1.10 Financial Evaluation

The synthetic evaluation of the Master Plan is described in "1.1 Overview, 1.1.2, Evaluation of the Master Plan". The flow of the Master Plan evaluation is shown in Fig. 1.10.1.

(1) Preconditions of financial evaluation

1) Fare levels

A fare level influences demand. Costs and expense change with demand and revenue changes with fares and demand. For financial analysis and demand forecast, fares are set as follows:

- Commuter service

  Basic condition : 0.215 baht/km (Current third class fare)

  Alternatives : 0.44 baht (Current second class fare)

  1.0 baht/km (Upper limit)

- Intercity express service

  Basic condition (only): 0.6 baht/km (Second class including express, seat reservation and airconditioning charges)

The estimated demand for commuter service in cases of 0.44 baht/km and 1.0 baht/km is 72% and 62%, respectively, of that in the case of the basic condition. Estimated expenses are 80% and 70%, respectively.

2) Condition of urban development

As described previously, conditions for urban development for demand forecasting are classified into the following eight cases for demand forecasting:

a. Railway project only

b. With integrated urban development

   i. Do minimum

   ii. Railway improvement

   iii. Railway improvement and feeder service improvement (average access/egress time decrease 30%)

iv. iii and fare system improvement (average access/egress cost decrease 30%)

(Combining a, b, with i, ii, iii, iv)

The most positive case, "b, iv" is adopted for the financial evaluation.

3) Investment costs of railway facilities

Investment costs for railway facilities are so huge that cases of being burdened 1/2 and 1/4 (Maeklong Line and SBIA New Line only) of them are settled.

This takes into consideration public burden, value capture, etc.

(2) Result of financial analysis

1) Check on financial situations

Financial situations classified by lines and conditions concerning the commuter service are calculated in cases of combined conditions, and shown in Tables 1.10.1 - 1.10.3, and the possibility of adopting conditions is checked.

As shown in the tables when burdened with all the investment cost and current third class fare level is alopted the project is not manageable.

2) Calculated FIRR

The FIRR for commuter service in the selected cases mentioned below, for intercity express service and for both are calculated and shown in Tables 1.10.2, 1.10.4 and 1.10.5.

- Selected conditions for commuter service
  Investment costs of railway facilities: 1/2
  1/4 (Maeklong Line and SBIA New Line only)

  Fare Level: 0.44 baht/km (Except SBIA New Line)
  1.0 baht/km (SBIA New Line)

Fare Level: 0.44 B/km (Except SBIA New Line)

1.0 B/km (SBIA New Line)

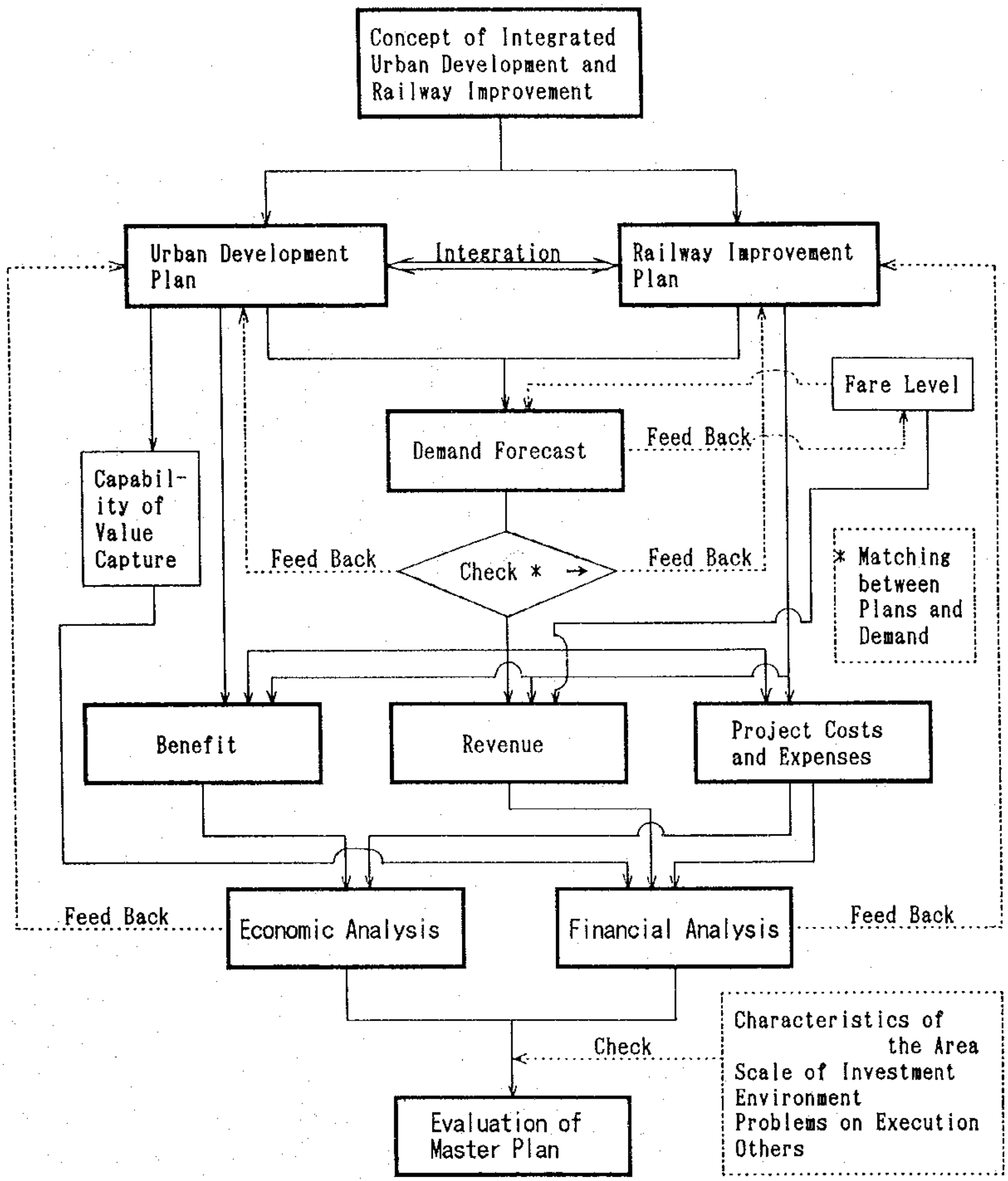


Fig. 1.10.1 Flow of Master Plan Evaluation

Table 1.10.1 Financial Situations Classified by Lines and Conditions (Commuter Service)

Unit : Million Baht

Item \ Lines	Conditions: Fare	Conditions: Subsidies	Cost & Expenses: Investment Cost: Facilities	Investment Cost: Rolling Stock	Investment Cost: Total	Expenses	Total (A)	Revenue (B)	Profit (B)-(A)	NPV Discounted by 7%	NPV 9%	NPV 11%	FIRR (%)
1 Eastern Line													
a)	3rd class	0	5,740	4,220	9,960	7,790	17,750	14,930	-2,820	-4,456.3	-4,365.1	-4,204.3	-2.54
b)	2nd class	0	5,740	3,370	9,110	6,270	15,380	22,510	7,130	-839.5	-1,500.4	-1,887.3	5.39
c)	upper limit	0	5,740	2,950	8,690	5,450	14,140	44,790	30,650	7,198.2	4,743.6	3,065.9	19.61
d)	3rd class	50%	2,900	4,220	7,120	7,790	14,910	14,930	20	-2,491.1	-2,572.0	-2,559.6	0.02
e)	2nd class	50%	2,900	3,370	6,270	6,270	12,540	22,510	9,970	1,125.7	292.6	-242.6	9.98
2. Northern Line													
a)	3rd class	0	7,760	6,580	14,340	13,050	27,390	26,780	-610	-5,149.5	-5,261.2	-5,201.6	-0.36
b)	2nd class	0	7,760	5,270	13,030	10,450	23,480	40,200	16,720	648.3	-794.6	-1,691.3	7.79
c)	upper limit	0	7,760	4,610	12,370	9,340	21,710	80,340	58,630	13,888.1	9,214.3	6,022.8	20.35
d)	3rd class	50%	3,890	6,580	10,470	13,050	23,520	26,780	3,260	-2,487.8	-2,837.4	-2,983.1	2.38
e)	2nd class	50%	3,890	5,270	9,160	10,450	19,610	40,200	20,590	3,310.1	1,629.1	527.2	12.37
3. Southern Line													
a)	3rd class	0	5,150	4,020	9,170	6,490	15,660	9,680	-5,980	-4,212.3	-3,724.8	-3,288.1	-8.14
b)	2nd class	0	5,150	3,220	8,370	5,220	13,590	14,630	1,040	-1,704.7	-1,761.4	-1,721.1	1.24
c)	upper limit	0	5,150	2,810	7,960	4,540	12,500	29,000	16,500	3,345.3	2,089.5	1,273.5	19.38
d)	3rd class	50%	2,600	4,020	6,620	6,490	13,110	9,680	-3,430	-2,858.3	-2,578.4	-2,311.7	-5.70
e)	2nd class	50%	2,600	3,220	5,820	5,220	11,040	14,630	3,590	-350.6	-614.9	-744.7	5.46
4. Macklong Line													
a)	3rd class	0	5,080	2,140	7,220	4,050	11,270	7,050	-4,220	-3,300.5	-2,960.7	-2,642.0	-6.78
b)	2nd class	0	5,080	1,720	6,800	3,250	10,050	10,670	620	-1,843.4	-1,882.0	-1,830.4	0.76
c)	upper limit	0	5,080	1,500	6,580	2,840	9,420	21,150	11,730	1,315.4	414.0	-135.4	10.41
d)	3rd class	50%	2,600	2,140	4,740	4,050	8,790	7,050	-1,740	-1,842.5	-1,697.5	-1,543.8	-3.79
e)	2nd class	50%	2,600	1,720	4,320	3,250	7,570	10,670	3,100	-385.4	-618.8	-732.2	5.17
f)	2nd class	75%	1,370	1,720	3,090	3,250	6,340	10,670	4,330	450.2	9.7	-185.6	9.08
5. SBIA New Line													
a)	3rd class	0	2,620	450	3,070	1,350	4,420	430	-3,990	-2,799.5	-2,602.4	-2,437.7	N.A.
b)	2nd class	0	2,620	450	3,070	1,350	4,420	1,210	-3,210	-2,559.6	-2,421.8	-2,298.8	N.A.
c)	upper limit*	0	2,620	450	3,070	1,350	4,420	4,920	500	-1,305.5	-1,454.0	-1,537.7	1.05
d)	upper limit*	50%	1,320	450	1,770	1,350	3,120	4,920	1,800	-155.5	-351.3	-480.4	5.85
e)	upper limit*	75%	660	450	1,110	1,350	2,460	4,920	2,460	407.1	188.1	37.5	11.64

*:Out of this fare (B.0.44 /km*25km=)B.11.- is allotted to Eastern Line

Target Year : 2010

Project Life : 1996---2025

Table 1.10.2 (1) Financial Situations of Commuter Servise (Eastern Line)

Investment Cost of Facilitie: : 1/2
Fare : Second Class (B 0.44/km)

Unit : Million Baht

Item / Year & Phase	Cost & Expenses: Investment Cost: Facilities	Rolling Stock	Total	Expenses	Total (A)	Revenue (B)	Profit (B)-(A)	NPY Discounted by 7%	9%	11%
1996	150	0	150	0	150	0	-150	-150.0	-150.0	-150.0
1997	130	30	160	70	230	110	-120	-112.1	-110.1	-108.1
I 1998	180	40	220	90	310	120	-190	-166.0	-159.9	-154.2
1999	450	50	500	110	610	150	-460	-375.5	-355.2	-336.3
2000	490	1,310	1,800	130	1,930	180	-1,750	-1,335.1	-1,239.7	-1,152.8
2001	40	30	70	210	280	470	190	135.5	123.5	112.8
2002	100	30	130	210	340	500	160	106.6	95.4	85.5
II 2003	140	30	170	210	380	510	130	81.0	71.1	62.6
2004	460	40	500	220	720	530	-190	-110.6	-95.4	-82.4
2005	550	870	1,420	220	1,640	560	-1,080	-587.4	-497.3	-422.2
2006			0	210	210	740	530	269.4	223.9	186.7
2007			0	210	210	800	590	280.3	228.6	187.2
III 2008			0	210	210	840	630	279.7	224.0	180.1
2009	70	0	70	210	280	900	620	257.3	202.2	159.7
2010	140	940	1,080	210	1,290	950	-340	-131.9	-101.7	-78.9
2011			0	250	250	1,010	760	275.5	208.6	158.8
2012			0	250	250	1,010	760	257.4	191.4	143.1
2013			0	250	250	1,010	760	240.6	175.6	128.9
2014			0	250	250	1,010	760	224.9	161.1	116.1
2015			0	250	250	1,010	760	210.1	147.8	104.6
2016			0	250	250	1,010	760	196.4	135.6	94.3
2017			0	250	250	1,010	760	183.5	124.4	84.9
2018			0	250	250	1,010	760	171.5	114.1	76.5
2019			0	250	250	1,010	760	160.3	104.7	68.9
2020			0	250	250	1,010	760	149.8	96.1	62.1
2021			0	250	250	1,010	760	140.0	88.1	55.9
2022			0	250	250	1,010	760	130.9	80.9	50.4
2023			0	250	250	1,010	760	122.3	74.2	45.4
2024			0	250	250	1,010	760	114.3	68.1	40.9
2025			0	250	250	1,010	760	106.8	62.4	36.9
Total	2,900	3,370	6,270	6,270	12,540	22,510	9,970	1,125.7	292.6	-242.6
FIRR							0.0998			
NPV (mmBts)								1,125.7	292.6	-242.6

