Figure 9.5.1 Road Network in the WSB under the Jurisdiction of DOH

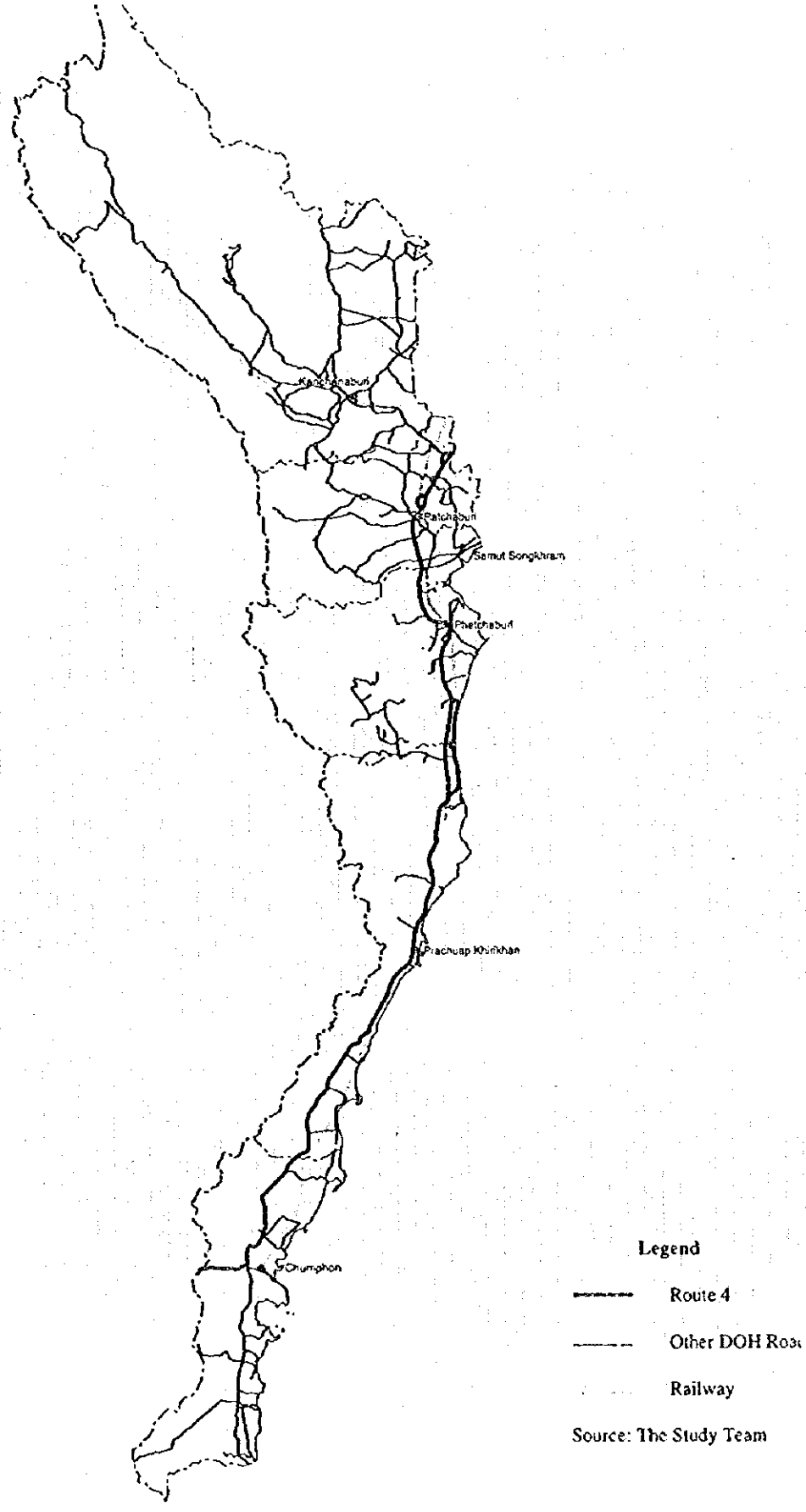
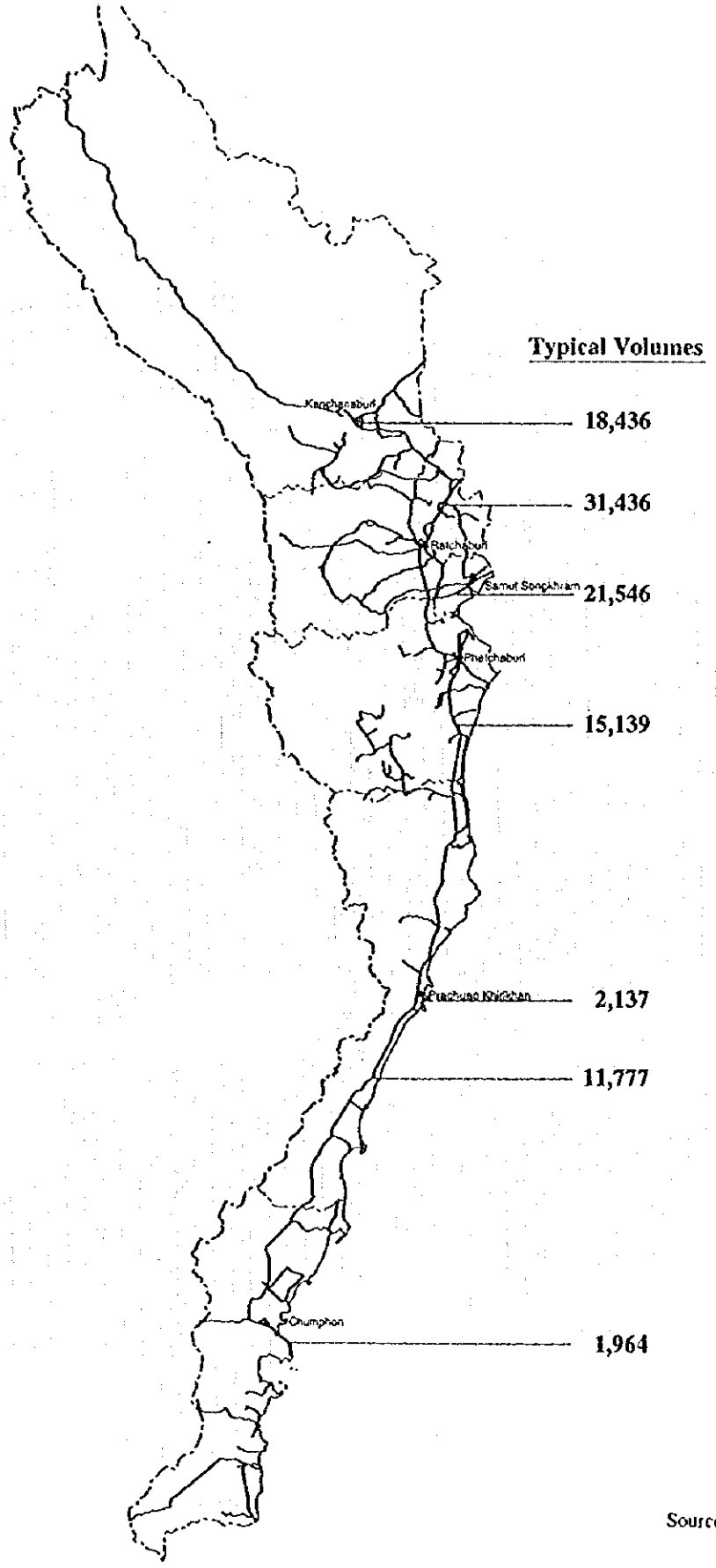
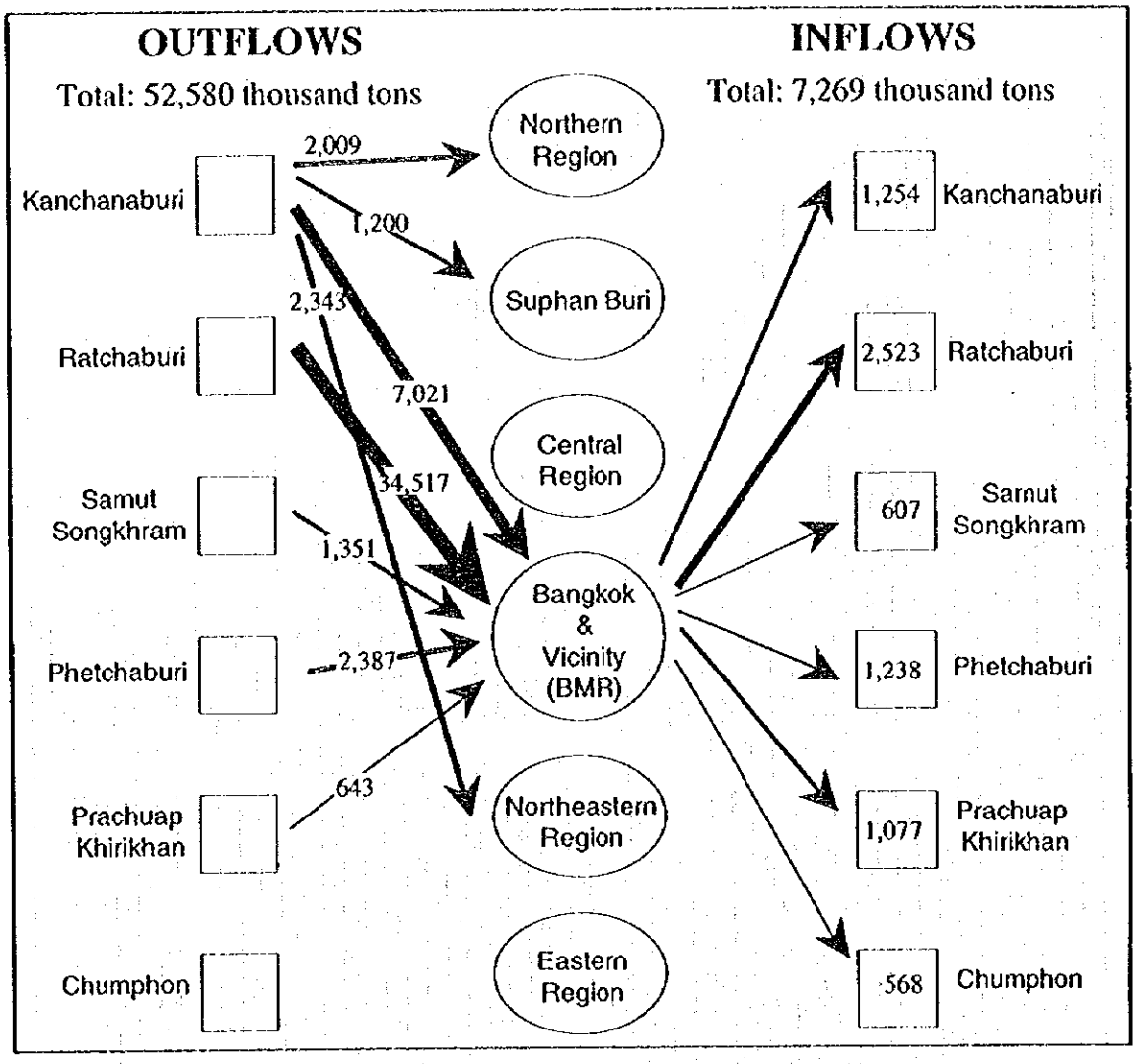


Figure 9.5.2 Schematic Map of Traffic in the WSB (1994 MVPD/AADT)



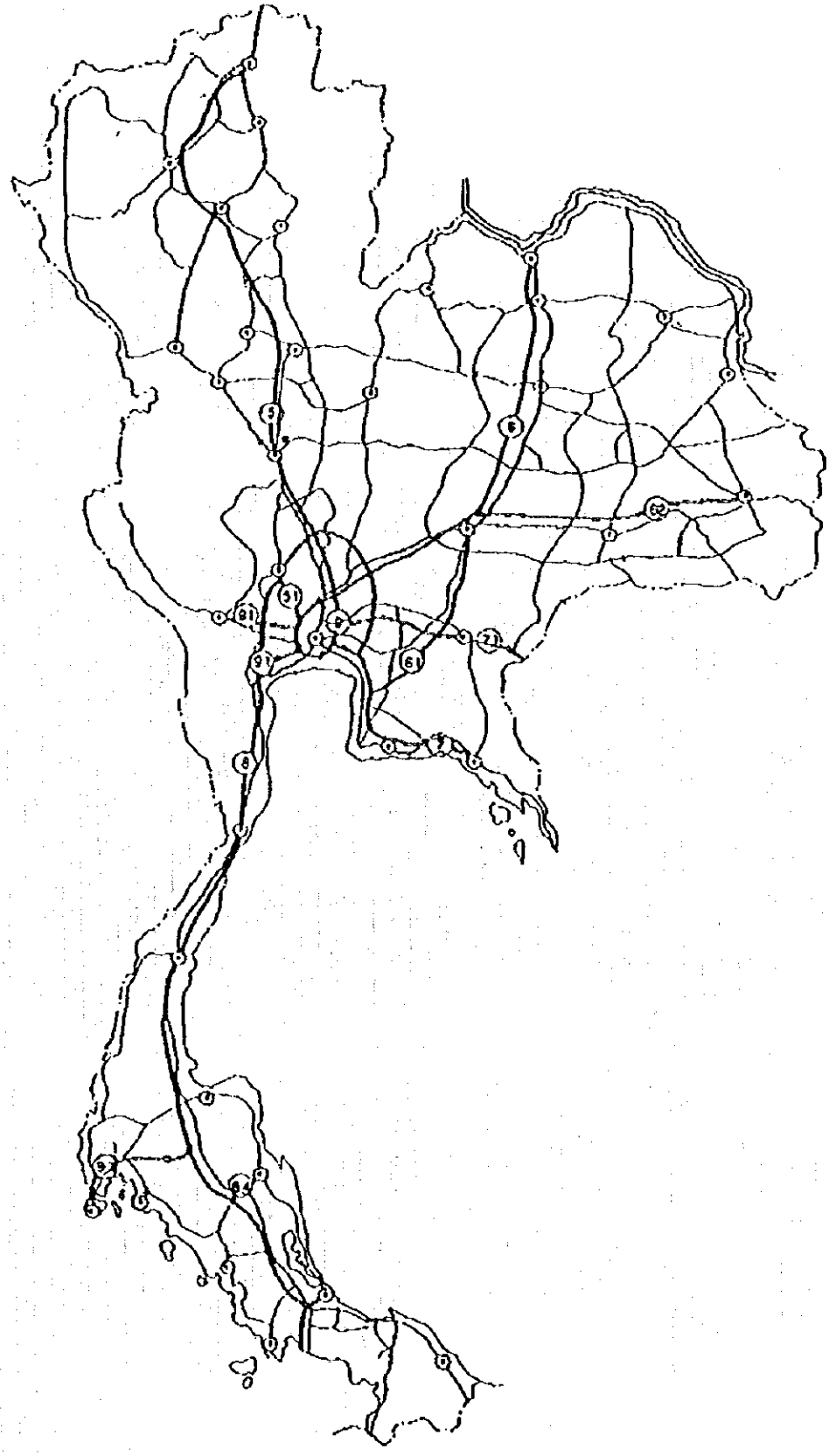
Source: The Study Team

Figure 9.5.3 Major Commodity Inflows and Outflows to/from the Western Seaboard (Schematic Showing Movements of Greater Than 0.5 Million Tons Per Year Only)



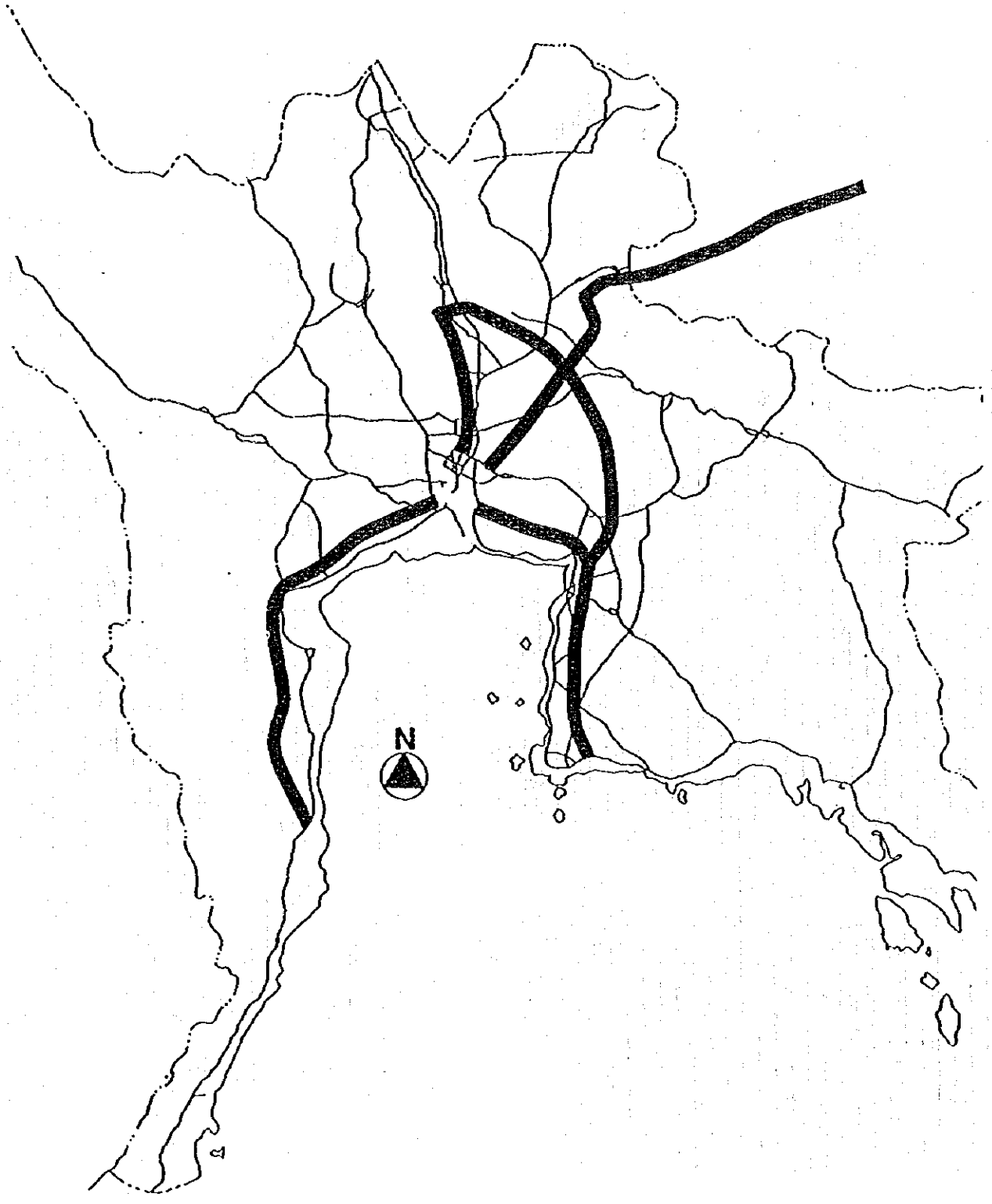
Note: Only linkages of 500,000 tons/year or more are shown.
Source: Annual Survey (Land Transport Department-MOTC)

Figure 9.5.4 DOH Recommended Motorway Network



Source: Department of Highways

Figure 9.5.5 ETA 4th Stage Intercity Alignments



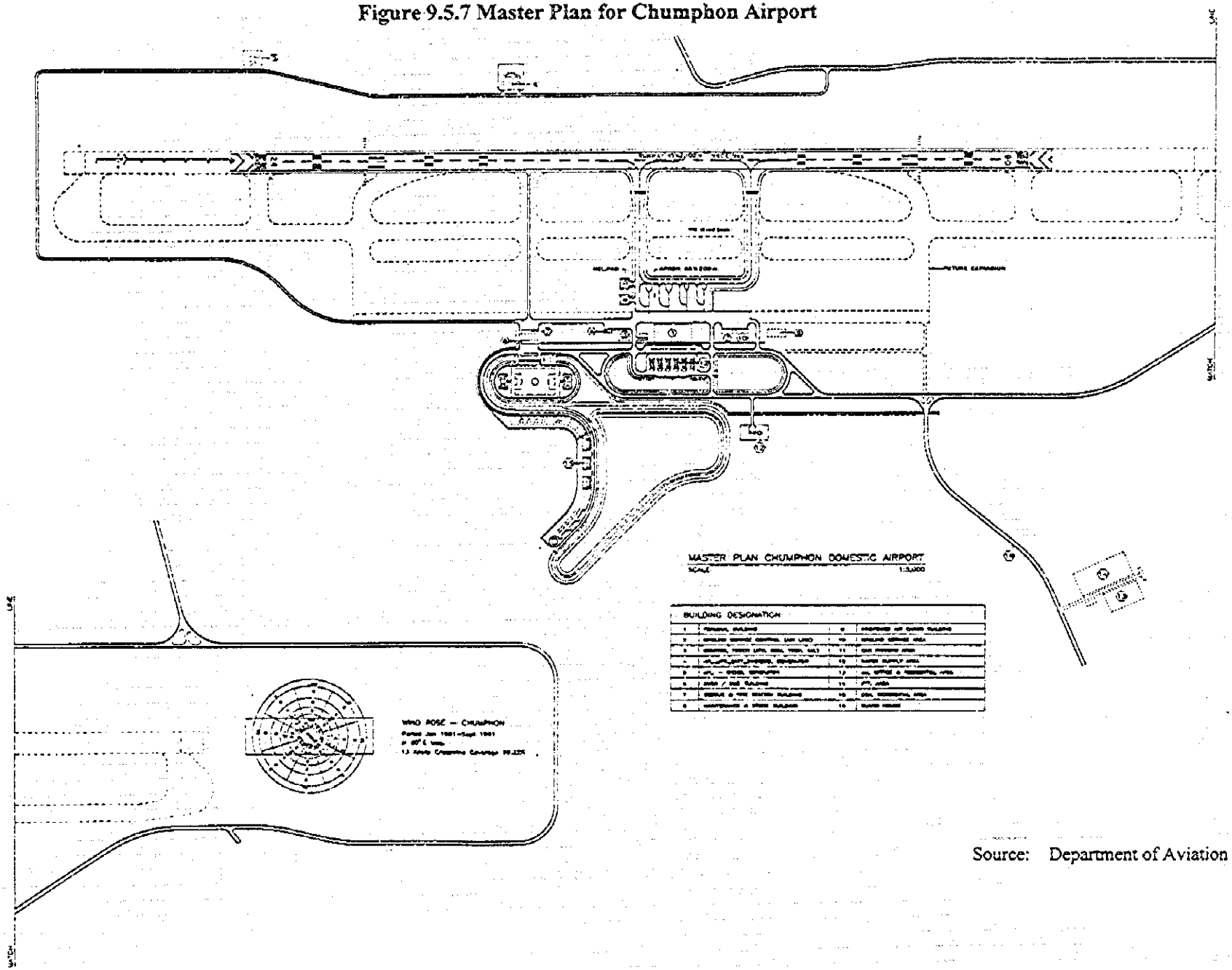
Source: Expressway and Rapid Transit Authority

Figure 9.5.6 Basic Technical and Operational Data of the Southern Line, Bangkok - Chumphon

Station	Bangkok	Nong Pladuk Junction	Ratchaburi	Hua Hin	Prachuap Khirikhan	Chumphon
Distance (km)	Okm	80 km	117 km	229 km	318 km	485 km
	Okm 25 50 75	100 125 150 175 200	225 250 275 300	325 350 375 400	425 450 475	
Max speed (km/h) Passenger Trains	105	105			100	
Freight Trains						
Average Speed (km/h)	52	65		71	58	
Axle load (tons/axle)	15					
Crossing Length (m)	500					
Track Capacity (2-way)	72	72	56	50	42	
Number of Trains	56	48	44	38	38	
(2-way) Passenger	42	32	30	26	26	
Freight	14	14	14	12	12	
Signalling System	Tokenless					
Crossing Stations	16	6	15	11	19	
Operational Gradient (%) For Down Trains	1.0					
Up Trains	1.4					
Minimum Curvature (m)	400					
Rail (kg/m)	35/40					
Sleeper Type/Density	Wood, Two block concrete, 1540					
Rail Fastening System	Rigid, elastic					
Ballast Depth	200-250					
Bridges No./Length (m)	602,8,545 m					
Distance	485					
Passing Tons	7					
Passenger Time	7 35'					

