

KINGDOM OF THAILAND
MINISTRY OF TRANSPORT AND COMMUNICATIONS
DEPARTMENT OF HIGHWAYS

**ROAD DEVELOPMENT STUDY
IN THE SOUTHERN REGION**

FINAL REPORT

VOLUME 4

**FEASIBILITY STUDY ON
THE EIGHT SELECTED PROJECTS**

SEPTEMBER 1991

JAPAN INTERNATIONAL COOPERATION AGENCY

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VOLUME 4: FEASIBILITY STUDY ON THE EIGHT SELECTED PROJECTS

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Chapter 1

Summary of the Feasibility Study

1. Summary of the Feasibility Study

1.1 Selection of the Priority Projects

Projects for the feasibility study in the Phase 3 Study were selected out of the nineteen (19) pre F/S projects by taking account of:

- (1) the results of the preliminary economic evaluation of the projects, the EIRRs being higher than the bench mark value of 12 %;
- (2) the policy judgement that the highway development will be of great contribution to the development of the Southern Region in conjunction with the government determination to construct additional two lanes on the mainstay of Route 4 and 41 from Bangkok to the Malaysian border; and
- (3) the requirements to develop highways to urgently resolve specific traffic issues in particular areas.

Table 1.1.1 shows the list of the eight projects selected for the Phase 3 Study and Fig. 1.1.1 shows their location in the Southern Region.

The eight projects are categorized into four groups:

- (1) Chumphon City Link (NC-1) in the northern part of the Southern Region to provide a flood free connection to the artery of Route 4;
- (2) East - West Corridor in the upper part of the Southern Region to support the development of the Surat Thani - Phuket Sub-Region including the projects of Surat Thani Additional Lane (AD-1), Phuket Additional Lane (AD-2) and Thap Put Bypass (NC-3) in between;
- (3) East - West Corridor in the lower part of the Southern Region to support the development of Satun - Songkhla Sub-Region including the projects of Hua Sai - Songkhla Highway (WD7-4), Palian - Khuan Kalong Highway (WD6-1) and Highway 4/406 Short Cut Route (NC-5) in between; and
- (4) Yala - Narathiwat Highway (RW7-1) in the Southern Border Provinces to stimulate the economic activities.

