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JAVA REGIONAL STUDY - PHASE I, PART B

CENTRAL JAVA

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TRANSPORTATION

8.1 Intermodal Relationship in Transportation

08.001 The comparison of freight flow by mode in the middle region (Central Java and D.I. Yogyakarta) for the years of 1970 and 1974 is shown in Table 8.1, which reveals that the freight carried by highways accounted for more than 66 percent in 1974, and it was about 40 percent in 1970. The average annual growth rate of freight carried by highways is extraordinary high, which may imply that highway transportation is increasingly replacing the role of sea and railway transportation in freight flow in the Province. In fact the relative decrease of the role of the railway is remarkable.

08.002 As for passenger flow, the data collection for highway transportation is rather difficult, and the passenger flow can be implied through the number of registered cars. In 1970 the total number of passenger cars and buses in the Province were 19,229 and in 1974 the number increased to 26,381; the average annual growth rate was 8.2 percent.[1/] Embarked and disembarked passengers in the middle region including Yogyakarta in 1970 were 35.4 million persons, which decreased in 1974 to 15.8 million persons. The number of the total embarking and disembarking air passengers at the Semarang airport in 1970 was 19,622 persons, while that in 1974 amounted to 108,420 persons. This implies that the average annual growth rate of air passengers is 53.3 percent. Taking into consideration the result of O-D survey (origin and destination of passengers survey) in 1972 and the number of registered cars at that time, it may be reasonable to assume that about 80 percent of all vehicles are operating with on average 8 persons per car. Thus the number of passengers on highways is estimated to be 61.6 million persons. This figure far exceeds the number of passengers carried by railways. Compared with this figure, the number of passengers by air is still almost negligible, but with the rate of increase, air transportation will soon become significant.

1/ However, this would be an underestimate. Comparison of the aggregate aver average daily traffic within the Province between 1972 and 1974 gives the average annual growth rate of traffic of 34% for passenger cars and 18% for buses.

Table 8.1 Freight Flow by Mode in the Middle Region

(Unit: Million Tons)

Year	Highways[1]		Sea[2]		Railway[3]		Total	
		Share(%)		Share(%)		Share(%)		Share(%)
1974	5.63	(66.8)	2.14	(25.3)	0.68	(0.8)	8.45	(100.0)
1971	1.12	(40.1)	1.03	(36.9)	0.64	(22.9)	2.79	(100.0)
Average Annual Growth Rate (%)	49.8		20.1		1.5		31.9	

Sources: 1/ DLLAJR, Jawa Tengah

2/ BPS, Cargo Loading and Unloading at Ports in Indonesia, 1970-1974

3/ BPS, Railways Statistics, 1961-1974

8.2 Highways Transportation

8.2.1 General

08.003 Central Java has 407.8 km of national highways which extend, as shown in Figure 8.1, along its northern coast from the west to Semarang and to Bawen, where one highway branches off to Yogyakarta through Magelang, and the other passes through Salatiga, Surakarta and Sragen up to Surabaya. The former highway meets the latter at Kartosuro through Yogyakarta and Klaten. The southern part of Central Java does not have a national highway network, and as a result Central Java accounts for only 23.2 percent of the total length of national highways in the Java Island, a figure much less than its share in population.

08.004 As for provincial highways, the share of Central Java is 27.1 percent of the whole Java, and the total length amounted to 1,807.5 km in 1974. The sum of local roads, i.e., kabupaten and kotamadya roads, amounted to 9,224.7 km in the same year, accounting for 44.0 percent of the total length of the same kinds of roads in the Java Island. Thus, in general, highways and roads of minor status prevail in Central Java.

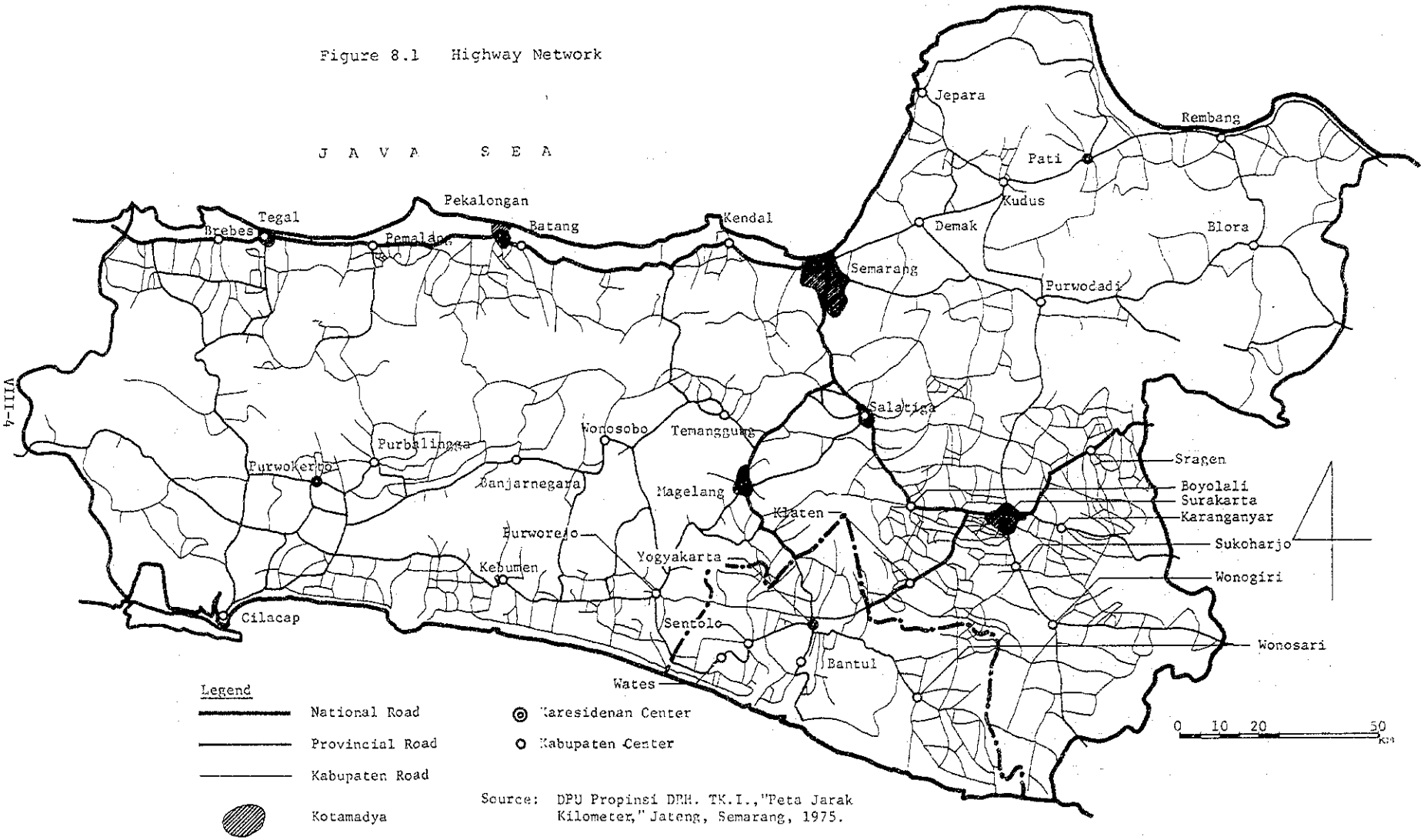
8.2.2 Present Conditions

(a) Province-Wide Conditions Regarding Roads

08.005 The surface type of highways in Central Java is as shown in Table 8.2, which reveals that, out of the total length of 11,400 km, asphalted roads account for 62.4 percent. This owes much to the increase of more than 2,400 km in asphalting kabupaten roads from 1971 to 1974. Accordingly, kabupaten roads with gravel, soil and other surface have decreased substantially. A considerable length of Provincial highways have been also asphalted in the same period. Thus, there is a growing tendency for highways in the Province to have an asphalt surface.

08.006 In the light of the national classification of highways by load capacity, there is no Class I highway in the Province (for the explanation of classes, see the note of Table 8.3). Table 8.3 shows the situation concerning highways in the Province by this classification. As for national highways there was only an addition of 1 km in Class IV during the period of 1971 to 1974, while Provincial highways changed a great deal in terms of road class, i.e., some Provincial highways in Classes III and IIIA were upgraded to Class II. However, Class III still had the largest share of the Provincial highways in 1974. Despite the increased asphalting, most of kabupaten roads belong to Class IV, though some of them moved up to Class III or down to Class IV during the period. As for kotamadya roads, growth in Classes II and V is remarkable.

Figure 8.1 Highway Network



Source: DPU Propinsi DPH. TK.I.,"Peta Jarak Kilometer," Jateng, Semarang, 1975.

Table 8.2 Length of Roads by Surface Type and Status

(Unit: km)

Surface type	Year	National R. Length	National R. Share(%)	Provincial R. Length	Provincial R. Share(%)	Kabupaten R. Length	Kabupaten R. Share(%)	Katamadya R. Length	Katamadya R. Share(%)	Total Length	Total Share(%)
Asphalt	1974	407.8	(99.8)	1,751.6	(96.9)	4,405.9	(55.0)	582.2	(47.9)	7,147.5	(62.5)
	1971	407.8	(100.0)	1,559.5	(86.5)	2,001.2	(26.6)	524.8	(45.4)	4,493.1	(41.3)
	Growth Rate (%)	0.0		12.3		120.2		10.9		59.1	
Gravel	1974	1.0	(0.2)	55.9	(3.1)	1,765.2	(22.1)	13.8	(1.1)	1,835.9	(16.0)
	1971	0		242.7	(13.5)	2,813.1	(37.4)	19.3	(1.7)	3,075.1	(28.2)
	Growth Rate (%)	-		-77.0		-37.3		-28.5		-40.3	
Soil	1974	0		0		1,667.3	(20.8)	554.3	(45.6)	2,221.6	(19.4)
	1971	0		0		2,079.5	(27.6)	546.4	(47.3)	2,625.9	(24.1)
	Growth Rate (%)	-		-		-19.8		1.4		-15.4	
Others	1974	0		0		171.7	(2.1)	64.3	(5.3)	236.0	(2.1)
	1971	0		0		633.5	(8.4)	64.4	(5.6)	697.9	(6.4)
	Growth Rate (%)	-		-		-72.9		-0.2		-66.2	
Total	1974	408.8	(100.0)	1,807.5	(100.0)	8,010.0	(100.0)	1,214.6	(100.0)	11,441.0	(100.0)
	1971	407.8	(100.0)	1,802.2	(100.0)	7,527.1	(100.0)	1,154.9	(100.0)	10,892.0	(100.0)
	Growth Rate (%)	0.2		0.3		6.4		5.2		5.0	

Source: Dinas Pekerjaan Umum Propinsi, Kabupaten & Kotamadya

Table 8.3 Length of Roads by Load-Capacity Class and Status

(Unit: km)

Class 1/	Year	National R. Length	National R. Share(%)	Provincial R. Length	Provincial R. Share(%)	Kabupaten R. Length	Kabupaten R. Share(%)	Kotamadya R. Length	Kotamadya R. Share(%)	Total Length	Total Share(%)
II	1974	387.5	(94.8)	169.7	(9.4)	16.0	(0.2)	236.2	(19.4)	809.4	(7.1)
	1971	387.5	(95.0)	24.2	(1.3)	17.3	(0.2)	219.1	(19.0)	648.1	(6.0)
	Growth Rate(%)	0.0		601.2		-7.5		7.8		24.9	
III	1974	0		1,384.3	(76.6)	1,160.3	(14.5)	94.4	(7.8)	2,639.0	(23.1)
	1971	0		1,510.2	(83.8)	863.8	(11.5)	100.8	(8.7)	2,474.8	(22.7)
	Growth Rate(%)	-		-8.3		34.3		-6.3		6.6	
IIIA	1974	20.3	(5.0)	182.2	(10.1)	1,358.1	(16.9)	20.5	(1.7)	1,581.1	(13.8)
	1971	20.3	(5.0)	205.4	(11.4)	1,829.8	(24.3)	15.5	(1.3)	2,071.1	(19.0)
	Growth Rate(%)	0.0		-11.3		-25.8		32.3		-23.7	
IV	1974	1.0	(0.2)	71.3	(3.9)	2,816.4	(35.2)	118.7	(9.8)	3,007.4	(26.3)
	1971	0		62.4	(3.5)	2,089.0	(27.8)	107.9	(9.4)	2,259.3	(20.7)
	Growth Rate(%)	-		14.3		34.8		10.0		33.1	
V	1974	0		0		1,798.0	(22.5)	241.2	(19.8)	2,039.2	(17.8)
	1971	0		0		2,032.9	(27.0)	206.9	(17.9)	2,239.8	(20.6)
	Growth Rate(%)	-		-		-11.6		16.6		-9.0	
Others	1974	0		0		861.3	(10.7)	503.6	(41.5)	1,364.9	(11.9)
	1971	0		0		694.3	(9.2)	504.7	(43.7)	1,198.9	(11.0)
	Growth Rate(%)	-		-		24.1		-0.2		13.8	

Note: 1/ Classes are defined on the basis of the load-capacity. Class I can bear the heaviest load, and Class V the lightest.

Source: Bappeda dan Kantor Sensus & Statik-Jawa Tengah, Jawa Tengah Dalam Angka 1973-1975

08.007 Highways and roads are classified also according to the surface conditions based on the possible running speed on them. Table 8.4 is the tabulation of road conditions in the Province in 1971 and 1974. National highways are extensively improved in this respect, and only 1 km is left in seriously damaged condition. For Provincial highways also there was considerable improvement, but it is notable that the proportion of seriously damaged condition roads has increased. Improvement of kabupaten roads is clear in the extensive increase in good condition roads, but in case of kotamadya roads, roads in damaged condition were decomposed into better and worse conditions, and the share of roads in seriously damaged condition has remarkably increased. As a whole, except national highways which underwent upgrading in terms of condition, decomposition of roads in moderate and damaged conditions into those in good and seriously damaged conditions can be observed.

(b) Geographic Differences in Road Conditions

08.008 The geographic differences of kabupaten and kotamadya roads is examined by using the same indices as in the case of province-wide situation. Table 8.5 shows the conditions of roads in each kabupaten and kotamadya in terms of surface type. It is clear from this table that the composition of surface type varies a great deal, and the KB/KDYS whose share of asphalted roads is more than 70 percent are kabupatens Banyumas, Purworejo, Karanganyar, Grobogan, Blora and Kendal, and kotamadyas Magelang, Salatiga and Pekalongan. On the other hand, kabupatens Demak, Temanggung and Tegal, and Kotamadya Surakarta have asphalted roads which are less than 30 percent of total road length. In some KB/KDYS, the sum of soil and unspecified roads exceeds 50 percent of the total length. These are: kabupatens Wonosobo, Boyolali, Kudus and Temanggung, and Kotamadya Surakarta. Thus, so far as the surface type of roads is concerned, kabupatens Temanggung and Kotamadya Surakarta are in the worst situation.

08.009 Regarding the class of roads shown in Table 8.6, kabupaten and kotamadya roads are generally in the lower classes, and only kabupaten Klaten and kotamadyas Magelang and Pekalongan are among those whose sum of Classes II and III surpass 60 percent. The sum of the length in Classes IV and V and others amounts to more than 90 percent in kabupatens Cilicap, Banjarnegara, Kebumen, Purworejo, Magelang, Sukoharjo, Grobogan, Rembang, Demak and Pemalang.

08.010 The condition of roads is as shown in Table 8.7, which reveals that the road condition in each kabupaten and kotamadya varies considerably, e.g., 80.5 percent of the roads are in good condition in Kotamadya Salatiga and none of the roads is in good condition in Kabupaten Magelang. The share of roads in good condition is more than 70 percent only in kabupatens Bannyumas and Kebumen and Kotamadya Salatiga, and less than 30 percent in kabupatens Cilacap, Banjarnegara, Boyolali, Grobogan, Blora, Demak, Temanggung, Batang, Pekalongan, Pemalang, Tegal and Brebes, and kotamadyas Magelang, Surakarta and Pekalongan. On the other hand, the sum of the length of damaged and seriously damaged conditions accounts for more than 50 percent in

Table 8.4 Length of Roads by Condition and Status

(Unit: km)

Condition	Year	National R. Length	National R. Share(%)	Provincial R. Length	Provincial R. Share(%)	Kabupaten R. Length	Kabupaten R. Share(%)	Katamadya R. Length	Katamadya R. Share(%)	Total Length	Total Share(%)
Good	1974	407.8	(99.8)	499.6	(27.6)	2,871.1	(35.9)	488.2	(40.2)	4,266.7	(37.3)
	1971	199.8	(49.0)	246.5	(13.7)	2,195.5	(29.2)	386.3	(33.4)	3,028.2	(27.8
	Growth Rate(%)	104.1		102.7		30.8		26.4		40.9	
Moderate	1974	0		623.5	(34.5)	1,981.7	(24.7)	259.5	(21.4)	2,864.7	(25.0)
	1971	179.9	(44.1)	711.8	(39.5)	1,984.6	(26.4)	124.3	(10.8)	3,000.6	(27.5)
	Growth Rate(%)	-100.0		-12.4		-0.1		108.8		-4.5	
Damaged	1974	0		343.1	(19.0)	1,418.4	(17.7)	228.5	(18.8)	1,990.0	(17.4)
	1971	26.1	(6.4)	673.4	(37.4)	1,719.5	(22.8)	584.2	(50.6)	3,003.2	(27.6)
	Growth Rate(%)	-100.0		-49.0		-17.5		-60.9		-33.7	
Seriously Damaged	1974	1.0	(0.2)	341.3	(18.9)	1,738.9	(21.7)	238.4	(19.6)	2,319.6	(20.3)
	1971	2.0	(0.5)	170.5	(9.4)	1,627.4	(21.6)	60.1	(5.2)	1,860.0	(17.1)
	Growth Rate(%)	-50.0		41.5		6.9		296.7		24.7	

Source: Bappeda dan Kantor Sensus & Statik-Jawa Tengah, Jawa Tengah Dalam Angka 1973-1975

Table 8.5 Length of Kabupaten/Kotamadya Roads by Surface Type, 1974

(Unit: km)

			Asphalted R. Length (%)	Gravel R. Length (%)	Soil R. Length (%)	Unspecified R. Length (%)	Total Length (%)
1.	KDY	Magelang	53.9 (100.0)	-	-	-	53.9 (100.0)
2.	KDY	Surakarta	113.1 (20.2)	-	438.9 (78.2)	9.0 (1.60)	561.0 (100.0)
3.	KDY	Salatiga	36.0 (79.6)	2.0 (4.4)	7.2 (15.9)	-	45.2 (100.0)
4.	KDY	Semarang	298.8 (67.6)	-	103.2 (23.4)	-	41.1 (100.0)
5.	KDY	Pekalongan	48.2 (87.2)	7.1 (12.8)	-	-	55.3 (100.0)
6.	KDY	Tegal	32.2 (56.1)	4.7 (8.2)	5.0 (8.7)	15.4 (26.8)	57.3 (100.0)
7.	KB	Cilacap	241.0 (69.8)	19.5 (5.6)	85.0 (24.6)	-	345.5 (100.0)
8.	KB	Banyumas	252.8 (90.7)	26.0 (9.3)	-	-	278.8 (100.0)
9.	KB	Purbalingga	107.7 (63.7)	49.5 (29.3)	11.8 (6.9)	-	169.0 (100.0)
10.	KB	Banjarnegara	103.8 (32.8)	120.0 (37.9)	93.0 (29.4)	-	316.8 (100.0)
11.	KB	Kebumen	178.5 (45.2)	128.3 (32.5)	88.5 (22.4)	-	395.3 (100.0)
12.	KB	Purworejo	185.3 (72.5)	70.4 (27.5)	-	-	255.7 (100.0)
13.	KB	Wonosobo	88.9 (38.5)	-	141.9 (61.5)	-	230.8 (100.0)
14.	KB	Magelang	210.2 (62.9)	-	123.6 (37.0)	-	338.8 (100.0)
15.	KB	Boyolali	169.9 (41.4)	20.5 (5.0)	219.5 (53.5)	-	409.9 (100.0)
16.	KB	Klaton	253.3 (59.6)	-	-	171.7 (40.4)	425.0 (100.0)
17.	KB	Sukoharjo	139.8 (66.5)	70.5 (33.5)	-	-	210.3 (100.0)
18.	KB	Wonogiri	169.3 (60.4)	39.9 (14.2)	72.1 (25.4)	-	280.4 (100.0)
19.	KB	Karanganyar	228.3 (80.2)	56.5 (19.8)	-	-	284.8 (100.0)
20.	KB	Sragen	150.0 (42.9)	199.4 (57.1)	-	-	349.4 (100.0)
21.	KB	Grobogan	150.6 (87.7)	21.0 (12.2)	-	-	177.6 (100.0)
22.	KB	Blora	350.5 (77.6)	110.2 (22.4)	-	-	451.7 (100.0)
23.	KB	Rembang	91.8 (49.5)	93.0 (50.2)	0.5 (0.3)	-	185.3 (100.0)
24.	KB	Pati	180.7 (56.8)	125.7 (39.5)	11.5 (3.6)	-	317.9 (100.0)
25.	KB	Kudus	143.9 (40.3)	11.5 (3.2)	201.1 (56.4)	-	356.5 (100.0)
26.	KB	Jepara	64.1 (57.6)	47.2 (42.4)	-	-	111.3 (100.0)
27.	KB	Demak	38.4 (24.2)	63.0 (39.7)	57.2 (36.0)	-	158.6 (100.0)
28.	KB	Semarang	137.5 (62.9)	43.7 (20.0)	37.1 (17.0)	-	218.3 (100.0)
29.	KB	Temanggung	54.2 (26.1)	8.5 (4.1)	144.8 (69.8)	-	207.5 (100.0)
30.	KB	Kendal	171.5 (84.9)	30.4 (15.0)	-	-	201.9 (100.0)
31.	KB	Batang	70.6 (35.8)	34.0 (16.0)	102.0 (48.1)	-	212.0 (100.0)
32.	KB	Pekalongan	107.0 (36.3)	90.0 (30.5)	98.0 (33.2)	-	295.0 (100.0)
33.	KB	Pemalang	131.6 (53.3)	88.7 (34.7)	30.5 (11.9)	-	255.3 (100.0)
34.	KB	Tegal	77.8 (25.9)	146.6 (48.9)	75.5 (25.2)	-	299.9 (100.0)
35.	KB	Brebes	147.0 (52.2)	60.2 (21.4)	74.6 (26.5)	-	281.8 (100.0)
Total			4,988.1 (54.1)	1,779.0 (19.3)	2,221.6 (24.1)	236.0 (2.6)	9,224.7 (100.0)

Source: Bappeda dan Kantor Sensus & Statistik-Jawa Tengah, Jawa Tengah Dalam Angka 1973-1975

Table 8.6 Length of Kabupaten/Kotamadya Roads by Class, 1974

(Unit: km)

