IV. JAPAN

IV. JAPAN

IV.1 General

The land of Japan located in the eastern part of the Pacific Ocean has 4 main islands; Hokkaido, Honshu, Shikoku and Kyushu, and it is 73.5% to that of Thailand.

Japan has a population of 121,492 million in 1987 which is about 2.3 times to that of Thailand.

GNP of Japan is 1,975,331 million Dollars in 1986 and Per Capita Income in 1986 is 16,264 Dollars which is 20.5 times to that of Thailand.

IV.2 Highway and Transport Conditions

IV.2.1 Road Network

Japanese highways and roads are divided into the following four categories except some exceptions under the Road Law Article 3.

- Expressway (Motorway)
- National road
- Prefectural road
- Municipal and city road

Even though it is not an expressway under the law, the highway administrator can designate the road as a motorway. The construction and operation of highways and roads are under the jurisdiction of the central government, the local government, and the public corporation. The Ministry of Construction, which is the central government authority is responsible for the highway and road administration.

The length of the highway and road network in Japan is shown in Table IV.1.

Table IV.1 JAPANESE HIGHWAY AND ROAD NETWORK

Unit : km

Year	Expressway	National Road	Prefectural Road	Municipal and city Road	Total	Pave ratio (%)
1950	0	9,322.3	126,121.9	-	135,444.2	-
1955	0	24,130.1	119,936.7	-	144,066.7	-
1960	0	24,937.3	122,017.9	825,732.5	972,687.8	2.0
1965	189	28,029.4	121,241.8	839,502.4	988,962.6	4.5
1970	649	32,650.3	122,323.7	867,962.3	1,023,585.3	9.0
1975	1,519	38,539.6	125,714.2	901,774.5	1,067,547.3	12.9
1976	1,888	40,081.2	127,328.7	909,909.8	1,079,207.8	13.9
1977	2,022	40,086.6	128,441.7	917,701.9	1,088,252.2	14.0
1978	2,195	40,195.7	129,278.9	925,578.2	1,097,247.7	14.7
1979	2,430	40,205.6	130,138.7	933,364.1	1,106,138.4	15.4
1980	2,579	40,211.7	130,836.4	939,760.3	1,113,387.4	16.0
1981	2,857	40,381.4	131,281.2	943,485.8	1,118,006.0	16.5
1982	3,010	46,275.3	126,228.9	947,515.3	1,123,029.5	16.9
1983	3,232	46,302.3	126,757.8	946,990.7	1,123,283.2	17.6
1984	3,435	46,417.5	127,038.8	948,325.9	1,125,217.2	18.2
1985	3,555	46,434.7	127,436.4	950,078.4	1,127,504.3	18.7
1986	3,721	46,543.7	127,574.5	949,565.7	1,127,404.8	19.2
1987	3,910	46,522.7	127,681.8	920,816.7	1,098,931.1	20.4
1988	4,280	46,661.3	128,202.3	925,137.9	1,104,281.5	20.9

Total extension of the ordinary roads as of April 1, 1988 consists of 46,661 km of national highways, 128,202 km of prefectural roads, and 925,138 km of municipal roads with total road area of 7,511 km2. The national highways and prefectural roads total to approximately 174,863 km, only about 16% of the overall extension. However, the share of those roads is as high as about 65% of the overall traffic volume. The low grade roads include roads with a width under 5.5 m where large vehicles can hardly pass by each other occupying 64,000 km (approximately 40%), sections where motor vehicles cannot pass totaling 3,000 km, and in addition, sections which are closed to motor vehicle traffic in winter season totaling about 5,000 km.

IV.2.2 Transportation Modes

The share of each transportation mode for the domestic transport of freights and passengers is shown in Tables IV.2 and IV.3, respectively.

Table IV.2 DOMESTIC FREIGHT TRANSPORT BY MODE IN TON - KM

Unit : million ton-km

Mode / Year	Roads car	Share %	Railways	Share %	Inland shipping	Share %	Airways	Share %	Total	Share %	Growth rate over previous year(%)
1976	4,355,945	87.1	186,024	3.7	457,594	9.2	203	0.0	4,999,743	100.0	-0.6
1977	4,456,443	87.4	175,164	3.4	468,693	9.2	229	0.0	5,101,530	100.0	0.2
1978	4,860,424	87.7	178,759	3.2	502,657	9.1	268	0.0	5,542,108	100.0	6.6
1979	5,258,277	88.3	183,847	3.1	514,839	8.6	315	0.0	5,957,278	100.0	7.5
1980	5,317,950	88.9	166,550	2.8	500,258	8.4	329	0.0	5,985,087	100.0	0.5
1981	5,230,784	89.2	151,684	2.6	479,097	8.2	369	0.0	5,861,934	100.0	-2.1
1982	5,171,623	90.0	136,236	2.4	437,584	7.6	401	0.0	5,745,844	100.0	-2.0
1983	5,123,371	90.2	121,531	2.1	438,038	7.7	443	0.0	5,683,382	100.0	-1.1
1984	5,114,657	90.1	107,212	1.9	450,277	7.9	497	0.0	5,672,643	100.0	-0.2
1985	5,048,048	90.1	99,341	1.8	452,385	8.1	538	0.0	5,600,312	100.0	-1.3
1986	4,969,101	90.3	89,728	1.5	440,677	8.0	603	0.0	5,500,109	100.0	-1.8
1987	5,204,257	90.5	82,189	1.4	462,546	8.0	698	0.0	5,749,690	100.0	4.5

Table IV.3 DOMESTIC PASSENGER TRANSPORT BY MODE IN PERSON - KM

Unit : million persons-km

Mode / Year	Auto mobiles: Passenger car	Share %	Bus	Share %	Total	Share %	Railways	Share %	Inland shipping	Share %	Airways	Share %		Total: Share %	Growth rate over previous year(%)
1976	264,499	37.3	98,714	13.9	363,213	51.2	319,566	45.1	6,651	0.9	20,119	2.8	709,549	100.0	0.2
1977	263,961	37.1	104,639	14.7	368,600	51.9	312,291	43.9	6,500	0.9	23,636	3.3	711,033	100.0	0.2
1978	295,043	39.6	107,009	14.3	403,053	53.9	311,129	41.6	6,384	0.9	26,923	3.6	747,489	100.0	5.1
1979	319,869	41.1	108,317	13.9	428,187	55.1	312,460	40.3	6,443	0.8	30,246	3.9	777,336	100.0	4.0
1980	321,272	41.1	110,396	14.1	431,669	55.2	314,542	40.2	6,132	0.8	29,688	3.8	782,031	100.0	0.6
1981	328,251	41.5	108,828	13.8	437,079	55.3	316,204	40.0	6,132	0.8	31,032	3.9	790,338	100.0	1.1
1982	347,219	43.2	104,836	13.0	452,055	56.2	316,375	39.3	5,859	0.7	30,106	3.7	804,395	100.0	1.5
1983	360,747	43.9	103,415	12.6	464,162	56.5	321,452	39.1	5,722	0.7	30,627	3.7	821,963	100.0	2.2
1984	365,631	43.9	103,064	12.4	468,695	56.3	324,334	39.0	5,780	0.7	33,498	4.0	832,310	100.0	1.2
1985	384,362	44.8	104,898	12.2	489,260	57.0	330,083	38.5	5,733	0.7	33,118	3.9	858,194	100.0	3.1
1986	398,216	45.5	101,629	11.6	499,843	57.1	334,745	38.2	5,684	0.7	35,324	4.0	875,596	100.0	2.0
1987	456,030	48.1	102,895	10.9	558,925	59.0	344,728	36.4	5,850	0.6	38,535	4.1	948,038	100.0	8.3

The share among the transportation modes in Japan in terms of domestic freight transportation and passenger transportation has shown a remarkable change along with the rapidly promoted motorization endorsed by the economic growth and road improvement policy, and the importance of the role of motor vehicles increased tremendously.

As shown in Table IV.3 for freight transportation, roads handle 90% of freights transported.

As of 1987, the transport by passenger cars occupies almost 50% out of the total modes.

IV.2.3 Number of Registered Vehicles

The number of registered vehicles by type since the World War II is shown in Table IV.4. The total number of vehicles increased by 1.53 times for the past ten years. However, the growth rates for passenger car and trucks remain almost the same for the past five years.

Table IV.4 NUMBER OF REGISTERED VEHICLES

Year	Passenger Car	Bus	Truck	Special Vehicle	Traiter	Total	Motor Cycle
1975	17,377,551	219,945	10,172,607	595,798	40,097	28,405,998	8,932,422
1976	18,618,213	222,312	10,786,780	631,029	42,443	30,300,777	9,326,721
1977	19,942,495	224,674	11,325,881	670,799	43,758	32,207,027	10,045,622
1978	21,409,307	226,674	11,972,025	720,064	47,980	34,376,050	10,901,116
1979	22,751,052	228,396	12,644,736	765,840	53,020	36,443,044	11,965,547
1980	23,646,119	229,429	13,245,391	794,525	57,313	37,972,777	13,091,427
1981	24,578,524	229,625	13,966,404	823,300	38,825	39,636,678	14,557,879
1982	25,435,492	229,717	14,724,927	851,726	59,219	41,301,081	16,212,645
1983	26,320,361	229,569	15,460,064	879,629	60,855	42,950,478	17,353,659
1984	27,038,230	230,084	16,295,855	911,809	63,853	44,539,821	18,180,409
1985	27,790,194	232,011	18,184,827	943,801	65,868	46,216,473	18,668,554
1986	28,538,497	234,648	19,274,305	1,037,272	70,971	50,218,288	18,450,266
1987	30,712,558	239,053	20,412,437	1,097,223	76,372	52,537,643	

IV.2.4 Accidents

The number of traffic accidents and other related indexes are shown in Table IV.5.

The number of accidents involving injury and killed persons per 100 million running km is shown in Figure IV.1.

Table IV.5 NUMBER OF TRAFFIC ACCIDENTS

Year	Number of accident	Number of killed	Number of injured	Vehicle running (km)	Length of roads
1975	472.9	10,792	622.5	2,863	106.6
1976	471.0	9,734	614.0	3,097	107.9
1977	460.6	8,945	593.2	3,423	108.8
1978	464.0	8,783	594.1	3,613	109.7
1979	471.6	8,783	596.3	3,613	110.6
1980	476.7	8,466	598.7	3,820	111.4
1981	485.6	8,760	607.3	3,891	111.8
1982	502.3	8,719	626.2	3,947	112.3
1983	526.4	9,073	654.8	4,031	112.3
1984	518.6	9,262	644.3	4,157	112.5
1985	552.8	9,261	681.3	4,284	112.8
1986	579.2	9,317	712.3	4,416	112.7
1987	590.7	9,347	722.2	4,577	109.9
1988	614.4	10,344	752.8		

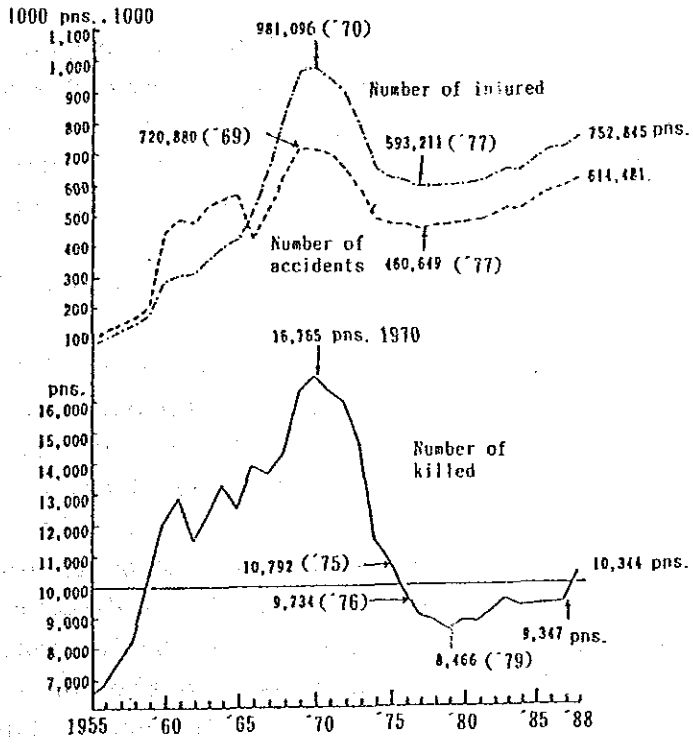


Figure IV.1 NUMBER OF KILLED PERSONS BY YEAR

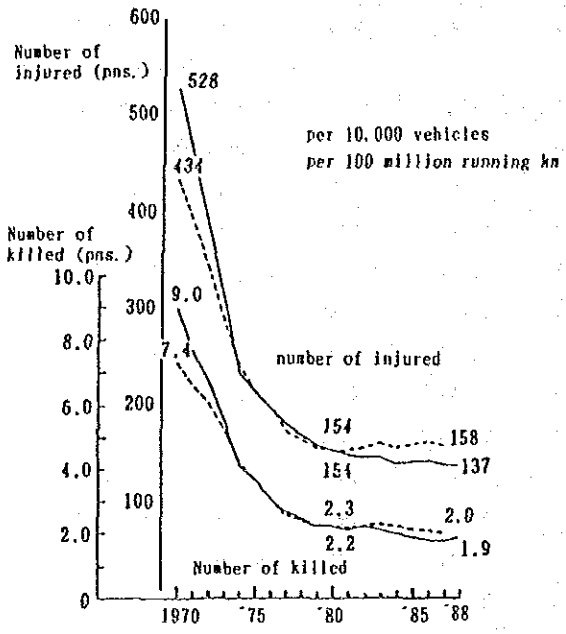


Figure IV.2 NUMBER OF ACCIDENTS INVOLVING INJURY TO PERSONS PER 100 MILLION RUNNING KM

As shown in Figure IV.2, the number of accidents and injured persons have decreased for the past twenty years.

IV.3 Motorway Development

IV.3.1 History

In Japan, the railway network was more developed than the road network since the Meiji era. Thus, the motorization started far behind European countries and the United States.

In 1943, the expenditures for the study on the national highway construction project between Tokyo and Kobe first included in the budget, and the route locationing, topographic surveys, and designs were conducted. However, because of the World War II, this study was terminated in 1944. After the War, the nation's reconstruction projects were implemented. However, any developments on the road network were not observed. The total road

length including national and provincial roads as of 1950 was 130,923 km with the paved ratio of 4.5%. The budget for the road development allocated was only 5.5 billion yen (US$15.28 million), which occupies 0.75% out of the total national budget.

In 1951, the study on the motorways was restarted, and the study results were completed as the Implementation Program for the Toll Expressway (Tokyo — Kobe) Construction Project.

In 1954, the provisional law on the funding for the road development was effected and thus the fund for road development was secured by collecting gasoline tax. From this year (1954), the five-year road development plan was implemented.

In 1956, the special provision law for road development was effected and in line with this law, the construction of toll roads by Nihon Doro Kodan (Japan Highway Public Corporation) was legally materialized. In 1957, the national expressway law and the national development arterial expressway construction law were effected. On October 17, 1957, the development of the Meishin Expressway was officially determined and the construction of expressway started.

In 1966, the old national development arterial expressway construction law was revised and the new National Development Arterial Expressway Construction Law was effected on July 1, 1966. In line with this law, the Ministry of Construction specifies the proposed expressway network with a total length of 7,600 km. The basic concepts for constructing expressways are as follows:

1) The arterial routes stretch longitudinally should be considered major arterial and trunk lines in the expressway network, and be defined.

2) Among the prospective routes interconnect the major local key stations, which will be a center core for the development of the community including rural major cities with a population of more than 100,000 and the new industrial development special zones, the routes should be selected.

3) Major cities and agricultural centers should be planned to be accessible within 2 hours.

In order to decentralize and spread economic activities to rural and local regions, the high-level arterial road network with a total length of 14,000 km was selected in the 4th National Development Plan in June, 1987. Out of this total 14,000 km, the length 7,600 km is the originally defined national arterial roads, 180 km for Honshu-Shikoku Bridge roads and other 6,220 km were future added. In September 1962, the National Development Arterial Expressway Construction Law in which additional 22 roads with a total length of 3,920 km were included, was partially revised and effected.

As a result, the total length of national arterial road network was increased to 11,520 km (7,600 km + 3,920 km).

IV.3.2 Motorway Network

The number of sections and the road length of motorways by jurisdictional institute are shown in Table IV.6.

The high-level arterial road (expressway) network is shown in Figure IV.3, including : completed, in progress and proposed sections.

Table IV.6 NUMBER OF SECTIONS AND THE ROAD LENGTH OF MOTORWAYS BY JURISDICTIONAL INSTITUTE

Jurisdictional Institute	Number of sections	Road length km
Japan Highway Public Corp. Expressways	391	4,279.6
Japan Highway Public Corp. Toll Highways	69	615.2
Metropolitan Expressway Public Corp. & Hanshin Expressway Public Corp.	49	339.7
Honshu Shikoku Bridge Corp.	6	70.0
Prefectural Government	57	564.2
Municipal Office	2	5.2
Local Highway Authority	143	1,041.1
Total	717	6,915.0

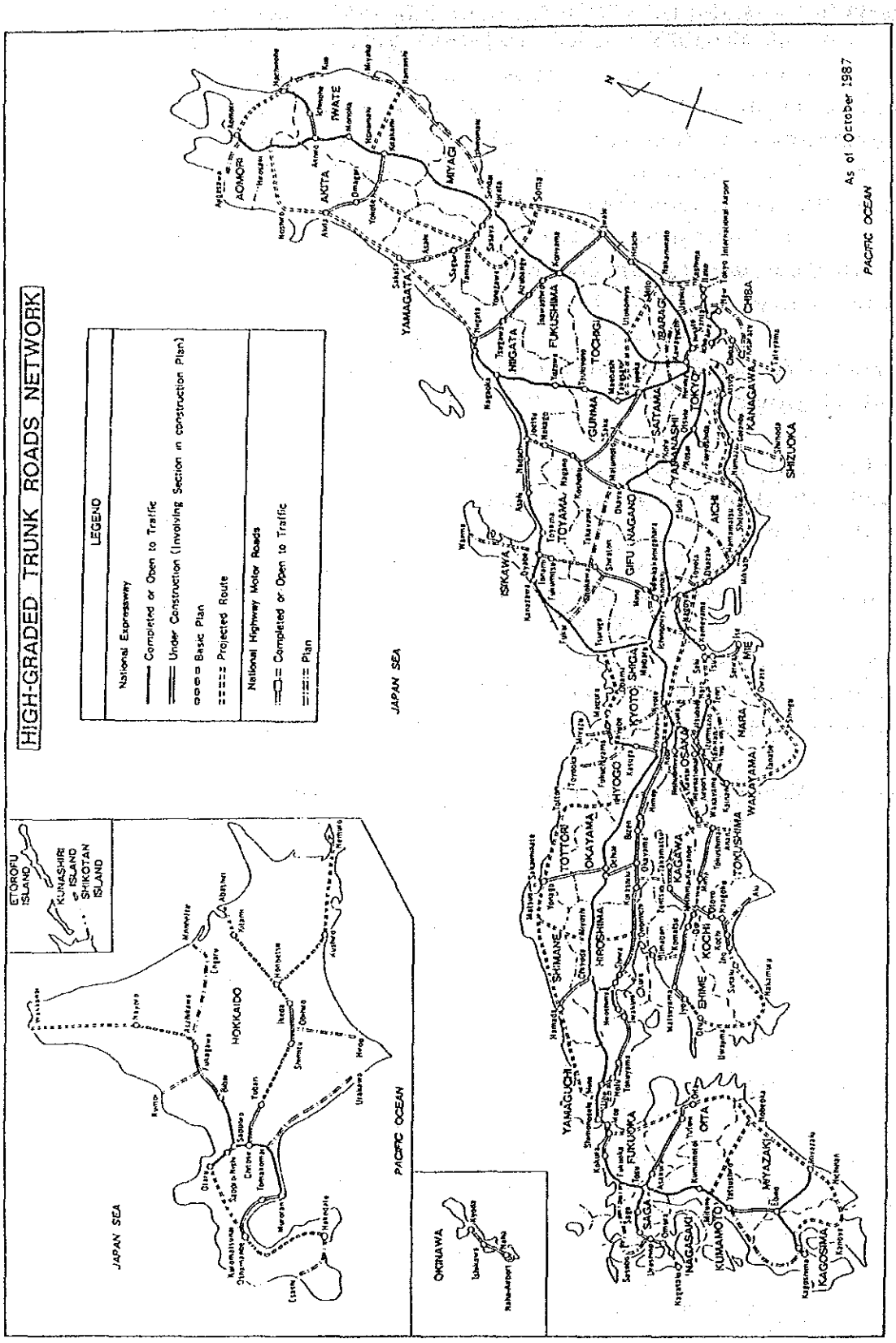


Figure IV.3 EXPRESSWAY NETWORK

IV.3.3 Future Plan

As mentioned in the previous section, the principle target for the 4th National Development Plan is to decentralize economic and industrial activities to rural and local regions all over the country, so that the local cities and towns, which are the centre core for the regional development, will be connected and accessed within one hour drive each other. Thus, the high-level arterial highway network with a total length of 14,000 km is proposed, including the following highways.

