6-2 Economic Analysis

6-2-1 Methodology

Economic analysis is conducted under the principle of "with and without the project". Transport services to satisfy estimated traffic demand in the future would be provided by two transportation systems which cover the cases of both with and without the project, and the sum of investments required and the economic benefits of the two cases are compared and evaluated.

(1) "With the project" and "without the project"

"With the project" ..... The case where the project is implemented
"Without the project"..... The case where the project is not implemented and traffic demand is satisfied by the existing transportation system

(2) Benefits and costs to be included in the analysis

(a) Benefits of possible savings in both time and cost to be generated by the project.

(b) Costs of purchase and maintenance of:
Railway facilities (civil structure/track, electrification facilities, signalling/telecommunication, workshop and container handling facilities), rolling stock (electric locomotives, diesel locomotives, coaches, wagons, containers, inspection cars), railway right of way, motor vehicles (car, bus, lorry), aircrafts for domestic air transport and vessels for coastal shipping.

(3) Valuation

The value of goods and services related to transportation facilities are based on economic prices which are determined by adjusting market prices in accordance with certain criteria. (See 6-2-2,(3).)

(4) Criteria for project evaluation

In general, the project is evaluated in accordance with the following three methods;

When B_i: benefit in the year;
C_i: cost in the year;
r : discount rate

(a) Net Present Value (NPV)

$$NPV = \sum_i \frac{Bi}{(1+r)^i} - \sum_i \frac{Ci}{(1+r)^i}$$

Given as the difference between the present value of total benefits and costs during the project life which are determined by discounting benefits and costs in each period using a certain rate.

(b) Benefit/Cost Ratio (BCR)

$$BCR = \sum_i \frac{B_i}{(1+r)^i} \Big/ \sum_i \frac{C_i}{(1+r)^i}$$

Given as the ratio of the present value of the benefits with the present value of the costs during the project life.

(c) Economic Internal Rate of Return (EIRR)

$$\phi(\rho) = \sum_i \frac{B_i}{(1+\rho)^i} - \sum_i \frac{C_i}{(1+\rho)^i}$$

Given as the value ρ representing a discount rate by which the present value of the benefits equals the present value of the costs during the project life.

This analysis is conducted using the EIRR in (c) which is widely used in project evaluation.

6-2-2 Assumption

The economic analysis is based on the following assumptions;

(1) Traffic volume

It is assumed that the railway will serve the following three types of traffic demand;

(a) Ordinary traffic volume: Traffic volume which will exist even if the project is not executed.

(b) Converted traffic volume: Traffic volume which will be attracted from other modes (motor vehicles, aircrafts and coastal ships) to the railway due to the project.

(c) Induced traffic volume: Traffic volume which is generated as a result of the railway's advantages (reduced travel time, improved amenities and higher safety) due to the project.

Ordinary and converted traffic volumes are estimated in terms of passenger-km for passenger traffic and ton-km for goods traffic on the basis of demand forecast by mode in Chaper 2. Passenger traffic volume is divided into business and non-business purposes, 80% for the former and 20% for the latter, on the basis of "Tourist Statistics in Brief 1979, TDC Malaysia" and taking into consideration future various changes (increased income, change in social structure and increased free time).

(2) Establishing the alternative

As alternative transportation systems in the case of "Without", to satisfy the future traffic demand when the project is not implemented, road transport (car and long-distance bus), air transport and rail transport (existing railway) are considered for passenger transport. And as for goods transport, road transport (lorry), coastal shipping and rail transport (existing railway) are considered. In formulating the alternatives, the characteristics of rail passenger travel (trip purpose, distance and frequency), characteristics of rail goods (type of goods, transport route and distance) are considered. Road network and capacity (including planned roads), domestic air transport network and airport facilities, and coastal shipping transport and port facilities are also taken account of. They are evaluated as to their suitability for the case of "Without the project" in terms of intermodal competition and modal capacity on the basis of information obtained from available materials and interviews with personnel from the Highway Planning Unit, Malaysian Airline System and Malaysian International Shipping Corporation as well as transportation plans of major industries.

(3) Market price versus economic price

Market prices are adjusted in accordance with the following procedures.

(a) Imported equipment/material cost

Because no customs would be imposed on most of equipments, and materials to be imported for this project (according to Malaysia Import Customs Rate Table), the import surtax (5%) is deducted from the import prices.

(b) Labor cost (domestic portion)

Personal income tax is deducted from the labor cost with reference to Malaysia Income Tax Table.

(c) Equipment/material cost (domestic portion)

Sales tax (5%) is deducted from the equipment and material cost to be domestically procured.

(d) Power cost

Since diesel oil is government subsidized for the purpose of keeping fares & tariffs at low levels, the subsidy is added to the market price.

(e) Others

Price distortion of land price, equipment/material prices and foreign exchange rates are not adjusted in this analysis since the Malaysian economy is generally operated under free competition and useful data are not sufficient. However, wage rates for unskilled workers are multiplied by 0.7 (income adjustment factor) which is determined in consideration of GDP per capita in the agriculture/fishing and construction sectors. The market prices are based on average prices in 1983 or 1984. Future potential inflationary factors are not incorporated into market prices in accordance with the general principle.

(4) Project life

The life of the project is established for each case on the basis of economic and physical life of facilities and maintainability, as follows;

Case I	1986	-	2030	: 45 years
	Construction periods		1986 - 1990	
			1991 - 1995	
			2000 - 2004	
			2005 - 2009	
Case II	1986	-	2018	: 33 years
	Construction periods		1986 - 1990	
			1991 - 1995	
Case III	1986	-	2015	: 30 years
	Construction period		1986 - 1990	
Case IV	1986	-	2018	: 33 years
	Construction periods		1986 - 1990	
			1991 - 1995	

(5) Construction schedule

Construction schedule for the project is assumed as follows;

Table 6-2-1 Construction Schedule

unit : percentage

Items \ Year	1	2	3	4	5	
Land acquisition	50	50				
Structure	15	20	30	30	5	
Track		30	45	20	5	
Electrification						
Signalling		20	30	45	5	
Telecommunication						
Rolling stock				30	70	
Workshop			20	50	30	
Container handling facilities				60	40	
Miscellaneous					100	

Table 6-2-2 Track-Doubling Schedule

unit : percentage

Items \ Year	1	2	3	4		
Structure	30	40	20	10		
Track		30	50	20		
Electrification, signalling, telecommunication		20	50	30		
Rolling stock			30	70		
Workshop			20	80		
Container handling facilities			60	40		
Miscellaneous				100		

These construction schedules are used as indications of progress of physical work in the economic analysis and as indications of capital expenditure in the financial analysis.

(6) Treatment of MRA land

Assuming that the land of approximately 714,000 m^2 in the Sentul and Brickfields areas used for workshop and yard can be converted to other uses if the project is implemented, the land values of approximately 1.3 billion M$ are accounted as negative investment cost.

6-2-3 Economic benefits

(1) Time saving benefit

(a) Reduced travel time

Because the time required for moving from one place to another is considered as having opportunity cost, the time saving effect due to faster transport service is valued as a benefit of the project. Travelling during business hours is assumed to cause loss in work time and production. The same logic can be applied to movement during non-business hours because it would cause disutility by restricting the available leisure hours.

To assess the time saving benefit of the project, average travel time per unit distance for the existing railway, road, air, water transport (each including access/egress time, check-in time and loading/unloading time) is determined for "Without the project" case. At the same time, the average travel time required for the railway after completion of the project is estimated. Then the average travel time saving as a result of the project (due to electrification, curvature improvement, new facilities, gauge change and partial double-tracking) is obtained by comparison.

Passenger transport

Unit: h/km

Existing line	0.0270
New Railway (inter-city)	0.0130
New Railway (Kuala Lumpur area)	0.0333
Bus (inter-city)	0.0263
Bus (Kuala Lumpur area)	0.0667
Car	0.0169
Airline	0.0109

Goods transport

Unit: h/km

Existing railway	0.1617
Projected Railway	0.0696
Lorry	0.0348
Coastal ship	0.0964

(b) Time value

Time values of passengers

The mean income of rail, bus, car and air passengers in calculating time value lost while travelling is determined as follows;

(i) For rail and bus passenger, mean wage rates in 1984 for general clerical workers, production workers and lower/middle management class.

(ii) For car and air passengers, mean wage rates in 1984 for senior engineers and management class.

On the other hand, the time value of passengers making non-business trips is judged to be 25% of the total time value of passengers on business trips, on the basis of the study by I.G. Heggie (p. 88, Transport Engineering Economics).

The time value of goods carried is obtained for major commodities (petroleum, palm oil and cement); weighted average by application of the goods loading ratio of each traffic mode (railway, lorry, coastal ship) to average prices in 1984 is obtained, and is adjusted by interest rate per unit time to obtain the time value.

General clerical worker/production worker	8,160 M$/year
Senior engineer/management class	21,840 M$/year
Palm oil	980 M$/t
Petroleum	553 M$/t
Cement	186 M$/t
	(indicated in economic price)
Interest rate on short-term loans	14% p.a.

(2) Cost saving benefit

The cost saving benefit is determined as the difference of maintenance, replacement, payroll and power costs between the "with the project" and "without the project" cases.

(a) Railway

For the case of "with the project", a maintenance operating system is determined for each type of facilities, and the equipment/materials and personnel costs necessary to maintain the facilities are estimated, and finally, power, personnel and head office administration overhead as may be necessary for management and operation of the railway business are estimated.

For the case of "without the project", actual operating and maintenance costs in MRA (1982 and 1983) are adjusted in accordance with the increased rail traffic volume forecasted for the case.

(b) Road

Operating and maintenance costs for cars are estimated for selected types of vehicle; TOYOTA CAROLLA 1200, DATSUN 120Y and MERCEDES BENZ 200 for passenger cars, MERCEDES BENZ 1113/44 (44 passengers) for buses, and BEDFORD J5L25 and MERCEDES BENZ LP709/42 (9 ton) for lorries. Maintenance, replacement, fuel, oil and crew wage costs for the above vehicles are estimated on the basis of data obtained by Highway Planning Unit and Ministry of Works.

(c) Coastal shipping

Maintenance, replacement, fuel and crew wage costs for 4,000 t class ships are estimated on the basis of data obtained by interviews with the Malaysian International Shipping Corporation.

(d) Air transport

Maintenance, replacement, fuel and crew wage costs for B-737 jets are estimated on the basis of interviews with the Malaysian Airline System.

(e) Unit costs

Road

		Car	Bus	Lorry
Crew wage cost	(M$/year)	7,500	16,200	12,100
Maintenance cost	(M¢/km)	3.4	8.8	14.2
Fuel cost	(M¢/km)	6.5	6.6	9.2
Oil cost	(M¢/km)	0.5	0.9	0.9
Tire cost	(M¢/km)	1.6	14.0	10.2

Air

Crew wage cost	(M$/year)	375,000
Maintenance/replacement costs	(M$/km)	11.2
Fuel cost	(M$/km)	79.5

Coastal shipping

Crew wage cost	(M$/year)	600,000
Maintenance/replacement costs	(M$/km)	13.5
Fuel cost	(M$/km)	11.9

(All costs are indicated in economic price)

(3) Other benefits

This economic analysis is confined to time saving and cost saving benefits which are generally used in the evaluation of tansportation projects. In addition, the following benefits, (a) through (g), are considered to result from this project. These benefits are not included in this analysis because of data constraints, and the fact that a uniform approach for evaluating these data has not yet been developed. Nevertheless, they should be reflected in the final evaluation of the project.

(a) Multiplier effect

According to the Keynesian theory, one unit of investment increases GDP directly or indirectly, up to the level reached through multiplying the amount of original investment by the reciprocal of the marginal propensity to save.

(b) Employment generation effect

In addition to employment which will be directly generated by the project, increased GDP (because of (a)) is expected to generate other employment opportunities.

(c) Effect to stimulate industrial structure evaluation

Since more people and goods can be transported faster and more cheaply after the project, the industrial structure is expected to undergo a metamorphosis to higher value-added sector-oriented.

(d) Effect to stimulate travel

New traffic demand will be induced by introducing a new railway system. Also, increases in income level and free time will generate additional traffic demand.

(e) Regional development effect

With a transportation project and accompanying infrastructure development, economic development of certain regions can be accelerated.

Particularly, the New East-West Railway, when combined with an east coast development project, is expected to accelerate the development of the region.

(f) Technological transfer effect

This project will bring advanced technologies in various fields to Malaysia, to stimulate modernization of local industries.

(g) Pollution reduction effect

Electrified railways produce less air pollution than other modes.

6-2-4 Composition of investment

The amount of investment used for this analysis is calculated as the total investment in the "with the project" case in excess of the total in the "without the project" case, i.e., incremental cost.

(1) "With the project" case

The amount of investment for this case is basically the same as the one shown in Chapter 4, except for the following points;

(a) Market prices are converted to economic prices.

(b) Reinvestment after depreciation and residual value at the end of project life for the facilities are included. Each facility is assumed to be depreciated over the following years (in accordance with JNR and MRA standards);

Track/structure	68 years
Electrification facilities	30 "
Signalling/telecommunication	20 "
Workshop building	35 "
Workshop equipment	12 "
Container handling facilities	5 "
Miscellaneous (automatic ticketing machine, air-conditioning systems)	15 "
Rolling stock	
Electric locomotive	20 "
Diesel locomotive (Large-size)	20 "
do.(Small-size)	10 "
Coach (Super express, express)	20 "
do.(Ordinary)	25 "
do.(KL urban)	25 "
Wagon (Express container)	25 "
do.(Container)	25 "
do.(Tank, hopper)	25 "
Inspection car	10 "
Container	5 "

(2) "Without the project" case

The following investment items and amounts are included in this case. The amounts are determined on the basis of interviews with the Highway Planning Unit, Highway Authority Malaysia, Ministry of Transport, Malaysian Airline System, and Malaysian International Shipping Corporation.

(a) Road

Car (TOYOTA CAROLLA 1200, DATSUN 120Y, MERCEDES BENZ 200)	11,988 M$
Bus (MERCEDES BENZ 1113/44)	83,011 M$
Lorry (BEDFORD J5L25, MERCEDES BENZ LP709/44)	42,900 M$

(b) Air

Aircraft (B-737)	30 mil. M$

(c) Coastal shipping 13 mil. M$

(All amounts are indicated in economic price)

6-2-5 Result

On the basis of costs, benefits and investment given in the previous sections, the EIRR is calculated for each case, as follows;

(a) Case I 14.1%
1986 to 1990 : Port Kelang to Paka
1991 to 1995 : Kuala Lumpur to Singapore
2000 to 2004 : Kuala Lumpur to Butterworth
Paka to Kota Bharu
2005 to 2009 : Almost all of the single track sections in the network will be double-tracked.

(b) Case II 13.5%
1986 to 1990 : Port Kelang to Paka
1991 to 1995 : Kuala Lumpur to Singapore

(c) Case III ... 13.3%
(1986 to 1990 : Port Kelang to Paka)

(d) Case IV 13.3%
1986 to 1990 : Port Kelang to Janda Baik
1991 to 1995 : Janda Baik to Paka

Note: Assumptions made for the calculation (traffic volume, alternative mode, valuation criteria, project life and construction schedule) are described in 6-2-2. The benefits included in the analysis (time saving and cost saving) are described in 6-2-3, and the investment items (for "with the project" and "without the project" cases) are described in 6-2-4.

Cost and benefit in each year for Cases I - III are shown in Fig. 6-2-1.

6-3 Financial Analysis

6-3-1 Basic concepts

Financial analysis is carried out to determine the profitability of a given project by calculating the Financial Internal Rate of Return (FIRR). FIRR is defined as the discount rate (ρ) at which $\phi(\rho) = 0$ is obtained in the following formula:

$$\phi(\rho) = \sum_{i} \{(Ri - Ci)/(1 + \rho)^{i}\}$$

where;

R_i = operating profit (before depreciation) in the year i and residual value

C_i : construction cost in the year i

FIRR suggests the porofitability of the project and thus its financial viability.

If a project is considered feasible in the economic analysis but evaluated otherwise in the financial analysis, the project will place financial burdens on the national economy. Therefore, the objective of financial analysis is to evaluate the project's profitability and cash flow over its life, repayment schedule for investment, and determine the optimum scheme of financing to cover investment costs. Also considered is how the negative cash flow during the project can be supplemented by government subsidies and short-term loans.

6-3-2 Scope of analysis and assumption

(1) Items to be included in the analysis

Items included in this analysis are operating revenue generated by the project (Passenger traffic in terms of passenger-km × unit fare, goods traffic in terms of ton-km × unit tariff), oeprating expense required for the project (maintenance, replacement, personnel, power and administration costs) and capital expenditure (track/structure, electrification facilities, signalling/telecommunication, rolling stock, workshop, container handling facilities and land acquisition).

(2) Assumption

(a) All costs and expenses related to the project are valued at market price. In addition, an annual price escalation rate of 5% is assumed during the project life, with reference to past records (consumer price increased at an annual average rate of 5.9% and the GDP deflator at 7.0% in the 1970's, and 6.0% and 3.7%, respectively, in the early 1980's).

(b) Fares and tariff for the New East-West Railway and the West Coast Railway are estimated with reference to the present system, as follows.

Fares : Super express trains ..... M¢6.56/person km
Express trains ..... M¢5.47/person km
KL urban trains ..... M¢3.36/person km

Tariffs: Container train ..... M¢7.56/ton km
Carload train ..... M¢6.30/ton km

Present fares and tariffs (as of August 1st 1984)

Express Rakyat ..... M¢5.47/person km
Ordinary third class ..... M¢3.36/person km
Goods tariffs (average of 19 items) ..... M¢6.30/ton km

Basically, the level of these fares and tariffs in relation to that of the existing railway and other modes is maintained. However, the fare for express trains of the new railway is set 20% above that for Express Rakyat because of reductions in travel time and better amenities. Also, the tariff for container trains of new railway is set 20% above that for carload trains in consideration of reduction in time (including loading/unloading time), easier loading/unloading work and better connections with other modes. Finally, a decrease in actual revenues due to inflation is assumed to be compensated by equivalent annual rate increases.

(c) The amount of investment is basically the same as the one shown in Chapter 4, to which reinvestment after depreciation and residual value at the end of project life for the facilities are added in the manner described in 6-2-4 and 5% escalation per year is added. The project life and construction schedule are same as 6-2-2.

(d) It was assumed that the investment required for each construction stages would be financed from the following sources;

Equity and/or subsidy (including sales proceeds of land): 50%

Long-term loan (10% interest per year, 10 year maturity, and 5 year grace period): 50%

The portion other than the above investment, (e.g., reinvestment after depreciation, additional purchase of rolling stock) would be financed by available cash of the project or otherwise short-term loans (10% interest per year and is to be subsidized).

6-3-3 Result

(1) FIRR

On the basis of assumptions, operating income and expense as well as investment amount given in the previous sections, FIRR for the four cases are calculated as follows;

CASE I	11.5%
CASE II	8.5%
CASE III	5.9%
CASE IV	6.8%

Basic assumptions made for the calculation (fare and tariff setting, inflation rate, project life), operating income and expense along with investment are described in 6-3-2.

