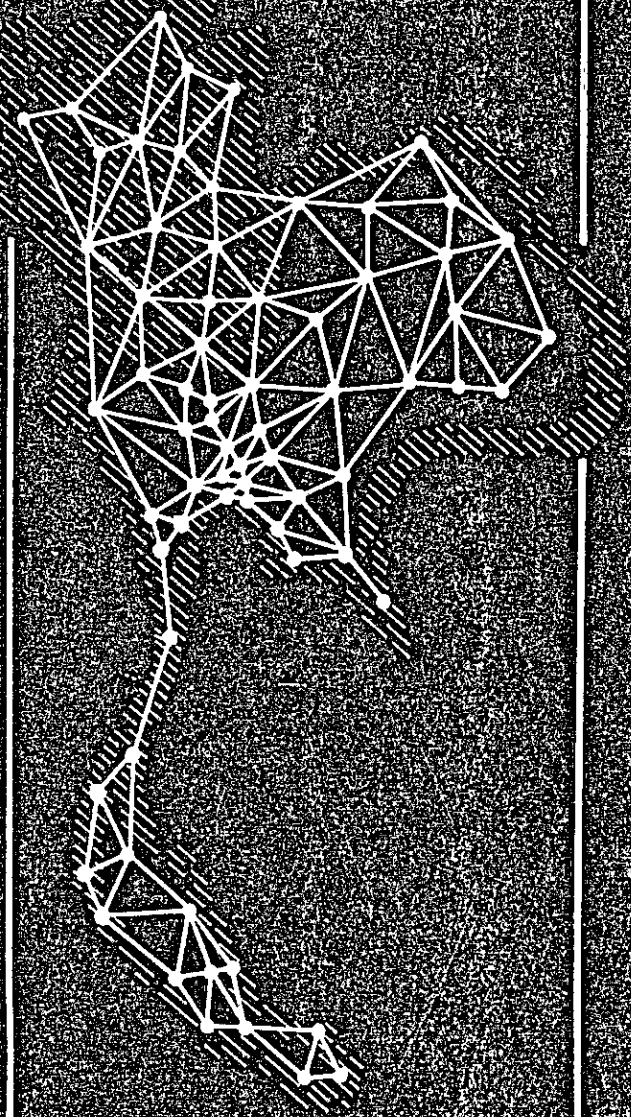
KINGDOM OF THAILAND
MINISTRY OF COMMUNICATIONS
DEPARTMENT OF HIGHWAYS

ROAD DEVELOPMENT STUDY IN THE NORTHERN REGION

PHASE 1 : PLANNING



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VOLUME 1 TEXT

JUNE 1981

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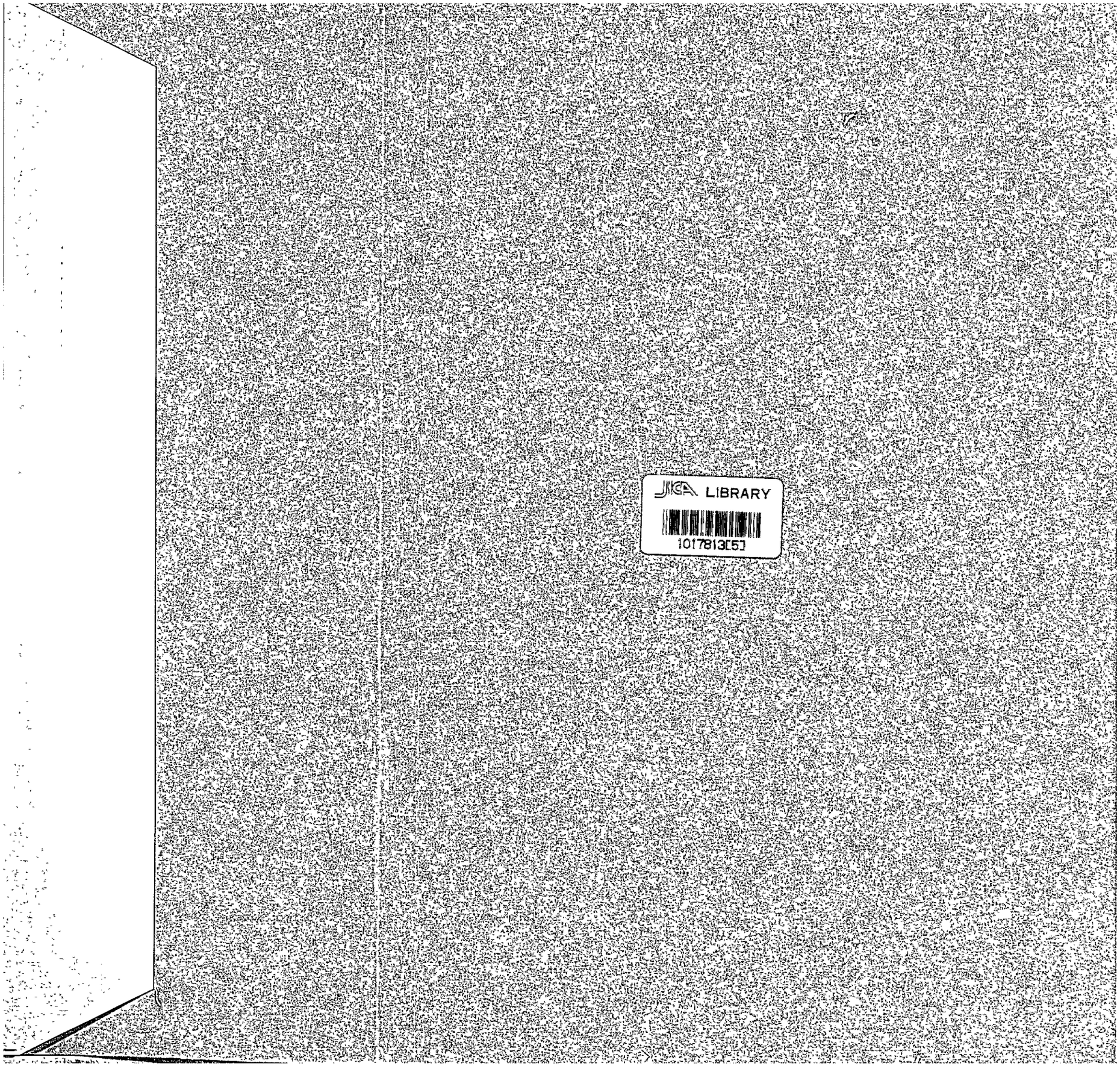