Table 1.10.2 (2) Financial Situations of Commuter Servise (Northern Line)

Investment Cost of Facilitie: : 1/2
Fare : Second Class (B 0.44/km)

Unit : Million Baht

Item / Year & Phase	Cost & Expenses: Investment Cost: Facilities	Rolling Stock	Total	Expenses	Total (A)	Revenue (B)	Profit (B)-(A)	NPY Discounted by 7%	9%	11%
1996	220	0	220	0	220	0	-220	-220.0	-220.0	-220.0
1997	120	0	120	0	120	0	-120	-112.1	-110.1	-108.1
I 1998	200	0	200	0	200	0	-200	-174.7	-168.3	-162.3
1999	610	0	610	0	610	0	-610	-497.9	-471.0	-446.0
2000	660	2,320	2,980	0	2,980	0	-2,980	-2,273.4	-2,111.1	-1,963.0
2001	60	0	60	230	290	680	390	278.1	253.5	231.4
2002	170	0	170	230	400	720	320	213.2	190.8	171.1
II 2003	230	0	230	230	460	750	290	180.6	158.6	139.7
2004	630	0	630	230	860	780	-80	-46.6	-40.1	-34.7
2005	760	1,690	2,450	230	2,680	830	-1,850	-1,006.3	-851.8	-723.2
2006			0	390	390	1,260	870	442.3	367.5	306.4
2007			0	390	390	1,400	1,010	479.8	391.4	320.5
III 2008			0	390	390	1,520	1,130	501.7	401.8	323.0
2009	70	0	70	390	460	1,670	1,210	502.1	394.7	311.6
2010	160	1,260	1,420	390	1,810	1,790	-20	-7.8	-6.0	-4.6
2011			0	490	490	1,920	1,430	518.3	392.6	298.9
2012			0	490	490	1,920	1,430	484.4	360.2	269.3
2013			0	490	490	1,920	1,430	452.7	330.4	242.6
2014			0	490	490	1,920	1,430	423.1	303.2	218.5
2015			0	490	490	1,920	1,430	395.4	278.1	196.9
2016			0	490	490	1,920	1,430	369.5	255.2	177.4
2017			0	490	490	1,920	1,430	345.4	234.1	159.8
2018			0	490	490	1,920	1,430	322.8	214.8	144.0
2019			0	490	490	1,920	1,430	301.7	197.0	129.7
2020			0	490	490	1,920	1,430	281.9	180.8	116.8
2021			0	490	490	1,920	1,430	263.5	165.8	105.3
2022			0	490	490	1,920	1,430	246.2	152.1	94.8
2023			0	490	490	1,920	1,430	230.1	139.6	85.4
2024			0	490	490	1,920	1,430	215.1	128.1	77.0
2025			0	490	490	1,920	1,430	201.0	117.5	69.3
Total	3,890	5,270	9,160	10,450	19,610	40,200	20,590	3,310.1	1,629.1	527.2
FIRR							0.1237			
NPV (mmBts)								3,310.1	1,629.1	527.2

Table 1.10.2 (3) Financial Situations of Commuter Servise (Southern Line)

Investment Cost of Facilities : 1/2
Fare : Second Class (B 0.44/km)

Unit : Million Baht

Item / Year & Phase	Cost & Expenses					Revenue (B)	Profit (B)-(A)	NPV		
	Investment Cost			Expenses	Total (A)			Discounted by		
	Facilities	Rolling Stock	Total					7%	9%	11%
1996										
1997	0	20	20	40	60	30	-30	-30.0	-30.0	-30.0
I 1998	0	20	20	60	80	30	-50	-46.7	-45.9	-45.0
1999	0	30	30	70	100	50	-50	-43.7	-42.1	-40.6
2000	0	40	40	90	130	60	-70	-57.1	-54.1	-51.2
2001	110	60	170	130	300	140	-160	-122.1	-113.3	-105.4
2002	120	60	180	140	320	170	-150	-106.9	-97.5	-89.0
II 2003	160	60	220	140	360	180	-180	-119.9	-107.3	-96.2
2004	390	60	450	140	590	200	-390	-242.9	-213.3	-187.8
2005	420	1120	1,540	140	1,680	210	-1,470	-855.6	-737.7	-637.9
2006	40	50	90	220	310	450	140	76.2	64.5	54.7
2007	110	50	160	220	380	470	90	45.8	38.0	31.7
III 2008	160	50	210	220	430	500	70	33.3	27.1	22.2
2009	510	60	570	230	800	510	-290	-128.8	-103.1	-82.9
2010	580	1540	2,120	230	2,350	530	-1,820	-755.2	-593.6	-468.7
2011			0	210	210	740	530	205.5	158.6	123.0
2012			0	210	210	740	530	192.1	145.5	110.8
2013			0	210	210	740	530	179.5	133.5	99.8
2014			0	210	210	740	530	167.8	122.5	89.9
2015			0	210	210	740	530	156.8	112.4	81.0
2016			0	210	210	740	530	146.5	103.1	73.0
2017			0	210	210	740	530	137.0	94.6	65.7
2018			0	210	210	740	530	128.0	86.8	59.2
2019			0	210	210	740	530	119.6	79.6	53.4
2020			0	210	210	740	530	111.8	73.0	48.1
2021			0	210	210	740	530	104.5	67.0	43.3
2022			0	210	210	740	530	97.7	61.5	39.0
2023			0	210	210	740	530	91.3	56.4	35.1
2024			0	210	210	740	530	85.3	51.7	31.7
2025			0	210	210	740	530	79.7	47.5	28.5
Total	2,600	3,220	5,820	5,220	11,040	14,630	3,590	-350.6	-614.9	-744.7
FIRR							0.0546			
NPV(mmBts)								-350.6	-614.9	-744.7

Table 1.10.2.(4) Financial Situations of Commuter Servise (Maeklong Line-1)

Investment Cost of Facilities : 1/2
Fare : Second Class (B 0.44/km)

Unit : Million Baht

Item / Year & Phase	Cost & Expenses					Revenue (B)	Profit (B)-(A)	NPV		
	Investment Cost			Expenses	Total (A)			Discounted by		
	Facilities	Rolling Stock	Total					7%	9%	11%
1996	100	0	100	0	100	0	-100	-100.0	-100.0	-100.0
1997	0	0	0	0	0	0	0	0.0	0.0	0.0
I 1998	0	0	0	0	0	0	0	0.0	0.0	0.0
1999	0	0	0	0	0	0	0	0.0	0.0	0.0
2000	0	0	0	0	0	0	0	0.0	0.0	0.0
2001	160	0	160	0	160	0	-160	-114.1	-104.0	-95.0
2002	320	0	320	0	320	0	-320	-213.2	-190.8	-171.1
II 2003	380	0	380	0	380	0	-380	-236.6	-207.9	-183.0
2004	730	0	730	0	730	0	-730	-424.9	-366.4	-316.8
2005	810	1,380	2,190	0	2,190	0	-2,190	-1,191.2	-1,008.3	-856.1
2006	0	0	0	140	140	380	240	122.0	101.4	84.5
2007	0	0	0	140	140	410	270	128.3	104.6	85.7
III 2008	0	0	0	140	140	450	310	137.6	110.2	88.6
2009	30	0	30	140	170	500	330	136.9	107.6	85.0
2010	70	340	410	140	550	530	-20	-7.8	-6.0	-4.6
2011			0	170	170	560	390	141.4	107.1	81.5
2012			0	170	170	560	390	132.1	98.2	73.4
2013			0	170	170	560	390	123.5	90.1	66.2
2014			0	170	170	560	390	115.4	82.7	59.6
2015			0	170	170	560	390	107.8	75.9	53.7
2016			0	170	170	560	390	100.8	69.6	48.4
2017			0	170	170	560	390	94.2	63.8	43.6
2018			0	170	170	560	390	88.0	58.6	39.3
2019			0	170	170	560	390	82.3	53.7	35.4
2020			0	170	170	560	390	76.9	49.3	31.9
2021			0	170	170	560	390	71.9	45.2	28.7
2022			0	170	170	560	390	67.2	41.5	25.9
2023			0	170	170	560	390	62.8	38.1	23.3
2024			0	170	170	560	390	58.7	34.9	21.0
2025			0	170	170	560	390	54.8	32.0	18.9
Total	2,600	1,720	4,320	3,250	7,570	10,670	3,100	-385.4	-618.8	-732.2
FIRR							0.0517			
NPV(mmBts)								-385.4	-618.8	-732.2

Table 1.10.2 (5) Financial Situations of Commuter Servise (Maeklong Line-2)

Investment Cost of Facilitie: : 1/4
Fare : Second Class (B 0.44/km)

Unit : Million Baht

Year & Phase	Item	Cost & Expenses					Revenue (B)	Profit (B)-(A)	NPV Discounted by		
		Investment Cost			Expenses	Total (A)			7%	9%	11%
		Facilities	Rolling Stock	Total							
I	1996	100	0	100	0	100	0	-100	-100.0	-100.0	-100.0
	1997	0	0	0	0	0	0	0	0.0	0.0	0.0
	1998	0	0	0	0	0	0	0	0.0	0.0	0.0
	1999	0	0	0	0	0	0	0	0.0	0.0	0.0
	2000	0	0	0	0	0	0	0	0.0	0.0	0.0
II	2001	80	0	80	0	80	0	-80	-57.0	-52.0	-47.5
	2002	160	0	160	0	160	0	-160	-106.6	-95.4	-85.5
	2003	190	0	190	0	190	0	-190	-118.3	-103.9	-91.5
	2004	370	0	370	0	370	0	-370	-215.3	-185.7	-160.6
	2005	410	1,380	1,790	0	1,790	0	-1,790	-973.6	-824.2	-699.8
III	2006	0	0	0	140	140	380	240	122.0	101.4	84.5
	2007	0	0	0	140	140	410	270	128.3	104.6	85.7
	2008	0	0	0	140	140	450	310	137.6	110.2	88.6
	2009	20	0	20	140	160	500	340	141.1	110.9	87.6
	2010	40	340	380	140	520	530	10	3.9	3.0	2.3
	2011			0	170	170	560	390	141.4	107.1	81.5
	2012			0	170	170	560	390	132.1	98.2	73.4
	2013			0	170	170	560	390	123.5	90.1	66.2
	2014			0	170	170	560	390	115.4	82.7	59.6
	2015			0	170	170	560	390	107.8	75.9	53.7
	2016			0	170	170	560	390	100.8	69.6	48.4
	2017			0	170	170	560	390	94.2	63.8	43.6
	2018			0	170	170	560	390	88.0	58.6	39.3
	2019			0	170	170	560	390	82.3	53.7	35.4
	2020			0	170	170	560	390	76.9	49.3	31.9
	2021			0	170	170	560	390	71.9	45.2	28.7
	2022			0	170	170	560	390	67.2	41.5	25.9
	2023			0	170	170	560	390	62.8	38.1	23.3
	2024			0	170	170	560	390	58.7	34.9	21.0
	2025			0	170	170	560	390	165.5	32.0	18.9
Total		1,370	1,720	3,090	3,250	6,340	10,670	4,330	450.2	9.7	-185.6
FIRR								0.0908			
NPV (mmBts)									450.2	9.7	-185.6

Table 1.10.2 (6) Financial Situations of Commuter Servise (SBIA New Line-1)

Investment Cost of Facilitie: : 1/2
Fare:Hua Lamphong -SBIA B.1.-/km (B .30.)
(B .11.-: Allotted to Eastern Line)
Unit : Million Baht