(2) Cash flow

Finally, cash flow for each case is calculated as follows; (all amounts are indicated in current price)

(a) Case I

Equity and/or subsidy			10,446 mil.M$
Long-term loan			10,446 mil.M$
Debt service coverage ratio			
	(Lowest)	-	(Highest)
1991 - 2000	0.36	-	1.09
2001 - 2010	1.35	-	2.45
2011 -	3.02	-	5.08
Working capital required (mil.M$)			
	(Lowest)	-	(Highest)
1991 - 2000	121	-	345
2001 - 2010		NIL	
2011 -		NIL	
Maximum cumulative working capital required			1,563 mil.M$ (1999)
Year of final maturity of long-term loan			2019

(b) Case II

Equity and/or subsidy			3,470 mil.M$
Long-term loan			3,470 mil.M$
Debt service coverage ratio			
	(Lowest)		(Highest)
1991 - 2000	0.36	-	1.09
2001 - 2010	1.34	-	77.19
2011 -		NIL	

Working capital required (mil.M$)

	(Lowest)	-	(Highest)
1991 - 2000	121	-	345
2001 - 2010		NIL	
2011 -		NIL	

Maximum cumulative working capital required 1682 mil.M$ (2000)
Year of final maturity of long-term loan 2005

(c) Case III

Equity and/or subsidy 1,903 mil.M$
Long-term loan 1,903 mil.M$

Debt service coverage ratio

	(Lowest)	-	(Highest)
1991 - 2000	0.36	-	0.70
2001 - 2010	2.10	-	23.01
2011 -		NIL	

Working capital required (mil.M$)

	(Lowest)	-	(Highest)
1991 - 2000	86	-	524
2001 - 2010		NIL	
2011		NIL	

Maximum cumulative working capital required 2,391 mil.M$ (2000)
Year of final maturity of long-term loan 2000

(d) Case IV

Equity and/or subsidy 2,147 mil.M$
Long-term loan 2,147 mil.M$
Debt service coverage ratio

	(Lowest)	-	(Highest)
1991 - 2000	0.00	-	0.83
2001 - 2010	0.72	-	82.07
2011 -		NIL	

Working capital required (mil.M$)

	(Lowest)	-	(Highest)
1991 - 2000	86	-	243
2001 - 2010	146	-	200
2011 -		NIL	

Maximum cumulative working capital required 2,013 mil.M$ (2003)
Year of final maturity of long-term loan 2005

The cash flows are summarized in Fig. 6-3-1 and 6-3-2. In these graphs, blank bars represent the sum of capital expenses (each construction cost for track/structure, electrification facilities, signalling/telecommunication, rolling stock, workshop, container handling facilities, land cost, etc., the interest of its fund during construction term, reinvestment after depreciation and additional procurement cost of rolling stock) and operating expenses (maintenance, replacement, personnel and power cost). On the other hand, solid bars represent operating revenue from passenger and goods services. Broken lines represent outstandings of short-term loans and long-term loans.

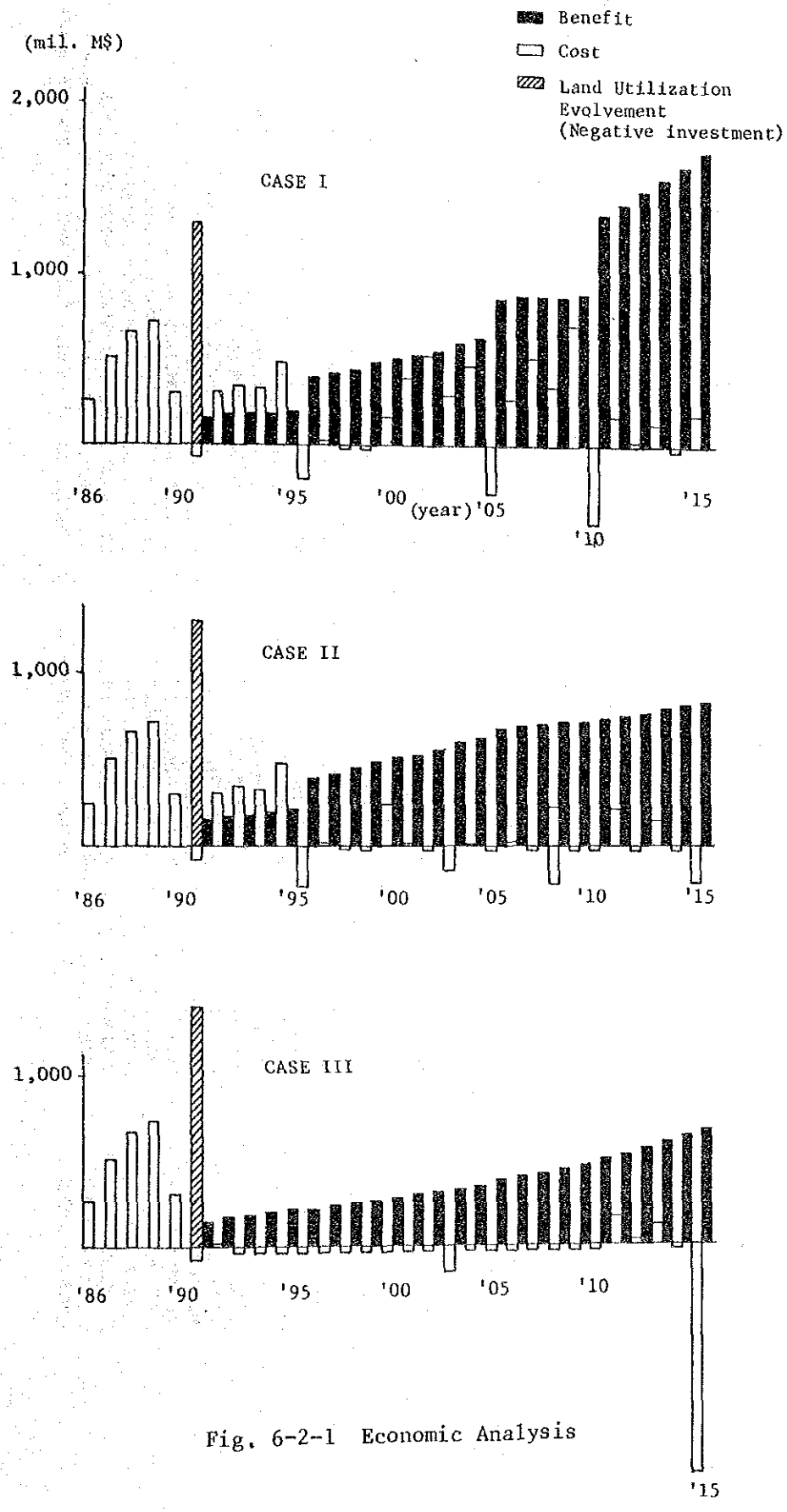


Fig. 6-2-1 Economic Analysis

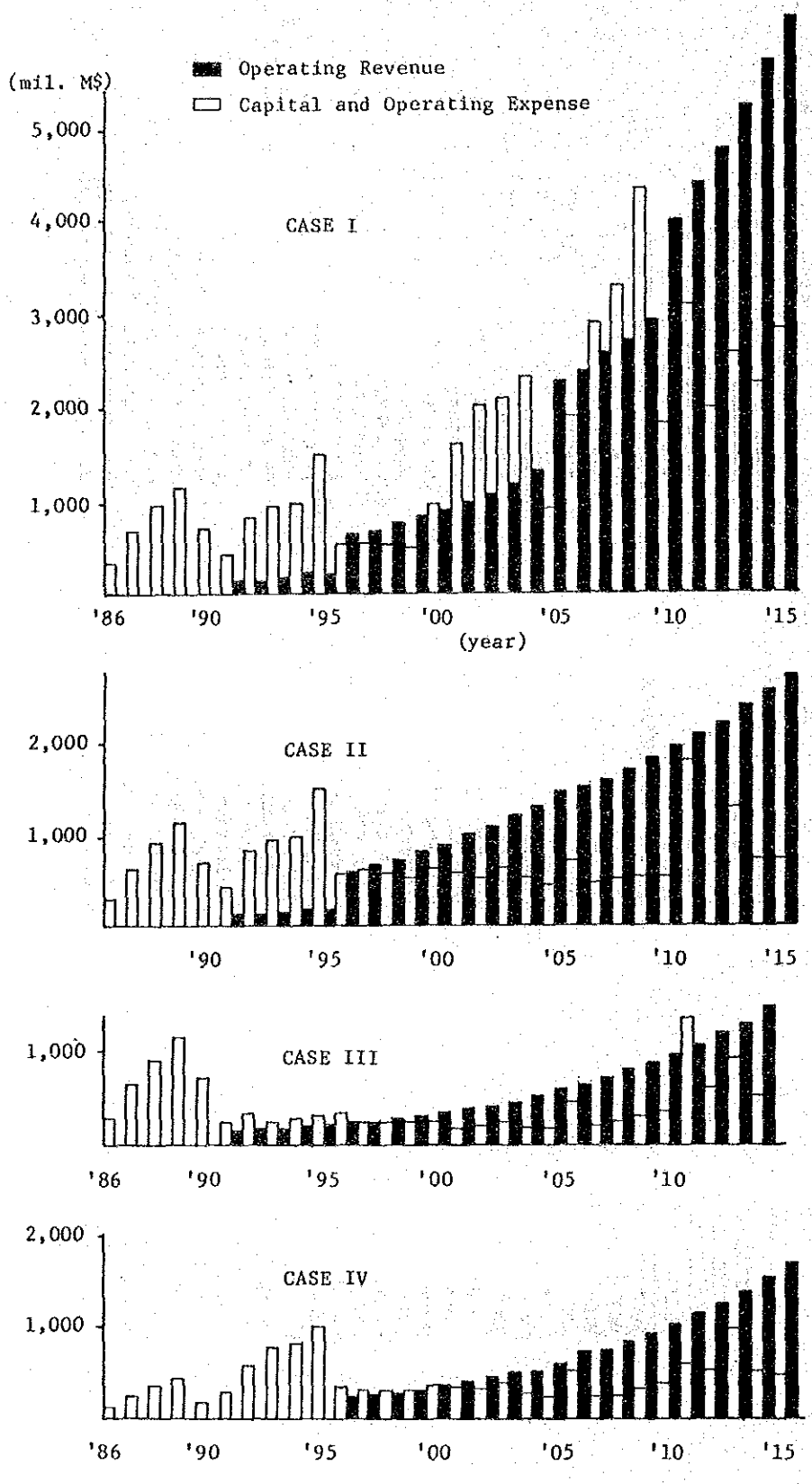


Fig. 6-3-1 Financial Analysis

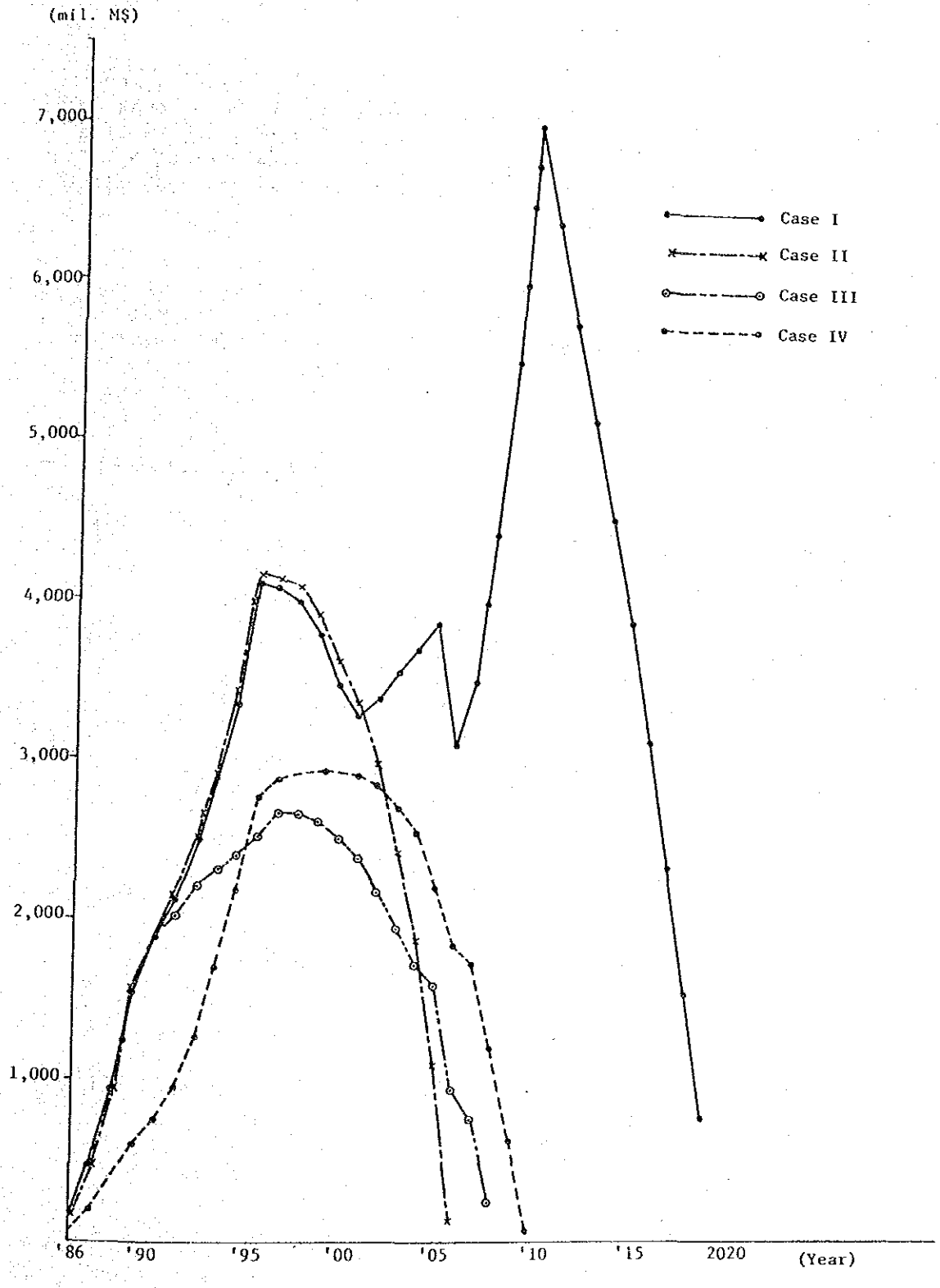


Fig. 6-3-2 Outstandings (Long-term loan and short-term loan)

6-4 Sensitivity Analysis

6-4-1 Basic concept

Social and economic framework (economic growth rates, population growth rates, distribution of national wealth among regions, income groups, etc.) may deviate from goals in the long project life. The deviation will give rise to changes in projected traffic demand generation/distribution, cost estimates, etc., and accordingly, irregularities in FIRR and cash flow.

6-4-2 Methodology

To simplify the work, three unfavorable and two favorable deviations are assumed, each at a discretionary rate. Their impacts are probed for each deviation on FIRR and on cash flow.

(1) Unfavorable deviations

		Deviation compared with Base Case
(a)	Decrease in traffic	-30%
(b)	Increase in construction cost	+30%
(c)	Delay in industrial development in the east coast (Trengganu zones ① & ②)	
	- Population growth rates (1985 - 1990) 2.6% → 2.5% (1990 - 2005) 2.35% → 2.3%	
	- GDP growth rates (1985 - 1990) 7.31% → 6.0% (1990 - 2005) 6.23% → 5.0%	
	- Steel and Petroleum production	-30%
(d)	Delay in construction	+5 years
(e)	Decrease in equity and/or subsidy ratio (probed to see the impact of a hypothetical extreme)	-50% (financed all by loan)

(2) Favorable deviations:

		Deviation compared with Base Case
(f)	Increase in equity and/or subsidy ratio	+20% (i.e. equity and/or subsidy ratio at 70%)
(g)	Increase in inter-city passenger fare rate	+50%
	With resultant decrease in traffic due to fare raise	-10%

Impacts from other favorable deviations, such as a higher case in GDP growth rate, are not calculated, because an approximate value of impact could be obtained using Tables 2-4-4, 2-5-6 and Figures 6-4-1 and 6-4-2.

(3) Result

The results are given in Table 6-4-1, and commented in 6-5-4.

Table 6-4-1 Result of Sensitivity Analysis

	Item	FIRR (%)	Cash Flow		
			Debt Service* Coverage Ratio min. - max.	(Unit: mil. M$) Working Capital Required (WCR) * min. - max.	(Unit: mil. M$) Cumulative WCR max. (in year ---)
	Base Case	5.9	0.36 - 0.70	86 - 524	2,391 (2000)
(a)	30% decrease traffic	2.9	0.13 - 0.57	145 - 596	3,104 (2000)
(b)	30% increase in construction costs	4.0	0.23 - 0.61	158 - 739	3,683 (2000)
(c)	Delay in industrial development in the east coast - GDP/population growth rate at national average - 30% decrease in Steel/Petroleum production	(5.0) obtained from Fig. 6-4-1.	-	-	-
(d)	5 year delay in construction period	5.9	0.55 - 0.94	176 - 522	2,269 (2005)
(e)	50% decrease (i.e. 0%) in equity and/or subsidy ratio	5.9	0.16 - 0.54	311 - 1198	6,434 (2000)
(f)	20% increase (i.e. 70%) in equity and/or subsidy ratio	5.9	0.62 - 1.04	6.3 - 284	950 (2000)
(g)	50% raise in inter-city passenger fare with 10% decrease in traffic	7.1	0.36 - 0.79	53 - 482	1,980 (2000)

Notes: 1. * During the first decade (i.e. 1991 - 2000)
2. WCR is in current price.

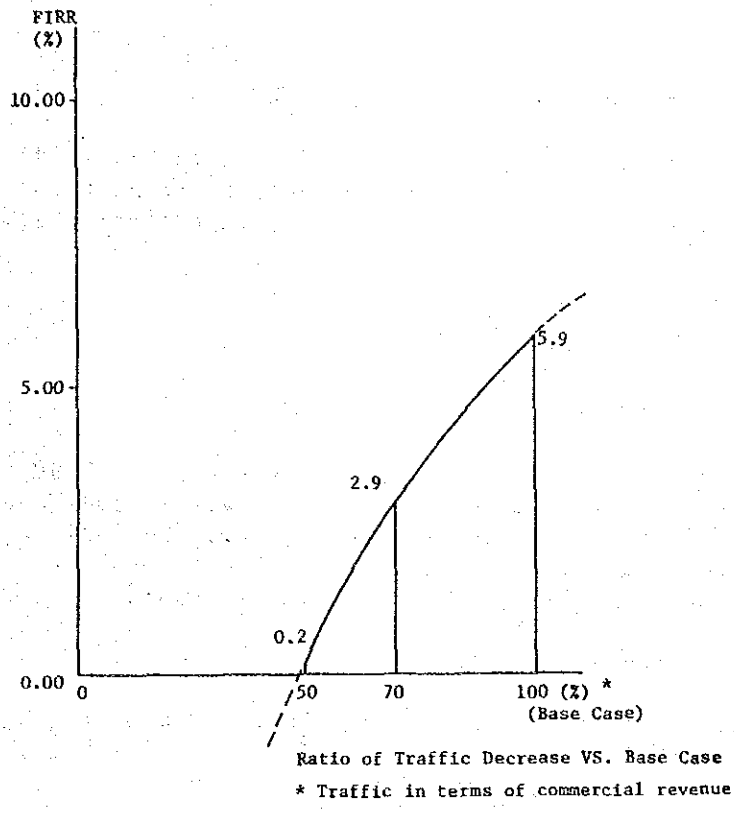


Fig. 6-4-1 Relationship between Traffic Decrease and FIRR (Case III)

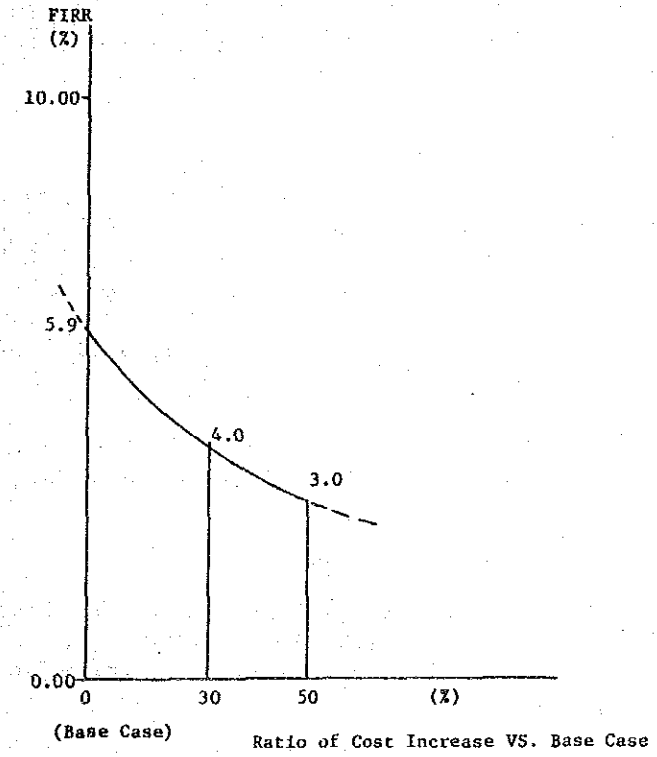


Fig. 6-4-2 Relationship between Construction Cost Increase and FIRR (Case III)

6-5 Observation

6-5-1 Economic Internal Rate of Return (EIRR)

The EIRR of Case I to IV is respectively 14.1%, 13.5%, 13.3%, 13.3%. This indicates that the economic effectiveness of the project for the national economy is similar in all four cases under the premises assumed by this Study.

