

## Project viability

The economic benefits to be induced by the Project will be large enough to justify the investments as illustrated for the regional artery by the estimated industrial value-added in 2001 in the provinces of Buri Ram, Surin and Si Sa Ket. Effects of the Project, however, would be far reaching with respect to both spatial extent and economic activities to be induced.

### **5.4.2 Railway improvement**

#### **(1) Background**

Although railways are superior to other transport means regarding punctuality and safety, the market share for inter-regional transport in Thailand is dominated by bus and air transport. Currently railways can not compete with bus for even those traffic demand of over 400km. in trip length, for which SRT expects that railways would be dominant. Despite the high standard of fares, air transport is steeply expanding its market. This situation is supposed to be caused by the existing relatively disadvantageous condition of infrequency and travel time of railway.

However, for the better utilization of transport means, railway transport system in Thailand should be improved to show the preferable characteristics which originally railways are bestowed.

As the economy in LNE-UE will grow, the role of railways in the Study Area is expected to change.

Appropriate prospects to be promoted in the Study Area were discussed by the Study Team with the various concerned agencies. A few examples of such major prospect related to the improvement of railway transport are outlined below.

- The exploration of the region's massive underground resources (rock salt and potash), the largest in the world, should be promoted along with complementary improvements to various seaports, particularly those at Laem Chabang and Map Ta Phut. Railway improvements would be of great importance since mineral resources are particularly suitable for rail transport rather than truck haulage because of their large volume.
- A container transport system using the railway should be developed between the Eastern Seaboard and the LNE-UE. Inland container depots should be established to serve a dryport function oriented toward the transport of freight between the LNE-UE and foreign countries.

According to the SRT plan, extension of northeastern line into Vientiane, the capital city of Laos, and new branch line construction in the upper part of Northeastern region are proposed. The former is already budgeted. Therefore it will be necessary for the Northeastern line to take over the resulting traffic demand of these railway constructions at the root of the line.

To meet those demand and the demand for international network formation and for the improvement of accessibility to the strategic cores proposed in this study, the northeastern line, especially between Bangkok and Nakhon Ratchasima, is expected to perform better by electrification, adoption of automatic signalling and

telecommunication system, or by construction of double track. This line is expected to extend further to Vietnam's coast.

## **(2) Project development**

### **a) The direction of improvement**

To ensure the safe train operation is the prerequisite to any improvement of railway. "One train occupies one section" is the essential principle for train operation. Accordingly increase of sections which can be used as a occupied section (blockade section) is indispensable for the enhancement of railway transport capacity.

The process of railway transport capacity improvement generally adopts following steps and as shown in Fig.5.16.

- i) Single track with manual control
  - Each section between stations is blockade section
- ii) Single track with automatic control
  - More than two blockade sections are set up by automatic signalling
- iii) Single track with electrification
  - electrification of step ii).
  - increase of operating speed
  - simplification of maintenance
- iv) Double track with automatic control
  - improvement of step ii) by construction of another additional track
- v) Double track with electrification
  - improvement of step 3) by construction of another additional track

Considering the existing situation of railway in LNE-UE, the railway capacity improvement is a matter of choice between the process from i) to iii) and the process from i) to iv).

In case of the processes from i) to ii) or from i) to iii), a substantial rise in transport capacity can not be expected. The adoption of automatic signalling system will bring about a reduction of blockade sections and increase a modicum of railway capacity improvement. However, substantial rise in transport capacity needs the establishment of facilities such as sidetracks and brush pasting tracks. The merits of electrification are the increase of operating speed and simplification of maintenance. Electrification will also lead to the curtailment of expenditure including staffs in a long term. Besides electrification will enable improvement of servicing level and increase of demand for railway transport.

Advancing to step iv) leads directly to the enforcement of transport capacity. In this case, although automatic signalling system is an essential condition for the improvement, establishment of facilities such as sidetracks and brush pasting tracks are not necessary which is different from the case of advancing to step iii). Compared with step i), transport capacity will become more than three times as much as that of step i) (Tables 5.3, and 5.4).

For the improvement of transport capacity of railway, the following issues must be considered.

- a) Forecast of transport demand
  - existing situation of supply and demand balance of transport capacity
  - future situation of supply and demand balance of transport capacity
  - estimation of future revenue
- b) Characteristics of transport demand
  - dominant use in transport between cargo transport and passenger transport
- c) acquisition of land
  - availability of land for the construction of additional track (Partial double track construction is possible if the span of section is long enough. The construction of double track all along the line can be attained by the accumulative partial double track constructions)
- d) existing conditions of rolling stocks
  - type of rolling stock
  - residual life of rolling stock

From the civil engineering point of view, there are two factors in railway alignment improvement for the railway capacity, the design speed and ruling gradient. The design speed has been determined from market studies, but this is usually expected to be fastest possible. Currently the maximum permitted is 90 kmph, but with improving technology the design speed used for alignment should be based on a higher maximum speed, and 120 kmph is suggested. The ruling gradient is currently 10 per mille on the existing main lines and is a normal acceptable standard. However, to compensate for curvature which has the effect of increasing the gradient the preferred design gradient should be 3 per mille less than the ruling gradient.

The economic design of the alignment must balance the construction costs of maximum permitted speeds and less than ruling gradients. Assumed design criteria are follows.

- design speed: mainline 120 kmph
- minimum horizontal radius for 120 kmph: 1,000 m.
- preferred minimum radius for 120 kmph: 5,000 m.
- minimum radius for vertical curve: 10,000 m.

For the construction of double track, it is preferable right of way be secured for the width of 50 m. The track formation will generally be about 2 m. above the ground level and the top of rail would be about 2.5 m. above ground. In flood prone areas the effect of this bund on flood flows must be carefully examined. he direction of railway capacity improvement

b) Stage-wise development

Initially, the section between Nakhon Ratchasima and the BMR will be improved. This improvement by double track construction will bring about the close connection between western part of LNE and BMR or ESB. together with the new railway (Khleng Sip Kao - Kaeng Khoy) which will be completed during the Seventh Five Year period.

It is desirable that other sections of the northeastern line should also be improved as soon as possible. They will be, however, improved mainly during the Eighth Plan period with the step-wise construction of double track. This improvement will realize the better connection with western part of LNE and BMR or ESB.

The extension of northeastern line will be left at the last stage of the development. International commodities flow and person trips between the border and Ubon Ratchathani will depend on the road transport for the time being.

In connection with the initial improvement of the railway serving Nakhon Ratchasima, an inland container depot should be established first in Nakhon Ratchasima. It will serve a dry port function connected to the ESB by the railway. Its feasibility study should be conducted in Phase I and the implementation should follow.

### **(3) Implementing agencies**

The Project will be implemented by SRT, and the central governments.

### **(4) Project viability**

#### Project costs

The construction cost of the section between BMR and Nakhon Ratchasima for double track is estimated at 5.8 billion baht depending on the average construction cost supplied by SRT. The portion for construction within the Study Area has a distance of some 120 km and this will involve a cost 2.4 billion baht. The section between Ubon Ratchathani and Nakhon Ratchasima, having some 310 km, would cost about 6.8 billion baht.

The total Project costs would be 9.2 billion bahts, excluding cost of the section within Central Region. The project cost from the BMR to Ubon Ratchathani reaches to 12.6 billion baht.

The extension of northeastern line having a distance of some 80 km. will cost additionally 1.8 billion baht.

#### Project benefits

The improvement of northeastern line would contribute to the rise of value-added in LNE-UE as well as strengthening the regional artery.

Industry induced service activities, tourism related services, border trade and related activities would also be induced.

#### Project viability

The economic benefits to be induced by the Project will be large enough to justify the investments. Effects of the Project, however, should be counted with respect to both spatial extent and economic activities to be induced.

### **5.4.3 Rural road maintenance system**

#### **(1) Background**

As the economy grew, some of the marginally-economic roads built by non-DOH agencies were taken in the national or provincial networks, and responsibility for

their maintenance and upgrading was assumed by DOH. These agencies are the Mobile Development Units(MDU), the Accelerated Rural Development program (ARD), the Rural Roads Division of the Department of Public Works (PWD), the National Security Command(NSC), the Land Settlement Division of the Department of Public Welfare, and others. Non-DOH agencies continued to build roads in accordance with the officially-determined missions of those agencies. Public resources have been allotted for their accomplishment and both bilateral and multilateral aid were contributed or loaned, generally in accordance with Thailand's five-year National Economic and Social Development Plans. However, available funds are not always distributed in a manner most responsive to the transport needs of the rural areas because nation-wide or regional planning information is not available.

## **(2) Project development**

There are two main sources of financing rural road construction and maintenance, i.e., national and local budgets. Within the national budget, there is no attempt to earmark specific sources of revenue for rural road construction and maintenance. Financing from national budget usually takes the form of grants-in-aid to the local governed authorities, including the Changwat Administration Organization, or to the Tambon Councils in the case of special rural development programs e.g., employment generation program, or the funds may be channelled through other local organization such as Village Development Committee in the case of NVDP program. Local revenues, on the other hand, constitute largely land development taxes, most of which are earmarked for expending on local activities including rural road construction and maintenance, and contributions of the CAOs under the Rural Highway Project. At present local government revenues come from four major sources:

- a) the locally levied taxes,
- b) surcharges on taxes levied nationally,
- c) taxes collected by the national government but given to local governments on a shared basis, and
- d) other sources including general and specific grants from the national government.

In accordance with the category of road builders, all of the major agencies which are responsible for road maintenance are DOH,ARD,PWD,CDD,MDU,and R.I.D. The road maintenance system related to local rural road are stated below.

### **- System of ARD Road maintenance**

ARD classifies maintenance works into five categories: routine maintenance, resurfacing, reconstruction, rehabilitation and flood damage repairs. Routine maintenance is usually made twice a year on a given stretch of the road.

### **- System of PWD road maintenance**

PWD is involved in the maintenance of the rural roads under the Rural Highways Project. In order to be able to maintain the 8.40 meters wide lateritic roads to be in a passable condition all year round, PWD plans to set up maintenance centers throughout the country. These centers will function as coordinator of rural road maintenance in nearby changwats within the radius

of 200 kms. Each center will be responsible for maintaining about 1,500kms of rural roads. It will also function as the center for distribution, exchange, and repair of machines used in road maintenance work. PWD planned that in the future maintenance sub-centers will also have to be set up under the supervision of the above changwat centers. Each sub-center will maintain about 300kms of rural highways within 1-2 changwats.

There are three types of maintenance work under the rural Highway Projects:

- i) routine maintenance,
- ii) emergency repair work, and
- iii) road improvement.

Lateritic roads that are being used regularly by over 200 vehicles per day, or roads that run past densely populated areas, or industrial areas or official area, or roads that are under rainfall all the year round should be improved into asphalt or concrete roads.

#### - System of CAOs road maintenance

The CAO is charged with maintaining the rural highways registered with the changwat. Many of these comprise roads that have been built by ARD or PWD. ARD roads are usually maintained by ARD unless the roads have been turned over to DOH for maintenance and improvement. Roads constructed by PWD were to be maintained by the CAO. PWD has started maintaining the roads that it has built.

#### - System of CDD road maintenance

The Community Development Department (CDD)'s role in road-building and maintenance is limited to helping villagers build relatively small, low quality roads, including many of the so-called "tambon road".

#### - System of NSC road maintenance

Since 1965 most of the road built by the Engineering Division of NSC were turned over to the DOH or the changwats for maintenance. The Mobile Development Units (MDU) are multi-service organization, consisting of both military and civilian personnel. The MDUs are responsible for maintenance of rural roads.

#### - System of Self-help Land Settlement Division

The self-help Land Division (SLSD) of the Department of Public Works is established for the land settlement. There are a number of settlements in all parts of the country operating under this Division's program. The settlement area do not take the geographic shape of typical villages. Roads are spaced evenly, usually in grid form, and spaced at least one kilometer apart over a relatively large area. The total kilometers of roads that are the apparent responsibility of the community are larger than the number that a normal village would be expected to maintain. It is expected that local cooperatives will be able to assume much of the responsibility for maintenance.

- System of Agricultural Land Reform Office, Ministry of Agriculture and Cooperatives

It is planned to organize cooperatives, with the possibility that the cooperatives can assume responsibility for the maintenance.

- System of Royal Forestry Department road maintenance

The Royal Forestry Department has two divisions that perform road construction and maintenance: the National Forest Land Management Division and the Watershed Management Division. The RFD maintains its own roads although it hopes that local cooperatives will be established that can take over maintenance.

- System of Royal Irrigation Department road maintenance system

The roads built by RID are kept in excellent condition since their maintenance is essential to the main task of canal upkeep. There seem little possibility that these roads will be maintained by any other organization as long as the canals are in use for irrigation.

- System of Department of Highways road maintenance

The DOH is responsible for construction and maintenance of national highways, provincial roads and "minimum maintenance" roads. The minimum maintenance roads usually were not constructed by DOH but have been transferred to it recently, and have not upgraded to DOH standards. In general, DOH does not maintain rural roads.

The principles of road maintenance basically consist of the need for resources, finance, staff, equipment and information and for an organization suitable for the development of these resources. A local self-help method at Tambon or Amphoe level should be established for effective road maintenance system.

### Finance

The level of finance to be allocated must be provided on the basis of actual need, not on some arbitrarily decided figure, and must be on a continuing basis so that the staff can carry out all forward planning with assurance that the long term needs will be met. Accordingly finance should be more available for local self-help organizations.

### Staff

Maintenance has its own special techniques and skills, many of which can only be fully developed through years of formal training and on the job experience, and no maintenance organization can function efficiently unless such staff is available at all levels. This implies that training procedures are established at each provincial level, so that self-help method is established at Tambon or Amphoe level.

### Equipment

Economical use of equipment depends on the deployment of that equipment over a sufficiently large area. The allocation of a number of machines must be controlled at

some regional level which permits flexibility in transfer of equipment according to planned usage.

#### Implementing agencies

The project will be implemented by the Community Development and the Public Works Department of Ministry of Interior and Changwat Administrative Organizations.

#### Project viability

Transfer and supply of funds, skills and equipment to the subordinate municipalities at Amphoe level will increase the well-being of the rural communities. The benefits are that health care can be reached with only normal delay, that children can travel to and from a secondary school, that surplus crops can be marketed and that consumer goods can be obtained from towns.

### **5.4.4 Regional truck terminals**

#### **(1) Background**

Since the construction of modern highways was started in Thailand some 28 years ago, the country's economic development has proceeded at a high rate, due in large part to the rapid improvement and extension of the highway and road network. Consequently the transport sector, and particularly the road transport industry, have grown correspondingly to meet the ever expanding transport demands of a burgeoning economy.

Today, all Thailand's main towns and amphoes can be reached on paved roads, and roads serve most rural areas. Transport of passengers and freight by road dominates the transport sector, and is expected to grow.

The trucking industry is now the lifeblood of Thailand's economy. This traffic predominantly comprises commodities for export being transported to ports and shipping terminals, and the distribution of imported and locally produced manufactured goods from ports and industrial regions to all parts of the country.

Nowadays in major cities, the activities by heavy vehicles, such as loading, unloading, pick-up and delivery, have caused many problems. To improve these conditions, goods transported may first be sorted at a point and then transported by small vehicles in accordance with the demand of each delivery zone. The total cost to the economy of truck transport comprises:

- the greatest part of the costs of roads, and road maintenance and repairs,
- the capital cost of trucks,
- the operating costs of trucks,
- the costs of ancillary facilities to the trucking industry,
- a large part of the costs of policing highway traffic, and administering the basic control functions of vehicle registration, safety inspections, etc.

Obviously it is most important to ensure that these huge expenditures are appropriately balanced, and provide optimum economic returns to the economy as a whole. In order to improve the overall efficiency of the entire national transportation



system, many countermeasures are conceived and proposed. The realization of truck terminals is considered to be one of such efficient countermeasures.

## **(2) Project development**

### **a) Roles and functions of truck terminals**

The roles and functions of truck terminal are conceived as follows.

#### Improvement of transport conditions

Truck terminals are expected to improve conditions of traffic jams and traffic accidents caused by the activities by heavy vehicles

#### Modernization and rationalization of trucking industry

Truck terminals are expected to develop the modernization and rationalization of physical distribution through co-operative activities.

#### Systematization of terminals

Operation of truck terminals will require changes in the traditional pattern of physical distribution in Thailand. In order to realize this change, there should be an incentive to reduce physical distribution cost and to increase their profits for both shippers and trucking companies, and it cannot be provided without systematic operation of individual regional truck terminals.

Whether each regional truck terminal can function effectively or not depends on establishment of a network system for trucking on a national scale.

Co-operative operations of general cargo distribution by organized individual trucking companies in each region would bring up this transport-by-trucking into a more developed trucking business, in which more accurate, more speedy and more effective transport could be possible.

Various systems for truck terminals may be established such as physical distribution and management operation systems including material-handling by machines, temporary storage and some production facilities. Truck terminals would not be able to function effectively without cooperating with each through these physical distribution and management operating systems.

For the provision of speedy physical distribution, reduction of the physical distribution cost, and increase of profit of related business, setting up modular unit loading is considered as one of practical means to operate handling of transport goods easily and safely.

#### Proper combination of sub-systems

Along the chain of physical distribution system, it is composed of sub-systems such as pick-up and delivery, loading and unloading, storage in warehouse (including temporary storage), some kinds of productive functions and transport.

## b) Type of truck terminal

The difference between private and public truck terminals is not facilities, especially, the usage of berths. This difference must be defined in the relevant terminal laws and regulations.

The large trucking companies may be able to build their own private truck terminals with their own capital on the outskirts of a big city. Since public truck terminals will be large, it will be beneficial if they are utilized not only by large trucking companies but especially also by small trucking companies who may not have enough capital to build their own truck terminals.

In this study JICA Study Team proposes the establishment of regional public truck terminals for the rationalization of cargo flow cooperated with the public truck terminals in BMR.

The basic facilities and activities are outlined. All forwarders will carry out business from their platform, using common facilities where required. In this way each forwarder is allotted his own loading bay while parking and driveway will be common facilities.

The cargoes are to be handled and completed in a one day operation; very small volumes will be stored for the next day's delivery. Cargo handling will be basically manual with assistance of wheeled push cart and by forklifts.

There are several types of physical distribution facilities as summarized below.

### Ordinary public truck terminal

Ordinary public truck terminals mainly consist of platforms and berths. Ordinary public truck terminals aim at starting from a smaller scale terminal and at expanding its size and operation at later stages. This is attributable to scarce management skills and experiences available for this specific purpose in this country (Fig.5.17).

### Freight centers

The term "Freight Center" comes from the report of the Seventh Plan Urban and Regional Transport (SPURT) commissioned by NESDB. The SPURT report describes the characteristics of the freight center as follows:

- \* It must cater for break bulk, and general cargo, and
- \* It must provide the following services; freight forwarding, 'for-hire' services, wholesale distribution, vehicle maintenance/fuelling services, and secure parking.

The SPURT report also recommends that a private management company be established to operate and manage the freight center. With regard to the type of physical distribution facilities, the SPURT Report also recommends to take the form of a "commodity distribution complex." The idea of the freight center is a wider concept than that of a public truck terminal which consists mainly of platforms and berths.

### Physical distribution zone

This physical distribution zone is a more advanced concept than public truck terminal alone. This zone aims at:

- \* refining urban functions, and
- \* improvement of commodity flow and smoothing road traffic by transferring distribution facilities, market, freight forwarders near the public truck terminal.

Land use in this zone is very strictly controlled and the zone is exclusively used by the physical distributors alone.

The type of truck terminal to be planned should be further studied.

#### c) Potential for establishing terminals

As most of the inbound cargoes for Bangkok are comprised of bulk cargoes on a full truck load basis, and as the majority of truck operators have to search for their own inbound cargoes, most of the changwat terminals do not handle Bangkok-bound traffic. As such their role is confined to delivery of freight from Bangkok and freight fee collection. The activity of these terminals is thus limited to sorting cargoes by delivery routes in the town and providing handling labor for delivery. In most cases the cargoes are delivered by the same heavy truck to the consignees, at the expense of the truck operator. Most changwat terminals are also roadside shophouses. In general these terminals do not cause severe congestion as they use the road for parking only.

In the future as industries in the Region will develop, a substantial portion of return cargoes will comprise of consumable goods and half finished goods. These goods are handled at freight forwarders' terminals.

The potential for establishing terminals in the major changwat centers are justified only in cases where local traffic restrictions have placed severe limitations on truck movement hours to an extent that incoming trucks carrying break bulk cargo cannot affect delivery in time, and are delayed by one day. This justification is then subject to a further consideration, that of traffic volume, inbound and outbound.

If these two criteria are met, a case could be made for locating a terminal outside the areas of traffic restrictions. In most changwat centers cost reductions would be confined to improvements in sorting systems for local delivery of consignments received from Bangkok by 10 wheel trucks.

#### **(3) Implementing agencies**

The owner or operator of the facility is sometimes a trading company, real estate company, local government, joint venture or a trucking company.

#### **(4) Project cost**

The construction cost will vary depending on the size of the truck terminal facilities and location.

Supposing the moderate size for the regional public truck terminal, total investment cost is roughly estimated at 42 million baht.

Land 30,000 square meters * 300 baht/sq.m.	9 milion baht
Construction cost (35 berths) * including earth works, utilities	30 milion baht
Supervision	3 milion baht
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Total	42 milion baht

## CHAPTER 6

### STRATEGY AND PROJECTS/PROGRAMS

#### 6.1 Coordination with Development Strategy in LNE-UE

##### 6.1.1 Consideration of staged development

According to the Master Plan Development Scenario, three phases are proposed with the following macro frame characteristics. Table 6.1 gives details.

- (1) Phase I (-1996)
  - Preparation for economic taking-off
  - Re-structuring within the Study Area
  - Preferential treatment by the government for implementation of new land policies, industrial location, and investment into key infrastructure
  - Economic growth rates 5-7%
- (2) Phase II (1997-2001)
  - Taking-off by the end of the century
  - Strengthened links with the ESB and initial international links
  - Strong Private sector initiative for all the economic activities
  - Economic growth rates 8-11%
- (3) Phase III (2002-2010)
  - Establishment of economic structure for self-sustained growth
  - Establishment of international links
  - Private sector participation in the provision of some infrastructure and social services
  - Economic growth rates 8 %

In this section, following the Master Plan Development Scenario, the assumable development stages for transport improvement are described.

Staged transportation development should be discussed in terms of restrictions of budget allocation and relevance to other sector, especially effective influence on realization of Master Plan. In accordance with the development scenario presented in the Master Plan, the principles in preparing transportation sector programs are set as follows.

- a) Adjustment of development stages of Regional Artery and other transport projects
- b) Development priority of gateway to Indochina
- c) Development priority of international railway network
- d) Adjustment of development stages of existing railway improvement and new railway construction
- e) Development priority of local service airports

As for roads, the projects of road transport improvement cover not only the construction of new roads but also widening, paving, rehabilitation and construction of interchange. The rough cost estimated for the proposed new Regional Artery

compares with the annual budget of DOH for the Study Area. Therefore, consideration of development stages of Regional Artery and other transport projects is necessary.

This Regional Artery is the essential component of development corridor proposed in the Master Plan. This project is the prerequisite for other sector projects. It poses a great impact on the realization of development projects especially industrial development and spatial development in LNE-UE. Considering these, it is conceived that the Regional Artery has high priority, therefore needs early implementation.

With respect to the second issue, there are currently four gateways to Indochina within the Study Area, Mukdahan, Aranyaprathet, Phibun Mangsahan (Ubon Ratchathani) and Kap Choeng (Surin). Three out of these four gateways except Mukdahan are served with roads. As the Mekong River lies between Mukdahan and Savannakhet, the second largest city in Laos, the transport across the river is served by ferry. As the transport demand is relatively high here, improve is needed at the early stage. New bridge over the Mekong River between Nong Khai and Vientiane in Laos on the North-South corridor is under construction, and existing road on the East-West corridor is utilized at present. From the viewpoint of the formation of main development corridor shown in the Master Plan, the gateways of North-South corridor and East-West corridor are expected to accommodate the road transport demand. Therefore, improvement of gateway to Indochina for the establishment of the secondary development corridor is essential. The improvement of the gateway to Indochina at Mukdahan with the construction of the new Regional Artery should be prior to other gateways.

The third issue is related to the formation of international railway network. Two international railway network formation projects in LNE-UE are proposed in this study, the extension of northeastern line from Ubon Ratchathani into Pakse in Laos and utilization of existing railway network with Cambodia at Aranyaprathet. At present, the extension of northeastern line into Vientiane is planned, although there exists no railway in Laos. As for the network between Thailand and Cambodia, the eastern line is connected with Cambodian railway at Aranyaprathet. The railway in Cambodia reaches the Cambodian seaport passing through Phnom Penh.

Prioritization of railway projects should be made in due consideration of political condition, the efficiency of international network, and possibility of technical standardization. Although the utilization of the eastern line as the international railway network offers an appeal, its extension into Ho Chi Minh city in Vietnam, is much influenced by unstable political condition. The extension of northeastern line from Ubon Ratchathani further into Laos is also appealing: the construction of new railway along the Mekong River to form a large international ring railway connected with the two northeastern lines in Thailand. However, the stage for railway transport is still premature at present in Laos. The formation of international railway network is still in the stage to see the run of events. If the political condition in Cambodia will take a favorable turn, the utilization of eastern line as an international railway network will be carried out in short term because the railways in both countries utilize the narrow gauge. It is considered that the effort to extend the northeastern line into Pakse is a little preferable.

The fourth is the issue about the priority between reinforcement of existing railway as a transport axis and new line construction for the formation of development corridor. The new line construction between Nakhon Ratchasima and ESB seems to

have feasibility problem; that is, traffic demand is insufficient compared with the investment amount. Another disadvantage for the project is the on-going new line construction between Kaeng Khoy and Klong Sip Kao with the cost of 3,153 mil.baht (Figure 6.1). This new line is expected to substitute the proposed new line between Nakhon Ratchasima and ESB. Although the formation of multi-transport axis is desirable as a concept, high priority does not seem to be accorded to this project. The reinforcement of the existing lines by double track construction will be the urgent subject in near future for the improvement of railway transportation and formation of development corridor. It is preferable to consider the priority of the reinforcement of existing lines and the line under construction.