National arterial highway (expressway)	11,520 km
Honshu - Shikoku Bridge Expressway	80 km
Ordinary national motorway	2,300 km
Total	14,000 km

IV.3.4 Motorway Administration

Construction and operation of roads in Japan are mainly undertaken by the Government, local governments, public corporations and government enterprises, and to a very limited extent by private bodies. Therefore, the essential portion of road administration is undertaken by the Ministry of Construction.

The Ministry of Construction makes plans for new construction of roads according to the Road Law and associated regulation, executes new construction, improvement, maintenance, repair and associated administrative tasks of the roads, assists and supervises new construction and alterations of roads undertaken by local government, controls the special account for road improvements, instructs and supervises the public corporations and government enterprises relating to roads, assists recovery from disaster damage of roads, supervises truck and motorway businesses, and supervises street improvement projects as part of urban planning projects. There are eight Regional Construction Bureaus nationwide in order to execute those projects under direct jurisdiction of the Ministry. As for the road construction projects in Hokkaido and Okinawa, however, Hokkaido Development Bureau and Okinawa Administrative Bureau are undertaking these tasks.

Prefectural and municipal governments are executing road administration from the standpoint of local benefits. That is to say, according to the Local Government Act, they handle administrative affairs which do not belong within the responsibility of the Government regarding construction and operation of the roads. According to sharing this task with the Government, prefectural and municipal governments have their own organizations in charge of road administration. Such organizations are mainly represented by Civil Engineering Department or Section, though the name of the organization is not necessarily the same. Road projects associated with urban planning projects are generally undertaken by organizations responsible for urban planning such as Urban Planning Section. Road projects of prefectural and municipal governments are in many cases carried out as subsidized projects to which subsidies from the Government are given. But there are still many independent projects which local governments plan and execute independently. In case of road projects of municipal governments, independent projects occupy a large portion of the overall programs.

Beside the abovementioned Government and local governments, there is the third kind of road administrator; public corporations and government enterprises. They are juridical public entities established for construction and improvement of National Expressways and ordinary toll roads. Investors are limited to the Government and local governments. Authorization or approval of the Minister of Construction is required for construction of roads and setting of toll rates.

Many public corporations and government enterprises have been established in the area of roads as juridical public entities which execute toll road business. The first public corporation was Japan Highway Public Corporation established in 1956, followed by Metropolitan Expressway Public Corporation founded in 1959, then Hanshin Expressway Public Corporation founded in 1962 and Honshu-Shikoku Bridge Authority founded in 1970. In addition to those four public cooperations relating to roads, many local road public corporations were established in many areas according to the Local Road Public Corporation Law enacted in May 1970. The first of the local road public corporations was Nagoya Expressway Public Corporation which was established in September 1970, followed by 35 public corporations until May 1985, including two Designated City Expressway Public Corporations and 33 general local road public corporations.

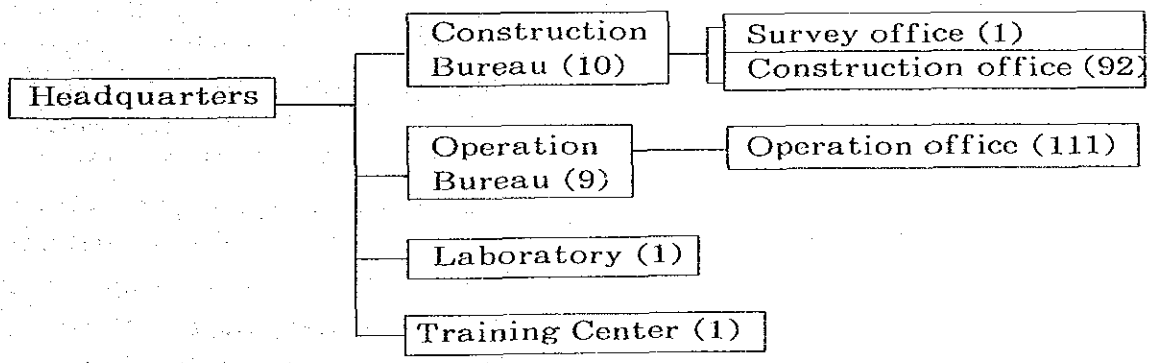
Duties of the Japan Highway Public Corporation are explained below.

Japan Highway Public Corporation (Nihon Doro Kodan)

(1) Date of Establishment : April 16, 1956

(2) Duties : The Corporation is responsible for comprehensive administration of toll roads using the borrowings effective use of the funds for development and improvement of the toll road network. The purpose of Kodan is to contribute to promotion of road improvement and guarantee of smooth traffic flow through comprehensive and efficient control and administration of new construction, improvement, maintenance, repair and other adminis trative tasks of the toll road system.

(3) Organization : The Organization of Japan Highway Public Corporation expands nationwide, and good discipline and control are definitely required for efficient execution of its duty. To achieve this target, the headquarters, which are the core of the organization; Construction Bureau and Operation Bureau, which are in charge of the policy and order transfer and execution; Field Office, the front of the construction and operational site; Laboratory, responsible for solution of technical problems and technological development, and the Training Center responsible for training of the employees, all cooperate with each other. As for the Field Office which executes the actual business, Construction Offices are located at 30 km intervals, and Operation Offices are at 50 km spacing. About 200 Field Offices are deployed nationwide. The Organization chart is shown in Figure IV. 4.



Numerical figures in parenthesis ( ) are number of organizations included.

Figure IV.4 ORGANIZATION CHART

The number of employees is increasing along with the expansion of the business, and the latest number and composition of the employees are shown in Table IV.7.

Table IV.7 NUMBER OF EMPLOYEES

Headquarters, etc.	Construction Bureau (incl. Survey and Construction Offices)	Operation Bureau (incl. Operation Offices)
500	3,000	5,000

Figure IV.5 gives the principle operator for the different types of toll roads.

Principal Operator	Toll Roads
Japan Highway National expressway Public Corporation	Ordinary toll road (National highway, prefectural road, municipal road) *1
Metropolitan Expressway Public Corporation Hanshin Expressway Public Corporation Designated City Expressway Public Corporation	Urban Expressway
Honshu-Shikoku Bridge Authority	Honshu-Shikoku connecting road
Local Road Public Corporation	Ordinary toll road (National highway, prefectural, road, municipal road)
Prefectural Government, Municipal Government (Prefectural road, municipal road)	Ordinary toll road (National highway, prefectural road, municipal road) *2 Toll bridge, toll ferry

Notes: *1 National highway, prefectural road & designated city road.
*2 For Prefectural Government & Municipal Government, their own roads only.

Figure IV.5 PRINCIPAL OPERATOR AND CORRESPONDING TOLL ROADS

IV.3.5 Financing

Government-affiliated organizations, including Japan Highway Public Corporation, Metropolitan Expressway Public Corporation, Hanshin Expressway Public Corporation and Honshu-Shikoku Bridge Authority, fund part of their projects with their own toll revenue, but are for the most part dependent on the Treasury Fund.

Besides, in order to make up for shortfalls, they are raising funds on their own, such as by flotation of private bonds, borrowing money from private financial institutions, in addition to receiving investments from the Government.

These corporations are more or less similar to each other in the manner of raising funds, except that the three corporations other than Japan Highway Public Corporation are receiving investments not only from the central government but also from the local public bodies, but not floating foreign bonds to raise funds.

The financial structure of Japan Highway Public Corporation is described below.

Japan Highway Public Corporation's total budget for fiscal 1988 runs up to about US$26 billion and finances about one-third (US$8.7 billion) of these budgeted expenditures with toll revenue, its own income, raising the rest of the funds from external sources.

More than 80 percent of these external funds come from the Treasury Fund (about US$14.6 billion) consisting of government-accepted and — guaranteed bonds. In particular, nearly half the fund required will be covered by the Government accepted bonds (about US$13 billion).

Besides, in order to complement deficits in funds from the Treasury Account, Japan Highway Public Corporation is raising funds amounting to about US$2.8 billion, slightly more than 10 percent of total fund requirements for itself from private sources, including private bonds, private borrowings and foreign bonds. Also, Japan Highway Public Corporation gets contributions of about US$480 million from the Government in the form of capital funds and subsidies. Table IV.8 gives the

financial sources of the Japan Highway Public Corporation.

Table IV.8 JAPAN HIGHWAY PUBLIC CORPORATION'S FINANCIAL SOURCES (FY 1988 budget)

	Value		Composition (%)
	Yen (¥100 million)	US Dollar ($1 million)	
Government capital funds	544	418	1.6
Government subsidies	90	69	0.3
Sub-total	634	47	1.9
Government-accepted bonds	16,849	12,961	48.5
Government-guaranteed bonds	2,123	1,633	6.1
Sub-total	18,972	14,594	54.6
Private bonds	1,324	1,018	3.8
Private borrowings	2,020	1,554	5.8
Foreign bonds	420	323	1.2
Sub-total	3,764	2,895	10.8
Toll revenue	11,379	8,753	32.7
Total	34,748	26,729	100.0

Note: Exchange rate used (¥130 = US$1.00)

The Government-accepted bond is similar to the Government-guaranteed bond in terms of nominal interest rate and issue price, but is slightly more lucrative for bond issuers than the latter in respect of handling commission.

IV.3.6 Motorway Operation

The example of the motorway operations by Japan Highway Public Corporation is shown in Figure IV.6.

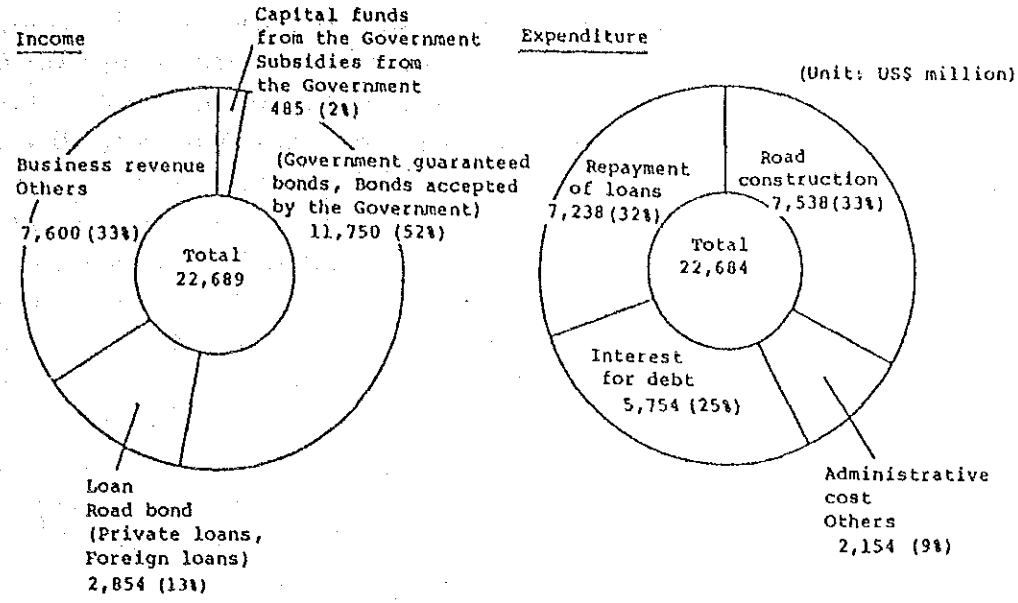


Figure IV.6 MOTORWAY OPERATIONS BY JAPAN HIGHWAY PUBLIC CORPORATION

IV.3.7 Toll System

The present method for establishing tolls is based on two principles, financial redemption and fair cost-bearing convenience. At present, the term of toll collection is delined to be within 30 years.

National and urban expressways with the highway priority must be built and put into service first.

However, these roads cannot be built simultaneously because of the budget constrains, and thus, construction costs differ with the time of construction. If tolls must be established for each road with varying construction costs and dates of service, then tolls for roads made available at an earlier date will naturally be lower. Charges for newer roads will rise.

National expressway construction signifies the formation of a nationwide road network connecting major economic centers, and urban expressway to aid smoother flow of traffic within an area. Roads adjoining to them are closely related to them for motor vehicle transit. When built together, tolls must be

established to eliminate regional and time inequities. A system of calculating revenues from cumulative road construction cost that means pooling funds (reserving surplus from profit-making roads to compensate for losses on unprofitable ones) must be created. From the standpoint of national economy, the fund-pool system is adopted in Japan.

Figure IV.7 Illustrates the flow of the current system.

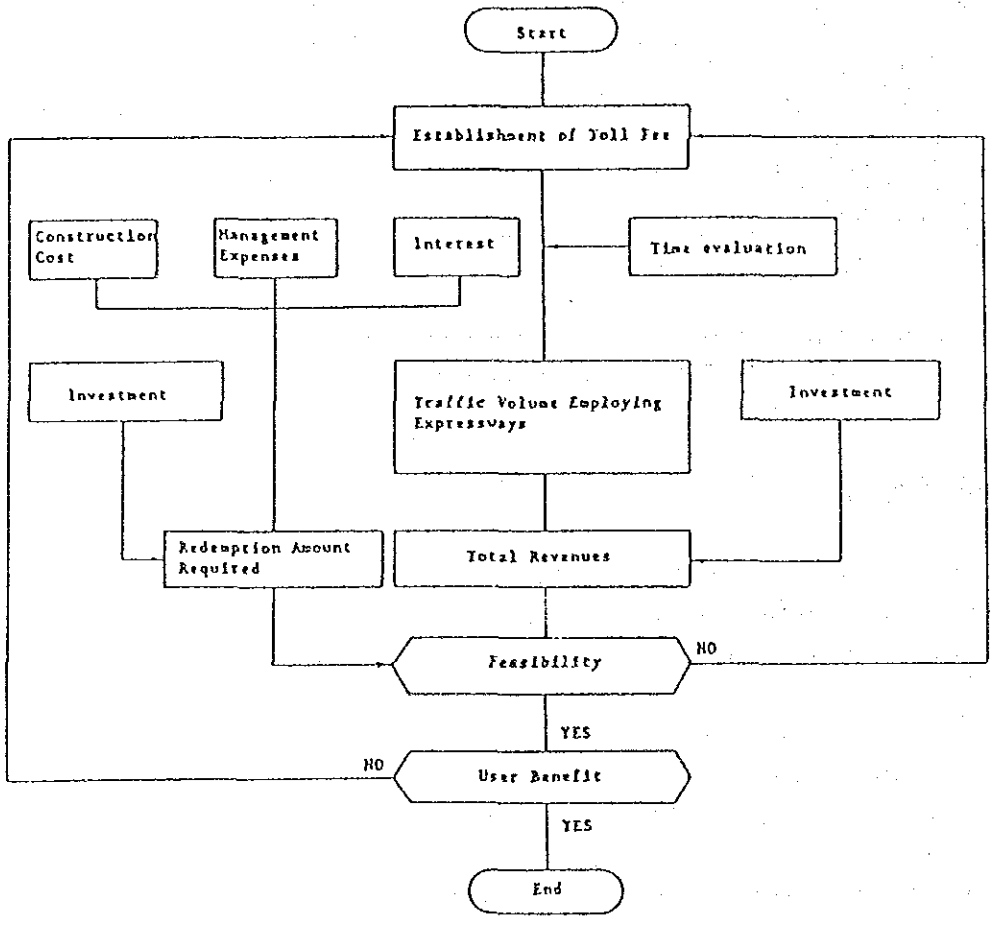


Figure IV.7 TOLL ESTABLISHMENT SYSTEM

Toll road charges are divided into a fee system proportionate to distance or a flat fee system. This distinction depends on whether the fee is determined by the user's travel distance or is uniform regardless of distance.

The former is adopted in national expressways and the latter is

employed for urban expressways. In Japan, all the toll roads employ the closed system except some toll roads serving of the local community.

The toll fees for national expressways employ the uniform rate all-over the country. The toll fee to be charged includes the variable portion, which is proportionate to distance (21.7 yen/km for passenger cars) and the fixed portion, which is imposed for each use (100 yen per use for all vehicles). The types of vehicles for the purpose of collecting tolls are divided into the three categories; Ordinary car, Large car, and Extra-large car, and the ratio imposed is 1 : 1.5 : 2.75.

The toll rates adopted for national expressways are shown in Table IV.9.

Table IV.9 TOLL RATES ADOPTED FOR NATIONAL EXPRESSWAYS

Type of Vehicle / Ratio	Section	Normal	Urban area	Kanmon bridge	Enasan tunnal	Kanetsu tunnal	Sections with less traffic: Tatsuno-Nishi-Bizen Nagasaki-Tarami-Ohmura	Sections with less traffic: Ikarigaseki-Aomori Kyoda-Ishidawa
Ordinary car	1	21.70	26.04	64.0	34.72	34.72	19.60	17.36
Large car	1.5	32.5	39.06	96.00	52.08	52.08	29.40	26.04
EXtra-large	2.75	59.675	71.61	176.0	95.48	95.48	53.90	47.74
Termunal charge	100 per use for all vehicles							

However, on the above toll rates, several discount systems are applied.