6-5-2 Financial Internal Rate of Return (FIRR)

(1) Below current funding interest rate

The financial analysis indicates that the highest FIRR is 11.5% for Case I, the lowest 5.9% for Case III. Case II and Case IV are in-between (8.5% and 6.8%, respectively). All the indices, except for Case I, are observed to be below the current interest rate in the international finance market. (See Table 6-5-1.)

(2) Network coverage and FIRR

It is observed that, the more area the network will cover, the better the FIRR of the network will be. This is because the initial portion of the entire network, Port Kelang - Paka (Network A), requires the most intensive investments (90% of tunnel length, workshop, depots, marshalling yards, centralized train control system, Kuala Lumpur Station, etc.), and other portions (extended lines in Networks B and C) can be constructed at a smaller cost per route kilometer. The operational revenue per route kilometer being similar in any network (see Table 2-4-7 and 2-5-5.), the FIRR will improve as the network covers more areas.

(3) Synchronization with traffic growth

It is also observed that the more synchronized the network expansion will be with the traffic growth, the better the FIRR of the expanded network will be. This observation is verified by a trial calculation for an assumed case where the final phase of the project, Network D, will be achieved prematurely in the year 2001 (instead of 2010 for Case I). In this assumption, the EIRR would be 9.7% instead of 11.5% (Case I).

The simulation indicates that the investment in line with the traffic demand growth yields more profit than unripe investment.

(4) Less interest payment

The FIRRs lower than market interest rate in Case II through IV show that it is necessary for the project to be financed at a higher equity and/or subsidy ratio than 50%, by securing more interest-free fund for the construction cost.

Table 6-5-1 Results of Economic/Financial Analysis

	EIRR	FIRR	Debt Service Cover. Ratio	Working* Capital Required (WCR)	Maximum* Cumulative WCR i.e., Short-term Loan	CASH FLOW Maximum* Cumulative Long-term Loan	Maximum* Cumulative Long-term and Short-term Loan	Final Maturity of Short-term Loan / Final Maturity of Long-term Loan	Construction** Cost
					(in year ——)	(in year ——)	(in year ——)		
			min. - max. *** during the first decade	min. - max. *** during the first decade					
	(%)	(%)		(mil. M$)	(mil. M$)	(mil. M$)	(mil. M$)		(mil. M$)
Case I	14.1	11.5	0.36 - 1.09	121 - 345	1,563 (yr 1999)	7,021 (yr 2009)	7,021 (yr 2009)	yr 2005 / yr 2019	10,025
Case II	13.5	8.5	0.36 - 1.09	121 - 345	1,682 (yr 2000)	3,441 (yr 1995)	4,154 (yr 1995)	yr 2006 / yr 2005	5,070
Case III	13.3	5.9	0.36 - 0.70	86 - 524	2,391 (yr 2000)	1,903 (yr 1990 - 1995)	2,675 (yr 1996 - 1997)	yr 2008 / yr 2000	3,078
Case IV	13.3	6.8	0.00 - 0.83	86 - 243	2,013 (yr 2003)	2,147 (yr 1995)	2,926 (yr 1998)	yr 2010 / yr 2005	3,078

Note: * in current price
** 1984 price
*** 1991 to 2000

6-5-3 Cash Flow Analysis

According to the cash flow analysis, all Cases I through IV are observed to be in need of considerable sums of borrowings to cover deficit in the first ten years.

The outstanding of the long-term and short-term debt for the construction cost and for the working capital required after the completion, will reach in Case I, Case II. Case III and Case IV, each approximate sum of 7.0 billion, 4.2 billion, 2.7 and 2.9 billion M$, respectively (Fig. 6-3-2).

Although each of these sums is below the construction cost of the relevant Network, it is a large sum. In order to prevent the project from being put into a serious financial difficulty it is necessary to reduce the sum of the outstanding debt to the smallest possible, by increasing the equity and/or subsidy portion of the initial construction cost to the largest possible.

The key issue is to reduce the sum total, throughout the project life, of the repayment and interest payment.

When an amount of interest-free fund is placed initially in the equity and/or subsidy portion of the initial construction cost, it will contribute more to the cash flow improvement, than when the equivalent amount will be placed later as subsidy in filling up the negative cash flow.

Hence, the upgrading of the equity and/or subsidy ratio of the initial construction cost, better than 50%, is essential for the success of the project.

(1) Case I (Network D)

In Case I which shows the highest FIRR, the annual borrowings, 1991 through 1999, will be 121 million M$ in the best year and 345 million M$ in the worst year (each in current price, the same in subsequent description). The cumulative borrowing will reach the peak of 1,563 million M$ in the year 1999, and the year of the final maturity when all the borrowings are repaid, will be the year 2019.

(2) Case III (Network A)

In Case III, which shows the smallest FIRR, the annual borrowing will be 86 million M$ in the best year and 524 million M$ in the worst year. The cumulative borrowing will reach the peak of 2,391 million M$ in the year 2000, and the maturity, in the year 2008.

So far as the fund available to the government for allocation to the projects without entailing interest is limited to a certain amount, it must be considered that any project whose equity and/or subsidy portion required surpasses this amount will be non-feasible.

According to the Malaysian side, the amount of available fund, such as equity and from sales proceeds of the MRA land, which could be allocated to the equity and/or subsidy portion of the project cost, is assumed to be 1.5 to 2.0 billion M$.

Cases I or II is estimated to cost 10.1 and 5.1 billion M$, respectively. The said amount 1.5 to 2.0 billion M$ does not suffice even the equity and/or subsidy ratio assumed at 50% in the cash flow simulation for these Cases.

Meanwhile, Case III or IV, is estimated to cost 3.1 billion M$. The said amount, 1.5 to 2.0 billion M$, would improve the equity and/or subsidy ratio, considerably over 50%.

Accordingly, despite its FIRR, Case III or IV is considered to have the highest feasibility, since the equity and/or subsidy ratio for Case III or IV has the highest possibility of being increased.

6-5-4 Sensitivity analysis

Social and economic framework (economic growth rates, population growth rates, distribution of national wealth among regions, income groups, etc.) may deviate from premises assumed in this Study in the long project life. The deviation will give rise to changes in traffic demand forecast, cost estimates, etc., and accordingly, it will cause changes in EIRR, FIRR and cash flow.

Therefore, the impact of unfavorable deviations are examined to provide elements to be considered in the decision-making. The analysis is made on Case III, which seems to have a highest feasibility in over-all perspective, assuming discretionary rates of deviations.

On the other hand, the impact of favorable deviations, such as raise in fare level and in equity and/or subsidy ratio, are also studied.

From the results of risk analysis mentioned below, it is pointed out that this project has several elements of uncertainty in the sense that deviations in GDP and population growth rate, project cost and industrial development pace of the east coast area might lead to considerable decrease in feasibility of the project.

The result is shown in Table 6-4-1.

(1) It is observed that the impact of decrease in traffic demand is the greatest on FIRR, while the impact of the increase in construction cost is the greatest on the required sums of the borrowings ("Working Capital Required").

   (a) 30% decrease in traffic demand would decrease the FIRR to 2.9%, from 5.9% of Base Case, and increase the maximum cumulative borrowing to 3,104 million M$ (current price, the same in subsequent descriptions), compared with 2,391 million M$ of the Base Case.

   (b) 30% increase in construction cost would decrease FIRR to 4.0%, and increase the working capital required up to 3,683 million M$.

   (c) The effect of a 5 years delay in construction period is not significant.

(2) An increase in equity and/or subsidy ratio to 70% would alleviate the working capital required to between 6 and 284 million M$ (Base Case, between 86 and 524 million M$), and the maximum cumulative borrowing, to 950 million M$ (Base Case, 2,391 million M$).

(3) 50% raise in fare-level and resultant 10% decrease in traffic demand as to inter-city passenger traffic would improve FIRR up to 7.2% and alleviate working capital required to between 53 and 482 million M$ and the cumulative borrowing down to 1,980 million M$.

(4) Actual amount of the Governmental subsidy accorded to MRA is approximately 40 million M$ annually. This is equivalent to 83 million M$ in the year 2000 (at +5% p.a. escalation). The working capital required between 6 to 284 million M$ calculated in (2) might seem to be manageable with the Governmental subsidies.

However, since the possibility of situation mentioned in (1) cannot be excluded, necessity of maximization of equity and/or subsidy ratio or Governmental support should also be considered.

(5) Impact of delay in industrial development in the east coast (Trengganu zone ① & ②)

Decrease in GDP and population growth rates to the national average in the two zones of Trengganu State will cause 3% decrease in passenger traffic (X)

Decrease in GDP growth rate to national average in the two zones will cause 13% decrease in goods traffic (Y)

30% decrease in Steel and Petroleum production in Trengganu State will cause 8% decrease in goods traffic (Z)

The maximum traffic decrease will be X+Y+Z.
The minimum will be within X+Y.

Such maximum and minimum decreases in traffic demand correspond to 8 and 6% decreases in total revenue, respectively. Assuming it at 10%, and applying it to the curve given in Fig. 6-4-1 FIRR would be 5.0% and the maximum cumulative working capital required would be 2,600 million M$.

(6) Impact of the Construction of Karak to Kuantan Highway

In this case, FIRR would be 5.5%.

CHAPTER 7 CONCLUSION AND RECOMMENDATION

7-1 Limitation of the Study

7-2 Recommendation

CHAPTER 7 CONCLUSION AND RECOMMENDATION

7-1 Limitation of the Study

The object of the present Study is a project which aims at providing a modernized high-speed railway network in Malaysia. The project is purposed to realize an all-round development of the Peninsula through founding a general basis for expediting industrial activities and people's mobility at large. The project is also intended to encourage the industrialization of the east coast, southern Trengganu, etc. The area had been characterized until recently with a lower GDP, where a rapid industrialization is now under way.

Prior to the evaluation of the project, attentions are to be paid to the following limitations of the Study.

(1) Limitation in construction sequence

Comparison is not made in this Study between the case where New East-West Railway is built in the first phase and the other cases where, for example, the southern portion of West Coast Railway which covers relatively developed area is built first. This is because the sequence of project implementation was set at the strong request of the Malaysian Government as follows:

1st: Section between Port Kelang and Paka (340 km); double track for Port Kelang - Janda Baik, single track for Janda Baik - Paka. (New East-West Railway)

2nd: Section between Kuala Lumpur and Singapore (380 km) (southern portion of West Coast Railway), not necessarily double-tracked

3rd: Section between Kuala Lumpur and Butterworth (northern portion of West Coast Railway), not necessarily double-tracked
Section between Paka and Kota Bharu (remaining portion of New East-West Railway), not necessarily double-tracked

(2) Limitation in modes compared

Comparison is not made in this Study between the railway and other alternative modes. The Malaysian Government has no implementation plan for the East-West Expressway at present. An analysis is made to study its impact on the new railway network, but it is not considered as an alternative.

(3) Possible deviation in long-term forecast of premises

Traffic demand forecast and cost estimate, bases for economic and financial analysis of this Feasibility Study, assume certain trend for long-term forecast of economic and population growth during the next thirty (30) to forty-five (45) years. These forecasts may deviate from real figures in the long run and result in large fluctuations in project evaluation indices including FIRR. Forecasts concerning the New East-West Railway have a larger possibility for fluctuations particularly because they depend largely on the progress of the development of the industrialization in the east coast area. Therefore, this Study includes sensitivity analysis concerning the effects of fluctuations in important premises.

7-2 Recommendation

(1) Based on the results of the Study which is conducted with the limited scope mentioned in the preceding section 1, Cases III and IV are evaluated to have relative superiority among the four cases studied. However, even in these cases, this project has several elements of uncertainty in the sense that the deviations in GDP and population growth rates, the project cost and industrial development pace in the east coast area might lead to considerable decrease in the feasibility of the project as is shown in Sensitivity Analysis. (See 6-4 of the report.) Hence, for the success of the project, it is indispensable that the prerequisites enumerated in subsequent (2) will be realized. Therefore, it is recommended that the possibility of fulfilling these prerequisites should be deliberately examined at first. Implementation of the project should not be decided until these prerequisites are certain to be fulfilled.

(2) Prerequisites for the success of the project

(a) Socio-economic conditions

It is essential for the success of the project that the economic and social conditions do not deviate much from the premises assumed in the socio-economic framework. (See 2-2-2 of the report.)

The judgement on the implementation of the project and the decision on the scale of the project should be taken after careful consideration of social conditions and economic trend of the nation and the region.

The trend of the east coast development needs special attention. Upon any deviation from premises the plan should be reconsidered rapidly and carefully.

(b) Transport policies

The project should be established and fortified as a national project based on the Governmental consensus considering that a huge sum of money is required, continuous financial support from the Government is essential and, several generations of Malaysian people are to be involved in both costs and benefits. The project should be firmly established in transport policies and following transport policies should be implemented.

(i) Since it is necessary to bear large capital expenditure for certain period of time after start of the operation of the Railway, Railway favoring policies have to be taken as much as possible until prospect for the stable management of the Railway becomes certain.

In additon, it should be considered that the simultaneous construction of a new transport mode other than railway, for example, an expressway in parallel with the New East-West Railway will lead to the decrease in the traffic demand for the Railway.

(ii) When the traffic demand grows enough to introduce free competition, it is necessary to coordinate the conditions for competition among traffic modes so that over-all efficiency way be maximized with below-mentioned measures:

Fair competition

Competition must be fair: Conventional privileges and obligations, imposed or accorded on particular modes should be eliminated, such as: Financial assistance to construction/ maintenance/operation of infrastructure, application of favored or disfavored tax/toll rates.

Competition must be orderly: Strict observance of the loading limits of vehicles, of the minimum rate application, maximum length of haul, etc., should be enforced.

Coordination

In order to obtain most efficient and organic connection between the networks of railway and other modes, and in order to make each mode play the best of the role according to its inherent charateristics, the policies should be oriented to coordinate these networks and their operation schedules, as well as to provide appropriate connecting facilities (e.g., car parks, bus terminals in railway station plaza; container terminals, etc.). The policies should also aim at reorganizing the existing transport networks based on the new perspective (esp. Kelang Valley).

(iii) The Entity should be remunerated or compensated for the public service specifically requested by the Government and performed.

(c) Financing program

Since alleviation of capital expenditure burden determines the success of the project, it is necessary to increase Governmental subsidies or interest-free fund as much as possible so that the equity and/or subsidy portion of the initial construction cost be maximized.

For the working capital required, the Governmental subsidies or credits with specially favorable conditions are desired.

Under the given financial premises of the present cash flow simulation, it is observed that, in many fiscal years, the negative balance due to the interest payment will have to be covered by new borrowing. Such a vicious circle should be avoided by all means.

(d) Construction

(i) Construction timing, phasing, sections to be operated have to be selected everytime, investments are made with careful consideration of economic conditions and the trend of traffic demand.

Rather than preceding the growth of traffic demand, investments following after the growth ensure a higher rate of return.

(ii) Appropriate project mangement should be undertaken.

a. Technical control
b. Cost control
c. Schedule control (particularly regarding the acquisition of right of way)
d. Fund control (particularly regarding the allocation of the fund to adequate item of outlay according to the cost of funding)

Emphasis of the project management should be placed on avoiding the following;

- Cost-overrun
- Delay in construction
- Defects in constructed facilities

(e) Operation

(i) Training

The operation of the projected network calls for the new capabilities of officers and employees. Education and training should be carefully prepared. A new administrative system should be established in the Entity to make its operation most efficient.

(ii) Fare and rate system

Based on the continued adequate market surveys, new fare/rate systems should be developed, flexibly suited to the competitiveness of the new railway (particularly concerning goods rate system).

(iii) Diversification of business

The Entity should be prepared to make the best profits from what values the Entity has added to the land, along the line, around the stations by building the railway.

For this, the Entity should be able to run realty development/leasing businesses, endeavoring to maximize the value of the space it creates, through multi-purposed use of the railway properties.

It is necessary to make efforts to induce passenger traffic demand or absorb development benefits through the high-degree and multi-purpose utilization of the Railway site and real estate development along the Railway.

The Entity should also reserve rights to manage such business concerning transport as feeder service, forwarder service, warehousing, travel agents, hotels, and so on.

(f) Independent railway

- The policies should assure the Entity of its independent administration of the network, by legislation, describing its powers and obligations.
- The legislation should include descriptions empowering the Entity to make independent decisions on its fare level, train operation plans, personnel affairs and on salary/wage levels.
- By the same legislation, the Entity should be remunerated or compensated for the public service specifically requested by the Government and performed.

(g) Co-existence of new and conventional networks

- Guidelines should be established on the investments for the existing West Coast Line to cover the following areas;

  (i) Every effort should bre devoted to maintain its railway potentials, to keep hold of the customers until the new West Coast Railway is built.

  (ii) When the new West Coast Railway is completed with a single track, the conventional West Coast Line is planned to be abolished. smooth shift from old to the new system should be prepared, containerization of goods, for example.

(3) The economic/financial analysis of this Study is conducted under a certain assumption that 50% of the initial construction cost will be financed by equity and/or subsidy, and another 50% by bank loan with 10% interest p.a., etc.

It is desirable, at a stage where the over-all funding program, will be formulated concretely, that a review of the feasibility of the project based on the said funding program will be solicited from a neutral and credible third party, such as an international financial institution.

(4) Cases I and II should be regarded as matters for future consideration. It is recommended that whether or not these plans should be implemented is to be determined based o careful feasibility studies which should consider the general economic conditions and availability of financial resources.