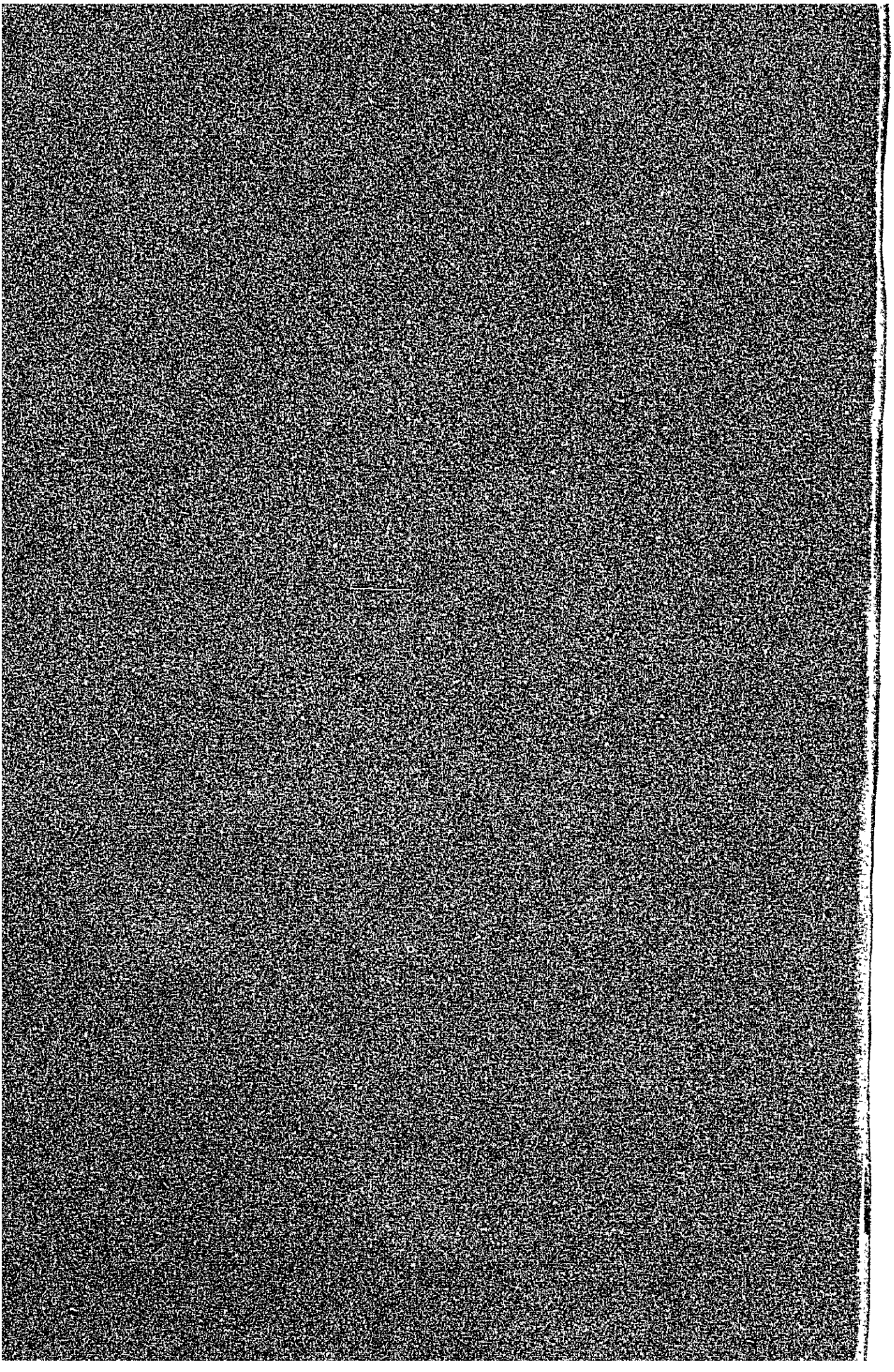

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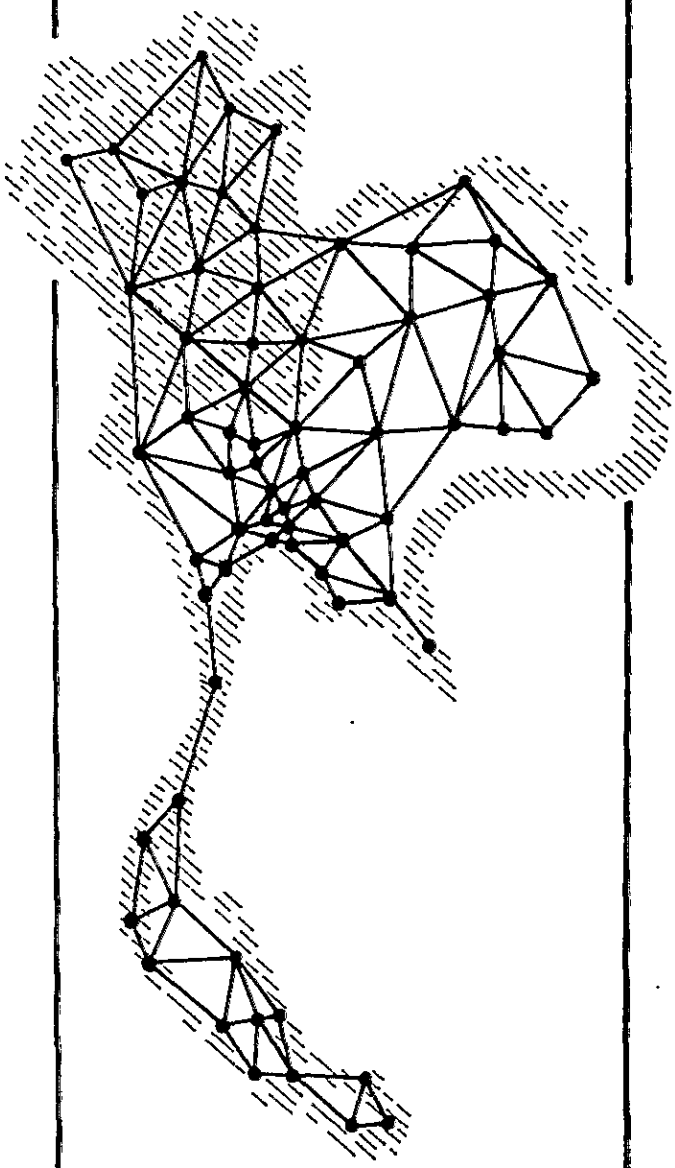