IV.3.8 Maintenance

The maintenance and operation activities implemented by Japan Highway Public Corporation are described hereinafter.

Maintenance and operation is routine everyday work and consists of highway inspection, cleaning, minor repairs, snow removal, etc. Work to enchance the existing road systems such as construction of additional interchanges, expansion of rest areas, and installation of noise barriers are also carried out. Since

Japan tends to be affected by natural disasters such as storms and earthquakes, countermeasures to prevent highways from being adversely affected by such disasters are of extreme importance. This work is becoming even more complicated and diverse, hence in order to cope with these problems and to perform maintenance work on schedule, a new system utilizing various types of data is being developed using computers linked by nationwide on-line network.

Breakdown of the 1988 expenditure on maintenance and operation of expressways is shown in Figure IV.8.

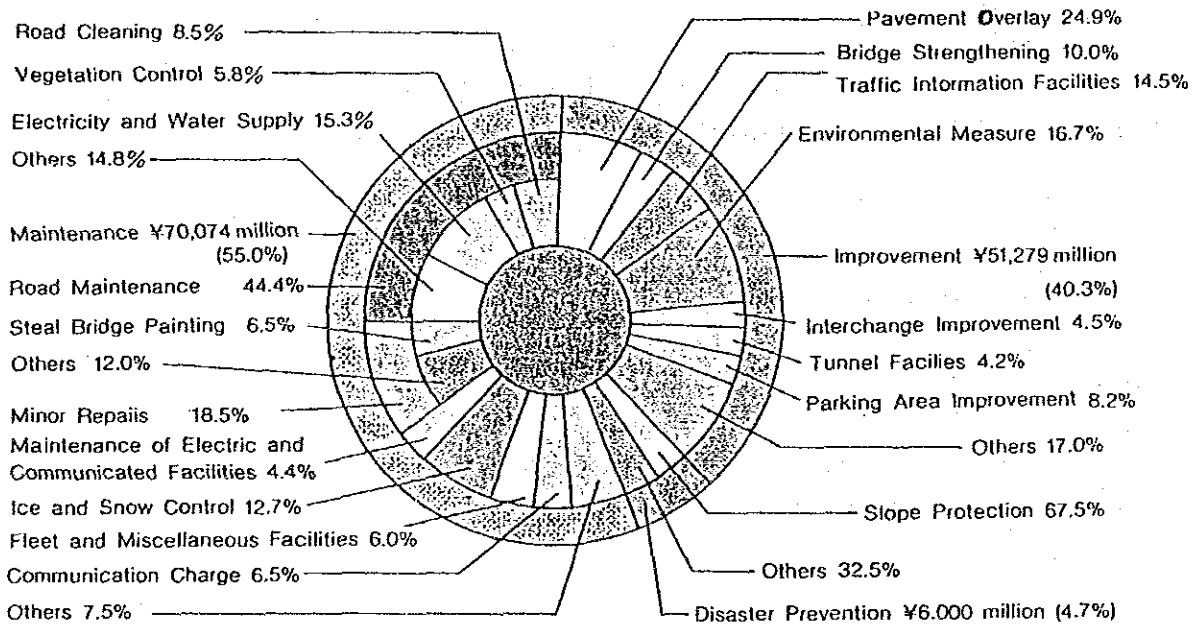


Figure IV.8 BREAKDOWN OF EXPENDITURE ON MAINTENANCE AND OPERATION OF EXPRESSWAYS

- Patrolling and Inspection

This is performed to grasp the conditions of the expressways and traffic, and to discover any existing abnormality along the roads and their facilities at the earliest possible stage.

- Road Cleaning and Vegetation Control

Cleaning is an indispensable task for safe and comfortable

driving, and is conducted so as to maintain the expressway and its vegetation and to preserve the environment along the expressways.

- Ice and Snow Control

It is very important to provide maximum safety in snowy areas by removing ice or the spreading of de-icing chemicals. These tasks are sometimes carried out all day, or even at night, when there is a snow storm. Provisions for supplying adequate information to drivers are also of prime importance.

- Traffic Regulations

For maintenance or repair work, traffic regulations are imperative to assure safe and efficient work, while minimizing traffic hindrances.

- Repavement

Potholes or uneven road conditions are repaired as soon as possible, and such problems as cracks, rutting and wear, requiring careful planning, are corrected after a thorough investigation.

- Disaster Prevention

Efforts to prevent disasters are being made through the use of protected slopes, widened piers and other means so as to protect highways against yearly typhoons, heavy snow-falls, or strong earthquakes.

- Environmental Protection

Measures are constantly being taken to reduce the adverse effects to make the expressway in harmony with the surrounding environment.

IV.3.9 Typical Design Standard

The typical design standards adopted for national expressways are described hereinafter.

(i) Classification of the Expressway

General technical standards for expressways are provided in the "Road Geometric Ordinance". The expressway is classified

(determination of categories) according to designed daily volume and typographical conditions. Design criteria including design speed and width construction are determined according to the classification as shown in Tables IV.10 and IV.11.

Table IV.10 CLASSIFICATION OF NATIONAL EXPRESSWAY

Topography	Designed daily volume (No. of vehicles/day)		
	over 30,000	over 10,000 under 30,000	under 10,000
Flat terrain	Grade 1	Grade 2	Grade 3
Mountaineous area	Grade 2	Grade 3	Grade 4

Table IV.11 CLASSIFICATION OF DESIGN SPEED

Classification of road	Design speed (km/hr)	
	Standard	Special
Grade 1	120	100
Grade 2	100	80
Grade 3	80	60
Grade 4	60	50 except for National Expressway

(ii) Typical Cross Sections and Standard Width

Cross section of the National Expressway consists of roadway, median and shoulder as shown in Figure IV.9. Roadway is gener - ally provided with four lanes, two for each direction. Six lanes are provided for National Expressways in the vicinity of large cities where traffic is rather heavy.

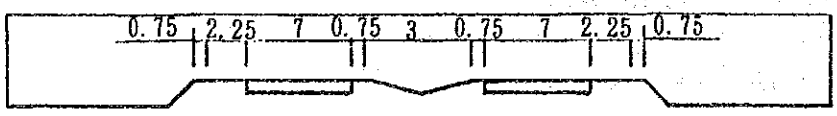


Figure IV.9 TYPICAL CROSS SECTION AND STANDARD WIDTH

The median consists of separator and marginal strip, with a marginal strip provided at the edge of shoulder at which the shoulder contacts the roadway.

(iii) Interchange

Interchanges are provided along national expressways. Standard distance between adjacent interchanges are determined according to region as shown in Table IV.12.

Table IV.12 STANDARD DISTANCE BETWEEN ADJACENT INTERCHANGES

Region	Standard distance
In the vicinity of large cities, and principal industrial areas	5 km — 10 km
Flat area having scattered small cities	15 — 25
Local villages, mountaineous areas	20 — 30

(iv) Rest Facilities

Rest facilities are provided along national expressways.

Rest facilities are divided into two groups; service area and parking area, according to the size and the kinds of facilities provided.

Types and definitions, distribution, and the basic configuration are as described below.

(a) Types and definitions

Types and definitions of rest facilities are as follows:

(1) Service Area

Such rest facilities are equipped with parking lot, garden, communal lavatory (including those for handicapped people), free public rest house, as well as such commercial

service functions as restaurant, gas station (including repair station) and kiosk.

(2) Parking Area

Such rest facilities are equipped with parking lot, garden, communal lavatory and such commercial service functions as kiosk. Gas station can be provided as required.

(b) Distribution

Standard distribution of rest facilities shall be as specified in Table IV.13.

Table IV.13 DISTRIBUTION SPACING OF REST FACILITIES

	Std. spacing	Max. spacing
Between any adjacent two rest facilities	15 km	25 km
Between adjacent two service areas	50 km	100 km

V. UNITED KINGDOM

V. UNITED KINGDOM

V.1 General

The land of the United Kingdom and Northern Ireland (hereinafter United Kingdom) is located at the north-western part of the Europe Continent apart between the Dover Straits, and its land area is 244,100 km2 which is about 1/2 to that of Thailand.

United Kingdom has a population of 56.147 million which is almost the same as that of Thailand.

GNP of United Kingdom is 547,798 million Dollars in 1986 and Per Capita Income in 1986 is 9,651 Dollars which is about 12.2 times to that of Thailand.

V.2 Highway and Transport Conditions

V.2.1 Road Network

The road network is divided into three (3) categories from the administrative functions - Trunk Roads, Principal Roads and Other Roads.

The construction and operations of trunk roads are implemented under the control of the central government. They are further divided into two (2) roads - Motorways and Non-motorway Trunk Roads. Principal roads are constructed and operated by the local authority with the assistance of the central government. They are also sub-divided into local authority motorways and other principal roads. Other roads are the roads which are constructed and operated solely by the local authority's responsibility.

The expressways, which are discussed hereinafter involves Motorways and Dual Carriageways among Non-motorway Trunk Roads. The total road length as of April 1, 1984 is shown in Table V.1. Trunk Roads and Principal Roads occupy 4.9% and 10.0% of the total length respectively. The ratio of trunk roads out of

the total road length is 4.5%, which is equivalent to the aggregated road length of the national highways and expressways in Japan.

Figure V.1 shows road categories and road length.

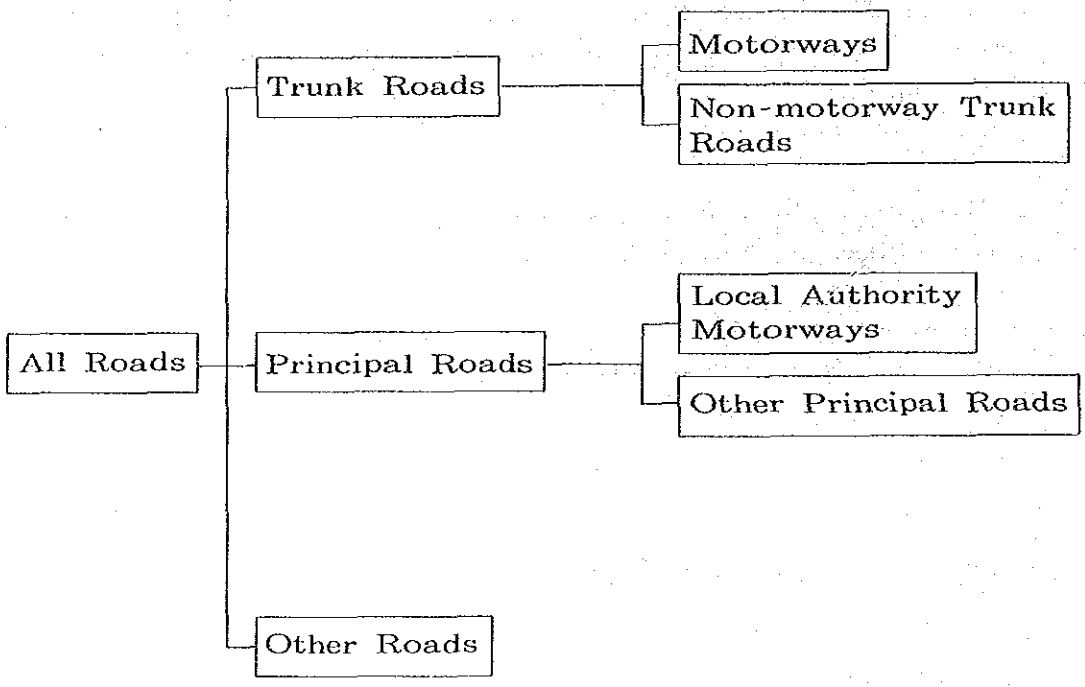


Figure V.1 ROAD CATEGORIES

Table V.1 TOTAL ROAD LENGTH AS OF APRIL 1, 1984

(in kilometer)

Trunk Road	15,128 (4.4%)
(Motorways)	2,690 (0.8%)
Principal Roads	34,820 (10.0%)
(Motorways)	103
Other Roads	296,940 (85.6%)
Classified	109,167 (31.5%)
Not-classified	187,773 (54.1%)
Total	396,872 (100 %)

The increase in highway length is shown in Table V.2.

Table V.2 ROAD LENGTH BY TYPE OF ROAD

Year	Motorway	Non-Motorway Trunk Roads	Local Authority Mortorways	Other Mortorways	Other Roads	Total	Number of vehicle per km
1965	558	13,425	13	0	298,885	312,881	41
1970	1,022	13,441	35	32,549	275,437	322,484	46
1975	1,881	13,359	94	32,994	281,711	330,039	53
1980	2,445	12,393	111	34,187	290,497	339,633	57
1981	2,519	12,969	104	34,482	292,256	341,730	57
1982	2,561	12,317	105	34,486	294,120	343,588	58
1983	2,620	12,322	100	34,582	295,745	345,369	59
1984	2,702	12,396	101	34,709	297,295	347,153	60
1985	2,737	12,293	101	34,534	298,680	348,344	61

V.2.2 Transportation Modes

The share of each transportation mode for the domestic transport of freights and passengers is shown in Tables V.3 and V.4, respectively.

Table V.3 DOMESTIC FREIGHT TRANSPORT BY MODE IN TON-KM

Year	Truck		Railways		Inland shipping		Pipelines		civil aviation		Total	
	Quantity	%	Quantity	%	Quantity	%	Quantity	%	Quantity	%	Quantity	%
1968	1707.0	84.8	211.0	10.5	56.0	2.8	39.0	1.9			2013.0	100.0
1969	1658.0	84.4	211.0	10.7	59.0	3.0	36.0	1.8			1964.0	100.0
1970	1610.0	84.1	209.0	10.9	57.0	3.0	39.0	2.0			1915.0	100.0
1971	1582.0	84.1	198.0	10.5	52.0	2.8	49.0	2.6			1881.0	100.0
1972	1629.0	85.5	177.0	9.3	51.0	2.7	45.0	2.4			1902.0	100.0
1973	1660.0	84.7	196.0	10.0	55.0	2.8	50.0	2.5			1961.0	100.0
1974	1537.0	84.6	176.0	9.7	54.0	3.0	50.0	2.8			1817.0	100.0
1975	1519.0	84.6	175.0	9.7	49.0	2.7	52.0	2.9			1795.0	100.0
1976	1505.0	81.9	176.0	9.6	103.0	5.6	53.0	2.9			1837.0	100.0
1977	1419.0	79.9	171.0	9.6	111.0	6.3	75.0	4.2			1776.0	100.0
1978	1491.0	79.9	171.0	9.2	120.0	6.4	83.0	4.5			1865.0	100.0
1979	1487.0	79.5	169.0	9.0	129.0	6.9	85.0	4.5			1870.0	100.0
1980	1383.0	79.1	154.0	8.8	126.0	7.2	83.0	4.7			1748.0	100.0
1981	1286.0	78.7	154.0	9.4	119.0	7.3	75.0	4.6			1634.0	100.0
1982	1376.0	79.9	142.0	8.2	127.0	7.4	78.0	4.5			1723.0	100.0
1983	1344.0	78.9	145.0	8.5	133.0	7.8	82.0	4.8			1704.0	100.0
1984	1385.0	82.3	78.0	4.6	132.0	7.8	88.0	5.2			1683.0	100.0
1985	1435.0	80.8	122.0	6.9	131.0	7.4	89.0	5.0			1777.0	100.0
1986	1455.0	80.5	140.0	7.7	133.0	7.4	79.0	4.4			1807.0	100.0

Table V.4 DOMESTIC PASSENGER TRANSPORT BY MODE IN PERSONS-KM AND THE SHARE

Units : one billion persons-Km

Year	Passenger car		Bus		Railways		Inland shipping		civil aviation		Total	
	Quantity	%	Quantity	%	Quantity	%	Quantity	%	Quantity	%	Quantity	%
1968	243.0	72.6	56.0	16.7	34.0	10.2			1.9	0.6	334.9	100.0
1969	248.0	73.0	55.0	16.2	35.0	10.3			1.9	0.6	339.9	100.0
1970	263.0	74.3	53.0	15.0	36.0	10.2			2.0	0.6	354.0	100.0
1971	281.0	75.9	51.0	13.8	36.0	9.7			2.0	0.5	370.0	100.0
1972	296.0	77.0	51.0	13.3	35.0	9.1			2.2	0.6	384.2	100.0
1973	307.0	77.3	53.0	13.3	35.0	8.8			2.4	0.6	397.4	100.0
1974	297.0	78.4	54.0	14.3	36.0	9.5			2.0	0.5	378.9	100.0
1975	294.0	76.2	55.0	14.2	35.0	9.1			2.0	0.5	386.0	100.0
1976	309.0	77.8	53.0	13.3	33.0	8.3			2.4	0.6	397.4	100.0
1977	323.0	78.7	51.0	12.4	34.0	8.3			2.2	0.5	410.2	100.0
1978	342.0	79.6	50.0	11.6	35.0	8.1			2.7	0.6	429.7	100.0
1979	342.0	79.9	48.0	11.2	35.0	8.2			3.0	0.7	428.0	100.0
1980	361.0	81.3	45.0	10.1	35.0	7.9			3.0	0.7	444.0	100.0
1981	367.0	82.3	42.0	9.4	34.0	7.6			2.8	0.6	445.8	100.0
1982	376.0	83.4	41.0	9.1	31.0	6.9			2.9	0.6	450.9	100.0
1983	380.0	82.8	42.0	9.2	34.0	7.4			2.9	0.6	458.9	100.0
1984	395.0	83.1	42.0	8.8	35.0	7.4			3.4	0.7	475.4	100.0
1985	401.0	83.1	42.0	8.7	36.0	7.5			3.6	0.7	482.6	100.0
1986	424.0	83.8	41.0	8.1	37.0	7.3			3.7	0.7	505.7	100.0

The share of each transportation mode for freight transport has not changed for the past ten years. Trucks occupy approximately 80% out of all the modes.

In relation to the passenger transport, the aggregated total of passenger cars and buses occupies approximately 90%. These figures show that, in the United Kingdom, the roads serve as the most important role for the national economy and industrial activities.

V.2.3 Number of Registered Vehicles

The number of registered vehicles by type is shown in Table V.5.

The total number of vehicles increased by 20% for the past ten years. The average growth rate for the total vehicles during the past ten years is approximately 3%. The rate for passenger cars for the same period is 2%.