The fifth issue is the matter related to the priority of local service airport. In this study, local service airports are proposed at Mukdahan and Aranyaprathet. In either case, the conversion or partial utilization of military base airport is not expected because of no existing military airport within the province. As the construction of airport will require large investment cost, prioritization of local airport construction should duly take this into account. At present, DOA is planning a new provincial airport construction at Loi Et from the viewpoint of service coverage area. This project does not reduce the necessity of new local airport construction either at Mukdahan or Aranyaprathet. Priority assessment of these two airports is also necessary. From the viewpoint of the formation of development corridor, establishment of local airport at Mukdahan has the advantage. Local airport at Mukdahan also has the advantage for the expansion of potential action area proposed in this report as a design policy. If well coordinated airline network is established, one day round trip to BMR or ESB would become possible from the most areas of LNE-UE. For the international network of tourism, Aranyaprathet close to the Siem Liep has the advantage. However, a new provincial airport at Surin, the tourism center of the Region, is supposed to assume more active role in this aspect.

Air transport to/from Aranyaprathet would by no means become the competitor with other transport means due to its closeness with major origins and destinations such as BMR and ESB

It can be concluded that the priority in the local airport establishment can be accorded to Mukdahan.

### **6.1.2 Principles of staged development**

According to the Master Plan Development Scenario, and the consideration above, principles of staged development for transportation corresponding to the design policies are shown in Table 6.2. Conceptual stage-wise development schemes of transportation in LNE-UE are shown in Figure 6.2 through 6.5.

## **6.2 Projects/Programs for the Transport Improvement in LNE-UE**

### **6.2.1 Projects/programs**

Detailed project programs based on the principles of stage-wise development for transportation are described in Table 6.3.

### **6.2.2 Project cost**

Project costs in each stage based on the program of staged development for transportation are described in Table 6.4.



# Tables



**Table 2.1 Passenger Traffic to/from Bangkok and Vicinity, 1989**

(Unit : 1,000person)

	Northeastern		Eastern	
<b>To Bangkok &amp; Vicinity</b>				
Bus	4,382*	61.0%	13,399*	90.0%
Rail	2,702	37.6%	1,488	10.0%
Air	97	1.4%	-	-
Total	7,181	100.0%	14,887	100.0%
<b>From Bangkok &amp; Vicinity</b>				
Bus	4,382*	60.8%	13,399*	90.8%
Rail	2,728	37.9%	1,365	9.2%
Air	96	1.3%	-	-
Total	7,206	100.0%	14,764	100.0%

Source : "Transport Statistics", Ministry of Communication

\* as of 1987

**Table 2.2 Freight Traffic to/from Bangkok and Vicinity, 1989**

(Unit : 1,000person)

	Northeastern		Eastern	
<b>To Bangkok &amp; Vicinity</b>				
Road	6,540	96.8%	24,415	72.8%
Rail	217	3.2%	136	0.4%
Inland Waterways	-	-	-	-
Coastal Shipping	-	-	8,981	26.8%
Air	-	-	-	-
Total	6,757	100.0%	33,532	100.0%
<b>From Bangkok &amp; Vicinity</b>				
Road	6,610	91.5%	2,157	72.6%
Rail	615	8.5%	29	1.0%
Inland Waterways	-	-	-	-
Coastal Shipping	-	-	787	26.5%
Air	-	-	-	-
Total	7,225	100.0%	2,973	100.0%

**Table 2.3 Road Length and Density of DOH Road in LNE-UE, 1988**

Province	Road length (km)	Land area (km <sup>2</sup> )	Road density (km/km <sup>2</sup> )
Ubon Ratchathani	1,548	18,906	0.08
Mukdahan	-	-	-
Yasothon	232	4,162	0.06
Surin	851	8,124	0.10
Si Sa Ket	688	8,840	0.08
Nakhon Ratchasima	1,359	20,494	0.07
Buri Ram	811	10,322	0.08
Prachin Buri	1,103	11,958	0.09
Nakhon Nayok	177	2,122	0.08

Source : DOH, Dept. of Local Administration, and Dept. of Public Works

**Table 2.4 Road Length, Population and Land Area (1991)**

Region	Road Length (km)				Population (million)	per km	Land Area km <sup>2</sup>	Density km/km <sup>2</sup>
	Paved	Unpaved	Others*	Total				
All Roads**				199,520	54.53	3,659	514,204	0.388
DOH Roads								
North	10,990	2,950	2,620	16,560	10.63	715	169,536	0.098
Northeast	10,240	1,420	1,320	12,980	18.91	1,364	168,897	0.077
Central	10,800	1,000	1,970	13,770	17.82	1,396	103,918	0.133
South	7,520	680	890	9,090	7.17	857	70,733	0.129
Total DOH	39,550	6,050	6,800	52,400	54.53	1,041	513,084	0.102

Notes:

\* : Roads under Construction, Rehabilitation etc., includes paved and unpaved roads.

\*\* : All Roads in Country, 1990

Source : Highways in Thailand, DOH(1989) & Consultants'Estimates

**Table 2.5 Transport Vehicles in the Study Area, 1991**

Provinces	Light Truck	Motorcycle	Bicycle	Mini-Truck	Other (Cars, etc.)
<b>East</b>					
Nakon Nayok	1,833	14,567	25,253	502	694
Prachinburi	5,285	25,612	72,056	4,042	3,359
<b>Northeast</b>					
Yasothon	1,505	13,590	53,841	654	1,100
Nakon Ratshasima	7,927	63,188	141,793	19,529	5,072
Buri Ram	2,603	26,271	112,625	2,690	1,757
Si Sa Ket	3,137	24,039	124,883	1,036	1,827
Surin	3,060	25,130	114,409	1,179	2,249
Ubon Ratchatani	4,762	43,680	161,737	691	3,066
Mukdahan	833	6,690	24,087	92	657
<b>Total</b>	<b>30,945</b>	<b>242,767</b>	<b>830,684</b>	<b>30,415</b>	<b>19,781</b>

Source :National Rural Development Cooperation Center, NESDB

**Table 2.6 Public Transport Vehicles in the Regional Cities, est.1989**

City	Public Transport Vehicles (1)		Taxi (3)	Tuk-tuk	Sam-lor
	Bus/Mini-bus	Songthaew (2)			
Chiang Mai	70	3,820	55	1,510	3,500
Hat Yai	-	2,500	-	60	3,000
Khon Kaen	250	840	-	660	3,000
Nakhon Ratchasima	270	40	-	830	5,400
Nong Khai	70	100	-	-	3,000
Phuket	40	700	70	-	2,350
Phitsanulok	35	300	-	40	2,200
Ubon Ratchatani	90	330	100	200	2,000

Source : SPURT Final Report, March 1991

- (1) The data are derived from two main sources : Vehicle registrations by Changwat (DLT) and a study by OCMRT in "Proposal for Traffic and Transport Management Plan"
- (2) Songthaew is a converted pick-up, truck, or si-lor that operates like a shared taxi.
- (3) In some of the changwats there is no record of taxis, but there are rented cars which operate like taxis and are included under taxis.

**Table 2.7 DOH Roads in the Study Area (1/2)**

Provinces/Sub-Region	Highways Route No.	Termini	Distance km	Average Daily Traffic	Importance to Development
<b>Prachinburi Sub-Region</b>					
<b>Prachinburi</b>					
Existing Highway Arterial Roads	33	Nakhon Nayok-Prachinburi -Aranyaprathet	155	19,472	Industrial, Border, Trade Transport, Tourism
Collector Roads	304	Nakhon Ratchasima-kabin buri-Chachoeng Sao	85	11,156	Transport to ESB, Trade Industrial
	317	SaKaeo-Wang Nam Yan-Chanthaburi	75	2,510	Tourism,Transport to East Region
	319	Chachoeng Sao-Prachinburi	32	10,979	Industrial, Transport to ESB
Provincial Roads Highway Under Construction	23Route		-	-	Agriculture Transportation Roads
Provincial Roads	2,345	Klong Ma Ka-Pang Sida	49	-	Tourism
	3,124	Ban Sang-B.Bang Khanak	20	-	Agriculture Transportation Road
	3,446	Ban Klong Louk-B.San Lao Changan	60	-	Agriculture Transportation Road
<b>Nakhon Nayok</b>					
Existing Highway Arterial Roads	33	Prachinburi	40	5,024	Tourism, Transport
Collector Roads	305	Thanyaburi-Nakhon Nayok	37	6,383	Tourism, Transport to BMR.
Provincial Roads	7Route		-	-	Tourism
<b>Nakhon Ratchasima Sub-Region</b>					
<b>Nakhon Ratchasima</b>					
Existing Highway Arterial Roads	2	MuakLek-Nakhon Ratchasima-KhonKhaen	200	76,544	Industrial, Trade, Transport Tourism
Collector Roads	24	Chok Chai-Nong Bun Nak	30	4,258	Industrial, Transport
	201	Sikhiu-Dan Khunthot	50	8,843	Transport
	202	Chiyaphum-PraThai	50	5,485	Agriculture Transportation Roads
	205	Nakhon Ratchasima-Non Thai-Nong Bua Khok	50	12,827	Transport
	206	Talat Khae-Phimai	-	6,150	Tourism
	207	Ban Wat-PraThai-Khon Khaen	70	5,420	Transport
	224	Nakhon Ratchasima-Chok Chai	29	8,772	Industrial
	226	R.No224-Chakkarat-Lampfalmat	54	2,980	Trade, Transport
	304	Nakhon Ratchasima-Pak Thong Chai-Kabinburi	82	14,187	Industrial, Trade, Transport to ESB
Provincial Roads Highway Under Construction	23Route		-	-	Agriculture Transportation Roads
Arterial Roads	2	Muak Lek-Nakhon Ratchasima	76	45,341	Industrial, Trade, Transport
	24	Shikiu-ChokChai	52	-	Transport, Industrial
Collector Roads	-	Bypass Nakhon Ratchasima	20	-	Transport
	201	Bypass Shikhiu	8	-	Transport
	224	Nakhon Ratchasima-Chok Chai	18	-	Industrial
	304	Nakhon Ratchasima-Pak Thong Chai	15	-	Industrial
Provincial Roads	2,317	Soeng Sang-Nong Ki	20	-	Agriculture Transportation Road
	-	Khok Si-B.Tako	34	-	
	-	Khaeng Kham-B.Don Pai	24	-	
<b>BuriRum</b>					
Existing Highway Arterial Roads	24	Nong ki-Prakhon Chai-Prasat	90	8,117	Transport, Tourism
Collector Roads	202	R.No207-Phuttaisong-Phayakkaphum Phisai	20	1,427	Agriculture Transportation Road
	218	Nang Rong-Buri Rum	50	4,400	Tourism, Trade
	219	Prakhon Chai-Buri Rum-Satuk	85	7,558	Tourism
	226	Lamplaimat-Buri Rum-Surin	65	10,181	Transport, Trade, Tourism
Provincial Roads	15Route		-	-	Agriculture Transportation Roads, Tourism
Highway Under Construction					
Provincial Roads	2,208	Pra Khon Chai-Ka Sang	47	-	Agriculture Transportation Road

**Table 2.7 DOH Roads in the Study Area (2/2)**

Provinces/Sub-Region	Highways Route No.	Termini	Distance km	Average Daily Traffic	Importance to Development
<b>Ubon Ratchatani Sub-Region</b>					
<b>Ubon Ratchatani</b>					
Existing Highway					
Arterial Roads	23	Ubon-khuang Nai	60	2,231	Transport
	24	Khu Khan-Det Udom-Ubon	70	4,732	Agro-industry, Transport
Collector Roads	202	Amnat Charoen-Khemarat	90	2,974	Agriculture Transportation Roads, Tourism
	212	Ubon-Amnat Charoen- Mukdahn	100	23,715	Transport, Agro-industry
	217	Ubon-Phibun Mangsahan- Chong Mak	85	7,422	Border Trade, Transport, Tourism
Provincial Roads		22Route	-	-	Agriculture Transportation Roads
Highway Under Construction					
Arterial Roads	24	warin Chamrap-Det Udom	10	-	Industrial
Provincial Roads	-	Ubon-Tan Sum	30	-	-
	-	B.Nong saeng-B.Puthai- Parrana-B.Laoin Plaeng	53	-	-
	2,232	B.nong Pua-Kudkhaeopan	39	-	Agriculture Transportation Road
<b>Mukdahan</b>					
Existing Highway					
Collector Roads	212	Loeng Nok Tha-Mukdahan- Thai Phanom	79	5,586	Border Trade, Transport, Tourism
Provincial Roads	2,042	Mukdahan-Nong Sung	75	-	Agriculture Transportation Road
	2,277	Loeng Nok Tha-Don Tan	30	-	-
	2,287	B.Kan Dong Hluang- Khao Vong	80	-	-
	2,292	B.non Toom-B.Kan Dong- Hiuang	20	-	-
Highway Under Construction					
Provincial Roads	-	B.Nikhom Kham Soi- B.Nong Sung	35	-	-
<b>Yasothon</b>					
Existing Highway					
Arterial Roads	23	Khuang Nai-Yasothon	40	5,688	Transport
Collector Roads	202	Yasothon-Amnat Charoen	34	2,697	Agriculture Transportation Road
Provincial Roads		5Route			
Highway Under Construction					
Provincial Roads	-	Khuang Nai-Yang Chum Noi	22	-	-
	-	Kho Vang-Yang Chum Noi	13	-	-
	2,227	Panom Prai-Mahachana Chai	10	-	Agriculture Transportation Road
<b>Surin Sub-Region</b>					
<b>Surin</b>					
Existing Highway					
Arterial Roads	24	Prasat-Sang Kha	90	3,769	Transport, Tourism
Collector Roads	214	Ta Tum-Surin-Chong Jom	130	7,659	Tourism, Border Trade
	226	Surin-Sikhoraphum- Huai Thap Than	65	5,154	Transport
Provincial Roads		12Route			
Highway Under Construction					
Provincial Roads	-	Sikhonraphum-Sang Kha	37	-	Agriculture Transportation Road
	2,076	B.Som Poy Noi-B.Moung Mak	10	-	Agriculture Transportation Road
	2,283	Sang Kha-B.Dan	30	-	-
	-	B.Na Sanuon-B.Duonaow- B.Pumison	115	-	-
<b>Si Sa Ket</b>					
Existing Highway					
Arterial Roads	24	Sang Kha-Khu Khan- Det Udom	80	3,426	Transport
Collector Roads	220	Si Sa Ket-Khu Khan	56	1,368	Transport, Tourism
	221	Si Sa Ket-Kan Tharalak- Khao Phra Winhan	90	3,428	Tourism
	222	Huai Thap Than-Si Sa Ket- Warin Chamrap	85	7,344	Trade, Transport Agriculture Transportation Roads
Provincial Roads		10Route			
Highway Under Construction					
Provincial Roads	-	B.NonSam Nak-B.Khaeng	30	-	Agriculture Transportation Road
	2,076	B.Som Poy Noi-B.Moung Mak	-	-	-
	2,157	Khu Khan-B.Khok Tan	22	-	-

Source : DOH, Ministry of Communications

**Table 2.8 Definitions for Bus Categories**

- 
- i) Fixed Route
- Category 1 : Urban area only, within a municipality
  - Category 2 : Inter-city, with Bangkok at one end of the route
  - Category 3 : Inter-city, between cities other than Bangkok
  - Category 4 : Inter-amphoe (inter-district), operating within the boundary of a changwat (province)
- ii) Small Vehicles (with seven or more seats)  
Pick-ups and small trucks, usually fitted with seats and roofs, carrying both passengers and cargo on a fixed route or anywhere within a defined area in urban and semi-urban areas.
- iii) Non-Fixed Route (or For-Hire Service)  
Charter buses (e.g. tourist coaches for local and foreign tourists) and, in certain cities such as Hat Yai, providing a commuter service within a defined area.
- iv) Private Buses  
School buses, factory buses, and others.
- 

**Table 2.9 Routes and Route Length (as of March, 1987)**

Region	Category 2		Category 3		Category 4	
	No.of Routes	Average Route Length (km)	No.of Routes	Average Route Length (km)	No.of Routes	Average Route Length (km)
North	29	571	52	188	140	53
Central	57*	169*	68*	84*	124	20
West	-	-	-	-	129	35
East	25	206	12	92	88	33
Northeast	33	566	104	125	268	48
South	19	754	33	141	85	41
Total	163	395	377	150	834	40

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Source : LTD

\* Including West.



**Table 2.10 Regional Daily Trip Table**

Category 2

Destination Origin	North	Northeast	Central	East	West	South	Bangkok	Total
North	0	0	0	0	0	0	6,739	6,739
Northeast	0	0	0	0	0	0	12,006	12,006
Central	0	0	0	0	0	0	25,133	25,133
East	0	0	0	0	0	0	36,710	36,710
West	0	0	0	0	0	0	49,232	49,232
South	0	0	0	0	0	0	3,437	3,437
Bangkok	6,739	12,006	25,133	36,710	49,232	3,437	0	133,259
Total	6,739	12,006	25,133	36,710	49,232	3,437	133,259	266,516

Category 3

Destination Origin	North	Northeast	Central	East	West	South	Bangkok	Total
North	40,139	2,934	4,478	0	406	0	0	47,957
Northeast	2,934	74,554	483	2,773	0	0	0	80,744
Central	4,478	483	25,919	658	4,179	0	0	35,717
East	0	2,773	658	25,720	0	0	0	29,151
West	406	0	4,179	0	30,767	218	0	35,569
South	0	0	0	0	218	44,867	0	45,085
Bangkok	0	0	0	0	0	0	0	0
Total	47,957	80,744	35,717	29,151	35,569	45,085	0	274,226

Category 4\*

Destination Origin	North	Northeast	Central	East	West	South	Bangkok	Total
North	67,086	0	1,132	0	331	0	0	68,549
Northeast	0	87,402	0	0	0	0	0	87,402
Central	1,132	0	105,295	4,011	0	0	8,378	118,816
East	0	0	4,011	41,236	391	0	0	45,638
West	331	0	0	391	55,202	714	0	56,638
South	0	0	0	0	714	71,988	0	72,702
Bangkok	0	0	8,378	0	0	0	0	8,378
Total	68,549	87,402	118,816	45,638	56,638	72,702	8,378	458,124

Source : " Study of Inter-City and Rural Bus Transport" 1988, LTD

\* Some category 4 services cross provincial and regional boundaries.

**Table 2.11 Regional Trip Rate Analysis, 1985**

Regions	Population 1985 (million)	Annual Trips per Person by Route Category				
		2	3	4	Small Vehicle	Total
North	10.39	0.24	1.67	2.40	3.40	7.71
Northeast	18.06	0.24	1.60	1.76	1.98	5.58
East	3.96	3.40	2.63	4.20	5.26	15.49
West	4.02	4.50	3.07	5.14	5.84	18.55
South	6.44	0.20	2.56	4.20	4.74	11.70
Bankok& Central	8.92	6.52	1.35	5.20	6.04	19.11
Total	51.79	1.89	1.89	3.23	3.86	10.86

Source : "Study of Inter-City and Rural Bus Transport" 1988, LTD

**Table 2.12 Road Condition (Road to Ampoe), 1991**

Provinces	There is no road to Ampoe Center (mubans)	There is Road to Ampoe Center (mubans)
East		
Nakon Nayok	13	362
Prachinburi	27	1,080
Northeast		
Yasothon	7	699
Nakon Ratshasima	12	2,712
Buri Ram	32	1,910
Si Sa Ket	13	1,845
Surin	19	1,742
Ubon Ratchatani	33	2,527
Mukdahan	8	427
Total	164	13,304

Source : NESDB

**Table 2.13 Road Condition (Road to Amphoe), 1991**

Provinces	There are no bus services in rainy season (mubans)	There are bus services (but not frequently) (mubans)	There are bus services (frequently) (mubans)
<b>East</b>			
Nakon Nayok	14	60	230
Prachinburi	23	359	590
<b>Northeast</b>			
Yasothon	10	360	328
Nakon Ratshasima	75	781	1636
Buri Ram	52	771	1001
Si Sa Ket	56	850	795
Surin	63	716	873
Ubon Ratchatani	54	936	1493
Mukdahan	10	168	235
<b>Total</b>	<b>357</b>	<b>5,001</b>	<b>7181</b>

Source : NESDB

**Table 2.14 Road Condition (Road to Amphoe), 1991**

Provinces	There are no bus services (mubans)	There are bus services (mubans)
<b>East</b>		
Nakon Nayok	73	295
Prachinburi	158	948
<b>Northeast</b>		
Yasothon	31	683
Nakon Ratshasima	293	2,444
Buri Ram	156	1,788
Si Sa Ket	203	1,659
Surin	164	1,608
Ubon Ratchatani	107	2,454
Mukdahan	33	405
<b>Total</b>	<b>1,218</b>	<b>12,284</b>

Source : NESDB

**Table 2.15 Road Condition (Road to Amphoe), 1991**

Provinces	There are no light bus services	There are light bus services
	(mubans)	(mubans)
East		
Nakon Nayok	74	294
Prachinburi	200	903
Northeast		
Yasothon	40	671
Nakon Ratshasima	358	2,380
Buri Ram	209	1,741
Si Sa Ket	312	1,550
Surin	214	1,553
Ubon Ratchatani	158	2,401
Mukdahan	72	362
Total	1,637	11,855

Source : NESDB

**Table 2.16 Road Condition (Road to Amhpoe), 1991**

Provinces	There are no light bus services in rainy season	There are light bus services (but not frequently)	There are light bus services (frequently)
	(mubans)	(mubans)	(mubans)
East			
Nakon Nayok	15	64	227
Prachinburi	31	346	554
Northeast			
Yasothon	15	369	310
Nakon Ratshasima	76	802	1568
Buri Ram	70	784	955
Si Sa Ket	75	821	719
Surin	75	731	818
Ubon Ratchatani	79	968	1398
Mukdahan	13	167	194
Total	449	5,052	6743

Source : NESDB

**Table 2.17 Road Condition (Road to Amphoe), 1991**

Provinces	There is no road to shop	There is Road to shop
	(mubans)	(mubans)
East		
Nakon Nayok	15	358
Prachinburi	25	1,068
Northeast		
Yasothon	6	702
Nakon Ratshasima	23	2,688
Buri Ram	24	1,905
Si Sa Ket	18	1,836
Surin	28	1,727
Ubon Ratchatani	19	2,541
Mukdahan	8	428
Total	166	13,253

Source : NESDB

**Table 2.18 Railway Passenger Traffic by Category**

(Unit : 1,000)

Fiscal Year	One-Way (thousands)	Round-Trip (thousands)	Commuter (thousands)	Total (thousands)
1982	60,629	8,811	10,866	80,306
1983	62,844	8,143	10,417	81,404
1984	66,293	7,976	7,229	81,498
1985	64,992	6,737	6,284	78,013
1986	64,360	5,877	5,516	75,753
1987	66,301	5,170	5,386	76,857
1988	71,345	4,994	5,279	81,618
1989	72,824	4,851	5,293	82,968
1990	74,315	4,854	5,298	84,467

Source : SRT Information Booklets

**Table 2.19 Tonnage Transported by SRT**

Fiscal Year	FCL Freight		LCL Freight		Total
	Tons	Percentage	Tons	Percentage	
1982	5,518	98.3%	96	1.7%	5,614
1983	5,177	98.4%	82	1.6%	5,259
1984	5,506	98.8%	67	1.2%	5,573
1985	5,616	99.4%	32	0.6%	5,648
1986	5,265	99.6%	23	0.4%	5,288
1987	5,570	99.6%	20	0.4%	5,590
1988	6,198	99.7%	20	0.3%	6,218
1989	7,030	99.7%	21	0.3%	7,051
1990	7,861	99.7%	25	0.3%	7,886

Source : SRT Information Booklets

**Table 2.20 Inter-Regional Rail Passenger Traffic, 1989**

Origin	Destination	Bangkok and Vicinities	Northern	Northeastern	Central	Eastern	Western	Southern	Unknown	Total
Bangkok and Vicinities		15,280	1,600	2,728	1,766	1,365	1,044	1,877	572	26,231
Northern		1,624	4,779	6	468	0	1	1	4	6,883
Northeastern		2,702	4	7,195	445	0	1	2	4	10,353
Central		1,916	499	402	3,781	0	1	0	9	6,610
Eastern		1,488	1	0	0	1,722	0	0	0	3,212
Western		628	3	4	2	0	1,226	280	1	2,145
Southern		1,901	1	6	1	0	253	9,962	25	12,148
Unknown		976	1	0	8	2	23	15	5,020	6,045
Total		26,516	6,888	10,341	6,471	3,091	2,550	12,137	5,636	73,629

Source : State Railway of Thailand

**Table 2.21 Loaded Commodity Volume by Station in Fiscal Year 1990**

	Rice	Maize	Coconut	Rubber	Bean	Log	Wood	Sugar	Cement	Gypsum	Oil,Fuel	Noodle	Flour	Container	L.P.G	Total
1. Pak Chong																411.7
2. Nakhon Ratchasima	11450.9										157.3		14,929.7			26,642.6
3. Thanun Chira Junc.	1542															1,542.0
4. Hong Sung	369.1		36.0													405.1
5. Muang Khong																0.0
6. Bua Yai Junc.	1645.4	495.3	8.0													2,148.7
7. Chakkarat	30															30.0
8. Lam Praiat	9065.6															9,065.6
9. Buri Ram	9639.2															9,639.2
10. Lamchi					78.0											78.0
11. Surin	13130.4						32.9									13,163.3
12. Sikhora Phom	454.1															454.1
13. Si Sa Ket	8112.8	30.0											2,868.1			11,010.9
14. Ubon Ratchathani	29279.8				13.5			4,036.0								33,329.3
15. Yothaka																0.0
16. Prachin Buri																0.0
17. Kabin Buri																0.0
18. Wathana Nakhon																0.0
19. Aranyaprathet																0.0

