— Efficiency
The demands or needs for the road transport will be adequately reflected in the road investment. The over - investment or under - investment will be, therefore, prevented and the effective resource allocation will be realized.

— Equity
The road services are directly enjoined by a specific group in society, i.e., road users. Therefore, the "Special Fund" is more fair than an application of the general tax revenues.

— Stability
The road network is a basic social capital and has to be implemented based on a long term planning. The "Special Fund" will ensure the stable funds required for road improvement/construction during the long planning period.

— Persuadability
The "Special Fund" is a system that the taxes charged on oad users are appropriated solely for purposes of road improvement/construction. Tax payers, therefore, will be able to clearly recognize the purposes of this system.

However, this system is not yet introduced in Thailand. In order to promote the highway and the motorway development which is the most important and predominant transportation means in Thailand, the establishment of the "Special Fund" for road works is strongly recommended.

9.1.2 Toll Road System

Toll roads are constructed with loans, which are to be paid back with future toll revenues. Sometimes subsides from the State and local governments are granted to help maintain sound management.

Reasons why the toll road system is introduced for construction of motorways are:

— Huge amount of initial investment costs required for construction of motorways can be redeemed with future toll

revenues.

— The motorways which are to be newly constructed will provide users with higher quality of services such as on - time, comfortable and safe driving conditions. These differences in the service quality between existing roads and new motorways are the bases of charging the toll fees because the users will enjoy more benefits by using them.

— Although the construction of motorways requires huge amount of initial investment costs, once they are opened to the public, they will provide the society with great benefits for a long time, not only to the present generation but also to the next generations to come.

— The toll road system is a reasonable procedure to distribute the initial burden equally between present and coming generations by collecting toll fees until the redemption of the initial costs is completed.

— For the toll road system, since loans independent of the government budget are used, raising funds for construction of motorways is comparatively easy and the early implementation is expected.

For the above mentioned reasons, many countries which lagged behind such countries as the U.S. and West Germany in starting motorway construction, namely, France, Italy, Japan, etc., adopt the toll road system and have achieved a highly successful level in motorway development within a comparative short period.

In conclusion, since the initial investment of the motorway construction is a huge amount, introduction of the toll road system is strongly recommended.

1) Toll Rate

The toll rates have been generally decided by the governments in various countries under two principles, which are:

a. Redemption principle:

The total amount of toll collected through the entire collec-

tion period should cover the total project cost.

b. Benefit Principle:

The toll rates should not exceed the benefit normally available by the use of the toll roads.

The actual toll rates, however, widely vary from country to country, reflecting socio-economic situations, such as the balance among those of other transportation means, paying capability of the users and other policies related to commodity price stability.

Figure 9.1 shows the relationship between the average toll rates and G.N.P. Per Capita in various countries based on 1988 data.

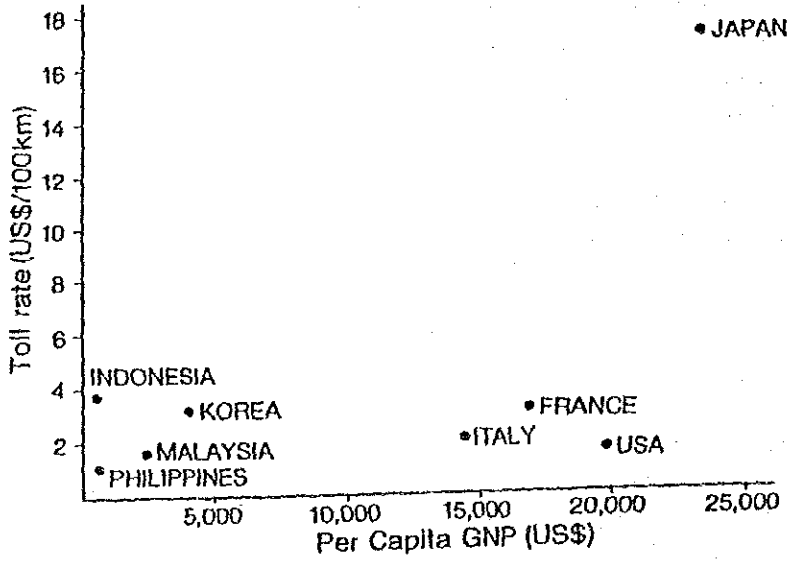


Figure 9.1 TOLL RATES AND GNP PER CAPITA

The average toll rates for motorways shown in Figure 9.1, except that in Japan, range between US$ 1.0 and US$ 4.0/100 km, i.e. 0.25 Baht/km to 1.0 Baht/km.

2) Toll Collection Systems

Toll collection system is categorized in two types, which are:

a. Open system:

In this system, fee is paid once at the entrance, exit or mainline in the middle of the toll motorway sections. A fixed fee is usually imposed for some type of vehicles.

This system has been generally adopted to urban motorway networks, and toll road sections whose length is not so long, usually 50—60 Km, sometimes including long bridge or tunnel which cost much for implementation.

b. Closed system:

In this system, a toll ticket is issued at the entrance and the toll fee is paid at the exit according to the distance traveled. In practice, the toll fee is determined by the distance between interchanges where a vehicle enters and leaves and vehicle type in round numbers for easy payment.

This system has been mostly applied to toll motorways whose coverage is long and nationwide.

3) Pool Payment System

The pool payment system in which profit from highly redeemable motorway sections is used to compensate loss from non-redeemable sections would be recommendable for the nationwide motorways formation.

This kind of pool system has been functioning successfully in Japan, Italy, France and other countries to implement motorways in less-developed areas.

4) Concession System

Concession system is also adopted in many countries and is very useful to promote motorway implementation under limited government budget. However, since a major objective of private companies is to pursuit profit, the concession system is apt to apply for only highly redeemable motorway sections. If the pool

payment system is not introduced in this case, implementation of motorway sections in less-developed area will be interrupted because benefits gained from the profitable section is not appropriated to these sections.

9.2 MANAGEMENT SYSTEM

9.2.1 Proposed Execution Bodies

In general, motorways which have been implemented and operated by governments are free of toll, and toll motorways have been implemented by public corporations or concession companies. The experiences in various countries suggest that nationwide toll motorways have to be implemented and operated by public corporation or concession companies.

Generally, the executing body is only one when it is a public corporation, and of a plural number in the case of private companies. It is hard to say which is the better. But when viewed from a long-term standpoint for completing the nationwide motorway network, it is better that the executing body be one, and a public corporation as well.