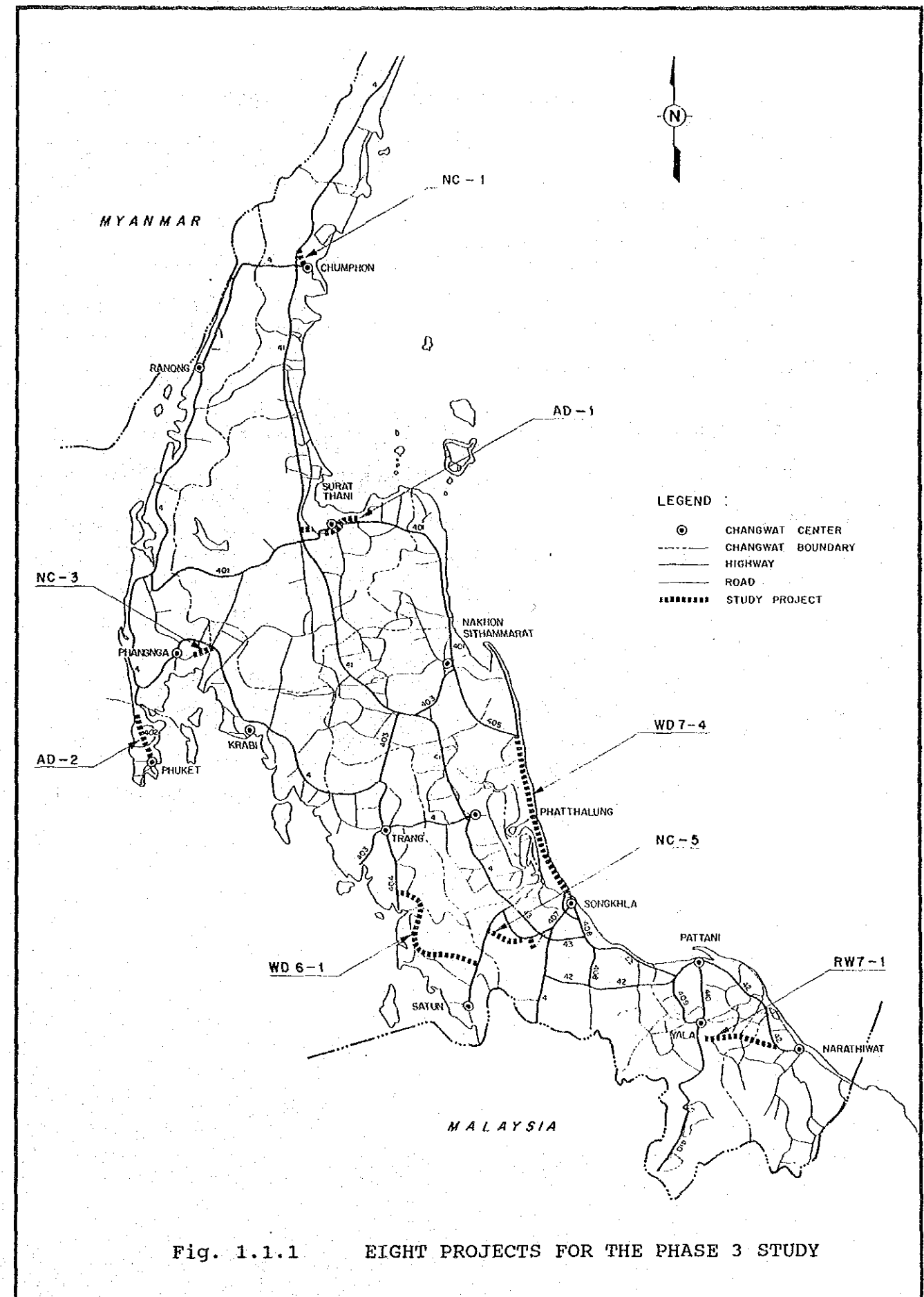


Fig. 1.1.1 EIGHT PROJECTS FOR THE PHASE 3 STUDY

Table 1.1.1 EIGHT PROJECTS FOR THE PHASE 3 STUDY

No.	Project Name	Length(km)
NC-1	Chumphon City Link	9.1
AD-1-1	Surat Thani Additional Lane	32.0
AD-1-2	Surat Thani Additional Lane (Airport Route)	40.1
AD-2-1	Phuket Additional Lane	38.4
AD-2-2	Phuket New Highway on the West Coast	35.2
NC-3	Thap Put Bypass	8.0
WD7-4-1	Hua Sai - Songkhla Highway	96.3
WD7-4-2	Hua Sai - Songkhla Highway (Hua Sai 4 Lanes)	96.3
WD6-1	Palian - Khuan Kalong Highway	82.6
NC-5	Highway 4/406 Short Cut Route	24.1
RW7-1	Yala - Narathiwat Highway	53.0
Total <u>1/</u>		351.6

Note: NC - New Construction
 AD - Additional Lane Construction
 WD7 - Widening of Carriageway to 7.0 Meters
 WD6 - Widening of Carriageway to 6.0 Meters
 RW7 - Reconstruction and Widening of Carriageway to 7.0 Meters
1/ AD-1-1, AD-2-2 and WD7-4-2 are not included in "Total"

1.2 Objectives of the Projects

1) Chumphon City Link (NC-1)

This new link will connect Chumphon city with the north-south artery of Route 4 to relieve traffic congestions and alleviate traffic hinderance to be caused by flooding in rainy season on the existing highway Route 327. On top of this, the new link will assure a fail-safe linkage to Route 4 from Chumphon city even if Route 327 becomes impassable by such a serious disaster as experienced in 1989.

2) Surat Thani Additional Lane (AD-1)

The project aims to improve the accessibility between the north-south artery of Route 41 and the designated main urban center of Surat Thani city as well as to relieve traffic congestions in Surat Thani municipal area. To cope with the increasing traffic in recent years, DOH has partly constructed additional two lanes along the existing Route 401. Additional two lanes should be extended to the west and east of Surat Thani city to accommodate the increasing traffic generated by new industrial location, airport related traffic, through traffic to and from Nakhon Si Thammarat and so on.

There are two alternatives to be studied in the feasibility study: AD-1-1; and AD-1-2. AD-1-1 is a project to construct additional two lanes along the existing highway as described in the above. AD-1-2 is a project to construct a new two lane highway from Surat Thani Airport to Ban Huai Mat on Route 401 to facilitate airport related traffic to and from Surat Thani city as proposed by the Department of Town and Country Planning (DTCP). As AD-1-1, additional two lanes are to be constructed along the existing highway except for the section parallel to the new construction section.