Source : State Railway of Thailand

**Table 2.22 Airports in Thailand, 1988**

Airport	Daily Passengers	Daily Commercial Flight Departures	Public Auto Parking Spaces per Average Daily Passenger	Operating Profit (baht) per Passenger	Passengers per Flight Departure
BANGKOK	28,917	100.3	0.10	185	144
PHUKET	2,757	11.9	0.03	62	116
CHIANG MAI	2,508	11.8	0.05	23	106
HAT YAI	1,069	6.1	0.19	66	88
Surat Thani	392	3.9	0.77	2	50
Phitsanulok	290	4.0	0.17	-23	37
Khon Kaen	243	2.6	0.29	-5	46
Chiang Rai	144	2.6	0.19	-19	28
Mae Hong Son	136	2.4	0.73	-23	29
Samui	132	2.2	0.08	-	31
Udon Thani	95	1.0	0.74	-54	47
U-Tapao	82	1.1	1.10	-	120
Ubon Ratchathani	82	1.0	0.61	-83	41
Trang	31	1.0	0.71	-93	15
Nakhon Si Thammarat	22	1.0	0.45	-13	11
Phrae	21	1.9	2.39	-155	6
Sakon Nakhon	20	0.7	1.50	-121	13
Mae Sot	20	1.1	1.82	-193	9
Nan	18	1.4	1.13	-173	6
Nakhon Ratchasima	17	1.5	N/A	-	6
Narathiwat	10	0.6	3.86	-359	9
Loei	8	0.4	9.53	-427	11
Tak	5	1.1	9.73	-668	2
Lampang	3	0.3	15.05	-1375	5
Pattani	1	0.3	38.42	-2722	2

Source : ASMPS inventory data base

**Table 2.23 Airport Infrastructures**

Airport	Runway	Remarks
Ubon Ratchathani	3000x45	as of May 1991
Nakhon Ratchasima	2743x38	as of May 1991

Source : Technical Division, the Department of Aviation, Ministry of Communications

**Table 2.24 Passengers and Freight at Nakhon Ratchasima and Ubon Ratchathani Airports**

Year	Nakhon Ratchasima			Ubon Ratchathani		
	Number of Flights	Number of Passengers	Freight (Tons)	Number of Flights	Number of Passengers	Freight (Tons)
1985	-	-	-	722	25,564	33
1986	-	-	-	728	23,713	36
1987	-	-	-	735	26,605	62
1988	532	6,326	-	726	29,806	55
1989	1,414	21,038	15	711	37,174	49

Source : Department of Aviation, Ministry of Communications

**Table 2.25 Traffic on the Mekong River**

Transport /Year Reach	Cargo (1000ton)		Passengers (persons) 1986
	1986	1990	
Savannakhet - Vientiane	24.7	38	44,800
Vientiane - Luang Prabang	24.2	20	28,300
Pakse - Muang Khong	8.2	N.A.	94,400

Source : Statistics on Inland Waterborne Transport in The Lao PDR  
Interim Mekhon Committee 1987. (for 1986 traffic)  
Consultant's estimate for 1990



**Table 3.1 Seventh Plan Projects of Road Construction (1/3)**

(Unit : million baht)

Route No.	Project	Std.	Kms.	Total Budget		1995	1996	1992-96	C/F to	
				Cost	1992				Kms.	Cost
Rehabilitation /Reconstruction										
24	A. Warin Chamrab - A. Det Udom	P2	20	81	24	57		20	81	
23	A. Kham Khuan Kaew - A. Khuang Nai	P1	39	221	45	88	88	39	221	
23	Yasothon - A. Kham Khuan Kaew	P1	19	108		32	76	19	108	
226	A. Kanthararom - A. Warin Chamrab	S2	35	204	62	71	71	35	204	
226	A. Kra Sang - Surin	S1	11	56	22	34		11	56	
218	Buriram - B. Nong Song Hong	S2	22	102			31	7	31	71
221	A. Kantharalak - Khao Pra Wihan	S3	36	172			34	7	34	138
2226	A. Chumphuang - B. Thangpat Phuthaisong	F3	30	101	30	71		30	101	
2171	B. Tha Phosri - A. Nam Yuen	F3	45	194	40	77	77	45	194	
2169	Yasothon - A. Kutchum	F1	35	197	39	79	79	35	197	
2169	A. Kutchum - A. Loeng Noktha	F3	28	98	30	68		28	98	
2068	J Rt.2(B. Khok Kruat) - B. Nong Suang	F2	20	70	21	49		20	70	
348/3068	B. Chong Tako - A. Lahan Sai	F2	39	100	20	40	40	39	100	
2034	Mudahan - A. Chanuman	F3	47	138	28	55	55	47	138	
2287	A. Dong Luang - Km.83	F4	83	265		31	61	29	92	173
2083	B. Som Poi Noi - A. Rasi Salai	F2	20	83			25	6	25	58
319	J to A. Sri Mahapho - Prachin Buri	S2	9	36		14	22	9	36	
317	B. Wang Chik - A. Sra Kaew	S1	22	55	22	33		22	55	
317	A. Wang Nam Yen (B. Ka lung)- B. Wang Chik	S1	30	75		30	45	30	75	
317	B. Ta mun - A. Wang Nam Yen (B. Ka lung)	S1	38	95			38	15	38	
3067	A. Aranya Prathet - B. Thap Prik	F4	26	46	18	28		26	46	
3124	A. Bang Nam Prieu - B. Bang Khanak	F2	11	44	18	26		11	44	
3198	A. Watthana Nakhon - B. Chong Kurn	F2	25	104	41	63		25	104	
3395	A. Watthana Nakhon - Rt.317 (K.A. Soi Dao)	F4	74	185	46	69	70	74	185	
3393	B. Kho Khlan - Rt.3198 (A. Chong Kurn)	F2	30	111		28	42	19	70	41

**Table 3.1 Seventh Plan Projects of Road Construction (2/3)**

(Unit : million baht)

Route No.	Project	Std.	Kms.	Total Budget		1993	1994	1995	1996	1992-96		C/F to 8th Plan
				Cost	Cost					Kms.	Cost	
<b>Widening</b>												
	24 A. Warin Chamrab - A. Det Udorn	PD	10	140	28	112				10	140	
	23 A. Khuang Nai - Ubon Ratchathani	PD	5	81		32	49			5	81	
	2 J.to A. Phimai (B. Thalat Khae) - B. Sida	PD	36	650	130	173	174			36	650	
	224 Nakhon Ratchasima - A. Chok Chai	SD	27	249				99		11	99	150
	304 A. Kabinburi - A. Pak Thong Chai (Km.55-105)	SD	50	500				100		10	100	400
	33 Hin Kong - A. Ban Na	PD	26	577	144	150	283			26	577	
	33 B. Nong Cha - Om - J.to Prachinburi	PD	6	125	50	75				6	125	
	33 A. Ban Na - Nakhon Nayok	PD	17	325		81	100	144		17	325	
	304 A. Kabinburi (Km.31+794) - A. Pak Thong Chai	SD	25	393	98	147	148			25	393	
	304 B. Khlong Rang - Rt.33 (A. Kabinburi)	SD	23	295			75	100	120	23	295	
	305 A. Thanyaburi - A. Ongkharak	SD	32	440			50	100	290	32	440	
	305 A. Ongkharak - Nakhon Nayok	SD	30	416				104	156	19	260	156
	304 A. Kabinburi (Km.93+300) - A.Pak Thong Chai (Km.31+745)	SD	33	487			127	180	21	307	180	
<b>Interchange</b>												
	33-304 Flyover at A. Kabinburi	S1	0.4	70				28		0.16	28	42
<b>New Link</b>												
	24 Nang Rong Bypass	P2	13	60					18	4	18	42
	212 Mukdahan Bypass	S3	6	30		9	21			6	30	
	219 Buriram Bypass	S3	7	32		10	22			7	32	
	348 Pa-kham Bypass	S3	10	45					45	10	45	
	- A.Ban Luam - B.Ta Noen	F4	12	40			12	28		12	40	
	- A.Kham Kuan Kaec - A.Hua Ta-phan	F4	20	65			20	45		20	65	
	- Ubon Ratchathani Bypass	P2	12	48					19	5	19	29
	224 Nakhon Ratchasima Bypass (East)	S1	16	80				24	56	16	80	
	- A.Phanom Sarakham A.Sra Kaew	S1	60	360			108	126	126	60	360	
	- Ban Khlong 16 Prachinburi	F1	45	280			84	98	98	45	280	
	- J.Rt.305 (Bang Or) A.Bang Nam Prieu	F1	45	300			90	105	105	45	300	

**Table 3.1 Seventh Plan Projects of Road Construction (3/3)**

(Unit : million baht)

Route No.	Project	Std.	Kms.	Total Budget					C/F to 8th Plan			
				Cost	1992	1993	1994	1995		1996	1992-96	Kms. Cost
	- Prachinburi Bypass	S1	8	50				20	30	8	50	
	- Nakhon Nayok Bypass	P1	7	45				18	27	7	45	
	- J.Rt.33 (B.nong Kung) Rt.3198 (B.Nong Thao)	F2	8	40				16	24	8	40	
<b>Paving</b>												
	2081 J.Rt.219 - A. Phuthaisong	F4	36	120		36	42	42			36	120
	2135 B. Don Yai - B.Fa Huan - B.Nam Thaeng	F4	38	109			23	43	43	38	109	
	2236 J.Rt.2127 (B.Samrong Kiat) - B. Chong Phra Phlai	F4	24	66				20	46	24	66	
	2200 B. Prang Ku-B.Kam - B.Phon Yang	F4	23	71				21	50	23	71	
	2341 B. Huai Chan - B. Samrong Kiat	F4	15	42					42	15	42	
	2254 B. Huai Kha - B.Khambak	F4	11	29					29	11	29	
	2337 A. Pho Sai - B. Song Don	F4	17	43					17	7	17	26
	33 B. Sadu - B.Phai	F4	9	28				11	17	9	28	
	33 B. Phra Prong - B. Kaeng	F4	8	23					9	3	9	14
	3076 A. Ban Sang-B. Bang Hoi - Nakhon nayok	F4	34	100	30	30	40			34	100	
	3197 J.Rt.33 (B.Huai Chod) - B.Bo Nang Ching	F4	11	28		11	17			11	28	
	2247 B. Pang - Rt.205 (B.Chong Ko)	F4	16	43		17	26			16	43	
	3426 B. Saton - B. Thung Khanan	F4	11	29			11	18		11	29	
	3308 B. khok Phek - B. San Ro Changan	F4	24	79				31	48	24	79	
	3434 J.Rt.317-B.Thung Maha Charoen - B.Kac Chakan	F4	54	158					39	13	39	119

Source : DOH, Ministry of Communication

**Table 3.2 Proposed Motorway Network in LNE-UE**

Proposed Route No.	Origin	Destination	Length (km)	Selected Route No.
TM-2	Bang Pa-In	Nong Khai	535.5	TR-2
TM-21	Nakhon Ratchasima	Ubon Ratchathani	301.1	TR-202
TM-34	Thanyaburi	Aranya Prat het	211.7	TR-32
TM-35	Chonburi	Nakhon Ratchasima	239.1	TR-33

Source : Toll Highway Development Study (1991, DOH and JICA)

**Table 3.3 Recommended Inter-city Expressway Corridor for Further Study**

Corridor	Origin-Destination	Length (km)
	Ramindra - Outer Ring Road	5.25
	Outer Ring Road - A. Ban Na	52.55
	A.Bang Na - Route 33 - A.Kaeng Khoi	31.70
	A.Kaeng Khoi - A.Pak Chong	50.90
	A.Pak Chong - Nakhon Ratchasima	79.50
	Ramindra - Nakhon Ratchasima	219.90

Source : ETA

**Table 3.4 Budget Secured Plan of SRT**

Projects	Objective/Contents	Budget Plan (unit : million baht)					Remarks
		1992	1993	1994	1995	1996	
Construction of New Railway between Kaeng Khoi and Khlong Sip Kao	Objective: To provide new railway connecting E.S.B. with Bangkok and other parts of Thailand for support the industrial development	89.76					* Total budget is 3153 mil. baht * Construction schedule is from 1993 to 1995
Extension of Northeastern line from Nongkhai to Vientien	Contents: * 82km of railway length  Objective: To establish a more convenient and safer route of transportation in Thailand	22.50					* Total budget is 1365 mil. baht * Financed by Australian grant of 30 mil. USS, Thailand government and Laos government
	Contents: * 1.6km of realignment within Thailand 1.2km of bridge length over Mekong River 18.8km of new construction 21.6km of total length						

Source : State Railway of Thailand

Table 3.5 Airport Improvement Plan

Projects	Objective/Contents	Budget Plan (unit : million baht)				Remarks
		1992	1993	1994	1995	
Construction of Buri Ram Airport	Objective: To provide commercial airport services in the area with enough users	41.03	48.84	17.61		* Ongoing Project * Total budget is 107.48 mil. baht * Cabinet approved the project May 13, 1989 * At present, new site is under review since the previous one had environmental problems and thus did not pass the review of the National Environmental Board. * Part of 1992 budget was changed to be spent on Roi-Et Airport Project.
Improvement of Aviation Communication Center System and Airport Network	Contents: To build a passenger terminal and runway of 30x1500m to support 50-100 seated planes. Also, to install communications network, aviation related equipment and public utilities.					
	Objective: To change the aviation news transmission system to be more efficient in terms of accuracy, clarity and quickness so as to make air traffic safer					
	Contents: To procure and install Automatic Message Switching Machine at * Ubon Ratchathani Center and Sub Station (Khon Kaen, Udon Thani, Nakhon Ratchasima, Sakon Nakhon, Loei)	5.00	53.00			* 58.0 mil. baht
Ubon Ratchathani Airport Development	Contents: To buy 167 Rai of land To build Arrival Passenger Terminal and a flight control tower To extend the runway length and build car bays etc.		628.29	(1989-1992)		* Cabinet resolved May 26, 1987 to separate it from military control area * Cabinet resolved April 8, 1989 to enlarge the Project to develop into an international airport * Expected to be completed by June 1992 * Expected to start service by June 1992

Source : DOA

**Table 3.6 Proposed Development Program for Airports**

Airport	1990-1995	1995 -2000	2000-2010
Nakhon Ratchasima	<ul style="list-style-type: none"> <li>*Select terminal location which alllows direct public access (no military checkpoint)</li> <li>* Construct 250m2 stage 2 terminal</li> <li>* Construct 2,500m2 apron</li> <li>* Construct 15m-wide access taxiway</li> <li>* Install VOR</li> </ul>		<ul style="list-style-type: none"> <li>* Enlarge terminal by 150m2</li> </ul>
Ubon Ratchathani	<ul style="list-style-type: none"> <li>* If terminal remains at present site, enlarge baggage claim area by 100m2</li> </ul>	<ul style="list-style-type: none"> <li>* Construct new 550m2 stage 3 terminal outside military area</li> <li>* Construct 3,000m2 apron</li> <li>* Construct 23m-wide taxiway</li> <li>* Strengthen pavement to PCN38</li> <li>* Widen runway to 45 meters</li> </ul>	
Buriram/Surin	<ul style="list-style-type: none"> <li>* Construct 250m2 Stage 1 terminal</li> <li>* Construct 1,500x30 meter runway</li> <li>* Construct 2,500m2 apron</li> <li>* Construct 15m-wide taxiway</li> <li>* Construct pavement to strength PCN22</li> <li>* Install NDB</li> </ul>	<ul style="list-style-type: none"> <li>* Create Stage 2 terminal by adding 120m2 departure hold room</li> <li>* Lengthen runway to 2,000 meters</li> <li>* Install VOR</li> </ul>	

Source : Airport System Master Plan Study in Thailand (1990, AAT)  
 Louis Berger International, Inc.

**Table 5.1 Direction of Modal Split**

Transport means		Road						Railway			Air Transport		
		non-public			public			intra- regional	inter- regional	inter- national	intra- regional	inter- regional	inter- national
trip purpose		intra- regional	inter- regional	inter- national	intra- regional	inter- regional	inter- national						
Person Trip	commuting												
	business												
	private business												
	tourism												
Cargo Flow	materials												
	manufactured goods												

main transport means     
 possible transport means

**Table 5.2 Standard for Intercity Travel Times by Road**

	Long-Range Standard	Remark
Travel Time to Bangkok, E.S.B.	within 6 -8 hours	to ensure one-day trip
Travel Time to Major Industrial Center	within 4 hours	to ensure one-day roundtrip
Travel Time to Changwat Center	within 1 hour	to ensure half-day roundtrip
Travel Time to District Center	within 30 min.	to ensure commuting
<hr/>		
Travel Time to Motorway	within 1 hour	
Travel Time to Airport	within 1 hour	

**Table 5.3 Ways of Increase Railway Transport Capacity of Railway**

single track	<ol style="list-style-type: none"> <li>1. reduction of blockade section               <ol style="list-style-type: none"> <li>1) construction of new sidetrack</li> <li>2) construction of new signal station</li> </ol> </li> <li>2. curtailment of travel time at blockade section               <ol style="list-style-type: none"> <li>1) enhancement of running speed</li> </ol> </li> <li>3. reduction of signal operating time               <ol style="list-style-type: none"> <li>1) improvement of signaling system such as automated signaling system</li> </ol> </li> <li>4. thorough countermeasure               <ol style="list-style-type: none"> <li>1) adoption of double track</li> </ol> </li> </ol>
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**Table 5.4 Comparisons of Motive Power**

		electromotive	diesel-motive
management	cost of equipment	high cost for electric facilities	low
	cost of rolling stock	high although the life-expectancy of rolling stock is long	high because of the complicated engine
	thermal efficiency	high	high
	suitable section	high-density transport demand	low- or medium-density transport demand
performance	generating power	high	high
	acceleration	good	fair
	maneuverability	easy	easy
comfortability	comfortability	good	emergence of emission gas
energy	energy supply	continuous supply	refueling needed
	energy resource	flexible	light oil or heavy oil

**Table 6.1 Development Scenario in Master Plan**

Phase I ( -1996)	Phase II (1997-2001)	Phase III (2002-2010)
<p>To take initial step to transform structure of the Study Area.</p> <p>To fully exploit readily available development opportunities</p> <p>- spatial development</p> <p>To expand two urban areas of population concentration (from the western border of LNE-UE to Nakhon Ratchasima, Ubon Ratchathani)</p> <p>- socio-economy</p> <p>To improve agricultural products marketing</p> <p>To establish more footloose industries in Nakhon Ratchasima and Prachin Buri</p> <p>To facilitate the expansion of market of consumer goods into the neighboring countries</p> <p>To induce adequately the establishment of industries between ESB and Nakhon Ratchasima</p> <p>To cater the dominant domestic tourism</p>	<p>To realize rapid transformation of the development structure of the Study Area</p> <p>- spatial development</p> <p>To strengthen the link with the ESB</p> <p>To expand urban areas from the two areas of urban population concentration toward the central part of the Study Area</p> <p>- socio-economy</p> <p>To establish footloose industries widely in the Study Area</p> <p>To establish research and communication/conference functions</p> <p>To establish technical training and consultancy function in the central part of the Study Area serving Laos and Cambodia as well</p> <p>To activate the broad based border trade with Indochina countries and related industries</p> <p>To form the various international services with information network</p>	<p>To realize balanced development structure to allow self-sustained growth</p> <p>- spatial development</p> <p>To establish international links with Indochina countries</p> <p>To well establish urban areas along the east-west axis connecting the cities of Nakhon Ratchasima and Ubon Ratchathani</p> <p>- socio-economy</p> <p>To practice direct export of fresh fruits,vegetables and flowers in the Study Area</p> <p>To establish industries linked with ESB</p> <p>To develop agro-processing and a wide range of other industries by supply of raw materials from the Study Area and the neighboring countries</p> <p>To assist industries in transferring their manufacturing bases to Indochina countries</p> <p>To locate manufacturers of intermediate goods based on local and imported raw materials in the Ubon Ratchathani - Mukdahan - Yasothon industrial triangle</p> <p>To develop agglomerated engineering and machinery industries in Nakhon Ratchasima</p> <p>To develop a variety of handicraft manufacturers and rural industries</p> <p>To establish a n international tourism network encompassing the BMA, the ESB, the Study Area, and the Indochina countries.</p>

**Table 6.2 Basic Concept of Staged Transport Development**

Design Policy	Road Transport	Railways	Air Transport
<p>Formation of Multi-Transport Axis</p>	<p>Stage I - Formation of partial multi-transport axis</p> <p>Stage II - Completion of multi-transport axis skeleton</p> <p>Stage III - Formation of duplicated multi-transport axis</p>	<p>Stage I - New line construction in charge of substitutive role</p> <p>Stage II - Reinforcement of multi-transport axis by double track construction</p> <p>Stage III - Completion of the network for multi-transport axis</p>	<p>Stage I - Establishment of provincial airport on the development corridor</p> <p>Stage II - Establishment of local service airport on the development axis</p> <p>Stage III - Completion of multi-transport axis by the arrangement of local airport</p>
<p>Formation of International Network</p>	<p>Stage I - Improvement of existing Indochina gate</p> <p>Stage II - Formation of new gateway to Indochina</p> <p>Stage III - Completion of international network with Vietnamese coast</p>	<p>Stage I (- Extension of northeastern line into Vientiane)</p> <p>Stage II - Accommodation to the future international network formation by extension of existing line to the border</p> <p>Stage III - Completion of international network with Cambodia, Laos and Vietnam (formation of international ring railway)</p>	<p>Stage I - Improvement of existing airport for the international flight</p> <p>Stage II - Formation of partial international airline network</p> <p>Stage III - Systematic connection of local air network and international network</p>
<p>Expansion of Potential Action Area</p>	<p>Stage I - Improvement of direct accessibility to ESB</p> <p>Stage II - Improvement of transportation nodal point (airport, railway)</p> <p>Stage III - Formation of high speed tollway network</p>	<p>Stage I - Enhancement of travel speed by the improvement of existing line</p> <p>Stage II - Improvement of transport capacity and frequency by double track construction</p> <p>Stage III - Enhancement of travel speed by electrification</p>	<p>Stage I - Expansion of coverage area by the construction of new provincial airport</p> <p>Stage II - Expansion of local air network</p> <p>Stage III - Formation of one day round trip to BMR or ESB by completion of local air network</p>

**Table 6.3 Transportation Development Stages (1/2)**

	Phase I (-1996)	Phase II ( 1997-2001)	Phase III ( 2002-2010)
<b>I. Road Transport</b>			
<b>1 ESB to Mukdahn Highway</b>	Feasibility Study		
- Phanom Sarakhan - Sa Kaeo	D/D & Construction	Operation of Services	Operation of Services
- Sa Kaeo - Route No. 3068	D/D & Construction	D/D & Construction	Operation of Services
- Improvement of Route No. 2169	D/D & Construction	Operation of Services	Operation of Services
- Direct ESB link (Sa Kaeo - ESB)		D/D & Construction	Operation of Services
- Other sections	D/D & Construction	D/D & Construction	Operation of Services
<b>2 New Mekong ("Rainbow") Bridge</b>	Feasibility Study	D/D & Construction	Operation of Services
<b>3 ESB to Nong Khai Highway</b>		D/D & Construction	Operation of Services
- Phanom Sarakhan - Sa Kaeo	D/D & Construction	Operation of Services	Operation of Services
- Phanom sarakhan - Nakhon Ratchasima (part)		D/D & Construction	Operation of Services
- Other sections			D/D & Construction
<b>4 ESB to Nong Khai Motorway</b>	Feasibility Study		D/D & Construction
<b>5 BMR to Ubon Ratchathani motorway</b>	Feasibility Study		D/D & Construction
<b>6 BMR to Aranyaprathet Highway</b>			
- BMR - Route No. 319		D/D & Construction	Operation of Services
- Route 319 - Aranyaprathet			D/D & Construction
<b>7 BMR to Aranyaprathet Motorway</b>	Feasibility Study		D/D & Construction
<b>8 Improvement of Route No.24</b>			
- Chok Chai - Nong Ki	D/D & Construction	Operation of Services	Operation of Services
- Other sections			D/D & Construction
<b>9 Route No. 226 Bypass at Surin</b>		D/D & Construction	Operation of Services
<b>10 Si Sa Ket to</b>		D/D & Construction	Operation of Services

**Table 6.3 Transportation Development Stages (2/2)**

	Phase I (-1996)	Phase II ( 1997-2001)	Phase III ( 2002-2010)
Yasothon Highway			
11 Road Maintenance System Improvement	Study & Implementation		
12 Regional truck terminals	Feasibility Study	D/D & Construction	Operation of Services
<b>II. Railways</b>			
1 Improvement of Northeastern Line	Feasibility Study		
- BMR - Nakhon Ratchasima (double track)		D/D & Construction	Operation of Services
- Nakhon ratchasima - Ubon Ratchathani (double track)			D/D & Construction
- Ubon Ratchathani - Pakse (extension)			D/D & Construction
2 Nakhon Ratchasima to ESB railway			
- Kaeng Khoy - Khlong Sip Kao (substitutive line)	D/D & Construction	Operation of Services	Operation of Services
- Nakhon Ratchasima - Kabin Buri		Feasibility Study	D/D & Construction
3 Surin to Nakhon Phanom railway		Feasibility Study	D/D & Construction
<b>III. Air Transport</b>			
1 New Provincial Airport at Surin	Feasibility Study D/D & Construction	Operation of Services	Operation of Services
2 Local airport at Mukdahan		Feasibility Study D/D & Construction	Operation of Services
3 Local Airport at Aranyaprathet			Feasibility Study D/D & Construction
<b>IV. Others</b>			
1 Mekong River Transport			Implementation

**Table 6.4 Project Costs (1/2)**

Project Name	Figures	Total Project Cost	Disbursement		
			Phase I ( -1996)	Phase II ( 1997-2001)	Phase III ( 2002-2010)
I. Road Transport					
1 ESB to Mukdahn Highway		8,660			
- Phanom Sarakhan - Sa Kaeo	l=60kms., 2 lanes	[360]		-	-
- Direct ESB link (Sa Kaeo - ESB)	l=163.3km, 2 lanes	2,600		2,600	-
- Other sections	l=471.9km, 2 lanes	6,060	1,732	4,328	-
2 New Mekong ("Rainbow") Bridge	l=1,484m, 2 lanes	820	-	820	-
3 ESB to Nong Khai Highway	l=255kms.*, additional 2 lanes	3,320	-	3,320	-
4 ESB to Nong Khai Motorway	l=245kms.*, 4-6 lanes	24,200	-	-	24,200
5 BMR to Ubon Ratchathani Motorway	l=435kms.*, 4-6 lanes	40,400	-	-	40,400
6 BMR to Aranyaprathet Highway	l=195kms.*, additional 2 lanes	2,540	-	1,270	1,270
7 BMR to Aranyaprathet Motorway	l=185kms.*, 4-6 lanes	20,000	-	-	20,000
8 Improvement of Route No. 24	l=400kms., additional 2 lanes	5,200	140	2,530	2,530
9 Route No. 226 Bypass at Surin	l=10kms. 4 lanes	40	-	40	-
10 Si Sa Ket to Yasothon Highway	l=70kms, 4 lanes	315	-	315	-
11 Road Maintenance System Improvement					
12 Regional Truck Terminals	(3ha, 35 berths)x2	90	-	90	-