The advantages of a public corporation are as follows:

a. **Trustworthiness**

The trustworthiness as a public corporation is one of the important factors to acquire the investment funds from various resources, not only from international financial institutions such as IBRD but from the private sector as well.

b. **Maneuverability and Flexibility**

The other advantages of the public corporation from the management point of view are:

- to adjust the scale of organization flexibly to match the volume of works
- to manage the toll motorways effectively by checking the

account separately from the government account.
- to promote the toll motorway business by making the organization smaller than the government for quicker response.

c. **Applicability of the Pool Repayment System**

As concession companies tend to be reluctant to extend the toll network from high profitable sections/routes to lower profitable ones, it is considered to be difficult to promote the nationwide motorways only by the BOT method. For the formation of the nationwide motorway network, it is desirable to concentrate the implementation works on the single public corporation through the pool payment system.

As mentioned above, the Study recommends that a public corporation should be established under the Ministry of Transport and Communications to complete effectively the nationwide toll motorway network in a possible short period.

When agencies related to the government are newly established, they usually take time. Therefore, DOH must construct and operate toll motorways through its existing organization during a preparatory period by the time when the public corporation is established.

9.2.2 Proposed Public Corporation

1) Role

The roles of the public corporation are:

- To manage all equipment, facilities and its property.
- To plan, survey, design the motorways in details, and in conformity to the basic plan established by the government.
- To construct motorways.
- To operate the works of the maintenance, traffic operation and control, and toll collection.
- To issue bonds and other financial instruments for investment promotion.
- To supervise concession companies (if any).
- To handle all the business in relation to the operation of the toll motorway system.

In case that the public corporation is established, the responsibilities of the Government (DOH) are assumed to be as follows:

- Establishment of the basic plans
- Supervision of the public corporation
- Decision and approval of financial matters such as capital fund, subsidies, issuing bonds, borrowing from financial institutions, etc.
- Granting concession contracts (if any)
- Decision and approval of the toll fee

2) Organization

The proposed public corporation will have a hierarchical structure, that is, a headquarter, division offices, on-site offices, laboratory and training center. Major roles of respective offices can be roughly described as follows:

Headquarter:	Sets the basic technical specifications and basic managerial polices.
Division Bureaus:	Act in accordance with polices laid down by the head quarter within their jurisdictions.
On-site Offices:	Carry out all necessary in-the-field works within their jurisdictions.
Laboratory:	Conducts research to solve engineering problems and develops new methods.
Training Center:	Indoctrinate and train staff of the public corporation.

The organizational structure can be illustrated as in Figure 9.2.

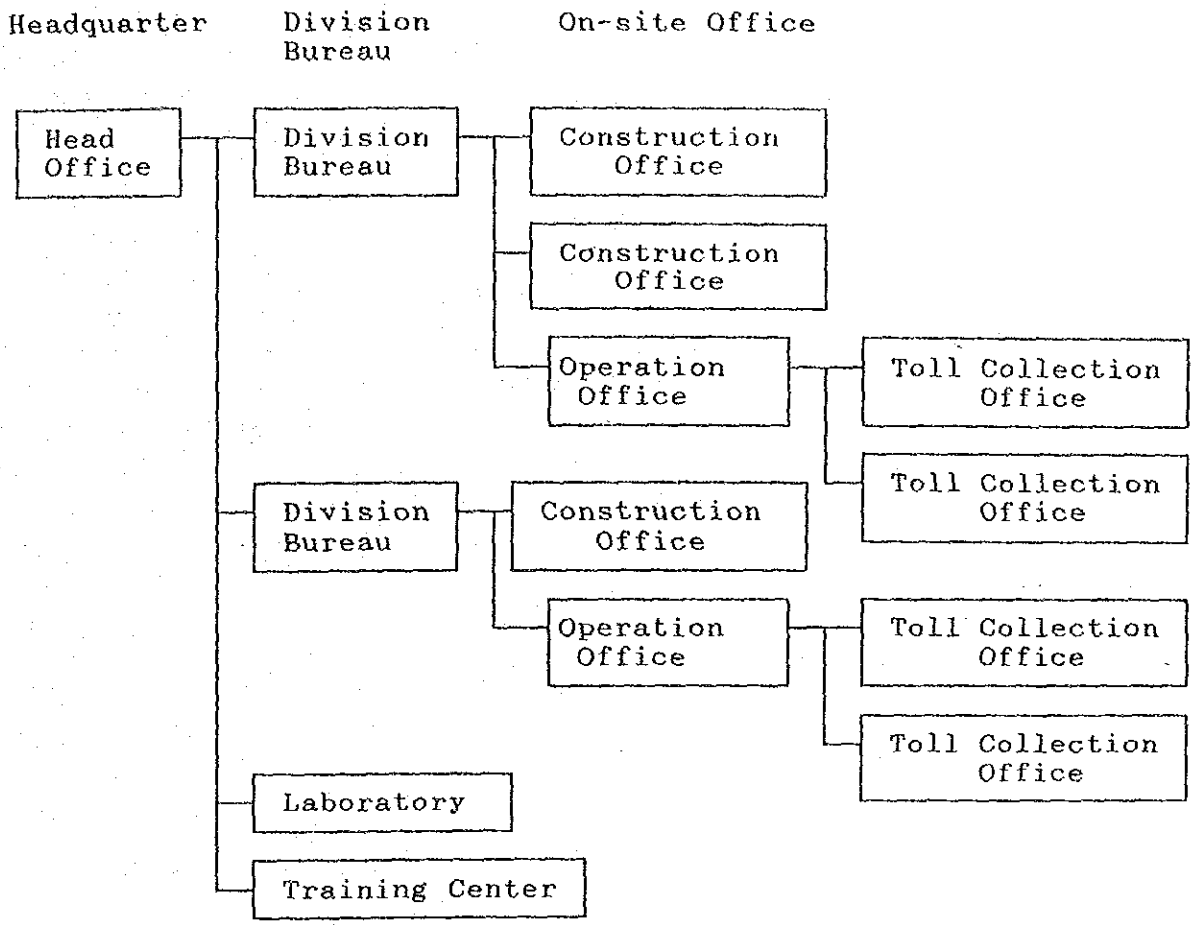


Figure 9.2 ORGANIZATIONAL STRUCTURE OF PUBLIC CORPORATION

9.2.3 Maintenance and Traffic Operation

Motorway maintenance and traffic operation has three goals, namely; ensuring traffic safety, smooth traffic flow and users comfort on the motorway.