Year & Phase	Item	Cost & Expenses					Revenue (B)	Profit (B)-(A)	NPV Discounted by		
		Investment Cost			Expenses	Total (A)			7%	9%	11%
		Facilities	Rolling Stock	Total							
I	1996	160	0	160	0	160	0	-160	-160.0	-160.0	-160.0
	1997	220	0	220	0	220	0	-220	-205.6	-201.8	-198.2
	1998	230	0	230	0	230	0	-230	-200.9	-193.6	-186.7
	1999	330	0	330	0	330	0	-330	-269.4	-254.8	-241.3
	2000	380	150	530	0	530	0	-530	-404.3	-375.5	-349.1
II	2001	0	0	0	40	40	150	110	78.4	71.5	65.3
	2002	0	0	0	40	40	160	120	80.0	71.6	64.2
	2003	0	0	0	40	40	160	120	74.7	65.6	57.8
	2004	0	0	0	40	40	170	130	75.7	65.2	56.4
	2005	0	150	150	40	190	170	-20	-10.9	-9.2	-7.8
III	2006	0	0	0	50	50	180	130	66.1	54.9	45.8
	2007	0	0	0	50	50	190	140	66.5	54.3	44.4
	2008	0	0	0	50	50	190	140	62.2	49.8	40.0
	2009	0	0	0	50	50	200	150	62.2	48.9	38.6
	2010	0	150	150	50	200	200	0	0.0	0.0	0.0
	2011			0	60	60	210	150	54.4	41.2	31.4
	2012			0	60	60	210	150	50.8	37.8	28.2
	2013			0	60	60	210	150	47.5	34.7	25.4
	2014			0	60	60	210	150	44.4	31.8	22.9
	2015			0	60	60	210	150	41.5	29.2	20.7
	2016			0	60	60	210	150	38.8	26.8	18.6
	2017			0	60	60	210	150	36.2	24.6	16.8
	2018			0	60	60	210	150	33.9	22.5	15.1
	2019			0	60	60	210	150	31.6	20.7	13.6
	2020			0	60	60	210	150	29.6	19.0	12.3
	2021			0	60	60	210	150	27.6	17.4	11.0
	2022			0	60	60	210	150	25.8	16.0	9.9
	2023			0	60	60	210	150	24.1	14.6	9.0
	2024			0	60	60	210	150	22.6	13.4	8.1
	2025			0	60	60	210	150	21.1	12.3	7.3
Total		1,320	450	1,770	1,350	3,120	4,920	1,800	-155.5	-351.3	-480.4
FIRR								0.0585			
NPV (mmBts)									-155.5	-351.3	-480.4

Table 1.10.2 (7) Financial Situations of Commuter Servise (SBIA New Line-2)

Investment Cost of Facilities : 1/4
Fare:Hua Lamphong -SBIA B. 1.-/km (B .. 30.-)
(B . 11.-: Allotted to Eastern Line)
Unit : Million Baht

Year & Phase \ Item	Cost & Expenses: Investment Cost: Facilities	Rolling Stock	Total	Expenses	Total (A)	Revenue (B)	Profit (B)-(A)	NPV Discounted by 7%	9%	11%
I 1996	80	0	80	0	80	0	-80	-80.0	-80.0	-80.0
1997	110	0	110	0	110	0	-110	-102.8	-100.9	-99.1
1998	120	0	120	0	120	0	-120	-104.8	-101.0	-97.4
1999	160	0	160	0	160	0	-160	-130.6	-123.5	-117.0
2000	190	150	340	0	340	0	-340	-259.4	-240.9	-224.0
II 2001	0	0	0	40	40	150	110	78.4	71.5	65.3
2002	0	0	0	40	40	160	120	80.0	71.6	64.2
2003	0	0	0	40	40	160	120	74.7	65.6	57.8
2004	0	0	0	40	40	170	130	75.7	65.2	56.4
2005	0	150	150	40	190	170	-20	-10.9	-9.2	-7.8
III 2006	0	0	0	50	50	180	130	66.1	54.9	45.8
2007	0	0	0	50	50	190	140	66.5	54.3	44.4
2008	0	0	0	50	50	190	140	62.2	49.8	40.0
2009	0	0	0	50	50	200	150	62.2	48.9	38.6
2010	0	150	150	50	200	200	0	0.0	0.0	0.0
2011			0	60	60	210	150	54.4	41.2	31.4
2012			0	60	60	210	150	50.8	37.8	28.2
2013			0	60	60	210	150	47.5	34.7	25.4
2014			0	60	60	210	150	44.4	31.8	22.9
2015			0	60	60	210	150	41.5	29.2	20.7
2016			0	60	60	210	150	38.8	26.8	18.6
2017			0	60	60	210	150	36.2	24.6	16.8
2018			0	60	60	210	150	33.9	22.5	15.1
2019			0	60	60	210	150	31.6	20.7	13.6
2020			0	60	60	210	150	29.6	19.0	12.3
2021			0	60	60	210	150	27.6	17.4	11.0
2022			0	60	60	210	150	25.8	16.0	9.9
2023			0	60	60	210	150	24.1	14.6	9.0
2024			0	60	60	210	150	22.6	13.4	8.1
2025			0	60	60	210	150	21.1	12.3	7.3
Total	660	450	1,110	1,350	2,460	4,920	2,460	407.1	188.1	37.5
FIRR							0.1164			
NPV (mmBts)								407.1	188.1	37.5

Table 1.10.3 (1) Financial Situations of Commuter Service (Eastern Line)

Investment Cost of Facilities : 1 (Basic Condition)
Fare : Third Class (B .0.215 /km)

Unit : Million Baht

Phase	Year	Cost & Expenses: Investment Cost: Facilities	Rolling Stock	Total	Expenses	Total (A)	Revenue (B)	Profit (B)−(A)	NPV Discounted by 7%	9%	11%
	1996	290	0	290	0	290	0	-290	-290.0	-290.0	-290.0
	1997	260	40	300	90	390	70	-320	-299.1	-293.6	-288.3
I	1998	360	50	410	110	520	80	-440	-384.3	-370.3	-357.1
	1999	900	60	960	140	1,100	100	-1,000	-816.3	-772.2	-731.2
	2000	980	1.640	2,620	160	2,780	120	-2,660	-2,029.3	-1,884.4	-1,752.2
	2001	70	40	110	260	370	310	-60	-42.8	-39.0	-35.6
	2002	190	40	230	260	490	330	-160	-106.6	-95.4	-85.5
II	2003	280	40	320	260	580	340	-240	-149.5	-131.3	-115.6
	2004	920	50	970	280	1,250	350	-900	-523.8	-451.7	-390.5
	2005	1,090	1.090	2.180	280	2,460	370	-2,090	-1,136.8	-962.3	-817.0
	2006			0	260	260	490	230	116.9	97.2	81.0
	2007			0	260	260	530	270	128.3	104.6	85.7
III	2008			0	260	260	560	300	133.2	106.7	85.8
	2009	130	0	130	260	390	600	210	87.1	68.5	54.1
	2010	270	1,170	1,440	260	1,700	630	-1,070	-415.0	-320.2	-248.2
	2011			0	310	310	670	360	130.5	98.8	75.2
	2012			0	310	310	670	360	121.9	90.7	67.8
	2013			0	310	310	670	360	114.0	83.2	61.1
	2014			0	310	310	670	360	106.5	76.3	55.0
	2015			0	310	310	670	360	99.5	70.0	49.6
	2016			0	310	310	670	360	93.0	64.2	44.7
	2017			0	310	310	670	360	86.9	58.9	40.2
	2018			0	310	310	670	360	81.3	54.1	36.2
	2019			0	310	310	670	360	75.9	49.6	32.6
	2020			0	310	310	670	360	71.0	45.5	29.4
	2021			0	310	310	670	360	66.3	41.7	26.5
	2022			0	310	310	670	360	62.0	38.3	23.9
	2023			0	310	310	670	360	57.9	35.1	21.5
	2024			0	310	310	670	360	54.1	32.2	19.4
	2025			0	310	310	670	360	50.6	29.6	17.5
Total		5,740	4,220	9,960	7,790	17,750	14,930	-2,820	-4,456.3	-4,365.1	-4,204.3
FIRR								-0.0254			
NPV (mmBts)									-4,456.3	-4,365.1	-4,204.3

Table 1.10.3 (2) Financial Situations of Commuter Servise (Northern Line)

Investment Cost of Facilities : 1 (Basic Condition)
Fare : Third Class (B .0.215 /km)

Unit : Million Baht

Phase	Year	Cost & Expenses: Investment Cost: Facilities	Rolling Stock	Total	Expenses	Total (A)	Revenue (B)	Profit (B)−(A)	NPV Discounted by 7%	9%	11%
	1996	440	0	440	0	440	0	-440	-440.0	-440.0	-440.0
	1997	230	0	230	0	230	0	-230	-215.0	-211.0	-207.2
I	1998	400	0	400	0	400	0	-400	-349.4	-336.7	-324.6
	1999	1,220	0	1,220	0	1,220	0	-1,220	-995.9	-942.1	-892.1
	2000	1,310	2,900	4,210	0	4,210	0	-4,210	-3,211.8	-2,982.5	-2,773.3
	2001	120	0	120	290	410	450	40	28.5	26.0	23.7
	2002	340	0	340	290	630	480	-150	-100.0	-89.4	-80.2
II	2003	460	0	460	290	750	500	-250	-155.7	-135.8	-120.4
	2004	1,260	0	1.260	290	1,550	520	-1,030	-599.5	-516.9	-446.9
	2005	1,520	2,110	3,630	290	3,920	550	-3,370	-1,833.1	-1,551.6	-1,317.4
	2006			0	490	490	840	350	177.9	147.8	123.3
	2007			0	490	490	930	440	209.0	170.5	139.6
III	2008			0	490	490	1,010	520	230.9	184.9	148.6
	2009	140	0	140	490	630	1,110	480	199.2	156.6	123.6
	2010	320	1,570	1,890	490	2,380	1,190	-1,190	-461.5	-356.1	-276.1
	2011			0	610	610	1,280	670	242.8	183.9	140.0
	2012			0	610	610	1,280	670	227.0	168.8	126.2
	2013			0	610	610	1,280	670	212.1	154.8	113.7
	2014			0	610	610	1,280	670	198.2	142.0	102.4
	2015			0	610	610	1,280	670	185.3	130.3	92.2
	2016			0	610	610	1,280	670	173.1	119.5	83.1
	2017			0	610	610	1,280	670	161.8	109.7	74.9
	2018			0	610	610	1,280	670	151.2	100.6	67.4
	2019			0	610	610	1,280	670	141.3	92.3	60.8
	2020			0	610	610	1,280	670	132.1	84.7	54.7
	2021			0	610	610	1,280	670	123.4	77.7	49.3
	2022			0	610	610	1,280	670	115.4	71.3	44.4
	2023			0	610	610	1,280	670	107.8	65.4	40.0
	2024			0	610	610	1,280	670	100.8	60.0	36.1
	2025			0	610	610	1,280	670	94.2	55.0	32.5
Total		7,760	6,580	14,340	13,050	27,390	26,780	-610	-5,149.5	-5,261.2	-5,201.6
FIRR								-0.0036			
NPV (mmBts)									-5,149.5	-5,261.2	-5,201.6

Table 1.10.3 (3) Financial Situations of Commuter Servise (Southern Line)

Investment Cost of Facilities : 1 (Basic Condition)
Fare : Third Class (B .0.215/km)

Unit : Million Baht

Item / Year & Phase	Cost & Expenses: Investment Cost: Facilities	Rolling Stock	Total	Expenses	Total (A)	Revenue (B)	Profit (B)-(A)	NPV Discounted by 7%	9%	11%
1996										
1997	0	20	20	50	70	20	-50	-50.0	-50.0	-50.0
I 1998	0	30	30	70	100	20	-80	-74.8	-73.4	-72.1
1999	0	40	40	90	130	30	-100	-87.3	-84.2	-81.2
2000	0	50	50	110	160	40	-120	-98.0	-92.7	-87.7
2001	210	70	280	160	440	90	-350	-267.0	-247.9	-230.6
2002	240	80	320	180	500	110	-390	-278.1	-253.5	-231.4
II 2003	320	80	400	180	580	120	-460	-306.5	-274.3	-245.9
2004	770	80	850	180	1,030	130	-900	-560.5	-492.3	-433.5
2005	830	1,400	2,230	180	2,410	140	-2,270	-1,321.2	-1,139.2	-985.0
2006	70	60	130	270	400	300	-100	-54.4	-46.0	-39.1
2007	210	60	270	270	540	310	-230	-116.9	-97.2	-81.0
III 2008	320	60	380	270	650	330	-320	-152.0	-124.0	-101.5
2009	1,020	70	1,090	290	1,380	340	-1,040	-461.8	-369.8	-297.3
2010	1,160	1,920	3,080	290	3,370	350	-3,020	-1,253.2	-985.1	-777.7
2011			0	260	260	490	230	89.2	68.8	53.4
2012			0	260	260	490	230	83.4	63.1	48.1
2013			0	260	260	490	230	77.9	57.9	43.3
2014			0	260	260	490	230	72.8	53.1	39.0
2015			0	260	260	490	230	68.0	48.8	35.1
2016			0	260	260	490	230	63.6	44.7	31.7
2017			0	260	260	490	230	59.4	41.0	28.5
2018			0	260	260	490	230	55.5	37.7	25.7
2019			0	260	260	490	230	51.9	34.5	23.2
2020			0	260	260	490	230	48.5	31.7	20.9
2021			0	260	260	490	230	45.3	29.1	18.8
2022			0	260	260	490	230	42.4	26.7	16.9
2023			0	260	260	490	230	39.6	24.5	15.3
2024			0	260	260	490	230	37.0	22.4	13.7
2025			0	260	260	490	230	34.6	20.6	12.4
Total	5,150	4,020	9,170	6,490	15,660	9,680	-5,980	-4,212.3	-3,724.8	-3,288.1
FIRR							-0.0814			
NPV (mmBts)								-4,212.3	-3,724.8	-3,288.1

Table 1.10.3 (4) Financial Situations of Commuter Servise (Maeklong Line)