**Table 6.4 Project Costs (2/2)**

Project Name	Figures	Total Project Cost	Disbursement		
			Phase I ( - 1996)	Phase II ( 1997-2001)	Phase III ( 2002-2010)
II. Railways					
1 Improvement of Northeastern Line		11,000			
- BMR - Nakhon Ratchasima	l=105kms. *, additional one track	2,310	-	2,310	-
- Nakhon Ratchasima - Ubon Ratchathani (double Track)	l=about 420kms., additional one track	6,890	-	-	6,890
- Ubon Ratchathani - Pakse (extension)	l=80kms., single track	1,800	-	-	1,800
2 Nakhon Ratchasima to ESB railway	l=217kms. *, double track	7,340	-	-	7,340
- Kaeng Khoi - Khlong Sip Kao (substitutive line)	(l=82kms., single track)	[3,153]	[3,153]	-	-
3 Surin to Nakhon Phanom Railway	l=65kms. *, single track	1,430	-	-	1,430
III. Air Transport					
1 New Provincial Airport at Surin	500 ha., 2,500m runway	500	107	393	-
2 Local airport at Mukdahan	170 ha., 1,500m runway	170	-	170	-
3 Local Airport at Aranyaprathet	170 ha., 1,500m runway	170	-	-	170
IV. Others					
1 Inland Container Depot	(9 ha)x2	190	-	-	190
2 Mekong River Transport					
Total		126,385	1,979	18,186	106,220

Note : \* Figures are measured within Study Area





# Figures



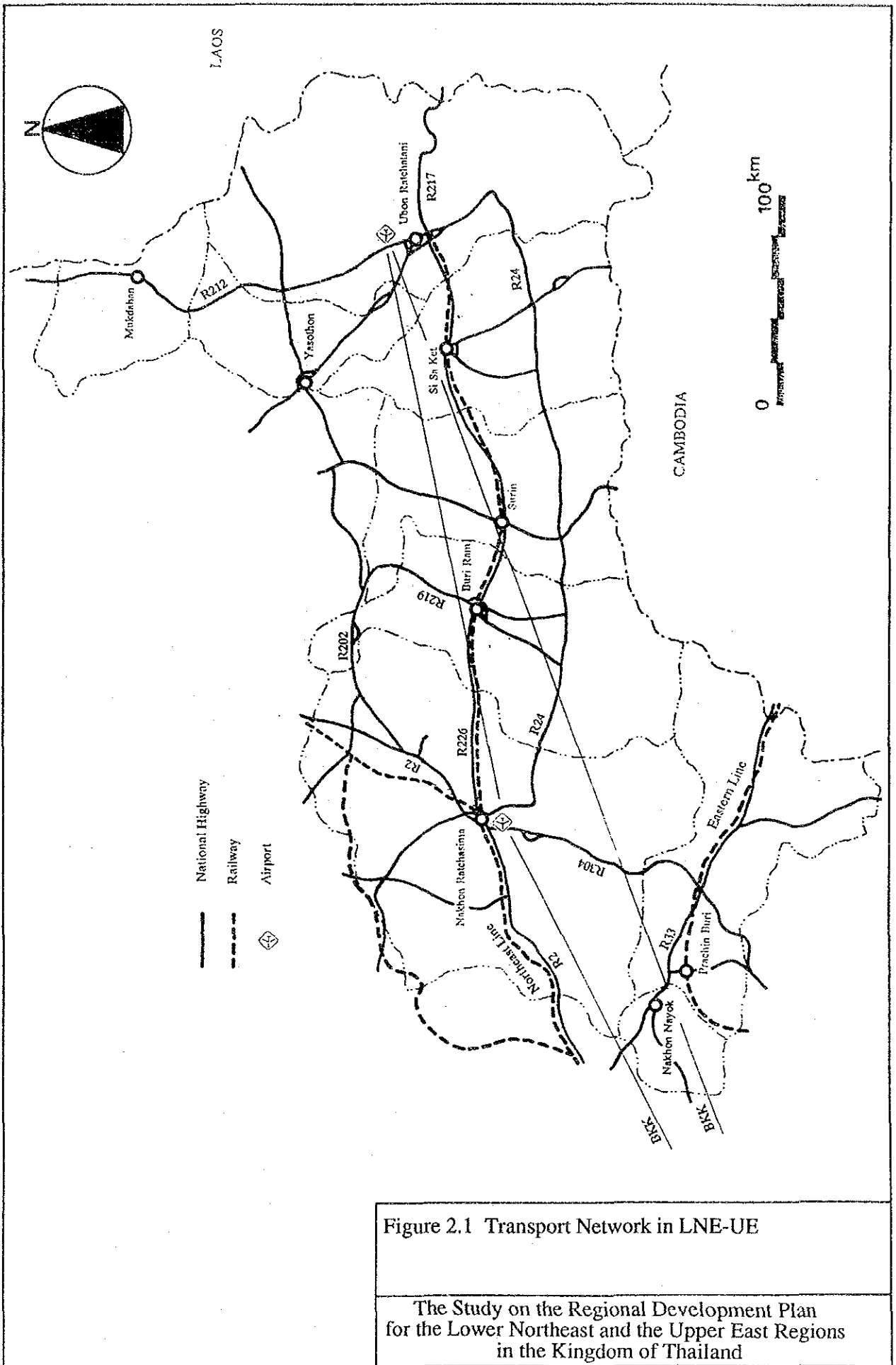
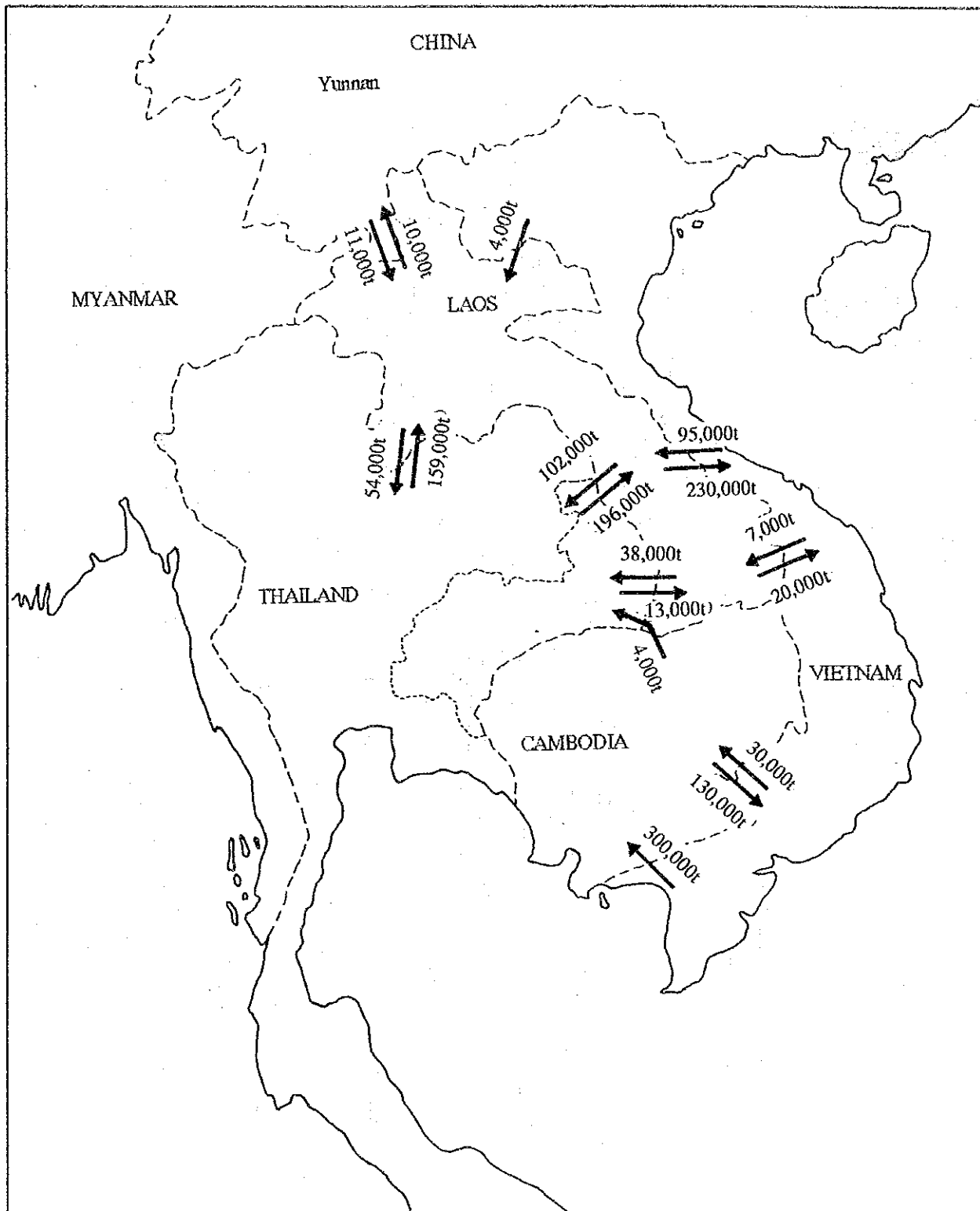


Figure 2.1 Transport Network in LNE-UE

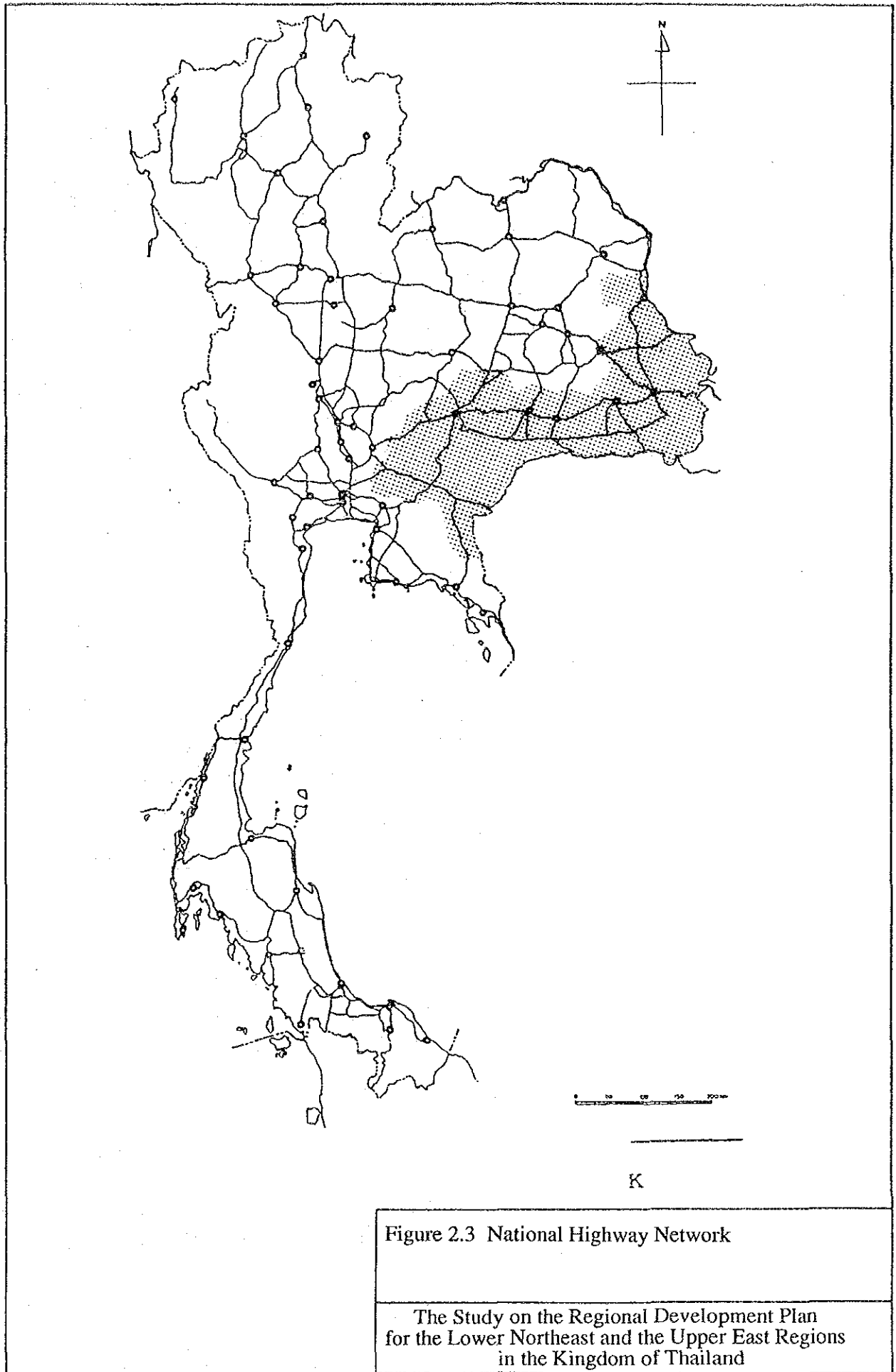
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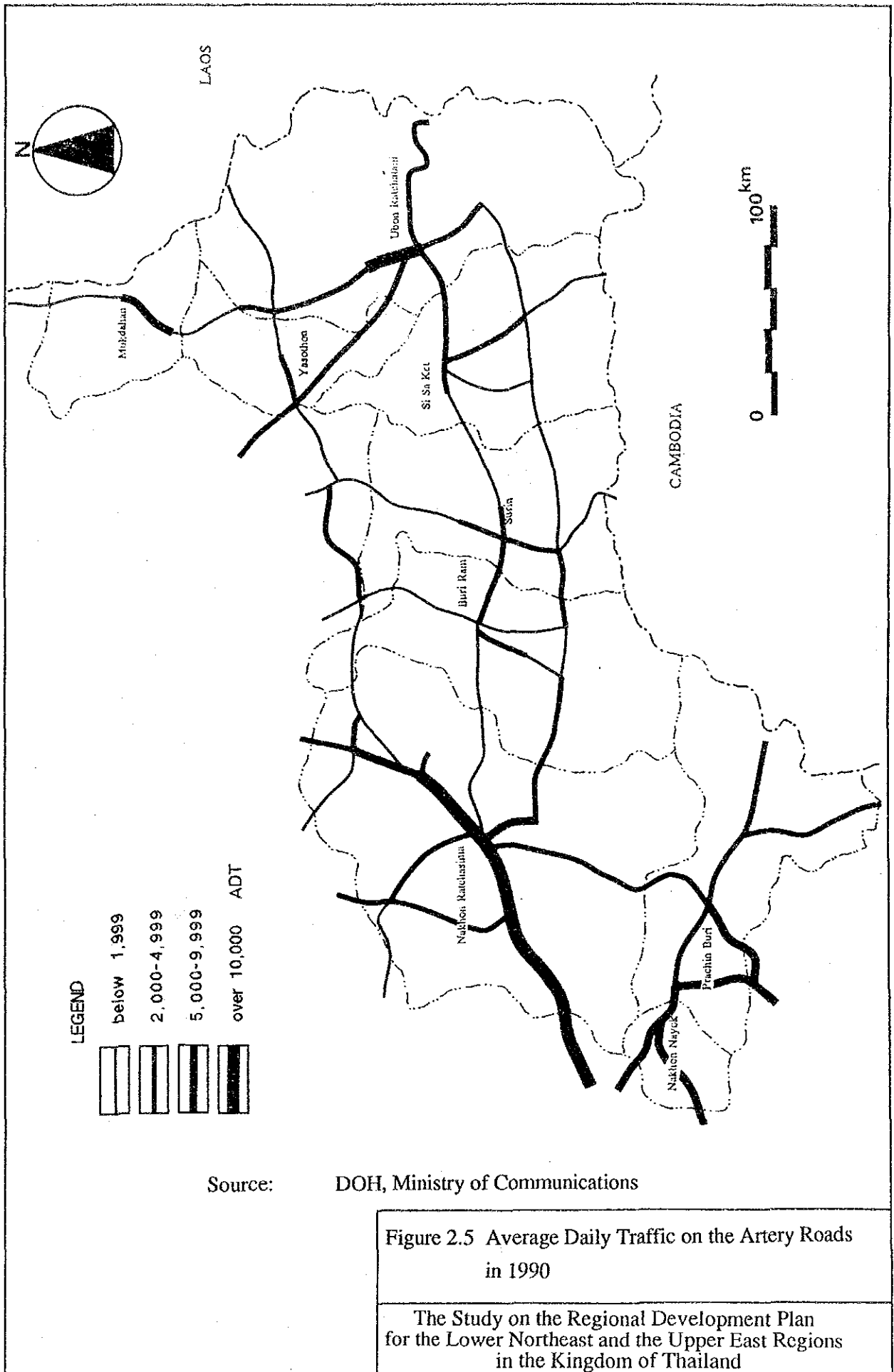
Source: Reconnaissance Study on the Role of the Mekong River in Regional and Sub-Regional Transport Development, Interim Committee for Co-ordination of Investigations of the Lower Mekong Basin, 1992

Figure 2.2 Flows of Goods in IndoChina

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Source: DOH, Ministry of Communications

Figure 2.5 Average Daily Traffic on the Artery Roads in 1990

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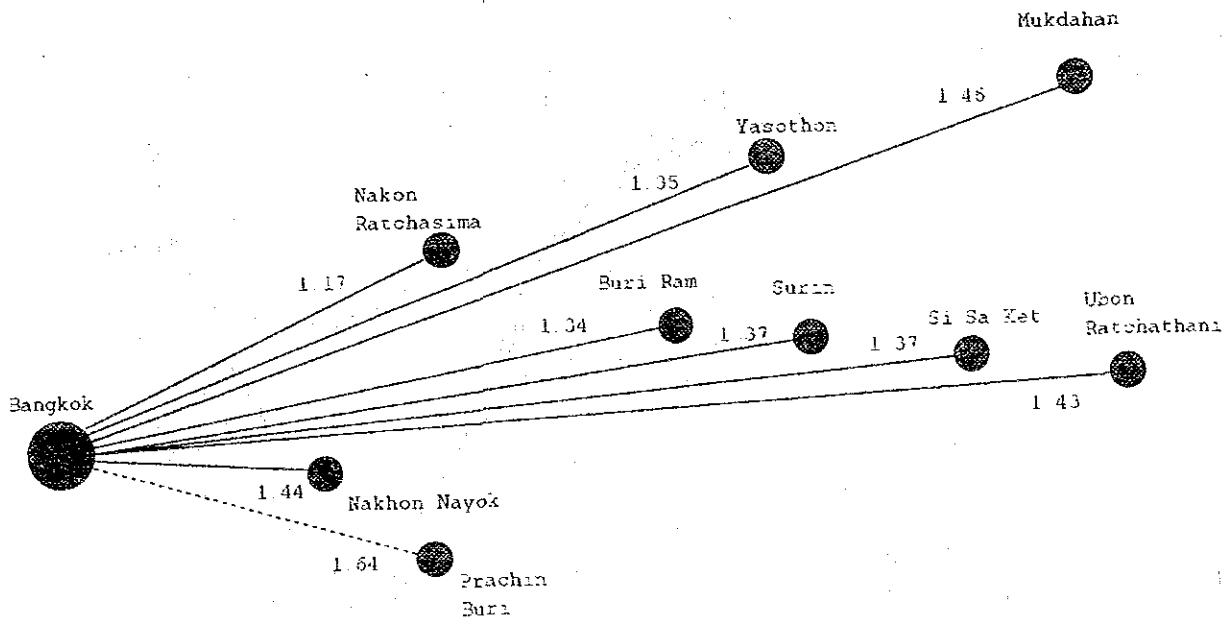
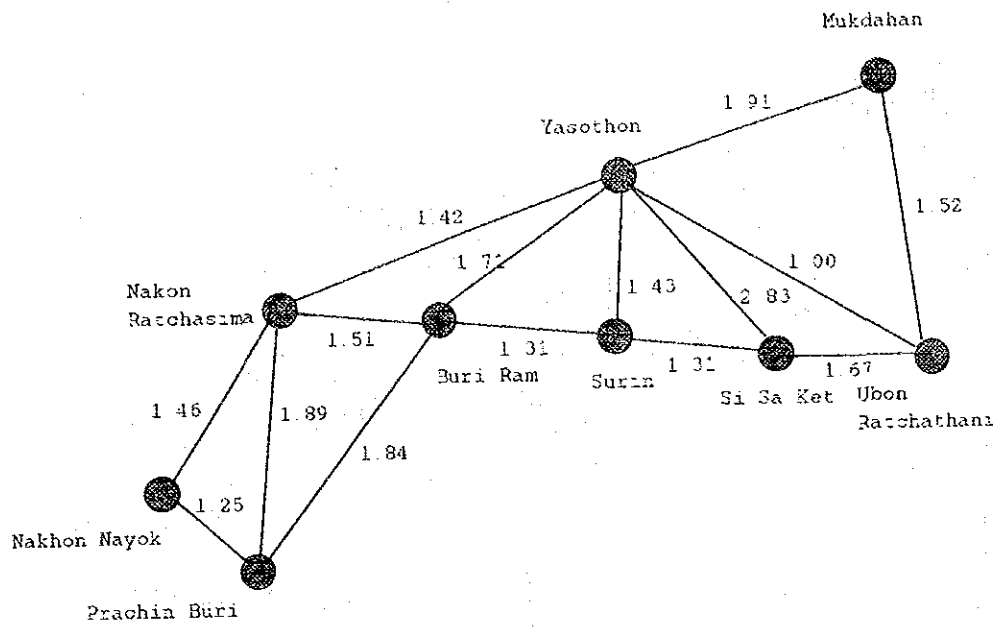


Figure 2.6 Circuitry Factors Among the Strategic Cores and Provinces in LNE-UE (1/2)

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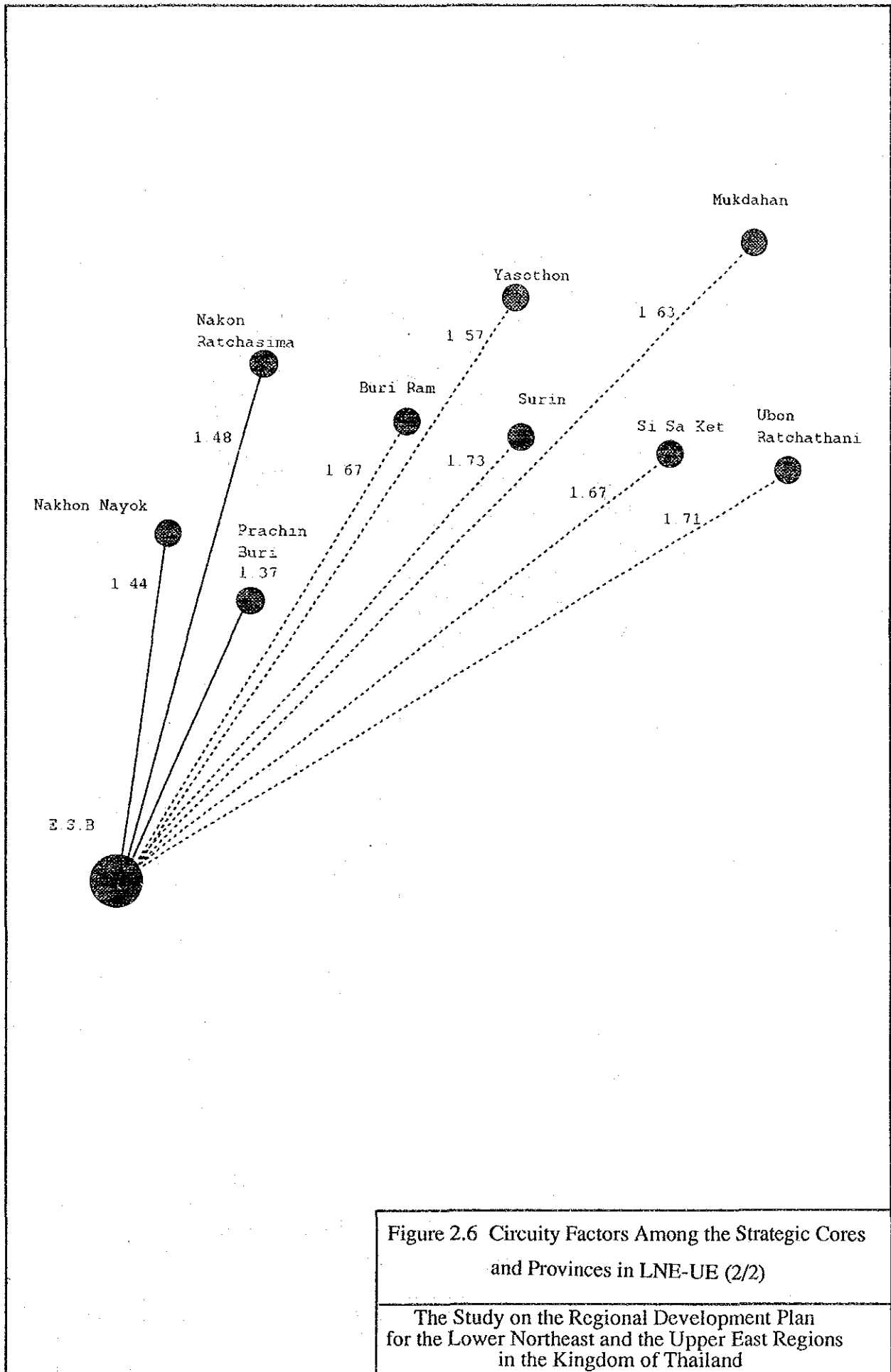
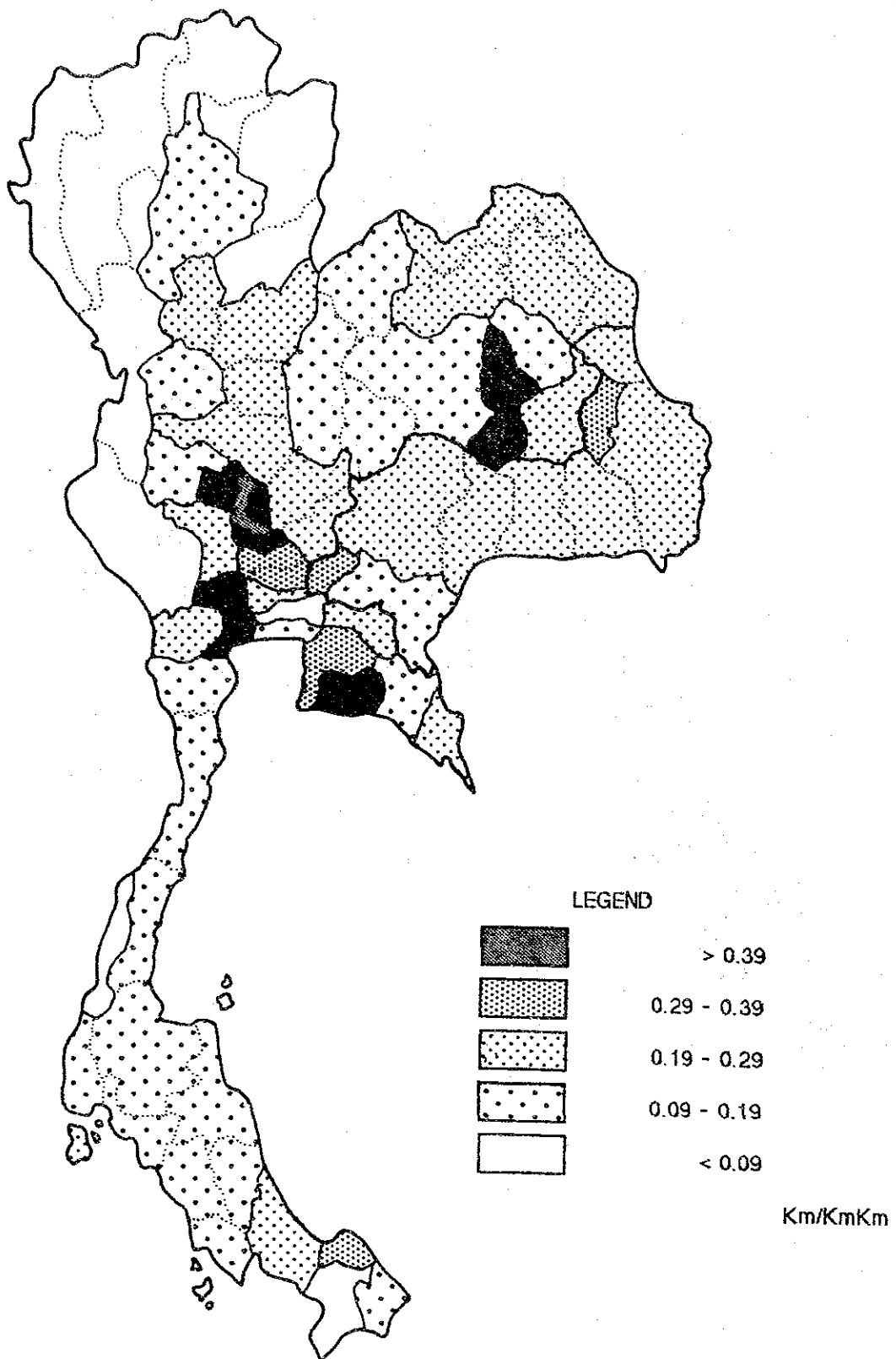