The maintenance function of motorways can be distinctively divided into the following three components:

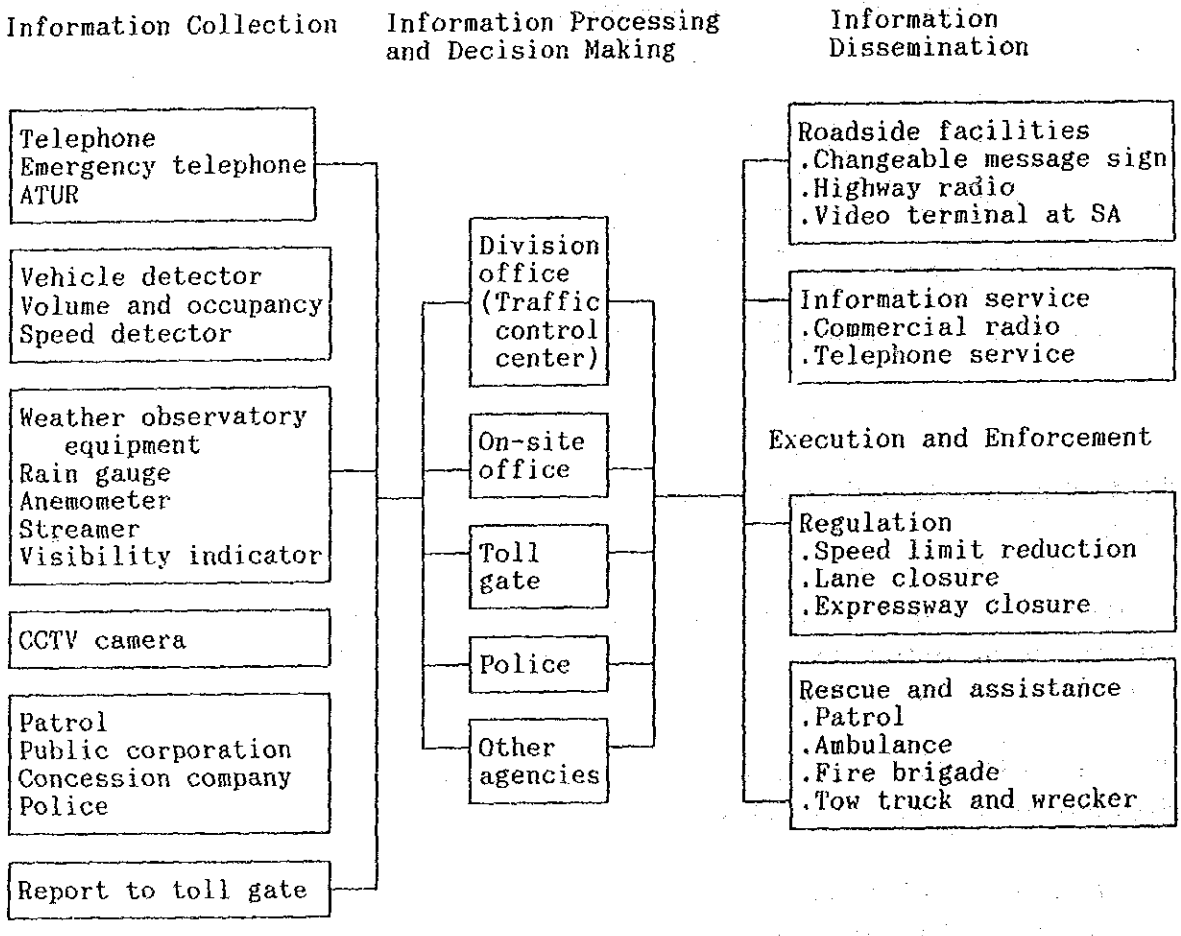
- Routine maintenance
- Periodical maintenance
- Emergency maintenance

The traffic operation has four components, which are:
- Traffic Control

— Traffic Surveillance
— Toll Collection
— Traffic Regulation

9.2.4 Traffic Control and Management System

In order to manage a motorway efficiently and in an organized manner, a traffic control and management system is proposed to be established. The system has four major functions; namely, information collection, information processing and decision making, information dissemination, and execution and enforcement of the decision. Figure 9.3 illustrates the structure of traffic management system.



CCTV: Closed circuit television
ATUR: Automobile telephone using radio
SA: Service area

Figure 9.3 TRAFFIC MANAGEMENT SYSTEM STRUCTURE

CHAPTER TEN

ECONOMIC EVALUATION

CHAPTER 10

ECONOMIC EVALUATION

10.1 CONSTRUCTION COSTS

The construction costs for the routes of the toll motorway network are estimated for each link between two interchanges including junctions of each proposed route.

For common major work items, construction costs are calculated by applying standard costs per kilometer derived from the analysis of typical sections selected in consideration of road and terrain characteristics.

The costs of special road structures such as long span bridges, tunnels, interchanges, rest facilities, etc., are separately estimated depending on the structure size, and added to the construction cost for common major work items.

Costs for land acquisition are also separately estimated by typical link and added to the above construction costs.

Quantities of major works are calculated per kilometer base on typical sections classified for the cost estimation by road and terrain characteristics.

The unit costs of major work items are derived from actual contract unit costs in similar highway construction projects of DOH in 1990.

The cost of miscellaneous works is estimated at 7% of the total cost of major work items. The total construction costs are computed by adding the following cost items to the above construction costs:

- Physical contingency : 10 % of direct construction costs
- Design and construction supervision : 10% of "direct construction costs + physical contingency"

The estimated financial and economic construction costs are summarized for all routes in Table 10.1.