3) Phuket Additional Lane (AD-2)

Phuket city is the biggest city on the west coast of the Peninsula designated as a major urban center like Surat Thani on the east coast. Tourism development on the island has remarkably been progressed in these years. Due to these factors as well as limited highway capacity between the Sarasin Bridge and Phuket city, traffic congestion on the artery of Route 402 has been worsening. The project aims to increase traffic capacity of Route 402 by constructing additional two lanes along the existing highway.

There are two alternatives to be studied in the feasibility study: AD-2-1; and AD-2-2. AD-2-1 is a project to construct additional two lanes along the existing highway as described in the above. AD-2-2 is a project to construct a new two lane highway on the west coast from near Phuket Airport to Phuket Bypass in view of a proposal by the Seventh Plan Urban and Regional Transport (SPURT) Study.

4) Thap Put Bypass (NC-3)

The east - west highway link connecting the two main urban centers of Surat Thani and Phuket on both sides of the Peninsula will become more important in the future as they grow. The project aims to shorten the distance of the highway between both cities as well as to detour the existing intersection with Route 4 where the crowded local market hinders smooth traffic flow.

5) Hua Sai - Songkhla Highway (WD7-4)

Intercity traffic between Songkrah and Nakhon Si Thammarat is expected to grow: the former designated as a regional urban center and the latter as an urban growth center. The project aims to improve the existing highway Route 408 to S1 standard. This improved highway will become an alternative route for the north - south artery of Route 41 between both cities.

There are two alternatives to be studied in the feasibility study: WD7-4-1; and WD7-4-2. WD7-4-1 is a project to widen the existing pavement width of 6 meters to 7 meters as described in the above. WD7-4-2 is a project to construct additional two lanes on the existing highway from Hua Sai to the provincial border between Nakhon Si Thammarat and Songkhla, the remaining section being same as WD7-4-1.

6) Palian - Khuan Kalong Highway (WD6-1)

The project aims at improving the west coast highway which constitutes one of the arteries in the Southern Region. The project offers better accessibility between Palian on Route 404 directing to Trang city and Khuan Kalong on Route 406 directing to Hat Yai city and Hat Yai International Airport. The improved accessibility to Trang and Hat Yai directions will support the economic and tourism development in the project area.

7) Highway 4/406 Short Cut Route (NC-5)

The project aims to provide Satun with better accessibility to Hat Yai airport and Hat Yai city. It also facilitates transport services from Hat Yai to Trang and Krabi direction coupled with the project WD6-1 described in the above.

8) Yala - Narathiwat Highway (RW7-1)

Major highway network in the Southern Border Provinces is composed of Route 42 which runs along the east coast between Pattani and Narathiwat and Route 410 which directs to the Malaysian border from Pattani via Yala. The project aims at providing direct link between two cities of Yala and Narathiwat to encourage economic as well as tourism development of both cities in the border provinces including several towns in the project area.

1.3 Project Costs

Table 1.3.1 summarizes the project cost. Total cost of the projects amounts to 2,517 million baht over a total distance of 351.6 kilometers excluding alternative projects of AD-1-1, AD-2-2 and WD7-4-2.

Table 1.3.1 PROJECT FINANCIAL COST OF THE F/S PROJECTS

No.	Project	Project Length 1/ (km)	Project Cost (mil.baht)
NC-1	Chumphon City Link	9.1	110.2
AD-1-1	Surat Thani Additional Lane	32.0	375.6
AD-1-2	Surat Thani Additional Lane	40.1	468.6
AD-2-1	Phuket Additional Lane	38.4	612.6
AD-2-2	Phuket Additional Lane	35.2	1,401.0
NC-3	Thap Put Bypass	8.0	120.3
WD7-4-1	Hua Sai - Songkhla Highway	96.3	215.6
WD7-4-2	Hua Sai - Songkhla Highway	96.3	271.8
WD6-1	Palian - Khuan Kalong Highway	82.6	318.3
NC-5	Highway 4/406 Short Cut Route	24.1	285.3
RW-7-1	Yala - Narathiwat Highway	53.0	385.9
Total 2/		351.6	2,516.8

Note: 1/ "Project Length" means the total length of a project. Project Length is not equal to Design Length only for AD-1-2 and WD7-4-2.