Figure 2.6 Circuitry Factors Among the Strategic Cores and Provinces in LNE-UE (2/2)

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Source: Road Inventory Analysis, DOH, 1981

Figure 2.7 Rural Road Network Density

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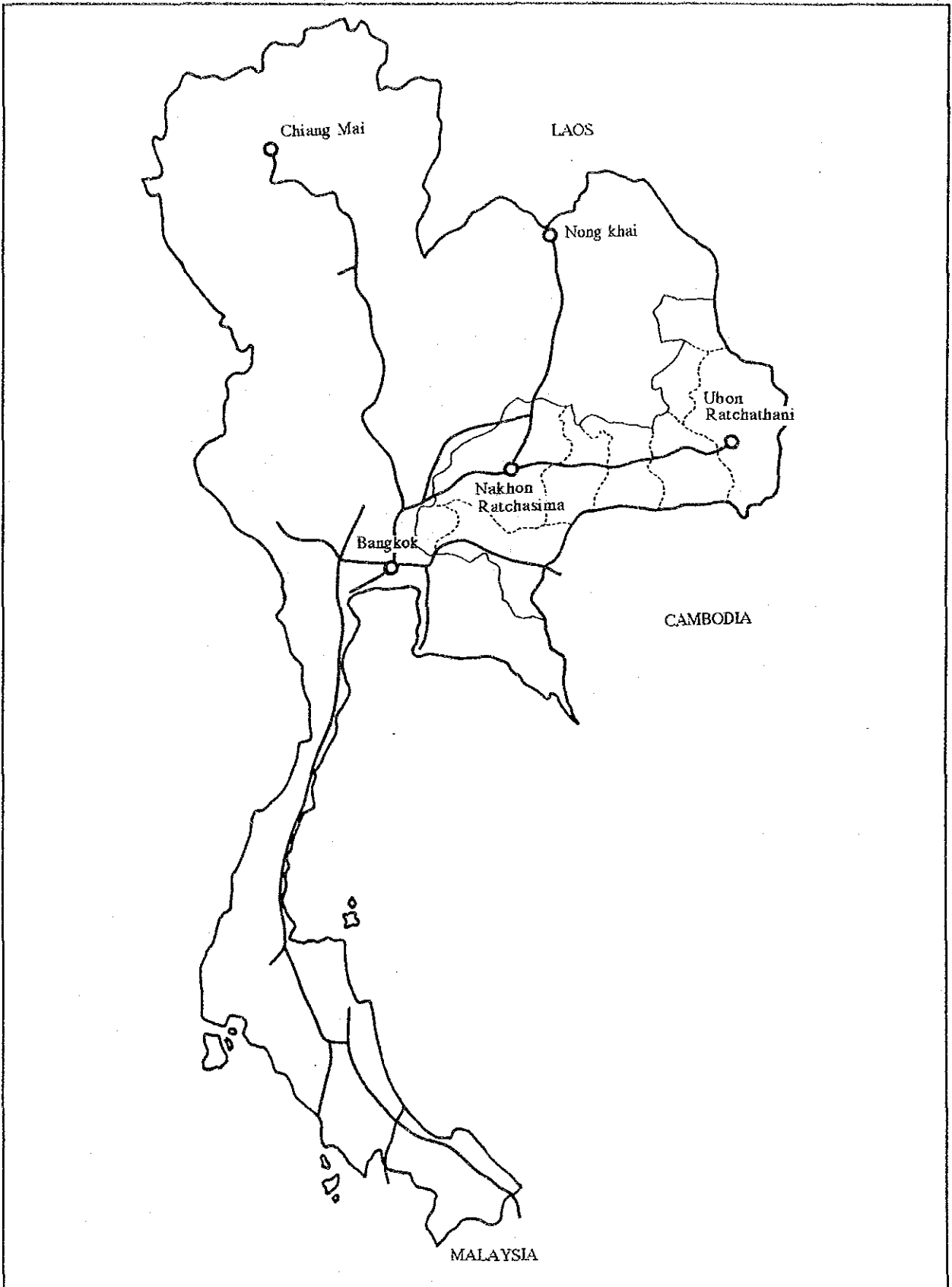
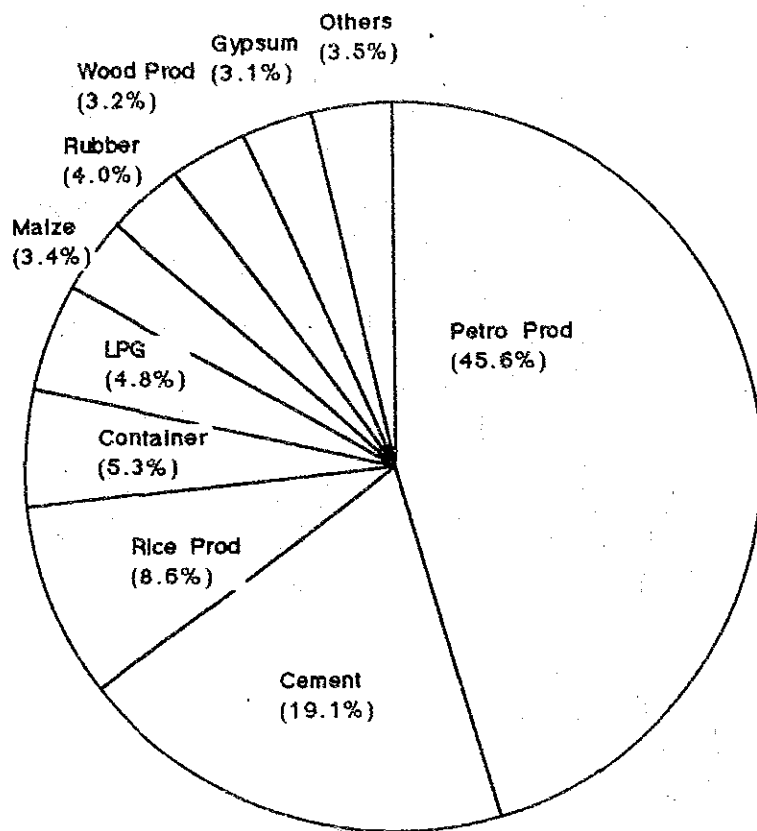


Figure 2.8 Existing Railway Network

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Source : SRT Information Booklet

Figure 2.9 SRT Freight Revenue by Commodity

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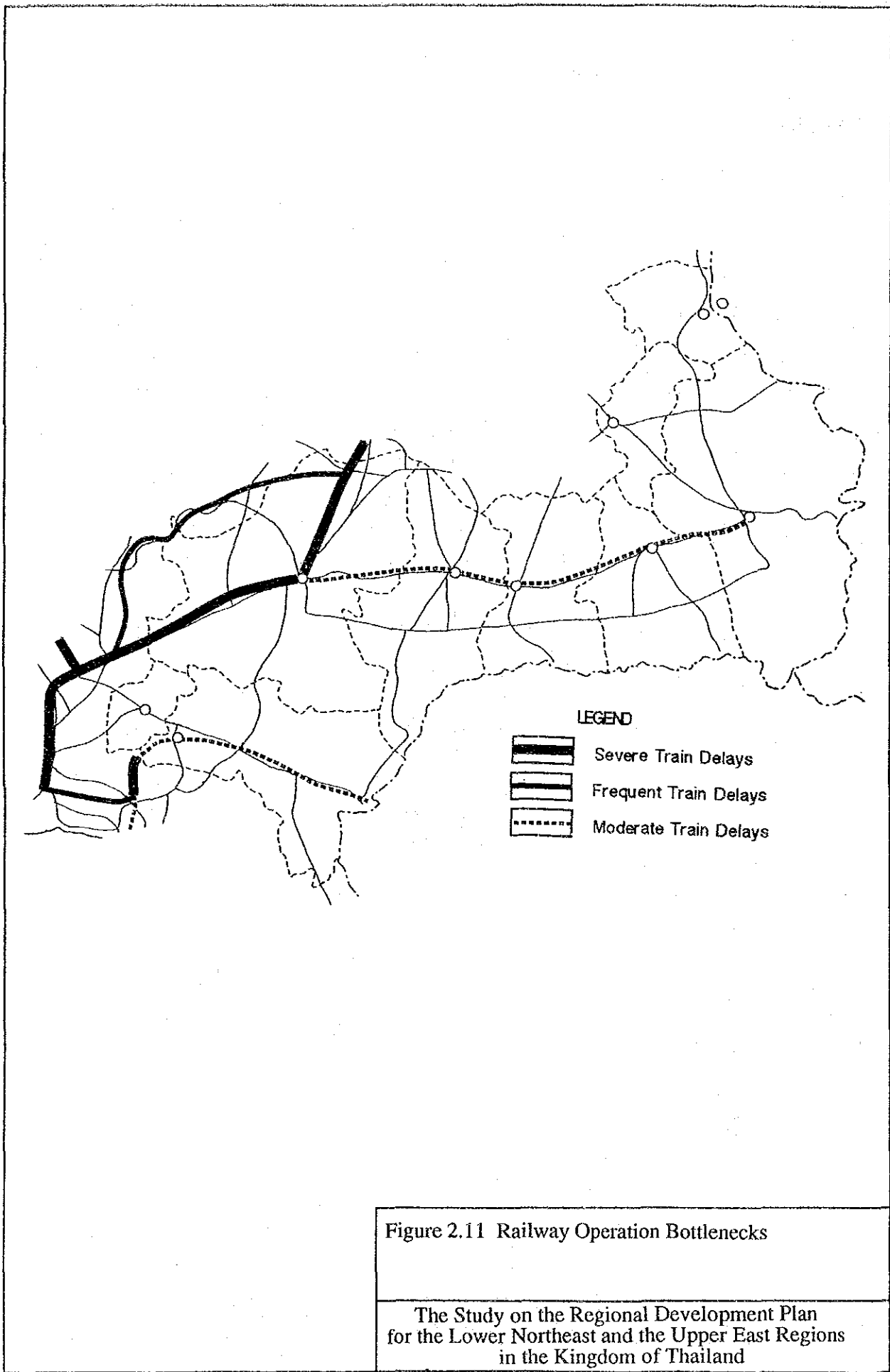


Figure 2.11 Railway Operation Bottlenecks

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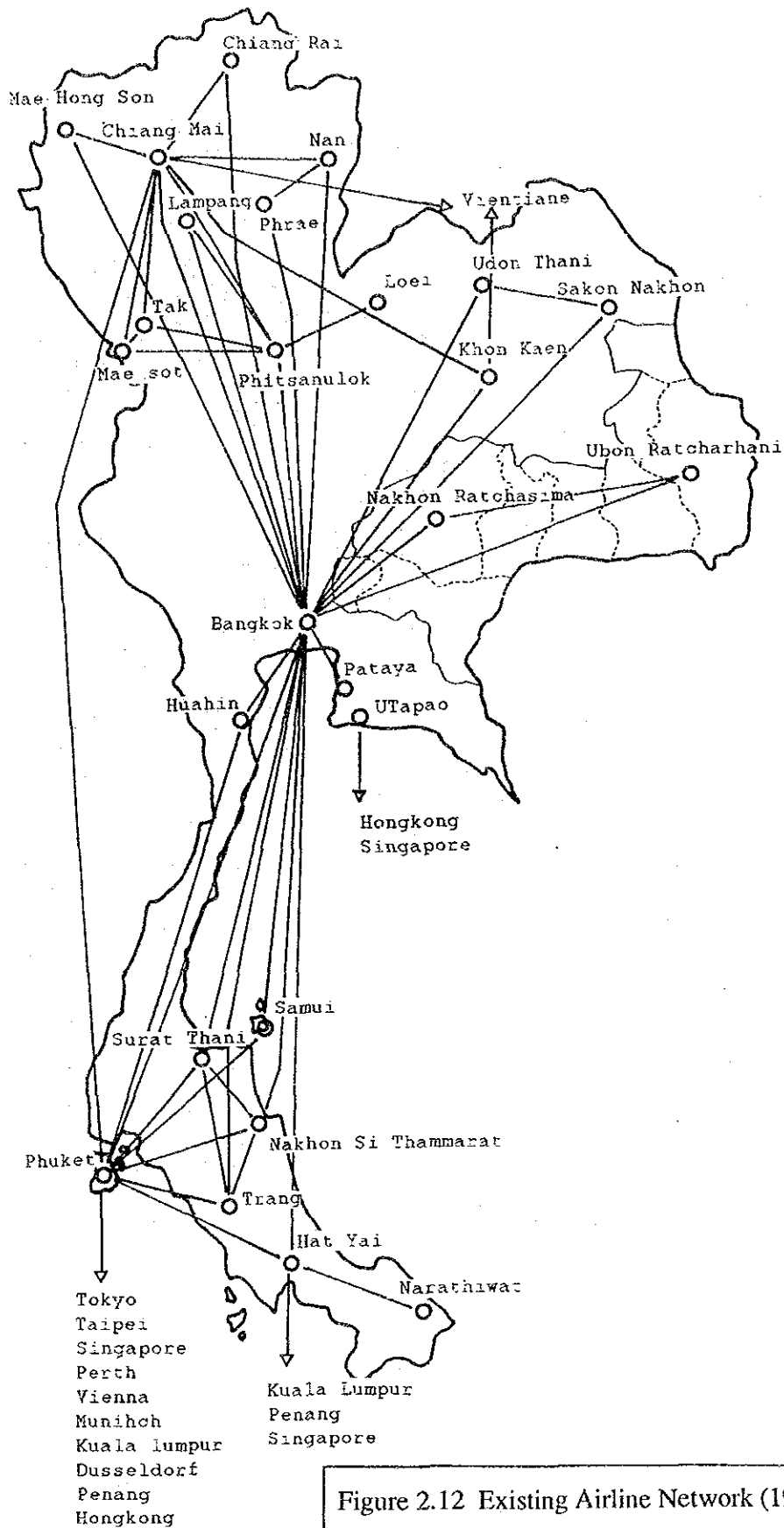
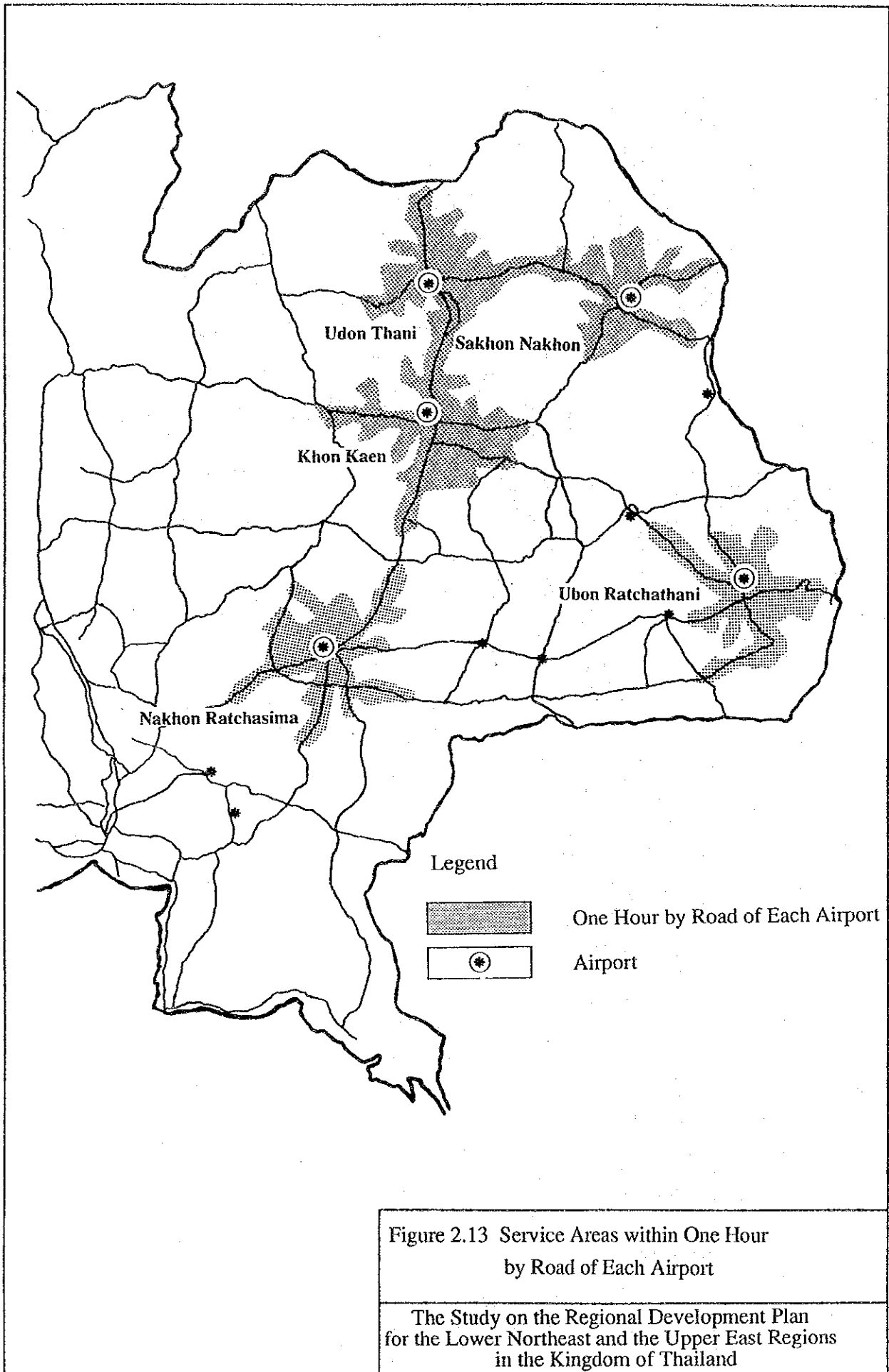


Figure 2.12 Existing Airline Network (1992)

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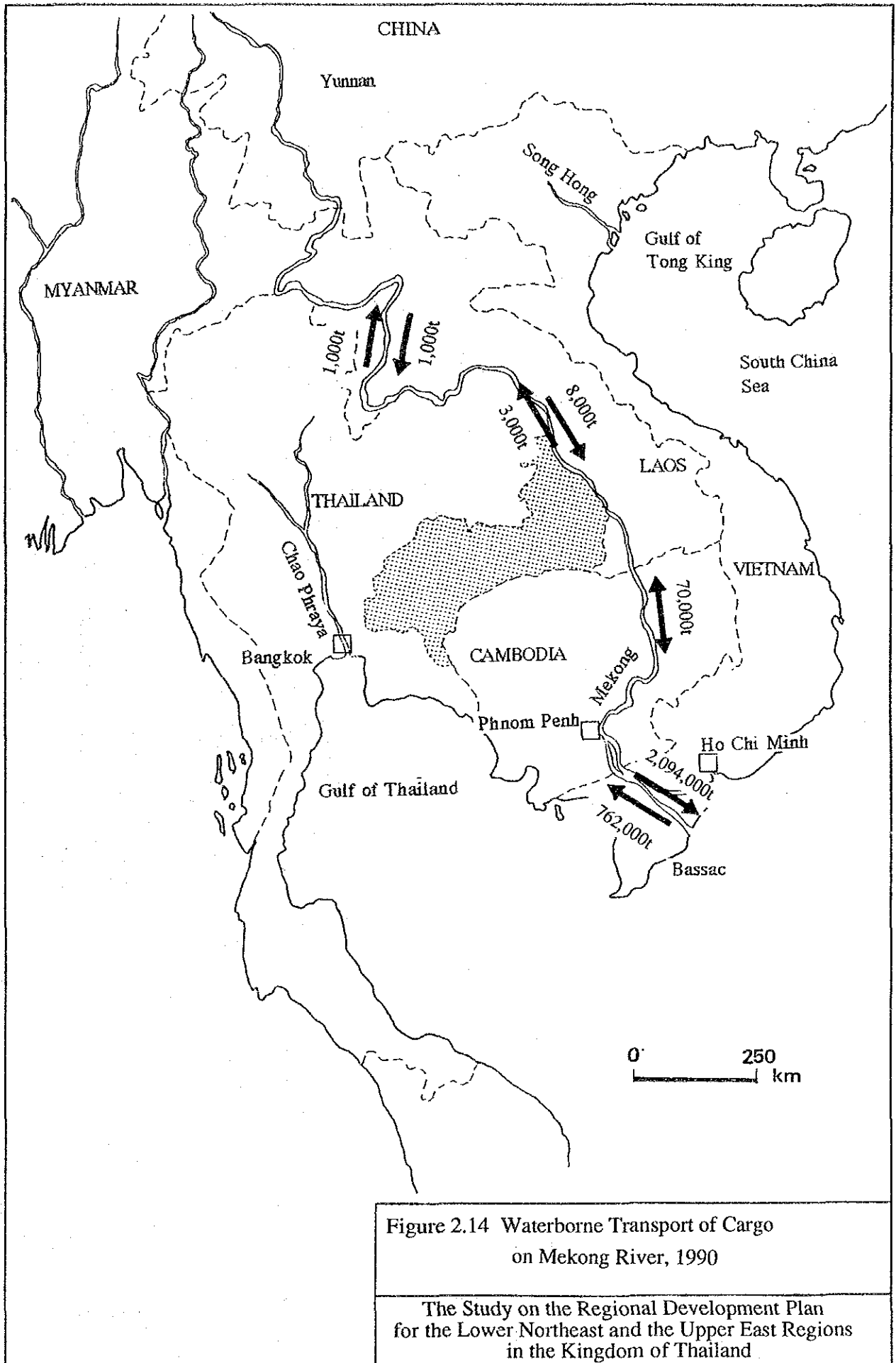