Table 10.1 TOTAL CONSTRUCTION COST BY ROUTE (million Baht)

ROUTE	ORIGIN	DESTINATION	LENGTH (km)	DIRECT CONSTRUCTION COST	PHYSICAL CONTIN-GENCIES	ENGINEERING & SUPERVISION	LAND ACQUISITION	FINANCIAL COST	FINANCIAL COST / KM	ECONOMIC COST
TK-1	O.B.R.R.	CHIANG RAI	755.6	42,553.8	4,255.4	4,680.9	2,676.5	54,166.6	71.7	49,017.6
TK-2	O.B.R.R.	NONG KAI	535.5	29,968.4	2.986.8	3,285.5	1,883.2	38,024.0	71.0	34,409.9
TK-3	PHRA KHANONG	SATTAHIP	291.9	18,972.2	1,897.2	2,086.7	6,373.5	29,329.8	100.5	27,034.3
TK-4	O.B.R.R.	HAT YAI	951.4	52,054.0	5,205.2	5,725.9	4,005.2	66,990.4	70.4	6,0691.7
TK-21	NAKHON RATCHASIMA	UBON RATCHATANI	301.1	15,800.0	1,580.1	1,738.0	903.3	20,021.4	66.5	18,909.6
TK-31	O.B.R.K.		167.7	33,700.0	3,370.0	3,707.0	0.0	40,777.0	243.2	36,699.3
TK-32	O.B.R.R.	KANCHANABURI	100.0	7,415.8	741.6	815.7	1,000.0	9,973.1	99.7	9,075.8
TK-33	O.B.R.R.	SUPHAN BURI	62.0	3,557.3	355.7	391.3	620.0	4,924.4	79.4	4,493.9
TK-34	O.B.R.R.	ARANYAPRATHET	211.7	13,965.1	1,396.5	1,536.2	1,667.5	18,565.3	87.7	16,875.5
TK-35	CHON BURI	NAKHON RATCHASIMA	239.1	16,213.2	1,621.3	1,783.4	1,104.3	20,722.2	86.7	18,760.4
TK-36	RATCHABURI	CHACHOENGSAO	365.8	20.377.0	2,037.7	2,241.5	3,658.0	28,314.2	77.4	25,846.6
TK-41	KRABI	KHANON	190.7	9,241.1	924.1	1,016.5	953.5	12,135.2	63.6	11,017.0
TK-42	PHRASAENG	PHUKET	136.0	7,046.1	704.6	775.1	680.0	9,205.8	67.7	8,353.2
TK-43	KON PHIBUN	NAKHON SI THAMMARAT	36.9	2,063.7	206.4	227.0	184.5	2,681.5	72.7	2,431.8
TOTAL			4,345.4	272,827.8	27,282.4	30,010.5	25,709.5	355,830.8	81.9	322,818.7

The economic construction costs shown in Table 10.1 are computed by deducting the tax component from the financial construction costs.

As seen in Table 10.1, the construction cost of the whole network of 4345.4 kilometer in total is estimated at 355,830.8 million Baht and the average cost per kilometer is 81.9 million Baht.

10.2 MAINTENANCE AND OPERATION COSTS

Generally, toll motorways require more amount of maintenance and operation costs than ordinary non-toll highways. This is due to users of toll motorways expect higher level of services such as safe and on-time driving, at the expense of the toll fee.

No local basic data to estimate maintenance and operation costs are available because there are no existing inter-city toll motorways in Thailand. In the study, therefore, the maintenance and operation costs for toll motorways are estimated referring to the method applied in most countries. In this method, the maintenance costs and the operation costsare classified as follows:

1) Maintenance costs
   - Road cleaning cost
   - Road maintenance cost
   - Lighting cost
   - Bridge maintenance cost
   - Tunnel maintenance cost
   - Overlay cost

2) Operation costs
   - Operation office cost
   - Toll collection cost
   - Traffic control cost

3) Administration cost (expenditure for a head office, division bureaus, etc.)

Thus maintenance costs are estimated to be 400,000 Baht/year/km and operation costs to be 500,000 Baht/year/km.

10.3 BENEFITS

Benefits which are expected from a road construction project can be classified usually into the following two types:

— Direct Benefits
— Indirect Benefits (Regional Development Effects)

10.3.1 Direct Benefits

The economic direct benefits of motorways are calculated as savings in Vehicle Operating Cost (VOC) and savings in Travel Time Cost through a "With Project" and "Without Project" comparison scenario.

VOC is estimated by applying the methods of the "Standardization of Vehicle Operation Cost in Thailand" (SVOCT) established by DOH.

Savings in time cost of passenger movement are measured in terms of money and quantified in economic evaluation. The time costs of drivers and assistants are reflected in VOC estimation as crew costs. Only the time values of passengers, therefore, are calculated here to avoid double counting. The following factors are taken into account for the estimation of time values:

a. Average wage rates of car-owning group and non-car owning group.
b. Working hours.
c. Trip purpose composition (business and others).
d. Differences in time values between business trip and other trip purposes.
e. Average occupancy by passenger vehicle type.

The proposed motorway network consists of 14 (fourteen) routes of which the total length attains to about 4,300 km. The main issue in evaluating such a big project is that the implementation should be started from which route and from which part of the network. Therefore, the following 3 (three) scenarios are prepared for the first 5 years (1991—1995).

Scenario — 1 : Traffic Volume Criterion
— To give high priority to sections with high traffic volume.
— To connect regions with Bangkok and form a network for the Eastern Sea Board.

— To construct a motorway around major local cities for regional development.

Scenario — 2 : Bangkok Metropolitan Development Criterion

— To expand network steadily from Bangkok metropolitan area to outside areas.

Scenario — 3 : Arterial Routes Promotion Criterion

— To place high priority on arterial backbone routes to connect Bangkok with regions, or between regions.

Expanding variations in the second 5 years (1996—2000), two cases are prepared for each of Scenario—1 and —3, and 5 (five) alternative staging cases are established as illustrated in Figure 10.1.

The benefits calculated for the 5 alternative staging cases are shown in Table 10.2.

Table 10.2 TOTAL BENEFIT (million Baht/Year)

Year	Type of Benefit	Case 1	Case 2	Case 3	Case 4	Case 5
1996	VOC	14,691	14,691	21,741	13,159	13,159
	Time	4,626	4,626	5,565	6,566	6,566
	Induced	502	502	937	452	452
	Total	19,819	19,819	28,242	20,177	20,177
2001	VOC	48,440	34,818	53,463	35,272	40,730
	Time	20,359	13,974	21,734	16,603	18,904
	Induced	4,872	2,574	5,966	2,333	3,349
	Total	73,671	51,366	81,163	54,208	62,983
2011	VOC	10,888	10,888	10,888	10,888	10,888
	Time	41,593	41,593	41,593	41,593	41,593
	Induced	2,822	2,822	2,822	2,822	2,822
	Total	55,303	55,303	55,303	55,303	55,303

10.3.2 Regional Development Effects

In Thailand, the main objective of building the motorway network is to promote economic activities for the country as a whole, and to raise the living standards of the local society in rural areas.