2/ AD-1-1, AD-2-2 and WD7-4-2 are not included in "Total".

1.4 Project Evaluation

Table 1.4.1 shows results of the economic evaluation. All of the eight projects are judged viable with the EIRRs ranging from the lowest rate of 19.2 % for WD6-1 to the highest rate of 69.9 % for NC-1. The lowest EIRR of 19.2 % is calculated to be further lowered to 14.0 % in the sensitivity test of 20 % benefit down and 20 % cost up.

Table 1.4.1 ECONOMIC EVALUATION OF THE EIGHT PROJECTS

No.	Project	NPV	B/C	EIRR1	EIRR2
NC-1	Chumphon City Link	322	6.3	69.9	52.8
AD-1-1	Surat Thani Additional Lane	1,792	8.8	57.3	45.5
AD-1-2	Surat Thani Additional Lane	1,804	7.7	58.1	45.4
AD-2-1	Phuket Additional Lane	4,260	12.0	69.2	55.3
AD-2-2	Phuket Additional Lane	1,220	2.5	27.4	19.8
NC-3	Thap Put Bypass	76	2.2	23.0	17.0
WD7-4-1	Hua Sai - Songkhla Highway	263	3.1	34.3	25.3
WD7-4-2	Hua Sai - Songkhla Highway	256	2.7	29.9	21.7
WD6-1	Palian - Khuan Kalong Highway	144	1.8	19.2	14.0
NC-5	Highway 4/406 Short Cut Route	1,146	8.0	52.3	41.4
RW-7-1	Yala - Narathiwat Highway	282	2.2	24.7	17.8

- Note: 1) NPV in million baht at 12 % discount
 2) B/C at 12 % discount
 3) EIRR1 in percentage
 4) EIRR2 in percentage with benefit down of 20 % and cost up of 20 %

Table 1.4.2 shows the outline of the project evaluation from various points of view. In terms of economic evaluation, all the projects are judged viable even in sensitivity tests. In terms of flood prevention and traffic accidents, there is no projects that would have negative effects. In terms of environment impact assessment, however, some projects are likely to have small effects on environment: AD-2-2 and RW7-1 in particular.

Chumphon City Link (NC-1), Phuket Additional Lane (AD-2-1), Surat Thani Additional Lane (AD-1-2), Hua Sai - Songkhla Highway (WD7-4-1) are the promising projects from every point of view. Highway 4/406 Short Cut Route (NC-5), Thap Put Bypass (NC-3) and Palian - Khuan Kalong Highway (WD6-1) are the second promising projects that would have small effects on environment. Yala - Narathiwat Highway (RW7-1) would be the only project that needs policy coordination between development and environmental conservation.

Table 1.4.2 OVERALL PROJECT EVALUATION

No.	Project	EIRR	EIA	FP	TA
NC-1	Chumphon City Link	69.9	0	+1	+1
AD-2-1	Phuket Additional Lane	69.2	0	+1	+1
AD-1-2	Surat Thani Additional Lane	58.1	-2	0	+1
AD-1-1	Surat Thani Additional Lane	57.3	0	+1	+1
NC-5	Highway 4/406 Short Cut Route	52.3	-3	0	0
WD7-4-1	Hua Sai - Songkhla Highway	34.3	0	+1	0
WD7-4-2	Hua Sai - Songkhla Highway	29.9	0	+1	0
AD-2-2	Phuket Additional Lane	27.4	-5	0	0
RW7-1	Yala - Narathiwat Highway	24.7	-4	0	0
NC-3	Thap Put Bypass	23.0	-2	0	+1
WD6-1	Palian - Khuan Kalong Highway	19.2	-3	0	0

- Note: 1) EIRR - Economic Internal Rate of Return (%)
 2) EIA - Environmental Impact Assessment
 "0": No Significant Effects
 "-N": Number of Items of Small Effects
 3) FP - Flood Prevention
 "0": No Significant Change
 "+1": Improvement
 4) TA - Traffic Accidents
 "0": No Significant Change
 "+1": Improvement in Urban Area

Chapter 2

Chumphon City Link (NC-1)

2. Chumphon City Link (NC-1)

2.1 Natural Conditions and Land Use

The project locates in the north-west area of Chumphon city which belongs to a flatland along the east coast of the Gulf of Thailand. Mean annual rainfall of the area amounts to 2,000 mm. In every November and December, depression from the south-east hits the area, sometimes causing serious damages. General geology is of alluvium and terrace deposits.