Figure 2.14 Waterborne Transport of Cargo on Mekong River, 1990

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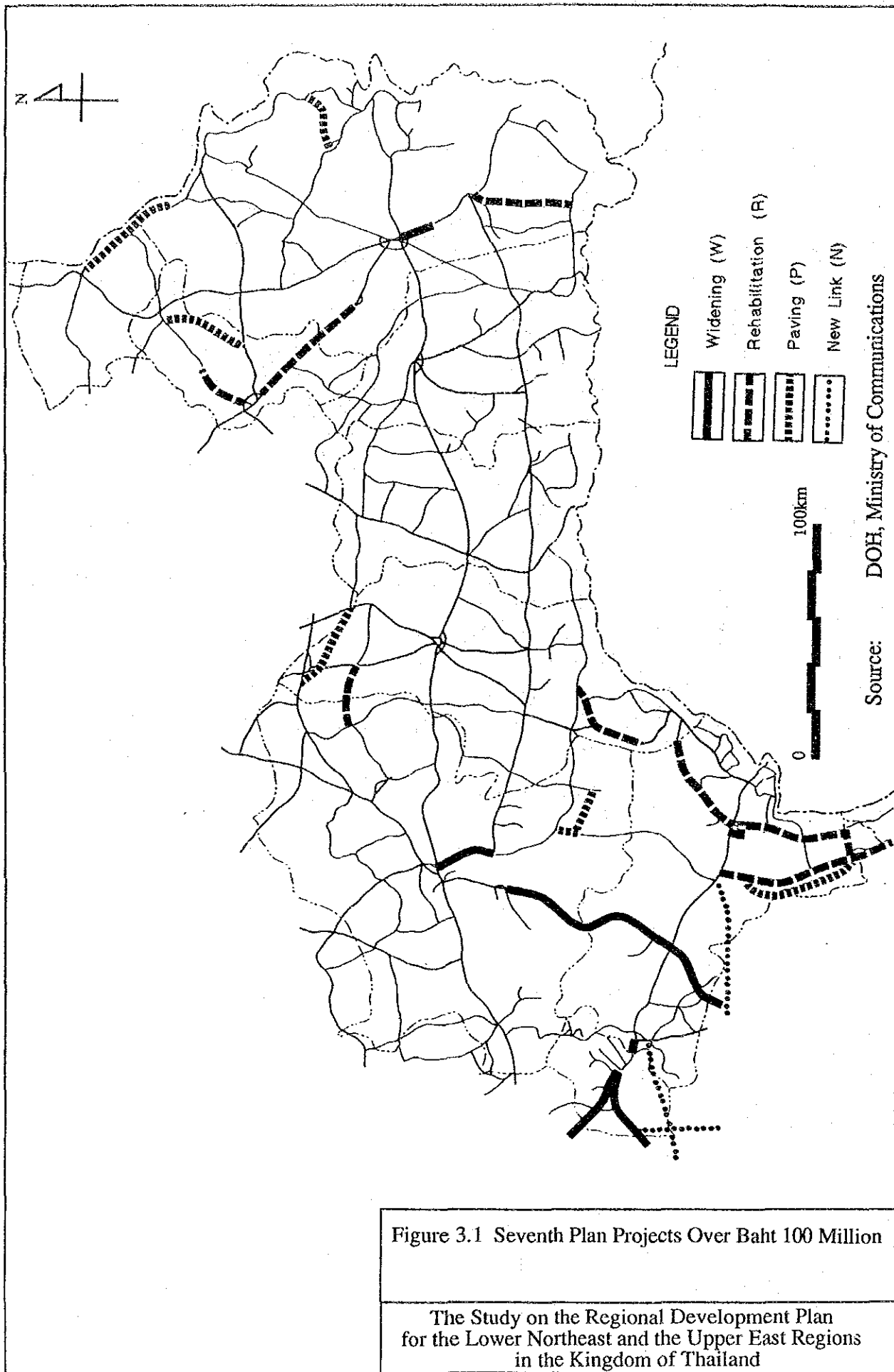


Figure 3.1 Seventh Plan Projects Over Baht 100 Million

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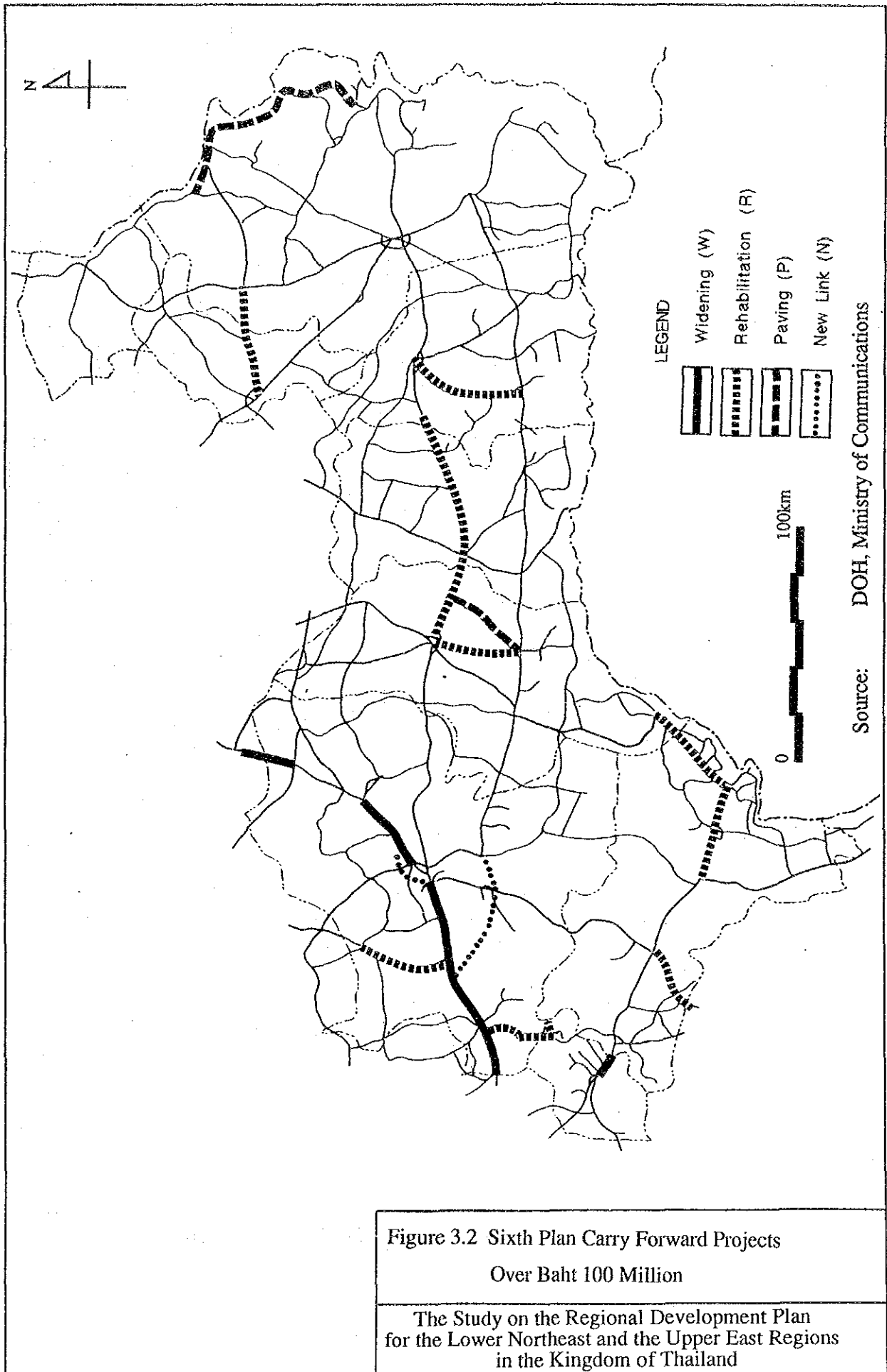


Figure 3.2 Sixth Plan Carry Forward Projects  
Over Baht 100 Million

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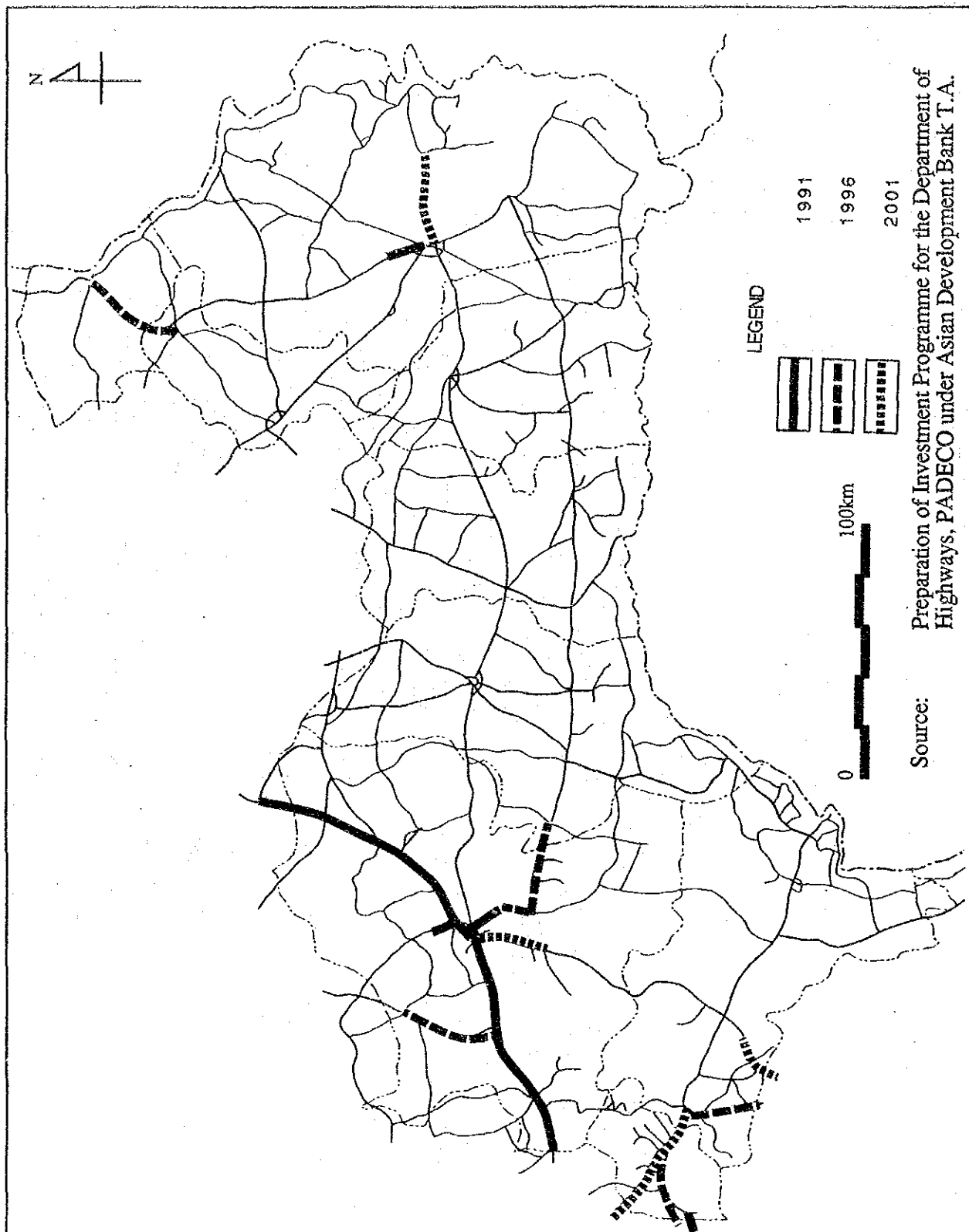
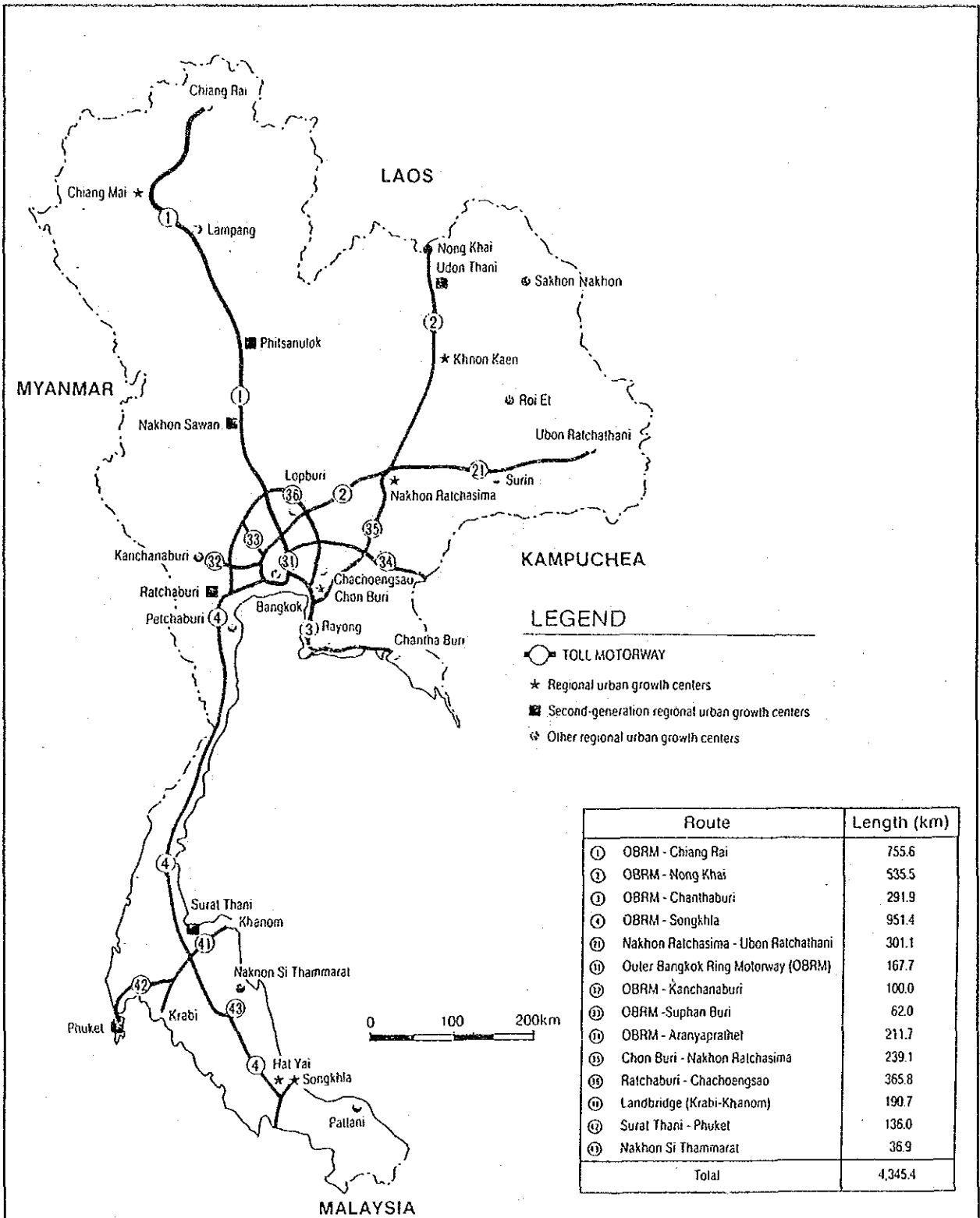


Figure 3.3 Dual-Carriage Way Requirements  
1991 to 2001

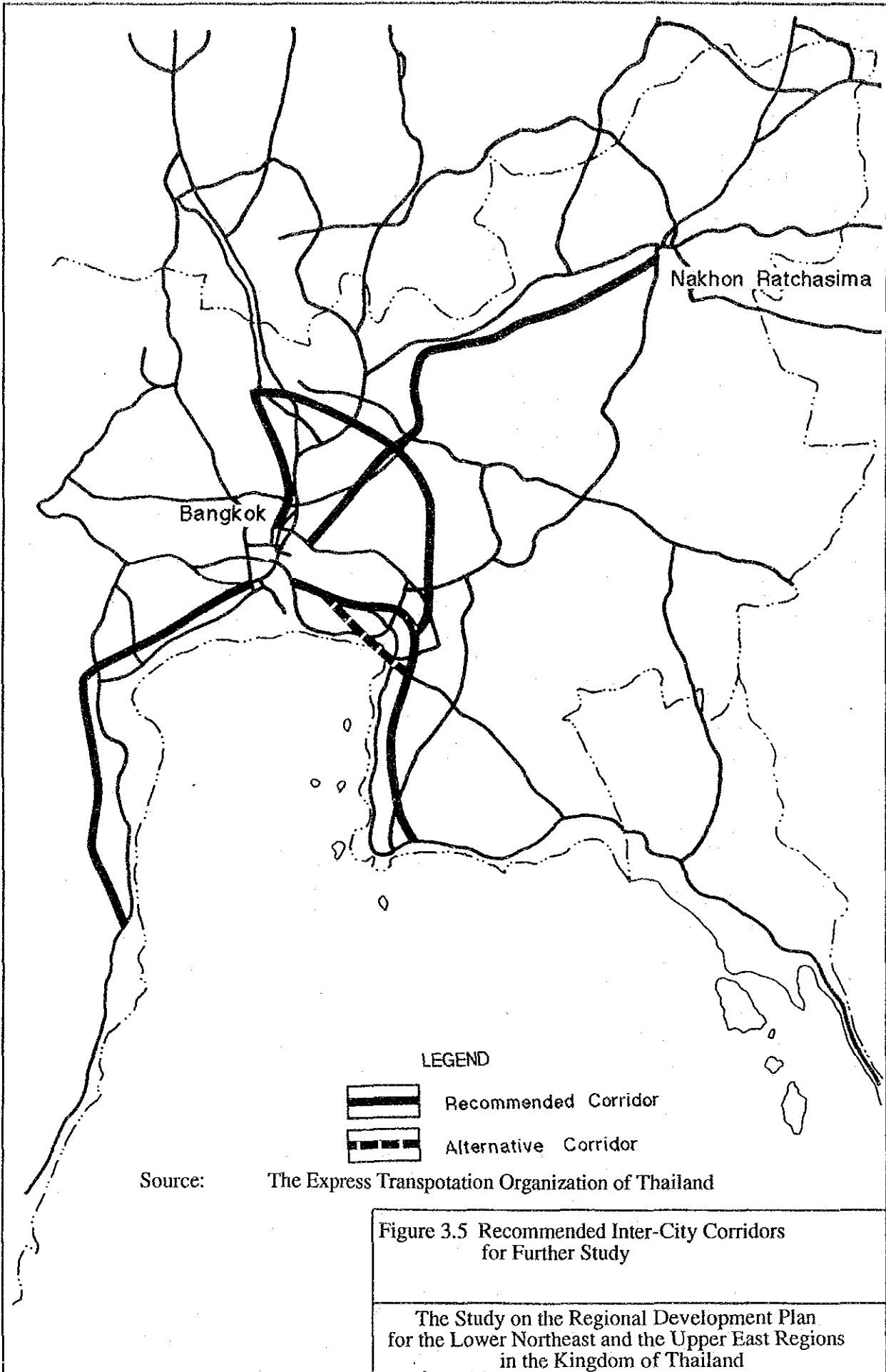
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Source: The Toll Highways Development Study in the Kingdom of Thailand, JICA, 1991

Figure 3.4 Proposed Motorway Network

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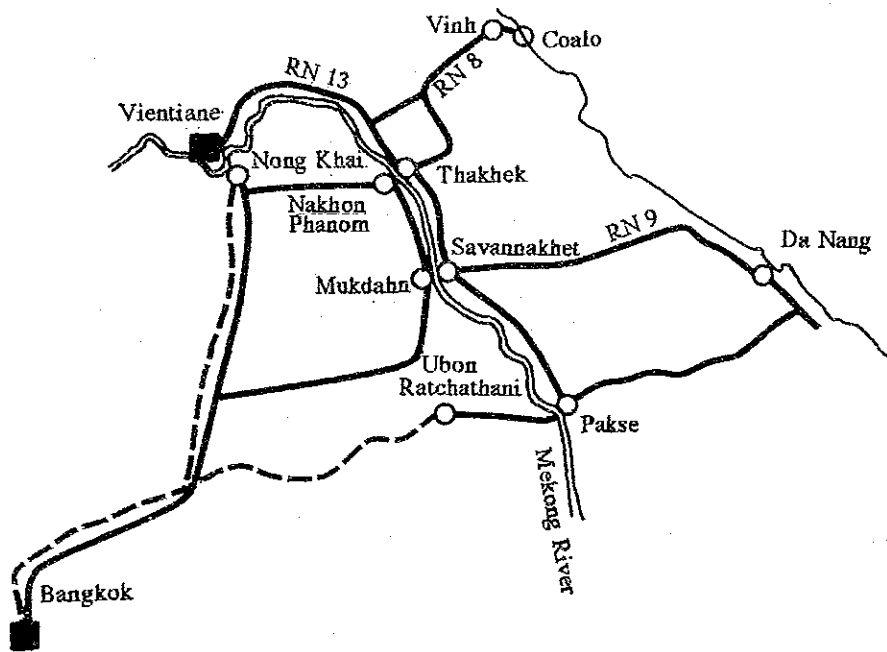
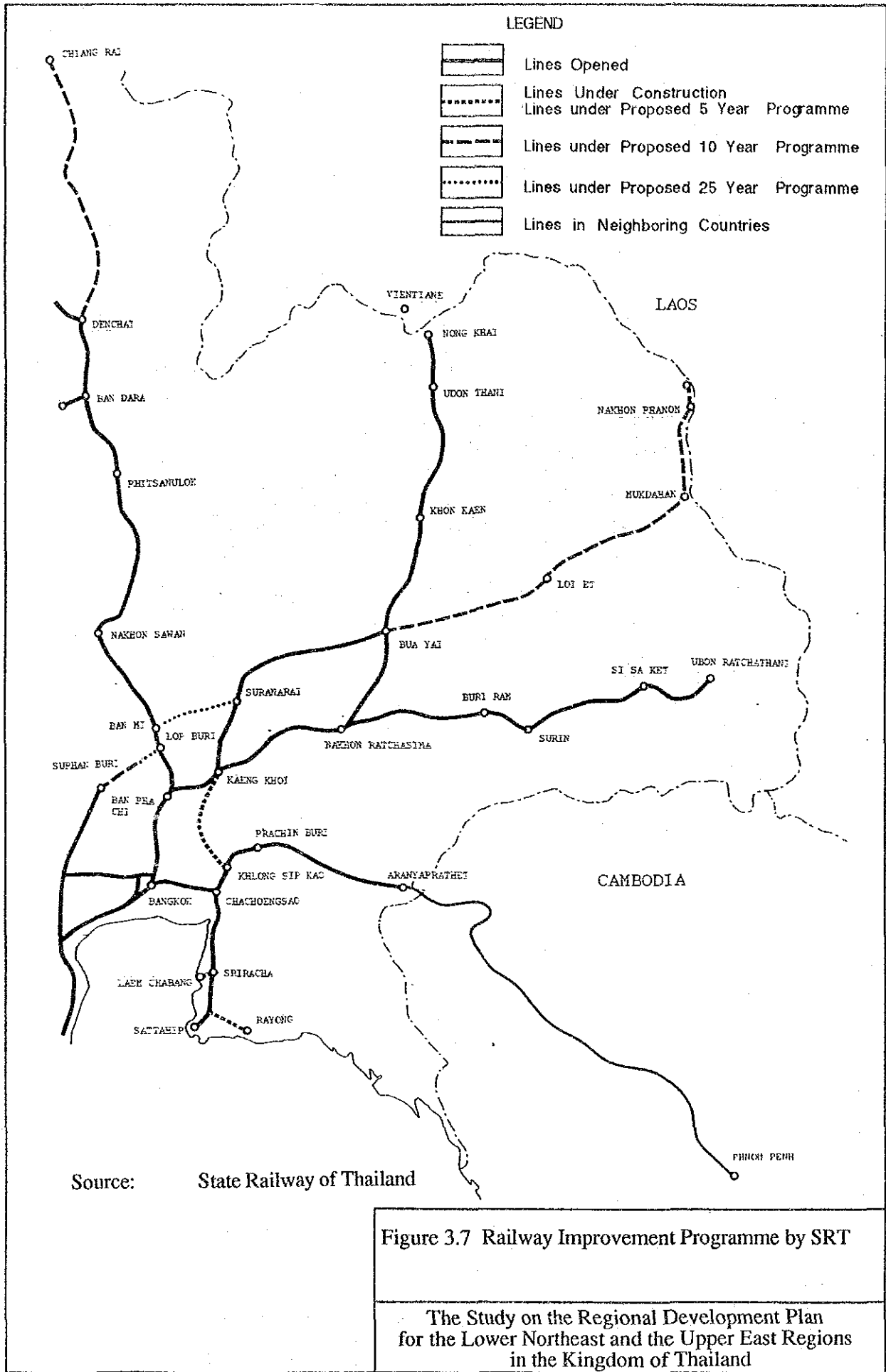
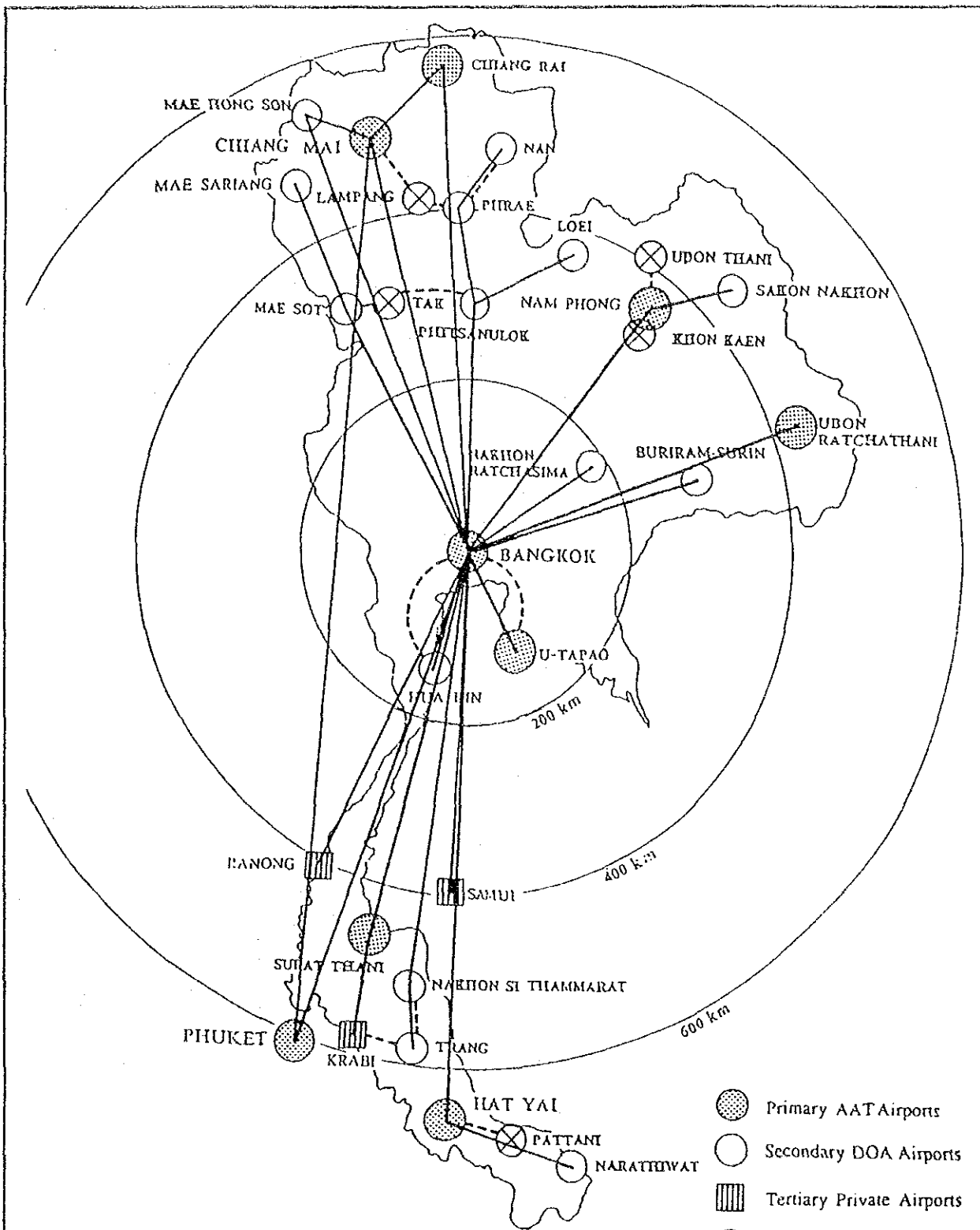