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PREFACE

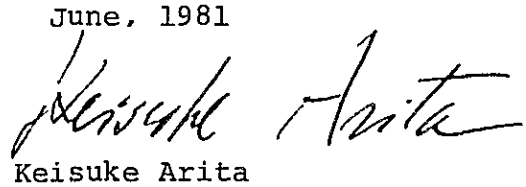
In response to a request of the Government of the Kingdom of Thailand, the Japanese Government decided to conduct a Road Development Study in the Northern Region of Thailand and entrusted the Study to the Japan International Cooperation Agency. The study consists of two phases: Phase I (Master Planning) and Phase II (Feasibility Study on Priority Projects). For Phase I, the JICA sent to Thailand a survey team headed by Mr. M. Tohi from June 26, 1980 to March 7, 1981.

The team exchanged views with the officials concerned of the Government of Thailand and conducted a field survey in the Northern Region. After the team returned to Japan, further studies were made and the present report has been prepared.

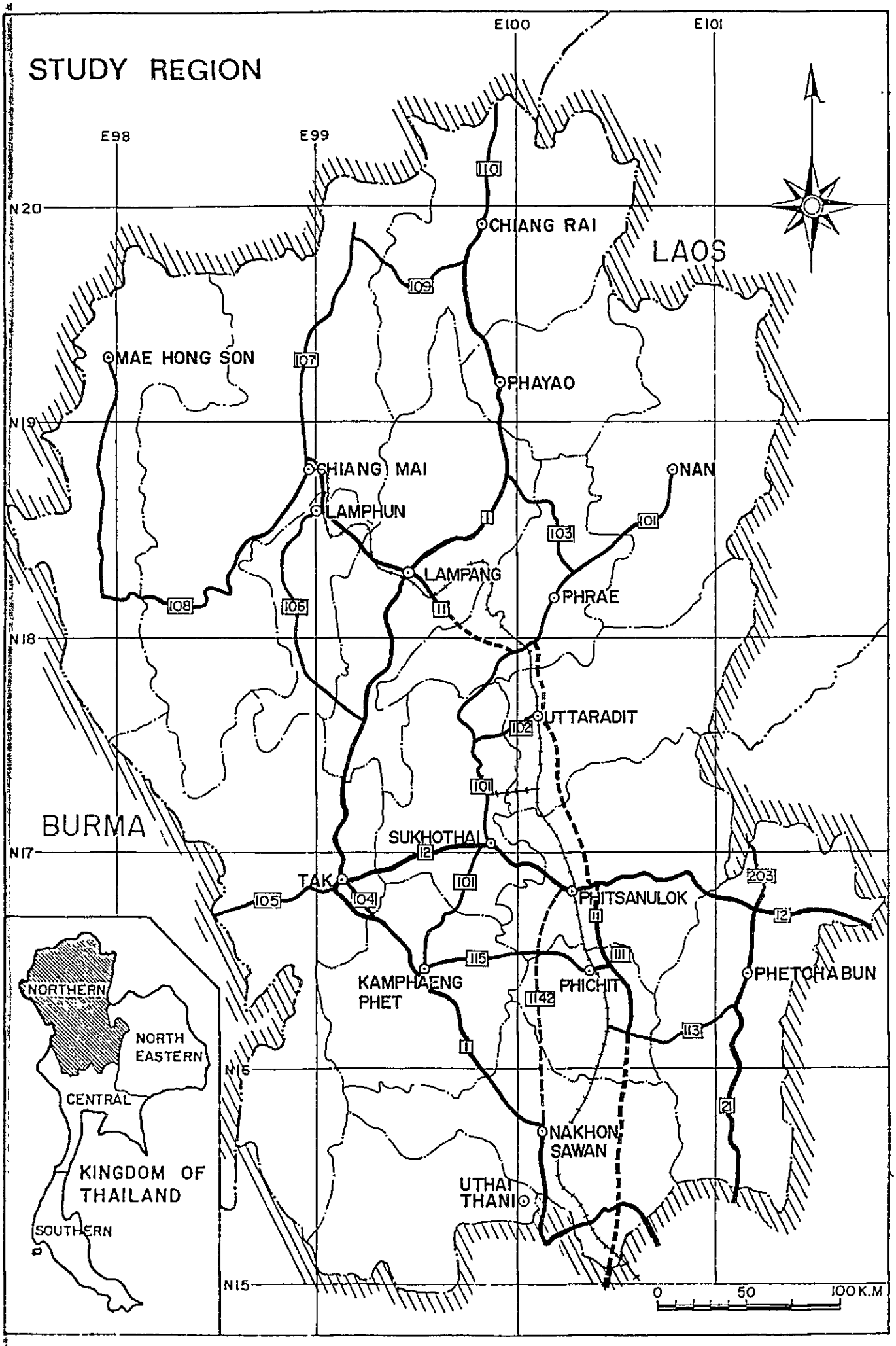
I hope that this report will serve for the development of the project and contribute to the promotion of friendly relations between our two countries.

I wish to express my deep appreciation to the officials concerned of the Government of the Kingdom of Thailand for their close cooperation extended to the team.