APPENDIX

Appendix 2-2-1 Gross Domestic Product by Sector of Origin

Unit: mil.M$ in 1970 prices

Sector	1970*	1980**	1985**	Average annual growth rate (%)		Share of GDP (%)		
				1970-1980	1980-1985	1970	1980	1985
Primary	4,575	7,426	9,369	5.0	4.8	37.1	28.3	26.2
Agriculture, forestry livestock and fishing	3,797	6,255	7,673	5.1	4.2	30.8	23.8	21.5
Mining and quarrying	778	1,171	1,696	4.2	7.7	6.3	4.5	4.7
Secondary	2,125	6,084	8,624	11.1	7.2	17.3	23.2	24.1
Manufacturing	1,650	4,875	6,534	11.4	6.0	13.4	18.6	18.3
Construction	475	1,209	2,090	9.8	11.6	3.9	4.6	5.8
Tertiary	5,152	11,900	17,261	8.7	7.7	41.9	45.4	48.3
Electricity, gas and water	229	605	933	10.2	9.0	1.9	2.3	2.6
Transport, storage and communications	581	1,803	3,153	12.0	11.8	4.7	6.9	8.8
Wholesale and retail trade, hotels and restaurants	1,633	3,529	4,757	8.0	6.2	13.3	13.5	13.3
Finance, insurance, real estate and business service	1,036	2,041	2,971	7.0	7.8	8.4	7.8	8.3
Government services	1,367	3,202	4,533	8.9	7.2	11.1	12.2	12.7
Other services	306	720	914	8.9	4.9	2.5	2.7	2.6
Less: Imputed bank service charges	117	407	883	-	-	-	-	-
Plus: Import duties	573	1,225	1,384	-	-	-	-	-
Equals: Gross Domestic Product at Purchasers' Value	12,308	26,228	35,755	7.9	6.4	-	-	-

Source: * Fourth Malaysia Plan
** Mid-Term Review

Appendix 2-2-2 Gross Domestic Product by Expenditure Category

Unit: mil.M$ in 1970 prices

	1970	1980	1985	Average annual growth rate (%)	
				1970-1980	1980-1985
Private consumption	7,310	15,345	19,929	7.7	5.4
Private investment	1,490	4,510	7,501	11.7	10.7
Public consumption	1,917	5,131	6,716	10.3	5.5
Public investment	706	2,676	3,202	14.3	3.7
Changes in stocks	357	-85	50		
Export of goods and non-factor services	5,396	11,353	16,856	7.7	8.2
Imports of goods and non-factor services	4,868	12,702	18,499	10.1	7.8
Gross Domestic Product at Purchasers' value	12,308	26,228	35,755	7.9	6.4

Source: Fourth Malaysia Plan,
Mid-Term Review

Appendix 2-2-3 Balance of Payment, 1980 - 1983

Unit: mil.M$

	1980	1981	1982	1983
Current account balance	-620	-5,406	-7,298	-6,714
Merchandise	+5,238	-29	-1,199	+1,631
Services	-5,813	-5,299	-6,021	-8,295
Transfers	-45	-78	-78	-50
Capital account balance	+1,622	+4,313	+6,684	+6,659
Official	+322	+2,916	+4,589	+4,367
Corporate investment	+2,033	+2,833	+2,940	+2,797
Commercial credit	-140	+101	+581	+1,095
Private financial capital	+939	+86	-75	+295
Errors and omissions	-1,532	-1,632	-1,351	-1,895
Overall balance	+1,002	-1,093	-614	-55

Source: Mid-Term Review,
Central Bank of Malaysia

Appendix 2-2-4 Land Development Progress and Revised FMP Target by State

Unit: hectares

State	Original FMP target	Revised FMP target	Land development 1981∿1983	Achievement of the original FMP target (%)	Expected land development 1984∿1985
Johor	65,230	77,685	44,831	68.7	32,854
Kedah/Perlis	13,094	15,193	10,629	81.2	4,564
Kelantan	71,226	58,067	31,344	44.0	26,723
Melaka	2,470	1,672	1,077	43.6	595
Negri Sembilan	17,618	28,888	21,674	123.0	7,214
Pahang	168,992	132,677	76,374	45.2	56,303
Perak	49,404	48,845	28,513	57.7	20,332
Pulau Pinang	-	-	-	-	-
Sabah	83,805	95,721	51,701	61.7	44,020
Sarawak	16,599	16,599	4,980	30.0	11,619
Selangor/Federal Territory	16,498	17,105	8,373	50.8	8,732
Trengganu	38,525	37,192	23,738	61.6	13,454
Total	543,461	529,644	303,234	55.8	226,410

Source: Mid-Term Review

Appendix 2-2-5 Distribution of Industrial Estate by State, 1983

Unit: hectares

State	Number of industrial estate	Planned area	Developed area	Saleable area	Allocated area	Unallocated area
Johor	12	1,637.52	1,195.22	1,099.96	924.23	175.46
Kedah/Perlis	8	508.95	502.55	412.63	312.68	99.95
Kelantan	5	621.31	277.32	253.65	125.77	127.88
Melaka	7	344.84	266.66	241.02	214.02	26.52
Negri Sembilan	6	401.51	401.51	299.65	292.19	7.46
Pahang	8	1,304.5	739.07	569.31	308.89	260.48
Perak	9	746.85	715.30	558.65	503.60	55.05
Pulau Pinang	8	1,356.00	708.08	1,166.32	627.70	540.02
Sabah	7	403.34	402.34	301.56	270.96	30.60
Sarawak	6	910.71	753.18	581.42	511.97	69.45
Selangor/Federal Territory	16	2,411.65	1,733.88	1,399.49	1,176.40	223.10
Trengganu	9	609.73	364.71	536.53	212.73	323.80
Total	101	11,256.91	8,059.91	7,420.19	5,480.14	1,939.77

Source: MIDA

Appendix 2-2-6 Crops by Hectarage 1980 - 1985

Unit: hectares

	1980	1981	1982	1983	1984	1985
Rubber	2,010,000	2,006,488	1,966,400	1,990,000	2,000,000	2,012,000
Oil palm	1,609,507	1,140,538	1,212,486	1,226,585	1,306,000	1,400,000
Pepper	12,720	13,405	12,800	11,362	11,007	10,800
Cocoa	108,556	150,030	190,000	205,000	211,000	237,000
Timber	383,000	391,197	486,950	585,907	560,000	560,000
Padi	735,215	767,640	758,400	764,200	769,750	775,220
Pineapple	12,101	11,685	9,734	8,170	7,177	7,003
Tabacco	12,535	12,970	13,610	14,610	14,955	15,749
Vegetables	18,367	15,330	16,106	18,278	20,745	23,546
Orchards	93,000	87,800	89,000	90,000	92,000	94,000

Source: Mid-Term Review

Appendix 2-3-1 Registration of Motor Vehicles

Types of vehicles	1975	1980	1983	Annual rate of growth (%)	
				1975-1980	1980-1983
Bus	8,688	14,960	18,160	11.5	6.7
Taxi and hired car	9,239	18,750	26,270	15.2	11.9
Lorry and van	92,207	189,860	248,180	15.5	9.3
Private car	398,014	843,270	1,150,630	16.2	10.9
Motorcycle	722,309	1,445,630	2,029,100	14.9	12.0
Others	36,662	85,640	97,900	18.5	4.6
Total	1,267,119	2,598,110	3,570,240	15.4	11.2

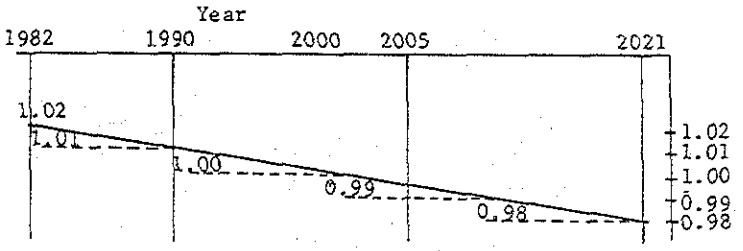
Source: Mid-Term Review

Appendix 2-4-1 Correlation between GDP per Capita and Travel Frequency per Passenger

Year	GDP	Population	GDP per capita	Number of Trips per Capita	Elasticity Factor	Number of Passengers*
1970	10,501	9,147	1,148			31,925
					1.02	
1980	22,758	11,849	1,921	7.00		82,929
1982	25,668	11,984	2,144	8.32	1.01	99,700
1990	40,867	14,502	2,818			
1991	42,840	14,823	2,890	11.14	1.00 ***	165,174
1996	54,219	16,531	3,280	12.65		209.047
2000						
2001	68,603	18,434	3,722	14.21	0.99 ***	261.851
2005	82,798	20,110	4,117	15.10		303,591
2010					0.98 ***	
2021	180,735	28,935	8,240	17.97		520,033
Unit	Mil. M$ in 1970 price	'000	M$	Trips/year	/year	'000

350,788

Trend of Elasticity Factor



* Note: Long distance and short distance passengers

** Note: Elasticity factor 0.98 was obtained from the data in Japan as of 1965.

*** Note: Elasticity factor 0.99, 1.00, 1.01 were assumed as intermediates between 0.98 and 1.02.

* Number of passengers corresponding to the M/P 2005

Population (19,517)

$17.97 \times 19{,}517 = 350{,}788$

$$\text{Elasticity Factor} = \frac{TR_I / TR_{I-1}}{PG_I PG_{I-1}}$$

where: I : Year

TR_I: Number of Trips/Passenger

PG_I: GDP per capita

Appendix 2-4-2

OD Table of the Railway Passenger (1991 Network A)

for both directions (Unit: 1,000 persons/year)

O \ D		①	②	③	④	⑤	⑥	⑦	⑧	⑨	⑩	⑪	⑫	⑬	⑭	⑮	⑯	⑰	Total
①	Kedah/Perlis		11	0	29	2	2	1	1	0	2	2	6	3	1	9	70	1	139
②	Pinang			8	577	33	30	13	12	2	25	5	108	47	12	114	29	18	1,044
③	Perak				278	48	33	17	1	0	32	5	94	41	11	107	5	29	708
④	Selangor					40	410	134	24	3	503	17	388	248	102	813	9	0	3,574
⑤	N. Sembilan/Melaka						115	39	1	6	31	3	30	18	7	160	1	3	536
⑥	Johor (Keluang)							131	1	5	34	3	41	22	8	613	1	13	1,460
⑦	Johor (J. Bahru)								6	2	13	1	18	10	3	115	1	4	508
⑧	Pahang (Temerloh)									5	28	3	23	17	9	36	0	25	191
⑨	Pahang (K. Lipis)										5	21	98	2	1	13	0	3	166
⑩	Pahang (Kuantan)											4	89	97	37	87	1	16	1,003
⑪	Kelantan (Ulu Kelantan)												216	6	1	9	0	1	296
⑫	Kelantan (Kota Bharu)													8	17	168	2	12	1,316
⑬	Trengganu (K. Trengganu)														13	89	1	8	630
⑭	Trengganu (Kemaman)															33	0	3	258
⑮	Singapore																5	25	2,397
⑯	Thailand																	0	124
⑰	Janda Baik																		160
Total																			14,510

OD Table of the Railway Passenger (2005 Network A)

for both directions (Unit: 1,000 persons/year)

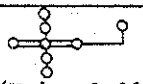
O \ D		①	②	③	④	⑤	⑥	⑦	⑧	⑨	⑩	⑪	⑫	⑬	⑭	⑮	⑯	⑰	Total
①	Kedah/Prlis		17	0	46	2	2	2	1	0	3	0	7	4	1	10	100	2	200
②	Pinang			13	1,441	55	48	34	28	4	64	14	204	115	23	205	64	76	2,406
③	Perak				484	56	35	31	1	0	58	8	122	71	14	135	7	85	1,121
④	Selangor					69	673	370	58	5	1,355	44	727	627	203	1,548	21	0	7,672
⑤	N. Sembilan/Melaka						127	72	1	7	57	5	37	30	9	206	1	9	745
⑥	Johor (Keluang)							234	1	5	61	4	50	37	11	754	2	35	2,079
⑦	Johor (J. Bahru)								15	3	38	2	36	26	7	231	1	19	1,123
⑧	Pahang (Temerloh)									8	69	7	39	38	16	61	1	101	444
⑨	Pahang (K. Lipis)										9	38	129	4	1	18	0	9	244
⑩	Pahang (Kuantan)											10	171	250	74	169	2	71	2,462
⑪	Kelantan (Ulu Kelantan)												411	17	1	18	0	2	583
⑫	Kelantan (Kota Bharu)													15	25	234	3	38	2,250
⑬	Trengganu (K. Trengganu)														26	169	2	33	1,465
⑭	Trengganu (Kemaman)															49	1	11	472
⑮	Singapore																9	81	3,896
⑯	Thailand																	1	215
⑰	Janda Baik																		576
Total																			27,953

OD Table of the Railway Passenger (2005 Network B)

for both directions (Unit: 1,000 persons/year)

O \ D		①	②	③	④	⑤	⑥	⑦	⑧	⑨	⑩	⑪	⑫	⑬	⑭	⑮	⑯	⑰	Total
①	Kedah/Perlis		17	0	46	2	3	2	1	0	3	0	7	4	1	14	100	3	205
②	Pinang			13	1,439	60	59	46	28	4	64	14	205	116	23	278	64	78	2,508
③	Perak				484	61	45	42	1	0	58	8	122	71	14	187	7	87	1,201
④	Selangor					1,116	924	543	58	6	1,353	44	729	628	202	2,317	21	0	9,910
⑤	N. Sembilan/Melaka						154	94	2	9	66	5	41	33	11	273	1	151	2,079
⑥	Johor (Keluang)							271	1	7	82	6	64	48	15	893	2	50	2,623
⑦	Johor (J. Bahru)								17	5	56	3	50	36	10	616	2	29	1,821
⑧	Pahang (Temerloh)									8	69	7	39	38	16	91	1	104	479
⑨	Pahang (K. Lipis)										10	41	137	4	1	25	0	10	268
⑩	Pahang (Kuantan)											10	172	251	74	251	2	73	2,594
⑪	Kelantan (Ulu Kelantan)												420	17	1	25	0	2	604
⑫	Kelantan (Kota Bharu)													15	28	323	3	39	2,394
⑬	Trengganu (K. Trengganu)														26	236	2	34	1,558
⑭	Trengganu (Kemaman)															71	1	11	506
⑮	Singapore																13	125	5,738
⑯	Thailand																	1	221
⑰	Janda Baik																		798
Total																			35,507

OD Table of the Railway Passenger (2005 Network C)



for both directions (Unit: 1,000 persons/year)

O \ D		①	②	③	④	⑤	⑥	⑦	⑧	⑨	⑩	⑪	⑫	⑬	⑭	⑮	⑯	⑰	Total
①	Kedah/Perlis		18	0	78	4	5	4	2	1	5	1	18	9	2	25	104	4	278
②	Pinang			48	2,233	93	90	69	43	8	93	8	444	200	34	412	69	121	3,981
③	Perak				874	77	56	51	1	0	71	4	207	98	17	231	10	157	1,903
④	Selangor					1,116	924	543	57	6	1,341	18	924	703	201	2,317	35	0	11,370
⑤	N. Sembilan/Melaka						154	94	2	9	66	5	55	39	11	273	2	151	2,150
⑥	Johor (Keluang)							271	1	7	82	5	84	56	15	893	3	50	2,696
⑦	Johor (J. Bahru)								17	5	56	3	66	42	10	616	3	29	1,879
⑧	Pahang (Temerloh)									8	69	6	50	43	15	91	1	103	509
⑨	Pahang (K. Lipis)										10	40	135	5	1	11	0	10	258
⑩	Pahang (Kuantan)											4	226	287	74	251	3	72	2,711
⑪	Kelantan (Ulu Kelantan)												429	22	2	10	0	1	557
⑫	Kelantan (Kota Bharu)													422	93	426	8	50	3,635
⑬	Trengganu (K. Trengganu)														80	274	4	38	2,322
⑭	Trengganu (Kemaman)															71	1	11	638
⑮	Singapore																21	125	6,045
⑯	Thailand																	2	267
⑰	Janda Baik																		925
Total																			42,125

Appendix 2-5-1

OD Table of the Railway Goods (1991 Network A)

(Unit: 1,000 tons/year)

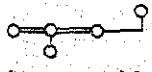
O \ D		①②③	④	⑤⑥⑦	⑧	⑩	⑭	⑫⑬	⑨⑪	Total
①②③	Kedah/Perlis Pinang Perak		-	-	65.6	70.7	23.4	29.5	32.7	221.9
④	Selangor	-		-	204.8	316.1	59.8	74.0	13.3	668.0
⑤⑥⑦	N. Sembilan/ Melaka Johor (Keluang) Johor (Johor Bahru)	-	-		16.2	19.7	6.9	5.3	13.8	61.9
⑧	Pahang (Temerloh)	6.5	61.5	14.7		1.0	0.3	0.4	0	84.4
⑩	Pahang (Kuantan)	17.3	204.7	20.7	6.7		7.4	21.7	6.6	285.1
⑭	Trengganu (Kemaman)	316.7	663.3	33.8	12.4	21.1		0	3.4	1,050.7
⑫⑬	Kelantan (K. Bharu) Trengganu (K. Trengganu)	1.8	12.8	1.1	0.2	4.6	0		20.1	0.6
⑨⑪	Pahang (Lipis) Kelantan (Ulu Kelantan)	7.5	7.1	17.7	0	1.6	0.5	0.2		34.6
Total		349.8	949.4	88.0	305.9	434.8	98.3	131.1	69.9	2,427.2

OD Table of the Railway Goods (2005 Network A)

(Unit: 1,000 tons/year)

O \ D		①②③	④	⑤⑥⑦	⑧	⑩	⑭	⑫ ⑬	⑨ ⑪	Total
①②③	Kedah/Perlis Pinang Perak		-	-	100.4	104.6	42.8	34.7	52.6	335.1
④	Selangor	-		-	317.8	508.5	100.0	72.1	16.0	1,014.4
⑤ ⑥ ⑦	N. Sembilan/ Melaka Johor (Keluang) Johor (Johor Bahru)	-	-		23.4	33.1	13.7	5.3	22.6	98.1
⑧	Pahang (Temerloh)	13.7	89.2	18.8		0.9	0.6	0.4	0	123.6
⑩	Pahang (Kuantan)	33.0	316.4	32.7	9.9		14.6	35.0	12.1	453.7
⑭	Trengganu (Kemaman)	319.3	1,283.5	68.2	14.5	12.7		0	8.3	1,706.5
⑫ ⑬	Kelantan (K. Bharu) Trengganu (K. Trengganu)	3.0	14.1	1.4	0.2	3.7	0		0.1	22.5
⑨ ⑪	Pahang (Lipis) Kelantan (Ulu Kelantan)	11.0	7.2	22.2	0	2.1	0.7	0.2		43.4
Total		380.0	1,710.4	143.3	466.2	665.6	172.4	147.7	111.7	3,797.3

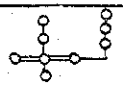
OD Table of the Railway Goods (2005 Network B)



(Unit: 1,000 tons/year)

O \ D		①②③	④	⑤	⑥	⑦	⑧	⑩	⑭	⑫ ⑬	⑨ ⑪	Total
①②③	Kedah/Perlis Pinang Perak		—	24.3	16.0	210.8	104.7	109.1	43.8	39.2	55.1	603.0
④	Selangor	—		173.2	50.4	541.8	339.0	546.0	105.8	98.3	12.6	1,867.1
⑤	N. Sembilan/ Melaka	12.4	670.2		0	286.3	0	86.2	2.2	0	2.6	1,059.9
⑥	Johor (Keluang)	6.0	29.3	0		243.4	0	10.0	1.5	0	1.1	291.3
⑦	Johor (Johor Bahru)	106.0	433.1	187.0	320.0		35.6	65.2	28.3	19.0	23.0	1,217.2
⑧	Pahang (Temerloh)	14.5	98.1	0	0	34.6		1.8	0.7	0.7	0	150.4
⑩	Pahang (Kuantan)	34.2	348.3	14.7	13.1	275.1	12.6		17.6	39.3	12.7	767.6
⑭	Trengganu (Kemaman)	322.3	1,305.6	13.4	12.0	245.5	15.7	15.1		0	6.1	1,935.7
⑫ ⑬	Kelantan (Kota Bharu) Trengganu (K. Trengganu)	3.7	22.0	0	0	12.7	0.4	6.1	0		0.1	45.0
⑨ ⑪	Pahang (Lipis) Kelantan (Ulu Kelantan)	11.8	5.4	2.8	2.5	20.8	0	2.2	0.6	0.2		46.3
Total		510.9	2,912.0	415.4	414.0	1,871.0	508.0	841.7	200.5	196.7	113.3	7,983.5

OD Table of the Railway Goods (2005 Network C)



(Unit: 1,000 tons/year)

O \ D		①	②	③	④	⑤	⑥	⑦	⑧	⑩	⑭	⑬	⑫	⑨ ⑪	Total
①	Kedah/Perlis		-	39.6	99.7	0.4	0.3	6.2	21.6	20.9	3.6	8.9	0	8.0	209.2
②	Pinang	-		203.2	337.1	33.2	31.9	295.5	91.8	102.9	35.7	121.8	36.3	29.5	1,318.9
③	Perak	13.5	303.9		733.9	94.1	66.2	107.4	98.0	78.6	62.1	130.4	75.6	17.7	1,781.4
④	Selangor	78.2	207.2	356.4		133.0	35.7	528.8	318.0	508.7	100.2	277.5	121.7	16.1	2,681.5
⑤	N. Sembilan/ Melaka	0.9	12.3	219.4	439.0		0	236.8	0	80.0	1.9	11.8	6.7	2.2	1,011.0
⑥	Johor (Keluang)	0.5	9.2	1.7	17.8	0		201.6	0	7.1	1.3	7.0	0.8	0.9	247.9
⑦	Johor (Johor Bahru)	5.9	127.9	68.3	420.3	166.1	262.0		28.7	60.0	26.6	79.2	12.4	21.4	1,278.8
⑧	Pahang (Temerloh)	1.5	31.8	7.5	89.2	0	0	22.6		0.9	0.6	3.1	2.1	0	159.3
⑩	Pahang (Kuantan)	4.1	105.8	25.8	316.4	12.3	11.7	242.5	9.9		14.6	45.1	52.1	13.2	853.5
⑭	Trengganu (Kemaman)	6.9	323.1	40.2	1,283.6	11.3	10.4	224.7	14.5	12.7		247.4	279.8	5.7	2,460.3
⑬	Trengganu (K. Trengganu)	1.1	11.0	7.6	80.9	4.1	2.0	80.0	1.8	16.6	4.9		4.6	0.6	215.2
⑫	Kelantan (Kota Bharu)	0	9.5	8.9	58.1	6.0	0.8	3.4	13.3	11.8	6.1	22.0		-	139.9
⑨ ⑪	Pahang (Lipis) Kelantan (Ulu Kelantan)	1.1	7.5	3.2	7.2	2.5	2.2	19.8	0	2.2	0.5	2.1	-		48.3
	Total	113.7	1,149.2	981.8	3,883.2	463.0	423.2	1,969.3	597.6	902.4	258.1	956.3	592.1	115.3	12,405.2

Appendix 3-2-1 Required Number of Trains

Network A

Number of Trains by Section (for both directions)

Station/section \ Kind of train	Passenger train					Goods train					Total
	Super express	Express	Ordinary	KL urban	Subtotal	Express container	Container	Carload through	Ordinary	Subtotal	
Port Kelang	-	-	-	90 (24)	90 (24)	-	-	-	10 (6)	10 (6)	100 (30)
Kuala Lumpur	8 (6)	16 (6)		30 (8)	54 (20)	2 (2)	8 (4)	16 (10)	-	26 (16)	80 (36)
Janda Baik	8 (6)	16 (6)		-	24 (12)	2 (2)	8 (4)	16 (10)	-	26 (16)	50 (28)
Kuantan	8 (6)	8 (2)		-	16 (8)	-	4 (2)	14 (8)	-	18 (10)	34 (18)
Kerteh											

(Note) 1. Required number of trains for both directions to be operated in the year 2005.
2. Figures in parentheses are for the year 1991.

