503	632	960	112	2,195	10,891
(%)	(85.1)	(57.4)	(42.0)	(75.0)	(12.0)	(73.0)	(28.4)	(30.8)	(45.7)
Highways	196	212	267	135	126	176	269	3,716	5,097
(%)	(4.0)	(5.9)	(52.2)	(20.1)	(2.4)	(13.4)	(68.3)	(52.2)	(21.4)
Maritime	542	1,309	30	33	4,488	180	13	1,198	7,793
(%)	(10.9)	(36.7)	(5.8)	(4.9)	(85.6)	(13.6)	(3.3)	(16.8)	(32.7)
Aviation	-	-	-	-	-	-	-	11	11
(%)	-	-	-	-	-	-	-	(0.2)	(0.2)

Note: Figures in parentheses indicate per-means share, in percentage.

Source: Mission to Korea.

KOREA
TRANSPORT SECTOR

Transportation Investment Plans by Modes (1967-86)
(Billion won)

Modes	Second five-year plan (1967-71) /a		Third five-year plan (1972-76) /b		Fourth five-year plan (1977-81) /c		Fifth five-year plan /d /e										Subtotal	
	Amount	%	Amount	%	Amount	%	1982		1983		1984		1985		1986		Amount	%
							Amount	%	Amount	%	Amount	%	Amount	%	Amount	%		
Railways	46.5	31.0	105.6	9.8	402.1	14.5	187.2	10.5	271.9	13.1	269.5	13.9	211.4	10.0	390.8	19.2	1,330.8	13.4
Road Transport	59.2	39.4	682.8	63.5	1,225.6	44.0	633.1	35.6	716.5	34.6	746.1	38.5	777.7	36.7	845.4	41.6	3,718.8	37.4
Roads	30.2	20.1	227.1	21.1	457.8	16.4	210.3	11.8	235.6	11.4	274.9	14.2	281.5	13.3	307.4	15.2	1,309.7	13.2
Vehicles	28.1	18.7	394.7	36.7	741.2	26.6	402.5	22.7	453.5	21.9	457.3	23.6	473.1	22.3	521.2	25.6	2,307.6	23.2
Others	0.9	0.6	61.0	5.7	26.6	1.0	20.3	1.1	27.4	1.3	13.9	0.7	23.1	1.1	16.8	0.8	101.5	1.0
Sea Transport	34.0	22.7	204.2	19.0	994.1	35.7	484.8	27.3	494.9	23.9	521.3	26.9	566.6	26.7	587.5	28.9	2,655.1	26.7
Ships	17.5	11.7	146.6	13.6	773.3	26.3											2,061.4	20.7
Ports and facilities	16.5	11.0	57.6	5.4	260.8	9.4											593.7	6.0
Aviation	10.3	6.9	11.2	1.0	58.9	2.1	15.1	0.9	95.9	4.6	130.5	6.7	188.9	8.9	164.1	8.1	594.5	6.0
Subway	-	-	72.3	6.7	101.0	3.6	455.5	25.7	492.6	23.8	268.7	13.9	373.7	17.7	45.0	2.2	1,635.5	16.5
Waterway	-	-	-	-	1.9	0.1	0.8	-	0.8	-	3.1	0.1	0.2	-	0.1	-	5.0	-
<u>Total - Transport Sector</u>	<u>150.0</u>	<u>100.1</u>	<u>1,076.1</u>	<u>100.0</u>	<u>2,783.6</u>	<u>100.0</u>	<u>1,776.5</u>	<u>100.0</u>	<u>2,072.6</u>	<u>100.0</u>	<u>1,939.2</u>	<u>100.0</u>	<u>2,118.5</u>	<u>100.0</u>	<u>2,032.9</u>	<u>100.0</u>	<u>9,939.7</u>	<u>100.0</u>

/a The Second Five-Year Economic Development Plan (1967-71), Government of the Republic of Korea, 1966, pp. 232-237 (1965 prices).

/b The Third Five-Year Economic Development Plan (1972-76), Government of the Republic of Korea, 1971, pp. 188-191 (1970 prices).

/c The Fourth Five-Year Economic Development Plan (1977-81), Government of the Republic of Korea, 1976, pp. 152-153 (1975 prices).

/d "Draft" for Preparation of the Fifth Five-Year Social and Economic Plan-Transport Sector Plan, August 1981, MOT, Korea, pp. 64-67 (1980 prices).

/e The Fifth Five-Year Economic and Social Development Plan - Transportation Sector Plan (1982-1986), December 1981, Transportation Sector Planning Task Force, MOT, Korea, p. 80, p. 126.

Sources: EPB, MOT, MOC and MOHA.

KOREA
TRANSPORT SECTOR

Actual Capital Expenditures by Sectors (1962-80)
(Unit: Billion won)

	Agriculture & forestry		Fishery		Mining		Manufacturing		Electricity		Transportation		Communication		Housing		Science, tech. & education		Others		Total	
	Amt.	%	Amt.	%	Amt.	%	Amt.	%	Amt.	%	Amt.	%	Amt.	%	Amt.	%	Amt.	%	Amt.	%	Amt.	%
First FYP																						
1962	7.4	27.2	0.5	1.8	1.4	5.1	4.5	16.6	3.4	12.5	3.8	14.0	1.1	4.0	0.6	2.2	-	-	4.5	16.6	27.2	100.0
1963	5.0	18.4	1.3	4.8	0.5	1.9	4.9	17.9	3.6	13.2	6.5	23.9	1.3	4.8	0.6	2.2	-	-	3.5	12.9	27.2	100.0
1964	4.5	18.2	0.5	2.1	0.5	2.0	4.4	17.9	3.5	13.8	4.7	18.3	2.6	14.3	0.3	1.2	0.9	3.9	1.9	8.3	23.8	100.0
1965	6.9	23.2	1.5	5.2	0.5	1.8	6.6	22.3	1.1	3.8	5.2	17.9	3.8	12.8	0.4	1.2	1.3	4.9	2.2	7.5	29.5	100.0
1966	14.2	22.7	3.2	5.0	0.9	1.4	10.8	17.2	2.8	4.5	13.1	21.0	6.9	11.1	0.5	0.8	5.9	9.4	4.3	6.9	62.6	100.0
Second FYP																						
1967	13.3	16.9	6.7	8.4	1.7	2.2	12.0	15.1	3.6	4.6	17.0	21.6	8.8	11.0	0.6	0.7	9.3	11.9	6.0	7.6	79.0	100.0
1968	26.3	22.3	6.0	5.1	2.1	1.9	9.9	8.4	7.6	6.6	32.0	27.2	10.5	8.9	1.0	0.8	13.1	11.1	9.1	7.7	117.6	100.0
1969	44.0	25.0	5.0	2.9	2.6	1.5	17.5	9.9	5.9	3.3	47.8	27.3	14.3	8.1	1.1	0.7	17.8	10.1	19.6	11.2	175.6	100.0
1970	39.2	21.2	5.8	3.2	5.4	2.9	17.2	9.3	8.0	4.3	44.0	23.8	15.9	8.7	1.2	0.8	23.7	12.8	23.9	13.0	184.3	100.0
1971	46.2	21.7	6.3	2.9	6.3	2.9	26.1	12.2	6.4	3.0	56.0	21.6	18.9	8.9	2.3	1.1	20.4	14.3	24.4	11.4	213.3	100.0
Third FYP																						
1972	53.1	17.1	6.5	2.1	5.6	1.8	90.8	29.3	7.7	2.5	60.4	19.5	27.5	8.9	2.6	0.8	32.2	10.4	23.4	7.6	309.8	100.0
1973	58.8	23.6	5.8	2.4	7.6	3.1	22.7	9.1	5.1	2.0	59.3	23.8	31.6	12.7	3.9	1.7	29.0	11.7	24.8	10.0	248.6	100.0
1974	108.9	27.6	2.4	0.6	14.1	3.6	25.1	6.4	27.6	7.0	84.9	21.5	44.6	11.3	1.1	0.3	35.5	9.0	50.4	12.7	394.6	100.0
1975	114.7	21.4	3.6	0.5	17.0	2.5	62.3	9.2	22.2	3.3	142.6	21.0	82.1	12.2	8.4	1.2	48.9	7.2	145.7	21.5	677.5	100.0
1976	153.1	17.6	6.6	0.8	18.5	2.1	94.5	10.8	93.4	10.7	180.7	20.7	112.0	12.9	11.4	1.3	69.9	8.0	130.9	15.1	871.0	100.0
Fourth FYP																						
1977	188.0	18.4	10.5	1.0	23.9	2.3	57.1	5.6	102.5	10.0	233.5	22.8	149.8	14.9	11.0	1.1	92.0	9.1	154.4	15.1	1,022.7	100.0
1978	181.6	14.6	15.1	1.2	30.8	2.5	100.3	8.1	69.6	5.6	257.8	20.7	211.3	17.0	17.6	1.4	131.6	7.2	228.9	21.3	1,244.6	100.0
1979	261.8	12.2	24.7	1.2	65.1	3.0	61.6	2.9	85.0	4.0	490.2	22.9	238.8	11.2	49.9	2.3	220.8	10.3	640.3	30.0	2,138.3	100.0
1980 /a	297.0	12.8	34.5	1.5	103.5	4.4	116.1	5.0	45.0	1.9	405.5	17.5	650.1	28.0	41.9	1.8	311.0	13.4	316.3	13.7	2,320.9	100.0

/a Based on the budget.

Source: Handbook of Korean Economy - 1980, EPB, Korea, p. 44-45.

KOREA

TRANSPORT SECTOR

Evolution of Transport Facilities and Equipment (1961-80)

	Unit	1961	1966	1971	1976	1980	1980/61 multiplier
Railroad Total Length	km	4,360.0	5,049.0	5,582.0	5,653.0	6,007.4	1.3
- Route length	km	3,021.8	3,062.7	3,198.7	3,144.3	3,134.6	1.04
- Double-track lines	km	477.0	505.0	559.0	580	719.6	1.5
Subway total length	km	-	-	-	9.5	22.1	
Locomotives	ea	463	587	589	774	971	2.1
Diesel engine	ea	95	173	337	386	425	
Electric engine	ea	-	-	-	69	90	
Steam engine	ea	350	251	96	68	30	
Diesel-driven car	ea	18	163	157	123	130	
Electric-driven car	ea	-	-	-	128	296	
Passenger car	ea	1,303	1,418	1,621	1,806	1,901	1.5
Freight car	ea	9,455	11,454	15,189	16,055	16,702	1.8
Road Total length	km	27,169	34,476	40,635.4	45,513.6	46,951	1.7
National Highway Pavement Total Length	km	720	1,419	2,302.2	3,746.0	5,547	7.7
Expressway Total Length	km	-	-	655.0	1,142.4	1,224.6	
Business-use motor vehicle	ea	21,489	31,331	77,608	89,544	149,710	7.0
Sedan	ea	4,674	10,889	29,627	29,319	62,816	13.4
Bus	ea	6,287	7,675	15,646	19,229	28,214	4.5
Truck	ea	10,528	12,767	32,335	40,996	58,680	5.6
Nonbusiness motor vehicle	ea	7,710	18,829	62,661	129,434	378,019	49.0
Sedan	ea	2,985	10,761	37,955	66,780	186,286	62.4
Bus	ea	94	387	1,765	4,414	14,249	151.6
Truck	ea	4,631	7,681	22,941	58,240	177,484	38.3
Harbor stevedoring capacity	'000 ton/yr	9,020	14,650	18,751	34,000	82,261	9.1
Ship Tonnage	'000 GT	240	294	1,138	3,139	5,436	22.7
International-line vessel	'000 GT	178	219	932	2,907	5,175	29.1
Domestic-line vessel	'000 GT	62	75	206	232	261	4.2
Airplane in service	ea	3	6	23	25	38	12.7
(No. of seats supplied)	seat	120	328	1,514	4,414	7,278	60.6
Tourist hotel guest room	room	578	1,920	5,673	11,514	18,547	32.1

Source: Fifth Five-Year Economic and Social Development Plan, Transportation Sector Plan (1982-86), December 1981, Transportation Sector Planning Task Force, MOT, Korea, p. 18.

KOREA

TRANSPORT SECTOR

Transport Equipment by Age Groups
(as End of 1981)

<u>A. Railways and Vessels</u>						
	<u>Under</u> <u>10 years</u>	<u>11-12</u> <u>years</u>	<u>21-25</u> <u>years</u>	<u>26-30</u> <u>years</u>	<u>Over</u> <u>31 years</u>	<u>Total</u>
<u>Railways (each)</u>						
Passenger car	928	1,135	14	47	27	2,150
Freight car	7,406	6,263	159	1,812	925	16,565
<u>Total</u>	<u>8,334</u>	<u>7,398</u>	<u>173</u>	<u>1,859</u>	<u>952</u>	<u>18,716</u>
<u>Vessels (ton)</u>						
Passenger ship	15,276	12,817	436	-	-	29,529
Freight ship	1,569,278	1,747,705	124,349	17,234	18,483	3,477,049
Tanker	680,203	656,134	24,053	13,989	4,734	1,379,113
Others	41,616	25,283	1,490	937	4,796	74,122
<u>Total</u>	<u>2,306,373</u>	<u>2,441,939</u>	<u>150,328</u>	<u>32,160</u>	<u>28,013</u>	<u>4,958,813</u>
<u>B. Motor Vehicles</u>						
	<u>Under</u> <u>5 years</u>	<u>6-10</u> <u>years</u>	<u>11-15</u> <u>years</u>	<u>Over</u> <u>16 years</u>	<u>Total</u>	
<u>Commercial Motor Vehicles (each)</u>						
Passenger car	65,692	237	25	-	66,224	
Bus	28,829	1,647	161	29	30,666	
Truck	50,943	7,041	2,030	339	60,353	
<u>Total</u>	<u>145,734</u>	<u>8,925</u>	<u>2,216</u>	<u>369</u>	<u>157,243</u>	
<u>Non-commercial Motor Vehicles (each)</u>						
Passenger car	187,073	12,256	1,872	180	201,381	
Bus	16,361	3,172	372	24	19,929	
Truck	170,817	17,729	3,293	1,362	143,201	
<u>Total</u>	<u>374,251</u>	<u>33,157</u>	<u>5,337</u>	<u>1,565</u>	<u>414,510</u>	
<u>Grand Total</u>	<u>519,985</u>	<u>42,082</u>	<u>7,753</u>	<u>1,934</u>	<u>571,754</u>	
<u>Passenger</u>	<u>253,035</u>	<u>12,493</u>	<u>1,897</u>	<u>180</u>	<u>267,605</u>	
<u>Bus</u>	<u>45,190</u>	<u>4,819</u>	<u>533</u>	<u>53</u>	<u>50,595</u>	
<u>Truck</u>	<u>221,760</u>	<u>24,770</u>	<u>5,323</u>	<u>1,701</u>	<u>253,554</u>	

Source: Statistical Yearbook of Transportation - 1982, MOT, Korea, p. 44.

KOREA
TRANSPORT SECTOR

Allocation of Gross National Product (1979-86)
(Unit: billion won)

	1979		1980		1981		1982		1983		1984		1985		1986		Average annual increase (%) (1982-86)
	Amount	Composite ratio	Amount	Composite ratio	Amount	Composite ratio	Amount	Composite ratio	Amount	Composite ratio	Amount	Composite ratio	Amount	Composite ratio	Amount	Composite ratio	
	(Actual)		(Tentative)						(Forecast)								
Gross national product (% increase)	37,138.8 (6.4)	100.0	35,030.6 (-5.7)	100.0	37,216.0 (6.2)	100.0	40,193.3 (8.0)	100.0	43,207.8 (7.5)	100.0	46,448.4 (7.5)	100.0	49,932.0 (7.5)	100.0	53,676.9 (7.5)	100.0	7.6
Consumption expenditure	27,802.1	74.9	27,593.4	78.8	28,420.0	76.4	29,913.0	74.4	31,486.9	72.9	33,146.1	71.4	34,891.6	69.9	36,730.2	68.4	5.3
Government	(4,400.1)	(11.8)	(4,402.9)	(12.6)	(4,622.0)	(12.4)	(4,806.9)	(12.0)	(4,999.2)	(11.6)	(5,199.1)	(11.2)	(5,407.1)	(10.8)	(5,623.4)	(10.5)	(4.0)
Private	(23,402.0)	(63.0)	(23,190.5)	(66.2)	(23,797.9)	(64.0)	(25,106.1)	(62.4)	(26,487.7)	(61.3)	(27,947.0)	(60.2)	(29,484.5)	(59.1)	(31,106.8)	(57.9)	(5.5)
(% increase)	(8.7)		(-0.9)		(2.6)		(5.5)		(5.5)		(5.5)		(5.5)		(5.5)		
Gross investment (% increase)	14,359.0 (17.5)	38.6	10,869.8 (-24.3)	31.0	11,818.9 (8.7)	31.7	12,764.4 (8.0)	31.8	13,720.5 (7.5)	31.8	14,961.1 (9.0)	32.2	16,378.5 (9.5)	32.8	18,030.2 (10.1)	33.6	8.6
Fixed capital formation (% increase)	(13,017.1)	(35.0)	(11,094.0)	(31.7)	(11,060.7)	(29.7)	(12,078.3)	(30.1)	(13,105.0)	(30.3)	(14,258.2)	(30.7)	(15,541.4)	(31.1)	(17,017.8)	(31.7)	(9.0)
ICOR	(9.7)		(-14.8)		(-0.3)		(9.2)		(8.5)		(8.8)		(9.0)		(9.4)		
Increase in stocks	(5.87)		-		(5.06)		(4.06)		(4.35)		(4.40)		(4.46)		(4.54)		
Increase in stocks	(1,341.9)	(3.6)	(-224.2)	(-0.7)	(758.2)	(2.0)	(686.1)	(1.7)	(615.5)	(1.5)	(702.9)	(1.5)	(837.1)	(1.7)	(1,012.4)	(1.9)	
Exports	12,716.8	34.2	13,672.5	39.0	15,693.8	42.2	17,532.8	43.6	19,593.6	45.3	21,485.0	46.3	23,820.2	47.7	26,318.8	49.0	10.9
Foreign trade	(9,370.2)	(25.2)	(10,487.9)	(29.9)	(11,967.2)	(32.2)	(13,351.7)	(33.2)	(14,897.3)	(34.5)	(16,508.1)	(35.5)	(18,425.6)	(36.9)	(20,555.6)	(38.3)	(11.4)
Invisibles (receipt)	(3,346.2)	(9.0)	(3,184.6)	(9.1)	(3,726.6)	(10.0)	(4,181.1)	(10.4)	(4,696.3)	(10.9)	(4,976.8)	(10.7)	(5,394.6)	(10.8)	(5,763.2)	(10.7)	(9.1)
Imports	17,739.1	47.8	17,105.0	48.8	18,716.6	50.3	20,016.9	49.8	21,593.2	50.0	23,143.8	49.8	25,158.3	50.4	27,402.2	51.1	7.9
Foreign trade	(14,415.4)	(38.8)	(13,258.7)	(37.8)	(14,018.4)	(37.7)	(15,089.4)	(37.5)	(16,305.2)	(37.7)	(17,528.9)	(37.7)	(19,127.6)	(38.3)	(21,007.7)	(39.1)	(8.4)
Invisibles (payment)	(3,323.7)	(8.9)	(3,846.4)	(11.0)	(4,698.2)	(12.6)	(4,927.5)	(12.3)	(5,288.0)	(12.2)	(5,614.9)	(12.1)	(6,030.7)	(12.1)	(6,394.6)	(11.9)	(6.4)
Foreign savings	5,022.3	13.5	3,432.6	9.8	3,022.8	8.1	2,484.1	6.2	1,999.6	4.7	1,658.8	3.6	1,338.1	2.7	1,083.5	2.0	-
Domestic savings	9,336.7	25.1	7,437.2	21.2	8,796.1	23.6	10,280.3	25.6	11,720.9	27.1	13,302.3	28.6	15,040.4	30.1	16,946.7	31.6	-
Net factor income from abroad	-231.1	-0.6	-928.4	-2.7	-2,243.1	-3.3	-1,217.0	-3.0	-1,188.3	-2.8	-1,203.6	-2.6	-1,250.5	-2.5	-1,285.3	-2.4	-
Gross domestic product	37,369.9	100.6	35,959.0	102.7	38,459.1	103.3	41,410.3	103.0	44,396.1	102.8	47,652.0	102.6	51,182.5	102.5	54,962.2	102.4	7.4

Source: "Draft" for Preparation of Fifth Five-Year Social and Economic Plan - Transportation Sector, Aug. 1981, MOT, Korea, p. 12.

KOREA

TRANSPORT SECTOR

Major Economic Indicators - Summary (1980-1986)

	Unit	1980	1981	1986	Annual increase (%) 1982-86
Gross national product	W bln, current prices	35,030.6	44,650.4	107,461.2	-
	W bln, 1980 prices	35,030.6	37,216.0	53,676.9	-
(% increase)	%	(-5.7)	(6.2)	(7.5)	7.6
Gross investment rate	%, current prices	31.0	31.2	32.4	20.2
(Fixed investment)	%, current prices	(31.7)	(29.8)	(30.1)	(19.4)
Domestic savings rate	%, current prices	21.2	22.3	29.6	-
Overseas savings rate	%, current prices	9.8	8.9	2.8	-
Per capita gross national product	US\$, current prices	1,506	1,703	3,471	-
	US\$, 1980 prices	1,506	1,576	2,103	5.9
Total population	'000 persons	38,124	38,723	41,839	1.55
GNP deflator	1980 = 100	100.0	120.0	200.2	10.8
Monetary circulation	Balance, W bln	3,807.0	4,682.0	10,720.0	-
(% increase)	%	(16.3)	(23.0)	(16.0)	18.0
Current account (balance of payments)	US\$ mln, current prices	-5,700	-5,400	-3,600	-
Commodity export	US\$ mln, current prices	17,212	21,000	53,000	20.3
Commodity import	US\$ mln, current prices	21,972	25,200	55,500	17.1
Exchange rate	Annual ave., W per \$	610	677	740	1.8
	Year-end, W per \$	660	693	743	0.8

Source: "Draft" for Preparation of Fifth Five-Year Social and Economic Plan - Transportation Sector, Aug. 1981, MOT, Korea, p. 9.

KOREA
TRANSPORT SECTOR

Comparison of Investment Plans (1977-81 and 1982-86)
(Billion won)

Transport investment	The Fourth Plan (1977-81) /a /c				The Fifth Plan (1982-86) /b			
	Investment requirements			Composi- tion ratio (%)	Investment requirements			Composi- tion ratio (%)
	Domestic capital	Foreign capital (US\$ mln)	Total		Domestic capital	Foreign capital (US\$ mln)	Total	
Railways	289.9 (719.0)	231.7 (574.6)	402.1 (997.2)	14.5	894.3	715.6	1,330.8	13.4
Road transport	1,141.0 (2,829.7)	174.9 (433.8)	1,225.6 (3,039.5)	44.0	3,568.9	245.8	3,718.8	37.4
Roads /d	373.1 (925.3)	174.9 (451.2)	457.8 (1,135.3)	16.4	1,175.0	220.8	1,309.7	13.2
Vehicles /e	741.2 (1,838.2)	-	741.2 (1,838.2)	26.6	2,307.6	-	2,307.6	23.2
Others	26.6 (66.0)	-	26.6 (66.0)	1.0	86.3	25.0	101.5	1.0
Sea transport	557.4 (1,382.4)	902.3 (2,237.7)	994.1 (2,465.4)	35.7	1,693.2	1,576.9	2,655.1	26.7
Ships	358.8 (889.8)	773.6 (1,918.5)	733.3 (1,818.6)	26.3	1,228.6	1,365.2	2,061.4	20.7
Ports and facilities	200.6 (497.5)	128.7 (319.2)	260.8 (646.8)	9.4	464.5	211.7	593.7	6.0
Aviation	51.4 (127.5)	15.5 (38.4)	58.9 (146.1)	2.1	175.4	687.0	594.5	6.0
Subway	54.1 (134.2)	97.0 (240.6)	101.0 (250.5)	3.6	1,324.5	509.8	1,635.0	16.5
Waterway	1.9 (4.7)	-	1.9 (4.7)	0.1	5.0	-	5.0	-
<u>Total</u>	<u>2,095.7</u> <u>(5,197.3)</u>	<u>1,421.4</u> <u>(3,525.1)</u>	<u>2,783.6</u> <u>(6,903.3)</u>	<u>100.0</u>	<u>7,661.4</u>	<u>3,735.0</u>	<u>9,939.7</u>	<u>100.0</u>
Total capital expenditure	14,188.0 (35,186.2)	10,000.0 (24,800.0)	19,028.0 (47,189.4)		57,659.2/f	23,673.4	72,100.0	
Total transport investment as % of total capital expenditure	14.8	14.2	14.6		13.3	15.8	14.0	

/a The Fourth Plan figures are in 1975 constant value.

/b The Fifth Plan figures are in 1980 constant value.

/c The figures in parentheses indicate the 1980 constant value.

/d Including construction, repairing and loan repayment.

/e Including increase of vehicle fleet and vehicle replacement.

/f Estimate.

Note: GNP deflator: 1975 = 100, 1980 = 247.9.

Sources: (1) The Fourth Five-Year Economic Development Plan (1977-81), 1976, EPB, Korea, pp. 140-141, pp. 152-153.
 (2) The Fifth Economic and Social Development Five-Year Plan - Transport Part for Implementation (1982-86), October 1981, MOT, Korea, p. 51.
 (3) Transport Part of the Investment Plan, October 12, 1981, EPB, Korea, pp. 17, 26, 8.

KOREATRANSPORT SECTORTransport Investment by Government and Private Sectors (1982-1986)
(Billion Won; 1980 Price)

	Government	Private	Total
Railways	1,330.8	0	1,330.8
Highways	1,210.7	2,508.1	3,718.8
Maritime	578.2	2,076.9	2,665.1
Aviation	163.4	431.1	594.5
Subway	951.5	684.0	1,635.5
Waterway	5.0	0	5.0
<u>Total</u>	<u>4,329.6</u>	<u>5,700.1</u>	<u>9,939.7</u>

- Source: (1) The Fifth Five-Year Economic and Social Development Plan - Transportation Sector Plan (1982- 1986), Transportation Sector Planning Task Force, December 1981, MOT, Korea, P. 87,126, 140,200.
- (2) "Draft" for preparation of Fifth Five-Year Social and Economic Plan-Transport Sector Plan, August 1981, MOT, Korea, p. 31.

KOREA
TRANSPORT SECTOR

Demand for Domestic Passenger Transport (1980-86) /a

Sectors	1980			1981			1982			1983			1984			1985			1986			1982-86 Average growth	1986-80 Multi- plier
	Traffic	Share %	Growth	Traffic	Share %	Growth	Traffic	Share %	Growth	Traffic	Share %	Growth	Traffic	Share %	Growth	Traffic	Share %	Growth	Traffic	Share %	Growth		
<u>Passenger ('000)</u>																							
<u>Total</u>	8,544,916	100.0	5.4	9,108,880	100.0	6.6	9,864,917	100.0	8.3	10,733,029	100.0	8.8	11,634,603	100.0	8.4	12,600,275	100.0	8.3	13,633,497	100.0	8.2	8.40	1.60
Railways	430,773	5.0	1.7	470,754	5.2	9.3	523,873	5.3	11.3	585,856	5.5	11.8	650,931	5.6	11.1	721,065	5.7	10.8	793,702	5.8	10.1	11.01	1.84
Subways	65,076	0.8	(2.1)/b	102,200	1.1	37.0	113,515	1.2	11.1	181,405	1.7	59.8	363,905	3.1	100.6	805,555	6.4	121.4	962,140	7.1	19.4	56.59	14.78
Highways	8,039,006	94.1	5.6	8,525,291	93.6	6.0	9,216,447	93.4	8.1	9,954,056	92.7	8.0	10,607,368	91.2	6.6	11,060,434	87.8	4.3	11,863,642	87.0	7.3	6.83	1.48
Maritime	8,580	0.1	8.2	9,006	0.1	5.0	9,329	0.1	3.6	9,772	0.1	4.7	10,253	0.1	4.9	10,826	0.1	5.7	11,441	0.1	5.7	4.90	1.33
Aviation	1,481	-	(18.3)	1,629	-	10.0	1,753	-	7.6	1,941	-	10.7	2,146	-	10.6	2,395	-	11.6	2,672	-	11.6	10.40	1.80
<u>Pass-km (mln.)</u>																							
<u>Total</u>	87,626	100.0	2.6	94,023	100.0	7.3	101,921	100.0	8.4	110,788	100.0	8.7	120,537	100.0	8.8	130,903	100.0	8.6	141,375	100.0	8.0	8.50	1.61
Railways	21,640	24.7	1.2	23,401	24.9	8.1	25,654	25.2	9.6	28,177	25.5	9.8	31,004	22.7	10.0	33,958	25.9	9.5	36,990	26.1	8.9	9.59	1.71
Subways	926	1.1	2.4	1,362	1.4	47.1	1,517	1.5	4.4	2,227	2.0	46.8	4,084	3.4	83.4	8,162	6.2	99.9	9,745	6.9	19.4	48.22	10.52
Highways	64,131	73.1	3.3	68,247	32.6	6.4	73,669	72.3	7.9	74,210	71.5	7.5	84,172	69.8	6.3	87,391	66.8	3.8	93,115	65.9	6.5	6.41	1.45
Maritime	401	0.5	3.9	426	0.5	6.2	443	0.4	4.0	464	0.4	0.7	489	0.4	5.4	516	0.4	5.5	549	0.4	6.4	5.20	1.37
Aviation	528	0.6	(17.0)	587	0.6	11.2	638	0.6	8.7	710	0.6	11.3	788	0.7	11.0	876	0.7	11.2	976	0.7	11.4	10.70	1.85

/a Forecast figures as indicated in FFYP; actual figures for 1981 are shown in Table 1.4.

/b Figures in brackets () indicate negative growth.

Source: "Draft" for preparation of Fifth Five-Year Social and Economic Plan-Transport Sector. August 1981, MOT, Korea, p. 17.