Table V.5 NUMBER OF REGISTERED VEHICLES BY TYPE

Units : per 1000

Year	Passenger car	Others						Total	Motorcycle
			Bus	Truck	Van	Special	Trailer		
1968	10,836	1,651	80	1,565	6	1,651		12,487	1,324
1969	11,252	1,649	79	1,564	6	1,649		12,901	1,223
1970	11,540	1,699	78	1,616	5	1,699		13,239	1,141
1971	12,087	1,701	78	1,618	5	1,701		13,788	1,141
1972	12,728	1,723	77	1,640	6	1,723		14,451	1,069
1973	13,497	1,832	106	1,722	4	1,832		15,329	1,006
1974	13,639	1,875	107	1,762	6	1,875		15,514	1,042
1975	13,747	1,895	112	1,776	7	1,895		15,642	1,161
1976	14,047	1,876	113	1,756	7	1,876		15,923	1,220
1977	14,300	1,881	114	1,760	7	1,881		16,181	
1978	14,068	1,820	110	1,703	7	1,820		15,889	1,194
1979	14,568	1,897	111	1,778	8	1,897		16,465	1,292
1980	15,073	1,879	110	1,761	8	1,879		16,952	1,372
1981	15,267	1,855	110	1,737	8	1,855		17,122	1,371
1982	15,303	2,173	111	2,062		2,173		17,476	1,370
1983	15,543	2,215	113	2,102		2,215		17,758	1,290
1984	16,055	2,282	116	2,166		2,282		18,337	1,225
1985	16,453	2,742	120	2,622		2,742		19,195	1,048
1986	16,981	2,932	125	2,807		2,932		19,913	1,065
1987	17,421	3,008	129	2,879		3,008		20,429	978

V.2.4 Accidents

The number of traffic accidents involving injury to persons and other related data are shown in Table V.6.

Table V.6 NUMBER OF TRAFFIC ACCIDENTS

Year	Nomber of accidents involving injury	Number of injured	Number of killed	Accident ratio (per million vehicle km)		
				Number of accidents	Number of injured	Number of killed
1968	364,200	342,398	6,810	1139.0	180.0	3.6
1969	261,778	345,811	7,383	134.0	177.0	3.8
1970	267,457	355,847	7,501	130.0	172.0	3.6
1971	259,025	344,390	7,696	118.0	156.0	3.5
1972	265,105	352,013	7,779	115.0	153.0	3.4
1973	262,413	346,374	7,406	106.0	140.0	3.0
1974	244,042	317,726	6,876	102.0	132.0	2.9
1975	246,286	318,584	6,366	101.0	130.0	2.6
1976	253,000	331,600	6,520	101.0	130.0	2.6
1977						
1978	264,769	342,964	6,831	95.0	126.0	2.5
1979	254,967	328,158	6,351	91.0	120.2	2.3
1980	252,300	320,779	5,953	98.0	127.3	2.4
1981	248,276	318,994	5,846	96.0	125.9	2.3
1982	255,980	328,362	5,934	94.0	123.4	2.2
1983	242,876	303,139	5,445	83.0	111.7	2.0
1984	253,183	318,705	5,599	91.0		
1985	247,000	314,969	5,209	86.0	111.6	1.8
1986	247,854	321,451	5,382	82.0	106.0	1.8
1987	239,161	307,844	5,108	75.0	97.0	1.6

V.3 Motorway Development

V.3.1 History

In relation to expressways (Motorway), the Country Surveyors Association prepared the highway development plan with a total length of 1,600 km on seven (7) routes, and recommended it to the government.

In 1949, the Special Road Act, which deals with the functional classification, was enacted and combined into the present Road Law in 1959.

In 1949, the motorway was proposed for the section between Bristol and Birmingham in line with the above law. This motorway was in operation as the Bristol Bypass in 1958. The status of planning, construction and in-operation stages of Motorways and Local Authority Motorways since 1965 is shown in Figure V.2.

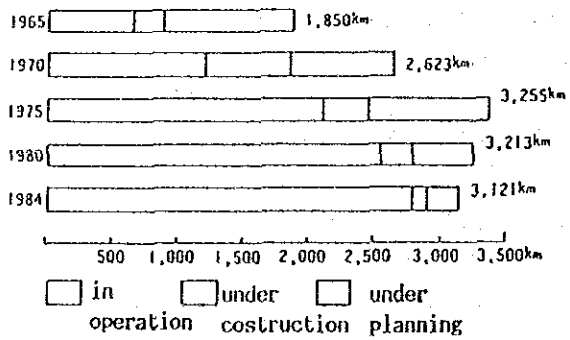


Figure V.2 DEVELOPMENT STATUS OF MOTORWAYS AND LOCAL AUTHORITY MOTORWAYS

In the Unied Kingdom, the motorway network (trunk road network) is composed of Motorways and Dual Carriageways.

V.3.2 Motorway Network

The motorway network in the United Kingdom is shown in Figure V.3.

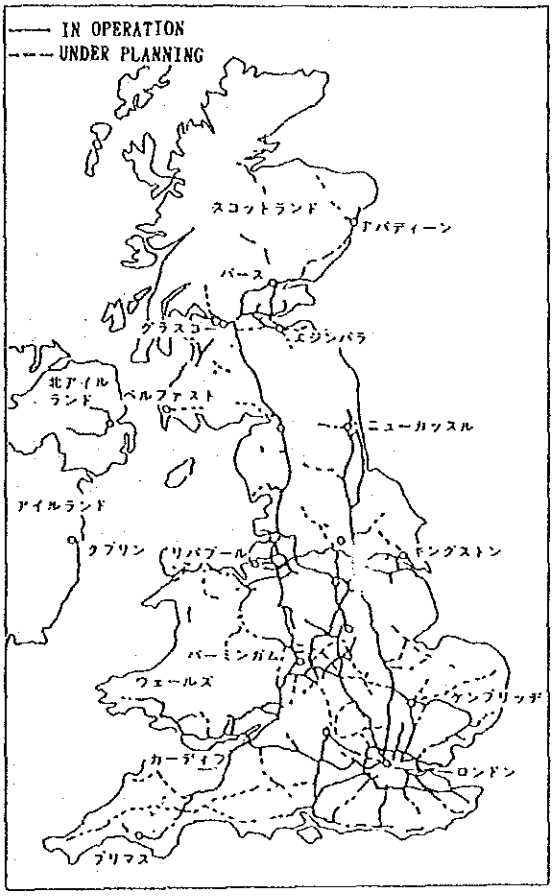


Figure V.3 MOTORWAY NETWORK

The total length of proposed motorway network in each year is shown in Table V.7. The length of Motorway sections which were completed in each year is shown in Table V.8.

Table V.7 TOTAL LENGTH OF PROPOSED MOTORWAYS IN EACH YEAR

Year	1975	1976	1977	1978	1979
km	3,335	3,450	3,331	3,204	3,150

Year	1980	1981	1982	1983	1984
km	3,213	3,207	3,128	3,197	3,121

Table V.8 LENGTH OF COMPLETED MOTORWAYS IN EACH YEAR

Year	1975	1976	1977	1978	1979
km	101	189	72	130	59
Year	1980	1981	1982	1983	1984
km	105	79	37	52	82

V.3.3 Future Plan

Most of existing motorways are located in the United Kingdom. As of 1984, among the total proposed motorway network with a length of 3,121 km, sections with 2,692 km length are now in operation. The aggregated length of the remaining proposed length is 429 km including the sections under construction. The motorway network including in-operation sections and the proposed ones is shown in Figure V.4. The dual carriageway network including existing and proposed sections is shown in Figure V.5.

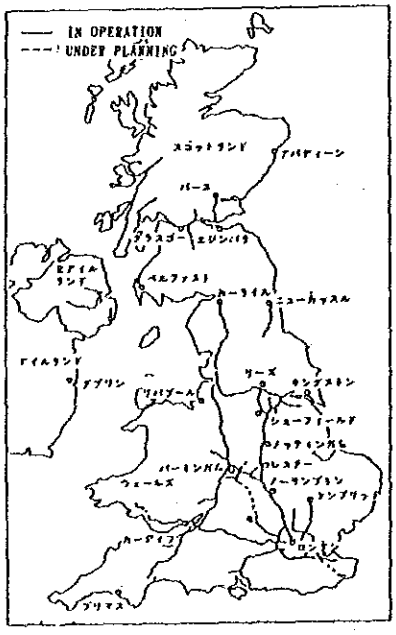


Figure V.4
MOTORWAY NETWORK
INCLUDING IN-OPERATION
& PROPOSED SECTIONS

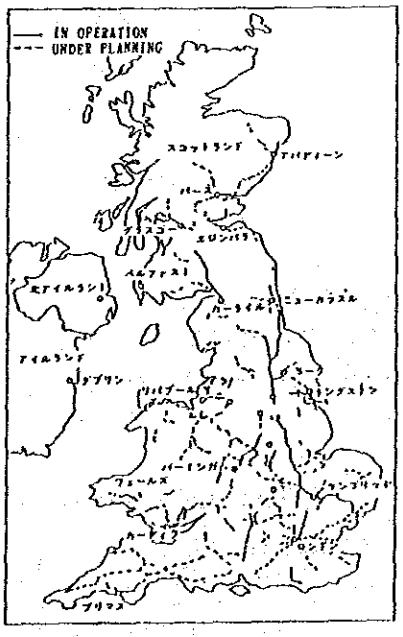


Figure V.5
DUAL CARIAGEWAY NETWORK
INCLUDING EXISTING
& PROPOSED SECTIONS

V.3.4 Motorway Administration

Since 1976, the Department of Transport is in charge of transportation and traffic administration. The Department is responsible for the nation trunk roads (include Motorways and non-motorway trunk roads) and the management of British Rail. It also provides the transport supplementary grant (TSG) to the concerned countries. The organization of the Department is shown in Figure V.6.

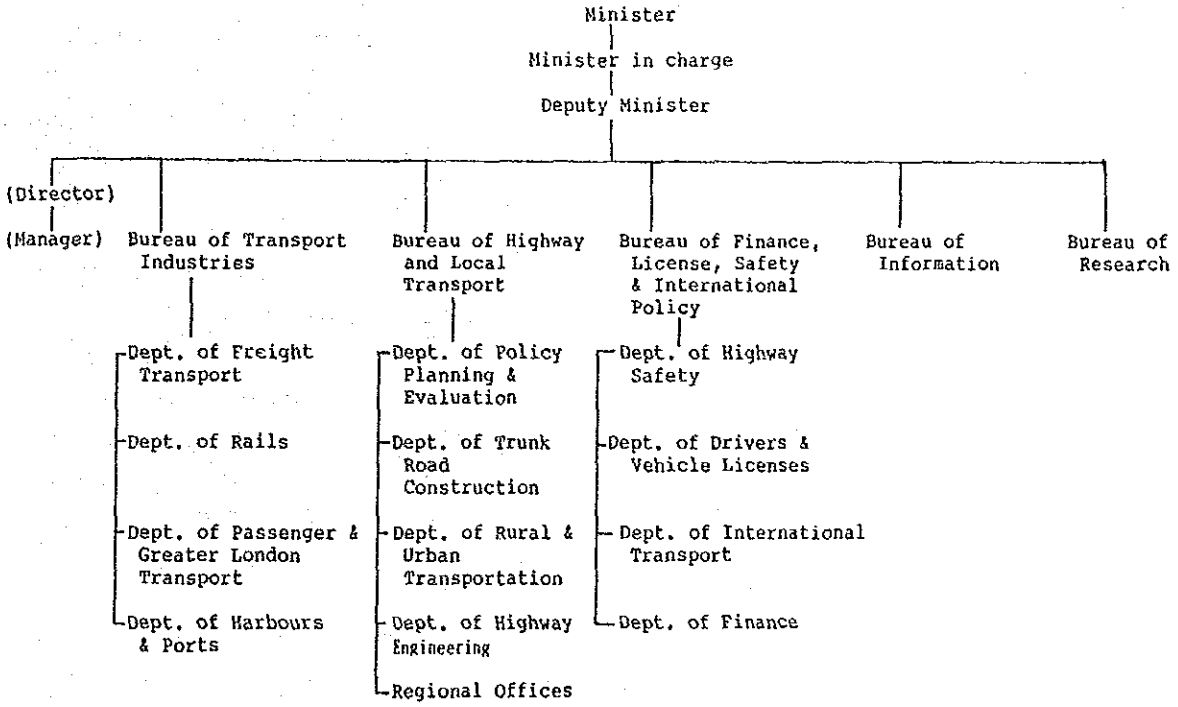


Figure V.6 ORGANIZATION OF DEPARTMENT OF TRANSPORT

The local government is responsible for all the roads excluding motorways and non-motorway trunk roads, planning and coordination for bus services and establishment of policies on traffic controls on rural roads.

V.3.5 Financing

The special financial sources such as taxes and tolls for the road development are not legally established. The road development is implemented in the ordinary national budget.

The total expenditure by the Government for the transportation sectors in the fiscal year of 1984 is 5,486 million pounds, which occupies 4.5% out of the total budget. The total expenditures for highway sectors, which include the capital investment and the ordinary expenditure on trunk roads and principal roads are 2,899 million pounds, which occupies 52.8% out of the total expenditures for the transportation sectors. The expenditures for the highway sector are shown in Table V.9.

Table V.9 EXPENDITURES FOR THE HIGHWAY SECTOR

Unit: million pounds

	1979	1980	1981	1982	1983	1984	1985	1986
Trunk roads	484.3	568.2	631.7	713.0	702.0	738.0	758.0	766.7
New construction/ Improvement	60.1	72.0	108.2	167.9	152.0	174.0	177.0	240.0
Maintenance/ Rehabilitation	60.1	68.1	99.9	89.6	102.0	107.0	103.0	112.3
Total	605.0	208.3	839.8	970.5	956.0	1,019.0	1,038.0	1,119.4
Roads under local government authority								
New construction/ Improvement	472.7	556.5	524.0	565.2	612.0	610.0	686.0	684.0
Maintenance Improvement	718.8	831.7	993.2	1,063.1	1,102.0	1,172.0	1,208.0	1,321.7
Total	1,191.5	1,388.2	1,517.2	1,628.3	1,714.0	2,782.0	1,894.0	2,005.7
Operating expreases	204.3	255.5	254.1	261.2	249.0	244.0	236.0	217.0
Parking : Capital	16.7	23.8	17.0	22.0	18.0	52.0	38.0	39.9
Management	-8.5	-14.5	-19.5	-30.2	-24.0	-47.0	-55.0	-55.0
Traffic safety, Others	12.4	13.7	9.6	11.8	15.0	16.0	19.0	
Highway Total	2,021.4	2,375.0	2,618.2	2,863.6	2,928.0	3,065.0	3,167.0	3,346.0

The expenditures for the highway sector were doubled for the past seven years. The grants from the central government to local governments involve the Rate Support Grant (RSG) and the Transport Support Grant (TSG). The RSG is distributed by the Department of Transport based on the fixed formula. The RSG is not limited to the highway sector, but also to the other sectors including education, housing, social welfare and other sectors. The TSG is limited to the funds for the transportation policies. Bonds issued by the local government authority are utilized for the new construction and betterment.

V.3.6 Motorway Operation

The motorway operation is implemented under the national ordinary budget as discussed in the previous section. In the United Kingdom, motorways and trunk roads have been developed as public works and hence a toll roads does not exist except tunnels and bridges.

V.3.7 Maintenance

As discussed in section V.3.5, the maintenance is also undertaken by the government authorities concerned. The maintenance work for bridges and pavement is undertaken based on the guidelines established.

V.3.8 Typical Design Standards

The speed limit in the United Kingdom is 112 km/hr. The maximum design speed is 120 km/hr. Either 120 km/hr or 100 km/hr is used for motorways and dual carriageways. The typical cross section of motorways and dual carriageways is shown in Figure V.7.

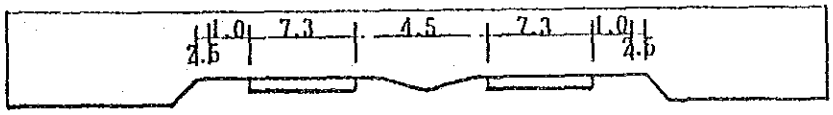


Figure V.7 TYPICAL CROSS SECTION

At present, forty-four (44) service areas are provided along motorways in the United Kingdom. The interval between adjacent areas is originally 40 km, and later as traffic volume increases, additional area is provided in between, so that the spacing at the final stage is 20 km.

VI. AMERICA

VI. AMERICA

VI.1 General

The land of the United States of America (hereinafter U.S.A.) is largely occupying the central part of the North American Continent with a land area of 9,372,614 km^2, which is about 18.2 times to that of Thailand.

U.S.A. has a population of 241.6 million in 1986 which is about 4.6 times to that of Thailand.

GNP of the U.S.A. is 4,185,490 million Dollars in 1986 and Per Capita Income in 1986 is 17,323 Dollars which is 21.8 times to that of Thailand.

VI.2 Highway and Transport Conditions

VI.2.1 Road Network

The total length of highways and roads in the USA is 6.21 million km. These roads are divided into the following categories by the administrative classifications.

Federal Highway

1) National system of interstate and defense highway

The interstate highway is provided to connect the major cities and the industrial centers each other, and with the important international highways on the borders with Canada and Mexico. As of 1987, out of the proposed total length of 68,861 km, the sections with a length of 67,034 km, which occupies 97%, have been completed and in operation. The interstate highways network occupies only 1.1% out of the total highways and roads network in the USA. It carries 20.9% of the total traffic.

This highway network is grade separated as a standard and fully access controlled. The number of lanes provided is between four (4) and eight (8).

2) Federal-aid primary system

The primary system is the network connecting the important major highways which serve the interstate, state and regional traffic. The total length of this highway system excluding interstate highways is 414,000 km. This highway system was approved by the Federal-aid Road Act 1921.

3) Federal-aid secondary system

The secondary system involves the access roads from the agricultural area to the market, the rural postal roads, schooling roads, suburban roads in the rural area, the roads connecting with airports, county roads, township roads, roads connecting with the Federal-aid system in the urban area, and the major collector roads in the rural area. The total length is 640,000 km.

4) Federal-aid urban system

The Federal-aid urban system is provided in the urban area or in the other region designated by the State Highway Department. The total length is 220,000 km.

State Highway

The state highway system is designated by the State, and involves the primary and secondary roads which are classified depending on the level of importance in the State. In some States, county roads and municipal streets are also under the jurisdiction of the State. The total length is 1,470,000 km.

Roads under the control of the local government authority

The majority of the road sections is occupied by the roads which are under the control of the local government authority. County roads, township roads, town roads and village roads are the roads under this category. The total length is 4,320,000 km. Two thirds (2/3) of this category are county roads.

Federal lands highway

The forest highway, the public lands highway, the park road, the parkway and the Indian reservation road are called Federal Lands Highway.

Freeway

Freeways are the highway-grade principal arterial highways. They are divided and fully access controlled highways. The Interstate highway is considered to be a principal arterial highway from the functional viewpoint and also a freeway in term of structural aspects.

The road length by type is shown in Table VI. 1.