Figure 3.6 Alternative Routes to Vietnamese Coast






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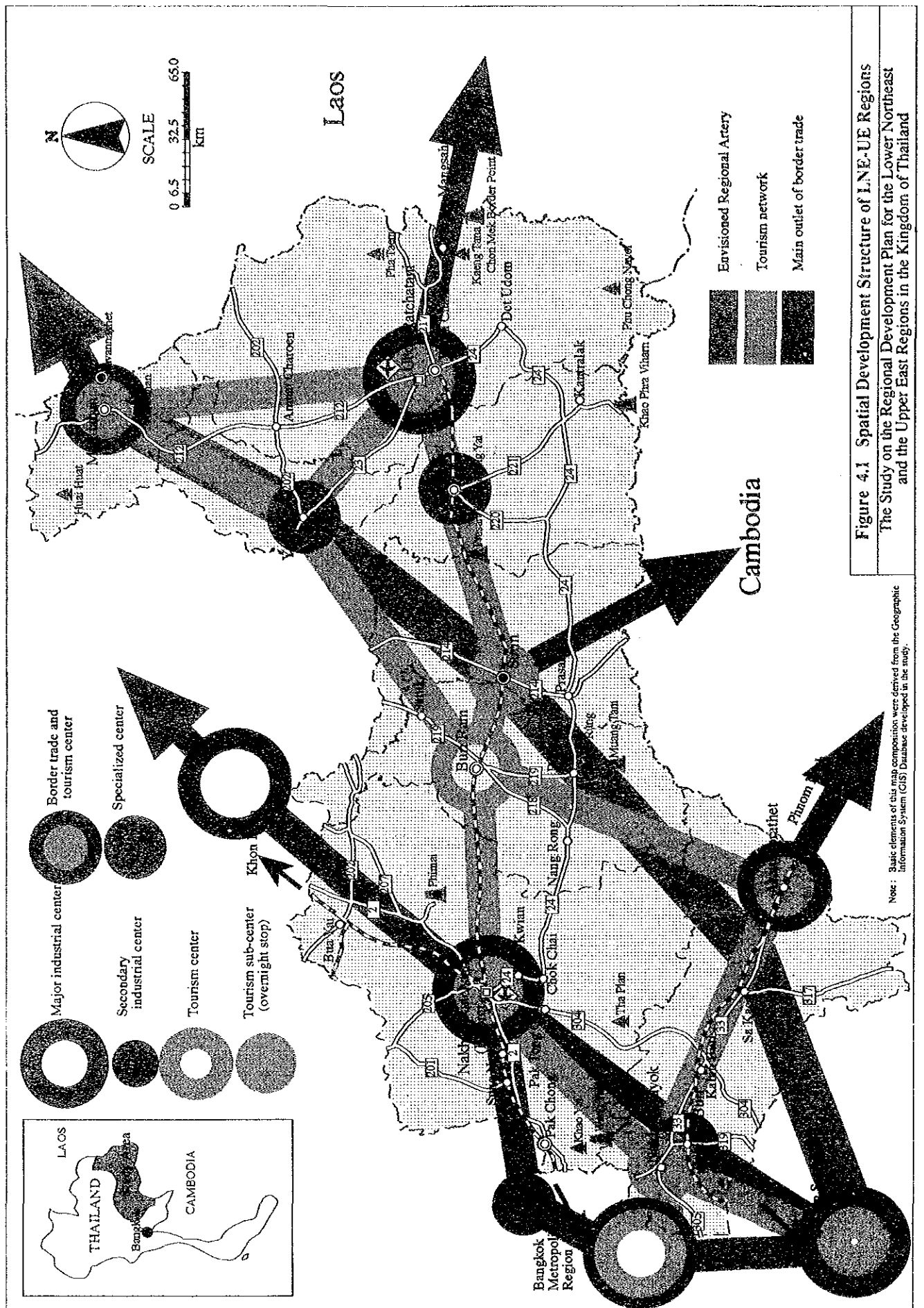


Source:  
 Airport System Master Plan Study in Thailand, AAT, Ministry  
 of Transport and Communications, 1991

-  Primary AAT Airports
-  Secondary DOA Airports
-  Tertiary Private Airports
-  Potential Termination of Scheduled Service
-  Potential Surface Link

**Figure 3.8 Proposed Thai Airport Network**

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**Figure 4.1** Spatial Development Structure of I.N.E-UE Regions  
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and the Upper East Regions in the Kingdom of Thailand

Note: Basic elements of this map composition were derived from the Geographic Information System (GIS) Database developed in the study.

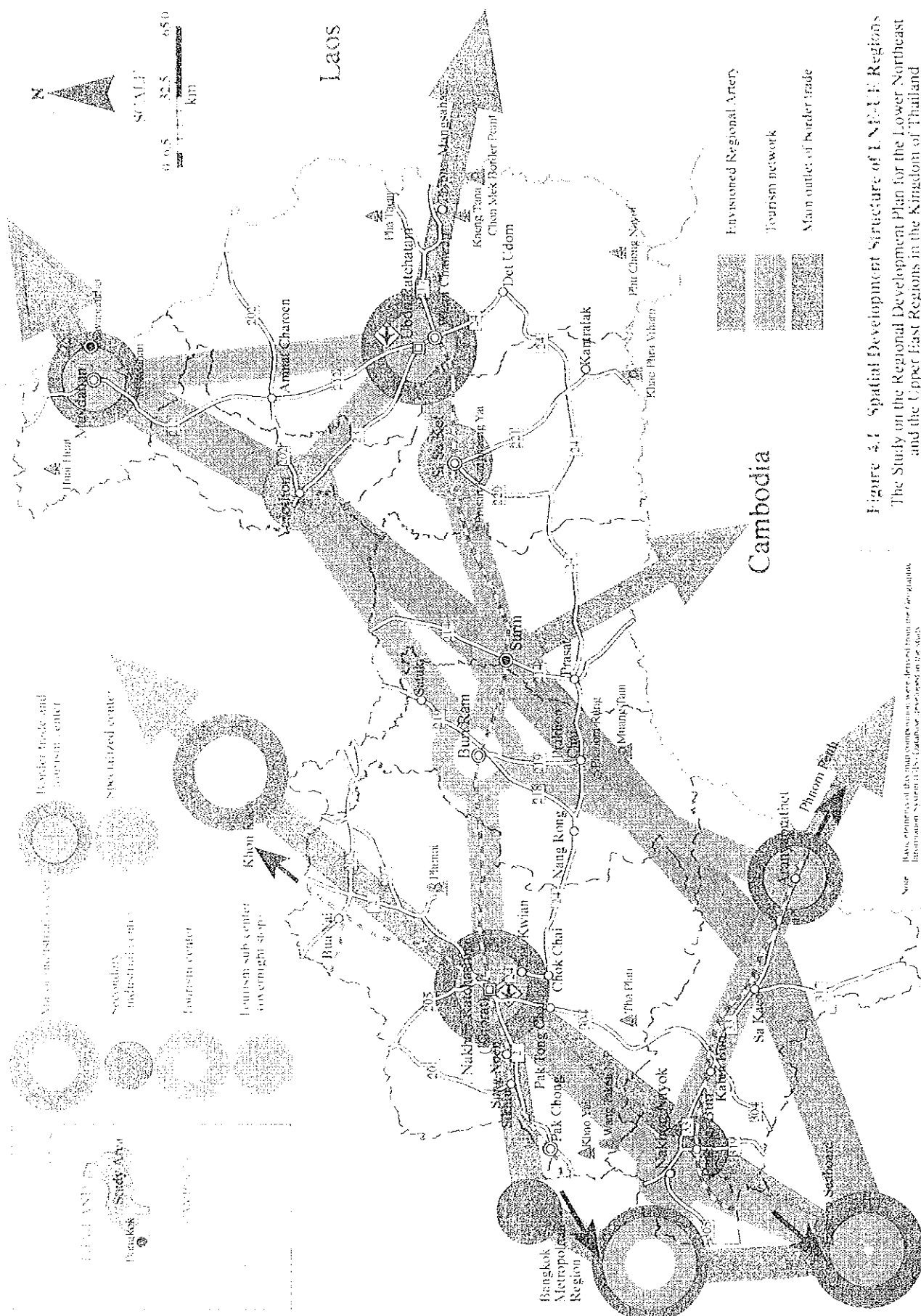
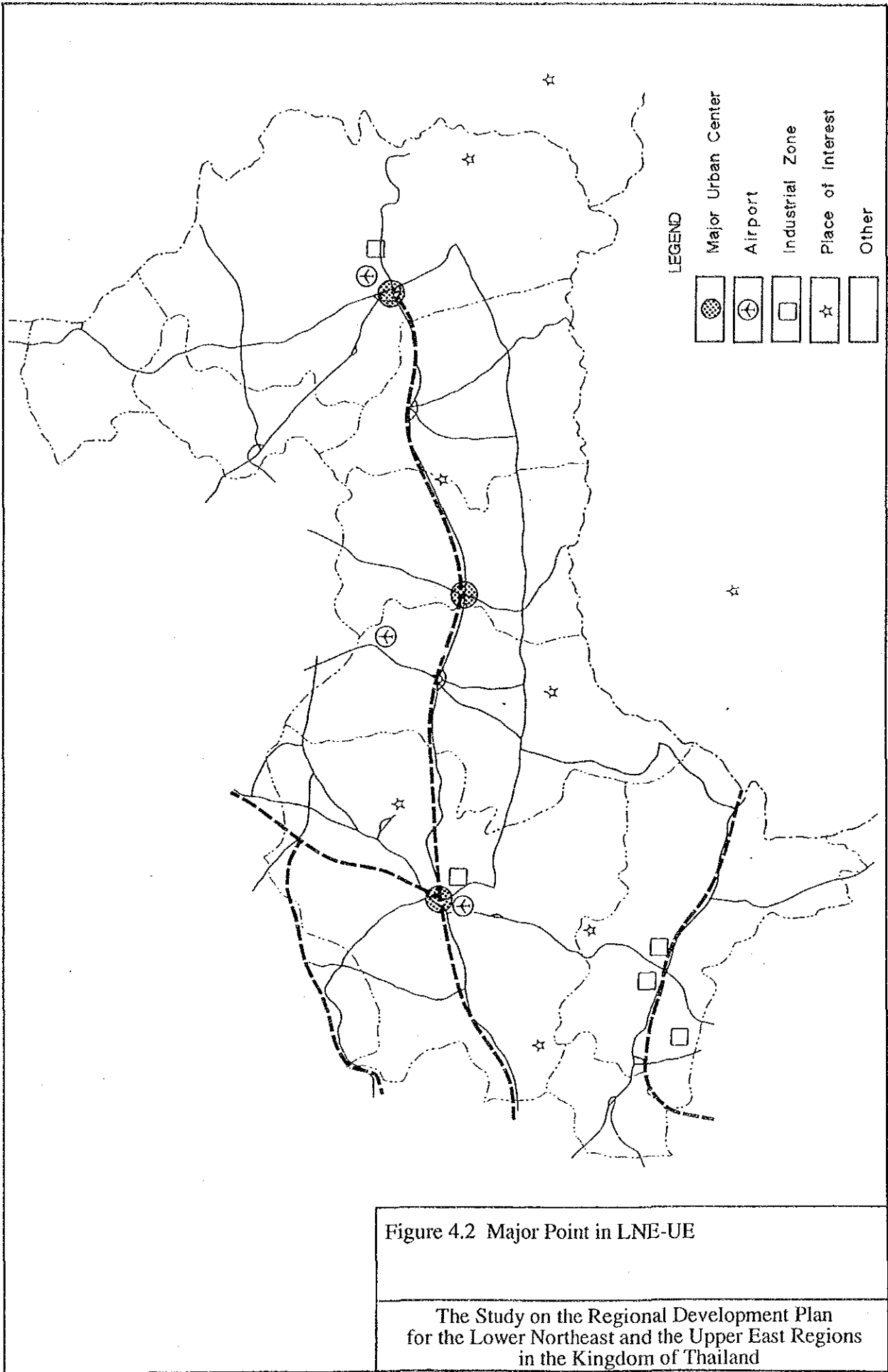


Figure 4.1 Spatial Development Structure of L.N.E.E. Regions  
The Study on the Regional Development Plan for the Lower Northeast  
and the Upper East Regions in the Kingdom of Thailand

Note: Basic elements of this map composition were derived from the Geographic Information System (GIS) Database developed in the study.



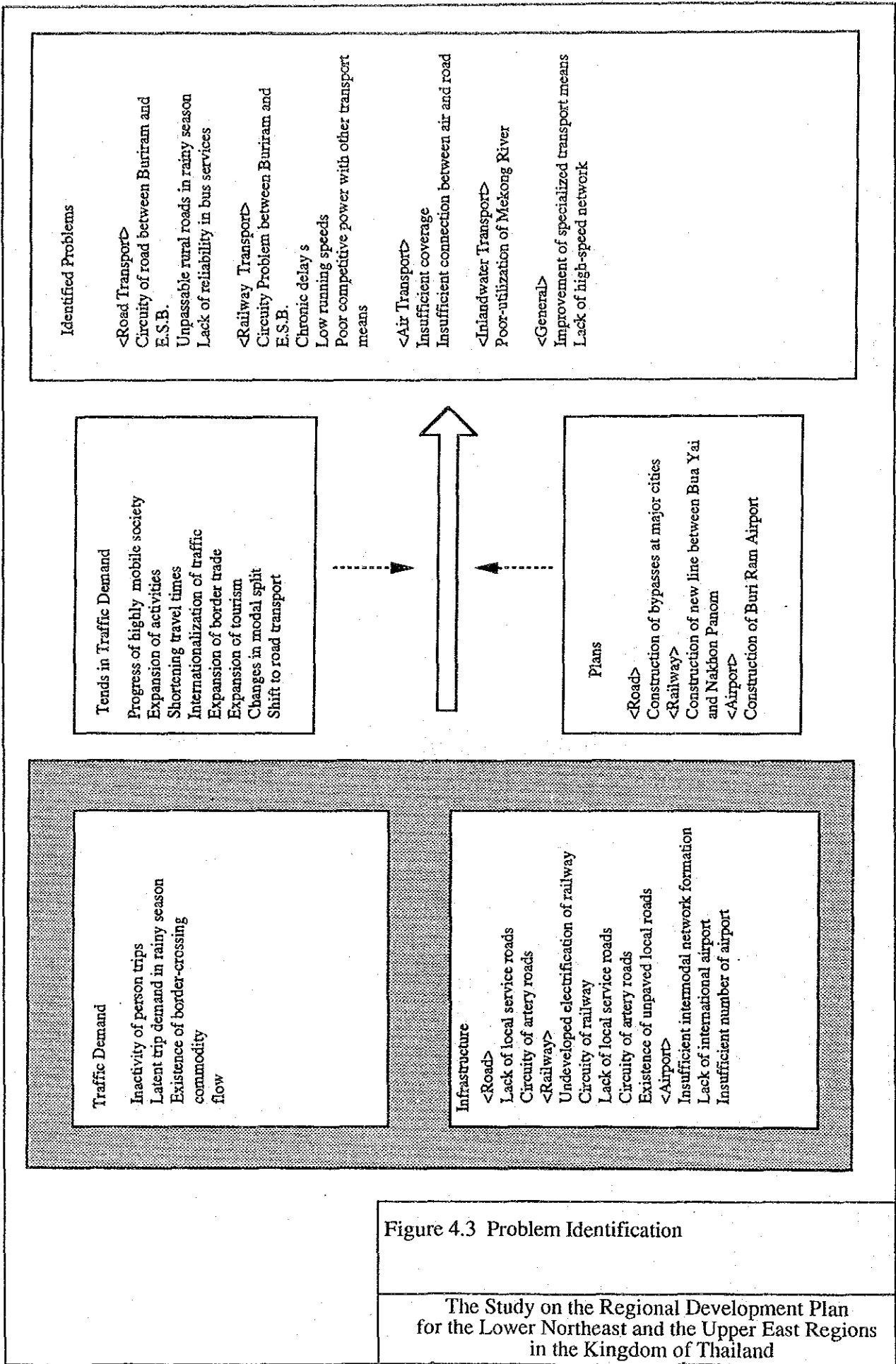


Figure 4.3 Problem Identification

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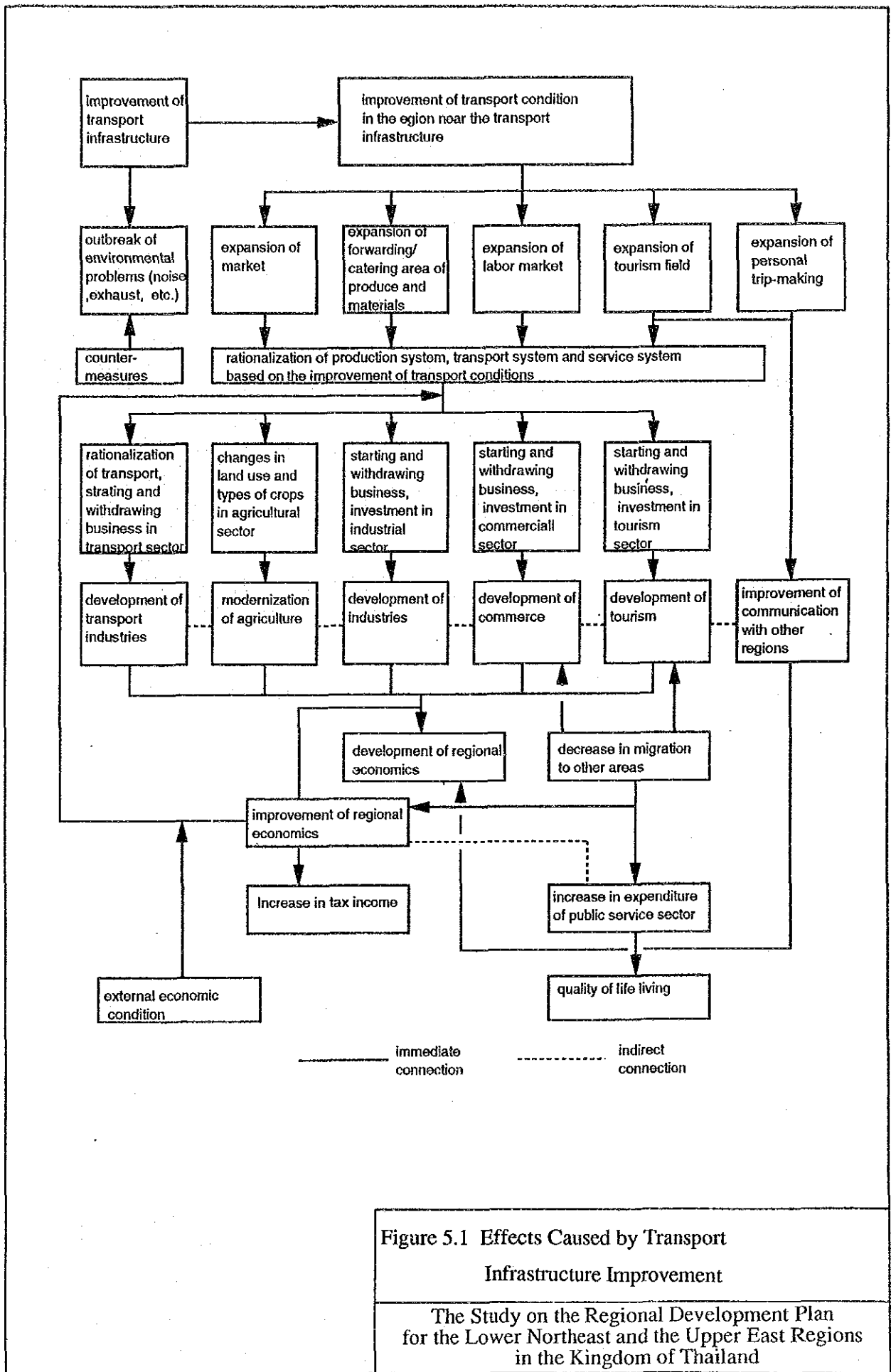


Figure 5.1 Effects Caused by Transport Infrastructure Improvement

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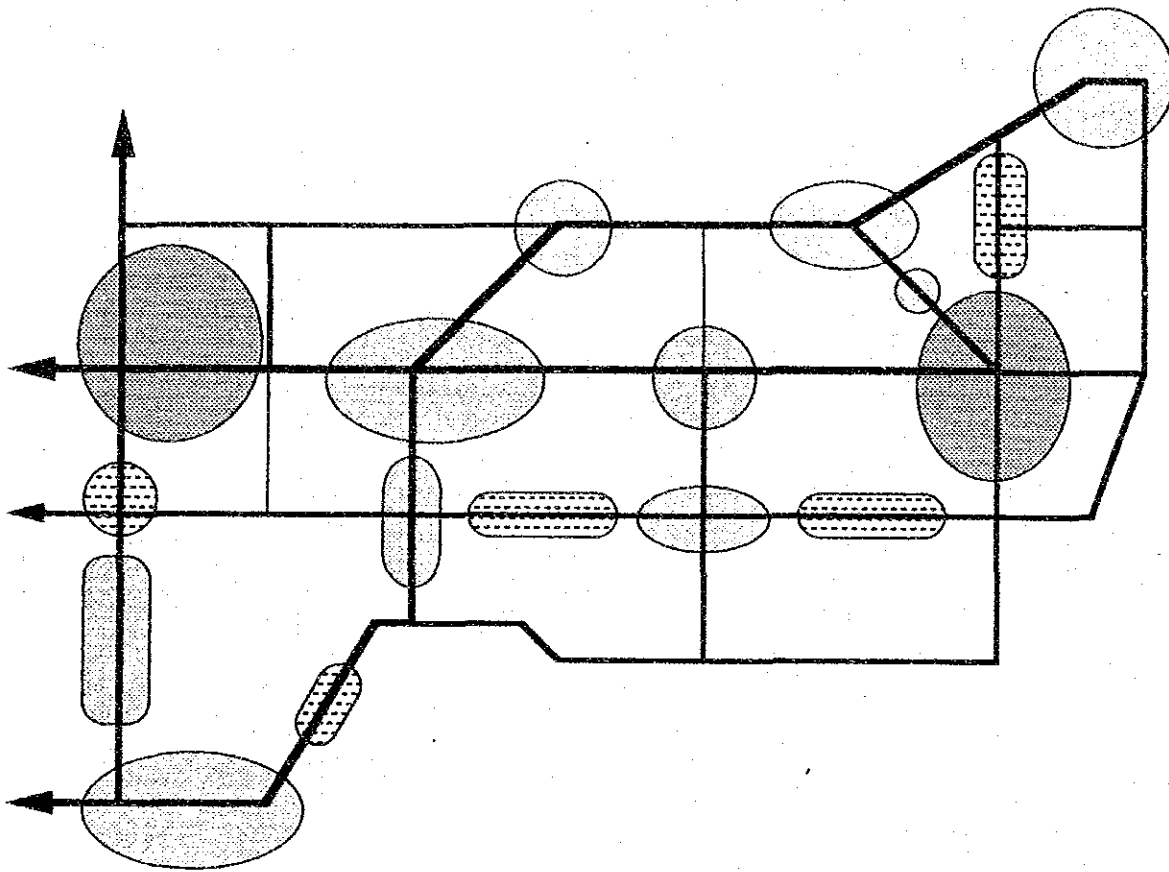
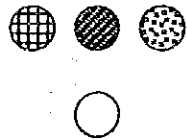
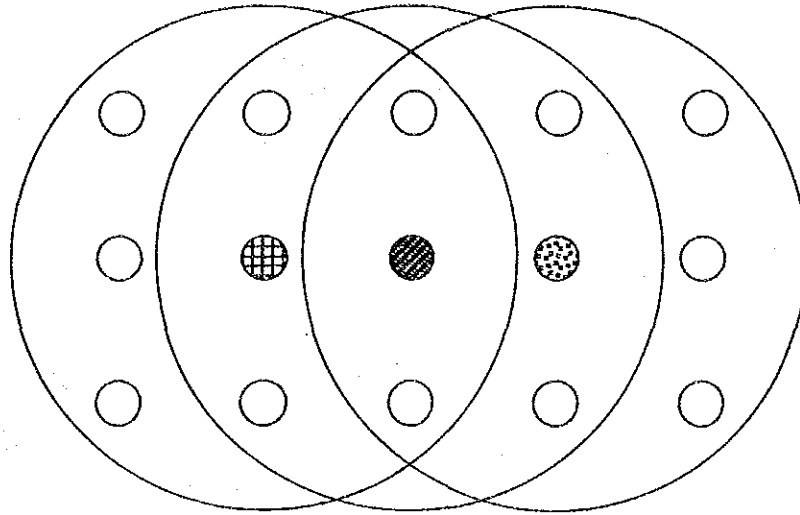


Figure 5.2 Image of Random Access Network

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Activities field of major cities