			II	III	IIIA	IV	V	Others	Total
			Length (%)	Length (%)	Length (%)	Length (%)	Length (%)	Length (%)	Length (%)
1.	KDY	Magelang	16.2(30.1)	17.5(32.5)	-	3.9(7.2)	16.3(30.2)	-	53.9(100.0)
2.	KDY	Surakarta	83.1(14.8)	5.5(1.0)	-	34.3(6.1)	-	438.1(78.1)	561.0(100.0)
3.	KDY	Salatiga	7.0(15.5)	13.1(29.0)	0.1(0.2)	13.6(30.1)	8.4(18.6)	3.0(6.6)	45.2(100.0)
4.	KDY	Semarang	93.0(21.1)	42.1(9.5)	-	50.4(11.4)	216.5(49.0)	39.9(9.0)	441.9(100.0)
5.	KDY	Pekalongan	31.9(57.7)	9.4(17.0)	-	6.8(12.3)	-	7.2(13.0)	55.3(100.0)
6.	KDY	Tegal	5.0(8.7)	6.8(11.9)	20.4(35.6)	9.7(16.9)	-	15.4(26.9)	57.3(100.0)
7.	KB	Cilacap	-	-	5.3(1.5)	235.6(68.2)	19.5(5.7)	85.1(24.6)	345.5(100.0)
8.	KB	Banyumas	-	116.3(41.7)	136.5(49.0)	26.0(9.3)	-	-	278.8(100.0)
9.	KB	Purbalingga	-	-	107.7(63.7)	49.5(29.3)	11.8(7.0)	-	169.0(100.0)
10.	KB	Banjarnegara	-	-	-	223.8(70.6)	-	93.0(29.4)	316.8(100.0)
11.	KB	Kebumen	-	-	29.3(7.4)	190.7(48.2)	87.0(22.0)	88.5(22.4)	395.3(100.0)
12.	KB	Purworejo	-	9.4(3.7)	14.9(5.8)	35.5(13.9)	195.9(76.6)	-	255.7(100.0)
13.	KB	Wonosobo	-	3.1(1.4)	21.0(9.1)	64.7(28.0)	-	142.0(61.5)	230.8(100.0)
14.	KB	Magelang	-	-	24.7(7.4)	189.6(56.8)	119.5(35.8)	-	333.8(100.0)
15.	KB	Boyolali	-	82.4(20.1)	86.5(21.1)	43.7(10.7)	197.3(48.1)	-	409.9(100.0)
16.	KB	Klaten	8.5(2.0)	246.4(58.0)	29.6(6.9)	67.4(15.9)	73.1(17.2)	-	425.0(100.0)
17.	KB	Sukoharjo	-	11.1(5.3)	-	199.2(94.7)	-	-	210.3(100.0)
18.	KB	Wonogiri	-	58.0(20.7)	68.3(24.3)	127.2(45.4)	26.9(9.6)	-	280.4(100.0)
19.	KB	Karanganyar	1.5(0.5)	14.7(41.8)	92.7(32.6)	73.7(25.9)	46.2(16.2)	28.9(10.1)	284.8(100.0)
20.	KB	Sragen	-	188.8(54.0)	96.8(27.7)	63.8(18.3)	-	-	349.4(100.0)
21.	KB	Grobogan	-	9.6(5.6)	-	-	162.0(94.4)	-	171.6(100.0)
22.	KB	Blora	-	77.0(17.1)	20.0(4.4)	253.5(56.1)	101.2(22.4)	-	451.7(100.0)
23.	KB	Rembang	-	6.4(3.5)	-	97.3(52.5)	81.6(44.0)	-	185.3(100.0)
24.	KB	Pati	-	57.8(18.2)	41.0(12.9)	152.9(48.1)	66.2(20.8)	-	317.9(100.0)
25.	KB	Kudus	-	99.4(27.9)	40.2(11.3)	11.5(3.2)	205.4(57.6)	-	356.5(100.0)
26.	KB	Jepara	-	17.5(15.7)	19.6(17.6)	72.2(64.9)	2.0(1.8)	-	111.3(100.0)
27.	KB	Demak	-	3.4(2.1)	8.5(5.4)	70.2(44.3)	76.5(48.2)	-	158.6(100.0)
28.	KB	Semarang	-	18.4(8.4)	16.9(7.8)	96.7(44.3)	86.3(39.5)	-	218.3(100.0)
29.	KB	Temanggung	-	9.6(4.6)	56.5(27.3)	78.9(38.0)	62.5(30.1)	-	207.5(100.0)
30.	KB	Kendal	4.0(2.0)	-	151.7(75.1)	36.4(18.0)	9.8(4.9)	-	201.9(100.0)
31.	KB	Batang	2.0(0.9)	48.5(22.9)	45.0(21.2)	14.5(6.9)	-	102.0(48.1)	212.0(100.0)
32.	KB	Pekalongan	-	36.0(12.2)	129.0(43.7)	21.0(7.1)	11.0(3.8)	98.0(33.2)	295.0(100.0)
33.	KB	Pemalang	-	8.0(3.1)	-	110.7(43.4)	17.3(6.8)	119.3(46.7)	255.3(100.0)
34.	KB	Tegal	5.0(8.7)	6.8(11.9)	20.4(35.6)	9.7(16.9)	-	15.4(26.9)	57.3(100.0)
35.	KB	Brebes	-	11.4(4.0)	28.8(10.2)	149.6(53.1)	63.0(22.4)	29.0(10.3)	281.8(100.0)
Total			252.2(2.8)	1,254.7(13.6)	1,378.6(14.9)	2,935.1(31.8)	2,039.2(22.1)	1,364.9(14.8)	9,224.7(100.0)

Source: Bappeda dan Kantor Sensus & Statistik-Jawa Tengah, Jawa Tengah Dalam Angka 1973-1975

kabupatens Cilacap, Boyolali, Karanganyar, Temanggung, Batang, Pekalongan and Pemalang and in kotamadyas Surakarta and Tegal. Thus, it is concluded that the actual bad conditions of roads are found in kabupatens Cilacap, Boyolali, Temanggung, Batang, Pekalongan and Pemalang and in Kotamadya Surakarta.

08.011 Specifically the situation of roads in Kabupaten Banyumas and Kotamadya Salatiga is fairly good, while that in Kabupaten Temanggung and Kotamadya Surakarta is quite poor.

(c) Number of Registered Vehicles

08.012 Table 8.8 shows the number of registered vehicles in Central Java exclusive of Yogyakarta. The data for 1975 was collected from a source different from other data and there is some discrepancy especially in the bus and truck category. The average annual growth rate of each type of vehicle between 1969 and 1974 reveals that the sedan type cars have not increased so much as compared with other types. In 1974 the ratio of vehicle ownership was 1 vehicle including motorcycles per every 140 persons.

8.2.3 Major Issues

(a) Conditions of Roads

08.013 While the province-wide conditions of roads were already explained in the previous section, the additional data for 1975 and 1976 reveal major problems related to conditions of roads. Table 8.9 shows the conditions of national and Provincial highways in 1974, 1975 and 1976. The data for 1974 were from Table 8.4. The most conspicuous problem is the degradation of national highways especially in 1974 and 1975, and more than one-fourth of highways in good condition in 1974 fell into the next category of "Moderate". Provincial highways also deteriorated in 1975 and 1976, and more than 120 km of Provincial highways in good condition was degraded down to moderate condition. However, there seems to be some independable factor in the data, since the length of roads in good condition shows a sudden drop in 1975. So, we have to be careful in interpreting the data. Depending on the reliability of the data, two comments can be made as follows:

(1) If the data are correct and are based on the proper classification, the problem of degradation is serious, and not only financial but also technical measures should be taken to improve and to maintain the conditions of highways.

(2) It seems that one possible cause of the undependability of data is the improper or ambiguous definitions of road conditions which could result in the unstable classification of roads year by year. Since the conditions of roads

Table 8.7 Length of Kabupaten/Kotamadya Roads by Condition, 1974

(Unit: km)

			Good Length (%)	Moderate Length (%)	Damaged Length (%)	Seriously Damaged Length (%)	Total Length (%)
1.	KDY	Magelang	0 (0.0)	28.9(53.6)	15.0(27.8)	10.0(18.6)	53.9(100.0)
2.	KDY	Surakarta	112.2(20.0)	140.2(25.0)	140.3(25.0)	168.3(30.0)	561.0(100.0)
3.	KDY	Salatiga	36.4(80.5)	4.9(10.9)	3.9 (8.6)	0 (0.0)	45.2(100.0)
4.	KDY	Semarang	306.4(69.3)	57.3(13.0)	51.1(11.6)	27.1 (6.1)	441.9(100.0)
5.	KDY	Pekalongan	15.2(27.5)	28.2(51.0)	4.7 (8.5)	7.2(13.0)	55.3(100.0)
6.	KDY	Tegal	18.0(31.4)	0 (0.0)	13.5(23.6)	25.8(45.0)	57.3(100.0)
7.	KB	Cilacap	34.4(10.0)	45.9(13.3)	112.1(32.4)	153.1(44.3)	345.5(100.0)
8.	KB	Banyumas	209.8(75.2)	43.0(15.4)	13.0 (4.7)	13.0 (4.7)	278.8(100.0)
9.	KB	Purbalingga	95.8(56.7)	14.6 (8.6)	46.8(27.7)	11.8 (7.0)	169.0(100.0)
10.	KB	Banjarnegara	86.3(27.2)	110.3(34.8)	60.1(19.0)	60.1(19.0)	316.8(100.0)
11.	KB	Kebumen	296.5(75.0)	35.7 (9.0)	31.5 (8.0)	31.6 (8.0)	395.3(100.0)
12.	KB	Purworejo	153.6(60.1)	51.1(20.0)	38.3(15.0)	12.7 (4.9)	255.7(100.0)
13.	KB	Wonosobo	88.9(38.5)	141.9(61.5)	0 (0.0)	0 (0.0)	230.8(100.0)
14.	KB	Magelang	158.3(47.4)	66.1(19.8)	109.4(32.8)	0 (0.0)	333.8(100.0)
15.	KB	Boyolali	63.0(15.4)	0 (0.0)	20.1 (7.3)	316.8(77.3)	409.9(100.0)
16.	KB	Klaten	215.2(50.6)	104.9(24.7)	42.0 (9.9)	62.9(14.8)	425.0(100.0)
17.	KB	Sukoharjo	94.3(44.4)	45.5(21.6)	20.0 (9.5)	50.5(24.0)	210.3(100.0)
18.	KB	Wonogiri	125.9(44.9)	43.3(15.5)	39.9(14.2)	71.2(25.4)	280.4(100.0)
19.	KB	Karanganyar	103.3(36.3)	0 (0.0)	0 (0.0)	181.5(63.7)	284.8(100.0)
20.	KB	Sragen	150.0(42.9)	193.0(55.3)	6.4 (1.8)	0 (0.0)	349.4(100.0)
21.	KB	Grobogan	35.2(20.5)	98.8(57.6)	37.6(21.9)	0 (0.0)	171.6(100.0)
22.	KB	Blora	51.0(11.3)	116.0(25.7)	284.7(63.0)	0 (0.0)	451.7(100.0)
23.	KB	Rembang	95.4(51.5)	53.5(28.3)	25.4(12.7)	12.0 (6.5)	185.3(100.0)
24.	KB	Pati	127.2(40.0)	36.1(11.4)	25.6 (8.0)	129.0(40.6)	317.9(100.0)
25.	KB	Kudus	142.9(40.1)	78.0(49.9)	30.0 (8.4)	5.6 (1.6)	356.5(100.0)
26.	KB	Jepara	53.5(48.0)	8.1 (7.3)	16.9(15.2)	32.8(29.5)	111.3(100.0)
27.	KB	Demak	38.4(24.2)	63.0(39.7)	57.2(36.1)	0 (0.0)	158.6(100.0)
28.	KB	Semarang	91.8(42.1)	45.7(20.9)	43.7(20.0)	37.1(17.0)	218.3(100.0)
29.	KB	Tamanggung	51.9(25.0)	29.2(14.1)	68.2(32.9)	58.2(28.0)	207.5(100.0)
30.	KB	Kendal	90.0(44.6)	21.9(10.8)	50.0(24.8)	40.0(19.8)	201.9(100.0)
31.	KB	Batang	33.9(16.0)	21.2(10.0)	45.4(21.4)	111.5(52.6)	212.0(100.0)
32.	KB	Pekalongan	23.0 (7.8)	122.0(41.4)	21.0 (7.1)	129.0(43.4)	295.0(100.0)
33.	KB	Pemalang	8.0 (3.1)	110.7(43.4)	17.3 (6.8)	119.3(46.7)	255.3(100.0)
34.	KB	Tegal	77.8(26.0)	116.1(38.7)	85.5(28.5)	20.5 (6.8)	299.9(100.0)
35.	KB	Brebes	75.8(26.9)	67.0(23.8)	60.3(21.4)	78.7(27.9)	281.8(100.0)
Total			3,359.3(36.4)	2,241.2(24.3)	1,646.9(17.9)	1,977.3(21.4)	9,224.7(100.0)

Source: Bappeda dan Kantor Sensus & Statistik-Jawa Tengah, Jawa Tengah Dalam Angka 1973-1975

Table 8.8 Number of Registered Vehicles by Type

Year	Sedan	Bus	Truck	Motorcycle	Total
1969	17,274	1,220	9,541	47,352	75,387
1970	17,883	1,346	9,921	55,450	84,600
1971	19,689	1,556	10,958	65,283	97,485
1972	20,279	1,775	11,429	73,376	106,849
1973	23,318	2,628	14,420	88,599	128,965
1974	23,394	2,987	20,080	117,122	163,583
1975	27,744	2,012	9,309	...	...
Average Annual Growth Rate (%) 1969 - 1974	6.3	19.5	16.0	19.9	16.8

Sources:
1. Bappeda dan Kantor Sensus & Statistik-Jawa Tengah, Jawa Tengah Dalam Angka 1973-1975
2. JICA, Feasibility Study on Central and East Jawa Road Betterment Project, Interim Report, March 1976

Table 8.9 Length of Roads by Condition and Status

(Unit: km)

Condition	Year	National R. Length (%)	Provincial R. Length (%)	Total Length (%)
Good	1976	243.4(58.6)	387.0(22.0)	630.4(29.0)
	1975	291.1(71.2)	510.4(29.3)	801.5(37.1)
	1974	407.8(99.8)	499.6(27.6)	907.4(40.9)
Moderate	1976	156.1(37.5)	922.0(52.5)	1,078.1(49.7)
	1975	111.3(27.2)	718.0(41.2)	829.3(38.4)
	1974	0.0 (0.0)	623.5(34.5)	623.5(28.1)
Damaged	1976	11.1 (2.7)	308.9(17.6)	320.0(14.7)
	1975	5.5 (1.4)	283.2(16.3)	288.7(13.4)
	1974	0.0 (0.0)	343.1(19.0)	343.1(15.5)
Seriously Damaged	1976	5.0 (1.2)	137.9 (7.9)	142.9 (6.6)
	1975	1.0 (0.2)	230.1(13.2)	240.1(11.1)
	1974	1.0 (0.2)	341.3(18.9)	342.3(15.5)
Total	1976	415.6(100.0)	1,755.8(100.0)	2,171.4(100.0)
	1975	408.9(100.0)	1,741.7(100.0)	2,159.6(100.0)
	1974	408.8(100.0)	1,807.5(100.0)	2,216.3(100.0)

Source: DPU Propinsi Jateng, Road Condition Map, 1975 and 1976

have much to do with the budget allocation for highways, careful investigation on the definitions and the measurement criteria for the classification of road conditions and its relation to budget allocation should be taken.

08.014 These points may also apply to kabupaten and kotamadya roads, although detailed information is not available at the present. The major causes of deterioration of roads would in general be: that maintenance of roads does not catch up with the routine damage to roads, caused by vehicular traffic, that is, the budget allocation for routine and periodic maintenance and for rehabilitation is not enough; and that there are unexpected amount of damage to roads caused by chronic floods and inundations which absorb a considerable amount of the budget for their rehabilitation.

(b) Intraprovincial Accessibility to the Activity Centers

08.015 The intraprovincial accessibility to activity centers is examined to see which part of the Province enjoys good access or suffers from poor access to the major activity centers of the Province. For this purpose all the six kotamadyas and the kabupaten center of Cilacap are taken as the major activity centers, and the accessibility to these centers from all kabupaten centers and kotamadyas is simulated as follows:

(1) Accessibility between two points is measured by "transportation distortion" which is here defined as the multiplied figure of distortion in distance and distortion in travel time. The distortion in distance is the ratio of the length of the actual route between the two points to their geodesic distance. This distortion in distance is considered to be caused mainly by natural topographical conditions. On the other hand, distortion in time is the ratio of the actual travel time to the minimum travel time based on the hypothetical maximum speed on the route, that is, 60 km per hour. The major factor which affects travel time is supposed to be the conditions of the route. For the selection of the route between two points, only the national and provincial highway networks are used, and the speeds on the portions of good, moderate, damaged and seriously damaged conditions are assumed to be 60, 45, 25 and 10 km per hour, respectively. The input data of conditions of highways for this study are those in March 1976, and the route between the two points is chosen on the basis of the shortest time rather than of the shortest distance. Thus, simple calculation shows that transportation distortion is the ratio of the actual travel time to the time needed to travel the geodesic distance between the two points by the hypothetical maximum speed, that is, 60 km per hour in this case. Accessibility between two points is, therefore, greater, if the value of transportation distortion is closer to 1.

(2) Table 8.10 shows the geodesic distance between each kabupaten center or kotamadya and those selected seven major activity centers in the Province. Kabupatens Blora, Remban, Pati and Wonogiri are rather separated from those seven centers as these kabupaten centers are located on the periphery of the Province. The total distance to those centers from Cilacap is considerably long, even though Cilacap itself is one of those centers. Of all those seven centers Kotamadya Salatiga enjoys the shortest total distance to all the other centers in the Province.

(3) The actual road distance between each kabupaten or kotamadya center and those seven centers is tabulated in Table 8.11. Kabupatens Semarang (whose center is Ungaran) and Temanggung, and kotamadyas Salatiga, Magelang and Semarang enjoy comparatively short road distance to those seven centers. Those kabupatens on the periphery including Cilacap have a long distance to those seven centers, and among those seven, Kotamadya Semarang has the shortest sum of road distance to all the centers.

(4) Table 8.12 is made from tables 8.10 and 8.11 and shows distortion in distance for each pair of two points. High distortion appears between Surakarta and Blora, between Salatiga and Grobogan, between Pekalongan and those located in mountain areas and southern part of the Province such as Banyumas, Purbalingga, Banjarnegara, Kebumen, Purworejo and Wonosobo. In case of Tegal the situation is much the same as in the case of Pekalongan except Banyumas and Purworejo.

(5) Actual travel time between each pair of points on the shortest time route is shown in Table 8.13 which reveals that the situation of Blora is exceptionally bad and that the total travel time from Kotamadya Semarang to all other centers is almost exactly half of that from Cilacap.

(6) Table 8.14 shows distortion-in-time calculated from tables 8.11 and 8.13. Comparatively large distortion appears in the case between Magelang and Banjarnegara, Purworejo, Wonosobo and Temanggung, also in the case between Surakarta and Grobogan. The large distortions in these cases are due to poor conditions of the route, and as a whole the connections to those seven major centers from Purbalingga, Banjarnegara and Wonosobo has larger distortion. Where the value of its distortion is 1.00, it means that the route is in good condition. The connection from Klaten to those seven centers and that from Surakarta to all the other centers enjoy smaller distortion close to 1.00.

Table 8.10 Geodesic Distance Between KB/KDY Centers

(Unit: km)

	KDY Magelang	KDY Surakarta	KDY Salatiga	KDY Semarang	KDY Pekalongan	KDY Tegal	KB Cilacap	Total
KDY Magelang	na	66.3	35.0	58.5	87.0	135.8	133.8	516.4
KDY Surakarta	66.3	na	42.8	77.5	144.5	198.8	197.8	727.7
KDY Salatiga	35.0	42.8	na	39.8	102.0	157.5	167.8	544.9
KDY Semarang	58.5	77.5	39.8	na	81.0	140.0	172.5	569.3
KDY Pekalongan	87.0	144.5	102.0	81.0	na	59.3	115.0	588.8
KDY Tegal	135.8	198.8	157.5	140.0	59.3	na	93.5	784.9
KB Cilacap	133.8	197.8	167.8	172.5	115.0	93.5	na	880.4
KB Banyumas	106.8	173.0	138.0	136.8	74.5	61.5	40.5	731.1
KB Purbalingga	93.5	160.0	124.7	122.5	63.0	61.3	53.0	678.0
KB Banjarnegara	57.3	123.8	88.0	90.3	54.5	84.3	82.5	580.7
KB Kebumen	64.3	127.5	99.3	111.3	83.3	103.3	70.3	659.3
KB Purworejo	33.0	88.3	67.0	90.3	95.5	132.3	109.0	615.4
KB Wonosobo	37.3	103.0	66.0	69.8	56.0	99.0	104.3	535.4
KB Boyolali	42.3	24.3	24.5	64.0	122.5	175.5	174.3	627.4
KB Klaten	48.0	28.8	41.8	81.5	133.8	183.8	172.8	690.5
KB Sukoharjo	71.3	13.0	52.8	89.5	153.0	206.0	199.3	784.9
KB Wonogiri	83.8	29.0	68.8	106.0	167.8	219.5	207.0	881.9
KB Karanganyar	80.0	13.8	55.5	88.3	157.5	212.3	210.8	818.2
KB Sragen	87.8	27.0	57.3	81.8	157.3	214.3	221.3	846.8
KB Grobogan	86.8	52.8	51.8	55.5	136.3	195.3	217.8	796.3
KB Blora	141.5	91.0	106.5	109.0	189.5	248.8	273.8	1,160.1
KB Rembang	147.8	108.3	113.3	104.8	182.3	241.0	276.0	1,173.5
KB Pati	119.0	91.0	85.5	72.0	149.0	207.8	244.0	968.3
KB Kudus	99.0	81.5	67.3	49.8	127.0	186.0	222.0	832.6
KB Jepara	107.8	106.8	82.0	49.8	112.5	169.5	217.5	845.9
KB Demak	79.0	75.8	50.3	25.8	105.3	164.5	199.0	700.7
KB Semarang	42.8	65.3	24.5	17.0	83.3	141.3	164.3	538.5
KB Tamanggung	17.8	74.5	35.0	45.0	72.3	124.5	134.5	503.6
KB Kendal	60.0	96.8	55.0	23.8	57.3	116.5	155.3	564.7
KB Batang	81.3	138.3	95.8	74.8	6.5	65.3	117.5	579.5
KB Pemalang	110.8	172.5	130.8	112.5	31.8	27.5	98.0	683.9
KB Brebes	144.8	208.5	167.5	150.8	69.8	10.8	91.8	844.0
Total	2,560.2	3,002.3	2,493.9	2,592.0	3,230.4	4,436.8	4,937.0	23,248.1

Source: Measurement by the Study Team
based on DPU Proping: Jateng, Peta Jarak Kilometer 1975

Table 8.11 Road Distance Between KB/KDY Centers

(Unit: km)

	KDY Magelang	KDY Surakarta	KDY Salatiga	KDY Semarang	KDY Pekalongan	KDY Tegal	KB Cilacap	Total
KDY Magelang	na	99.2	45.6	75.7	137.3	201.9	172.9	732.6
KDY Surakarta	99.2	na	53.6	100.2	201.2	265.8	256.0	976.0
KDY Salatiga	45.6	53.6	na	46.6	147.6	212.2	218.5	724.1
KDY Semarang	75.7	100.2	46.6	na	101.0	165.6	248.6	737.7
KDY Pekalongan	137.3	201.2	147.6	101.0	na	64.6	194.4	846.1
KDY Tegal	201.9	265.8	212.2	165.6	64.6	na	129.8	1,039.9
KB Cilacap	172.9	256.0	218.5	248.6	194.4	129.8	na	1,220.2
KB Banyumas	162.7	245.8	223.3	244.4	166.5	101.9	65.2	1,209.8
KB Purbalingga	163.6	246.7	171.1	192.2	188.2	123.6	66.1	1,124.6
KB Banjarnegara	92.9	180.8	127.3	148.4	163.8	168.8	94.3	976.3
KB Kebumen	85.8	168.9	131.4	161.5	223.1	216.9	87.1	1,074.7
KB Purworejo	44.2	127.3	89.8	119.9	181.5	220.4	128.7	911.8
KB Wonosobo	62.8	150.7	97.1	118.3	133.7	198.3	124.4	885.3
KB Boyolali	72.7	26.5	27.1	73.7	174.7	239.3	260.3	874.3
KB Klaten	82.6	35.7	67.1	113.7	214.7	279.3	220.3	1,013.4
KB Sukoharjo	112.2	13.0	66.6	113.2	214.2	278.8	269.0	1,067.0
KB Wonogiri	131.2	32.0	85.6	132.2	233.2	297.8	288.0	1,200.0
KB Karanganyar	114.2	15.0	68.6	115.2	216.2	280.8	271.0	1,081.0
KB Sragen	127.6	28.4	82.0	128.6	229.6	294.2	284.4	1,174.8
KB Grobogan	139.5	63.3	110.4	63.8	164.8	229.4	319.3	1,090.5
KB Blora	205.2	246.5	192.9	146.3	247.9	311.9	394.9	1,745.0
KB Rembang	186.5	211.0	157.4	110.8	211.8	276.4	359.4	1,513.3
KB Pati	151.0	175.5	121.9	75.3	176.3	240.9	323.9	1,264.8
KB Kudus	126.7	150.2	97.6	51.0	152.0	316.6	299.6	1,094.7
KB Jepara	161.8	186.3	132.7	86.1	187.1	251.4	334.7	1,340.4
KB Demak	101.9	126.4	72.8	26.2	127.2	191.8	274.8	921.1
KB Semarang	55.7	80.2	26.6	20.0	121.0	185.6	228.6	717.7
KB Tamanggung	22.5	110.4	56.8	78.0	114.8	179.4	164.7	726.6
KB Kendal	104.3	128.8	75.2	28.6	72.4	137.0	220.2	766.5
KB Batang	128.5	192.4	138.8	92.2	8.8	73.4	203.2	837.3
KB Pemalang	171.7	235.6	182.0	135.4	34.4	30.2	160.0	949.3
KB Brebes	213.9	277.8	224.2	177.6	76.6	12.0	141.8	1,123.9
Total	3,727.4	4,432.2	3,550.4	3,490.3	4,880.0	6,076.3	6,804.1	32,981.5

Source: DPU Propinsi Jateng, Peta Jarak Kilometer 1975

Table 8.12 Distortion in Distance 1/

(Unit: Ratio)

	KDY Magelang	KDY Surakarta	KDY Salatiga	KDY Semarang	KDY Pekalongan	KDY Tegal	KB Cilacap	Total Average
KDY Magalang	na	1.50	1.30	1.29	1.58	1.49	1.29	1.42
KDY Surakarta	1.50	na	1.25	1.29	1.39	1.34	1.29	1.34
KDY Salatiga	1.30	1.25	na	1.17	1.45	1.35	1.30	1.33
KDY Semarang	1.29	1.29	1.17	na	1.25	1.18	1.44	1.30
KDY Pekalongan	1.58	1.39	1.45	1.25	na	1.09	1.69	1.44
KDY Tagal	1.49	1.34	1.35	1.18	1.09	na	1.39	1.32
KB Cilacap	1.29	1.29	1.30	1.44	1.69	1.39	na	1.39
KB Banyumas	1.52	1.42	1.62	1.79	2.24	1.66	1.61	1.65
KB Purbalingga	1.75	1.54	1.37	1.57	2.99	2.02	1.25	1.66
KB Banjarnegara	1.62	1.46	1.45	1.64	3.01	2.00	1.14	1.68
KB Kebumen	1.33	1.32	1.32	1.45	2.68	2.10	1.24	1.63
KB Purworejo	1.34	1.44	1.34	1.33	1.90	1.67	1.18	1.48
KB Wonosobo	1.68	1.46	1.47	1.69	2.39	2.00	1.19	1.65
KB Boyolali	1.72	1.09	1.11	1.15	1.43	1.36	1.49	1.39
KB Klaten	1.72	1.24	1.61	1.40	1.60	1.52	1.27	1.47
KB Sukoharjo	1.57	1.00	1.26	1.26	1.40	1.35	1.35	1.36
KB Wonogiri	1.57	1.10	1.24	1.25	1.39	1.36	1.39	1.36
KB Karanganyar	1.43	1.09	1.24	1.30	1.37	1.32	1.29	1.32
KB Sragen	1.45	1.05	1.43	1.57	1.46	1.37	1.29	1.39
KB Grobogan	1.61	1.20	2.13	1.15	1.21	1.17	1.47	1.37
KB Blora	1.45	2.71	1.81	1.34	1.31	1.25	1.44	1.50
KB Rembang	1.26	1.95	1.39	1.06	1.16	1.15	1.30	1.29
KB Pati	1.27	1.93	1.43	1.05	1.18	1.16	1.33	1.31
KB Kudus	1.28	1.84	1.45	1.02	1.20	1.16	1.35	1.31
KB Jepara	1.50	1.74	1.62	1.73	1.66	1.48	1.54	1.58
KB Demak	1.29	1.67	1.45	1.02	1.21	1.17	1.38	1.32
KB Semarang	1.30	1.23	1.09	1.18	1.45	1.31	1.39	1.33
KB Tamanggung	1.26	1.48	1.62	1.73	1.59	1.44	1.22	1.44
KB Kendal	1.74	1.33	1.37	1.20	1.26	1.18	1.42	1.36
KB Batang	1.58	1.39	1.45	1.23	1.35	1.12	1.74	1.44
KB Pemalang	1.55	1.37	1.39	1.20	1.08	1.10	1.63	1.39
KB Brebes	1.48	1.33	1.34	1.18	1.10	1.11	1.54	1.33
Total Average	1.46	1.48	1.42	1.35	1.51	1.37	1.38	1.42

Note: 1/ Distortion is defined as the road distance in Table 8.11 divided by the geodesic distance in Table 8.10.