Table VI.1 ROAD LENGTH BY TYPE

Year	Length (km)					Paved
	Freeway	Arterial Highway	Secondary Road	Others	Total	Ratio (%)
1968	43,845	6,401,128	405,556	4,839,265	5,928,794	42.7
1969	48,807	705,187	438,135	4,879,031	5,971,160	43.6
1970	53,701	603,335	438,870	4,907,101	6,003,007	44.5
1971	55,666	657,129	441,590	4,950,546	6,104,931	45.1
1972	59,563	757,760	472,512	4,863,864	6,153,699	79.7
1973	61,936	763,115	466,800	4,896,650	6,188,501	79.7
1974	64,062	771,218	457,818	4,910,597	6,203,695	80.4
1975	64,653	772,812	460,430	4,942,335	6,240,230	80.8
1980						
1981	83,000	545,400	755,600	4,815,000	6,199,000	85.0
1982	80,000	551,400	707,000	4,883,000	6,221,400	52.0
1983	80,530	555,440	698,570	4,907,800	6,242,340	52.0
1984	81,105	558,159	696,702	4,925,910	6,261,876	55.0
1985	81,678	562,142	696,300	4,873,732	6,213,852	55.0
1986	82,279	569,175	695,288	4,895,436	6,242,178	56.0
1987						

VI.2.2 Transportation Modes

The passenger transport by transportation mode is shown in Table VI. 2.

When referring to the growth from 1974 to 1984, the roads show an increase by 120% and occupy almost 85% out of all the modes. The passenger transport is dependent mainly on the roads in the USA.

Table VI.2 PASSENGER TRANSPORT BY TRANSPORTATION MODE

(Unit: One billion persons-km)

Year	Passenger Car	Bus	Railways	Civil Ariation	Total
	Quantity	Quantity	Quantity	Quantity	Quantity
1975	1884.0	40.9	16.3	238.7	2179.8
1976	2027.1	40.4	16.9	264.6	2348.9
1977	2117.8	41.4	16.7	284.8	2460.8
1978	2192.3	41.2	16.9	327.0	2577.5
1979	2128.1	44.6	18.7	367.2	2558.6
1980	2092.7	44.1	17.7	352.6	2507.1
1981	2123.1	43.6	17.7	347.6	2532.1
1982	2164.3	43.3	16.6	364.8	2589.0
1983	2195.2	42.6	16.7	394.1	2648.7
1984	2233.9	39.9	17.5	424.4	2715.7
1985	2282.5	38.6	18.3	468.0	2807.4
1986	2349.1	37.2	19.2	514.5	2919.9

The freight transport by transportation mode is shown in Table VI.3. The average share of each transportation mode during the period from 1974 to 1984 shows 2% for civil aviation, 20.4% for pipe lines, 31% for railways, 20.2% for roads and 28.2% for inland shipping. The share of roads is quite low comparing with the rate for the passenger transport. However, this is due to that the above data is limited to the intra-urban transport. When considering the short trips in the urban area, the share of roads will be tremendously high.

Table VI.3 FREIGHT TRANSPORT BY TRANSPORTATION MODE

(Unit: One billion persons-km)

Year	Truck	Railways	Land Shipping	Pipelines	Civil Ariation	Total
	Quantity	Quantity	Quantity	Quantity	Quantity	Quantity
1975	730.6	1221.5	550.4	815.9	6.0	3324.4
1976	820.7	1287.4	600.3	828.8	6.3	3543.5
1977	893.2	1342.2	592.2	878.7	6.7	3712.9
1978	964.0	1396.9	658.2	943.0	7.6	3969.7
1979	978.5	1491.8	684.0	978.5	7.5	4140.1
1980	893.2	1499.9	655.0	946.3	7.8	4002.1
1981	848.1	1487.0	659.8	907.6	8.2	3910.7
1982	836.8	1303.5	564.9	910.9	8.3	3624.4
1983	925.3	1353.4	577.7	894.8	9.4	3760.7
1984	975.2	1504.7	642.1	914.1	11.3	4047.5
1985	981.7	1440.3	614.8	907.6	9.8	3954.2
1986	1023.5	1443.5	605.1	933.4	11.4	4017.0

VI.2.3 Number of Registered Vehicles

The increase of registered vehicles is shown in Table VI.4.

Table VI.4 NUMBER OF REGISTERED VEHICLES

Year	Passenger Car	Bus	Trucks	Sub-Total	Trailer	Total	Motorcycle
1975	106,713	462	25,776	26,238	5,291	138,242	4,967
1976	110,351	478	27,720	28,198	5,836	144,385	4,989
1977							
1978	116,575	501	31,702	32,203	6,166	154,944	5,142
1979	120,248	520	33,350	33,870	6,242	160,360	6,502
1980	121,724	529	33,637	34,166	6,224	162,114	6,925
1981	123,462	544	34,451	34,995	5,683	164,140	6,831
1982	123,698	559	35,253	35,812	14,470	173,980	6,793
1983	126,728	586	36,548	37,134	11,935	175,797	5,585
1984	127,867	584	38,047	38,631	12,561	179,059	
1985	132,108	594	38,989	39,583	12,838	184,529	5,480
1986	135,431	594	40,166	40,760			6,444
1987							6,262

During the period from 1975 to 1985, the number of registered vehicles increased by 124% to be 132 million vehicles. Trucks increased by 151% from 25.8 million to 39 million units during the same period.

VI.2.4 Accidents

In 1974, the speed limit was determined to be 88 km/hr (55 MPH) on all the roads in the USA. However, in 1987, and in limited sections on the interstate highways, the speed limit of 104 km/hr (65 MPH) was allowed.

The number of killed persons by accidents on each highway category for the past several years is shown in Table VI.5.

Table VI.5 NUMBER OF KILLED PERSONS BY TRAFFIC ACCIDENTS

Year		1982	1983	1984	1985	1986	1987	82-86 Average	1987/82-86 Average
Inter state highway	urban	1,990	1,878	2,043	1,951	2,119	2,101	1,996	1.05
	rural	2,081	2,130	2,225	2,163	2,131	2,504	2,146	1.17
	total	4,071	4,008	4,268	4,114	4,250	4,605	4,142	1.11
Others		39,862	38,577	39,987	39,711	41,837	41,781	39,995	1.04
Total		43,933	42,585	44,255	43,825	46,087	46,386	44,137	1.05

Every year, more than 4,000 persons are killed by traffic accidents on the Interstate highways.

The number of traffic accidents involving injury to persons and other related data are shown in Table VI.6.

Table VI.6 NUMBER OF TRAFFIC ACCIDENTS

Year	Number of traffic accidents	Number of injured	Number of killed	Accident rate (million veh-km) number of accidents	number of injured	number of killed
1975	1,861,131	2,808,323	45,500	87.0	131.0	2.1
1976	1,926,350	2,913,066	46,430	83.0	125.0	2.0
1977						
1978	2,156,000	3,166,700	51,153	87.0	127.0	2.0
1979	2,155,200	3,150,000	51,083	87.0	128.0	1.8
1980	2,053,200	3,150,000	51,077	82.0	120.0	2.1
1981	2,059,200	3,010,000	49,268	81.0	120.0	1.7
1982	1,999,015	2,928,000	43,862	81.0	114.0	1.6
1983	2,042,966	3,001,000	42,985	76.0	113.0	1.6
1984	2,189,622	3,210,000	44,237	78.0	116.0	1.5
1985	2,257,668	3,340,400	43,795	78.0	117.0	1.5
1986	2,292,962	3,400,000	46,056	76.1	115.0	1.5
1987			46,386			

VI.3 Motorway Development

VI.3.1 History

In 1907, the New York State Assembly approved the establishment of the Bronx River Commission, which was later acquired the land on both banks of the river, and constructed the strip parks and roads on the parks. This road is called the parkway, which was planned as a motorway with four (4) lanes. Originally, an environmental engineer, Hahman Marck planned this road as a divided road with uninterrupted land in the median. The basic design principles proposed were as follows:

- wide right-of-way acquisition like a park
- access controlled road
- grade separation with other roads topography, without deep cuts and high embankments
- minimum disruption to natural beauty and vegetation

These basic principles were formed and implemented before 1926. However, these concepts were not always introduced, and later in 1933, these concepts were gradually applied. In the 1920s, traffic congestion was observed in the urban areas and in the intra-urban highways. The easy countermeasure to solve this congestion was to increase the number of lanes; 2 lanes to 3 lanes and to 4 lanes. Furthermore, it was obvious that the separation from the other direction traffic is necessary in order to operate the multi-lane road safely.

The total length of divided highways except inter-urban highways as of 1937 was 1,920 km. In the beginning of 1937, President Roosevelt ordered the Bureau of Public Roads to conduct the study on the proposed six (6) toll highways which traverse the continent.

The study report indicated that the construction of toll highways traversing the continent is not recommendable, but the inter-regional and intra-urban highway network with a total length of 42,700 km is necessary.

Based on the recommendations in the report, the National Inter-regional Highway Committee was established in 1941 and the study report on the motorway network was prepared in 1944. The

report recommended the motorway network with a total length of 62,400 kms including the access roads. The total length of interstate highway network should be 64,000 km and the routing should be finalized through the discussion with the State authorities concerned. The accumulated length of proposed highways recommended by each state was 72,110 km.

In August 1947, the preliminary routings of the interstate highway network was disclosed. The total length was 60,320 km. In September 1955, the circumferential interstate highways with a total length of 3,680 km were added.

By the Federal-Aid Road Act 1956, the total length of interstate highways was increased from 64,000 km to 66,000 km. Due to this act, the Federal subsidy was secured.

The road development in 1960's was focused on the treatment of the traffic demand in urban areas. In the Federal-Aid Road Act, 1968, the length of the Interstate highway network was further expanded by 2,400 km to be in total 68,400 km. The road development in 1970's was concentrated on the treatment of the rapid urbanization, traffic congestion, environmental issues, and energy related problems.

The road development in 1980's as focused on the rehabilitation and maintenance of the existing deteriorated highways.

VI.3.2 Motorway Network

In recent years, no toll highways have been constructed. The present status of toll highways (motorways) as of 1985 is shown in Table VI.7.

The number of administrations of toll highways is 40 institutions, and the classification is shown in Table VI.8.

Table VI.7 PRESENT STATUS OF TOLL HIGHWAYS (MOTORWAY)
As of 1.1.1985

(km)

Highway Classification		Total Length	Toll Road Sections
Federal-aid Highways	Interstate Highway	4,329.50	3,968.28
	Primary system	1,531.61	1,271.91
	Secondary system	43.44	41.99
	Urban system	52.13	52.13
Other Highway	State Highways	2,072.39	2,047.77
	Other local government highways	298.95	298.31
Total		8,328.02	7,680.39

Table VI.8 CLASSIFICATION OF TOLL HIGHWAY ADMINISTRATING INSTITUTIONS

Toll Highway Administrating Institutions	Number of institutions	Number of routes	Length km
State Transportation Dept.	2	5	256.96
State Highway Dept.	3	7	252.13
State's other Dept.	2	4	118.10
County			
City and Village	2	2	29.77
District			
Authority	15	38	3,984.37
Commission	6	16	2,322.43
Administration	1	1	68.38
JV of Commission & State Trans. Dept.	2	8	670.63
Private Company	7	7	50.68
Total	40	88	7,753.45

The expressway network in USA is shown in Figure VI. 1.

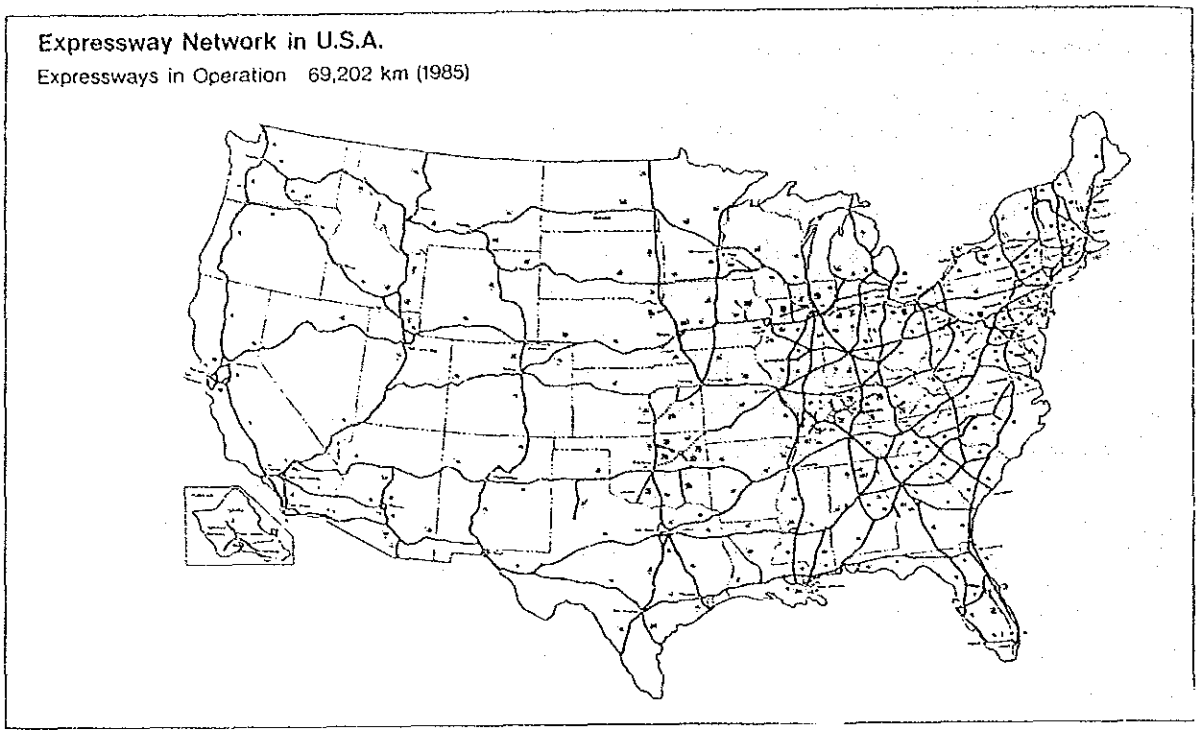


Figure VI.1 THE EXPRESSWAY NETWORK

VI.3.3 Future Plan

The construction of the Interstate highway network, which commenced in 1960's has almost reached to the completion except some sections. By the 1987 Act, this network is scheduled to be completed by September 30, 1993. However, no future plan of the motorway construction has been disclosed.

VI.3.4 Highway Administration

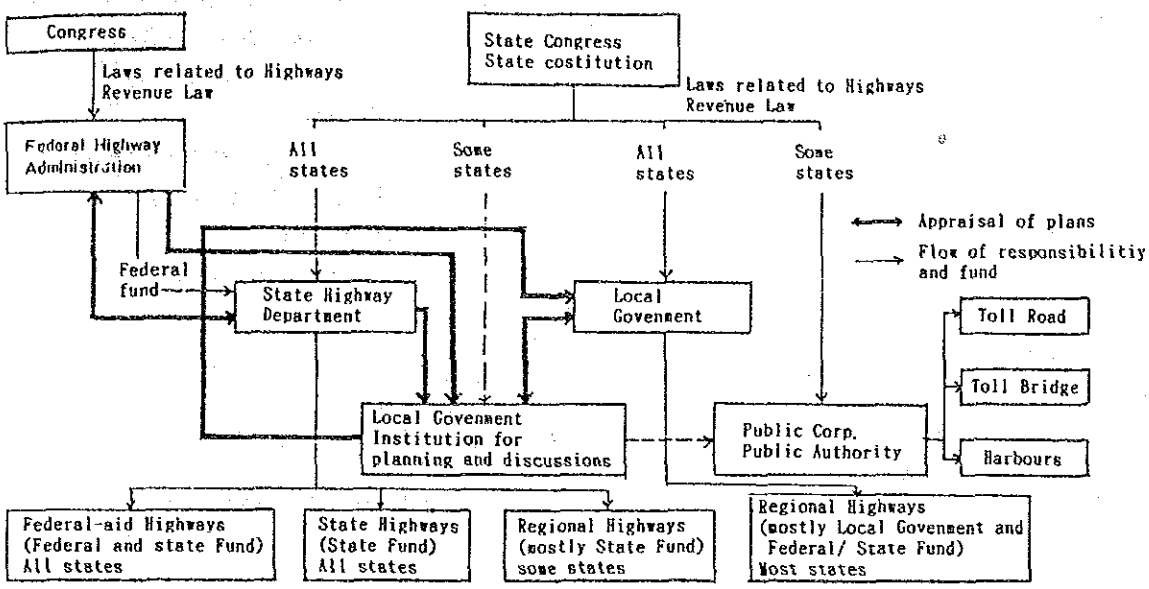
The highway administration is implemented by Federal government, State and the local government. Excluding some exceptions, the duty of the Federal government is to promote the highway policy by utilizing the Federal-aid system. Duties and responsibilities of the Federal government in relation to the highway developments are divided into the following:

Federal government - responsible for preparing and enforcing

the common standards and specifications, and for distributing the federal subsidies.

State and local government - in charge of design, construction and maintenances rehabilitation.

The organization chart for the highway development is shown in Figure VI.2.



*1 Financing for Federal-aid Highways

*2 Financing for State Highways or local government Highways. Authorities are given to the local government to finance the project, and to the Public Corporation or Authority to collect tolls.

Figure VI.2 ORGANIZATION CHART FOR THE HIGHWAY DEVELOPMENTS

VI.3.5 Financing

The financial sources for the highway development are collected mostly as highway users tax including gasoline tax and diesel oil tax. By the Highway Revenue Act, 1956, the Federal Highway Trust Fund, which is responsible for the highway users tax, was founded. Most of the State Governments established also the Highway Trust Fund.

The State Taxes related to highways and automobiles as of December, 1985 are shown in Table VI. 9.

Table VI.9 STATE TAXES RELATED TO HIGHWAYS & AUTOMOBILES

Taxes	States collect	Tax rate
Fuel Tax	All States	7 - 18 cents/galon
Gasoline	All States	Average 11.08 cents/galon
Light oil	All States	7 - 18 cents/galon (except State of Wyoming)
Gasohol	46 States	3 - 16.5 cents/galon
Petroleum gas	47 States	4 - 17.4 cents/galon
Sales Tax	13 States	2 - 6% (average 4.21%)
License Tax for Fuel dealer	15 States	
Registratoin Fee, License Fee	All States	
Cargo Mile Tax, Passenger Mile Tax	17 States	
Other handling charge		

The share of the Federal Government in the Federal-aid highway project is shown in Table VI. 10.

Table VI.10 SHARE OF THE FEDERAL GOVERNMENT IN THE FEDERAL-AID HIGHWAY PROJECT

Federal-aid Highway	Share of Federal Government (%)
Interstate	90
Primary system	75
Secondary system	
Urban system	

The revenue and expenditure of the highway related program as of 1985 is shown in Table VI. 11. The total revenue is 59.6 billion US dollars in which the revenue from the highway user

tax including fuel tax and automobile tax occupies 59% (33.4 billion dollars) out of the total revenue. Regarding the expenditure, 47% (26.9 billion dollars) is spent to the capital investments including construction and 28% (16.0 billion dollars) to the maintenance and rehabilitation programs.