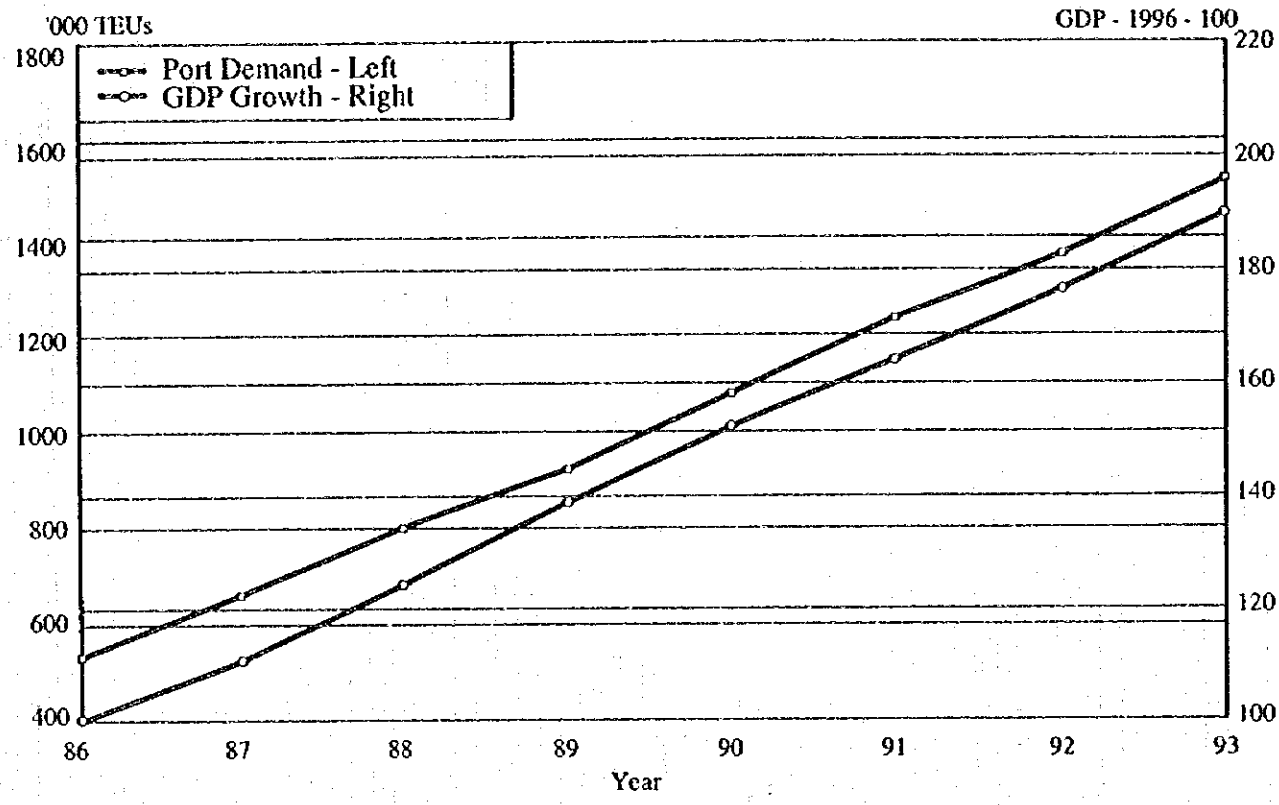
Source : Economic and Social Commission for Asia and the Pacific

Figure 9.5.7 Master Plan for Chumphon Airport



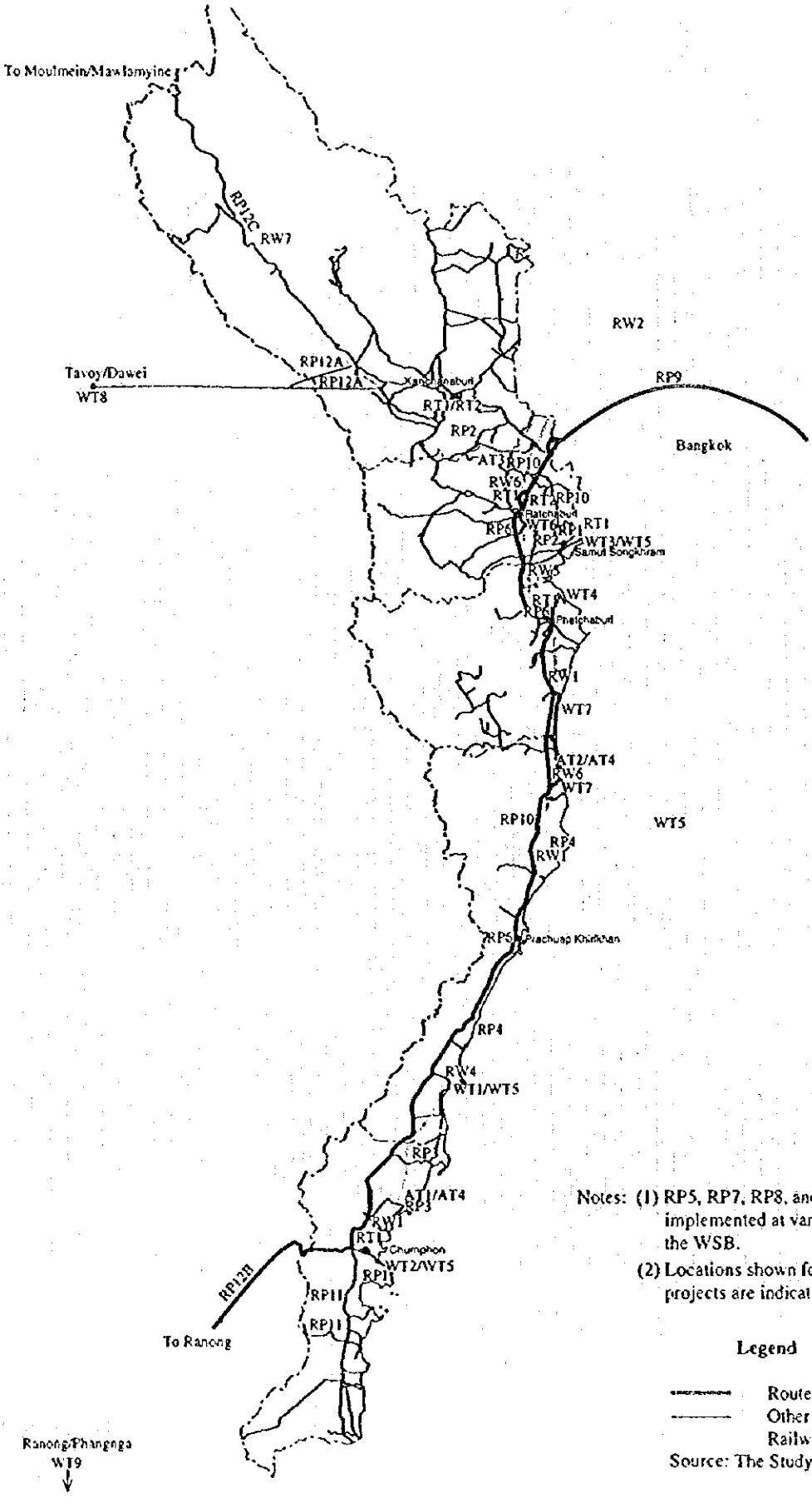
Source: Department of Aviation

Figure 9.5.8 Container Traffic and GDP Growth in Thailand, 1986 - 93



Source: The Study Team

Figure 9.5.9 Locations of All Transport Projects



Notes: (1) RP5, RP7, RP8, and RT3 woul implemented at various locatio the WSB.

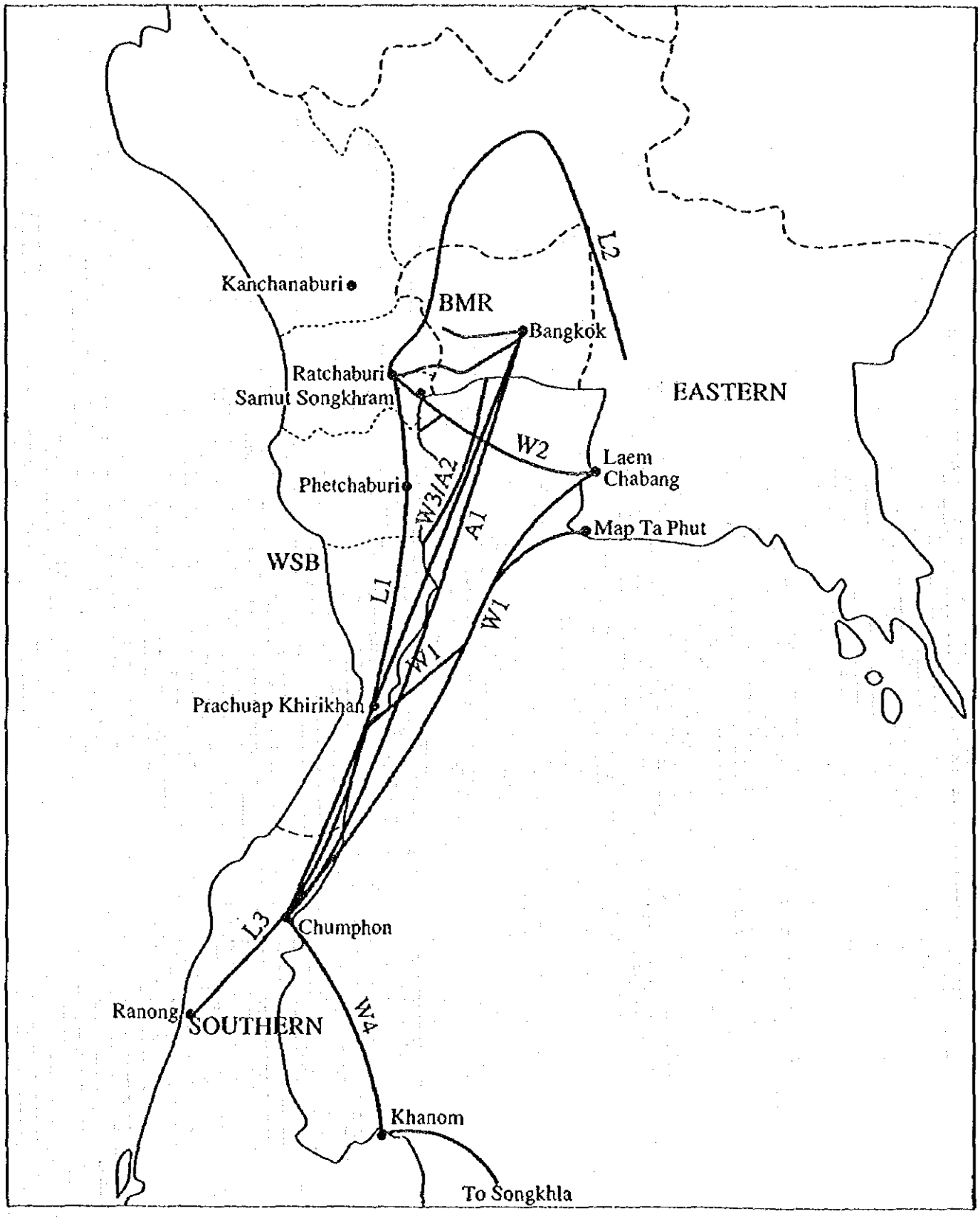
(2) Locations shown for certain otl projects are indicative only.

Legend

Route 4
Other DOH Road
Railway

Source: The Study Team

Figure 9.5.10 Interregional Transport Corridors (Schematic)



Source: The Study Team

Figure 9.5.11 Subregional/Global Transport Corridors

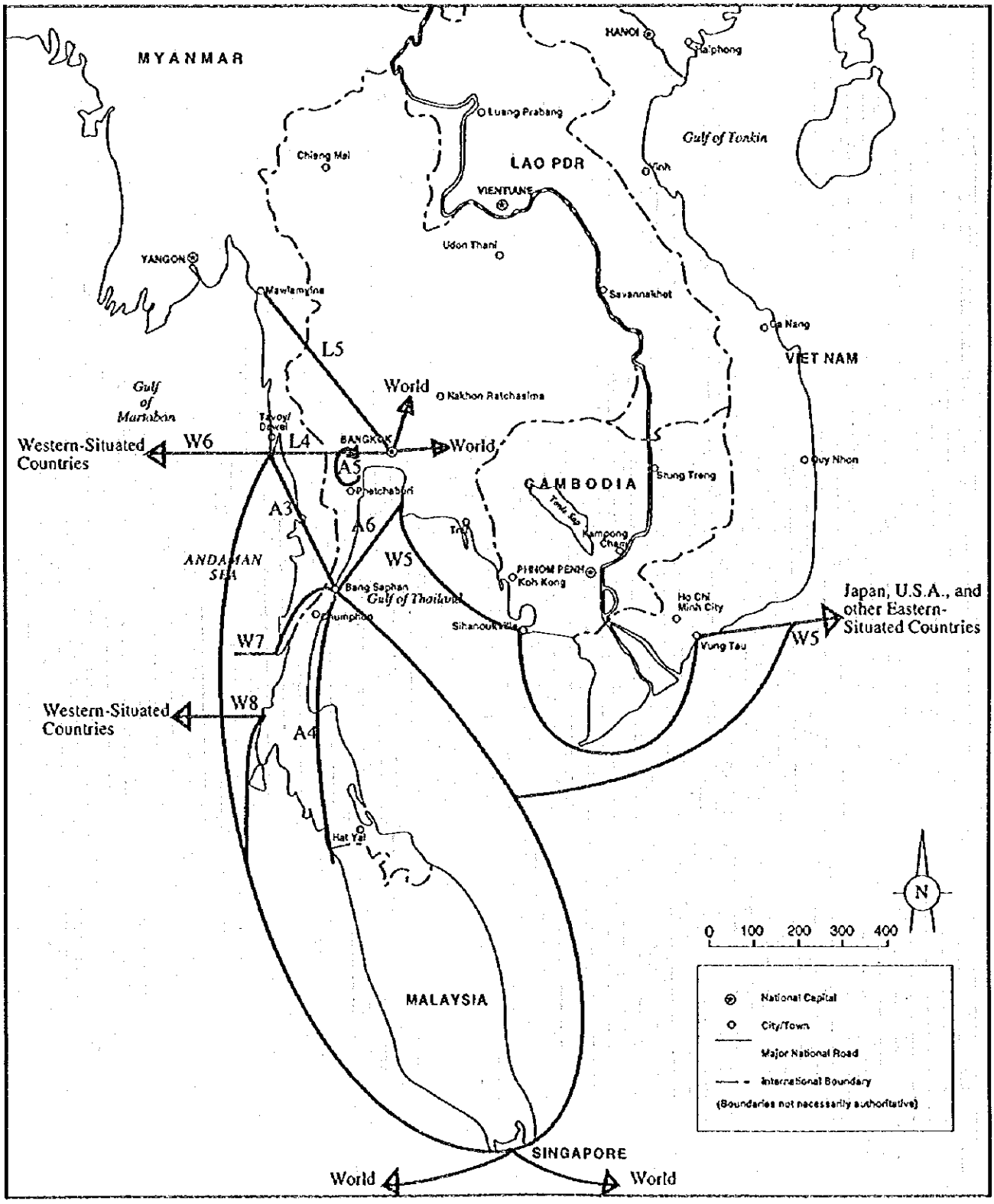
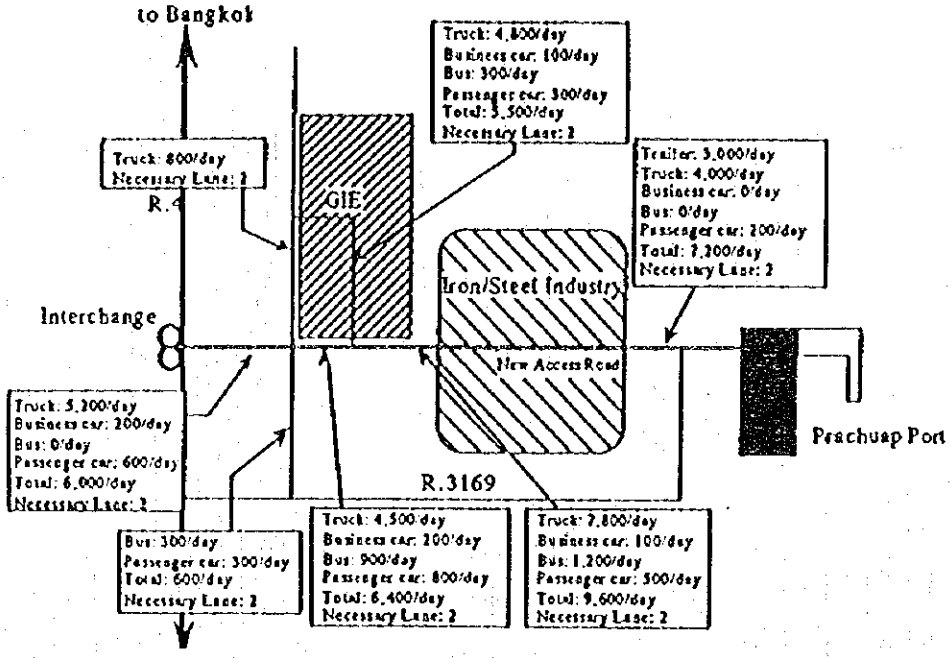
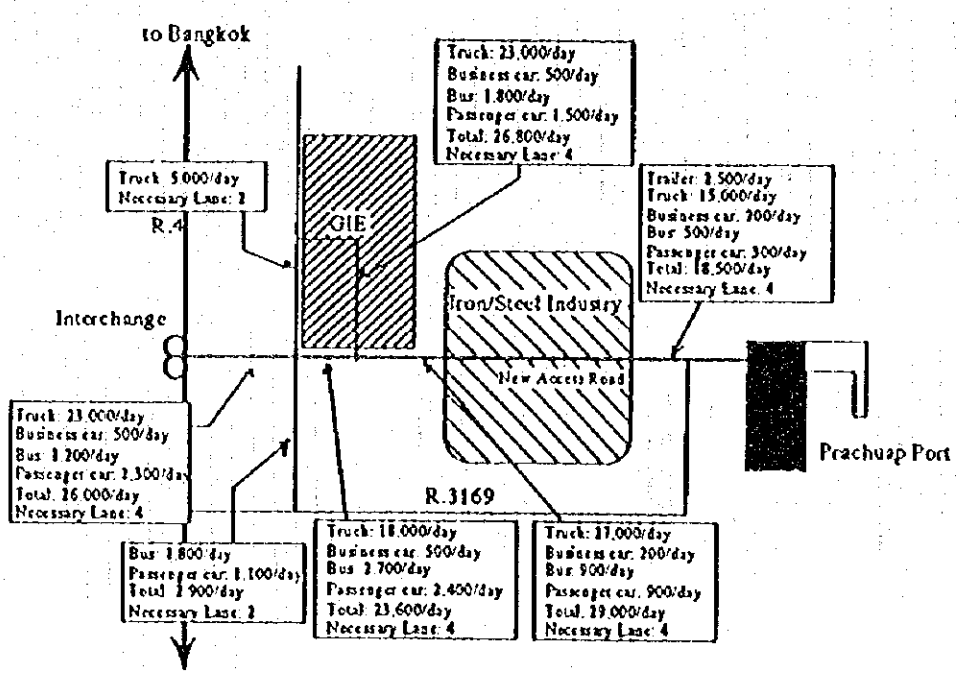


Figure 9.5.12 Schematic Drawing of Bang Saphan Industrial Complex (2001 and 2011)



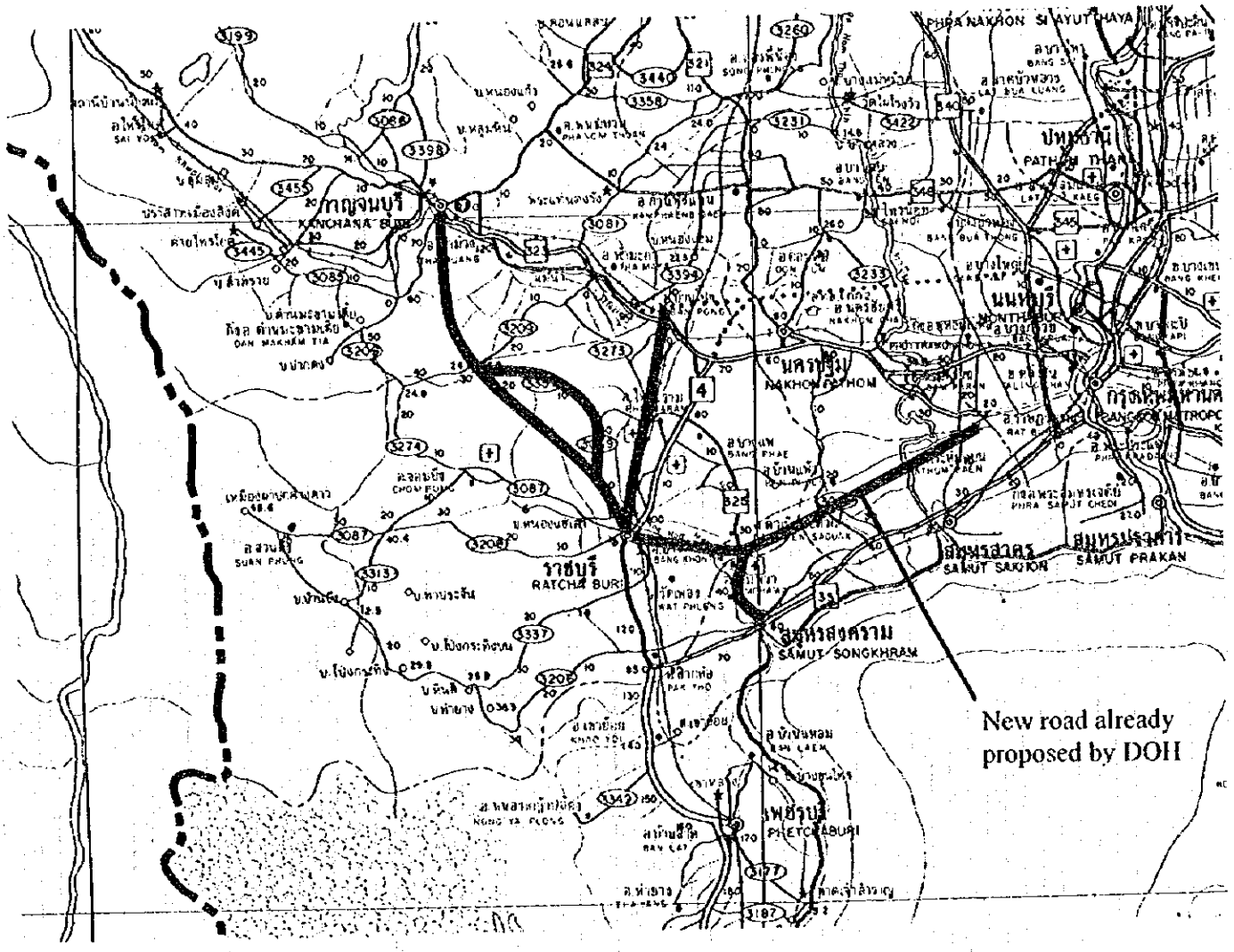
Road Traffic Projection (PCU, 2001)



Road Projection (PCU, 2011)

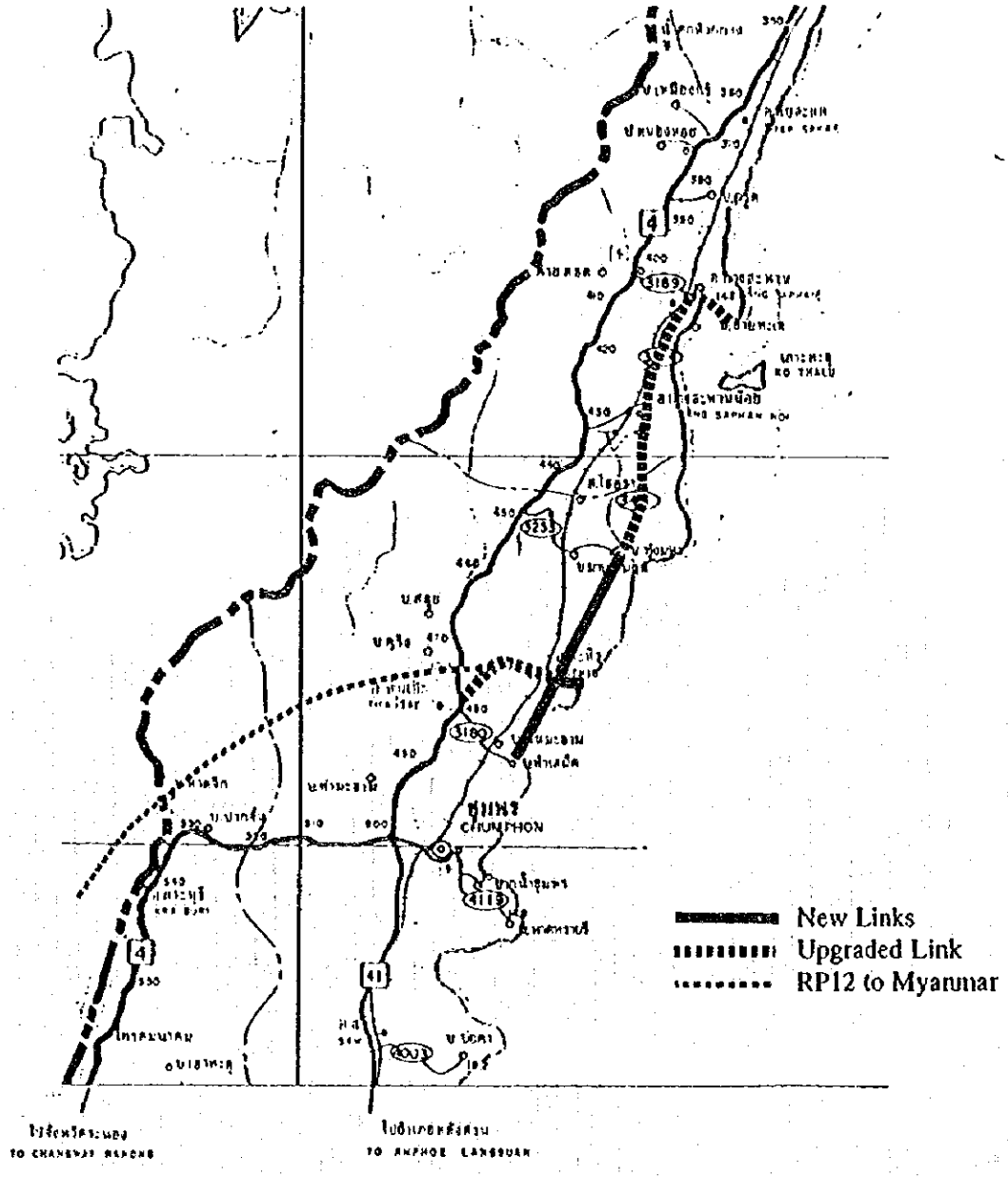
Source: JICA and International Estate Authority of Thailand, *Feasibility Study on Bang Saphan Industrial Estate In the Kingdom of Thailand*, Final Report, January 1997, p. 87