September 1982

KOREA
TRANSPORT SECTOR

Demand for Domestic Freight Transport (1980-86) /a

Sectors	1980			1981			1982			1983			1984			1985			1986			1982-86 Average growth	1986-80 Multi- plier
	Traffic	% Share	Growth	Traffic	% Share	Growth	Traffic	% Share	Growth	Traffic	% Share	Growth	Traffic	% Share	Growth	Traffic	% Share	Growth	Traffic	% Share	Growth		
Tons ('000)																							
Total	172,776.8	100.0	(18.4)/b	182,279.4	100.0	5.5	194,856.0	100.0	6.9	208,691.3	100.0	7.1	223,717.4	100.0	7.2	240,048.7	100.0	7.3	257,812.0	100.0	7.4	7.18	1.49
Railways	49,008.0	28.4	(3.7)	51,225.0	28.1	4.5	53,680.0	27.5	4.8	56,161.0	26.9	4.6	58,916.0	26.3	4.9	61,933.0	25.8	5.1	65,386.0	25.4	5.6	5.00	1.33
Highways	104,526.0	60.3	(26.1)	110,826.0	60.8	6.0	119,573.0	61.4	7.9	129,391.0	62.0	8.2	139,995.0	62.6	8.2	151,495.0	63.1	8.2	163,870.0	63.5	8.2	8.14	1.37
Maritime	19,230.0	11.1	-	20,215.0	11.1	5.1	21,589.0	11.1	6.8	23,124.0	11.1	7.1	24,790.0	11.1	7.2	26,603.0	11.1	7.3	28,537.0	11.1	7.3	7.14	1.48
Aviation	12.8	-	(7.9)	13.4	-	4.7	14.3	-	6.7	15.3	-	7.0	16.4	-	7.2	17.7	-	7.9	19.0	-	7.3	7.23	1.48
Tons-km (million)																							
Total	23,186.1	100.0	(8.3)	24,322.3	100.0	4.9	25,781.8	100.0	6.0	27,457.2	100.0	6.5	29,242.7	100.0	6.5	31,201.5	100.0	6.7	33,354.0	100.0	6.9	6.52	1.44
Railways	10,798.0	46.6	(2.6)	11,267.0	46.3	4.3	11,756.0	45.6	4.3	12,329.0	44.9	4.9	12,938.0	44.3	4.9	13,603.0	43.6	5.1	14,357.0	43.1	5.5	4.97	1.33
Highways	4,920.0	21.2	(36.4)	5,235.0	21.6	6.4	5,780.0	22.2	9.0	6,246.0	22.8	9.4	6,818.0	23.3	9.2	7,461.0	23.9	9.4	8,153.0	24.4	9.3	9.26	1.66
Maritime	7,463.0	32.2	(0.7)	7,815.0	32.1	4.7	8,312.0	33.2	6.4	8,876.0	32.3	6.8	9,480.0	32.3	6.8	10,100.0	32.5	6.9	10,836.0	32.5	7.0	6.75	1.45
Aviation	5.1	-	2.0	5.3	-	3.9	5.8	-	9.4	6.2	-	4.9	6.7	-	8.1	7.5	-	1.9	8.0	-	6.7	8.58	1.57

/a Forecast figures as indicated in PFYP, actual figures for 1981 are shown in Table 1.5.

/b Figures in brackets () indicate negative growth.

Source: "Draft" for preparation of Fifth Five-Year Social and Economic Plan-Transport Sector. August 1981, MOT, Korea, p. 18.

KOREA
TRANSPORT SECTOR

Demand for Domestic Freight by Commodities and Modes (1980-1986)
(Unit: Million tons; Billion ton-km)

	1980			1981			1982		1983		1984		1985		1986		
	Traffic	% in-crease	Mode share (%) Rail Road Sea	Traffic	% in-crease	Traffic	% in-crease	Traffic	% in-crease	Traffic	% in-crease	Traffic	% in-crease	Traffic	% in-crease	Mode share (%) Rail Road Sea	
Tons																	
Anthracite coal	25.1	(6.8)/a	74 19 7	26.3	4.8	27.2	3.5	27.7	1.9	28.2	1.8	28.8	2.2	29.4	2.0	72 21 7	
Cement	21.2	(10.4)	46 40 14	23.4	10.5	25.5	9.0	27.4	7.4	30.9	12.6	32.6	5.7	36.2	10.9	41 42 17	
Petroleum	17.6	(14.5)	22 18 60	18.5	5.1	19.2	4.5	20.3	5.4	21.5	5.7	22.8	6.1	24.3	6.6	23 20 57	
Fertilizer	5.6	(15.7)	30 68 2	6.0	7.0	6.1	2.8	6.3	0.9	6.3	0.9	6.4	1.0	6.4	0.9	31 67 2	
Grains	9.0	(18.9)	11 88 1	11.9	32.5	12.1	2.3	12.5	2.4	12.7	1.7	13.0	2.6	13.3	2.0	10 90 -	
Mineral ore	7.2	(18.8)	46 37 17	7.6	5.2	8.0	5.0	8.4	4.7	8.8	4.8	9.2	4.5	9.6	4.4	51 34 15	
Lumber	5.6	(20.6)	12 87 1	5.9	4.6	6.2	6.4	6.6	5.1	6.9	5.1	7.3	4.9	7.6	4.9	12 88 0	
Other	81.4	(23.7)	12 84 4	82.7	1.6	90.1	9.1	99.6	10.4	108.4	8.9	119.9	10.6	131.0	9.2	11 84 5	
Total Tons	172.7	(18.4)	28 61 11	182.3	5.5	94.8	6.9	208.6	7.1	223.7	7.2	240.0	7.3	257.8	7.4	26 63 11	
Ton-km																	
Anthracite coal	4.6	1.4		4.8	4.7	4.9	2.5	5.1	2.1	5.2	1.8	5.3	2.2	5.4	2.1		
Cement	3.3	(7.9)		3.6	9.5	3.8	8.7	4.2	7.2	4.7	12.2	4.9	5.5	5.4	10.6		
Petroleum	6.4	(1.6)		6.7	5.3	7.0	5.6	7.5	5.8	5.9	5.8	8.4	6.1	8.9	6.2		
Fertilizer	.6	(12.9)		.7	4.1	.6	3.1	.7	2.1	.7	2.0	.7	2.0	.7	2.1		
Grains	.6	(15.5)		.7	21.1	.7	1.5	.8	1.5	.8	1.1	.8	1.7	.8	1.2		
Mineral ore	1.1	(9.5)		1.1	3.8	1.1	4.8	1.2	5.2	1.3	5.1	1.4	5.0	1.4	5.1		
Lumber	.4	(19.0)		.4	4.2	.4	5.5	.4	4.7	.5	4.5	.5	4.5	.5	4.3		
Other	6.3	(18.2)		6.3	1.0	6.8	8.7	7.6	11.3	8.3	8.4	9.3	11.9	10.1	9.5		
Total Ton-km	23.2	(8.3)		24.3	4.9	25.7	6.0	27.5	6.5	29.3	6.5	31.2	6.7	33.4	6.9		

/a Figures in brackets () indicate negative growth.

Source: "Draft" for preparation of Fifth Five-Year Social and Economic Plan - Transportation Sector, Aug. 1981, MOT, Korea, p. 24.

KOREA
TRANSPORT SECTOR

Demand for International Transport (1980-86)

Sectors	1980			1981			1982			1983			1984			1985			1986			1982-86 Average growth	1986-80 Multi- plier
	Traffic	Share %	Growth	Traffic	Share %	Growth	Traffic	Share %	Growth	Traffic	Share %	Growth	Traffic	Share %	Growth	Traffic	Share %	Growth	Traffic	Share %	Growth		
Passenger ('000)																							
Total	<u>2,963.0</u>	<u>100.0</u>	(2.3)/a	<u>3,125.0</u>	<u>100.0</u>	<u>5.5</u>	<u>3,589.0</u>	<u>100.0</u>	<u>14.8</u>	<u>4,166.0</u>	<u>100.0</u>	<u>16.1</u>	<u>4,836.0</u>	<u>100.0</u>	<u>16.1</u>	<u>5,639.0</u>	<u>100.0</u>	<u>16.6</u>	<u>6,575.0</u>	<u>100.0</u>	<u>16.6</u>	16.04	2.22
Maritime	41.0	1.4	(4.7)	43.0	1.4	4.9	44.0	1.2	2.3	46.0	1.1	4.5	49.0	1.0	6.5	52.0	0.9	6.1	55.0	0.8	5.8	5.05	1.34
Aviation	2,922.0	98.6	(2.2)	3,086.0	98.6	5.6	3,545.0	98.6	14.9	4,120.0	98.9	16.2	4,787.0	99.0	16.2	5,587.0	99.1	16.7	6,520.0	99.2	16.7	16.14	2.23
Tons ('000)																							
Total	<u>94,226.0</u>	<u>100.0</u>	<u>3.6</u>	<u>102,207.2</u>	<u>100.0</u>	<u>8.5</u>	<u>112,294.1</u>	<u>100.0</u>	<u>9.9</u>	<u>122,930.5</u>	<u>100.0</u>	<u>9.5</u>	<u>134,922.0</u>	<u>100.0</u>	<u>9.8</u>	<u>149,515.0</u>	<u>100.0</u>	<u>10.8</u>	<u>165,415.0</u>	<u>100.0</u>	<u>10.6</u>	10.12	1.76
Maritime	94,025.0	99.8	3.5	102,000.0	99.8	8.5	112,051.0	99.8	9.9	122,644.0	99.8	9.5	134,584.0	99.7	9.7	149,115.0	99.7	10.8	164,941.0	99.7	10.6	10.09	1.75
Aviation	191.0	0.2	14.0	207.2	0.2	8.5	243.1	0.2	17.3	286.5	0.2	17.9	338.0	0.2	18.0	400.0	0.3	18.3	474.0	0.3	18.5	18.00	2.48

/a Figures in brackets () indicate negative growth.

Source: "Draft" for preparation of Fifth Five-Year Social and Economic Plan- Transport Sector. August 1981, MOT, Korea, p. 19.

KOREA
TRANSPORT SECTOR

Pump Price of Major Petroleum Products in Korea (1980-83)
(Won/liter)

			Ex-refinery price				Wholesale price			Retail price		
			Ex-refinery price	Tax /a	Price	Tax rate (%)	Margin	Price	Margin rate (%)	Margin	Price	Margin rate (%)
Premium gasoline	1980	NOV	321.28	499.62	820.90	60.9	23.15	844.05	2.7	35.95	880.00	4.1
	1981	APR	-	-	944.04	-	-	-	-	-	1,010.00	-
	1982	MAR	391.64	609.05	1,000.69	60.9	22.52	1,023.21	2.2	36.79	1,060.00	3.5
	1983	FEB	377.59	453.11	830.70	54.5	22.52	853.22	2.6	36.78	890.00	4.1
	1983	MAY	377.59	453.11	830.70	54.5	22.52	853.22	2.6	36.78	890.00	4.1
Regular gasoline	1980	NOV	249.91	380.43	630.34	60.4	17.23	657.57	2.6	22.43	680.00	3.3
	1981	APR	261.00	399.34	660.34	60.5	-	-	-	-	700.00	-
	1982	MAR	272.78	427.19	699.97	61.0	17.41	717.38	2.4	22.62	740.00	3.1
	1983	FEB	281.80	338.16	619.96	54.5	17.41	637.37	2.7	22.63	660.00	3.4
	1983	MAY	281.80	338.16	619.96	54.5	17.41	637.37	2.7	22.63	660.00	3.4
Kerosene	1980	NOV	180.12	22.84	202.96	11.3	9.30	212.26	4.4	13.74	226.00	6.1
	1981	APR	-	-	242.92	-	-	-	-	-	268.00	-
	1982	MAR	237.34	29.62	266.96	11.1	10.10	277.06	3.6	14.94	292.00	5.1
	1983	FEB	247.24	-	-	-	-	-	-	-	297.00	-
	1983	MAY	241.79	24.18	265.97	9.1	10.10	276.07	3.7	14.93	291.00	5.1
Diesel	1980	NOV	160.30	33.54	193.84	17.3	8.90	202.03	4.4	12.97	215.00	6.0
	1981	APR	197.00	34.97	231.97	15.1	-	-	-	-	255.00	-
	1982	MAR	211.25	43.68	254.93	17.1	8.94	263.87	3.4	14.13	278.00	5.1
	1983	FEB	216.60	-	-	-	-	-	-	-	283.00	-
	1983	MAY	211.60	42.10	253.70	16.6	9.17	262.87	3.5	14.13	277.00	5.1

/a Including excise tax, V.A.T., and transportation cost.

Sources: (1) A Study on the Improvement of Energy Price Structure in Korea, Dec. 1982, EPB, Korea, pp. 66-67.
(2) MOER and mission to Korea.

Table 1.20

KOREA

TRANSPORT SECTOR

Projected Final Energy Demand By Fuel Type and Source (1980-86) /a

Source	Unit (%)	Historic			(Preliminary)		Projected				Growth rate 1982-86
		1970	1975	1980	1981	1982	1983	1984	1985	1986	
<u>Domestic Energy</u>	MTOE	10,332 (52.5)	11,397 (41.2)	11,622 (26.5)	11,662 (25.4)	11,811 (24.3)	11,994 (21.9)	12,068 (20.6)	12,189 (19.4)	12,117 (18.1)	6.3
Anthracite	Ton ('000)	11,500 (29.4)	15,945 (27.3)	18,715 (19.5)	18,450 (18.5)	19,231 (18.2)	20,300 (17.0)	21,800 (16.3)	21,200 (15.5)	21,500 (14.7)	2.5
Hydroelectric power	GwH	1,220 (1.5)	1,863 (1.5)	1,984 (1.1)	2,732 (1.5)	2,193 (1.1)	2,146 (1.0)	2,144 (0.9)	2,760 (1.1)	2,903 (1.1)	5.4
Firewood	MTOE	4,251 (21.6)	3,420 (12.4)	2,517 (5.7)	2,492 (5.4)	2,417 (5.0)	2,120 (3.9)	1,964 (3.3)	1,747 (2.8)	1,501 (2.2)	-9.3
<u>Imported Energy</u>	MTOE	9,347 (47.5)	16,247 (58.8)	32,493 (73.7)	34,167 (74.6)	36,707 (75.7)	42,842 (78.1)	46,606 (79.4)	50,533 (80.6)	54,952 (81.9)	8.8
Petroleum	Bbl ('000)	62,256 (47.0)	104,040 (56.3)	178,998 (60.3)	176,797 (57.3)	183,828 (56.3)	215,953 (58.3)	217,916 (54.7)	218,962 (51.1)	229,389 (49.8)	3.9
Gas	Ton ('000)	37 (0.2)	149 (0.6)	392 (1.0)	431 (1.1)	575 (1.4)	1,113 (2.4)	1,238 (3.5)	2,172 (4.3)	3,002 (5.6)	44.6
Anthracite coal	Ton ('000)	-	-	2,115 (2.8)	3,222 (4.2)	3,580 (4.4)	4,724 (4.0)	4,618 (3.6)	4,510 (3.3)	4,648 (3.2)	4.5
Bituminous coal	Ton ('000)	80 (0.3)	786 (1.9)	5,032 (7.5)	7,176 (10.3)	8,612 (11.7)	8,918 (10.7)	11,798 (13.3)	13,930 (14.7)	13,772 (13.6)	93.4
Nuclear energy	GwH	-	-	3,477 (2.0)	2,887 (1.6)	3,599 (1.9)	5,935 (2.7)	12,613 (5.4)	18,243 (7.3)	26,242 (9.8)	53.3
<u>Total</u>	MTOE	<u>19,679</u> (100.0)	<u>27,644</u> (100.0)	<u>44,115</u> (100.0)	<u>45,829</u> (100.0)	<u>48,518</u> (100.0)	<u>54,836</u> (100.0)	<u>58,674</u> (100.0)	<u>62,722</u> (100.0)	<u>67,069</u> (100.0)	7.0

/a In computing final energy, all electricity (including energy consumed in power generation, distribution and consumption) is allocated to the final or ultimate use sector.

Source: Ministry of Energy and Resources (MOER).

KOREA

TRANSPORT SECTOR

Current and Projected Final Energy Demand by Sector (1980-1986) /a

	1980	1981	1982	1983	1984	1985	1986	Growth rate 1982-86
Industry MTOE (%) /a	208161 (47.2)	23,086 (48.4)	24,841 (48.5)	26,559 (48.4)	28,351 (48.3)	30,182 (48.1)	32,156 (48.0)	6.9
Transportation MTOE (%) /a	4,979 (11.3)	5,936 (12.4)	6,846 (13.4)	7,729 (14.1)	8,731 (14.9)	9,867 (15.7)	11,141 (16.6)	13.4
Residential/commercial MTOE (%) /a	15,379 (34.8)	16,158 (33.8)	16,859 (32.9)	17,668 (32.2)	18,502 (31.5)	19,335 (30.8)	20,187 (30.1)	4.6
Public MTOE (%) /a	2,941 (6.7)	2,582 (5.4)	2,702 (5.2)	2,880 (5.3)	3,090 (5.3)	3,338 (5.4)	3,615 (5.3)	7.0
<u>Total</u>	<u>44,115</u>	<u>47,762</u>	<u>51,248</u>	<u>54,836</u>	<u>58,674</u>	<u>62,722</u>	<u>67,069</u>	7.0
<u>MTOE (%)</u>	<u>(100.0)</u>							

/a In computing final energy, all electricity (including energy consumed in power production, distribution and consumption) is allocated to the final or ultimate use sector.

/b Thousand tons of oil equivalent (1 TOE = 10⁷ KCal.)

Source: Ministry of Energy and Resources (MOER).

KOREA
TRANSPORT SECTOR

Current and Projected Petroleum Product Demand by Sector (1980-1986)

	1980	1981	1982	1983	1984	1985	1986	Growth rate 1982-86
Industry MTOE (%) /a	10,611 (39.9)	10,807 (38.4)	11,750 (38.4)	12,030 (37.6)	12,659 (39.5)	13,236 (41.3)	13,952 (41.7)	5.2
Transportation MTOE (%) /a	4,695 (17.7)	5,580 (19.8)	6,333 (20.7)	7,132 (22.3)	8,064 (25.1)	9,038 (28.2)	10,226 (30.6)	12.9
Residential/commercial MTOE (%) /a	2,084 (7.8)	2,119 (7.5)	2,359 (7.7)	2,558 (8.0)	2,775 (9.3)	2,976 (9.3)	3,247 (9.7)	8.9
Public MTOE (%) /a	2,198 (8.3)	1,988 (6.4)	1,902 (6.2)	2,039 (6.4)	2,191 (6.8)	2,349 (7.3)	2,529 (7.6)	7.2
Electric MTOE (%) /a	6,988 (26.3)	7,835 (27.9)	8,273 (27.0)	8,220 (25.7)	6,348 (19.9)	4,411 (13.9)	3,477 (10.4)	-15.0
<u>Total</u>	<u>26,576</u>	<u>28,129</u>	<u>30,164</u>	<u>31,979</u>	<u>32,073</u>	<u>32,037</u>	<u>33,431</u>	3.5
<u>MTOE (%)</u>	<u>(100.0)</u>							

/a Thousand tons of oil equivalent (1 TOE = 10⁷ KCal.)

Source: Ministry of Energy and Resources (MOER).

KOREA

TRANSPORT SECTOR

Estimated Activity and Energy Demand by Mode and Fuel Type - 1980

Subsector/Mode	Fuel type	Consumption /a		Passenger or ton-km	
		MTOE	%	Billion	%
<u>Road</u>					
<u>Automobile</u>					
Private and Government cars	Gasoline	490	9.8		
Taxis	Gasoline	300	6.1		
	LPG	130	2.6		
	Diesel	5	0.1		
<u>Total Automobile</u>		<u>925</u>	<u>18.6</u>	<u>21.1</u>	<u>20.2</u>
<u>Bus</u>					
Urban buses	Diesel	480	9.7	23.1	
Interurban buses	Diesel	390	7.8	32.8	
Other buses	Diesel	100	2.9	4.1/b	
<u>Total Bus</u>		<u>970</u>	<u>19.5</u>	<u>60.0</u>	<u>57.3</u>
<u>Truck</u>					
Commercial	Diesel	675	13.6	4.9	
Private	Diesel	780	15.6	4.6	
<u>Total Truck</u>		<u>1,455</u>	<u>29.2</u>	<u>9.5</u>	<u>34.2</u>
<u>Total Road</u>		<u>3,350</u>	<u>67.3</u>		
<u>Railway</u>					
<u>Freight</u>					
	Diesel	75	1.4		
	Electric	35	0.6		
<u>Total Freight</u>		<u>100</u>	<u>2.0</u>	<u>10.8</u>	<u>38.8</u>
<u>Passenger</u>					
	Diesel	100	2.0		
	Electric	60	1.2		
<u>Total Passenger</u>		<u>160</u>	<u>3.2</u>	<u>21.6</u>	<u>20.6</u>
<u>Total Railway</u>		<u>260</u>	<u>5.2</u>		
<u>Subway</u>					
	Electric	15	0.3	0.9	0.9
<u>Air Transport /c</u>					
Domestic /d	Jet fuel	320	6.4	0.5	0.5
Foreign /e	Jet fuel	100	2.0	10.5	-
<u>Total Air</u>		<u>420</u>	<u>8.4</u>	<u>11.0</u>	<u>0.5 /g</u>
<u>Maritime Transport</u>					
<u>Coastal shipping</u>					
	Diesel	65	1.3		
	Heavy fuels	40	0.8		
<u>Total Coastal</u>		<u>105</u>	<u>2.1</u>	<u>7.5</u>	<u>26.9</u>
<u>Foreign trade /d</u>					
	Diesel	185	3.7		
	Heavy fuels	525	10.6		
<u>Total Foreign Trade</u>		<u>710</u>	<u>14.3</u>	<u>625.6</u>	-
<u>Foreign bunkering /e</u>					
	Diesel	15	0.3		
	Heavy fuels	105	2.1		
<u>Total Bunkering /e</u>		<u>120</u>	<u>2.4</u>		
<u>Passenger service</u>					
	/f			0.4	0.4
<u>Total Maritime</u>		<u>935</u>	<u>18.8</u>		
<u>Total Transport Sector</u>		<u>4,980</u>	<u>100.0</u>	<u>99.2(PK)</u>	<u>100.0 /g</u>
				27.8(TK)	100.0 /g

/a Calculated from consumption and official estimates of fuel economy (see Table 1.25).

/b Charter and private bus.

/c Consumption includes belly freight. Activity is total KAL passenger-km (1980 KAL air freight activity = 5.1 million domestic and 1,032.6 million intl. ton-km).

/d Domestic refueling by Korea flag carriers.

/e Domestic refueling by foreign flag carriers.

/f Energy consumption included in freight totals.

/g Domestic only.

KOREA

TRANSPORT SECTOR

Comparative Energy Efficiencies of Transport Modes
(In Gram of Oil Equivalent (GOE) /a)

	GOE Per Ton or Passenger-km				GOE Per Vehicle-Km			
	Korea	USA	France	Argentina	Korea	USA	France	Argentina
Passengers								
<u>Automobile</u>								
Total	44/m		39	85		70		
Urban	46		67		91/b			
Interurban	25		32		68/c	65		
<u>Bus</u>								
All services	16		14-20	12	550/d		250-315	
Urban	19		16-20	13	277/e	430-510	-	
Interurban	11		13-20	12	277/e	3.25	-	
<u>Subway</u>	15		25	22	-	-	-	-
<u>Railway</u>								
All services	7		14	12	-	-	-	-
Express	11			-	-	-	-	-
Freight								
Truck	125-170/f	40/135/g	28-70	40-70	138-417/h	250-485		
Railway	10	12-30	8-10	16	150/i	-	-	-
Coastal shipping	7-15/j	10-27/k	7-27/l	13/k	-	-	-	-

/a 1 gram of oil equivalent (GOE) = 10KCal.

/b 35% fuel economy penalty for urban traffic conditions (Merlin et al, Comment Economiser l'Energie dans les Transports).

/c Fuel economy of 11 km/l (Ministry of Commerce and Industry).

/d Average load of 29.4 passengers (Korea Research Institute for Highway Safety).

/e Fuel economy of 3 km/l (Korea Advanced Institute of Science and Technology).

/f Commercial only.

/g Intercity only.

/h Fuel efficiency of 50 l/100 km (Several Korean trucking companies).

/i Fuel efficiency of 18 l/100 km (Korean National Railways).

/j Based on experience of one shipping company.

/k River and coastal shipping.

/l River shipping only.

/m Average occupancies of 2.0 for urban operation and 2.7 for interurban operation (Source: Korea Advanced Institute for Science and Technology).

Sources: Korea: Estimated by transport sector mission based on above assumptions.

USA: American Bus Association, Bus Facts, 1981 Edition.

A.B. Rose, The Role of Air Freight in View of Energy Intensity and Related Parameters - An Intermodal Comparison, 1978 SAE International Air Transportation Meeting, May 1978.

American Public Transit Association, Transit Fact Book, 1981 Edition.

G. Kulp, et al., Transportation Energy Conservation Data Book, Edition 5, Oak Ridge National Laboratory, 1981.

Argentina: Secretaria de Estado de Transporte y Obras Publicas, Plan Nacional de Transporte, Programa del Sector Transporte - 1980.

France: Jean-Marie Beauvais and Jean-Philippe Pillet, Transports et Energies: Nouveaux Enjeux, Enertrans, April 1981.

KOREA

TRANSPORT SECTOREx-Refinery Prices of Major Petroleum Products in Korea (1970-83)
(Won/l) /a

Date of pricing change	Regular gasoline	Premium gasoline	Kerosene	Diesel	Exchange rate (US\$)
03/17/70	8.29	9.78	9.35	8.08	311.00
06/02/71	9.91	11.79	13.04	9.66	
08/20/71	11.99	14.27	14.78	11.69	347.00
07/21/72	14.04	16.71	18.48	13.69	393.97
08/08/73	15.87	18.88	20.88	15.47	
12/04/73	20.31	24.17	26.73	19.80	398.00
02/01/74	35.54	42.30	46.73	34.65	
04/08/74	39.63	47.16	46.73	38.63	
10/07/74	39.63	47.16	46.78	38.42	
12/07/74	41.42	49.28	55.20	38.39	400.43
11/21/75	45.09	53.66	60.10	41.80	484.00
05/20/77	47.02	55.95	62.67	43.59	
07/01/77	59.54	71.34	50.91	43.21	484.00
01/28/78	61.68	73.91	52.74	45.85	484.00
03/07/79	67.54	80.93	57.75	50.21	
07/10/79	107.39	128.68	87.49	78.33	484.00
01/29/80	171.21	205.15	139.49	124.88	
08/24/80	196.41	252.50	160.02	142.41	
11/19/80	249.91	321.28	180.12	160.30	607.43
04/19/81	261.01	373.14	220.83	197.09	681.03
11/29/81	276.67	395.53	242.69	216.60	
03/11/82	276.67	395.53	242.69	216.60	714.30
02/06/83	281.80	377.59	247.24	216.60	
04/19/83	281.80	377.59	241.79	211.60	765.60

/a 1 gallon = 3.7853 liters.

- Sources: (1) Ministry of Energy and Resources (MOER).
(2) International Financial Statistics Yearbook, International Monetary Fund, Feb. 1975, p.227, Dec. 1981, p.236
(3) Mission to Korea.

KOREA
TRANSPORT SECTOR

Wholesale Prices of Gasoline and Diesel Oil/a in Korea (1970-83)
(Won/1)

	Gasoline	Diesel
1970	30.16	15.12
1971/b	43.50	20.50
1972	51.00	26.00
1973	73.00	37.00
1974	189.50	67.50
1975	206.00	73.00
1976	206.00	73.00
1977	190.00	65.00
1978	198.50	69.50
1979	232.50	76.00
1980/c	630.34/e	193.84
1981/d	660.34/e	231.97
1981 (Nov 29)	717.38/e	263.87
1982 (Mar 11)	717.38/e	263.87
1983 (Feb 6)	637.37/e	268.87
1983 (Apr 19)	637.37/e	262.87

/a Retail or pump prices include additional agent (i.e., distributor) and service station markups. In November 1980 these were 17.23 and 22.43 won/1 of regular gasoline and 8.90 and 12.97 won/1 of diesel. In November 1980 pump prices were 680, 880 and 215 won/1 for regular gasoline, premium gasoline and diesel oil (see Table 1.20).

/b 1971-79 estimated from crude oil price increases over 1970 and gasoline and diesel tax rates.

/c As of November 19, 1980.

/d As of April 19, 1981.

/e Regular gasoline.

Sources: MOER and mission to Korea.

KOREA
TRANSPORT SECTOR

Public Roads Network (1962-82) /a
(Unit: km)

	National roads /b			Provincial roads			County roads			Special city roads			City roads			Total		Grand total
	Paved	Gravel	Total	Paved	Gravel	Total	Paved	Gravel	Total	Paved	Gravel	Total	Paved	Gravel	Total	Paved	Gravel	
First FYP																		
1962	857	4,886	5,743	73	10,470	10,543	-	-	n.a./c	-	-	-	345	10,539	10,884	1,275	25,894	27,169
1963	865	4,947	5,810	54	11,244	11,298	-	-	n.a.	8	55	63	515	10,329	10,845	1,443	26,573	28,016
1964	963	4,936	5,899	54	11,343	11,397	-	-	n.a.	27	36	63	515	10,270	10,785	1,558	26,587	28,145
1965	1,042	4,857	5,899	71	12,267	12,338	-	-	n.a.	27	36	63	486	9,359	9,843	1,627	26,517	28,145
1966	1,349	6,837	8,186	31	10,364	10,395	-	-	n.a.	345	1,517	1,862	208	13,824	14,033	1,934	32,542	34,476
Second FYP																		
1967	1,442	6,744	8,186	52	10,600	10,652	-	-	n.a.	353	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	354	32,294	14,535	2,200	32,750	34,949
1969	2,110	6,461	8,571	134	10,703	10,837	-	-	n.a.	452	2,293	2,744	427	14,590	15,016	2,970	34,199	37,169
1970	2,461	6,197	8,658	202	10,692	10,894	-	-	n.a.	724	4,751	5,476	477	14,739	15,216	3,864	36,681	40,244
1971	2,943	5,843	8,786	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	703	15,949	16,652	6,769	36,099	42,867
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	35,761	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	1,155	16,812	17,967	10,000	34,906	44,905
1976	4,876	4,486	9,360	811	10,057	10,868	-	-	n.a.	3,880	3,419	7,291	1,347	16,648	17,995	10,912	34,602	45,514
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	45,664
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/d	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	8,720	10,005	597	10,848	11,445	6,186	3,296	9,482	2,571	6,956	9,527	19,283	34,653	53,936
	(64.1%)	(35.9%)	(100%)	(12.8%)	(87.2%)	(100%)	(5.2%)	(94.8%)	(100%)	(65.2%)	(34.8%)	(100%)	(27.0%)	(73.0%)	(100%)	(35.8%)	(64.2%)	(100%)

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

/b Includes roads under the jurisdiction of KHC, totalling 1,245 km in 1981.

/c Length not available (n.a.) before 1977 as city roads were tabulated jointly with gun roads. Length of gun roads in 1962 believed to have been about 10,000 km.

/d Road networks were reclassified during the early part of 1981.

- Sources: 1. Statistical Yearbook of Transportation - 1973, MOT, Korea, pp. 112-113.
2. Statistical Yearbook of Transportation - 1981, MOT, Korea, pp. 166-167.
3. Statistical Yearbook of Transportation - 1982, MOT, Korea, pp. 170-171.
4. MOC and mission to Korea.