Sources: Table 8.10 and Table 8.11.

Table 8.13 Time Distance Between KB/KDY Centers

(Unit: Minutes)

		KDY Magelang	KDY Surakarta	KDY Salatiga	KDY Semarang	KDY Pekalongan	KDY Tegal	KB Cilacap	Total
KDY	Magelang	na	107.6	54.0	89.4	184.8	255.3	226.0	917.1
KDY	Surakarta	107.6	na	53.6	100.2	240.5	311.0	283.2	1,096.1
KDY	Salatiga	54.0	53.6	na	46.6	186.9	257.4	280.0	878.5
KDY	Semarang	89.4	100.2	46.6	na	140.3	210.8	315.4	902.7
KDY	Pekalongan	184.8	240.5	186.9	140.3	na	70.5	252.9	1,075.9
KDY	Tegal	255.3	311.0	257.4	210.8	70.5	na	182.4	1,287.4
KB	Cilacap	226.0	283.2	280.0	315.4	252.9	182.4	na	1,539.9
KB	Banyumas	222.0	279.2	275.7	296.9	200.6	130.1	88.8	1,493.3
KB	Purbalingga	217.2	284.2	241.2	262.4	235.4	164.9	92.4	1,497.7
KB	Banjarnegara	155.7	233.3	179.7	200.9	234.5	226.1	126.2	1,356.4
KB	Kebumen	118.2	175.4	172.2	207.6	303.0	233.9	107.8	1,318.1
KB	Purworejo	75.1	132.3	129.1	164.5	259.9	277.0	150.9	1,188.8
KB	Wonosobo	107.6	185.2	131.6	152.8	186.4	256.9	174.3	1,194.8
KB	Boyolali	81.1	26.5	27.1	73.7	214.0	284.5	287.5	994.4
KB	Klaten	89.9	35.7	67.1	113.7	254.0	324.5	247.5	1,132.4
KB	Sukoharjo	124.9	17.3	70.9	117.5	257.8	328.3	300.5	1,217.2
KB	Wonogiri	148.2	40.6	94.2	140.8	281.1	351.6	323.8	1,380.3
KB	Karanganyar	125.0	17.4	71.0	117.6	257.9	328.4	300.6	1,217.9
KB	Saragen	141.5	33.9	87.5	134.1	274.4	344.9	317.1	1,333.4
KB	Grobogan	174.5	105.6	131.7	85.1	225.4	295.9	388.8	1,407.0
KB	Blora	280.2	291.2	237.4	190.8	331.1	401.6	506.2	2,238.5
KB	Rembang	232.9	243.9	190.1	143.5	283.8	354.3	458.9	1,907.4
KB	Pati	180.2	191.2	137.4	90.8	231.1	301.6	406.2	1,538.5
KB	Kudus	147.8	158.8	105.0	58.4	198.7	269.2	373.8	1,311.7
KB	Jepara	193.9	204.9	151.1	104.5	244.8	315.3	419.9	1,634.4
KB	Demak	124.3	135.3	81.5	34.9	175.2	245.7	350.3	1,147.2
KB	Semarang	69.4	80.2	26.6	20.0	160.3	230.8	295.4	882.7
KB	Temanggung	38.7	116.3	62.7	83.9	146.1	216.6	243.2	907.5
KB	Kendal	129.9	140.7	87.1	40.5	99.8	170.3	315.7	984.0
KB	Batang	174.8	230.5	176.9	130.3	10.0	80.5	262.9	1,065.9
KB	Pemalang	222.8	278.5	224.9	178.3	38.0	32.5	214.9	1,189.9
KB	Brebes	269.1	324.8	271.2	224.6	84.3	13.8	196.2	1,384.0
Total		4,762.0	5,059.0	4,309.4	4,270.8	6,263.5	7,466.6	8,489.0	40,641.8

Source: Measured by the Study Term based on DPU Propinsi Jateng, Road Condition Map 1976 and on Table 8.11.

Table 8.14 Distortion in Time

(Unit: Ratio)

	KDY Magelang	KDY Surakarta	KDY Salatiga	KDY Semarang	KDY Pekalongan	KDY Tegal	KB Cilacap	Total Average
KDY Magelang	na	1.08	1.18	1.18	1.35	1.26	1.31	1.25
KDY Surakarta	1.08	na	1.00	1.00	1.20	1.17	1.11	1.12
KDY Salatiga	1.18	1.00	na	1.00	1.27	1.21	1.28	1.21
KDY Semarang	1.18	1.00	1.00	na	1.39	1.27	1.27	1.22
KDY Pekalongan	1.35	1.20	1.27	1.39	na	1.09	1.30	1.27
KDY Tegal	1.26	1.17	1.21	1.27	1.09	na	1.41	1.24
KB Cilacap	1.31	1.11	1.28	1.27	1.30	1.41	na	1.26
KB Banyumas	1.36	1.14	1.23	1.21	1.20	1.28	1.36	1.23
KB Purbalingga	1.33	1.15	1.41	1.37	1.25	1.33	1.40	1.33
KB Banjarnegara	1.68	1.29	1.41	1.35	1.43	1.34	1.34	1.39
KB Kebumen	1.38	1.04	1.31	1.29	1.36	1.08	1.24	1.23
KB Purworejo	1.70	1.04	1.44	1.37	1.43	1.26	1.17	1.30
KB Wonosobo	1.71	1.23	1.36	1.29	1.39	1.30	1.40	1.35
KB Boyolali	1.12	1.00	1.00	1.00	1.22	1.19	1.10	1.14
KB Klaten	1.09	1.00	1.00	1.00	1.18	1.16	1.12	1.12
KB Sukoharjo	1.11	1.33	1.06	1.04	1.20	1.18	1.12	1.14
KB Wonogiri	1.13	1.27	1.10	1.07	1.21	1.18	1.12	1.15
KB Karanganyar	1.09	1.16	1.03	1.02	1.19	1.17	1.11	1.13
KB Sragen	1.11	1.19	1.07	1.04	1.20	1.17	1.11	1.14
KB Grobogan	1.25	1.67	1.19	1.33	1.37	1.29	1.22	1.29
KB Blora	1.37	1.18	1.23	1.30	1.34	1.29	1.28	1.28
KB Rembang	1.25	1.16	1.21	1.30	1.34	1.28	1.28	1.26
KB Pati	1.19	1.09	1.13	1.21	1.31	1.25	1.25	1.22
KB Kudus	1.17	1.06	1.08	1.15	1.31	1.24	1.25	1.20
KB Japara	1.02	1.10	1.14	1.21	1.31	1.25	1.25	1.22
KB Demak	1.22	1.07	1.12	1.33	1.38	1.28	1.27	1.25
KB Semarang	1.25	1.00	1.00	1.00	1.32	1.24	1.29	1.23
KB Tamanggung	1.72	1.05	1.10	1.08	1.27	1.21	1.48	1.25
KB Kendal	1.25	1.09	1.16	1.42	1.38	1.24	1.43	1.28
KB Batang	1.36	1.20	1.27	1.41	1.14	1.10	1.29	1.27
KB Pemalang	1.30	1.18	1.24	1.32	1.10	1.08	1.34	1.25
KB Brebes	1.26	1.17	1.21	1.26	1.10	1.15	1.38	1.23
Total Average	1.28	1.14	1.21	1.22	1.28	1.23	1.25	1.23

Source: Table 8.11 and Table 8.13.

(7) Finally, transportation distortion is calculated from Tables 8.12 and 8.14 and is shown in Table 8.15. Larger distortion can be observed between Tegal and Purbalingga, Banjarnegara, Kebumen and Wonosobo. The links to those seven major centers from Purbalingga, Banjarnegara and Wonosobo show larger distortion. Other points which have the distortion value more than 1.90 are Banyumas, Kebumen, Jepara, Blora and Purworejo.

08.016 Thus, the accessibility of kabupaten centers to the activity centers was estimated, although traffic volume is not taken into consideration, in terms of transportation distortion for each pair of points and also for a given set of points. The points or areas stated in the paragraph (7) above are minus areas in transportation based on highway conditions in 1976.

08.017 Figure 8.2.a shows the frequency of selected routes in this study which shows relatively good correlation with the actual traffic flow pattern in Central Java. The result of this analysis tabulated in Table 8.15 provides a basis for identifying future highway projects, either improvement or new construction. The figures provide ideas about the extent of improvement in accessibility possible by (1) reduction of distance distortion by finding new routes and (2) decrease of time distortion by improving highway conditions.

(c) Intrakabupaten Accessibility

08.018a Intrakabupaten accessibility is studied by examining (1) the status of roads and (2) the distances from all the kecamatan centers in a kabupaten to the kabupaten center. The result is shown in Table 8.16.a. High dependency on national and Provincial roads for access to kabupaten centers can be observed in Grobogan, Jepara and Brebes, which may imply kabupaten road networks have not developed well in these kabupatens. On the other hand, Pekalongan, Boyolali and Sragen show high dependency on kabupaten and other roads. In general, national and Provincial roads are used more for this purpose in the Province. This high rate of dependence on national and Provincial roads will reduce the burden of the maintenance not of kabupaten roads for kabupatens. This is one aspect of benefit for kabupatens, but on the other hand, for the purpose of achieving better accessibility from kecamatan centers to a kabupaten center, bettermant of kabupaten roads might be necessary. This seems to be true especially in kabupatens Grobogan, Jepara, and Brebes. However, it is too early to decide whether or not kabupaten roads are not well developed in these areas, considering the few data available for this purpose. At the same time, the functional division between kabupaten roads and the national-and-Provincial roads seems to be not well articulated. Therefore, it will be necessary to redefine the functions of kabupaten roads and national-and-Provincial roads.

08.018b An examination of critical highway links in the Province by 1983 from the viewpoint of traffic capacity is carried out on the basis of the following assumptions:

Table 8.15 Transportation Distortion 1/

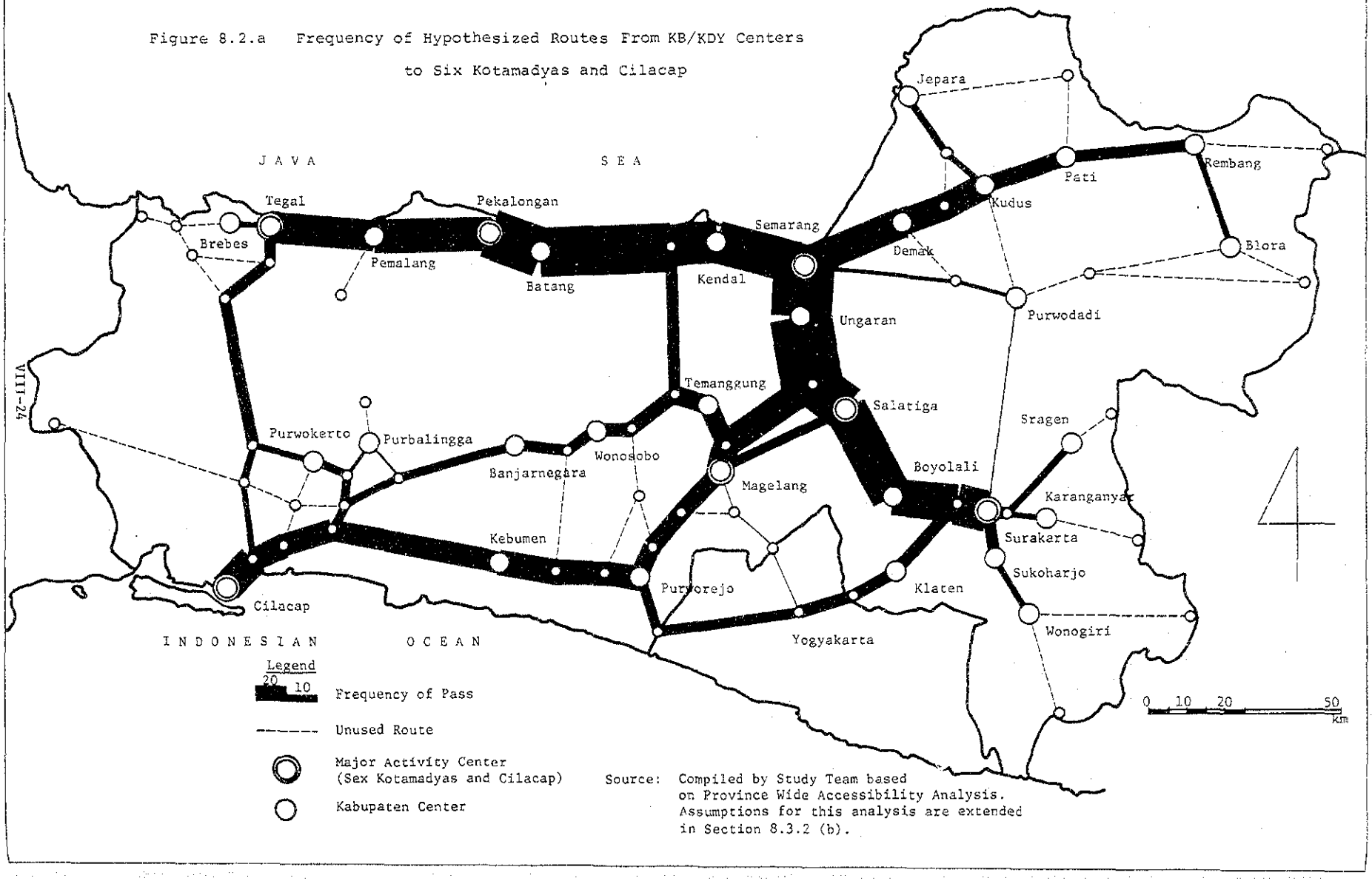
(Unit: Ratio)

	KDY Magelang	KDY Surakarta	KDY Salatiga	KDY Semarang	KDY Pekalongan	KDY Tegal	KB Cilacap	Total Average (1)	Average (2)	Ratio (2)/(1)
KDY Magelang	-	1.62	1.53	1.52	2.13	1.88	1.69	1.78	1.48	0.83
KDY Surakarta	1.62	-	1.25	1.29	1.67	1.57	1.43	1.50	1.26	0.84
KDY Salatiga	1.53	1.25	-	1.17	1.84	1.63	1.66	1.61	1.30	0.81
KDY Semarang	1.52	1.29	1.17	-	1.74	1.50	1.83	1.59	1.29	0.81
KDY Pekalongan	2.13	1.67	1.84	1.74	-	1.19	2.20	1.83	1.54	0.84
KDY Tegal	1.88	1.57	1.63	1.50	1.19	-	1.96	1.64	1.39	0.85
KB Cilacap	1.69	1.43	1.66	1.83	2.20	1.96	-	1.75	1.54	0.88
KB Banyumas	2.07	1.62	1.99	2.17	2.69	2.12	2.19	2.03	2.12	1.04
KB Purbalingga	2.33	1.77	1.93	2.15	3.74	2.69	1.75	2.21	2.38	1.08
KB Banjarnegara	2.72	1.88	2.04	2.21	4.30	2.68	1.53	2.34	2.48	1.06
KB Kebumen	1.84	1.37	1.73	1.87	3.64	2.27	1.54	2.00	2.04	1.02
KB Purworejo	2.28	1.50	1.93	1.82	2.72	2.10	1.38	1.92	1.96	1.02
KB Wonosobo	2.87	1.80	2.00	2.18	3.32	2.60	1.67	2.23	2.35	1.05
KB Boyolali	1.93	1.09	1.11	1.15	1.74	1.62	1.64	1.58	1.47	0.93
KB Klaten	1.87	1.24	1.61	1.40	1.89	1.76	1.42	1.65	1.60	0.97
KB Sukoharjo	1.74	1.33	1.34	1.31	1.68	1.59	1.51	1.55	1.50	0.97
KB Wonogiri	1.77	1.40	1.36	1.34	1.68	1.60	1.56	1.56	1.53	0.98
KB Karanganyar	1.56	1.26	1.28	1.33	1.63	1.54	1.43	1.49	1.43	0.96
KB Sragen	1.61	1.25	1.53	1.63	1.75	1.60	1.43	1.58	1.54	0.97
KB Grobogan	2.01	2.00	2.53	1.53	1.66	1.51	1.79	1.77	1.86	1.05
KB Blora	1.99	3.20	2.23	1.74	1.76	1.61	1.84	1.92	2.05	1.07
KB Rembang	1.58	2.26	1.68	1.38	1.55	1.47	1.66	1.63	1.65	1.01
KB Pati	1.51	2.10	1.62	1.27	1.55	1.45	1.66	1.60	1.59	0.99
KB Kudus	1.50	1.95	1.57	1.17	1.57	1.44	1.69	1.57	1.56	0.99
KB Jepara	1.80	1.91	1.85	2.09	2.17	1.85	1.93	1.93	1.94	1.01
KB Demak	1.57	1.79	1.62	1.36	1.67	1.50	1.75	1.65	1.61	0.98
KB Semarang	1.63	1.23	1.09	1.18	1.91	1.62	1.79	1.64	1.49	0.91
KB Tamanggung	2.17	1.55	1.78	1.87	2.02	1.74	1.81	1.80	1.85	1.03
KB Kendal	2.18	1.45	1.59	1.70	1.74	1.46	2.03	1.74	1.74	1.00
KB Batang	2.15	1.67	1.84	1.73	1.54	1.23	2.24	1.83	1.77	0.97
KB Pemalang	2.02	1.62	1.72	1.58	1.19	1.19	2.18	1.74	1.64	0.94
KB Brebes	1.86	1.56	1.62	1.49	1.21	1.28	2.13	1.64	1.59	0.97
Total Average (a)	1.87	1.69	1.72	1.65	1.93	1.69	1.73	1.75		
Average (b)	1.84	1.58	1.61	1.55	1.97	1.66	1.70		1.70	
Ratio (b)/(a)	0.98	0.93	0.94	0.94	1.02	0.98	0.98			0.97

Note: 1/ Transportation distortion is defined as (Distortion in Distance) x (Distortion in Time)

Source: Table 8.12 and Table 8.14.

Figure 8.2.a Frequency of Hypothesized Routes From KB/KDY Centers to Six Kotamadyas and Cilacap



Source: Compiled by Study Team based on Province Wide Accessibility Analysis. Assumptions for this analysis are extended in Section 8.3.2 (b).

Table 8.16.a Access From Kecamatan Centers to Kabupaten Center, 1975

(Unit: km)

		Total Access Distance by National/Provincial Road (1)	Average Distance Per Desa	Total Access Distance by Kabupaten/Other Road (2)	Average Distance Per Desa	Ratio (1)/(2)
7. KB	Cilacap	760.7	44.7	95.3	5.6	7.98
8. KB	Banyumas	423.6	17.7	68.9	2.9	6.10
9. KB	Purbalingga	75.5	5.8	79.7	6.1	0.95
10. KB	Banjarnegara	171.8	9.5	176.4	8.8	1.08
11. KB	Kebumen	312.1	14.2	145.6	6.6	2.15
12. KB	Purworejo	174.7	10.9	42.4	2.7	4.04
13. KB	Wonosobo	141.8	10.9	43.9	3.8	2.87
14. KB	Magelang	275.5	13.1	58.9	2.8	4.68
15. KB	Boyolali	174.3	9.2	281.2	14.8	0.62
16. KB	Klaten	154.7	6.2	153.5	6.1	1.01
17. KB	Sukoharjo	88.0	6.8	87.1	6.7	1.01
18. KB	Wonogiri	454.3	20.7	124.9	5.7	3.63
19. KB	Karanganyar	146.4	10.5	97.3	7.0	1.50
20. KB	Sragen	120.0	6.0	178.7	8.9	0.67
21. KB	Grobogan	372.0	20.7	31.8	1.8	11.50
22. KB	Blora	282.2	18.8	129.1	8.6	2.19
23. KB	Rembang	266.7	19.1	66.6	4.8	3.98
24. KB	Pati	236.3	11.3	172.8	8.2	1.38
25. KB	Kudus	36.5	4.1	25.3	2.8	1.46
26. KB	Jepara	144.2	16.0	12.5	1.4	11.43
27. KB	Demak	118.3	8.5	65.8	4.7	1.81
28. KB	Semarang	272.9	19.8	48.6	3.5	5.66
29. KB	Temanggung	104.3	9.5	28.0	2.5	3.80
30. KB	Kendal	251.7	14.8	99.9	5.9	2.51
31. KB	Batang	191.5	17.4	101.2	9.2	1.89
32. KB	Pekalongan	80.4	5.0	283.0	17.7	0.28
33. KB	Pemalang	271.0	28.8	57.6	4.4	6.55
34. KB	Tegal	311.5	18.3	69.4	4.1	4.46
35. KB	Brebes	668.0	44.5	69.1	4.6	9.67
Total		7,080.9		2,894.5		2.45

Source: Measured by the Study Team based on DPU Jateng, Peta Jarak Kilometer 1975.

