mouth of the river. Neither of these ports has exclusive mooring facilities for roll-on/roll-off ferry service.

Bakauheni - Merak. This route is the vital connection between the road systems of Java and Sumatra islands. In 1991, the volume of traffic on it reached 8,137,000 persons, 3,716,000 tons of cargo, and 996,000 vehicles (Figure 7.1.18). The main facilities at Bakauheni terminal are two ferry berths (water depths of 8 m and 12 m), each with a movable ramp, one terminal building, an administration building and a parking area.

This link is the most heavily traveled passenger ferry route in the nation after the Surabaya-Madura route and is vital to the national economy. Recent passenger traffic growth on the route has been high, as road links on both islands improve with portions of the Jakarta-Merak toll road already completed. The operation is frequent and generally reliable. Prices are set by the Ministry of Transportation and most of the 10 vessels on the route are private owned and operated. However, because long distance road travel over Sumatra's road network is somewhat difficult, only about one third of passenger traffic on the ferry is travelling to/from provinces other than Lampung. According to the 1988 National Nonroad Origin and Destination Survey, about 67% of travelers on the route are travelling to/from only one province, namely Lampung (Table7.1.7). Similarly, of cargo carried on the ferry route, about 58% is Lampung-Java traffic (Table 7.1.8).

Table 7.1.7 Key Sumatra-Java Passenger Flows 1988-Ferry

(Unit: passengers)

Route	Total		Daily average
Northern Sumatra-Java	385,000	6%	1,052
Southern Sumatra-Java	2,581,000	39%	7,053
Java-Northern Sumatra	366,000	6%	1,000
Java-Southern Sumatra	3,213,000	49%	8,779
Total	6,545,000	100%	17,883
Lampung-Java and vice versa	4,398,000	67%	12,049
Bangka and Belitung Island Services	108,000	-	296

Source: Saltrannas88 - 1988 National Nonroad Origin and Destination Survey.
Note: Current volume is in area of 10 million passengers. Air passengers are excluded.

Table 7.1.8 Key Sumatra-Java Cargo Flows 1988

(Unit: tons)

Route	Surface (ferry) (000s)	%	Sea (000s)	%	Total (000s)	Daily average
Northern Sum-Java	156	1%	11,548	99%	11,703	32,000
Southern Sum-Java	1,061	14%	6,519	86%	7,580	21,000
Java-Northern Sum	314	7%	4,371	93%	4,685	13,000
Java-Southern Sum	870	23%	2,874	77%	3,745	10,000
Total	2,401	9%	25,312	91%	27,713	76,000
Lampung-Java and vice versa	1,381	58% of ferry total				

Note: Surface means ferry + road or rail or both. Air cargo is excluded.
Source: Saltrannas88 - 1988 National Nonroad Origin and Destination Survey.

7.1.2 Organizational Considerations

There are three factors that will be shaping the development of transportation systems in the Region (and in all Indonesia) in the near and distant future. The government apparatus currently responsible for transportation will be changing fundamentally because of these factors.

(1) Improving Planning Capabilities

1) Roads

According to the existing organization, road planning and construction is the responsability not of the Dept of Communications, but of the Dept of Public Works, through its Highways Dept called Bina Marga. Over the past three years, Bina Marga, has been developing a system for the efficient management of intercity roads, called the Interurban Road Management System or IRMS. This is a long term project that includes both the central office in Jakarta as well as provincial offices of the agency, and it is being undertaken under the guidance of World Bank experts. The purpose of IRMS is to serve as a planning tool for the upkeep and improvement of the nation's national and provincial road network. It integrates in one computerized system, a descriptive data base of the networks and actual traffic data, and has an analyti cal capability to calculate the optimal timing and budget for road betterment and maintenance purposes for a given period on the basis of purely economic and technical data. Among other objectives, the IRMS reduces the arbitrary and inefficient nature of past investment which was undertaken in a less rigorous manner. As a result, the system in Southern Sumatra is developing into a more integrated one with multiple links between provinces and a more rapid identification of areas with critical need.

On the local level, the ability of kabupatens and kotamadyas for road planning is much more limited and requires substantial strengthen ing. Some World Bank assistance is being provided to extend the IRMS to the local level, but it is years behind the Bina Marga program which does not function directly at the local level.

In the separate area of vehicle taxation, the government will probably adopt an increasingly heavier road taxation position for heavy vehicles because its recent research has shown that with present taxes these vehicles do not cover their economic cost to the nation's roads, and they operate at the expense of lighter vehicles and other modes of transportation. Over the medium term, these taxes should get relatively higher.

2) Rail

The situation regarding planning for the nation's railroad company is quite different. Perumka has never been operated on an efficient basis and has been plagued with heavy losses from the time it was formed from its predecessor, PJKA (see yield and cost information in Table 7.1.4 above). However, the organization is in the midst of a restructuring program undertaken with the assistance of some foreign experts, intended to eliminate its losses. The program has had considerable success over the past decade in cutting losses, but the company's problems remain severe, and there is great uncertainty as to its long term future in its present state. It cannot plan on any major capital renewal or expansion projects in the near future until its restructuring has advanced further. In Southern Sumatra, the system functions quite separately from other modes, so while it does not hinder the operation of any other mode, it does not complement any other, either.

3) Water

A very positive recent development in transportation planning was the resumption in 1991 of the Directorate General for Land Transport's (DGLT) phase two of its Land Transport Development Plan (LTDP-II) which was suspended a few years ago. This effort, funded by the World Bank, is oriented to defining long term policy in the near and distant future, and is focusing on particularly basic issues such as the competitive relation between road and sea modes for Sumatra-Java traffic, which is relevant to sea and ferry

traffic. At present, the ferry system is defined as an adjunct to the nation's road system, and is under the jurisdiction of DGLT.

4) Air

The most centralized form of transportation is commercial aviation, since the more than 140 airports in the nation are under the responsibility of the Directorate General for Air Communication (DGAC), through one of its two operating companies (PAP I. and PAP II). At present, the priority areas for investment for the DGAC consist of the key gateway airports to Indonesia, Medan, Soekarno Hatta, Surabaya, Balikpapan, Denpasar and Biak, and no major investment has been undertaken in the study area. Furthermore, none is scheduled. The agency gets its funding for capital improvements from the central government budget or from foreign loans, and does not generate them internally. As a result, it has accomplished minimal improvement of facilities in the study region during Pelita V and will probably not meet the targets set forth in that plan.

(2) Adoption of Sound Operating Principles

At the urging of foreign development agencies, the government is undertaking a major change in planning stance by adopting principles of economic and financial rigor in the shaping and selection of future capital investment projects. As the government relies more heavily on foreign funding, and as it takes measures to strengthen its internal financial management, its agencies are developing their capability to function with efficiency through creation of operating authorities (airports and ports), and to develop investment plans along economically sound principles little used in the past. This is happening as the government in recent decrees, has liberalized some fields of transportation to make possible private investment in infrastructure, namely for roads (toll roads), and some aspects of rail, sea and ferry operation. The creation of PERUM and PERSERO companies is further evidence of this trend. These are highly positive developments that will result in rigorous screening of projects in the future.

(3) Decentralization

Another beneficial trend is that of decentralization of planning, most evident in the road planning process, which is being improved to include the provincial level in planning of the national network, and to develop the ability at the local level to manage the local road systems. As regards operation, the dividing of infrastructure (ports, airports or roads) into small groups for operation by specific entities is also a step in the direction of decentralization. Privatization is another development related to decentralization. The main benefit is to develop infrastructure that efficiently meets local and regional transport needs at the appropriate investment level. Through this trend of decentralization of planning and of operation, the government intends to achieve investment programs of a sufficient economic return in partnership with the private sector.

7.2 KEY ISSUES FOR TRANSPORTATION IN THE REGION

7.2.1 The Role of Transportation in the Development Context

The basic function of transportation is to move resources efficiently for processing into capital or consumer goods, and to provide efficient distribution of consumer goods to their final markets. Its function is also to provide travel services to the public at economical cost in terms of money, comfort and time. The transportation systems of Southern Sumatra have been examined in this context against the development philosophy defined for the region (Volume 2) which can be summarized as a gradual process of resource or agriculture-based industrialization. This direction of development is based upon a spatial strategy that requires improved communication both within the region (intra-regional linkage) as well as between it and Java, Northern Sumatra, and foreign points, particularly Singapore (inter-regional linkages). This direction of development also implies a capability

in the long run of providing timely transport for new types of cargo of higher value and time sensitivity than today's traffic. These include intermediate inputs for manufacturing and distribution purposes, which are generally not yet produced in significant quantities in the region.

7.2.2 Main Issues

With reference to this goal of economic development for the region, a number of main issues of regional importance emerge. They include:

- the importance of bulk commodities: Commodities such as palm oil, rubber, lumber, oil products, and coal are mainly outbound cargoes to Java or abroad, and will continue to dominate cargo flows for the forseeable future. Who should plan and pay for the infrastructure required for these and other commodities?

- containerization: The use of containers on roads and on the sea for international trade is increasing. What should Sumatra do to prepare its roads and port facilities for it?

- a new seaport on the east coast: The region needs cheap and quick shipping for interisland and international trade. Is a new general cargo seaport the best way to achieve this, and if so, where and how soon should it be built?

- coal transport: Shipments of coal to Suralaya (Java) and to points abroad will grow substantially. What is the best way to ship coal from Sumatra?

- the weakness of Perumka: In a region with long distances and substantial bulk cargoes, it seems obvious that rail would be feasible to haul more cargo other than coal, than it does today. Does rail have a larger future role in the region's transportation system in competition with other modes?

- Palembang as an air hub: Because of its location in the center of the region, Palembang would be the natural location for a hub operation. Is the region really suffering from a lack of internal air service, and if so, should Palembang's airport be developed to handle a hub operation?

Responses to these issues are provided in the following sections. Although no specific issue focuses directly on roads, the region's road system is central to all of these issues with the exception of coal transport and the air hub.
Strategies have been formulated to resolve these issues.

7.3 STRATEGY FOR TRANSPORTATION DEVELOPMENT

A strategy for the long term strengthening of transportation in the study area, must be defined to reflect the Master Plan's intended development model (an open economy focused on agro-industrialization). This is done regardless of existing or expected constraints (supply). The prevailing conditions and constraints are defined separately, and appear both by province and by mode in a later section.

The strategy for the improvement of transportation in the region takes the form of five functional linkages or traffic flows, which are illustrated in Table 7.3.1 and in Figure 7.3.1. Each one of these linkages corresponds in some way to an aspect of the agro-industrial development model adopted in this Master Plan. On this same table, concrete objectives that relate to the reinforcement of each linkage, are also identified. Any project recommended in this Master Plan can be justified in terms of at least one of the indicated linkages and objectives.

Table 7.3.1 Transportation Development Strategy

Linkage	Objectives/Benefits
JAVA-SUMATRA	- efficient flow by sea and road of capital and consumer goods between the islands, and of bulk cargoes from Sumatra to Java - improved passenger travel and express delivery services per higher frequency road and air links between Java and Sumatra
INTERIOR-PERIPHERY	- market broadening for resource-based production (agriculture, mining, forestry) from interior producing areas via improved road networks into additional markets in Sumatra, and also to seaports for onward shipment to Java and abroad - reduced isolation of Bangka and Belitung islands through creation of reliable ferry service from Palembang and improved roads
NORTHERN SUMATRA-SOUTHERN SUMATRA	- broadening of market opportunities for goods produced in any part of Sumatra through improved road network - better shipping options for shippers in Bengkulu and Jambi provinces through improved road access to ports in West Sumatra and Riau - stronger economic linkage between Northern Sumatra and Java via the improved Trans-Sumatra Highway and the new Eastern Sumatra Highway
SUMATRA-OVERSEAS	- increased flexibility for shippers to use ports of Panjang, Palembang, Jambi and Riau through construction of highways and east-west roads that improve regional access - access to international shipping networks by use of frequent feeder services between Singapore, Tanjung Priok and (in the future) Batam and Sumatra's seaports - efficient handling of high value commodities through ongoing expansion of container handling capabilities on roads and at key seaports
WEST COAST-INTERIOR	- broadening of markets for agricultural output from west coast farming areas to all of Sumatra through construction of cross mountain links to the Trans-Sumatra Highway - integration of west coast towns into main commercial trading networks of Sumatra - export accessibility through ports at Padang, Bengkulu and Bandar Lampung

7.3.1 Underlying Conditions and Development Perspectives

The underlying conditions and development perspectives for transportation in each province of the region are presented below in Table 7.3.2.

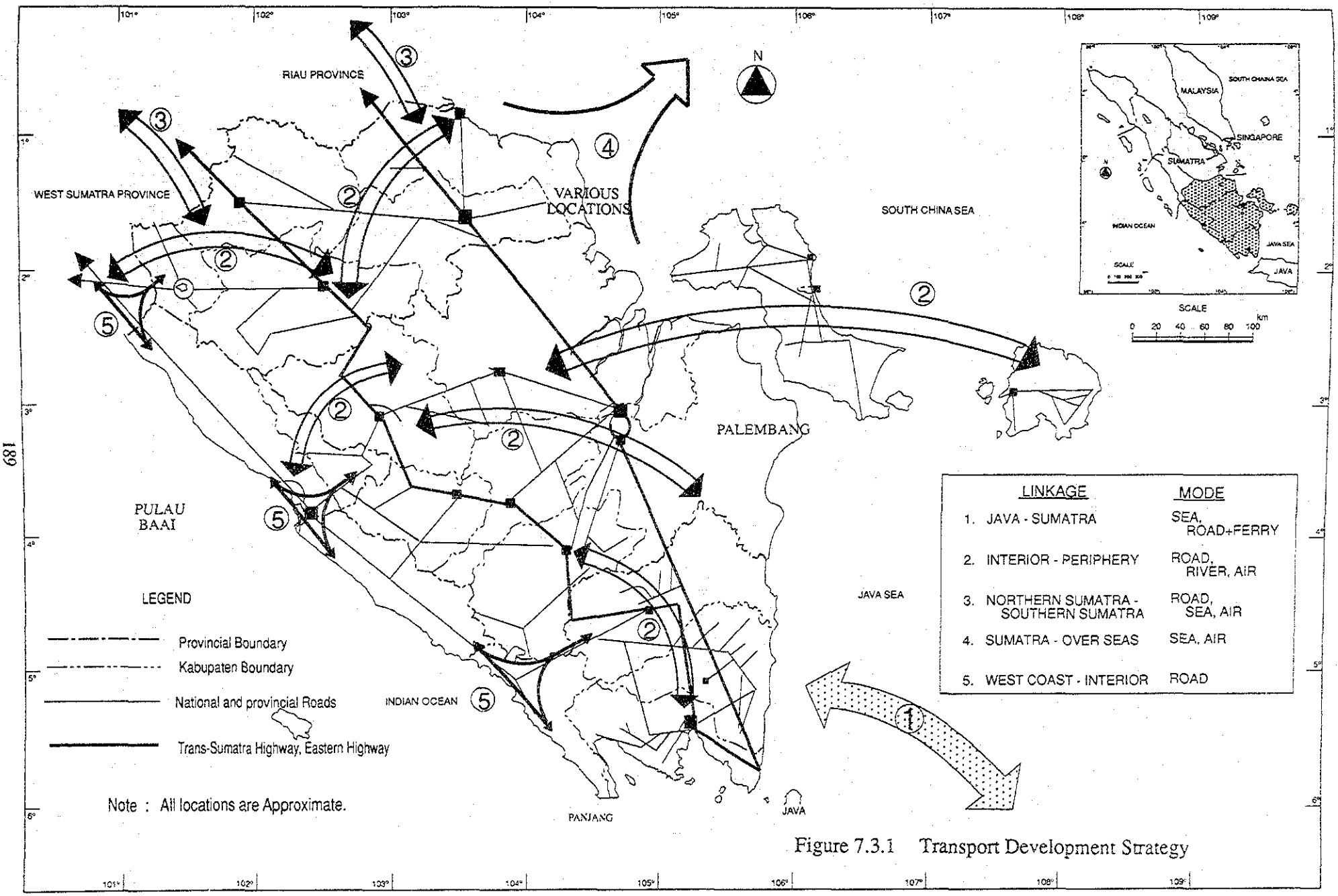

Figure 7.3.1 Transport Development Strategy

Table 7.3.2 Conditions and Development perspectives by Province

Local Conditions	Perspectives for Development
Jambi Province	
Use of Batanghari River for bulk transportation (wood, rubber, etc) between interior plantation areas & coastal ports & factories in the east.	Improvement of navigating conditions along the Musi river with channel markings and better maintenance.
Use of rivermouth ports of Kuala Tungkal, Muara Sabak & Jambi river port for shipment to Java, foreign points.	Better river & road access to all Jambi ports, and new road access to Riau ports from Jambi for heavy vehicles.
Portions of province in Padang (western part) & Palembang (eastern part) port hinterlands.	
Proximity to Growth Triangle ports of Singapore, Batam & Riau islands ports within 1 day sailing time.	Introduction of rapid sea services (fast boats, roll-on/roll-off ferry) to the Growth Triangle & Riau islands to build inter-regional links.
Remoteness of some interior kabupatens lacking local roads to feed trunk roads.	Strengthening of local road links in interior kabupatens to the Trans-Sumatra and Eastern Sumatra highways to broaden markets for small-scale agriculture & plantation output.
Isolation from Riau cities and ports for lack of good paved roads between Jambi & Riau.	
South Sumatra Province	
A major oil producing area for the nation, with cement, coal & fertilizer other major products each having specially designed transportation infrastructures.	Modernization & expansion of rail and port facilities for shipping of increased bulk volumes.
Historic importance in the region of the Musi river basin and its tributaries for bulk transportation.	Improvement of navigating and shipping conditions in the Batanghari River at Jambi City and at rivermouth ports (Muara Sabak, Nipah Panjang).
Vast swampy areas covering the eastern third of the mainland having few towns & roads, and limited production.	Construction of roads to open up remote eastern areas with direct links to Palembang and Lampung Province.
Relatively good road network in the western third of the province (plains & foothills).	
For the islands of Bangka & Belitung improving air and fast boat links from Palembang for passenger service.	Reduction of isolation of Bangka & Belitung island through introduction of reliable roll-on/roll-off ferry service from the mainland for passenger and cargo (truck) service.

Local Conditions	Perspectives for Development
For Belitung island relative isolation from lack of fast surface transport to Palembang or Jakarta (no fast boats).	
For western kabupatens, a long distance from seaports on the east coast and lack of reliable service from Bengkulu port (Pulau Baai) on the west coast.	Development of east-west trunk roads serving interior farm & plantation areas and connecting western kabupatens to the Eastern Sumatra Highway and seaports in the east.
Palembang's airport emerging as a regional hub for commercial air service to cities in Java and Sumatra.	Upgrading of Palembang airport to function as a regional hub with new service to small communities.
Bengkulu Province	
Isolation of the west coast areas from city markets and ports of the east of Sumatra because of the Bukit Barisan Mountain Range.	Linkage of the coastal areas to the rest of Sumatra via improved cross-mountain road links.
Isolation of the province from the main shipping lanes to Java, Singapore & other Asian points.	Improvements at Pulau Baai port as demand develops in line with provincial production.
Improving access to South Sumatra and Lampung through construction of new roads.	Development of corridors along the ocean coastline and from Manna eastward to Lahat (South Sumatra).
Isolation of Enggano Island from infrastructure, markets and services on the mainland.	Introduction of improved sea links to the island through introduction of ferry service and opening of a pioneer airfield.
Year round export of coal from Pulau Baai port through its special coal loading dock facilities.	Expansion of facilities to handle increased coal volume as new mines in the province start operating.
Lampung Province	
Concentration of population & industry in the southeast part of the province in Bandar Lampung & nearby areas.	Road network development to harmoniously accommodate local and regional traffic flows, particularly those related to the ports at Panjang and Bakauheni.
Heaviest traffic volumes in the region, on the Trans-Sumatra Highway in the vicinity of Bandar Lampung.	
Concentration of deep water port infrastructure near Bandar Lampung at Panjang (general & bulk cargoes) & Tarahan (coal port).	Continued expansion of cargo handling capacity including containerization as region's export markets develop and cargo traffic grows.

Local Conditions	Perspectives for Development
Good road access and fair rail access to the deepwater ports from the interior of the province extending their hinterlands into South Sumatra province.	Broadening of port hinterlands via improved road and rail links and expansion of facilities in line with demand growth.
The well functioning and high frequency Java-Sumatra ferry service from Bakauheni to Merak.	Continued expansion of capacity through construction of new facilities and operational improvements.
The isolation of the west coast (West Lampung) behind the Bukit Barisan Mountain Range for lack of paved roads or cross-mountain routes.	Expansion of provincial & national road systems into isolated areas across the Bukit Barisan.
The current opening up of North Lampung through new road construction eliminating its remoteness and past reliance on river transportation.	Linkage of this remote region with infrastructure and markets in developed areas of South Lampung and South Sumatra province to the north.

7.3.2 Principal Constraints of the Existing Infrastructure

A number of factors characterizing the existing transportation systems in the region constitute deficiencies in them because they are (or will be) hindering improvements in transportation efficiency if they are not remedied in the long run. Major hindrances from the geographical or spatial standpoint, have been identified for each province in the study area and appear in Table 7.3.3. Such obstacles or constraints, from the standpoint of each mode of transportation, road, rail air and water (sea and river transportation), are presented in Table 7.3.4.

The region's transportation suffers from problems of unlinkage, both functional and geographical. The assessment varies substantially from one mode to another. As regards the road system, some areas remain remote (geographic unlinkage), but extension of networks into them will reduce this problem. The region's main cities are somewhat poorly linked together at present, but the completion of the Eastern Sumatra Highway will largely remedy this problem. The rail mode is functionally isolated from (unlinked to) other modes since the system is designed primarily to carry coal in one direction and to one destination, the coal port at Tarahan. Air service is heavily focused on Jakarta (Figure 7.1.8) and provides minimal service between the provinces. With long distances and slow roads, the region is in great need of integrated air service.

As regards waterborne transportation, the functional link between sea and rail transport is weak, with the exception of Panjang port which does have a rail line to dockside. For nonbulk cargoes, road-sea transport is well developed (intermodal linkage) as each seaport has adequate road access except Muara Sabak. However, because of the limitations of roads, containerization is absent from the region with the exception of the vicinities around Panjang, Palembang and Jambi ports. The lack of container handling capability beyond the immediate port areas by road or rail is an example of intermodal unlinkage between sea and road and sea and rail. An example of successful linkage between two modes is river-sea, with heavy use made of river transport by the rubber and wood industries to move their bulk cargoes from interior points to their riverside plants downriver for processing into semi-processed commodities. These products are then shipped out from the waterside factories directly abroad in oceangoing vessels, in what is a very efficient intermodal pattern that has been developed basically by private sector initiative to meet the specific needs of each company.

Table 7.3.3 Key Constraints by Province

JAMBI
- remoteness of interior kabupatens from Padang, eastern ports
- costly dredging of Batanghari river
- low waterlevel of Batanghari hindering port operations
- Muara Sabak's inaccessibility by land
- limiting natural conditions at Kuala Tungkal
- poor eastwest road connection inside the province
- poor accessibility of Riau ports by road

SOUTH SUMATRA
- 170 km distance from Palembang to the Trans-Sumatra Highway
- lack of rail connection at Palembang's Boom Baru river port
- poor railroad intermodal capability
- unreliability of ferry service to Bangka and Belitung islands
- inaccessibility of Musi Rawas/Musi Banyuasin interior areas
- costly dredging of Musi river

BENGKULU
- relative isolation from rest of Sumatra per location 144 km off the Trans-Sumatra Highway
- isolation from heavy vehicles per poor mountain crossing (Kepahiyang-Bengkulu City road)
- poor sea service at Pulau Baai port per low demand
- restricted hinterland
- relative remoteness of upper and lower ends of the province

LAMPUNG
- some congestion and hazardous conditions on the Trans-Sumatra Highway between Tegineneng and Tanjung Karang
- hazard of several rail crossings in Bandar Lampung
- lack of roads for heavy vehicles such as container trucks
- remoteness of Kabupaten Lampung Barat on the west coast

Table 7.3.4 Key Constraints by Mode

ROAD
- hazardous conditions due to weather, substandard road design
- long trip times per low average speeds of 40-60 kph
- poor links between main traffic generating points: Jambi-Palembang
- Bandar Lampung-Bakauheni (Java ferry)
- Java remoteness from all of Sumatra except Lampung
- isolation of the west coast
- congestion at Bakauheni ferry for heavy trucks

RAIL
- low competitiveness against truck delivery
- unresponsiveness to private customers (coal dominance)
- inability to build feeder lines to plants, plantations

AIR
- hi cost structure requiring high air fares and light traffic
- unreliability of interprovincial service in the study area

WATER - SEA AND RIVER
- unbalanced cargo flows in/out of specific ports
- worsening of natural conditions at Jambi, Palembang ports (channel dredging, midstream handling dry season)
- Batang Hari, Musi river navigating problems in dry season
- weakness of traffic at west coast ports (Bengkulu and Padang)
- poor road access to some ports - Muara Sabak, Riau ports

It is important to note that processing and manufacturing industries in Southern Sumatra are still very few, and so linkages between them are similarly very few. As industry within the region develop mutual links and mature, better inter-regional and intra-regional links will become necessary to make possible any integration between industries. Transportation and industry will develop such links in parallel with each other.