Investment Cost of Facilities : 1 (Basic Condition)
Fare : Third Class (B .0.215/km)

Unit : Million Baht

Item / Year & Phase	Cost & Expenses: Investment Cost: Facilities	Rolling Stock	Total	Expenses	Total (A)	Revenue (B)	Profit (B)-(A)	NPV Discounted by 7%	9%	11%
1996	100	0	100	0	100	0	-100	-100.0	-100.0	-100.0
1997	0	0	0	0	0	0	0	0.0	0.0	0.0
I 1998	0	0	0	0	0	0	0	0.0	0.0	0.0
1999	0	0	0	0	0	0	0	0.0	0.0	0.0
2000	0	0	0	0	0	0	0	0.0	0.0	0.0
2001	310	0	310	0	310	0	-310	-221.0	-201.5	-184.0
2002	640	0	640	0	640	0	-640	-426.5	-381.6	-342.2
II 2003	760	0	760	0	760	0	-760	-473.3	-415.7	-366.1
2004	1,460	0	1,460	0	1,460	0	-1,460	-849.7	-732.7	-633.5
2005	1,620	1,720	3,340	0	3,340	0	-3,340	-1,816.7	-1,537.8	-1,305.7
2006	0	0	0	180	180	250	70	35.6	29.6	24.7
2007	0	0	0	180	180	270	90	42.8	34.9	28.6
III 2008	0	0	0	180	180	300	120	53.3	42.7	34.3
2009	60	0	60	180	240	330	90	37.3	29.4	23.2
2010	130	420	550	180	730	350	-380	-147.4	-113.7	-88.2
2011			0	210	210	370	160	58.0	43.9	33.4
2012			0	210	210	370	160	54.2	40.3	30.1
2013			0	210	210	370	160	50.7	37.0	27.1
2014			0	210	210	370	160	47.3	33.9	24.5
2015			0	210	210	370	160	44.2	31.1	22.0
2016			0	210	210	370	160	41.3	28.5	19.8
2017			0	210	210	370	160	38.6	26.2	17.9
2018			0	210	210	370	160	36.1	24.0	16.1
2019			0	210	210	370	160	33.8	22.0	14.5
2020			0	210	210	370	160	31.5	20.2	13.1
2021			0	210	210	370	160	29.5	18.6	11.8
2022			0	210	210	370	160	27.6	17.0	10.6
2023			0	210	210	370	160	25.7	15.6	9.6
2024			0	210	210	370	160	24.1	14.3	8.6
2025			0	210	210	370	160	22.5	13.1	7.8
Total	5,080	2,140	7,220	4,050	11,270	7,050	-4,220	-3,300.5	-2,960.7	-2,642.0
FIRR							-0.0678			
NPV (mmBts)								-3,300.5	-2,960.7	-2,642.0

Table 1.10.3 (5) Financial Situations of Commuter Servise (SBIA New Line)

Investmen: Cost of Facilitie: : 1 (Basic Condition)
Fare : Third Class (B .0.215/km)

Unit : Million Baht

Item / Year & Phase	Cost & Expenses: Investment Cost: Facilities	Cost & Expenses: Investment Cost: Rolling Stock	Cost & Expenses: Investment Cost: Total	Cost & Expenses: Expenses	Cost & Expenses: Total (A)	Revenue (B)	Profit (B)-(A)	NPV Discounted by 7%	NPV Discounted by 9%	NPV Discounted by 11%
1996	310	0	310	0	310	0	-310	-310.0	-310.0	-310.0
1997	440	0	440	0	440	0	-440	-411.2	-403.7	-396.4
I 1998	460	0	460	0	460	0	-460	-401.8	-387.2	-373.3
1999	650	0	650	0	650	0	-650	-530.6	-501.9	-475.3
2000	760	150	910	0	910	0	-910	-694.2	-644.7	-599.4
2001	0	0	0	40	40	10	-30	-21.4	-19.5	-17.8
2002	0	0	0	40	40	10	-30	-20.0	-17.9	-16.0
II 2003	0	0	0	40	40	10	-30	-18.7	-16.4	-14.4
2004	0	0	0	40	40	10	-30	-17.5	-15.1	-13.0
2005	0	150	150	40	190	10	-180	-97.9	-82.9	-70.4
2006	0	0	0	50	50	10	-40	-20.3	-16.9	-14.1
2007	0	0	0	50	50	10	-40	-19.0	-15.5	-12.7
III 2008	0	0	0	50	50	20	-30	-13.3	-10.7	-8.6
2009	0	0	0	50	50	20	-30	-12.4	-9.8	-7.7
2010	0	150	150	50	200	20	-180	-69.8	-53.9	-41.8
2011			0	60	60	20	-40	-14.5	-11.0	-8.4
2012			0	60	60	20	-40	-13.5	-10.1	-7.5
2013			0	60	60	20	-40	-12.7	-9.2	-6.8
2014			0	60	60	20	-40	-11.8	-8.5	-6.1
2015			0	60	60	20	-40	-11.1	-7.8	-5.5
2016			0	60	60	20	-40	-10.3	-7.1	-5.0
2017			0	60	60	20	-40	-9.7	-6.5	-4.5
2018			0	60	60	20	-40	-9.0	-6.0	-4.0
2019			0	60	60	20	-40	-8.4	-5.5	-3.6
2020			0	60	60	20	-40	-7.9	-5.1	-3.3
2021			0	60	60	20	-40	-7.4	-4.6	-2.9
2022			0	60	60	20	-40	-6.9	-4.3	-2.7
2023			0	60	60	20	-40	-6.4	-3.9	-2.4
2024			0	60	60	20	-40	-6.0	-3.6	-2.2
2025			0	60	60	20	-40	-5.6	-3.3	-1.9
Total	2,620	450	3,070	1,350	4,420	430	-3,990	-2,799.5	-2,602.4	-2,437.7
FIRR							N.A.			
NPV (mmBts)								-2,799.5	-2,602.4	-2,437.7

Table 1.10.4 (1) Financial Situations of Intercity Express Service

Unit : Million Baht

Item / Line	Cost & Expenses: Investment Cost: Facilities	Rolling Stock	Total	Expenses	Total (A)	Revenue (B)	Profit (B)-(A)	NPV discounted by 9%	FIRR (%)
Eastern Line	210	1,690	1,900	2,370	4,270	8,640	4,370	418.3	12.70
Northern Line	420	2,860	3,280	4,230	7,510	13,530	6,020	241.3	10.18
Southern Line	300	2,440	2,740	3,340	6,080	9,450	3,370	-138.7	8.07

Target Year : 2010 : Project Life : 1996-2025 (30 Years)

Table 1.10.4 (2) Financial Situations of Intercity Express Service (Eastern Line)

Unit : Million Baht

Item / Year & Phase	Cost & Expenses: Investment Cost: Facilities	Rolling Stock	Total	Expenses	Total (A)	Revenue (B)	Profit (B)-(A)	NPV Discounted by 7%	9%	11%
1996	0	570	570	0	570	0	570	-570.0	-570.0	-570.0
1997	0	0	0	30	30	120	90	84.1	82.6	81.1
I 1998	60	0	60	30	90	130	40	34.9	33.7	32.5
1999	60	0	60	30	90	150	60	49.0	46.3	43.9
2000	90	490	580	30	610	160	-450	-343.3	-318.8	-296.4
2001			0	60	60	170	110	78.4	71.5	65.3
2002			0	60	60	190	130	86.6	77.5	69.5
II 2003			0	60	60	200	140	87.2	76.6	67.4
2004			0	60	60	220	160	93.1	80.3	69.4
2005	0	490	490	60	550	240	-310	-168.6	-142.7	-121.2
2006			0	90	90	250	160	81.3	67.6	56.3
2007			0	90	90	280	190	90.3	73.6	60.3
III 2008			0	90	90	300	210	93.2	74.7	60.0
2009			0	90	90	330	240	99.6	78.3	61.8
2010	0	140	140	90	230	350	120	46.5	35.9	27.8
2011			0	100	100	370	270	97.9	74.1	56.4
2012			0	100	100	370	270	91.5	68.0	50.8
2013			0	100	100	370	270	85.5	62.4	45.8
2014			0	100	100	370	270	79.9	57.2	41.3
2015			0	100	100	370	270	74.7	52.5	37.2
2016			0	100	100	370	270	69.8	48.2	33.5
2017			0	100	100	370	270	65.2	44.2	30.2
2018			0	100	100	370	270	60.9	40.5	27.2
2019			0	100	100	370	270	57.0	37.2	24.5
2020			0	100	100	370	270	53.2	34.1	22.1
2021			0	100	100	370	270	49.7	31.3	19.9
2022			0	100	100	370	270	46.5	28.7	17.9
2023			0	100	100	370	270	43.5	26.4	16.1
2024			0	100	100	370	270	40.6	24.2	14.5
2025			0	100	100	370	270	38.0	22.2	13.1
Total	210	1,690	1,900	2,370	4,270	3,640	4,370	796.1	418.3	158.2
FIRR							0.1270			
NPV (mmBts)								796.1	418.3	158.2

Table 1.10.4 (3) Financial Situations of Intercity Express Service (Northern Line)

Unit : Million Baht

Item / Year & Phase	Cost & Expenses					Revenue (B)	Profit (B)-(A)	NPV Discounted by		
	Investment Cost			Expenses	Total (A)			7%	9%	11%
	Facilities	Rolling Stock	Total							
1996	0	1,150	1,150	0	1,150	0	-1,150	-1,150.0	-1,150.0	-1,150.0
1997	0	0	0	70	70	250	180	168.2	165.1	162.2
I 1998	150	0	150	70	220	260	40	34.9	33.7	32.5
1999	150	0	150	70	220	270	50	40.8	38.6	36.6
2000	120	980	1,100	70	1,170	280	-890	-679.0	-630.5	-586.3
2001			0	120	120	300	180	128.3	117.0	106.8
2002			0	120	120	320	200	133.3	119.3	106.9
II 2003			0	120	120	340	220	137.0	120.3	106.0
2004			0	120	120	370	250	145.5	125.5	108.5
2005	0	560	560	120	680	390	-290	-157.7	-133.5	-113.4
2006			0	160	160	410	250	127.1	105.6	88.0
2007			0	160	160	440	280	133.0	108.5	88.8
III 2008			0	160	160	470	310	137.6	110.2	88.6
2009			0	160	160	500	340	141.1	110.9	87.6
2010	0	170	170	160	330	530	200	77.6	59.8	46.4
2011			0	170	170	560	390	141.4	107.1	81.5
2012			0	170	170	560	390	132.1	98.2	73.4
2013			0	170	170	560	390	123.5	90.1	66.2
2014			0	170	170	560	390	115.4	82.7	59.6
2015			0	170	170	560	390	107.8	75.9	53.7
2016			0	170	170	560	390	100.8	69.6	48.4
2017			0	170	170	560	390	94.2	63.8	43.6
2018			0	170	170	560	390	88.0	58.6	39.3
2019			0	170	170	560	390	82.3	53.7	35.4
2020			0	170	170	560	390	76.9	49.3	31.9
2021			0	170	170	560	390	71.9	45.2	28.7
2022			0	170	170	560	390	67.2	41.5	25.9
2023			0	170	170	560	390	62.8	38.1	23.3
2024			0	170	170	560	390	58.7	34.9	21.0
2025			0	170	170	560	390	54.8	32.0	18.9
Total	420	2,860	3,280	4,230	7,510	13,530	6,020	795.3	241.3	-140.2
FIRR							0.1018			
NPV (mmBts)								795.3	241.3	-140.2

Table 1.10.4 (4) Financial Situations of Intercity Express Service (Southern Line)

Unit : Million Baht

Item / Year & Phase	Cost & Expenses					Revenue (B)	Profit (B)-(A)	NPV Discounted by		
	Investment Cost			Expenses	Total (A)			7%	9%	11%
	Facilities	Rolling Stock	Total							
1996	0	990	990	0	990	0	-990	-990.0	-990.0	-990.0
1997	0	0	0	60	60	170	110	102.8	100.9	99.1
I 1998	90	0	90	60	150	180	30	26.2	25.3	24.3
1999	90	0	90	60	150	190	40	32.7	30.9	29.2
2000	120	540	660	60	720	200	-520	-396.7	-368.4	-342.5
2001			0	90	90	210	120	85.6	78.0	71.2
2002			0	90	90	230	140	93.3	83.5	74.8
II 2003			0	90	90	240	150	93.4	82.1	72.2
2004			0	90	90	260	170	98.9	85.3	73.8
2005	0	420	420	90	510	270	-240	-130.5	-110.5	-93.8
2006			0	110	110	290	180	91.5	76.0	63.4
2007			0	110	110	310	200	95.0	77.5	63.5
III 2008			0	110	110	330	220	97.7	78.2	62.9
2009			0	110	110	350	240	99.6	78.3	61.8
2010	0	490	490	110	600	370	-230	-89.2	-68.8	-53.4
2011			0	140	140	390	250	90.6	68.6	52.3
2012			0	140	140	390	250	84.7	63.0	47.1
2013			0	140	140	390	250	79.1	57.8	42.4
2014			0	140	140	390	250	74.0	53.0	38.2
2015			0	140	140	390	250	69.1	48.6	34.4
2016			0	140	140	390	250	64.6	44.6	31.0
2017			0	140	140	390	250	60.4	40.9	27.9
2018			0	140	140	390	250	56.4	37.5	25.2
2019			0	140	140	390	250	52.7	34.4	22.7
2020			0	140	140	390	250	49.3	31.6	20.4
2021			0	140	140	390	250	46.1	29.0	18.4
2022			0	140	140	390	250	43.0	26.6	16.6
2023			0	140	140	390	250	40.2	24.4	14.9
2024			0	140	140	390	250	37.6	22.4	13.5
2025			0	140	140	390	250	35.1	20.5	12.1
Total	300	2,440	2,740	3,340	6,080	9,450	3,370	193.3	-138.7	-366.3
FIRR							0.0807			
NPV (mmBts)								193.3	-138.7	-366.3