June, 1981



Keisuke Arita
President
Japan International Cooperation Agency


STUDY REGION
E98
E99
E100
E101
N20
N19
N18
N17
N16
N15
CHIANG RAI
LAOS
MAE HONG SON
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CHIANG MAI
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NAN
LAMPANG
PHRAE
UTTARADIT
BURMA
SUKHOTHAI
TAK
PHITSANULOK
KAMPHAENG PHET
PHICHIT
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NAKHON SAWAN
UTHAI THANI
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NORTHERN
NORTH EASTERN
CENTRAL
KINGDOM OF THAILAND
SOUTHERN
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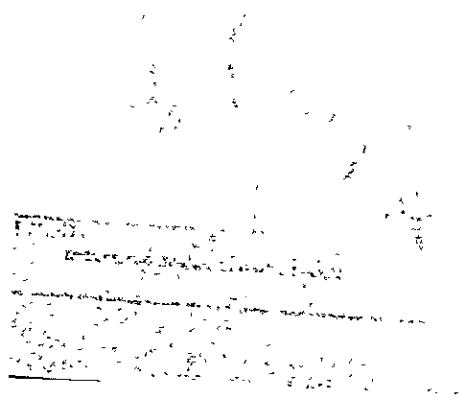

ROAD DEVELOPMENT STUDY IN THE NORTHERN REGION

PHASE 1 : PLANNING

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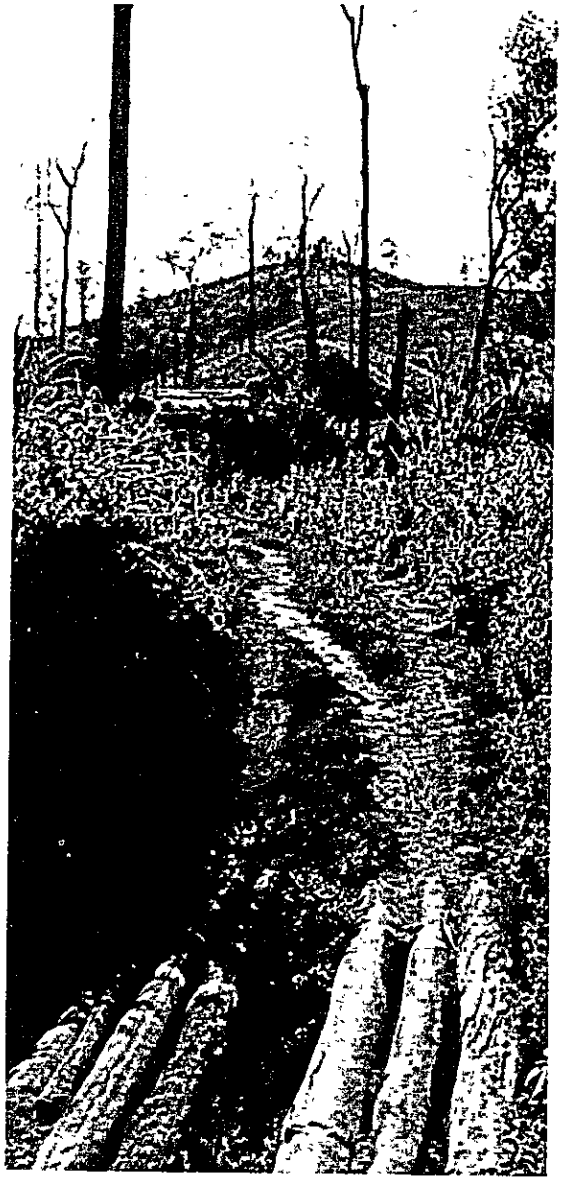
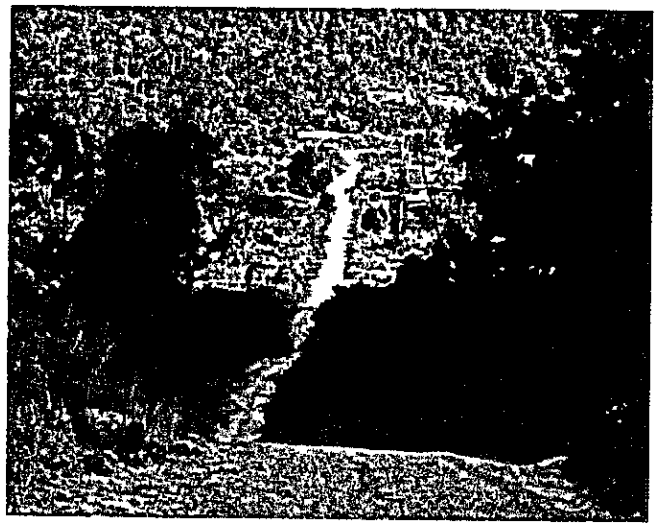
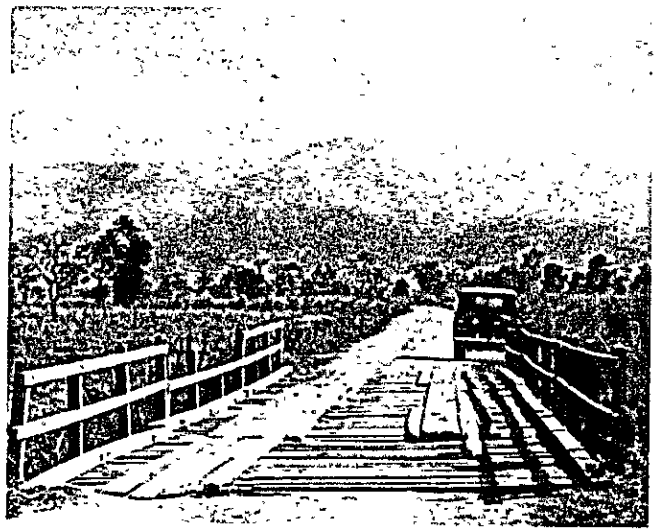