1) Betterment of Nationwide Development

The motorway network will shorten distances between different areas in the country in terms of travel time. When the motorway network, which connects five regional urban centers together, is completed, the travel time between Bangkok and Chiang Mai, Khon Kaen, Nakhon Rachasima, Chon Buri and Song Khla will be shortened by about 40% as shown in Figure 10.1. Through such improved transportation conditions as less travel time, the motorway network will bring large opportunities for encouraging development of industry, agriculture, tourism and other socio-economic activities in the core cities as well as in their surrounding areas. These new conditions will provide jobs through industrial development, reduce disparities in income, and produce a more balanced distribution of population.

2) Promotion of Manufacturing Industries

Factories and facilities of relevant businesses will be constructed along motorways, especially in the vicinity of interchanges, since motorways will offer speedy and on schedule transport of raw materials and products. When the proposed motorway network is put into service, the area which will be available for the development of industrial estates will become 4 times as large as the present one.

3) Promotion of Tourism

According to the statistics published by the Tourism Authority of Thailand, the number of international tourists has shown a remarkable growth, standing at 4.2 million in 1988, nearly doubling that of five years before.

Even though a large number of foreigners is visiting Thailand, there are still many attractive sites and areas which are not visited by them because of their remote locations. If the

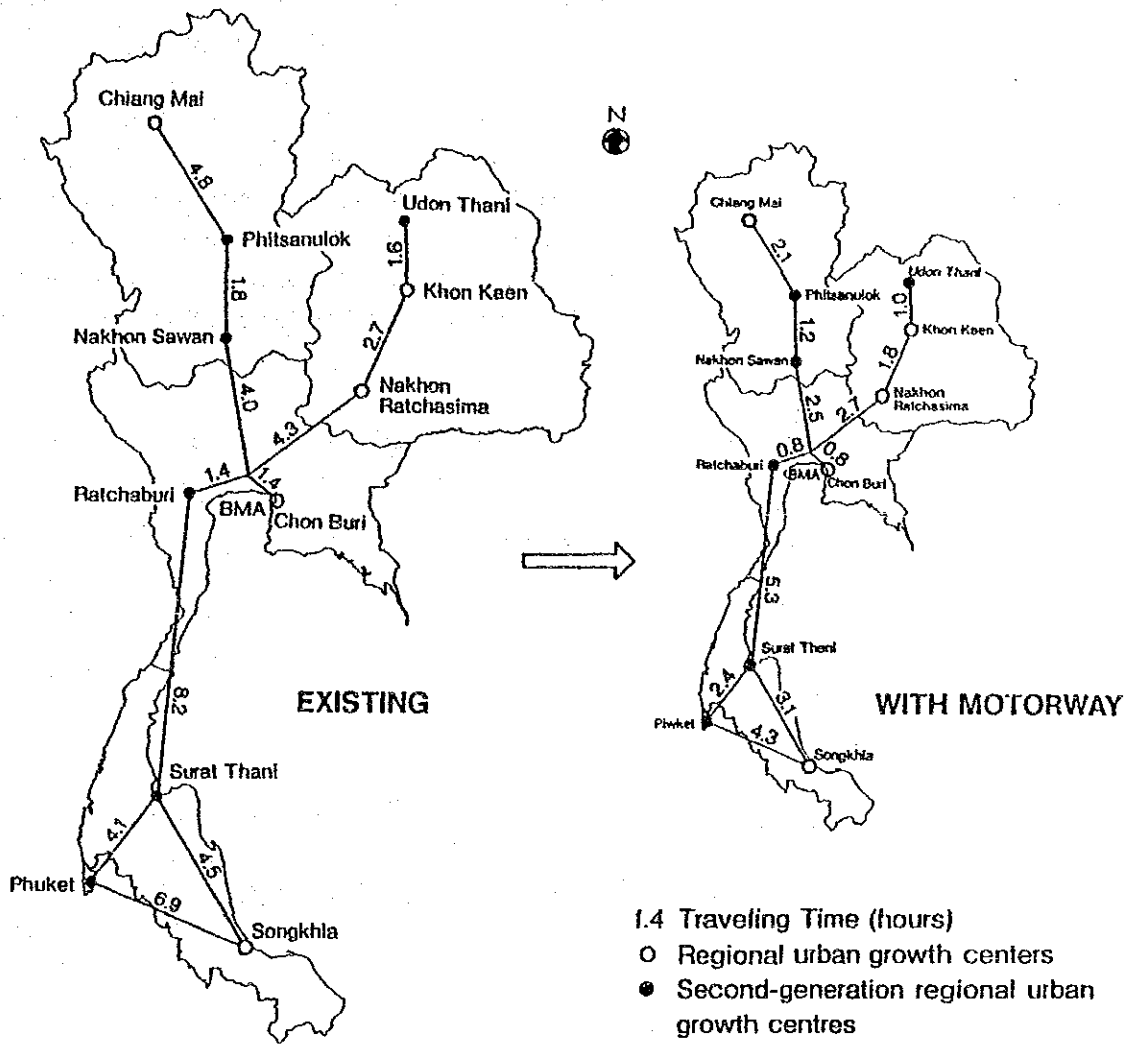


Figure 10.1 BETTERMENT OF NATIONWIDE DEVELOPMENT

tourists can travel on the proposed motorway network, they will be able to enjoy more sites within limited days.

4) Promotion of Agriculture and Fisheries

The motorway will encourage new factories to be constructed in the roadside areas, and at the same time, will stimulate production activities in such existing industries as agriculture and fisheries.

Such products as vegetables, fruits, flowers and fishery products can be cultivated in wider areas by shortening the time required for delivery to big markets as well as food processing plants.

5) Promotion of Commercial Activities

With the reduction in travel time, commercial activities will be stimulated in both cases of domestic and foreign exchangs with neighboring countries. Figure 10.2 shows that travel time will be reduced to two thirds after completion of proposed motorways.