Table 1.10.5 (1) Financial Situations of Commuter Service Intercity Express Service (Adding up)

Unit : Million Baht

Line \ Item	Cost & Expenses: Investment Cost: Facilities	Rolling Stock	Total	Expenses	Total (A)	Revenue (B)	Profit (B)-(A)	NPV discounted by 9%	FIRR (%)
Eastern Line	3,110	5,060	8,170	8,640	16,810	31,150	14,340	710.9	10.74
Northern Line	4,310	8,130	12,440	14,680	27,120	53,730	26,610	1,870.4	11.69
Southern Line	2,900	5,660	8,560	8,560	17,120	24,080	6,960	-702.9	6.65

(To be continued)

Target Year : 2010 : Project Life : 1996-2025 (30 Years)
Conditions of Commuter Service : Investment Cost of Facilities : 1/2
Fare : Second Class (Bs.0.44/km)

Table 1.10.5 (2) Financial Situations of Commuter Service Intercity Express Service (Adding up)

(Continued)

Unit : Million Baht

Year & Phase \ Item		Eastern Line: Profit or Deficit(-)	Eastern Line: NPV discounted by 9%	Northern Line: Profit or Deficit(-)	Northern Line: NPV discounted by 9%	Southern Line: Profit or Deficit(-)	Southern Line: NPV discounted by 9%
	1996	-720	-720.0	-1,370	-1,370.0	-990	-990.0
	1997	-30	-27.5	60	55.0	80	73.4
I	1998	-150	-126.3	-160	-134.7	-20	-16.8
	1999	-400	-308.9	-560	-432.4	-10	-7.7
	2000	-2,200	-1,558.5	-3,870	-2,741.6	-590	-418.0
	2001	300	195.0	570	370.5	-40	-26.0
	2002	290	172.9	520	310.1	-10	-6.0
II	2003	270	147.7	510	279.0	-30	-16.4
	2004	-30	-15.1	170	85.3	-220	-110.4
	2005	-1,390	-640.0	-2,140	-985.3	-1,710	-787.3
	2006	690	291.5	1,120	473.1	320	135.2
	2007	780	302.3	1,290	499.9	290	112.4
III	2008	840	298.6	1,440	512.0	290	103.1
	2009	860	280.5	1,550	505.6	-50	-16.3
	2010	-220	-65.8	180	53.9	-2,050	-613.5
	2011	1,030	282.8	1,820	499.7	780	214.1
	2012	1,030	259.4	1,820	458.4	780	196.5
	2013	1,030	238.0	1,820	420.6	780	180.2
	2014	1,030	218.4	1,820	385.8	780	165.4
	2015	1,030	200.3	1,820	354.0	780	151.7
	2016	1,030	183.8	1,820	324.7	780	139.2
	2017	1,030	168.6	1,820	297.9	780	127.7
	2018	1,030	154.7	1,820	273.3	780	117.1
	2019	1,030	141.9	1,820	250.8	780	107.5
	2020	1,030	130.2	1,820	230.1	780	98.6
	2021	1,030	119.4	1,820	211.1	780	90.5
	2022	1,030	109.6	1,820	193.6	780	83.0
	2023	1,030	100.5	1,820	177.6	780	76.1
	2024	1,030	92.2	1,820	163.0	780	69.8
	2025	1,030	84.6	1,820	149.5	780	64.1
Total		14,340	710.9	26,610	1,870.4	6,960	-702.9
FIRR		0.1074		0.1169		0.0665	
NPV(mmBts)			710.9		1,870.4		-702.9

1.11. Initial Environmental Impact Examination

(1) Introduction

With the rapid economic growth in Thailand, particularly in the Bangkok Metropolitan Region (BMR), infrastructure development has been seriously taken into consideration by the government. Accompanying infrastructure development, the relative impact which may be caused by the development is presently a major concern of all relevant agencies, including non-government organizations (NGO). As can be seen recently, a plan to construct an elevated mass rapid transit system has been protested by an NGO due to various reasons on environmental issues.

The JICA study team realizes the importance of the environment and has considered the environmental evaluation as one of the major topics of this Study.

The environmental evaluation was conducted according to the requirements of the Office of Environmental Policy and Planning (OEPP) and the National Environmental Board, covering the following items.

(2) General

Positive impact includes relief of traffic congestion and upgrading of slum areas. Negative impact involves relocation of people, blocking against the existing path of traffic, noise pollution, vibration, air pollution and visual impact. The general impact is summed up in Tables 1.11.1 and 1.11.2, and locations of related areas are shown in Fig. 1.11.1.

(3) Impact on relocation of people

Land acquisition is always needed for railway or urban development projects. This includes houses, slums, shop houses, factories, temples and other infrastructure. Land acquisition causes severe problems to people, especially the poor.

The relocation of people should be done under the conditions that everyone, and every household will have, at least, the same living standard as they had before the relocation.

Therefore, the estimation of land acquisition and compensation costs must be done carefully. In addition, the effect of income level due to the relocation shall be considered. For estimation, detailed information on houses, buildings and facilities is needed.

(4) Impact on existing roads

A project may block the existing traffic on roads, sois, walkways, etc. Therefore, it is necessary to have the data on traffic volume, road users, travel purposes, and income level in order to assess the impact on travel patterns with and without the project.

(5) Impact from noise and vibration

The estimation of noise and vibration levels is needed. The average level per day and the highest level of the sensitive areas must be carried out to compare conditions with and without the project. This data will be used for the route selection and for introducing the mitigation measures such as noise barriers or other methods in order to reduce the noise level as specified in the standard. The traffic noise and railway vibration simulated by computer shows the economic evaluation along the route, especially at communities, schools and temples.

(6) Visual impact

Views along the route shall be shown for both cases; with and without the project. Public hearings for people in the project area and experts on this aspect should be held to gather information for estimating the value of these views. This data will be used in selecting alternative alignments and in improving the aesthetic view of the project area.

Both analyses will be done during the feasibility study period.

(7) Conflicts with city pollution

In planning the project, careful attention should be paid to the integration and conformity with other projects and city plans. The conflicts of each alternative alignment shall be identified for use in the route selection.

(8) Impact from air pollution

The project will generate more traffic which will result in increasing air pollution. Therefore, it is necessary to measure the qualities of air in the existing and future situations (with project). The measurements should be done to identify the average daily value and the highest value of air quality for carbon monoxide, nitrogen oxide, hydrocarbon and dust. More attention should be paid to the sensitive areas such as hospitals, schools and highly-populated areas.

(9) Impact on valuable buildings

These buildings include all buildings which can not be re-built to have the same configuration and value such as historic places and buildings with high social and cultural values. The data on these buildings are used in the selection of alternative alignments.

(10) Other impact

Besides the aforementioned impact, there are some other forms of impact such as flooding resulting from the project and the changes in land price.

Table 1.11.1 Preliminary Assessment on Urban Transport Project

Issue for screenings	Project phase		
	Planning	Construction	Operation
Socio-economic environment			
Social conditions	×		○
Economic conditions	×		○
Resettlement and land acquisition			
Important places			
Transport and public facilities			○
Split of communities			
Water rights and right of common			
Waste		△	
Hazards		△	
Land use			○
Natural environment			
Wild animal and vegitation			
Hydrogical situation			
Visual impact		△	△
Environmental pollution			
Air quality			○
Noise		△	○
Vibration		△	
Soil pollution			
Water quality			

○ : Possitive effect
△ : Need for monitoring
× : Need for further study

Table 1.11.2 Preliminary Assessment on Intercity Railway Project

Issue for screenings	Project phase		
	Planning	Construction	Operation
Socio-economic environment			
Social conditions	×		○
Economic conditions	×		○
Resettlement and land acquisition			
Important places			
Transportation and public facilities			○
Split of communities			
Water rights and right of common			
Waste		△	
Hazards		△	△
Natural environment			
Wild animal and vegitation			
Hydrogical situation			
Topography and soil condition			
Visual impact			
Environmental pollution			
Air quality			○
Noise		△	△
Vibration		△	△
Soil pollution			
Water quality			

○ : Possitive effect

△ : Need for monitoring

× : Need for further study

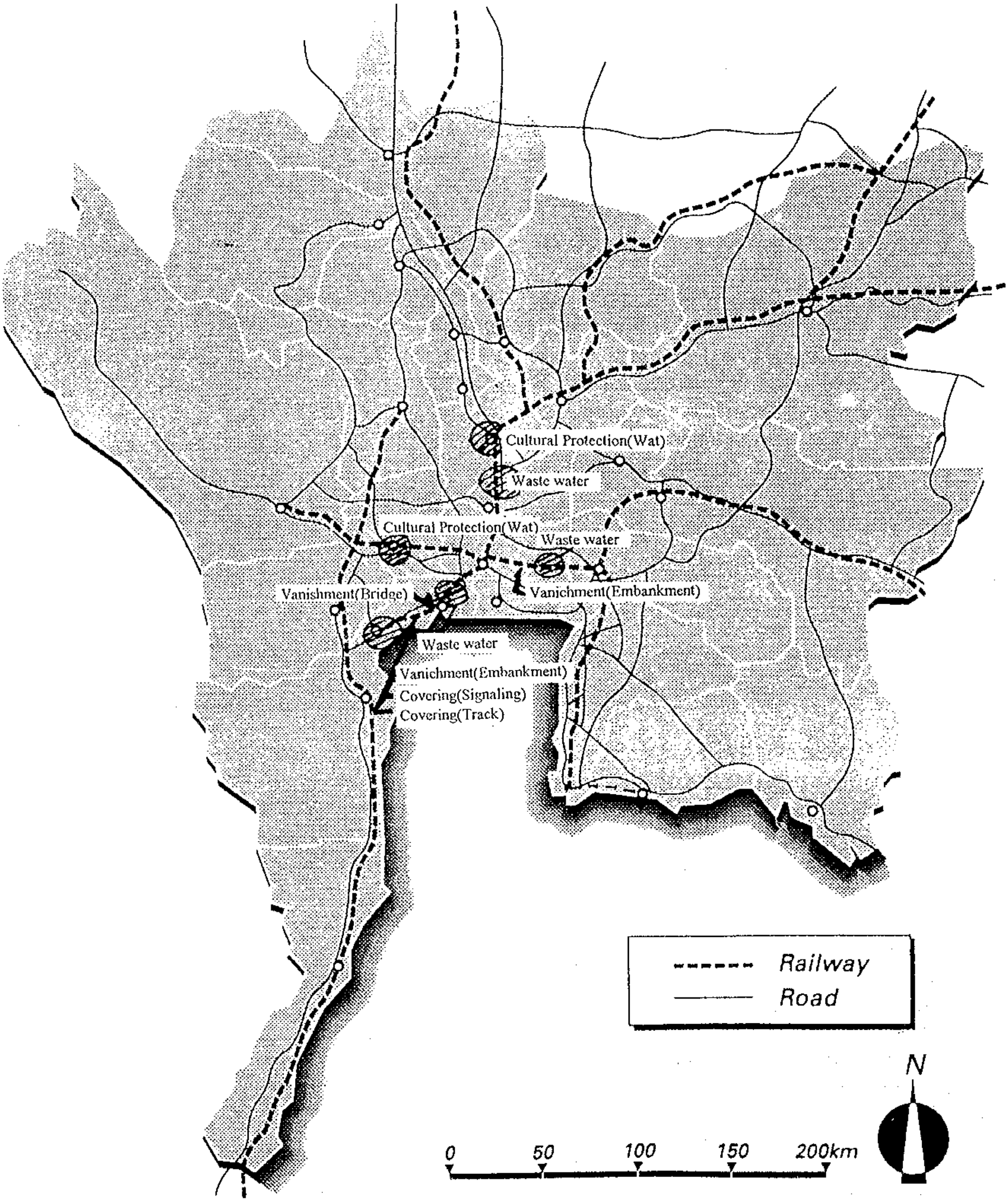


Fig. 1.11.1 Location Map

FEASIBILITY STUDY ON RAILWAY IMPROVEMENT
OF THE EASTERN LINE
INTEGRATED WITH URBAN DEVELOPMENT

2. Feasibility Study on Railway Improvement of the Eastern Line Integrated with Urban Development

2.1 Concept of Railway Improvement

2.1.1 Basic Policy on Railway Improvement

(1) Introduction

Remarkable economic development in Thailand in recent years has brought concentrated growth of economic activity in the Bangkok Metropolis, the political and economic center of Thailand. Accompanied with this, traffic congestion in the Bangkok Metropolis has become extremely severe, which prevents further development and brings environmental deterioration.