KOREA
TRANSPORT SECTOR

Status of KHC Expressways Network

Sections	Route no.: Unit	1	2	3	4	5	6-1	6-2	7	8
		Seoul- Busan	Seoul- Incheon	Daejeon- Suncheon	Suweon- Gangreung	Gangreung- Mugho	Busan- Suncheon	Busan- Masan	Daegu- Masan	Onyang- Ulsan
Length	km /a	428	29.5	261.1	201	30	176.5	20.6	84.2	14.3
Lanes	each	4	4	2	2	2	2	4	2	4
Work period		1968.2.1 - 1970.7.7	1967.3.24 - 1968.12.21	1970.4.15 - 1973.11.14	1971.3.24 - 1975.10.14	1974.3.28 - 1975.10.24	1972.1.10 - 1973.11.14	1978.5.20 - 1981.9.4	1976.6.24 - 1977.12.17	1969.6.20 - 1969.12.29
Construction costs	million Won	40,972	2,601.5	21,654	21,530	5,588	19,524	61,662	20,888	1,595
Right of way costs	"	2,001	548.5	2,167	1,446	1,848	2,659	4,683	3,531	220
Earth works	'000 cu m	61,494	3,179	26,347	24,164	4,263	16,543	4,882	8,721	2,021
Bridges	Each/m	317/17,240 (325/18,544)	33/951 (49/1,833)	153/8,343 (159/8,612)	77/4,510 (79/4,538)	11/573	93/6,290 (97/6,580)	24/3,381	35/2,705	12/333
Tunnels	"	6/1,593	-	1/689	2/850	2/971	3/1,539	1/432	1/565	-
Interchanges	Each	19(20)	4(6)	6(13)	7(10)	-	5(7)	5	3	-
Rest facilities	"	(12)	-	(4)	2(6)	-	(4)	1	1	-
Cattle path	"	523	13	284	229	23	259	20	135	18
Bus stops	"	83	5	47	42	8	32	2	13	4
Road crossings	"	-	-	33(26)	19(16)	9(7)	34(28)	-	16	-

/a Total distance is 1,245.2 km, of which 515.3 km are 4 lanes and 729.9 km are 2 lanes.

Note: 1. Numbers in parenthesis are as of end-1981 and indicate changes since the opening.
2. Construction costs include 1.4% for detailed design and 0.7% for construction supervision.

Source: Korea Highway Corporation and mission to Korea.

KOREATRANSPORT SECTORMotor Vehicle Fuel Consumption (1962-82)
(¹000 Kiloliters)

Year	Gasoline ^{a/}	Diesel
<u>First FYP</u>		
1962	108	307
1963	97	358
1964	102	386
1965	223	507
1966	336	558
<u>Second FYP</u>		
1967	481	765
1968	573	1,251
1969	748	1,507
1970	865	1,775
1971	992	2,099
<u>Third FYP</u>		
1972	976	2,338
1973	1,040	2,838
1974	698	2,918
1975	664	3,328
1976	838	4,103
<u>Fourth FYP</u>		
1977	642	1,687 ^{b/}
1978	962	2,065
1979	1,160	2,426
1980 ^{c/}	915	2,592
1981	771	2,861
<u>Fifth FYP</u>		
1982	551	2,814
<u>Average Annual Growth (% p.a.)</u>		
1962-67	25.5	12.7
1967-72	15.2	22.4
1972-77	-3.0	11.9
1977-81	3.9	11.2

^{a/} Gasoline consumption is totally for vehicles, but diesel consumption includes 20-30% of other consumption.

^{b/} Diesel consumption from 1977 corresponds only to motor vehicle consumption.

^{c/} Figures from computer data.

Source: Ministry of Commerce and Industry and mission to Korea.

KOREATRANSPORT SECTORMotorization Rates, Korea and Other Countries (1979 or 1980)

	GNP per capita (US\$)	4-wheel motor vehicles per 1,000 inhabitants	Passenger cars per 1,000 inhabitants	Buses and trucks per 1,000 inhabitants	Buses and trucks per million US\$ of GDP	Buses and trucks as a % of 4-wheel motor vehicles
India (1980)	240	1.8	1	1	4	55
Indonesia (1979)	370	7.2	4	3	9	44
Thailand (1979)	600	18.3	9	10	17	31
Philippines (1979)	640	19.4	12	7	11	36
Morocco (1979)	780	29.0	19	9	12	31
Nigeria (1980)	1,010	12.3	6	6	6	49
Ivory Coast (1980)	1,150	21.2	15	7	6	33
Turkey (1979)	1,380	23.7	15	9	7	38
Malaysia (1979)	1,450	67.1	54	13	9	20
Korea (1980)	1,520	13.7	7	7	5	51
Brazil (1979)	1,770	85.0	70	17	10	20
Mexico (1979)	1,880	80.8	59	21	11	26
Chile (1980)	2,160	58.3	38	21	10	36
Romania (1980)	2,340	17.1	11	6	3	35
Portugal (1980)	2,350	120.0	93	24	10	20
Argentina (1980)	2,390	153.6	108	43	18	28

Sources: (1) Statistical Yearbook of Transportation - 1981, MOT, Korea, pp. 160 - 163.

(2) 1981 World Bank Atlas, 1982, the World Bank, Washington, D.C., USA.

(3) Bank missions.

KOREA
TRANSPORT SECTOR

Registered Motor Vehicles (1962-82)

Years	Cars/a	Trucks/b	Buses/c	Motorcycles	Others/d	Total
<u>First FYP</u>						
1962	8,733	13,093	6,747	1,846	395	30,814
1963	9,569	13,929	8,132	2,029	569	34,228
1964	11,409	14,951	8,617	2,158	678	37,813
1965	13,001	16,015	9,316	2,385	794	41,511
1966	17,502	19,432	10,888	1,322	1,016	50,160
<u>Second FYP</u>						
1967	23,235	22,955	11,499	1,722	1,286	60,697
1968	33,112	31,582	12,786	2,188	1,283	80,951
1969	50,299	40,134	14,237	2,531	1,468	108,669
1970	60,677	48,901	15,831	2,865	1,097	129,371
1971	67,582	53,405	17,411	4,068	1,871	144,337
<u>Third FYP</u>						
1972	70,244	55,116	17,550	4,297	2,727	149,934
1973	78,334	64,584	18,871	5,407	3,518	170,714
1974	76,462	76,833	20,060	6,039	4,150	183,544
1975	84,212	82,862	21,818	6,594	5,035	200,521
1976	96,099	93,885	23,643	7,342	5,351	226,320
<u>Fourth FYP</u>						
1977	125,613	118,150	26,710	7,440	4,839	282,752
1978	184,886	161,886	30,597	12,020	7,167	696,556
1979	241,422	206,822	37,697	181,976	8,437	676,354
1980	249,102	226,940	42,463	216,498	9,224	744,227
1981	267,605	243,828	50,595	276,335	9,726	848,089
<u>Fifth FYP</u>						
1982	305,811	263,939	66,326	410,286	10,920	1,057,282
<u>Average Annual Growth (% p.a.)</u>						
1962-67	14.9	8.2	10.0	- 6.5	21.0	10.2
1967-72	23.9	18.4	8.7	8.8	7.8	18.9
1972-77	6.5	11.2	6.1	11.3	14.4	8.6
1977-81	16.3	15.6	13.6	206.1	14.9	25.0
<u>Fleet Composition (%)</u>						
1962	28.3	42.5	21.9	6.0	1.3	100
1967	38.3	37.8	18.9	2.9	2.1	100
1972	46.8	36.8	11.7	2.9	1.8	100
1977	44.4	41.8	9.5	2.6	1.7	100
1982	28.9	25.0	6.3	38.8	1.0	100

/a Includes taxis and Government vehicles.

/b Includes public carriers as well as private and government-owned trucks.

/c Includes minibuses.

/d Public service and special vehicles.

- Sources: (1) Statistical Yearbook of Transportation - 1973, MOT, Korea, pp. 102-105.
 (2) Statistical Yearbook of Transportation - 1982, MOT, Korea, pp. 164-167.
 (3) Mission to Korea.

Cars by Categories of Ownership (1967-82)
(¹000 vehicles)

Years	Government	Private	Commercial (mostly taxis)	Total
<u>Second FYP</u>				
1967	2.2	9.9	11.1	23.2
1968	2.8	14.4	15.9	33.1
1969	3.1	23.7	23.5	50.3
1970	3.6	28.7	28.4	60.7
1971	4.0	34.0	29.6	67.6
<u>Third FYP</u>				
1972	4.5	36.4	29.3	70.2
1973	5.0	43.4	29.9	78.3
1974	4.9	44.6	27.0	76.5
1975	5.0	50.1	29.1	84.2
1976	5.2	61.6	29.3	96.1
<u>Fourth FYP</u>				
1977	5.7	85.1	34.8	125.6
1978	6.1	128.8	50.0	184.9
1979	6.8	172.9	61.7	241.4
1980	7.8	178.5	62.8	249.1
1981	7.9	193.5	66.2	267.6
<u>Fifth FYP</u>				
1982	7.8	225.6	72.4	305.8
<u>Fleet Composition (%)</u>				
1967	9.5	42.7	47.8	100
1972	6.4	51.9	41.7	100
1977	4.5	67.8	27.7	100
1982	2.6	73.7	23.7	100
<u>Cars per 1,000 Population</u>				
	<u>Population</u> (million)	<u>Private</u> (¹ 000)	<u>Total</u> (¹ 000)	
1967	30.1	0.33	0.77	
1972	33.5	1.09	2.10	
1977	36.4	2.34	3.45	
1982	39.3	5.74	7.78	

- Source: (1) Handbook of Korean Economy-1980, EPB, Korea, p.395.
(2) Statistical Yearbook of Transportation-1976, MOT, Korea, p. 125.
(3) Statistical Yearbook of Transportation-1982, MOT, Korea, p. 164.
(4) Mission to Korea.

Trucks by Categories of Ownership (1967-82)
([^]000 vehicles)

Years	Government	Private/a	Commercial/b	Total
<u>Second FYP</u>				
1967	2.2	5.6	15.1	22.9
1968	2.7	7.6	21.3	31.6
1969	2.8	11.0	26.3	40.1
1970	3.0	15.2	30.7	48.9
1971	3.3	18.5	31.6	53.4
<u>Third FYP</u>				
1972	3.6	21.5	30.0	55.1
1973	4.9	26.8	32.9	64.6
1974	4.9	45.3	36.6	76.8
1975	5.0	39.9	38.0	82.9
1976	5.9	49.4	38.6	93.9
<u>Fourth FYP</u>				
1977	7.3	69.5	41.4	118.2
1978	7.6	105.4	48.9	161.9
1979	8.3	146.2	52.3	206.8
1980	8.9	165.4	52.6	226.9
1981	9.2	180.6	54.0	243.8
<u>Fifth FYP</u>				
1982	9.1	199.2	55.6	263.9
<u>Fleet Composition (%)</u>				
1967	9.6	24.5	65.9	100
1972	6.5	39.0	54.5	100
1977	6.2	58.8	35.0	100
1982	3.4	75.5	21.1	100

/a For carrying own goods.

/b Common carriers.

Source: (1) Statistical Yearbook of Transportation-1976, MOT, Korea, p. 123.
(2) Statistical Yearbook of Transportation-1982, MOT, Korea, p. 166.
(3) Mission to Korea.

KOREATRANSPORT SECTORKorean Motor Vehicle Production (1962-82)

Year	Cars	Buses	Trucks	Motorcycles	Total
<u>Actual</u>					
<u>First FYP</u>					
1962	991	42	884	-	1,917
1963	1,430	233	143	-	1,806
1964	179	405	108	343	1,035
1965	166	1,251	965	507	2,889
1966	3,398	1,482	559	1,461	6,900
<u>Second FYP</u>					
1967	5,033	941	1,512	4,635	12,121
1968	11,421	1,632	5,212	17,374	35,639
1969	19,727	1,884	9,626	13,735	44,972
1970	13,636	3,690	13,032	16,242	46,600
1971	11,870	3,059	8,072	12,317	35,318
<u>Third FYP</u>					
1972	9,952	2,581	6,115	9,012	27,660
1973	12,751	3,494	9,979	13,851	40,075
1974	9,069	3,945	17,276	11,495	41,785
1975	18,570	3,808	14,913	11,665	49,016
1976	26,701	3,468	19,219	16,798	66,186
<u>Fourth FYP</u>					
1977	43,981	5,453	35,263	32,629	117,326
1978	86,823	7,279	63,446	70,654	228,202
1979	113,564	12,307	76,661	100,496	303,028
1980	57,225	12,053	51,660	110,773	231,711
1981	68,760	13,358	52,166	123,521	257,805
<u>Fifth FYP</u>					
1982 /a	98,751	20,872	44,428	124,351	288,402
<u>Average Annual Growth Rate (%)</u>					
1972-76	21.8	6.1	25.6	13.3	19.9
1977-81	10.3	19.6	8.1	30.5	17.0

/a Economic Statistics Yearbook 1983, The Bank of Korea, Korea, p. 167.

Source: (1) Statistical Yearbook of Transportation-1973, MOT, Korea, p. 115.
 (2) Statistical Yearbook of Transportation-1982, MOT, Korea, p. 173.
 (3) Mission to Korea.

KOREA

TRANSPORT SECTOR

Commercial Licensing of Road Transport Companies (1974-82)

<u>Year</u>	<u>Taxis</u>			
	<u>Number of companies</u>	<u>Number of vehicles</u>	<u>Owners-drivers</u>	<u>Total taxis</u>
1974	669	28,906	652	29,558
1976	711	29,104	856	29,960
1977	722	29,830	4,773	34,603
1980	1,517	53,588	15,958	69,546
1981	1,881	51,951	19,163	71,114
1982	1,932	53,153	24,435	77,588

<u>Year</u>	<u>Trucks</u>					
	<u>Area license</u>		<u>Route license</u>		<u>Total</u>	
	<u>Number of companies</u>	<u>Trucks ('000)</u>	<u>Number of companies</u>	<u>Trucks ('000)</u>	<u>Number of companies</u>	<u>Trucks ('000)</u>
1974	839	39.2	30	1.9	869	41.1
1976	889	37.0	32	1.6	921	38.6
1977	1,029	40.6	32	1.6	1,061	42.2
1980	1,245	56.9	30	1.9	1,275	58.8
1981	1,415	57.3	29	1.9	1,444	59.2
1982	1,659	61.4	26	1.4	1,685	62.8

<u>Year</u>	<u>Buses</u>							
	<u>Intracity</u>		<u>Intercity /a</u>		<u>Charter</u>		<u>Total</u>	
	<u>Number of co.</u>	<u>Buses ('000)</u>						
1974	n.a.	n.a.	n.a.	n.a.	80	1.0	341	16.5
1976	199	9.5	144	8.7	93	1.3	436	19.5
1977	204	10.2	150	9.5	108	1.9	462	21.6
1980	336	15.4	161	11.2	153	2.8	650	29.4
1981	359	16.9	177	11.2	171	3.1	707	31.2
1982	376	18.3	177	11.4	182	3.3	735	33.0

/a Include companies operating services on the expressways (12, 11 and 10 in 1974, 1977 and 1980).

Sources: (1) Statistical Yearbook of Transportation - 1982, MOT, Korea, pp. 162-163, 168.

(2) MOT and mission to Korea.

KOREA
TRANSPORT SECTOR

Regular Bus Route Developments in Remote Areas by Year (1976-80)

Province	Until 1976	1977	1978	1979	1980	Total
Gyeonggi	34	10	7	14	8	73
Gangweon	29	14	16	4	-	63
Chungbug	49	25	10	8	6	98
Chungnam	69	62	17	3	4	155
Jeonbug	17	20	15	13	18	83
Jeonnam	8	8	23	17	8	64
Gyeongbug	87	24	28	14	16	169
Gyeongnam	27	22	12	8	3	72
Jeju	15	7	2	2	1	27
<u>Total</u>	<u>335</u>	<u>192</u>	<u>130</u>	<u>83</u>	<u>64</u>	<u>804</u>

Source: MOT, October 1981.

KOREA

TRANSPORT SECTOR

Road Commercial Transport Passenger Demand (1980-86)
(Unit: '000 passengers)

	1980	1981	1982	1983	1984	1985	1986	Average annual increase (%) (1982-86)
City bus	5,239,834	5,537,989	5,998,774	6,477,679	6,861,989	7,029,138	7,533,951	
(% increase)	(8.8)	(5.7)	(8.3)	(8.0)	(5.9)	(2.4)	(7.2)	6.35
(% share)	(65.2)	(64.9)	(65.1)	(65.1)	(64.7)	(63.5)	(63.5)	
Suburban bus	794,522	849,344	914,743	987,008	1,062,021	1,141,673	1,223,873	
(% increase)	(-3.2)	(6.9)	(7.7)	(7.9)	(7.6)	(7.5)	(7.2)	7.58
(% share)	(9.9)	(10.0)	(9.9)	(9.9)	(10.0)	(10.3)	(10.3)	
Express bus	55,627	59,577	63,688	67,891	72,168	76,570	80,935	
(% increase)	(-0.5)	(7.1)	(6.9)	(6.6)	(6.3)	(6.1)	(5.7)	6.32
(% share)	(0.7)	(0.7)	(0.7)	(0.7)	(0.7)	(0.7)	(0.7)	
Chartered bus	40,090	43,458	47,630	52,345	57,265	62,476	67,912	
(% increase)	(17.7)	(8.4)	(9.6)	(9.9)	(9.4)	(9.1)	(8.7)	9.34
(% share)	(0.5)	(0.5)	(0.5)	(0.5)	(0.5)	(0.6)	(0.6)	
Passenger cars	1,908,983	2,034,923	2,191,612	2,369,133	2,553,925	2,750,577	2,956,871	
(% increase)	(1.5)	(6.6)	(7.7)	(8.1)	(7.8)	(7.7)	(7.5)	7.76
(% share)	(23.7)	(23.9)	(23.8)	(23.8)	(24.1)	(24.9)	(24.9)	
<u>Total</u>	<u>8,039,006</u>	<u>8,525,291</u>	<u>9,216,447</u>	<u>9,954,056</u>	<u>10,607,368</u>	<u>11,060,434</u>	<u>11,863,542</u>	
(% increase)	(5.6)	(6.0)	(8.1)	(8.0)	(6.6)	(4.3)	(7.3)	6.83
(% share)	(100.0)	(100.0)	(100.0)	(100.0)	(100.0)	(100.0)	(100.0)	

Source: Draft for Preparation of Fifth Five-Year Social and Economic Plan - Transportation Sector, Aug. 1981, MOT, Korea, p. 23.

KOREA

TRANSPORT SECTOR

Motor Vehicle Fleet Expansion Plan (1980-86)
(Unit: Vehicles)

	1980		1981		1982		1983		1984		1985		1986		1982-86 Total
	Increase	Holdings													
Motor Vehicles Annual Net Increase /a															
Passenger Cars															
Commercial	1,131	62,816	3,796	66,612	5,129	71,741	5,811	77,552	6,049	83,601	6,438	90,039	6,752	96,791	30,179
Noncommercial	6,549	186,286	18,815	205,101	36,139	241,240	42,506	283,746	56,692	340,438	68,020	408,458	81,610	490,068	284,967
Total	7,680	249,102	22,611	271,713	41,268	312,981	48,317	361,298	62,741	424,039	74,458	498,497	88,362	586,859	315,146
Buses															
Commercial	1,478	28,214	1,920	30,134	2,461	32,595	2,635	35,230	2,395	37,625	1,831	39,456	2,874	42,330	12,196
City	880	14,882	1,384	16,266	1,350	17,616	1,409	19,025	1,123	20,148	483	20,631	1,486	22,117	5,851
Suburban	481	9,321	300	9,621	741	10,362	818	11,180	850	12,030	902	12,932	931	13,863	4,242
Express	53	1,385	16	1,401	97	1,498	99	1,597	100	1,697	104	1,801	102	1,903	502
Charter	64	2,626	220	2,846	273	3,119	309	3,428	322	3,750	342	4,092	355	4,447	1,601
Noncommercial	3,288	14,249	2,380	16,629	2,672	19,301	3,102	22,403	3,600	26,003	4,179	30,182	4,850	35,032	18,403
Total	4,766	42,463	4,300	46,763	5,133	51,896	5,737	57,633	5,995	63,628	6,010	69,638	7,724	77,362	30,599
Trucks															
Commercial	988	58,680	800	59,480	4,699	64,179	5,263	69,442	5,694	75,136	6,161	81,297	6,666	87,963	28,483
Noncommercial	19,917	177,484	25,277	202,761	28,995	231,756	33,141	264,897	37,880	302,777	43,297	346,074	49,489	395,563	192,802
Total	20,905	236,164	26,077	262,241	33,694	295,935	38,404	334,339	43,574	377,913	49,458	427,371	56,155	483,526	221,285
Grand Total															
Commercial	3,597	149,710	6,516	156,226	12,289	168,515	13,709	182,224	14,138	196,362	14,430	210,792	16,292	227,084	70,858
Noncommercial	29,754	378,019	46,472	424,491	67,806	492,297	78,749	571,046	98,172	669,218	115,496	784,714	135,949	920,663	496,172
Total	33,351	527,729	52,988	580,717	80,095	660,812	92,458	753,270	112,310	865,580	129,926	995,506	152,241	1,147,747	567,030
Commercial Motor Vehicles Expected to be Scrapped /b															
Passenger cars	14,988		15,925		21,375		21,798		19,851		23,162		26,322		112,508
Buses	5,446		4,059		4,236		5,475		6,279		6,668		6,769		29,427
Trucks	9,625		9,146		10,394		11,520		10,953		10,973		12,032		55,872
Total	30,059		29,130		36,005		38,793		37,083		40,803		45,123		197,807
Noncommercial Motor Vehicles Expected to be Scrapped															
Passenger cars	23,332		16,464		15,357		39,885		67,408		82,380		110,316		315,346
Buses	1,588		4,041		5,031		6,788		6,726		7,322		6,507		32,374
Trucks	16,670		14,377		13,512		22,076		21,473		19,569		15,813		92,443
Total	41,590		34,882		33,900		68,749		95,607		109,271		132,636		440,163
Gross Annual Addition to the Vehicle Fleet /c															
Passenger cars	46,000		55,000		78,000		110,000		150,000		180,000		225,000		743,000
Buses	11,800		12,400		14,400		18,000		19,000		20,000		21,000		92,400
Trucks	47,200		49,600		57,600		72,000		76,000		80,000		84,000		369,600
Total	105,000		117,000		150,000		200,000		245,000		280,000		330,000		1,205,000

/a Net increase is annual sales from local production and imports less vehicles that are scrapped.

/b Assuming the vehicle's operating life is as follows: passenger car: commercial - 4 years, noncommercial - 5 years; bus: 7 years; truck: 13 years; funeral: 10 years.

/c For simplification, the production forecast by MOCI has been used and this omits the few imported vehicles.

- Sources: 1. "Draft" for Preparation of Fifth Five-Year Economic and Social Plan - Transportation Sector, August 1981, MOT, Korea, pp. 38-39.
2. Fifth Five-Year Economic and Social Development Plan - Transportation Sector Plan (1982-86), Transportation Sector Planning Task Force, MOT, Korea, p. 80.
3. EPB, Korea.

KOREATRANSPORT SECTORMotor Vehicle Production Program (1980-88)
(000)

Production	1980	1981	1982	1983	1984	1985	1986	1987	1988
<u>Passenger Cars</u>									
Total production	61	71	95	135	186	227	288	371	469
- Domestic market	46	55	78	110	150	180	225	285	355
- Export market	15	16	17	25	36	47	63	86	114
Production capacity	238	238	192	192	492	492	492	492	492
% of production for export	25	23	18	19	19	21	22	23	24
<u>Trucks and Buses</u>									
Total production:	70	74	89	107	113	120	128	141	155
- Domestic market	59	62	72	90	95	100	105	115	125
- Export market	11	12	17	17	18	20	22	26	30
Production capacity	122	122	145	145	145	145	145	175	175
% of production for export	16	16	19	16	16	12	12	18	19

/a According to a MOCI forecast, 1986 motor vehicle production will total one million units, 312 thousand of which will be for the export market. A Comparable KDI (Korea Development Institute) forecast pegs 1986 production at 241-527 thousand units, 39-87 thousand of which will be for the export market.

Source: Economic Planning Board (EPB).

KOREATRANSPORT SECTORRoad Transport Investment Plans - Summary (1982-86)

(Unit: billion won, 1980 prices)

Project name	Project scale	Capital required			Financial sources	
		Domestic (US\$ mln)	Foreign	Total	Government	Private
Addition to commercial vehicles fleet	70,858 vehicles	703.2	-	703.2	-	703.2
Replacement of scrapped commercial vehicles	197,807 vehicles	1,604.4	-	1,604.4	-	1,604.4
Construction of 36 terminals	370 thousand pyongs	45.8	25.0	61.0	15.3	45.7
Construction of 135 warehouses		40.5	-	40.5	-	40.5
Roads construction and improvement		1,175.0	220.8	1,309.7	1,195.4	114.3
1. Expressways	183.1 km (new) 172.8 km (widening)	291.4	-	291.4	177.1	114.3
2. National roads		531.1	214.2	661.8	661.8	-
IBRD 4th		130.7	65.9	170.9	170.9	-
IBRD 5th		72.5	74.1	117.7	117.7	-
ADP 5th		68.6	73.2	113.2	113.2	-
General projects		259.3	1.0	259.9	259.9	-
3. National road maintenance		186.9	6.6	190.9	190.9	-
4. Debts repayment and miscellaneous		165.6	-	165.6	165.6	-
<u>Total</u>		<u>3,568.9</u>	<u>245.8</u>	<u>3,718.8</u>	<u>1,210.7</u>	<u>2,508.1</u>

/a This road transport plan does not include the development programs for the provincial, county, city and special city roads which are all funded by local governments' resources and MOHA grants. This has revealed a sizable omission as those investments are expected to exceed the total expenditure on expressway and national roads.

Source: Fifth Five-Year Economic and Social Development Plan - Transportation Sector Plan (1982-86), Transportation Sector Planning Task Force, MOT, Korea, p. 87, 206-209.

Table 2.13

KOREA
TRANSPORT SECTOR

Fifth Five-Year Plan: Expenditures on Roads (1982-86)
(In 1980 prices)

	1982	1983	1984	1985	1986	Total		Qty. (km)
						W bln.	US\$ mln. /a	
<u>Central Government</u>								
<u>Financing</u>								
<u>Construction & Improvement</u>								
Expressways (KHC) /b	38.5	52.3	117.4	37.8	45.4	291.4	477.7	360
<u>National Highways</u>	<u>99.5</u>	<u>101.3</u>	<u>65.4</u>	<u>133.3</u>	<u>153.4</u>	<u>552.9</u>	<u>906.4</u>	-
Paving	91.9	93.9	51.9	92.6	109.9	440.2	721.6	2,239
Widening	7.6	7.4	13.5	40.7	43.5	112.7	184.8	182
Bridges (length in m)	3.9	3.7	6.8	8.4	6.2	29.0	47.5	7,591
Provincial roads paving	2.9	2.9	2.6	9.4	8.0	25.8	42.3	82
Subtotal	<u>144.8</u>	<u>160.2</u>	<u>192.2</u>	<u>188.9</u>	<u>213.0</u>	<u>899.1</u>	<u>1,473.9</u>	-
<u>Others</u>								
National highway maintenance	28.6	31.6	37.1	43.5	50.1	190.9	313.0	-
Overhead & studies	10.5	10.7	12.3	14.4	7.6	55.5	91.0	-
Loan amortization	26.4	33.1	33.3	34.7	36.7	164.2	269.1	-
Subtotal	<u>65.5</u>	<u>75.4</u>	<u>82.7</u>	<u>92.6</u>	<u>94.4</u>	<u>410.6</u>	<u>673.1</u>	-
<u>Total</u>	<u>210.3</u>	<u>235.6</u>	<u>274.9</u>	<u>281.5</u>	<u>307.4</u>	<u>1,309.7</u>	<u>2,147.0</u>	-

/a Exchange rate 1980: US\$1 = W 610.

/b Excluding maintenance expenditures of KHC.

Sources: MOC and mission to Korea.

KOREA

TRANSPORT SECTOR

Fourth Five-Year Plan: Expenditures on Roads (1977-81)
(Won billion)

	1977	1978	1979	1980	1981	Total	
						1977-81	%
<u>National & Express Highways /a</u>							
Administration	9.8	12.2	16.6	24.8	35.8	99.2	5.2
Construction	80.9	70.0	105.0	117.4	180.1	553.4	28.8
Maintenance	21.0	25.7	43.4	55.5	76.6	222.2/b	11.6
Subtotal	<u>111.7</u>	<u>107.9</u>	<u>165.0</u>	<u>197.7</u>	<u>292.5</u>	<u>874.8</u>	<u>45.6</u>
<u>Others /c</u>							
<u>Provincial, Gun (County)</u>							
<u>& City Roads</u>							
Administration	0.7	0.8	1.9	2.8	2.8	9.0	0.5
Construction	44.9	32.9	51.5	92.1	56.5	277.9	14.5
Maintenance	2.6	3.1	6.1	14.6	15.5	41.9	2.2
Subtotal	<u>48.2</u>	<u>36.8</u>	<u>59.5</u>	<u>109.5</u>	<u>74.8</u>	<u>328.8</u>	<u>17.2</u>
<u>Special Cities</u>							
Administration	-	1.8	2.7	32.9	21.3	58.6	3.0
Construction	67.7	115.1	32.4	159.7	131.0	606.0	31.5
Maintenance	1.9	3.4	3.0	4.7	36.6	49.6	2.6
Subtotal	<u>69.6</u>	<u>120.3</u>	<u>138.1</u>	<u>197.3</u>	<u>188.9</u>	<u>714.2</u>	<u>37.2</u>
<u>Total, Current Prices</u>	<u>229.5</u>	<u>265.0</u>	<u>362.6</u>	<u>504.5</u>	<u>556.2</u>	<u>1,917.8</u>	<u>100.0</u>
<u>Total, 1975 Prices /d</u>	<u>167.6</u>	<u>160.5</u>	<u>184.1</u>	<u>203.5</u>	<u>191.0</u>	<u>906.7</u>	
<u>Total, 1980 Prices /d</u>	<u>415.6</u>	<u>397.9</u>	<u>456.3</u>	<u>504.5</u>	<u>473.5</u>	<u>2,247.8</u>	

/a Including MOC and KHC.

/b Maintenance of KHC network amounted to W 124 billion or 56%.

/c Fourth Year Plan document did not include those expenditures funded by MOHA and local government and by MOC on a few provincial roads.

/d GNP deflator: 1975 = 100, 1977 = 136.9, 1978 = 165.1, 1979 = 197.0, 1980 = 247.9, 1981 = 291.2.

Source: MOC and MOHA.