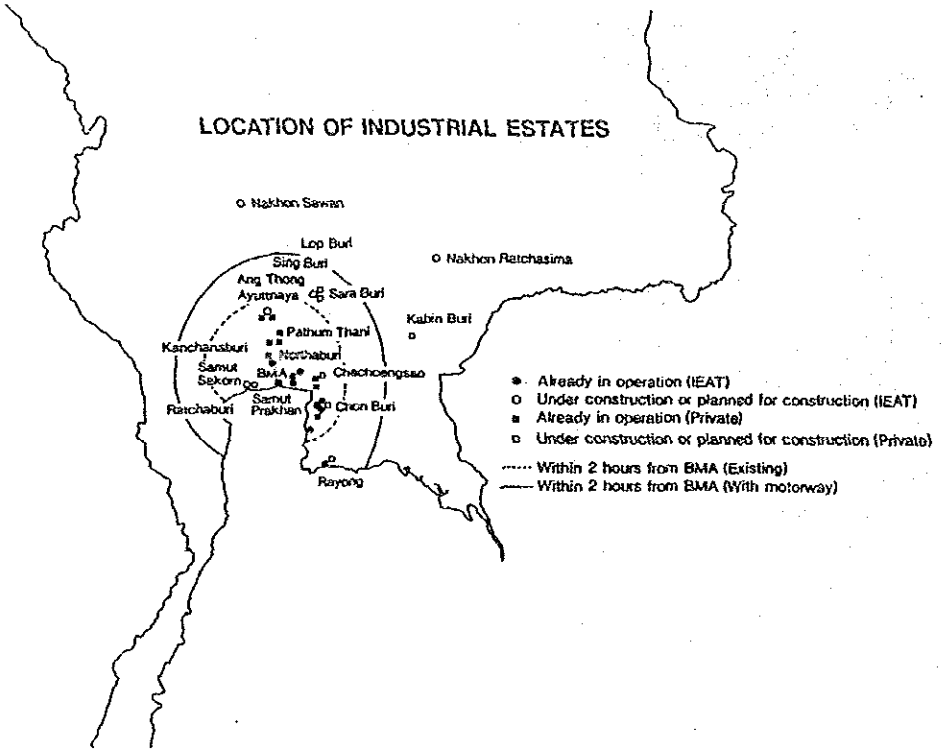


Figure 10.2 COMPARISON OF INTERNATIONAL TRAVELING TIME

6) Improvement in Living Conditions

The motorways will promote development of industries, thereby increasing both shipment and employment as well as income not only for individuals but also for the Government. The improvement in transportation conditions with the motorway may also help remarkably people in local areas in utilizing and gaining access to such social service facilities as hospitals, schools, government offices, among others.

10.4 ECONOMIC ANALYSIS

10.4.1 Economic Costs

Economic construction cost is calculated by applying the average conversion factor (0.90) to the financial construction costs (except for land acquisition cost).

The construction cost of each alternative staging case is summarized in Table 10.3.

Table 10.3 ECONOMIC CONSTRUCTION COST (Baht in 1990 price)

Case	Stage	1991-1995	1996-2000	2001-2010
Case 1		80,830.3	84,979.4	157,009.0
Case 2		80,830.3	83,941.8	158,046.0
Case 3		113,704.1	59,440.5	149,674.1
Case 4		54,488.5	61,329.1	207,001.1
Case 5		54,488.5	64,759.0	203,571.2

Economic maintenance and operation costs are estimated as 363,000 Baht/km/year and 454,000 Baht/km/year, respectively, by applying the same conversion factor.

10.4.2 Conditions for Economic Analysis

Conditions of economic benefit-cost analysis are described as follows:

a. Construction costs of each stage are equally allocated to the years contained in the corresponding planning period.

b. Benefits are assumed to be generated from the next year of starting construction.

c. Benefit streams between the years 1996—2001 and 2001—2011 are estimated by means of interpolation.

d. Annual benefits after the year 2011 are assumed to be the same benefits as in the year 2011.

e. No residual value is assumed for all alternatives.

10.4.3 Results of Economic Analysis

Results of the economic analysis are shown in Table 10.4. Of these alternative plans, the internal rate of return ranges from 23% to 35% and all alternatives are considered to be economically feasible.

Table 10.4 SUMMARY OF ECONOMIC EVALUATION

Case / Index	Case 1	Case 2	Case 3	Case 4	Case 5
EIRR(%)	27.78	23.09	27.75	33.40	35.44
*NPV (Million)	133,094	91,098	154,544	117,356	133.160
*B/C	2.01	1.69	2.07	2.05	2.19

Note: * Discount Rate = 12%

Considering progress of other on-going development projects (Eastern Sea Board, for example) and the promotion of regional development in local areas in the next 5 years, Staging Case 1 is recommendable as the most efficient implementation plan.

10.4.4 Economic Sensitivity Analysis

Sensitivity analysis for the Staging Case 1 is carried out to provide probabilistic judgment on the investment.

The result of analysis shows that even if the project costs go up by 20% and benefits go down by 20% simultaneously, an EIRR of more than 17% is still maintained.

CHAPTER ELEVEN

FINANCIAL EVALUATION

CHAPTER 11

FINANCIAL EVALUATION

11.1 FINANCIAL COST

Financial construction costs in 1990 price are presented in the previous chapter, and summarized in Table 11.1.

Table 11.1 FINANCIAL CONSTRUCTION COST

Stage	(million Baht in 1990 price) 1991-1995	1996-2000	2001-2010
Case 1	88,807.8	94,030.8	172,992.2
Case 2	88,807.8	92,946.0	174,077.0
Case 3	125,180.5	65,655.8	164,994.5
Case 4	59,926.6	67,682.9	228,221.3
Case 5	59,926.6	71,536.1	224,368.1

Costs under inflation are also studied by using an increase rate of 5% per annum (source: "Quarterly Bulletin", Bank of Thailand, June 1989).

Financial unit costs of maintenance and operation are as estimated in the previous chapter and shown below in 1990 price.

Effects of inflation on these costs are also taken into account assuming the same escalation rate of 5% per annum.

11.2 TOLL RATE

The proposed motorways are planned to be operated as toll roads and basic toll rates are set at 1.0 Baht/km for light vehicles and 2.0 Baht/km for medium and heavy vehicles.

There are 2 (two) criteria for the determination of toll rates as described below:

1) Possibility of repayment of loaned investment costs within a given payback period.
   — A toll rate that will enable the total project costs to be covered by the total revenue.

2) Equity and rationality
   — A reasonable toll rate compared with fares of other transport modes with reasonable difference between light and heavy vehicles.