7.4 OUTLOOK BY MODE

The outlook in the foreseeable future for each mode is summarized below. Where possible, traffic forecasts are provided to give an indication of likely future traffic volumes.

7.4.1 Road

The outlook for the improvement of road transport is positive for several reasons. The government of Indonesia is actively improving and expanding physical infrastructure, as well as its ability to efficiently plan and manage its road systems. Substantial increases in income expected for the study area serve as a basis for forecasts of strong traffic growth. Two traffic projects being funded by JICA (Development Study on Coastal Roads in East Coast of Sumatra, and, National Origin and Destination Traffic Survey) have recently developed estimates and forecasts of traffic volumes in Sumatra, of which the gist is stated in the following exhibits.

Table 7.4.1 Growth in Trip Demand by Province in Sumatra 1991-2010

(unit: vehicle trips)

	1991	1997	2010	1991-1997	1997-2010	1991-2010
Aceh	4,937	7,360	17,457	6.9%	6.9%	6.9%
North Sumatra	28,034	36,940	83,226	4.7%	6.4%	5.9%
West Sumatra	12,996	20,166	49,976	7.6%	7.2%	6.2%
Riau	7,787	10,499	24,470	5.1%	6.7%	6.2%
Jambi	2,535	5,116	17,593	12.4%	10.0%	10.7%
South Sumatra	10,996	19,135	51,586	9.7%	7.9%	8.5%
Bengkulu	3,000	5,711	18,593	11.3%	9.5%	10.1%
Lampung	9,592	17,642	63,768	10.7%	10.4%	10.5%
Total	79,877	122,569	326,669	7.4%	7.8%	7.7%

Growth of traffic from 1991 to 1997 approximates 11% per year for the study area (4 provinces) falling into the 9%10% range to 2010, significantly higher than the growth forecast for Northern Sumatra. In Southern Sumatra, the kabupatens with the strongest growth roughly follow the route of the Eastern Sumatra Highway and also include the west coast kabupatens (Figure 7.4.1). Jambi and Bengkulu are the provinces with the strongest traffic growth patterns. Figures 7.4.2 and 7.4.3 show maps depicting future traffic volumes for Sumatra (1997 and 2010), clearly identifying the areas with the heaviest concentra tions. In Southern Sumatra, these lie along the Trans-Sumatra Highway in Lampung, and along the route of the future Eastern Sumatra Highway extending from Lampung up to Jambi. On Table 7.4.2 the 17 kabupatens of the study area are ranked in (declining) order of traffic volume (and growth rate). The (formerly) three Lampung kabupatens consistently appear in the top five positions, resulting from their high absolute populations and densities.

As regards the Java-Sumatra ferry at Bakauheni a summary of the forecast for this service appears in Table 7.4.3. The outlook for this route is discussed along with road traffic because it exists precisely to link the road systems of the two islands.

Table 7.4.2 Road Traffic Forecasts for Southern Sumatra 1997 and 2010 Rankings by Kabupaten

unit: daily trips attracted

	1991		1997		2010
order: traffic volume					
1	Lampung Selatn 4,848		Lampung Selatn 8,347		Lampung Selatn 30,883
2	Ogan Komrg Ilr 4,319		Ogan Komrg Ilr 8,134		Ogan Komrg Ilr 24,077
3	Lampung Tengah 2,839		Lampung Tengah 4,842		Lampung Utara 16,761
4	Musi Banyuasin 2,641		Musi Banyuasin 4,551		Lampung Tengah 16,124
5	Lampung Utara 2,007		Lampung Utara 4,452		Musi Banyuasin 12,640
6	Muara Enim 1,519		Bengkulu Utara 2,547		Batang Hari 9,305
7	Bengkulu Utara 1,276		Batang Hari 2,364		Bengkulu Utara 8,473
8	Ogan Komrg Ulu 1,274		Rejang Lebong 1,938		Rejang Lebong 5,864
9	Batang Hari 1,128		Ogan Komrg Ulu 1,903		Musi Rawas 4,315
10	Rejang Lebong 1,121		Muara Enim 1,902		Bengkulu Selat 4,256
11	Musi Rawas 818		Musi Rawas 1,507		Ogan Komrg Ulu 4,116
12	Lahat 764		Bengkulu Selat 1,227		Muara Enim 3,642
13	Bengkulu Selat 689		Lahat 1,139		Tanjung Jabung 2,899
14	Tanjung Jabung 581		Tanjung Jabung 966		Lahat 2,797
15	Bungo Tebo 469		Bungo Tebo 764		Bungo Tebo 2,471
16	Saro Bangko 314		Saro Bangko 597		Saro Bangko 2,029
17	Kerinci 303		Kerinci 425		Kerinci 889
order: growth rate					
1	- -	- -	Lampung Utara 14.2%		Lampung Utara 11.8%
2	- -	- -	Batang Hari 13.1%		Batang Hari 11.7%
3	- -	- -	Bengkulu Utara 12.2%		Bengkulu Utara 10.5%
4	- -	- -	Saro Bangko 11.3%		Saro Bangko 10.3%
5	- -	- -	Ogan Komrg Ilr 11.1%		Lampung Selatn 10.2%
6	- -	- -	Musi Rawas 10.7%		Bengkulu Selat 10.1%
7	- -	- -	Bengkulu Selat 10.1%		Lampung Tengah 9.6%
8	- -	- -	Rejang Lebong 9.6%		Ogan Komrg Ilr 9.5%
9	- -	- -	Musi Banyuasin 9.5%		Musi Rawas 9.1%
10	- -	- -	Lampung Selatn 9.5%		Bungo Tebo 9.1%
11	- -	- -	Lampung Tengah 9.3%		Rejang Lebong 9.1%
12	- -	- -	Tanjung Jabung 8.8%		Tanjung Jabung 8.8%
13	- -	- -	Bungo Tebo 8.5%		Musi Banyuasin 8.6%
14	- -	- -	Ogan Komrg Ulu 6.9%		Lahat 7.1%
15	- -	- -	Lahat 6.9%		Ogan Komrg Ulu 6.4%
16	- -	- -	Kerinci 5.8%		Kerinci 5.8%
17	- -	- -	Muara Enim 3.8%		Muara Enim 4.7%
order: geographical					
	Kerinci 303		425		889
	Saro Bangko 314		597		2,029
	Batang Hari 1,128		2,364		9,305
	Tanjung Jabung 581		966		2,899
	Bungo Tebo 469		764		2,471
	Ogan Komrg Ulu 1,274		1,903		4,116
	Ogan Komrg Ilr 4,319		8,134		24,077
	Muara Enim 1,519		1,902		3,642
	Lahat 764		1,139		2,797
	Musi Rawas 818		1,507		4,315
	Musi Banyuasin 2,641		4,551		12,640
	Bengkulu Selat 689		1,227		4,256
	Rejang Lebong 1,121		1,938		5,864
	Bengkulu Utara 1,276		2,547		8,473
	Lampung Selatn 4,848		8,347		30,883
	Lampung Tengah 2,839		4,842		16,124
	Lampung Utara 2,007		4,452		16,761
	total 26,910		47,605		151,541

note: Kotamadyas are included in surrounding kabupatens.

source: JICA Coastal Roads in East Coast of Sumatra Study

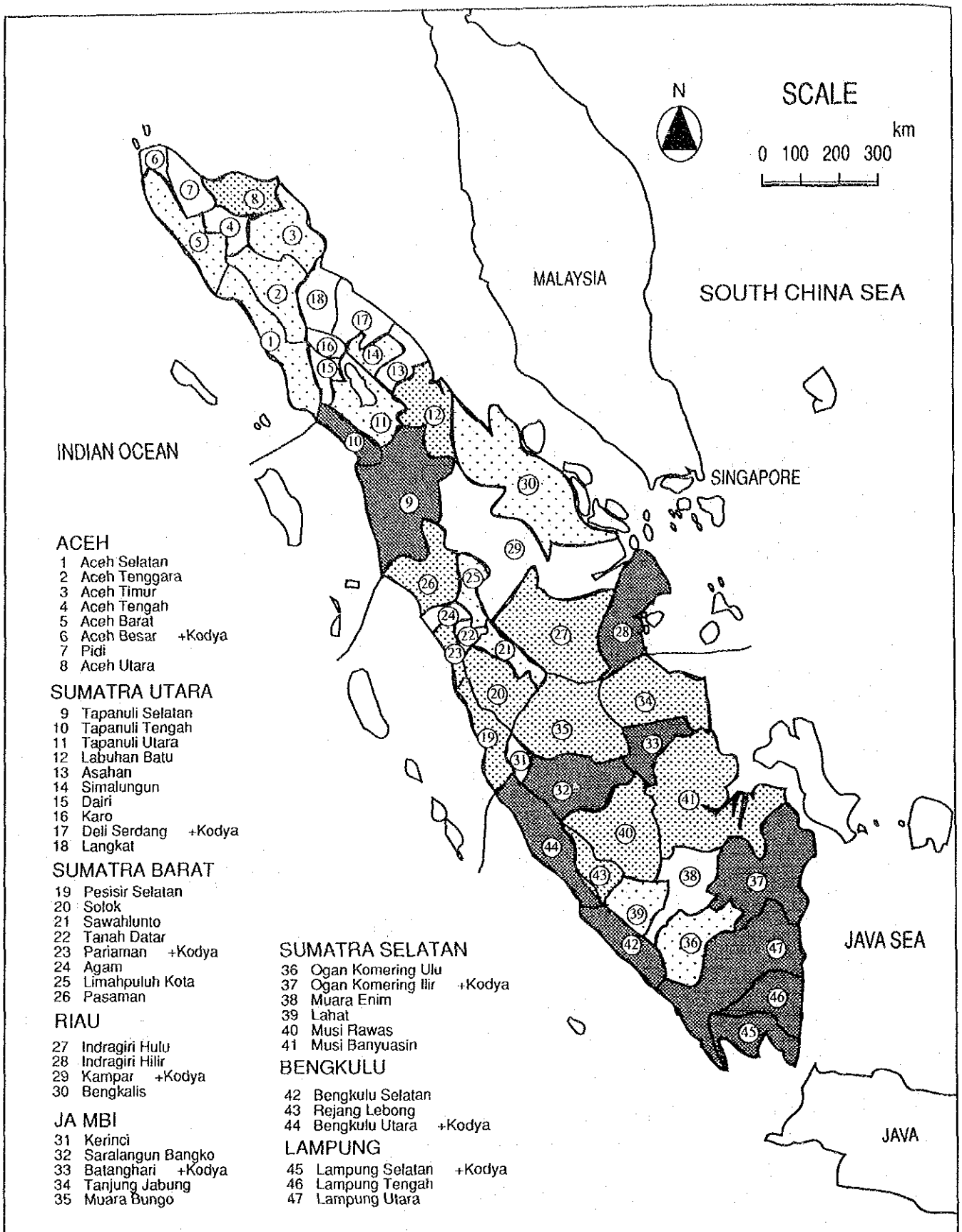

Figure 7.4.1 Traffic Growth Rates in Sumatra by Kabupaten, 1991-2010

Source: JICA Coastal Roads in East Coast of Samatra Study

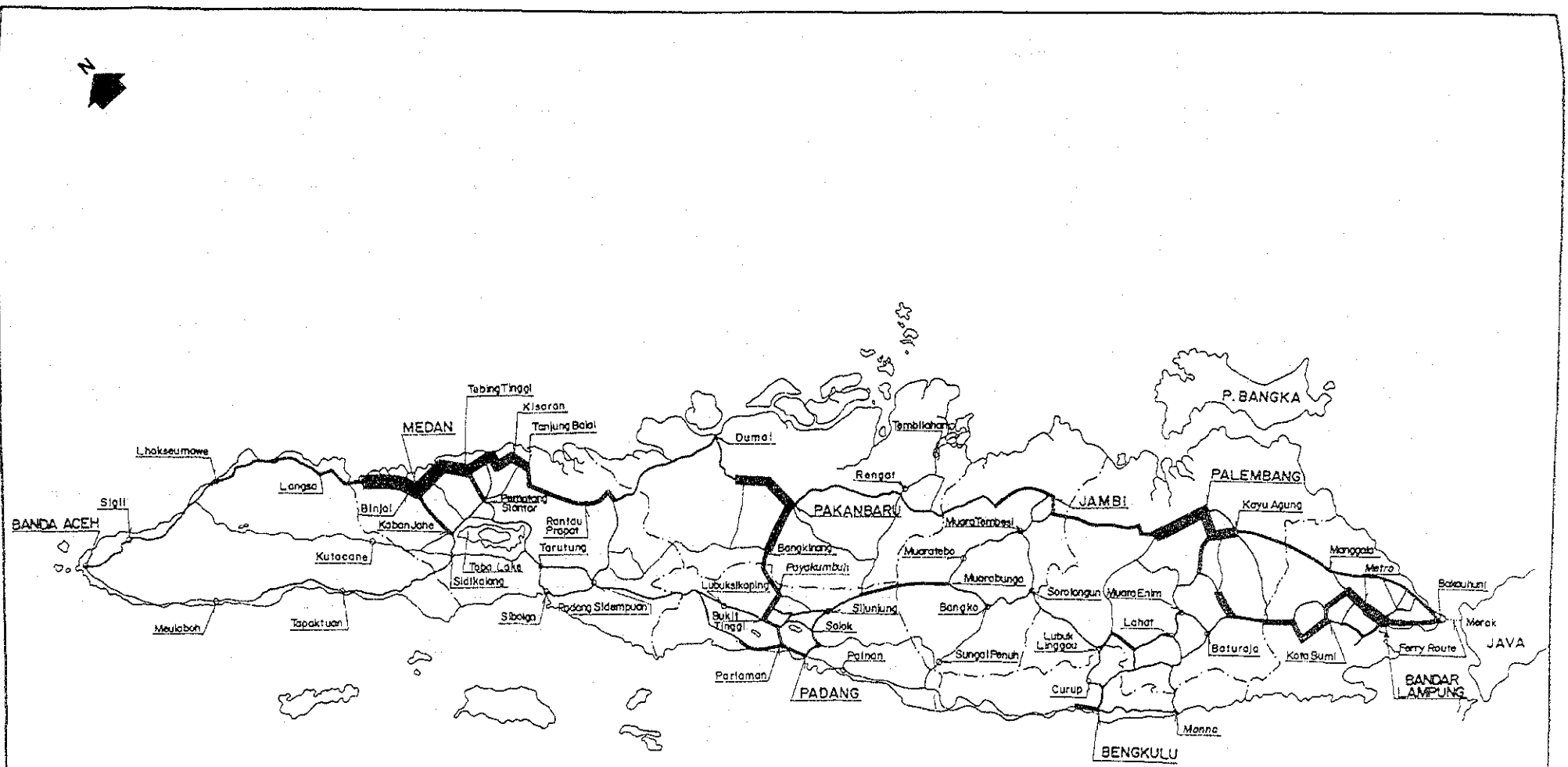

Figure 7.4.2

COASTAL ROADS IN EAST COAST OF SUMATRA	TRAFFIC VOLUME IN 1997 (WITH PROJECT)

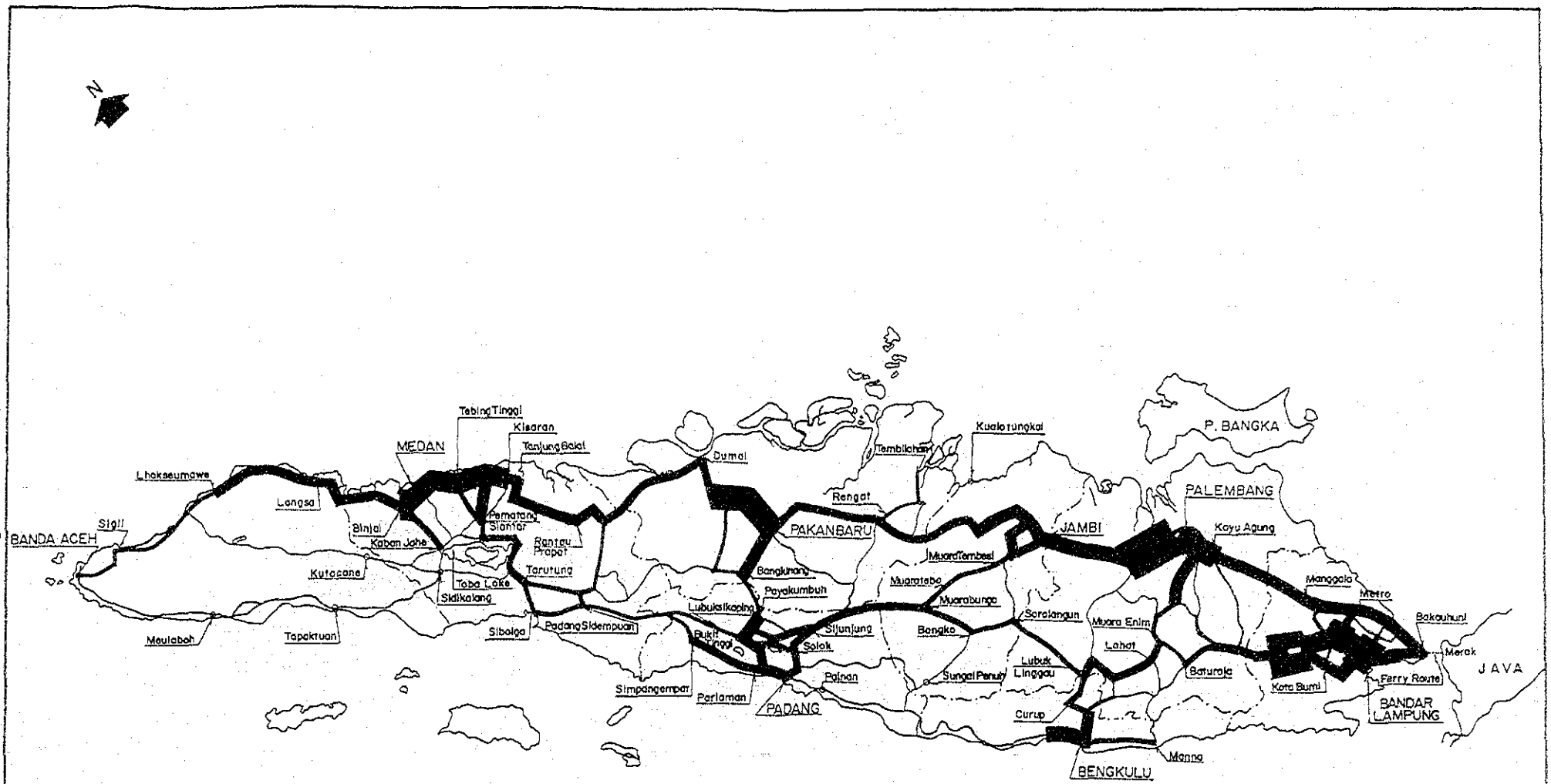

Figure 7.4.3

COASTAL ROADS IN EAST COAST OF SUMATRA	TRAFFIC VOLUME IN 2010 (WITH PROJECT)

This forecast appears reasonable in view of several factors. This growth rate corresponds approximately to general traffic growth trends for Sumatra island on the whole. There is room for expansion of the port facilities at Bakauheni and Merak, and a master plan exists to accomplish this. There is also a capability to expand capacity by using larger vessels and by using more powerful ones to make more daily trips than at present.

On the Java end, it is significant that a toll road extension from Tangerang to Merak will most likely not be completed before the year 2000, and that road conditions between Merak and the Jakarta area may grow more congested than now before they are alleviated by improve ments to the road network in West Java. It is also significant that there does not appear to be any potential alternative crossing of the Sunda Strait for vehicle traffic in the forseeable future (the next 20 years), and that the ferry service in essence will keep its monopoly status. [This is less so for bus traffic which to a limited extent must compete with rail and hydrofoil services.] The completion of a bridgetunnel crossing from Java to Sumatra by the year 2010 at this point appears impossible because of difficult technical design problems posed by the depth and soft soil conditions of the Sunda Strait.

Table 7.4.3 Summary of JavaSumatra Ferry Traffic Forecast

(unit: daily vehicles)

	vehicles	average annual growth
1991	2,681	-
1997	4,161	7.6%
2010	11,474	8.0%

Source: JICA Study on Coastal Roads in East Coast of Sumatra

7.4.2 Railroad

The outlook for the area's rail service is quite unclear since its main objective is to increase coal hauling capacity to a level of 8 or 9 million tons on the Tanjung Enim-Tarahan route by 2000, with other types of traffic taking second priority to this. No funding yet has been secured for the coal capacity expansion project and with the restructuring of Perumka still far from certain, the outcome of any such expansion is uncertain. With the history of decline of some types of traffic in recent years, and in view of the possibility of contrac tion or elimination of some services, at the present juncture it is problematic to forecast any growth in overall traffic for ESS in the medium or distant future. No existing forecast of future rail traffic is presented here and no new such forecast has been prepared as part of this study.

7.4.3 Air Service

The outlook for air service to the Region is positive because of the government's policy of gradual liberalization of the industry granting route awards to more carriers, because the Region has a positive outlook for general economic growth, and because it has plenty of unused capacity at its 6 existing airports. With the exception of Jambi, growth across the Region has been moderate between 1985 and 1990. The reason for the drop in volume at Jambi is probably because the improved road to Palembang has shifted some traffic from Jambi's airport to Palembang's airport which is now 3.5 to 4 hours away by road.

The forecast volumes reflect far higher growth rates than those achieved in the past, but since most of the airports handle relatively light volumes in absolute terms, high growth rates for a period of years can be achieved. If economic and regulatory conditions in the industry stimulate expansion of the commercial airline service, the industry will grow quickly, as has occurred in a number of other countries that have liberalized the commercial airline industry. The growth at Palembang's airport in particular is realistic should one or

volume at Jambi is probably because the improved road to Palembang has shifted some traffic from Jambi's airport to Palembang's airport which is now 3.5 to 4 hours away by road.

Table 7.4.4 Past and Forecast Air Passenger Traffic 1985-2005

(unit: passengers 000s)

	1985	1990	1993	2000	2005	annual average growth rates			
						1985-90	1990-93	1990-2000	1990-2005
Jambi	122	88	181	252	219	-6%	27%	11%	10%
Palembang	426	510	759	885	1,200	4%	14%	6%	9%
Pangkal Pinang	164	200	329	540	749	4%	18%	10%	14%
Tanjung Pandan	55	80	114	188	262	8%	13%	9%	13%
Bengkulu	49	76	96	151	209	9%	8%	7%	11%
Bandar Lampung	81	105	179	304	443	5%	19%	11%	15%
Padang	178	284	370	670	1,034	10%	9%	9%	14%
Medan	870	1,110	1,500	2,350	3,150	5%	11%	8%	11%
Jakarta (2 airports)	6,203	8,654	10,906	13,699	16,105	7%	8%	5%	6%

Source: Directorate General for Air Communication.
Note: 1985 and 1990 data are actual.

The forecast volumes reflect far higher growth rates than those achieved in the past, but since most of the airports handle relatively light volumes in absolute terms, high growth rates for a period of years can be achieved. If economic and regulatory conditions in the industry stimulate expansion of the commercial airline service, the industry will grow quickly, as has occurred in a number of other countries that have liberalized the commercial airline industry. The growth at Palembang's airport in particular is realistic should one or more carriers decide to launch hub operations from that location. However, it is not clear that such an expansion can be achieved this early in the decade of the nineties because route awards are few and competition, which takes time to develop, is very limited. Consequent ly, achievement of these forecasts, while physically possible, is highly questionable.

7.4.4 Sea Shipping

The outlook for sea traffic is positive for several reasons. Infrastructure development is gradually lessening the constraints that hinder the Region, as discussed above. The completion of more and more portions of the Eastern Sumatra Highway will improve access to all the ports located on the eastern coast (Panjang, Palembang, Jambi, Riau ports, etc.) extending the hinterlands of each and increasing competition between the ports. Shippers in Jambi will choose from ports in lower Riau, Jambi and South Sumatra provinces. Similarly, those in Palembang will choose between Palembang (or the future Tanjung Apiapi), Panjang and Jambi ports. This will be a major benefit of the Eastern Sumatra Highway project and its later phased upgrading to heavy vehicles (through the Heavy Loaded Road project).

Similarly, shippers on the west coast will have the opportunity to truck shipments over to east coast ports with frequent service, or all the way to Java by truck (and ferry). This is the result of hinterland broadening made possible by better road networks.

Another positive factor is the use of nonconventional vessels that are viable in shallow water. For passenger service, the fast boats now operating between Palembang and Muntok, and between Kuala Tungkal and some Riau islands, are examples of this. These services have resulted from private sector initiatives. A public initiative is the turbine powered hydrofoil linking Panjang to Jakarta-Tanjung Priok port, started in early 1992. As regards cargo, there is some use in Sumatra of barges such as LCT and LASH to provide feeder service from river points to the Growth Triangle. These efforts also appear to be primarily private sector initiated. The addition of roll-on/roll-off ferry services capable of taking trucks to points in the Riau islands is probable in the short and mid term.