NC-1 diverts from Route 4 into farm land, leading to the outskirts of Chumphon municipality. Land use along the proposed NC-1 is mostly coconut orchard and paddy field, occupying about 73 % of the corridor. Of the remaining 27 %, grass land shares 26 %, residential area accounting for a minimal 1%.

Residential Land	1 %
Orchard Land (Coconut)	15 %
Paddy Field	58 %
Grass Land	26 %

The proposed highway does not pass through any villages. Due to sparsely scattered houses in the highway corridor, however, removal of houses would be required in the range of twenty houses. Prevailing land price in the project area is in the range of B24,000 - 240,000 per rai.

2.2 Socio-Economic Conditions

The project starts at the southern edge of Amphoe Tha Sae and ends at the northern part of Amphoe Muang, running through four tambons. It is estimated that the total population living in the project corridor reaches about 174,000 persons. Table 2.2.1 summarizes the population changes of two amphoes of Tha Sae and Muang.

Two Amphoes shows two different characters in population density and trend of population growth. Population density of A. Tha Sae is 32 persons per sq.kilometer in 1989 while that of A. Muang 184 person. In terms of population growth, however, A. Muang had a stagnant growth rate of 0.6% during a period of 1979-89. On the contrary, A. Tha Sae showed a growth rate of 2.6% during the same period, higher than the average growth rate of the Southern Region.

Employment structure of the area is mainly dependent on agriculture, accounting for 63 % of the total employment. Service sector has the second highest percentage of 34 % while manufacturing sector accounts for 3 %.

3.2 Chumphon City Link (NC-1)

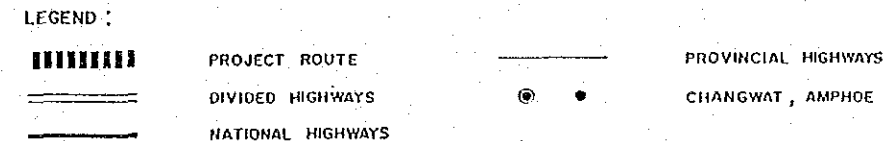
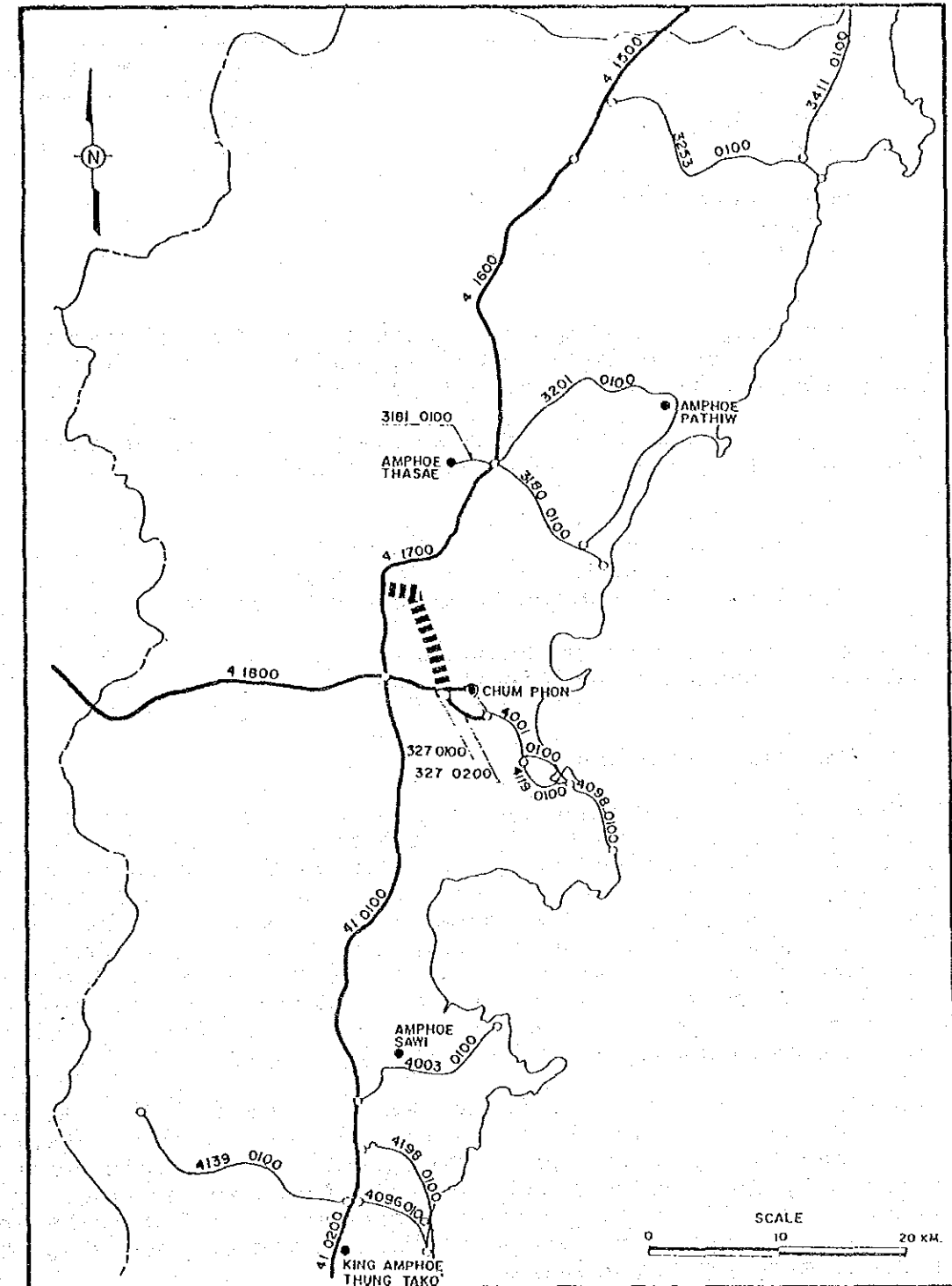