For a large volume transport demand in a great city area such as the Bangkok Metropolis, railways/mass rapid transit systems (MRT), which provide fast and reliable transport with efficient space use and environment-friendliness, are essential. However, in the Bangkok Metropolis railways/MRT have not been realized yet, only plans have been proposed. This Study proposes to improve and activate the railway system of the State Railway of Thailand (SRT), which stretches in four directions (east, north, west, south-west) from the center of Bangkok reaching the whole country, so as to ease the traffic congestion which is the most largest problem of the Bangkok Metropolis.

The feature of this Study is not only to plan railway improvement but also to integrate it with urban development, in order to promote urban development such as housing of good quality and environment with reliable, comfortable transport means and also to create sure demand and value capture for sound railway investment.

With this scope, the Master Plan Study for within the 200km radius area was carried out by August, 1994.

This Study is to execute a feasibility study on integrated urban development and railway development along the Bangkok-ESB corridor, which is selected as a priority, based on the Master Plan.

(2) Characteristics and role of railways

Characteristics of railways are listed as follows in the Master Plan.

i) Merits
- Fast
- Reliable (Punctual)
- Safe
- Comfortable
- Inexpensive (for large volume transport)
- Suitable for large volume transport
- Environment-friendly
- Natural-resource-saving (for large volume transport)
- Space-saving (small space requirement / availability of underground because of no exhaust fume problems)

ii) Demerits
- Not door-to-door
- Not at any time

Roles of railways should be those which can make the most of the merits and minimize the demerits. The roles are specialized to emphasize "large volume" and "fast and reliable" transport enumerated below. In great city areas, railways are the only transport means "saving valuable, hard-to-get spaces".

i) Commuter service in large city areas
ii) Intercity express service / shuttle freight service
iii) National/international trunk line service

Among the above roles, "Commuter service in large city areas" and "Intercity express service" are the objects of this Study, in which railway improvement integrated with urban development will be examined and proposed.

(3) Aim of the Study

The aim of the Study is to plan railway improvement integrated with urban development for

Commuter Service within the "50km" radius area including airport access service, and **Intercity express service within the 200km radius area.**

As to the trunk line service for passengers and freight and shuttle freight service, which are the existing main roles of the SRT, they will be executed successively corresponding to increasing demand brought on by the economic growth of Thailand. Those are out of scope of this Study, but are to be taken into consideration.

A network of railways proposed to be improved in the Master Plan is shown in Fig. 2.1.1.

(a) Proposed concrete railway improvement plan for commuter service including airport access service

In the Bangkok Metropolis, where there is over concentration of population brought on by the enormous and rapid economic growth of Thailand, it is hoped that good housing areas as well as reliable and comfortable commuting means such as railways / mass rapid transit systems (MRT) can be created in order to ease the force of the increase of the remarkable congestion of roads, to alleviate the deterioration of the environment caused by exhaust gas, noise, etc. along congested roads and to save natural resources such as petroleum.

In a great city such as the Bangkok Metropolis, airport access is an important transport requirement as well. It is essential that fast and reliable railway access service be provided efficiently as an integrated system with commuter service.

To deal with the above, in the Bangkok Metropolis within the "50km" radius area, railway lines are to be improved to suitable systems for commuter service including airport access service. Major facilities of the improved railway are as follows:

Double (or more) track
Electrification

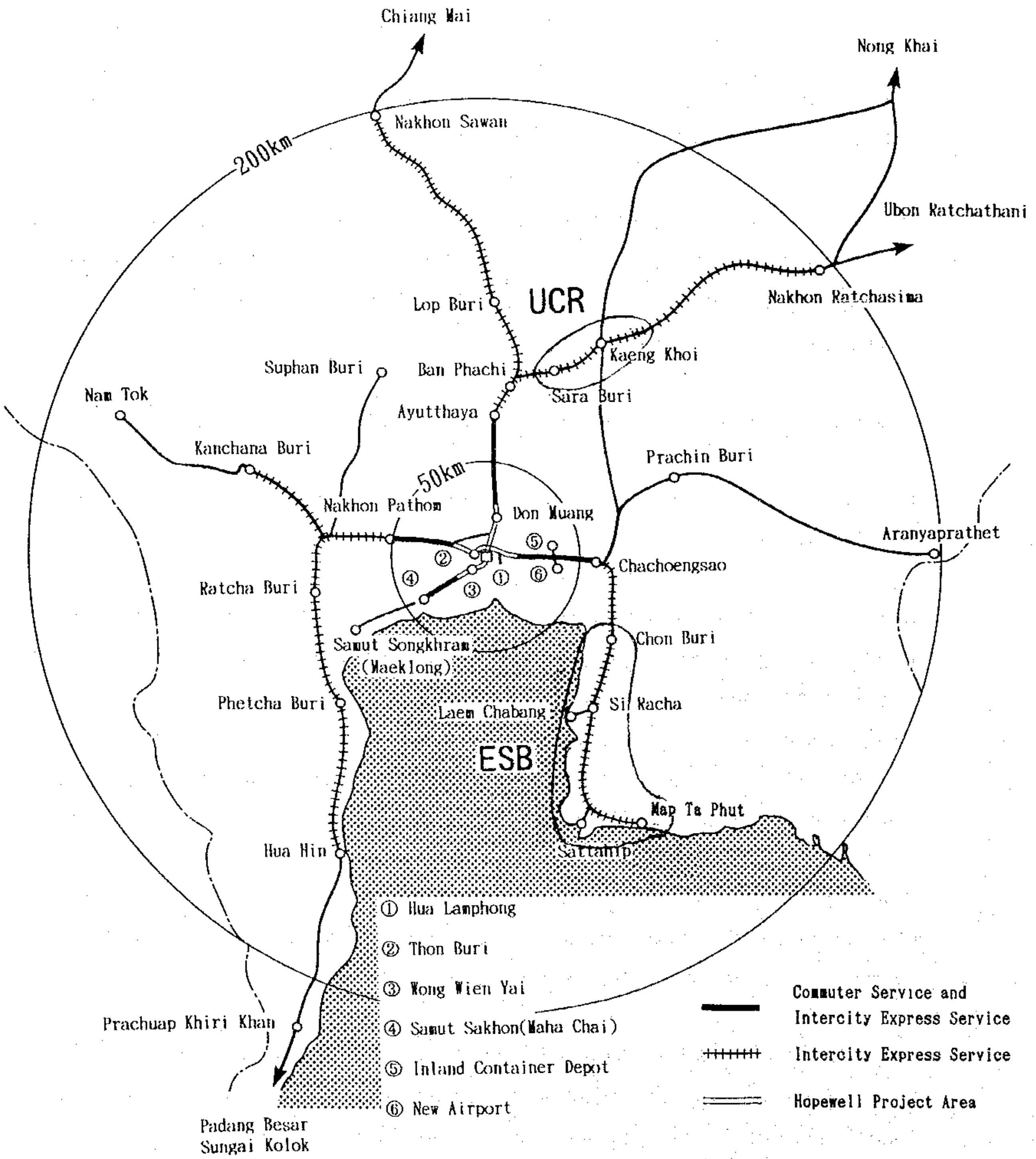


Fig. 2.1.1 Network of Railway in the Master Plan

Automatic signalling system
Sufficient refuge tracks

On these lines, commuter transport service as well as fast, reliable, frequent and comfortable airport access service by commuter-transport-type electric railcars will be provided.

(b) Proposed concrete railway improvement plan for intercity express service

In the area in a 200km radius from the center of Bangkok, it is aimed to provide fast, reliable, safe and comfortable express train service between cities in order to make travel between Bangkok and other cities and among regional cities comfortable and easy, for activation of the economy of regional cities, promotion of decentralization, and easing the deterioration of the environment and frequent occurrence of accidents on trunk roads.

For this purpose, within the 200km radius area, railway facilities such as track, signalling, crossing loops, refuge tracks and at-grade crossing safety devices are to be reinforced in order that express service of high speed and high quality by high performance diesel railcars, which can take the place of air-conditioned buses and automobiles, may be offered.

(4) Selection of the priority project

Out of all the projects of railway improvement integrated with the urban development expanding towards the four directions from the center of Bangkok, the priority project of 100km railway lines on which a feasibility study is to be executed in succession was selected and approved at the third Steering Committee held on 10th Aug., 1994. It is as follows:

Section:	Eastern Line	Hua Mak - Chon Buri
	SBIA branch line	Lat Krabang - SBIA North Terminal
Role:	Commuter service including airport access service	
	Intercity express service	

The project is actually to be executed on the following section and with the following role as a unit of the project.

Section:	Eastern Line	Hua Lamphong - Yommarat - Chachoengsao - Map Ta Phut
	SBIA branch line	Lat Krabang - SBIA North Terminal
	Others, if necessary, concerned with urban development	
Role:	Commuter service within a "50km" area including airport access service	
	Intercity express service	

This priority project is selected so that the line connects Bangkok, the Capital of Thailand, with the Eastern Seaboard (ESB) where the government is placing special emphasis on development, passes by the Second Bangkok International Airport and so forth, in other words, it is located in the most active area of Thailand.

2.1.2 Urban Development Plan

"Integrated urban and railway development (IURD)"
This Study aims to formulate an urban development plan which puts stress on public transport especially on railways / mass rapid transit systems(MRT) as its transport means in association with a railway improvement plan integrated with the urban development plan. The urban development scheme is described in "Volume I Part II Integrated Urban and Railway Development"

2.1.3 Feasibility Study Project

(1) Outline

The Study is a feasibility study on railway improvement of the Bangkok - ESB corridor integrated with the urban development which is the other portion of this Study described in the "Volume I Part II Integrated Urban and Railway Development"

Contents of the projects, which are selected as the priority project on the Master Plan, are as follows:

Area: Railway lines of Bangkok - ESB and its branches
Hua Lamphong - Yommarat - Lat Krabang - Chachoengsao - Map Ta Phut
Lat Krabang - SBIA North Terminal

Service: Commuter service within a "50km" area (Yommarat - Chachoengsao)
SBIA access service
Intercity express service (Bangkok - ESB)

Remarks: Trunk line service and regional shuttle freight service on these lines are out of the scope of this Study but are to be taken into consideration.

Target year of the project is 2010, and project life to be examined is 30 years from 1996 to 2025.

Outline of the aimed projects is as follows and shown in Fig.2.1.2. and Fig.2.1.3.

(Commuter service)
Improvement and reinforcement of railway commuter transport is indispensable for sound development of a great city area. Integrated urban development and railway improvement are highly desirable for the Bangkok Metropolis which has realized recent remarkable growth. Proposed improvement is for a suburban commuter railway system within the "50 km" radius area. Importance is attached to "fast" service for rather a long haul of 20 to 60 km. Therefore, a rapid-local-combining operation pattern of 10 minutes headway respectively with not so short station intervals of 2 - 3 km is to be proposed. Capacity can be adjusted by the number of cars making up a train.

(SBIA access service)
Railway access for an airport of a great city area such as the Bangkok Metropolis is essential as a reliable and fast access means, especially in the Bangkok Metropolis because of the extremely congested roads. SRT Eastern Line is passing near the Second Bangkok International Airport now under construction and is most advantageous as an airport access railway. SRT SBIA access service is to be carried out effectively as a unified system with the commuter service which will be managed by itself. Transport service between the airport and the CBD within 30 minutes of 20 minutes headway is to be proposed.