Figure 9.5.13 RP2-Links Between Ratchaburi and Other Provincial Capitals (i.e., Kanchanaburi and Samut Songkhram)



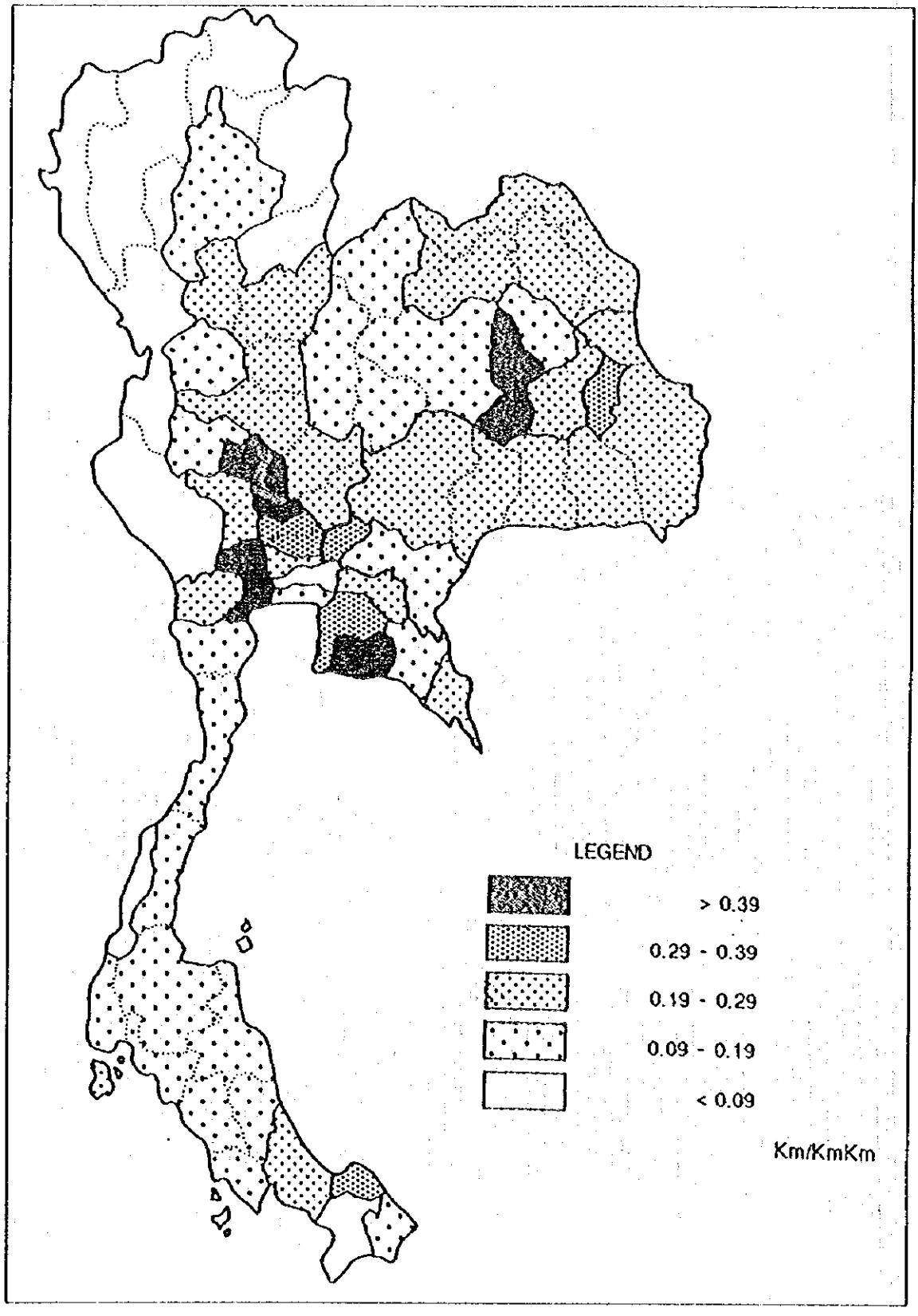
Source: The Study Team and Department of Highways (Base Map)

Figure 9.5.14 RP3-Pathiu-Route 4 and Pathiu-Bang Saphan Links



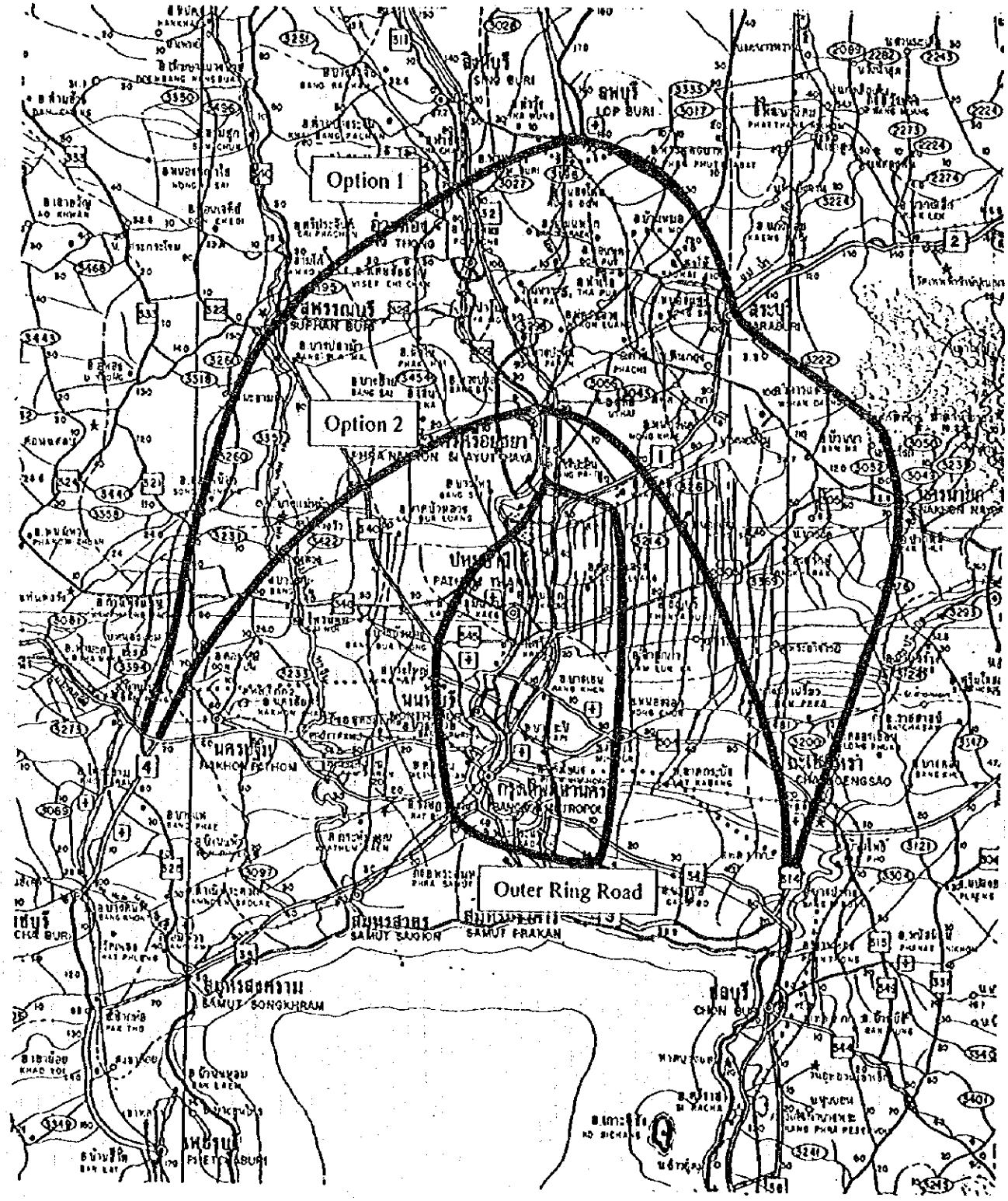
Source: The Study Team and Department of Highways (Base Map)

Figure 9.5.15 Latest Available Nationwide Comprehensive Rural Road Inventory Analysis



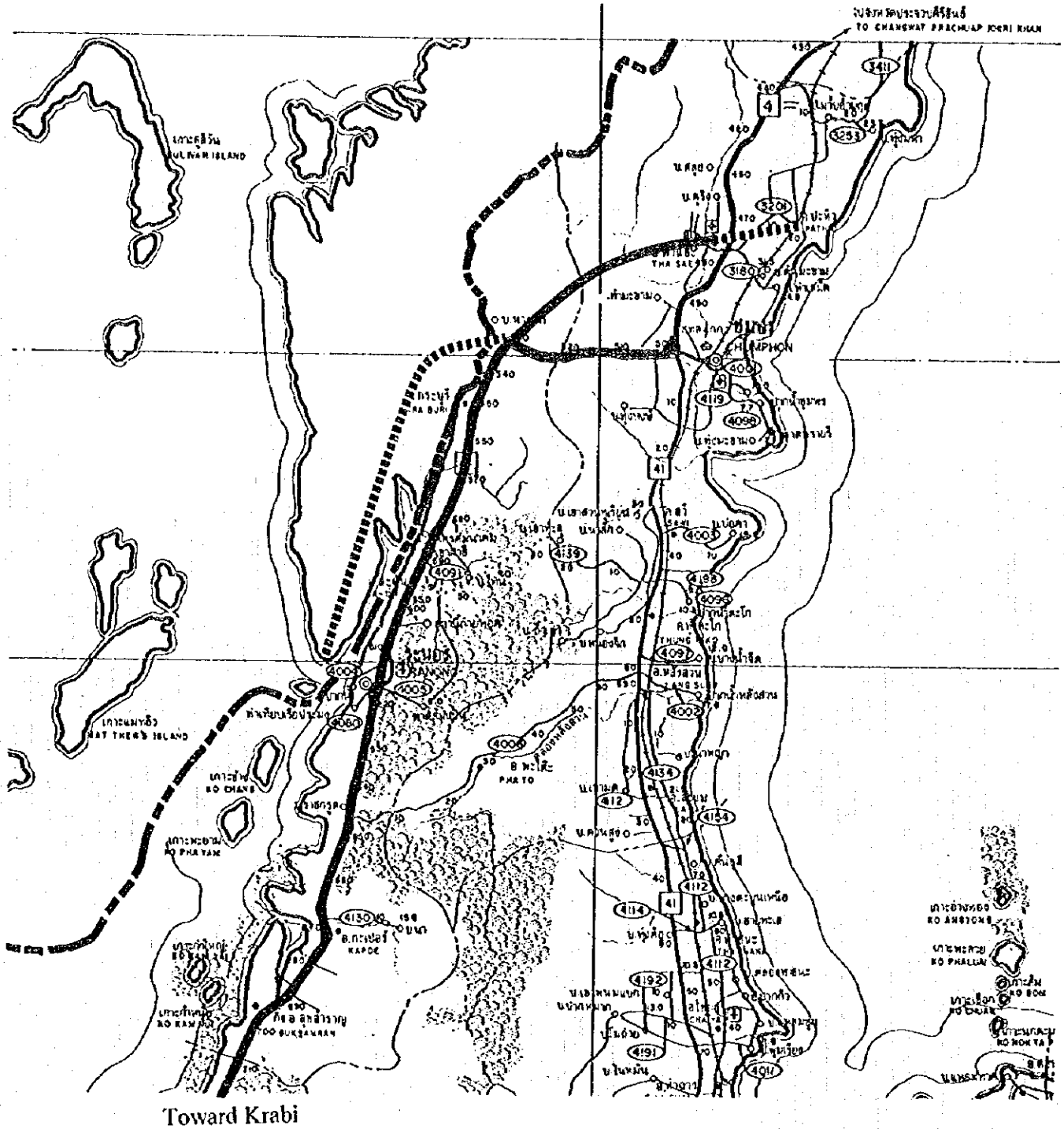
Source: Road Inventory Analysis, DOH, 1981

Figure 9.5.16 Options for an Outer-Outer Orbital Rute (RP9)



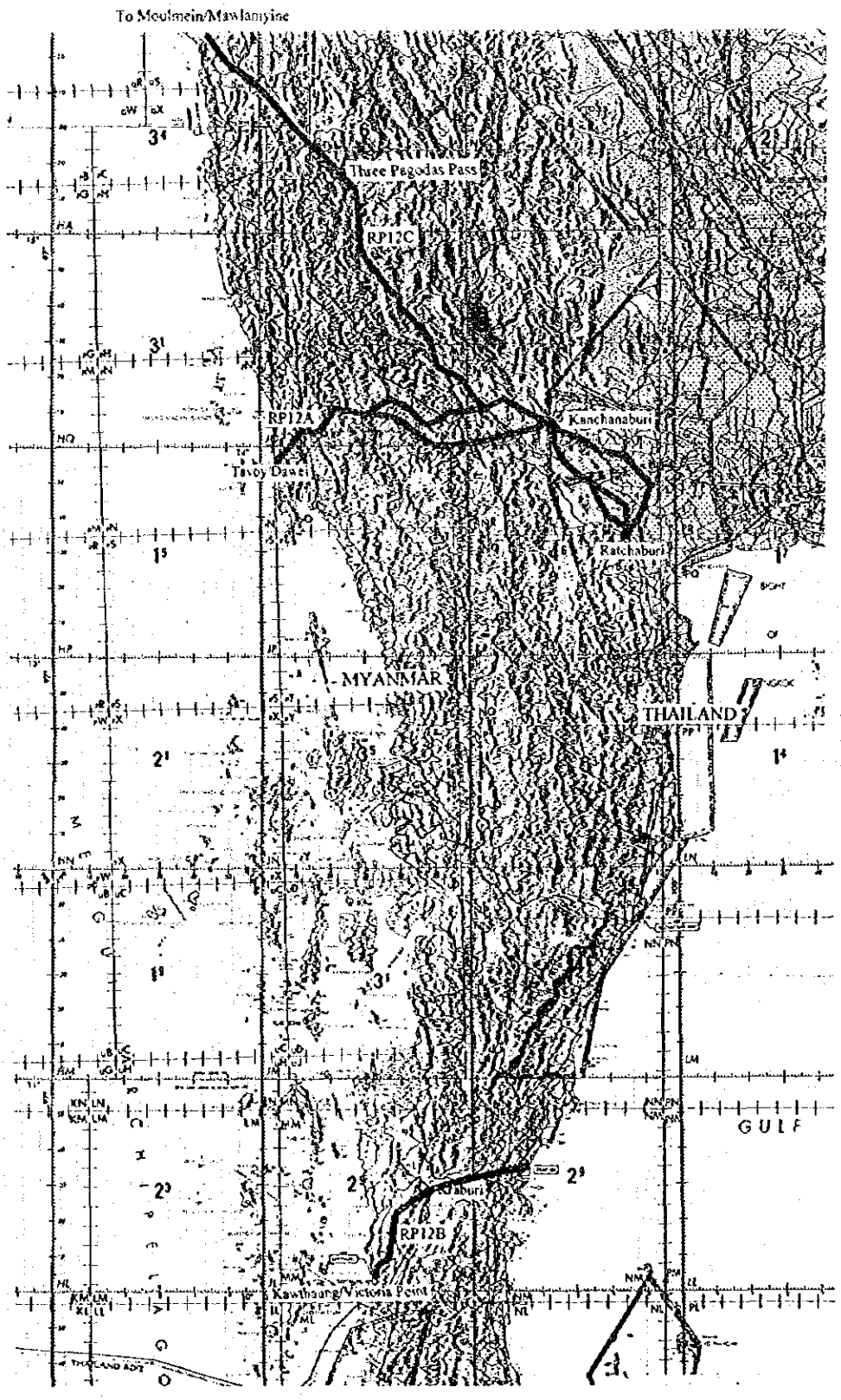
Source: The Study Team and Department of Highways (Base Map)

Figure 9.5.17 RP11-Chumphon (Bang Saphan)-Ranong Links



Source: The Study Team and Department of Highways (Base Map)

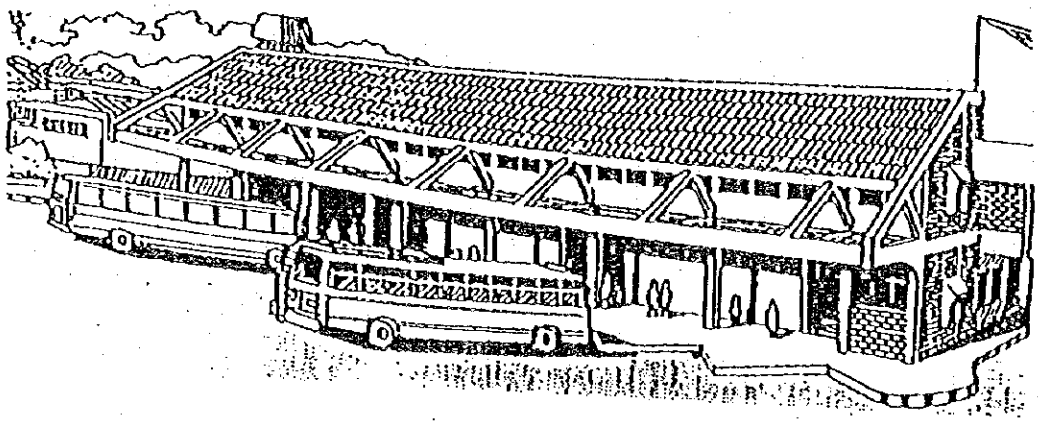
Figure 9.5.18 RP12 - Subregional Links with Myanmar (Alternative Alignments)



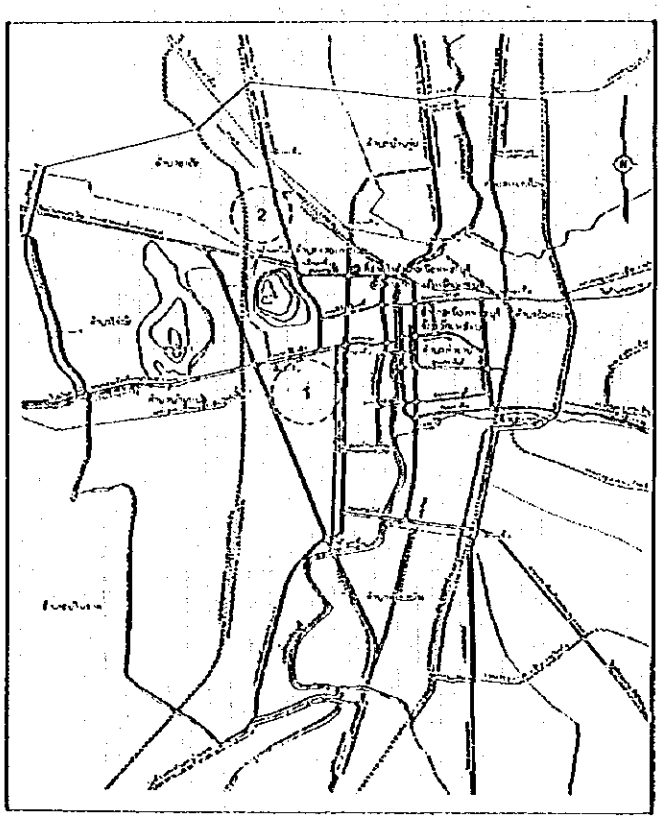
Source: The Study Team and base map courtesy of the United States Defence Mapping Agency and National Oceanic and Atmospheric Administration

Figure 9.5.19 Bus Terminal Plans for Petchaburi

Perspective of a Suitable Bus Terminal



Possible Locations in Petchaburi



Source: Pak Pok & Kneebone Pty. Ltd. and Asian Engineering Consultants Crop. Ltd., *Study of Inter-City and Rural Bus Transport, Phase II, Final Report*, January 1991, p. 233 and Land Transport Department