(1) Maximum traffic capacity by 1983 on all the two-lane highway links: 4,600 vehicles per day

(2) Annual growth rate of ADT:

National highway links	10%
Other highway links	15%

These two assumptions give the level of critical traffic volume in 1974 as follows:

National highway links	1,950 vehicles/day
Otehr highway links	1,300 vehicles/day

Thus, if the traffic volume on a highway link in 1974 is equal to or more than the respective figure shown above, a full two-lane highway link will reach the assumed maximum capacity by 1983. Comparison of ADT in 1974, which is shown in Figure 8.2.b and Table 8.16.b, with the above figures reveals that the following highway links will have a greater ADT by 1983 than the present capacity can handle:

(1) National highway links

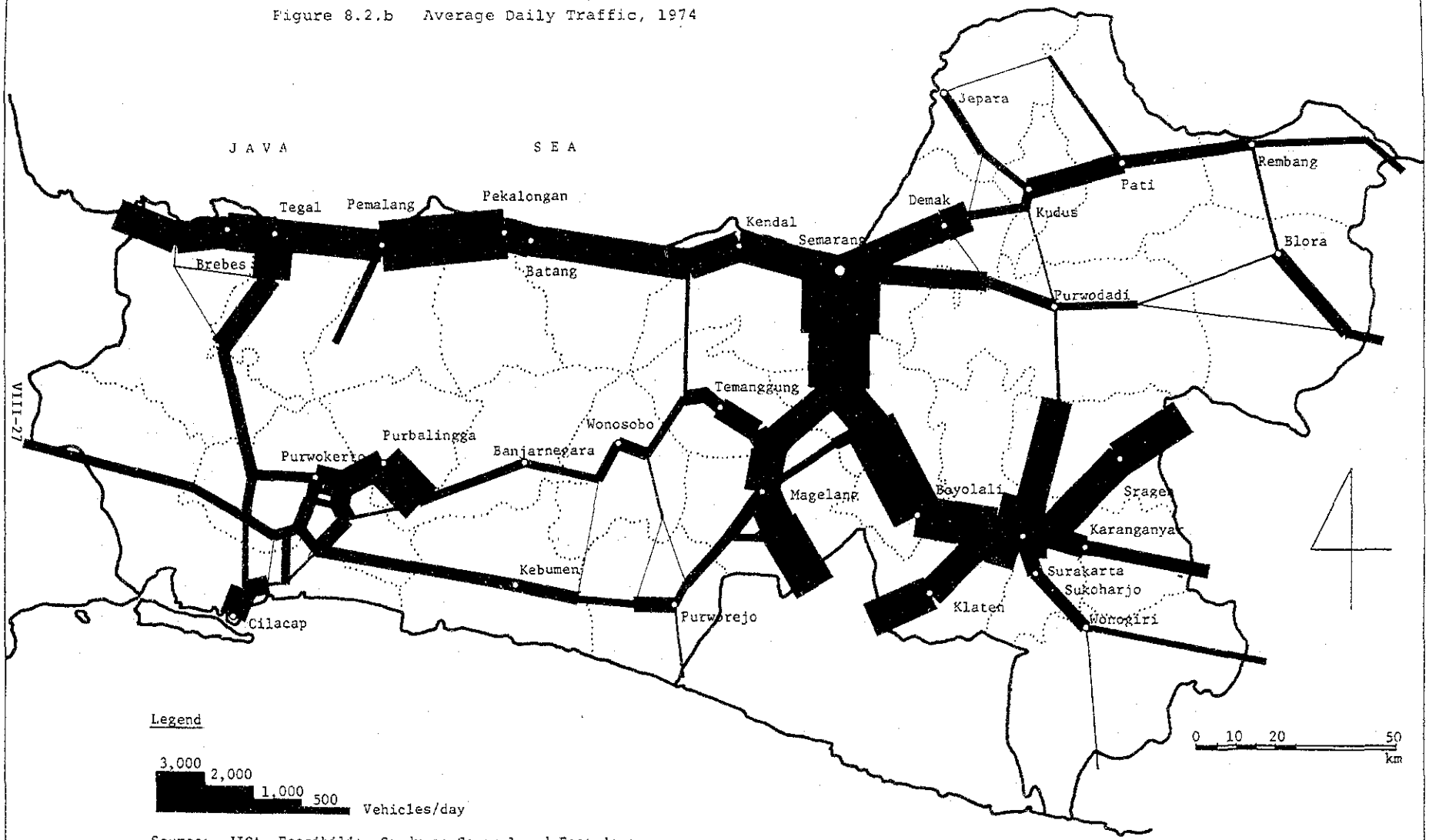
A001, A009, A013, A019
B015, B024
C002, C003, C004, C005
C006, C007, C008, C010
C011, C012, C014, C016
C017, C018, C020, C021
C022, C023

(2) Other highway links

B210, B262, B283
C204, C205, C220, C221
C222, C223, C247, C258
C260, C263, C267, C274

These links requiring improvement are shown in Figure 8.2.c. It is observed that all the links of the national highways within the Province will have a greater traffic volume than a full two-lane highway can adequately handle by 1983. Therefore, improvements will be needed. In addition, there are several links of provincial highways requiring improvement before 1983. They are located near the following centers: Tegal, Cilacap, Banyumas, Demak, Kudus, Semarang, Surakarta, Magelang and Cepu.

Figure 8.2.b Average Daily Traffic, 1974



Source: JICA, Feasibility Study on Central and East Java Road Betterment Project, Interim Report, March 1976.

Table 8.16.b Average Daily Traffic, Central Java, 1972 and 1974

(Unit: Vehicles/day)

No. of Post	1972	1974	Annual Growth Rate (%)	No. of Post	1972	1974	Annual Growth Rate (%)	No. of Post	1972	1974	Annual Growth Rate (%)
A001	1759	2315	14.7	C206	262	524	41.4	C246	10	13	14.0
009	2254	2305	1.1	208	564	620	4.8	247	1159	1586	16.9
013	1776	3753	46.1	209	426	361	-7.9	248	531	728	17.1
019	2046	2408	8.5	211	323	567	32.5	249	247	369	22.2
B015	1577	2144	16.6	212	323	570	32.8	250	403	728	34.4
024	1343	2689	14.5	213	592	1276	46.8	251	643	877	16.8
207	662	752	6.6	214	114	245	46.5	252	356	525	21.4
210	871	1972	50.5	215	3	7	52.8	253	430	860	41.4
229	437	530	10.1	216	480	693	20.2	254	812	1106	16.7
230	634	904	42.6	217	452	1018	50.2	255	651	943	20.4
262	1447	2052	19.1	218	800	794	-0.4	256	157	148	-2.9
277	247	486	40.3	219	699	693	-0.4	257	292	384	14.6
283	1003	2785	66.6	220	2051	2035	-0.4	258	1020	1706	29.3
C002	1476	2305	25.0	221	964	1993	43.8	259	372	970	73.6
003	1833	2785	23.3	222	1464	3258	49.2	260	940	2180	52.8
004	1457	2229	23.7	223	972	1416	20.7	261	196	220	5.9
005	1788	3707	44.0	224	179	211	8.6	263	702	1313	36.8
006	1401	2442	32.0	225	229	484	45.4	264	461	663	19.9
007	1559	2213	19.1	226	479	984	43.3	265	8	14	32.3
008	1449	2202	23.3	227	408	751	35.6	266	232	118	-28.7
010	3567	5896	28.6	228	485	588	10.1	267	1221	2323	37.9
011	2761	4459	27.0	231	599	864	20.1	268	1224	601	-29.9
012	1722	2776	26.9	232	9	57	251.6	269	29	50	31.3
014	1414	3006	45.8	233	589	454	-12.2	270	708	444	-20.9
016	1830	2608	19.4	234	1390	1074	-12.1	271	345	556	26.9
017	1837	2595	18.8	235	215	165	-12.4	272	166	85	-28.4
018	2200	3120	19.1	236	660	506	-12.4	273	217	322	21.8
020	1856	2685	20.3	237	38	45	8.8	274	1216	1466	9.8
021	3901	5326	16.8	238	59	60	0.8	275	595	882	21.8
022	1807	3207	33.2	239	173	173	0.0	276	254	369	20.5
023	1312	2407	35.4	240	558	700	12.0	278	220	319	20.4
201	25	34	16.6	241	680	878	13.6	279	245	352	19.9
202	2	12	144.9	242	433	542	11.9	280	46	66	19.8
203	17	34	41.4	243	115	155	16.1	281	95	137	20.1
204	656	1466	49.5	244	803	1078	15.9	282	372	987	62.9
205	1383	2715	40.1	245	169	244	20.2	283	-	594	-
								284	-	615	-

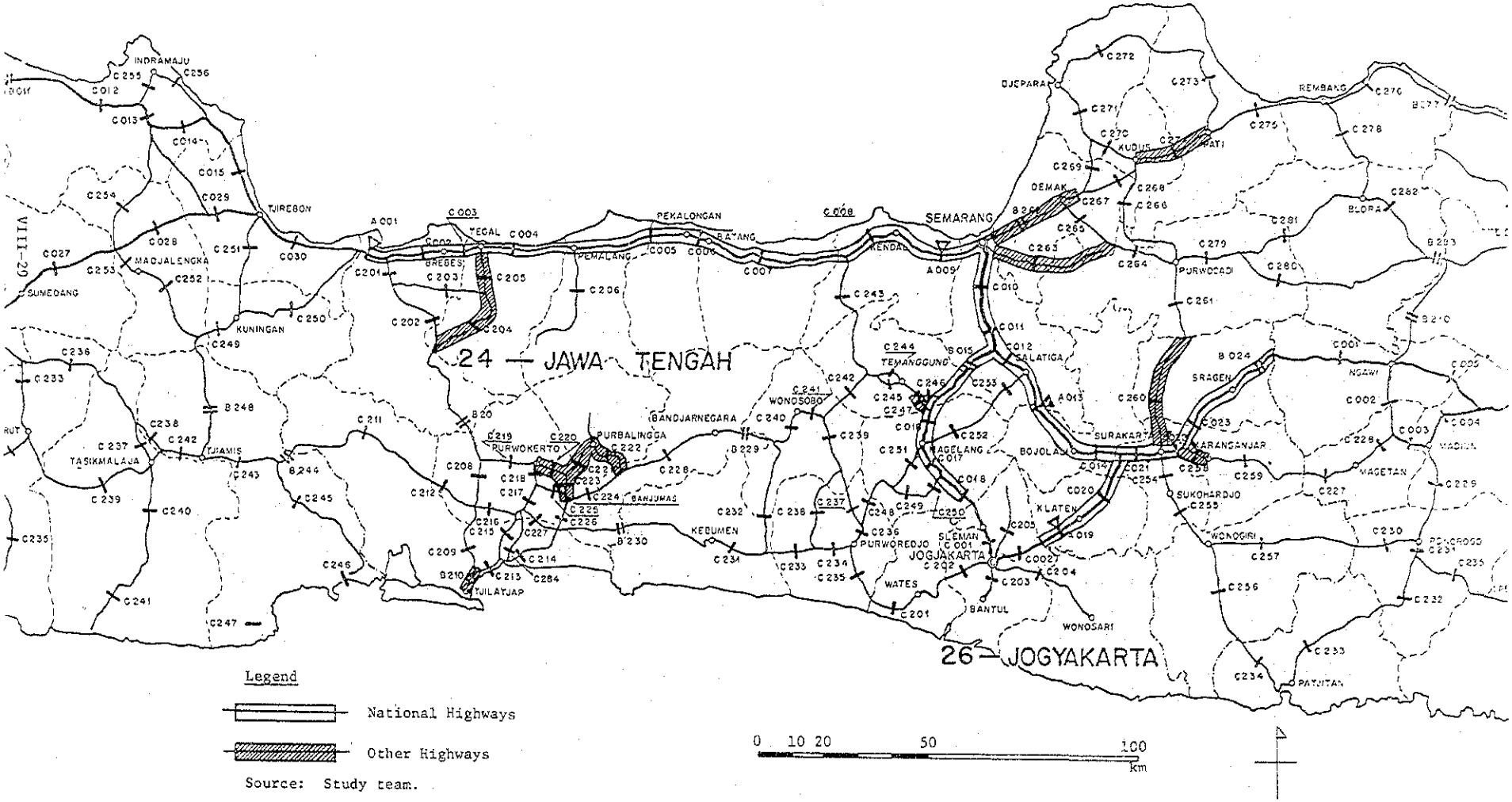
(to continue)

(to continue)

Notes: 1. Figures include only passenger cars, buses and trucks.
2. Locations of posts are shown in Figure 8.2.c.

Source: JICA, Feasibility Study on Central and East Java Road Betterment Project, Interim Report, March 1976.

Figure 8.2.c Highway Links Requiring Improvement by 1983



8.2.4 Recommendations

(a) Financial and Technical Assistance for Rehabilitating Flood-Damaged Portions of Highways

08.019 Floods and inundations mostly in the wet season damage considerably large portions of national and Provincial highways and local roads. This damage is not only an obstacle to traffic in that period but also one of the major causes of deterioration of highway conditions. For the chronically damaged portions such as those in Demak, Pati, Brebes, Tegal and Kebumen, consideration should be given to major efforts in terms of financial and technical aspects.

(b) Clarification of the Relationship Between Highway Classification and Investment Criteria

08.020 As stated previously, the budget allocation for maintenance and rehabilitation of roads does not seem to keep up with the ongoing deterioration of road conditions. In this respect, it is vital to set up proper investment criteria in accordance with the road conditions as well as to provide for increasing investments for maintenance. At the same time, a proper highway classification should be developed to enable the adequate allocation of maintenance budgets. In order to achieve high efficiency of investment, the appropriate data-collection system of road conditions is required and at the same time some tools to use those data and to evaluate the effects of investments should be devised.

(c) Proper Use of Technology in Highway Improvement

08.021 In order to prevent premature deterioration of highways, some mechanized technology should be introduced in accordance with the kind of improvement. For instance, for the maintenance of the surface of raods, labor-intensive operation may suffice, but in case of construction which may have something to do with preparation of the road bed, mechanized technology should be applied in order to achieve high durability of the road conditions. In this connection, traffic control should be intensified to protect highways as well as to reduce traffic accidents.

(d) Improvement of Transportation in Minus Areas

08.022 Minus areas in terms of transportation extracted in the previous section are those which suffer from comparative difficulty in access to major activity centers of the Province. Also, some of these areas, e.g., Blora and Kebumen, are areas suffering from chronical floods and inundations. Moreover, it is quite interesting that overall socio-economic "minus areas" as defined in Chapter I conform fairly well to the minus areas in terms of transportation, although those minus areas in terms of poor access are extracted with little consideration about their socio-economic conditions. Actually, it seems that one of the major causes of poor conditions of the "minus areas" is the poor transportation system. Hence, the improvement of transportation

in "minus areas" will stimulate the overall socio-economic development of those areas. In order to improve the socio-economic situation of "minus areas", the improvement of access to and from those areas, that is, the betterment of road conditions, should be undertaken, preceded by careful planning in close connection with the development plan of other sectors in the areas.

8.3 Railway Transportation

8.3.1 General

08.023 The railway networks of Indonesia exist in only two regions: Java and Madura with 4,684 km, and Sumatra with 1,953 km in 1974. Three gauges of track are in use (1.067 m, 0.750 m, and 0.600 m) and the lengths of 1.067 m gauge track in the two regions are 4,592 km and 1,442 km respectively. Out of this 4,592 km in Java and Madura, the "middle region" covering Central Java and Yogyakarta has 1,673 km which is 36.4 percent of the total length in Java & Madura. Fig. 8.3 shows the railway network of the region. On the other hand, out of 132,187 sq. km of the total land area of Java and Madura, the area of the middle region is 37,375 sq. km accounting for 28.3 percent of the whole region. Thus, the network density of the railway system in the middle region of Java is relatively high, as is shown in Table 8.17. Statistics reveal that the total length of track of all gauges in Java and Madura has not changed since the beginning of the 1950s, but 13.1 percent of the total length in 1939 has been scrapped, and in the middle region, 10.9 percent.

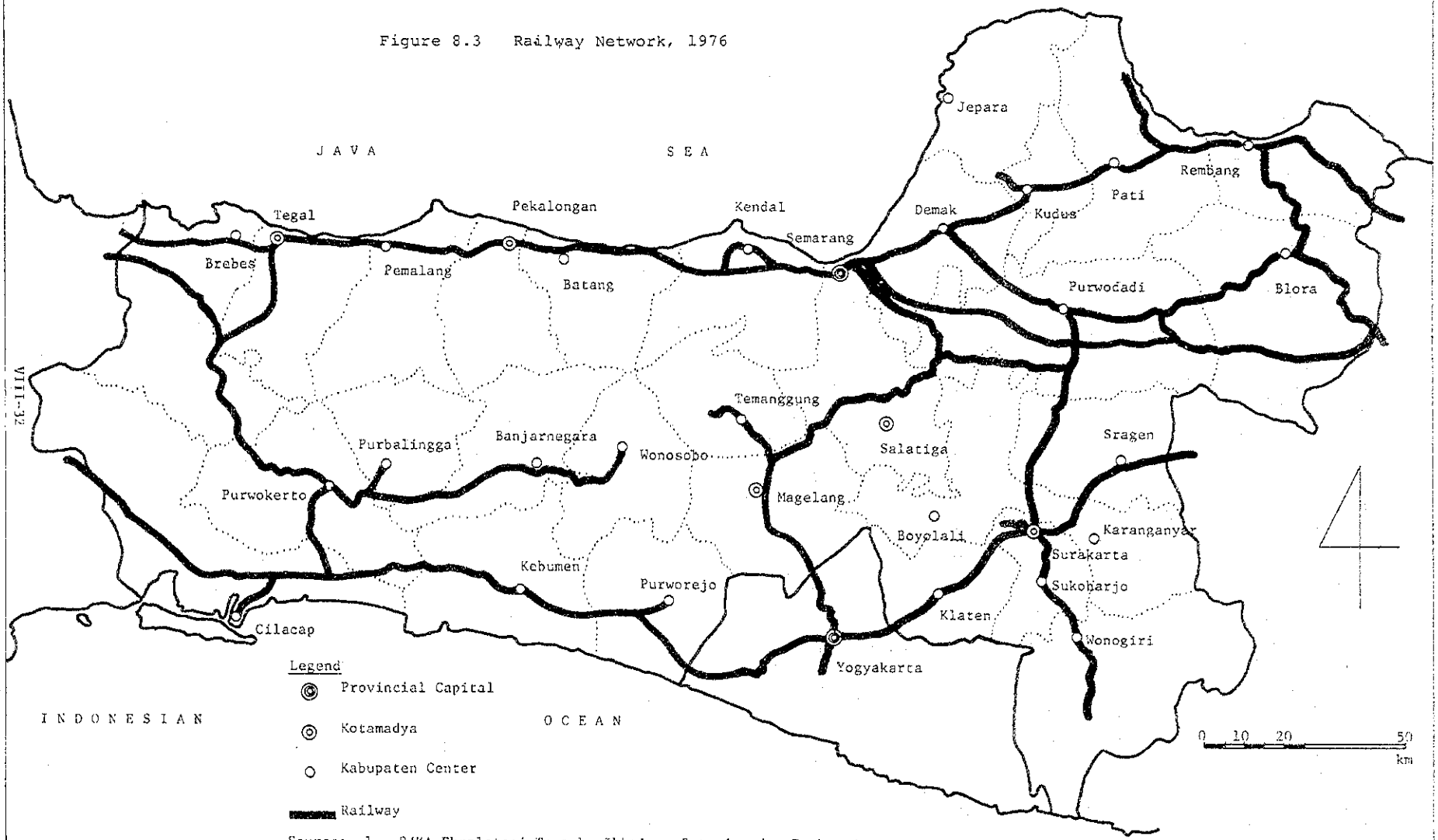
08.024 Thus, as far as the length of tracks or the network density is concerned, the role of railways in the middle region of Java and Madura seems to be comparatively high to the other regions, but the important question is whether the railways are duly used--whether they carry, actual railway traffic. This aspect is studied in the following sections.

8.3.2 Present Situation

08.025 As mentioned above, the railway track was laid long ago, but the double track system and electrification of the system have not progressed so much, and in Central Java no double track or electrification has been done yet.

08.026 Table 8.18 reveals that the locomotives in Java and Madura are also old, and more than 60 percent of all locomotives are 20 years old or alder. All of the 15 recently acquired locomotives are diesels. Table 8.19 shows the situation of locomotives in the middle region of Java and Madura, and it tells that, although steam locomotives are superior in number and horsepower (H.P.), the major power source for the system in the middle region is diesel engines. This is also a general tendency in the whole Java and Madura as shown in Table 8.20.

Figure 8.3 Railway Network, 1976



Source: 1. PJKA Eksplotasi Tengah, Ikhtisar Setasium dan Perhention.
2. P.T. Pembina, Jawa Tengah & D.I. Yogyakarta 1974/1975.

Table 8.17 Network Density of Railways in Java & Madura, for 1.067 m Gauge, 1974

Region	Network Length (km)	(%)	Land Area (sq.km)	(%)	Density (m/sq.km)
West Region	1,320	(28.8)	46,890	(35.5)	28.2
Middle Region	1,673	(36.4)	37,375	(28.3)	44.8
East Region	1,599	(34.8)	47,922	(36.2)	33.4
Total	4,592	(100.0)	132,187	(100.0)	34.7

Sources: 1. BPS (Central Bureau of Statistics), Railways Statistics 1961-1974.

2. BPS (Central Bureau of Statistics), Statistical Pocketbook 1974/1975

Table 8.18 Inventry of Locomotives in Java & Madura by Type and Age, 1974

(Units: Number of Locomotives)

Type	Age of Locomotive (years) - 4	5 - 9	10 - 19	20 - 34	35 -	Total
Steam (1) 1/	-	-	-	2	165	167
Steam (2) 2/	-	-	-	73	105	178
Diesel	15	-	229	19	-	263
Electric	-	-	-	-	9	9
Total	15	-	229	94	279	617

Notes: 1/ Steam (1) is steam locomotive burning coal or wood.

2/ Steam (2) is locomotive buring oil.

Source: BPS, Railways Statistics 1967-1974

Table 8.19 Locomotives in Middle Region, 1976

Type		Hosepower per Locomotive	Number	Locomotive - km	
				1975	1976
Steam					
	Coal & Wood	330 - 1500	30	1,285,408	1,144,740
	Oil	330 - 1500	34	1,399,311	1,265,468
Diesel					
	Electric	875	24	4,354,755	4,483,850
	Hydraulic	340	31	2,345,190	1,667,943
Electric					
	Electric	-	-	-	-
	Self Propelled	200	6	215,374	229,037
Total		-	125	9,600,038	8,791,038

Source: Middle Exploitation Office of State Railways

Table 8.20 Locomotive-km in Java & Madura

Year	Steam (%)	Diesel (%)	Electric (%)	Total (%)
	(L-km)	(L-km)	(L-km)	
1968	14,884 (47.1)	16,548 (52.4)	176 (0.5)	31,600(100.0)
1969	14,436 (44.5)	17,800 (54.9)	206 (0.6)	32,442(100.0)
1970	---	---	---	---
1971	12,067 (38.2)	19,317 (61.1)	219 (0.7)	31,603(100.0)
1972	11,002 (35.9)	19,330 (63.1)	321 (1.0)	30,653(100.0)
1973	9,019 (32.2)	18,782 (67.1)	200 (0.7)	28,001(100.0)
1974	7,763 (29.5)	18,340 (69.7)	197 (0.8)	26,300(100.0)

Source: BPS, Railways Statistics 1961-1974.

which illustrates clearly that diesel engines have been taking the place of steam engines as a power source, and that the contribution of electric power to the railway system is at a low and stagnant level.

08.027 The number of railway passengers in Java and Madura has been substantially decreasing from 1961 to 1974 as shown in Table 8.21 and in Figure 8.4. The table reveals that in terms of embarked passengers the middle region is the most rapidly decreasing area, and the number of embarked passengers in 1974 is only 15.9 percent of that in 1961. This means that the average rate of decrease per year is 13.2 percent. The table also shows that, in the overall situation of decrease in the number of passengers, the middle region which once had about 40 percent of all the embarked passengers in Java and Madura at the beginning of the 1960s has been replaced by the west region the share of which has exceeded 40 percent in recent years.

08.028 On the other hand, the passenger-kilometers have not shown so much decrease as the number of passengers carried. The rate of decrease is about 50 percent during the period, between 1961 and 1974 as shown in Table 8.22 and Figure 8.4. This is due to the increase of the average travel distance of passengers and Figure 8.4 shows that this increase is remarkable from 1968 on. For the middle region, this tendency can be also observed in Table 8.23 where, in spite of the considerable decrease in the number of passengers and the passenger-kilometers, the average travel distance has substantially increased.

08.029 Further investigation of passenger traffic characteristics in Java and Madura reveals that in 1973 a drastic change took place in the passenger traffic by class as tabulated in Table 8.24. The most remarkable facts are the radical decrease in the number of passengers and passenger-kilometers of the second class and the abrupt increase in those of the third class. The first class traffic was not affected so much as the other classes. The tendency of this change became clearer in 1974, and the share of passenger-kilometers of the third class amounted to 86 percent of the total passenger-kilometers. Moreover, with the growth of the average travel distance of the third class passengers, the allotment of each class to long, middle and short distance travels is changing, especially in the third class.

08.030 The characteristics of freight traffic in Java and Madura are shown in Table 8.25 and Figure 8.5. One of the remarkable points is the sharp decrease of tons loaded and ton-kilometers until 1967 and their recovery after 1967 up to 1973. Another is the comparatively constant average haul distance compared with the average travel distance of passenger traffic, which means that tons loaded and ton-kilometers correlate more closely than passengers carried and passenger-kilometers.