Excess capacity at some of the existing ports and the existence of master plans indicate that severe congestion is not probable. The increasing use of containers at ports is a positive factor, especially as roads are upgraded to handle container trucks safely.

An additional factor that may improve shipping conditions for Sumatra is the possible construction in the next 10 to 20 years of a deep water container port in West Java, possibly at Bantem or on the Sunda Strait within easy trucking distance of the Merak terminal of the Java-Sumatra ferry. Such a port would most likely offer much more complete international service than any port in Sumatra, and draw traffic from Southern Sumatra by truck (via the Bakauheni ferry). This could result in a shift of traffic from Palembang and Panjang to the new port in Java. It is too early at this stage to determine the probability of this development.

All of these factors favour better shipping conditions, lower costs and faster shipping times in the Region in the long run. A very approximate projection of port activity in the Region is presented in Table 7.4.5. This projection indicates that Panjang (Lampung) will bypass Palembang to become by far the most heavily used port. On the other hand, Bengkulu's Pulau Baai will remain the port with the least traffic volume.

Table 7.4.5 Preliminary Cargo Volume Forecasts - Sea Traffic Year 2010

(million tons)

Province	CargoVolume	20 Year Growth Rate
Jambi	3.8	5%
South Sumatra	11.6	2
Bengkulu	2.5	8
Lampung	21.0	7

Source: Team's projection.

7.4.5 River Traffic

The outlook for river traffic is very unclear as it depends on how quickly the road networks in the Region improve. Excepting bulk cargoes (rubber, logs, etc.) once roads are opened in a region, traffic, both passenger and cargo, has been observed to shift from river to road, and this trend is likely to continue. Problems with operations during dry season when water levels can be low do hamper river traffic. However, in general use of rivers by private sector companies such as those in the lumber and rubber businesses will continue as in the past.

7.5 Formulation of Projects

In the light of the above explained issues and strategies, a list of physical projects to improve transport conditions has been drawn up and is presented later in this volume. These projects were formulated from two perspectives, the first being the broader regional one in which network strengthening is required (top down), and the second being the local perspective reflecting needs generally at the kabupaten level (bottom up). A number of corridors were identified and examined as to their function and potential improvements, providing the basis for the proposed projects (Table 7.5.1, 7.5.2 and Figure 7.5.1). Each corridor corresponds to at least one of the five linkages defined in the strategy for development. The development of these corridors as linkages is explained below first from the geographic standpoint, then from the modal standpoint.

7.5.1 Linkage Development from the Geographic Standpoint

The corridors defined above are identified to fulfill certain functions and to achieve certain benefits for the affected regions. In most of these corridors, some improvement to infrastructure is required in the near or distant future. The type of

Table 7.5.1 Southern Sumatra Key Transportation Corridors Development - Functions

	Function (Benefit)
1 Padang-Bungo Tebo-Jambi	-east-west trunk, opening of interior areas -better Jambi & Padang port access for agricultural output
2 West Coast-Kerinci-Sarolangun Bangko-Jambi	-east-west route, opening of interior plantation area -better Jambi & Padang port access for agricultural output
3 Jambi-Riau & North Sumatra	-north-south trunk creating inter-regional linkages -better access Jambi to Riau ports (Kuala Enok, Dumai)
4 Jambi ports-Riau islands & Singapore	-water link from Jambi & South Sumatra to Sijori industries -feeder connection to Singapore & Batam seaports
5 Jambi City-Kuala Tungkal	-access road for port -outlet to interior for coastal agriculture production
6 Jambi-Muara Sabak	-direct access road for seaport -outlet for coastal agriculture production
7 Jambi-Palembang	-north-south trunk creating inter-regional linkages -better access for Jambi & Palembang ports
8 Sarolangun-Sekayu-Palembang (via Surulangun)	-east-west trunk, opening of interior plantation areas -outlet for interior agriculture production
9 Kerinci-Muaraaman-Curup	-Kerinci Seblat Nat'l Park road for tourism & park management -highland agriculture access to west coast ports/markets
10 Palembang-Bangka I	-key surface link between mainland and Bangka & Belitung benefiting tourism & trade
11 Bangka I-Belitung I	-key surface link between mainland and Belitung benefiting tourism & trade
12 Riau islands & Singapore-Bangka & Belitung-Jakarta	-air link for tourism to Bangka & Belitung -sea link for essential low cost transport
13 Bengkulu City-Musi Rawas/Lahat	-main link between West Coast & Sumatra interior -hinterland broadening for Pulau Baai port
14 Lahat/Muara Enim-Palembang	-east-west trunk serving interior areas -mining, oil, agriculture corridor
15 Palembang-Baturaja-Bandar Lampung	-north-south trunk for road & rail traffic -primary approach to Java ferry
16 Palembang-Kayuagung-Menggala-Br Lampung	-north-south trunk creating inter-regional linkages -future primary approach to Java ferry
17 Baturaja-D Ranau-Liwa	-outlet for agricultural production to Palembang -improved access from north to tourist areas of D Ranau
18 Padang-Bengkulu City	-improved access for remote coastal areas -new north-south route
19 Bengkulu City-Krui	-improved access for remote coastal areas -new north-south route
20 Bengkulu City-Enggano I	-passenger & cargo access for remote island
21 Manna-Lahat	-link remote coastal area to Trans-Sumatra Hwy & Palembang
22 Tanjung Iman-Martapura	-outlet for highland agriculture, coastal area -link between West Coast Rd & Trans-Sumatra Hwy
23 Krui-Kotabumi	-improved access for remote coastal areas -link between West Coast Rd & Trans-Sumatra Hwy
24 Kotajawa-Kotaagung-Br Lampung	-improved access for remote coastal areas -link between West Coast Rd & Trans-Sumatra Hwy
25 Liwa-Kotaagung	-improved access for remote rural areas -outlet for agricultural production to Br Lampung
26 Menggala-Sukadana-Bakauheni	-improved access for agriculture & tourism in east Lampung -shortest north-south trunk Palembang to Java ferry
27 Tegineneng-Metro-Way Kambas	-improved access from Metro southward -link between Way Kambas Park and Br Lampung
28 Tegineneng-Br Lampung-Tarahan	-key artery through Br Lampung metro area -main access to Panjang and Bakauheni ports
29 Bakauheni-Merak	-vital Java-Sumatra link for road traffic
30 Teluk Betung/Kalianda-Sunda Strait islands	-access to Krakatau islands & resort areas

note: Road projects also include bridge improvements/work as necessary.
Short term < 5 years; medium term 6-10 years; long term > 10 years.

source: consultant

Table 7.5.2 Southern Sumatra Key Transportation Corridors Development - Potential Improvements

	Timing	Potential Improvements
1 Padang-Bungo Tebo-Jambi	medium	road upgrading for heavy vehicles
2 West Coast-Kerinci-Sarolangun Bangko-Jambi	long	road upgrading
3 Jambi-Riau & North Sumatra	short	road upgrading for heavy vehicles (East Sumatra Highway)
4 Jambi ports-Riau islands & Singapore	short	increased small-medium ship & barge feeder services increased interisland fast boat services for passengers
5 Jambi City-Kuala Tungkal	--	road construction (recent completion)
6 Jambi-Muara Sabak	long	construction of direct access road from Jambi City channel markers & warnings on Batang Hari River
7 Jambi-Palembang	medium	road upgrading for heavy vehicles (East Sumatra Highway) rail line through plantation lands
8 Sarolangun Bangko-Sekayu-Palembang	long	road upgrading for heavy vehicles
9 Kerinci-Muaraaman-Curup	long	construction of new highland road
10 Palembang-Bangka I	short	construction of new ferry docks at Palembang & Muntok increased air service Palembang to Pangkal Pinang
11 Bangka I-Belitung I	short	construction of new ferry docks on each island increased air service Palembang to Tanjung Pandan
12 Riau islands & Singapore-Bangka & Belitung-Jakarta	medium	airport upgrading on Bangka & Belitung & immigration office use of air charter flights & increased scheduled flights
13 Bengkulu City-Musi Rawas/Lahat	medium	road upgrading/realignment for heavy vehicles
14 Lahat/Muara Enim-Palembang	medium	road upgrading for heavy vehicles possible rail upgrading
15 Palembang-Baturaja-Bandar Lampung	medium	road upgrading for heavy vehicles (Trans-Sumatra Hwy) possible rail line upgrading
16 Palembang-Kayuagung-Menggala-Br Lampung	long	road upgrading for heavy vehicles (completion as East Sumatra Hwy)
17 Baturaja-D Ranau-Liwa	long	road upgrading for large tourist coaches
18 Padang-Bengkulu City	medium	road upgrading, erosion control measures (completion as West Coast Road)
19 Bengkulu City-Krui	long	road upgrading, erosion control measures (completion as West Coast Road)
20 Bengkulu City-Enggano I	medium	new ferry service from either Bengkulu port or Linnau (eventual replacement of existing pioneer service)
21 Manna-Lahat	--	road upgrading (project committed)
22 Tanjung Iman-Martapura	long	road upgrading (portion in S Sumatra completed)
23 Krui-Kotabumi	--	road upgrading (in progress, nearing completion)
24 Kotajawa-Kotaagung-Br Lampung	medium	road construction & upgrading of portion west of Sanggi
25 Liwa-Kotaagung	long	road construction & upgrading (coordination with Semangka R dam project)
26 Menggala-Sukadana-Bakauheni	medium	construction of road for heavy vehicles (completion as East Sumatra Hwy)
27 Tegineneng-Metro-Way Kambas	long	road upgrading
28 Tegineneng-Br Lampung-Tarahan	medium	upgrading, possible widening for heavier traffic proposed parallel Outer Bypass road for Br Lampung
29 Bakauheni-Merak	medium	gradual capacity expansion measures new berths, larger vess bridge-tunnel possibility in distant future
30 Teluk Betung/Kalianda-Sunda Strait islands	long	national park development oriented to water transportation (construction of boat docks, control of private boat traffi

note: Road projects also include bridge improvements/work as necessary.
Short term < 5 years; medium term 6-10 years; long term > 10 years.

source: Consultant

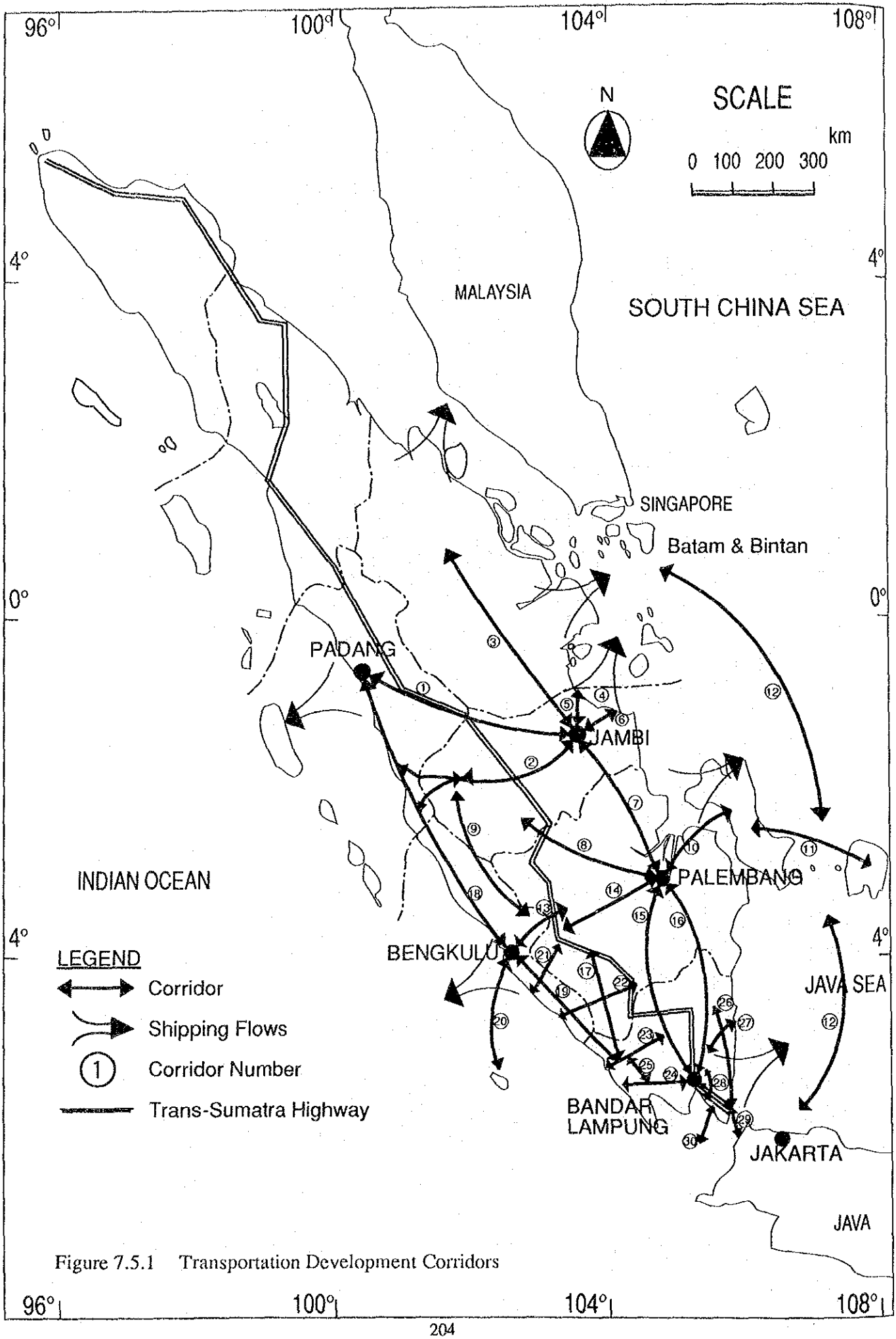

Figure 7.5.1 Transportation Development Corridors

improvement is identified under the column labeled Potential Improvements (Table 7.5.2). These listings serve as the basis for many of the transportation projects contained in the long list of the Development Plan [Part 4].

(1) Java - Sumatra Linkage [corridors 15, 16, 26, 29]

These corridors function to provide road access between the country's two main islands. All the proposed improvements make vehicle access between the islands faster, safer and cheaper than at present. In an indirect way, measures in other corridors that improve internal access within the Region, particularly road improvements, will contribute to reinforcement of this linkage by feeding traffic onto one of the island's two main arteries, the Trans-Sumatra Highway, or the Eastern Sumatra Highway.

(2) Interior - Periphery Linkage [all corridors except 3-6, 28 and 29]

Most of the corridors affect one or more remote areas, most of which are located in the interior of the Region away from the Trans-Sumatra Highway and at some distance from the Region's seaports. As plantation areas expand and mature, there will be increased movement of output between the interior plantation areas and processing points and onward to seaports, primarily by truck but also by river. For palm oil, for example, a pipeline may be feasible in some areas. For bulk transport, however, most of the improvements proposed in these corridors are related to road network improvements since river transport is already in wide use, and pipelines are a specialized mode not closely examined under this study.

In addition, the islands of Bangka and Belitung (corridors 10 and 11) are included as remote areas under this category of linkage since access to these points is not well developed. Improvements in ferry and air infrastructure and in scheduled ferry and air service to these islands are proposed.

(3) Northern Sumatra - Southern Sumatra Linkage [corridors 1 - 4, 18]

Corridors 1, 2, 3 and 18 are served by road links between Bengkulu and Jambi provinces on the one hand and points in West Sumatra and Riau provinces to the north. Corridor 4 includes water links between the ports in Jambi province and the Riau islands. Commercial and industrial links between these provinces are not strong, but will probably develop over the long term particularly as shippers in Southern Sumatra make increasing use of seaport facilities in these two provinces and as processing industries grow in Batam and Bintan (and also in Singapore). Improvements in these corridors between Northern and Southern Sumatra also improve overland access between Northern Sumatra and Java, which is a significant benefit for Northern Sumatra.

(4) Sumatra - Overseas Linkage [corridors 1 - 7, 12]

Improvements in port facilities as well as in the roads providing access to them improve the import-export infrastructure for the Region, and therefore reinforce the overseas linkage. Lower Riau province and West Sumatra have seaports whose hinterlands already extend somewhat into Jambi and Bengkulu provinces, and these hinterlands will be broadened further as the road networks in all of these provinces improve (corridors 1, 2 and 3) especially upon completion of the Eastern Sumatra Highway. Road improvements in corridors 5, 6, and 7 will improve access to ports at Muara Sabak, Kuala Tungkal, Jambi City and Palembang. As containerization in the Region grows, feeder services from these points to the Growth Triangle (corridor 4) will expand providing a rapid link between Southern Sumatra's exports and the international shipping trunk routes radiating from Singapore, and according to future plans, from Batam. A combination of improvements at the ports and on the access routes is needed.

A different type of traffic is symbolized by corridor 12 which represents growing tourist traffic to these islands, of both Indonesians and foreigners. As hotel capacity

on the islands expands, direct service from Singapore will be required, and more frequent service from Jakarta and possibly Batam, as well as Palembang, will develop. In the future the islands will be accessible from abroad through air connections at either Jakarta or Singapore.

(5) West Coast - Interior Linkage [corridors 2, 13, 18, 19, 21 - 24]

These corridors are opening up because of the current construction of a major road along the western coastline, the West Coast Road (corridors 18 and 19), and of construction and improvement in other corridors crossing the Bukit Barisan (corridors 2, 13, 21 - 24). This region corresponds to Agro-zone 3 and the road network improvements will make possible a much broader distribution of the zone's output to other regions in Sumatra and Java by road, and abroad by sea. As these links are built, the coast's historical isolation will be eliminated.

7.5.2 Linkage Development from the Modal Standpoint

(1) Factors Influencing Future Transportation Development

Certain factors that affect the planning environment for transportation have already been reviewed in section 7.1.2 above. These have serious implications for future development of transport networks in the country, and three such implications are explained below. These factors affect transportation planning in all of Indonesia, but are important enough to stress in this Development Plan since they will probably heavily influence future investment in the Region.

1) Advantages of Small Scale Development

In view of the wasteful investment in some roads and in some railroad and port facilities that has been undertaken in many countries, development agencies tend to consider small scale projects for which traffic volumes can be identified and measured with some certainty, as preferable to large scale ones designed for multiple types of traffic. To avoid unfeasible or poorly timed investment, it is ideal to tailor projects to needs of specific cargoes or users (oil, liquid bulk, grains, containers); for ports, this means for example, that small ports with facilities tailored for one or two types of cargoes, involve less risk than general cargo ports that require extensive cargo handling facilities. For rail it implies that new lines will be built for specific cargoes for a specific function, such as for haulage from plantation to plant or from plant to port. Projects can be planned to form a network in the future, but each component must be able to justify itself according to sound economic principles.

2) Development by Direct Beneficiaries

The direct beneficiaries or users can plan transport systems and undertake investment suited to their needs, be they refiners, agroindustries, mining companies or power companies, for example. They may be either private sector corporations or state enterprises. They are the most aware of the risks related to their own transport needs and can compare broad alternatives such as road, rail, pipeline or conveyor belt, for example, some of which government planning agencies may not be fully familiar with. The area of bulk commodity transport is an example of one that lends itself well to direct development by the user, as is apparent in the oil and fertilizer industries at Palembang. In an oversimplification, this means that those generating the traffic are in the best position to measure its characteristics and long term needs.

3) Private Sector Involvement

Closely related to the preceding point is the growing trend of increased private sector ownership or risk-taking in transportation infrastructure. As already mentioned, private participation in transportation is increasing in Indonesia, and as the government

develops its ability to plan and regulate public services, and to cede new areas of transportation to private operation, companies will invest in new areas of transport where they can identify legitimate needs. The use of fast boats on certain river routes and on routes to Bangka island from Palembang are examples of private sector initiative adapted to specific services. The benefit to the economy is efficient investment in infrastructure and operations, less waste and ultimately lower transport costs than in a totally government run system.

(2) Modal Development

1) Road

This is geographically the most comprehensive mode of all, and is one that is vital to reinforce each of the five linkages to be developed. There appears to be no major role in road construction for the private sector in the short and mid term since the one area that may ultimately justify a toll road, the Bandar Lampung vicinity, may not be able to support one until sometime after the year 2000. Special use roads, of course, such as those serving oil fields, parklands or reserves, or plantation areas, will continue to be built under special initiatives, but are not a part of this Development Plan.

The road projects proposed in this Plan are intended to reinforce road networks in each province, and also those in certain kabupatens where the Study has been able to focus close attention. As regards the regional network, it is comprehensive, and as regards kabupatens, it is therefore, somewhat uneven. Because of increasing planning capabilities at the local level, this is not a major deficiency. [Projects G-79 and G-81 support decentralization and strengthening of planning capabilities at the local government level.]

It is necessary to clarify that many road projects require the upgrading of existing roads to carry heavy vehicles safely. This is particularly important for the Eastern Sumatra Highway which will to some extent will relieve the Trans-Sumatra Highway as the island's key artery. As containerization of cargo is adopted in Sumatra, and as the volume of bulk commodities hauled by truck rises, roads of a minimum 6 meter width and 10 ton ESA will become necessary, and the projects of upgrading for heavy vehicles have been defined for exactly this purpose. Tractor-trailer trucks (articulated trucks) are needed to handle containers safely between seaports and inland factories and distribution points. Road will continue to be the primary mode of access for containers (over rail) for the foreseeable future.

Three projects, G-50, G-59 and G-66 are proposed specifically to make safety improvements (disaster prevention) to poorly designed stretches of road subject to recurring damage and repair. Also included in these projects is realignment of coast roads because of ocean erosion, and safeguarding of railroad crossings. The exact locations for such work cannot be known now for programs to be undertaken five or ten years from now. They are included since it is probable that as in the past, such problems will continue to afflict the road system and some of them will be too expensive to undertake within the scope of routine maintenance or road betterment. For these reasons, these projects are proposed for execution in late Repelita VI or in Repelita VII.

2) Eastern Sumatra Highway

By far the most important project in road development is the Eastern Sumatra Highway [G-38], whose feasibility study funded by JICA is near completion (as of December 1992). Directly connecting five provincial capitals in eastern Sumatra (Medan, Pekanbaru, Jambi, Palembang, Bandar Lampung), the Highway will without doubt accelerate the social and economic development of the island in general and of its eastern part in particular. As is seen in the Region's development concept schematically illustrated in Figure 2.9.1 of Vol. 2, the new artery road represents a transportation linkage of vital strategic implications to the Region's future.

The Highway is highly justifiable for the following reasons. First, the existing roads network of Sumatra, of the Region in particular, is such that major cities along the east coast lack direct mutual connection. Since most economic activity centers around those capital cities, a direct road linkage among them will streamline the Region's basic infrastructural system hereby facilitating the consolidation of the regional economy. Second, related to the first reason, the projected pattern of future traffic (Table 7.4.2 and Figure 7.4.3 above) clearly indicates that heavy demand will be induced in those kabupaten/kotamadya located along the east coast. Third, potential land still remains relatively unexploited on the coastal areas due partly to the nonexitent or poor land transportation access. (This is particularly the case with those areas between Pekanbaru and Jambi as well as those between Palembang and Bandar Lampung.) The Highway can open a new possibility of marketing agricultural products and, further, manufactured goods produced in the areas. Fourth, the trunk line will strengthen southern Sumatra's economic integration with various parts. It will better integrate the northern and southern parts of Sumatra on the one hand and, on the other, help form the Java-Sumatra axis as envisaged in this Plan. It will also improve access to the seaports thereby widening trade possibility for the Region-made products.

In addition, it is worth mentioning a special relation of this Highway with a telecommunication project proposed in this Plan [H-6 New Backbone Transmission Fiber Optic System]. An optical fiber transmission system is proposed for Sumatra to meet rapidly increasing demand for telecommunication services. According to the proposal, the system extends from Bandar Lampung to Banda Aceh, the northern end of the island, along the new Eastern Sumatra Highway connecting major urban centers in a very efficient way. A preliminary study of this project (see Part 2 of Volume 4) demonstrates its good prospects in terms of economic feasibility. One crucial precondition of this undertaking, however, is the existence of the Highway as planned. This is just one example of the far reaching, profound impacts of the Eastern Sumatra Highway on the island's socio-economic development.

3) Rail

The uncertain future of the rail company has already been noted several times before, and is an issue for the long term development of transportation in the Region. In a region where bulk products will become increasingly important, in some areas rail might prove to be a viable means of transportation if it can be competitive with road and possibly river transportation. This is a case where small rail projects focusing on specific cargoes, developed directly by the user and with some private sector backing, may prove to be competitive with other modes. New rail lines tailored for specific functions, properly equipped, and developed with or without Perumka participation, appear to be the only way for the rail mode to spread in the Region. This Plan does not recommend any regional rail network development plan since a line by line pattern (link by link) of development that is undertaken by interested parties with a direct stake in the profitability of each link is a more realistic pattern for growth. It could be that development of different and unconnected lines in a scattered fashion across the Region will occur, somewhat repeating the disconnected colonial pattern of development in Sumatra in three sections. If the goal is efficient transportation, and if the private sector is responsive, then the development of a unified or continuous route system will not be an objective or issue in itself.