Network B

Number of Trains by Section (for both directions)

Station/section \ Kind of train	Passenger train					Goods train					Total
	Super express	Express	Ordinary	KL urban	Subtotal	Express container	Container	Carload through	Ordinary	Subtotal	
Port Kelang											
	-	-	-	90 (36)	90 (36)	-	-	-	16 (12)	16 (12)	106 (48)
Kuala Lumpur											
	10 (8)	16 (8)	-	30 (12)	56 (28)	2 (2)	8 (6)	20 (16)	-	30 (24)	86 (52)
Janda Baik											
	10 (8)	16 (8)	-	-	26 (16)	2 (2)	8 (6)	20 (16)	-	30 (24)	56 (40)
Kuantan											
	10 (8)	8 (4)	-	-	18 (12)	-	4 (2)	16 (12)	-	20 (14)	38 (26)
Kerteh											
Kuala Lumpur											
	20 (14)	14 (10)	8 (8)	-	42 (32)	4 (2)	8 (6)	12 (8)	2 (2)	26 (18)	68 (50)
Seremban											
	20 (14)	14 (10)	4 (4)	-	38 (28)	4 (2)	8 (6)	8 (6)	2 (2)	22 (16)	60 (44)
Gemas											
	20 (14)	10 (8)	4 (4)	-	34 (26)	4 (2)	8 (6)	8 (6)	4 (4)	24 (18)	58 (44)
Kempas Baru											
	20 (14)	10 (8)	4 (4)	-	34 (26)	-	2 (2)	-	2 (2)	4 (4)	38 (30)
Johor Bahru											
	20 (14)	10 (8)	6 (4)	-	36 (26)	-	2 (2)	-	2 (2)	4 (4)	40 (30)
Singapore											

(Note) 1. Required number of trains for both directions to be operated in the year 2005.
2. Figures in parentheses are for the year 1996.

Network C

Number of Trains by Section (for both directions)

Station/section \ Kind of train	Passenger train					Goods train					Total
	Super express	Express	Ordinary	KL urban	Subtotal	Express container	Container	Carload through	Ordinary	Subtotal	
Port Kelang											
	-	-	-	90 (60)	90 (60)	-	-	-	-	20 (18)	110 (78)
Kuala Lumpur											
	14 (12)	16 (14)	-	30 (20)	60 (46)	2 (2)	12 (10)	24 (22)	-	38 (34)	98 (80)
Janda Baik											
	14 (12)	16 (14)	-	-	30 (26)	2 (2)	12 (10)	24 (22)	-	38 (34)	68 (60)
Kuantan											
	14 (12)	8 (6)	-	-	22 (18)	2 (2)	8 (6)	16 (14)	2 (2)	28 (24)	50 (42)
Kerteh											
	14 (12)	8 (6)	-	-	22 (18)	2 (2)	6 (4)	8 (6)	2 (2)	18 (14)	40 (32)
Kuala Trengganu											
	10 (8)	4 (4)	4 (4)	-	18 (16)	-	2 (2)	4 (4)	2 (2)	8 (8)	26 (24)
Kota Bharu											
Butterworth (Perai)											
	12 (10)	8 (6)	6 (6)	-	26 (22)	4 (4)	8 (6)	6 (6)	4 (4)	22 (20)	48 (42)
Ipoh											
	12 (10)	18 (14)	6 (6)	-	36 (30)	4 (4)	12 (10)	14 (12)	4 (4)	34 (30)	70 (60)
Kuala Lumpur											
	20 (18)	16 (16)	8 (8)	-	44 (42)	4 (4)	10 (8)	14 (12)	2 (2)	30 (26)	74 (68)
Seremban											
	20 (18)	16 (16)	4 (4)	-	40 (38)	4 (4)	10 (8)	8 (8)	2 (2)	24 (22)	64 (60)
Gemas											
	20 (18)	10 (10)	4 (4)	-	34 (32)	4 (4)	10 (8)	8 (8)	4 (4)	26 (24)	60 (56)
Kempas Baru											
	20 (18)	10 (10)	4 (4)	-	34 (32)	-	2 (2)	-	2 (2)	4 (4)	38 (36)
Johor Bahru											
	20 (18)	10 (10)	6 (6)	-	36 (34)	-	2 (2)	-	2 (2)	4 (4)	40 (38)
Singapore											

(Note) 1. Required number of trains for both directions to be operated in the year 2005.
2. Figures in parentheses are for the year 2001.

Appendix 3-2-2 Basic Running Time Table

1. Train basic running time for the direction from Kuala Lumpur to terminal stations (excluding stopping times) is shown below.

2. Distance* denotes the distance between adjacent stations in km, " : " marks indicate in "minutes and seconds", and bold lines indicate the stopping stations for each type of trains.

New East-West Railway

Station	Distance* (km)	Passenger train				Goods train		
		Super express	Express	Ordinary	Urban	Express container	Container and car-load through	Ordinary
Kuala Lumpur	14.4	8m:00s	8m:00s	8m:00s	9m:00s	9m:30s	10m:30s	10m:30s
Batu Caves	21.3	10:30	11:30	11:30	13:00	11:30	14:00	14:00
Janda Baik	18.3	9:30	10:30	10:30		9:30	13:00	13:00
Bentong	53.0	22:00	23:30	23:30		28:00	38:30	38:30
Temerloh	53.0	22:00	23:00	23:00		28:00	39:00	39:00
Maran	37.0	14:30	17:00	17:00		19:30	26:00	26:00
Gembang	30.0	12:30	14:00	14:00		17:00	22:00	22:00
Kuantan	46.4	19:30	20:30	20:30		26:00	34:00	35:00
Chukai	25.6	11:00	12:30	12:30		14:30	19:00	20:30
Kerteh	34.5	15:00	16:00	16:00		19:30	26:00	27:00
Dungun	71.0	29:00	30:30	30:30		38:30	51:30	53:00
Kuala Trengganu	87.7	35:30	36:30	36:30		47:00	63:00	64:00
Jerteh	15.3	6:00	7:30	8:30		8:30	11:00	12:30
Pasir Puteh	28.5	11:00	11:00	13:30		15:00	20:00	20:00
Bachok	11.0	4:30	4:30	7:00		6:00	7:30	7:30
Kemasin	10.9	5:30	5:30	7:00		7:00	8:30	8:30
Kota Bharu								
Total	557.9	236:00	252:00	259:30	22:00	305:00	403:30	411:00

Port Kelang Line

Station	Distance (km)	Urban passenger train	Goods train
Port Kelang	9.8	6m:30s	6m:30s
Kelang	9.6	6:30	6:30
Shah Alam	8.5	6:00	6:00
Subang Jaya	5.3	4:00	4:00
Petaling Jaya	9.2	6:30	6:30
Kuala Lumpur			
Total	42.4	29:30	29:30

Northern portion of West Coast Railway

Station	Distance (km)	Passenger train			Goods train		
		Super express	Express	Ordinary	Express container	Container and car-load through	Ordinary
Butterworth	1.5	2m:00s	2m:00s	2m:00s	-	-	-
Perai							
Bukit Mertajam	9.9	4:00	5:00	5:00	7m:00s	8m:30s	8m:30s
Nibon Tebal	22.2	9:00	10:30	11:30	12:00	15:30	15:30
Parit Buntar	4.7	2:00	2:00	4:30	2:30	3:30	4:30
Bagan Serai	12.1	5:00	5:00	7:30	6:30	8:30	10:00
Taiping	29.7	11:30	12:30	14:00	15:30	21:00	22:00
Padang Rengas	18.9	7:30	9:00	10:00	10:00	13:30	15:00
Kuala Kangsar	8.5	3:30	4:30	6:00	4:30	6:00	7:00
Ipoh	49.1	20:30	22:00	22:00	27:00	35:30	36:30
Batu Gajah	12.2	6:30	6:30	7:30	8:00	10:00	11:30
Malim Nawar	18.4	7:00	7:00	9:30	9:30	13:00	13:00
Kampar	5.1	2:00	2:00	4:30	3:00	3:30	4:30
Tapah Road	16.1	6:30	7:30	9:00	8:30	11:30	14:00
Bidor	9.2	3:30	5:00	6:00	5:00	6:30	8:00
Sungkai	16.5	6:30	6:30	9:00	9:00	11:30	11:30
Slim River	20.5	8:00	8:00	10:30	11:00	14:30	15:30
Behrang	11.2	4:30	4:30	7:00	6:00	8:00	9:30
Tanjong Malim	10.7	4:30	5:30	7:00	5:30	7:30	7:30
Kuala Kubu Road	16.7	6:30	8:00	9:00	9:00	11:30	11:30
Rawang	33.1	13:30	14:30	16:00	18:30	24:30	24:30
Sungei Buloh	13.7	5:30	7:00	8:00	9:00	11:00	11:00
Kuala Lumpur	17.4	10:30	10:30	12:00	9:30	12:00	12:00
Total	357.3	150:00	165:00	197:30	196:30	257:00	272:00

Telok Intan Line

Station	Distance (km)	Goods train
Tapah Road	28.5	22m:00s
Telok Intan		

Southern portion of West Coast Railway

Station	Distance (km)	Passenger train			Goods train		
		Super express	Express	Ordinary	Express container	Container and car-load through	Ordinary
Kuala Lumpur	10.8	5m:00s	5m:00s	6m:00s	6m:00s	8m:30s	8m:30s
Sungei Besi	12.5	6:30	7:30	8:30	7:30	9:30	9:30
Kajang	5.0	2:00	3:30	3:30	3:00	3:30	4:30
Bangi	37.3	15:30	15:30	15:30	19:30	26:00	28:30
Seremban	43.8	18:30	19:30	19:30	24:00	32:00	33:30
Tampin	25.4	10:00	11:30	12:30	15:00	19:30	19:30
Batang Melaka	25.4	10:00	11:00	12:30	13:30	19:00	19:00
Gemas	25.3	10:00	12:30	12:30	13:30	19:00	20:00
Segamat	28.3	11:00	12:30	13:30	15:00	20:00	22:30
Labis	53.4	22:00	22:00	23:30	29:00	38:30	40:00
Keluang	54.9	22:30	22:30	23:30	30:30	39:00	39:00
Kulai	16.2	6:30	6:30	9:00	8:30	11:30	12:30
Kempas Baru	13.6	6:30	6:30	8.00	7:30	9:30	11:00
Johor Bahru	26.5	17:30	17:30	17:30	19:00	20:30	20:30
Singapore							
Total	378.4	163:30	173:30	186:00	211:30	276:00	288:30

Port Dickson Line

Station	Distance (km)	Goods train
Seremban	36.1	28m:30s
Port Dickson		

Pasir Gudang Line

Station	Distance (km)	Goods train
Kempas Baru	31.6	24m:30s
Pasir Gendang		

Appendix 4-1-1 Impact of Expressway Opening on Railway Traffic
- Cases in Japan -

1. Case: 120* km/h

JNR conventional narrow gauge lines provide passenger service at a maximum speed of 120* km/h or so. As shown in Table 1-1, with expressways opened to traffic, the railway traffic can not escape being seriously affected. It is observed that 5 to 15% decrease in traffic will be almost certain.

In Table 1-1, the comparison is made with the traffic affected soon after the opening of new expressways. Fig. 1-2, in contrast, shows the medium-term (5 to 10 years) impact of expressways on railway, in which 20 to 35% decrease in rail traffic is observed. It is probable that, longer trips than shown in the Tables, and goods traffic may also follow this trend with the railway speed level of 120 km/h.

2. Case: 210 km/h

In contrast, JNR standard gauge Shinkansen offers passenger service at the maximum speeds of 210 or 240 km/h. As shown in Fig. 2-1, with this high speed, the impact of the expressway opening has scarcely affected the railway traffic. It is particularly noteworthy that, in Tohoku route, the railway traffic, total of the Shinkansen and the conventional lines, has shown a considerable increase, and the expressway traffic has shown a slight decrease since the opening of Tohoku Shinkansen Railway.

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* It will be improved to 130 km/h in due course.

Incidentally, in San-yo route, 2/3 of the increased traffic on Expressway is due to lorries (Shinkansen does not operate goods trains).

Table 1-1 Traffic Decrease in Conventional JNR Line Affected by Highway Opening

Section	Section of conventional railway			Railway traffic decrease ratio **		
	From	To		Regarding the traffic between two prefectures* in O D table (A) %	Railway share in overall traffic between the section (B)%	(C): (A)x(B) %
	City, Pref.	City, Pref.	Length (km)			
A	Sendai, Miyagi	Morioka, Iwate	184	-14.7	(25)	3.7
B	Kohriyama, Fukushima	Sendai Miyagi	125	-8.0	(31)	2.5
C	Kanazawa, Ishikawa	Fukui, Fukui	77	-9.2	(18)	1.7
D	Ina, Nagano	Komaki, Aichi	174	-21.1	(44)	9.3
E	Yawata, Fukuoka	Yatsushiro, Kumamoto	210	-24.2	(35)	8.5
F	Kagoshima, Kagoshima	Miyazaki Miyazaki	123	-31.0	(53)	16.4
Weighted average	-	-	-	-17.2	(30)	5.2

Note: * The two prefectures are adjacent: city-pairs above have the prefectural boundary line inbetween.

** The ratio is calculated, comparing the traffic in the previous year of the partial opening of expressway section, with the traffic in the following year of whole section opened.

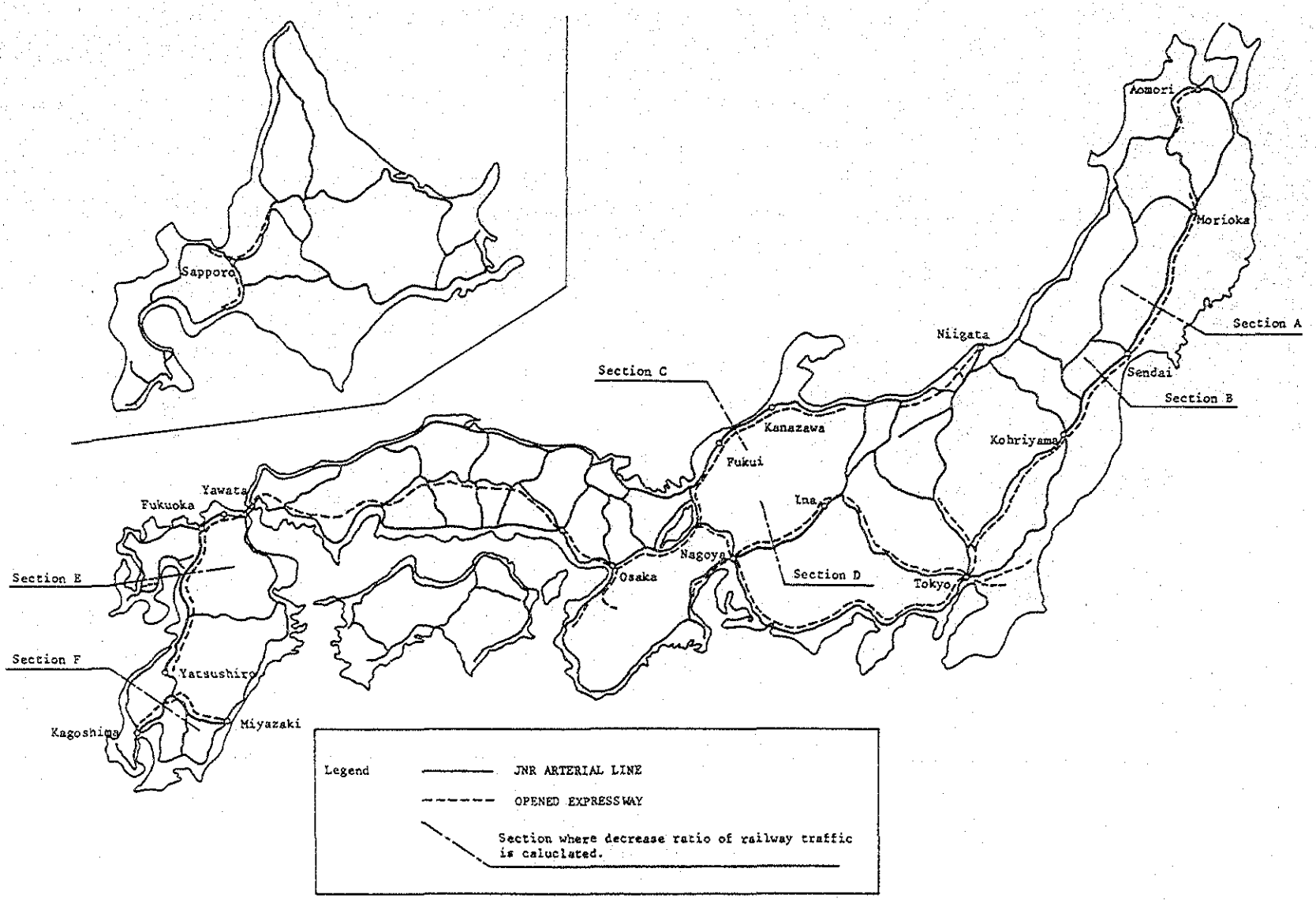
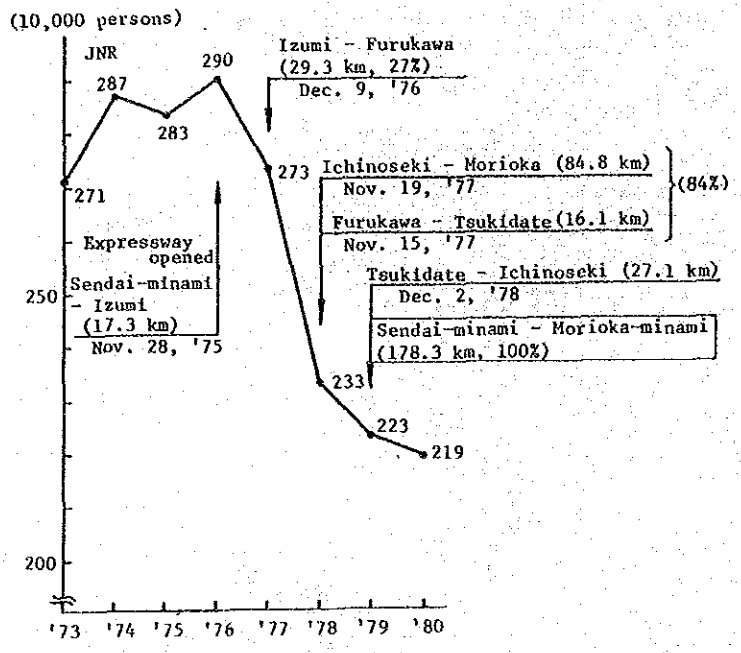
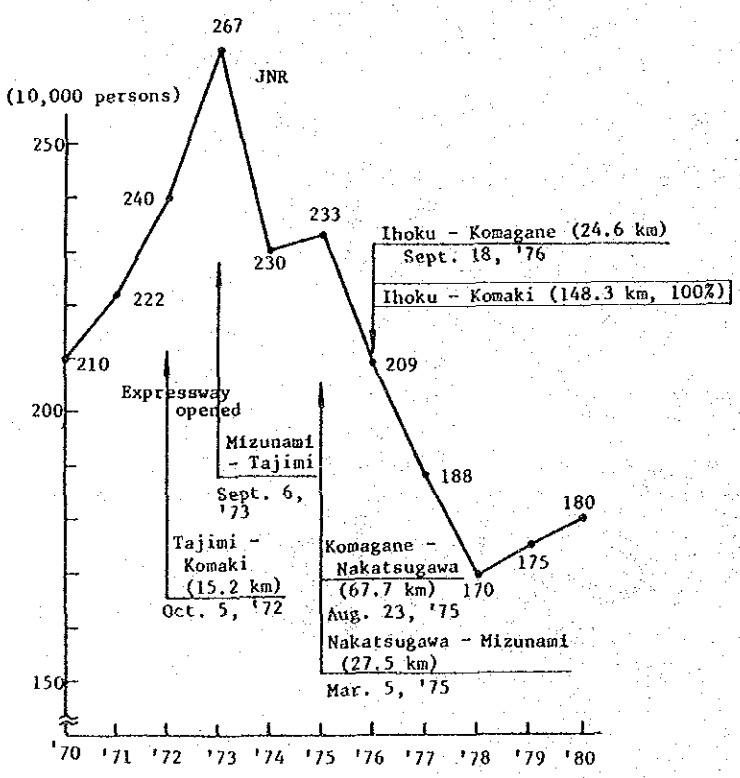