08.031 Table 8.26 presents the characteristics of loading and unloading of freight in each region. The west region has a constant inflow surplus, while the east region has an outflow surplus. The magnitude

Table 8.21 Embarked Passengers in Java and Madura for 1,067 m Gauge

(Unit: 1,000 Persons)

Year	West Region Number (%)	Middle Region Number (%)	East Region Number (%)	Total Number (%)
1961	38,232(30.0)	49,697(39.0)	39,570(31.0)	127,499(100.0)
1962	31,815(28.3)	46,202(41.1)	34,532(30.7)	112,549(100.0)
1963	28,297(26.4)	45.096(42.0)	33,913(31.6)	107,306(100.0)
1964	29,558(28.5)	40,522(39.0)	33,765(32.5)	103,845(100.0)
1965	33,864(30.0)	39,632(35.1)	39,436(34.9)	112,932(100.0)
1966	25,902(31.3)	29,471(35.7)	27,298(33.0)	82,671(100.0)
1967	23,058(35.5)	24,646(37.9)	17,261(26.6)	64,965(100.0)
1968	22,766(38.3)	23,131(38.9)	13,561(22.8)	59,458(100.0)
1969	19,267(38.8)	19,201(38.6)	11,217(22.6)	49,685(100.0)
1970	17,955(38.9)	17,738(38.5)	10,409(22.6)	46,102(100.0)
1971	16,384(36.9)	17,656(39.7)	10,427(23.4)	44,467(100.0)
1972	14,307(40.7)	12,347(35.1)	8,542(24.3)	35,196(100.0)
1973	10,594(42.2)	8,566(34.2)	5,922(23.6)	25,082(100.0)
1974	10,292(41.8)	7,909(32.1)	6,442(26.1)	24,643(100.0)
Average Rate of Decrease (%)	9.6	13.2	13.0	11.9

Source: BPS, Railways Statistics 1961-1974

Figure 8.4 Passenger Traffic in Java and Madura

Source: BPS, Railways Statistics 1961-1974.

Table 8.22 Passenger Traffic Characteristics of Java & Madura

Year	Passenger Carried (Million Persons)	Passenger-km (Million km)	Average Travel Distance (km/Passenger)
1961	128	6415	50.1
1962	113	6223	55.1
1963	108	5788	53.6
1964	103	5596	54.3
1965	113	6602	58.4
1966	80	5306	66.3
1967	66	4375	66.3
1968	60	3524	58.7
1969	49	3055	62.3
1970	46	3138	68.2
1971	45	3306	73.5
1972	35	3058	87.4
1973	23	2736	119.0
1974	23	3118	135.6

Source: BPS, Railways Statistics 1961-1974.

Table 8.23 Passenger Traffic Characteristics in the Middle Region

Year	Passenger Carried (Thousand Persons)	Passenger-km (Thousand km)	Average Travel Distance (km/Passenger)
1975	7,853	995,031	126.7
1976	6,543	920,906	140.7

Source: Middle Exploitation Office of State Railways

Table 8.24 Passenger Traffic Characteristics of Java and Madura by Passenger Class

Year	Class 1			Class 2			Class 3		
	P.C. (Thousand)	P.K. (Million)	A.T.D. (km)	P.C. (Thousand)	P.K. (Million)	A.T.D. (km)	P.C. (Million)	P.K. (Million)	A.T.D. (km)
1970	308.1	134.3	435.9	7,290	1,921	263.5	39	1,083	27.8
1971	455.9	151.5	332.3	8,644	2,205	255.1	36	950	26.4
1972	802.5	243.1	309.2	8,395	2,142	255.2	26	673	25.9
1973	437.0	181.0	414.2	2,479	663	267.4	20	1,892	94.6
1974	276.5	155.4	562.0	1,085	283	260.8	22	2,683	121.8

Notes: P.C.: Passengers Carried
P.K.: Passenger-km
A.T.D.: Average Travel Distance

Source: BPS, Railways Statistics 1961 - 1974.

Table 8.25 Freight Traffic in Java and Madura

Year	Tons Loaded (Thousand Tons)	Ton-km (Million Ton-km)	Average Haul (km)
1961	4,173	971	232.7
1962	3,580	913	255.0
1963	3,126	823	263.3
1964	2,940	810	275.5
1965	2,727	742	272.1
1966	2,390	695	290.8
1967	1,739	503	289.2
1968	2,139	576	269.3
1969	2,725	662	242.9
1970	2,673	683	255.5
1971	2,836	765	269.7
1972	3,131	831	265.4
1973	3,471	882	254.1
1974	3,279	873	266.2

Source: BPS, Railways Statistics 1961-1974.

Table 8.26 Loading and Unloading of Freight Traffic by Region

(Unit: 1,000 Tons)

Year	West Region		Middle Region		East Region	
	Loaded	Unloaded	Loaded	Unloaded	Loaded	Unloaded
1970	1,114	1,409	643	589	917	631
1971	1,260	1,626	686	557	890	611
1972	1,370	1,696	758	693	1,004	698
1973	1,612	1,833	775	760	1,084	837
1974	1,488	1,692	688	666	1,104	872

Source: Same as Table 8.25.

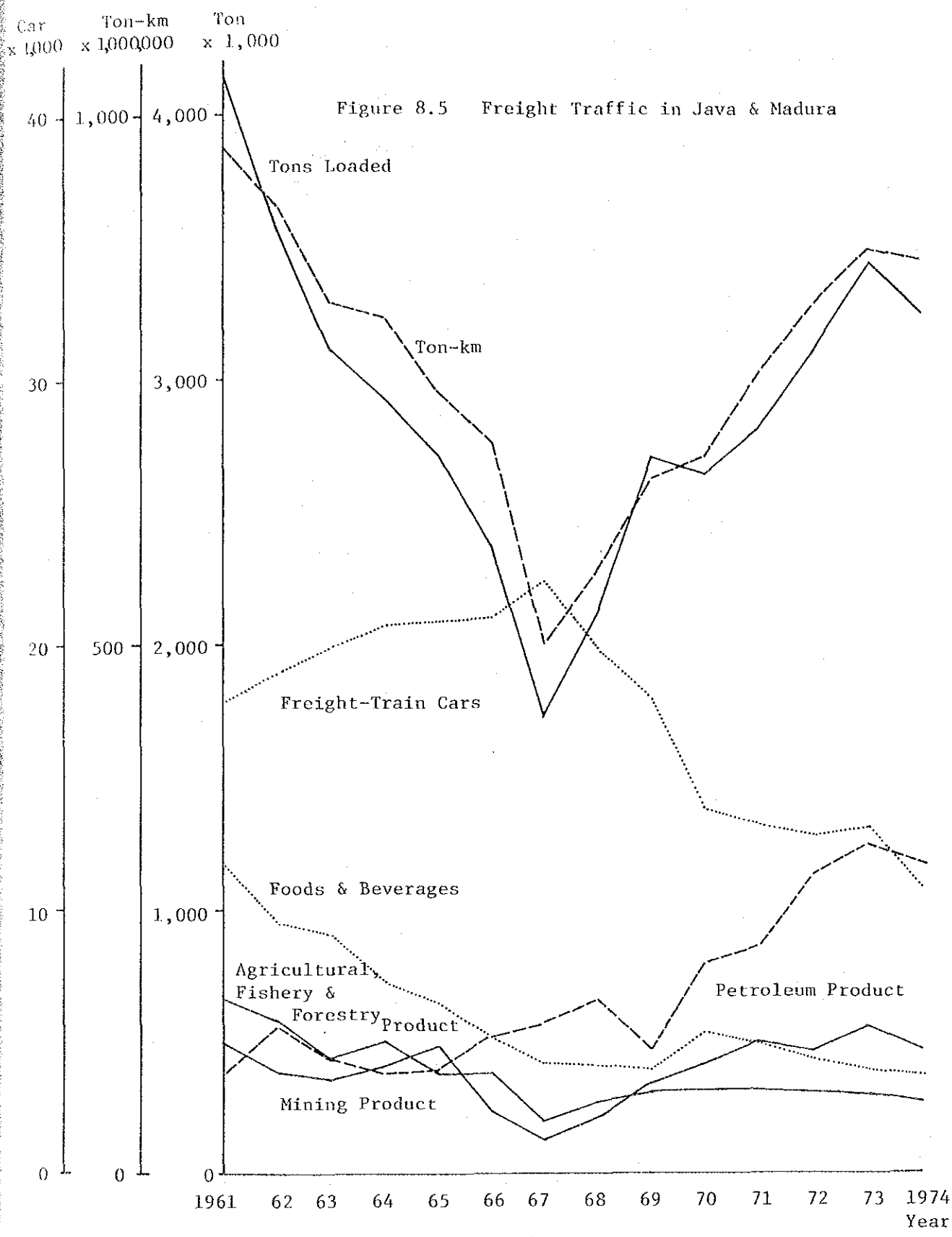


Figure 8.5 Freight Traffic in Java & Madura

Source: BPS, Railways Statistics 1961-1974.

of the difference between these two regions roughly balances one to the other, and the scale of outflow surplus of the middle region is rather small. This may mean that the west and east regions have inter-regional freight traffic, while the freight flow of the middle region is rather confined to being intra-regional in nature Table 8.27 illustrates the situation of freight traffic in the middle region in 1975 and 1976. Petroleum, wood and fertilizer are the major commodities carried by the railways, and out of these, petroleum and fertilizer are dominantly intra-regional flow. No significant commodity flow is observed destined for the east region from the middle region, and the major commodities going to the west region are wood, granulated sugar, hulled rice and salt.

8.3.3 Major Issues

08.032 As pointed out in the previous section, the density of the railways network of the middle region is the highest in Java and Madura. However, the following should be taken into consideration as the factors having an effect on the future role of railways in the region:

(1) Some parts of the network in the region are now out of use: 83.44 km between Yogyakarta and Ambarowa through Secang, and 21.7 km between Secang and Parakan. This is caused by the damage to a bridge some 20 km from Yogyakarta on the way to Magelang, and it is not sure at this moment whether these tracks will be rehabilitated or not. In kabupaten Wonogiri, about 20 km of track will fall into disuse due to the Wonogiri Dam project which has already started. Thus, a growing tendency can be observed toward abandonment of branch lines, for one reason or another.

(2) Contrary to the fact of the high density of tracks in the region, the railway traffic of both passengers and freight is showing the trend of substantial decreasing. However, as is mentioned already, the tracks themselves are indispensable to the through traffic of freight between the east and west regions.

08.033 As for passenger traffic, the decrease in the number of passengers may be attributed to the following reasons:

(1) Competition with other transportation modes: With the growth of highway and air transportation, a considerable volume of passenger traffic must have transferred to these two modes. The number of embarked passengers at the Semarang Airport, for instance, increased by more than five times between 1970 and 1974, and the daily traffic volume of passenger cars between Pemaran and Pekalongan showed an increase of 2.2 times over two years from 1972 to 1974.

Table 8.27 Freight Traffic in Middle Region

Commodity	Tons Loaded		Ton-km		Origin	Destination
	1975	1976	1975	1976		
Petroleum	205,475.9	201,823.2	33,166,100	32,303,181	Maos, Semarang, Cepu, Cilacap	Tegal, Pekalongan Yogyakarta, Surakarta
Wood	49,716.4	41,672.9	27,724,238	23,176,254	Randublatung, Doplang, Sulur, Kradenan, Cepu, Bojonegoro, Kedungjati, Gedangan, Telawa, Purwodadi, Kunduran, Ugawen, Vepon, Blola, Mantingan, Bangilan, Vatirogo, Sembung	West Java
Firewood	15,171.3	15,291.6	2,324,715	2,293,740	idem	Central Java
Salt	6,731.0	6,019.5	3,836,670	3,431,115	Sponcol, Smpelabuhan, Juana, Delok, Pati, Rembang, Cilacap	West Java
Granulated Sugar	14,171.3	15,124.1	6,320,070	6,338,990	Sokaraja, Tegal, Sragi, Smpelabuhan, Ngabean, Srowot, Ceper, Purwosari, Solobalapan, Kudus	West Java
Molasses	28,114.8	27,829.2	5,981,237	5,723,774	Sokaraja, Kendal, Srowot, Ceper, Kudus, Purwosari, Tayu	Tegal, Kalimas
Hulled Rice	22,265.5	12,721.6	4,453,100	2,544,320	Kawumganten, Delanggu, Smpelabuhan, Gandrungmangum, Lempuyangan	West Java
Fertilizer	88,377.5	46,824.9	17,675,500	9,364,980	Cilacap, Smpelabuhan, Tegal	Central Java
Stone, Rock & Boulders	6,909.3	1,232.0	123,200	297,500	Notos, Kebumen, Legok, Tambak, Purwosari, Kedungjati	Central Java
Manganese	2,975.0	3,355.0	431,375	486,475	Wates	Cilacap
Quarts Sand	2,292.0	9,347.3	985,560	4,019,339	Jatirogo, Pamotan	Cilacap
Iron Sand	4,242.0	-	1,637,412	-	Cilacap	West Java
Others	69,519.0	58,364.5	13,903,800	11,672,900		
Total	516,387.8	439,795.8	118,562,977	101,651,568		

Source: Middle Exploitation Office of State Railways

(2) Poor and unreliable service; This is mainly due to superannuated facilities which need rehabilitation or improvement whether of the track, motive power, or rolling stock and signaling and telecommunication system together with maintainance of these facilities. It is said that during the past 30 years lack of funds has caused their deterioration. As for the track, the rehabilitation of the north line from Jakarta has made progress from the west up to the point between Tegal and Pekalongan, and will reach to Semarang in 1978/79. This re-laying of track will ensure maximum permissible speeds of 80 to 90 km per hour. The condition of locomotives was already explained and Table 8.28 shows that serviceable passenger cars account for less than 30 percent, and that more than 50 percent of all the passenger cars are of 30 years of age or older. Thus, in reality, there is no favorable evidence for the future that reliable service will be provided for passengers.

(3) The drastic change in passenger traffic taken place in 1973 may be attributed to the introduction of a new system of passenger fares in May 1973. This new system fixes fares in accordance with class and distance together with the categories of trains related to the level of their speed, comfort and services. There is also the minimum fare, the comparatively high price of which is said to discourage short-distance travel. Other reasons which affected the diminution of short-distance passengers might be an operational reduction on branch lines and cancellation of services for commuters due to lack of locomotives and passenger cars. In spite of these changes, however, the passenger revenue in the middle region is steadily increasing, and that in 1976 shows a 210 percent gain over the past 6 years.

08.034 Regarding freight traffic, competition with other transportation modes and poor and unreliable service is much the same as the case of passenger traffic. Traffic on branch lines must have been replaced much by highway transportation, and as Table 8.28 shows serviceable freight cars account for only 45.3 percent of all the freight cars. Other major points to be observed are as follows:

(1) The reason of the abrupt decrease in freight traffic in 1967 might be due to the general depression of the economy in Indonesia and reduced production in the agriculture and mining sectors.

(2) In the process of recovery in freight traffic from 1967 on, what has contributed to the increase of tons loaded and ton-kilometers is petroleum product. This is also the case in the middle region, and in 1976 its share in

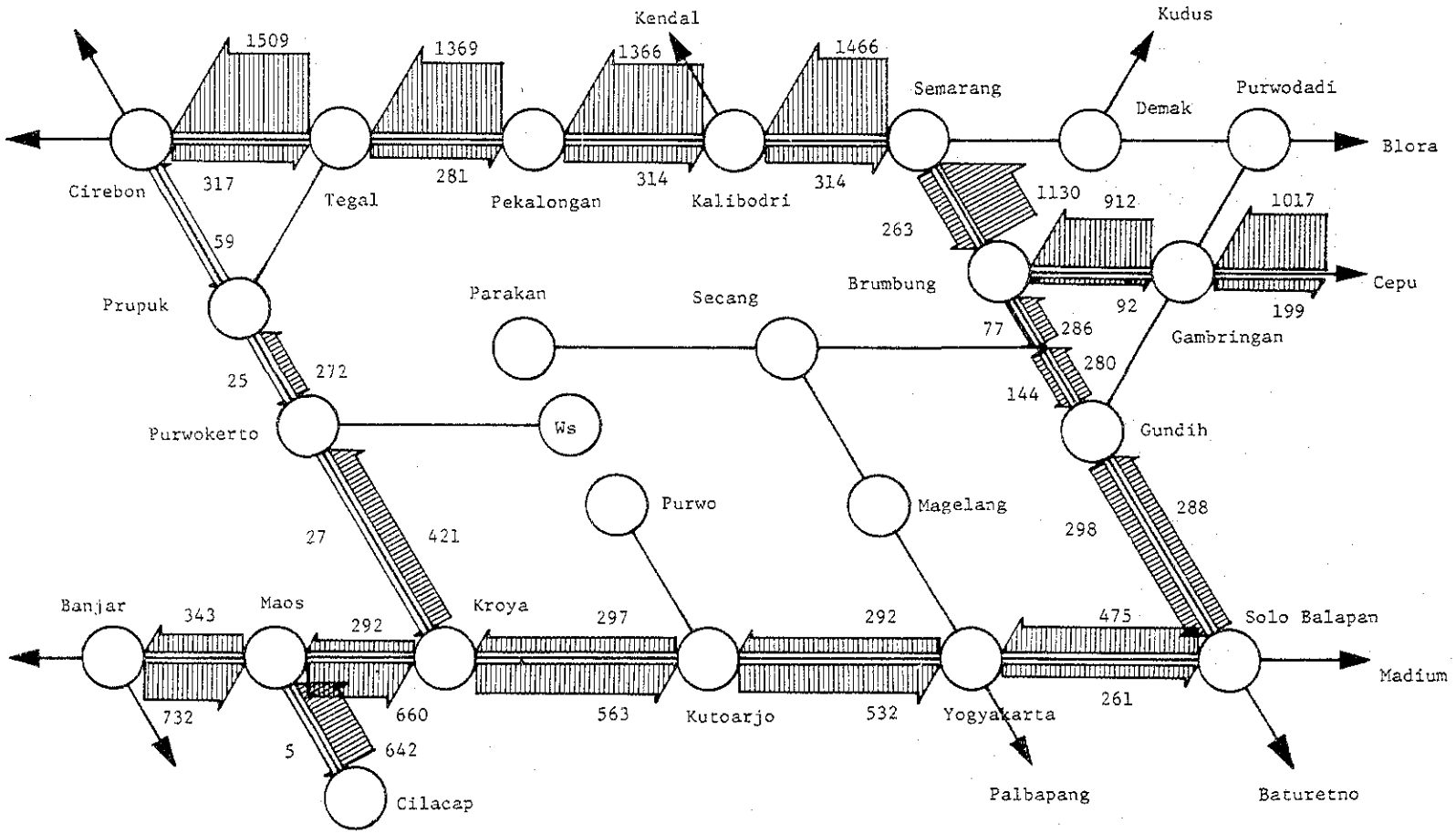
Table 8.28 Inventory of Rolling Stock as of June 30, 1970

(Unit: Number of Cars)

	Passenger Cars		Freight Cars	
	Bogie	4-Wheeler	Bogie	4-Wheeler
Total in Fleet	2,184	313	2,381	19,893
Serviceable	647	12	1,389	8,694
(%)	(30)	(4)	(58)	(44)
Not Serviceable	1,537	301	992	11,204
(%)	(70)	(96)	(42)	(56)
Under Repair	158	-	128	632
Awaiting Repair	212	-	61	200
Awaiting Scrapping	1,167	301	803	11,204
Age				
Less Than 10 Years	578	12	1,283	2,912
11 to 20 Years	439	-	-	4,003
21 to 30 Years	5	-	6	-
31 to 40 Years	26	-	-	-
Over 41 Years	1,136	301	1,092	12,933

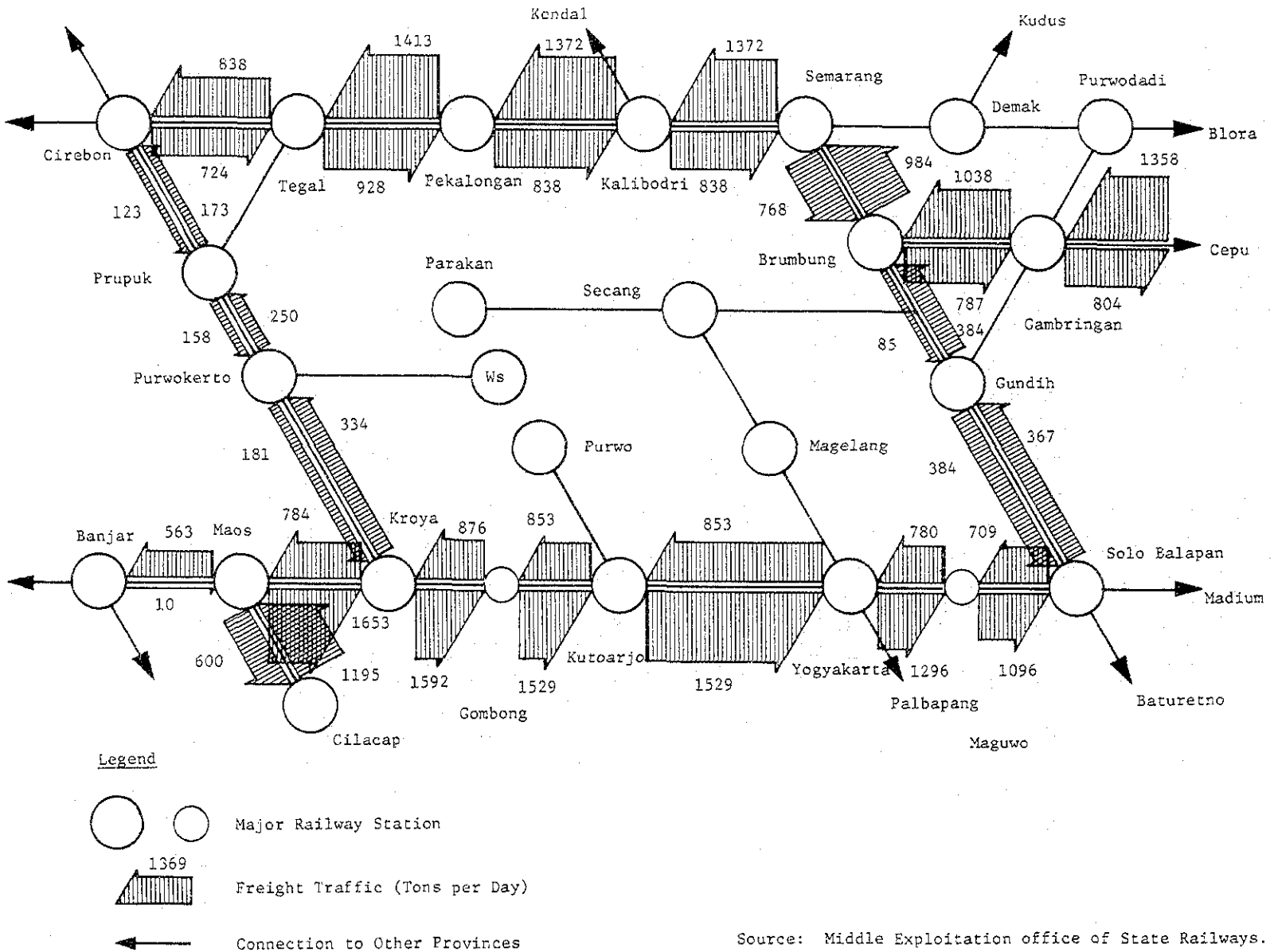
Source: IBRD, Appraisal of a Railway Project Indonesia, May 1974

Figure 8.6 Freight Traffic, 1969



Source: JICA, Feasibility Study on Central and East Java Road Betterment Project Interim Report, 1976.

Figure 8.7 Planned Allocation of Freight Traffic, 1977



Source: Middle Exploitation office of State Railways.

tons loaded was 46 percent and its ton-kilometers amounted to 32 percent of the totals.(see Table 8.27). In future, however, the proportion of traffic in petroleum and its products will drop if the pipeline now operating between Cilacap and Yogyakart will be extended further in the region.

(3) Figure 8.6 illustrates the average daily volume of freight traffic in the middle region in October 1969, which shows that the flow from east to west on the north line has a large share of traffic in the region, and also Yogyakarta receives a supply of goods both from west and east, that is, from Cilacap and from East Java through Surakarta. On the other hand, Figure 8.7 shows the planned allocation of freight traffic for 1977 on trunk lines in the region. The comparison of this figure with Figure 8.7 reveals that the role of the south line is supposed to grow substantially, and its traffic is supposed to exceed that on the north line. The origin of traffic on the south line is Cilacap, and the supply of goods from Cilacap goes beyond Yogyakarta up to Surakarta and even to Semarang and East Java. The flow from east to west on the north line is not expected to show much change, but about 60 percent of the flow is supposed to be through traffic from East Java to West Java, while the flow from west to east is supposed to considerably increase although the flow including idlers. The west line connecting Cilacap to Tegal and Cirebon and the east line connecting Surakarta to Semarang is also supposed to show little change in traffic from that in 1969. However, this allocation plan has the flow of 575 tons of processed oil from Semarang to Tegal, and considering the start of operation of the oil refinery in Cilacap the flow of processed oil to Tegal will possibly be switched to the west line and from Cilacap. This switching may apply not only to oil but to other goods produced or imported at Cilacap, for instance, cement, fertilizer and others.