KOREA

TRANSPORT SECTOR

Expenditures on Roads (1962-81) /a
(million won)

	Total First Plan		Total Second Plan		Total Third Plan		Total Fourth Plan	
	1962-66	%	1967-71	%	1972-76	%	1977-81	%
<u>Government Expenditures</u> <u>on National Highways/b</u>								
Administration	74	1	946	1	5,887	2	99,241	8.2
Construction	3,811	53	89,022	72	179,424	66	553,388	46.0
Maintenance/c	193	3	1,448	1	11,479	4	222,087	18.5
Subtotal	<u>4,078</u>	<u>57</u>	<u>91,416</u>	<u>74</u>	<u>196,790</u>	<u>72</u>	<u>874,716</u>	<u>72.7</u>
<u>Expenditures on Provincial</u> <u>Gun (County), and City</u> <u>Roads /d /e</u>								
Administration	-	-	-	-	-	-	8,979	0.7
Construction	2,174	31	26,286	21	65,150	24	277,984	23.0
Maintenance /f	851	12	5,737	5	11,516	4	41,930	3.5
Subtotal	<u>3,025</u>	<u>43</u>	<u>32,023</u>	<u>26</u>	<u>76,666</u>	<u>28</u>	<u>328,893/g</u>	<u>27.3</u>
<u>Total</u>	<u>7,103</u>	<u>100</u>	<u>123,439</u>	<u>100</u>	<u>273,456</u>	<u>100</u>	<u>1,203,609</u>	<u>100.0</u>

/a At current prices.

/b Includes roads under the jurisdiction of KHC.

/c Does not include funds contributed by provinces for the maintenance of national highways.

/d Seoul City excepted in First to Third Plans, and Special Cities (Seoul, Busan, Daegu and Incheon) excepted in the Fourth Plan.

/e Includes Government grants.

/f Maintenance includes expenditures on gravelled national highways, estimated at up to 70% of the total except the value of voluntary labor provided for all by farmers until 1971.

/g Investments under the Fourth Plan for the Special Cities amount to an additional W 714.2 billion and would represent 37%, if taken into account, of total road expenditures.

Source: Ministry of Construction, Ministry of Home Affairs and mission to Korea.

KOREA

TRANSPORT SECTOR

Expenditures on Roads (1981)
(million Won)

	MOC /a	KHC /b	Local government /c	Total	%
<u>Expressways</u>					
Administration	-	4,178	-	4,178	
Construction	20,000	19,889	-	39,889	
Maintenance	-	37,551	-	37,551	
<u>Total</u>	<u>20,000</u>	<u>61,618</u>	<u>-</u>	<u>81,678</u>	14.7
<u>National Highways</u>					
Administration	30,691/d	-	898	31,589	
Construction	100,527	-	39,687	140,214	
Maintenance	32,596	-	6,431	39,027	
<u>Total</u>	<u>163,814</u>	<u>-</u>	<u>47,016</u>	<u>210,830</u>	37.9
<u>Special City Roads /e</u>					
Administration	-	-	21,299	21,299	
Construction	-	-	131,036	131,036	
Maintenance	-	-	36,605	36,605	
<u>Total</u>	<u>-</u>	<u>-</u>	<u>188,940</u>	<u>188,940</u>	34.0
<u>Provincial Roads</u>					
Administration	-	-	1,713	1,713	
Construction	2,719	-	26,686	29,405	
Maintenance	-	-	6,835	6,835	
<u>Total</u>	<u>2,719</u>	<u>-</u>	<u>35,234</u>	<u>37,953</u>	6.8
<u>City Roads</u>					
Administration	-	-	651	651	
Construction	-	-	14,206	14,206	
Maintenance	-	-	5,706	5,706	
<u>Total</u>	<u>-</u>	<u>-</u>	<u>20,563</u>	<u>20,563</u>	3.7
<u>Gun Roads</u>					
Administration	-	-	409	409	
Construction	-	-	12,935	12,935	
Maintenance	-	-	2,976	2,976	
<u>Total</u>	<u>-</u>	<u>-</u>	<u>16,320</u>	<u>16,320</u>	2.9
<u>Total</u>					
Administration	30,691	4,178	24,970	59,839	
Construction	123,246	19,889	224,550	367,685	
Maintenance	32,596	37,551	58,553	128,700	
<u>Total</u>	<u>186,533</u>	<u>61,618</u>	<u>308,073</u>	<u>556,224</u>	100.0

/a Ministry of Construction.

/b Korea Highway Corporation.

/c Nine provincial governments and four special cities.

/d Reimbursement cost W 24,190 million for previous loan is included.

/e Seoul, Busan, Daegu and Incheon special cities.

Source: MOC, MOHA, KHC and mission to Korea.

KOREA

TRANSPORT SECTOR

MOHA - Tentative Road Investment Program (1982-86)

(In billion Won 1980 prices, length in km)

	1982		1983		1984		1985		1986		Total	
	Length (km)	Won (billion)										
Capital												
Provincial roads-paving	490.0	110,200	445.0	95,750	302.0	64,950	271.0	58,240	295.0	63,400	1,803.0	392,550
County roads-paving	17.4		400.0	57,980	606.0	81,640	340.0	58,500	340.0	58,500	1,703.4	256,630
Maintenance equipment	0.0	0	0.0	11,270	0.0	9,720	0.0	0	0.0	0	0.0	20,990
City roads-paving			180.0	38,710	210.0	45,170	230.0	49,470	250.0	53,770	870.0	187,110
Special city roads paving	59.4	95,300	400.0	137,650	400.0	137,650	400.0	137,650	420.0	144,530	1,679.4	652,770
Subtotal	<u>566.8</u>	<u>205,500</u>	<u>1,425.0</u>	<u>341,370</u>	<u>1,518.0</u>	<u>339,130</u>	<u>1,241.0</u>	<u>303,860</u>	<u>1,305.0</u>	<u>320,200</u>	<u>6,055.8</u>	<u>1,510,050</u>
Subtotal (excluding city roads)	<u>507.8</u>	<u>110,200</u>	<u>845.0</u>	<u>165,000</u>	<u>908.0</u>	<u>156,320</u>	<u>611.0</u>	<u>116,740</u>	<u>635.0</u>	<u>121,900</u>	<u>3,506.4</u>	<u>670,170</u>
Recurrent												
Provincial roads	60.8	26,600	0.0	11,010	0.0	13,680	0.0	17,380	0.0	21,340	60.8	90,000
County roads			0.0	4,820	0.0	9,290	0.0	13,420	0.0	19,870	0.0	47,400
City roads			0.0	7,570	0.0	8,860	0.0	9,720	0.0	10,500	0.0	36,650
Special city roads	30.8	61,200	0.0	120,440	0.0	96,780	0.0	135,670	0.0	155,460	30.8	569,550
Others												
Consultants' studies			0.0	3,790	0.0	4,300	0.0	0	0.0	0	0.0	8,090
Subtotal	<u>91.6</u>	<u>87,800</u>	<u>0.0</u>	<u>147,630</u>	<u>0.0</u>	<u>132,920</u>	<u>0.0</u>	<u>176,190</u>	<u>0.0</u>	<u>207,160</u>	<u>91.6</u>	<u>751,690</u>
Subtotal (excluding city roads)	<u>60.8</u>	<u>26,600</u>	<u>0.0</u>	<u>19,610</u>	<u>0.0</u>	<u>27,270</u>	<u>0.0</u>	<u>30,800</u>	<u>0.0</u>	<u>41,210</u>	<u>60.8</u>	<u>145,490</u>
Total	<u>658.4</u>	<u>293,300</u>	<u>1,425.0</u>	<u>488,990</u>	<u>1,518.0</u>	<u>472,040</u>	<u>1,241.0</u>	<u>480,040</u>	<u>1,305.0</u>	<u>527,360</u>	<u>6,147.4</u>	<u>2,261,740</u>

Source: MOHA

KOREA

TRANSPORT SECTOR

KHC Expressways Investment Plan by Project (1982-86)

(Unit: Billion Won)

Project name	Length (km)	Project period	Amount of investment	1982	1983	1984	1985	1986	Standard
<u>New Construction</u>									
Daegu-Gwangju	174.9	1981-84	160.0/a	38.5	41.7	80.3	-	-	1988 Olympics super highway 2 lanes
Songnam-P'angyo	8.2	1985-86	16.6	-			8.0	8.6	2 lanes
<u>Widening</u>									
Seoul-Pup'gyong	15.2	1983-84	21.2	-	10.6	10.6		-	4 to 6 lanes
Seoul-Suwon	26.5	1984-85	30.4	-	-	15.2	15.2		4 to 6 lanes
Daejon-Chonju	79.5	1984-86	54.7	-	-	11.4	14.5	28.8	2 to 4 lanes
Chinju-Masan	51.6	1986-87	8.0/b	-	-	-	-	8.0	2 to 4 lanes
<u>Total</u>			<u>291.4</u>	<u>38.5</u>	<u>52.3</u>	<u>117.5</u>	<u>37.7</u>	<u>45.4</u>	

/a Total investment is 182.5, taking into account 22.5 billion spent in 1981.

/b Total investment is 35.1, taking into account 27.1 billion to be spent in 1987.

Source: (1) Fifth Five-Year Economic and Social Development Plan - Transportation Sector Plan (1982-1986), Transportation Sector Planning Task Force, MOT, Korea, p. 75.

(2) MOC and mission to Korea.

KOREA

TRANSPORT SECTORRoad Development Financing Plan (1982-86)

(Unit: Billion Won)

Project name	Project period	Amount of investment	1982	1983	1984	1985	1986
<u>National Roads Improvement and Paving</u>							
IBRD 4th	1979-83	165.2	82.6	82.6	-	-	-
		(258.4)/a					
ADB 5th	1983-86	90.9	-	2.5	22.5	26.2	39.7
IBRD 5th	1984-88	46.0	-	-	3.3	22.9	19.8
		(121.7)/b					
Domestic funding	1982-86	138.1	9.3	8.8	26.0	43.5	50.5
Subtotal		<u>440.2</u>	<u>91.9</u>	<u>93.9</u>	<u>51.8</u>	<u>92.6</u>	<u>110.0</u>
<u>Provincial Roads Paving</u>							
IBRD 4th	1979-83	5.7	2.9	2.9	-	-	-
		(6.2)/a					
IBRD 5th	1984-88	20.0	-	-	2.6	9.4	8.0
		(40.9)/b					
Subtotal		<u>25.8</u>	<u>2.9</u>	<u>2.9</u>	<u>2.6</u>	<u>9.4</u>	<u>8.0</u>
<u>Total</u>		<u>466.0</u>	<u>94.8</u>	<u>96.8</u>	<u>54.4</u>	<u>102.0</u>	<u>118.0</u>

/a Total investment is 264.6 billion won, taking into account 93.2 billion won to be spent on national roads and 0.5 billion won on provincial roads paving in the 1979-81 period.

/b Total investment is 162.6 billion won, taking into account 75.7 billion won to be spent on national roads and 20.9 billion won on provincial roads paving in the 1987-88 period.

Source: (1) Fifth Five-Year Economic and Social Development Plan - Transportation Sector Plan (1982-1986), Transportation Sector Planning Task Force, MOT, Korea, p. 78.

(2) MOC and mission to Korea.

KOREA
TRANSPORT SECTOR

Paving Program by Road Class (1981-86)

	(Oct 1980) Total network length km	1981		1982		1983		1984		1985		1986		1982-86 Total additional length km
		Total length Paved km	%											
Expressways	1,245	1,245	100.0	1,245	100.0	1,245	100.0	1,420	100.0	1,420	100.0	1,428	100.0	
National highways	12,190	6,646 (320)	54.5	7,291 (645)	59.8	7,737 (446)	63.5	7,903 (166)	64.8	8,324 (421)	68.3	8,885 (561)	72.9	(2,239)
Special city roads	9,304	5,905 (300)	63.5	6,305 (400)	67.8	6,705 (400)	72.1	7,105 (400)	76.4	7,525 (420)	80.9	7,955 (430)	85.5	(2,050)
Provincial roads	10,065	1,071 (276)	10.6	1,255 (184)	12.5	1,557 (302)	15.5	1,828 (271)	18.2	2,123 (295)	21.1	2,421 (298)	24.1	(1,350)
City roads	6,204	1,970 (150)	31.8	2,150 (180)	34.7	2,360 (210)	38.0	2,590 (230)	41.7	2,840 (250)	45.8	3,110 (270)	50.1	(1,140)
County roads	11,479	633 (87)	5.5	683 (50)	5.9	896 (213)	7.8	1,109 (213)	9.7	1,322 (213)	11.5	1,536 (214)	13.4	(903)
<u>Total</u>	<u>50,487</u>	<u>17,470</u> (1,133)	<u>34.6</u>	<u>18,929</u> (1,459)	<u>37.5</u>	<u>20,500</u> (1,571)	<u>40.6</u>	<u>21,955</u> (1,280)	<u>43.3</u>	<u>23,554</u> (1,599)	<u>46.5</u>	<u>25,335</u> (1,773)	<u>50.0</u>	(7,682)

Note: Figures in () indicate paving lengths for each year.

Source: (1) Fifth Five-Year Economic and Social Development Plan - Transportation Sector Plan (1982-86), Transportation Sector Plan Task Force, MOT, Korea, p.76-77.
(2) MOC.

Table 2.21

KOREA
TRANSPORT SECTOR

Regular Bus Route Development Plan for Remote Areas /a (1982-85)

Province	1982	1983	1984	1985	Total
Gyeonggi	14	-	-	-	14
Gangweon	3	2	5	7	17
Chungbug	7	6	5	12	30
Chungnam	6	7	5	3	21
Jeonbug	18	9	9	-	36
Jeonnam	28	21	20	8	77
Gyeongbug	-	2	3	21	26
Gyeongnam	11	15	25	26	27
Jeju	2	1	-	-	3
<u>Total</u>	<u>89</u>	<u>63</u>	<u>72</u>	<u>77</u>	<u>301</u>

/a Serving villages of over 100 households.

Source: MOT, October 1982.

KOREA

TRANSPORT SECTOR

Road Authorities and Agencies

	Toll highways	National roads	Provincial roads /a	City/county (gun) roads
<u>Planning</u>	MOC	MOC	9 Provincial Construction Bureaus (PCB)/b	City/county Construction Divisions (CCD)
<u>Construction</u> Design and super- vision	MOC/Korea High- way Corporation (KHC)	MOC, through its 5 Regional Construction Offices (RCO's)	PCB /b	CCD
<u>Financing</u>	MOC/KHC /c		Provinces with Ministry of Home Affairs (MOHA) grants; also from MOC budget for special projects	City/county with provincial grants
<u>Maintenance</u> Execution authority/ agency				
Paved	KHC	MOC /d	PCB	CCD
Unpaved	-	PCB	PCB	CCD
Financing	KHC	MOC	Provinces with MOHA grants	City/county with provincial grants

/a The Special Cities of Seoul and Busan (City Construction Bureaus) have functions similar to Provincial Authorities (Provincial Construction Bureaus).

/b The MOC has so far handled the planning, design and supervision of construction or major improvement of a number of provincial roads, particularly those for which external financing is involved.

/c KHC was established in January 1969, but has not so far financed any construction.

/d MOC has responsibility for maintenance of all national roads; it directly maintains paved national roads through its 19 National Highway Maintenance Offices (NHMO's) under its 5 Regional Construction Offices (RCOs); it delegates maintenance of the unpaved national roads to the provinces (PCBs) with financial grants from the MOC's budget, and assistance provided by its TCMOs.

Source: Ministry of Construction.

KOREA

TRANSPORT SECTOR

Expressway Traffic and Toll Revenue by Routes (1970-81)

(Unit: Vehicles: 000's, Toll Revenue: Million Won)

Year	Seoul-Busan		Seoul-Incheon		Daejeon-Jeonju		Jeonju-Busan		Daegu-Masan		Singal-Ganreung		Total	
	Number of vehicles	Toll revenue												
1970	3,689	1,564	3,530	423	3								7,222	1,987
1971	5,152	2,941	4,553	557	695						58		10,458	3,498
1972	6,302	3,982	3,834	545	777	277					693	192	11,606	4,996
1973	7,914	5,070	4,423	683	905	325					779	198	14,021	6,276
1974	7,565	5,498	4,237	757	969	403					773	229	13,544	6,887
1975	8,909	8,210	4,340	946	1,123	609					1,063	425	15,435	10,190
1976	10,581	11,358	5,253	1,259	1,317	836	1,177	433			1,481	644	19,809	14,530
1977	13,089	13,339	7,094	1,581	1,635	998	2,750	1,082			1,992	915	26,560	17,915
1978	17,918	17,348	10,693	2,390	2,110	1,228	7,034	3,350	41	16	2,796	1,276	40,592	25,608
1979	20,962	24,458	11,318	3,680	2,508	1,689	10,425	5,978	2,510	1,151	3,794	2,286	51,517	39,242
1980	20,318	28,450	10,416	4,404	2,630	1,988	9,785	6,650	2,467	1,295	3,845	2,624	49,461	45,411
1981	21,419	37,001	9,654	5,626	2,777	2,518	11,428	9,370	2,580	1,613	4,105	3,457	51,963	59,585

Source: KHC, Korea.

KOREA

TRANSPORT SECTOR

Expressway Traffic and Toll Revenue by Vehicle Categories (1970-81)

Year	Number of Vehicles (000's)				Toll Revenue (million Won)			
	Auto- mobile	Bus	Truck	Total	Auto- mobile	Bus	Truck	Total
1970	3,831 (53.1%)	789 (10.9%)	2,602 (36.0%)	7,222 (100%)	649 (32.7%)	673 (33.9%)	664 (33.4%)	1,986 (100%)
1971	4,689 (44.8%)	1,221 (11.7%)	4,549 (43.5%)	10,459 (100%)	847 (24.2%)	1,417 (40.5%)	1,234 (35.3%)	3,498 (100%)
1972	4,384 (37.8%)	1,725 (14.9%)	5,496 (47.3%)	11,605 (100%)	1,078 (21.6%)	2,256 (45.2%)	1,661 (33.2%)	4,995 (100%)
1973	4,974 (35.5%)	1,910 (13.6%)	7,138 (50.9%)	14,022 (100%)	1,327 (21.2%)	2,635 (42.0%)	2,314 (36.8%)	6,276 (100%)
1974	3,842 (28.4%)	2,059 (15.2%)	7,643 (56.4%)	13,544 (100%)	1,226 (17.8%)	2,928 (42.5%)	2,734 (39.7%)	6,888 (100%)
1975	4,317 (28.0%)	2,440 (15.8%)	8,677 (56.2%)	15,434 (100%)	1,479 (14.5%)	4,257 (41.8%)	4,453 (43.7%)	10,189 (100%)
1976	5,655 (28.6%)	3,057 (15.4%)	11,098 (56.0%)	19,810 (100%)	2,159 (14.9%)	6,072 (41.8%)	6,299 (43.3%)	14,530 (100%)
1977	7,973 (30.0%)	3,698 (13.9%)	14,889 (56.1%)	26,560 (100%)	3,056 (17.1%)	6,837 (38.2%)	8,022 (44.7%)	17,915 (100%)
1978	12,779 (31.5%)	5,063 (12.5%)	22,749 (56.0%)	40,591 (100%)	5,196 (20.3%)	8,623 (33.7%)	11,789 (46.0%)	25,608 (100%)
1979	16,651 (32.3%)	6,835 (13.3%)	28,032 (54.4%)	51,518 (100%)	9,365 (23.9%)	12,178 (31.0%)	17,699 (45.1%)	39,242 (100%)
1980	14,589 (29.5%)	7,749 (15.7%)	27,124 (54.8%)	49,462 (100%)	9,777 (21.5%)	15,392 (33.9%)	20,242 (44.6%)	45,411 (100%)
1981	15,057 (29.0%)	8,723 (16.8%)	28,183 (54.2%)	51,963 (100%)	12,607 (21.2%)	20,288 (34.1%)	26,690 (44.7%)	59,585 (100%)

Source: MOT, KHC, Korea.

KOREA
TRANSPORT SECTOR

KHC Income and Expenditure (1977-86)
(Unit: Million won)

Item	Actual						Total 1977-82	Forecast /a				Total 1983-86
	1977	1978	1979	1980	1981	1982		1983	1984	1985	1986	
Income												
Toll revenue	17,915	25,608	39,242	45,411	59,585	76,801	264,562	95,525	104,183	112,517	121,519	433,744
Other income	5,633	3,397	2,657	3,572	2,033	1,956	19,248	2,269	2,439	2,633	2,843	10,184
Reserve fund:												
Appropriation fund for retirement	1,402	1,519	3,085	3,580	3,287	5,067	17,940	5,729	6,564	7,524	8,625	28,442
Appropriation fund for depreciation	769	834	1,693	1,966	1,804	2,781	9,847	3,145	3,604	4,130	4,734	15,613
Debt and others	4,782	10,727	10,068	10,170	18,443	6,747	60,937	70	226	162	65	523
Total	30,501	42,085	56,745	64,699	85,152	93,352	372,534	106,738	117,016	126,966	137,786	488,506
Expenditure												
Expenses for highway management and maintenance	12,837	13,027	19,941	26,052	28,433	42,807	143,097	63,481	68,524	71,763	73,594	277,362
Expense for construction /b	-	6,606	20,033	19,858	19,889	3,000	69,586	20,300	65,550	82,455	81,280	249,585
Expense for highway improvement	5,616	9,690	12,164	13,264	22,182	23,879	86,795	14,311	16,941	20,459	25,731	77,442
Repayment of loan and debt	12,048	12,762	4,607	5,525	14,648	23,666	73,256	8,646	6,601	6,289	6,081	27,617
Total	30,501	42,085	56,745	64,699	85,152	93,352	372,534	106,738	157,616	180,966	186,686	632,006
(Deficit)									(40,600)	(54,000)	(48,900)	(143,500)

/a In 1983 current prices and based on 8% p.a. increase in traffic volume.

/b Funded by MOC.

Source: KHC, Korea.

KOREA
TRANSPORT SECTOR

Road User Charges (1966-81)
(Million Won)

Revenue	1966	1971	Third FYF					Fourth FYF						
			1972	1973	1974	1975	1976	1972-76	1977	1978	1979	1980	1981	1977-81
National Taxes														
Fuel taxes	2,887	29,083	27,717	36,582	83,717	95,016	114,874	357,906	133,082	120,536	210,606	362,714	356,124	1,183,062
Gasoline tax	(1,840)	(21,185)	(19,593)	(25,821)	(57,236)	(60,026)	(72,185)	(234,861)	(94,149)/a	(104,209)/a	(184,352)/a	(310,394)/a	(290,122)/a	(983,226)/a
Diesel tax	(1,047)	(7,898)	(8,124)	(10,761)	(26,481)	(34,990)	(42,689)	(123,045)	(38,933)/a	(16,327)/a	(26,254)/a	(52,320)/a	(66,002)/a	(199,836)/a
Transport tax	2,421	14,641	16,000	18,801	13,484	16,868	21,262	86,415	15,054/b	-	-	-	-	-
Commodity tax /c	348	4,465	3,535	6,613	7,499	11,764	16,642	46,053	9,330/b	28,279	35,798	20,600	19,184	128,245
Subtotal	5,656	48,189	47,252	61,996	104,700	123,648	152,778	490,374	157,466	148,815	246,404	383,314	375,308	1,311,307
Local Taxes														
Vehicle tax (inc. surcharge)	1,081	6,393	7,191/d	7,866	12,016	12,353	14,137	53,563	17,900	26,518	51,416	60,866	61,014	217,714
License fee /d	-	-	-	1,804	1,784	2,092	2,388	9,729	3,949	7,735	7,845	8,340	8,665	36,534
Acquisition tax /e	181/e	1,799/e	1,661/e	1,622	2,643	3,708	4,636	12,609	6,143	15,388	21,110	19,393	19,005	81,039
Subtotal	1,262	8,192	8,852	11,292	16,443	18,153	21,161	75,901	27,992	49,636	80,371	88,599	88,734	335,058
Tolls	-	3,498	4,995	6,276	6,887	10,189	14,531	42,878	17,915	25,608	39,242	45,411	59,585	187,761
Total	6,918	59,879	61,099	79,564	128,030	151,990	188,470	609,153	203,373	224,059	366,017	517,324	523,627	1,834,100
Overall expenditures on road /f			68,300	68,000	83,800	149,400	145,900	515,400	229,470	265,040	362,571	504,560	561,453	1,923,054

/a Special excise tax excluding Value Added Tax (VAT).

/b These taxes were incorporated in the newly adopted Value Added Tax from July 1, 1977 when the Korean Tax system was changed.

/c Estimated 10% of total commodity tax (from 1972-1980).

/d Both license fee and acquisition tax figures are estimates of the portion of the revenues from these taxes attributable to road vehicles.

/e Including license fee and acquisition tax.

/f Economic Statistics Yearbook 1982, The Bank of Korea, pp. 86-87.

Sources: Ministry of Construction, Ministry of Finance, Ministry of Home Affairs and BCEOM.

KOREA

TRANSPORT SECTOR

Railways' Network and Fleet (1961-80)

	Unit	1961	1966	1971	1976	1980	Multiplier (1961-80)
Total route-km /a	km	3,021	3,062	3,199	3,144	3,135	104
Single track	km	2,439	2,480	2,537	2,522	2,368	97
Double track	km	457	457	537	575	720	158
Narrow track	km	125	125	125	47	47	38
Electrified track	km	-	-	-	416	428	-
Total rail prolongation	km	4,630	5,049	5,582	5,653	6,007	130
Number of stations	unit	492	545	589	566	585	119
Steam locomotives	unit	350	251	95	68	30	9
Diesel locomotives	unit	95	173	337	386	425	447
Electric locomotives	unit	-	-	-	69	90	-
Diesel-powered cars	unit	18	163	157	123	130	722
Electric-powered cars	unit	-	-	-	128	286	-
Passenger cars	unit	1,303	1,418	1,621	1,806	1,901	146
Box cars	unit	9,455	11,454	15,189	16,055	16,702	177
Heater cars	unit	44	67	136	140	163	371
Crane	unit	6	6	10	16	14	233
Number of employees	persons	27,943	30,078	34,481	33,481	33,477	120

/a Of which 428 km is electrified track.

Sources: (1) Fifth Five-Year Economic and Social Development Plan, Transportation Sector Plan (1982-86), December 1981, Transportation Sector Planning Task Force, MOT, Korea, p. 42.

(2) Statistical Yearbook of Railroad - 1981, KNR, Korea, p. 4, p. 26, pp. 934-935.

KOREA

TRANSPORT SECTOR

Railways' Rolling Stock by Age (end-1981)

	Diesel loco- motives	Diesel rail cars	Electric loco- motives	Electric rail cars	Steam loco- motives	Passen- ger cars	Freight cars	Heater cars	Crane	Electric car (2nd class)
<u>By Age</u>										
1- 5 years	45	10	21	194	-	684	3,344	25	3	20
6-10 years	50	2	69	126	-	244	4,062	20	6	-
11-15 years	214	4	-	-	-	506	5,351	60	5	-
16-20 years	29	108	-	-	-	629	912	20	-	-
21-25 years	93	2	-	-	-	14	159	-	-	-
26-30 years	3	-	-	-	2	47	1,812	-	-	-
Over 31 years	-	-	-	-	18	27	925	20	-	-
<u>Total</u>	<u>431</u>	<u>126</u>	<u>90</u>	<u>320</u>	<u>20</u>	<u>2,151</u>	<u>16,565</u>	<u>145</u>	<u>14</u>	<u>20</u>
Exceeding age limit	93	2	-	-	18	74	2,737	20	-	-
Under age limit	338	126	90	320	2	2,077	828	125	14	20
Average age	13.8	15.8	8.0	5.5	37.7	10.9	13.3	15.8	9.0	1.5
Endurance age - limit (year)	20	20	40	20	30	25	25	-	-	-

Source: (1) Statistical Yearbook of Railroad - 1982, KNR, Korea, p. 90.
 (2) The Fifth Five-Year Economic and Social Development Plan - Transportation Sector Plan (1982-1986),
 Transportation Sector Planning Task Force, MOT, Korea, p. 46.

KOREA
TRANSPORT SECTOR

Train and Engine Performance by Type of Traction (1961-81)
(¹000 km)

Years	Traction type:	Coal/ anthra- cite	Oil B/C	Diesel	Elec- tricity	Diesel rail car	Elec- tricity rail car	Total
<u>Train-km</u>								
1961		4,933.5	2,952.2	11,170.2	-	1,003.6	-	20,059.5
1966		5,412.9	2,300.1	17,924.4	-	6,441.0	-	32,078.4
1971		308.4	667.4	35,425.8	-	5,824.2	-	42,225.8
1976		4.1	41.4	41,325.5	5,475.3	4,661.9	3,884.7	55,392.9
1981		-	15.4	48,382.9	7,037.9	4,072.3	7,736.0	67,244.7
(%)		-	-	72.0	10.5	6.1	11.4	100.0
<u>Engine-km</u>								
1961		6,762.6	5,266.7	13,567.2		1,080.7	-	26,677.2
1966		7,750.8	5,430.5	21,203.1	-	10,149.8	-	44,534.0
1971		847.4	3,668.5	43,122.4	-	12,285.5	-	59,923.8
1976		317.2	734.5	51,250.7	6,508.9	11,640.7	23,306.9	93,758.9
1981		-	17.5	59,089.9	9,339.0	12,326.1	55,046.8	135,819.4
(%)		-	-	43.5	6.9	9.1	40.5	100.0

Source: (1) Statistical Yearbook of Transportation - 1982, MOT, Korea, pp. 88-89.
(2) Statistical Yearbook of Railroad - 1981, KNR, Korea, pp. 754-757.