Figure 9.5.20 Water Depth Chart of the WSB

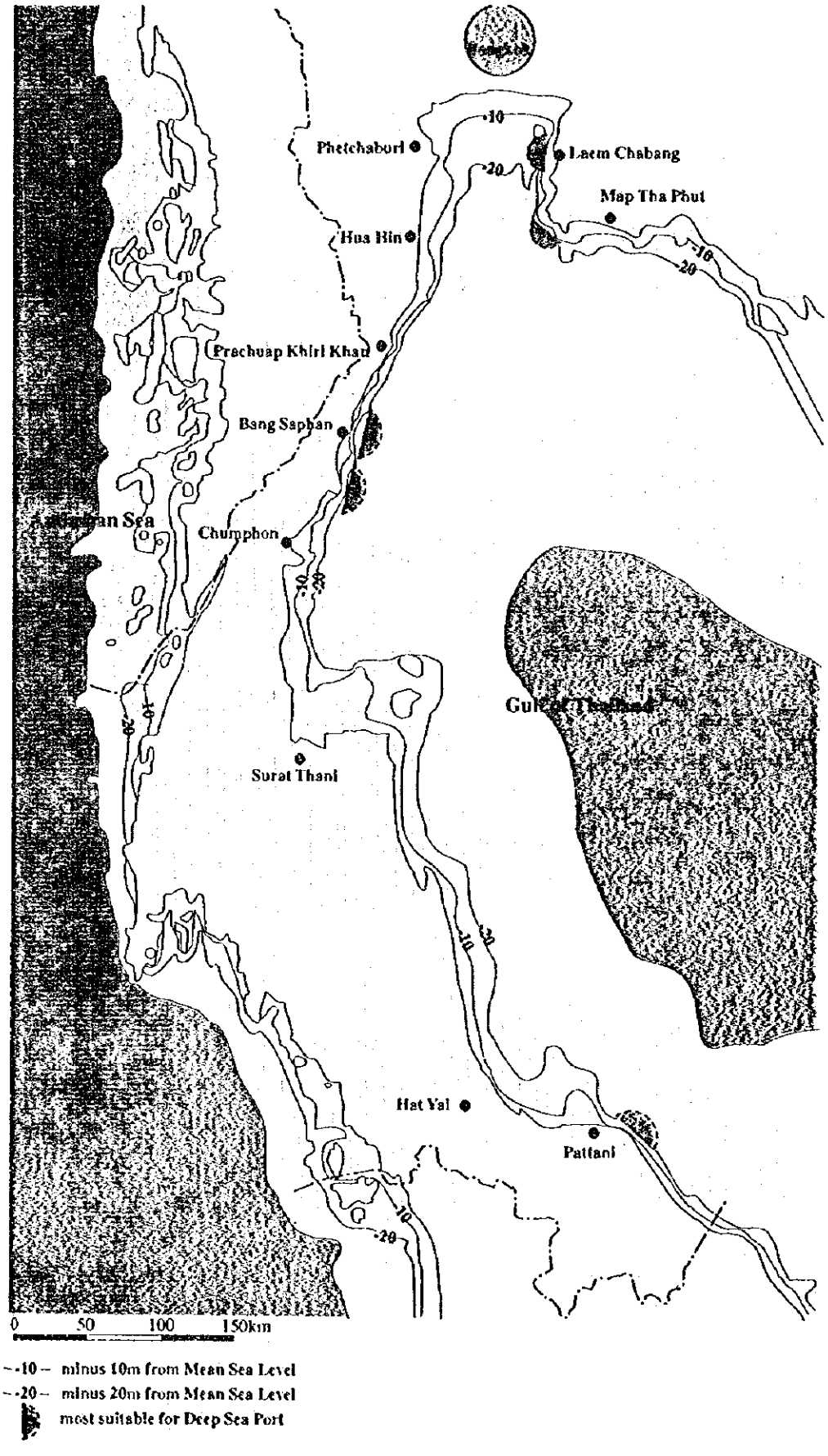


Figure 9.5.20 Water Depth Chart of the WSB

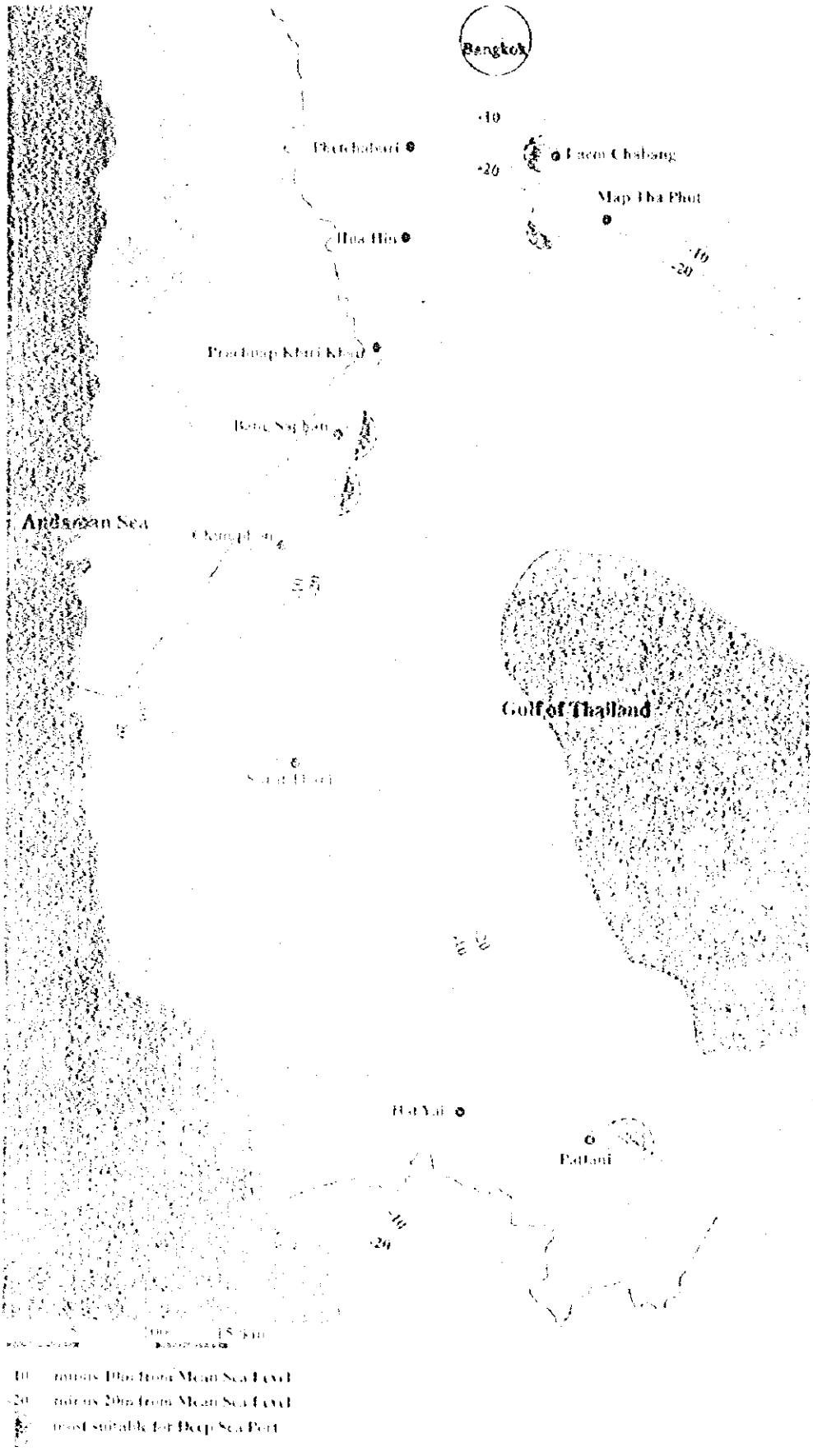
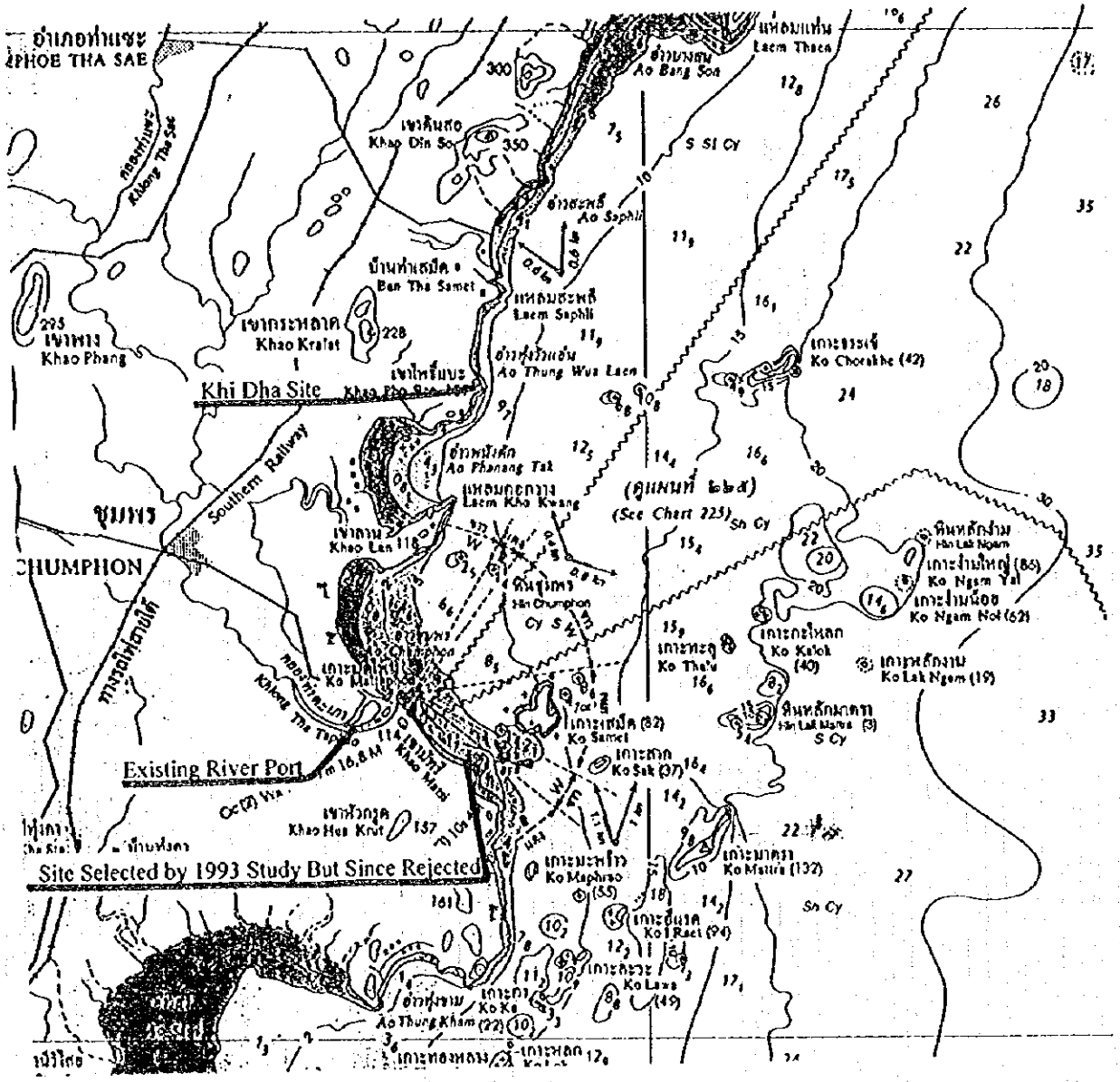
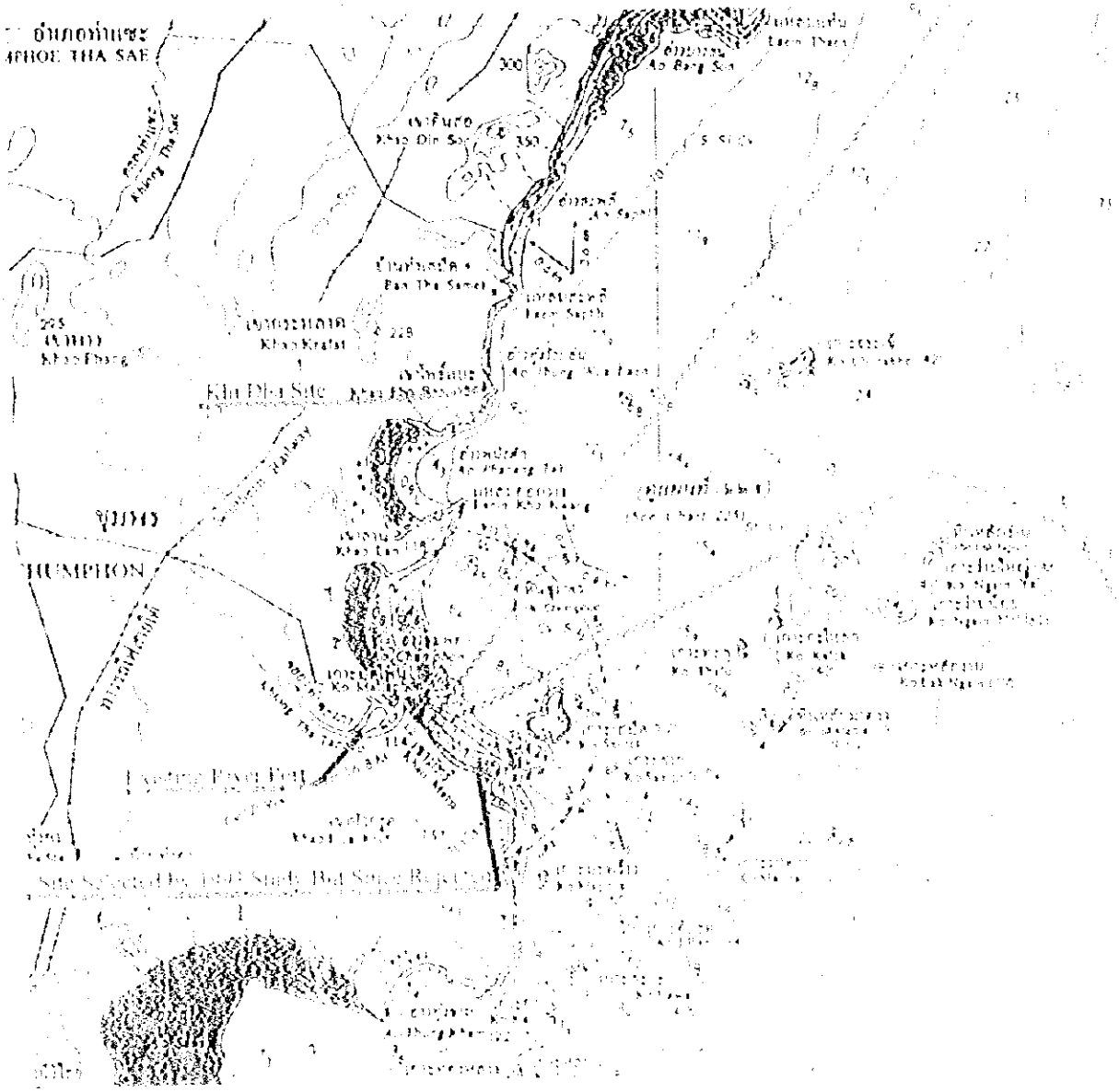


Figure 9.5.21 Water Depth Chart for the Chumphon Area



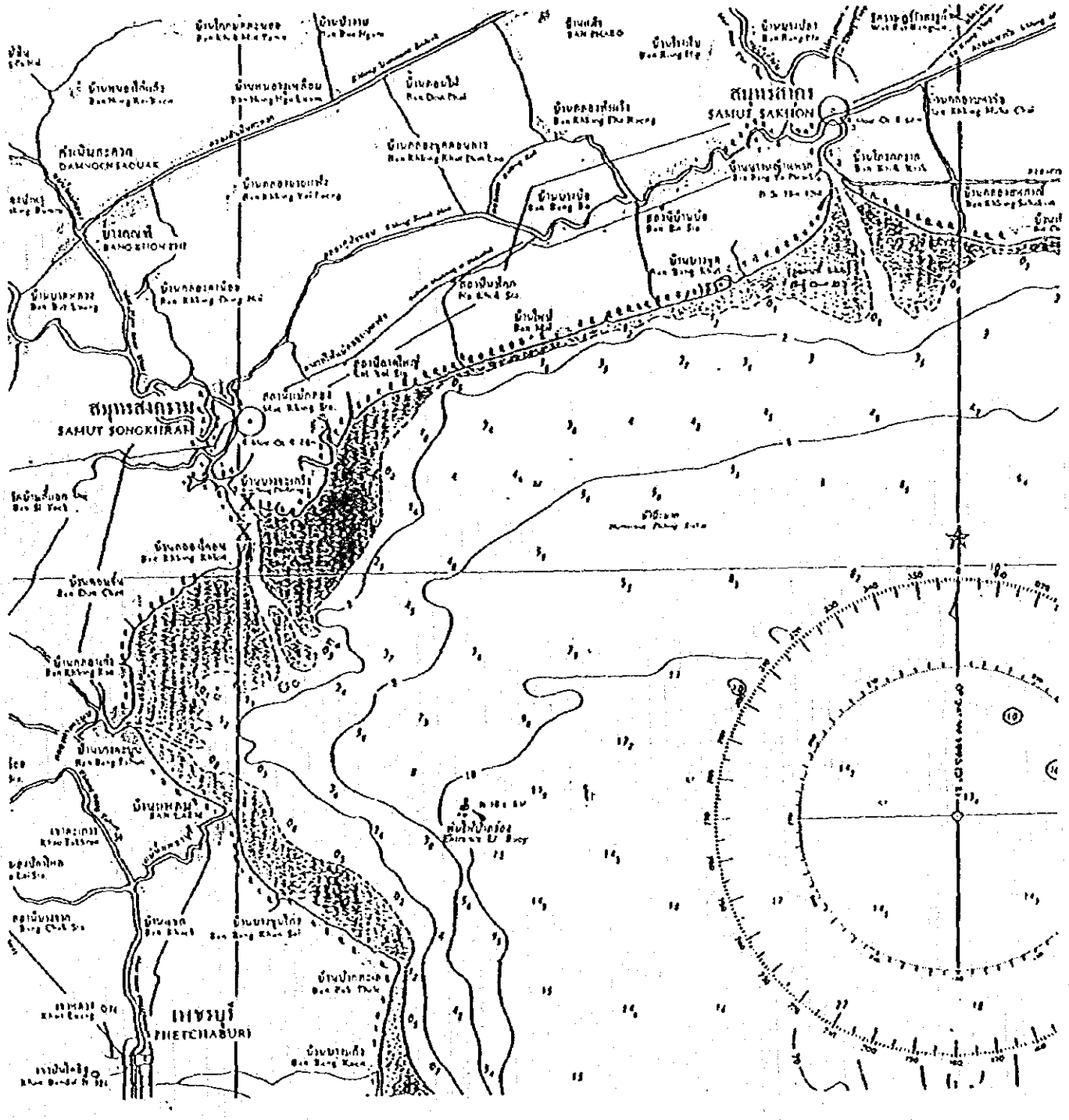
Source: The Study Team and the Royal Thai Navy (Base Map)

Figure 9.5.21 Water Depth Chart for the Chumphon Area



Source The Study Team and the Royal Thai Navy (Base Map)

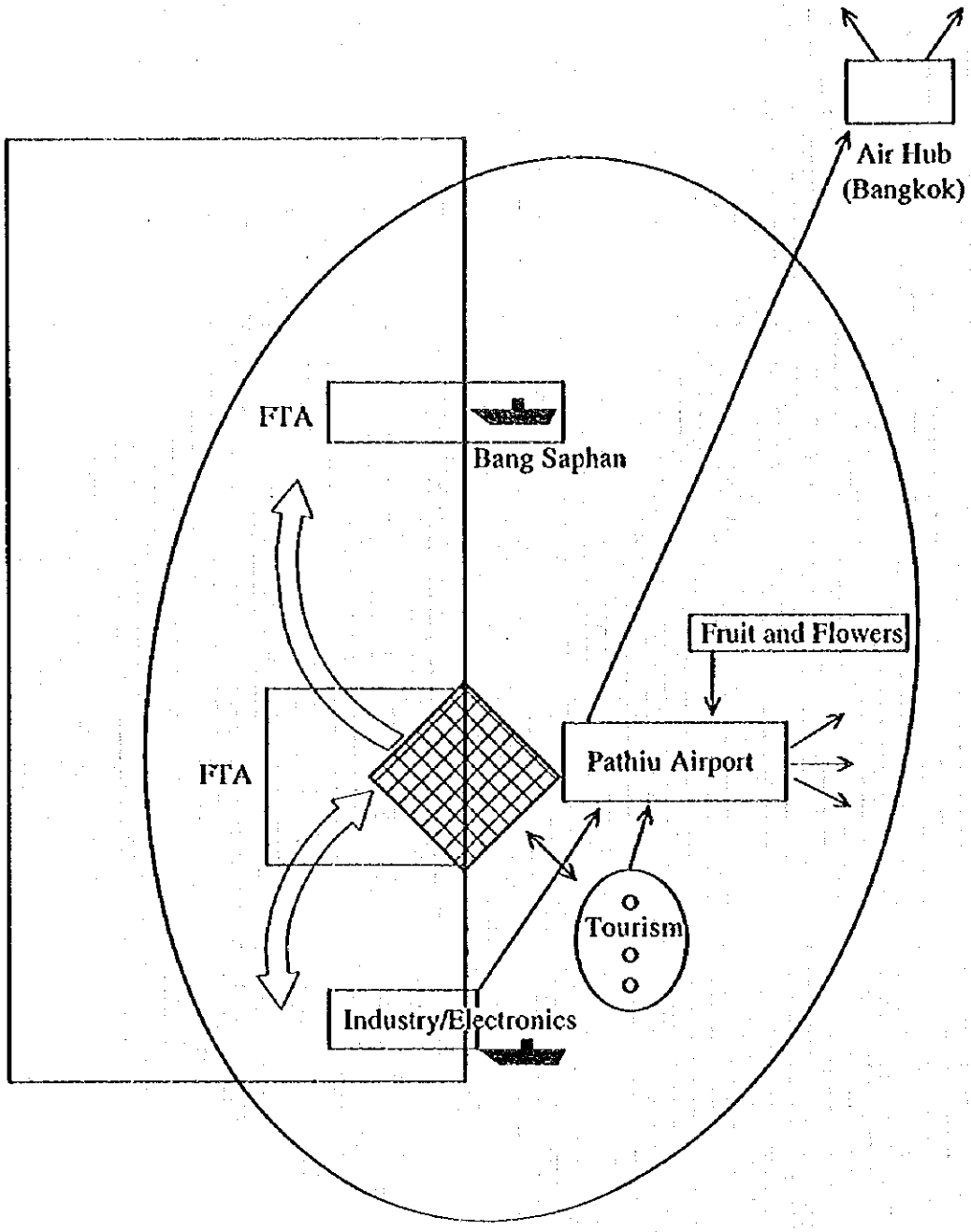
Figure 9.5.22 Water Depth Chart for Samut Songkhram, Ban Leam and Samut Sakhon



X denotes possible port sites

Source: Royal Thai Navy, Hydrographic Department

Figure 9.5.23 Conceptual Plan of the Market for the New Chumphon (Pathiu) Airport



Source: The Study Team

APPENDIX I To CHAPTER 5

BRIEF PROJECT PROFILES

Water Transport Projects

Railway Projects

Project No. RP1

1.	PROJECT TITLE	Roads to Support Specific Industrial Developments	
2.	LOCATION	In and near industrial estates at Samut Songkram, Bang Saphan (Prachuap Khirikhan province), and Chumphon	
3.	AGENCIES	Department of Highways and Industrial Estate Authority of Thailand	
4.	OBJECTIVES	(1)	To facilitate industrial development at designated bases in the WSB
		(2)	To provide adequate road transport capacity, so as to minimize congestion impacts on local communities
5.	PHASING	Phase I :	Access road for Bang Saphan industrial estate urgently required
		Phase II :	Access/Circular road for Samut Songkhram FTA

6. DESCRIPTION

A vitally important project at the intraregional level is to construct the necessary road facilities to support planned industrial developments, e.g., at Bang Saphan, Samut Songkram, and Chumphon. The level of detail to which this project can be specified necessarily reflects the stage of formulation of the respective industrial estate plans. In the case of the Bang Saphan industrial complex (see Figure 9.5.12), the industrial estate in the WSB at the most advanced stage, the JICA-assisted *Feasibility Study on Bang Saphan Industrial Estate* has concluded that a new four-lane access road plus interchange connecting Route 4 with the iron/steel industry complex and Prachuap Port should urgently be developed to serve the increasing volumes of heavy traffic; improvement and upgrading of Route 3169 between Route 4 and Bang Saphan town is already in the advanced planning stage by DOH. Improvement of other roads in the vicinity, administered by the province, is also recommended. Similar assessments of other planned industrial developments in the WSB (e.g., at Samut Songkram[1]) should be prepared based on development details (e.g., estate area, location, land use plan).

7.	RELATION WITH OTHER PROJECTS	WT1 (Prachuap Port Expansion) UD2 (Bang Saphan Industrial City) ID3 (Industrial Core and Satellite)	
8.	COST (APPROX.)	Phase I :	(Route 4-Bang Saphan):- US$47 million
		Phase II :	(Access/Circular road for Samut Songkhram FTA):- US$68 million

[1]It is expected that a circular road linked to Route 35 would be required in the abandoned shrimp fields in Samut Songkram as part of the industrial park plan.

Project No. RP2

1.	PROJECT TITLE	Links Between Ratchaburi and Other Provincial Capitals (i.e., Kanchanaburi, Samut Songkram)
2.	LOCATION	Between Ratchaburi and Kanchanaburi and between Ratchaburi and Samut Songkram
3.	AGENCIES	Department of Highways
4.	OBJECTIVES	(1) To provide more direct links between certain provincial capitals (2) To reduce transport costs in the Project influence area and increase the efficiency of movement of goods and passengers
5.	PHASING	Phase I : Ratchaburi-Samut Songkhram (Study) Phase II : Ratchaburi-Samut Songkhram (Construction) Ratchaburi-Kanchanaburi (Study) Phase III : Ratchaburi-Samut Songkhram (Construction)

6. DESCRIPTION

The project would address the indirect connection between Kanchanaburi and Ratchaburi and the indirect connection between Samut Songkram and Ratchaburi. Further, the indirect connection between Kanchanaburi and Samut Songkram would be addressed by dealing with the indirect connection between Ratchaburi and Samut Songkram.[1] Specifically, the link between Ratchaburi and Kanchanaburi could be upgraded by (i) utilizing the planned Ban Pong-Cha Am motorway and widening the Ban Pong-Kanchanaburi section of Route 323 to a dual three-lane facility, as recommended for 2001-2006 by the *Long-Term Strategic Study of Highway Planning and Investment*, (ii) constructing a new direct alignment, or (iii) improving Routes 3089 and 3357; the link between Samut Songkram and Ratchaburi may be improved through extending an already proposed new road project linking a point on Route 3091 about 12 km north of Samut Sakhon (Thumbaen) with Route 325 and by improving Route 325 north of Samut Songkhram.

7.	RELATION WITH OTHER PROJECTS	RP12 (Subregional linkages with Myanmar) TR1 (Free Trade Area/Samut Songkhuam) UD1 (WSB Urban Planning)
8.	COST (APPROX.)	Phase I : Ratchaburi-Samut Songkhram (Study): US$0.5 million Phase II : Ratchaburi-Samut Songkhram (Construction): US$20 million Phase II : Ratchaburi-Kanchanaburi (Study): US$1.0 million Phase III : Ratchaburi-Samut Songkhram (Construction):US$20-60 million

[1]Links between Kanchanaburi and provincial capitals in the Central and Lower WSB (i.e., Petchaburi, Prachuap Khirikhan, and Chumphon) are not addressed because of the limited traffic between these areas at present and in the foreseeable future, because the traffic that materializes will be well-served by improvements of Route 4 and/or motorway construction as well as the proposed upgrading of the Ratchaburi-Kanchanaburi link, and because of the procedural difficulties and environmental costs of traversing national parks in the western part of the WSB.) New alignments connecting (i) Routes 3301 and 3206 in central Petchaburi Province and (ii) Pranburi and Route 3218 may be worth considering, however.

Project No. RP3

1.	PROJECT TITLE	Pathiu-Route 4 Links and Pathiu-Bang Saphan Links
2.	LOCATION	Between Pathiu and Route 4 and between Pathiu and Bang Saphan, in Chumphon and Prachuap Khirikhan provinces
3.	AGENCY	Department of Highways
4.	OBJECTIVES	(1) To provide improved access to/from the new Chumphon Airport at Pathiu, including access from/to Bang Saphan
		(2) To promote economically efficient utilization of the new Chumphon Airport
		(3) To promote industrial development, at Pathiu and Bang Saphan
5.	PHASING	Phase I and Phase II
6.	DESCRIPTION	

Operations at the new Chumphon Airport at Pathiu are expected to commence in 1997, but at present access from the airport to Route 4 takes about an hour by car. Access links are required to link Pathiu with (i) Route 4 and (ii) Bang Saphan (directly). Regarding the Pathiu-Route 4 link, the immediate need is to provide a connection with Route 3201, a four-digit road that runs into Route 4; Route 3201 may also require upgrading later,[1] considering the likelihood of new traffic in the form of passengers on round-trip service to Bangkok, airport employees and employees and customers of new businesses induced by the airport, and truck traffic carrying air freight shipments. The Pathiu-Bang Saphan link is also vitally important considering the size of the industrial development likely to occur at Bang Saphan and the proposal for a linked airport-seaport zone. While DOH already has a secondary road under construction completing the connection between Bang Saphan and Pathiu by filling in the "missing link" south of Route 3411, further upgrading is likely to be required as Route 3411 is a Class 5 road (9 m wide with no shoulder) and Route 3374 (leading north to Bang Saphan via Route 3169) is a Class 4 road (5.5 m wide with a 1.75 m wide shoulder on one side).

7.	RELATION WITH OTHER PROJECTS	AT1 (Marketing of Chumphon/Pathiu) Airport TR1 (Free Trade Area) UD2 (Bang Saphan Industrial City) RP12B (Subregional Links to Myanmar)
8.	COST (APPROX.)	Phase I : (Route 4-Pathiu): US$15 million Phase II : (Bang Saphan-Pathiu): US$70 million

[1]Route 3201 (32 km long) is a two-lane facility that includes both Class 4 and Class 5 sections, with a carriageway width of generally 5.5 m and shoulder width from 0.0 to 1.5 m on each side.