In this context, six projects, G-10 to G-15, have been included in the long list to give an indication of the types of new projects that could be studied only once Perumka succeeds in restructuring itself for long term survival. All these projects involve modifications of the existing network. They are assigned low priority except for the two located in the vicinity of Bandar Lampung, one being an access line to Bakauheni (G-13) and the second, a rail bypass around the urban area (G-14) to points south (Panjang, Tarahan and Bakauheni).

However, network extension in itself is not a goal. There may be branch lines for carrying coal, crude palm oil, or other bulk commodities that could be added to the

network (coal mines to Lubuk-linggau), or be built as entirely separate lines (linking coal mines to Pulau Baai port in Bengkulu). The goal is efficient carriage, not network extension.

It is beyond the scope of this Study to evaluate the restructuring of Perumka. However, it is worth noting that such a restructuring could result in such radical changes as:

- complete separation (divestiture) of the Southern Sumatra operation from Perumka
- new profit-making operations such as real estate developments (industrial parks, shopping centers at terminals)
- privatization of all activities except rail infrastructure
- total privatization
- launching of an integrated containerization service with refrigeration and inter modal capabilities

No prefeasibility work has been prepared for any specific rail project. Ample explanation of Perumka's uncertain future is given above, and this is a major factor slowing the upgrading of the existing system. However, there are a number of projects that could be undertaken by the direct beneficiaries such as coal, cement or lumber companies, or plantation companies (rubber, oil palm, coconut, cassava, etc.) or related agro-industries needing cheap transport of bulk commodities as the plantations mature and yield in the future. Such projects can be undertaken in conjunction with Perumka, which recently has been authorized to enter into joint ventures with private parties. Furthermore, it is possible that in the future, new rail operations or systems independent of Perumka may be permitted.

A major benefit of having users invest in the new facilities is their ability to objectively compare modes, such as pipeline or barge versus rail and truck. (Such a discussion regarding modal alternatives for coal transport is following.) Development of systems in which the users are involved is intended to avoid problems of underfunding and mismanagement that plague the existing rail system. Some possible projects that could be studied in Southern Sumatra are listed in Table 7.5.3.

Table 7.5.3 Possible New Railroad Projects

type of traffic	possible route or project
all	Bandar Lampung city bypass
passenger	Bandar Lampung - Bakauheni ferry terminal
agro bulk	Lampung plantation areas - Bandar Lampung/Panjang
agro bulk	plantation areas - Palembang/new seaport
coal	Musi Rawas - existing system or to Pulau Baai
coal	mining regions - Pulau Baai port
coal	Tanjung Enim - Pulau Baai port
all	reconstruction & expansion of existing lines
cargo	branches mainline - new industrial estates
passenger	branch to Metro
all	modern line Palembang - Bandar Lampung/Bakauheni
--	terminal area property development at Palembang, Bandar Lampung city terminals

Source: JICA Study Team

In the long run, the construction of a bridge-tunnel crossing the Sunda Strait could provide for a rail link between the two islands and require the construction of modern systems on each island. It is possible that by the year 2000 sufficient research on the concept

will determine its likely feasibility and call for serious study of rail alternatives such as is being undertaken for the Chunnel linking England and France across the English Channel (now under construction). At present, research on this island link is very preliminary and because of technical problems, it is unlikely such a structure could be designed and built prior to the year 2010. However, once findings are more promising, perhaps by the year 2000, feasibility work on a Java-Sumatra rail line through the bridge-tunnel will be necessary (see below).

4) Coal Transport

Coal constitutes a special case and is a major issue in the Region; for this reason it is discussed in this section on transport modes. In fact there are two broad issues, how to get coal to Suralaya (Java) and how to export coal to other countries. These two issues are quite related. To give an idea of different inter modal solutions, and how rail is affected, the following points are raised.

Different options are possible to ship out coal as the following table indicates. This list is not a complete one as other routes may be possible, but it is presented to stress the diversity of possible options and the complexity and intermodal nature of the problem.

Table 7.5.4 Modal Alternatives for Sumatra Coal Export

modes	transfer point(s)
rail + sea (main route)	Tarahan
rail + sea (secondary route)	Palembang/new South Sumatra port
rail + barge	nearby river port
rail + barge + ship	nearby river port + seaport
conveyor belt + barge	nearby river port
conveyor belt + barge + ship	nearby river port + seaport
rail + ship	Pulau Baai port (Bengkulu)

note: The seaport could be Palembang, Tanjung Api Api or any down river location on the Musi River. The river port would be in the Enim River.

It is logically the responsibility of the company marketing the coal to determine the best route for shipment. For the Bukit Asam mines in South Sumatra, the company is PT Tambang Batubara Bukit Asam (Persero). In future years it will bid for the coal supply contract for the expanded Suralaya power plant, and with this in mind is studying how to expand coal hauling capacity between the mines in South Sumatra and Java (the KP3BAKA project) where Suralaya is located some 60 nautical miles from Tarahan port south of Bandar Lampung. Bukit Asam must study all options some of which may even exclude rail entirely. The point is that options are numerous and will take some time to study. In addition, rail is not the sole mode, although it is the main one at present. Furthermore, if in the future rail carries little extra coal than at present, it can try to build capacity for other traffics not yet being carried today. This case illustrates the degree of uncertainty brought on by the need to restructure operations and decision-making (at the power company, the railroad and the mining company) along principles of efficiency rather than by central planning. It also means that the railroad must strive for efficiency to capture the expanded coal business. In the meantime, Perumka does not have the flexibility or resources to modify its Southern Sumatra operation to actively compete for other types of freight traffic in the Region, and its operation will remain focused on coal for the foreseeable future. Because of its weak financial health and the dominance of coal, as a mode it cannot readily diversify to carry other types of cargo in the short to mid term.

5) Air

As the most centralized mode of travel, the only main improvements to the system are to the airports located in the Region. It is already stated that there is much excess

capacity in the Region's airports, and that no major physical improvement is urgently needed in the short or medium term. As regards safety, that issue is best solved at a national policy level, which is beyond the scope of any regional development plan.

As regards quality of air service, other than Palembang, other points in the study area have few daily flights, but all have regular nonstop services to Jakarta which is the air hub for the nation. For the present, this situation is adequate. The main constraints hindering better quality air service, high cost and lack of reliable interprovincial services, will be conquered as more carriers grow and as competition is allowed to develop by the regulatory agencies. Once traffic builds, then a provincial point like Palembang may be able to function as a good regional hub with small aircraft and high frequency schedules. This can probably be achieved in the medium to long term but not in the short term. Some of the new routes that can be opened into the Region, including a few international ones, have been marked on Figure 7.1.8.

6) Sea Shipping

Figure 7.3.1 shows the linkages for development of the Region which need to be reinforced in the future. Sea transportation is relevant primarily to the Java linkage (number 1) and the overseas one (number 4), and to a lesser extent to the Northern Sumatra linkage (number 3). The basic long term objective is to develop infrastructure that will offer better shipping conditions at lower cost than today.

Several measures can achieve this objective. The advantage of broadening of port hinterlands through better road networks has already been discussed. This is already in progress. In the longer run, railroad branch lines and even specially designed pipelines to ports can feed specific cargoes to them (petroleum products, palm oil). Such infrastructure can be developed by the beneficiaries at little or no public risk. In addition, as the value of cargoes to and from Sumatra rises, considerations such as time, security, quality of handling and frequency of service will become more important than at present. Containerised cargo will grow as a result.

A major response to these needs is frequent feeder services between the Region and hub ports such as Tanjung Priok, Singapore, and maybe Batam if it develops as one. Such services can be offered in mid and small size vessels capable of reaching river ports (Kuala Tungkal, Jambi, Palembang, etc.) to provide reliable high frequency scheduled services. This Master Plan proposes improvements to several ports in Jambi and South Sumatra for this very purpose. In addition, many of the corridors depicted on Figure 7.3.1 indicate that links between the interior and even western kabupatens of Southern Sumatra will provide improved access to the eastern ports via the eastwest links to be developed (corridors 1, 2, 5, 6, 8, 10, 13, 14, 15, 16, 21-24).

The idea of a new deepwater port at a coastal location in Jambi or in South Sumatra province is put forth as a major project to improve export possibilities for the Region. The need for such a facility is unclear and its feasibility needs to be studied with respect to each potential type of cargo: petroleum and related cargoes, palm oil, coal, other bulks like fertilizer or cement, containerable cargoes (mostly general cargo), and other types. In addition, ferry services to Bangka, Belitung or to the various Riau islands could be moved to such a port. However, no such study exists to date. Such a study is essential before any investment in infrastructure at Tanjung Apiapi or at any other coastal location, can be made public expense.

On the demand side the study will have to analyze the above mentioned types of activity, and the modal alternatives for each. On the supply side, such a study must begin with reliable data on the natural conditions at any possible site regarding seabed/soil conditions, water conditions, and if the site is near a rivermouth, sedimentation conditions. This is the case at Tanjung Apiapi, where available data on the natural conditions are insufficient to answer these major questions regarding natural conditions. Without this

information, a reliable cost estimation for construction and for operation is impossible. The sedimentation rate along the east coast of Sumatra is significant and must be measured before any such a port can be designed.

As regards Southern Sumatra, the Region contains a number of deepwater ports with improvement programs and excess capacity. This issue of a new deepwater port deserves study in the near term and several proposed projects on the long list call for port construction in Jambi and South Sumatra, including G-29 which specifies Tanjung Apiapi. This Master Plan (or any well made plan) cannot affirm feasibility of any location in the absence of information on the natural conditions, which requires a specifically designed plan for measurement. Consequently, one recommendation of this Plan is for a survey of conditions at Tanjung Apiapi and at any other possible location to be undertaken in the short term to enable a feasibility study to be completed in the mid term. Figure 7.5.2 shows the locations of the port projects contained in the long list of this Master Plan.

7) The Java-Sumatra Bridge-Tunnel

This concept is presently being studied on a very preliminary basis by experts at several agencies (including JICA, Bina Marga, BPPT). The Sunda Strait has natural conditions of geology and water depth that pose major design problems for such an undertaking, either for a bridge structure or a tunnel. As bridge and tunnel design technologies are improved in other countries in the future, it is possible that some innovations will be usable for this crossing, and that possibly by the year 2010 a project could be fully designed and constructed.

Such a structure would reinforce linkage 1 (Java-Sumatra) and very much complement the transport networks on the two islands with no probable distortion to the road or rail systems on either island. This development would serve only to reinforce the existing east-west corridor that has developed along upper Java, and which functionally is extending westward into Lampung via the Merak-Bakauheni ferry. It would be consistent with the intended phase of accelerated economic growth after Pelita 6 (takeoff phase and afterwards) when time will acquire greater value and rapid shipment will be demanded. However, because of the long time needed for research and design work, it is unlikely such a project can be completed within the time frame of this study, and as such it has not been included as a project in the long list. Nevertheless, the concept deserves continued research from the present time onward, and long term road and rail network planning must take it into consideration.

7.6 THE LONG LIST OF PROJECTS

A number of comments are in order in interpreting the projects contained in the Long List in Volume 4, Part 4.

(1) Grouping of Projects into Packages

In reality, for administrative and operational efficiency reasons, projects other than the largest scale ones, are commonly combined for implementation in packages or groupings rather than undertaken individually. This is especially true for road projects. However, the purpose of this Development Plan is to identify needs of specific areas, so each project idea is presented separately in the interest of clarity. No grouping of projects has been done in this Study.

(2) Uneven Coverage by Province

The number and cost of projects, especially of the road projects, varies greatly from one province to the next. An example is South Sumatra province which has the largest territory of any in the study area, but has only 9 road projects. This happens for several

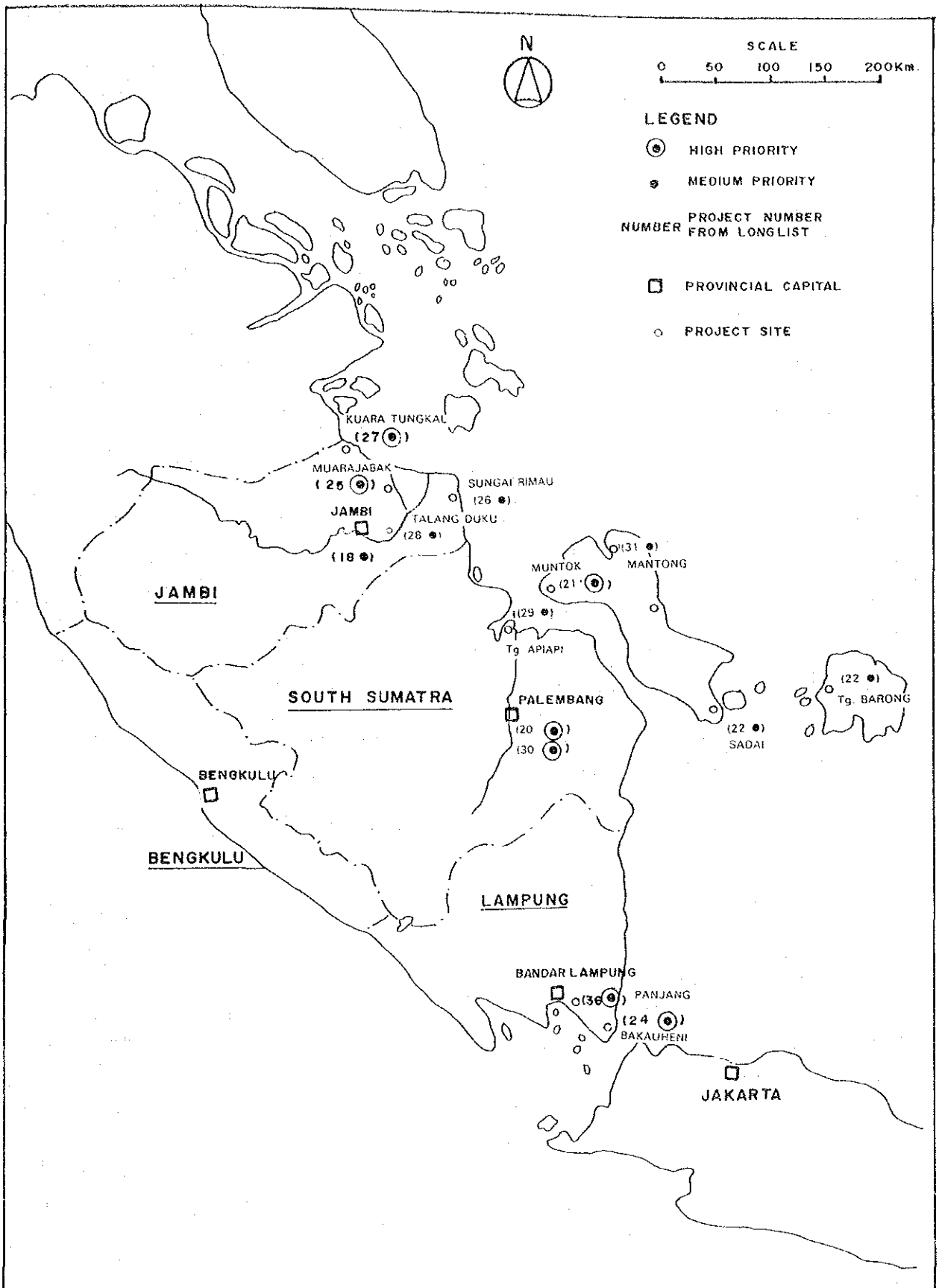

Figure 7.5.2 Port Project (High and Medium Priority)

reasons. The needs and deficiencies of road networks vary significantly from one province to the next, as do planning capabilities. In addition, the level of analysis that the Study Team was able to devote from one kabupaten to the next varied mainly because of time constraints. However, South Sumatra province has a relatively advanced road planning capability that can capably evaluate needs in the province. In addition, it is this province that represents the largest share of project G-38, the Eastern Sumatra Highway project, which is by far the most costly one. For these reasons, no effort has been made to balance the number of projects across all provinces or kabupatens.

(3) The Timing of Projects

The timing of project implementation is flexible, and will be affected by budgetary and other factors such as the grouping together of projects or IDEP formulation. It is likely that in reality many projects will be undertaken before or after the suggested period. A part of any feasibility analysis should focus on optimal timing of a project, and it is possible that results may differ somewhat from timings proposed in this Study.

(4) Definition of Road Projects

Various comments regarding the definition of road projects are enumerated below.

- Road projects are understood to include associated bridge work where necessary, to a standard consistent with or superior to the road's standard. Specific bridge improvement or replacement requirements have not been specified in the project definitions or cost estimates. This is one reason for the approximate nature of the project cost estimates.

- The specification of the project end points is also approximate, since frequently different sources indicate different end points for the same road.

- Access roads to new ferry ports or seaports have generally not been specified as road projects since because they fulfill a specific function, they most logically are to be evaluated as part of the respective port project rather than as an isolated road project.

- The term 'heavy vehicles' refers to multi-axle (3 or more) freight or tanker trucks, also referred to as articulated trucks. The term is used to indicate a design standard of at least 10 ton ESA (equivalent standard axle load), the minimum road strength needed to carry heavy vehicle traffic.

- Reclassification of roads refers to a change in its administrative status from provincial road to national road or from kabupaten road to provincial. Although recommended within a certain time frame, this change could be accomplished at any time.

8. TELECOMMUNICATION[1]

8.1 BACKGROUND

Telecommunications of today are no longer only a means of correspondence but a tool to control information system which are essential for all economic activities. The movement of information has become the determining factor in the movement of people, goods and money. While people and goods must make physical movement, money transactions are simply settled between computers using telecommunication facilities. Daily economic activities are entirely based on information and telecommunication system, which carries and processes vital information, commands the highest status in modern infrastructure along with the transport system.

This telecommunication-based information network has widened its coverage in all Japan today to include ordinary households, in addition to the business world, in the form of facsimile, personal computer communication and videotex, etc. The advent of a more advanced Intelligent Network (IN) has open up the horizon for new services, including free call (charging to called party), mobile communication (for example, cellular communication system) and video conference.

The importance of telecommunication is understood throughout society and telecommunications are leading the way towards a more advanced society. Moreover, countless advanced services will be available in the next 20 years, including such Visual communication(V) services as high definition CATV, database and 3-D(dimension) pictures, such Intelligent communications(I) service as voice dialing, electric secretary and customer programmed and Personal communication(P) services using personal use portable wireless sets, giving everyone a taste of affluent. This study is aiming 2010. Therefore, in the Southern Part of Sumatra, the telecommunication will be in the same conditions in the year 2010.

Generally, the telephone penetration ratio (of main telephone) is in proportion to their GDP. It means the level of telecommunication is in close connection to economic power (the coefficient of correlation is about 0.9). Now expansion of telecommunication network has been doing in this area. But still now many waiting applicant backlog are existing. Today's penetration ratio of telephone lines is about 0.5 per 100 persons in this area (about 73,000 subscribers/15,500,000 persons of population). It is a little lower than the average of all Indonesia (0.6) which is very low level comparing other countries for today's their economic power.

Based on this background, this study will focus on the following points of view.

(1) Clarifying the present status of the telecommunication sector in the province
(2) Identifying its development needs relating other sectors
(3) Specifying the telecommunication development needs
(4) Preparing the programs for supporting an strengthen social and economic infrastructures in this region based on (1) to (3)

8.2 CURRENT CONDITION OF TELECOMMUNICATION NETWORK

(1) Network Structure

Telecommunication Network hierarchy is the level of exchange centers to optimize network cost. It is different depending on the size of the country . In Indonesia, it is 4 levels (see Figure 8.2.1).

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[1] In this report, this means public telecommunication network. Therefore personal use system such as personal radio is beside the discussion.

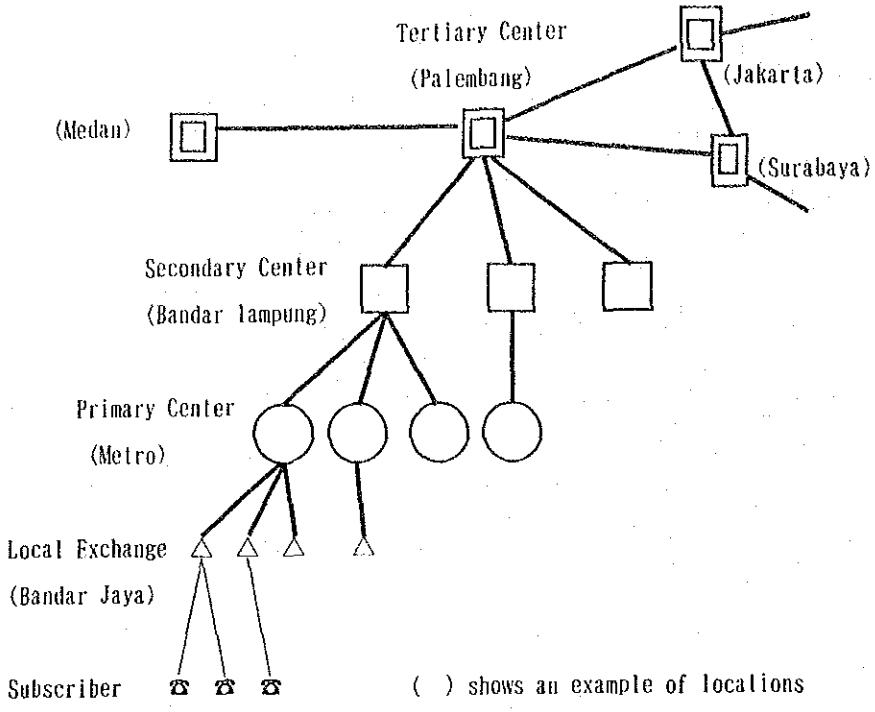


Figure 8.2.1 Telecommunication Network Hierarchy

An exchange in which subscriber lines are terminated is called **"Local Exchange"**. That is lowest level of the hierarchy.

The telephone calls to out side of the local exchange are switched by **transit exchanges**. There are 3 levels in the transit exchanges. The calls among local exchange units in about one kabupaten area, are exchanged by a **"Primary Center"**. The calls among the primary center areas in about a same Province area are exchanged by a **"Secondary Center"**. In each region of Indonesia like the Southern Part of Sumatra, there is a **"Tertiary Center"** like Palembang Central, which exchange calls among secondary centers in the area or to outside of the area including international calls. It stands on the top of the network hierarchy.

In Southern Part of Sumatra, under the Tertiary Center of Palembang, there are 4 Secondary Centers. They are in Bandar Lampung (Tanjung Karang), Lahat, Jambi and Palembang itself. There are 27 primary centers, in which there are trunk exchange systems which exchange trunk transit calls. Bengkulu office is one of those primary centers. Others are local exchange centers which accommodate subscribers and exchange local calls. In the tertiary center, secondary centers and primary centers, they have the function of local exchange center too. Some of primary centers and local exchange centers are not connected by terrestrial transmission systems. They are connected by satellite communication systems only. The most international calls from this area pass through Medan.