KOREA

TRANSPORT SECTOR

Rail Freight Traffic: 1966-80 Actual and 1981-86 Forecast
(Million tons)

Years	Major commodities							Others					Total
	Coal	Cement	Ore	Oil	Ferti- lizer	Grain	Sub- total	General cargo	Private car return	Con- tainer	Mili- tary	KNR	
<u>Actual</u>													
1966	10.0	1.7	1.1	0.9	1.2	1.2	16.6	4.4	-	-	2.1	0.9	24.1
<u>Second FYP</u>													
1967	11.2	2.2	1.4	1.4	1.2	1.3	18.7	5.6	-	-	2.3	0.8	27.4
1968	9.7	3.2	1.7	1.7	1.5	1.6	19.4	5.9	-	-	2.8	1.0	29.1
1969	10.4	4.4	1.7	2.1	1.2	1.4	21.2	5.6	-	-	2.7	1.2	30.7
1970	12.1	4.9	1.8	2.4	1.1	1.3	23.6	5.0	-	-	2.1	1.0	31.7
1971	12.0	5.8	1.6	2.5	1.1	1.4	24.6	4.6	-	-	1.9	0.9	32.0
<u>Third FYP</u>													
1972	11.3	6.0	1.5	2.2	1.3	1.6	23.9	4.6	-	-	2.4	0.7	31.6
1973	13.6	7.5	2.3	2.7	1.5	1.6	29.2	5.5	-	0.2	1.7	1.0	37.6
1974	15.1	7.8	2.9	2.7	1.9	1.3	31.7	5.1	-	0.2	1.3	1.1	39.4
1975	16.7	9.0	3.0	3.1	2.2	1.0	35.0	3.5	1.5	0.2	1.4	1.1	42.7
1976	16.1	10.2	3.4	3.1	1.8	1.3	35.9	3.2	1.6	0.3	1.5	1.3	43.8
<u>Fourth FYP</u>													
1977	17.5	10.3	3.2	3.5	2.1	1.2	37.8	4.6	1.9	0.5	1.5	1.3	47.6
1978	17.9	10.9	3.1	3.8	2.2	1.2	39.1	4.8	2.0	0.6	1.5	1.6	49.6
1979	18.0	11.2	3.4	4.3	2.1	1.1	40.1	4.7	2.0	0.6	1.5	2.0	50.9
1980	18.0	9.0	3.4	3.1	1.7	1.0	38.4	4.8	1.8	0.4	1.4	2.2	49.0
1981	21.4	8.4	3.9	3.2	1.9	0.6	39.4	4.4	1.6	0.5	1.3	1.6	48.8
<u>Fifth FYP - Forecast</u>													
1982	21.3	9.1	4.1	3.5	2.0	0.7	41.2	4.6	1.7	0.8	1.5	1.7	51.5
1983	22.3	9.6	4.3	3.7	2.1	0.8	42.8	5.0	1.8	1.0	1.5	1.8	53.9
1984	22.7	10.4	4.6	3.9	2.2	0.9	44.7	5.2	1.8	1.2	1.5	1.8	56.2
1985	23.1	11.3	4.9	4.2	2.3	1.0	46.8	5.4	1.9	1.4	1.5	1.9	58.9
1986	23.5	12.3	5.2	4.5	2.4	1.1	49.0	5.6	2.0	1.6	1.5	2.0	61.7

Note: Since 1977 General Cargo includes slag and gypsum previously included under Ore. Slag and gypsum accounted for 0.8 million tons in 1977 and 1.1 million tons in 1979. Return of private cars, mostly oil tankers, are now shown separately from General Cargo. KNR charges the tare weight at Class III freight rate for this traffic.

Source: KNR and Bank estimated forecast, June 1982.

KOREA

TRANSPORT SECTOR

Rail Freight Traffic: 1966-80 Actual and 1981-86 Forecast
(Million ton-km)

Years	Major commodities							Others					Total
	Coal	Cement	Ore	Oil	Ferti- lizer	Grain	Sub- total	General cargo	Private car return	Con- tainer	Mili- tary	KNR	
<u>Actual</u>													
1966	2,077	476	269	238	187	328	3,575	1,180	-	-	403	29	5,450
<u>Second FYP</u>													
1967	2,306	565	335	423	202	338	4,169	1,472	-	-	454	83	6,178
1968	2,125	845	368	589	312	406	4,645	1,577	-	-	548	97	6,867
1969	2,397	911	402	624	330	384	5,048	1,602	-	-	553	125	7,328
1970	2,785	1,003	453	641	312	402	5,595	1,526	-	-	439	148	7,709
1971	2,861	1,222	435	648	344	403	5,913	1,281	-	-	449	198	7,841
<u>Third FYP</u>													
1972	2,613	1,126	347	574	347	402	5,337	1,172	-	-	575	157	7,241
1973	3,194	1,344	568	568	420	381	6,475	1,414	-	72	433	197	8,591
1974	3,396	1,336	751	579	525	334	6,921	1,433	-	85	357	209	9,005
1975	3,677	1,437	760	625	590	256	7,345	960	304	92	385	207	9,293
1976	3,654	1,804	889	638	516	352	7,854	858	280	110	399	227	9,728
<u>Fourth FYP</u>													
1977	3,933	1,781	785	732	561	289	8,081	1,290	308	232	383	215	10,509
1978	3,963	1,846	741	868	595	338	8,351	1,338	358	275	376	228	10,926
1979	3,829	2,085	817	931	525	351	8,538	1,240	382	254	411	256	11,081
1980	3,943	2,018	1,798	833	461	310	8,363	1,249	352	179	406	249	10,798
1981	4,413	1,793	963	660	488	158	8,475	1,257	303	229	374	177	10,815
<u>Fifth FYP - Forecast</u>													
1982	4,578	1,911	984	718	510	193	8,894	1,311	323	344	420	196	11,488
1983	4,683	1,968	1,032	759	536	220	9,198	1,400	342	320	420	207	11,987
1984	4,767	2,080	1,104	800	561	248	9,560	1,430	342	492	420	207	12,459
1985	4,851	2,223	1,176	861	587	275	9,973	1,485	361	560	420	219	13,018
1986	4,935	2,397	1,248	923	612	303	10,358	1,540	380	640	420	230	13,568

Note: Until 1975, return of private cars and containers were included in general cargo.

Source: KNR and Bank estimated forecast, June 1982.

KOREA

TRANSPORT SECTOR

Rail Freight Traffic: 1966-80 Actual and 1981-86 Forecast
(Average distance in km)

Years	Major commodities						Others					Total average
	Coal	Cement	Ore	Oil	Ferti- lizer	Grain	General cargo	Private car return	Com- tainer	Mili- tary	KNR	
<u>Actual</u>												
1966	208	284	250	344	160	267	268	-	-	192	170	227
<u>Second FYP</u>												
1967	206	257	239	302	168	260	263	-	-	197	104	
1968	219	264	216	346	208	254	267	-	-	196	97	
1969	321	207	236	297	275	274	286	-	-	205	104	
1970	230	205	252	267	284	309	305	-	-	209	148	
1971	233	211	265	293	303	289	279	-	-	234	113	245
<u>Third FYP</u>												
1972	232	188	231	265	267	244	258	-	446	242	150	230
1973	235	179	247	239	273	238	255	-	439	260	147	228
1974	226	171	255	240	278	265	262	-	440	273	151	227
1975	221	160	257	223	268	256	279	185	439	270	144	217
1976	228	177	261	224	287	273	276	170	439	270	148	223
<u>Fourth FYP</u>												
1977	225	171	251	224	258	251	279	169	440	258	131	221
1978	221	170	242	229	262	277	277	183	440	260	139	220
1979	213	187	239	217	254	305	264	190	438	269	127	218
1980	212	205	238	213	270	315	264	194	440	283	112	220
1981	206	213	247	206	257	263	286	189	458	288	111	222
<u>Fifth FYP - Forecast</u>												
1982	210	210	240	205	255	275	285	190	430	280	115	223
1983	210	205	240	205	255	275	280	190	420	280	115	222
1984	210	200	240	205	255	275	275	190	410	280	115	222
1985	210	195	240	205	255	275	275	190	400	280	115	221
1986	210	190	240	205	255	275	275	190	400	280	115	220

Source: KNR and Bank estimated forecast, June 1982.

KOREA

TRANSPORT SECTOR

Intercity Passenger Rail Traffic: 1966-80 Actual and 1981-86 Forecast

Years	No. of passengers (millions)				Passenger-km (millions)				Average distance (km)			
	Com- muter	Long dis- tance	Mili- tary	Total	Com- muter	Long dis- tance	Mili- tary	Total	Com- muter	Long dis- tance	Mili- tary	Total
<u>Actual</u>												
1966	38.4	98.0	1.9	138.3	830	7,288	546	8,664	21.6	74.4	285.0	62.7
<u>Second FYP</u>												
1967	41.6	108.4	1.9	151.9	883	8,150	543	9,576	21.2	75.2	288.9	63.6
1968	38.7	110.6	1.6	150.9	828	9,280	482	10,590	21.3	83.9	301.2	70.1
1969	37.9	114.8	2.0	154.7	799	9,680	598	11,077	20.0	84.0	304.0	71.0
1970	38.2	91.4	1.7	131.3	854	8,425	539	9,818	22.4	92.2	299.4	74.8
1971	41.4	85.2	1.6	128.2	940	7,300	510	8,750	22.7	85.7	320.0	68.3
<u>Third FYP</u>												
1972	26.3	109.2	1.6	137.2	629	8,914	519	10,062	23.9	81.6	324.4	73.3
1973	22.5	118.9	1.6	143.0	552	9,681	487	10,720	24.5	81.4	304.4	75.0
1974	20.6	117.6	1.6	139.8	481	9,581	471	10,533	23.4	81.4	294.4	75.3
1975	15.1	122.0	1.4	138.6	326	10,626	434	11,386	21.6	87.1	310.0	82.1
1976	17.2	130.1	1.3	148.6	367	11,678	395	12,440	21.3	89.8	303.8	78.6
<u>Fourth FYP</u>												
1977	17.4	143.5	1.3	162.2	380	13,782	401	14,563	21.8	96.0	308.5	89.8
1978	18.2	155.7	1.7	175.6	402	15,670	516	16,588	22.1	100.6	306.0	94.5
1979	19.6	162.1	1.3	183.0	434	16,253	399	17,086	22.2	100.3	318.9	93.4
1980	18.9	164.9	1.3	185.0	428	16,376	400	17,204	22.7	99.3	319.5	93.0
1981	18.0	153.5	1.2	172.8	410	15,740	403	16,553	22.8	102.5	310.0	95.8
<u>Fifth FYP - Forecast</u>												
1982	18.3	164.6	1.4	184.3	421	17,246	448	18,115	23.0	105.0	320.0	198.3
1983	19.1	176.2	1.4	196.7	439	19,240	448	20,127	23.0	109.0	320.0	102.3
1984	19.9	182.8	1.4	204.1	458	20,418	448	21,324	23.0	112.0	320.0	108.4
1985	20.8	191.4	1.4	213.6	478	21,381	448	22,307	23.0	112.0	320.0	104.4
1986	21.7	199.7	1.4	222.8	499	22,388	448	23,335	23.0	112.0	320.0	104.7
Average annual growth rate (%) (1982-86)	3.5	4.0	0.0	3.8	3.5	5.4	0	5.2	0.0	1.3	0.0	1.3

Source KNR and Bank estimated forecast, June 1982.

KOREA

TRANSPORT SECTORSeoul Urban Passenger Traffic (SMESRS) /a
1974-80 Actual and 1981-86 Forecast

Years	Number of passengers (millions)			Passenger-km (millions)	Average distance (km)
	Commuter	Noncommuter	Total		
<u>Actual</u>					
1974	5.9	22.7	28.6	545	19.1
1975	17.1	65.3	82.4	1,540	18.7
1976	19.1	80.5	100.2	1,865	18.6
<u>Fourth FYP</u>					
1977	25.9	113.5	139.4	2,536	18.2
1978	38.3	157.1	195.4	3,466	17.7
1979	50.2	190.5	240.7	4,300	17.9
1980	50.1	195.7	245.8	4,436	18.0
1981/a	56.2	212.2	268.4	4,998	18.6
<u>Fifth FYP - Forecast</u>					
1982	64.8	244.7	309.5	5,726	18.5
1983	75.7	283.3	359.0	6,606	18.4
1984	87.5	323.1	410.6	7,514	18.3
1985	100.3	366.5	466.8	8,496	18.2
1986	113.7	411.2	524.9	9,501	18.1

/a Seoul Metropolitan Electrified Suburban Railway System.

Source: KNR and Bank estimated forecast, June 1982

KOREA
TRANSPORT SECTOR
Korean National Railroad (KOR)

Calculation of Unit Costs and Revenues (end-1981)
(Costs in \$ million)

Passengers	Traffic PK/TRK average (mln)	Total		Working cost updated to 12/31/81 /a	Total costs		Depreciation 12/31/81	Total operating cost 12/31/81	Interest charges	Grand total 12/31/81	Variable operating cost		Fixed operating cost	Gross operating		Net operating		% of operating cost variable	Cost coverage			
		1981	1981		12/31/81 /a	12/31/81					12/31/81	12/31/81		12/31/81	12/31/81	1981	1981 /a		1981	1981 /a	1981	1981 /a
Special express	722	18.84	14.96	16.00	1.10	17.10	2.77	19.87	71.3	11.41	0.78	12.19	4.99	0.32	4.91	29.30	32.11	15.01	53	12.24	405	162
Limited express air-conditioned	2,040	9.80	7.30	7.82	1.13	8.95	1.37	10.32	70.0	5.47	0.79	6.26	2.33	0.34	2.69	16.14	17.49	8.74	51	7.37	425	171
Limited express	6,793	8.17	5.89	6.30	1.13	7.13	1.15	8.38	67.9	4.27	0.77	5.04	2.03	0.36	2.39	11.15	12.15	4.77	61	3.57	297	141
Ordinary express	616	17.85	14.12	15.10	1.13	16.23	2.60	18.83	32.7	6.33	0.78	7.11	3.02	0.65	3.77	16.31	(7.92)	196	44	(10.52)	28	44
Ordinary trains	5,599	16.88	13.16	14.08	1.13	15.21	2.59	17.80	42.6	5.99	0.48	6.47	0.99	0.65	8.74	5.75	6.30	(8.91)	241	97	-	36
SMESMS (Seoul subway)	4,976	6.89	4.76	5.09	1.15	6.24	0.98	7.22	46.3	2.36	0.53	2.89	2.73	0.62	3.35	6.97	7.64	1.40	82	0.42	100	100
Military	403	8.68	6.45	6.90	0.99	7.89	1.24	9.13	68.6	4.73	0.67	5.40	2.17	0.32	2.49	10.71	11.74	3.85	67	2.61	142	129
Postage	410	25.61	21.22	22.71	0.98	23.69	3.41	27.10	32.3	7.33	0.32	7.65	15.38	0.65	16.04	11.14	12.21	(11.48)	194	67	28	45
Freight	435	35.17	26.89	28.77	3.45	32.22	4.83	37.05	30.0	8.63	1.04	9.67	20.14	2.40	27.54	22.66	24.83	(7.38)	130	130	67	67
Grain	138	18.35	13.92	14.89	1.90	16.79	2.53	19.32	52.2	8.22	1.06	9.28	6.67	0.84	7.51	12.66	14.99	(1.80)	112	(4.33)	74	78
Fertilizer	488	18.65	14.55	15.57	1.44	17.01	2.50	19.51	52.0	8.74	0.81	9.55	6.85	0.63	7.48	12.32	14.38	(2.43)	117	(5.09)	100	74
Iron	763	14.64	11.01	11.76	1.62	13.18	2.29	15.47	70.9	8.35	1.18	9.53	4.63	0.68	3.91	12.55	14.86	1.42	90	(0.59)	100	68
Cement	1,262	17.72	13.48	14.42	1.63	16.09	2.58	18.67	64.9	8.36	1.05	9.41	4.33	0.57	5.20	13.76	16.29	1.48	91	(0.81)	100	128
Oil	4,613	15.91	12.06	12.90	1.63	14.53	2.22	16.75	99.8	8.62	1.00	9.62	5.80	0.67	6.47	16.43	19.69	3.60	82	1.02	100	105
Military	374	18.71	14.44	15.45	1.60	17.05	2.67	19.72	55.7	8.61	0.88	9.49	6.84	0.72	7.56	12.90	15.86	1.33	92	(0.89)	100	127
Coal	229	10.04	6.98	7.47	1.75	9.22	1.31	10.53	60.9	4.55	1.05	5.60	2.92	0.70	3.62	13.39	15.83	6.63	137	(7.23)	100	93
Other	1,560	16.73	12.76	13.65	1.60	15.25	2.37	17.62	62.1	8.48	1.01	9.49	5.17	0.59	5.76	11.22	13.28	(1.97)	115	(4.26)	100	150

/a Average 1981 + 7%
/b Passengers average 1981 + 9.6% to reflect tariff increases as of June 1:13.5% and December 15:3%. Freight average 1981 + 18.3% to reflect tariff increases as of June 1:22.3% and December 15:12% (coal 13%).

Source: KOR and bank estimates.

KOREA

TRANSPORT SECTOR

Traffic Revenues and Operating Costs (1967-80)
(Won billion; current prices)

	1967	1971	1976	1980
<u>Traffic Revenues</u>				
Passenger	10.7	17.4	52.8	165.1
Freight	1.4	11.6	45.0	101.7
Baggage	1.0	1.2	3.3	8.0
Others	0.5	0.9	2.8	8.7
<u>Total</u>	<u>19.6</u>	<u>31.1</u>	<u>103.9</u>	<u>283.5</u>
<u>Operating Expenses /a</u>				
Staff	-	13.2	44.6	110.1
Materials	-	11.2	38.5	89.5
Fuel	-	(3.9)	(15.3)	(35.7)
Others	-	(7.3)	(23.2)	(53.8)
Other costs	-	3.4	14.5	17.7
<u>Total</u>	<u>-</u>	<u>27.8</u>	<u>97.6</u>	<u>217.3</u>

/a 1980 figures for operating expenses have been revised from original budget.

Sources: (1) Statistical Yearbook of Railroad - 1981, KNR, Korea, p. 702.

(2) Bank's mission estimates.

KOREA
TRANSPORT SECTOR

KNR Railway Passenger Demand Forecast (1980-86)
(Unit: '000 passengers; million pass-km)

	1980	1981	1982	1983	1984	1985	1986	Average annual increase (%) (1982-86)
<u>Passengers</u>								
General	184,997	195,916	207,187	218,692	230,835	243,551	256,670	
(% increase)	(1.1)	(5.9)	(5.8)	(5.6)	(5.6)	(5.5)	(5.4)	5.6
Capital region	245,776	274,838	316,686	367,163	420,096	477,514	537,032	
(% increase)	(2.1)	(11.8)	(15.2)	(15.9)	(14.4)	(13.7)	(12.5)	14.3
<u>Total</u>	<u>430,773</u>	<u>470,754</u>	<u>523,873</u>	<u>585,855</u>	<u>650,931</u>	<u>721,065</u>	<u>793,702</u>	
(% increase)	(1.7)	(9.3)	(11.3)	(11.8)	(11.1)	(10.8)	(10.1)	11.0
<u>Passenger-km</u>								
General	17,204	18,477	20,030	21,685	23,607	25,548	27,529	
(% increase)	(0.7)	(7.4)	(8.4)	(8.3)	(8.9)	(8.2)	(7.8)	8.3
Capital region	4,436	4,924	5,624	6,492	7,397	8,410	9,461	
(% increase)	(3.2)	(11.0)	(14.2)	(15.4)	(13.9)	(13.7)	(12.5)	14.0
<u>Total</u>	<u>21,640</u>	<u>23,401</u>	<u>25,654</u>	<u>28,177</u>	<u>31,004</u>	<u>33,958</u>	<u>36,990</u>	
(% increase)	(1.2)	(8.1)	(9.6)	(9.8)	(10.0)	(9.5)	(8.9)	9.6
<u>Average Transport Distance (km)</u>								
General	93.0	94.3	96.7	99.2	102.3	104.9	107.3	
Capital region	18.0	17.9	17.8	17.7	17.6	17.6	17.6	

Source: "Draft" for preparation of Fifth Five-Year Social and Economic Plan - Transportation Sector, Aug. 1981, MOT. Korea, pp. 20-21.

KOREA

TRANSPORT SECTOR

Railway Investment Plan Summary (1982-86)
(Unit: Billion won; US\$ million; in 1980 prices)

Project category/project details	Funds required											Grand total	% of total	
	Local					Foreign								
	1982	1983	1984	1985	1986	Total	1982	1983	1984	1985	1986			Total
New Line Construction	3.5	3.7	-	-	83.4	90.6	-	-	-	-	191.2	191.2	207.2	15.7
High-speed line (Seoul-Daejeon, 160 km)	-	-	-	-	83.4	83.4	-	-	-	-	191.2	191.2	200.0	
Gunsan port line (Gunsan-Port, 10.4 km)	3.5	3.7	-	-	-	7.2	-	-	-	-	-	-	7.2	
Electrification	16.7	4.7	1.0	5.3	7.6	35.3	-	-	11.4	-	3.0	14.4	44.1	3.3
Gyeongwon line (Seongbug-Euijeongbu, 13.1 km)	16.7	4.7	-	-	-	21.4	-	-	-	-	-	-	21.4	
Jungang line (Jecheon-Yeongju, 64 km)	-	-	1.0	5.3	5.4	11.7	-	-	11.4	-	-	11.4	18.7	
Taebaeg line (Jecheon-Yeondang, 25.3 km)	-	-	-	-	2.2	2.2	-	-	-	-	3.0	3.0	4.0	
Increase in Station and Line Capacity	68.5	87.4	108.6	70.0	25.1	359.6	-	63.3	46.1	13.0	13.0	135.4	442.2	33.2
Double tracking	35.0	34.2	34.2	18.6	4.0	126.0	-	-	-	-	-	-	126.0	
Honam line (Iri-Songjeongri, 101.2 km)	35.0	34.2	34.2	16.6	-	120.0	-	-	-	-	-	-	120.0	
Taebaeg line (Jecheon-Yeondang, 25.3 km)	-	-	-	2.0	4.0	6.0	-	-	-	-	-	-	6.0	
Su-in line (gauge widening)	-	12.3	19.0	5.5	5.1	41.9	-	13.1	13.1	13.1	13.0	52.3	73.8	
Suweon, electric train turning-back line (Suweon-Pyeongdong, 4.1 km)	-	3.3	6.3	6.8	2.4	18.8	-	-	-	-	-	-	18.8	
Installation of crossing loops (10 places)	2.0	1.3	1.3	1.3	0.8	6.7	-	-	-	-	-	-	6.7	
Marshalling yards	2.5	4.2	8.3	-	-	15.0	-	-	-	-	-	-	15.0	
Station yards	3.2	3.2	3.2	3.2	3.2	16.0	-	-	-	-	-	-	16.0	
Freight terminals	10.5	11.8	11.8	10.5	1.4	46.0	-	-	-	-	-	-	46.0	
Extension of crossing loops	1.7	2.1	2.5	1.2	0.8	8.3	-	-	-	-	-	-	8.3	
Station installation	8.5	2.7	2.7	2.7	3.2	19.8	-	-	-	-	-	-	19.8	
Additional crossings	1.3	2.0	2.0	0.7	0.7	6.7	-	-	-	-	-	-	6.7	
Signaling	3.8	10.3	17.3	19.5	3.5	54.4	-	50.1	33.0	-	-	83.1	105.1	
Improvement of Way and Structures	18.4	18.6	20.0	31.6	38.6	127.2	18.7	18.7	18.7	18.7	18.3	93.1	184.0	13.8
Main-line improvement	-	-	-	13.0	17.0	30.0	-	-	-	-	-	-	30.0	
Rail renewal (750 km)	1.3	1.3	1.3	1.4	1.4	6.7	9.2	9.3	9.2	9.2	8.9	45.7	34.6	
Continuous welded rail (300 km)	0.8	0.8	0.8	0.8	0.9	4.1	3.5	3.4	3.4	3.4	3.3	17.1	14.5	
Sleeper renewal (200,000)	1.7	1.7	1.6	1.6	1.5	8.1	-	-	-	-	-	-	8.1	
Ballast (250,000 cu m)	0.6	0.6	0.6	0.6	0.5	2.9	-	-	-	-	-	-	2.9	
Separation of rail/road at crossing	5.0	5.0	5.0	5.0	5.0	25.0	-	-	-	-	-	-	25.0	
Track renewal (100 km)	2.3	2.3	2.3	2.3	2.4	11.6	1.1	1.1	1.2	1.2	1.1	5.7	15.1	
Point and crossings (500 sets)	0.9	1.0	0.9	1.0	1.0	4.8	-	-	-	-	-	-	4.8	
Tunnel strengthening (51)	1.0	0.9	1.0	0.9	1.0	4.8	-	-	-	-	-	-	4.8	
Bridge strengthening (50 spans)	1.5	1.6	1.5	1.6	1.6	7.8	-	-	-	-	-	-	7.8	
Track material workshop	0.3	0.3	2.0	0.3	2.9	5.8	4.9	4.9	4.9	4.9	5.0	24.6	20.8	
Water supply (34)	0.2	0.2	0.2	0.2	0.3	1.1	-	-	-	-	-	-	1.1	
Station facilities (12)	0.5	0.4	0.5	0.4	0.5	2.3	-	-	-	-	-	-	2.3	
Level crossing barriers (100)	0.2	0.2	0.2	0.2	0.2	1.0	-	-	-	-	-	-	1.0	
Right-of-way improvement - earthwork (55 places)	0.6	0.7	0.6	0.7	0.7	3.3	-	-	-	-	-	-	3.3	
Fence (79 places)	0.3	0.4	0.3	0.4	0.4	1.8	-	-	-	-	-	-	1.8	
Safety sidings (32)	0.3	0.3	0.3	0.3	0.3	1.5	-	-	-	-	-	-	1.5	
Right-of-way improvement	0.9	0.9	0.9	0.9	1.0	4.6	-	-	-	-	-	-	4.6	
Motive Power, Rolling Stock and Equipment	23.4	48.3	43.4	45.2	46.7	207.0	24.4	67.5	2	48.2	68.0	273.9	374.1	28.1
Motive power	21.2	42.1	36.4	39.6	39.2	178.5	8.5	10.6	4.6	0.5	0.7	24.9	193.7	
New	9.5	25.7	33.5	33.6	38.9	141.2	-	-	-	-	-	-	141.2	
Improvement	11.7	16.4	2.9	6.0	0.3	37.3	8.5	10.6	4.6	0.5	0.7	24.9	52.5	
New passenger car (464)	0.2	2.9	3.2	2.1	3.1	11.5	3.6	36.7	39.5	27.1	38.4	145.3	100.1	
Passenger car - improvement, installation of air-conditioning devices on existing limited express coach (425 cars)	-	0.8	2.0	1.6	2.0	6.4	-	3.6	9.7	8.0	10.0	31.3	25.5	
New freight cars (3,465)	2.0	2.5	1.8	1.9	2.4	10.6	12.3	16.6	12.0	12.6	19.0	72.4	54.8	
Rolling Stock Maintenance and Manufacturing	12.6	7.4	0.6	0.2	0.3	21.1	3.1	1.3	1.3	1.2	0.7	7.5	25.7	1.9
Daejeon workshop	10.0	4.3	-	-	-	14.3	-	-	-	-	-	-	14.3	
Improvement, existing workshops	1.9	2.5	-	-	-	4.4	1.8	-	-	-	-	-	1.8	
Sheds - improvement	0.4	0.3	0.3	-	-	1.0	-	-	-	-	-	-	1.0	
Machineries	0.3	0.3	0.3	0.2	0.3	1.4	1.3	1.3	1.3	1.2	0.7	5.7	4.9	
Telecommunications, Power and Others	15.9	9.8	8.5	9.6	9.7	53.5	-	-	-	-	-	-	53.5	4.0
Telecommunications	10.1	3.1	0.8	-	-	14.0	-	-	-	-	-	-	14.0	
Power facilities	1.3	2.2	2.4	0.3	0.4	6.6	-	-	-	-	-	-	6.6	
Buildings and others	-	-	-	4.8	4.8	9.6	-	-	-	-	-	-	9.6	
Welfare	2.5	2.5	3.3	2.5	2.5	13.3	-	-	-	-	-	-	13.3	
Office furniture and other	2.0	2.0	2.0	2.0	2.0	10.0	-	-	-	-	-	-	10.0	
Total	159.0	179.9	182.1	161.9	211.4	894.3	46.2	150.8	143.3	81.2	294.1	715.6	1,330.8	100.0

Source: KNR, April 1982.

KOREA

TRANSPORT SECTOR

Status of Investment for SMESRS (1972-86)^{/a}

			<u>Fixed Installations</u>		
<u>Lines</u>	<u>Sections</u>	<u>Items</u>	<u>Investment periods (W mln)</u>		
			<u>1972-76</u>	<u>1977-81</u>	<u>1982-86</u>
<u>Past Investments</u>					
Gyeongin line	Guro-Incheon	Electrification	5,045	-	-
Gyeongbu line	Seoul-Suweon	Electrification	3,420	-	-
Gyeongweon line	Yongsan-Seongbug	Electrification	1,197	-	-
Gyeongbu line		Double tracking	-	36,010	-
Other facilities		Railcar depot, signal & etc.	15,522	-	-
<u>Planned Investments</u>					
Gyeongweon line	Seongbug-Euijeongbu	Electrification	-	-	21,400

Rolling Stocks

<u>Past Investments</u>	<u>1974</u>	<u>1975</u>	<u>1976</u>	<u>1977</u>	<u>1978</u>	<u>1979</u>	<u>1980</u>	<u>1981</u>
No. of railcars in fleet	126	126	128	171	215	252	286	320
<u>Planned Investments</u>	<u>1982</u>	<u>1983</u>	<u>1984</u>	<u>1985</u>	<u>1986</u>			
No. of railcars in fleet	320	340	362	414	445			

^{/a} Seoul Metropolitan Electrified Suburban Railway System.

Source: KNR, April 1982.

KOREA

TRANSPORT SECTOR

Major Constraints for Operating Longer Trains by Line

Line	Passenger		Freight		Length of crossing loops		Major constraints	Improvement plan
	No. of cars	Meters	No. of cars	Meters	Up (m)	Down (m)		
Gyeongbu								
Maximum	17+1	375	35+1	500	440	440	Pass. train: weak traction power to attain high speed.	Installation of CTC between Suweon and Daejeon (5th plan).
Average	10+1	229	25+1	363			Frequent train: crossing loop and frequency of pass. train.	Construction of new high-speed line (1986 and beyond).
Honam								
Maximum	11+1	250	35+1	500	341	341	Inferior track (speed) and single line.	Double tracking between Iri and Sonjeongri 1981-85).
Average	8+1	187	24+1	349			Short crossing loops (2 stations).	Additional crossing loops (1 station between Songjeongri and Mogpo).
Jeonra								
Maximum	12+1	271	14+1	212	264	275	Shortage of traction power due to bad alignment and sharp grade.	Upgrading through realignment and track strengthening (5th-6th plan).
Average	7+1	166	13+1	198			Short crossing loops.	Add'l crossing loops (2 stations in 5th plan).
Jungang								
Maximum	13+1	292	28+1	404	418	407	Bad alignment and sharp grade.	Electrification between Jecheon and Yeongju (64 km, 5th plan).
Average	8+1	187	26+1	376			Short crossing loops (south of Jecheon). Capacity limit.	Add'l crossing loops (2 stations in 5th plan).
Taebaeg								
Maximum	11+1	250	27+1	390	308	308	Bad alignment and sharp grade.	Installation of CTC between Jecheon-Baegsan (107 km, 5th plan).
Average	8+1	187	26+1	376			Capacity limit.	Partial double tracking between Jecheon-Yeondang (5th plan).
Janghang								
Maximum	9+1	208	28+1	404	286	264	Shortage of traction power due to bad alignment.	Upgrading through realignment and track strengthening (5th-6th plan).
Average	7+1	166	17+1	253			Short crossing loops.	Add'l crossing loop (1 station in 5th plan).
Yeongdong								
Maximum	11+1	229	27+1	390	209	209	Same as above.	Electrification between Yeongju-Cheolam (6th plan).
Average	7+1	166	23+1	335				Extension of crossing loops.
Donghaenambu								
Maximum	7+1	166	27+1	390	242	242	Short crossing loops.	Additional crossing loop (1 station).
Average	6.5+1	156	21+1	308			Capacity limit.	Double tracking (beyond 6th plan)
Gyeongjeon								
Maximum	7+1	166	20+1	294	242	242	Bad alignment.	1 additional crossing loop.
Average	6+1	140	17+1	253			Short crossing loops.	Extension of crossing loops.
Gyeongbug								
Maximum	6+1	140	14+1	212	363	363	Bad alignment and sharp grade (between Jeomchon-Gimcheon).	Same as Gyeongjeon line.
Average	5+1	125	13+1	198			Short crossing loops.	