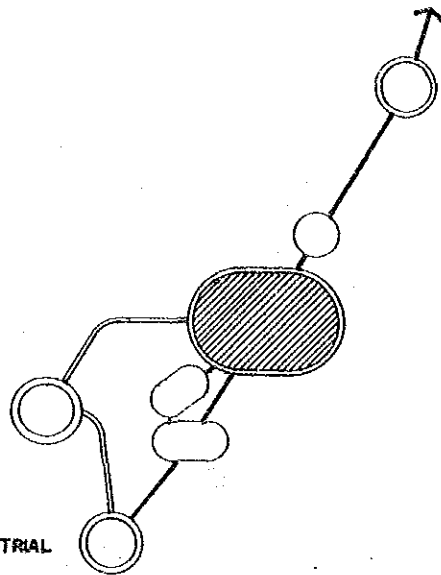
Activities field of other cities

Figure 5.3 Composition of Diverse Activities Area

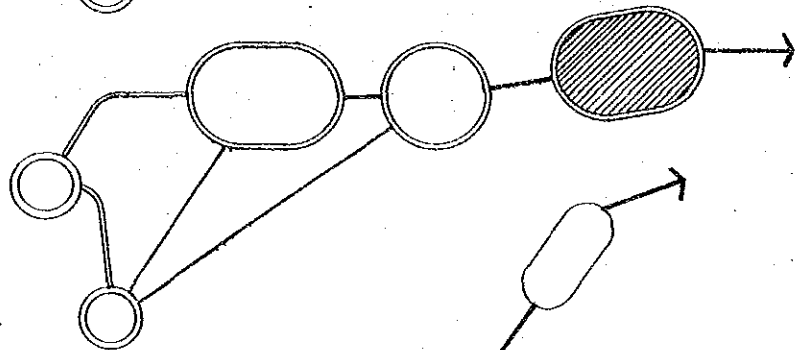
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(a) GREATER NAKHON RATCHASIMA INDUSTRIAL CENTER DEVELOPMENT



(b) UBON RATCHATHANI AGRO. INDUSTRIAL FRONT DEVELOPMENT



(c) BURI-RAM / SURIN INTEGRATED CENTRAL AREA DEVELOPMENT

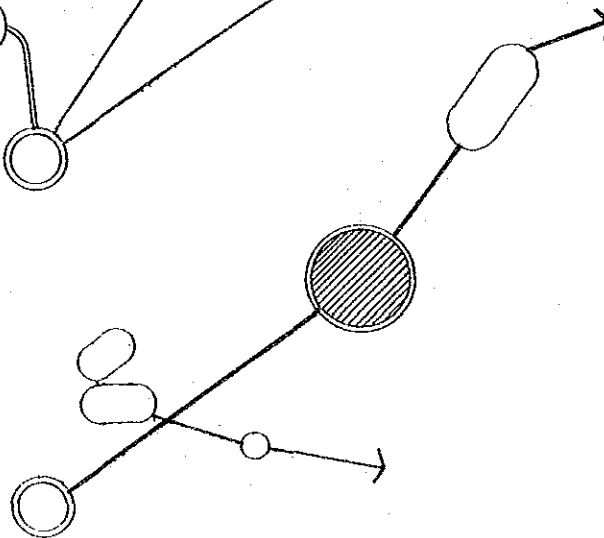
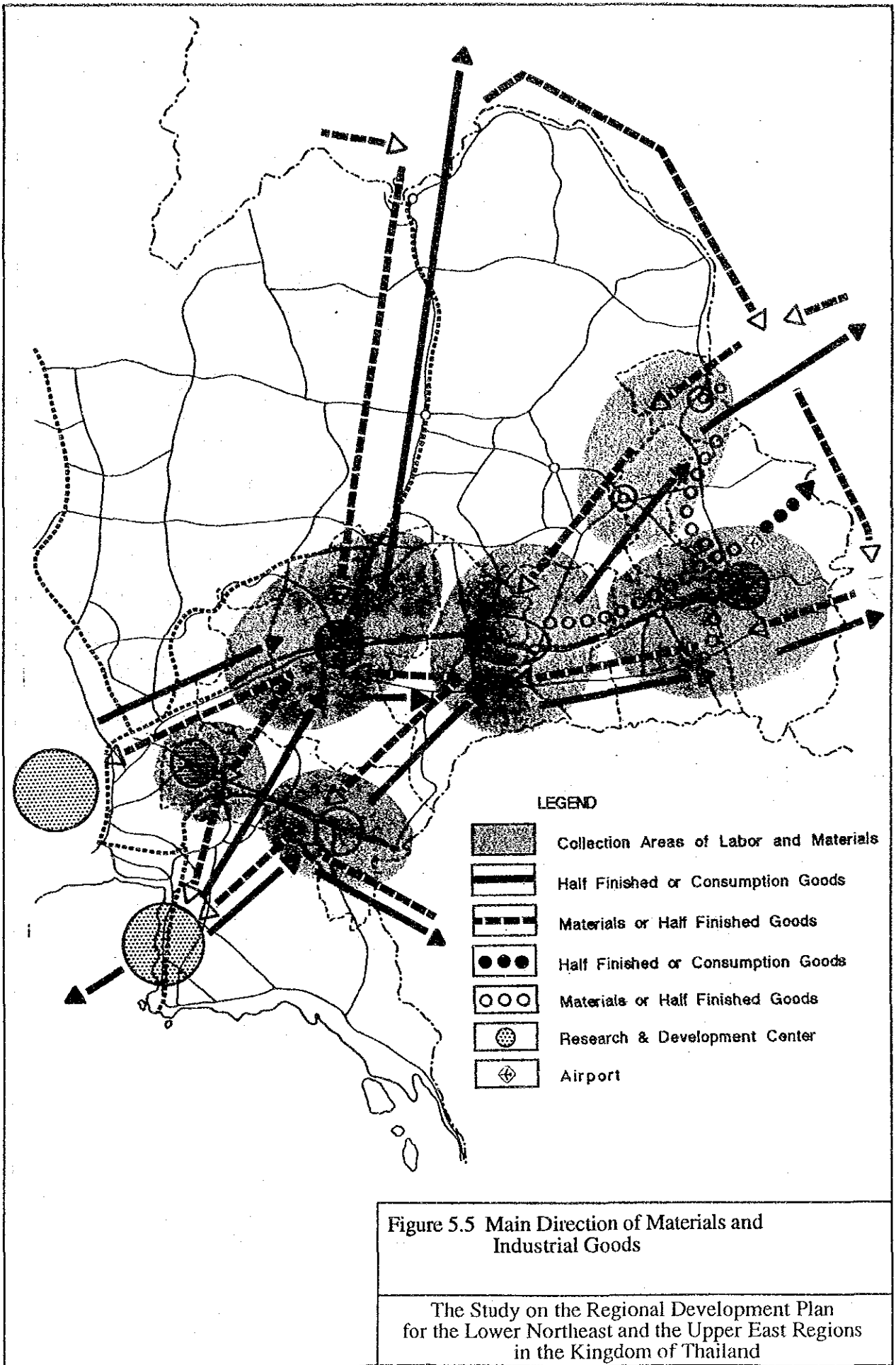
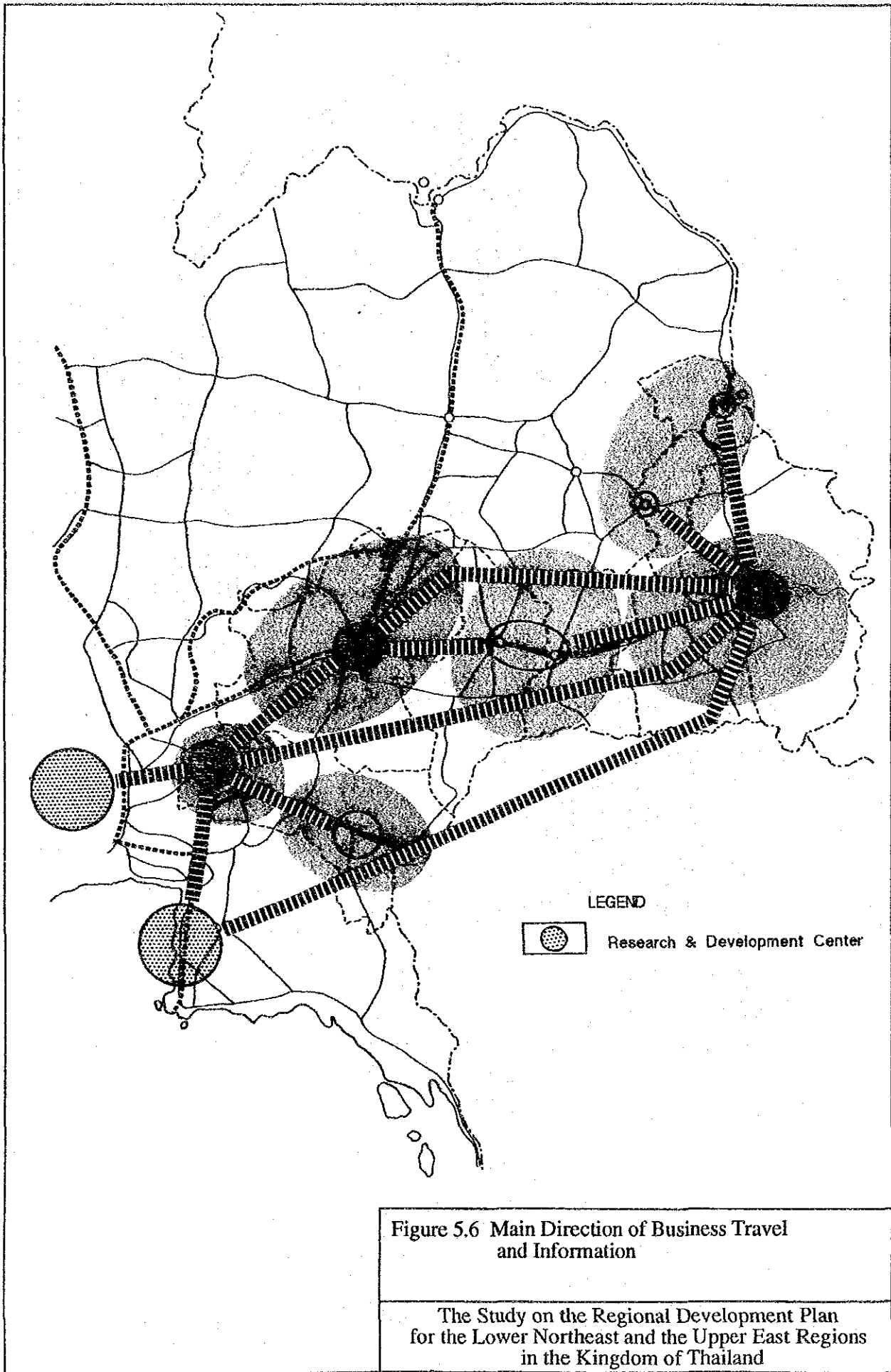
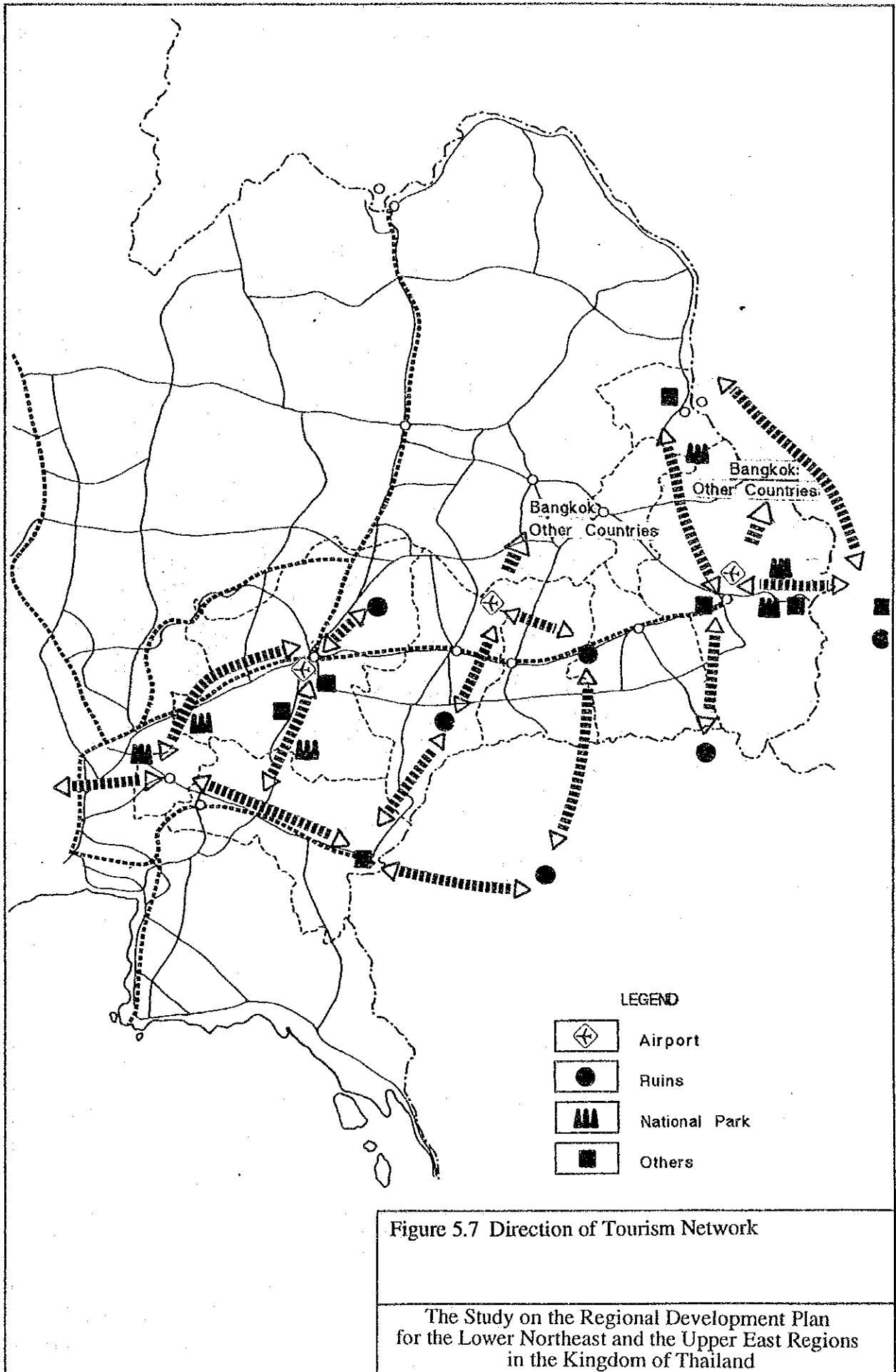


Figure 5.4 Development Structure of LNE-UE Regions

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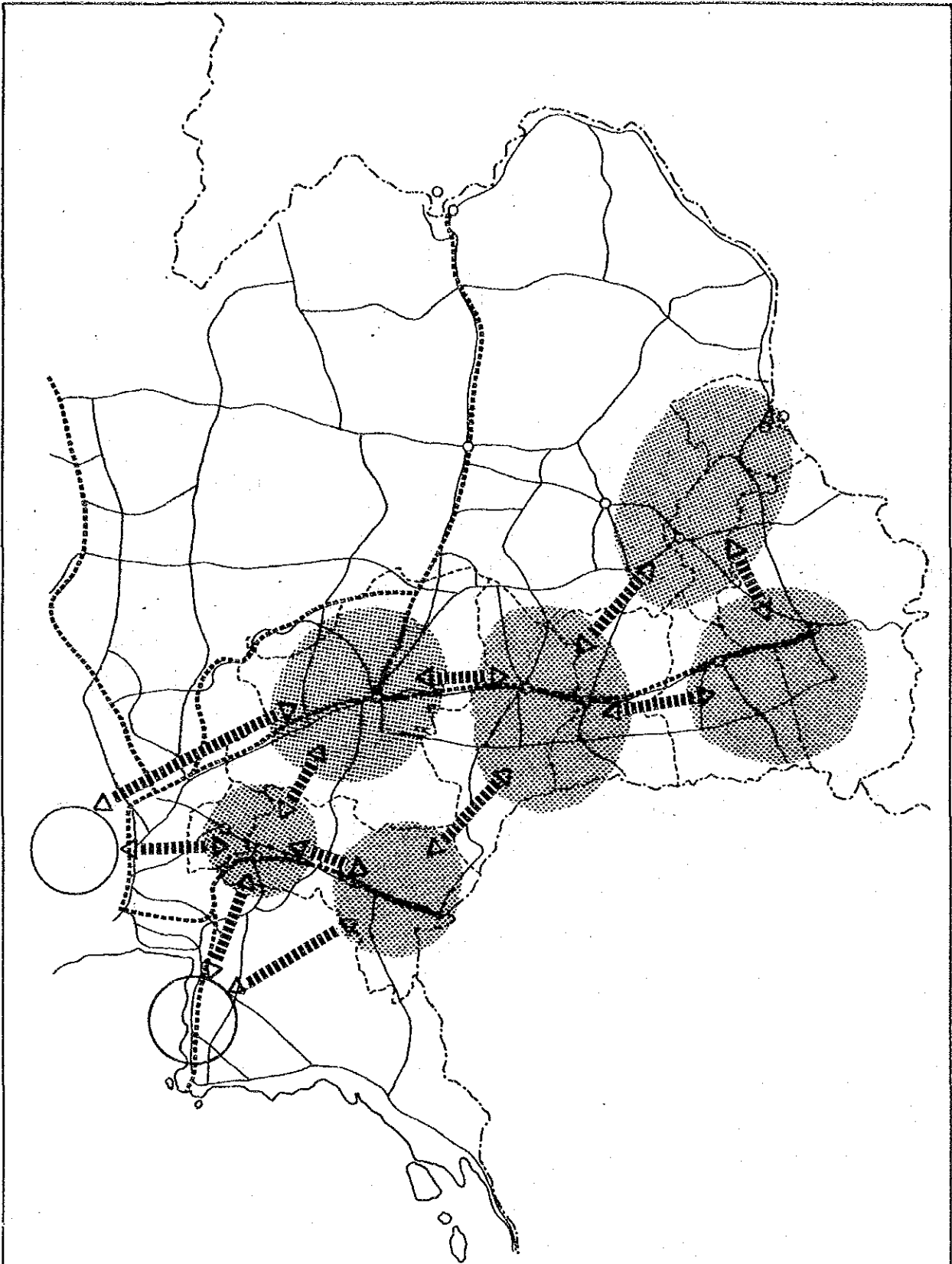


Figure 5.8 Direction of Linkage among Urban Clusters, BMR and E.S.B.

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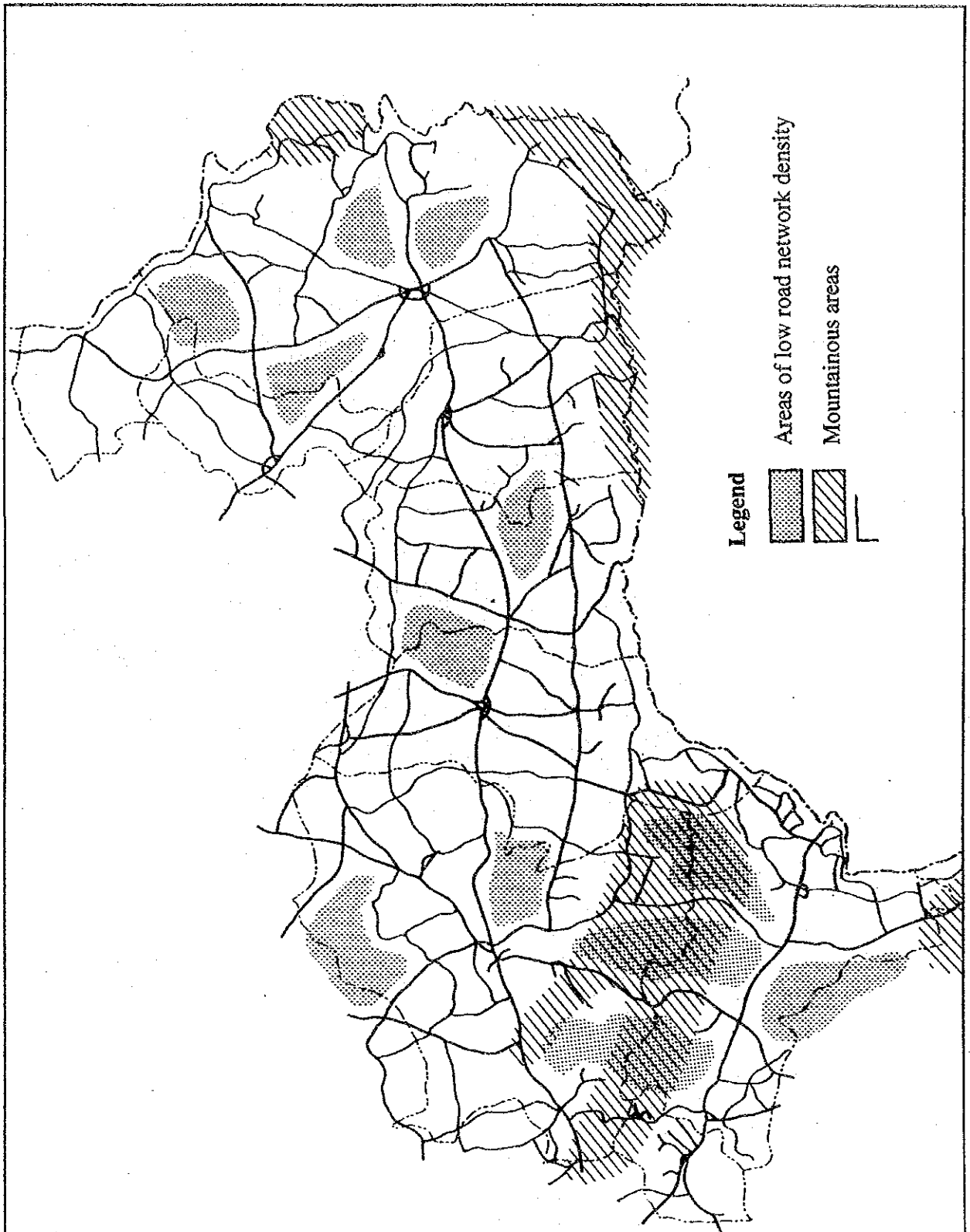


Figure 5.9 Areas of Low Road Network Density

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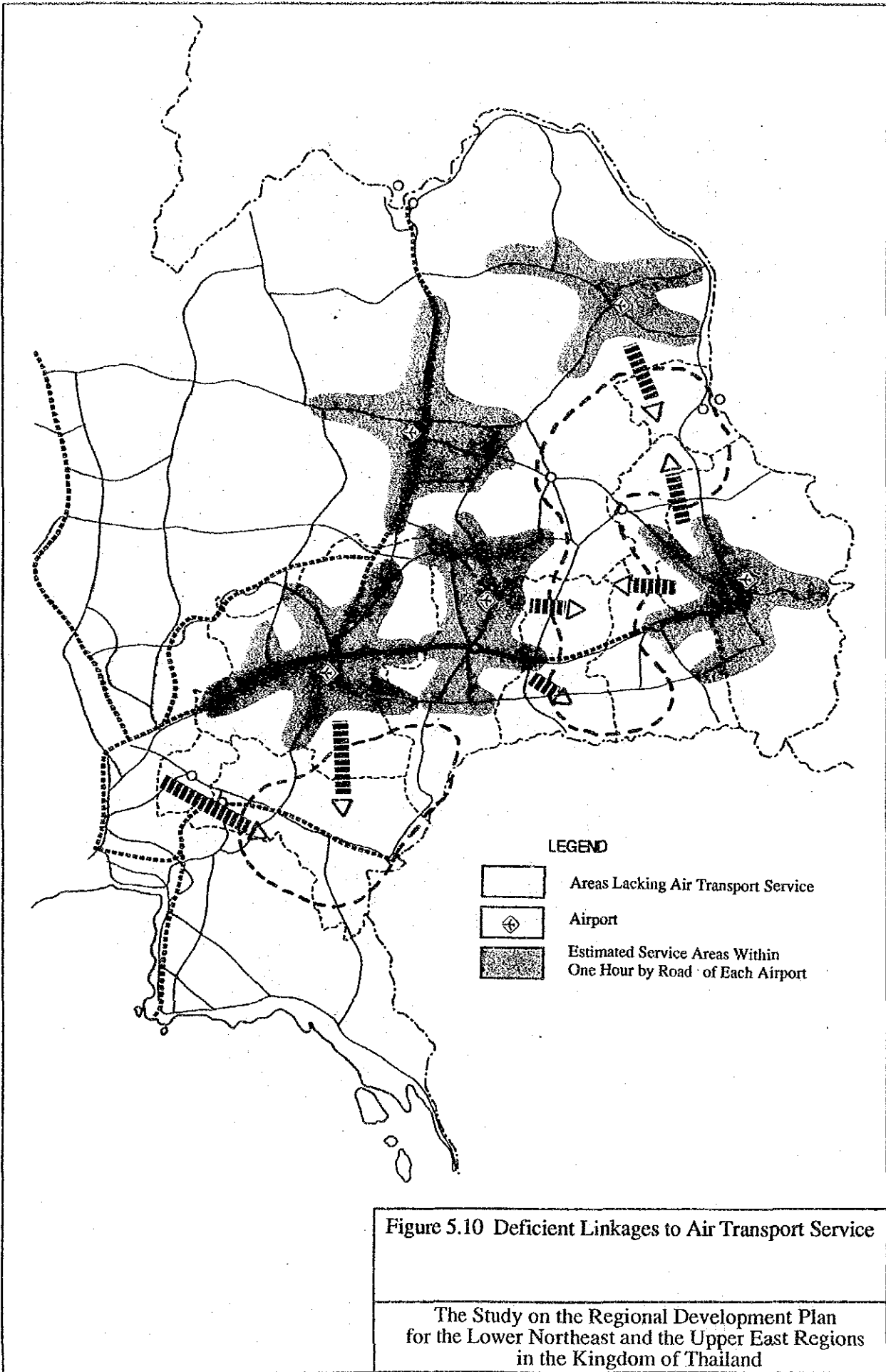


Figure 5.10 Deficient Linkages to Air Transport Service

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