The expenditures of the Federal Highway Trust Fund in the fiscal year 1985 are shown in Table VI.12. Out of the total expenditures, 29.5% (3.9 billion dollars) goes to the interstate highway program, 27.5% (3.7 billion dollars) to the primary, secondary and urban systems and 17.5% (2.3 billion dollars) to the interstate highway program.

Table VI.11 REVENUE AND EXPENDITURE OF THE HIGHWAY IN 1985

Unit: million $

	Amount	Ratio
A Tax imposed to highway users		
Fuel tax, Automobile tax	33,381	58.6
Toll load revenue	2,218	3.9
B Other taxes and fees	14,749	25.9
C Revenue from investments	4,231	7.4
D Revenue (A+B+C)	(1000.0) 54,579	95.8
E Revenue from issuing bonds	5,279	9.6
F Transfer		
Highway trust fund	-	
Other funds	-	
State	-	
Country, town	-	
Other local governmts	-	
G Withdraw (+), deposit (-) from/to savings	-2,912	-5.1
H Financial sources appropriable	(100%) 56,946	100.0
I Expenditure to capital investments	26,888	47.2%
J Maintenance, rehabilitation, traffic control	16,032	28.2
K General administration, studies	4,033	7.1
L Traffic enforcement, safety	5,334	9.4
M Payment of interest	2,106	3.7
N Repayment of debt	2,553	4.5
O Total of Expenditure	56,946	100.0

Table VI.12 EXPENDITURES OF THE FEDERAL HIGHWAYS TRUST FUND IN 1985

		amount unit: million $	%
Federal-aid Highway Financial Source (Payment from the Highway Trust Fund)	Interstate system	3,923	29.5
	Primary system	2,239	16.8
	Secondary system	590	4.4
	Urban system	833	6.3
	Interstate	2,322	17.5
	Others (Research, Study, Rehabilitation)	2,976	22.4
Sub-total		12,883	96.9
	Other financial sources	407	3.1
Total		13,290	100.0

VI.3.6 Motorway Operation

The operating status of the toll highways under the jurisdiction of the public institutions is shown in Table VI.13.

The total revenue in 1985 was 7 billion dollars, in which 3.3 billion was from the income from operations, and the remaining was from the profits by issuing bonds. The income from toll collections was 2.5 billion dollars, which occupies 36% out of the total revenue.

The total amount of expenditures was 4.8 billion dollars in which 1.06 billion dollars was spent to the capital investments, one billion dollars to the maintenance and operations, 2 billion dollars to the repayment of bonds and payment of interest.

The average construction cost of the typical state-controlled toll highways, with an aggregated length of 2,904 miles, is

2.19 million dollars per mile (1.37 million dollars per km). The average revenue per mile is 390,000 dollars, which is equivalent to 18% of the construction cost. In these toll highways the redemption period is 5—15 years, which shows the sound operation.

Table VI.13 OPERATING STATUS OF THE TOLL HIGHWAYS

Revenue					Expenditure				
Item	State Control	County Control	City Control		Item	State Control	County Control	City Contol	Total
Beginning reserved balance	(4) 3,068,970	-	-	-	Expenditure	4,171,051	115,648	481,732	4,768,431
Revenue	6,202,677	292,353	489,554	6,984,584	Expenditure to capital investiment	973,263	42,248	40,470	1,055,981
Revenue from highway users	158,742	0	0	158,742					
Toll revenue	2,027,931	53,531	425,572	2,507,034	Maintenance & Operation expenses (including expenses for toll collection)	877,278	28,720	100,676	1,006,674
Net revenue from investments	285,594	7,576	29,100	322,270					
Other revenue	(5)229,118	(6)31,191	(7)26,291	286,600	General expenses	185,575	20,753	) 27,173	233,501
Sub-Total	2,764,348	92,325	489,554	3,346,727	Traffic enforcement	82,598	1,191		83,789
Revenue by issuing bonds	3,437,829	200,028	0	3,637,857	Transformation (ordinary expenditure)	(8) 147,773	(9) 7,769	(10) 241,903	397,445
					Repayment of bonds	1,293,224	58,433	369,752	1,721,409
					Payment of interest (including office expenses)	411,596	6,288	49,531	467,415
					Ending reserved balance	(4) 5,100,605	-	-	-
Total	9,271,647	292,353	489,554	-	Total	9,271,656	115,648	481,732	-

VI.3.7 Toll System

Toll rates to be charged are determined by considering the construction costs, maintenance costs, expenses for payment of interest, the forecast traffic volume, and the required period to be free of charge (40 years).

The vehicle classification for the toll collection purpose in major toll highways are as follows. Basically, there are three methods - number of axles, weight, and type of vehicle systems.

In most toll highways, the axle number system is adopted. Depending on the highway, the classification varies between 4 — 5 categories in the shorter highway and more than 8 categories in the longer highway. In the weight system, the vehicles are

classified by the weight of vehicle.

In the type of vehicle system, vehicles are classified into three types - passenger car, truck, and bus. The toll rates adopted in the major toll highways are shown in Table VI. 14. In relation to the ratio between types of vehicle, by making the passenger car 1.0, trucks with two (2) axles are imposed by 1.0 — 2.0 times, three (3) axles by 1.0 — 3.0 times, four (4) axles by 1.5 — 4.0 times, five (5) axles by 2.0 — 5.0 times and six (6) axles by 2.4 — 6.0 times. Buses are also charged by the same rate as the trucks.

Table VI.14 TOLL RATES IN MAJOR TOLL HIGHWAYS

(Unit : cent per mile)

Name of Toll Highway	passenger car	Trucks with five axles
Intra-urban Toll Highway		
Blue Grass Parkway (Kentucky)	1.8	5.5
Everglades Parkway (Florida)	1.0	3.8
Indiana Toll Road	3.0	9.3
JFK Memorial Highway Segment	9.1	27.3
New Jersey Turnpike	2.3	7.7
Turner Turnpike	2.3	7.6
Intra-urban Toll Highway		
Dallas North Tollway (Texas)	5.0	12.0
Dallas Toll Road (Virginia)	7.0	—
Massachusetts Turnpike-Boston Extension	6.3	16.3

In the case of New Jersey Turnpike, which has a total length of 189 km, twenty-eight (28) interchanges are provided. This highway is operated by the closed system. On the Garden State Parkway, fourteen (14) toll plazas and nineteen (19) ramps are provided to collect tolls with an application of the open system.

VI.3.8 Maintenance

The AASHTO Maintenance Manual defines the maintenance and construction works in the following four (4) categories.

1) maintenance

— traffic services
— physical maintenance

2) Construction

— betterment
— reconstruction

The authorities in charge of highways adopt the new management method in the maintenance work, which includes the following activities.

— Establishment of the yearly work schedule
— Programming of budgets and distribution of funds
— Approval of work and supervision
— Work implementation schedule
— Evaluation of work
— Financial control

Figure VI.3 shows the distribution of the maintenance services and expenses.

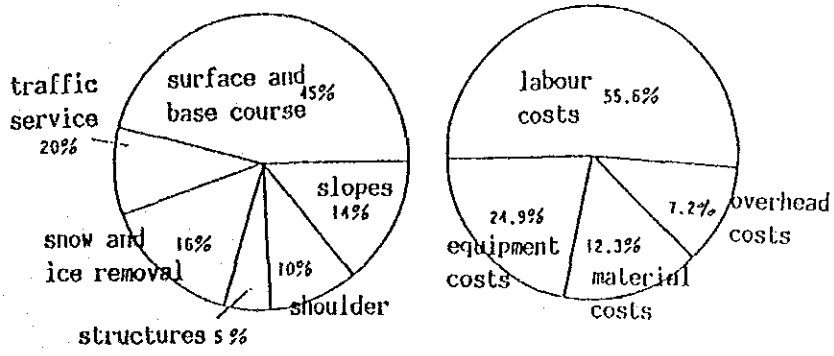


Figure VI.3 DISTRIBUTION OF THE MAINTENANCE SERVICES AND EXPENSES

VI.3.9 Typical Design Standards

The design standards for highway design which were agreed through AASHTO are used all over the country. The standards which were determined of the Federal government level are quite a few. In the Federal-aid Road Act, 1916, it is required that the roadway width to be more than 4.8 m and that the height clearance to be not less than 4.2 m.

At present, a policy on Government Design of Highways and Streets, 1984, published by AASHTO is used as a guide.

The recommended design speeds of motorways are 96 km/hr in the suburban region and 112 km/hr in the rural area. However, 80 or 96 km/hr is also applicable in the mountains regions.

The typical cross section in the rural area recommended in the AASHTO Geometric Design Policy is shown in Figure VI.4. The number of lanes shall be at least two (2) lanes for each direction. The lane width should be 3.6 m.

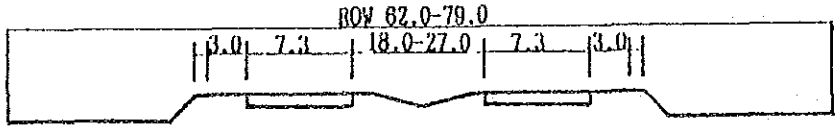


Figure VI.4 TYPICAL CROSS SECTION IN THE RURAL AREA

Taking the Ohio Turnpike as an example, every 40-60 km a Service Plaza is provided.

VII. INDONESIA

VII. INDONESIA

VII.1 General

The land of the Republic of Indonesia (hereinafter Indonesia) is located in the eastern end of the Indian Ocean. It has some 13,000 islands with a land area of 1,905,000 km^2 which is 3.7 times the area of Thailand. The Java Island, which is the most developed island in Indonesia, has an area of 132,187 km^2, which is 7% and 25% to that of the whole Indonesia and Thailand respectively.

Indonesia has a population of 170,180,000 in 1987 which is about 3 times to that of Thailand.

GNP of Indonesia reached 75,232 million Dollars in 1986 and Per Capita Income in 1986 was 451 Dollars, which is 57% to that of Thailand in the same year.

VII.2 Highway and Transport Conditions

VII.2.1 Road Network

The growth of road network in the years of 1984 - 1986 is presented in Table VII.1.

Table VII.1 GROWTH OF ROAD NETWORK

Year	Number of kilometres					Percentage paved	Density to total network per sq. km.
	Motor-ways	Highways, main or national roads	Secondary regional roads	Other roads	Total		
1984		12,235	36,146	129,515	177,896	64.3	0.19
1985		12,424	39,003	153,605	205.030	61.47	0.11
1986	198	12,942	42,453	163,614	219,009	62.25	0.11

The percentage of length of motorways and national roads to total network is about 7%.

VII.2.2 Transport Modes

There has been less data for the transport by every mode in Indonesia.

According to country Paper of Seminar-Cum-Study Tour on Toll Road System in Japan (ESCAP 9 Nov. — 18 Nov. 1988), the trend of transport modes was stated as follows;

The greatest transport growth has occured in the road sector where there was a 14.1% average traffic growth rate recorded at all traffic counting stations from 1973 to 1981 and in the aviation sector where there was an 18% average passenger growth rate from 1972 to 1980. The growth rate of regular liner service shipping tonnage was about 6% in 1970, whereas demand in the railway sector has remained static in this same period.

Road transport dominates the land transport system, according to the 1977 Government survey, 90% of all land based passenger traffic and 74% of goods movement were carried out by motorized road transport".

VII.2.3 Number of Registered Vehicles

The number of registered vehicles from 1984 to 1986 is shown in Table VII.2.

Table VII.2 NUMBER OF REGISTERED VEHICLES

Year	Four-plus wheels				Tractors, trailers & semi-trailers	Motor-cycles
	Cars	Buses & coaches	Goods vehicles and vans	Total		
1984	929,587	191,110	793,849	1,913,546	b)	4,556,095
1985	987,099	231,463	845,338	2,063,900	b)	4,765,076
1986	1,059,851	256,576	876,684	2,193,111	b)	5,115,925

The average growth rates of the vehicles for the passenger and freight transport from 1984 to 1986 are;

Vehicles for passenger transport (Cars / Buses)	17.5%
Vehicles for freight transport (Goods vehicles)	10.6%

VII.2.4 Accidents

In 1986, there were a total of 38,000 traffic accidents involving vehicles, in which 9,714 people were killed and over 46,000 injured, 20,000 of them seriously. Although the numbers of accidents and fatalities have declined marginally in recent years as shown in Figure VII.1, in part due to improvements in the safety standards of both roads and vehicles, there is no cause for complacency.

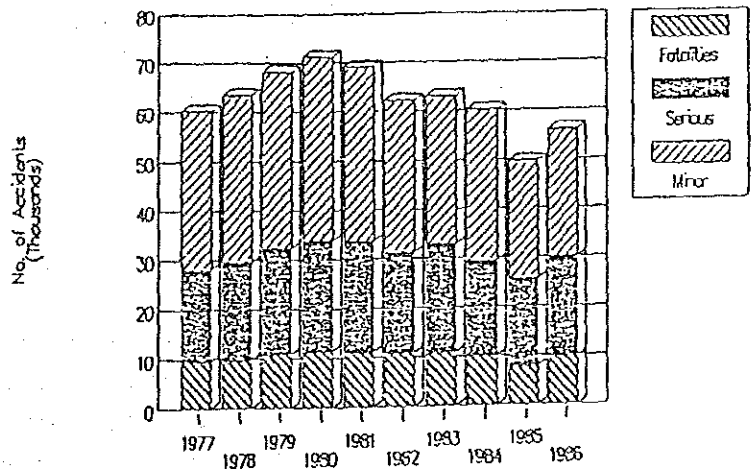


Figure VII.1 ROAD ACCIDENTS 1977–1986

On the other hand, Figure VII.2 shows general trends of traffic accidents on toll roads.

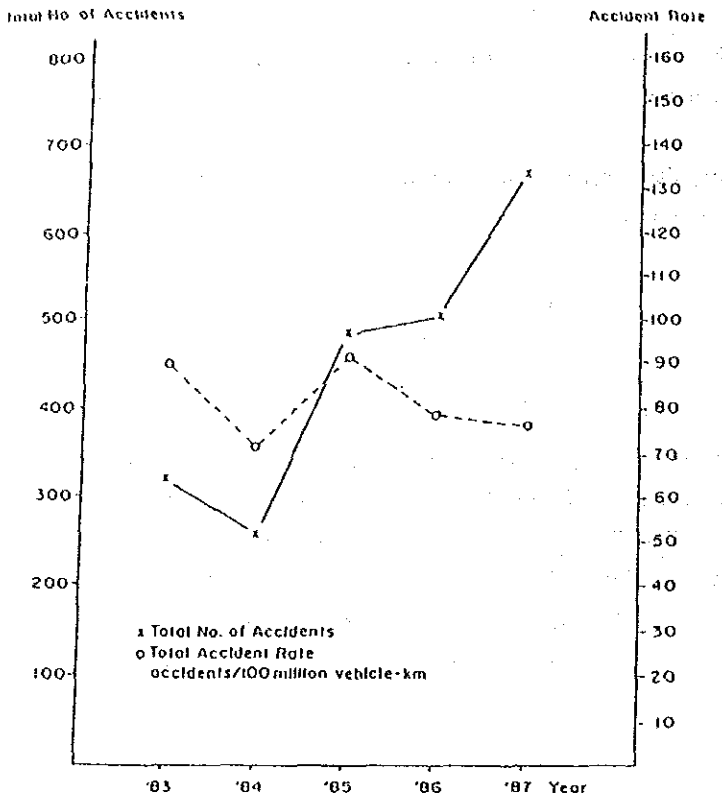


Figure VII.2 TRAFFIC ACCIDENTS ON TOLL ROADS

VII.3 Motorway Development

VII.3.1 History

The rapid growth of the Indonesian economy since 1965 has caused significant demands in the transport sector, not only in economic terms, but politically in achieving the national motto of "Unity in Diversity" as well. The greatest transport growth has occured in the road sector where there was a 14.1% average traffic growth rate recorded at all traffic counting stations from 1973 to 1981, and in the aviation sector where there was an 18% average passenger growth rate from 1972 to 1980. The growth rate of regular liner service shipping tonnage was about 6% in 1970, whereas demand in the railway sector has remained static in this same period.

Road transport dominates the land transport system, according to the 1977 government survey, 90% of all land based passenger

traffic and 74% of goods movement were carried out by motorized road transport.

The number of motorized vehicles presently on the road in Indonesia is somewhat difficult to obtain accurately as the official number of registered vehicles does not take account of those obsolete ones and no longer in use. The corrected figures from 1972 to 1977 indicated that the number of motorized vehicles in Indonesia had more than doubled in this period with an average annual growth are of 15.4%. The average growth of the truck fleet was even higher at 18.4% per annum in this period.

Through the above sense on national social and economical development, a state Toll Road Authority in the form of limited liability corporation called PT Jasa Marga or in English The Indonesia Highway Corporation (IHC) was established in March 1978.

Since 1978, PT Jasa Marga has constructed and managed the toll roads and bridges as shown in Table VII.3, and a total of 287.7 km toll roads and bridges are in operation at present.

Table VII.3 OPERATING TOLL ROADS AND BRIDGES

Road Link	Length (in km)	Starting date of operation
— Jagorawi (Jakarta, Bogor, Ciawi)	61	90—03—1978
— Citarum bridge	0.2	14—08—1979
— Tallo Lama bridge	0.2	26—08—1981
— Kapuas and Landak bridge	0.8	27—91—1982
— Mojokerto bridge	0.2	15—07—1982
— Semarang artery (section A & B)	15.0	09—07—1983
— Jakarta-Tangerang-Merak	39.0	27—11—1984
— Prof. Dr. Ir. Sediyatmo (Jakarta Airport Access Road)	14.0	01—04—1985
— Belmera (Belawan, Medan, Tanjung Morawa)	34.6	15—12—1986
— Surabaya-Gempol	43.0	26—07—1986
— Cawang-Semanggi	6.7	20—04—1987
— Jakarta-Cikampek	73.0	1988
Total	287.7	

VII.3.2 Motorway Network

At present (1989), there are 12 operational toll facilities covering both urban and intraurban regions. This network consists of 8 toll roads and 4 toll bridges with a total length of 287.7 km (see Table VII.3 in previous section).

Figure VII.3. illustrates the trend of the toll roads development between 1978 and 1988.