Source: KNR, April 1982.

KOREA
TRANSPORT SECTOR

Railway Capacity Requirements Forecast
(Unit: runs per day)

Line name	Section	Present capacity	Requirements					Action planned	Post-action capacity
			1982	1983	1984	1985	1986		
<u>Gyeongbu</u> (Seoul-Busan)	Seoul-Suweon	133	150	168	183	282	221	Build Double-Double Track	266
	Suweon-Chonan	101	95	115	123	135	145	Increase CTC & ABS	145
	Chonan-Chochiwon	95	82	104	112	122	132	Increase CTC & ABS	136
	Chochiwon-Daejeon	102	79	91	98	106	115	Increase CTC & ABS	136
<u>Jungang</u>	Jecheon-Todam	29	29	31	33	34	37	Electrification and improvement of signals	40
	Todam-Yongju	31	21	23	24	26	27	Build a new interchange station	37
	Tongju-Tongcheon	30	29	29	30	32	32	Build a new interchange station	32
<u>Honam</u>	Iri-Songjeongri	33	26	29	31	35	37	Change to Double track	61
	Songjeongri-Mogpo	27	22	23	25	27	29	Build a new interchange station	30
<u>Jeonra</u>	Chonju-Suncheon	24	20	21	22	25	26	Build a new interchange station	26
<u>Taebaeg</u>	Jecheon-Ssangyong	47	44	47	45	50	53	CTC between Chechon-Cholam	113
	Ssangyong-Yongweol	32	31	36	41	43	44	(Double-track electric line	83
	Yongweol-Paeksan	29	28	31	33	33	35	(Chechon-Yondang	35
<u>Donghaenambu</u>	Busan-Ulsan	22	22	20	20	22	23	Build a new interchange station	28
	Ulsan-Gyeongju	26	27	27	28	30	31	Build a new interchange station	36
<u>Gyeongjeon</u>	Hwasun-Gwangju	19	18	18	19	21	21	Build a new interchange station	23
<u>Janghang</u>	Daecheon-Janghang	19	19	22	23	24	26	Build a new interchange station	45
<u>Gyeongin</u>	Yonggok-Munsan	26	22	23	24	25	27	Build a new interchange station	30
<u>Gyeongweon</u>	Seongbuk-Eijongbu	28	27	29	32	36	38	Double-track electric line	67

Source: The Fifth Five-Year Economic and Social Development Plan - Transportation Sector Plan (1982-1986), 1981, Transportation Sector Planning Task Force, MOT, Korea, p. 44.

KOREA

TRANSPORT SECTOR

KNR Financing Plan (1982-86)
(Unit: Billion Won)

	1982	1983	1984	1985	1986	Total
<u>Funds Required</u>	222.8	310.9	314.4	269.5	444.7	1,559.3
For investment	187.2	271.9	269.5	211.4	390.8	1,330.8
For debt repayment	35.6	39.0	41.9	58.1	53.9	228.5
<u>Current Account</u>						
Earnings	419.0	461.9	508.4	549.9	593.7	2,532.9
Expenditures	399.4	421.4	447.2	483.4	497.6	2,249.0
Usable funds	19.6	40.5	61.2	66.5	96.1	283.9
Shortage of funds	167.6	231.4	208.3	144.9	294.7	1,046.9
<u>Funding Measures</u>						
Own capital	71.0	97.0	122.5	145.7	172.8	609.0
Net profit per period	24.7	45.8	65.9	83.5	103.6	323.5
Depreciation allowances	36.8	41.6	47.0	52.6	59.6	237.6
Sale of assets	9.5	9.6	9.6	9.6	9.6	47.9
Borrowing	74.4	71.9	54.5	37.0	6.8	244.6
Foreign credit	28.2	92.0	87.4	49.5	179.4	436.5
Subsidy	49.2	50.0	47.0	37.3	85.7	269.2

Source: The Fifth Five-Year Economic and Social Development Plan - Transportation Sector Plan (1982-86), Transportation Sector Planning Task Force, MOT, Korea, p. 65.

KOREA
TRANSPORT SECTOR

Korean National Railroad (KNR)

Summarized Forecasted Financial Statements
(Won billion)

	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
Traffic										
Passengers (million pass-km)	21,343	22,464	23,443	24,478	25,705	26,862	28,071	29,334	30,654	32,033
Freight (million ton-km)	10,383	10,833	11,601	12,415	12,953	13,600	14,281	14,995	15,744	16,532
Total (million traffic units)	31,726	33,297	35,044	36,893	38,658	40,462	42,352	44,334	46,398	48,565
Income Statement										
Gross operating revenue	404.6	471.0	546.2	614.4	684.8	709.6	862.8	967.2	1,084.2	1,217.0
Working costs	357.5	379.3	410.7	445.6	479.7	515.6	569.4	628.6	704.7	791.0
Depreciation	46.2	51.0	56.7	63.1	70.4	75.0	81.0	88.0	94.0	100.0
Net Operating Revenue /a	0.9	40.7	78.8	105.7	134.7	179.0	212.4	250.6	285.5	326.0
Net nonoperating revenue	3.0	3.0	3.1	3.2	3.3	3.5	4.0	4.5	5.0	5.5
Interest charges	80.6	92.0	104.1	117.0	125.5	136.9	156.7	164.8	179.1	191.4
Net Profit (Loss)	(76.7)	(54.3)	(22.2)	(8.1)	12.5	45.6	59.7	90.3	111.4	140.1
Ratios (%)										
Working	88.0	81.0	75.0	73.0	68.0	67.0	66.0	65.0	65.0	65.0
Operating	100.0	91.0	86.0	83.0	80.0	77.0	75.0	74.0	74.0	73.0
Sources and Applications of Funds										
Sources										
Cash generated by KNR	55.1	100.7	145.1	179.5	216.8	267.0	308.4	355.6	399.4	447.5
Government contributions	18.0	27.5	40.0	70.0	60.0	60.0	65.0	70.0	75.0	80.0
Subsidies against operating losses	34.8	35.4	65.0	65.0	50.0	-	-	-	-	-
Borrowing	178.0	184.2	134.7	233.2	185.3	218.0	273.0	228.0	205.0	200.0
Total Sources	285.9	347.8	384.8	547.7	512.1	545.0	646.4	653.6	679.4	727.5
Applications										
Investments	176.1	208.5	231.2	257.8	275.9	300.0	325.0	350.0	375.0	400.0
Debt services	121.5	134.8	146.6	217.9	227.1	199.1	272.6	237.2	259.0	280.6
Total Applications	297.6	343.3	377.8	475.7	503.0	499.1	597.6	587.2	634.0	680.6
Annual variations in working capital	(11.7)	4.5	7.0	72.0	9.1	45.9	48.8	66.4	45.4	46.9
Ratios										
Debt service coverage										
Balance Sheet										
Assets										
Working capital	(92.6)	(88.1)	(81.1)	(9.1)	0.0	45.9	94.7	161.1	206.5	253.4
Net fixed assets	2,105.4	2,318.6	2,553.3	2,814.1	3,097.5	3,390.4	3,721.3	4,077.3	4,455.4	4,864.4
Other assets	70.1	70.1	70.1	70.1	70.1	75.0	77.0	80.0	85.0	90.0
Total Assets	2,082.9	2,300.6	2,542.3	2,875.1	3,167.6	3,511.3	3,893.0	4,318.4	4,746.9	5,207.8
Liabilities										
Long-term debt	844.4	988.8	1,084.5	1,220.3	1,308.0	1,463.8	1,620.9	1,776.5	1,901.6	2,012.4
Equity equivalent	1,238.5	1,311.8	1,457.8	1,654.8	1,859.6	2,047.5	2,272.1	2,541.9	2,845.3	3,195.4
Total Liabilities	2,082.9	2,300.6	2,542.3	2,875.1	3,167.6	3,511.3	3,893.0	4,318.4	4,746.9	5,207.8
Ratios										
Average net fixed assets in use	1,861.0	2,068.0	2,271.0	2,501.0	2,756.0	3,035.0	3,341.0	3,674.0	4,032.0	4,415.0
Rate of return on average net fixed assets in use (%)	-	2.0	3.5	4.2	4.9	5.9	6.4	6.8	7.1	7.4
Debt to equity	41/59	43/57	43/57	42/58	41/59	42/58	42/58	41/59	40/80	39/61

/a Compensation for losses on ordinary trains and commuters not included in the net operating revenue.

Source: KNR and Bank Staff.

Date: February 1983.

KOREA

TRANSPORT SECTOR

KNR's Programs to Reduce Uneconomic Services
(1974-86)

A. Closing Uneconomic Lines

<u>Line</u>	<u>Section</u>	<u>Length (km)</u>	<u>Date</u>
<u>Actual, 1974-81</u>			
Danginri	Seogang-Danginri	2.4	Mar 1980
Kimpo	Bucheon-Kimpo	9.2	Jul 1980
Jinsam	Sacheon-Samcheonpo	18.6	Oct 1980
<u>Planned, 1982 and Beyond</u>			
Anseong	Cheonan-Anseong	28.4	Apr 1982
Hwasun	Hwasun-Bogam	11.1	
Ogku	Gunsan-Oggu	11.8	
Jinsam	Jinju-Samcheonpo	29.1	

B. Discounting Local Trains (1974-81)

<u>Line</u>	<u>Section</u>	<u>No. of trains</u>	<u>Date</u>
Gyeongbu		1	Nov 1974
	Seoul-Cheonan	2	Nov 1974
Jungang		2	Nov 1974
Daegu	Daegu-Pohang	2	Jan 1977
	Daegu-Gyeongju	2	Jan 1977
	Daegu-Yeongcheon	2	Jan 1977
Jinsam	Jinju-Samcheonpo	2	Nov 1980
Donghaenambu	Pohang-Gyeongju	1	Jan 1977
	Gyeongju-Busan	2	Jan 1977
	Ulsan-Busan	2	Jan 1977
	Busan-Gyeongju	1	Nov 1977
	Gyeongju-Pohang	1	Nov 1981

C. Adjustment of Train Class

Actual (1974-81):

<u>Line</u>	<u>Section</u>	<u>No. of trains</u>	<u>Date</u>	<u>Past class</u>	<u>New class</u>
Jungang	Cheongryangri-Andong	2	Nov 1976	Local	Local express
Chungbug	Seoul-Jecheon	2	Nov 1976	Local	Ltd. express
Taebaeg	Cheongryangri-Bugpyeong	2	Nov 1980	Ltd. express	A/C Ltd. express
Gyeongbu	Seoul-Busan	8	Nov 1980	Ltd. express	A/C Ltd. express
Jungang	Cheongryangri-Andong	2	Nov 1980	Ltd. express	A/C Ltd. express
Taebaeg	Cheongryangri-Gangneung	2	Dec 1980	Local	Ltd. express
Jungang	Cheongryangri-Busan	2	Dec 1980	Local	Ltd. express
Gyeongchun	Cheongryangri-Chuncheon	4	Nov 1980	Local express	Ltd. express
Gyeongbu	Seoul-Busan	4	Mar 1981	Ltd. express	A/C Ltd. express
Jungang	Cheongryangri-Andong	2	Mar 1981	Local express	Ltd. express
Jungang	Yeongju-Dongdaegu	2	Mar 1981	Local express	Ltd. express
Gyeongchun	Cheongryangri-Chuncheon	4	Jul 1981	Local	Ltd. express
Jungang	Cheongryangri-Guyeolri	2	Oct 1981	-	New A/C Ltd.exp.
Gyeongjeon	Busan-Mogpo	2	Oct 1981	-	New A/C Ltd.exp.
	<u>Total</u>	<u>40</u>			

Planned (1982-86):

Gyeongbu	Daegu-Busan	6	1982	Ord. express	Ltd. express
	Throughout network	6	1983	Local	Local
		12	1983	Ord. express	Ltd. express
		-	1983	Ltd. express	A/C Ltd. express
Suin	Operating ratio:	4	1984	Local	Closing
Jinhae	300 and above	4	1984	Local	Closing
Samcheog		2	1984	Local	Closing
Gyeongchun		4	1984	Local	Closing
Gyeongjeon		2	1984	Local	Closing
Gunsan		4	1984	Local	Closing
Gyeongbug		2	1984	Local	Closing
Mungeong		4	1984	Local	Closing
Chungbug		4	1984	Local	Closing
	Throughout network	-	1985	Ltd. express	A/C Ltd. express
	Throughout network	-	1986	Ltd. express	A/C Ltd. express

Source: KNR, April 1982.

KOREA
TRANSPORT SECTOR

Subway Investment Plan by Year (1982-86)
(Unit: Billion Won)

(1980 prices)

Subway line	Area covered	Distance (km)	Construction period	Amount of investment	1982	1983	1984	1985	1986
<u>Seoul</u>									
No. 2 line	City hall-City hall (loop line)	48.8	1978-83	440.4	207.4	233.0	-	-	-
No. 3 line	Kupabal - Yangjae Dong	27.0	} 1980-85	889.7	191.1	202.6	218.0	278.0	-
No. 4 line	Sangkye Dong - Sadang Dong	30.0							
<u>Pusan</u>									
No. 1 line	Stadium - Chongyong Dong	25.3	1980-85	215.4	57.0	57.0	50.7	50.7	-
No. 2 line	Kamjeon-Samkori - Suyong	20.8	1985-89	90.0	-	-	-	45.0	45.0
<u>Total</u>				<u>1,635.5</u>	<u>455.5</u>	<u>492.6</u>	<u>268.7</u>	<u>373.7</u>	<u>45.0</u>

Source: The Fifth Five-Year Economic and Social Development Plan - Transportation Sector Plan (1982-1986), 1981, Transportation Sector Planning Task Force, MOT, Korea, pp. 92-93.

KOREATRANSPORT SECTORSubway Investment Financial Plan (1982-86)

(Unit: Billion Won)

(1980 prices)

Project	Capital required		Total	Financial sources		Period
	Domes- tic	Foreign (US\$ M)		Govern- ment	Private	
Seoul #2 City hall-City hall (Loop line)	425.6	24.3	440.4	317.6	122.8	1978-83
Seoul 3 + 4 Kupabal-Yangjae Dong Sangkye Dong-Sadang Dong	659.8	376.8	889.7	320.0	569.7	1980-85
Busan #1 Stadium-Chongyong Dong	169.1	75.9	215.4	125.1	90.3	1980-85
Busan #2 Kamjeon-Samkori-Suyong	70.0	32.8	90.0	45.0	45.0	1985-89
<u>Total</u>	<u>1,324.5</u>	<u>509.8</u>	<u>1,635.5</u>	<u>807.7</u>	<u>827.8</u>	

Source: The Fifth Five-Year Economic and Social Development Plan - Transporta-
tion Sector Plan (1982-1986), 1981, Transportation Sector Planning Task
Force, MOT, Korea, pp. 218-221.

KOREA

TRANSPORT SECTOR

Comparative Rail and Road Tariffs for Selected Commodities
(As of March 20, 1982)

(Won per ton)

Commodity	Section	Dis- tance (km)	Railroad			Road /a			Road /b			Road /c		
			Line haul rates	Other charges/d	Total	Line haul rates	Other charges	Total	Line haul rates	Other charges	Total	Line haul rates	Other charges	Total
Steel	Goedong-Oryudong	432	6,453	11,510	17,963	22,206	2,038	24,244	18,875	2,038	20,913	11,000	2,038	13,038
Con- tainer	Busanjin-Yongsan	420	6,453	4,046	10,499	10,633	-	10,633	-	-	-	-	-	-
Cement	Ssangyong-Yongsan	246	4,134	5,754	9,888	15,320	1,528	16,848	13,022	1,528	14,550	-	-	-
Grain	Jeongeub-Yongsan	297	3,780	8,453	12,233	17,370	1,019	18,389	15,630	1,019	16,649	-	-	-

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/a Authorized rates.

/b Discounted rates (15%, for distance beyond 170 km).

/c Dumping rates (applied by most companies now).

/d Handling and delivering charges invoiced by trucking companies.

Source: KNR, April 1982.

Table 3.20

KOREA

TRANSPORT SECTOR

Occupancy Ratio of Passenger Trains (January 1982)

Line	Saemaul			A/C limited express			Limited express			Local express			Local			Total		
	Pass. capacity by coach	No. of pass.	Ratio	Pass. capacity by coach	No. of pass.	Ratio	Pass. capacity by coach	No. of pass.	Ratio	Pass. capacity by coach	No. of pass.	Ratio	Pass. capacity by coach	No. of pass.	Ratio	Pass. capacity by coach	No. of pass.	Ratio
Gyeongbu	36.5	77		53.0	78		78.5	112		53.4	47		75.6	66		66.2	68	
Jungang	14.2	30		47.8	71		63.7	91		-	-		81.7	72		65.3	67	
Honam	21.6	45		40.8	60		61.3	89		75.7	66		76.5	67		61.4	63	
Jeonra	7.1	15		31.1	46		44.5	64		14.1	12		46.0	40		43.4	45	
Chungbug							28.6	41		-	-		61.7	54		52.0	53	
Suin							-	-		-	-		-	-	50.0	21.3	43	
Janghang				50.0	74		61.6	88		-	-		63.2	55		60.6	62	
Gyeongeu													59.7	52		59.7	61	
Gyeongweon							36.1	52					27.4	24		27.6		
Gyeongchun							57.6	83					36.2	32		41.5	43	
Gyeongbug										79.3	70		44.6	39		48.7	50	
Yeongdong				20.1	30		56.7	81		-	-		46.6	41		49.9	51	
Taebaeg				57.9	86		53.3	76		-	-		62.4	55		58.6	60	
Donghaenambu							53.2	76		18.4	16		75.9	67		67.8	69	
Daegu	15.4	32		-			36.8	53		-	-		57.8	51		45.6	47	
Gyeongjeon	21.4	45		30.2	45		41.8	60		39.0	34		59.4	52		50.7	52	
Total	47.7	34.5	72	67.7	50.6	75	69.8	68.6	98	114.0	49.8	44	114.0	63.9	56	97.6	61.3	63

Source: KNR, April 1982.

KOREA
TRANSPORT SECTOR

Operating Patterns of SMESRS /a (1974-82)

	<u>August 1974</u>			<u>January 1976</u>			<u>April 1978</u>			<u>July 1979</u>			<u>January 1981</u>			<u>January 1982</u>		
	<u>Headway</u>		<u>No. of trains</u>	<u>Headway</u>		<u>No. of trains</u>	<u>Headway</u>		<u>No. of trains</u>	<u>Headway</u>		<u>No. of trains</u>	<u>Headway</u>		<u>No. of trains</u>	<u>Headway</u>		<u>No. of trains</u>
<u>Number of trains and headway (min.)</u>	<u>Rush hour</u>	<u>Nor-mal</u>		<u>Rush hour</u>	<u>Nor-mal</u>		<u>Rush hour</u>	<u>Nor-mal</u>		<u>Rush hour</u>	<u>Nor-mal</u>		<u>Rush hour</u>	<u>Nor-mal</u>		<u>Rush hour</u>	<u>Nor-mal</u>	
<u>Section</u>																		
Seongbug-Cheongryangri	40	40	27	11	125	85	7	8	127	6	8	135	6	8	127	6	8	129
Cheongryangri-Guro	10	10	105	5.5	6	165	3.5	4	250	3	4	270	3	4	260	3	4	263
Guro-Incheon	20	20	54	11	12.5	88	7	8	132	6	8	139	6	8	137	6	8	140
Guro-Suweon	40	40	27	22	25	42	14	24	52	12	24	56	12	16	69	12	16	70
Yongsan-Seongbug							18	24	24	18	24	45	18	24	45	18	24	70
<u>Occupancy Ratio</u>																		
	<u>1977</u>			<u>1978</u>			<u>1979</u>			<u>1980</u>			<u>1981</u>					
No. of passengers ('000)	139,386			195,397			240,718			245,776			268,364					
Passenger-km ('000)	2,536,321			3,466,229			4,299,766			4,435,714			4,976,136					
Passenger car-km ('000)	26,426			36,357			42,008			43,085			53,068					
No. of passengers per car	96			95			102			103			94					
Regular capacity (seating 54, standing 102)	156			156			156			156			156					
Occupancy ratio (%)	62			61			65			66			60					

Number of Cars per Train Increased from 6 to 8:

January 12, 1981: 6 trains
April 1, 1981 : 11 trains

December 1, 1980: 14 trains
March 13, 1981 : 7 trains

Total: 38 trains

/a Seoul Metropolitan Electrified Suburban Railway System.

Source: KNR, April 1982.

KOREA

TRANSPORT SECTOR

Korean Ports System

<u>Commercial ports</u>		<u>Industrial ports</u>	<u>Fishing ports</u>			<u>Others</u>	
<u>1st class</u>	<u>2nd class</u>		<u>1st class</u>	<u>2nd class</u>	<u>3rd class</u>	<u>Without basic facilities</u>	
Busan	Yeongpyeongdo	Pohang					
Incheon	Gwangcheon	Changwon					
Kunsan	Daecheon	Onsan					
Mokpo	Daeheugsando	Bukpyung					
Yeosu	Wando	Yochun					
Masan	Geomundo	Samcheonpo					
Ulsan	Narodo	Ogpo					
Mukho	Hanrim	Ulsan					
Cheju	Seongsanpo	Jugdo					
Janghang	Hwansun	Anjeon					
Seogwipo	Gujora	Jisepo					
Chungmu	Busan Southern Port	Asan					
Samcheonpo	Gampo						
Jinhae	Guryongpo						
Jangseungpo	Weolpo						
Ogpo	Gangu						
Pohang	Dodong						
Samil	Hupo						
Bugpyeong	Jugbyeon						
Sogcho	Imwon						
Samcheog	Jumunjin						
	Geojin						
<u>Total</u>	<u>21</u>	<u>22</u>	<u>12</u>	<u>37</u>	<u>344</u>	<u>24</u>	<u>1,409</u>
<u>GRAND TOTAL</u>	<u>1,869</u>			<u>403</u>			

Source: KMPA.

KOREA
TRANSPORT SECTOR

Ports Cargo Handling Capacities (1961-80)
([^]000 M/T)

	1961	1966	1971	1976	1980
<u>General Ports</u>					
Busan	3,950	4,990	5,740	7,000	14,000
Incheon	1,300	1,420	1,420	8,720	8,720
Kunson	520	540	540	540	1,540
Mokpo	320	443	443	515	515
Yosu	610	681	698	2,998/a	4,722
Masan	670	670	703	1,433	2,033
Ulsan	-	500	1,312	1,466	2,390
Mukho	980	2,450	4,420	4,500	6,500
Cheju	150	150	236	593	800
Others /b	160	2,446	2,909	1,210	5,465
Subtotal	<u>8,660</u>	<u>14,290</u>	<u>18,421</u>	<u>28,975</u>	<u>46,685</u>
<u>Industrial Ports</u>					
Pohang	360	360	360	5,025	22,160
Bukpyung	-	-	-	-	10,070
Subtotal	<u>360</u>	<u>360</u>	<u>360</u>	<u>5,025</u>	<u>32,230</u>
<u>GRAND TOTAL</u>	<u>9,020</u>	<u>14,650</u>	<u>18,781</u>	<u>34,000</u>	<u>78,915</u>

/a Cargo Handling Capacity of Samil Port are included with Yosu Port.

/b Includes also industrial ports.

Sources: Handbook of Korean Economy - 1980, EPB, Korea, pp. 365-366.

KOREA

TRANSPORT SECTOR

Ports Cargo Traffic (1961-81)
(¹000 Revenue Tons)

Year	Entered			Cleared			Total		
	Ocean-going vessels	Coastal vessels	Subtotal	Ocean-going vessels	Coastal vessels	Subtotal	Ocean-going vessels	Coastal vessels	Total
1961	2,450	1,158	3,608	964	1,073	2,037	3,414	2,231	5,645
<u>First FYP</u>									
1962	3,700	1,489	5,189	803	1,593	2,395	4,503	3,082	7,585
1963	4,396	1,527	5,923	861	1,694	2,555	5,257	3,221	8,478
1964	4,163	1,598	5,761	1,061	1,912	2,973	5,224	3,510	8,734
1965	5,174	2,271	7,445	1,577	2,282	3,859	6,751	4,553	11,304
1966	6,772	2,406	9,178	1,663	2,184	3,847	8,435	4,590	13,025
<u>Second FYP</u>									
1967	9,732	4,186	13,923	1,786	4,159	5,945	11,523	8,345	19,868
1968	13,542	5,657	19,199	2,253	5,548	7,801	15,795	11,205	2,7000
1969	17,109	8,063	25,172	2,891	8,164	11,055	20,000	16,227	36,227
1970	18,695	10,477	29,172	3,589	10,544	14,133	22,284	21,021	43,305
1971	24,257	11,264	35,521	4,192	11,261	15,453	28,449	22,525	50,974
<u>Third FYP</u>									
1972	24,699	8,916	33,615	6,010	8,657	14,667	30,709	17,573	48,282
1973	31,798	9,747	41,545	7,964	9,747	17,711	39,762	19,494	59,256
1974	33,830	10,827	44,657	8,258	10,827	19,085	42,088	21,654	63,742
1975	35,142	11,541	46,683	9,986	11,540	21,526	45,128	23,081	68,209
1976	41,447	13,532	54,979	14,311	13,532	27,843	55,757	27,064	82,822
<u>Fourth FYP</u>									
1977	51,498	15,816	67,314	16,814	15,816	32,830	68,312	31,632	99,944
1978	61,843	16,827	78,670	16,039	16,827	32,866	77,882	33,654	111,536
1979	72,992	18,759	91,751	17,828	18,759	36,587	90,820	37,518	128,338
1980	71,400	18,900	90,300	22,700	18,900	41,600	94,100	37,800	131,900
1981	79,000	21,850	100,850	26,300	21,850	48,150	105,300	43,700	149,000
<u>Average Annual Growth Rate (%)</u>									
1962-67	12.8	10.1	12.1	15.7	6.5	9.9	13.4	8.3	11.4
1967-72	20.1	22.0	20.5	18.6	29.9	21.0	19.8	22.0	20.4
1972-77	10.9	8.7	10.3	19.0	9.4	13.7	12.7	9.0	11.4
1977-81	8.9	6.7	8.4	9.4	6.7	8.0	9.0	6.7	8.4

Sources: (1) Handbook of Korean Economy - 1980, EPB, Korea, p. 359.
(2) KMPA.

KOREA

TRANSPORT SECTOR

Comparison of Stevedoring Capacity and Requirement (end-1981)
('000 M/T/year)

	Maximum vessel size ('000 DWT)	Berthing capacity (ships)	Stevedoring capacity (A)	Stevedoring requirement (B)	Excess (+) deficiency (-) (B-A)
<u>General Ports</u>					
Busan	50	52	15,000	25,985	-10,985
Incheon	50	30	9,700	15,955	-6,255
Kunsan	20	6	1,540	1,624	-84
Mokpo	10	4	1,000	759	+241
Yosu	6	7	1,698	1,202	+496
Masan	20	11	2,130	2,271	-141
Ulsan	40	15	2,657	5,160	-2,503
Mukho	10	6	6,530	3,230	+3,300
Cheju	5	6	843	1,287	-444
Others	-	18	6,824	4,721	+2,103
<u>Total</u>		<u>155</u>	<u>47,922</u>	<u>62,194</u>	<u>-14,272</u>
<u>Industrial Ports</u>					
Pohang	100	20	23,815	24,105	-290
Changwon	20	4	1,200	1,850	-650
Onsan	20	1	1,190	750	+240
Bukpyung	50	10	10,600	6,882	+3,718
Yochun	50	12	4,024	3,032	+992
<u>Total</u>	<u>240</u>	<u>47</u>	<u>40,829</u>	<u>36,819</u>	<u>+4,010</u>
<u>GRAND TOTAL</u>		<u>202</u>	<u>88,751</u>	<u>99,013</u>	<u>-10,262</u>
Capacity and requirement ratio (A/B)					0.896

Sources: (1) "Draft" for Preparation of the Fifth Five-Year Social and Economic Plan - Transportation Sector Plan, August 1981, MOT, Korea, p. 49.

(2) Transport Plan - Sea Transport and Ports, September 1, 1981, The 2nd Planning Section, MOT, Korea, p.5

KOREATRANSPORT SECTORComparison of Stevedoring Capacity and Requirement (1961-86)
(¹000 M/T/year)

	Stevedore Requirement	Stevedore Capability	Excess (+) Deficiency (-)
<u>Actual</u>			
1961	5,645	9,020	3,375
1966	10,080	14,650	4,750
1971	20,312	18,751	-1,561
1976	48,509	34,000	-14,509
1980	83,400	82,261	-1,139
1981	99,013	88,751	-10,262
<u>Forecast</u>			
1982	112,051	102,026	-10,025
1983	122,644	113,780	-8,864
1984	134,584	119,010	-15,574
1985	149,115	120,987	-28,128
1986	164,941	133,640	-31,301

Sources: (1) The Fifth Five-Year Economics and Social Development Plan - Transportation Sector Plan (1982-1986), December 1981, Transportation Sector Planning Task Force, MOT, Korea, p. 106.

(2) "Draft" for preparation of the Fifth Five-Year Social and Economic Plan - Transportation Sector Plan, August 1981, MOT, Korea, p. 49.

(3) KMPA.