Fig. 2.1.1 CHUMPHON CITY LINK (NC-1)

Table 2.2.1 POPULATION IN NC-1 CORRIDOR

	A. Tha Sae	A. Muang
Area (km ²)	1,531.2	675.1
Total Pop. (1989)	49,600	124,537
Pop. Density (Per/km ²)	32	184
Pop. Growth Rate (% per annum.) 1979-89	2.6	0.6

The total number of shops/factories in the two amphoes was 216 in 1989, total employment amounting to 2,076. Average number of employment is calculated at 9.6 persons.

Future development plans of Chumphon province are outlined in the New Opportunity Establishment Plan, consisting of:

- Port Construction Plan;
- Industrial Estate Construction Plan;
- Telecommunication System Improvement Plan; and
- Major Highway Network Improvement Program.

The Plan aims to develop Chumphon province as a Regional Transport and Communication Center in the region.

2.3 Traffic Conditions

Route 327 presently connects Chumphon city with Route 4. Route 327 is of S3 standard with asphaltic concrete surface of 6 meters which is designed to accommodate 1,000 - 2,000 AADT. The present AADT far surpasses the designed traffic volume. On top of the insufficient traffic capacity of the existing highway, a typhoon attacked Chumphon province in 1989 destroyed the only one highway of Route 327 connecting Chumphon city with the outside world. A new highway is thus proposed to increase the traffic capacity to and from Chumphon city as well as to provide an alternative highway to access Chumphon city even in case of emergency.

The roadside OD survey on Route 327 in December 1990 revealed that 30 % of trucks on the highway carried construction materials and 27 % manufactured products. Construction materials were mostly carried by 10 wheeled trucks and manufactured products by pickup trucks. As to trip purposes of passengers, 53 % of cars were for work and business trip and 42 % for private purpose trip. Tourism purpose trip were negligible.

The proposed highway is expected to accommodate traffics mainly those related to Bangkok direction. The future traffic volume on the proposed highway was estimated at 8,300 AADT in 1996, 13,200 AADT in 2001 and 18,700 AADT in 2006 as shown in Fig. 2.3.1. The estimated AADT in 1996 slightly exceeds the design traffic volume for two lane highway. The study team, however, proposes a two lane highway by taking account of the likely improvement of the existing Route 327 to increase traffic capacity. Phased development for four lane highway toward 2001 would be a better solution from financial point of view.