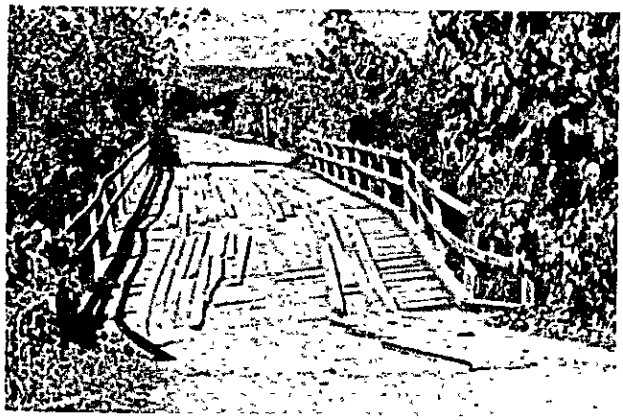
Route 1098
in Changwat Chiang Rai



Route 1048 in Changwat Lampang



Route 1174 in Changwat Chiang Rai



ARD road near Chon Daen
in Changwat Phetchabun

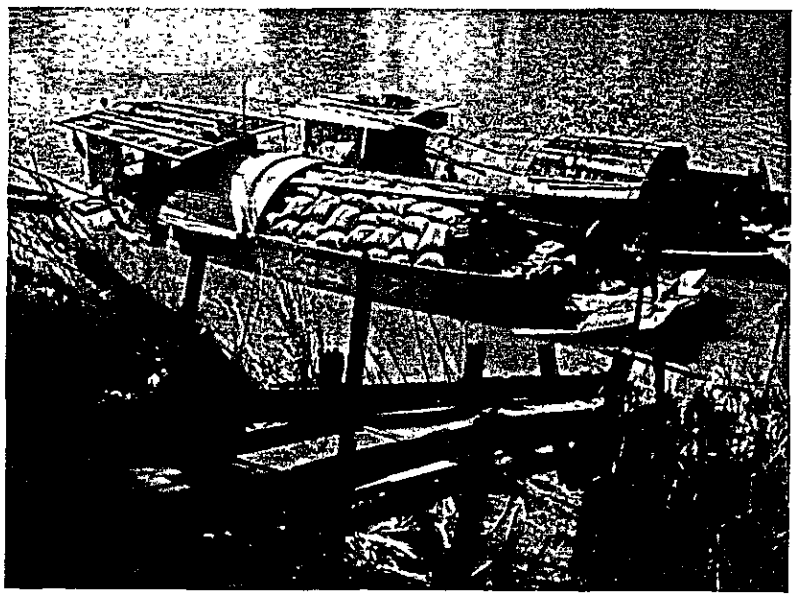
Timber bridge on Route 1048
in Changwat Lampang

Flood section on provincial road in Changwat Nakhon Sawan

Rural road in rainy season near Khlong Khlung
in Changwat Kamphaeng Phet

Light Bus

Vehicles for freight traffic

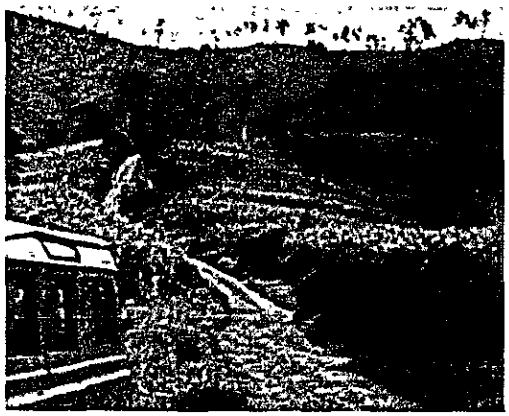


Maize transportation by waterway,
Taphan Hin in Changwat Phichit

Paddy transplanting in Changwat Nan

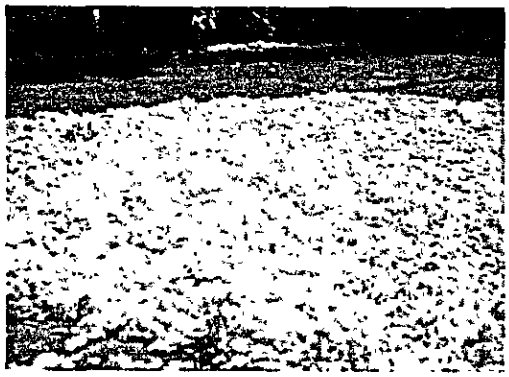
Rice threshing by machine
in Changwat Sukhothai

Paddy assembly market
in Changwat Nakhon Sawan

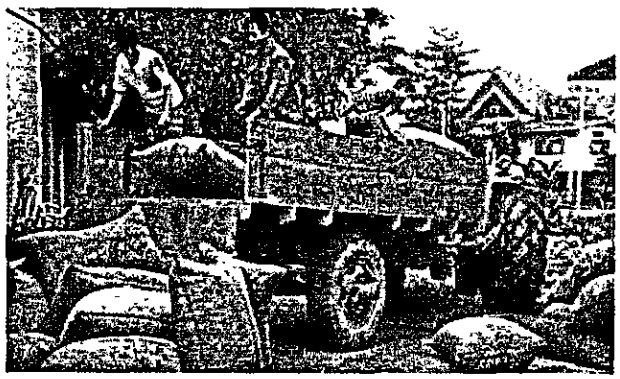


Maize field
in Changwat Uttaradit

Maize assembly market
in Changwat Phitsanulok



Cotten assembly market and
factory in Changwat Sukhothai



Assembling of agricultural product

SUMMARY AND RECOMMENDATIONS

SUMMARY AND RECOMMENDATIONS

1. The current national strategy puts emphasis on the decentralization of basic infrastructures in order to stimulate socio-economic activities in the less developed regions. In conformity with this strategy, the highway development policy has paid an attention to the improvement of highway networks at provincial level. Within this policy framework, the Department of Highways (DOH) of the Ministry of Communications requested the Japanese Government to carry out an overall study of the road development in the Northern Region. The study comprises two phases; master planning in Phase I and feasibility study in Phase II. This report presents a result of the Phase I study which has been carried out since June 1980. The objectives of the Phase I Study is to identify priority road routes and to recommend a phased program, especially a short term project package which is to be the subject of Phase II study. The study flow is shown in Figure 1-1 (page 5).