KOREA
TRANSPORT SECTOR

Evolution of Marine Fleet (1961-80)
(Unit: '000 G/T)

	<u>Passenger</u>		<u>By tonnage of vessels</u>								<u>By type of movement</u>				<u>Freight coverage rate by native ships</u>					
			<u>Cargo</u>		<u>Tanker</u>		<u>Others</u>		<u>Grand total</u>		<u>Coastal</u>		<u>Ocean-going</u>		<u>Total freight</u>	<u>Korean flag</u>	<u>Coverage</u>	<u>Shipping income</u>		
	<u>No.</u>	<u>Ton- nage</u>	<u>No.</u>	<u>Ton- nage</u>	<u>No.</u>	<u>Ton- nage</u>	<u>No.</u>	<u>Ton- nage</u>	<u>No.</u>	<u>Ton- nage</u>	<u>No.</u>	<u>Ton- nage</u>	<u>No.</u>	<u>Ton- nage</u>	<u>No.</u>	<u>Ton- nage</u>	<u>-- ('000 tons) --</u>	<u>cover- age</u>	<u>(%)</u>	<u>(US\$ mln)</u>
1961	215	12	711	134	58	17	1,069	79	2,053	242	-	64	-	178	4,126	920	22.0			
1966	234	17	691	215	145	19	489	19	1,559	270	1,461	50	98	219	8,435	2,067	25.0		19.9	
1971	211	18	1,570	582	278	347	861	30	2,920	977	2,785	235	135	742	28,449	6,543	23.0		85.0	
1976	155	17	1,511	1,779	437	1,229	1,220	47	3,323	3,072	2,896	165	427	2,907	55,757	21,578	38.7		424.8	
1980	148	27	1,338	3,536	440	1,824	1,971	49	3,897	5,436	-	261	-	5,175	94,035	46,450	49.4		1,884.7	

- Sources: (1) Handbook of Korean Economy - 1980, EPB, Korea, p. 358.
(2) The Fifth Five-Year Economics and Social Development Plan - Transportation Sector Plan (1982-1986), December 1981, Transportation Sector, Planning Task Force, MOT, Korea, p. 101.
(3) "Draft" for Preparation of the Fifth Five-Year Social and Economic Plan - Transportation Sector Plan, Aug. 1981, MOT, Korea, p. 45.

KOREATRANSPORT SECTORCoastal Shipping Fleet by Type (end-1981)

Tonnage	Passenger ship		Cargo ship		Tanker		Total	
	No.	Tonnage	No.	Tonnage	No.	Tonnage	No.	Tonnage
Over 10,000 GT	-	-	-	-	1	11,791	1	11,791
5,000-10,000 GT	-	-	-	-	3	19,911	3	19,911
1,000- 5,000 GT	3	7,808	17	49,204	24	57,261	44	114,273
500- 1,000 GT	4	3,128	34	23,012	28	20,686	66	46,826
300- 500 GT	11	4,445	64	23,511	23	8,954	98	36,910
100- 300 GT	49	7,444	72	14,863	31	6,641	152	28,948
Under 100 GT	91	5,291	26	4,065	43	1,881	160	11,237
Bare boat	-	-	-	-	1	17,285	1	17,285
Chartered vessel	-	-	-	-	1	2,494	1	2,494
<u>Total</u>	<u>158</u>	<u>28,116</u>	<u>213</u>	<u>114,655</u>	<u>155</u>	<u>146,924</u>	<u>526</u>	<u>289,675</u>

Source: KMPA.

KOREA

TRANSPORT SECTOR

Coastal Shipping Fleet by Age (end-1981)

Ship's age	Passenger ship		Cargo ship		Tanker		Total	
	No.	%	No.	%	No.	%	No.	%
Less than 5 years	64	40.5	83	39.0	28	18.1	175	33.3
Less than 10 years	56	35.4	45	21.1	27	17.4	128	24.3
Less than 15 years	25	15.8	53	24.9	33	21.3	111	21.1
Less than 20 years	12	7.6	17	8.0	32	20.6	61	11.6
Less than 25 years	1	10.7	9	4.2	13	8.4	23	4.4
More than 25 years	-	-	6	2.8	22	14.2	28	5.3
<u>Total</u>	<u>158</u>	<u>100.0</u>	<u>213</u>	<u>100.0</u>	<u>155</u>	<u>100.0</u>	<u>526</u>	<u>100.0</u>

Note: Ships over 20 years are small. Among 28 cargo ships and tankers more than 25 years, only 2 are above 5,000 GT.

Source: KMPA.

KOREA

TRANSPORT SECTOR

Coastal Cargo Traffic by Major Commodities (1966-81)
(Million tons-km)

	<u>1966</u>		<u>1971</u>		<u>1976</u>		<u>1981</u>		1971-81 average annual growth rate (%)
	Freight share	(%)							
Oil	151	23	3,581	77	3,812	69	5,680	72	4.7
Cement	3	-	563	12	935	17	882	11	4.6
Coal	206	31	382	8	510	9	566	8	4.0
Others	312	46	127	3	276	5	705	9	18.7
<u>Total</u>	<u>672</u>	<u>100</u>	<u>4,653</u>	<u>100</u>	<u>5,533</u>	<u>100</u>	<u>7,928</u>	<u>100</u>	<u>5.5</u>
Combined % of oil + coal + cement		<u>54</u>		<u>97</u>		<u>95</u>		<u>93</u>	

Sources: (1) Statistical Yearbook of Transportation - 1976, MOT, Korea, p. 31.
(2) Statistical Yearbook of Transportation - 1982, MOT, Korea,
pp. 42-43.

KOREA
TRANSPORT SECTOR

Port Traffic Forecast by Major Commodities (1980-86)
(Million revenue tons)

	1980	1981		1986	1982-86 average annual growth rate (%)
	Actual	Forecast	Actual	Forecast	
Grains (I)	5.5	5.4	7.3	6.0	-2.3
Logs (I)	5.4	8.5	5.1	11.0	16.6
Fertilizer, raw					
Material (I)	1.7	2.9	1.1	3.2	23.5
Coal (I,C)	11.0	13.3	12.6	29.6	18.6
Cement (E,C)	10.4	12.6	11.0	15.0	6.4
Iron ore (I,C)	9.6	13.0	12.4	19.0	8.9
Iron & steel (I,E,C)	8.8	7.7	11.1	13.5	4.0
Minerals (I,E,C)	3.2	4.7	4.3	6.9	9.9
Containerized (I,E)	10.8	12.0	14.1	24.0	11.2
Uncovered (I,E,C)	10.8	17.2	13.9	24.2	11.8
Petroleum (I,C)	48.9	50.6	47.6	60.8	5.0
Subtotal	<u>126.1</u>	<u>147.9</u>	<u>139.9</u>	<u>213.2</u>	<u>8.8</u>
Others	5.6	7.0	9.1	10.1	2.2
Total	<u>131.7</u>	<u>154.9</u>	<u>149.0</u>	<u>223.2</u>	<u>8.4</u>

Note I = Import, E = Export, C = Coastal trade.

Source: KMPA.

KOREA

TRANSPORT SECTORPorts Cargo Volume Forecast (1980-86)
(¹000 revenue tons) /b

Port	1980	1981	1982	1983	1984	1985	1986	1982-86 average annual growth rate (%)
<u>General Ports</u>								
Busan	29,563	31,254	32,409	35,137	37,210	39,949	42,946	5.8
Incheon	23,895	25,006	26,481	28,391	29,868	31,887	34,339	5.3
Kunsan	2,306	2,906	3,009	3,337	3,612	3,992	4,104	6.4
Mokpo	1,362	1,982	2,112	2,276	2,418	2,856	3,286	9.2
Yosu	1,610	1,728	1,864	2,029	2,240	2,436	2,594	6.9
Masan	2,915	3,282	3,729	4,198	4,631	5,266	6,090	10.3
Ulsan	22,871	23,175	24,694	26,279	27,538	24,462	29,673	3.8
Mukho	4,707	4,589	4,399	4,556	4,728	4,923	5,113	3.1
Cheju	1,443	1,735	1,853	1,982	2,124	2,277	2,441	5.7
Others/a	28,718	36,057	40,286	44,617	46,576	52,132	63,361	9.5
Subtotal	<u>119,392</u>	<u>131,714</u>	<u>140,836</u>	<u>152,802</u>	<u>160,945</u>	<u>174,106</u>	<u>193,947</u>	<u>6.6</u>
<u>Industrial Ports</u>								
Pohang	19,030	23,192	23,939	26,297	27,276	28,375	29,324	4.1
Total	<u>138,422</u>	<u>154,906</u>	<u>164,775</u>	<u>179,099</u>	<u>188,221</u>	<u>202,481</u>	<u>223,271</u>	<u>6.3</u>

/a Industrial cargo included, oil and timber included.

/b A revenue ton is the larger of a metric ton in weight or a cubic meter (cu m) in volume.

Sources: (1) Transport Plan - Sea Transport and Ports, September 1, 1981. The 2nd Planning Section, MOT, Korea, p. 45.

(2) KMPA.

KOREA
TRANSPORT SECTOR

Forecast of Coastal Shipping Fleet Requirements (1982-86)

	Unit	1982	1983	1984	1985	1986	1982-86 average annual growth rate (%)
Total trade volume	'000 tons	43.7	47.4	51.1	55.7	60.4	6.7
Required merchant fleet	'000 G/T	371	400	431	463	501	6.2
Additional tonnage required /a	'000 G/T	12	29	31	32	38	

/a Including 95% net additions to capacity.

Source: KMPA.

KOREA
TRANSPORT SECTOR

Ports and Maritime Investment Plan Summary (1982-86)
(Unit: Billion Won)

(1980 prices)

Name of Project	Capital Requirement		Total	Financial Sources	
	Domestic	Foreign (US\$ M)		Government --- 1980 prices ---	Private
<u>Augmentation of Shipping Tonnage</u>					
(Increase of 5,153,000 G/T):					
Outbound ships (5,011,000 G/T)	1,107.0	1,315.4	1,909.4	-	1,909.4
Coastwise ships (142,000 G/T)	121.6	49.8	152.0	-	152.0
Subtotal	<u>1,228.6</u>	<u>1,365.2</u>	<u>2,061.4</u>	-	<u>2,061.4</u>
<u>Port Construction</u>					
Busan	102.2	147.6	192.2	192.2	-
Incheon	67.6	64.1	106.7	106.9	-
Cheju area	38.2	-	38.2	38.2	-
Ulsan	32.0	-	32.0	32.0	-
Kunsan	8.8	-	8.8	8.8	-
Wando	3.1	-	3.1	3.1	-
Sugcho	7.4	-	7.4	7.4	-
Mokpo	10.7	-	10.7	10.7	-
Other ports	44.6	-	44.6	44.6	-
New ports development	2.5	-	2.5	2.5	-
Maintenance, dredging, etc.	47.9	-	47.9	47.9	-
Signs and signal facilities	5.6	-	5.6	5.6	-
Subtotal	<u>370.6</u>	<u>211.7</u>	<u>499.7</u>	<u>499.7</u>	-
<u>Intensification of Shipping and Port Facilities</u>					
Seamen's School and Training Institute	8.3	-	8.3	8.3	-
Stevedore Equipment and Others	18.5	-	18.5	3.0	15.5
Subtotal	<u>26.8</u>	-	<u>26.8</u>	<u>11.3</u>	<u>15.5</u>
<u>Debt Services</u>	<u>67.2</u>	-	<u>67.2</u>	<u>67.2</u>	-
<u>GRAND TOTAL</u>	<u>1,693.2</u>	<u>1,576.9</u>	<u>2,655.1</u>	<u>578.2</u>	<u>2,076.9</u>

Source: The Fifth Five-Year Economic and Social Development Plan - Transportation Sector Plan (1982-1986), Transport Sector Planning Task Force, MOT Korea, p.126, pp. 212-215.

KOREATRANSPORT SECTORVessels Tonnage Expansion Plan (1980-86)

(Unit: '000 G/T)

	1980	1981	1982	1983	1984	1985	1986	Average annual growth rate (%) 1982-86
<u>Coastal Vessels</u>								
Passenger	27	28	29	30	31	32	33	3.3
Cargo	141	147	154	171	189	208	230	9.4
Tanker	93	96	100	111	123	135	150	9.4
Subtotal	<u>261</u>	<u>271</u>	<u>283</u>	<u>312</u>	<u>343</u>	<u>375</u>	<u>413</u>	<u>8.8</u>
<u>Ocean-going Vessels</u>								
Passenger	-							
Cargo	3,444							
Tanker	1,731							
Subtotal	<u>5,175</u>	<u>5,810</u>	<u>6,383</u>	<u>6,987</u>	<u>7,667</u>	<u>8,495</u>	<u>9,397</u>	<u>10.1</u>
<u>Total</u>	<u>5,436</u>	<u>6,081</u>	<u>6,666</u>	<u>7,299</u>	<u>8,010</u>	<u>8,870</u>	<u>9,810</u>	<u>10.0</u>

Source: (1) "Draft" for Preparation of the Fifth Five-Year Social and Economic Plan - Transportation Sector Plan, Aug. 1981, MOT, Korea, p. 45.

(2) Transport Plan - Sea Transport and Ports, September 1, 1981, The 2nd Planning Section, MOT, Korea, p. 4.

KOREA
TRANSPORT SECTOR

Development Plan of Port Stevedoring and Berthing Capacities (1982-86)
(Unit: 000 ton/year; No. of ships)

	1982		1983		1984		1985		1986		1982-86			
	Stevedoring	Berthing	Stevedoring A	B	Berthing A	B								
General Ports														
Busan	19,600	54	19,600	54	19,600	54	19,600	54	30,500	70	10,900	9.3	16	5.3
Incheon	11,700	30	14,700	35	18,700	36	18,750	36	18,700	36	7,000	9.8	6	3.8
Kunsan	2,140	7	2,140	7	2,140	7	2,140	7	2,140	7	0	0	0	0
Mokpo	1,800	4	1,800	4	1,930	5	2,275	6	2,355	7	555	5.5	3	11.9
Yosu	1,698	7	1,698	7	1,698	7	1,698	7	1,698	7	0	0	0	0
Masan	2,130	11	2,130	11	2,430	10	2,630	15	2,920	7	790	6.5	-4	-9.0
Ulsan	2,657	15	5,057	16	5,057	16	5,927	18	6,677	20	4,020	20.5	5	5.9
Mukho	6,620	6	6,620	6	6,620	6	6,620	6	6,620	6	0	0	0	0
Cheju	923	6	963	6	963	6	963	6	1,263	9	340	6.5	3	8.5
Others	7,109	19	7,485	20	7,485	20	7,747	21	8,080	23	971	2.6	4	3.9
Subtotal	<u>56,377</u>	<u>159</u>	<u>62,193</u>	<u>166</u>	<u>66,623</u>	<u>170</u>	<u>68,300</u>	<u>176</u>	<u>80,953</u>	<u>202</u>	<u>24,576</u>	<u>7.5</u>	<u>43</u>	<u>4.9</u>
Industrial Ports														
Pohang	25,835	25	31,273	31	32,073	33	32,073	33	32,073	33	6,238	4.4	8	5.7
Changwon	1,600	5	21,000	6	2,100	6	2,400	7	2,400	7	800	8.5	2	7.0
Onsan	1,190	1	1,190	1	1,190	1	1,190	1	1,190	1	0	0	0	0
Bukpyung	13,000	10	13,000	10	13,000	10	13,000	10	13,000	10	0	0	0	0
Yochun	4,024	12	4,024	12	4,024	12	4,024	12	4,024	12	0	0	0	0
Subtotal	<u>45,649</u>	<u>53</u>	<u>51,587</u>	<u>60</u>	<u>52,387</u>	<u>62</u>	<u>52,687</u>	<u>63</u>	<u>52,687</u>	<u>63</u>	<u>7,038</u>	<u>2.9</u>	<u>10</u>	<u>3.5</u>
GRAND TOTAL	<u>102,026</u>	<u>212</u>	<u>113,780</u>	<u>226</u>	<u>119,010</u>	<u>232</u>	<u>120,987</u>	<u>239</u>	<u>133,640</u>	<u>265</u>	<u>31,614</u>	<u>5.6</u>	<u>53</u>	<u>4.6</u>

Note: A = Increment of capacity or unit.
B = Average Annual Growth Rate (%).

Source: "Draft" for Preparation of the Fifth Five-Year Social and Economic Plan - Transportation Sector Plan, Aug. 1981, MOT, Korea, p. 49.

KOREA

TRANSPORT SECTOR

Ports' Capacity Expansion Plan and Estimated Requirements (1981-86)
(Million revenue tons)

Port	1981 capacity	Fifth plan addition	Total	1986 forecast	Deficit(-) surplus(+)
<u>General Ports /a</u>					
Busan	29.8	11.5	41.3	43.0	-1.7
Incheon	24.4	7.0	31.4	34.0	-2.6
Kunsan	2.0	0.6	2.6	4.1	-1.5
Mokpo	1.0	1.5	2.5	3.3	-0.8
Yosu /b	1.2				
Masan	2.9				
Ulsan	23.0	4.0	27.0	29.7	-2.7
Mukho	3.9				
Cheju	1.4	0.7	2.1	2.4	-0.3
Others	34.4				
<u>Industrial Ports</u>					
Pohang	25.0				

/a Including oil and timber.

/b Without Samil port.

Source: KMPA.

KOREATRANSPORT SECTORIndustrial Ports' Capacity Expansion Plan (1982-86)
(M M/T tons)

Port	Type of cargo	Capacity	Cargo volume	Development plan
Pukpyung	Cement, coal, miscellaneous	8.9	7.3	A coal berth is under construction under KMPA; otherwise, no further expansion.
Pohang	Iron ore, coal, miscellaneous	23.8	29.0	13 more berths will be constructed to increase steel mill capacity from 8.5 to 9.6 million tons.
Onsan	Oil	1.19	4.0	No new developments planned.
Ogpo	Shipbuilding	1.0	-	No new developments planned.
Changwon (Masan)	Machinery	0.9	2.6	4 more berths will be added by 1983.
Yochun	Petrochemicals	4.0	4.0	One more berth will be ready by end of 1982 for LPG terminal.
Ansan	Oil	Existing berths owned by private companies		LNG berth will be added in the next five-year plan under MOC.
Kwangyang area	Another steel mill will be constructed in the next five years; steel company will prepare designs and submit it to MOC for approval and construction.			

Source: Ministry of Construction, Korea.

KOREA
TRANSPORT SECTOR

Performance of Civil Air Transport (1961-81) /a

	Domestic					International				
	1961	1966	1971	1976	1981	1961	1966	1971	1976	1981
No. of aircraft holdings	9	37	76	75	93	-	-	-	-	-
No. of flight ('000)	3.8	9.6	39.2	15.4	14.3	1.2	2.3	11.9	15.4	27.6
kms flown (million)	0.8	2.8	9.8	5.2	5.0	1.5	2.6	12.8	44.7	77.6
Hours flown ('000)	3.3	11.6	32.7	14.2	12.3	4.0	5.3	23.2	63.2	107.6
Passenger ('000)	61.5	191.6	1,105.5	773.9	1,456.6	30.9	131.4	508.3	1,910.6	3,130.3
Pass-km (million)	18.0	62.4	314.0	267.0	517.9	42.2	152.3	572.5	4,106.9	10,853.1
Available seat -km (million)	N.A.	52.6	523.1	377.1	754.4	N.A.	229.0	1,322.6	8,809.8	20,356.7
Pass-seat ratio (%)	N.A.	58.5	60.0	70.6	68.6	N.A.	66.2	43.3	46.6	53.4
<u>Ton-km (million)</u>										
Passenger	N.A.	4.2	20.2	17.4	33.5	N.A.	38.1	38.9	282.5	734.3
Cargo	0.1	0.5	2.2	1.9	6.0	1.4	9.0	27.1	431.6	1,115.7
Mail	-	-	-	-	0.1	2.4	4.5	5.7	10.4	34.3
Subtotal	N.A.	4.7	22.4	19.3	39.6	N.A.	51.6	71.7	724.5	1,884.3
Available weight (million)	N.A.	11.2	136.8	78.8	89.4	N.A.	65.9	248.5	1,929.1	4,913.2
Load weight ratio (%)	N.A.	42.6	16.4	24.4	44.3	N.A.	50.1	28.8	37.5	38.4

/a Scheduled flight only.

- Sources: (1) Economic Statistics Yearbook-1981, The Bank of Korea, Korea, p. 183.
(2) Statistics Yearbook of Transportation-1973, MOT, Korea, p. 274-277.
(3) Statistics Yearbook of Transportation-1982, MOT, Korea, p. 277-287, p. 311.
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(5) Statistics Yearbook of Korea-1962, Bureau of Statistics, EPB, Korea, p. 71.

KOREA

TRANSPORT SECTOR

Aviation Investment Financial Plan (1980-86)
(Unit: Billion Won)

Project	Scale	(1980 prices)			Financial sources		Period
		Capital required		Total	Government	Private	
		Domes- tic	Foreign (US\$ M)				
<u>Kimpo Airport Expansion</u>		97.2	-	97.2	97.2	-	1982-87
Runway	4,000 m x 60 m						
Mooring area	4,000 sq m						
Taxiway	2,000 sq m						
International lines, passenger building	100,999 sq m						
Cargo hanger	26,000 sq m						
Land	345,000 sq m						
<u>New International Airport</u>		16.7	-	16.7	16.7	-	1982-86
Preliminary design							
Detailed design							
Land aquisition							
<u>Kimhae Airport Expansion</u>		17.5	-	17.5	17.5	-	1982-87
Runway overlay	122,000 sq m						
Taxiway overlay							
Runway	500 m x 45 m						
Taxiway	500 m x 30 m						
Mooring area	100,000 sq m						
	112,000 sq m						
<u>Cheju Airport Expansion</u>		14.4	-	14.4	14.4	-	1979-83
Runway	3,000 m x 45 m						
Mooring area	48,000 sq m						
Passenger building	15,000 sq m						
P'Yung land purchasing	222,000 sq m						
<u>Other Airports</u>		3.8	-	3.8	3.8	-	1982-86
<u>Debt Services</u>		13.8	-	13.8	13.8	-	1982-86
<u>New Aircrafts</u>	B-747 (8) Z-X (7)	12.0	687.0	431.1	-	431.1	1983-86
<u>Grand Total</u>		<u>175.4</u>	<u>687.0</u>	<u>594.5</u>	<u>163.4</u>	<u>431.1</u>	

Source: The Fifth Five-Year Economic and Social Development Plan - Transportation Sector Plan (1982-1986), 1981, Transportation Sector Planning Task Force, December 1981, MOT, Korea, pp. 216-219.

KOREA

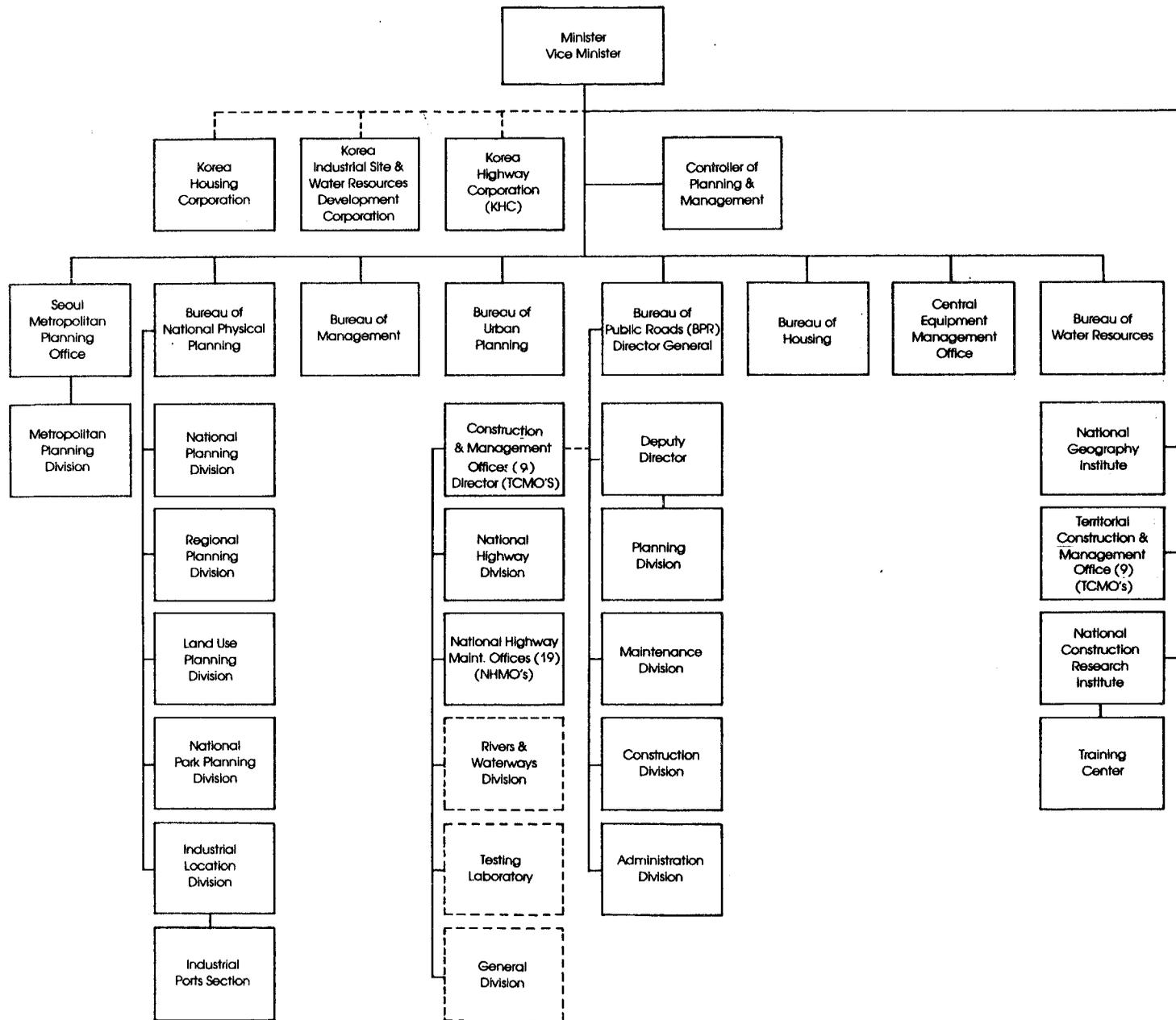
TRANSPORT SECTOR

Expansion Plan of Three International Airports (1982-86)

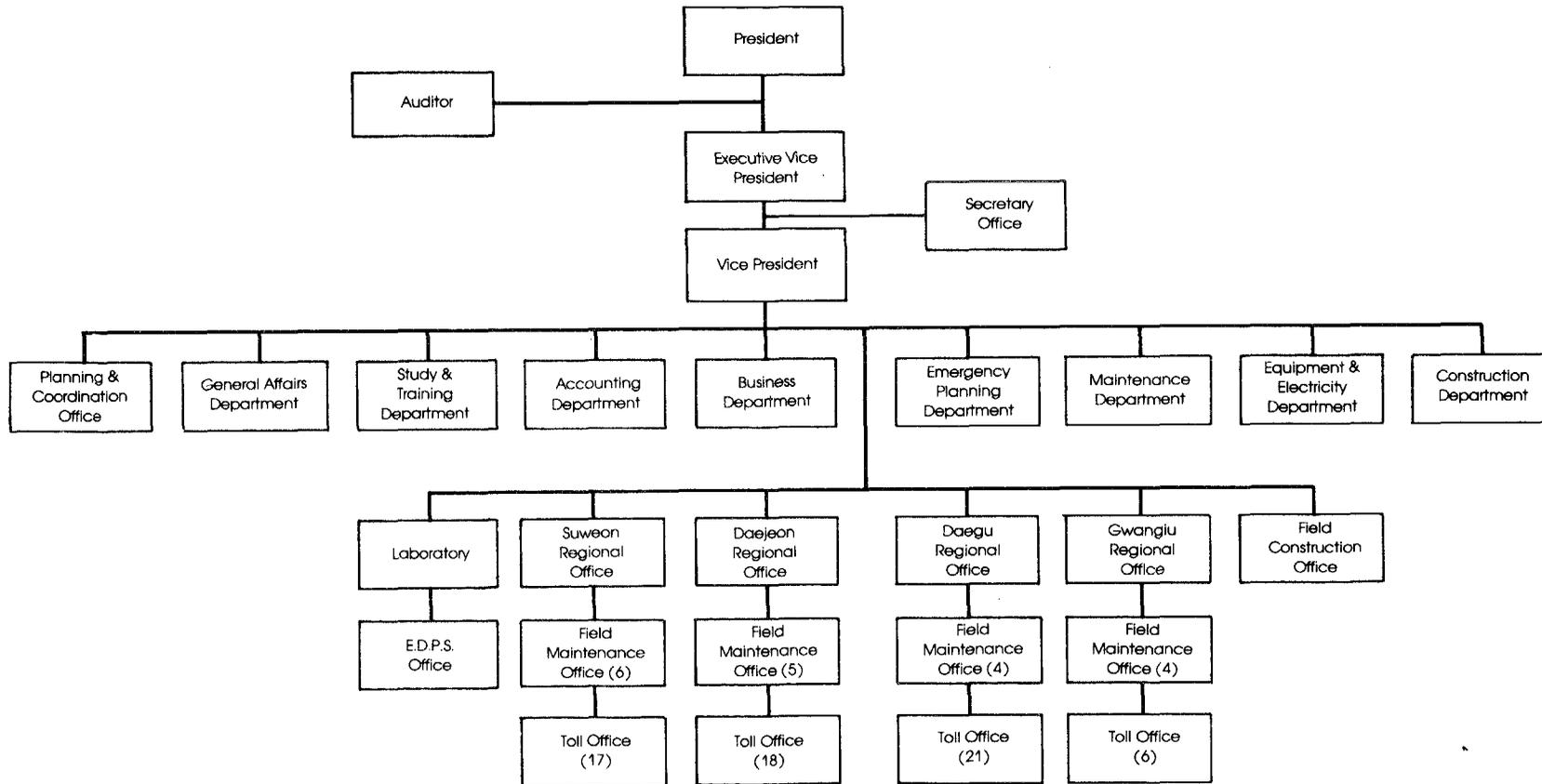
Facilities	Present size	Expansion	After expansion
<u>Kimpo International Airport</u>			
Runway	3,200 sq m x 45 m	4,000 m x 60 m	4,000 m x 60 m 3,200 m x 45 m
Taxiway	154,000 sq m	200,000 sq m	354,000 sq m
Mooring area	400,000 sq m	400,000 sq m	800,000 sq m
International lines passenger building	70,000 sq m	100,000 sq m	170,000 sq m
Cargo hangar	14,000 sq m	26,000 sq m	40,000 sq m
Land	1.4 mln pyong	0.35 mln pyong	1.75 mln pyong
<u>Cheju International Airport</u>			
Runway	2,000 m x 45 m	3,000 m x 45 m	3,000 m x 45 m 2,000 m x 45 m
Taxiway	7,000 sq m	12,630 sq m	19,630 sq m
Mooring area	22,000 sq m	48,000 sq m	70,000 sq m
Passenger terminal	6,500 sq m	26,000 sq m	32,500 sq m
Land	0.37 mln pyong	0.29 mln pyong	0.66 mln pyong
<u>Kimhae International Airport</u>			
Runway	2,700 m x 45 m	500 m x 45 m	3,200 m x 45 m
Taxiway	2,700 m x 23 m	500 m x 30 m	3,200 m x 30 m
Mooring area	100,000 sq m	100,000 sq m	100,000 sq m
Loading bridge	-	2	2
Land	67,000 pyong	75,000 pyong	142,000 pyong

Source: The Fifth Five-Year Economic and Social Development Plan -
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**KOREA
TRANSPORT SECTOR
Ministry of Construction: Organization**