The main transmission systems are Trans Sumatra microwave system and Cross Sumatra micro wave system. They transmitting TV programs as well as telephone calls. It is not too much to say that it is one of the most important trunks of the society of the country. The Trans Sumatra microwave system is running from Padang, through Bkt. Pedukuh (extending to Jambi), Bkt. Sulap (extending to Bengkulu): Bkt. Asam (extending to Palembang and Lahat), Gn. Balau (extending to Tj. Karang, Bandar Lampung) and to Jakarta. The Cross Sumatra microwave system is running on Bengkulu--Bt. Sulap--Bkt. Asam--Palembang. It can't be said these systems have enough capacity to meet their traffic demand. There are about

Table 8.2.1 Situation of Telecommunication in The Southern Part of Sumatra No.1

No.	Office (Switching office)	Switching type	Switching Capacity	Subscribers	Waiting customers	area population	Penetration ratio / 100 persons
1	Jambi Centrum A	Analog	5,000	4,648		339,786	1.998
2	Jambi Centrum B	Digital	3,000	2,141	2,186		
3	Kualatungkal	Digital	1,500	562	18		
4	Muarabulian	Digital	470	104	30		
5	Bangko	Digital	470	221	80	89,537	0.247
6	Sarolangun	Manual	20	0		70,779	0.000
7	Muarabungo	Digital	470	317	60	97,546	0.325
8	Sungaipenuh	Digital	1,000	932	90	62,543	1.490
	Jambi Total	Analog 1	5,000	4,648		province population	penetration ratio against province population /100 persons=
		Digital 6	6,910	4,277			
		Manual 1	20	0			
		Total 8	11,930	8,925		2,018,463	
	automatic ratio=	0.875	0.998	1.000			0.442
1	PG centrum-I	Digital	4,000	3,763			
2	PG centrum-II	Digital	15,000	12,807	2,954	1,085,007	1.879
3	PG Talang Kelapa	Digital	3,000	1,924	216		
4	PG Kentenujung	Digital	2,000	1,891	273		
5	Kayuagung	Digital	896	230		138,873	0.166
6	Tanjungraja	Manual	100	100		96,731	0.103
7	Sungaipahit	Manual	20	4			
8	Sekayu	Digital	512	268		128,493	0.209
9	Pangkalpinang	Analog	3,600	3,283		108,603	3.023
10	sungailiat	Digital	568	565		76,040	0.743
11	Tanjungpandang	Digital	1,000	733		95,919	0.764
12	Lahat	Analog	2,000	1,786		93,627	1.908
13	Pagaralam	Digital	1,000	868	169	106,075	0.818
14	Tebingtinggi	Manual	200	187	24	52,813	0.354
15	Pendopolintang	Manual	100	66	12	41,538	0.159
16	Lubuklinggau	Digital	2,000	1,861		104,619	1.779
17	Muaraenim	Digital	1,000	675		55,533	1.215
18	Muararupit	Manual	200	78		40,347	0.193
19	Tanjungenim	Digital	1,500	255			
20	Baturaja	Digital	1,904	1,321	270	90,499	1.460
21	Parabumulih	Digital	920	673	281	163,232	0.412
22	Martapura	Digital	388	322	20	78,665	0.409
23	Belitang	Manual	300	287	230	133,589	0.215
24	Muaradua	Manual	300	311	62	83,007	0.375
	Sumatra Selatan Total	Analog 2	5,600	5,069		province population	penetration ratio against province population /100 persons=
		Digital 13	35,688	28,156			
		Manual 9	1,220	1,033			
		Total 24	42,508	34,258		6,275,339	
	automatic ratio=	0.625	0.971	0.970			0.546

Table 8.2.1 Situation of Telecommunication in The Southern Part of Sumatra No.2

No.	Office (Switching office)	Switching type	Switching Capacity	Subscribers	Waiting customers	area population	Penetration ratio / 100 persons
1	Bengkulu Centrum	Analog	2,000	4,639	646	170,183	2.726
2	Bengkulu	Digital	2,872				
3	Curup	Digital	1,128	1,082	190	128,166	0.844
4	Kepahyang	Manual	200	144	11	94,561	0.152
5	Manna	Digital	500	459	42	77,553	0.592
6	Bintuhan	Manual	100	90	20		
7	Argamakmur	Digital	500	390	30	31,725	1.229
8	Muaraaman	Manual	100	55			
	Bengkulu	Analog 1	2,000	4,639		province	penetration
	Total	Digital 4	5,000	1,931		population	ratio against
		Manual 3	400	289			province
		Total 8	7,400	6,859		1,178,951	population
	automatic ratio=	0.625	0.946	0.958			/100 persons=
							0.582
1	BDL Centrum 1A	Analog	5,000	4,829			
2	BDL Centrum 1B	Digital	6,976	3,544	2,257		
3	BDL Teluk Betung	Analog	5,000	4,703			
4	BDL Teluk Betung	Digital	1,976	790	723	636,418	2.841
5	BDL Panjang	Analog	1,016	573	161		
6	BDL Kedaton	Digital	4,016	3,643			
7	Gedongtataan	Manual	100	96		125,430	0.077
8	Kotaaguyng	Manual	200	192	49	73,227	0.262
9	Tarangpadang	Manual	200	195		113,088	0.172
10	Kurui	Manual	300	92	113		
11	Kotabumi	Digital	2,032	1,109	448		
12	Metro	Analog	1,662	1,603			
13	Kalianda	Digital	388	330		76,430	0.432
14	Liwa	Digital	400	57			
15	Pringsewu	Analog	500	206		88,417	0.233
16	Bndarjaya	Digital	888	363		88,417	0.411
	Lanpung	Analog 5	13,178	11,914		province	penetration
	Total	Digital 7	16,676	9,836		population	ratio against
		Manual 4	800	575			province
		Total 15	30,654	22,325		5,915,803	population
	automatic ratio=	0.733	0.974	0.974			/100 persons=
							0.377
	southern Part	Analog 9	25,778	26,270		The Southern	penetration
	of Sumatra	Digital 30	64,274	44,200		Part of	ratio
	Total	Manual 17	2,440	1,897		Sumatra total	against total
		Total 56	92,492	72,367		Population	population
	automatic ratio=	0.696	0.974	0.974		15,388,556	/100 persons=
							0.470

As of June 1992
Source: WITEL-III

* Population is from Penduduk Provinsi 1990, Kantor Provinsi

73 thousands subscribers in this area. And there are 239 Kecamatans. About 80 % of the Kecamatans have no telecommunication.

(2) Telephone Penetration Ratio

As mentioned above, the Telephone Penetration Ratio (of main telephone) is in proportion to their GDP. However, Indonesia's ratio (0.6) is far below the regression line against the GDP: about US$ 600. Comparing today's economic level of Indonesia, it should be more than twice (=1.2) based on the world statistics. It may be a source of obstruction of economic growth of Indonesia.

(3) Telephone Demand and Waiting Applicants

The waiting applicants for telephone lines in the whole country in Indonesia were about 600 thousands which is about 70 % of existing subscribers as of 1990. The Southern Part of Sumatra was not an exception.(about 60 % of the number of subscribers as of 1990). However it is not clear in the waiting applicants of all exchange areas as of Summer, 1992. But in only the capital cities of 4 provinces, the number of the total subscribers is about 50 thousands, and the number of waiting customers is about 9,500, which is about 20% of the number of subscribers in May 1992.

(4) Automatization Ratio of Exchange Systems

The number of the subscribers connecting to the automatic exchange system is about 71,000 as of May, 1992. On the other side connecting to manual switching system is about 1,900 as of May, 1992. The ratio of the automatic subscribers is 97%.(the average of Indonesia is about 97%). Then 17 manual exchange equipment are existing in May, 1992. Digital exchange systems are now introducing rapidly in this area replacing manual exchange systems. It is very clear that full automatization of exchange systems will be soon.

(5) Quality of Network

Connection quality is low because of the low successful call ratio. The successful call ratio in Palembang is about 32% based on the study done by NTT (Nippon Telegraph and Telephone Corporation) SCR Project team in August 1992. About 25% of it is called party busy. This causes redialing, and this phenomenon causes traffic congestion in the network again. This makes a kind of vicious circle.

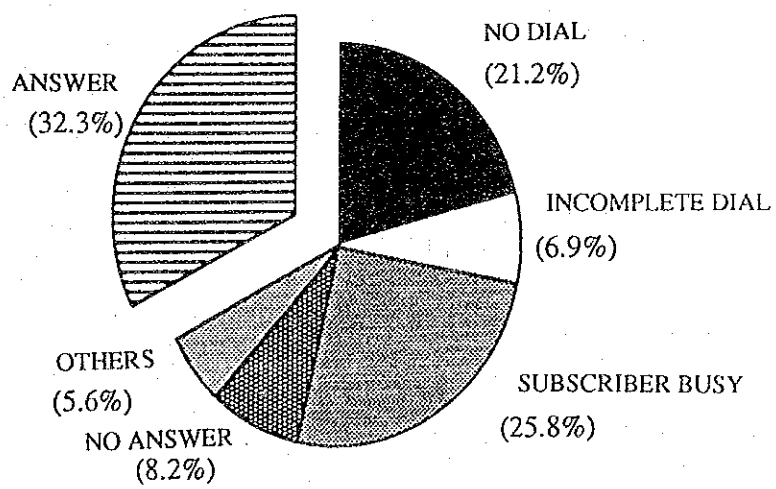


Figure 8.2.2 Originating Call Distribution in Palembang Exchange as of August 1992 (From Report of NTT SCR Project Team)

NTT team analyzed the cause too. One of main causes is subscriber's line faults as well as real subscriber busy and trunk and junction channel busy. It is a remarkable point. It means improving the quality of outside plant can also improve SCR. Speech quality is also low as we often experienced noise, cross talk and echo. It comes from the quality of the telecommunication network system and maintenance.

As to stability quality, it is about 5 faults per 100 subscribers per a month in this area. It is not so bad comparing with the average of all Indonesia which is 8 to 9. However it can't be said that it is good.(in Japan it is 0.5). This failure is caused by mostly trouble of outside plant (about 90%).

(6) Existing Problems (from Field Survey in the Southern Part of Sumatra)

The team has identified the following problems in the Region.

1) from customers side:

   a) lots of waiting applicants
   b) many kecamatans without telephone network (about 80% of kecamatans don't have telephone network)
   c) low level of SCR (successful call ratio)

2) from operators of telephone network side

   a) old equipment (especially in exchange system and outside plant)
   b) inadequate equipment
   c) inadequate space of building for future equipment expansion
   d) inadequate organization of demand forecasting by the members of the telephone office (they have the most knowledge about the area)
   e) equipment construction by maker (the maintenance members of telephone offices losing best chance to know the system know-how)
   f) few leased line service in nation wide (this is one of the causes of the traffic congestion because they occupy normal telephone channels, and they can't make on-line information systems)
   g) inadequate experts who can manage and maintain equipment facing big expansion program
   h) a lot of failure in outside plant
   i) being requested good and cheap systems for rural telecommunication
   j) even if they can offer rural telecommunication services, it is a scanty revenue for the big construction cost.
   k) for telecommunication cable construction and repairing, not good coordination among power supplier, water supplier and the organization of road for road digging.

8.3 OBJECTIVES OF THE PROJECTS

Based on the above mentioned problems, the objectives of this study are as follows from the view points of users needs.

1) elimination of applicant backlog
2) elimination of no telephone Kecamatans
3) improving SCR
4) improving quality
5) various enhanced services
6) cheep and better services

Then the main projects corresponding to these objectives are as follows as shown at right hand side in Figure 8.3.1.

1) Expansion of city telecommunication network
   a) expansion of exchange capacity
   b) expansion of outside plant(cables and civil works from local exchange to subscribers)
2) Introduction of rural telecommunication system.
3) Replacement of old equipment (switching systems and cables)
4) Strengthen of maintenance system
   a) diffusion of outside plant maintenance centers
   b) at the next, establishment of maintenance centers
5) Digitalization of network to improve the network quality and introduction of ISDN in the future
6) Improving management system
   a) demand forecast organization system
   b) unattended exchange center
   c) CAI training system
7) Coordination for road digging among power supplier, water supplier and the organization of road

These are not existing alone but relating to each other.

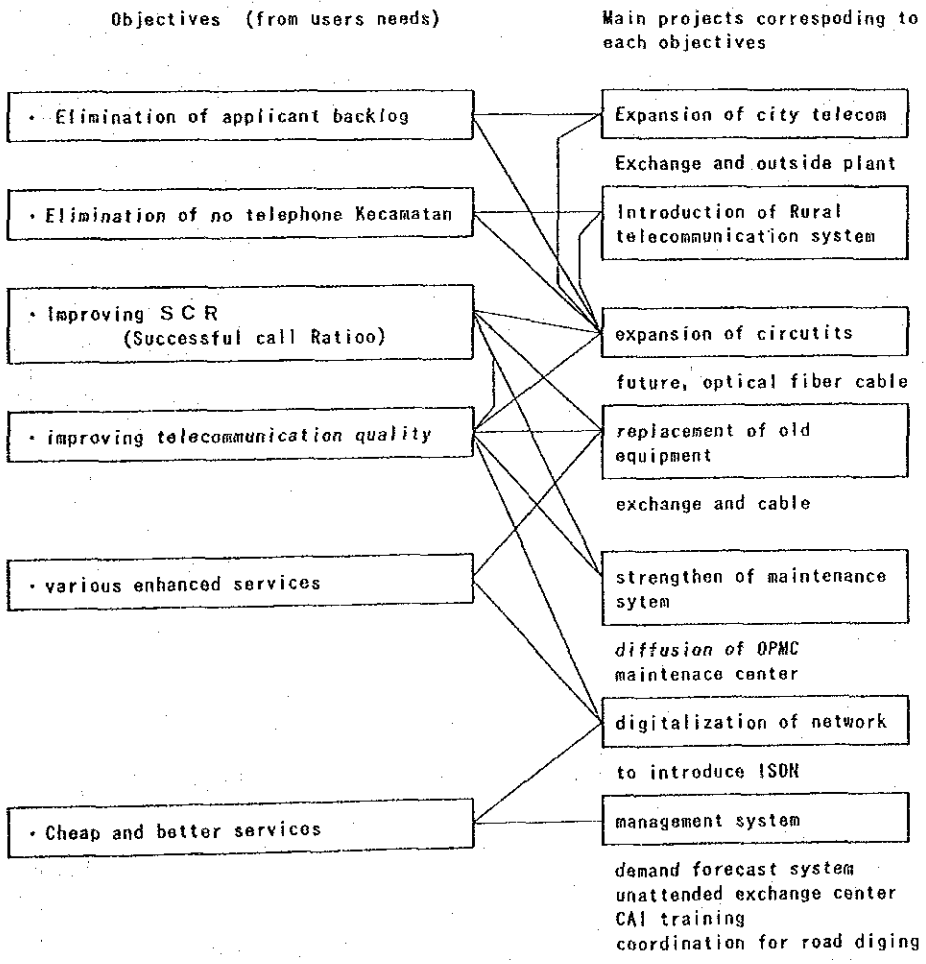


Figure 8.3.1 Basic Concept for Improving Telecommunication Service

8.4 STRATEGIES OF DEVELOPMENT PROJECTS

Some kinds of demand forecast for telephone lines for future 20 years are existing. The study team selected the data from another JICA team that is the study team on TELECOMMUNICATION NETWORK DEVELOPMENT PLAN FOR REPELITA-VI. Table 8.4.1 shows the data of major cities. (The source of the demand forecast is from PT. TELKOM and adjusted by the JICA team.) As seen the table, the volume of future demand in 2010 is about 10 times as the number of today's system capacity, and about 2 times as the demand of 1998. It means that if the telephone network accommodates all demand in 2010, the telephone traffic also becomes more than 10 times as today's volume. The equipment needs also 10 times bigger in the scale. Then the employees must of PT. TELKOM be increased up to more than 2 times than the today's.

The demand in Table 8.4.1 includes the demand of the kecamatans as well as that ibukota. The total number of subscribers in this area is about 73,000, while in big cities, it is about 70,000 (about 96%). It is recognized that the demand is centralized in big cities like Palembang, Bandar Lampung. As above mentioned, telecommunication leads the economic activity, and the center of the area like a provincial capital has the leading function of the economic activity in the area. Besides telephone is generally used more economic activity in bigger cities than rural areas. Therefore, from the view points of economic growth, expansion of telecommunication network of bigger cities is the highest priority. But it doesn't mean to stop expanding telephone network in rural area. The growth of economic level of big cities leads the economic level of surrounding areas by increasing market scale, more employees, etc. It is natural that surrounding areas will become to need telephone lines. And in the future, from the view points of social security, it is desirable that all desas have some telephone lines like public telephone in the center and normal telephone sets for the desa office.

8.5 BASIC CONCEPT OF EXPANSION OF TELECOMMUNICATION NETWORK AND PRIORITY OF PROJECTS

Getting above mentioned terms into shape, the strategy is that the expansion of big cities' telephone network is highest priority (that is expansion of size of a dot), but simultaneously expanding the network to the surrounding areas is also essential (that is expansion of the number of dots). Then to carry the increasing traffic, it needs expansion of the transmission system connecting above mentioned areas. Then the next, to improve the quality of service level including SCR, introducing new equipment and promoting the maintenance level are essential.

Based on the above objectives, development projects to get to the goals are as follows in order of high priority:

1) Expanding the telephone network in big cities and elimination of the waiting applicant backlog (expanding the size of dot)
   - Expanding exchange capacity
   - Expanding outside plant

2) Expanding network to surrounding rural area (expanding the number of dots = expanding service area)
   - Introducing rural area telecommunication technics

3) Altogether with 1) and 2) (expanding dots and areas):
   - Expanding transmission system is essential to treat the increasing traffic. (expanding lines from dot to dot)
   - Expanding the capacity of transmission system in the area as a trunk route after 2000, fiber optic system will be suitable.
   - Then installing branch transmission system from the trunk route to rural areas.

Table 8.4.1 Demand Forecast and Expansion Exchange Capacity in Big Cities in The Southern Part of Sumatra Area

Location	Existing condition			Capacity after ongoing plan completion in 1998	Demand forecast of the kota				Minimum expansion capacity after ongoing plan, up to 2010
	Capacity	Subscribers	Waiting		in 1998	in 2003	in 2008	in 2010	
Ibukota Propinsi									
Jambi	8,000	6,789	2,186	39,820	42,982	57,909	82,508	92,348	52,528
Palembang	24,000	20,385	3,443	99,670	114,558	144,761	206,255	230,863	131,183
Bengkulu	4,872	4,639	640	36,490	83,595	110,301	157,155	175,897	139,407
Bandar Lampung	23,934	18,082	3,141	67,854	73,361	100,765	143,555	160,675	92,821
Kotamadya									
Pangkalpinang	3,600	3,283		7,450	7,781	10,164	14,482	16,209	8,759
Ibukota Kabupaten									
Jambi									
Kualatungkal	1,000	932	18	2,270	1,493	1,834	2,612	2,923	653
Muarabulian	470	104	30	890	802	1,268	1,806	2,021	1,131
Bangko	470	221	80	710	379	439	624	698	0
Sungaipenuh	1,000	932	90	1,990	1,881	2,162	3,187	3,597	1,607
Muerabungo	470	317	60	850	723	913	1,301	1,456	606
Sumatera Selatan									
Sekayu	512	258		1,082	1,058	1,426	2,032	2,274	1,192
Kayuagung	894	230		896	1,047	1,403	1,999	2,237	1,341
Baturaja	1,904	1,321	270	7,830	5,396	7,885	11,377	12,734	4,904
Muaraenim	1,000	675		2,630	3,026	4,726	6,733	7,536	4,906
Lahat	2,000	1,786		10,500	17,121	27,416	39,061	43,719	33,219
Tubuklinggau	2,000	1,861		5,720	7,348	10,528	15,001	16,798	11,078
Sungailiat	508	565		3,478	5,159	9,998	14,244	15,942	12,464
Tanjungpandang	1,000	733		3,330	4,440	7,214	10,279	11,505	8,175
Bengkulu									
Manna	500	459	42	2,340	3,708	5,895	8,410	8,416	7,076
Curup	1,128	1,082	190	9,670	14,483	24,338	34,677	38,813	29,143
Argamakmur	500	390	38	1,560	2,019	3,212	4,576	5,122	3,562
Lampung									
Kalianda	388	330		988	999	1,377	1,962	2,196	1,208
Metro	1,662	1,603		5,530	3,935	5,373	7,655	8,568	3,038
Kotabumi	1,136	1,109	448	3,742	5,511	7,693	10,960	12,267	8,525
Liwa	388	57		840	802	1,156	1,647	1,843	1,003
Kota Administratip									
Sumatera Selatan									
Prabumulih	920	673	281	3,489	4,667	7,731	11,014	12,327	8,847
total	84,366	68,816	10,955	321,610	388,274	557,977	795,112	889,966	568,398
	1	0.816	0.130	3.812	4.602	6.614	9.425	10.549	
					1	1.437	2.048	2.292	

"Existing condition"is as of May 1992. The source is from WITEL-III
A blank of "Waiting column" shows no data.
The source of "Demand forecast" is from P.T.TELKOM and adjusted by JICA team of study on
"TELECOMMUNICATION NETWORK DEVELOPMENT PLAN REPELITA-VI".
It is including the demand of all desas in the kecamatans
The source of "Capacity after ongoing plan completion" is from above mentioned JICA team.
The capacity covers some sorrounding kecamatans.
It is defferent from the condition in 2010 when each kecamatan has
its own exchange fanction covering its own kecamatan only.
Demand forecast in 2010 is calculated by proootional distribution of increasing demand from 2003 to 2008.
2010= 2008+(2008-2003)x2/5
Minimum expansion capacity after ongoing plan, up to 2010 is culculated by difference between
"Capacity after ongoing plan completion in 1998" and "deamnd in 2010".

These are related to improving SCR. Figure 8.5.1 shows the concept of above strategies.(from 1) to 3)).

4) Improving quality
   - Promoting the maintenance level of outside plant.
   - It needs diffusion of OPMC (Outside Plant Maintenance Center)
   - In the next, establishment of Maintenance Centers in which all kinds of maintenance engineers and technicians as well as outside plant engineers are working. When some failure happened, it dispatches some suitable engineers to the site with meters and tools to test and repairer the system. It is saving manpower too.

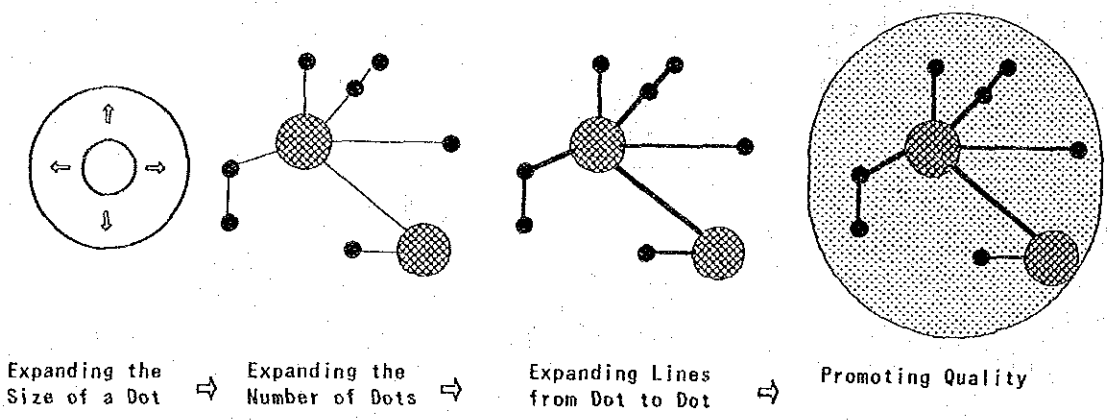


Figure 8.5.1 Concept of Telecommunication Development Strategy of Southern Part of Sumatra Area

8.6 MAJOR CITY TELEPHONE NETWORK

Some ongoing plans up to 1998 are running already. For elimination of waiting applicant backlog in big cities by 2010, this study team calculated expansion capacity from 1998 to 2010 after ongoing plan completion.

Table 8.4.1 shows that the scale of the telephone network of the major cities will become 10 times as today's network in 2010. The target of this project is to eliminate waiting backlog by 2010. The expansion capacity after ongoing plan completed will be about 710 thousands line units of the switching equipment and 900 thousand pairs of cable lines until 2010. It needs many kinds of measures against this phenomenon such as employment, training of employees, some efficient organization systems and new technics as well as big finance.

(1) Expansion of Capacity of Exchange

Assuming that unit cost per one line unit of switching system is about US$ 300, the total cost of expanding exchange capacities after completion of existing plan (1998-2010) is about US$ 213,000,000 (=300 x 710,000). In bigger cities as Palembang and Bandar Lampung, to make economical local network, a tandem switching system will be needed.

(2) Expansion of Capacity of Outside Plant

To keep pace with (1) expansion of exchange capacity in major cities, expansion of cable equipment is essential project. Copper cable is normal case, but in a future, optical fiber cable for subscribers lines will be common. To improving today's outside plant condition, it is considerable points. It makes the network easy to introduce ISDN in future and Broad band ISDN too.

Estimating the expansion cost using copper cable with US$ 500 for a unit cost per one pair subscriber cable, it becomes about US$ 450,000,000 (=US$ 500 x 900,000).

The total cost of expansion of major cities' telecommunication network (expansion of exchange and outside plant) is about US$ 660,000,000. It is not small. It means some government support is needed.

8.7 TRANSMISSION ROUTE TO RURAL AREA

In the Southern Part of Sumatra area, now Trans Sumatra microwave route and Cross Sumatra microwave route make the main artery circuits. They are connecting among the bigger cities. Figure 8.7.1 shows today's transmission route and new routes planned by PT. TELKOM up to 1997. Based on the Figure, today's almost satellite connection will be replaced by terrestrial connection, including Bangka Island and Belitung Island.

Next stage is expanding the network to kota kecamatans to eliminate no telephone kecamatans. Based on the existing plan, study team planned how to connect to all kecamatans from existing planned route by studying on a rough geographic map and site survey of some parts. Figures 8.7.2 to 8.7.5 show the output of the study. But it is not complete one, because the study team couldn't make enough study because of time limitation. Therefore, before implementation of it, the detail feasibility study including site survey is essential.

The next preconditions were adopted to study:

1) along a main road, fiber optic system should be adopted, because in the future, optical fiber cable system may be comparatively cheaper than microwave system;

2) in a microwave route, if it is difficult to connect directly between two centers because of geographical reason as existing a high mountain, one or more relay stations are settled between the two centers;

3) taking into consideration of administrative border line, an exchange center of kota kecamatan should be connected to the exchange center of the belonging kota kabupaten, but geographical reason is disturbing this precondition, some centers of kota kecamatans are connecting from the next kabupaten;

4) according to the data from another JICA team study on TELECOMMUNICATION NETWORK DEVELOPMENT PLAN REPELITA-VI, the demand for telephone lines of each kecamatan area including desas in the year 2008 is dispersing mainly about 30 to 300. Therefore, for the scale of the exchange capacity of a kota kecamatan, about 500 is acceptable scale to accommodate subscribers of surrounding areas, using a kind of rural telecommunication system in 2010; and

5) therefore, the exchange type of the center of a kota kecamatan may be RSU (Remote Switching Unit) or LC (Line Concentrator). It should be decided depending on the scale of demand for telephone lines in the kecamatan including the desas.