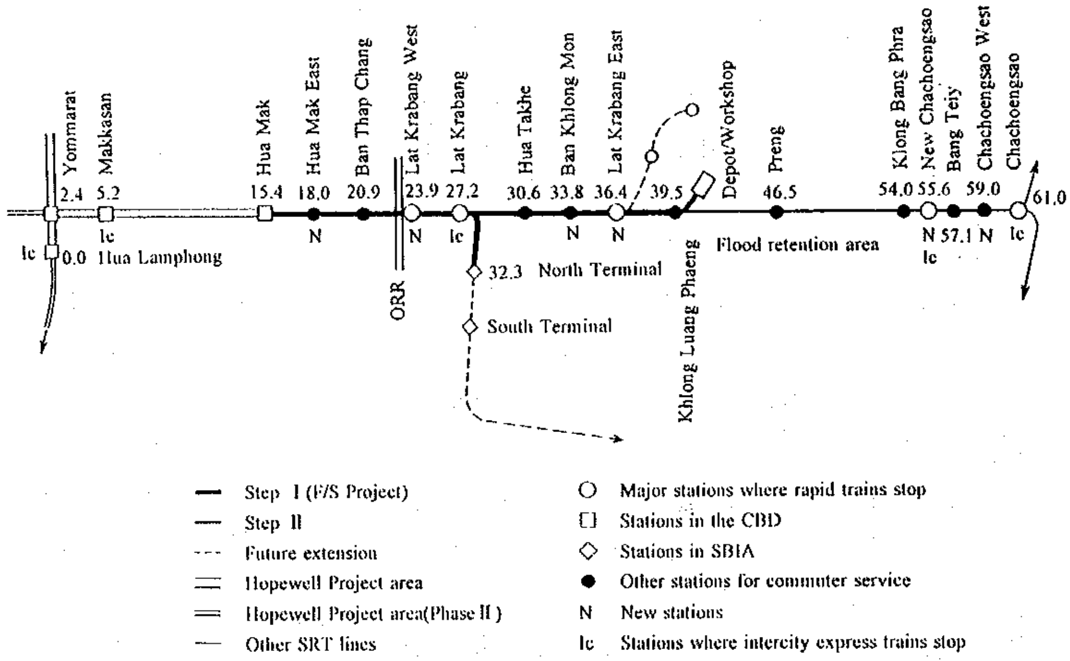


Fig. 2.1.2 Proposed Railway Route and Station Disposition
(Commuter Service and SBIA Access Service)

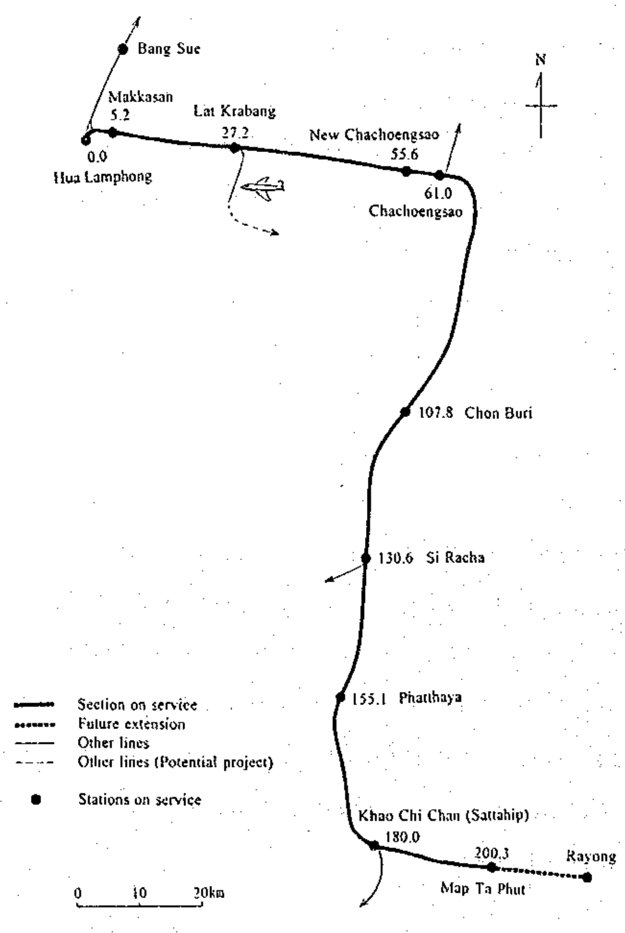


Fig. 2.1.3 Proposed Railway Route and Station Disposition
(Intercity Express Service)

(Intercity express service)

Intercity transport demand between the Bangkok Metropolis and the ESB, which is developing remarkably, will grow sharply. Demand for intercity express service has high potential as a fast, reliable and comfortable transport means notwithstanding it is not door-to-door. However, it contains much uncertainty and large investment at a stretch requires running many risks. Therefore, moderate and sound investment executed step by step is proposed in this Study. Diesel railcar trains of one hour headway consisting of 10 - 15 cars on a single track between Chachoengsao and Map Ta Phut are to be proposed. When demand actually exceeds the proposed capacity, it will be easy to reinforce the capacity by setting up sound investment supported by actual customers and revenue.

(2) Commuter Service within a "50km" area

(a) Aim of the project

A great city area such as the Bangkok Metropolis, where a vast number of people live and work, needs urban transport systems of railways / mass rapid transit systems (MRT), which can provide fast, reliable, safe, environment-friendly and national-resource-saving transport for a great many passengers, saving the valuable space of the area. Automobiles alone can not deal with such a large volume of traffic demand sufficiently because too much space is required for roads.

This Project is to, or rather must, deal with the above need. The urban development projects of the new towns around the Lat Krabang West / Lat Krabang , Lat Krabang East, New Chachoengsao and other areas are planned. This railway improvement planning is to be carried out integrated with them.

The railway commuter service planned in this Study is for commuting and business transport rapidly between the center (CBD) of the Bangkok Metropolis and suburbs/satellite cities along the Eastern Line in a radial direction. Average schedule speed is 60 - 70km/h and practical service distance is 15 - 60km.

(b) Position of the project in general classification of railways/MRT

In great city areas like the Bangkok Metropolis, various types of railways/MRT (Mass rapid transit systems) can be adopted building up synthetic transport networks to deal with many kinds of transport demands, dependent on such factors as transport distance, speed, frequency, capacity, construction circumstances; etc.

Generally, individual railway/MRT may be classified into the following three types by:

i) Intra-urban railway/MRT
ii) Suburban railway/MRT
iii) Inter-urban railway/MRT

These three types can be characterized by practical service distance, schedule speed, station intervals and headway. Dense station intervals and short headway can offer convenient service, but make the schedule speed low and practical service distance short. These are incompatible. Each classified railway/MRT puts stress on one of those factors as shown in Table 2.1.1.

The position of this project is at the "suburban railway" connecting the center(CBD) of Bangkok Metropolis with the suburban areas and satellite cities (Chachoengsao, etc.).

Table 2.1.1 Classification of Urban Railway/MRT

Classification	Practical service distance	Schedule speed	Station interval	Headway
Intra-urban	Short Up to 20km	Low Approx. 30km/h	Short 0.5 - 1km	2 - 5min.
Suburban	Medium 20 - 50km (or more)	Medium Approx. 60km/h	Medium 2 - 5km	10 - 20min.
Inter-urban	Long 50 - 100km (or more)	High 80 - 100km/h	Long 20 - 30km	20 - 60min.

*Remarks: To make practical schedule speed higher, rapid-local-combining operation pattern is adopted. Headway is that of rapid trains on the operation pattern.

(c) Aimed service criteria

Aimed service criteria of the proposed railway improvement for commuter service on the Eastern Line are as follows:

i) Section

Yommarat - Hua Mak - Lat Krabang - Khlong Luang Phaeng - Chachoengsao

Remarks: Between Yommarat and Hua Mak (Hopewell Project area), the infrastructure of double track connecting the East and West of Bangkok penetrating the City Center is to be provided by the Hopewell Project as the "Green Line" by the year 2000. Through operation between the Eastern Line and the Southern Line is to be realized. The Study aims at the section of the Eastern Line, eastward from Yommarat Station, and the portion of the Southern Line is out of the scope. (Improvement of the Southern Line is another project.) Necessary additional investment such as electrification and rolling stock procurement and management, operation and maintenance for this service is to be executed in this project. Provisional countermeasures for the intermediate stage concerning the mass rapid transit project in Bangkok, especially the Hopewell Project, are to be described in Appendix II-1.

ii) Aimed schedule speed

65km/h Average in operation pattern of rapid-local-combining operation

iii) Headway

Rush hours: Max. 10min. (1 rapid and 1 local / 10min. [Future possibility, 2 rapid and 1 local / 10min. --- Maximum capacity on double track])

Off peak: 20min.

iv) Operation pattern

Rapid-local-combining operation pattern, which can make the total travel time among all the stations shorter.

v) Station disposition

2 - 5km in general

vi) Rolling stock

High performance commuter-transport type electric railcars making up a train of up to 10cars [Future possibility: 15cars]

vii) Maximum available capacity in rush hours

Approx. 27,000 passengers / h·direction (Making up each train of 10 cars, 1 rapid 1 local / 10min.--- Proposed service in this project in the target year of 2010)

[Approx. 60,000 passengers / h·direction (Making up each train of 15 cars, 2 rapid 1 local / 10min.--- Future possibility by additional investment on the double track)]

viii) Investment steps

First Step	Yommarat - Khlong Luang Phaeng	
	(Including Lat Krabang - SBIA North Terminal)	
	Construction	1996 - 2000
	Commencement of service	2000
Second Step	Khlong Luang Phaeng - Chachoengsao	
	Construction	2001 - 2005
	Commencement of service	2005

Remarks: Possible further investment after the target year of 2010

Capacity expansion	Expansion of cars making up a train : 10 to 15
	Reinforcement of operation pattern
	1 rapid 1 local / 10min." to "2 rapid 1 local / 10min."
Potential project	Expansion of service section

Concerning SBIA expansion

SBIA North Terminal - SBIA South Terminal

Concerning urban development

Branch Line within Lat Krabang East New Town

Extension from SBIA toward Bang Bo

(Extension up to the south edge of the SBIA at early time providing a bus terminal is an possible option.)

ix) Provisional service previous to completion

In order to support smooth prosperity of the relevant urban development, provisional service utilizing diesel railcars previous to completion of the railway improvement is to be carried out.

Hua Lamphong - Khlong Luang Phaeng	1997 - 2000
Khlong Luang Phaeng - Chachoengsao	2001 - 2005

Outline of the proposed railway improvement plan for commuter service including SBIA access service is shown in Fig.2.1.2.

(3) SBIA access service

(a) Background of the project

The Bangkok Metropolis is one of the world's greatest city areas, requiring a large international airport to deal with the vast transport demands supporting the socio-economic activities.

The Second Bangkok International Airport (SBIA) is now under construction and commencement of service is expected by the year 2000. Its planned capacity is 30 million air passengers in the year 2000 and 100 million ultimately.

In the world, great cities such as Bangkok have large airports commensurate with the scale of activity of the cities. Most of these airports have (or have plans for) access means by railway / mass rapid transit system (MRT) of various types according to locations, demand, etc. to deal with a large number of air passengers, greeters/well-wishers, employees, etc.

Railway/MRT airport access has a considerable share valuing its merits such as fast, reliable, comfortable, inexpensive service. Even international air passengers who have large baggage may utilize railway/MRT access regardless of its demerit of not being door-to-door.

The plan of the SBIA recognizes that railway/MRT access is indispensable and incorporates it in the project. The study of ground access (Report on Ground Access to Second Bangkok International Airport, March 1993, Airport Authority of Thailand) greatly expects railway/MRT to play its role as an access means especially in the future to deal with demand forecasted to increase explosively which will be unable to be caught up with by expansion of roads. In the plan, the SBIA provides two double-track railways penetrating the airport area in a north-south direction. However, concrete lines/enterprises have not been decided yet.

This Study proposes to extend a branch line from Lat Krabang of the Eastern Line as the most appropriate railway access for the airport which is to be managed as an integrated system/network with the commuter service on the Eastern Line.

Lines/enterprises which will execute SBIA access transport have not been decided yet. Access systems now under consideration are as follows, including the branch line of the SRT Eastern Line which is proposed in this Study.

- Branch line of the SRT Eastern Line from Lat Krabang, approximately 5km (to SBIA North Terminal)
- Extending the Hopewell Community Train (CT) from Hua Mak into SBIA, approximately 17km
- High Speed Rail (HSR) project, studied by the NESDB, branch line from the Airport Junction at Lat Krabang on the main line connecting the ESB with Bangkok (Huai Khwang), approximately 26km (Huai Khwang - SBIA NT)
- Extending the Bangkok Transit System (BTS) along No.34 Highway, approximately 18km

(b) Principles of SBIA access railway/MRT

In planning the SBIA access railway, the principles of airport access railways/MRT is to be examined, which are listed as follows:

i) To be built in to an urban transport system

It is preferable that an airport access railway/MRT is not a line/enterprise managed only for the access but a part built in to a city area urban transport system. As its scale can be large and it can obtain customers widely, it will be effective in utilizing facilities and rolling stock and stabilizing the management.

ii) To be an extension of a self-supporting system

The section out of the airport area of an airport-access line should have its own ridership as an urban transport-line which enables it to be self-supporting in order to avoid placing too much burden on airport passengers. An airport access railway/MRT should not be a transport means for only a handful of air passengers of high income but should be used by the general public including airport employees. Therefore, it is preferable that an airport access railway/MRT is a short extension of a self-supporting system/line.

iii) Various mode/types dependent on location of airport (Variety choice)
A mode/type of an airport access railway/MRT will be selected by the location especially the distance between the airport and the city center.

That is, in case of a long distance (60 - 80km), the only criteria required for access mode is "high speed", and comfortable accommodation follows. Airport passengers move between the airport and the city center being gathered on an airport access railway of high speed.

On the other hand, in case of not so long distances, because airport passengers go to / start from wide areas of the city, it is preferable that the access transport is not a limited line to transport airport passengers but parts of an urban transport network with a variety of choice. Bangkok and the SBIA fits the latter case. The plan within the SBIA area of two double track lines penetrating in a north-south direction is based on this standpoint. This plan allows a network of variety of choice to be formed.

iv) Characteristics of passenger flow on airport access railway/MRT
Passenger flow on airport access railways/MRT are mainly between residences and the airport, being different from ordinary urban transport main flow between residences and CBD and within CBD. Therefore, the existing network is not always used for the purpose.

v) Characteristics of passengers on airport access (Secondary access by automobile)
Out of airport access passengers, air passengers, especially international air passengers, usually have large baggage. Therefore, most of them uses automobiles within the city as secondary access. That is, automobiles are used for short distance trips within the city instead of long distance trips on extremely congested trunk roads in radial directions. They use an access railway/MRT only for one line without transferring to/from another line. In this regard it is essential that stations within the city should provide facilities for secondary access by automobile, such as a station entrance porch, an elevator/escalator, carts, etc. A railway/MRT

which reaches an airport provides such facilities as the above, but other railways/MRT tend not to provide them because of the few passengers with large baggage.