Project No. RP4

1.	PROJECT TITLE	Hua Hin-Prachuap Khirikhan-Chumphon Scenic Coastal Road
2.	LOCATION	Along the coast from Hua Hin to Chumphon, in Prachuap Khirikhan and Chumphon provinces
3.	AGENCY	Department of Highways
4.	OBJECTIVES	(1) To promote tourism (2) To serve local transport demand (3) To link coastal areas in the Lower WSB with the new Chumphon Airport.
5.	PHASING	To be implemented in Phases II (2002-06) and III (2007-11)

6. DESCRIPTION

The project would upgrade the generally low-quality roads in the coastal corridor from Hua Hin to Chumphon. Regarding the northern portion of this corridor, the December 1992 JICA-assisted *Tourism Development Study on the Hua Hin Cha-Am Beach Area in Thailand* recommended improvement of the "Petchaburi Coastal Road," at a cost of about 63 million Baht (79 million Baht in 1996 values) to increase travel speeds from 20 to 50 km per hour, yielding an economic rate of return of 27.0 per cent. DOH and PWD have various plans to improve the coastal road south of Petchaburi; DOH already has a road under construction from Bang Krud to Bang Saphan in Prachuap Khirikhan province, with plans to continue construction from Bang Saphan to Bang Saphan Noi, then onto Pathiu (the site of the new Chumphon Airport) and Bang Ton Ma Kham, while the section from Bang Ton Ma Kham to Chumphon is under the authority of PWD and to be completed to a Class 4 standard (i.e., pavement width of 6 m) by 1997. More detailed study is required to assess the likely rate of return from improving the corridor to a higher standard. Considering that in at least some sections traffic is relatively low and consists mainly of motorcycles, one approach may be to widen the road in certain town areas in the initial stages, with development to a higher standard (e.g., Class 3) in later years as traffic develops.[1]

7.	RELATION WITH OTHER PROJECTS	TO3 (Tourism Related Infrastructure) AT1 (Marketing of Chumphon/Pathiu Airport) UD2 (Bang Saphan Industrial City)
8.	COST (APPROX.)	Phase II : US$20 million Phase III : US$20 million

[1]Another consideration, a consequence of the scenic nature of the road, is that the alignment may be somewhat circuitous with curves to follow the coastline.

Project No. RP5

1.	PROJECT TITLE	Secondary/Feeder Road Improvements
2.	LOCATION	All WSB provinces
3.	AGENCY	Department of Highways
4.	OBJECTIVES	(1) To promote rural development and increase the earnings of low-income groups by enhancing the mobility of rural communities
		(2) To reduce transport costs in the Project influence area and increase the efficiency of movement of goods and passengers
		(3) To serve local transport demand
5.	PHASING	To be implemented in Phases I, II, and III

6. DESCRIPTION

A project to upgrade secondary and feeder roads in the DOH network has been formulated because the assessment of traffic in the WSB from 1990 to 1994 showed that the greatest rates of traffic growth were found on three- and four-digit roads.[1] These roads, important for the region's socioeconomic development, are overcapacity in certain cases and require upgrading based on both engineering and economic considerations, particularly in light of the rapid future traffic growth expected. In formulating this project, the Study Team forecast traffic volumes on all three- and four-digit DOH roads in WSB for which 1994 traffic data was available and compared these forecasts with estimated capacities. The Team identified the road sections and the years for which traffic projections would exceed 14,000 PCU, the warrant for widening to four lanes. In addition to upgrading existing secondary roads, a separate subproject under the RP5 Project would consider the development of new feeder roads where necessary to connect amphoe centers with the recently upgraded Route 4 and/or planned motorways (see Project RP10, North-South Links). Also, secondary and feeder roads required to support the tourism development plan for the WSB should be upgraded.

7.	RELATION WITH OTHER PROJECTS	RP7 (Rural Roads) RD1 (Rural Development Model) RP10 (North-South Links)
8.	COST (APPROX.)	Phase I : US$240 million Phase II : US$240 million Phase III : US$240 million
9.	FURTHER REFERENCE	Appendix II

[1] 15.5 per cent both in terms of MVPD and of PCU on three-digit roads and 12.3 per cent in terms of PCU and 14.3 per cent in terms of MVPD on four-digit roads.

Project No. RP6A

1.	PROJECT TITLE	Urban Ring/Bypass Roads
2.	LOCATION	Ratchaburi, Petchaburi, and Prachuap Khirikhan
3.	AGENCY	Department of Highways
4.	OBJECTIVES	(1) To promote orderly urban development
		(2) To remove impediments to traffic flow in urban areas
		(3) To increase land development potential and relieve overcrowding by decentralizing urban functions
5.	PHASING	Phase II (2002-2006) and Phase III (2007-2011)

6. DESCRIPTION

As a basic long-term planning proposition, all regional cities within the WSB (e.g., Ratchaburi, Petchaburi, Prachuap Khirikhan) should have ring or bypass roads built by DOH outside of the present and emerging urban core areas.[1] Bypasses eliminate impediments to traffic flow, making for more efficient use of roads. One bypass road that may logically present itself would connect points of Route 4 west of and south of Petchaburi, with one point about 10 km west of the city and another about 10 km south, which would provide good access to the sites under consideration for the proposed Science City.[2] Ring roads increase land development potential and relieve overcrowding by decentralizing city functions, which in turn contributes to upgrading of a city's residential function and the development of business functions in peripheral areas. A successful example of a ring road, within Thailand, is Route 11 around Chiang Mai, which has reduced commuting times and promoted a more desirable urban form.

7.	RELATION WITH OTHER PROJECTS	UD3 (urban development improvement)
8.	COST (APPROX.)	Phase II : US$25 million Phase III : US$25 million

[1]Many of the regional cities in the WSB have bypass roads in areas that will be required for future urban development.

[2]If the Ban Pong-Cha Am motorway runs through this corridor, as is currently planned, and is implemented in a timely manner, then this bypass road may be unnecessary.

Project No. RP6B

1.	PROJECT TITLE	Urban (Municipal) Road Project
2.	LOCATION	Provincial capitals, with the highest priority accorded Ratchaburi, Petchaburi, and Samut Songkram
3.	AGENCY	Public Works Department, Local Governments, and Community Development Department under the Ministry of Interior
4.	OBJECTIVE	To provide localized road improvements in municipalities, in order to promote more efficient urban development
5.	PHASING	To be implemented in 1997-2001 (Ratchaburi and Petchaburi or Samut Songkhram) and 2002-11 (Kanchanaburi, Petchaburi or Samut Songkram, Prachuap Khirikhan, and Chumphon)

6. DESCRIPTION

While Project RP6A would provide urban ring/bypass roads, Project RP6B would provide more localized road improvements within municipalities in the WSB region; these improvements are assigned high priority in accordance with the strong emphasis on equity and decentralization in the Eighth Plan. Particular needs include: (i) the expansion of street networks, to combat the tendency in Thai regional cities for expansion to take place in the form of ribbon development along the main roads leading out of the cities, which is undesirable since it leads to dangerous, congested traffic conditions; (ii) the planning and restructuring of public transport; and (iii) the development and application of a suitable car parking policy plus selected provision of off-street parking space. Particularly suitable candidates for projects to address these needs in the WSB include Ratchaburi and Petchaburi or Samut Songkram. Ratchaburi is the most obvious candidate in that the province has the highest motorization rate in the WSB and the fastest motorization growth rate (city data is not readily available); Petchaburi is a candidate as it has the second-highest motorization rate in the region, while Samut Songkram should be considered because it has the second-highest motorization growth rate and a very inadequate street network. Initiatives in other WSB regional cities (e.g., Chumphon, Kanchanaburi) should follow in due course.

7.	RELATION WITH OTHER PROJECTS	UD3 (Urban Infrastructure)
8.	COST (APPROX.)	Phase I : US$10 million Phase II : US$10 million Phase III : US$10 million
9.	FURTHER REFERENCE	Appendix II

Project No. RP7

1.	PROJECT TITLE	Rural Road Project
2.	LOCATION	All WSB provinces
3.	AGENCIES	Public Works Department and Office of Accelerated Rural Development (mainly)
4.	OBJECTIVES	(1) To promote rural development and increase the earnings of low-income groups by enhancing the mobility of rural communities
		(2) To reduce transport costs in the Project influence area and increase the efficiency of movement of goods and passengers
		(3) To serve local transport demand
5.	PHASING	To be implemented in Phases I, II and III
6.	DESCRIPTION	

While other proposed road projects would upgrade primary and secondary roads, the RP7 project would upgrade rural roads, i.e., roads at the changwat, amphoe, and tambon level. As was shown in Figure 9.5.15, which depicts the results of the latest available comprehensive nationwide rural road inventory analysis, one of the provinces in the WSB (Kanchanaburi) was grouped in the category with the lowest road density, three of the other WSB provinces (Petchaburi, Prachuap Khirikhan, Chumphon) also had significantly lower rural road network densities than the Kingdom average, one province had a rural road density about equal to the Kingdom average (Ratchaburi), and one province had a rural road density somewhat greater than the Kingdom average. It is beyond the scope of this multisectoral regional study to specify the detail of specific subprojects, but as outlined in the spatial plan, it is expected that at a minimum this would include road links to upland/interior areas in Kanchanaburi and Chumphon provinces, with additional improvements concentrated in Petchaburi and Prachuap Khirikhan provinces, i.e., the other two WSB provinces with rural road densities less than the national average. Over time, the Rural Road Project will need to focus more on upgrading and maintenance of existing facilities than on the construction of new roads. The Public Works Department reckons that such a transition will occur by around 2002. Finally, the importance of local contributions to rural road projects, both for new construction and maintenance, should be stressed.

7.	RELATION WITH OTHER PROJECTS	RD1 (Rural Development Model) RP10 (North South Links)
8.	COST (APPROX.)	Phase I : US$25 million Phase II : US$25 million Phase III : US$25 million
9.	FURTHER REFERENCE	Appendix II

Project No. RP8

1.	PROJECT TITLE	Reinvestment in Existing Roads
2.	LOCATION	All WSB provinces
3.	AGENCIES	Department of Highways, Public Works Department, and Office of Accelerated Rural Development
4.	OBJECTIVE	To maintain the existing road network as economically efficiently as possible
5.	PHASING	To be implemented in Phases I, II and III (i.e., throughout the planning period)

6. DESCRIPTION

While there clearly are gaps in the existing WSB road network where new links may be required due to future travel demand as well as present deficiencies in the network function in certain areas, the existing road network is maturing and therefore requires significant reinvestment, i.e., maintenance, overlays, rehabilitation, and reconstruction. While it is accepted and well-advised practice that maintenance activities and expenditures have "first call" on available financial and logistical resources, a 1992 Asian Development Bank-sponsored technical assistance for the Department of Highways found that DOH has generally underfunded maintenance activities, although the network's condition is actually good to fair, a likely consequence of high investment in rehabilitation and reconstruction compensating for the low level of maintenance.[1] It is well beyond the scope of the current multisectoral regional planning study to specify a detailed road maintenance program for the WSB; however, for DOH roads, a detailed program may be specified based on existing DOH models or the latest version of the World Bank's Highway Design and Maintenance Standards (HDM) model calibrated to Thai conditions, while for rural roads, standard rural road planning methodologies may be applied.

7.	RELATION WITH OTHER PROJECTS	Synergies with all road sector projects involving new construction
8.	COST (APPROX.)	Phase I : US$140 million Phase II : US$140 million Phase III : US$140 million

[1] See PADECO Co., Ltd., *Preparation of an Investment Programme for the Department of Highways, Main Text, Volume I*, Asian Development Bank T.A. No. 1362-THA, p. 8-3, 8-8, July 1992. It should also be noted that underfunded maintenance is an issue with the rural road network under the authority of various agencies; with only limited funds available for recurrent expenditures, rural roads deteriorate rapidly due to traffic and natural causes (e.g., rainfall), with further investment sometimes required every two or three years to upgrade the roadway, which is both impractical and uneconomic.

Project No. RP9

1.	PROJECT TITLE	Outer-Outer Orbital Route for the Extended Bangkok Metropolitan Region
2.	LOCATION	Area between WSB and Extended Bangkok Metropolitan Region
3.	AGENCIES	Department of Highways
4.	OBJECTIVES	(1) From an interregional transport perspective, the route would facilitate the more efficient movement of interregional freight traffic with origins and destinations outside of the BMR. (2) From a metropolitan development perspective, the route would "activate" a number medium-size cities with high development potential in the area located about 50-100 km from Bangkok.
5.	PHASING	To be implemented in Phases I, II and III

6. DESCRIPTION

One of the most important projects proposed by the present study is the development of a new highway north of Route 4 to better link the WSB with the Northern, Northeastern, and Eastern Seaboard regions via an "outer-outer" Bangkok orbital route (i.e., ring road). There are two conceptual alignments: (i) Option 1, which was first put forward as the 366-km Toll Motorway (TM) 36 in the JICA-assisted *Toll Highway Development Study in the Kingdom of Thailand* (1991) and was repeated in a 1993 paper prepared for NESDB's *Metropolitan Regional Structure Planning Study*, would be an outer belt motorway about 50-100 km from Bangkok; and (ii) Option 2, which would run more directly in a northeasterly direction from Route 4 to Ayutthaya, and more directly toward Chonburi and the Eastern Seaboard in a southeasterly direction. Relative to Option 1, Option 2 would offer the benefit of somewhat shorter travel distances to the Northern Region but perhaps more importantly it would not serve well a number of the medium-sized cities traversed by Option 1 (e.g., Ang Thong, Lop Buri, Saraburi), even though a supplemental Suphan Buri link is part of the proposal; also, part of the Option 2 alignment may be too close to the proposed Outer Ring Road. It should also be noted that DOH has some planned road improvements in the area of the proposed project (in addition to the motorway set out in Option 1); these are mainly smaller in scale than envisaged by the RP9 Project, however.

7.	RELATION WITH OTHER PROJECTS	RP10 (North-South Links) UD1 (WSB Urban Planning) ID4 (Inland Depot)
8.	COST (APPROX.)	Phase I : US$5 million Phase II : US$300-500 million (depending on option) Phase III : US$440-680 million (depending on option)
9.	FURTHER REFERENCE	Appendix II

Project No. RP10

1.	PROJECT TITLE	North-South Links with the BMA
2.	LOCATION	Area between WSB and Bangkok Metropolitan Area
3.	AGENCIES	Department of Highways/Expressway and Rapid Transit Authority
4.	OBJECTIVES	(1) To improve the link between the WSB and the BMA, in order to stimulate economic growth in the WSB (2) To reduce transport costs in the Project influence area and increase the efficiency of movement of goods and passengers
5.	PHASING	To be implemented in 1997-2001, 2002-06, and 2007-11 (i.e., throughout the planning period)

6. DESCRIPTION

The main north-south artery in the WSB, Route 4, will have been widened into a four-lane divided highway throughout virtually the entire region by the end of 1997 as part of DOH's Regional Road Improvement Project. In addition, there are a number of proposals to add further capacity in the North-South Corridor in the WSB during the study planning horizon (i.e., until 2011); first and foremost among these are DOH's motorway plans, including Motorway No. 8 (Bangkok-Pak Tho in 2002-06, Pak Tho-Cha Am in 1997-2001, and Cha Am-Chumphon in 2002-06). An important issue, then, is to what extent extra capacity is required in this corridor for the development of the Kingdom and the WSB. An analysis of capacity requirements in the North-South Corridor is presented in Table 9.5.21; among other things, it indicates that the construction of the Ban Pong-Cha Am motorway, now scheduled for completion in 2000, is approximately correct in its timing, but that the development of a motorway from Cha Am to Chumphon in 2002-06 may provide too much capacity in certain sections (e.g., south of Km 364) too soon, although perhaps it could be justified on strategic grounds, assuming adequate funding can be found from the private or public sector.

7.	RELATION WITH OTHER PROJECTS	RP9 (Outer-Outer Orbital Route) RP5 (Secondary/Feeder Roads)
8.	COST (APPROX.)	Phase I : US$600 million Phase II : US$700 million Phase III : US$1000 million (To be refined in subsequent studies)

Project No. RP11

1.	PROJECT TITLE	Chumphon-Ranong Links
2.	LOCATION	Area between Chumphon and Ranong
3.	AGENCY	Department of Highways
4.	OBJECTIVES	(1) To improve the link between the Lower WSB and Ranong in order to stimulate economic growth in the WSB (and Ranong as well as points south)
		(2) To reduce transport costs in the Project influence area and increase the efficiency of movement of goods and passengers
5.	PHASING	1997-2001 (feasibility study) and 2002-06 (construction)

6. DESCRIPTION

The connection between Chumphon and the bordering province of Ranong is now along Route 4, a winding, two-lane facility running 120 km (compared to a direct distance of about 80 km, implying a route or circuitry factor of 1.5) from the junction of Routes 4 and 401 to Ranong. The RP11 project would improve the connection between Chumphon and Ranong provinces by: (i) widening and improving Route 4 to a four-lane facility, from Chumphon to Ranong and southward toward Phangnga and Krabi;[1] and/or (ii) constructing a new direct link between a point at around Km 530 of Route 4 (northeast of Kra Buri) and a point near Km 470 of Route 4 (north of Tha Sae), to provide more direct access to points north of Chumphon city, including the industrial estates being developed at Bang Saphan and Pathiu. The rationale and ultimate feasibility for all of these improvements hinges upon the development of a significant port in Ranong or Phangnga provinces, which could generate traffic to and from Chumphon (see the description of Project WT9, Ranong/Phangnga Port Development) and from points feeding into Chumphon or Prachuap Port at Bang Saphan via a Gulf of Thailand coastal shipping network (see the description of Project WT5, Gulf of Thailand "Inland Navigation Scheme").

7.	RELATION WITH OTHER PROJECTS	WT9 (Ranong/Phangnga Port Development) WT5 (Gulf of Thailand "Inland Navigation ") RP11 Chumphon (Bang Saphan)-Ranong Links
8.	COST (APPROX.)	Phase I (Study): US$1 million Phase II (Construction): US$100 million (widening Route 4)

[1] Many of these improvements are now programmed.

Projects No. RP12

1.	PROJECT TITLE	Subregional Links with Myanmar
2.	LOCATION	Between WSB and Myanmar's Tenasserim/Tanintharyi Division
3.	AGENCY	Department of Highways
4.	OBJECTIVES	(1) facilitate exchange and development between and among Thailand and Myanmar in the "twin regions" of the WSB and (Myanmar's) Tenasserim/Tanintharyi Division; (2) promote the foreign trade of the countries with the rest of the world, particularly with western-situated countries (e.g., the Indian Subcontinent, the Middle East, Europe); (3) advance industrial development in both countries; (4) support rural development and increase earnings of low-income groups, thereby reducing cross-border migration; and (5) promote tourism.
5.	PHASING	1997-2001, 2002-06, and 2007-11
6.	DESCRIPTION	

Project RP12 would open up new corridors between Thailand and Myanmar: (i) R12A: (Kanchanaburi-Tavoy/Dawei; (ii) R12B: Kraburi (Route 4)-Marang (Myanmar)-Victoria Point/Kawthaung; and (iii) R12C: Kanchanaburi-Three Pagoda Pass-Moulmein/Mawlamyine. All corridors would be developed in conjunction with corresponding ports. Additional Thai-Myanmar corridors within the general vicinity of the WSB are also possible, e.g., to provide access to new hydropower developments in the Tenasserim/Tanintharyi River system on the Myanmar side, to link the WSB with new industrial developments that logically present themselves on the Myanmar side within the context of the country's spatial structure (e.g., agro-industry).

The projects are viewed as "win-win" undertakings, i.e., offering net benefits for both countries. The northern corridors (RP12A and RP12C) appear most attractive because they are the closest the Bangkok, the largest metropolitan area in the two countries; in particular, RP12A would provide the shortest distance between Bangkok and the new port, a direct distance of only 250 km. All corridors, but particularly the RP12A alignment, would provide east-west transport links to supplement Thailand's strong north-south links, and which could be connected with the Bangkok-Phnom Penh-Ho Chi Minh City-Vung Tau Road, the most advanced on the list of priority projects promoted under the Greater Mekong Subregional cooperation scheme. In addition, all corridors offer Myanmar a gateway to ASEAN, which Myanmar is to join within a few years.

7.	RELATION WITH OTHER PROJECTS	Important synergy with WT8, Tavoy/Dawei Deep-Sea Port Development, and WT9, Ranong/Phangnga Port Development
8.	COST (APPROX.)	Phase I : US$1-2 million (study only)
9.	FURTHER REFERENCE	Appendix II

Project No. RT1

1.	PROJECT TITLE	Intercity and Rural Bus Transport Improvement Project
2.	LOCATION	All WSB provinces
3.	AGENCY	Land Transport Department
4.	OBJECTIVE	Upgrade public transport within the WSB and between the WSB and other regions (e.g., the BMA)
5.	PHASING	Phases I, II, and III

6. DESCRIPTION

While most problem and issue areas in intercity and rural bus transport must be addressed at the national level (e.g., route administration and licensing) and are therefore beyond the scope of this study, certain issues can be effectively addressed at the regional level and are therefore the focus of the RT1 project. The most important issue to be addressed in this project is the generally inadequate quantity and quality of bus terminals in the region. Table 9.5.22 sets out a summary of the existing situation and terminal improvement plans in the six provinces in the WSB during the period from 1997 to 2001. Figure 9.5.19 presented the perspective of a suitable bus terminal, as well as possible locations for bus terminal development in Petchaburi, as identified in a 1990 feasibility study but not yet constructed.[1] At least one other intercity bus transport issue that may be addressed on a regional basis includes the construction of bus stopping places along the major routes (i.e., rest areas).

7.	RELATION WITH OTHER PROJECTS	Synergies with road improvement projects
8.	COST (APPROX.)	Phase I : US$5 million Phase II : US$5 million Phase III : US$5 million

[1]Terminal planning should involve a consideration of the following issues: (i) requirements for local traffic management, pedestrian, and urban service improvements; (ii) site availability and ownership; (iii) methods of land parcel assembly; (iv) impact of choice of site location on bus operating and passenger access costs; (v) the effect of terminals on local land values and development activity including possible integration with the adjacent land use; (vi) the tradeoff between higher land values and greater development benefits and bus operating and passenger access costs; (vii) operational considerations to determine the optimum terminal configuration, e.g., the extent to which rural bus services can be accommodated in or near an intercity bus terminal; (viii) financial considerations; and (ix) implementation strategy. See Pak-Poy & Kneebone Pty Ltd and Asian Engineering Consultants Corp., Ltd., *Study of Inter-City and Rural Bus Transport, Phase II, Final Report*, January 1991, section 9.

Project No. RT2

1.	PROJECT TITLE	Truck Terminal Project
2.	LOCATION	Ratchaburi (Ban Pong) and Kanchanaburi
3.	AGENCY	Land Transport Department
4.	OBJECTIVES	(1) Improve freight transport capacity and operations
		(2) Serve as regional centers for receiving, sorting, and delivering general cargo brought from Bangkok (and other regions)
		(3) Manage the picking up, sorting, and loading of locally manufactured products for shipment to Bangkok (and other regions)
		(4) Reduce urban traffic congestion
5.	PHASING	2002-06
6.	DESCRIPTION	

A truck terminal complex may include: (i) facilities for vehicles (e.g., stopping places, parking area, marshalling yard, gasoline station, repair shop, wash, weighing station); (ii) facilities for freight handling (e.g., temporary storage areas); (iii) facilities for people (e.g., lodging, restaurant, medical clinic); and (iv) data processing facilities (e.g., telephone, fax machine). While the Land Transport Department puts a higher priority on developing truck terminals at sites other than the WSB (e.g., Bangkok, Chiang Mai, Nakhon Ratchasima, Khon Kaen, Nakhon Sawan), the WSB would seem to offer a number of possible sites for truck terminals, the most suitable at Ban Pong in Ratchaburi Province, which is at the crossroads of east-west highways and railways. LTD officials have suggested that sites in the WSB may become appropriate for development in 5-10 years. The cost of a medium-size regional truck terminal is estimated at about 200 million Baht.[1]

7.	RELATION WITH OTHER PROJECTS	ID4 (Inland Depot) RP10 (North-South Links)
8.	COST (APPROX.)	Phase II : US$16 million (for two terminals)
9.	FURTHER REFERENCE	Appendix II

[1]The substantial benefits from regional truck terminals in terms of reducing transport costs and urban traffic congestion are well established in Japan. For example, three years after the development of two major truck terminals in Tokyo, travel by line-haul (i.e., 10-ton) trucks within the Tokyo area decreased by 37 per cent and travel by distribution (i.e., 4-ton) trucks was reduced by 12 per cent.

Project No. RT3

1.	PROJECT TITLE	Road Safety Project
2.	LOCATION	All WSB provinces
3.	AGENCIES	National Safety Council, Department of Highways, Highway Police Division, Ministry of Health, and Ministry of Education
4.	OBJECTIVE	To reduce the number and severity of road accident injuries and fatalities in the WSB
5.	PHASING	Phases I, II, and III

6. DESCRIPTION

Most road safety problem and issue areas must be addressed at the national level (e.g., road safety administration and coordination, driver training/testing, vehicle regulations/inspection) and are therefore beyond the scope of this study, but certain issues can be effectively addressed at the regional level and are therefore the focus of the RT3 project. These issues include accident "blackspot" (i.e., high accident-location) improvement, road user publicity and campaigns, pedestrian and bicyclist safety, and emergency medical services:

(i) A detailed study of accident blackspots should be undertaken and specific engineering countermeasures recommended and implemented to address the problems found. DOH has already identified 26 accident blackspots in the WSB; of the 26 hazardous locations, 19 (73 per cent) were in Chumphon province, five (19 per cent) in Kanchanaburi province, and two (8 per cent) in Prachuap Khirikhan province.

(ii) Road user publicity campaigns should be undertaken based on scientific data, focused on target groups (e.g., vulnerable road users), integrated with enforcement, and supported with training on methods for design and implementation.

(iii) Pedestrian and bicyclist safety measures may include the design of NMV (nonmotorized vehicle)-friendly intersections and "community roads" (i.e., pedestrian-oriented ways) in residential districts.

(iv) Countermeasures concerning emergency medical services are also important, i.e., consisting of the provision of first aid and medical care at the accident site, the transportation of the victim to the hospital, and the subsequent provision of more definitive treatment.