Fig. 1-1 Section Where Decrease Ratio is Calculated

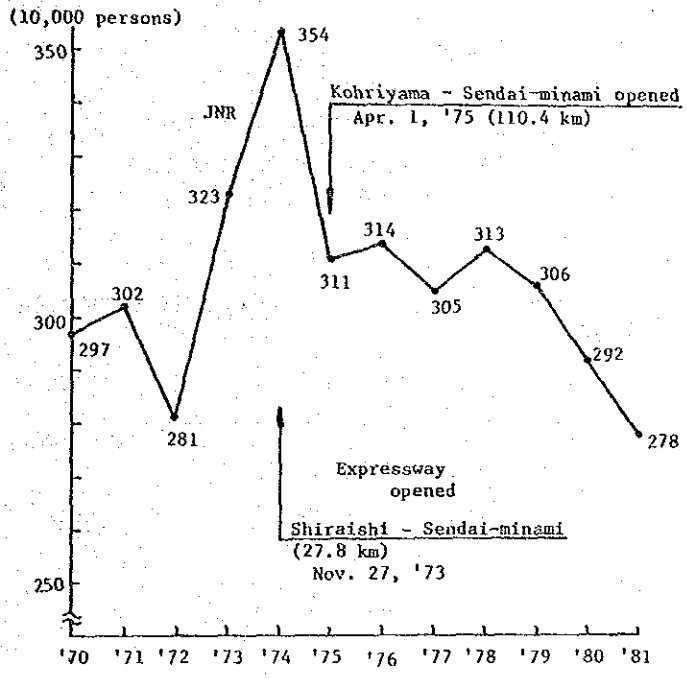
OD between Miyagi and Iwate Prefectures (JNR Ordinary train Traffic on conventional lines
The same with subsequent graphics)



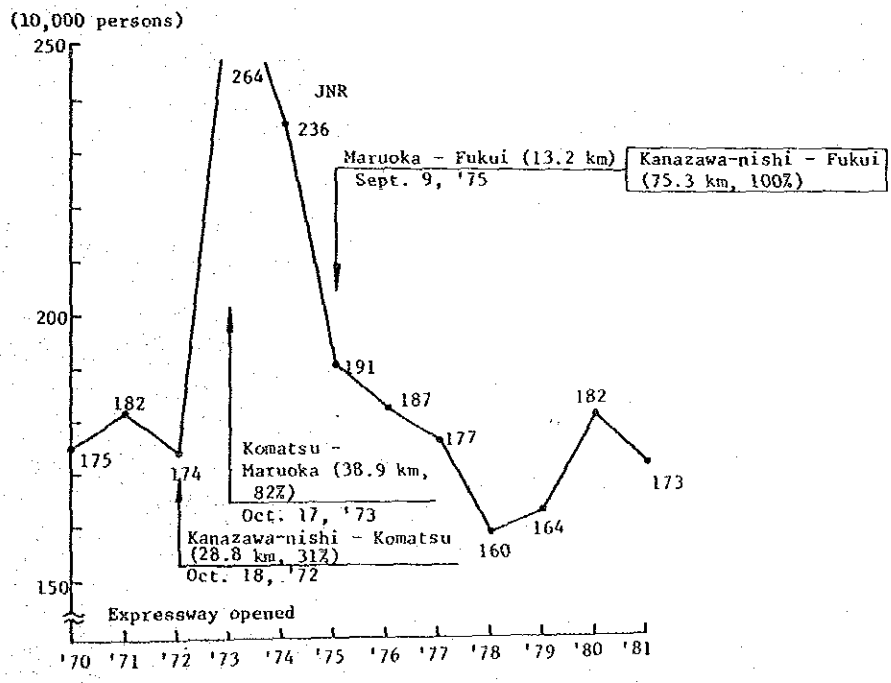
OD between Nagano and Aichi Prefectures



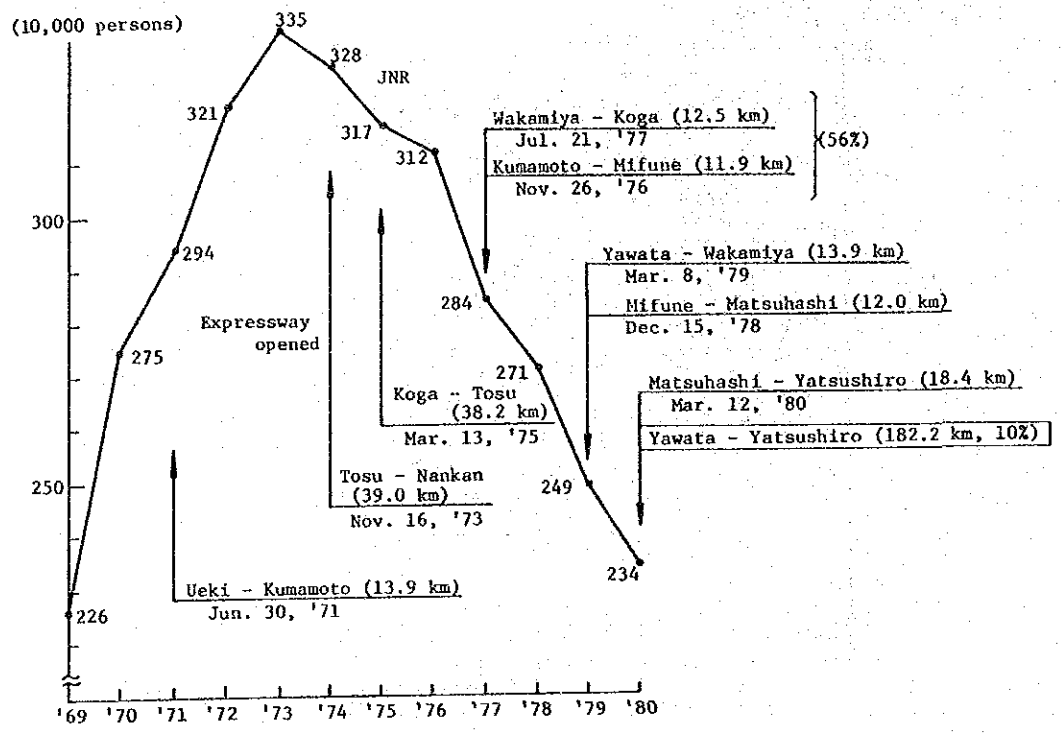
OD between Fukushima and Miyagi Prefectures



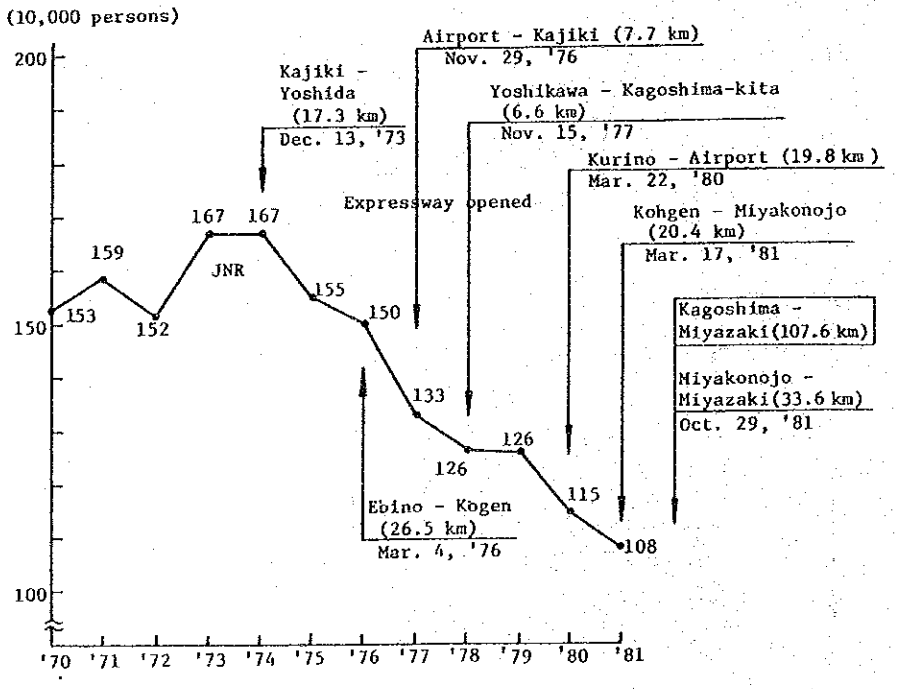
OD between Ishikawa and Fukui Prefectures



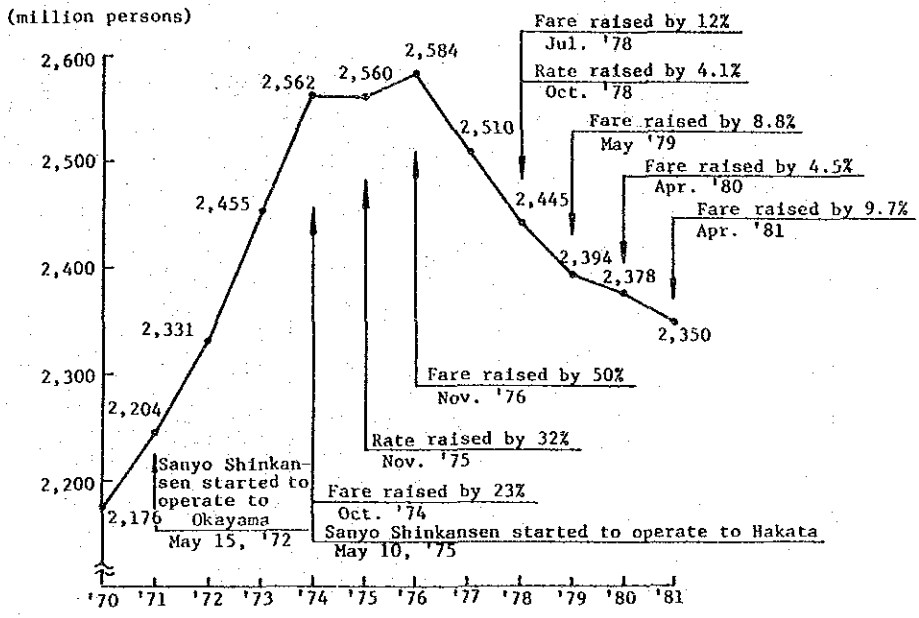
OD between Fukuoka and Kumamoto Prefectures



OD between Kagoshima and Miyazaki Prefectures



Total Passenger Carried by JNR



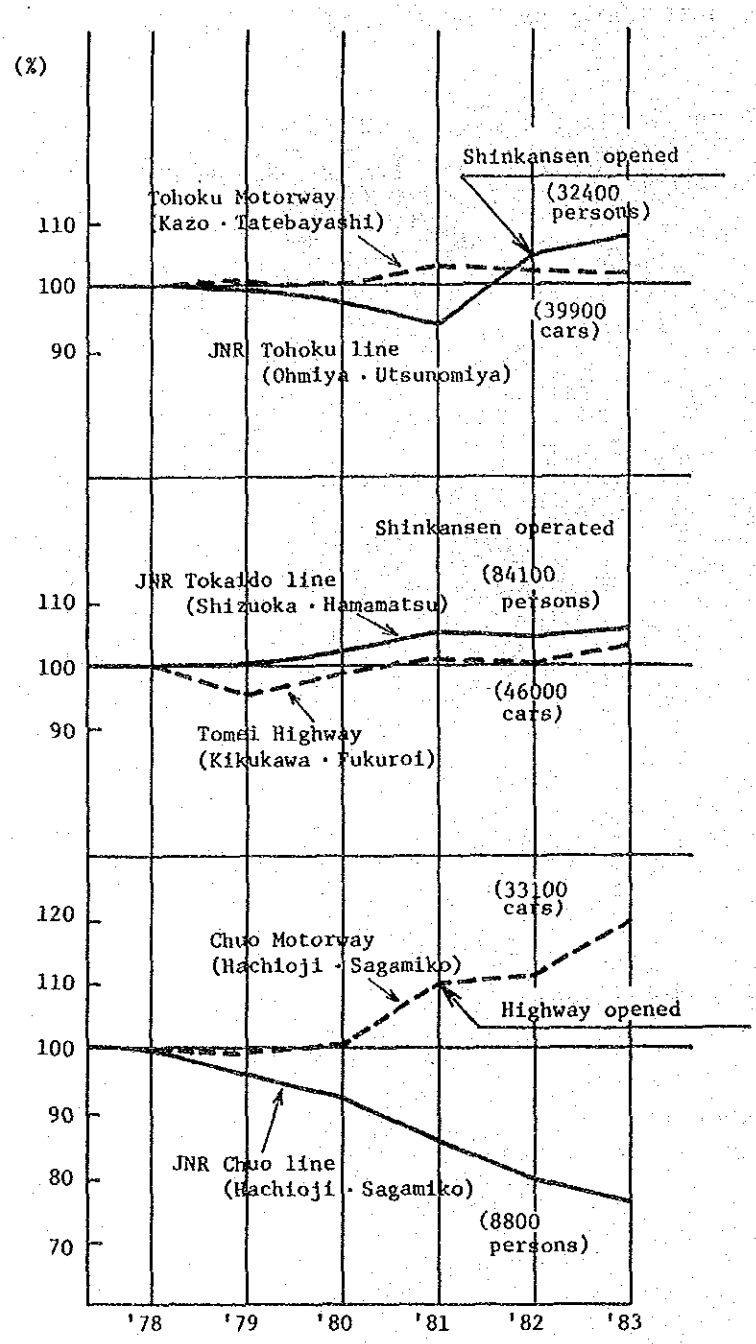

(%)
Shinkansen opened
Tohoku Motorway
(Kazo · Tatebayashi)
(32400
persons)
110
100
90
(39900
cars)
JNR Tohoku line
(Ohmiya · Utsunomiya)
Shinkansen operated
JNR Tokaido line
(Shizuoka · Hamamatsu)
(84100
persons)
110
100
90
(46000
cars)
Tomei Highway
(Kikukawa · Fukuroi)
(33100
cars)
120
110
100
90
80
70
Chuo Motorway
(Hachioji · Sagamiko)
Highway opened
JNR Chuo line
(Hachioji · Sagamiko)
(8800
persons)
'78
'79
'80
'81
'82
'83

Fig. 2-1 (1)

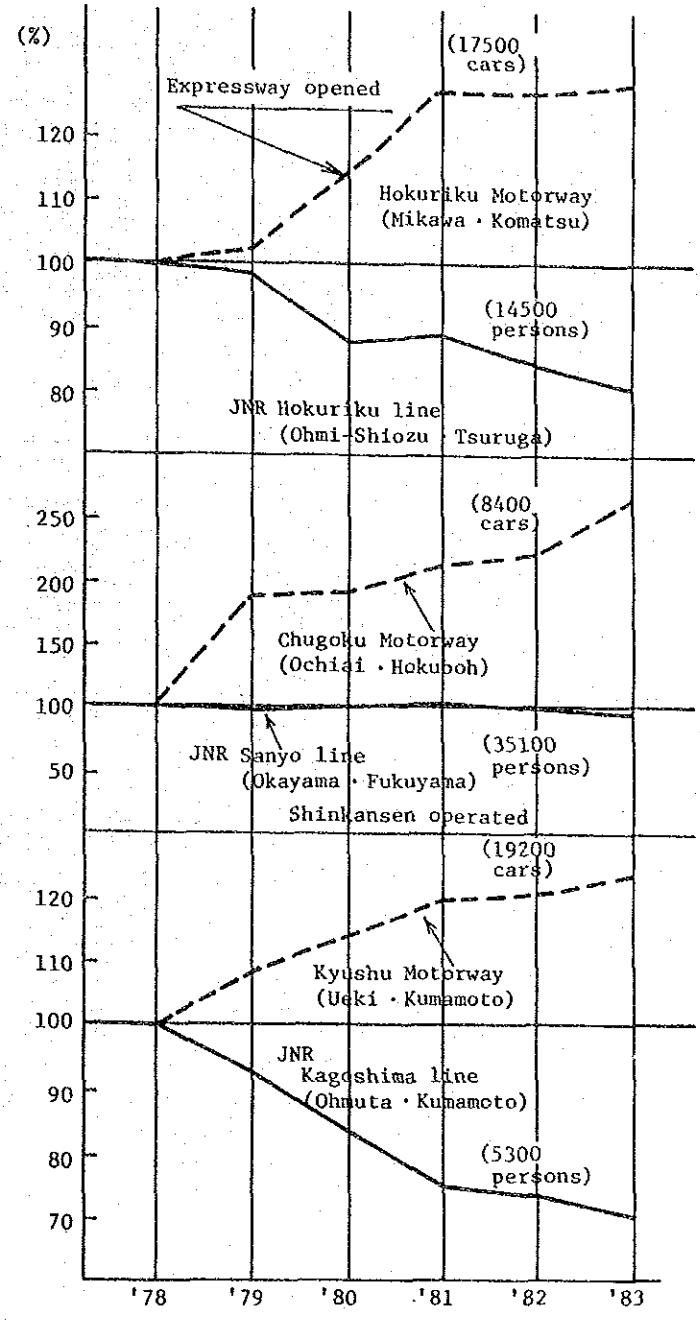


Fig. 2-1 (2)