08.035 The situation regarding the revenue of railways in the middle region is shown in Table 8.29. The most remarkable point to be seen from the table is that, despite the constant decrease in the number of passengers, the share of the passenger revenue shows a tendency to increase, and in 1976 it accounted for more than one-third of the total revenue. This may be the reflection of the process in which short-distance passengers have been weeded out and average travel distance has increased.

Table 8.29 Railway's Revenue in the Middle Region

(Unit: Rp. Million)

Year	Passenger (%)	Freight (%)	Others (%)	Total (%)
1970	1,329.2(59.2)	900.2(40.1)	16.4 (0.7)	2,245.8(100.0)
1971	1,473.2(60.0)	968.9(39.4)	14.5 (0.6)	2,456.6(100.0)
1972	1,469.4(55.9)	1,068.2(40.6)	93.1 (3.5)	2,630.7(100.0)
1973	1,689.7(59.8)	1,088.6(38.5)	49.3 (1.7)	2,827.6(100.0)
1974	2,130.3(64.8)	1,133.2(34.4)	25.8 (0.8)	3,289.3(100.0)
1975	2,447.8(70.4)	990.8(28.5)	37.6 (1.1)	3,476.2(100.0)
1976	2,814.8(76.8)	819.2(22.3)	33.6 (0.9)	3,667.6(100.0)

Source: Middle Exploitation Office of State Railways

8.3.4 Recommendations

(a) Concentration to Trunk Lines

08.036 As a consequence of the previous sections, it is recommended to take measures to gradually confine and concentrate railways operation on trunk lines in the middle region. This means, in other words, to abolish branch lines now being taken out of use. For this purpose, what is needed is to set up proper criteria for abolition based on detailed surveys of the role of railways in local areas. Economic appraisal of abolition is vital, and it is also inevitable to seek actual possibilities to convert railway traffic to road traffic in those areas where local lines are to be abolished.

(b) Improvement of the Line Between Cilacap and Tegal

08.037 Keeping pace with the industrial development of Cilacap, the volume of freight originating from Cilacap and to be distributed to Central Java and other provinces will increase. The line connecting cilacap to Tegal is an important route for this purpose. The present situation of this route is not favorable for freight traffic because of its lengthy distance through Maos, Purwokerto and Pupuk. In addition to the rehabilitation of the trunk lines, measures should be

taken to improve the flow of freight on this route in accordance with the industrial development of Cilacap.

8.4 Sea Transportation

8.4.1 General

08.038 Central Java faces the Java Sea on the north and the Indonesian Sea on the south. The Java Sea is ringed by the main islands of Indonesia and is the major field of sea transportation activities of the country. This is due not only to its locational advantage but to the calmness of its water. It is reported that, even in the season of westerlies, sea waves moving west to east little affect the activities at each port as the wave height is at most 1 or 1.5 m. On the other hand, the Indonesian Sea is rough and causes surges on the south coast. Accordingly, the development of a port is not an easy task.

08.039 In the whole country in 1974, out of the 100 ports for which statistics are available, Central Java has three on the north coast: Tegal, Pekalongan and Semarang, and one on the south coast: Cilacap. In terms of geographical location the three on the Java Sea are sea ports and Cilacap is an estuary port. The north coast of the Java Island has, in general, shallow water, which makes it difficult for vessels to approach the harbor directly. In case of the Semarang port, for instance, the access channel extends some 4 km out in the sea.

08.040 In view of cargo flow, the Pekalongan port is only for interinsular cargo, and the Tegal port shares only a small portion of foreign cargo and is mainly for interinsular cargo flow. Thus, the Semarang and Cilacap ports are the main two ports in Central Java, and from the standpoint of regional development, these two require special attention.

8.4.2 Present Situation of Cargo Flow

(a) The Tegal Port

08.041 The record of cargo flow at the Tegal port in recent years is tabulated in Table 8.30. The table shows that there is a tendency toward overall decrease of cargo flow at the port. Moreover, it seems that in the case of overseas trade the weight of exports is diminishing, while that of imports is relatively increasing. As for domestic cargo flow, inward flow has always exceeded outward flow and this tendency seem to be growing stronger. Thus, as a whole, within the frame of diminishing functioning, handling of inflow cargo is becoming the major function of the port.

Table 8.30 Cargo Flows at the Tegal Port

(Unit: Tons)

Year	Overseas		Domestic		Total
	Export	Import	Outward	Inward	
1970	-	-	-	-	-
1971	80,785	13,737	420	1,262	96,204
1972	69,259	11,587	684	2,734	84,264
1973	26,596	1,250	492	5,186	33,524
1974	36,166	14,675	1,242	2,795	54,878
1975	4,069	28,075	14	8,615	40,773

Sources: 1. BPS, Cargo Loading and Unloading at Ports in Indonesia 1970-1974.

2. Volume Lalulintas Muatan Kapal Lant di Pelabuhan-2 Indonesia Dalam Tahun 1975.

Table 8.31 Cargo Flows at the Pekalongan Port

(Unit: Tons)

Year	Domestic		Total
	Outward	Inward	
1970	595	989	1,584
1971	29	1,289	1,318
1972	20	1,790	1,810
1973	45	1,992	2,037
1974	102	2,585	2,687
1975	133	2,591	2,724

Source: As in Table 8.30.

08.042 Concerning export commodities, the share of molasses is high and growing. It is now about 60 to 80 percent. Rubber has a share of some 5 to 10 percent of total export commodities (according to a report by BPS: Cargo Loading and Unloading at Ports in Indonesia, 1970 - 1974). The volume of other export commodities has been fluctuating much, although dried cassava and fodder amounted sometimes to more than 10,000 tons a year. Among import commodities, fertilizer and yarn and cotton have been the items somewhat stable.

08.043 On the other hand, interinsular flow covers a variety of commodities, and, in case of outward flow, the share of various kinds of petroleum products and petroleum amount to almost 50 percent, and other somewhat notable items are rice, sugar, salt and onions. The major items of inward flow are copra, salt, fertilizer, wood bark, wood and horses, and of these, copra and wood are apparently increasing annually.

(b) The Pekalongan Port

08.044 The Pekalongan port is only for interinsular trade, and the recent record of the commodity flow is shown in Table 8.31. The amount of outward flow seems to have been fluctuating at first inspection but another interpretation is that the outward flow is now recovering from the stagnant stage of 1971 to 1973. However, the volume of inward flow has been exceeding the volume of outward flow by the substantial differencials, and at the same time the volume of inward flow has been on the steady growth.

08.045 As to outward flow of commodities, sugar has had the share of 10 to 30 percent and kerosene some 5 to 15 percent. Others are mostly general cargoes except flour, palm sugar, maize and salt, the total amount of them being around 10 percent in 1974. Regarding inward flow, there has been a growing tendency toward change of its composition in the recent years. The commodities decreased remarkably are salted fish, coconut and charcoal, which have reached almost naught, and the commodities increased substantially are salt and wood. In 1974, the share of wood is 92.5 percent and that of salt 6.6 percent, thus the sum of these two shares accounts for more than 99 percent of the inward flow at the port.

(c) The Semarang Port

08.046 The recent total commodity flow at the Semarang port is shown in Table 8.32, and the table reveals the dominant importance of the port in Central Java in terms of the amount of cargo handled. The total volume of the total commodity flow at the port has increased except in 1975, and the volume in 1976 was 173 percent of that in 1970. Only the export flow has been fluctuating and is on the decrease, and the most rapid growth can be observed in the domestic inward flow, which exceeded the domestic outward flow in 1973. This fact suggests the present stagnant economic situation of Central Java together with the fact that the import flow has been steadily growing.

Table 8.32 Cargo Flows at the Semarang Port

(Unit: Tons)

Year	Overseas		Domestic		Total
	Export	Import	Outward	Inward	
1970	119,422	246,650	57,338	43,080	466,490
1971	139,596	254,481	71,324	44,650	510,051
1972	113,852	324,278	74,599	71,475	584,204
1973	81,554	422,249	80,186	92,595	676,584
1974	109,861	443,824	89,611	99,666	742,962
1975	68,067	433,804	86,653	111,823	700,347
1976	81,795	488,439	102,320	136,222	809,176

Sources: 1. BPS, Cargo Loading and Unloading at Ports in Indonesia 1970-1974.

2. Port Administration at Semarang for 1975 and 1976

Table 8.33 Inland Cargo Flows to and From the Semarang Port

(Units: Tons)

Year	Inflow	Outflow	Total
1970	89,704	202,674	292,378
1971	146,066	234,277	380,343
1972	127,088	334,390	461,478
1973	68,617	421,721	490,338
1974	89,711	433,729	523,440
1975	94,810	485,717	580,527
1976	103,150	544,096	647,246

Source: As in Table 8.32.

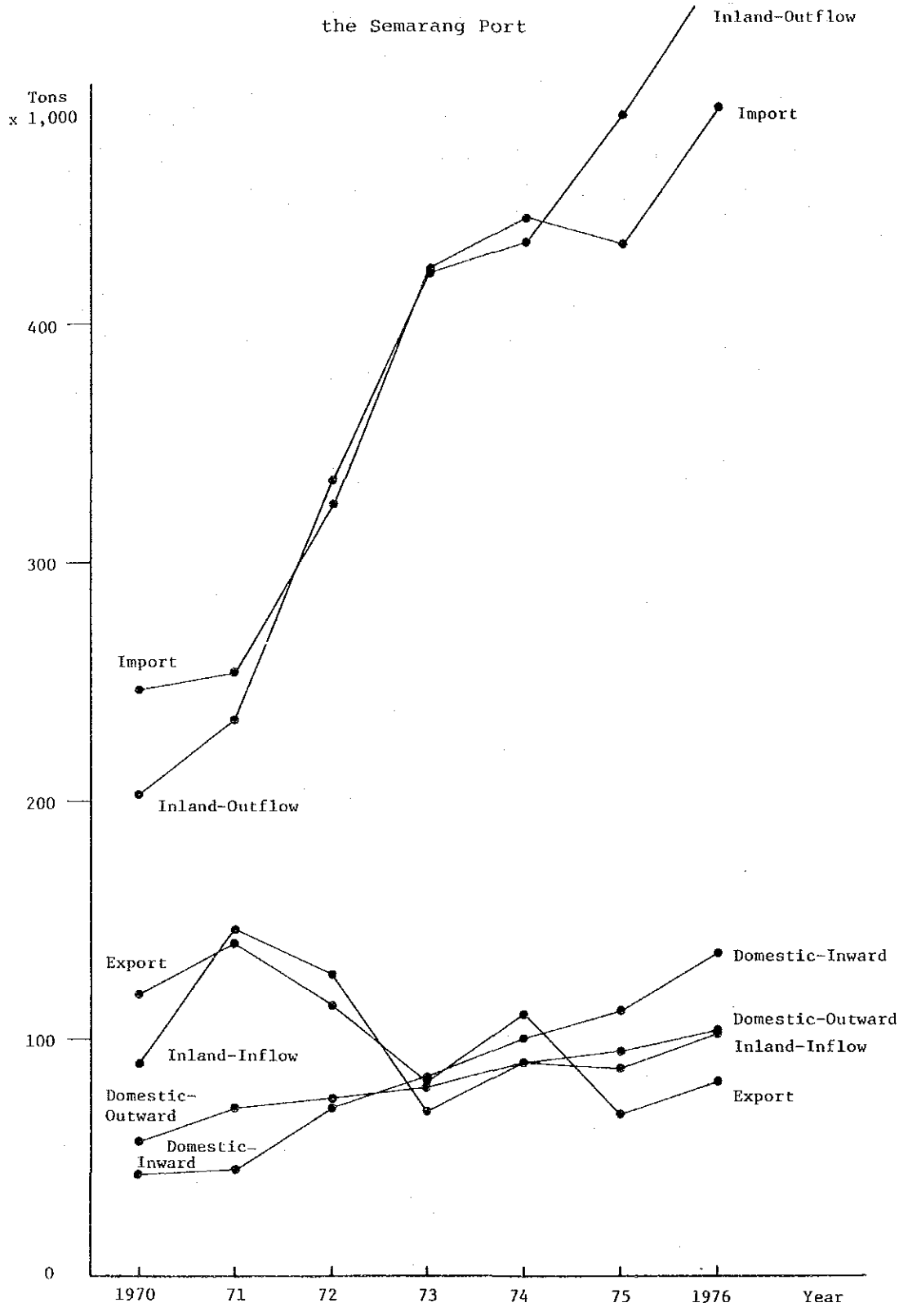
08.047 The rather detailed data on the commodity flow at the port makes it possible to analyze the flow of each commodity. The major items of export flow have been fodder, wood, rubber, coffee, tobacco, groundnut and animal hide. The volume of these commodities has been fluctuating year by year, but an apparent growing tendency can be observed in copra and quite recently in vegetable oil. As for the import flow, commodities which have kept the level of roughly more than 10,000 tons per year are fertilizer, rice, sugar, paper, asphalt, cotton and yarn. Although fluctuating yearly, fertilizer and rice show a growing tendency, and recently cement, machinery and electrical equipment have increased quite rapidly. On the other hand, wheat flour and galvanized iron have been on the decrease. The domestic outward flow has been composed mainly of sugar and rice which accounted for 70 percent of the total outward flow in 1976. The volume of sugar is steadily, while that of rice is diminishing quite recently. Salt and wheat flour also show a decreasing tendency, while cement is increasing. The major domestic inward flow consists of fertilizer, wood, rice and copra. The volume of wood has been increasing every year, and its share in 1976 is around 35 percent of all the domestic inflow. Fertilizer fluctuates in volume, but has achieved the high share of 23 percent in 1976. Copra also fluctuates around 10,000 tons yearly, and rice has no inflow in 1975 and 1976. Other major items which fluctuate year by year are wheat flour, asphalt and sugar. Thus, in case of inward flow of commodities, the fluctuation of the volume of each item is characteristically observed.

08.048 The amount of total inland commodity flow at the port is shown in Table 8.33 which reveals that the inland outflow from the port has been growing steadily, while the inland inflow to the port has been fluctuating and is now recovering from the minimum state in 1973. Including these inland flows to and from the port, the total volume of commodity flow is shown in Figure 8.8. This figure tells that considerable correlation can be identified (1) between the import flow and the inland flow from the port, (2) between the export flow and the inland flow to the port, and (3) between the domestic inward and outward flows. In order to see the correlation between those flows, the volume of flows are plotted in Figures 8.9 and 8.10 where the correlation can be observed more clearly, and from this it would be concluded that the inland commodity flow pertaining to the port is mainly related to the overseas flow and that the domestic inflow and outflow are correlated with each other.

(d) Cilacap Port

08.049 The Cilacap port has a peculiar feature in Central Java; that is, from the functional viewpoint, it is an industrial port. This aspect is shown in the tables 8.34 and 8.35. Table 8.34 tells that the total amount of cargo flow at the port far surpasses that at the Semarang port, and in this sense this port is the largest and the most active port in Central Java. However, the table also reveals that the amount of flows has been substantially biased toward the domestic inward flow and the overseas export flow, and this bias is still growing. In

Figure 8.8 Cargo Flows at the Semarang Port



Source: Tables 8.32 and 8.33.

Figure 8.9 Correlation of Cargo Flows at the Semarang Port

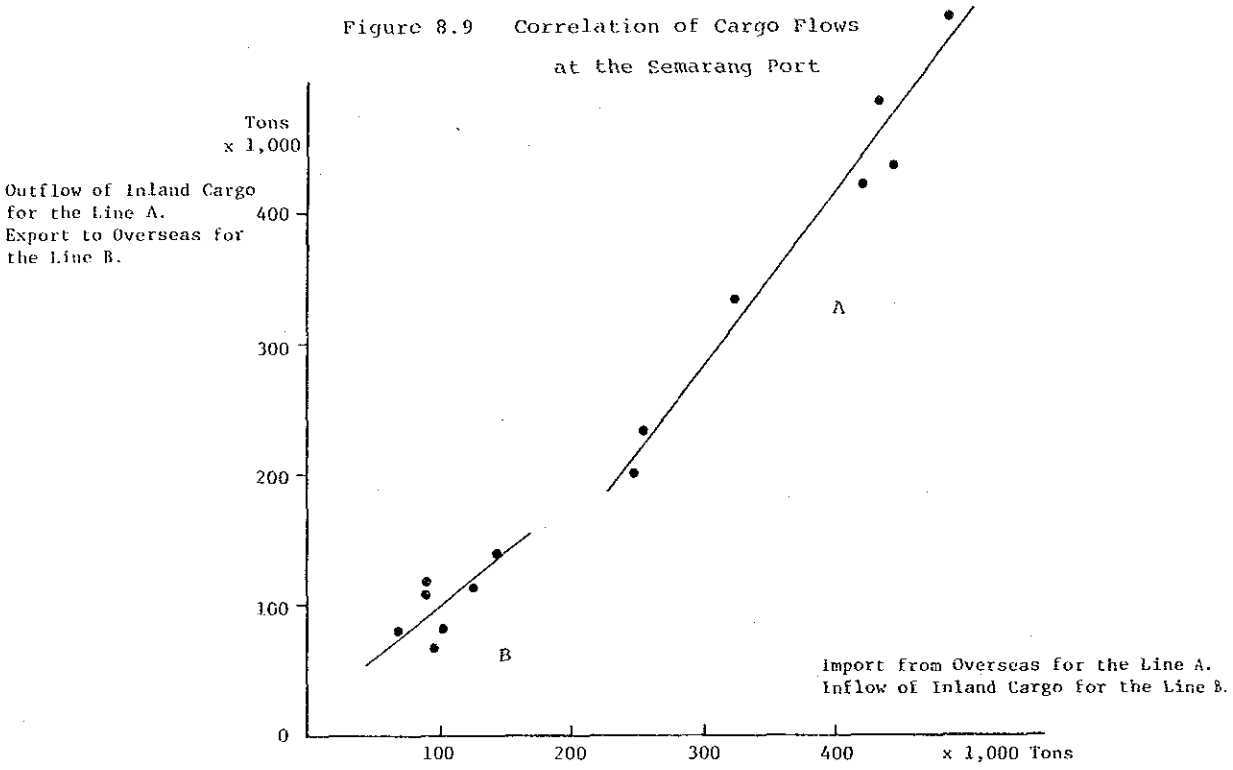
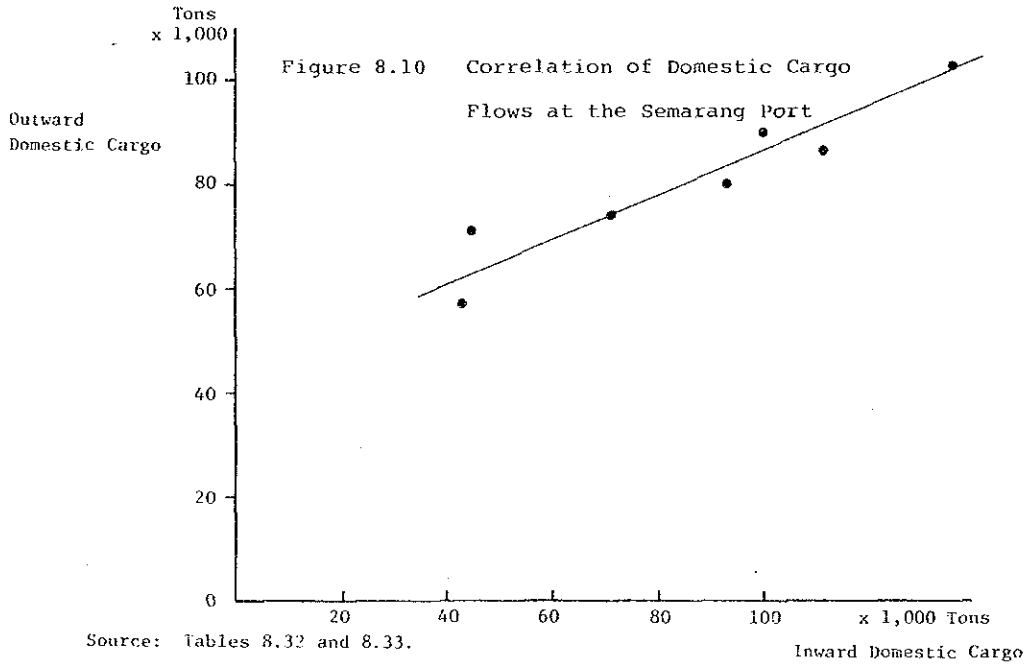


Figure 8.10 Correlation of Domestic Cargo Flows at the Semarang Port



Source: Tables 8.32 and 8.33.

Table 8.34 Cargo Flows at the Cilacap Port

(Unit: Tons)

Year	Overseas		Domestic		Total
	Export	Import	Outward	Inward	
1970	23,331	26,090	-	439,601	(499,022)
1971	274,183	74,697	2,000	473,382	824,262
1972	332,498	45,784	2,000	462,952	843,234
1973	322,133	85,591	2	472,109	879,835
1974	415,954	98,134	7	826,721	1,340,816
1975	389,695	182,534	2,500	1,044,486	1,619,215

Sources: 1. BPS, Cargo Loading and Unloading at Ports in Indonesia, 1970-1974

2. Port Authority at Cilacap, "Badan Pengusahan Pelabuhan Cilacap" for 1975

Table 8.35 Export of Iron Sand and Inward Flow of Processed Oil[1/] at Cilacap

(Unit: Tons)

Year	Iron Sand (%)	Processed Oil (%)
1970	0 (0.0)	439,601 (100.0)
1971	240,705 (87.8)	469,632 (99.2)
1972	282,412 (84.9)	462,952 (100.0)
1973	260,004 (80.7)	468,059 (99.1)
1974	337,746 (81.2)	818,399 (99.0)
1975	304,515 (78.1)	975,213 (93.4)

Note: 1/ For iron sand, total cargo flow for overseas export from Cilacap (in Table 8.34) as 100.0%. For processed oil, total inward flow of domestic cargo into Cilacap (in Table 8.34) as 100.0%.

Source: As in Table 8.34.

1975 the inward flow accounts for almost two-thirds of the total flow, and the export flow around one-fourth, and the outward flow is almost negligible. The comparison of this with that of the Semarang port shows conspicuous feature of this port. The inward flow predominantly consists of petroleum products such as benzine, and kerosene which account for more than 90 percent of the whole inward flow. As for the export flow, iron sand forms around 80 percent of the total export flow, although the share shows a decreasing tendency. These characteristics of the inward and export flows are tabulated in Table 8.35.

08.050 Thus, excluding iron sand and processed oil, the amount of cargo handled at the port in 1975 is a little less than half of that at the Semarang port, and this fact illustrates the position of the port as an industrial port in Central Java. Iron sand is exploited widely along the southern coast of Central Java, and processed oil through the port is distributed in Central Java. Other major export commodities are dried cassava, wood and fodder, and the volume of these export items has been fluctuating widely. Regarding import goods, rice, fertilizer, asphalt and cotton yarn are the major items, and although the volume of rice and fertilizer have been fluctuating, cotton yarn and asphalt have comparatively steady amount of around 5,000 tons per year. Almost all of the domestic outward flow is also iron sand, and the inward flow other than processed oil consists of fertilizer, cement and asphalt.

8.4.3 Major Issues and Comments

08.051 The comparison of cargo handled at each port in 1975 appears in Table 8.36, which shows the relative importance of each port in Central Java in Table 8.36, which shows the relative importance of each port in Central Java in terms of cargo flow, and the major points observed are as follows:

Table 8.36 Comparison of Cargo Handling by Ports in 1975

(Unit: Tons)

Port		Overseas		Domestic		Total
		Export	Import	Outward	Inward	
Tagal	(Tons)	4,069	28,075	14	8,615	40,773
	(%)	(0.9)	(4.4)	(0.0)	(0.7)	(1.7)
Pekalongan	(Tons)	-	-	113	2,591	2,704
	(%)			(0.2)	(0.2)	(0.1)
Semarang	(Tons)	68,067	433,804	86,653	111,823	700,347
	(%)	(14.7)	(67.3)	(97.0)	(9.6)	(29.7)
Cilacap	(Tons)	389,695	182,534	2,500	1,044,486	1,619,215
	(%)	(94.4)	(28.3)	(2.8)	(89.5)	(68.5)
Total	(Tons)	461,831	644,413	89,300	1,167,515	2,363,059
	(%)	(100.0)	(100.0)	(100.0)	(100.0)	(100.0)
Share	(%)	(19.5)	(27.3)	(3.8)	(69.4)	(100.0)

Source: Tables 8.30, 8.31, 8.32 and 8.34.

(1) The relative importance of the Pekalongan port in Central Java is next to negligible and that of the Tegal port is of little significance especially for import of goods.

(2) As a whole, the domestic outward flow from Central Java is quite small and the domestic inward flow is large as compared to the amount of the domestic outward flow. This fact tells the relatively stagnant economic situation of Central Java in terms of domestic flow of commodities. This high share of domestic inward flow is mainly due to the inward flow of oil products at the Cilacap port.