7.	RELATION WITH OTHER PROJECTS	Synergies with road improvement projects
8.	COST (APPROX.)	US$5 million in each phase
9.	FURTHER REFERENCE	Appendix II

Project No. WT1

1.	PROJECT TITLE	Prachuap Deep-Sea Port Extension Project
2.	LOCATION	Prachuap Port, Bang Saphan, Prachuap Khirikhan province
3.	AGENCIES	Harbour Department and the Industrial Estate Authority of Thailand
4.	OBJECTIVE	To support industrial development at Bang Saphan and the Lower WSB
5.	PHASING	Phases I and II
6.	DESCRIPTION	

A large industrial city is planned for Bang Saphan, including facilities for the iron/steel industry and general industry; indeed, a major deep-sea port has already been developed at Bang Saphan, including a 490 m long main berth 15 m below MSL and a 245 m long secondary berth 10 m below mean sea level (MSL). Since Bang Saphan appears to be the most suitable site in the WSB for deep-sea port development, Prachuap Port is expected to play a major role not only for the development of the Bang Saphan area, but for a larger hinterland including other parts of the WSB region. The JICA Bang Saphan Study has forecast traffic at Prachuap Port to increase from 2.3 million tons in 1995, to 6.3 million tons in 2001, to 12.7 million tons in 2006, and to 22.8 million tons in 2011. The WT1 project follows the recommendations of the JICA Bang Saphan team, which has put forward an optimum port expansion plan including phased development of a general cargo berth zone (1,200 m of berth in Phase I and 1,740 m in Phases II and III), along with a mineral bulk berth zone to serve about 15 million tons of cargo by 2011. It is proposed that port operation be undertaken by a single entity, most likely by Prachuap Port Co., Ltd. However, a critical issue to be resolved if the operator of the port is also a major (but not the sole) user of the port, relates to the fair treatment of vessels from enterprises with no connection to that operating the port. In this context, it is considered desirable that public investment be invited and the port operated under a public-private partnership.

7.	RELATION WITH OTHER PROJECTS	TR1 (Bang Saphan FTA) RP1 (Industry Supporting Roads) WT5 (Gulf Navigation)	
8.	COST (APPROX.)	Phase I (General Cargo Port) : Phase I (Bulk Cargo Port) : Phase II (General Cargo Port) : Phase II (Bulk Cargo Port) : Phase III (General Cargo Port) : Phase III (Bulk Cargo Port) :	US$81 million US$58 million US$21 million US$25 million US$21 million US$24 million
9.	FURTHER REFERENCE	Appendix II	

Project No. WT2

1.	PROJECT TITLE	Chumphon Feeder Port Project
2.	LOCATION	Chumphon province
3.	AGENCY	Harbour Department
4.	OBJECTIVE	To support industrial development in the Chumphon FTZ and the rest of the port hinterland
5.	PHASING	Phases I and II
6.	DESCRIPTION	

The WT2 project would develop a feeder port in the vicinity of Chumphon, which is emerging as the gateway to southern Thailand. In addition to serving "normal" traffic between Chumphon and the rest of the Southern region (i.e., existing traffic plus growth of this traffic), the new port would also serve new traffic generated by the industrial estate/free trade zone proposed as part of the WSB study and by opening a new corridor to Ranong (see Road Project RP11, Chumphon-Ranong Links and Water Transport Project WT9, Ranong/Phangnga Port Development). A 1993 feasibility study found that if a ro-ro (roll-on/roll-off) truck ferry were used to minimize port time, the cost of marine transport between Chumphon and Bangkok would be 23 per cent cheaper than the cost of land transport. Based on this 1993 analysis, there have been two proposals put forward for ro-ro ferry ports in Chumphon, one by the 1993 study and the other by the private-sector Khi Dha Group. The 1993 study forecast total freight traffic potential at a new Chumphon port to be about 1.6 million tons per year, i.e., 510 trucks per day multiplied by 365 days per year (assuming 8.5 tons per truck, consistent with trucking industry studies); the Khi Dha Group's plan seems consistent with this forecast. Economic analysis conducted by the 1993 study indicated an economic rate of return of 18.2 per cent for a proposed ro-ro port (at Laem Kho Thian). However, the same study found a rate of return of only 6.4 per cent if traffic were 20 per cent less than forecast. On the other hand, the rate of return could be higher than estimated if additional traffic materializes (e.g., from opening a corridor to Ranong/Phangnga); a further study is required to determine the scale, appropriate location, and functional role of Chumphon port, particularly with respect to a possible Chumphon-Ranong "landbridge" scenario.

7.	RELATION WITH OTHER PROJECTS	WT5 (Gulf of Navigation) RP11 (Chumphon-Ranong Links) WT9 (Ranong/Phangnga Port) AF4 (Fishery Processing Complex)
8.	COST (APPROX.)	Phase I (Study): US$1 million Phase II (Construction): US$25 million

Projects No. WT3 and WT4

1.	PROJECT TITLE	Ban Laem and Samut Songkram Feeder Port Projects
2.	LOCATION	Ban Laem, Petchaburi province and Samut Songkram, Samut Songkram province
3.	AGENCY	Harbour Department
4.	OBJECTIVES	(1) To reduce the road traffic problem in Bangkok, (2) to promote the Government's general decentralization policy, (3) to lessen congestion at Bangkok's Klong Toey Port and emerging congestion at Laem Chabang Port, and (4) to decentralize gasoline distribution outside of Bangkok
5.	PHASING	Phase III

6. DESCRIPTION

Samut Songkram provincial authorities have proposed construction of a general cargo port at the mouth of the Mae Klong River capable of receiving vessels up to 5,000 dwt (Project WT3). The WT3 project, as conceived in the WSB study, would be accompanied by development of an industrial estate/free trade zone, with roads developed to support the new industrial complex. Relative to developing a feeder port at Samut Sakhon, the neighboring province northeast of Samut Sakhon and also currently having a small estaurine port, the Samut Songkram authorities argue that land availability is limited in Samut Sakhon, which is closer to Bangkok.

Petchaburi provincial authorities have put forward a competing, although less well-defined, proposal for a feeder port at Ban Laem, another existing estaurine port, on the Petchaburi River; this proposal is the WT4 project. Without an industrial estate planned in the area, however, the project has a weaker rationale that the Samut Songkram proposal.

Based on an examination of the water depth chart for the area, the Study Team has concluded that dredging of the channel in any of the three proposed feeder ports discussed above to a depth of 6 m, i.e., that which is required to handle vessels of up to 5,000 dwt, may be cost prohibitive. Dredging the channel for use by smaller vessels may be justified, however (e.g., 120-126 m long, 2,500-2,600 dwt ro-ro vessels). Indeed, the Harbour Department already plans to dredge the Samut Sakhon channel to a depth of 4 m by 1997 to facilitate the proposed Samut Sakhon-Laem Chabang ro-ro ferry service to be operated by the Khi Dha Group (see Project WT5, Gulf of Thailand "Inland Navigation" Promotion Project); a similar strategy could be adopted at Samut Songkram.

7.	RELATION WITH OTHER PROJECTS	TR1 (FTA/Samut Songkram) ID3 (Industrial Core and Satellite) UD1 (Urban Planning)
8.	COST (APPROX.)	Phase III : US$6-12 million

Project No. WT5

1.	PROJECT TITLE	Gulf of Thailand "Inland Navigation" Promotion Project
2.	LOCATION	Between the Gulf of Thailand coast, at points from Samut Songkram to Chumphon (and including Bang Saphan), and the Eastern Seaboard
3.	AGENCY	Harbour Department
4.	OBJECTIVES	(1) To link the southern and eastern coasts by water transport, (2) to reduce transport costs and promote efficiency, (3) to ease traffic congestion in Bangkok and its perimeters, (4) to promote water transport as part of multimodal transport, and (5) to promote the Thai shipping industry.
5.	PHASING	Phases I, II, and III
6.	DESCRIPTION	

The WT5 project would establish a coastal shipping network within the Gulf of Thailand, connecting various WSB ports with the emerging deep-sea port at Laem Chabang. The project is consistent with the water transport development strategy of the Eighth Plan, which includes many of the objectives listed above. And while the project is classified as interregional, it could have subregional and global impacts, as Laem Chabang begins to serve as a gateway to Indochina and the rest of the world.

The project has been under consideration by both public and private sector organizations for a number of years; in 1995 the Khi Dha Group obtained a license from the Ministry of Transport and Communications to construct facilities and operate ro-ro cargo ferry services connecting Chumphon with Laem Chabang and Laem Chabang with Samut Sakhon. The stated rationale for Khi Dha's "Siam Sea Link" project is to provide a "Bangkok Bypass" solution, in order to (i) establish in Thailand a proven and efficient transport mode, (ii) provide an alternative to congested and polluted roads and delayed deliveries, (iii) extend the unit load concept and reduce unnecessary handling costs, (iv) reduce the risk of damage to goods in transport, (v) improve the utilization of road vehicles, and (vi) reduce the environmental impacts of road transport. Khi Dha is now planning to commence their Siam Sea Link operation in April 1997, first using Bang Saphan rather than Chumphon, to take advantage of existing facilities at the former location. The Project proposed here would build upon the initial Siam Sea Link operation to establish a full-scale coastal shipping network in the Gulf of Thailand.

7.	RELATION WITH OTHER PROJECTS	WT1 (Prachuap Port Extension) WT2-WT4 (Feeder Ports)
8.	COST (APPROX.)	Phase I : US$100 million Phase II : US$90 million Phase III : US$80 million
9.	FURTHER REFERENCE	Appendix II

Project No. WT6

1.	PROJECT TITLE	Mae Klong River Navigation Project
2.	LOCATION	Mae Klong River from the estuary at Samut Songkram to Kanchanaburi, a distance of 136 km, which may be divided into two stretches: (i) the 42 km long lower Mae Klong River stretch from the estuary to Ratchaburi and (ii) the 94 km long upper Mae Klong River stretch from Ratchaburi to the Wachira Longkon dam (81 km) and then on to Kanchanaburi (13 km).
3.	AGENCY	Harbour Department
4.	OBJECTIVES	(1) To promote the use of inland water transport, a low-cost mode of transport; (2) to reduce transport costs; and (3) to link the Mae Klong River with Laem Chabang
5.	PHASING	Phase II
6.	DESCRIPTION	

The Mae Klong River Navigation Project, drawing upon a proposal first made in 1988 by the *Study for the Improvement of Inland Waterways*, would allow year-round navigability up to potential future transshipment points upstream of Ratchaburi for sugar and molasses from mills near Ban Pong and gravel and sand near the Wachira Longkon Dam. Sugar and molasses would be transported in 700 dwt barges from the Mae Klong River directly to the sugar terminal at Laem Chabang instead of moving by truck to Bangkok. Construction materials such as sand and gravel would sail to Bangkok.

The proposal as put forward by the study cited above involves two methods of improving the river for three depth scenarios: (i) 1.70 m for a 700 dwt barge loaded to 320 tons; (ii) 2.80 m for a 700 dwt barge loaded to 615 tons; and (iii) 3.20 m for a 700 dwt barge loaded to capacity. In addition, the proposal includes a port 10 km south of Ban Pong (i.e., the limit of the river free flow improvement zone), with two loading platforms to allow sugar mills load barges en route to the sugar terminal at Laem Chabang. Although not considered by the 1988 consultants, port development at Ratchaburi would seem to warrant consideration, given the high volumes of bulk traffic generated by this province.[1]

7.	RELATION WITH OTHER PROJECTS	WT3 (Samut Songkram Feeder Port) UD1 (WSB Urban Planning) WR4 (Salinity Control)
8.	COST (APPROX.)	Phase II : US$30 million

[1]The consultants undertaking the *Study for the Improvement of Inland Waterways* estimated an economic rate of return of 15.0 per cent for their proposal for the Mae Klong River improvements, with benefits generated by cost savings in the transport of bulk cargo.

Project No. WT7

1.	PROJECT TITLE	Hua Hin/Cha Am Tourist Pier Project	
2.	LOCATION	Hua Hin/Cha Am Area	
3.	AGENCY	Harbour Department	
4.	OBJECTIVES	(1)	To promote the use of inland water transport, a low-cost mode of transport
		(2)	To reduce transport costs
		(3)	To link the Mae Klong River with Laem Chabang
5.	PHASING	Phase II	
6.	DESCRIPTION		

The WT7 project would improve tourist piers in Petchaburi (Chao Sam Ran, Thawisuk), Cha Am, Hua Hin, Pranburi, and Prachuap Khirikhan. The December 1992 JICA-assisted *Tourism Development Study on the Hua Hin/Cha-Am Beach Area in Thailand* noted that eight different sea transport routes for tourism purposes had been planned. Improved tourist piers will help promote the implementation of such a route as well as serving as a starting point for boat trips. The *Hua Hin/Cha-Am Study* forecast the modal share of sea transport to the region increasing from nil to 2.2-4.4 per cent after implementation of such a service, with the former share for Cha Am and the latter for Hua Hin. One caveat here is the reputed dislike by Thai people of travel by sea.

7.	RELATION WITH OTHER PROJECTS	TO3 (Tourism Related Infrastructure) WT5 (Gulf Navigation)
8.	COST (APPROX.)	Phase II : US$2.6 million

Project No. WT8

1.	PROJECT TITLE	Tavoy/Dawei Deep-Sea Port Development
2.	LOCATION	Tavoy/Dawei, Tenasserim/Tanintharyi Division, Myanmar
3.	AGENCY	Myanmar Port Authority
4.	OBJECTIVES	(1) Facilitate exchange and development between and among Thailand and Myanmar in the "twin regions" of the WSB and (Myanmar's) Tenasserim/Tanintharyi Division; (2) promote the foreign trade of the countries with the rest of the world, particularly with western-situated countries (e.g., the Indian Subcontinent, the Middle East, Europe); and (3) advance industrial development in both countries
5.	PHASING	Phases I and II
6.	DESCRIPTION	

Linked with Road Project RP12A, the Kanchanaburi-Tavoy/Dawei Link, the development of a deep-sea port at Tavoy/Dawei would provide an integrated east-west transport corridor in the Upper WSB and its "twin region" in Myanmar. The rationale and objectives of the project are similar to those set out in the discussion of the RP12A project, e.g., facilitate exchange and development between and among Thailand and Myanmar in the "twin regions" of the WSB and (Myanmar's) Tenasserim/Tanintharyi Division, promote the foreign trade of the countries with the rest of the world, particularly with western-situated countries (e.g., Indian Subcontinent, the Middle East, Europe), and advance industrial development in both countries.

While any forecast of future cross-border traffic would be highly speculative, the potential of such traffic in the future is considerable. A preliminary study forecast port demand of the order of 7.0-13.0 million tons per year, with most of this demand involving cross-border traffic of industrial goods or products from the Upper WSB and Bangkok. A staged approach to port development is recommended, with port extensions to be implemented as warranted by traffic growth. The initial stage facilities would include: (i) one 260 m multi-purpose berth for 40,000 dwt vessels, (ii) two secondary berths totaling 260 m for 5,000 dwt vessels, (iii) a small-craft basin, (iv) a 30,000 m^2 open-stage yard, (v) 5,000 m^2 of multipurpose shed, and (vi) other basic facilities/utilities (e.g., an operation building). As port demand builds up with the expected development of the Myanmar economy, additional berth space of about 3,300 m will be required, assuming port capacity of 10 million tons per year and a berth production rate of 3,000 tons/year/meter.

7.	RELATION WITH OTHER PROJECTS	RP12 (Subregional Links with Myanmar)
8.	COST (APPROX.)	US$1-2 million for comprehensive feasibility study of corridor, including road
9.	FURTHER REFERENCE	Appendix II

Project No. WT9

1.	PROJECT TITLE	Ranong/Phangnga Port Development
2.	LOCATION	Ranong/Phangnga provinces
3.	AGENCY	Harbour Department
4.	OBJECTIVE	The rationale underlying the WT9 project is the need for a high-volume port north of Phuket[1] in order to serve seaborne cargo demand to western-situated countries and, possibly, to serve as the western terminus of a land bridge across the Isthmus of Thailand if Krabi is deemed inappropriate for environmental or other reasons.
5.	PHASING	Phase II
6.	DESCRIPTION	

The Harbour Department already has formulated a plan to develop a 973 million baht, two-berth coastal port at Ranong capable of serving vessels up to 5,000 dwt; the port, to include both cargo and passenger terminals, is located about 8 km north of Ranong opposite Ko Song Tai, an island of interest to tourists. For reference purposes, freight traffic from the existing Ranong port to Myanmar (Victoria Point/Kawthaung) was recorded at 169,000 tons in 1994, 77,271 tons of exports (including 35,515 tons of building materials and 20,107 tons of industrial products) and 91,898 tons of imports (including 44,210 tons of frozen seafood and 34,462 tons of logs). While the planned coastal port development in Ranong appears suitably sized to serve likely demand in the near future, with a strengthened land link between Chumphon and Ranong (Project RP11) and the development of a coastal shipping network in the Gulf of Thailand (Project WT5), there may be merit to building a deep-sea port in the Ranong/Phangnga area, particularly if the western port were connected with a new deep-sea port at Khanom on the east coast in Nakhon Si Thammarat province.

7.	RELATION WITH OTHER PROJECTS	Synergies with Chumphon-Ranong Links (RP11) and the Gulf of Thailand "Inland Navigation" Promotion Projects (WT5)
8.	COST (APPROX.)	Phase II : Study cost in the range of US$500,000-1 million

[1] See Norconsult International A.S., *Formulation of a Spatial Development Framework for Thailand, Presentation Booklet for Seminar*, April 3, 1996.

Project No. RW1

1.	PROJECT TITLE	Improvement of the Southern Main Line
2.	LOCATION	Corridor of the Southern Line
3.	AGENCY	State Railway of Thailand (SRT)
4.	OBJECTIVES	(1) To reduce transport costs
		(2) To support industrial development
		(3) To improve the railway link to the BMA in the north, and the Southern region, Malaysia, and Singapore to the south
5.	PHASING	Phases I, II, and III

6. DESCRIPTION

The RW1 project would upgrade SRT's Southern Line, the principal existing railway line in the WSB. Both short- and long-term components are envisaged. The short-term component incorporates the planned railway improvements for the region in the Eighth Plan period (i.e., 1997-2001), which are noted in Section 5.1.4 (6) (e.g., 25 km of double tracking in Chumphon province, some bridge work, turnout replacement). The long-term component would be determined based upon an assessment of a number of recent proposals (e.g., the *High Speed Train Study*, which considered three high-speed rail alternatives for the Southern Corridor; the ESCAP *Report on the Development of the Trans-Asian Railway in the Indochina and Asean Subregion*; the proposal that emerged at the March 1996 Asia-Europe Meeting to study a high-speed railway linking Singapore, Malaysia, and Thailand. The Study Team also suggests consideration of the possibility of establishing an Inland Clearance Depot (ICD) at Chumphon (also see Project RW5, Freight Transport Improvement), which should be considered along with the other long-term components.

The RW1 project is listed as interregional but it has subregional elements to the extent that traffic to and from Malaysia is promoted. Therefore, any infrastructure investments in the line should be accompanied by measures to address non-physical barriers to cross-border rail transport (again, see also the RW5 project).

7.	RELATION WITH OTHER PROJECTS	Complementarities with industrial development and port projects in the WSB (e.g., at Bang Saphan), although competition with road and water transport projects
8.	COST (APPROX.)	Phase I : US$25 million Phase II (Study to determine subsequent components): US$2 million

Project No. RW2 and RW3

1.	PROJECT TITLE	RW2—Completion of Missing Link to Connect the Southern Line with the Northern and Northeastern Lines and RW3—Bangkok-Samut Songkram-Pak Tho Link
2.	LOCATION	Between Suphan Buri and the Northern Line (RW2) and between Samut Songkram and Pak Tho, Ratchaburi province (RW3)
3.	AGENCY	State Railway of Thailand (SRT)
4.	OBJECTIVES	(1) To increase the profitability of branch lines and reduce transport costs; (2) to support industrial development; and (3) to improve the railway link between the WSB and the Northern and Northeastern Lines (RW1) and to provide a more direct link between most of the WSB (and the Southern region) and the BMA
5.	PHASING	Phase III for RW2; after 2011 for RW3

6. DESCRIPTION

The RW2 project would provide a missing link between Suphan Buri, the terminus of the Nong Pla Duk-Suphan Buri Line (which is linked to the Southern Line), and the Northern Line, which traverses Lop Buri, as well as the Northeastern Line, which may be reached via Saraburi. The RW3 project would extend the Wong Wien Yai-Mae Klong Line at both ends to provide a direct link among Bangkok, Samut Songkram, and Pak Tho; major elements of the project would include links between Thonburi and Bangkok (including a bridge over the Chao Phraya River), bridges over the Tha Chin and Mae Klong Rivers, and new track between Samut Songkram and Pak Tho. As part of the Wong Wien Yai-Mae Klong Line is to be incorporated in the Hopewell urban transport project in the Bangkok area, certain legal issues might have to be resolved before implementation of the RW3. The two projects have been put forward previously by SRT as an alternative to abandonment of branch lines; the RW3 project, probably the less feasible of the two (because of the high construction costs), was first studied in 1971 in a Japanese-sponsored study that found the alternative of double tracking from Bang Sue to Nakhon Pathom (now under construction) more viable. However, a variant of the RW3 project focusing on upgrading of the existing link between Samut Songkram and Samut Sakhon may be worth considering, as a private-sector concern is considering an investment to improve the line between Thonburi (Bangkok) and Samut Sakhon.

7.	RELATION WITH OTHER PROJECTS	Complementarities with industrial development and port projects in the WSB, although competition with road and water transport projects
8.	COST (APPROX.)	Phase III : US$500 million for RW2

Project No. RW4

1.	PROJECT TITLE	Development of Spur Lines or Long Loop Lines to Major Industrial Estates
2.	LOCATION	Serving industrial estates at Bang Saphan and Chumphon (for example) and the Southern Line
3.	AGENCY	State Railway of Thailand (SRT)
4.	OBJECTIVES	(1) To serve new industrial developments (2) To reduce transport costs (3) To more effectively utilize existing rail infrastructure
5.	PHASING	After 2011

6. DESCRIPTION

The RW4 project would develop spur lines[1] or long loop lines serving major industrial sites in the region for the loading of bulk freight. Candidates sites to be served would include Bang Saphan and Chumphon. Consider, for example, that the JICA Bang Saphan team has forecast railway cargo traffic generated by the Bang Saphan complex to reach 0.25-0.40 million tons by 2004 and 1.16-1.22 million tons by 2010, i.e., 6.5-8.0 per cent and 13.4-13.6 per cent of the land traffic generated in 2005 and 2010, respectively. While this forecast is likely below the traffic density required to justify construction of a spur or long loop line (in the range of 2-3 million tons per year), it is likely that more traffic would move by rail if such a line were constructed.

7.	RELATION WITH OTHER PROJECTS	Complementarities with RW1, Improvement of the Southern Main Line, and various industrial development projects
8.	COST (APPROX.)	To be determined in a subsequent study; rough estimate of US$1 million per km

[1]Also referred to as stub tracks, short branch tracks, or industrial sidings.

Project No. RW5

1.	PROJECT TITLE	Freight Transport Improvement
2.	LOCATION	Throughout the railway network, existing and planned, in the WSB
3.	AGENCY	State Railway of Thailand (SRT)
4.	OBJECTIVES	(1) To serve industrial developments (2) To reduce transport costs (3) To more effectively utilize existing rail infrastructure
5.	PHASING	1997-2001, 2002-06, and 2007-11
6.	DESCRIPTION	

The RW5 Project calls for a number of related measures to upgrade freight transport in the WSB in order to increase rail's market share. These measures, targeted with an understanding of the kind of traffic suited for rail (e.g., bulk commodity haulage; trunk distribution of containerized cargoes, especially to and from ports), include:

(i) a more modernized approach to intermodal transport;

(ii) aggressive responses to specific opportunities (e.g., the transport of paper chips to a mill in Kanchanaburi);

(iii) procurement of new locomotives and wagons (i.e., freight cars), to alleviate the chronic motive power and rolling stock shortages;

(iv) upgraded container handling capacity (e.g., through ICD development) and improved rail access to container areas and stacking areas at ports;

(v) the undertaking of a detailed study of the relative costs and benefits of investing in low-profile container wagons as an alternative to expanding the dimensions of critical structures in order to accommodate super high-cube container wagons; and

(v) facilitation measures for cross-border rail transport.

7.	RELATION WITH OTHER PROJECTS	Complementarities with other railway projects (e.g., RW1-RW4) and various industrial development projects
8.	COST (APPROX.)	Phase I : US$50 million Phase II : US$50 million Phase III : US$50 million

Project No. RW6

1.	PROJECT TITLE	Tourist Train to Hua Hin/Cha Am
2.	LOCATION	Between Bangkok and Hua Hin/Cha Am
3.	AGENCY	State Railway of Thailand (SRT)
4.	OBJECTIVES	To promote tourism and increase rail ridership
5.	PHASING	After 2011
6.	DESCRIPTION	

The RW6 project would involve establishing a Bangkok-Hua Hin/Cha Am tourist train similar to the existing weekly (Sunday) tourist train service between Bangkok and Kanchanaburi. The JICA-assisted *Tourism Development Study on the Hua Hin/Cha-Am Beach Area in Thailand* (1992) also recommended such a project noting the benefits of providing increased public transportation capacity and offering a new type of service making traveling by train more attractive for tourists visiting the area. The time schedule for the Bangkok-Hua Hin/Cha Am run would have to be revised to allow introduction of the new service. Private-sector is participation possible, as in the case of a Bangkok-Kanchanaburi service, which was to be added to the luxury Eastern and Oriental Express route in January 1997. However, the project has become increasingly difficult to justify with the upgrading of the competing highway route to Hua Hin/Cha Am in recent years.