2. The Northern Region covers 170,000 square km or 33% of the national land and embraces the population of 9.5 million or 21% of the national total in 1978. Due

to its topography, the Region's cultivable land is only 42% of its total area, the lowest among four regions of the country. Nearly half of it, however, remains still uncultivated mainly due to the insufficient development of basic infrastructures.

3. The economy of the Region is predominantly agricultural. Out of its Gross Regional Product which accounts for 14% of Gross Domestic Product (GDP) of the Kingdom, the agriculture sector contributed 45% in 1978. In order to keep its economic stability, the agricultural diversification is one of the most vital importance. To support this, further investments to the sector of basic infrastructures are demanded.

4. The relatively lower rate, comparing with the national average, of population growth of the Region, 2.4% per annum, suggests that the Region is an out-migration area. One reason for this is a limited absorptive capacity of the land and another seems to be a low income level of the Region. Per capita income of the Region, 6,445 Baht in 1978, is low as 65% of the national average. In view of keeping off the out-migration especially from flocking into Bangkok, it is a crucial requirement to achieve the national strategy to reduce income disparities among regions by means of decentralization of infrastructures and social services.

5. Urbanization in the Region is still at a low level. The urban population of 630,000 in 24 municipal areas accounts for 7% of the total regional population. Although Chiang Mai and Phitsanulok are designated as growth centers in the national strategy on the regional development, the further demanded is to develop many other local centers simultaneously together with their hinterland development. In this context, the improvement of networks of rural-urban linkages, as well as inter-urban linkages, is important.

6. Out of total cultivated area of 24.4 million rai in the Region, rice ranks as primary crop followed by maize, beans, sugarcane, tobacco and other upland crops. Agriculture sector in the Region has shown relatively good performance in the crop production. In addition to the land expansion, increase of yields also has been so faster than national average to contribute to the production increase. Further challenges to be considered for the Region would be agricultural diversification as well as continuous efforts for yield increase. Emphasis is, therefore, to be laid on the diversification of infrastructures such as branch systems of roads, irrigation and power facilities. Improvement of linkages between farm and market and between production area and processing area is the requirement to the road sector.

7. Similarly with the other regions, the trunk transportation system of the Region has been developed in a manner to radiate from Bangkok. The Northern Line of the State Railway of Thailand extends from Bangkok to Chiang Mai in 751 km of total track-km. Inland waterways are maintained in the Chao Phraya river system. The major waterway is on its tributary Nan, about 370 km up to Uttaradit. Seven major riverside ports are located along the Nan and main stream of the Chao Phraya. Thai Airways connects 7 domestic airports of the Region with Bangkok by 24 flights a week. The total length of roads in the Region amounts at 16,000 km including 6,500 km of paved roads. Out of the total, 80% is under DOH and the remainings are managed by other agencies such as ARD, PWD and MDU. Among 3 primary national highways, Route 12 traverses in an east-west direction connecting Route 1 and 21. Another primary highway, Route 11, is under construction to serve also as an important artery. Among various modes of transport, land transport plays a predominant role in the Region. For example, more than 60% of commodity flow between the Region and Bangkok has depended on roads.

8. An analysis on the level of road development of the Region was attempted for inter-regional comparison in terms of road density related with various socio-economic indicators. The result reveals that the road density in the Regions is below the standard level from any view of indicators, comparing with other regions. Especially, if considered its level of economic production, urban activities and future land potential, the roads in the Region seem to be still insufficient.

9. Viewing that clear understanding of the area is of crucial importance for the identification of road development needs, this Study made an attempt to quantify area potentials, magnitude of socio-economic activities, at Amphoe level and Changwat level as well. Area potentials were assessed in normalized aggregation of figures of 17 indicators selected from the various aspects such as: future land potential, performance of major productive sectors, levels of urban activities and services, and population factor. The quantified area potentials, if ranked in the order of magnitude, reflect adequately the regional structures which is widely perceived. The estimated figures of area potential at Amphoe level were utilized in the analysis of some of key indicators for identification of priority links and areas.

10. Implicating the characteristics and background of the Region, the following major development objectives were set for the planning in this Study:

a) To reinforce network of linkages between and within administrative, social and economic units of the region in order to encourage inter-urban/urban-rural interactions and establish a physical frame for a balanced development of the region; and

b) To ensure access for the areas which are endowed with potential resources, including high productive lands, thereby attaining maximum utilization of the region's resources for national economic development as well as improving living standard of the people in such areas.

To make the identification of proposed roads consistent with the above development targets, the planning criteria for route identification were set as follows:

Criteria 1 To link among:

A. Centers of adjacent-Amphoe (Inter-Adjacent Amphoe Linkage),

B. Centers of adjacent Changwat (Inter-Changwat Linkage), and

C. Changwat centers and its Amphoe (Intra-Changwat Linkage).

Criteria 2 To link centers of Amphoe within Marketing Zone with:

D. Market center (Intra-Market Zone Linkage).

Criteria 3 To link existing artery paved highways directly:

E. With centers of neighbouring Amphoe (Amphoe-Artery Road Linkage), and

F. In an East-West direction (Lateral-Type Linkage).

Criteria 4 To ensure access to high potential lands by:

G. Improving existing unpaved roads with high development potential alongside (Improvement of DOH Unpaved Roads), and

H. Providing better access with isolated area of high development potentials, particularly in 8 Changwat in Lower North (Feeder Road Requirement).

11. Based on the planning criteria set forth, the identification of routes to be proposed was carried out according to the process shown in Figure 5-1 (page 79) and in the following 2 steps:

Step 1: The linkages or the road requirement areas to be analysed in the Step 2 were selected individually by each criterion mainly on a theoretical basis. The major indicators applied for the assessment are: i) the level of accessibility on each link and ii) relative importance of interaction between nodes of each link, which are expressed by inter-nodal gravity, commodity flow volume, road requirement index, etc.