8.8 RURAL TELECOMMUNICATION SYSTEM

Almost all desas don't have telephone lines. But after the year 2000, it is necessary for telephone network to be expanded to these areas to avoid isolation from information. It is also an inevitable plan to promote the society to advanced one.

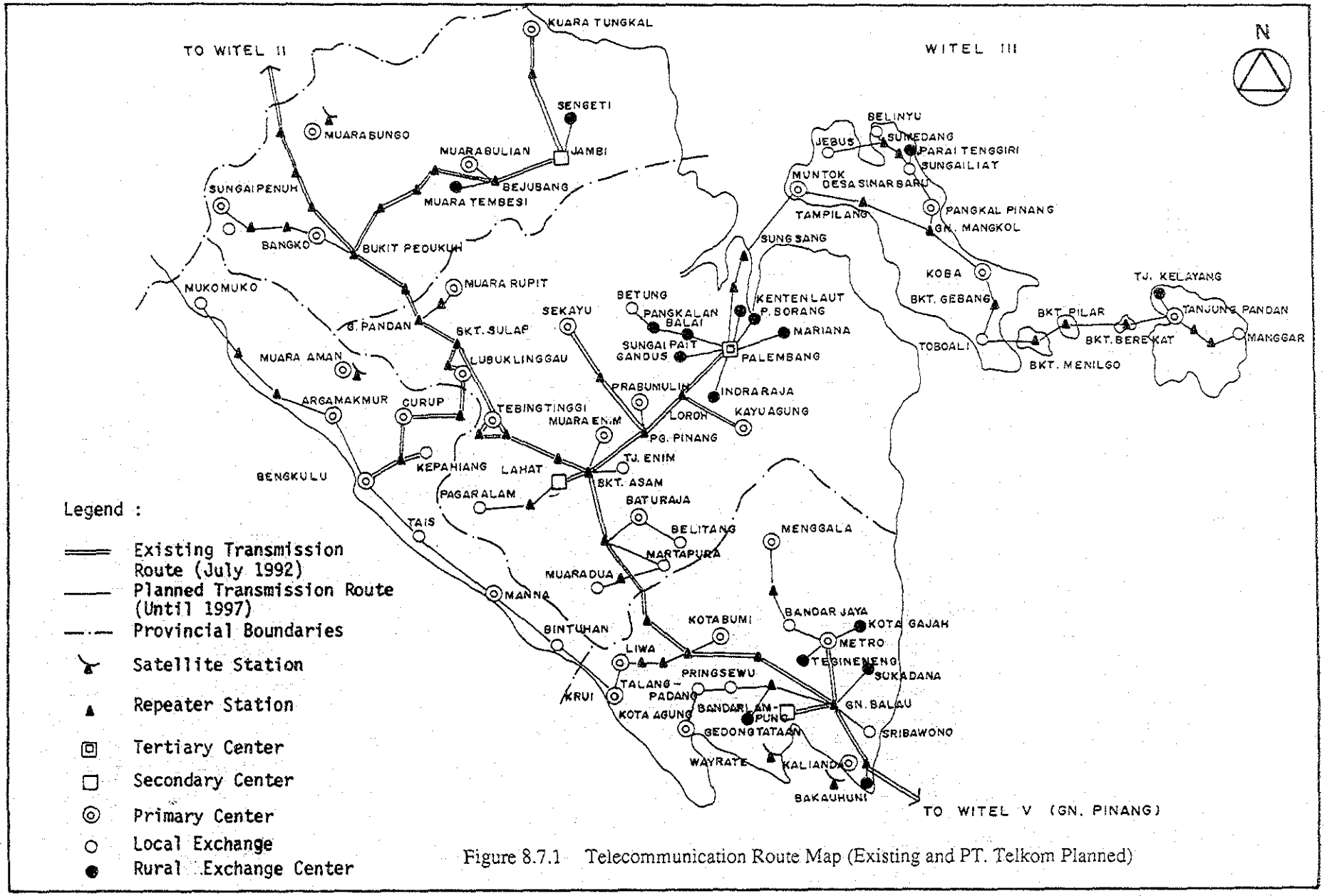


Figure 8.7.1 Telecommunication Route Map (Existing and PT. Telkom Planned)

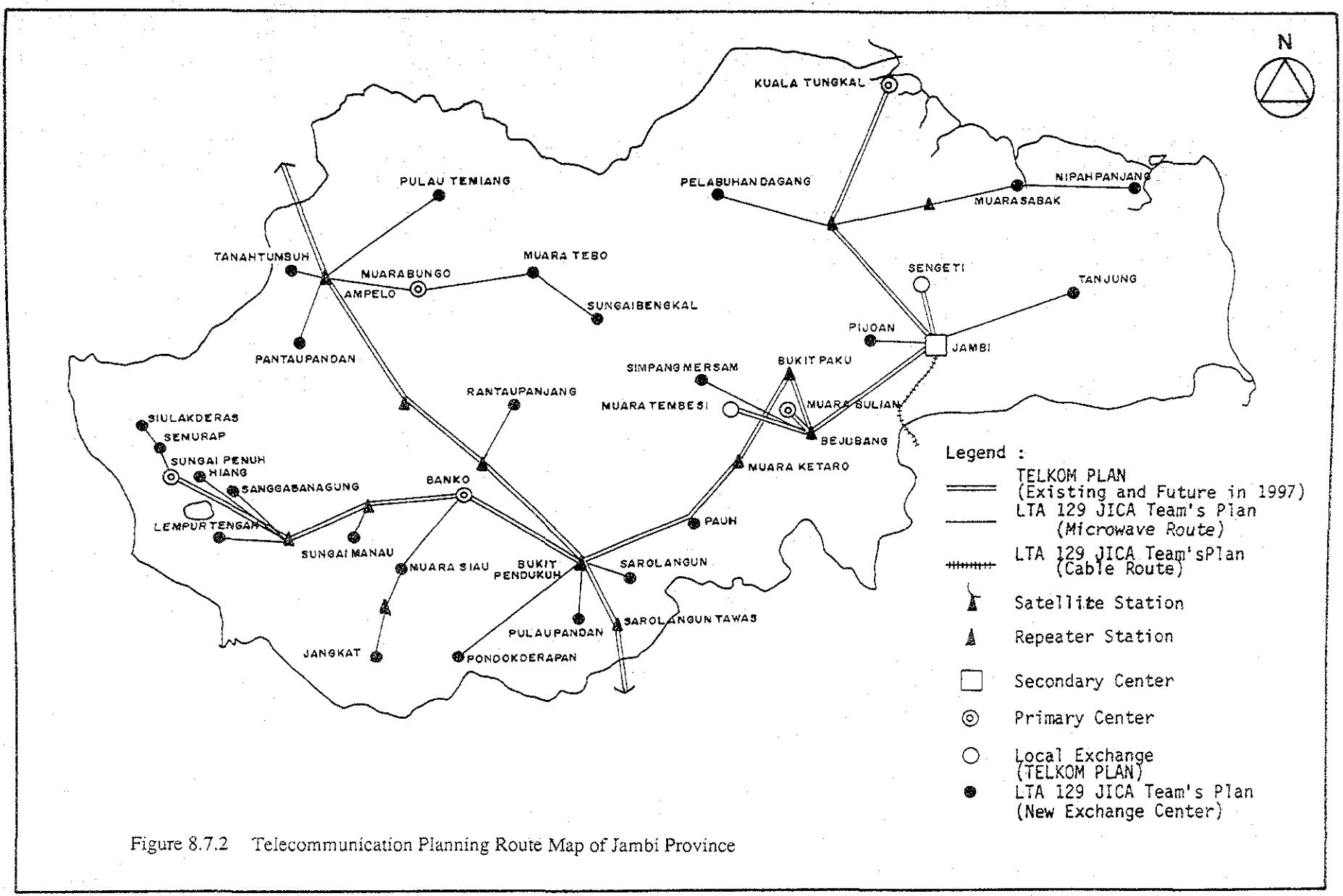


Figure 8.7.2 Telecommunication Planning Route Map of Jambi Province

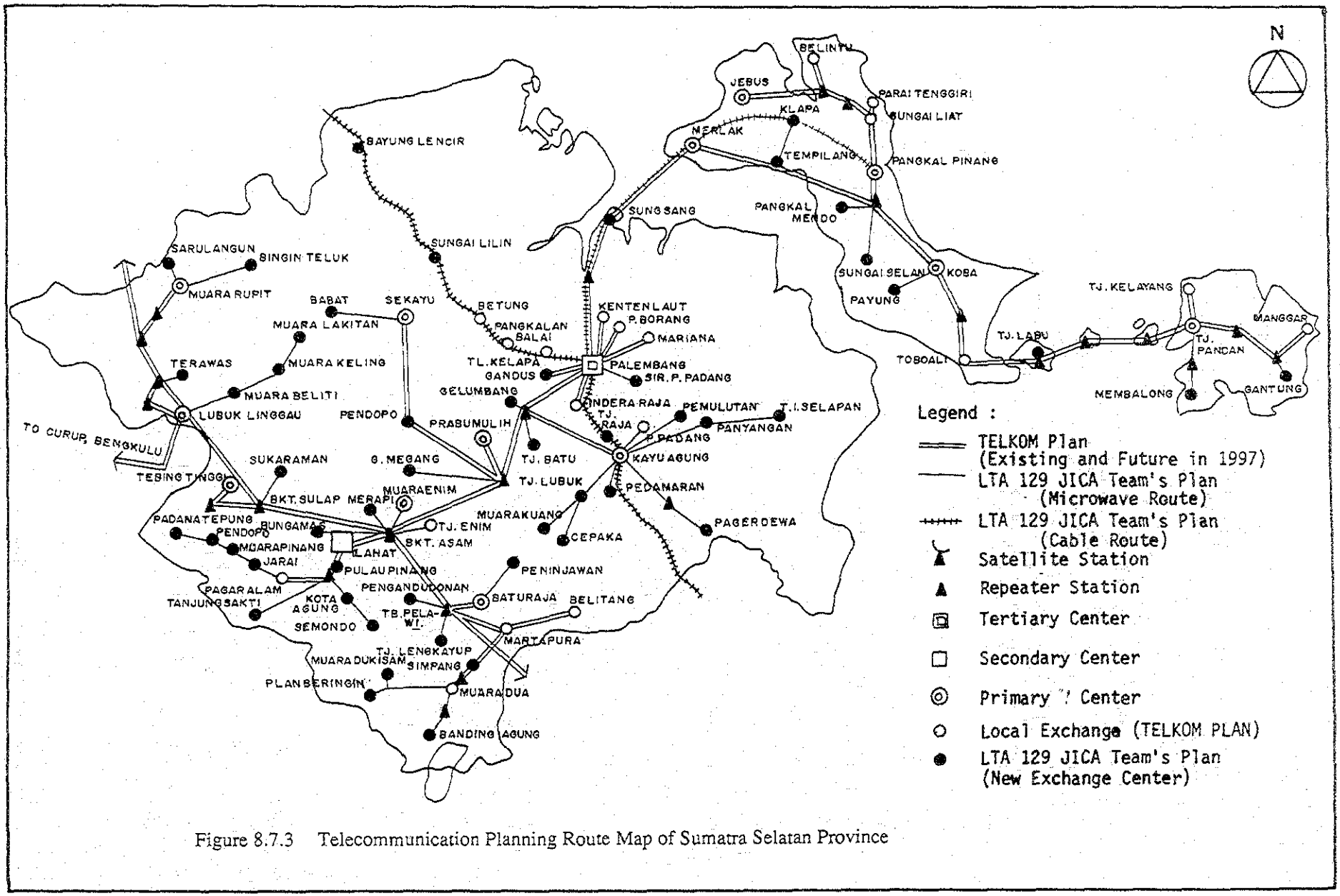


Figure 8.7.3 Telecommunication Planning Route Map of Sumatra Selatan Province

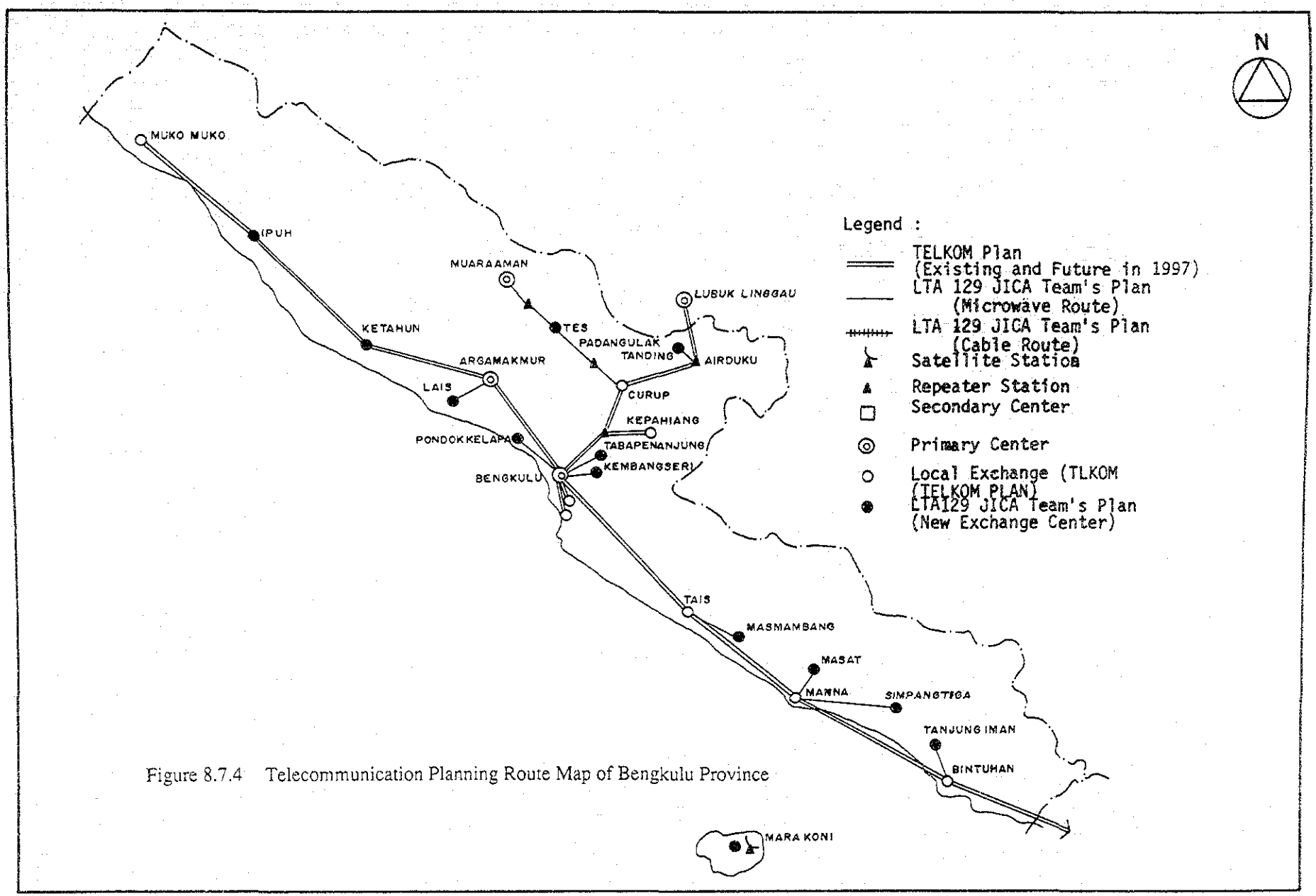


Figure 8.7.4 Telecommunication Planning Route Map of Bengkulu Province

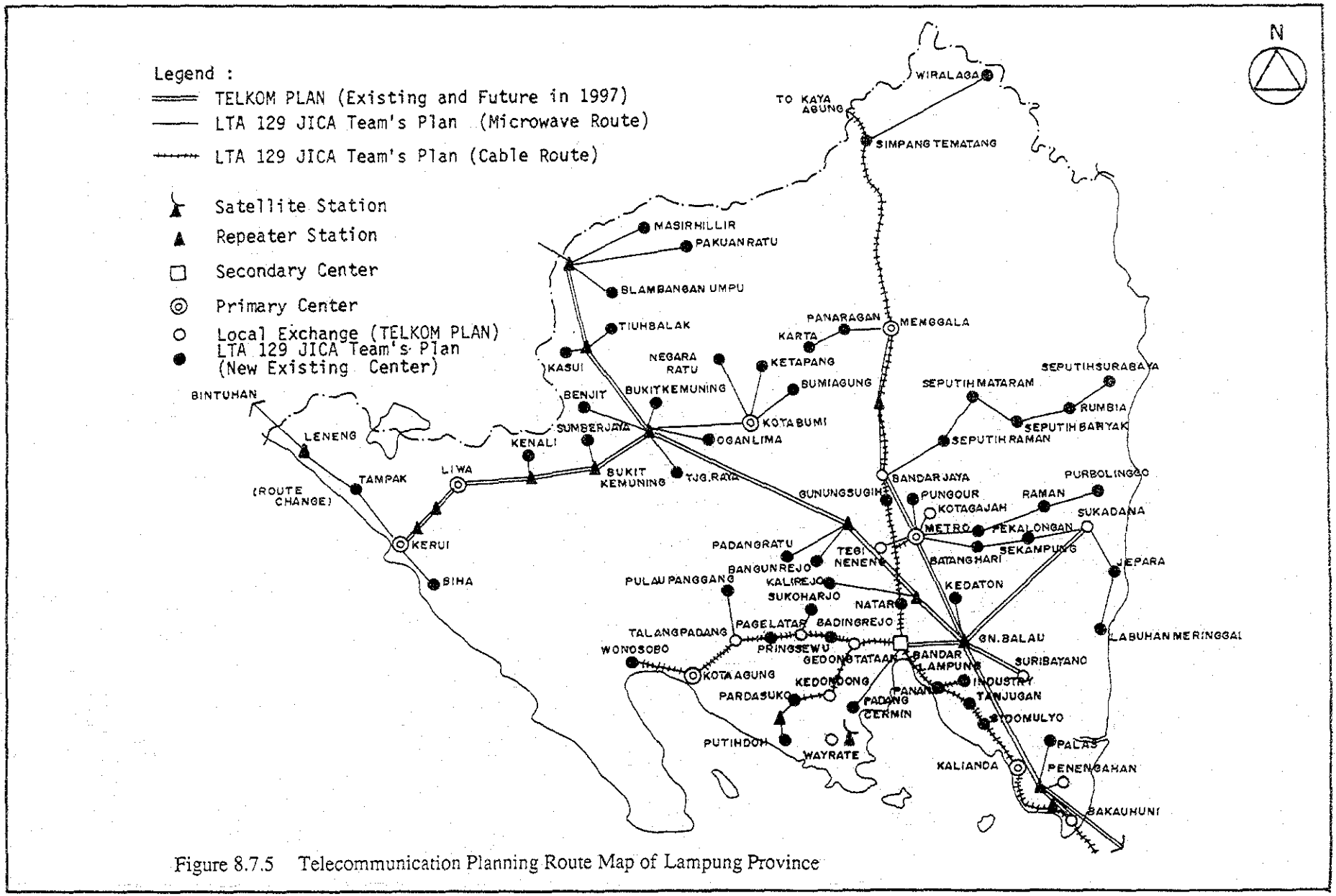


Figure 8.7.5 Telecommunication Planning Route Map of Lampung Province

However, here is a big problem in the cost to install and manage rural telecommunication systems now. The cost to make one subscriber in a normal telephone network is about US$ 1,500 to 2,000. But for a subscriber in a rural telecommunication system, it now takes more than US$ 1,000 additionally using the cheapest system, for example, a model of Digital Radio Multiple Access System (see Figure 8.8.1). It means that for one subscriber in rural areas, the cost will be about US$ 3,000 to 4,000 in total. It is too heavy load for PT. TELKOM to install and manage them. Though it needs big investment, the income is small. But the benefit will return to the desa people, not to PT. TELKOM. It helps promotion of the society and economy.

To expand telephone network to rural areas should be recognized that it is quite public and political matter. Therefore, the study team proposes that the government should support PT. TELKOM to install and manage them in the finance.

We hope a new cheaper system would be developed for rural areas. One possibilities is introducing modified cellular system (for mobile telephone) because the market of cellular system is now growing quickly in the world. It is in big competitive condition, so all manufactures in the world are trying to make cheaper and better systems by using new technic and mass production. It is sure to continue this motion to the future. This study is aiming 2010. Therefore, at that time, though cellular system is more sophisticated system than a kind of digital radio multiple access system, introducing a kind of cellular system for a rural area may be more economical way. But now it is not sure. Therefore, here adopted following preconditions of a model of digital radio multiple access system.

1) the number of repeater or terminal stations per a system is 16
2) the distance between one repeater to next repeater or a repeater to a terminal station is less than 40 km.(maximum is more)
   If it is more than 40 km, it needs a relay station between the two stations.
3) maximum capacity of the system is about 1,000 subscribers.
4) the number of subscribers per one terminal or one repeater is 64
5) maximum speech channels is 60. It means 60 persons can speak through the system simultaneously. If there are some bigger calling rate subscribers in the system, the maximum number of subscribers are less than 1,000 to keep good SCR.
6) distance of repeater to terminal sets is less than 20 km

Figure 8.8.2 shows examples of rural area systems based on the above preconditions in Kecamatan Tulangbawang Tengah and Kecamatan Terbanggibesar in Lampung province. Then the output of IRR calculation of a kind of standard model of these kecamatans is Appendix A8.1 to Chapter 8, Part 2, Volume 4. The IRR is about -0.2 (-20%). It means the network is not profitable. Therefore it needs a kind of government support.

8.9 TRANSMISSION SYSTEM

Increasing subscribers increases calling traffic. It needs increasing capacity of transmission lines especially among big cities including to Jakarta. In transmission systems, fiber optic system is achieving remarkable development recently. The distance from one repeater to the next repeater is more than 200 Km in 1.8Gb/s system (28,000 voice channels) today. Nevertheless the cost is decreasing day by day.

Comparing optical fiber cable transmission systems with microwave systems in the same transmission capacity, optical fiber cable transmission systems will be superior in the transmission capacity and cost in future. Therefore, it is profitable that a new transmission route is planned to adopt fiber optic systems as much as possible from now. We decided following courses here.

1) In a new transmission route, if a fiber optic system is possible to be installed in future, microwave transmission systems should not be installed newly.