Figures denote:
Traffic volume in '83:

1) Railway — passenger on the limited and ordinary express trains, daily. (one direction)
2) Highway — Number of vehicles for passenger and cargo, daily. (both directions)

Source: "White Paper for Transportation"
Ministry of Transport, JAPAN

Appendix 4-2-1 List of Railway Stations

The West Coast Railway

Name of stations	Kilometerage		Classification		Note
	Cumulative	Between	Passenger St.	Goods St.	
Butterworth	0		S	S	
		1K500			
Perai	1K500			D	
		9K900			
Bukit Mertajam	11K400		1		
		22K200			
Nibong Tebal	33K600		3		
		4K650			
Parit Buntar	38K250		4	A	
		12K150			
Bagan Serai	50K400		3		
		29K700			
Taiping	80K100		1	B	
		18K900			
Padang Rengas	99K000		3		
		8K500			
Kuala Kangsar	107K500		1	A	
		49K050			
Ipoh	156K550		2	D	
		12K250			
Batu Gajah	168K800		3		
		18K400			
Malim Nawar	187K200		3		
		5K100			
Kampar	192K300		3	A	
		16K000			
Tapah Road	208K300		1	B	
		9K200			
Bidor	217K500		3		
		16K500			
Sungkai	234K000		3		
		20K500			
Slim River	254K500		3	A	
		11K200			
Behrang	265K700		3		
		10K700			
Tanjong Malim	276K400		1		
		16K700			
Kuala Kubu Road	293K100		3		
		33K100			
Rawang-Kuang	326K200		1	S	
		13K650			
Sungei Buloh	339K850		3		
		17K400			
Kuala Lumpur	357K250		S		

Name of stations	Kilometerage		Classification		Note
	Cumulative	Between	Passenger St.	Goods St.	
Kuala Lumpur	357K250		S		
		10K750			
Sungei Besi	368K000		3		*
		12K500			
Kajang	380K500		1		
		5K000			
Bangi	385K500			A	
		37K250			
Seremban	422K750		2	B	
		43K850			
Tampin	466K600		1	C	
		25K400			
Batang Melaka	492K000		3		
		25K400			
Gemas	517K400		2	B	
		25K300			
Segamat	542K700		1	A	
		28K300			
Labis	571K000		3	A	
		53K400			
Keluang	624K400		1	C	
		54K900			
Kulai	679K300		3		
		16K200			
Kempas Baru	695K500		3	A	
		13K600			
Johor Bahru	709K100		2		
		26K500			
Singapore	735K600		S	B	

The New East-West Railway

Name of stations	Kilometerage		Classification		Note
	Cumulative	Between	Passenger St.	Goods St.	
Kuala Lumpur	0		S		
		1K000			
Existing K. L.	1K000		S		*
		13K500			
Batu Caves	14K500		3		*
		21K100			
Janda Baik	35K600		2		
		18K400			
Bentong	54K000		3		
		53K000			
Temerloh	107K000		1	C	
		53K000			
Maran	160K000		1		
		37K000			
Gambang	197K000		3		
		30K000			
Kuantan	227K000		2	D	
		46K400			
Chukai	273K400		1		
		25K600			
Paka (Kerteh)	299K000		S	C	
		34K500			
Dungun	333K500		1	A	
		71K000			
Kuala Trengganu	404K500		2	C	
		87K700			
Jerteh	492K200		1	A	
		15K300			
Pasir Puteh	507K500		1		
		28K500			
Bachok	536K000		3		
		11K000			
Kemasin	547K000		3		
		10K900			
Kota Bharu	557K900		S	C	

Port Kuantan Line					
Name of Station	Kilometerage		Classification		Note
	Cumulative	Between	Passenger St.	Goods St.	
Kuantan	0	5K200			
Port Kuantan	5K200			C	

Port Chukai Line					
Name of Station	Kilometerage		Classification		Note
	Cumulative	Between	Passenger St.	Goods St.	
Chukai	0	9K000			
Port Chukai	9K000			S	

Telok Intan Line					
Name of Station	Kilometerage		Classification		Note
	Cumulative	Between	Passenger St.	Goods St.	
Tapah Road	0	28K500			
Telok Intan	28K500			A	

Port Kelang Line					
Name of Station	Kilometerage		Classification		Note
	Cumulative	Between	Passenger St.	Goods St.	
Kuala Lumpur	0	9K200	S		
Petaling Jaya	9K200	5K300	4		*
Subang Jaya	14K500	8K500	4		*
Shah Alam	23K000	9K600	3		*
Kelang	32K600	9K800	4		*
Port Kelang	42K400		2	D	*

Port Dickson Line					
Name of Station	Kilometerage		Classification		Note
	Cumulative	Between	Passenger St.	Goods St.	
Seremban	0	36K100			
Port Dickson	36K100			S	

Pasir Gudang Line					
Name of Station	Kilometerage		Classification		Note
	Cumulative	Between	Passenger St.	Goods St.	
Kempas Baru	0	31K590			
Pasir Gudang	31K590			D	

Note: In the column "classification",

1,2,3,4 ; Stations classification shown in Fig. 4-3-4

A,B,C,D ; Stations classification shown in Fig. 4-3-5

S ; Stations not included in the model of 4-3-2 (1) in the report

In the column "Note",

* ; Stations only for the KL urban transport

Appendix 4-5-1 Layout for Rawang-Kuang Workshop

The workshop layout planned for the year 1991 is shown and, is common to four cases.

If the West Coast Railway opens and all railways are changed to standard gauge by the year 2005, the workshop layout will be modified as follows;

① The Diesel engine shop at the end of Electric and Diesel Locomotive body shop will be used for the Electric parts shop.

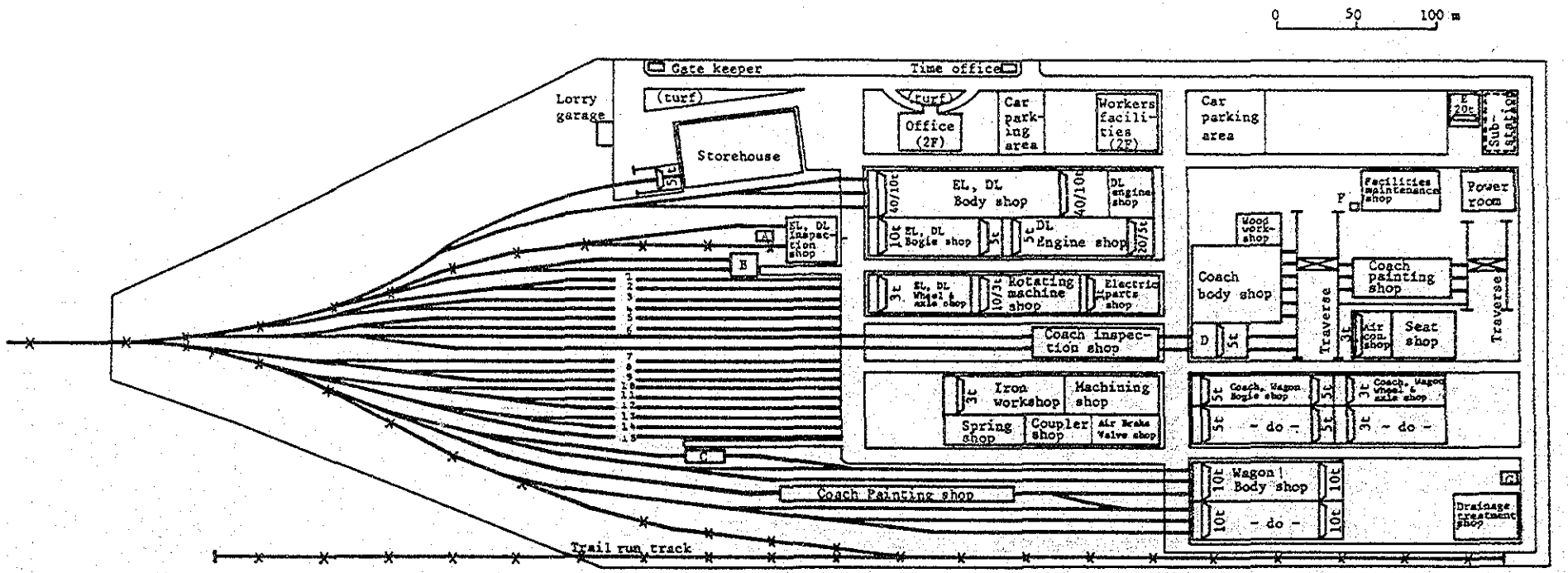
② The wood-work shop will be used for the coach body shop.

③ The yard tracks will be changed to standard gauge.

④ The two entering/outgoing tracks to the Electric and Diesel Locomotive maintenance shop will be electrified.

If the meter gauge tracks are retained, the workshop layout will be exactly the same between the year 1991 and 2005.

A Layout for Rawang-Kuang Workshop (As of 1991)



Where:

EL; Electric Locomotive

DL; Diesel Locomotive

Track: No. 1 - 4 Standard gauge track

No. 7 - 15 Meter gauge track

Others Double gauge track

A: Fuel, water & sand supplying facility

B: Shunting locomotive garage

C: Wagon tank washing shop

D: PC mounting, dismounting shop

E: DL engine testing shop

F: Oil store

G: Incinerator

⋆—⋆: Electrificated line

CASE I
EIRR

Appendix 6-2-1 Economic Analysis for Malaysia Railway Project

** ECONOMIC ANALYSIS FOR MALAYSIA RAILWAY PROJECT **

CASE I

(MIL. M$)

	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
BENEFIT													
TOTAL BENEFIT						161.9	171.8	180.9	192.0	203.8	399.7	425.1	450.4
TIME SAVING						27.2	28.5	29.9	31.5	33.3	88.8	94.1	99.9
PASS. FOR WORKS						25.0	26.2	27.5	29.0	30.6	82.6	87.5	92.8
PASS. FOR LEISURE						2.1	2.2	2.3	2.4	2.6	6.9	7.3	7.7
GOODS						0.1	0.1	0.1	0.1	0.1	-0.7	-0.7	-0.7
COST SAVING						134.7	143.3	150.9	160.4	170.5	310.9	331.0	350.5
WITH THE PROJECT COST						94.9	97.3	101.3	104.0	106.8	217.9	221.4	226.8
RAILWAY						85.0	87.1	90.7	92.9	95.2	197.7	200.6	205.3
ROAD						9.8	10.2	10.7	11.1	11.6	20.2	20.8	21.5
WITHOUT THE PROJECT COST						229.5	240.6	252.2	264.5	277.3	528.8	552.4	577.3
RAILWAY						15.3	16.0	16.7	17.4	18.1	77.3	80.6	84.1
ROAD						91.4	95.3	99.3	103.6	108.1	224.5	232.7	241.4
AIR FLIGHT						115.6	121.9	128.6	135.6	143.0	217.3	229.2	241.7
COASTAL SHIP						7.2	7.4	7.6	7.9	8.2	9.6	9.9	10.2
INVESTMENT													
INVESTMENT DIFF	276.1	513.3	665.2	724.3	316.1	-1376.1	309.3	351.5	333.7	484.0	-221.9	7.5	-4.0
WITH THE PROJECT INV.	276.1	513.3	665.2	724.3	316.1	-1116.7	320.6	363.4	346.1	497.0	30.9	29.8	19.4
RAILWAY	276.1	513.3	665.2	724.3	316.1	-1132.3	319.9	362.6	345.3	496.2	17.9	28.8	18.3
ROAD						15.6	0.7	0.7	0.7	0.8	13.0	1.0	1.1
WITHOUT THE PROJECT INV.						259.4	11.3	11.8	12.4	13.0	252.9	22.4	23.4
ROAD						196.2	8.5	9.0	9.4	9.9	226.7	18.1	18.9
AIR FLIGHT						30.0	1.6	1.7	1.8	1.9	19.3	3.1	3.2
SEA						33.1	1.1	1.1	1.2	1.2	6.9	1.2	1.2
CF FOR EIRR	-276.1	-513.3	-665.2	-724.3	-316.2	1538.0	-137.5	-170.7	-141.7	-280.2	621.7	417.7	454.4
EIRR	14.08	14.08	14.08	14.08	14.08	14.08	14.08	14.08	14.08	14.08	14.08	14.08	14.08

** ECONOMIC ANALYSIS FOR MALAYSIA RAILWAY PROJECT **

CASE I

(MIL. M$)

	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
BENEFIT													
TOTAL BENEFIT	478.8	508.7	537.3	569.4	602.4	638.0	864.6	872.4	881.0	890.7	901.6	1377.3	1445.2
TIME SAVING	106.1	112.7	120.1	129.1	138.8	149.3	227.7	233.7	240.4	247.9	256.4	347.5	366.7
PASS. FOR WORKS	98.6	104.7	111.5	119.9	128.8	138.5	211.2	216.7	222.9	229.9	237.7	322.9	340.6
PASS. FOR LEISURE	8.2	8.7	9.3	10.0	10.7	11.5	17.6	18.1	18.6	19.2	19.8	26.9	28.4
GOODS	-0.7	-0.7	-0.7	-0.8	-0.8	-0.8	-1.1	-1.1	-1.1	-1.1	-1.1	-2.3	-2.4
COST SAVING	372.7	395.9	417.3	440.3	463.6	488.8	637.0	638.7	640.6	642.8	645.2	1029.8	1078.6
WITH THE PROJECT COST	230.6	234.8	241.4	245.2	249.9	254.0	360.3	360.7	361.1	361.5	362.0	452.9	458.1
RAILWAY	208.4	211.9	217.8	220.9	224.8	228.2	340.6	340.9	341.4	341.8	342.2	423.6	427.8
ROAD	22.2	22.9	23.6	24.3	25.1	25.8	19.7	19.7	19.7	19.7	19.7	29.4	30.3
WITHOUT THE PROJECT COST	603.3	630.7	658.7	685.5	713.5	742.7	997.3	999.4	1001.7	1004.3	1007.1	1482.7	1536.7
RAILWAY	87.7	91.4	95.3	99.4	103.7	108.1	141.5	141.5	141.5	141.5	141.5	203.6	210.9
ROAD	250.4	259.8	269.7	279.8	290.4	301.4	386.7	388.8	391.1	393.7	396.5	591.2	613.2
AIR FLIGHT	254.8	268.7	282.6	295.0	307.9	321.3	456.0	456.0	456.0	456.0	456.0	673.4	697.6
COASTAL SHIP	10.4	10.7	11.0	11.3	11.6	11.9	13.1	13.1	13.1	13.1	13.1	14.5	15.0
INVESTMENT													
INVESTMENT DIFF	-13.7	170.1	400.8	536.8	298.6	482.7	-255.5	274.6	527.8	355.2	717.7	-447.9	180.2
WITH THE PROJECT INV.	10.8	195.7	457.5	565.1	524.4	522.2	-10.7	307.0	544.8	589.6	744.2	31.1	288.1
RAILWAY	9.7	194.6	456.3	564.0	507.6	520.3		306.7	544.4	577.8	743.6	16.1	286.0
ROAD	1.1	1.1	1.2	1.1	16.8	1.9	-10.7	0.3	0.3	11.8	0.6	15.0	2.0
WITHOUT THE PROJECT INV.	24.5	25.6	56.7	28.3	225.8	39.5	244.8	32.4	17.0	234.4	26.5	479.0	107.9
ROAD	19.8	20.7	21.7	22.1	219.3	32.7	202.3	13.0	13.9	231.2	23.1	412.4	65.9
AIR FLIGHT	3.4	3.6	33.6	4.8	5.1	5.3	36.9	19.3	3.1	3.2	3.4	60.0	39.9
SEA	1.2	1.3	1.3	1.3	1.4	1.4	5.6					6.6	2.1
CF FOR EIRR	492.4	338.5	136.5	32.6	303.8	155.3	1120.1	597.7	353.2	535.5	183.9	1825.2	1265.1
EIRR	14.08	14.08	14.08	14.08	14.08	14.08	14.08	14.08	14.08	14.08	14.08	14.08	14.08

** ECONOMIC ANALYSIS FOR MALAYSIA RAILWAY PROJECT **

(MIL. M$)

CASE I

	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
BENEFIT													
TOTAL BENEFIT	1514.0	1587.4	1663.0	1744.5	1828.7	1902.0	1995.9	2097.0	2202.7	2318.5	2435.2	2566.0	2681.5
TIME SAVING	387.2	409.5	433.5	459.4	487.6	518.1	551.4	587.5	626.9	669.9	716.9	768.3	824.6
PASS. FOR WORKS	359.7	380.3	402.5	426.6	452.6	480.9	511.7	545.1	581.6	621.3	664.8	712.3	764.4
PASS. FOR LEISURE	30.0	31.7	33.5	35.5	37.7	40.1	42.6	45.4	48.5	51.8	55.4	59.4	63.7
GOODS	-2.5	-2.5	-2.6	-2.7	-2.8	-2.9	-2.9	-3.0	-3.1	-3.2	-3.3	-3.4	-3.5
COST SAVING	1126.7	1177.9	1229.5	1285.0	1341.1	1383.9	1444.6	1509.5	1575.8	1648.6	1718.3	1797.8	1857.0
WITH THE PROJECT COST	466.1	473.3	482.5	490.1	499.8	525.6	536.2	545.7	556.9	565.0	579.7	588.4	621.3
RAILWAY	434.9	441.0	449.2	455.8	464.4	489.0	498.5	506.7	516.7	523.5	537.0	544.4	575.9
ROAD	31.3	32.3	33.3	34.4	35.5	36.6	37.8	39.0	40.2	41.5	42.8	44.1	45.4
WITHOUT THE PROJECT COST	1592.8	1651.2	1712.0	1775.2	1840.9	1909.5	1980.8	2055.2	2132.7	2213.6	2298.1	2386.2	2478.3
RAILWAY	218.4	226.2	234.3	242.7	251.3	260.3	269.6	279.2	289.1	299.5	310.1	321.2	332.7
ROAD	636.3	660.4	685.6	712.0	739.7	768.7	799.2	831.2	864.8	900.3	937.6	977.0	1018.5
AIR FLIGHT	722.7	748.7	775.7	803.6	832.5	862.5	893.6	925.7	959.1	993.6	1029.4	1066.4	1104.8
COASTAL SHIP	15.4	15.9	16.4	16.9	17.4	18.0	18.5	19.1	19.7	20.3	20.9	21.6	22.3
INVESTMENT													
INVESTMENT DIFF	2.0	103.7	-6.2	-190.8	385.5	-202.8	116.8	-56.1	-257.3	286.5	-487.5	15.6	-122.8
WITH THE PROJECT INV.	84.3	189.7	83.0	129.9	504.9	73.0	206.7	38.3	114.6	467.3	26.0	187.5	57.3
RAILWAY	82.2	187.5	80.8	118.7	502.3	68.5	204.7	36.2	100.9	464.8	9.1	183.5	53.1
ROAD	2.1	2.1	2.2	11.2	2.6	4.5	2.1	2.1	13.6	2.4	16.9	4.0	4.1
WITHOUT THE PROJECT INV.	82.3	86.0	89.2	320.7	119.4	275.8	89.9	94.4	371.9	180.7	513.5	171.9	180.1
ROAD	68.8	71.9	74.6	274.2	90.2	262.4	76.0	80.0	300.5	95.8	488.9	146.3	153.5
AIR FLIGHT	11.4	11.8	12.3	44.2	26.8	10.9	11.3	11.8	68.7	48.9	20.7	21.5	22.3
SEA	2.1	2.2	2.3	2.4	2.4	2.5	2.6	2.7	2.7	36.0	4.0	4.1	4.3
CF FOR EIRR	1512.0	1483.7	1669.2	1935.3	1443.2	2104.8	1879.1	2153.0	2460.0	2032.0	2922.7	2550.4	2804.3
EIRR	14.08	14.08	14.08	14.08	14.08	14.08	14.08	14.08	14.08	14.08	14.08	14.08	14.08