Setp 2: Technical possibility of the improvement of the links or areas selected in the Step 1 were examined based on topographic maps and the results of field reconnaissance. The routes thus determined were adjusted taking the DOH's comments into account and finally listed up separating into short/medium term program and long term program.

12. Priority links or areas were identified in the Step 1 as follows:

a) Linkage among socio-economic centers, i.e. inter-adjacent Amphoe linkage, inter-Changwat linkage, intra-Changwat linkage;
Accessibility of each linkage, in terms of ratio and difference between travel time on existing road and that on ideal route, was checked at first. And then inter-nodal gravity, putting the area potential into one of the variables of the gravity model, for each

linkage was assessed. Among 492 links fallen into this category, links identified under the above indicators were 22 of inter-adjacent Amphoe linkage, 3 for inter-Changwat and 1 for intra-Changwat.

b) Intra-Market Zone linkage;
Accessibility was checked in the same manner as in the above a), and then volume of commodity flows on the pertained links were assessed. Thus, out of 256 links in this category, 8 links were identified as priority link.

c) Amphoe-Artery Highway Linkage;
Based on the concept that every Amphoe should be linked with artery highway by paved road in better connection, 8 links were identified.

d) Lateral-Type-Linkage;
In view of the insufficient development of east-west highways in the Region, minimum requirement of the lateral-type-roads which link north-south highways each other was examined, and 3 links were identified.

e) Improvement of DOH Unpaved Roads;
For 118 links, population and cultivable land influenced by each roads were assessed, and 13 links were selected for further analysis as they had higher values than averages both in population density and cultivable land.

f) Feeder Road Requirement;
Especially in 8 Changwat, i.e. Nakhon Sawan, Phichit, Phitsanulok, Uttaradit, Phrae, Lampang, Sukhothai and Kamphaeng Phet, influenced by the ongoing Route 11 and 1142, feeder road requirement index was assessed based on a mesh analysis. Index was estimated for each mesh in terms of the product of mesh potential and distance

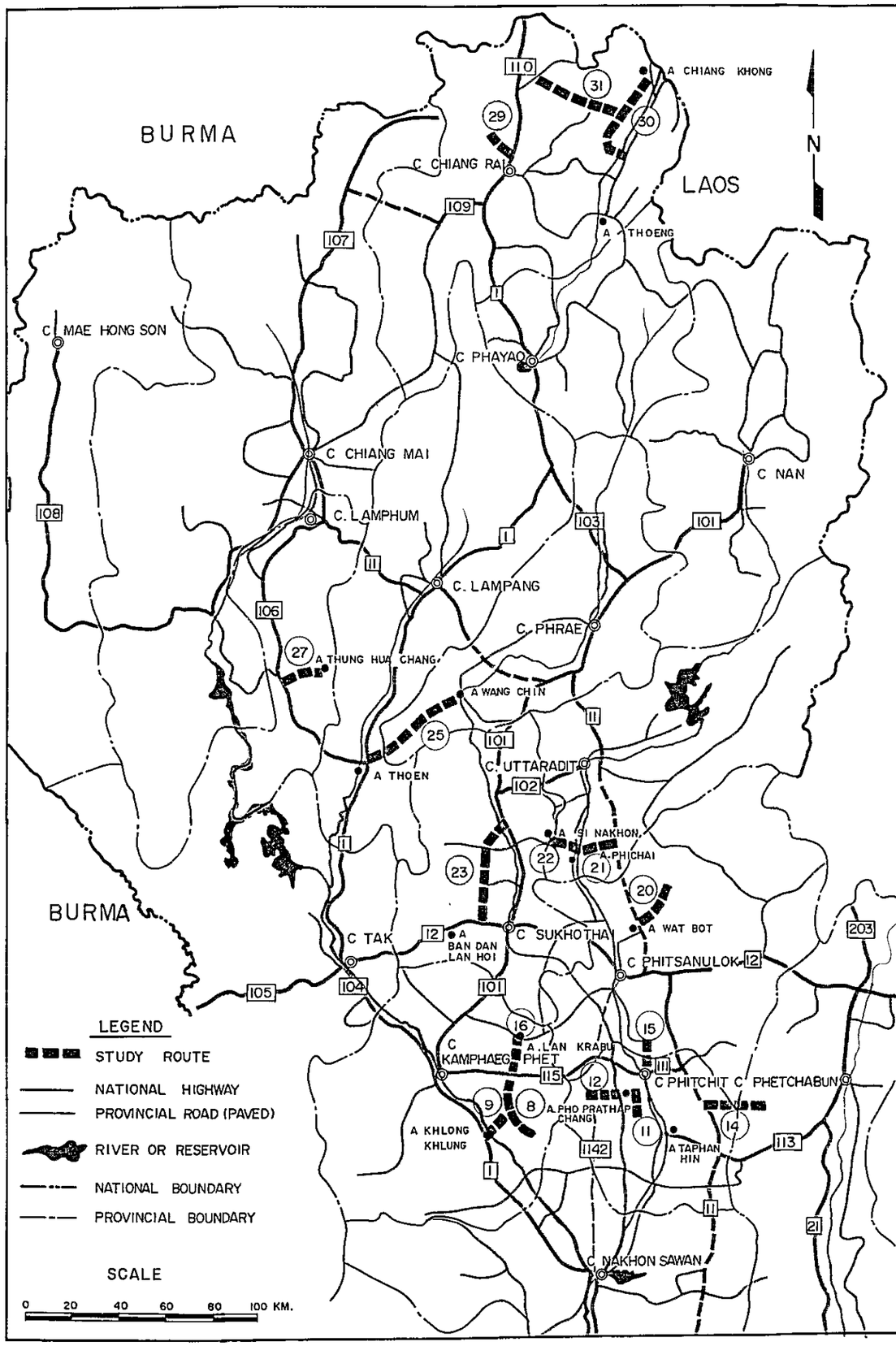
to the nearest existing road. Thus, the area with the agglomeration of meshes of large index value, 33 areas, were identified to be the road requirement area.