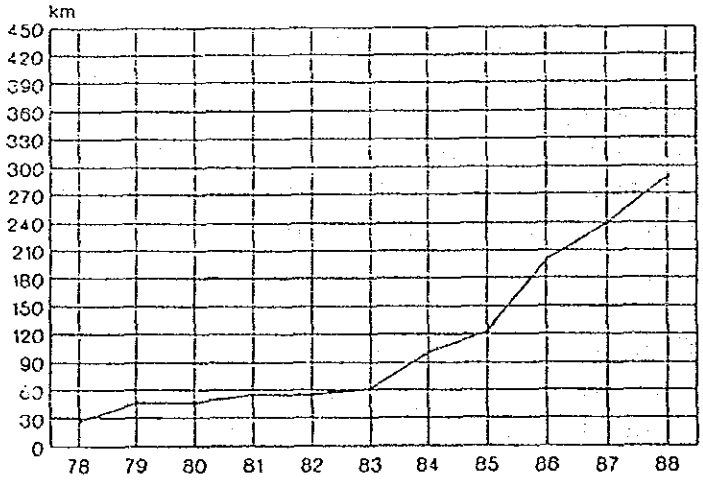
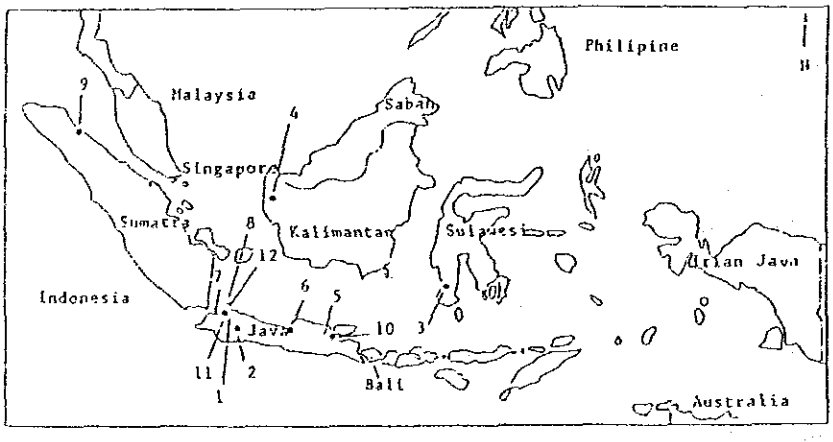


Figure VII.3 LENGTH OF TOLL ROADS

The locations of motorways are shown in Figure VII.4.



No.	Road Link	Length (in Km)
1	Jagorawi (Jakarta, Bogor, Ciawi)	61.0
2	Cikarum Bridge	0.2
3	Tallo Lama Bridge	0.2
4	Kapuas and Landak Bridges	0.8
5	Mojokerto Bridge	0.2
6	Semarang Artery (Section A & B)	15.0
7	Jakarta-Tangerang-Merak	39.0
8	Prof.Dr.Ir.Sedtyatmo (Jakarta Airport Access Road)	14.0
9	Belmera (Belawan, Medan, Tanjung Morawa)	24.6
10	Surabaya-Gempol	43.0
11	Cawang-Semanggi	6.7
12	Jakarta-Cikampek	73.0
	Total	287.7

Figure VII.4 LOCATION OF TOLL ROADS IN INDONESIA

VII.3.3 Future Development Plan

A number of toll facilities are now under construction so that by the year 1990 an additional 60.5 km of toll roads will be operational as in Table VII.4.

Table VII.4 TOLL ROADS UNDER CONSTRUCTION AS OF 1987

Road Link	Length (in km)	Construction commenced	Estimated date of completion
Semanggi-Grogol	10	1987	1989
Padalrang-Cileunyi	34	1987	1990
North-South link	16.5	1987	1990
Total	60.5		

There are also some road links planned as listed in Table VII.5, as potential toll roads to be constructed.

Table VII.5 TOLL ROADS PLANNED

Road Link	Length (in km)	Remarks
Semarang artery section C	12.0	FS
Surabaya-Gresik	19.0	FE
Jakarta harbour Road	22.0	FE
Jakarta Outer Ringroad	54.1	FE
Cikampek-Padalarang	60.0	FS
Grolgol-Pluit	7.0	FS
Medan-Binjai	24.0	FS
Cikampek-Cirebon	130.0	FS
Yogya-Solo	60.0	FS
Cirebon-Tegal	69.0	PFS
Semarang-Batang	75.0	PFS
Tegal-Batang	69.0	PFS
Surabaya-Mojokerto	39.0	PFS
Gempol-Malang	56.0	PFS
Gempol-Pasuruan	26.0	PFS
Tangerang-Merak	75.0	FE
Total	979.1	

PFS = Pre Feasibility Study FS = Feasibility Study
FE = Final Engineering

VII.3.4 Motorway Administration

— Related law and regulations: Law No. 13/1980

— Administration setup:

1. Name : PT Jasa Marga
2. Date of Establishment : March 1978
3. Nature : It is the only Toll Road Authority throughout the country whose responsibility is in the field of construction, operation and maintenance of all toll roads and toll bridges throughout Indonesia. The Government of Indonesia is the single share holder of the Company. Although the authority in managing the toll roads by law has already been transfered by the government to PT Jasa Marga as stipulated in Road Act Number 13 year 1980, it does not exempt the government from its responsibility for a proper toll roads operation.
4. Organization : The organization chart of PT Jasa Marga is presented in Figure VII.6.
5. Number of personnel and breakdown:
   The officials of PT Jasa Marga have been steadily increasing in the number together with the extended operation of toll roads and toll bridges in Indonesia. Figure VII.5 shows the trends of PT Jasa Marga officials since its establishment in 1978 with the following breakdown as of September 30, 1988.

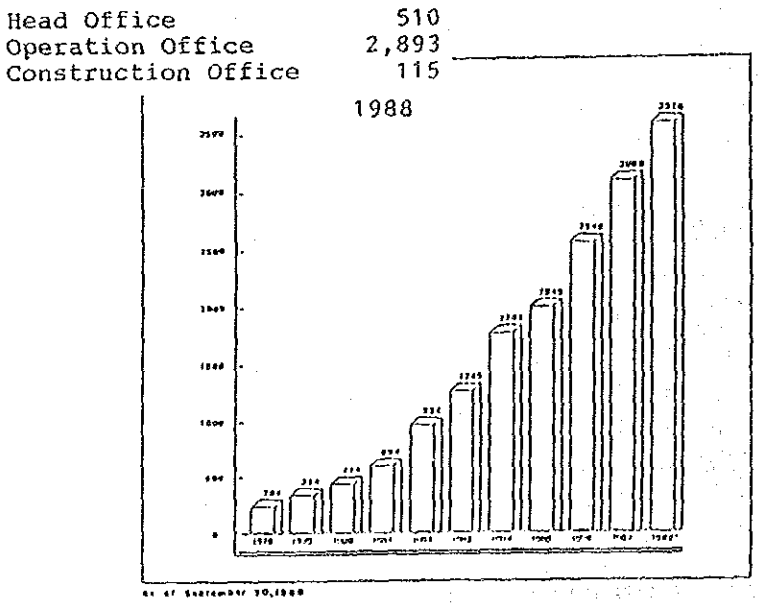


Figure VII.5 TRENDS OF OFFICIALS IN PT JASA MARGA

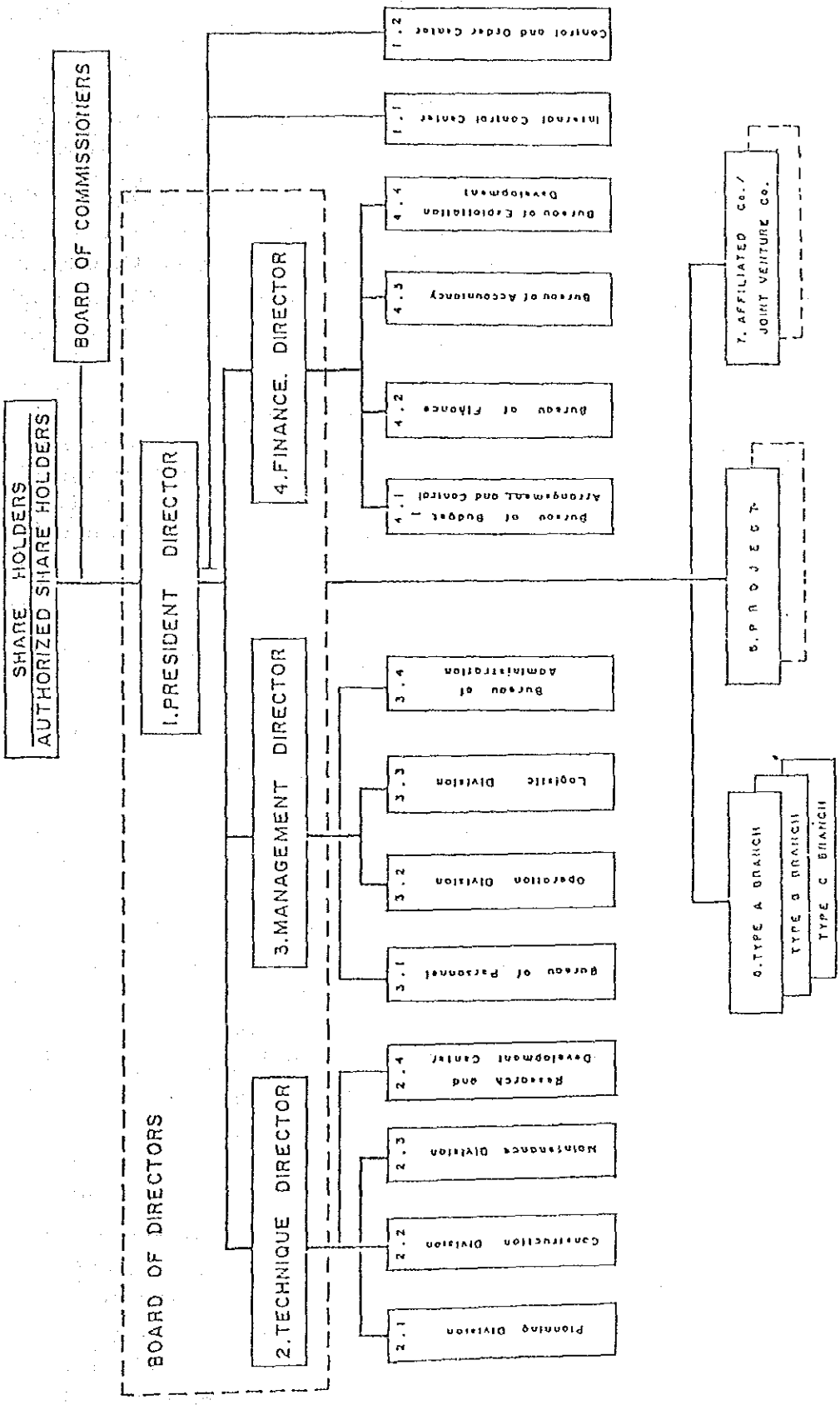


Figure VII.6 ORGANIZATION CHART OF PT JASA MARGA

VII.3.5 Financing

The financial resources are as follows:

— Capital funds from Government	Rp. 53,200,000,000
— Subsidies funds from Government	Rp. 267,637,814,000
— Borrowing from financial institutions	Rp. 293,718,000,000
— Operating revenues	Rp. 9,324,271,000
— Others	Public Obligation

VII.3.6 Operation

The toll income (1978 — 1988) which is the main revenue of PT Jasa Marga are as follows:

Table VII.6 TOLL INCOME (1978 — 1988)

Year	Toll Income
1978	Rp. 486,227,545
1979	Rp. 1,604,559,255
1980	Rp. 2,839,790,500
1981	Rp. 3,781,090,380
1982	Rp. 6,335,157,492
1983	Rp. 11,129,863,000
1984	Rp. 16,205,687,000
1985	Rp. 35,280,693,000
1986	Rp. 46,868,515,000
1987	Rp. 67,374,817,000
1988 (up to Nov.)	Rp. 84,812,631,000

The financial operation in 1986 of PT Jasa Marga is:

	in Rp.	Year 1986 in percentage
Revenue		
Toll income	46,868,515,000	75.3
Road bonds		
Public placed		
Private placed	15,433,620,000	24.7
Others	—	
Total	62,302,135,000	100.0
Expenditure		
Personnel	6,205,909,000	1.0
Tax	—	
Construction cost	565,444,415,000	93.7
Repair & maintenance	1,787,293,000	0.3
Interest payment	30,028,137,000	5.0
Repayment of credits	—	
Others	—	
Total	603,465,754,000	100.0

VII.3.7 Toll System

Toll collection system in Indonesia depends on where the toll roads are located, rural area or urban area, as follows;

Rural area	closed system
Urban area	closed and open system

Although toll rates also are varied by roads as shown in Table VII.7, the average toll rate for passenger car is Rp. 58.3/km.

Table VII.7 TOLL RATE BY ROAD (On August 1, 1988)

	Passenger car	Buses, trucks
Jagorawi	56.6	75.5
Jakarta-Tangerang	74.6	119.9
Surabaya-Gempol	45.9	80.3
Belmera	58.5	102.3
Semarang	33.3	66.7
Ciujung-Serang	64.5	64.5
Cengkareng	217.4	217.4
South-West	73.5	73.5
Jakarta-Cikampek	68.5	109.6

VII.3.8 Maintenance

Maintenance works have been increased recently due to the increase of traffic volume in order to maintain good driving conditions, to suit users' needs, and to provide safe and smooth traffic on toll roads.

Maintenance centres in toll roads are located in every 20 — 30 km in average, and the share in expenses for maintenance to the total is 0.3%.

VII.3.9 Typical Design Standards

The typical cross section adopted in the toll roads in rural area is shown in Figure VII.7.

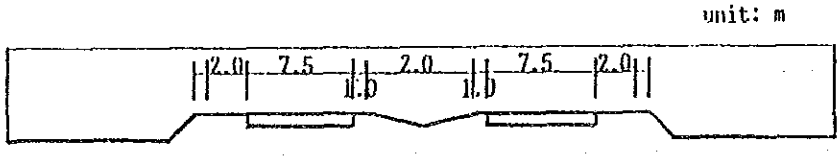


Figure VII.7 TYPICAL CROSS SECTION

The desgin speed for the toll roads in rural area is 120 km/h.

The interchanges and emergency parking bays are located in every 5 — 15 km and 10 km respectively.

VIII. KOREA

VIII. KOREA

VIII.1 General

The land of the Republic of Korea (hereinafter Korea) is located in the Korean Peninsular and is expanding 400 km in north-south and 300 km in east-west. Its land area is 99,000 km^2 which is approximately 1/5 to that of Thailand. And Korea has a population of 42,080,000 in 1987, which is approximately 80% to that of Thailand.

Gross National Product (GNP) of Korea reached 98,145 million Dollars in 1986 and Per Capita Income in 1986 was 2,383 Dollars which is 3 times to that of Thailand.

VIII.2 Highway and Transport Conditions

VIII.2.1 Road Network

The Korean roads are divided, according to the Road Law, into 6 classes, i.e. National Expressway, National Highway, Special City Road, Provincial Road, City Road and Gun (County) Road. The definition of these classes of roads in the said law and the agencies responsible for their management are shown in Table VIII.1.

Table VIII.1 CLASSIFICATION OF ROADS

Class	Definition	Agency Responsible for Management
National Expressway	Roads used exclusively by automobiles for high speed transportation linking major urban centers	Minister of Construction (with Korea-Highway corporation acting for him
National Highway	Roads linking important urban centers ports and harbours, airports and tourist resorts, etc. and constituting the national trunk road network	Minister of Construction (City Mayor in the municipal jurisdiction)
Special City Road	Roads within the boundaries of Seoul Special City, and Pusan, Taegu, Incho'on, Kwangju and Taejon cities under the direct control of the national government	Mayor of Special City under the direct control government
Provincial Road	Roads forming a secondary network which provides linkages between provincial tours	Governor of Province
City Road	Roads within the boundaries of each city	Mayor
Gun (County)	Rural public roads connecting villages with their Gun center or with neighboring towns	Gun (Count y) Chief

The growth of road network in the years 1984 — 1988 is presented in Table VIII. 2.

Table VIII.2 GROWTH OF ROAD NETWORK

Year	Length in kms					Percentage paved	Density of total network
	Motorways	Highways, main or National	Secondary or regional roads	Other roads	Total		
1984	1,421	12,244	10,079	27,259	51,003	46.3	0.51
1985	1,415	12,241	10,167	28,441	52,264	49.8	0.52
1986	1,415	12,258	10,314	29,666	53,653	54.2	0.54
1987	1,539	12,253	10,328	30,569	54,689	57.2	0.55
1988	1,550	12,255	10,577	31,396	55,778	61.4	0.56

The average growth rate of the motorways and the total road network in length, within 4 years 1984 — 1988, are 9.0% and 9.4% respectively.

The percentage in length of the motorways and national roads to the total road network is approximately 25% — 27% through the years 1984 — 1988.

VIII.2.2 Transport Modes

Domestic passenger and freight transport by modes are presented in Table VIII. 3 and Table VIII. 4 respectively.

Following characteristics on road traffic are identified through these tables:

— Shares on road traffic for passenger and freight are 73.6% and 48.4% respectively in 1987.

— Share on road traffic for passenger has kept continuously high value, i.e. 73 — 74% for 7 years of 1980 — 1987.

— As for freight, rail transport in 1980 was 10,798 million ton-km, which is more than road traffic.

However, road traffic has increased in large scale afterward to reach 24,965 million ton-km in 1987, with a share of 50%, while share of rail transport decreased from 38.9% to 25.3%.

Table VIII.3 DOMESTIC PASSENGER TRAFFIC BY MODES

Year	Passenger Transport (million passenger-km)				
	Road	Rail	Inland water	Air	Total
1970	20,045	9,819	241	257	30,362
	(66.0)	(32.4)	(0.8)	(0.8)	(100)
1975	38,865	13,269	252	300	52,686
	(73.8)	(25.2)	(0.5)	(0.5)	(100)
1980	64,131	22,566	401	528	87,626
	(73.2)	(25.8)	(0.4)	(0.6)	(100)
1985	78,025	27,072	570	1,182	106,849
	(73.0)	(25.3)	(0.6)	(1.1)	(100)
1987	96,964	32,422	489	1,770	131,645
	(73.6)	(24.7)	(0.4)	(1.3)	(100)

( ) : Share %

Table VIII.4 DOMESTIC FREIGHT TRAFFIC BY MODES

Year	Freight Transport (million ton-km)				
	Road	Rail	Inland water	Air	Total
1970	—	7,709	4,232	—	—
1975	—	9,293	4,832	2	—
1980	9,500	10,798	7,463	5	27,766
	(34.2)	(38.9)	(26.9)	(0.0)	(100)
1985	17,500	12,296	11,639	26	41,461
	(42.2)	(29.6)	(28.1)	(0.1)	(100)
1987	24,965	13,061	13,502	36	51,564
	(48.4)	(25.3)	(26.2)	(0.1)	(100)

( ) : Share %

VIII.2.3 Number of Registered Vehicles

Table VIII.6 shows the number of registered vehicles between 1970 and 1988.