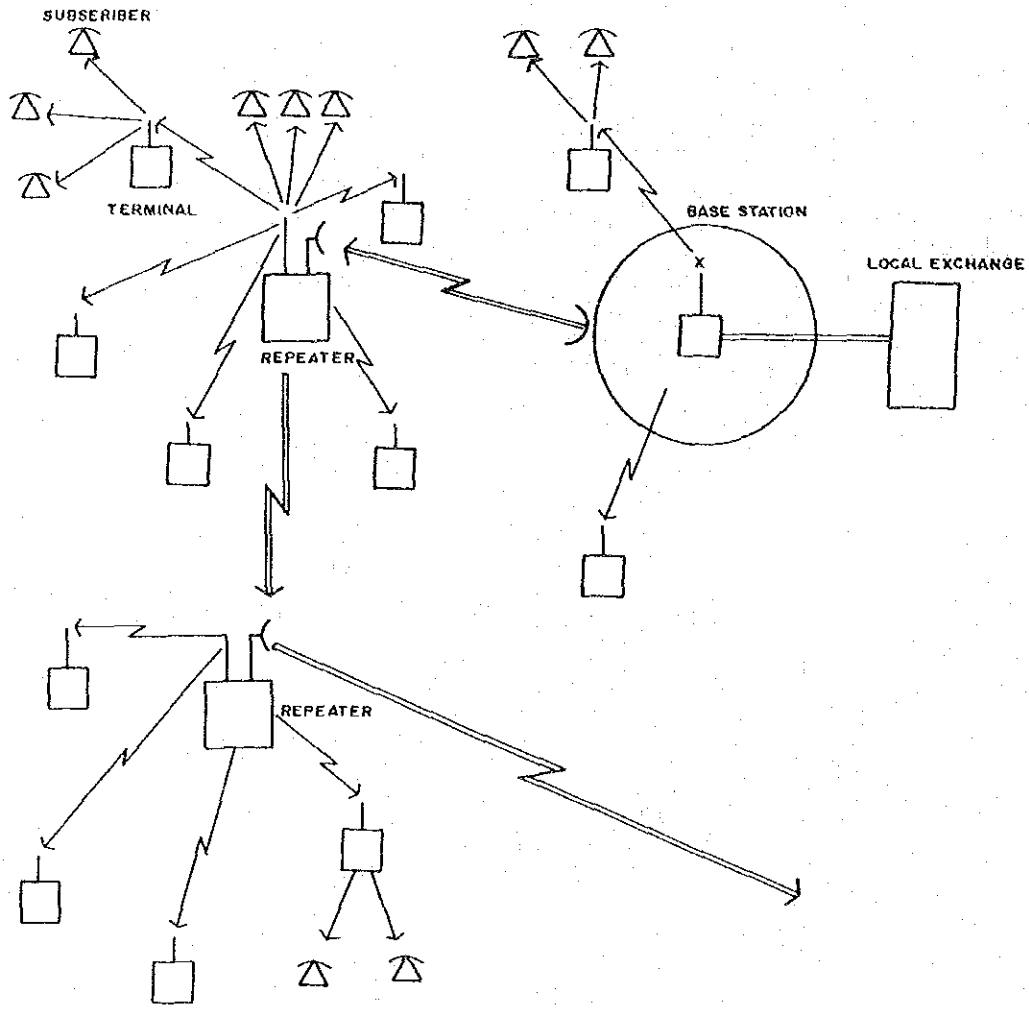


Figure 8.8.1 The Image of Digital Radio Multiple Access System for Rural Area

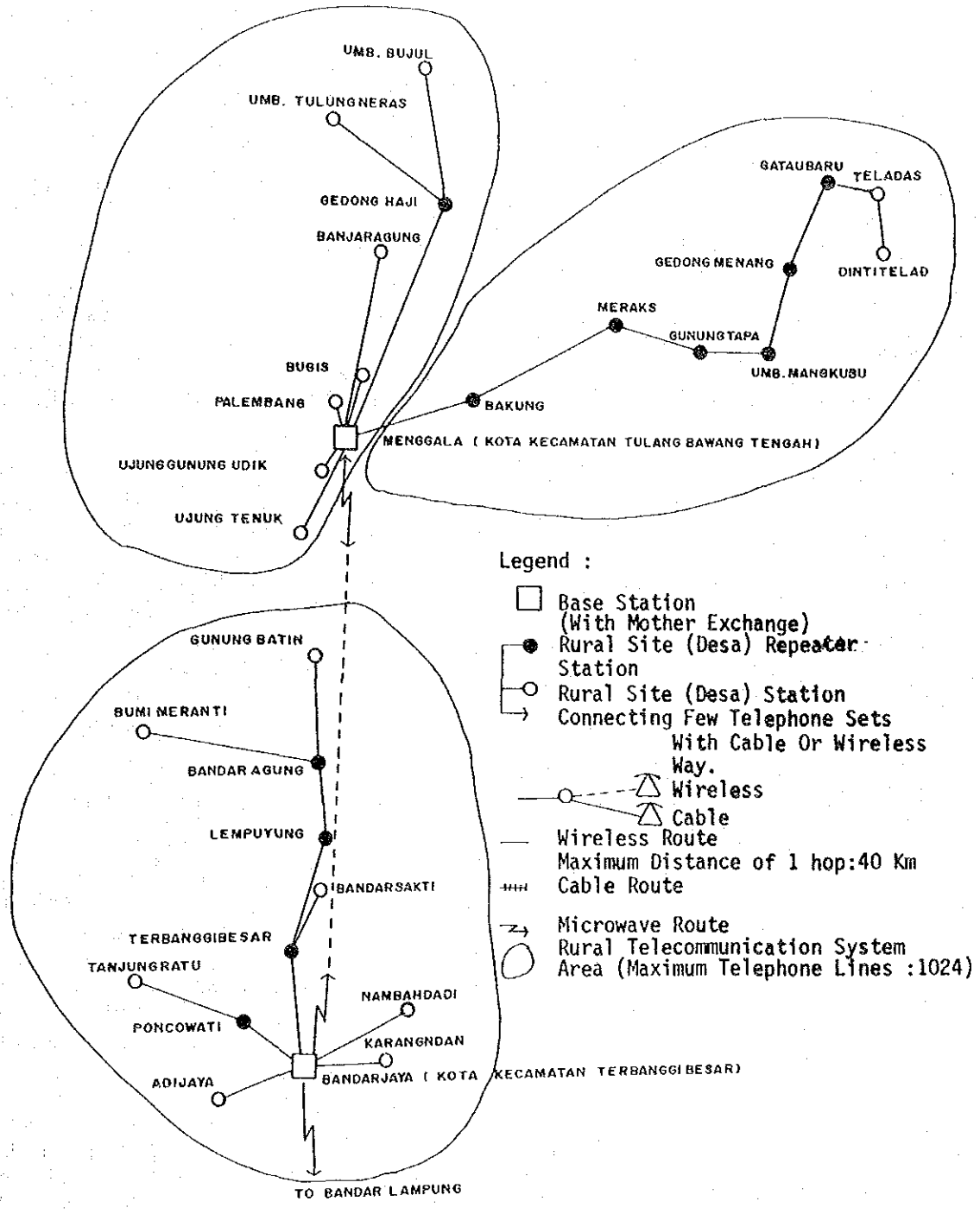


Figure 8.8.2 Example of Rural Telecommunication System Using A Kind of Digital Radio Multiple Access System

2) Microwave transmission systems should be used only in the section of valley, channel, river and forest where any fiber optic systems are not possible to be installed.

3) In the existing microwave systems, after setting up the terminal transmission equipment until full accommodation in it, if another route using fiber optic systems has enough capacity to transmit the increasing traffic which should flow in the existing microwave route, installation of new more microwave systems on the route should be stopped.

4) Basically, transmission route configuration must be designed considering improving network reliability making transmission route diversification and duplication in the nationwide and in a local area.

Figure 8.9.1 shows a draft plan of the fiber optic system routes in Southern part of Sumatra area. The remarkable point is the section of Jambi-Palembang-Bandar Lampung. It is settled along a newly planed road. Therefore the installation will be possible after construction of the road between Kayuagung and Menggala. This route is passing through four IDEPs (Tanjung Jabung Palembang, Lampung Utara and Bandar Lampung/Lampung Selatan).

It is thought that this route will be more important route than existing Trans Sumatra transmission route in the future. If this route comes into existence, the route passing trough Bangko-Lahat-Baturaja-Kotabumi which is a part of today's Trans Sumatra microwave route does not need to expand the capacity more. Main telephone traffic will shift to the new optical fiber cable route because almost big cities are locating on this route. It means the existing microwave system route will be used continuously without installation of new systems more in the future.

8.9.1 Relation with Telecommunication Network Development Plan Repelita VI

Based on the report of Telecommunication Network Development Plan Repelita VI studied by above mentioned another JICA study team, the backbone transmission network in Sumatra area is shown in Figure 8.9.2.

(1) Route From Palembang To Jakarta

Now a paved permanent road is not existing on the ground from Kayuagung to Menggala in this section. Based on the report, a sea route including a submarine optical fiber cable transmission system from Pangkalpinang to Jakarta instead of the ground route through Bandar Lampung (Tanjung Karang) is planned, because of unknown progress condition of the road construction from Kayuagung to Menggala and sea bed condition between Sumatra Island and Java Island.

If the rode construction is in time, the ground route through Bandar Lampung (Tanjung Karang) including submarine cable in the strait between Sumatra Island and Java Island is desirable because of the cost saving. If the installation of the submarine cable in the strait between Sumatra Island and Java Island in this ground route is not possible, a partial microwave transmission system for the section is worth considering.

(2) Route from Palembang to Medan through Jambi and Pekanbaru

The majority of big cities are located in east side of Sumatra. If the new transmission route of Medan-Pekanbaru-Jambi-Palembang is existing, the telecommunication traffic flows in this route mainly and it is economical way than flowing through today's west side microwave route. This route will become a new big backbone route. Therefore, big capacity optical fiber cable transmission systems are suitable in this route because of its expandability on the system capacity.

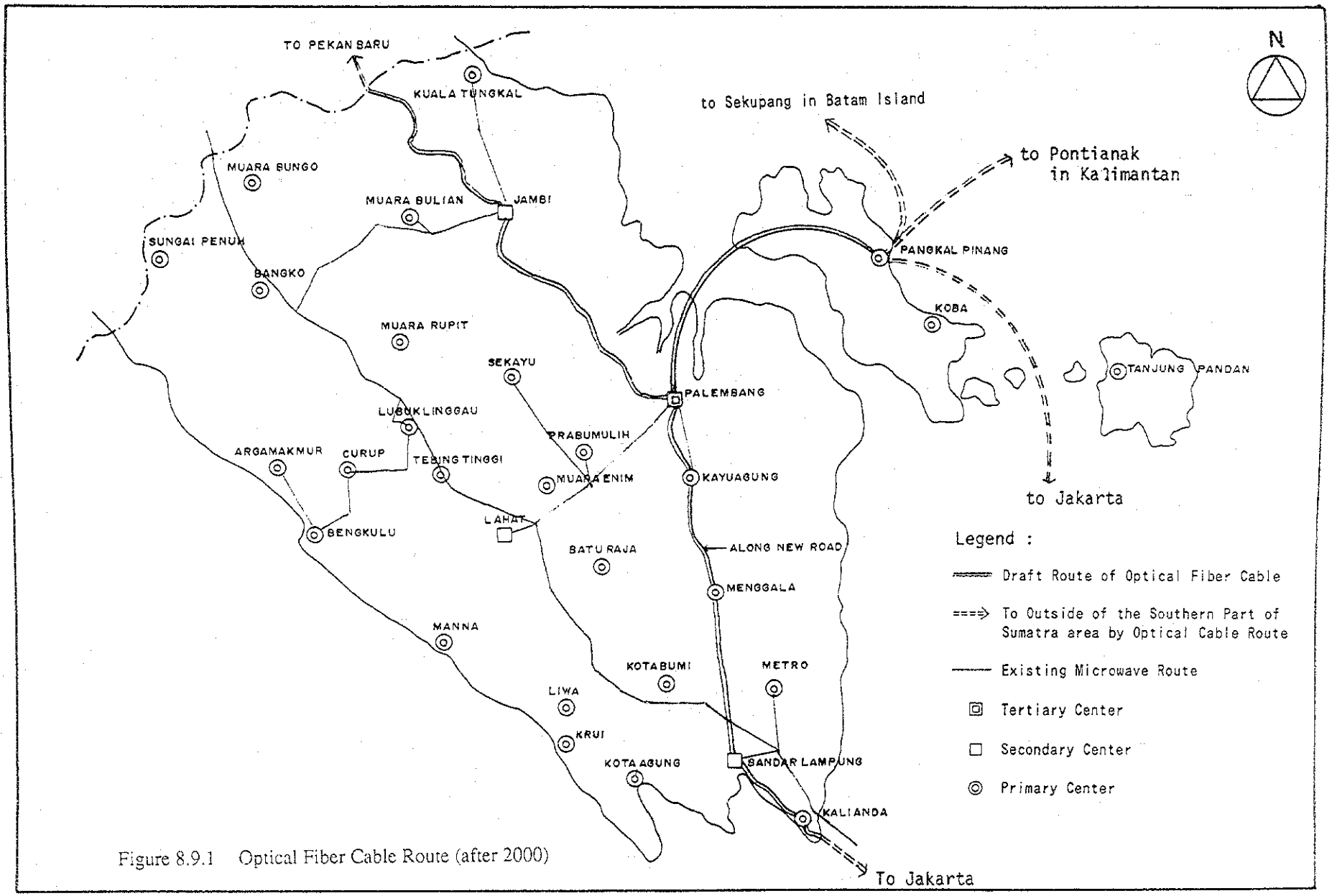


Figure 8.9.1 Optical Fiber Cable Route (after 2000)

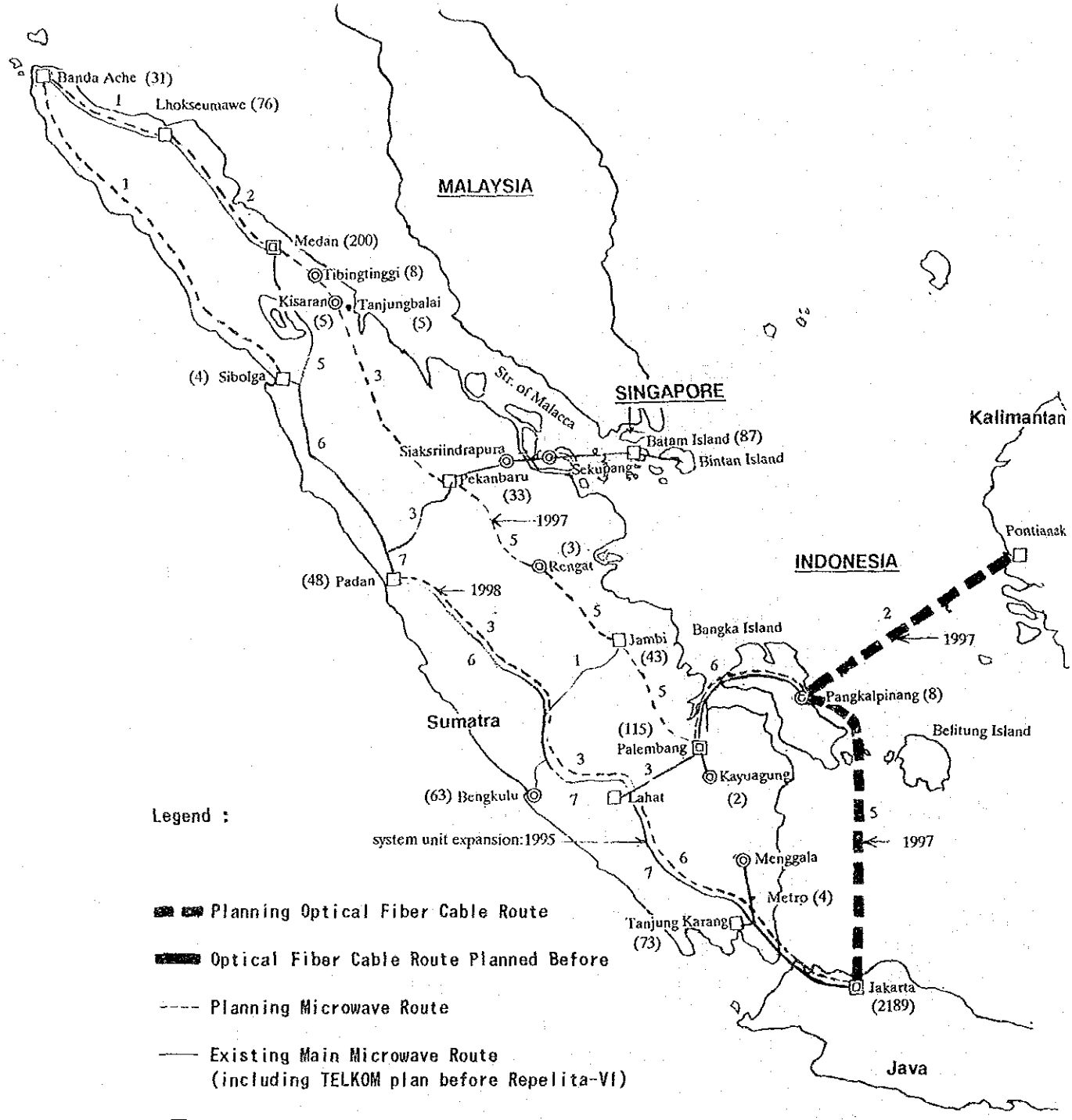


Figure 8.9.2 Transmission Route Plan Map of Sumatra Area in Telecommunication Newtwork Plan Repelita-VI(1994-1998)

But in the report of Telecommunication Network Development Plan Repelita VI studied by another JICA study team, this route is planned to install microwave systems tentatively because the road condition on this route is not clear. Now it has been brought to light that already a new road has been constructed on this route. But the road has not been drawn on the map yet. To install optical fiber cables on the route, it needs a site survey of the road condition on the route.

(3) Route from Padang to Jakarta through Bukit Asam (near Lahat)

In this route now, a new digital microwave system put into service recently. Adding more terminal equipment is possible from today's 3 transmission units to 7 units in it in future. However the traffic from the east side big cities also flowing in this route now. If a new microwave system is installed on the above route (2) Palembang-Medan, another new microwave system or optical fiber cable system from Padang to Jakarta is essential, because, after 1998, increasing traffic from the East Side Sumatra area can not run in the microwave route (2) smoothly due to the inadequate capacity.

If the route (2) is constructed with fiber optic systems, the existing west side microwave transmission system has enough capacity for long time. It does not need to install new additional transmission systems on this existing microwave route, because increasing traffic can run in the new optical fiber cable route (2).

The above mentioned alternative transmission routes in Sumatra area in Repelita VI will be possible as shown in Figure 8.9.3. It will be decided depending on the road condition. To get the final decision of the route and system, further feasibility study is essential.

After Repelita VI, considering transmission network reliability making loop configuration, route duplication and route diversification in the nation wide and Sumatra area, and considering connection to Batam Island where it is dynamic economic area called "Growth Triangle area with Singapore and Batam Island, the transmission route maps in Repelita VII and Repelita VIII are expected as shown in Figures 8.9.4 and 8.9.5.

Batam is close and next to Singapore and Malaysia. This cable can connect to Singapore and Malaysia from Batam easily. It is possible to connect from Jakarta to Singapore and Malaysia directly through Batam and this route will be able to give a big economic connection among these countries.

8.9.2 Implementation Schedule

Based on the report of Telecommunication Network Development Plan Repelita VI studied by above mentioned JICA study team, the subscriber in the year 2000 will be more than 6 times as bigger as today's. It needs quick expansion of the network. Today's transmission route with expansion of terminal equipment until full accommodation can not transmit the enough traffic after around 1998. Therefore, a next, new transmission system is needed around 1997.

Especially the construction of the backbone transmission systems from Medan to Jakarta and Pontianak becomes a big project and takes a long time to complete it. This project shows much profit based on the prefeasibility study, because the IRR of the optical fiber cable transmission systems only is estimated about 20% (see Appendix A8.2 to Chapter 8, Part 2, Volume 4).

Therefore we recommend to start the feasibility study soon to decide the transmission routes and systems to make service in around 1997 for the first system. Besides other sectors such as expansion plans of switching systems, outside plant and training stuff members to operate them should be considered simultaneously.

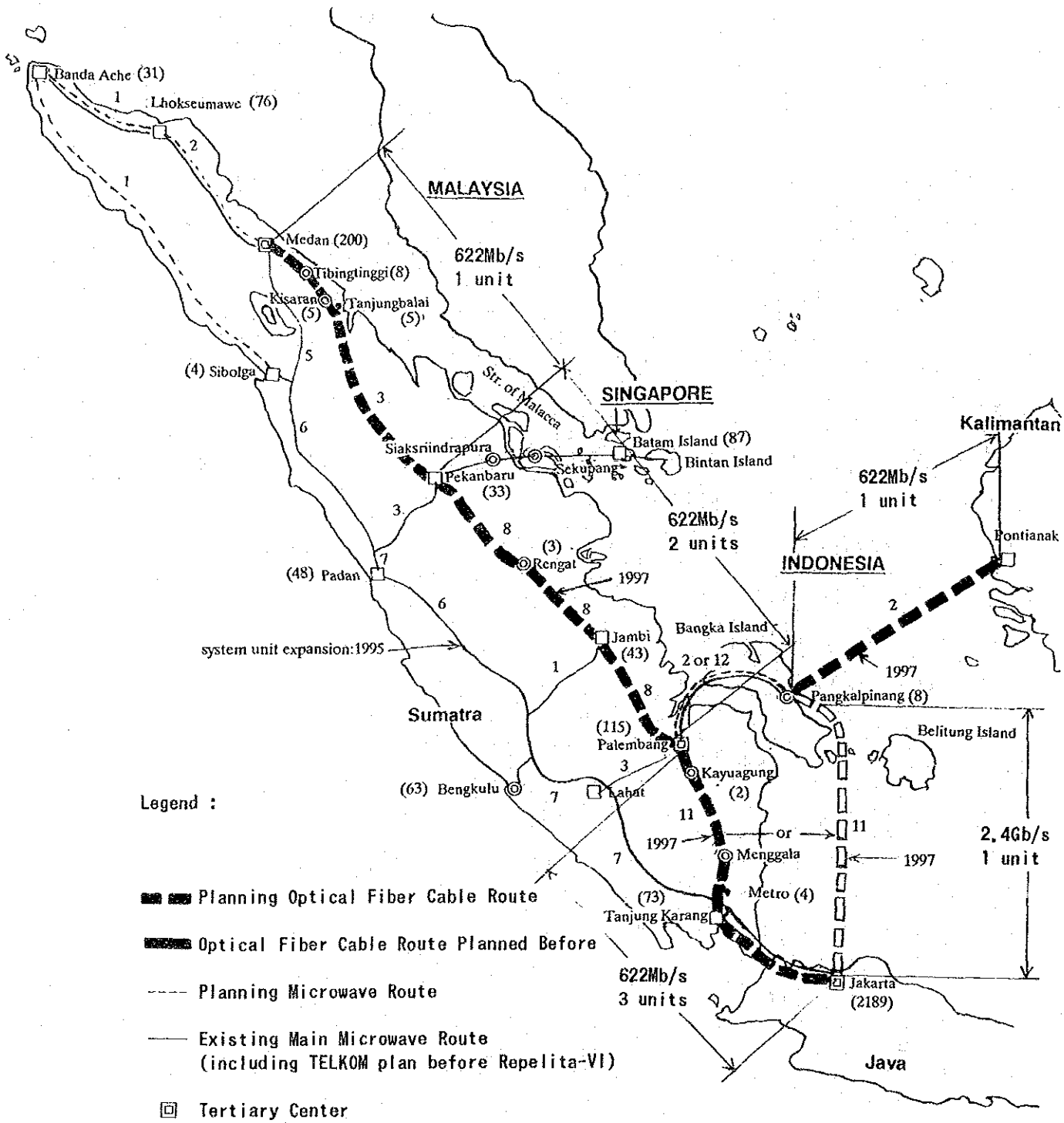


Figure 8.9.3 Alternative Transmission Route Plan Map of Sumatra Area in Repelita-VI(1994-1998)

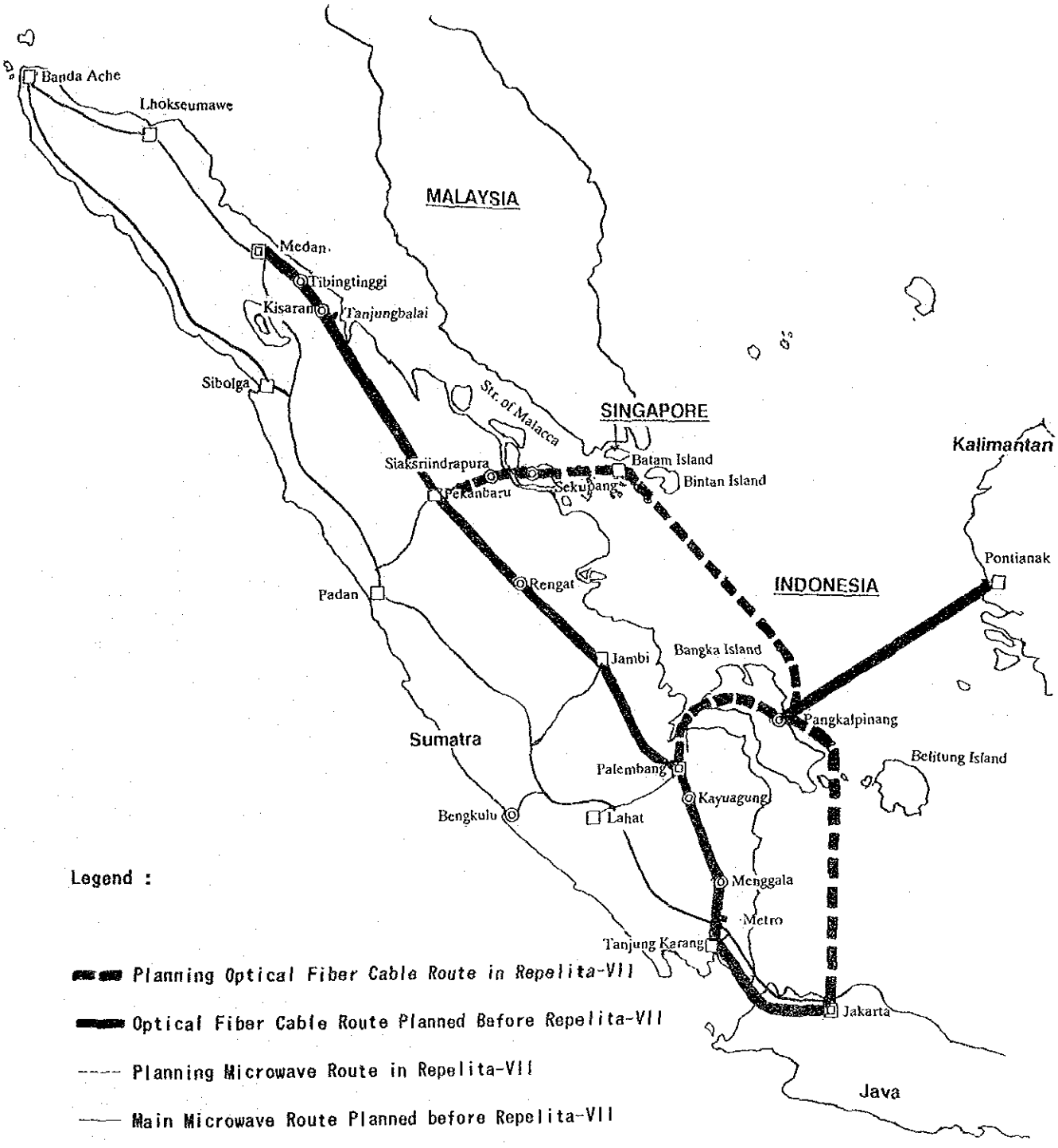


Figure 8.9.4 Expected Transmission Route Plan Map in Sumatra Area in Repelita-VII(1994-2003)