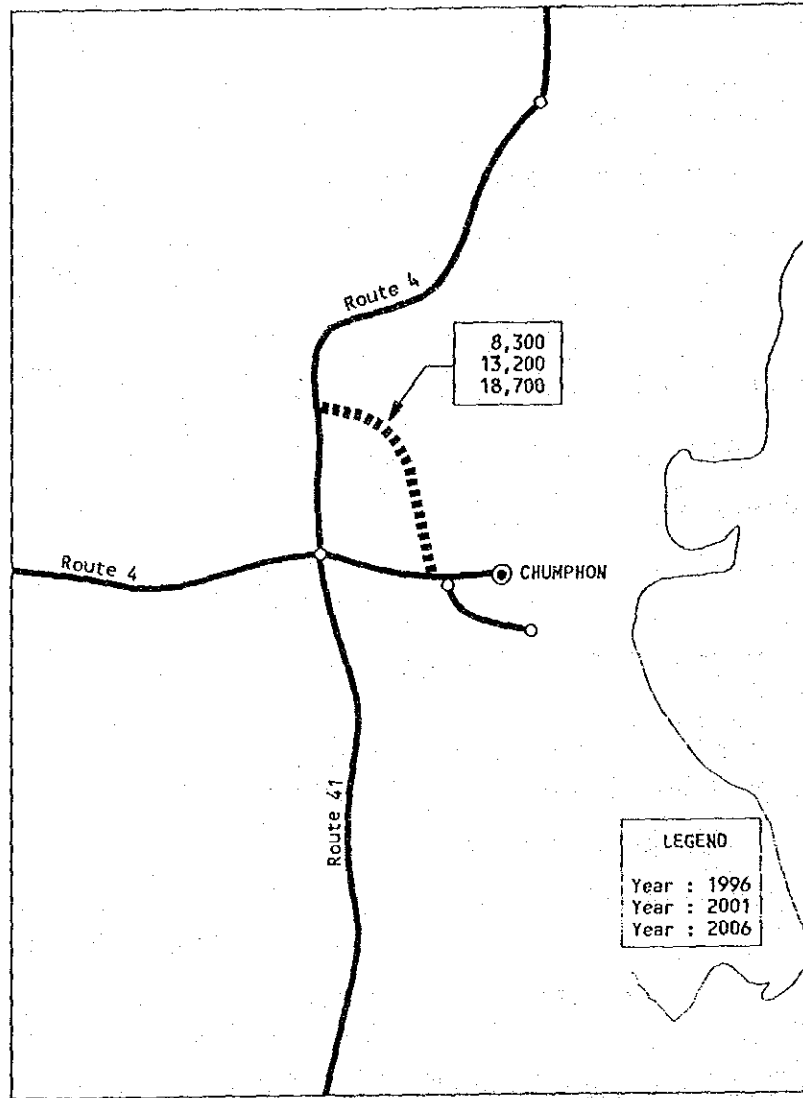
2.4 Project Evaluation

The EIRR was calculated at 69.9 % though it was as high as 73.5 % in the pre-feasibility study. The high EIRR is attributable to the fact that the existing highway capacity of Route 327 (S3 Standard) which is the only highway connecting Chumphon city with the artery of Route 41 is not enough to accommodate the increasing traffic demand in the future.

The EIRR will be lowered to 52.8 % in a sensitivity test of 20 % cost up and 20 % benefit down. In a case of 30 % down of the estimated traffic demand, the EIRR will be lowered to 46.8 %. The results of these tests are still high for this project. Highway capacity between Chumphon city and Route 41, therefore, should be increased at the earliest possible time.

Widening of and additional lane construction along the existing Route 327 would be an alternative with a view to coping with the increasing traffic demand. The proposed "New Highway Construction", however, should firstly be implemented to assure undisrupted transport connection between Chumphon city and Route 41 even in an emergency of flooding or road destruction by natural disaster.

The proposed new highway link lies in a flat land mostly of paddy field, grass land and coconut field. No significant effects on environment would be envisaged. Due to the traffic diversion of heavy trucks in particular from the existing Route 327 to this new highway, it is likely that this project would contribute to reduce traffic accident on Route 327.



Note; Average of ADTs on Route 4 in Chumphon District is 5,100 in 1990.

Fig. 2.3.1 TRAFFIC VOLUME ON NC-1