Table VIII.6 NUMBER OF REGISTERED VEHICLES

Year	Cars	Buses & coaches	Goods vehicles and Vans	Total	Motorcycles
1970	76,000		50,000	126,000	—
1975	106,000		88,000	194,000	7,000
1980	292,000		236,000	528,000	216,000
1984	465,149	108,018	360,364	948,319	640,297
1985	556,659	128,309	412,739	1113,430	711,439
1986	664,226	154,627	472,601	1291,454	812,349
1987	844,350	200,456	566,569	1611,375	924,187
1988	1117,999	259,600	657,849	2035,448	1066,841

The average growth rates of vehicles for passenger and freight transport from 1985 to 1987 are:

Vehicles for passenger transport (Cars/Buses)	52%
Vehicles for freight transport (Goods vehicles/Vans)	37%

VIII.2.4 Accidents

Table VIII. 7 gives the number of traffic accidents between 1984 and 1988 on all the roads of Korea. The total number is increasing notably, however, as a rate per 100 million veh-km, there is some decreasing in the rate of injury accidents.

Table VIII.7 TRAFFIC ACCIDENTS

Year	Total Number of accidents involving injury to persons	Number of injured	Number of killed	Rate per 100 million veh/kms		
				Injury accidents	Persons injured	Persons killed
1984	134,335	170,377	7,468	1,091	1,383	50
1985	146,836	184,420	7,522	1,071	1,345	46
1986	153,777	193,734	7,702	1,121	1,413	40
1987	175,661	222,701	7,206	805	1,021	28
1988	225,062	287,739	11,563	881	1,126	45

VII.3 Motorway Development

VIII.3.1 History

New road development plans which have been stagnant since the Korea War started in 1950, was steadily restored in the beginning of 1960's.

After 1961, the Korean government implemented a series of Five Year Economic Development Plans. The apparent importance of road constructions to economic development was recognized and significant amounts of investment were allocated for road construction. In the mean time, to expediate the balanced development of the land in Korea, the Ministry of Construction was established in 1962 and the Bureau of Public Roads became responsible for road construction.

Continuing to establishment of the Ministry of Construction, Korea Highway corporation was established in February, 1969, as

a government agency, to meet the nation's needs for the better transport role in the development of industry and transportation. The function and activities of the corporation include the planning, design, construction, maintenance, and the operation of expressways.

The first major expressway construction work in Korea was the road connecting Seoul and Incho'on (Four lane; 29.5 km) started in the early part of 1968 and finished in December of the same year. Also the Seoul-Pusan Expressway (Four lane; 428 km) was started in 1968 and finished in 1970. These two expressways were really the forerunners of modern expressway construction in Korea. New road construction technology were developed during the construction of these two expressways and conventional transportation systems, such as railroads, were replaced by a road system oriented toward automobiles.

As a result, the total length of expressway under its management at present reaches at 1,550 km as shown in Table VIII.8.

Table VIII.8 NATIONAL EXPRESSWAYS CONSTRUCTION

No.	Name of Route	Terminals (From-To)	Length (km)	No. of Lanes	Construction Period
	Total		1,550		
1	Kyongbu Line	Seoul-Pusan	428	4	Feb. 68—Jul. 70
2	Kyongin Line	Seoul-Inch'on	24.0	4	Mar. 68—Dec. 68
3	Honam Line	Taejon-Chonju	79.5	2	Apr. 70—Dec. 70
		Chonju-Sunch'on	172.3	2	Jan. 72—Nov. 73
4	Yongdong Line	Suwon-Saemal	104	2	Mar. 71—Nov. 71
		Saemal-Kangnung	97	2	Mar. 74—Oct. 75
5	Tonghae Line	Tonghae-Kangnung	41	2	Mar. 74—Oct. 75
6	Namhae Line	Pusan-Sunch'on	176.5	2	Jan. 72—Nov. 73
		Naengjong-Pusan	20.6	4	May 78—Sep. 81
7	Kuma Line	Taegu-Masan	86.3	2	Jul. 76—Dec. 77
8	Ulsan Line	Onyang-Ulsan	14.3	4	Jun. 69—Dec. 69
9	88 Olympic Line	Taegu-Kwangju	182.9	2	Oct. 81—Jun. 84
10	Chungbu Line	Seoul-Nami	123.6	4	Apr. 85—Dec. 87

VIII.3.2 Motorway Network

As mentioned in previous section, total length of toll expressways in 1988 is 1,550 km.

Growth and present network of toll expressways are shown in Table VIII.9 and Figure VIII.1 respectively.

Table VIII.9 GROWTH OF TOLL EXPRESSWAYS

Year	Length in km
1970	545.8
1975	1,136.6
1980	1,222.9
1985	1,426.4
1988	1,550.0
Future (2000)	more than 3,500.0

VIII.3.3 Future Development Plan

On the basis of the 2nd Comprehensive National Physical Development Plan and the 6th Five-Year Socio-Economic Development Plan, various projects are being steadily carried out to expand and improve Korea's road network. The national expressways are designed to promote the balanced regional development and to cater to long distance transportation as well as facilitate circulation in the metropolitan areas.

The Choongang Expressway (Taegu-Chunchon) and Western Coastal Expressway are scheduled to start service in 1989. The feasibility studies on the Taejon Chinju expressway, Taegu-Kup'o expressway and the central inland expressway were finished in 1988.

As a part of constructing the outer ring roads step by step in the capital region, the expressway between Pangyo and Kuri is under construction and set to finish in 1991. Also the expressway between Singal and Ansan connecting to the Yondong

Expressway is to be completed during the same period. It is expected that the total length of toll road in Korea will be more than 3,500 kms by the year 2,000.

Table VIII.10 FUTURE PLAN OF EXPRESSWAY

Name of Expressway	Origin/Destination	Year of operation
Choongang Expressway	Taegu - Chunchon	1989
Western Coastal Expressway	Pangyo - Kuri	1989
	Singal - Ausan	1991
Taejon Chinju Expressway		under F/S
Taegu - Kupo Expressway		under F/S
Central Inland Expressway		under F/S

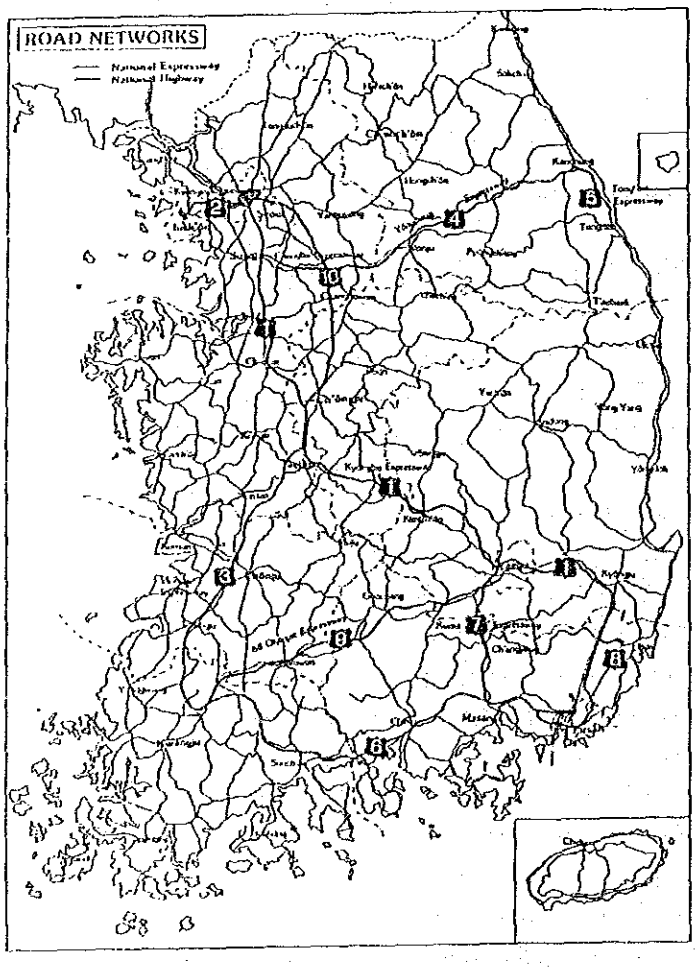


Figure VIII.1 TOLL EXPRESSWAY NETWORK

VIII.3.4 Motorway Administration

— Related law and regulations:

Public Roads Law
National Expressway Law
Tollways Law
Korea Highway Corporation Law

— Administration Setup

1. Name : Korea Highway Corporation (KHC)
2. Date of Establishment : February 15, 1969
3. Nature: State-run Corp.

— Functions of KHC

- Construction and improvement of toll roads
- Maintenance and management of toll roads
- Construction, maintenance, and management of facilities attached to toll roads
- Toll collection
- Construction and maintenance of roads of other types consigned by the government or local governments.

— Supervision by government

- Construction of new toll roads
- Improvement and expansion of existing toll roads
- Determination of toll rates

— Conditions of toll road construction

- A toll road should have an alternate road
- Toll roads under the control of KHC will become free roads after all the costs invested for the construction, maintenance and management are recovered.

— Concession period

- Until all the costs invested for the construction, maintenance and management of all toll roads under the control of KHC are recovered.

— Organization:

The organization chart of Korea Highway Corporation is illustrated in Figure VIII. 2.

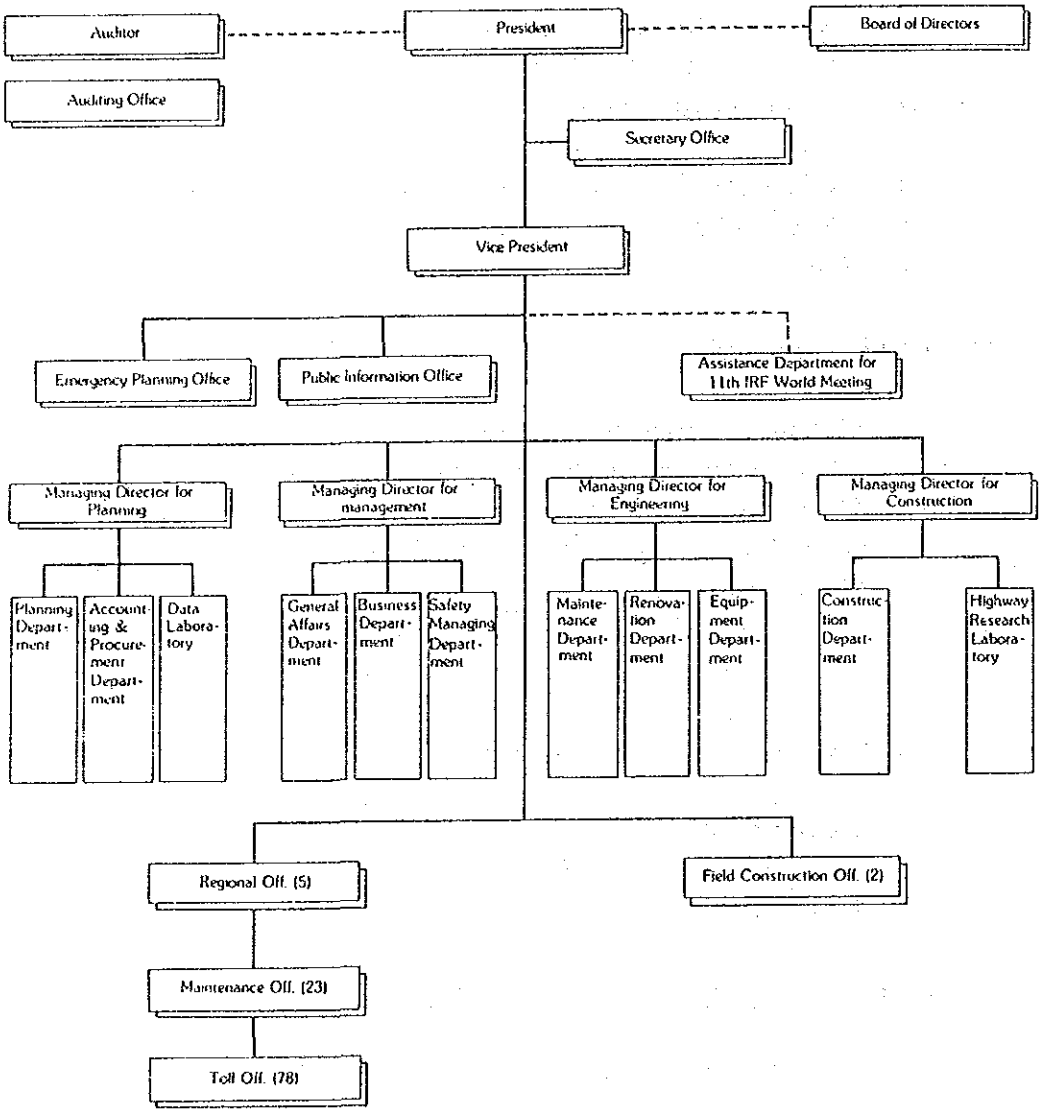


Figure VIII.2 ORGANIZATION CHART OF KHC

— Number of personnel and breakdown:

Table VIII. 11 gives the number and breakdown of personnel of Korea Highway Corporation.

Table VIII.11 NUMBER OF PERSONNEL AND BREAKDOWN

	Directors	Administrators	Engineers		Toll Collectors	Other	Total
			Civil	Others			
*Head Office	7	199	112	114	—	36	468
*Regional Office	—	122	97	100	19	15	353
*Maintenance Office	—	150	148	542	—	9	849
*Toll Office	—	11	—	2	1120	—	1133
*Field Construction Office	—	12	83	14	—	1	110
Total	7	494	440	772	1139	61	2913

VIII.3.5 Financing

Korea Highway Corporation depends financially on resources from:

—	Capital funds from Government	US$ 128 M
—	Subsidies funds from Government	US$ 39 M
—	Borrowing from financial institutions	US$ 43 M
—	Operating revenues	US$ 267 M
—	Others	US$ 5 M

VIII.3.6 Operation

Table VIII.12 gives the breakdown of revenue and expenditure of Korea Highway Corporation in 1987.

Table VIII.12 (1) REVENUE OF KHC IN 1987

Revenue		in percentage
Toll income	US$260.5 M	97.6%
Road bonds		
Public placed	—	
Private placed	—	
Others	US$ 6.5 M	2.4%
Total	US$267.0 M	

Table VIII.12 (2) EXPENDITURE OF KHC IN 1987

Expenditure		in percentage
Personnel	US$ 33.0 M	27.7%
Tax	US$ 6.5 M	5.5%
Construction cost	US$ 35.5 M	29.8%
Repair & maintenance	US$ 35.0 M	29.4%
Interest payments	US$ 1.7 M	1.4%
Repayment of credits	US$ 3.8 M	3.2%
Others	US$ 3.5 M	3.0%
Total	US$119.0 M	

VIII.3.7 Toll System

There are two kinds of toll collecting systems as in Table VIII. 13.

Table VIII.13 TOLL COLLECTION SYSTEM

Classification	Closed System	Open System
Collection Method	Issue of trip tickets (Purchase) to each destination at the time of toll gate entrance	Collection of fees at each toll gate exit.
Location of toll gate	O. D. : On the main route Other: Rampway	On the main route
Applied Route	Total length: 840.3 km Names of routes; — Seoul—Pusan Line — Ulsan Line — Honam Line (Taejon—Kwangju) — Yongdong Line (Shingal—Saemal) — Chungbu Line (Seoul—Nami)	Total length: 711.2 km Names of routes; — Seoul—Inchon Line Namhae Line — 88 Olympic Line — Yongdong Line (Saemal—Kangnung) Honam Line (Kwangju—Sunchon) — Tonghae Line
Remarks	— Route with heavy traffic volumes — Access roads with separate graded and longer spacing between interchanges — Routes with long distance traffic	— Routes with less traffic volumes — Shorter access roads spacings — Routes with short distance traffic

Toll rates by type of vehicle are shown in Table VIII. 14.

Table VIII.14 TOLL RATE (in 1988)

Type of Vehicle	Classification	Toll Rate
1st Class (Small car)	Cars and buses with capacity of boarding less than 16 persons, cargo trucks with capacity of loading less than 2.5 tons	20 Won/km
2nd Class (Bus)	Buses with capacity of boarding more than 17 persons	42 Won/km
3rd Class (Ordinary)	Cargo trucks with loading capacity between 2.5 tons and 10 tons	23 Won/km
4th Class (Heavy trucks)	Heavy trucks with loading capacity between 10 tons and 40 tons	46 Won/km

Note: The above rates are on the basis of four-lane expressways (those for two-lane highway correspond to 80% of those for four-lane roads)

VIII.3.8 Maintenance

There are 23 maintenance offices under 5 regional offices along the toll expressways, as shown in Table VIII. 15.

Maintenance Office Functions

- Patrol and traffic control
- Regular inspection of structures and other road facilities
- Cleaning, repairing and improvement of road structure and safety facilities
- Management of road safety
- Operation of communication facilities
- Dissemination of information of safe driving and comfortable travelling

Table VIII.15 LENGTHS MANAGED BY EACH REGIONAL OFFICE

Regional Office	Length (km)	Route	Maintenance Office
Chungbu	394.3	Part of Seoul-Pusan Expressway (No. 1)	Suwon
		Seoul-Inchon Expressway (No. 2)	Inchon
		Yongdong Expressway (No. 4)	Wonju
			Taegwallyong
		Tonghae Expressway (No. 5)	Kangnung
		Part of Chungbu Expressway	Kyongan
Chung-Chong	228.4	Part of Seoul-Pusan Expressway (No. 1)	Chonan
			Taejon
		Part of Honam Expressway (No. 3)	Nonsan
		Part of Chungbu Expressway (No. 10)	Chinchon
Kyongbuk	281.1	Part of Seoul-Pusan Expressway (No. 1)	Taegu, Kumi, Yongdong
		Part of 88 Olympic Expressway (No. 9)	Koryong
Kyongnam	331.3	Part of Kyongbu Expressway (No. 1)	Pusan
		Part of Kuma Expressway	Changnyong
		Part of Namhae Expressway (No. 3)	Chinju, Masan
Honam	316.4	Part of Honam Expressway (No. 1)	Chonju
		Part of Kuma Expressway (No. 6)	Kwangju
			Sunchon
		Part of 88 Olympic Expressway (No. 9)	Namwon
Total	1551.5		23

VIII.3.9 Typical Design Standards

- Design Speed: 120 km/hr on flat sections
- Width of Roadway
  - Width of Carriageway 2 x 2 x 3.6 m
  - Width of Shoulder Outer 3.0 m Inner 0.25 m

— Facilities Spacing:

. Interchanges	14.0 km
. Sarvice Areas	60.0 km
. Parking Areas	14.7 km
. Emergency Telephons	2.0 km
. Maintenance Centers	67.3 km
. Parking Bays	2.8 km

The typical cross section of the dual lane expressway constructed by KHC is shown in Figure VIII.3.

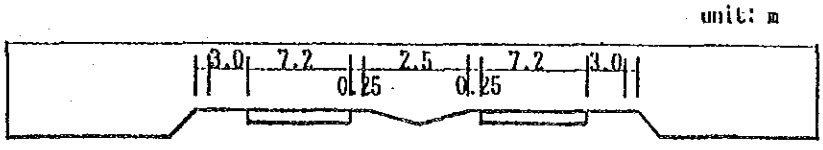


Figure VIII.3 TYPICAL CROSS SECTION