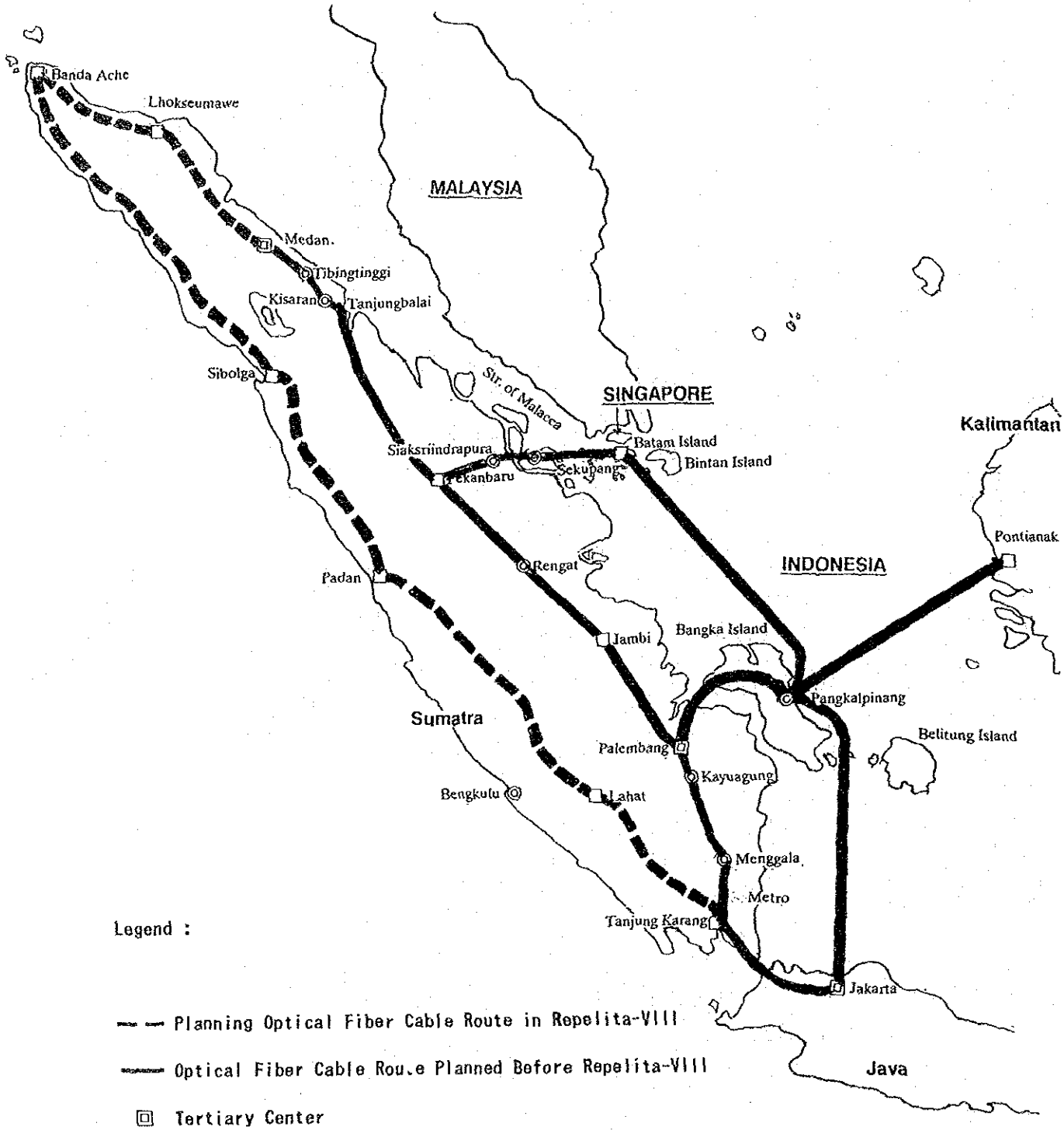


Figure 8.9.5 Expected Transmission Route Plan Map in Sumatra Area in Repelita-VIII(2004-2008)

8.10 IMPROVING QUALITY

One of the cause of low SCR is trouble of outside plant as well as short of transmission circuits. To improve this condition, as well as advertising to users to dial correctly, maintaining equipment to good condition is urgent. Introducing following projects earlier is desirable to prove maintenance and network quality.

(1) Diffusion of OPMC

Improving the maintenance level of outside plant is improving network maintenance level. Outside Plant Maintenance Center (OPMC) has been realized the great results by PT. TELKOM. The spread of the system should be promoted immediately. It is desirable OPMC will be diffused in secondary center level as soon as possible.

(2) Innovation of Outside Plant

The most failures (more than 90%) of telecommunication network are caused by trouble of outside plant. It means that if outside plant will be improved in the quality, the quality of all telecommunication system will be improved drastically.

Table 8.10.1 Failure of Outside Plan

(unit: %, as of July 1991)

Office	Customer House	Drop Wire	Under Ground	In Office	Remarks
Palembang	30	45	20	5	
Bengkulu	3	76	7	14	average of 1991
Jambi	29	47	15	9	average of 1991
Average	21	56	14	9	

Source: Each Telephone Office.

The repairing time also seems to be long. The following data is one example of Palembang Kandatel. This is normally changing depending on the season and equipment condition.

Table 8.10.2 Distribution of Repairing Time in Palembang Kandatel

Repairing Time	Distribution
within 1 day	about 50%
1 - 2 days	about 35%
2 - 3 days	about 10%
more than 3 days	about 5%

Especially the part of drop wire should be improved. It is better to be changed in the design including distribution point and wiring method technically. For example too many drop wires are coming out from one distribution point. It seems difficult for maintenance persons to find a fault cable. It is also the matter of nationwide.

(3) Establishment of Maintenance Center and Software Center

The next stage is establishment of maintenance center in which all kind of maintenance engineers and technicians as well as outside plant engineers are working. When some failure happened, it dispatches some suitable engineers to the site to test and repair the system. It is desirable to introduce the center in WITEL-III at first and next diffuse to secondary centers.

Today is software era and it is more complicated to be maintained. They should also make their own software for each exchange center depending on the local condition. It has a good effect on improving service quality too. Therefore, software engineer is more essential

and it is more difficult to get skillful software engineers. They should use few skillful engineers effectively. Therefore as well as maintenance center, we proposed here to establish Software Center as the same idea as maintenance center at least each WITEL at first stage, then next in secondary centers to cover their area to maintain or make their own software. Of course it is possible to make same organization with maintenance center.

(4) Leased Line

In Indonesia there are few leased lines. In the southern part of Sumatra there is not leased line service. In the condition of Indonesia's quick economic growth, big companies like manufactures, banks and government organizations are making big telephone traffic. they are calling to same destinations everyday, for example, inside of the same organization or among close relating organizations like between an airplane company and a tourist agency. If the big traffic flow moved to leased lines, the normal exchange traffic can pass through the exchange network easily.

Besides they can introduce enhanced information system using leased line, such as money exchange system, marketing information system, inventory control system, health care system. For these information systems, leased line service is essential. The advantages of leased line are as follows.

1) Big telephone traffic, of big organizations which occupy normal telephone network, escapes to leased line. It can improve SCR of normal network.
2) The organization which have leased lines can make sophisticated information system as above mentioned.
3) Empty line in normal network from which user replaced to leased lines can be sold to waiting applicants
4) PT. TELKOM can get stable income from leased lines besides normal network income.
5) Before introducing ISDN in this area, the subscribers who need enhanced service will be served by long distant ISDN subscriber service from Jakarta using digital leased line service.

8.11 IMPROVING MANAGEMENT

(1) Unattended Exchange and Transmission Supervision and Control Center

Even in small exchange centers with few satellite trunk circuits and few hundreds switching capacity, some administrative members and maintenance members are working today. To expand network quickly from now, the number of employees must be increased quickly. Therefore, to use manpower efficiently, introducing unattended exchange and transmission superivision and control centers is getting to be urgent matter. It is also saving cost automatically too. It may be better that the center located in the center of some local exchange centers like primary centers will be settled. If it is located in a Secondary Center, it should be settled in a Maintenance Center.

(2) Establishment of Construction Center

Now the makers or contractors construct their equipment (switching, transmission, etc.) to improve service level and promote PT. TELKOM's engineering level, the members of PT. TELKOM should construct the equipment by themselves.

Then, they can get enough knowledge to maintain through the construction work. Furthermore, they can get ability of designing and supervising construction of makers or constructors. We propose to establish construction center in each WITEL. At the beginning time, it is better to get foreign expert consultants.

After construction, some of them remain in the site as the maintenance members. They can enter to maintenance job smoothly after the construction, because they got enough

system knowledge through the construction work. It means that construction work is good on-the-job training for maintenance members too. We propose one center in WITEL-III at the beginning as a model case.

(3) Acceleration of Training and CAI System

To meet the expansion program, PT. TELKOM can't avoid to employ lots of good and skillful employees. For the purpose, it needs a good and efficient training system. One example is using CAI (Computer Aided Instruction) system using small desktop computers. If a good training software of it is developed, by copying it, many trainees can get training with it by themselves. The advantages are as follows:

1) complement to short of training instructors;
2) all trainees can get training in the best training method developed by the best members in Indonesia and foreign experts if necessary;
3) trainee can learn in his own pace;
4) trainee can't miss in the curriculums because he can't progress to the next without understanding previous lesson. Of course he can't skip;
5) The trainees can understand the curriculums completely;
6) when they want to introduce new system, at the first the centralized training center develop the CAI software, then all training center in Indonesia can get the new training software by coping that;
7) It means CAI can be flexible for quick technical change.

(4) Introduction of Demand Forecast and Planning Organization System

To perform big expansion program effectively, correct demand data is essential. Telephone office members know the condition of their service area mostly. Therefore it is the best way that they forecast the telephone demand of their area, then report to upper organization. Upper organization can make the next expansion program with their budget.

(5) Coordination about Road Digging

Under a road there are electric power supply cables, water supply pipes as well as telecommunication cables. It is nature to be a good coordination between PT. TELKOM, electric power supplier, water supplier and government in charge of road. But it doesn't seem good coordination now. It must be good coordination for people in the city and for each organization in economical reason.

It is desirable that they have coordination meetings periodically. Furthermore in rural areas, they must get electric supply before telecommunication network. Because Telecommunication doesn't work easily without electric power. As well as for urban areas, for rural areas they must have that kind of coordination meeting too.

8.12 SITUATION IN 2010

(1) Service level

1) eliminated applicant backlog
2) every time, every where, every person, communication available
3) high successful call ratio
4) modern service, and variety of services

(2) Society-secure society

1) modern economic and social activity
2) no disparities among different regions
3) improved administration activities

8.13 OTHERS

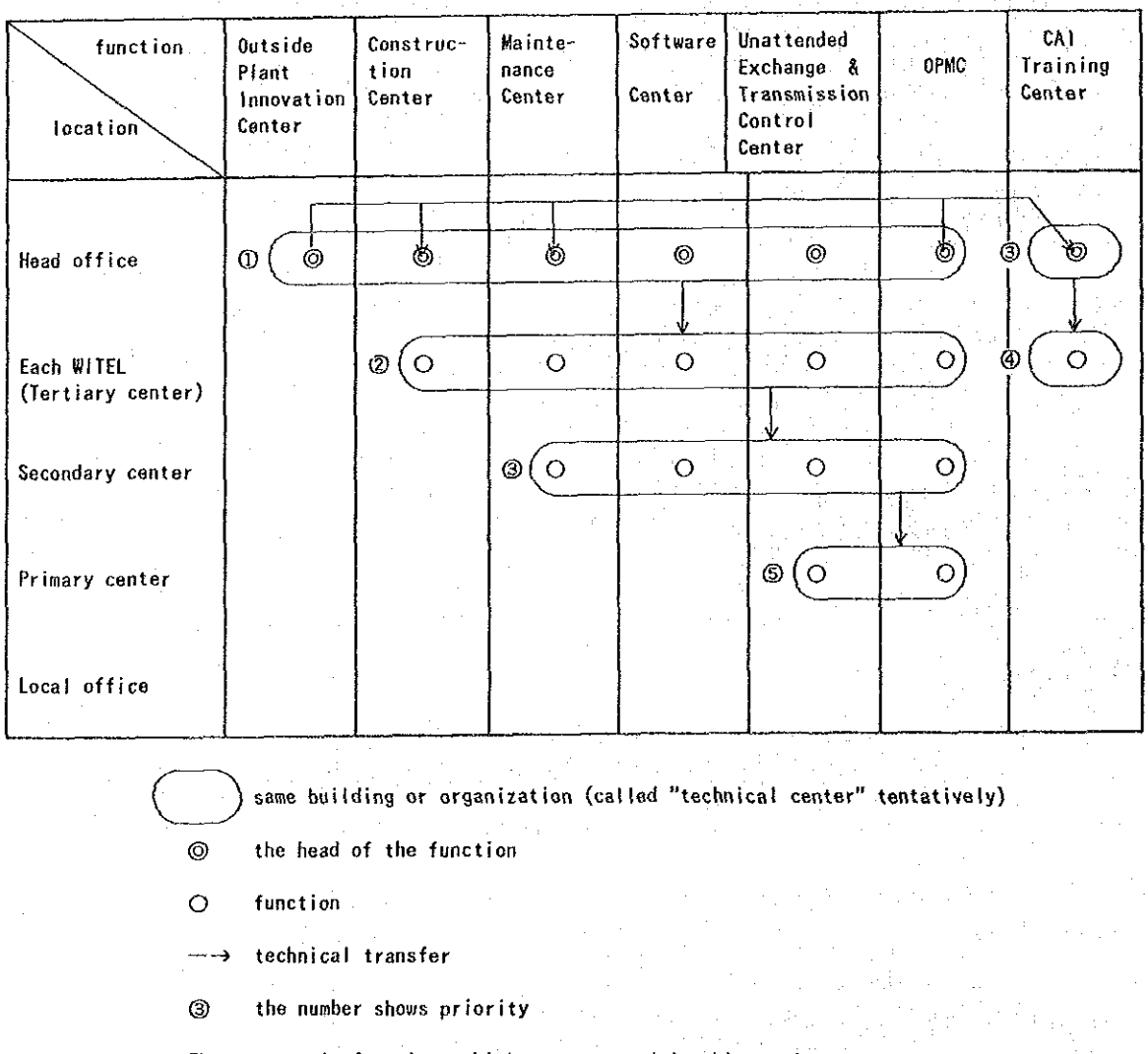
In this report, some functional centers are proposed. They are:

1) Outside Plant Innovation Center
2) Construction Center
3) Maintenance Center
4) Software Center
5) Unattended Eschange and Transmission Supervision and Control Center
6) Outside Plant Maintenance Center
7) CAI Training Center

They should not be existed independently. They have some relation in each other. To make organization effectively, we proposed here some organization system in Figure 8.13.1.

Basically, all terms in this report are common in the nationwide of Indonesia. We recommend that as well as PT. TELKOM, other organizations should understand the importance of telecommunication as the important role of the national nerve of Indonesia and the today's situation, then support to improve telecommunication service.

Figure 8.13.1 Operational Organization for Function of Construction, Maintenance, Training, etc., Proposed in Thirs Report



9. URBAN AND RURAL DEVELOPMENT

9.1 CURRENT CONDITIONS

(1) Urban and Rural Population

During 1980s, population growth of the urban areas was generally much faster than that of rural areas nationwide. The urban and rural population and their growth of Indonesia, Sumatra, each province of Southern Sumatra, and Java are set out in table 9.1.1. Total population and the ratio of urban population to total population are shown in table 9.1.2. Urban areas shown here are functional urban areas defined by BPS. About 31% of the total population lived in urban areas in Indonesia in 1990. In Sumatra on the whole about 26% of the population lived in urban areas. Southern Sumatra had only 21% of the population living in the urban areas. In Java, the ratio was 36%, higher than the national average.

However, the urban growth rate varies among provinces in Southern Sumatra. As shown in Table 9.1.1, the growth rate of the urban population is remarkable in Jambi (9.0%), and Bengkulu (12.7%). The ratio of the urban population to total population in both provinces have reached more than 20% in 1990. In South Sumatra and Lampung provinces, the urban growth rates are relatively moderate and the urban population ratios to total population have not changed very much. Interestingly, the ratio of Lampung province is extremely low, 12.4%.

Table 9.1.1 Urban and Rural Population in Indonesia, Sumatra, Southern Sumatra, and Java

	Kota (urban) population			Desa (rural) population		
region	1980 (000)	1990 (000)	growth %	1980(000)	1990(000)	growth%
Indonesia	32,846	55,389	5.4	114,486	123,805	0.8
Sumatra	5,481	9,292	5.4	22,514	27,129	1.9
Jambi	183	433	9.0	1,262	1,581	2.3
S. Sumatra	1,267	1,837	3.8	3,361	4,438	2.8
Bengkulu	72	240	12.7	695	939	3.0
Lampung	577	747	2.6	4,047	5,257	2.7
Southern Sumatra	2,099	3,258	4.5	9,365	12,215	2.7
Java	22,926	38,335	5.3	68,291	69,183	0.1

Source: BPS, Penduduk Sensus 1990

Table 9.1.2 Total Population and Urban Population Ratio in Indonesia, Sumatra, Southern Sumatra, and Java

	total population			urban/total pop.	
region	1980 (000)	1990 (000)	growth %	1980 %	1990 %
Indonesia	147,332	179,194	2.0	22.3	30.9
Sumatra	27,996	36,420	2.7	19.6	25.5
Jambi	1,444	2,014	3.4	12.7	21.5
S. Sumatra	4,628	6,276	3.1	27.4	29.3
Bengkulu	768	1,179	4.4	9.4	20.4
Lampung	4,624	6,004	2.7	12.5	12.4
Southern Sumatra	11,464	15,473	3.0	18.3	21.1
Java	91,217	107,518	1.7	25.1	35.7

Source: BPS, Penduduk Sensus 1990

As shown in these tables, in absolute terms much more people live in rural areas. About 123,805,000 people lived in rural areas in 1990 in the whole nation, 27,129,000 in Sumatra, and 12,215,000 in four provinces of Southern Sumatra. In Southern Sumatra the

rural population increase was about 2,850,000 from 1980, and the rural population ratio to the total population was 78.9%.

Table 9.1.3 shows the projections of the urban growth by National Urban Development Strategy (NUDS), which was established in 1985. The numbers of the urban population were estimated by NUDS and slightly different from the census data, therefore the data is not comparable. However, the projection can be a useful indicator of the urban growth. Compared with the estimates, the real growth rates of urban population from 1980 to 1990 in Jambi and Bengkulu provinces are much higher and those of South Sumatra and Lampung provinces are lower. Jambi and Bengkulu provinces in 1990 have already surpassed the projected urban population ratio to total population of 2000.

Table 9.1.3 NUDS Projection of Population

	Total pop. (000)		Urban pop. (000)		growth of	urb pop./total	
	1980	2000	1980	2000	urb. pop%	1980	2000
Jambi	1,446	3,422	215	461	3.8	14.9	13.5
Kodya Jambi			156	313	3.5		
S. Sumatra	4,630	9,607	1,253	3,120	4.6	27.1	32.5
Palembang			757	1,752	4.2		
Bengkulu	768	1,940	79	203	4.7	10.3	10.5
Kodya Bengkulu			32	89	5.1		
Lampung	4,625	9,303	603	1,525	4.6	13.0	16.4
Bandar Lampung			358	832	4.2		
Sumatra	28,016	51,368	5,490	12,944	4.3	19.6	25.2
Java	91,270	113,530	22,874	49,642	3.9	25.1	43.7
nation	146,935	209,840	32,844	75,837	4.2	22.4	36.1

Source: NUDS Final Report 1: Sumatra 1985

Jambi

Table 9.1.4 sets out the urban and rural population in Jambi. Total population and the urban population ratio to total population are shown in table 9.1.5, by Kabupaten /Kotamadya. In every Kabupaten the urban population grew very fast in the 1980s. The urban population ratio to total population in Kerinci grew from only 3.7% in 1980 to 11.0% in 1990. Kotamadya Jambi also shows fast urban population growth, with its rural population decreasing. According to NUDS estimate, the urban population of Kotamadya Jambi in 2000 is projected to reach 313,000 from 156,000 in 1980 with the assuming average annual growth rate of 3.5% (Table 9.1.3). In 1990, the urban population has reached 301,430, much faster than predicted. Its urban population ratio to total population has reached 83.4%. Kabupaten Bungo Tebo, Sarolangun Bangko, and Batang Hari also show relatively fast rural population growth, and the total population growth rates are more than 4% in these Kabupatens.

Table 9.1.4 Urban and Rural Population in Jambi

Jambi	Kota (urban) population			Desa (rural) population		
Kab/Kodya	1980	1990	growth%	1980	1990	growth%
Kerinci	8,990	30,646	13.05	231,927	248,500	0.69
Bungo Tebo	7,090	33,002	16.62	230,252	327,401	3.58
Sarolangun Bangko	4,100	14,754	13.66	213,280	334,793	4.61
Batang Hari	6,905	25,331	13.88	209,750	298,328	3.59
Tanjung Tabung	-	27,564	-	302,136	333,827	1.00
Kodya Jambi	155,761	301,430	6.82	74,285	38,478	-6.37
total	182,846	432,727	9.00	1,261,630	1,581,327	2.28

Source: BPS, Penduduk Indonesia 1990

Table 9.1.5 Total Population and Urban Population Ratio in Jambi

Jambi	total population			urban pop./total pop	
Kab/Kodya	1980	1990	growth%	1980 (%)	1990 (%)
Kerinci	240,917	279,146	1.48	3.7	11.0
Bungo Tebo	237,342	360,403	4.27	3.0	9.2
Sarolangun Bangko	217,380	349,547	4.86	1.9	4.2
Batang Hari	216,655	323,659	4.10	3.2	7.8
Tanjung Tabung	302,136	361,391	1.81	-	7.6
Kodya Jambi	230,046	339,908	3.98	67.7	83.4
total	1,444,476	2,014,054	3.38	12.7	21.5

Source: BPS, Penduduk Indonesia 1990

South Sumatra

In South Sumatra province, urbanization in the 1980s was relatively fair. The population figures are shown in table 9.1.6. Kabupaten Musi Banyu Asin and Ogan Komering Ilir show rapid urban population growth, with the growth rate 24.77% and 12.71% respectively. Another notable thing is that the urban population ratios to total population in both islands - Belitung and Bangka - are high, especially in Belitung. The rural population in Belitung even decreased. Kabupaten Muara Enim also have a relatively high urban population ratio. In kotamadya Palembang and Pangkal Pinang, the urban population ratio to total population in 1990 slightly decreased from 1980. According to NUDS estimate, the urban population of Palemban will grow by 4.2% from 1980 to 2000 (Table 9.1.3). However its growth rate during 1980s was 3.66%.

Table 9.1.6 Urban and Rural Population in South Sumatra

S. Sumatra	Kota (urban) population			Desa (rural) population		
Kab/Kodya	1980	1990	growth%	1980	1990	growth%
Ogan Komering Ulu	43,668	75,193	5.58	707,095	889,238	2.32
Ogan Komering Ilir	13,238	43,944	12.71	550,748	727,325	2.82
Muara Enim	95,648	122,317	2.49	335,179	459,780	3.21
Lahat	59,931	93,939	4.60	424,883	507,884	1.80
Musi Rawas	37,025	56,714	4.36	329,056	455,092	3.30
Musi Banyu Asin	3,258	29,780	24.77	587,816	853,939	3.81
Bangka	98,613	119,816	1.97	301,242	394,010	2.72
Belitung	71,243	101,937	3.65	92,356	90,990	-0.15
Palembang	757,491	1,085,475	3.66	29,116	55,443	6.65
Pangkal Pinang	86,849	108,377	2.24	3,219	4,752	3.97
total	1,267,009	1,837,492	3.79	3,360,710	4,438,453	2.82

Source: BPS, Penduduk Indonesia 1990

Table 9.1.7 Total Population and Urban Population Ratio in South Sumatra

S. Sumatra	total population			urban pop./total pop	
Kab/Kodya	1980	1990	growth%	1980 (%)	1990 (%)
Ogan Komering Ulu	750,763	964,431	2.54	5.8	7.8
Ogan Komering Ilir	564,031	771,269	3.18	2.3	5.7
Muara Enim	430,827	582,097	3.06	22.2	21.0
Lahat	484,814	601,823	2.19	12.4	15.6
Musi Rawas	366,081	511,806	3.41	10.1	11.1
Musi Banyu Asin	591,074	883,719	4.10	0.6	3.4
Bangka	399,855	513,826	2.54	24.7	23.3
Belitung	163,599	192,927	1.66	43.5	52.8
Palembang	786,607	1,140,918	3.79	96.3	95.1
Pangkal Pinang	90,068	113,129	2.31	96.4	95.8
total	4,627,719	6,275,945	3.09	27.4	29.3

Source: BPS, Penduduk Indonesia 1990