Toll rates which satisfy the first criterion are usually determined through a calculation of repayment programme under some conditions. The second criterion is examined by comparing with railway fare and the toll rate of passenger cars (1.0 Baht/km) is provided to be reasonable.

11.3 FINANCIAL ANALYSIS

Financial analysis is conducted for the same alternatives staging cases assessed in the economic analysis comparing the toll revenues against the costs of investment and maintenance and toll operation cost.

The toll rate for two vehicle groups is determined as follows:

1.0 Baht/km - - - PC, LB, PP and LT
2.0 Baht/km - - - MB, HB, MT and HT

Toll revenues by each alternative case are calculated by applying the above toll rates, and the results are summarized in Table 11.2.

Table 11.2 TOLL REVENUES (million Baht/year)

Year	1996	2001	2011
Case 1	3,465	15,453	54,625
Case 2	3,465	11,475	54,625
Case 3	4,700	16,121	54,625
Case 4	3,908	11,397	54,625
Case 5	3,908	12,892	54,625

Periodical revision of toll rates to cover the effect of inflation is also assumed. An average annual increase rate of 3% is applied (General Price Index in Transportation Sector: "Quarterly Bulletin," Bank of Thailand, June 1989) and the toll rates are assumed to increase every 5 (five) years by using the above rate.

The Financial Internal Rate of Return (FIRR) is estimated to be around 13% to 14% and no substantial differences are observed among staging cases, as shown in Table 11.3.

Table 11.3 FINANCIAL EVALUATION

Case	Case 1	Case 2	Case 3	Case 4	Case 5
FIRR(%)	12.88	13.09	12.54	14.16	14.03

If the average interest rate of investment costs can be reduced under the rate of 12% by various combinations of available funds, these alternatives will be financially viable.

Cash flow estimation for repayment is conducted for Staging Case I in order to find the year in which the flow begins to yield a surplus and the year in which the total accumulated revenues exceed the accumulated expenditure. Assumptions of the estimation are described below:

1) Funds of investment in financial terms:

In this estimation, the following 2 (two) programmes are prepared as combinations of fund resources:

Programme — 1 :

Source (A): Loan from an international financial institution

40% of total annual investment
Interest Rate: 3.0% per annum
Repayment Period: 30 years including 10—year grace period

Source (B): Loan from a syndicate of major local Banks

60% of total annual investment
Interest Rate: 15.0% per annum
Repayment Period: 20 years including 5—year grace period

Programme — 2 :

Source (A): Loan from an international financial institution

40% of total annual investment
Interest Rate: 9.0% per annum
Repayment Period: 20 years including 5—year grace period

Source (B): The same conditions as the source (B) of Programme—1

2) Price escalation: 5% per annum for construction cost, and maintenance and operation costs

3) Revenues: Toll rate revision at every 5 years with an increase rate of 3% per annum

4) Short-term loan: To cover the shortage in cash. Interest rate 15% per annum

Through the estimation, the followings are pointed out:

—The first year in which the annual revenue exceeds the total of annual expenditure will be 2007 in Programme—1 and 2009 in Programme—2 (15 years and 17 years after the first opening respectively).

—The year of the break even point in which the accumulated revenues exceed the accumulated expenditure will be 2014 in Programme—1 and 2016 in Programme—2 (22 and 24 years after the first opening respectively).

—The maximum accumulated deficit will reach an amount of 134,598 million Baht by Programme—1 and 234,565 million Baht by Programme—2 in 2007.

—The total amounts of interest to be paid until the end of repayment period are as in Table 11.4.

Table 11.4 AMOUNTS OF INTEREST CHANGES (million Baht)

Programme	Source	Total Interest
Programme-1	(A)	107,442.2
	(B)	547,620.6
	(Short Loan)	19,593.1
Programme-2	(A)	219,048.2
	(B)	547,620.6
	(Short Loan)	33,520.5

The above estimations are conducted assuming that the project will be implemented as public works, although no subsidies from the Government are taken into account in the calculation.

If the toll motorways are operated by the private sector, other cost components such as depreciation allowance, taxes and deposit/reserve should be taken into account as well in the above estimations.

Sensitivity analyses on financial evaluation are also carried out from various aspects.

In these analyses, Staging Case I is selected and tested to estimate the effects of changes in the assumptions prepared for the original evaluation. The assumptions and factors to be checked are as follows:

- Changes in the original costs and revenues.
- Changes in the price escalation rate for annual investment costs, and maintenance and operation costs.
- Changes in the rates of interest.
- Changes in toll rates applied in the base case.

The results are described in the Main Text.

CHAPTER TWELVE

IMPLEMENTATION SCHEDULE

CHAPTER 12

IMPLEMENTATION SCHEDULE

12.1 IMPLEMENTATION SCHEDULE

The implementation schedule is established so as to complete the whole motorway network of about 4,300 km during 20 years from 1991 to 2010. The average length of the section to be completed a year reaches 215 km. During the first five years, however, the yearly average is planned to be only 173 km, and then increases to 216 km during the following five years. Constructing nearly half of the network will put Thailand in a well experienced position to complete the network with a higher average of 240 km during the last ten years. The implementation schedule is shown in Table 12.1. The sections classified by each stage are shown in Figure 12.1.