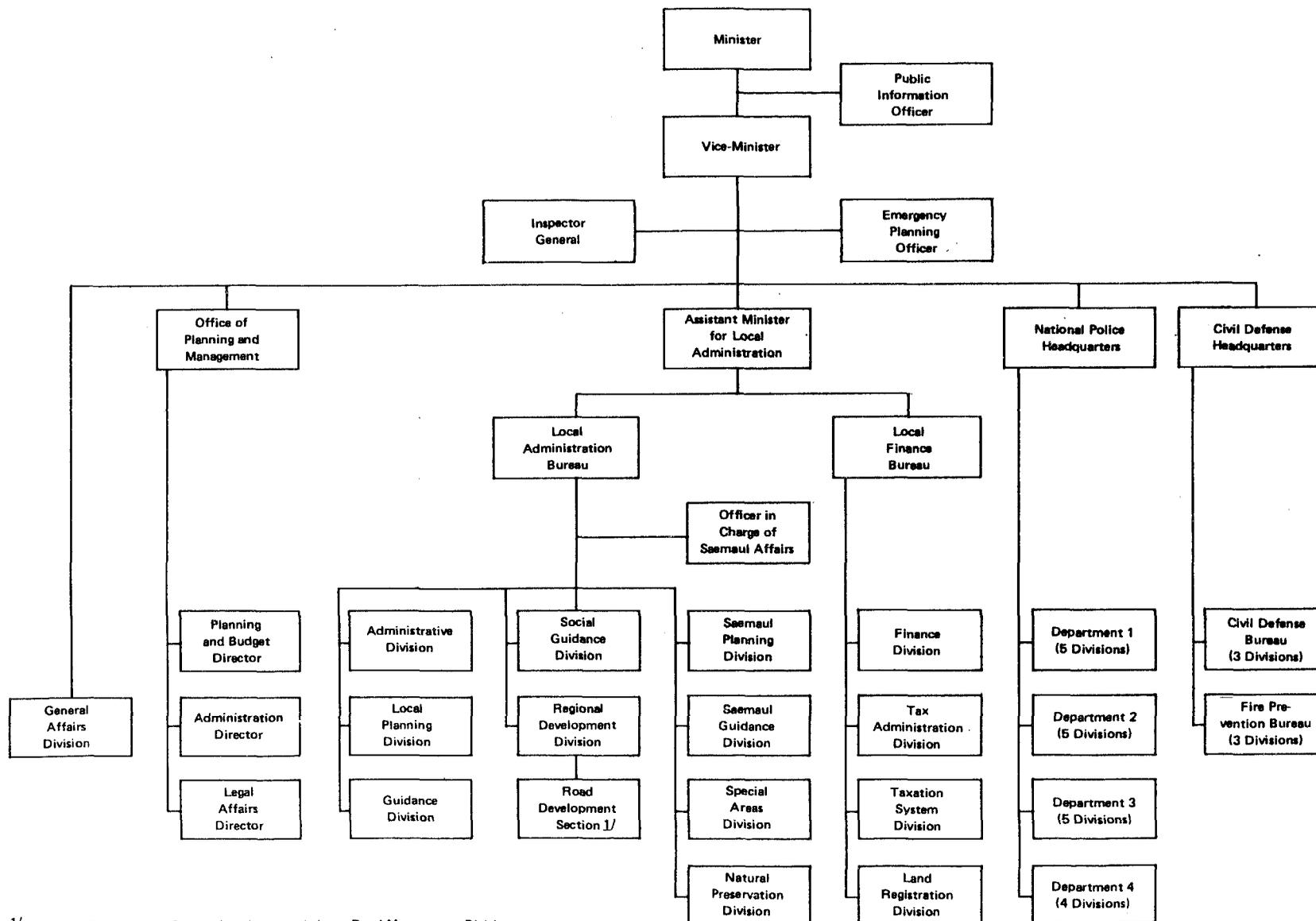
**KOREA
TRANSPORT SECTOR
Korea Highway Corporation: Organization**



Source: KHC

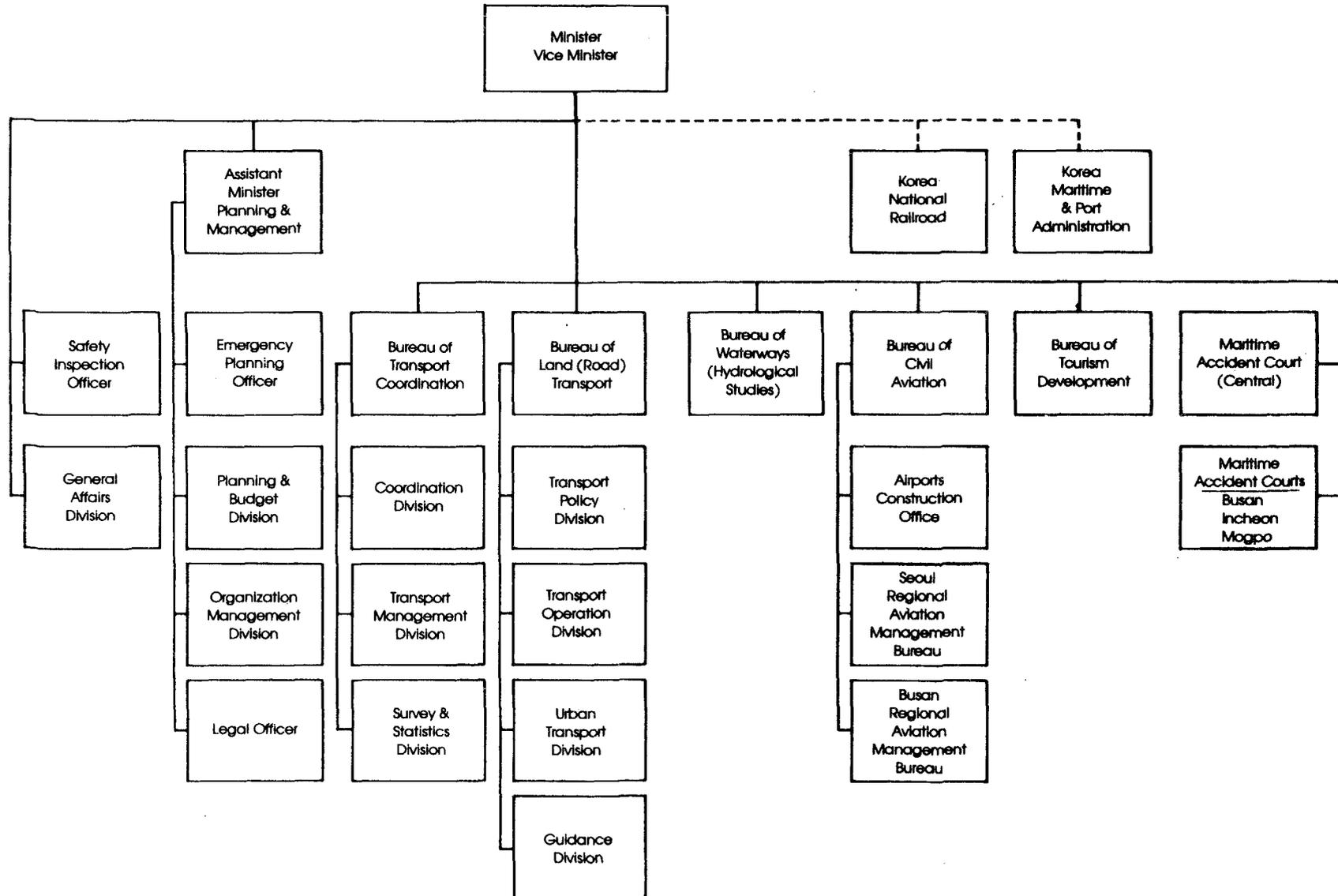
World Bank - 24504

**KOREA
TRANSPORT SECTOR
Ministry of Home Affairs: Organization**



^{1/} The Road Development Section is to be upgraded to a Road Management Division

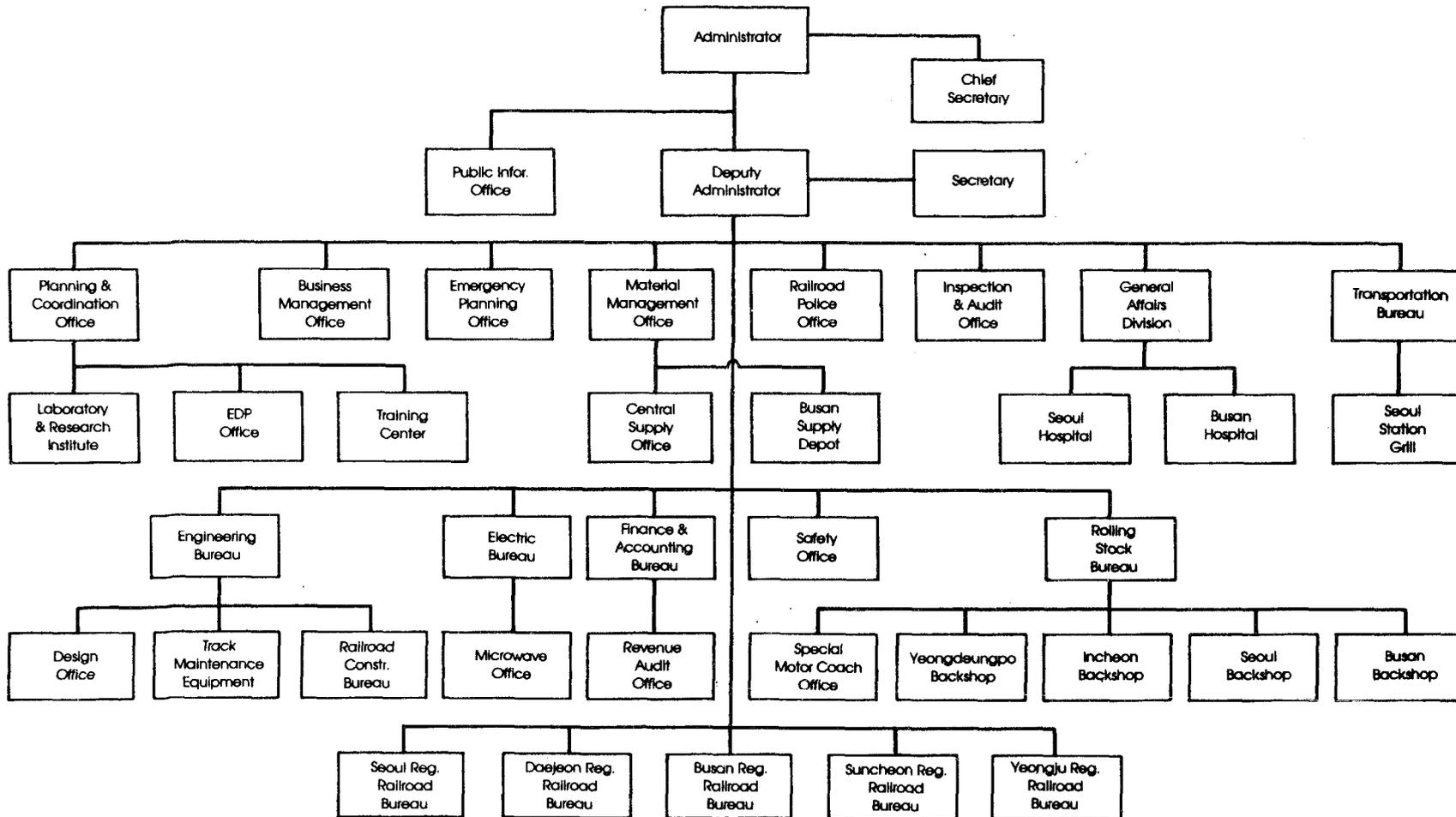
**KOREA
TRANSPORT SECTOR
Ministry of Transportation: Organization**



Source: Ministry of Transportation

World Bank—24486

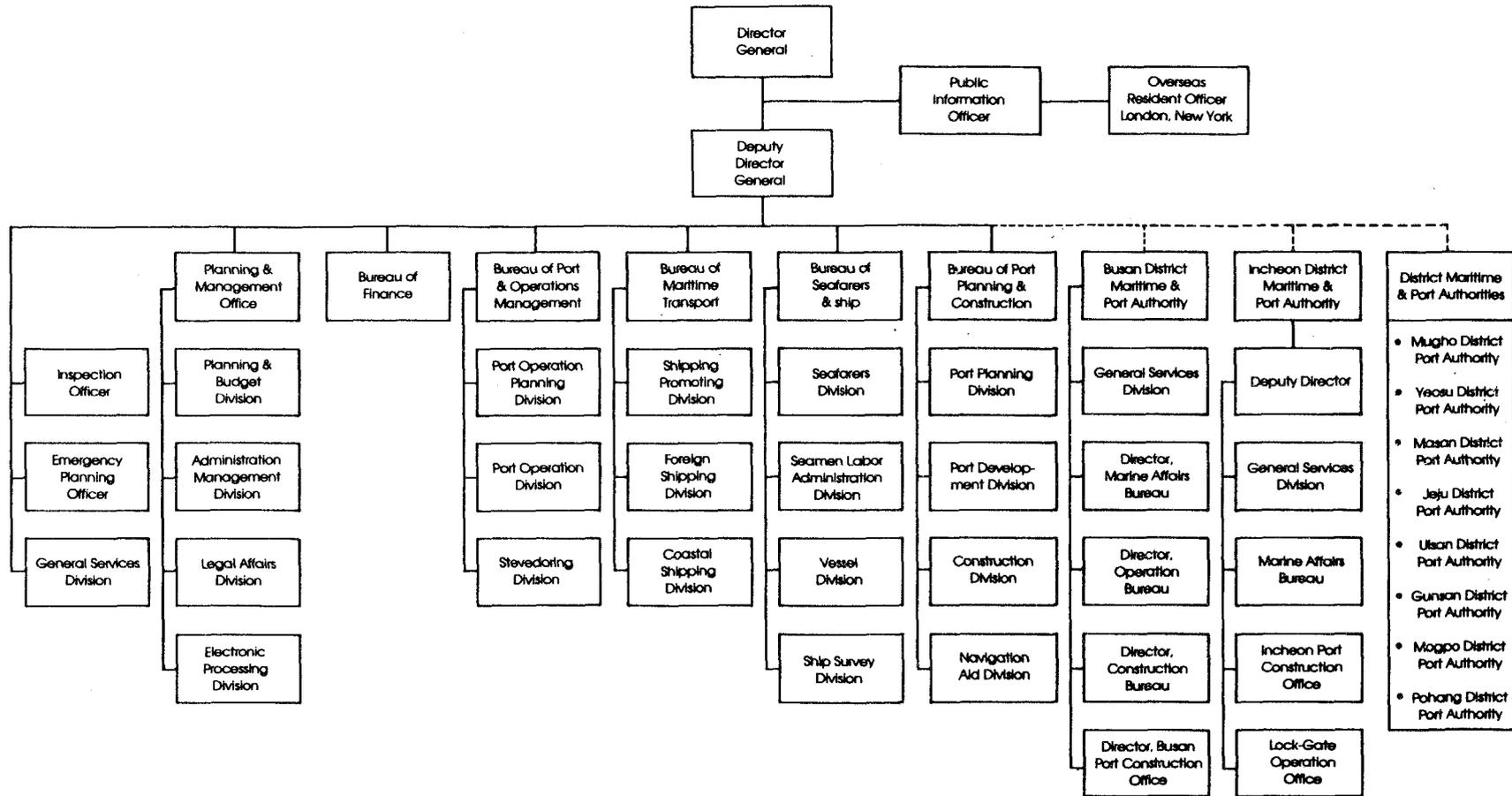
**KOREA
TRANSPORT SECTOR
Actual KNR Functional Organization**



Source: KNR

World Bank—24503

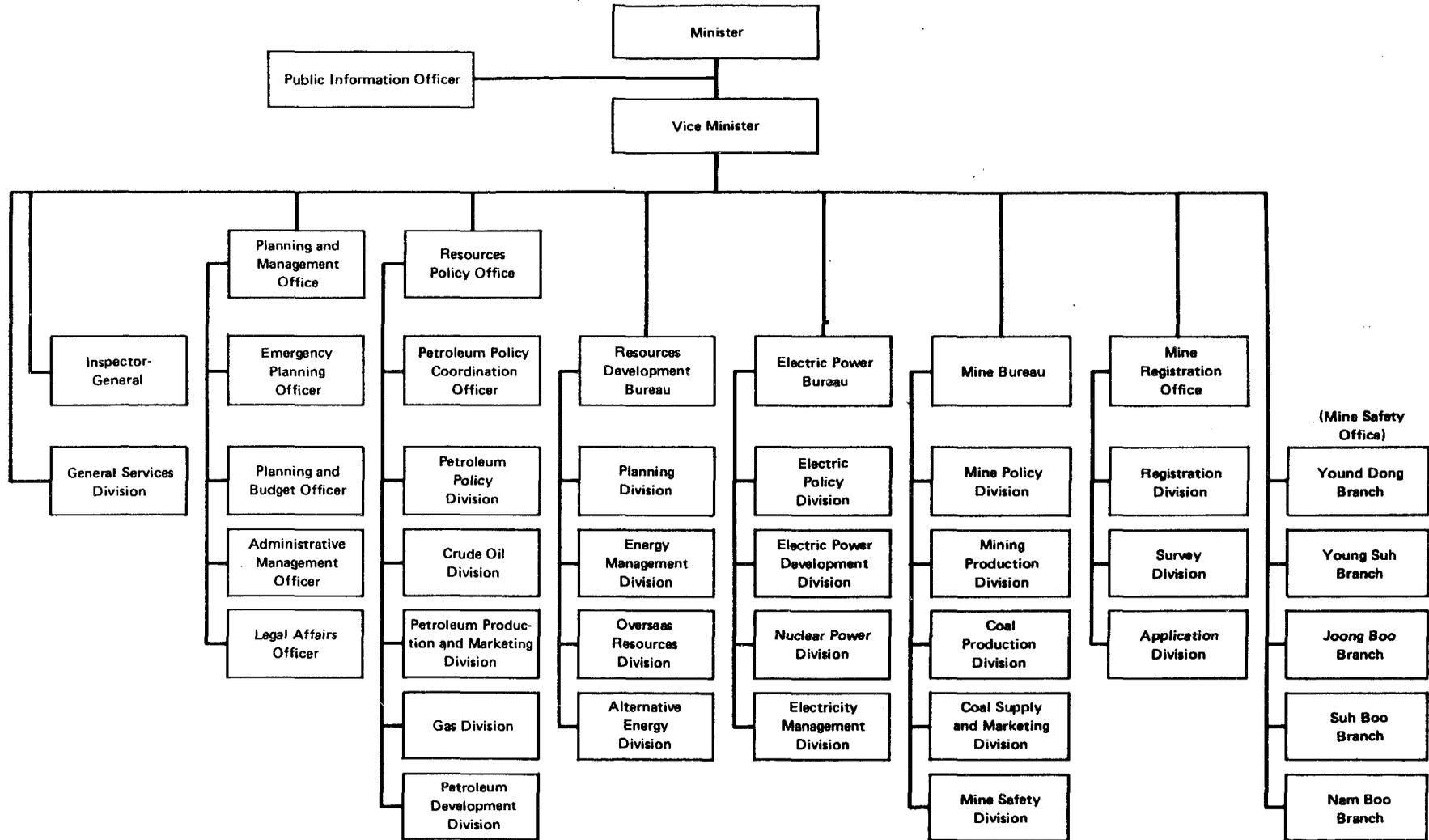
**KOREA
TRANSPORT SECTOR
Korea Maritime and Port Authority (KMPA): Organization**



Source: KMPA

World Bank—24487

**KOREA
TRANSPORT SECTOR
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KOREA
TRANSPORT SECTOR

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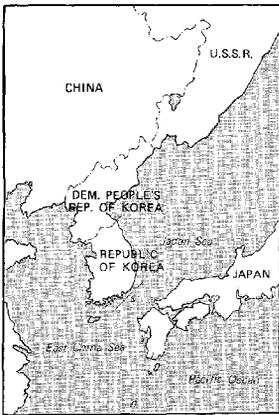
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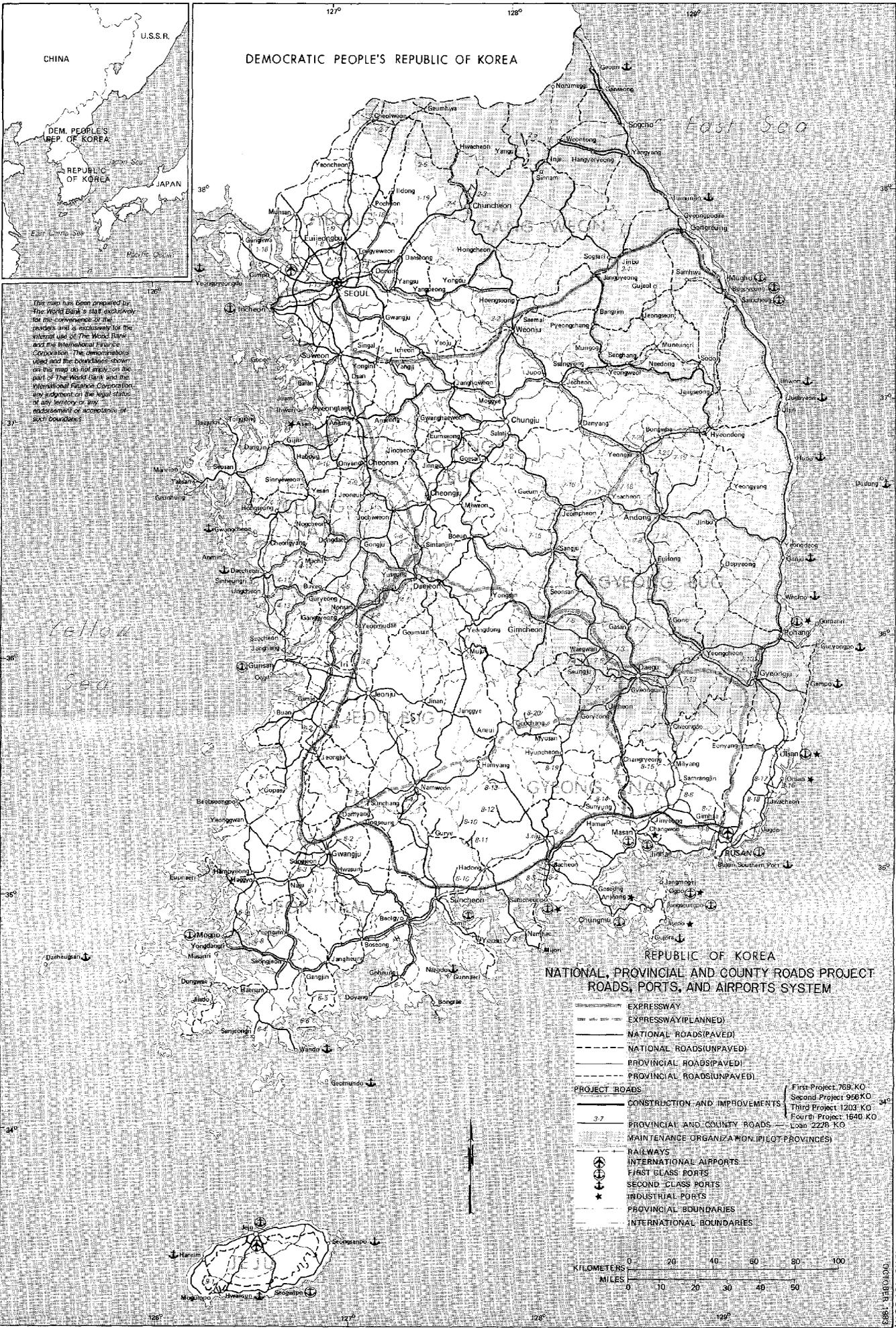
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DEMOCRATIC PEOPLE'S REPUBLIC OF KOREA

This map has been prepared by The World Bank's staff exclusively for the convenience of the readers and is exclusively for the internal use of The World Bank and the International Finance Corporation. The denominations used and the boundaries shown on this map do not imply on the part of The World Bank and the International Finance Corporation any judgment on the legal status of any territory or any recognition of its boundaries.



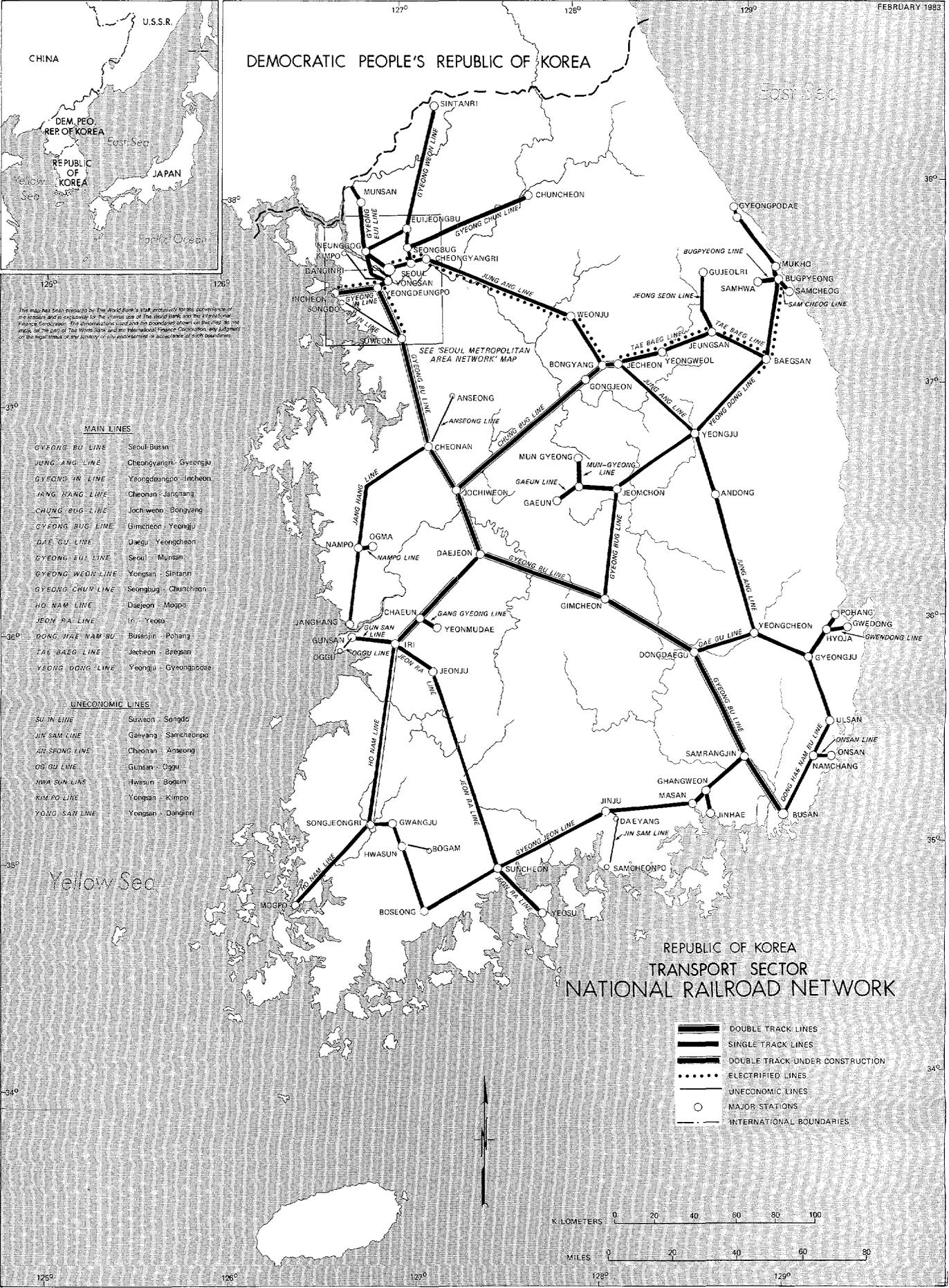
REPUBLIC OF KOREA
NATIONAL, PROVINCIAL AND COUNTY ROADS PROJECT
ROADS, PORTS, AND AIRPORTS SYSTEM

- EXPRESSWAY
- EXPRESSWAY (PLANNED)
- NATIONAL ROADS (PAVED)
- NATIONAL ROADS (UNPAVED)
- PROVINCIAL ROADS (PAVED)
- PROVINCIAL ROADS (UNPAVED)
- PROJECT ROADS
 - CONSTRUCTION AND IMPROVEMENTS
 - PROVINCIAL AND COUNTY ROADS
- MAINTENANCE ORGANIZATION (PILOT PROVINCES)
- RAILWAYS
- INTERNATIONAL AIRPORTS
- FIRST CLASS PORTS
- SECOND CLASS PORTS
- INDUSTRIAL PORTS
- PROVINCIAL BOUNDARIES
- INTERNATIONAL BOUNDARIES

First Project 768 KO
Second Project 956 KO
Third Project 1203 KO
Fourth Project 1640 KO
Loan 2228 KO



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OCTOBER 1983

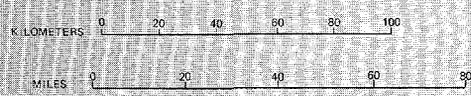


DEMOCRATIC PEOPLE'S REPUBLIC OF KOREA

REPUBLIC OF KOREA
TRANSPORT SECTOR
NATIONAL RAILROAD NETWORK

- MAIN LINES**
- GYEONG BU LINE Seoul-Busan
 - JUNG ANG LINE Cheongyangri-Gyeongju
 - GYEONG IN LINE Yeongdeungpo-Incheon
 - JANG HANG LINE Cheonan-Jangtong
 - CHUNG BUG LINE Jochiwon-Bongyong
 - GYEONG BUG LINE Gimcheon-Yeongju
 - DAE GU LINE Daegu-Yeongsan
 - GYEONG EU LINE Seoul-Munsan
 - GYEONG WOH LINE Yongsan-Sintanri
 - GYEONG CHU LINE Seongbuk-Churcheon
 - HO NAM LINE Daejeon-Mogpo
 - JEON RA LINE Iri-Yeosu
 - DONG HAE NAM BU Busanjin-Pohang
 - TAE BAE LINE Jechon-Baesgan
 - YEONG DONG LINE Yeongju-Oyeongsopdae
- UNECONOMIC LINES**
- SU IN LINE Surwon-Songdo
 - JIN SAM LINE Goryang-Sancheonpo
 - AI SEONG LINE Cheonan-Anseong
 - OS GU LINE Gunsan-Ogri
 - HWA SUN LINE Hwasun-Bogam
 - KIM PO LINE Yongsan-Kimpo
 - YONG SAN LINE Yongsan-Dangri

- DOUBLE TRACK LINES
- SINGLE TRACK LINES
- DOUBLE TRACK UNDER CONSTRUCTION
- ELECTRIFIED LINES
- UNECONOMIC LINES
- MAJOR STATIONS
- INTERNATIONAL BOUNDARIES



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