(3) Regarding overseas flows, the Semarang port is the most important in import flow, and the Cilacap port far excels all the others in the export flow owing to iron sand.

08.052 Thus in Central Java, the actually important ports are Cilacap and Semarang. Major features and current developments of these two ports are discussed here. As for Cilacap:

(1) The activity of the Cilacap port is dependent on its locational peculiarity: a good natural port exists, iron sand is exploited close to Cilacap along the southern coast of Central Java, and petroleum is distributed through the pipeline now extending up to Yogyakarta.

(2) At the end of 1974, the rehabilitation project of the Harbor II and the warehouse V was completed with Australian aid, to meet the needs created by increasing sea transportation to and from Cilacap.

(3) According to the port authority at Cilacap, the amount of cargo handled in 1976 at the port far exceeds that in 1975. Thus the activity of the port is steadily on the increase.

(4) The industrial growth at Cilacap has started quite recently. The Pertamina oil refinery with the capacity of 3,000 barrels per hour was put into operation toward the end of 1976, and a cement factory with the capacity of 500,000 metric tons at the initial stage to be stepped up to 1,200,000 metric tons per year will start. This situation will certainly change the role of the port as well as the flow: the inward flow of crude oil and outward flow of cement will inevitably increase. Thus, the port will become more and more an industrial port.

08.053 On the other hand, the following is observed concerning the Semarang port:

(1) The geographical location of the port is suitable for both overseas and domestic trads: it is said, for example, that it takes three more days for an vessel approaching the Java Island from the north to reach the Cilacap port than it does to reach the Semarang port. Moreover, the minor ports mainly for domestic trade are located on the northern coast of Central Java and the inland transportation systems are more developed along the northern coast for the present.

(2) In spite of the increasing amount of cargo handled at the port in the recent past, the handling capacity is quite limited. In connection with shallow water of the Java Sea the depth of the access channel is less than 4 m and only the vessels of less than 1,000 DWT are able to be accommodated in the basin area of the port. It is estimated that around 80 percent of all the cargo handled is carried out or carried in by barges from the off-shore point some 4 km from shore. In order to improve this situation, a development project of the port was designed by the Gajamada University in 1975, and also a study report on Semarang port development was submitted by Pacific Consultants International (PCI), Japan, in 1976. The latter has been studied by the advisory experts of the Directorate General of Sea Communications, and what seems to be a feasible proposal for the development was made in March, 1977 recommending the immediate start of the project.

08.054 A projection of future cargo flow at each port up to 1985 was made based on the available past data and their trend, and is tabulated in Table 8.37. The basic data and the process of projection employed are as follows:

(1) Semarang Port

The study report by PCI in 1976 gives its own projection, where the overall annual growth rate of cargo flow from 1975 to 1980 is 11.6 percent and that from 1980 to 1985 is 8.8 percent. Reflecting the present trend, however, the study team's projection assumed different growth rates to each of flow categories: with the highest rate of 18 percent to the domestic inward flow and the lowest rate of 7 percent to the overseas export flow. The overall annual growth rate resulted from the projection by each flow category is 13 percent from 1976 up to 1980, with the total flow of 1,318 thousand tons in 1980 as compared with 809 thousand tons in 1976. From 1980 on,

the annual growth rate will slacken down to 9.8 percent as a whole, but the total volume of flows will amount to over 2 million tons in 1985. The import flow accounts for 61.0 percent of the total cargo flow, which is almost equivalent to 60.4 percent in 1976.

Table 8.37 Projection of Cargo Flows in Central Java

(Unit: Thousand Tons)

Port	Year	Overseas		Domestic		Total
		Export	Import	Outward	Inward	
Semarang	1976	82	489	102	136	809
		(7.0)	(13.0)	(10.0)	(18.0)	(13.0)
	1980	107	797	150	264	1,318
		(5.0)	(10.0)	(8.0)	(12.0)	(9.8)
	1985	136	1,284	220	465	2,105
Cilacap	1975	390	183	3	1,045	1,621
		(10.0)	(20.0)	(-)	(15.0)	(16.9)
	1980	628	455	350	2,102	3,535
		(8.0)	(10.0)	(7.5)	(7.2)	(7.7)
	1985	923	725	503	2,969	5,120
Tegal	1975	4	28	0	9	41
		(-)	(-)	(-)	(-)	(-)
	1980	40	50	3	15	108
		(8.0)	(10.0)	(20.0)	(10.0)	(9.5)
	1985	59	81	7	24	171
Pakalongan	1975			0.1	2.6	2.7
				(-)	(-)	(-)
	1980			0.6	5.0	5.6
				(20.0)	(10.0)	(11.0)
	1985			1.4	8.0	9.4

Note: The figures in parentheses indicate the growth rate per annum in percent.

Source: Estimated by the Study Team.

(2) Cilacap Port

In case of the Cilacap port, the projection of cargo flow is rather complicated due to the start of industrial production--mainly of the oil refinery and the cement factries. It is reported that in 1976 the amount of cargo flow especially of domestic inward and overseas import flows reached an extraordinary high level. It would be wiser, however, to assume that this is owing to the construction demands of the above-mentioned factories and is a temporary phenomenon. Accordingly, the data used for the projection are those up to 1975. As to the export flow, the amount of iron sand which now accounts for more than three-fourths of the flow is supposed to be 350 thousand tons in 1980 and 400 thousand tons in 1985. The import flow will grow in line with the growth trend. Domestic flows will be effected substantially by the start of industrial production. The projection is based on the assumptions that the rate of operation of the cement factory in 1980 is about 60 percent and about 83 percent in 1985, and that half of these production levels will be loaded out from the port for domestic outward flow. The oil refinery will be operating fully up to its capacity of 300 barrels per hour in 1980 and in 1985. Out of 2,102 thousand tons of the inward flow in 1980, 500 thousand tons are crude oil for refinement in Cilacap and 1,000 thousand tons are processed oil to be distributed in Central Java through Cilacap. In 1980 another 500 thousand tons of processed oil are added to the inward flow. Thus, as a whole, the annual growth rate of cargo flows at the Cilacap port is 16.9 percent from 1975 to 1980, and 7.7 percent in the next five years.

(3) Other Ports

The projection of flows at the Tegal and Pekalongan ports is rather difficult because of the difficulty of finding a trend to be followed. In this situation, it is expected that by 1980 each flow will recover to the maximum level in the past five years or else it will increase by about 12 percent per year. After 1980, the growth rate of each flow is assumed as in Table 8.37 by the Study team.

08.055 In sum, the industrial development of Cilacap may exert a great influence on the future sea transportation in Central Java, especially at Cilacap. However, the projection is based on the assumption that inward flow of processed oil to Central Java is overwhelmingly through Cilacap, and if this assumption is taken as a policy, it seems there will be overload to the port and distribution capacities of Cilacap. Hence, it will be necessary to set up another distribution system to the north part of Central Java through Semarang.

8.4.4 Recommendations

(a) The Tegal Port

08.056 In relation to the development of the Semarang port, the function of the Tegal port will become more and more supplementary to that of Semarang on the northern coast of Central Java. Its relative proximity to Cilacap, however, will necessitate and encourage its industrialization (although in a minor scale), which is related to the industrial development of Cilacap. Thus, the development of the port should, first of all, keep pace with the industrial development of Cilacap, and attention should be paid to the encouragement of existing industries such as shipbuilding and others. And the inland transportation development between Cilacap and Tegal is indispensable.

(b) The Pekalongan Port

08.057 The future development of inland transportation along the northern coast of Central Java will reduce the role and significance of the port. However, the existing idea of centralization of fishing to Pekalongan will be of some importance for the local development to avoid functional competition with the Tegal port.

(c) The Cilacap Port

08.058 Since the major item of the increase in cargo flow is oil, an off-shore sea berth will be required, and, in this connection, a careful study should be undertaken on the distribution system of processed oil in Central Java together with the future demand in order to avoid too much concentration and over-reliance on Cilacap.

08.059 The recommendation for the Cilacap port is to develop the inland transportation means, i.e., the railways and roads, to match the increase in cargo handled and to prevent freight congestion at the port and in and around Cilacap. This may also help the supply of raw materials and distribution of products to and from the Cilacap industrial complex. In other words, the development of inland infrastructure is the basis of the industrial development of Cilacap.

(d) The Semarang Port

08.060 The ongoing study on the development of the port should be completed and its forthcoming recommendations should be examined as the first priority programs in Central Java. The basic ideas of the presently recommended plan by the advisory experts, from which the anticipated recommendations of the ongoing study are supposed not to deviate greatly, are to handle cargoes directly on wharves avoiding the system of cargo handling by barge and to expand the port step by step up to the level which meets the projected cargo flow of 5 million tons in the year 2,000. At this time, the required total length of wharves would amount to about 5 km. The plan recommends the earliest

possible start of the project beginning with engineering design with technical services from outsiders, and this recommendation is quite agreeable considering the present situation of the port.

08.061 The road system around the port should be improved in accordance with the port development. The port is adjacent to built-up areas of the city of Semarang and close to the city center. To avoid congestion in the built-up areas of the city caused by through-traffic to and from the port, a by-pass road connecting the port to the major highways should be developed as a part of the integrated road network of the city.

8.5 Air Transportation

8.5.1 General

08.062 In the island of Java there are now seven airports in use for civil aviation, located in six cities: Jakarta (Halim P.K. and Kemayoran), Bandung, Semarang, Surakarta, Yokyakarta, and Surabaya. Out of these, only one at Jakarta (Halim P.K.) is used for international flights. The Semarang and Surakarta airports are situated in Central Java and the port of Yokyakarta is quite near to these two. The aerial distance from Semarang and Surakarta to Yogyakarta is some 90 km and 45 km respectively, and that between Semarang and Surakarta is some 73 km. Naturally enough, therefore, there is no flight service between them. The airport at Surakarta (Panasan) was put into civil use in 1974.

8.5.2 Present Situation

08.063 Three airports at Semarang, Surakarta and Yogyakarta enjoy good access to the national highways which connect each airport to each city center, although in case of Surakarta the distance to the city center is some 15 km.

08.064 The dimensions of the runway of the Semarang airport is 1,410 m by 45 m, those of Surakarta 1,800 m by 45 m, and those of Yogyakarta 1,850 by 40 m, all of them being the standard of a domestic airport. The terminal buildings of all the three airports require extension due to the increase in the number of passengers and services for them. Table 8.38 shows the traffic statistics of the three airports, and in the case of Semarang and Yogyakarta the growth of traffic is also presented by indices taking the year of 1970 as the base. The remarkable points of the statistics are the following:

Table 8.38 Air Traffics, Central Java and Yogyakarta, Both Arriving and Leaving, 1970 - 1975

	Year	Number of Flights (No.)	(Index)	Carried Passengers (Persons)	(Index)	Carried Baggage (kg)	(Index)	Carried Cargo (kg)	(Index)	Carried Mail (kg)	(Index)
Semarang	1970	550	(1.0)	19,622	(1.0)	13,693	(1.0)	9,645	(1.0)	1,234	(1.0)
	1971	1,904	(3.5)	26,059	(1.3)	216,200	(15.8)	14,248	(1.5)	4,429	(3.6)
	1972	1,970	(3.6)	51,558	(2.6)	378,899	(27.7)	35,164	(3.6)	8,032	(6.5)
	1973	2,384	(4.3)	73,227	(3.7)	428,181	(31.3)	124,692	(12.9)	11,705	(9.5)
	1974	3,208	(5.8)	108,420	(5.5)	628,559	(45.9)	161,995	(16.8)	12,945	(10.5)
	1975	4,046	(7.4)	146,194	(7.5)	788,696	(57.6)	233,552	(24.2)	38,500	(31.2)
Surakarta	1974	526		12,444		19,820		56,918		1,454	
	1975	738		25,670		160,726		47,299		8,233	
Yogyakarta	1970	1,504	(1.0)	25,420	(1.0)	13,043	(1.0)	261,658	(1.0)	14,983	(1.0)
	1971	1,760	(1.2)	50,035	(2.0)	612,440	(47.0)	460,000	(1.8)	32,613	(2.2)
	1972	2,392	(1.6)	66,766	(2.6)	711,269	(54.5)	151,503	(0.6)	24,302	(1.6)
	1973	3,640	(2.4)	102,238	(4.0)	984,679	(75.5)	409,329	(1.6)	27,752	(1.9)
	1974	4,111	(2.7)	115,026	(4.5)	1,071,775	(82.2)	388,784	(1.5)	35,913	(2.4)
	1975	5,230	(3.5)	141,196	(5.6)	995,880	(76.4)	653,064	(2.5)	48,452	(3.2)

Source: Directorate General of Air Communication.

(1) With regard to the numbers of flights and passengers, the growth at Semarang has been more rapid than that of Yogyakarta. The magnitude of this growth is easily understood by comparing this to the growth of the passengers carried by the national airlines in the whole nation from 1970 to 1974, which is 2.7 by the same index.

(2) The number of flights ar Semarang in 1975 is less than that at Yogyakarta. On the other hand, the number of passengers at Semarang in the same year surpasses that at Yogyakarta, which implies that the passenger-load factor at Semarang has become more larger.

(3) The amount of baggage handled has grown faster at Yogyakarta than at Semarang, although in 1970 the amount is alsmot the same at the two airports. This probably indicates the higher ratio of tourist passengers at the Yogyakarta airport compared to the Semarang airport.

(4) The growth of cargo and mail traffic at Semarang is remarkable, although the total amount of both is still fur below that at Yogyakarta in 1975. Possibly this may be attributed, together with the larger passenger-load factor pointed out above, to the recent growth of Semarang as the center of administration and trade in Central Java.

(5) For Surakarta, the statistics are not enough to permit a definite statement, but the increase of passengers and baggage traffic is observed.

08.065 The origin and destination of the passengers at Semarang airports in 1974 is shown in Table 8.39 which excludes those whose origin and destination are unknown. In spite of the almost balanced number of the departing and arriving passengers in total, the breakdown in this table reveals the features of the passenger traffic at Semarang airport to be as follows:

Table 8.39 Air Passengers to and From Semarang, 1974

(Unit: Persons)

	From Semarang (1)	To Semarang (2)	(1)-(2)
Bandung	5,335	439	+4,896
Banjarmasin	186	172	+ 14
Denpasar	7,843	134	+7,709
Jakarta	30,228	48,618	-18,390
Surabaya	11,360	1,932	+9,428

Source: BPS, Air Transport Statistics 1975.

Table 8.40 Weekly Frequency of Flights, March, 1977

(Unit: Times)

Semarang	to Jakarta	38
	to Surabaya	15
	to Bangarmasin	5
	to Pangkalanbun	2
	to Denpasar	7
Surakarta	to Jakarta	7
Yogyakarta	to Jakarta	21
	to Surabaya	6
	to Denpasar	14

Source: Surveyed by Study Team at the Semarang airport.

(1) Except in the case of Banjarmasin, the balances between the departing and arriving passengers at Semarang to and from those towns listed in the table show high disparities between departing and arriving figures. The difference between the numbers of departing and arriving passengers to and from Jakarta almost correspond to the total of the difference to and from Bandung, Denpasar and Surabaya. This may imply that around 20,000 passengers from Jakarta, 42 percent of the total, are stopover passengers at Semarang and move to those three other cities in Java and Bali. From this flow route of the passengers, it may be said that they are all tourists and, to some extent, business passengers who stay at Semarang but do not return to it.

(2) On the other hand, roughly 50 to 60 percent of the total passengers at Semarang airport were the persons coming from Jakarta and returning to Jakarta without going to other cities, according to our analysis. This observation implies that the everyday interrelation between Semarang and Jakarta by air is exclusively and predominantly strong.

08.066 The present weekly frequencies of the flights from the three airports are shown in Table 8.40. This table shows that in respect to frequency of flights, Semarang has far surpassed Yogyakarta and also, the connection to Kalimantan is available only from Semarang. As for Surakarta, the connection to Jakarta is only once a week, and considering the comparatively near distance to Jogyakarta the Surakarta's

connection to East Java and Bali would be through Yogyakarta. It is said that, at every airport in Central Java in the wet season, the number of flights decreases by around 20 percent on account of the rough weather.

8.5.3 Major Issues and Recommendations

08.067 In general, demand for transportation by air is said to be closely related to economic growth of a region. It is, however, too difficult to make a projection of future demand, due to the shortage of data, but the following are some points which can be said from the observations of the existing situation of air transportation in Central Java.

(1) The future demand for air transportation may still grow quite rapidly as a result of the relative superiority in the intermodal competition of transportation especially in the field of passenger carriage. In the competition for passengers the railway system is experiencing serious setbacks on account of the poor condition of the track and rolling stock. The flight time between Semarang and Jakarta is less than one hour, while the travel time by rail is nine and a half hours at best. On the other hand the railway fare has already reached almost half of the air fare. The rehabilitation of railway track may shorten the travel time to a certain extent, but it will not suffice by itself to cut down the wide gap inherent and already evident between the two modes. On the other hand, bus service may be the foremost competing factor with the air system in terms of the tariff as it one-fifth of that by air. However, the gap in terms of travel time is still critical. Thus, although the air fare seems a bit too high, travellers seems to be inclined to choose air transportation, and especially for business purposes which may require occasionally a day trip to and from Jakarta the only choice will be the air travel. The present low level of economic development of Central Java seems to be accelerating this high growth of air passengers. At present, for more economic development, more contact is required with Jakarta, namely the Central Government, to get administrative and financial support. So, roughly speaking, until a certain and substantial level of economic development of the Province is attained, this necessity of close contacts with Jakarta will continue to exist, and after this, new phase of air transportation may start.

(2) Concerning the airport of Surakarta, the factors creating the demand for air transportation are mainly tourism and industry, and as mentioned above the present connection only with Jakarta will suffice for the moment and even the near future, although the frequency of flights to and from Jakarta will have to be increased rather promptly. The length of the runway is good enough and there will be no need to do anything for it. Only the improvement of terminal facilities is required.

(3) The expected industrial development at Cilacap may require, after all, airport facilities for civil aviation. The development is, however, now is in an stagnant stage, and this moment may be the time to improve the land transportation systems instead of air travel for the future balanced industrial development. The reported small-scale airport of Pertamina seems to be out of use now. But there is a plan, which seems to be reasonable, to alter it for civil use in the future. The dimension of the site is around 1 km by 1 km.

08.068 These are the general points observed together with some indications of the future of air transportation in Central Java. At the more practical level, the following have to be noted.

(1) Within 10 years, extensive improvement of the airport facilities of Semarang may be required. This is due not only to the growth of demand for air transportation but to technological innovation of airplanes. By 1984, it may be necessary to carry out a survey to set up the extension program. Considering the difficulty of land acquisition, some premeditation for purposes of the land acquisition will be required if the extension takes the form of relocation of the existing airport.

(2) The extension of the existing runway at the Semarang airport, to 1,650 m, and the improvement of the terminal facilities including the upgrading of related services such as access to and from the city should be made a short-term target.

CHAPTER IX

PUBLIC UTILITIES

CHAPTER IX

PUBLIC UTILITIES

9.1 Electric Power

9.1.1 The Present Situation of the Power Sector

(a) General

09.001 In 1968, just before Repelita I, the total installed power generating capacity of Perusahaan Listik Nasional (PLN) in the entire country was 652.4 (MW) and the total annual power generation was 1,381,711 megawatt hours (MWh). When the purchases of power from outside are included, the total power supply by PLN was 1,756,452 MWh. Of this amount, 82.7 percent was generated within Java, implying per capita supply of 19.6 kilowatt hours (kWh) for Java. This amount was, however, significantly supplemented with power generation in the private sector, the capacity of which was estimated at 547 MW at that time.

02.002 Since Repelita I, the power sector of Indonesia has made remarkable progress. The installed generation capacity of PLN had increased to 1,129.4 MW by 1975 and annual power generation was 2,989,108 MWh (Table 9.1 and Table 9.2). However, the power sector of Indonesia still remains at a low level among Southeast Asian countries, especially in terms of per capita generation, as shown in Table 9.3. The general characteristics of power generation and power sales by PLN as a whole in 1975 are summarized below:

(1) The installed generation capacity was 1,129.4 MW, while the actual generation capacity was 927.5 MW, which was about 82 percent of the installed capacity (Table 9.4).

(2) PLN generated 2,989,108 MWh and purchased 781,186 MWh, totalling to 3,770,294 MWh. However, the sales from PLN 2,803,613 MWh, implying that own consumption and transmission and distribution losses accounted for 25.6 percent on the average (Table 9.5).

Table 9.1 PLN Installed Generation Capacity in kW, 1975/1976

	XII[1/]	XII[1/]	Da[3/]	K[3/]	Whole Java	Whole PLN
Diesel	21,558	43,384	995	13,864	79,801	273,996
Steam	50,000	---	---	150,000	200,000	250,000
Hydro	151,752	39,900	572	90,995	283,219	320,558
Gas	27,500	35,500	---	168,760	231,760	284,860
Total	250,810	118,784	1,567	423,619	794,780	1,129,414
% to whole PLN	22.2 %	10.5 %	0.1 %	37.5 %	70.4 %	100 %
% to whole Java	31.6 %	14.9 %	0.2 %	53.3 %	100 %	na

Notes: 1/ Region XII is for East Java.
2/ Region XIII is for Central Java, Yogyakarta and a part of East Java.
3/ Regions K and Da are for West Java and Jakarta.

Source: PLN Pusat.

Table 9.2 Power Production by PLN in MWh, PLN 1975/76

	XII[1/]	XII[2/]	Da[3/]	K[3/]	Whole Java	Whole PLN
Diesel	39,990	88,969	1,245	26,770	156,974	551,854
Steam	128,836	---	---	628,073	756,909	896,997
Hydro	514,178	201,455	4,479	383,908	1,104,020	1,192,376
Gas	524	64,743	---	204,149	269,416	347,881
Total	683,528	355,167	5,724	1,242,900	2,287,319	2,989,108
% to whole PLN	22.9 %	11.9 %	0.2 %	41.6 %	76.5 %	100 %
% to whole Java	29.9	15.5 %	0.3 %	54.3 %	100 %	na

Note: As in Table 9.1.

Table 9.3 Main Features of Power Sector in Southeast Asian Countries

	Total Installed Generating Capacity (MW)	Aggregated Maximum Demand (MW)	Total Generation (Million kWh)	Per Capita Generation (kWh)	Total Energy Sales (Million kWh)	Total Length of High-Voltage Transm. & Distr. Lines (Circuit km)	Losses (% of Total Energy Generation)	Average Revenue per kWh Sold (US Cents)
Brunei	80.9	-	191.8	1,290.0	91.4	482.6	17.7	-
Burma	262.9	134.8	615.7	21.3	-	13,489.0	-	-
Hong Kong	1,835.4	1,239.0	6,187.7	1,515.0	5,407.4	4,798.8	12.4	2.76
Indonesia	789.0	485.7	2,498.5	20.4	1,892.6	23,486.6	24.2	2.18
Khmer Republic	55.2	-	-	-	-	877.0	-	-
Laos	50.5	-	228.1	73.7	-	374.6	-	-
Malaysia:East:Sabah	52.8	26.0	137.5	190.0	117.9	2,841.7	14.2	4.65
Sarawak	56.3	26.0	118.3[1/]	114.8[1/]	96.5[1/]	993.0[1/]	18.4[1/]	5.28[1/]
West	910.8	-	3,819.0	391.0	3,289.6	16,201.0	13.4	2.50
Philippines	2,449.0	1,371.0	10,398.0	263.2	1,742.4[2/]	16,658.2	-	-
Republic of Viet-Nam	839.0	292.0	1,481.0	77.2	1,093.8	4,524.0	25.8	3.15
Singapore	729.0	527.0	3,142.6	1,464.6	2,776.8	21,697.0	12.1	2.23
Thailand	1,639.4	1,118.0	6,209.6	162.0	5,329.3	17,856.1	14.5	2.19

Note: 1/ Figures only related to Sarawak Electricity Supply Corporation.

2/ Figures only related to National Power Corporation.

Source: United Nations, Electric Power in Asia and the Far East, 1972, 1974.

Table 9.4 Installed Capacity and Capability of Generation in kW, PLN 1975/76

	Installed Capacity (1)		Generation Capability (2)		(2)/(1) (%)
Diesel	273,996	(24%)	200,125	(22%)	73%
Steam	250,000	(22%)	191,000	(20%)	76%
Hydro	320,558	(29%)	283,729	(31%)	88%
Gas	284,860	(25%)	252,700	(28%)	88%
Total	1,129,414	(100%)	927,554	(100%)	82%

Source: PLN Pusat.

Table 9.5 Power Production and Sales in MWh, PLN 1975/76

	Region XIII[1/]		Whole PLN	
Power Production, PLN	355,166		2,989,108	
Purchased from Outside	-		781,186	
Sub-Total	355,166	(100%)	3,770,294	(100%)
Own Consumption and Transmission & Distribution Losses	89,462	(25.2%)	966,681	(25.6%)
Power Sales	265,704	(74.8%)	2,803,613	(74.4%)

Note: 1/ As in Table 9.1

Source: PLN Pusat.