Table 12.1 IMPLEMENTATION SCHEDULE

ROUT/SECTION			LENGTH(km)	1991-1995	1996-2000	2001-2010
TM-1 (755.6km)						
BANG PA-IN J.C.	-	NAKON SAWAN	175.5			
NAKON SAWAN	-	PHITSANULOK	141.5			
PHITSANULOK	-	LAMPANG	182.0			
LAMPANG	-	CHAIANG MAI	90.7			
CHAIANG MAI	-	CHIANG RAI	165.9			
TM-2 (535.5km)						
BANG PA-IN J.C.	-	N. NAKHON RATCHASIMA	206.0			
N. NAKHON RATCHASIMA	-	NONG KAI	329.5			
TM-21 (301.1km)						
NAKHON RATCHASIMA	-	UBON RATCHATANI	301.1			
TM-3 (291.9km)						
PHRA KHANONG	-	RAYONG	197.3			
RAYONG	-	CHANTABURI	94.6			
TM-31 (167.7km)						
BANG PA-IN JC.	-	PHRA KHAONG	53.1			
PHRA KHAONG	-	PHASI CHAROEN	51.2			
PHASI CHAROEN	-	BANG PA-IN JC.	63.4			
TM-32 (100.0km)						
BANG YAI	-	BANG PHONG J.C.	53.0			
BANG PHONG J.C.	-	KANCHANABURI	47.0			
TM-33 (62.0km)						
BANG BUA THONG	-	SUPHAN BURI	62.0			
TM-34 (211.7km)						
THANYABURI	-	NAKHON NAYOK	59.0			
NAKHON NAYOK	-	ARRANYAPRATHET	152.7			
TM-35 (239.1km)						
CHON BURI	-	NAKHON RATCHASIMA	239.1			
TM-36 (365.8km)						
WAT PHLENG	-	BANG PANG	41.3			
BANG PANG	-	BANG PAKONG	324.5			
TM-4 (951.4km)						
PHASI CHAROEN J.C.	-	PRACHUAP KHIRI KHAN	257.7			
PRACHUAP KHIRI KHAN	-	BAN NA SAN	365.3			
BAN NA SAN	-	MALAYSIA BORDER	328.4			
TM-41 (190.7km)						
KRABI	-	KHANON	190.7			
TM-42 (136.0km)						
PHRA SAENG	-	PHUKET	136.0			
TM-43 (36.9km)						
RON PHIBUN	-	NAKHON SI THAMARAT	36.9			
TOTAL LENGTH (km)			4,345.4	866.7	1,079.0	2,399.7

- TM-1: the section between Bangkok and Phitsanulok
- TM-2: the section between Bangkok and Nakhon Ratchasima
- TM-4 & TM-41: the section between Bangkok and Krabi-Khanom
- TM-31: the whole section of the Outer Bangkok Ring Motorway

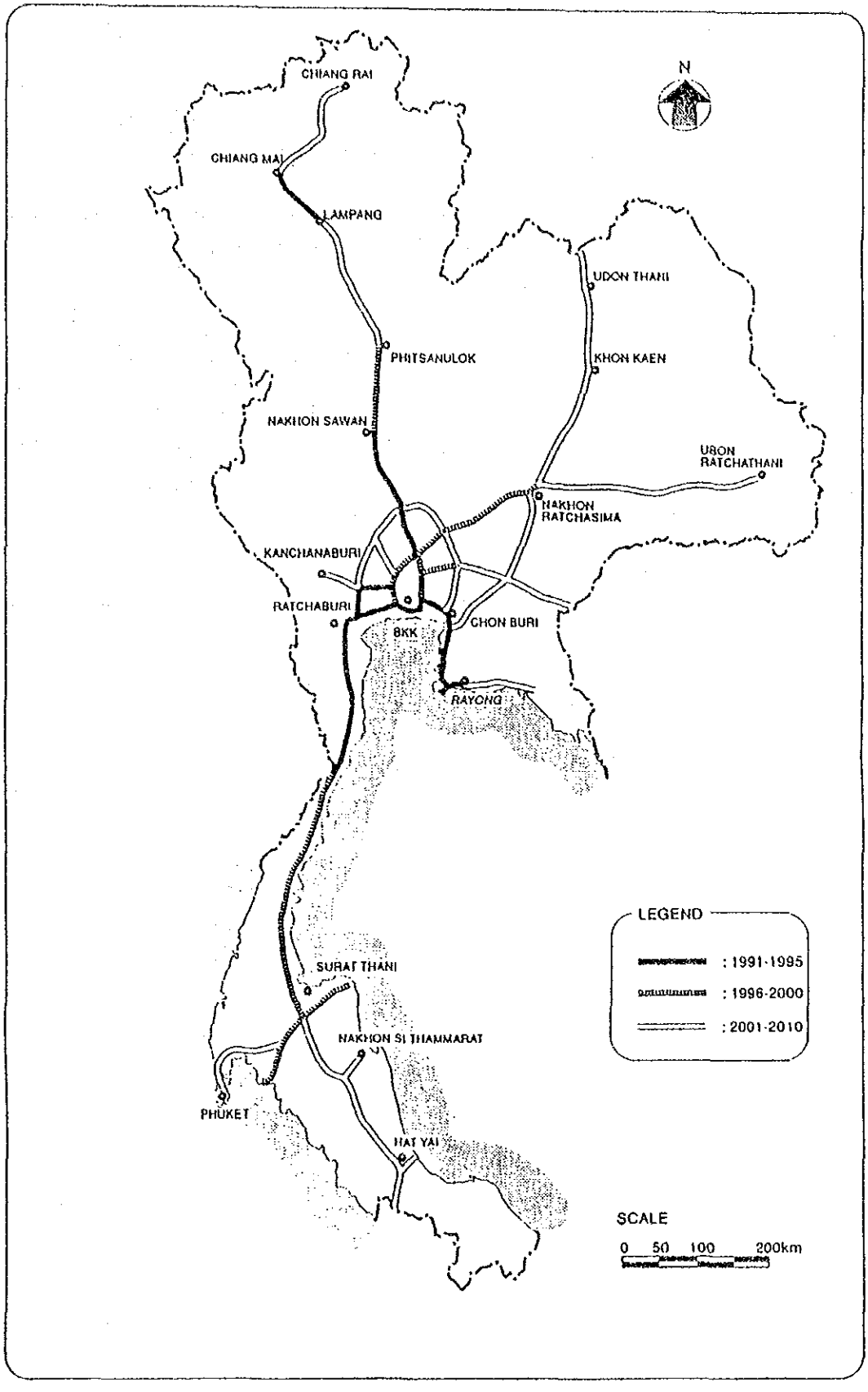


Figure 12.1 STAGING PLAN OF SCENARIO-1, CASE 1

12.2 INVESTMENT PROGRAM

A total investment for the whole motorway network of about 4,300 km is estimated to be 355,831 million Baht.

Table 12.2 shows the investment allocated to each implementation stage with amounts of the price escalation.

Table 12.2 INVESTMENT AMOUNT BY STAGE (million Baht)

	1991-1995	1996-2000	2001-2010	Total
Construction Cost	88,808	94,031	172,992	355,831
Price Escalation	14,243	45,226	199,152	258,626
Total	103,051	139,257	372,149	614,457
Composition (%)	(17.1)	(23.1)	(59.9)	(100)

From this table, amounts of the annual investment are calculated as follows:

Stage 1 : 20,610 million Baht/year
Stage 2 : 27,851 million Baht/year
Stage 3 : 37,215 million Baht/year