7.	RELATION WITH OTHER PROJECTS	TO3 (Tourism-Related Infrastructure)
8.	COST (APPROX.)	US$6 million

Project No. RW7

1.	PROJECT TITLE	Thailand-Myanmar Railway Project
2.	LOCATION	Various possible routings between Thailand and Myanmar
3.	AGENCY	State Railway of Thailand (SRT) and Myanmar Railways
4.	OBJECTIVES	To facilitate exchange and the development of trade between Thailand and Myanmar
5.	PHASING	After 2011

6. DESCRIPTION

The Thai and Myanmar railway systems were briefly connected by the Japanese during World War II, and a number of proposals have been put forward since then to reconnect the two systems, most recently in the Asian Development Bank-sponsored *Subregional Transport Sector Study*. In the WSB project area and neighboring provinces these proposals include: (i) restoring the original construction between the countries, following the Kwai Noi River before crossing into Myanmar at Three Pagoda Pass; (ii) a 196 km link between Phitsanalouk and Mae Sod; and (iii) a 377 km link between Suphan Buri and Mae Sod. The first-named option suffers from obstacles posed by the Kao Lam Dam on the Thai side and the lack of a connection to Myanmar on the Thai side. The second- and third-named options were studied in 1972 by the Overseas Technical Cooperation Agency of Japan (JICA's predecessor), which found that the Suphan Buri-Mae Sod link was economically more advantageous since it would pass through areas that were then and to some degree are still undeveloped and rich in resources. Both the second and third options would require extension to connect with the Myanma railway system, probably at Myaingalay, 24 km from Thaton; the section between Myaingalay and Mae Sod would be difficult as it would entail two tunnels (11.8 km and 14.6 km) on the Thai side of the border and a 2.5 km crossing of the Thanlwin River at Pa'an in Myanmar.

One virtue of the RW7 project would be its provision of a missing link of the Trans-Asian Railway. However, construction of such a new line should not proceed until after rationalization of the operations of SRT and Myanma Railways and an improvement in railway finances. Also, it would be necessary for the two regional railway administrations to agree on interchange standards (e.g., axle loading, method of payment for the use of railway cars of another railway administration).

7.	RELATION WITH OTHER PROJECTS	Possible complementarities with port development in Myanmar (e.g., WT8, Tavoy/Dawei Deep-Sea Port Development)
8.	COST (APPROX.)	US$200-400 million for the portion in Thailand, depending on the alternative and including a 11.8 km and a 14.6 km tunnel; US$150 million in Myanmar, including the cost of crossing the Thanlwin River

Project No. AT1

1.	PROJECT TITLE	Aggressive Marketing of Chumphon (Pathiu) Airport
2.	LOCATION	Market area for Chumphon Airport
3.	AGENCY	Airline serving Chumphon Airport (most likely Bangkok Airways)
4.	OBJECTIVES	To promote usage of the new airport and the economic development of the Lower WSB
5.	PHASING	1997-2001
6.	DESCRIPTION	

The Department of Aviation has been developing a new Chumphon (Pathiu) Airport, which will be opened in 1997. One indication of the level of demand that could be expected on the Bangkok-Chumphon air route, at least initially, is from the positive experience of the service between Bangkok and Ranong, initiated in October 1995. After achieving an occupancy rate of 100 per cent on flights three times a week, Bangkok Airways instituted daily service on the route, with occupancies in mid-1996 100 per cent during the weekends and 65-70 per cent on weekdays; in addition, air freight demand on the Bangkok-Ranong route exceeds capacity, with fish and shrimp from the Andaman Sea the most important commodity carried, to destinations in Bangkok and Japan.

The proposed project would involve aggressive marketing of the new airport in order to maximize its use and thereby promote the economic development of the Lower WSB, from Bang Saphan to Lang Suan. The conceptual plan of the market for the new Chumphon Airport involves serving (i) air passenger and freight demand from new free trade zones in Bang Saphan, Pathiu, and/or Chumphon, (ii) air freight demand for high-value perishable agricultural products (e.g., fruit, flowers), and (iii) tourism demand, which is expected to increase rapidly in this emerging tourist destination. The potential of a new airport to open up markets for certain exports with high value/weight ratios and which can be produced advantageously as a consequence of various factors, such as climate and resource availability, has been well-demonstrated elsewhere in Asia (e.g., in the southern Philippine island of Mindanao, which has developed a 20 per cent share of the Japanese asparagus market). Also worth noting is this study's forecast of annual growth rates in air freight, 30 per cent until 2001 and the 20 per cent until 2011. Regarding tourism demand, if Bangkok Airways operates the route, they could market a "triangle" diving involving a circuit of diving sites off of Chumphon, and boat connections to Ko Tao and Ko Samui.

7.	RELATION WITH OTHER PROJECTS	Related projects include RP3, Pathiu-Route 4 and Pathiu-Bang Saphan Links, and AT4, the project to prepare a Subregional Air Linkage Agreement
8.	COST (APPROX.)	Phase I : US$1 million (private sector)

Project No. AT2

1.	PROJECT TITLE	Expansion of Hua Hin Airport
2.	LOCATION	Hua Hin Airport
3.	AGENCY	Department of Aviation
4.	OBJECTIVES	To increase the usage of Hua Hin Airport, to promote tourism, and to promote the economic development of the surrounding area
5.	PHASING	Not within the study period (i.e., not between 1997 and 2011)
6.	DESCRIPTION	

The constraints of the Hua Hin Airport are well known and were enumerated in Section 5.1.5 (2) (e.g., a relatively short asphaltic concrete runway, 1200 m x 30 m, suitable only for ATR 72 class aircraft (62-seat capacity) with reduced payloads). In view of these constraints, the JICA-assisted *Tourism Development Study on the Hua Hin Cha-Am Beach Area in Thailand* (1992) proposed an "Airport and Air Transportation Service Improvement" Project, which would involve extending the existing runway at Hua Hin in order to allow the use of larger aircraft, or presumably at least heavier payloads with existing aircraft.[1] This project is strongly supported by Bangkok Airways, which notes several marketing opportunities that they must forego until extension of the runway (e.g., promoting their Bangkok-Hua Hin route among Scandinavian, English, and German tour operators, which provide most of the current traffic; promoting golf packages in the Singaporean market).

The project may be a difficult one to realize, however. The total number of passengers at Hua Hin Airport peaked in 1992 at 19,233, then decreased by 15.3 per cent to 16,283 in 1993, and by 31.2 per cent to 11,209 in 1994; the modal share of air transport for visitors to Cha Am and Hua Hin is less than one per cent. In addition, the cost of the project, estimated by the 1992 JICA study as only 12 million baht (US$0.48 million), has now been estimated at one billion Baht (US$40 million) in a preliminary internal study conducted by the Department of Aviation; such a high cost was estimated because extension of the runway may require relocation of Route 4 and perhaps also of SRT's Southern Line.

7.	RELATION WITH OTHER PROJECTS	TO3 (Tourism-Related Infrastructure)
8.	COST (APPROX.)	US$40 million (see above explanation)

[1]The 1992 study also indicated that the military airport in Prachuap Khirikhan was expected to be used for civil aviation in the longer run. Investigations by the Study Team for the current project found that such use is unlikely.

Project No. AT3

1.	PROJECT TITLE	Expansion of Ratchaburi Airport
2.	LOCATION	Ratchaburi Airport, Photharam, Ratchaburi province
3.	AGENCY	Thai Aerospace Corporation
4.	OBJECTIVE	To promote the economic development of the surrounding area
5.	PHASING	Not within the study period (i.e., not between 1997 and 2011)

6. DESCRIPTION

The Thai Aerospace Corporation has proposed expanding their Ratchaburi Airport ("The Eagle Airpark") by, among other things, extending the runway from 1,400 m to 2,800 m to accommodate larger aircraft. Their vision of the future of Ratchaburi Airport includes: (i) air freight distribution, (ii) a light aircraft maintenance center, (iii) an enhanced aviation education and training center, and (iv) ultimately, if possible, an additional airport for Bangkok linked by high-speed rail to Bangkok Noi station. While the last-named element appears unlikely given the airport's distance from Bangkok (i.e., about 90 km by road, or longer than any existing airport in the world from the city center), the other "niche" markets could be productively pursued, perhaps within the existing runway configuration.

7.	RELATION WITH OTHER PROJECTS	No strong relation to other projects identified in this study
8.	COST (APPROX.)	Would require a separate study to estimate costs within an appropriate "order of magnitude"

Project No. AT4

1.	PROJECT TITLE	Subregional Air Linkage Agreement
2.	LOCATION	Covering the market areas of all WSB airports (as well as all airports in Thailand and other subregional countries)
3.	AGENCY	Department of Aviation
4.	OBJECTIVE	To facilitate exchange, tourism, and the development of trade between cities not currently linked by air routes
5.	PHASING	To be begun as early as 1996, but benefits to the WSB not expected until 2007-11
6.	DESCRIPTION	

In 1994 the Asian Development Bank-sponsored *Subregional Transport Sector Study* put forward a Project to Establish New Subregional Routes, which was followed by a suggestion by the Thai delegation at the Inception Meeting of the Subregional Transport Forum in 1995 to establish a Working Group on Air Linkages, with the first meeting of the Working Group held in August 1996.[1] Although the priority routes to be considered are not within the WSB (e.g., Bangkok-Luang Prabang, Bangkok-Siem Reap, Chiang Mai-Jinghong), over time there may be a possibility of expanding demand for WSB airports (e.g., Chumphon/Pathiu) though subregional linkages. A related activity is Bangkok Airways' proposal for a meeting of the region's secondary carriers to discuss growth opportunities in the growing tourism industry in the region.

7.	RELATION WITH OTHER PROJECTS	AT1 (Marketing of Chumphon/Pathiu Airport)
8.	COST (APPROX.)	Only limited costs to the Government

[1]Also, the Asian Development Bank sponsored *Indonesia-Malaysia-Thailand Growth Triangle Development Project* in 1995 called for an air linkage agreement in that subregion.

APPENDIX II To CHAPTER 5

PROJECT PAPERS

RP5: SECONDARY/FEEDER ROAD IMPROVEMENTS

I. BACKGROUND

The basic background of this Project[1] is that the assessment of traffic in the WSB from 1990 to 1994 (section 5.2) showed that the greatest rates of traffic growth were found on three- and four-digit roads, 15.5 per cent both in terms of motor vehicles per day (MVPD) and passenger car units (PCU) on three-digit roads and 12.3 per cent in terms of PCU and 14.3 per cent in terms of MVPD on four-digit roads.[2] These roads, important for the region's socioeconomic development, are overcapacity in certain cases and require upgrading based on both engineering and economic considerations, particularly in light of the rapid future traffic growth expected. It is in this context that considering not only primary highways but also secondary and feeder roads has been deemed important in this Study.[3]

II. PROJECT CONCEPT/RATIONALE

The Project aims to increase accessibility within the WSB region (i.e., provide intraregional linkages) in order to expand the scope of social activities and strengthen GDP growth potential. It addresses communication needs between and among urban centers, as well as the improvement of rural transport to increase the access of rural communities to the services provided in urban areas and allow their effective participation in economic development.

The Project would support development efforts in the six WSB provinces, with intersectoral linkages with project/program proposals put forward in the agricultural,

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[1]In a sense, the Project is more of a program in that it includes several projects or subprojects located in diverse locations across the WSB.

[2]This compares with substantially lower forecast growth rates on the region's one one-digit road (Route 4), 10.5 per cent in terms of MVPD and 11.4 per cent in terms of PCU, and on the region's two-digit roads, 4.4 per cent in terms of PCU and 10.7 per cent in terms of MVPD.

[3]This Project has been set out in more detail, while the Rural Road Project has not, partly because scarce study resources did not permit both to be analyzed in detail, and partly in deference to the considered judgment of the Director of MOTC's Transport and Communication Policy Bureau, who in his remarks at the October 1996 Seminar suggested that Thailand may be overinvesting in rural roads at present.

industrial, tourism, and related sectors in the WSB development master plan. The Project would complement these projects/programs and redress transport deficiencies by providing more reliable and less costly transport services. Specific objectives include: (i) facilitating exchange and development within the WSB, (ii) reducing transport costs in the Project influence area and inducing the efficient movement of goods and passengers, (iii) supporting rural development and increasing the earnings of low-income groups by enhancing the mobility of rural communities, and (iv) alleviating poverty and providing employment opportunities for women in areas along the route.

III. PROJECT DESCRIPTION

A. Project Scope

The Project involves widening selected secondary/feeder roads within the WSB from two to four lanes, thereby increasing capacity to serve growing volumes of traffic. In formulating the Project, traffic volumes have been forecast on all three- and four-digit DOH roads in the WSB for which 1994 traffic data was available[1] and these forecasts have been compared with estimated capacities. The forecast traffic growth rates for the region indicated in Table 9.5.13 of Volume 9 (explained in section 5.2.2) were applied, while the capacity of a two-lane road was taken to be 14,000 PCU, as recommended in a July 1992 Asian Development Bank technical assistance for DOH and applied in other studies.[2]

Table RP5.1 identifies the road sections and the years for which traffic projections would exceed 14,000 PCU; as several links have been evaluated for many of the route numbers, each year shown in the body of the table represents a single link within each respective route number. It should be noted that the analysis has not been conducted for road sections that have already been widened to four lanes.

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[1]Traffic data for 1995 became available too late to apply in this assessment; the results of the analysis would not be substantially different, however.

[2]See footnote in the assessment of the RP1 Project. While DOH currently uses 8,000 AADT (i.e., MVPD) as the capacity of a two-lane road, the PCU approach was adopted here as it is believed to be a more appropriate measure of highway capacity since it reflects the unique vehicle mix on each road section. Analysis performed for NESDB's *Lower South Regional Planning Study* in 1996 found that road widening could be delayed 3.4 years on average per project by adopting the 14,000 PCU method of evaluating road capacity, although significantly lower PCU values were used in that study (e.g., 1.579 instead of 2.0 for heavy bus, 1.628 instead of 3.0 for heavy truck).

In addition to upgrading existing secondary roads, a separate subproject under the RP5 Project would consider the development of new feeder roads where necessary to connect amphoe centers with the recently upgraded Route 4 and/or planned motorways (see Project RP10, North-South Links).

C. Schedule/Phasing

An optimal project schedule is indicated in Table RP5.1, showing where from an engineering point improvements should have been made before 1997, and should be made from 1997 to 2001, from 2002 to 2006, from 2007 to 2011, and after 2011. However, it is recognized that the recommended improvements may lag the optimal schedule due to budgetary constraints.

D. Institutional Arrangements

The proposed Project would be implemented by the Department of Highways (DOH), under the Ministry of Transport and Communications, which is responsible for the administration, planning, construction, and maintenance of three- and four-digit roads in Thailand.[1] DOH's activities account for the largest share of all investment in the road subsector in Thailand, although this share has been declining in recent years. DOH is a well-organized, well-operated agency that functions with considerable autonomy. DOH's institutional competence is manifested in its continuing quest to improve maintenance performance; international transport experts generally acknowledge that Thailand's highway system is among the best maintained in Asia.

IV. PROJECT ASSESSMENT

A. Project Costs

The Project would entail costs on the order of 21 million Baht per km in flat or rolling terrain, and 27 million Baht per km in mountainous terrain, in 1996 prices.[2] With a target

[1]These latter roads were formerly classified as Provincial Highways.

[2]After Wilbur Smith Associates, Inc., Asian Engineering Consultants Corp. Ltd., and PADECO Co., Ltd., *Consultant's Services for Long-Term Strategic Study of Highway Planning and Investment, Final Report, Volume 1*, prepared for the Department of Highways, 1996, p. B3-2-19.

of 50 km per year of widening of secondary/feeder roads in the region, the total Project cost would be about 1.2 billion Baht per year.[1]

B. Project Assessment

The Project would increase accessibility within the WSB region (i.e., provide intraregional linkages) and thereby support rural development and increase the earnings of low-income groups by enhancing the mobility of rural communities, alleviating poverty, and providing employment opportunities for women along the Project routes. The main quantifiable benefit from the proposed road improvements would be operating cost savings accruing to passenger and freight traffic due to the widened road alignments. A recent evaluation of a similar widening project, undertaken as part of NESDB's *Lower South Regional Development Study*, found an economic rate of return of 44.1 per cent for widening of a section (of Route 410 between Pattani and Yala) for which a road capacity evaluation found that widening would be required around the year 2000;[2] similarly high returns can be expected for the widening projects selected in the Western Seaboard Study using a similar road capacity evaluation approach. Further, there would be several non-quantifiable benefits for persons living in the Project influence area as improved transport services would provide better travel to agricultural processing, manufacturing, commercial, educational, health, and administrative centers. The civil works generated by the Project would generate about 2,700 person-years of local employment. The reduction in vehicle operating costs (VOCs) resulting from improvement of the Project roads would initially benefit road transport operators; however, it is expected that transport operators would pass on part of the savings to shippers and passengers, through lower freight rates and passenger fares, and to the government, through taxes on incremental increases in operational profits through VOC savings.

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[1] As a point of reference, equal to 2.6 per cent of DOH's proposed 1997 budget.

[2] PADECO (Thailand), *Master Plan for the Five Southern Border Provinces, Interim Report*, Transport and Communications, Main Text (p. 9) and Attachment A (pp. 18-25).

C. Linkages with Other Projects

The RP5 Project involves important linkages with other projects, including the following:

(i) RP7, Rural Roads;
(ii) RD1, Rural Development Model; and
(iii) RP10, North-South Links.

These linkages, both intrasectoral and intersectoral, are expected to produce even greater benefits than envisaged by the conservative approach adopted above.

V. RECOMMENDED ACTION(S)

It is recommended that DOH proceed with implementation of the Project. Given the heavy workload of the Programming Section of DOH's Planning Division, consideration should be given to retaining consultants or experts to provide policy and programming advice to facilitate implementation of RP5.

Table RP5.1 Road Section Capacity Evaluation (Secondary Roads)

Route	Location	Year Traffic Exceeds 14,000 PCU				
		Before 1997	1997-2001	2002-2006	2007-2011	After 2011
321	Junction R. No. 4 (Nakhon Pathom) - Km. 88+000	before 1994				
321	Km. 88+500 - Junction Uthong		1997			
321	Junction Uthong - Km. 143+000	1995				
321	Km. 143+000- Junction Suphanburi	before 1994				
323	Junction Krachap - Bypass Ban Pong (B)	before 1994				
323	Bypass Ban Pong	before 1994				
323	Bypass Ban Pong (E) - Junction to Phrathaendongrang	before 1994				
323	Tha Maka - Junction Phrathaendong Rang (Old)	1996				
323	Junction to Phrathaen Dongrang - Km. 116+000	before 1994				
323	Km. 116+000 - Muni. of Kanchanaburi	before 1994				
323	Junction to Phrathaen Dongrang-R. No. 323 (Thamuang)		2001			
323	Bypass Kanchanaburi			2004		
323	Muni of Kanchanaburi-Kangsen	before 1994				
324	Muni of Kanchanaburi - Km. 23+072		1997			
324	Km. 30+000 - Junction Uthong		2002			
325	Junction E-Chang - Khlong Dam Noensaduak	1996				
325	Khlong Damnoensaduak - Muni of Samut Songkhram		1997			
326	Junction Prachuap Khirikhan	1996				
327	Junction Pathom Phon (Chumphon) - Muni. of Chum Phon	before 1994				
327	Junction to Chumphon	before 1994				
330	Junction Route No. 00040501 - Ratchaburi	before 1994				
346	R. No. 340 - Km. 52+112 (Banpong Dist.)	before 1994				
346	Km. 52+112 - R. No. 321 (Kamphaengsaen)	1995				
346	Kamphang San - Km. 36+000		1997			
3081	Tha Rua-Phrathaen Dong Rang		1999			
3084	Tha Muang - Km. 9+000		2001			
3085	Junction R. No. 3209 (Yang Ko) - Lamsai					after 2011
3087	Ratchaburi - Bypass Chom Bung		2000			
3087	Bypass Chom Bung			2006		
3087	Bypass Chom Bung (B) - Bypass Chom Bung (E)		2000			
3087	Junction Chom Bung					after 2011
3087	Bypass Chom Bung (E) - Chat Pa Wai				2008	
3087	Chat Pa Wai - Pha Pok Khang Khao				2010	
3088	Ratchaburi - R. No. 3093		1997			
3088	R. No. 3093 - R. No. 35	before 1994				
3089	Khao Ngu - Km. 28+000 (Ban Pong Dist.)		2000			
3089	Km. 28+600 (Ratchaburi Dist.) - Khok Sung	1996				
3089	Khok Sung - R. No. 323 (Bock Phrai)		1998			
3090	Khao Chong Phran - Mae Klong Bridge		1999			
3092	Samut Songkham - Km. 9+000 (Thonburi Dist.)			2003		
3092	Km. 32+850 - Samut Sakhom	before 1994				
3093	Tha Nam Samut Songkhram - R. No. 4 (Pak Tho)	1996				
3167	Prachuap Khirikhan - Nong Hin				2009	
3168	Junction R. No. 4 - Bypass Pranburi		2001			
3168	Bypass Pranburi			2004		
3168	Bypass Pranburi (E) - Km. 12+710				2007	
3169	Junction R. No. 4 - Chai Thale			2003		
3171	Muni. of Phetchaburi - Ban Dai It - R. No. 3204		1997			
3172	Junction Khao Yoi Railway Station					after 2011
3173	Phetchaburi - Khao Luang			2002		
3174	Junction R. No. 4 - Ban Tha			2002		
3175	Tha Yang - Khuan Phet			2002		
3176	Phetchaburi - Ban Laem			2005		
3177	Phetchaburi - Had Chao Samran		2000			
3179	Muni. of Phetchaburi - R. No. 4			2003		

Table RP5.1 Road Section Capacity Evaluation (Secondary Roads)

Route	Location	Year Traffic Exceeds 14,000 PCU				
		Before 1997	1997-2001	2002-2006	2007-2011	After 2011
3180	Junction R. No. 4 - Tha Samet					after 2011
3181	Junction R. No. 4 - Tha Sae			2002		
3187	Khan Phet - Ban Kula*				2007	
3201	Junction R. No. 4 - Pathiu - R. No. 3180 (Ton Makhan)				2011	
3203	Junction R. No. 4 - Hup Taphong					after 2011
3204	Route No. 4 - Petchaburi					after 2011
3205	Wat Chan - Rai Sat					after 2011
3206	Junction R. No. 4 (Pak Tho) - Tha Yang		2001			
3206	Tha Yang - Hin Si - Pong Kra Thing					after 2011
3209	Tha Maka - Km. 4+000 (Kanchanaburi Dist.)					
3209	Km. 4+000 (Banpong Dist.) - Nongtakya		2000			
3209	Junction R. No. 3209 0101 - Khao Chong					after 2011
3209	Nongtakya - Kanchanaburi Dist.			2005		
3209	Ratchaburi Dist. - Dan Makham Tia				2011	
3209	Dan Makham Tia - Kong Phasom Sat					after 2011
3209	Wang Pla Mu - Wang Lan					after 2011
3217	Junction R. No. 4 - Yang Chum				2010	
3218	Junction R. No. 4 - Huai Mong Khon			2003		
3219	Nong Ta Phao - Walai School			2002		
3236	Junction R. No. 325 (Hua Pho) - Pho Hak			2004		
3236	Junction R. No. 325 (Hua Pho) - Pho Hak				2008	
3236	Pho Hak - R. No. 3097			2005		
3253	Junction R. No. 4 - Thung Maha					after 2011
3273	Khok Sung - Nong Pet			2003		
3291	Junction R. No. 4 (Chedi Hak) - R. No. 3087 (Khao Ngu)	before 1994				
3301	Junction R. 3219 (Nong Phlap) - Yang Chum					after 2011
3305	Junction R. No. 323 (Tha Nam Tun) - R. No. 3228 (Khao Pun)				2009	
3313	Junction R. No. 3087 (Chat Pa Hwai) - Pong Krathing				2008	
3324	Junction R. No. 3313 - Huai Sua					after 2011
3325	Junction R. No. 4 - Hat Sai Yai					after 2011
3335	Junction R. No. 4 (Ban Sing) - R. No. 3237 (Bang Kra Do)		1999			
3337	Junction R. No. 4 (Chin Na Si) - Thung Luang					after 2011
3337	Thung Luang - R. No. 3206 (Hin Si)					after 2011
3338	Junction R. No. 4 (Chin Na Si) - Khu Bua					after 2011
3339	Ratchaburi - Khu Bua			2004		
3349	Junction R. No. 4 (Nong Khuang) - Nong Ya Plong			2005		
3357	Nong Tak Ya - Khao Khwang					after 2011
3361	Dan Makham Tia - Pak Dong					after 2011
3394	Junction R. No. 323 (Luk Kae) - Huai Krabok-Nong Khaem		2000			
3400	Junction R. No. 3301 - Thung Kham					after 2011
3410	Kho Lok Sang - Huai Sok					after 2011
3411	Don Yang - Huai Sak					after 2011
3416	Junction R. No. 3301 - Km. 7+108					after 2011
3432	Junction R. No. 3410 (Hin Lat) - Kaeng Kachan Dam					after 2011
3459	Junction R. No. 4 - Pak Khlong Ban Khrud					after 2011
3463	Junction R. No. 4 - Nikom Prachuap Khirikhan		1998			
4001	Muni. of Chumphon - Pak Nam Chumphon		1998			
4002	Langsuan - Pak Nam Langsuan				2010	
4003	Khuan Ta Lom - Sawi - Bo Kha					after 2011
4006	Junction R. No. 4 (Ratchakrut) - Lang Suan					after 2011
4096	Junction R. No. 41 - Pak Nam Ta Ko					after 2011
4097	Junction R. No. 41 - Bang Nam Chut				2011	
4098	Pak Nam Chumphon - Hat Sai Ri					after 2011
4099	Junction R. No. 41 - Mae Nam Lang Suan					after 2011
4119	Junction R. No. 4001 (Pak Khlong) - HongYen Chumphon		2000			

Table RP5.1 Road Section Capacity Evaluation (Secondary Roads)

Route	Location	Year Traffic Exceeds 14,000 PCU				
		Before 1997	1997-2001	2002-2006	2007-2011	After 2011
4134	Lang Suan - R. No. 4112 (La Mae)					after 2011
4139	Junction R. No. 41 (Na Nua) - Khao Thalu					after 2011
4198	Junction R. No. 41 - Pak Ta Ko					after 2011

Source: The Study Team

RP6B: URBAN (MUNICIPAL) ROAD PROJECT[1]

I. BACKGROUND

Motor vehicle ownership and traffic volumes are growing rapidly in the WSB, outstripping investment in the upgrading of urban transport systems in the region. Motorization rates, calculated as the number of cars and light vehicles (excluding motorcycles) per 1,000 population, averaged 59 in the Western Seaboard in 1994, ranging from 42 in Prachuap Khirikhan and 43 in Chumphon, to 75 in Ratchaburi, as shown in the table below; growth in vehicle registrations averaged 17.8 per cent in the WSB from 1990-94, ranging from 11.6 per cent in Kanchanaburi to 24.5 in Samut Songkram and 25.5 per cent in Ratchaburi. The street networks of WSB regional cities, clearly insufficient to meet this growing demand, are illustrated schematically in Figure RP6B.1.