** ECONOMIC ANALYSIS FOR MALAYSIA RAILWAY PROJECT **

(MIL. M$)

CASE I

	2025	2026	2027	2028	2029	2030
BENEFIT						
TOTAL BENEFIT	2829.8	2981.5	3150.6	3324.5	3518.3	3719.5
TIME SAVING	886.3	954.1	1028.5	1110.4	1200.5	1299.8
PASS. FOR WORKS	821.5	884.1	953.0	1028.7	1112.0	1203.7
PASS. FOR LEISURE	68.5	73.7	79.4	85.7	92.7	100.3
GOODS	-3.6	-3.8	-3.9	-4.0	-4.1	-4.2
COST SAVING	1943.5	2027.4	2122.0	2214.1	2317.8	2419.7
WITH THE PROJECT COST	631.0	647.7	658.4	676.7	688.6	707.9
RAILWAY	584.2	599.4	608.6	625.3	635.6	653.3
ROAD	46.9	48.3	49.8	51.3	52.9	54.6
WITHOUT THE PROJECT COST	2574.5	2675.2	2780.5	2890.8	3006.4	3127.6
RAILWAY	344.5	356.8	369.6	382.8	396.4	410.6
ROAD	1062.4	1108.9	1158.0	1210.2	1265.5	1324.3
AIR FLIGHT	1144.6	1185.8	1228.5	1272.7	1318.5	1366.0
COASTAL SHIP	23.0	23.7	24.4	25.2	25.9	26.7
INVESTMENT						
INVESTMENT DIFF	323.8	-16.8	-207.0	-161.3	-275.3	-3129.1
WITH THE PROJECT INV.	543.9	199.6	193.2	61.4	126.9	-4440.8
RAILWAY	539.7	195.2	179.7	56.5	120.0	-4413.9
ROAD	4.2	4.4	13.4	4.9	6.9	-26.8
WITHOUT THE PROJECT INV.	220.1	216.4	400.1	222.7	402.1	-1311.7
ROAD	161.2	168.8	373.6	195.3	373.6	-1145.8
AIR FLIGHT	54.5	37.5	21.9	22.8	23.7	-93.5
SEA	4.4	10.2	4.6	4.7	4.8	-72.4
CF FOR EIRR	2506.0	2998.3	3357.5	3485.8	3793.6	6848.5
EIRR	14.08	14.08	14.08	14.08	14.08	14.08

** ECONOMIC ANALYSIS FOR MALAYSIA RAILWAY PROJECT **

(MIL. M$)

CASE II

	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
BENEFIT													
TOTAL BENEFIT						162.1	172.0	181.0	192.1	203.9	399.7	425.1	450.3
TIME SAVING						27.2	28.5	29.9	31.5	33.3	88.8	94.1	99.9
PASS. FOR WORKS						25.0	26.2	27.5	29.0	30.6	82.6	87.5	92.8
PASS. FOR LEISURE						2.1	2.2	2.3	2.4	2.6	6.9	7.3	7.7
GOODS						0.1	0.1	0.1	0.1	0.1	-0.7	-0.7	-0.7
COST SAVING						134.8	143.5	151.1	160.6	170.6	310.8	330.9	350.4
WITH THE PROJECT COST						94.7	97.1	101.2	103.9	106.7	217.9	221.5	226.8
RAILWAY						84.9	86.9	90.5	92.7	95.1	197.7	200.7	205.3
ROAD						9.8	10.2	10.7	11.1	11.6	20.2	20.8	21.5
WITHOUT THE PROJECT COST						229.5	240.6	252.2	264.5	277.3	528.8	552.4	577.3
RAILWAY						15.3	16.0	16.7	17.4	18.1	77.3	80.6	84.1
ROAD						91.4	95.3	99.3	103.6	108.1	224.5	232.7	241.4
AIR FLIGHT						115.6	121.9	128.6	135.6	143.0	217.3	229.2	241.7
COASTAL SHIP						7.2	7.4	7.6	7.9	8.2	9.6	9.9	10.2
INVESTMENT													
INVESTMENT DIFF	276.1	513.3	665.2	724.3	316.1	-1376.1	309.3	351.5	333.7	484.0	-222.1	7.5	-4.0
WITH THE PROJECT INV.	276.1	513.3	665.2	724.3	316.1	-1116.7	320.6	363.4	346.1	497.0	30.7	29.8	19.4
RAILWAY	276.1	513.3	665.2	724.3	316.1	-1132.3	319.9	362.6	345.3	496.2	17.7	28.8	18.3
ROAD						15.6	0.7	0.7	0.7	0.8	13.0	1.0	1.1
WITHOUT THE PROJECT INV.						259.4	11.3	11.8	12.4	13.0	252.9	22.4	23.4
ROAD						196.2	8.5	9.0	9.4	9.9	226.7	18.1	18.9
AIR FLIGHT						30.0	1.6	1.7	1.8	1.9	19.3	3.1	3.2
SEA						33.1	1.1	1.1	1.2	1.2	6.9	1.2	1.2
CF FOR EIRR	-276.1	-513.3	-665.2	-724.3	-316.2	1538.1	-137.3	-170.5	-141.6	-280.0	621.8	417.6	454.3
EIRR	13.45	13.45	13.45	13.45	13.45	13.45	13.45	13.45	13.45	13.45	13.45	13.45	13.45

** ECONOMIC ANALYSIS FOR MALAYSIA RAILWAY PROJECT **

CASE II

(MIL. M$)

	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
BENEFIT													
TOTAL BENEFIT	478.7	508.6	537.6	569.6	602.7	636.5	692.8	701.4	710.2	720.9	732.8	746.0	760.9
TIME SAVING	106.1	112.7	120.1	129.1	138.8	149.3	162.3	169.1	176.7	185.2	194.7	205.4	217.3
PASS. FOR WORKS	98.6	104.7	111.5	119.9	128.8	138.5	150.5	156.8	163.8	171.7	180.5	190.3	201.4
PASS. FOR LEISURE	8.2	8.7	9.3	10.0	10.7	11.5	12.5	13.1	13.7	14.3	15.0	15.9	16.8
GOODS	-0.7	-0.7	-0.7	-0.8	-0.8	-0.8	-0.8	-0.8	-0.8	-0.8	-0.8	-0.8	-0.8
COST SAVING	372.6	395.8	417.5	440.6	463.9	487.2	530.5	532.3	533.5	535.7	538.1	540.6	543.6
WITH THE PROJECT COST	230.7	234.9	241.1	244.9	249.6	255.5	258.2	258.5	259.7	260.1	260.5	261.1	261.7
RAILWAY	208.5	212.0	217.5	220.6	224.5	229.7	231.6	231.9	233.0	233.5	233.9	234.5	235.0
ROAD	22.2	22.9	23.6	24.3	25.1	25.8	26.6	26.6	26.6	26.6	26.6	26.6	26.6
WITHOUT THE PROJECT COST	603.3	630.7	658.7	685.5	713.5	742.7	788.8	790.9	793.2	795.8	798.6	801.8	805.2
RAILWAY	87.7	91.4	95.3	99.4	103.7	108.1	112.8	112.8	112.8	112.8	112.8	112.8	112.8
ROAD	250.4	259.8	269.7	279.8	290.4	301.4	313.7	315.8	318.1	320.7	323.6	326.7	330.2
AIR FLIGHT	254.8	268.7	282.6	295.0	307.9	321.3	350.1	350.1	350.1	350.1	350.1	350.1	350.1
COASTAL SHIP	10.4	10.7	11.0	11.3	11.6	11.9	12.2	12.2	12.2	12.2	12.2	12.2	12.2
INVESTMENT													
INVESTMENT DIFF	-13.7	24.9	-3.8	-7.1	-162.6	-15.6	-45.3	29.9	-16.2	-221.4	-17.5	-27.0	203.4
WITH THE PROJECT INV.	10.8	50.5	52.8	21.2	63.1	23.8	2.0	62.3	0.8	13.0	9.0	1.1	263.0
RAILWAY	9.7	49.4	51.6	20.1	46.3	21.9		61.5			7.9		261.8
ROAD	1.1	1.1	1.2	1.1	16.8	1.9	2.0	0.7	0.8	13.0	1.0	1.1	1.1
WITHOUT THE PROJECT INV.	24.5	25.6	56.7	28.3	225.8	39.5	47.3	32.4	17.0	234.4	26.5	28.0	59.5
ROAD	19.8	20.7	21.7	22.1	219.3	32.7	36.5	13.0	13.9	231.2	23.1	24.4	25.9
AIR FLIGHT	3.4	3.6	33.6	4.8	5.1	5.3	9.4	19.3	3.1	3.2	3.4	3.6	33.6
SEA	1.2	1.3	1.3	1.3	1.4	1.4	1.4						
CF FOR EIRR	492.4	483.7	541.4	576.7	765.4	652.1	738.1	671.4	726.4	942.3	750.3	773.0	557.5
EIRR	13.45	13.45	13.45	13.45	13.45	13.45	13.45	13.45	13.45	13.45	13.45	13.45	13.45

** ECONOMIC ANALYSIS FOR MALAYSIA RAILWAY PROJECT **

CASE II

(MIL. M$)

	2012	2013	2014	2015	2016	2017	2018
BENEFIT							
TOTAL BENEFIT	777.5	795.4	816.1	839.2	865.1	893.2	925.5
TIME SAVING	230.7	245.7	262.5	281.2	302.2	325.7	351.9
PASS. FOR WORKS	213.7	227.6	243.0	260.4	279.7	301.4	325.6
PASS. FOR LEISURE	17.8	19.0	20.3	21.7	23.3	25.1	27.1
GOODS	-0.8	-0.8	-0.8	-0.8	-0.8	-0.8	-0.8
COST SAVING	546.8	549.7	553.7	558.0	562.9	567.5	573.5
WITH THE PROJECT COST	262.3	263.7	264.4	265.4	266.3	268.0	269.2
RAILWAY	235.7	237.1	237.8	238.8	239.7	241.4	242.6
ROAD	26.6	26.6	26.6	26.6	26.6	26.6	26.6
WITHOUT THE PROJECT COST	809.1	813.4	818.1	823.4	829.2	835.6	842.7
RAILWAY	112.8	112.8	112.8	112.8	112.8	112.8	112.8
ROAD	334.1	338.3	343.1	348.3	354.1	360.6	367.7
AIR FLIGHT	350.1	350.1	350.1	350.1	350.1	350.1	350.1
COASTAL SHIP	12.2	12.2	12.2	12.2	12.2	12.2	12.2
INVESTMENT							
INVESTMENT DIFF	-20.3	118.3	-26.6	-221.0	387.8	-48.7	-1862.1
WITH THE PROJECT INV.	11.9	152.6	9.1	16.8	449.9	2.0	-2209.4
RAILWAY	10.8	151.4	7.9		448.1		-2191.6
ROAD	1.1	1.2	1.1	16.8	1.9	2.0	-17.8
WITHOUT THE PROJECT INV.	32.3	34.2	35.6	237.8	62.1	50.7	-347.3
ROAD	27.4	29.2	30.3	228.4	42.8	47.7	-303.6
AIR FLIGHT	4.8	5.1	5.3	9.4	19.3	3.1	-34.5
SEA							-9.3
CF FOR EIRR	797.9	677.0	842.7	1060.3	477.3	942.0	2787.6
EIRR	13.45	13.45	13.45	13.45	13.45	13.45	13.45

** ECONOMIC ANALYSIS FOR MALAYSIA RAILWAY PROJECT **

CASE III

(MIL. M$)

	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
BENEFIT													
TOTAL BENEFIT						162.8	172.7	181.8	192.9	204.7	215.8	229.0	243.5
TIME SAVING						27.2	28.5	29.9	31.5	33.3	35.4	37.8	40.5
PASS. FOR WORKS						25.0	26.2	27.5	29.0	30.6	32.5	34.8	37.3
PASS. FOR LEISURE						2.1	2.2	2.3	2.4	2.6	2.7	2.9	3.1
GOODS						0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
COST SAVING						135.6	144.2	151.8	161.4	171.4	180.5	191.2	203.0
WITH THE PROJECT COST						93.9	96.4	100.4	103.1	105.9	110.6	114.1	117.3
RAILWAY						84.1	86.1	89.7	92.0	94.3	98.4	101.5	104.1
ROAD						9.8	10.2	10.7	11.1	11.6	12.1	12.7	13.2
WITHOUT THE PROJECT COST						229.5	240.6	252.2	264.5	277.3	291.0	305.3	320.3
RAILWAY						15.3	16.0	16.7	17.4	18.1	18.9	19.7	20.6
ROAD						91.4	95.3	99.3	103.6	108.1	112.7	117.7	122.9
AIR FLIGHT						115.6	121.9	128.6	135.6	143.0	150.9	159.2	167.8
COASTAL SHIP						7.2	7.4	7.6	7.9	8.2	8.4	8.7	9.0
INVESTMENT													
INVESTMENT DIFF	276.1	513.3	665.2	724.3	316.1	-1478.7	26.2	-10.5	-11.3	5.1	26.6	-13.5	-14.1
WITH THE PROJECT INV.	276.1	513.3	665.2	724.3	316.1	-1219.4	37.5	1.3	1.1	18.1	40.3	0.8	0.9
RAILWAY	276.1	513.3	665.2	724.3	316.1	-1235.0	36.8	0.6	0.4	17.3	39.4		
ROAD						15.6	0.7	0.7	0.7	0.8	0.8	0.8	0.9
WITHOUT THE PROJECT INV.						259.4	11.3	11.8	12.4	13.0	13.7	14.3	15.0
ROAD						196.2	8.5	9.0	9.4	9.9	10.3	10.9	11.4
AIR FLIGHT						30.0	1.6	1.7	1.8	1.9	2.1	2.1	2.3
SEA						33.1	1.1	1.1	1.2	1.2	1.3	1.3	1.3
CF FOR EIRR	-276.1	-513.3	-665.2	-724.3	-316.2	1641.5	146.5	192.3	204.2	199.6	189.2	242.5	257.7
EIRR	13.34	13.34	13.34	13.34	13.34	13.34	13.34	13.34	13.34	13.34	13.34	13.34	13.34

CASE III
EIRR

** ECONOMIC ANALYSIS FOR MALAYSIA RAILWAY PROJECT **

CASE III

(MIL. M$)

	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
BENEFIT													
TOTAL BENEFIT	259.0	275.3	292.5	310.7	328.7	348.7	379.5	400.9	421.2	445.5	471.6	499.3	527.4
TIME SAVING	43.6	47.0	50.8	55.8	61.3	67.5	74.3	81.9	90.5	99.9	110.3	121.8	134.5
PASS. FOR WORKS	40.1	43.3	46.7	51.3	56.4	62.1	68.4	75.5	83.3	92.0	101.6	112.2	124.0
PASS. FOR LEISURE	3.3	3.6	3.9	4.3	4.7	5.2	5.7	6.3	6.9	7.7	8.5	9.4	10.3
GOODS	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
COST SAVING	215.4	228.3	241.8	254.9	267.4	281.3	305.2	318.9	330.7	345.7	361.3	377.5	392.9
WITH THE PROJECT COST	120.7	124.4	128.6	132.1	137.1	141.5	145.5	149.0	155.1	158.9	162.8	167.1	173.0
RAILWAY	106.9	110.1	113.7	116.6	120.9	124.7	128.0	130.9	136.4	139.6	142.9	146.5	151.7
ROAD	13.8	14.4	15.0	15.6	16.2	16.8	17.5	18.1	18.7	19.3	19.9	20.6	21.3
WITHOUT THE PROJECT COST	336.1	352.7	370.4	387.0	404.5	422.8	450.7	467.9	485.8	504.6	524.1	544.5	565.9
RAILWAY	21.4	22.4	23.3	24.3	25.4	26.6	27.6	28.6	29.6	30.6	31.7	32.9	34.0
ROAD	128.3	134.1	140.2	146.5	153.2	160.2	167.7	174.8	182.3	190.1	198.4	207.2	216.5
AIR FLIGHT	177.0	186.6	197.0	205.9	215.3	225.0	244.1	252.9	262.0	271.4	281.2	291.3	301.8
COASTAL SHIP	9.3	9.6	9.9	10.3	10.6	10.9	11.3	11.7	12.0	12.4	12.8	13.2	13.6
INVESTMENT													
INVESTMENT DIFF	-4.0	7.1	-26.0	-4.9	-168.0	-25.0	-30.9	41.8	-27.8	-31.3	-13.2	-17.2	162.1
WITH THE PROJECT INV.	11.8	23.7	21.5	14.5	48.5	4.9	3.0	72.2	4.0	1.9	21.8	19.5	230.8
RAILWAY	10.8	22.7	20.5	13.5	31.9	3.2	1.1	70.5	2.2	0.1	19.9	17.6	228.7
ROAD	0.9	1.0	1.0	1.0	16.6	1.7	1.8	1.7	1.8	1.9	1.9	2.0	2.0
WITHOUT THE PROJECT INV.	15.8	16.6	47.5	19.4	216.6	29.9	33.8	30.3	31.7	33.3	35.0	36.7	68.7
ROAD	12.0	12.6	13.3	13.9	210.8	24.0	25.3	24.4	25.6	26.8	28.3	29.8	31.4
AIR FLIGHT	2.4	2.5	32.7	4.0	4.2	4.4	6.9	4.4	4.5	4.7	4.9	5.1	35.4
SEA	1.4	1.4	1.5	1.5	1.6	1.6	1.6	1.6	1.7	1.7	1.8	1.8	1.9
CF FOR EIRR	263.0	268.2	318.5	315.6	496.7	373.7	410.3	359.0	449.0	476.8	484.7	516.5	365.3
EIRR	13.34	13.34	13.34	13.34	13.34	13.34	13.34	13.34	13.34	13.34	13.34	13.34	13.34

** ECONOMIC ANALYSIS FOR MALAYSIA RAILWAY PROJECT **

(MIL. M$)

CASE III

	2012	2013	2014	2015
BENEFIT				
TOTAL BENEFIT	559.4	592.9	629.8	667.7
TIME SAVING	148.6	164.2	181.5	200.6
PASS. FOR WORKS	137.0	151.4	167.3	185.0
PASS. FOR LEISURE	11.4	12.6	13.9	15.4
GOODS	0.2	0.2	0.2	0.2
COST SAVING	410.8	428.7	448.3	467.1
WITH THE PROJECT COST	177.5	182.9	187.8	194.6
RAILWAY	155.5	160.2	164.3	170.3
ROAD	22.0	22.7	23.5	24.3
WITHOUT THE PROJECT COST	588.2	611.6	636.1	661.7
RAILWAY	35.2	36.5	37.8	39.2
ROAD	226.4	236.8	247.9	259.6
AIR FLIGHT	312.6	323.9	335.6	347.6
COASTAL SHIP	14.0	14.4	14.9	15.3
INVESTMENT				
INVESTMENT DIFF	3.9	109.7	-20.4	-1330.8
WITH THE PROJECT INV.	45.6	153.6	25.7	-1520.1
RAILWAY	43.5	151.4	23.6	-1512.3
ROAD	2.1	2.2	2.2	-7.8
WITHOUT THE PROJECT INV.	41.8	44.0	46.2	-189.3
ROAD	33.1	34.9	36.7	-125.7
AIR FLIGHT	6.8	7.1	7.4	-36.6
SEA	1.9	2.0	2.1	-27.1
CF FOR EIRR	555.5	483.2	650.2	1998.5
EIRR	13.34	13.34	13.34	13.34