(3) Table 9.6 presents the numbers of consumers and connected capaciteis in Region XIII. Consumers dominant in terms of number are A-1 (flat rate residentials; 52 percent) and B-1 (metered residential; 36 percent).
Consumers dominant in connected capacities are B-1 (31 percent) and E (large consumers over 100 kilovolt ampere [kVA]; 30 percent) followed by B-2 (commercial; 14 percent). Consumers dominant in power sales are B-1 (31 percent) and E (28 percent) followed by A-1 (17 percent) (Table 9.6).

(4) Installed generating capacity of Region XIII (Central Java & DIY) is about 11 percent of the entire PLN and about 15 percent of the PLN operating in Java (Table 9.1). Power production of Region XIII is about 12 percent of the entire PLN or about 16 percent of the PLN operating in Java (Table 9.2).

(5) Own consumption and transmission and distribution losses of Region XIII are estimated to total 25.2 percent; that is they correspond to almost the same value of the average of the whole PLN operation (Table 9.5).

(b) The Power Sector in Central Java

09.003 In 1975, the total load served by PLN Region XIII amounted to about 285 millions kWh (Table 9.7).[1/] The peak load of the PLN systems, at that time, was about 64 MW which consisted of the Tuntang system, 48 MW; the Ketenger system, 11.85 MW; and the local sector, 4.02 MW.

09.004 The PLN systems serving the Central Java area are not a continuous power system at present, although the construction of an interconnector of the Ketenger and Tuntang systems is being carried out between Semarang and Pekalongan. Figure 9.1 presents the power systems existing and under construction in 1976. The Tuntang system, in the eastern part of the Province, serves about 75 percent of the total load in the area with the larger cities of Semarang, D.I. Yogyakarta, Solo, and Magelang. The Ketenger system, in the western part of the Province, serves the town of Tegal, Pekalongan, Purwokerto, and Cilacap and accounts for about 19 percent of the total load in the area. The load served by isolated diesel generation in many surrounding towns accounts for only a minor part of the total.

09.005 The heaviest load concentration is the city of Semarang which accounts for about half of the load in the Tuntang system. Major loads of the rest of the Tuntang system are in D.I. Yogyakarta, Solo, and Magelang. In the Ketenger system, the larger cities and kabupaten

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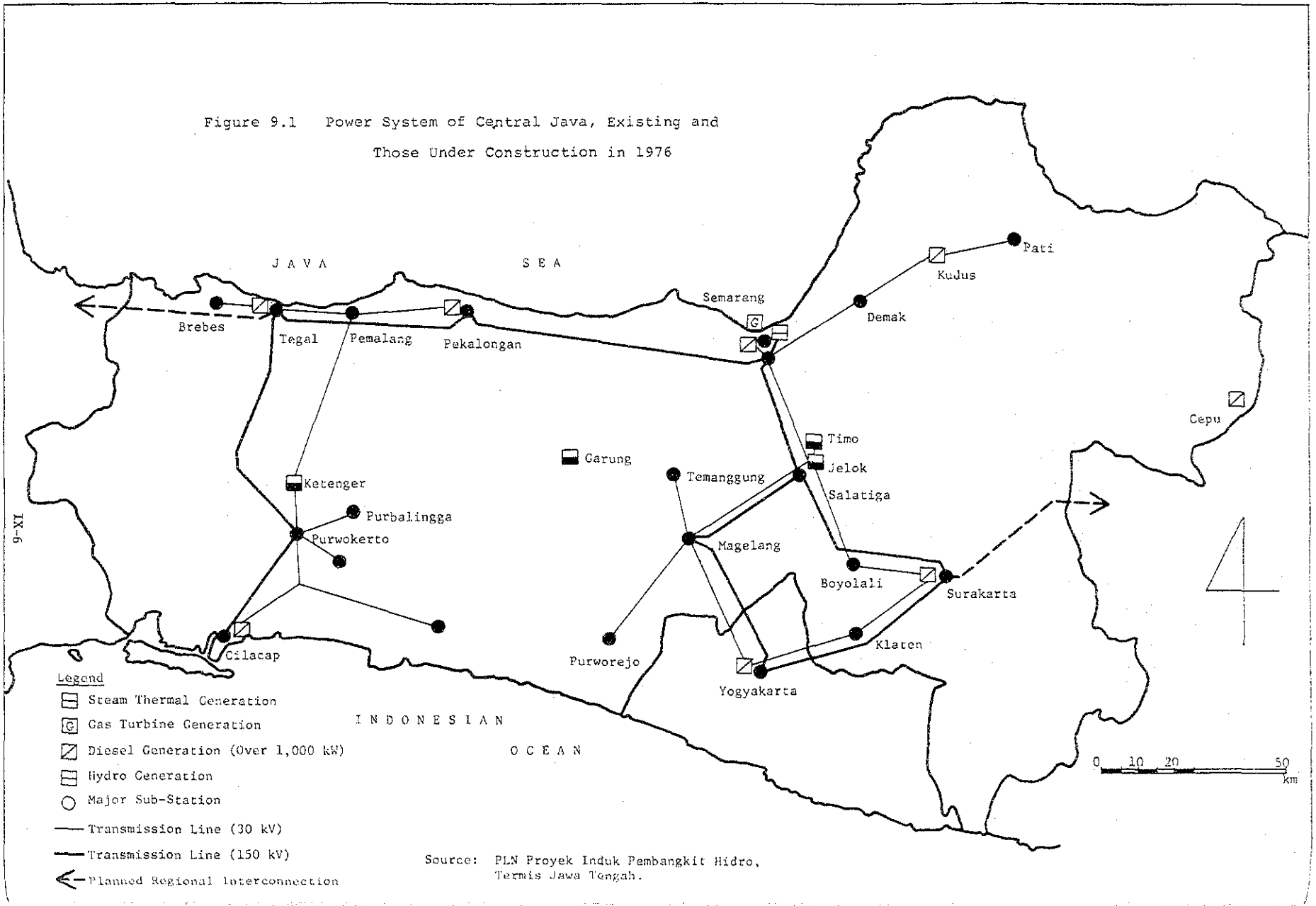
1/ PLN Region XIII serves the Central Java Province, D.I. Yogyakarta and a part of East Java Province.

Figure 9.1 Power System of Central Java, Existing and Those Under Construction in 1976



Source: PLN Proyek Induk Pembangkit Hidro, Termis Jawa Tengah.

Table 9.6 Numbers of Consumers, Connected Capacities, Power Sales by the Tariff Categories, PLN 1975/1976

Code	Categories for Tariff	Number of Consumers		Connected Capacities		Power Sales	
		Number	%	kVA	%	MWh	%
A - 1	Small Residential, Flat Rate	593,674	52.0	82,163	5.8	486,375	17.3
A - 2	Social, Metered	11,441	1.0	31,712	2.2	60,992	2.1
B - 1	Residential, Metered	408,886	35.8	439,415	30.8	803,837	30.8
B - 2	Commercial, Metered	95,327	8.4	198,692	13.9	280,024	10.0
C - 1	Industrial, Metered	5,428	0.5	138,618	9.3	109,624	3.9
C - 2	Office, Metered	17,131	1.5	78,938	5.6	184,650	6.6
D	Street lighting, Metered	1,026	0.1	17,633	1.2	74,721	2.7
E	Large Consumers, Metered	1,044	0.1	429,954	30.1	770,590	27.5
F	Special, Metered	6,788	0.6	9,250	0.7	32,800	1.2
	Total	1,140,745	100.0	1,426,375	100.0	2,803,613	100.0

Source : PLN Pusat.

Table 9.7 Power Generation and Power Sales in MWh, Average Tariff in Rp./kWh, PLN Region XIII, 1968 - 1975

	1968/69	1969/70	1970/71	1971/72	1972/73
1. Power Generation (MWh)	243,529	252,086	266,859	285,314	291,683
2. Power Sales (MWh)	172,794	192,518	201,483	211,282	218,708
3. Average Tariff (Rp./kWh)	6.81	6.71	6.78	7.02	7.14
4. Annual Increase of Av. Tariff (%, 1968/69 as 100)	100	98.5	99.6	103	105
5. Losses in Transm. Distr. & Others (%)	29.0	23.6	24.5	25.9	25.0

	1973/74	1974/75	1975/76	1976/77 (Until Dec. '76)
1. Power Generation (MWh)	322,473	334,039	355,166	279,583
2. Power Sales (MWh)	233,270	243,710	285,249	212,125
3. Average Tariff (Rp./kWh)	10.55	15.11	19.53	26.54
4. Annual Increase, ditto (%)	155	222	287	390
5. Losses in Transm. Distr. & Others (%)	27.7	27.0	19.7	24.1

Notes : Region XIII serves for the Central Java Province, Yogyakarta Special District and a part of East Java Province.
Power Sales and Losses in 1975/76 show slightly different figures from Table 9.5.

Source: PLN Region XIII, for the figures of Power Generation, Power Sales, and Average Tariff.

centers are Tegal and Cilacap, followed by Pekalongan and Purwokerto. They are the same order of magnitude as Magelang in the Tuntang system. Most of the town loads served by isolated generators are relatively small.

09.006 The existing loads served by PLN Region XIII are for predominantly residential and commercial uses, while the load of industrial customers is a minor portion of the total load. Almost all large industrial users in Central Java maintain their own generators. The total peak load of industrial users having their own generators is estimated to be almost equal to the peak load of PLN systems.

(c) Power Generation

09.007 PLN Region XIII has a total installed generating capacity of 123.25 MW, consisting of the following:

	Number of Stations	Installed Capacity (kW)	Station Capable (kW)
Gas Turbine	1	35,900	32,000
Diesel (>1,000 kW)	9	40,576.4	31,510
Diesel (<1,000 kW)	16	7,255.8	5,431
Hydro	3	39,520	28,700
Total	29	123,252.2	97,641

09.008 The actual total capability amounts to about 97.64 MW corresponding to about 79 percent of the nameplate rating (Table 9.8). The Tuntang system has a nameplate generating capacity of 88.53 MW, consisting of a 35.9 MW gas turbine, 32.48 MW of hydro units, and 19.97 MW of diesel units. The actual capability of the Tuntang system amounts to about 71.9 MW. The Ketenger system has a nameplate generating capacity of 24.17 MW, consisting of 7.04 MW hydro units and 17.13 MW diesel units. Actual capacity of the system is limited to aobut 17.0 MW.

09.009 The condition of equipment of many units in both systems appears to be poor and in particular the diesel units' generating capability is about 76 percent of the nameplate rating. Similarly, the generating capacity of isolated diesel units has declined to 8.74 MW, or about 81 percent of the rated capacity of 10.73 MW.

09.010 Water intake problems in the Tuntang and Ketenger systems reduce the hydro capabilities to about 76 percent and 59 percent of the nameplate capacity, respectively, at the optimum conditions.

Table 9.8 Installed Generation in PLN Region XIII, 1976

Type[1/]	Location	Units	Installed Capacity (kW)	Station Actual Capability (kW)	
G.T.	Semarang	2	35,900	32,000	
D	Semarang	6	6,020	3,500	
D	Yogyakarta (old)	4	4,060	2,800	(Yog)
D	Yogyakarta (new)	3	6,450	6,300	(Yog)
D	Kudus	2	1,120	800	
D	Surakarta	2	2,320	1,800	
H	Jelok	4	20,480	14,000	
H	Timo	3	12,000	10,700	
H	Ketenger	2	7,040	4,000	
D	Pekalongan	4	1,684	900	
D	Tegal (old)	5	3,992	2,200	
D	Tegal (new)	4	7,304	7,300	
D	Cilacap	5	4,148	2,600	
D	Jepara	6	397.6	316	
D	Purwodadi	5	823.2	720	
D	Weleri	2	275	180	
D	Cepu	6	4,928	4,000	(E.J.)
D	Lasem	2	530.4	370	
D	Tuban	6	1,354.4	1,010	(E.J.)
D	Sragen	2	500	480	
D	Sukoharjo	2	120	110	
D	Karanganyar	2	120	100	
D	Wonogiri	1	60	55	
D	Wates	5	200	145	(Yog)
D	Wonosari	2	120	110	(Yog)
D	Wonosobo	4	432	365	
D	Banjarnegara	1	256	240	
D	Majenang	2	427.2	390	
D	Bumiayu	2	190.4	150	
	Total	-	123,252.2	97,641	

Note: 1/ G.T. stands for gas turbine generation, D for diesel, and H for Hydro.

Source: PLN Region XIII.

(d) Transmission and Distribution

09.011 The transmission and distribution lines existing in PLN Region XIII are as follows.

High voltage transmission lines, 150 kilovolt (kV)	105 km
High voltage transmission lines, 30 kV	767 km
Medium voltage transmission lines, 20 kV	1,036 km
Medium voltage transmission lines, 15 kV	95 km
Primary distribution lines, 6 kV	1,089 km
Secondary distribution lines, 220/380 Volt (V)	1,388 km
Secondary distribution lines, 127/220 V	1,769 km

09.012 Formerly, the area was supplied by the Tuntang and Ketenger systems at the 30 kV operating level. At present, the construction of the main portions of the new 150 kV transmission system is scheduled to be completed by the end of 1977/78.

09.013 A part of the new 150 kV Tuntang system, namely a single line for the Semarang-Tuntang portion and the Tuntang-Solo portion, is already put into service. The new 150 kV Ketenger system will start operation after the completion of the interconnector in the Pekalongan-Semarang portion and the Semarang steam power plant.

09.014 The Tuntang transmission system serves the eastern portion of the Province, with radial feeders extending to Kudus-Pati in the north and to Purworejo in the south. The Ketenger transmission system serves the western portion of the Province extending to Cilacap and Karanganyar in the south.

09.015 A project of the 150 kV interconnector between Semarang and Pekalongan, which will link the Tuntang and Ketenger systems, is ongoing at present.

09.016 Primary distribution voltage are 6 kV and 20 kV, and the secondary distribution levels are 220/380 V and 127/220 V. It is reported that a certain voltage drop from the nominal service level are quite common throughout the area.

(e) Tariffs

09.017 The power rate or tariff schedule of PLN is presented in Table 9.9. It is characterized by a lower rate for residential customers which constitute a large portion of the total customers and higher rates for commercial sector.

09.018 The tariff is classified in the following categories:

A-1: Small residential use at a flat rate, classified from 60 to 200 volt amperes VA.

Table 9.9 Tariff or Power Rates of PLN, 1973

Tariffs & Purposes	Used Capacity		Consumer Payment per Month
I. Non-Metered, Flat Rate Tariff			
	Capacity	Flat Rate	Max. TBE 1/ Rp./month
A-1. Small residential	60 VA	Rp. 200	Rp. 420
	75 VA	Rp. 250	Rp. 525
	100 VA	Rp. 300	Rp. 700
	125 VA	Rp. 400	Rp. 875
	150 VA	Rp. 450	Rp. 1,050
	175 VA	Rp. 500	Rp. 1,225
	200 VA	Rp. 600	Rp. 1,400
II. Metered Tariff			
	Capacity	Fixed Charge	Energy Charge etc.
A-2. Social	min. 250 VA	Rp. 6/every 25 VA	1. Rp. 6/kWh 2. T.B.E. Rp. 14/kWh
B-1. Residential	min. 250 VA	Rp. 12/every 25 VA	1. Rp. 13/kWh, up to 200 hr/month 2. Rp. 6/kWh, over 200 hr/month 3. T.B.E. Rp. 14/kWh
B-2. Commercial	min. 250 VA	Rp. 27.50/every 25 VA	1. Rp. 20/kWh, up to 200 hr/month 2. Rp. 8/kWh, over 200 hr/month 3. T.B.E. Rp. 14/kWh
C-1. Industrial	min. 13.5 KVA	Rp. 160/every 0.5 KVA	1. Consumption outside peak hours Rp. 10/kWh, up to 150 hr/month 2. ditto: Rp. 6/kWh, over 150 hr/month 3. Rp. 20/kWh for consumption during peak hours. 4. For every kVArh, 2/ according the PLN regulation 5. T.B.E. Rp. 12.50/kWh daytime Rp. 14/kWh night
C-2. Office	min. 250 VA	Rp. 8/every 25 VA	1. Rp. 13/kWh, up to 200 hr/month 2. Rp. 6/kWh, over 200 hr/month 3. T.B.E. Rp. 14/kWh
D. Street lighting			1. Rp. 10/kWh 2. T.B.E. Rp. 7.50/kWh
E. Large Consumers	min. 100 KVA	1. Rp. 460/KVA for the first 400 KVA 2. Rp. 420/KVA for 401-1,000 KVA 3. Rp. 375/KVA for 1,001-2,000 KVA 4. Rp. 275/KVA for over 2,000 KVA	1. Consumption outside peak hours Rp. 5/kWh 2. Consumptions during peak hours Rp. 20/kWh 3. For every kVArh, according to the PLN regulations 4. T.B.E. Rp. 12.50/kWh daytime Rp. 14 kWh night
F. Special	min. 500 VA	---	1. Rp. 30/kWh, min. consumption 20 hr. 2. T.B.E. Rp. 14/kWh

Note : 1/ T.B.E. (Tambahan Beaya Exploitasi), Exploitation charges/Surcharges.
2/ kVArh stands for kilovolt ampere reactive hours.

Source: PLN Region XIII.

A-2: Social use, e.g., schools, hospitals, churches, etc.

B-1: Residential use, min. 250 VA.

B-2: Commercial use, min. 250 VA.

C-1: Industrial use, min. 13.5 kVA. Different rates are applied for during and outside of the peak load hours.

C-2: Office use, min. 205 VA.

D: Street lighting, with only energy charges.

E Large consumers, min. 100 kVA. Different rates are applied for during and outside of the peak load hours.

F: Special use, e.g., temporary use for some days, min. 500 VA, with only energy charges of min. consumption 20 hr per month.

A-1 is a non-metered, flat-rate tariff. The others are metered, composed of fixed charges and energy charges, and some taking into account peak load hours from 5 o'clock in the evening to 6 o'clock next morning.

09.019 The change in the average tariff from 1968 through 1975, calculated in Rp. per kWh, is presented in Table 9.7.

09.020 The average tariff has greatly increased since 1973, in comparison to the 1968 level to the extent that resulting doubled in 1974 and almost tripled in 1975. This increase appears to be due to the introduction of T.B.E. (Exploitation Charges) under the article of electric basic tariff, 1973, by PLN regulations.2/

9.1.2 The Development of Power Sector

(a) Development in the Past

09.021 The development of the power sector in Central Java since Repelita I is presented in Table 9.10. The major projects completed during this period are:

(1) Gas turbine generaiton unit II at Semarang with 1 x 21.5 MW,
(2) Diesel generation project at D.I. Yogyakarta with 3 x 2.15 MW,
(3) Diesel generation project at Purwodadi with 2 x 250 kW,
(4) 150 kV transmission lines 150 km in length for the Tuntang system,
(5) 20 kV transmission lines 64 km in length around Cepu,

2/ Tambahan Beaya Exploitasi, Pasal 7 Tarip Dasar Listrik 1973.

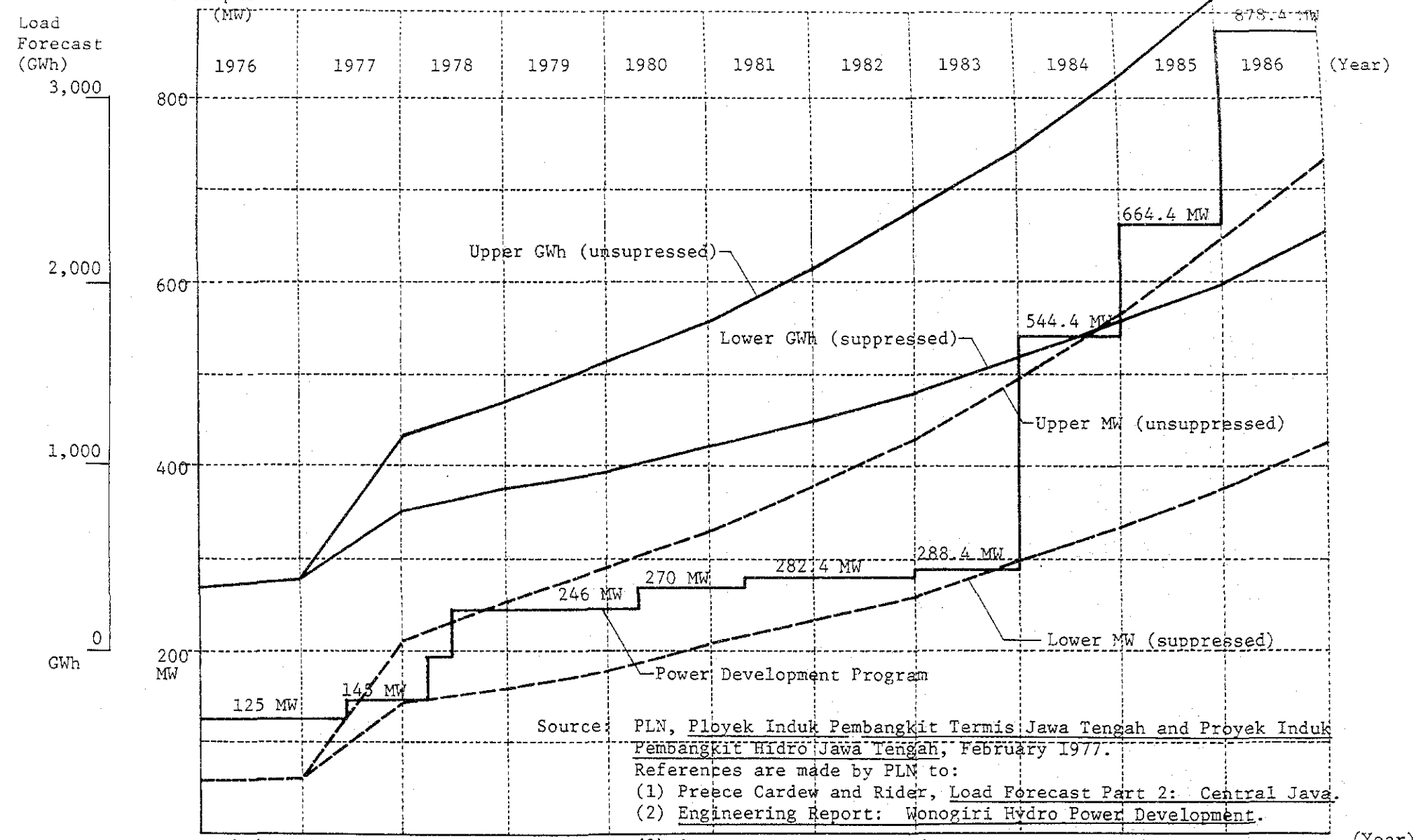
Table 9.10 Development Programs of the Power Sector in Central Java, PLN, During Repelita I & II

Projects	Capacity	Repelita I					Repelita II				
		69	70	71	72	73	74	75	76	77	78	79
I THERMAL GENERATION												
S Semarang	2x50MW									Unit I: Dec. '77	Unit II: Apr. '78	
G Semarang	1x21.5MW						unit II					
G Semarang	1x20MW									unit III		May '77
D Yogyakarta	3x2.15MW											
D Purwodadi	2x250kW											
II HYDRO GENERATION												
H Garung	2x12MW											compl. '80
III TRANSMISSION												
Tuntang System:												
Transm. 105 kV	150 km											
(West SMR-Jat, Jat-East SMR, and East SMR-West Solo)												1st Quarter
Transm. 20 kV	64 km + 2,307 km											
Substa. 150 kV x 7	122 MVA											
Substa. 20 kV x 2	2.6 MVA											
Interconnection:												
Transm. 150 kV	270 km											'78
(SMR-Pekal., and SMR-Magel.-Yogya.-Solo)												
Substa. 150 kV	8, 124 MVA											
Ketenger System:												
Transm. 150 kV	177 km											compl.
(Pekal.-Tegal-Cilacap)												
Substa. 150 kV x 3	70 MVA											almost compl.
IV DISTRIBUTION												
Tuntang System	1,489 km											
Ketenger System	1,286 km											

Source: PLN Proyek Induk Pembangkit Termis Jawa Tengah.

Power Development

Figure 9.2 Preliminary Load Forecast and Power Development Program



Source: PLN, Ployek Induk Pembangkit Termis Jawa Tengah and Proyek Induk Pembangkit Hidro Jawa Tengah, February 1977.

References are made by PLN to:

(1) Preece Cardew and Rider, Load Forecast Part 2: Central Java.

(2) Engineering Report: Wonogiri Hydro Power Development.

(3) Serayu River Basin Study Feasibility Report, Vol. 6: Hydro-electric Power Development, and

(4) Rencana Pengembangan dan Pemanfaatan Sumber-sumber Air Dikawasan Kedu Salatan (Dulang Mas).