13. Priority links or areas, 58 links and 33 areas, theoretically identified in Step 1 were then examined in a practical manner based on topographic maps and the results of field reconnaissance. Routes planned practically with necessary adjustment were then screened under the discussions with DOH to avoid duplication with the existing roads of other agencies and with the routes already committed. As a result, 44 routes of 1,187.8 km in total were proposed to be considered. Further, among this 44 routes proposed, 31 routes of 862.1 km in total were selected, incorporating the DOH's policy, as routes for short/medium term program, for which further evaluation be proceeded with in this Study.

14. For the 31 routes separated for short/medium term, economic evaluation at pre-feasibility level was worked out in order to present a priority ranking for them, according to the process as shown in Figure 6-1 (page 88). With regard to the subject routes, road inventory survey, traffic survey and agro-economic survey have been conducted. Traffic forecasts were elaborated for each proposed route based on the analysis of the result of O/D survey. Construction quantities were estimated basing on the predesign criteria determined, and construction costs in 1980 price level were estimated accordingly. Benefits were also estimated at 1980 price in terms of road user's cost savings, road maintenance costs savings and agricultural development benefit. Based on the costs and benefits thus estimated assuming 1986 the opening year, internal rates of return (IRR) were calculated for each route.

15. Priority ranking in terms of IRR was then scrutinized on a series of discussions among DOH, Study Team and its Steering Committee. As a consequence, 16 routes of 409.3 km in total were selected for a project package for feasibility study in Phase II. They are shown in the following list and chart.

16. Further actions recommended are to proceed with arrangement necessary for the earliest financing to the priority projects to be implemented during the next five-year-plan period. For this purpose, it is recommended to commence promptly feasibility studies on a project package, 16 routes, selected in this Study.



SUMMARY OF SELECTED ROUTES

Selected Routes				Projected ADT			Construction Costs (10^6Baht)	IRR (%)
Study Route No.	Changwat	Origin - Destination	Length (km)	1986	1992	2000		
22	Uttaradit/ Sukhothai	A.[1] Pichai - A. Si Nakhon	13.2	1717	2341	3432	17.7	46.4
15	Phichit/ Phitsanu-	B.[1] Wang Tham (R.1221) - B. Tha Makham(J.R.1114)	8.5	842	1167	1751	14.8	42.2
16	Kamphaeng Phet	B. Wang Phikun(J.R.115) - A. Lan Krabu (J.R.1065)	13.1	1798	2520	3750	19.9	38.1
21	Uttaradit	B. Na Isang (J.R.11) - A. Pichai	18.4	990	1387	2031	33.7	34.7
23	Sukhothai	B. Muang Kao (J.R.12) - B. Muang Kao (J.R.1201)	51.3	1381	2021	3188	115.5	34.2
12	Phichit	B. Wang Chik (R.1068) - B. Pa Daeng (J.R.1142)	15.4	657	911	1357	52.3	32.0
8	Kamphaeng	B. Thung Ma Ha Chai (J.R.115) - B. Nong Takhian	49.5	.950	1436	2250	102.8	26.9
27	Lamphun	B. Mae Thoei (J.R.106) - A. Thung Hua Chang (J.R.1184)	16.5	269	384	592	35.8	17.8
30	Chiang Rai	B. Thung Ngiu (J.R.1020) - B. Chomphu (J.R.1020)	43.5	152	216	369	87.7	14.7
31	Chiang Rai	B. Kiu Phrao (J.R.1016) - B. Kaen Tai (J.R.1174)	55.5	404	632	1126	103.8	14.6
25	Phrae/ Lampang	A. Wang Chin - B. Don Chai (J.R.1)	52.0	154	226	343	118.1	14.4
14	Phichit/ Phetchabun	B. Nong Khanak (J.R.11) - B. Wang Pong	24.4	491	690	1027	43.8	12.1
29	Chiang Rai	B. Rong Sua Ten(J.R.110) - B. Huai Khom	13.4	275	420	800	24.4	8.6
20	Phitsanu-lok	A. Wat Bot - B. Na Kham	15.0	270	522	1112	34.2	8.1
9*	Kamphaeng Phet	B. Thung Sai - B. Tha Makhua (J.R.1084)	11.3 (32.5)	- (896)	- (1370)	- (2161)	- (62.2)	- (24.6)
11*	Phichit	B. Tha Khoi (J.R.1068) - A. Pho Prathap Chang	8.3 (28.7)	- (672)	- (975)	- (1565)	- (47.4)	- (9.7)
		Total	409.3 =====					

Note: *1) A part of original route was selected.
2) Figures in Parentheses are those of the original routes.

1/ A.; Amphoe (District)
B.; Ban (Village)

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FIGURES

TABLES

GLOSSARY

AADT	:	Annual Average Daily Traffic
AASHTO	:	American Association of State Highway and Transportation Officials
AC	:	Asphaltic Concrete
ADT	:	Average Daily Traffic
ARD	:	Accelerated Rural Development Office
Amphoe	:	District
Ban	:	Village
Changwat	:	Province
DBST	:	Double Bituminous Surface Treatment
DLD	:	Department of Land Development
DOH	:	Department of Highways
DOLA	:	Department of Local Administration
FYR	:	First Year Return
GDP	:	Gross Domestic Product
GRP	:	Gross Regional Product
IRR	:	Internal Rate of Return
JICA	:	Japan International Cooperation Agency
MAC	:	Ministry of Agriculture and Cooperations
MDU	:	Mobile Development Unit
NESDB.	:	National Economic and Social Development Board
NSO	:	National Statistical Office
O/D	:	Origin and Destination
PWD	:	Public Works Department
rai	;	Unit of area (0.16 hectare)
RID	:	Royal Irrigation Department
RMC	:	Road Maintenance Cost
SBST	:	Single Bituminous Surface Treatment
SRNT	:	Studies of National and Provincial Road Network in Thailand
SRT	:	State Railway of Thailand
Tambon	:	Sub-District
VOC	:	Vehicle Operating Cost