Vehicle Registration in the WSB (1994)

Province	Total No. of Vehicles	Motorization Rate[1]	Growth Rate in Number of Vehicles[2]
Kanchanaburi	164,549	47	11.6
Ratchaburi	255,329	75	25.5
Samut Songkram	34,496	48	24.5
Petchaburi	109,784	52	12.6
Prachuap Khirikhan	129,130	42	14.1
Chumphon	98,809	43	17.6

Notes: (1) Number of cars and light vehicles (excluding motorcycles) per 1,000 population.
(2) Growth in cars and light vehicles (excluding motorcycles).
(3) Data for 1994 is presented due to anomalies in the 1995 data.

[1]This Project Profile draws upon site visits to the regional cities of the WSB as well on previous studies such as Halcrow Fox and Associates in association with Pak Poy & Knecbone Pty Ltd and Asian Engineering Consultants Corp., Ltd., *SPURT: Seventh Plan Urban and Regional Transport, Final Report*, March 1991, Chapter 26 [Policy Recommendations for Regional Cities].

II. RATIONALE/OBJECTIVES

While the urban traffic problems of the WSB are not nearly as serious as those found in the Bangkok Metropolitan Area, the prospects for the future are clearly of concern in view of the rapid growth and development of the region's dynamic urban centers. In this context, it is worth noting various issues identified by reviews of transport policy in the nation's regional cities, undertaken over the last few years but still applicable to the regional cities of the WSB. The first issue relates to the need for planned expansion of street networks, in contrast to the present practice by which expansion takes place in the form of ribbon development along the main road(s) leading out of the cities. The second of these issues relates to the redevelopment of city centers; while many regional cities have only modest centers built to serve the needs of quite small towns, redevelopment will occur as decentralization progresses in Thailand, requiring a new system of planning and planning controls. The third issue relates to the restructuring of public transport, e.g., to address the problem of limited affordable fixed-route services in certain areas. The fourth issue relates to the need for car parking policy, with the likelihood that the supply of private parking (especially commercial parking) will be too little too late unless parking charges and/or time limits are more widely imposed for street parking.

In view of the foregoing, the Project has been designed to equip regional centers in the WSB to better deal with the following:

(i) the expansion of street networks in the peripheries of the regional cities;

(ii) central area redevelopment;

(iii) the planning and restructuring of public transport; and

(iv) the development and application of a suitable car parking policy plus selected provision of off-street parking space.

III. PROJECT DESCRIPTION

A. Project Components

The Project would include various components[1] targeted at each of the objectives presented in the previous section; all of the proposed urban transport project components presuppose preparation of a viable urban plan for the target cities. The project components include the following:

(i) Given the tendency for expansion of street networks to occur in the form of ribbon development along the principal arteries leading out of the cities, and considering the undesirability of this practice as it leads to congested, hazardous traffic conditions and a poor living and working environment,[2] the first component of the Project involves the *planning of street systems ahead of development coupled with adequate funding for municipal road projects.* It is of vital importance that main roads (e.g., those built by DOH) have the supporting structure of minor roads in a complete road hierarchy; therefore, minor roads should be planned and built at the same time as main roads, in order to permit and encourage development close to, but alongside, the main roads. Also, such planning should be undertaken with water supply/sewerage system improvement.

(ii) Considering that the old centers of WSB regional cities are being or will be redeveloped with modern buildings, the second component of the Project involves implementation of a system of planning and planning controls, including new frontage requirements so that there will be room to widen streets where necessary.

(iii) Since public transport service levels at night and in low demand areas at the end of routes is often inadequate in the regional cities of the WSB, and since drivers often cut their routes, operate off their specified routes, or congregate in high demand areas, the third component of the Project involves *strengthening the planning, management, and enforcement role of the Land Transport Department in regional cities.* Indeed, as larger

[1] It should be noted that urban ring/bypass roads are addressed in Project RP6A, considered somewhat lower in priority than this Project (i.e., RP6B).

[2] Consider, e.g., the many kilometers of roads of this type in the BMA.

city sizes brings longer average urban trip distances, there will be an increasing need to introduce or expand fixed-route large bus services, which will require increased route planning and effective route management.

(iv) Finally, a *car parking policy* should be instituted in all but the smallest cities to allocate road space efficiently between moving vehicles and the various types of parked vehicles. Elements of this policy may include: (a) time limits and parking charges that vary with location to encourage short-term parking in shopping areas and direct long-term parking in more distant locations; (b) provision of adequate loading zones, bus stops, and taxi standing areas; (c) adequate provision of parking spaces and loading zones within buildings; and (d) selected provision of off-street parking spaces by the public or private sector.

It is recommended that the above components be implemented first in Ratchaburi and Petchaburi or Samut Songkram on a pilot basis. Ratchaburi is the most obvious candidate in that the province has the highest motorization rate in the WSB and the fastest motorization growth rate (city data is not readily available); Petchaburi is a candidate as it has the second-highest motorization rate in the region, while Samut Songkram should be considered because it has the second-highest motorization growth rate and a very inadequate street network. Initiatives in other WSB regional cities (e.g., Chumphon, Prachuap Khirikhan) should follow in due course.

B. Schedule/Phasing

It is envisaged that the pilot component in Ratchaburi and Petchaburi and/or Samut Songkram would be implemented in the Eighth Plan period (i.e., 1997-2001), while similar measures would then be adopted in other regional cities in the Ninth and Tenth Plan periods (i.e., 2002-2011) as required by their growth and development.

C. Institutional Arrangements

Implementation would be undertaken by the following authorities, among others:

(i) the Office of the Committee for the Management of Road Traffic (OCMRT), which has responsibility for urban transport planning not only in Bangkok but also in regional cities, and the function of which is now being upgraded;

(ii) the Land Transport Department, which is responsible for planning, management, and enforcement functions related to public transport in the WSB; and

(iii) the cities themselves, which have the authority and capability of constructing and reconstructing urban streets.

IV. PROJECT ASSESSMENT

The cost of the Project is estimated at about 125 million Baht per city, with 250 million Baht or about two cities to be taken up in each Five-Year Plan period. Total project cost during the WSB study planning horizon (i.e., 1997-2011) would amount to about 750 million Baht.

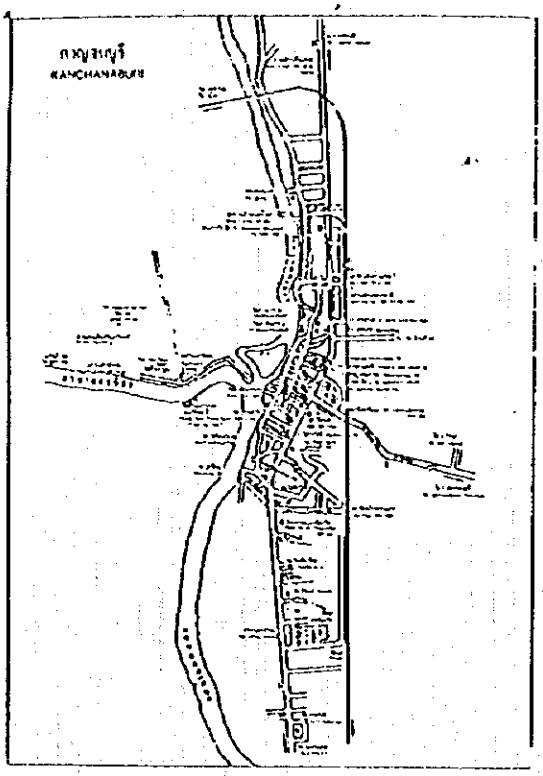
It is expected that the Project will generate large benefits by reducing vehicle operating costs, reducing travel time (the value of which will increase with the increasing incomes expected in the WSB), and promoting more orderly urban development. These benefits will be further enhanced to the extent the Project is implemented together with the Urban Infrastructure Project (UD3), with which the RP6B project has intersectoral linkages that will result in important synergies that should be maximized.

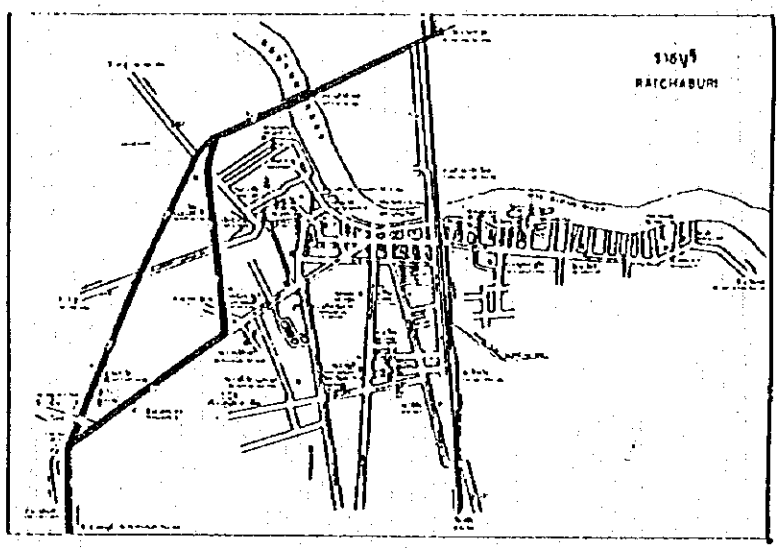
V. RECOMMENDED ACTION(S)

It is recommended that the Government proceed with implementation of the Project. In view of the valuable lessons of the Japanese experience in urban transport planning in cities with many characteristics similar to those in Thai cities, consideration should be

given for a request for a Japanese Expert, to give advice on transport planning and programming in regional cities, perhaps including those in regions of Thailand other than the WSB. An interagency committee could establishment for implementation of the project, including members from the Department of Highways and the Department of Town and Country Planning, as well as OCMRT.

Figure RPB6.1 Street Networks of WSB Cities





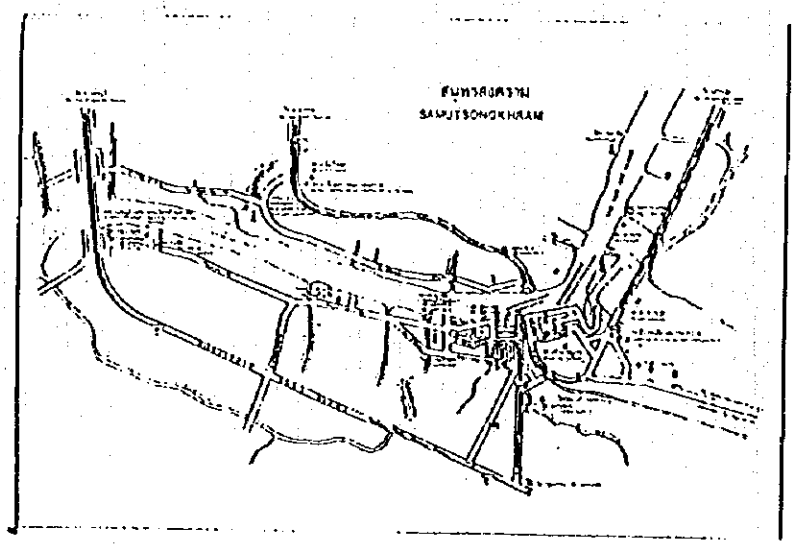
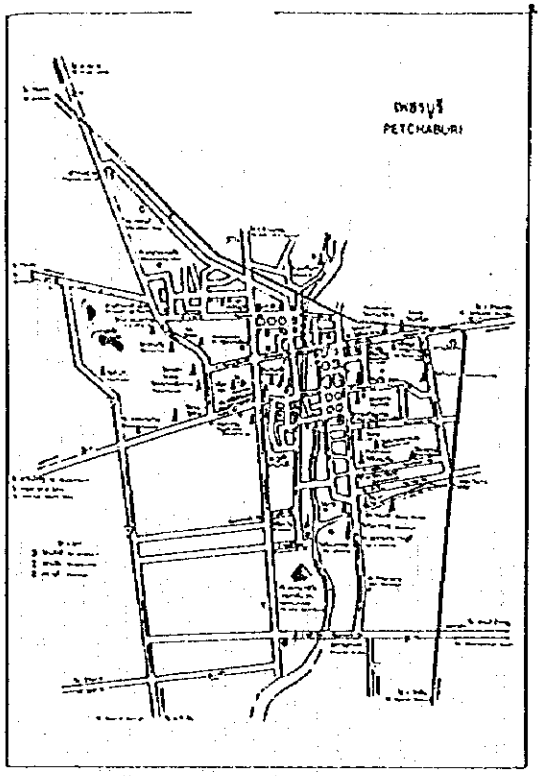
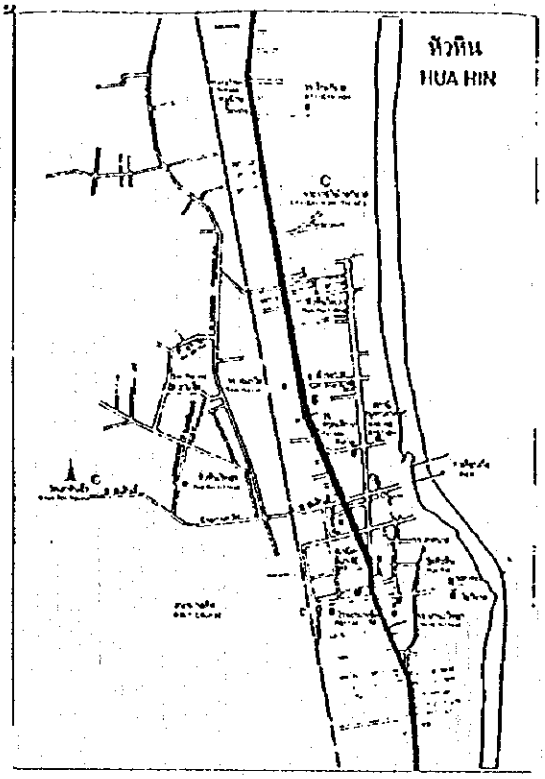
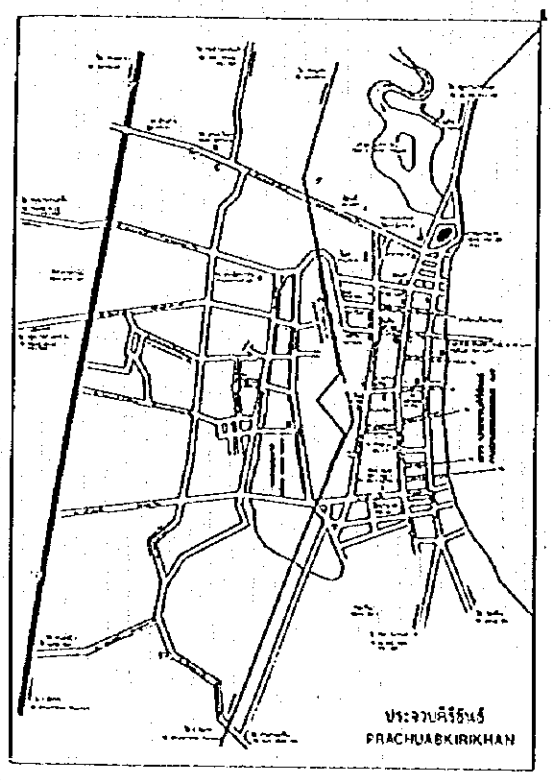
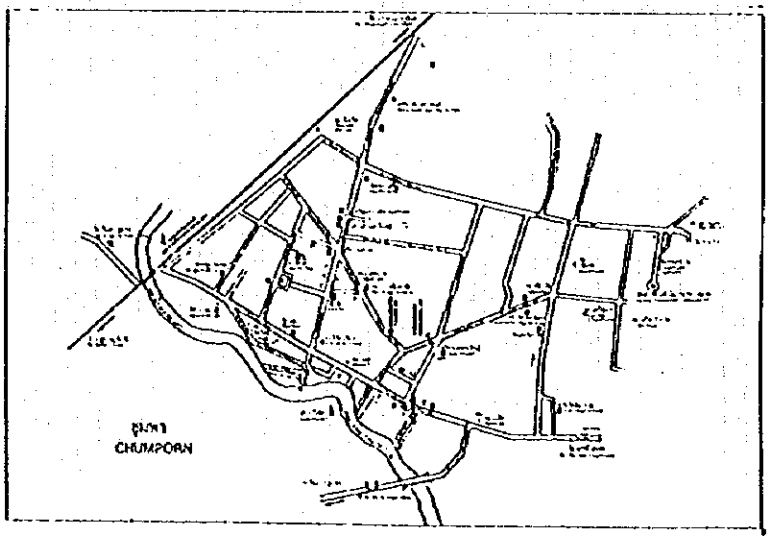


Figure RP6B.1 Street Networks of WSB Cities









RP9, RT2, AND RW5[1]—INTEGRATED TRANSPORT AND LAND USE DEVELOPMENT IN THE CORRIDOR BETWEEN BAN PONG AND AYUTTHAYA/LOP BURI IN THE EXTENDED BANGKOK METROPOLITAN REGION

I. BACKGROUND

A. Sectoral Background

Thailand's explosive growth in GDP, averaging almost 10 per cent per annum between 1988 and 1995, has led to substantially increased demand for transport and has put severe strains on existing infrastructure, especially in the area within about 100 km of Bangkok. Traffic growth has been most dramatic in road transport, with road traffic increasing at a rate of almost 15 per cent per annum since 1989, while the size of the vehicle fleet (excluding motorcycles) more than doubled, growing at an average rate of 9.6 per cent per annum between 1985 and 1993. With GDP growth projected at an annual rate of about 8 per cent in the medium term, and the fleet of about 11 million vehicles expected to continue growing at about these rates, there is an urgent need to increase road capacity and improve the efficiency of the use of road and road transport infrastructure to avoid serious bottlenecks to Thailand's continued economic growth. At the same time, it is important to revitalize the nation's railway subsector, which can move bulk loads more efficiently than road transport, and with greater energy efficiency and fewer environmental impacts.

In line with the increased importance of social equity objectives in development planning in Thailand, the proposed Project involves not only the transport sector but also the urban sector. The relevant background relating to this sector is that the urbanization of Bangkok is spreading out to the provinces of Ayutthaya and Saraburi in the north, and to Ratchaburi to the west, among others. The Extended Bangkok Metropolitan Region (EBMR) is expected to garner one-third of Thailand's total population increase between 1990 and 2010, which implies an increase in population of over 5 million during this period.

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[1]With respect to the transport sector, the Project comprises the western half of the Outer-Outer Orbital Route for the Extended Bangkok Metropolitan Region (RP9), the Ban Pong (Ratchaburi) component of the Truck Terminal Project (RT2), and the (Railway) Freight Transport Improvement (RW5).

B. Sectoral Development Policy

The 1990-91 JICA-assisted *Toll Highway Development Study in the Kingdom of Thailand*,[1] prepared for DOH, recommended a broad framework for development of 4,300 km of motorways over a 20-year period, including construction of an outer belt motorway for Bangkok. In addition, in 1992 the Expressway and Rapid Transit Authority of Thailand (ETA) prepared a master plan for 772 km of intercity expressways. Following upon these preliminary proposals, a JICA-sponsored feasibility study for the Ban Pong-Cha Am Motorway was completed in 1995. In addition, the *Interim Report* of the JICA-assisted *Western Seaboard Regional Development Master Plan Study in the Kingdom of Thailand* (i.e., this study) recommended an Outer-Outer Orbital Route for Bangkok, linking Ban Pong with the Extended Bangkok Metropolitan Region; this project would be linked with the development of a Ban Pong Truck Terminal and Inland Depot.

A number of proposals have also been put forward to improve railway service in all or part of the subject corridor, e.g., by the *High Speed Train Study* in 1994,[2] the JICA-assisted *Study on an Improvement Plan for Railway Transport in and around the Bangkok Metropolis in Consideration of Urban Development* completed in 1995,[3] the Economic and Social Commission for Asia and the Pacific (ESCAP), the Asia-Europe Meeting, and the JICA-assisted *Western Seaboard Study* (i.e., this study) in 1996.

In the related urban sector, the National Housing Authority (NHA) has prepared a proposal for the development of satellite towns around the Bangkok Metropolis, featuring civic center, commercial, financial, and sports functions; a number of these satellite towns would be located in the proposed Project Corridor, development of which would help stimulate planned urban development. Tied in with the NHA proposal is the

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[1]Japan International Cooperation Agency, *The Toll Highway Development Study in the Kingdom of Thailand*, Final Report, prepared for the Department of Highways, July 1991.

[2]Wilbur Smith Associates, Transmark, Asian Engineering Consultants Corp., Ltd., and Team Consulting Engineers, *High Speed Train Study (Thailand), The Potential Long-Term Role of High Speed Rail in Thailand*, prepared for the Office of the National and Economic Social Development Board, March 1994.

[3]Japan Railway Technical Service, Yachiyo Engineering, and Almec, *The Study on an Improvement Plan for Railway Transport in and around the Bangkok Metropolis in Consideration of Urban Development in the Kingdom of Thailand, Final Report*, prepared for the Japan International Cooperation Agency and the Office of the National Economic and Social Development Board, October 1995.

National Urban Development Policy Framework,[1] prepared by NESDB in 1993, which recommended the development of medium-scale centers to promote decentralization within an Extended Bangkok Metropolitan Region.

II. PROJECT CONCEPT/RATIONALE

The Project includes three transport-sector subprojects: (i) the western portion of an outer-outer orbital motorway for the Extended Bangkok Metropolitan Region (RP9), (ii) the Ban Pong (Ratchaburi) component of the truck terminal project (RT2), and (iii) selected components of the railway freight transport improvement project (RW5). The rationale for each of these interrelated subprojects is set out below.

The rationale for the *outer-outer orbital route* is two-fold:

(i) From an interregional transport perspective, the route would facilitate the more efficient movement of interregional freight traffic with origins and destinations outside of the BMR. Admittedly, a review of the most recent available origin-destination matrix of road freight traffic by region (Table RP9-1) shows that "Bangkok and vicinity" is currently the origin of 45 per cent and the destination of 19 per cent of all road freight transport in Thailand. However, there are still possibilities for better serving interregional freight flows such as those between the WSB and the Northern, Northeastern, and Eastern regions, as shown in the table.[2] More importantly, once the road network is developed to better accommodate such interregional movements, significant changes can be expected in this origin-destination matrix; almost certainly, the BMA is reaching its practical limit in terms of its capacity to accommodate all of this traffic. In addition, since most goods movement in the Kingdom pass through the BMR even if neither the origin nor the destination is in the region, the proposed project offers the prospect of substantially reducing congestion in metropolitan Bangkok. Indeed, one finding of the joint NESDB/UNDP/TDRI *National Urban Development Policy Framework* study was that "the improvement and

[1]Office of the National Economic and Social Development Board, *National Urban Development Policy Framework, Final Report, Volume 1*, 1993.

[2]Table 9.5.6 and Figure 9.5.3, presented with the main text, substantiate this point; for example, road freight flows from Kanchanaburi Province to the Northern Region in 1994 were 2.0 million tons, plus an additional 1.2 million tons to Suphan Buri Province.

construction of road and rail linkages between regional or provincial cities deserves additional attention."[1]

(ii) From a metropolitan development perspective, the route would "activate" a number of medium-size cities with high development potential in the area located about 50-100 km from Bangkok. An urban planning study following upon the aforementioned JICA toll motorway study developed a proposal for satellite towns in Ratchaburi (including Ban Pong and Photharam), Nakhon Pathom (including Kamphaeng Saen), Suphan Buri (including Bang Pla Ma), Saraburi (including Kaeng Khoi and Nong Khae), Nakhon Nayok (including Ban Na and Ongkharak), and Chachoengsao (including Suvintawong). Building the proposed road could therefore contribute to the development of these medium-scale centers, while at the same time decentralize activities within an extended Bangkok Metropolitan Region (or EBMR, as termed by the *National Urban Development Policy Framework* study).

The rationale for the *truck terminal subproject* is to: (i) improve freight transport capacity and operations; (ii) serve as a regional center for receiving, sorting, and delivering general cargo; and (iii) reduce urban traffic congestion in the Bangkok Metropolitan Area. The location of a truck terminal on the western fringe of the EBMR---away from the high-cost, congested, and more environmentally sensitive areas in central Bangkok---will minimize the disruption of trucks standing for long periods in more central locations.

The rationale for the *railway freight transport improvement subproject* is to: (i) reduce transport costs, (ii) more effectively utilize existing rail infrastructure, and (iii) improve the operating and financial performance of the State Railway of Thailand (SRT).[2]

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[1]Office of the National Economic and Social Development Board, *National Urban Development Policy Framework, Final Report, Volume 1*, 1993, p. 15.

[2]The RW2 Project, Completion of a Missing Link to Connect the Southern Line with the Northern and Northeastern Lines, should also be considered but in the longer term.