(c) Proposed access transport systems

Basically it is recommended that all the proposed alternatives providing different transport services and functions and in different service areas as shown in the Table 2.1.2 should be constructed with the principle of self-supporting ridership.

Table 2.1.2 Proposed SBIA Access Railway/MRT Plan

Line/Enterprise	Aimed schedule speed to CBD	Travel time	Service area
SRT Eastern Line Branch	70 km/h	Less than 30 min.	Center and suburban area, 50km radius area along the Eastern Line
(Transfer at Lat Krabang)	100 km/h		200km radius area on the ESB corridor
HSR	80 km/h	18 min. to/from Huai Khwang	East edge in the center of Bangkok
(Transfer at Airport Junction)			ESB corridor
Bangkok Transit System (Tanayong) extension	30 km/h	1 hour	South of Bangkok (Especially Bang-Na Urban Center)
Hopewell CT	30 km/h	1 hour	Center of Bangkok

i) Improved SRT Suburban Line

The SRT Eastern Line must be improved as a suburban commuter line as recommended in this Study whether with or without the High Speed Rail (HSR). It must be noted that this line is projected to live on its own passenger demand created by urban development. Whether or not the Eastern Line should serve the SBIA is not a crucial matter of financial consideration. Rather financial conditions will worsen if all the construction cost of the branch line to the SBIA is included in the Eastern Line improvement project. However, in such a situation that the suburban line with high speed and high frequency is running close to the SBIA, it is socially and economically undeniable to make the existing convenient transport service able to the airport passengers from the view point of urban transport policy.

ii) Limitation of Intra-urban MRT

In principle, the Intra-urban MRT, such as the Bangkok Transit System (Tanayong), Hopewell CT is not to be extended to the SBIA as main access transport, because the length of main haul is likely to exceed the practical service length in terms of train speed and capacity. If extended beyond 30km it will take more than one hour (general schedule speed of intra-urban MRT:30km/h) from one end to the other end (for example, SBIA-CBD of Bangkok).

In this regard the intra-urban MRT is not supposed to be the main access transport system between the SBIA to the CBD of Bangkok. However, the extension of the Bangkok Transit System (Tanayong) to SBIA is recommendable since the line can provide the direct airport access service to the proper service area of the line, especially subcenters such as Bang-Na and the southern part of Bangkok out of the SRT line service area, within a reasonable travel time.

iii) SBIA access of HSR

"High Speed Train Study, Volume III the Eastern Seaboard Corridor, NESDB, March 1994" proposes SBIA access by the branch line from the Airport Junction (at Lat Krabang) to the SBIA.

It proposes an exclusive double-track, electrified, standard gauge new line connecting Bangkok (Huai Khwang) with the ESB and the SBIA with both with a maximum operation speed of 160km/h. The main purpose of the project is essentially to provide high speed train service between Bangkok and the ESB, SBIA access service being subordinate.

As mentioned previously, airport access of not so long distance as in the Bangkok Metropolis should offer a variety of choice and the airport plan prepares two double-track railway lines penetrating the area in a north-south direction. The SBIA access of the HSR project providing the service for the passengers in the Bangkok-ESB corridor as one of the choices for access transport is a correct policy, if the main line, Huai Khwang - Rayong, should manage by itself. However, the plan proposes that the airport access transport should be executed monopolistically with extremely high fare levels to support the main line which will not manage by itself, providing a disadvantage to those who hope to utilize railway access service conveniently and easily.

(d) Advantages of the proposed SBIA access of the SRT branch line from the Eastern Line

Second Bangkok International Airport (SBIA) is planned to open by the year 2000. It is recognized that a railway/MRT is indispensable as an access means to the airport, so that the airport plan already includes structures for two lines of double-track railways/MRT penetrating the airport in a north-south direction.

The SBIA access of the branch line of the improved SRT Eastern Line proposed in this Study has many advantages as follows so that it is appropriate to serve as one of the access railways.

i) The SRT branch line can reach the airport area by only a extension of 2km. Accordingly, it represents the least investment cost of all.

ii) The Eastern Line will be a line for commuter service in a radial direction from the CBD with rapid train service. It can connect stations in the CBD with the airport station by fast rapid-trains within 30 minutes.

iii) The line can connect the SBIA with Don Muang Airport directly as well as the whole country by easy transfer at Yommarat, Hua Lamphong, Bang Sue or Lat Krabang.

iv) It has a large capacity with possibility of long trains consisting of 15 cars or more.

v) It can meet various requirements such as commuting, reserved seat 2nd class service, premium service of 1st class utilizing various types of cars in long trains.

vi) The necessary land is the SRT's right-of-way and main access road's right-of-way. Therefore, the execution has none of the uncertainty accompanied with land acquisition.

vii) In the CBD, access means such as MRT network will be provided.

viii) As the SRT access can connect the airport with stations in the innermost CBD, air passengers carrying large baggage can utilize trains with only short access on roads always congested by automobiles, reducing total time and uncertainty.

ix) Demand for an access railway/MRT at the airport station is not so much as to bear the investment cost of a long approach line. Therefore, sections other than those directly for the airport access should be able to manage on their own. This condition is applicable to the SRT Eastern Line .

As mentioned above, the possibility of realizing a certain airport access railway/MRT by the opening of the SBIA, expected to be in the year 2000, is only practical on this SRT branch line.

(Another access railway/MRT)

The distance between the center of Bangkok and the SBIA is only 25km and the urbanized area continues. Therefore, a SBIA access railway/MRT is not a corridor for a shuttle, but rather part of the network in the urban area. It is appropriate to introduce other access railways/MRT which reach near the SBIA so as to make up the network. However, most of them can not play the role of main access means between the CBD and the airport because of the characteristics brought of their main roles.

Although the prepared structures are to be for two double tracks, in some cases, if necessary, introduction of a third line by sharing the prepared structures or facilities might be possible.

(Extension toward the south)

Structures penetrating the airport in a north-south direction will be provided in the airport construction plan. Extension of the branch line southeasterly through them in the future will be preferable connecting the areas such as Bang Phli, Bang Bo with the north-eastern part of Bangkok conveniently. In the initial stage, it is possible to extend until the south edge of the airport area providing a bus terminal for effective use of the railway structures prepared by the airport project. It is not preferable, from the view point of security of the airport, for passengers who only pass through the airport to transfer between buses and trains in the airport terminal.

(e) Aimed service criteria

Aimed service criteria of the proposed railway improvement for the SBIA access service are as follows:

i) Principle of service

The access service is not to be managed individually but as a part of the commuter transport system on the Eastern Line with one group of staff, rolling stock and equipment/facilities.

ii) Service section

Yommarat - Makkasan - Lat Krabang - SBIA
(└Southern Line)

Remarks: Within a limited extent, through operation to/from Hua Lamphong/Bang Sue is available to connect with the CBD as an alternative access route and all over Thailand by transferring to the SRT network.

iii) Aimed schedule speed

70km/h — Less than 30min. by rapid trains between SBIA North Terminal and Yommarat stopping at Lat Krabang (connecting with eastward trains), Hua Mak, Makkasan, which operate through into/out of the Southern Line

iv) Headway

20min. — All day except midnight

v) Rolling stock

Electric railcars of the same specification with the commuter service for common utilization making up a train of up to 10 cars (Future possibility---15 cars)

Remarks: This study proposes as the above because for a travel time of less than 30minutes it is enough to utilize commuter-transport-type cars. However, if wished, special coaches with premium charges can be used in part (for example one coach in one train).

vi) Necessary facilities for airport access service

- For passengers with large and heavy baggage

Elevator/escalator, carts, etc. — SBIA NT, Lat Krabang,

	Makkasan, Yommarat, (Hua Lamphong, Bang Sue)
- For secondary access by automobiles	
Porch, taxi bay, etc.	Makkasan, Yommarat (Hua Lamphang)

vii) Investment steps

First Step	Lat Krabang - SBIA North Terminal (Together with the improvement for commuter service for Yommarat - Lat Krabang - Khlong Luang Phaeng)
Construction	1996 - 2000
Commencement of service	2000

Remarks: Further investment after the target year of 2010

Extension	SBIA North Terminal - SBIA South Terminal
Construction and commencement of service	Beyond 2010 depending on the SBIA Project

Outline of the proposed railway improvement plan for SBIA access service included in the commuter service system is shown in Fig.2.1.2.

(4) Intercity express service in the Bangkok-ESB corridor

(a) Strategy of intercity express service (Sound investment)

At present the SRT hardly provides intercity express service, especially not on the Eastern Line, even though the service is one of the important roles of railways. Accordingly, intercity passenger transport along the Bangkok-ESB corridor is mostly executed by buses and automobiles.

Intercity railway express service has the merits of being fast, reliable, safe, comfortable, etc., and on the other hand the demerits of not being door-to-door and not at anytime. In such conditions, the merits can make passengers choose railway transport in spite of its demerits.

Therefore, it is recommendable that the SRT provide the intercity express service. However, in Thailand, travel by a railway is not popular, the intercity bus system is completed, people, especially high income people, are accustomed to travel by private automobiles and, in addition, in such distances the absolute volume of reduced traveling time realized by using railways is not so large. Therefore, expecting to gain large share involves a great risk.

Under the circumstances mentioned above, sound implementation step by step utilizing the existing facilities effectively with conservative application of demand forecast is to be proposed. Large scale investment such as track doubling and electrification is not proposed for the service by the target year of 2010.

However, if demand will grow so much as to require further investment, it will be possible to be executed by funds brought about by the revenues of such a large demand. Investment in such a situation also will be able to be carried out step by step moderately, taking into consideration the changes in freight demand. If demand requires, it is easy to reinforce the service to a level providing exclusive high standard double track for intercity express because of the sufficient right-of-way already acquired.

The HSR Project aiming at the same target, proposes to execute such a large scale investment at once and requires to monopolizing SBIA access with extremely high fares to subsidize the lack of funds for investment.

(b) Aimed service criteria

Aimed service criteria of the proposed railway improvement for the intercity express service in the Bangkok - ESB corridor are as follows:

i) Service section

Hua Lamphong - Lat Krabang - Chachoengsao - Map Ta Phut

ii) Aimed schedule speed

100km/h (Actually it will be a little lower because of the waiting time on the single track line.)

iii) Headway

1 hour (Shorter headway will be difficult because of the small capacity of the single track line.)

iv) Stations in service

Only stations at cities / regional centers

Hua Lamphong, Makkasan, Lat Krabang, New Chachoeangsao, Chachoengsao, Chon Buri, Si Racha, Phatthaya, Khao Chi Chan (Sattahip), Map Ta Phut

v) Rolling stock

High performance diesel railcars of luxury accommodation making up a train of 3-15 cars

vi) Maximum available capacity

Approx. 15,000 passengers/day direction

vii) Investment steps

Equipment/facilities	1996 - 2000
Rolling stock	1997 - 2010 (making up a train of up to 16 cars successively dependent on demand)
Commencement of full service	2000

(Commencement of provisional service - 2 hour headway, available speed prior to the investment of facilities/equipment)

Remarks: Further investment after the target year of 2010

Automatic block signalling, track-doubling and electrification as an associated project with freight-service reinforcement

2.1.4 Importance of the SRT Lines within the Hopewell Project Area

The Hopewell Project area is out of the "Scope of Work" of this study. However, it does not mean that the project of this study is realized without the Hopewell Project. It would mean that the sections of the SRT lines in the area are to be improved by the Hopewell Project and no further Study of improvement is required.

The proposed improvement of the railway services on the Master Plan is formulated depending on the completion of the elevated and double (triple) tracked SRT lines in the area, which play the important role of connecting the SRT suburban lines with the center of Bangkok.

The proposed commuter service of the SRT is characterized by connecting suburban areas with the city center (CBD) in radial directions of longer distance (15 - 70km) by high schedule speed (more than 60km/h) operation. Therefore, through operation into/out of the urban center without loss of time and troublesome transferring is essential. The service is with only limited stations in the Hopewell Project area.

The roles of the proposed commuter service of the SRT and the MRT of Hopewell CT (Hopewell Community Train) are quite different and do not compete with each other.

(Problems on the proposed plan)

As explained in the Master Plan Study, the function of SRT railway proposed by the Hopewell side have serious problems. Especially the following problems should be solved, whether or not this Study/Project is executed, in order that the SRT railway might function sufficiently.

i) Yommarat Station

Yommarat is at the crossing point between the Eastern - Southern Line and the Northern - Mae Klong Line of the SRT railway network.

Although a station for connecting both the lines is essential, it is nevertheless not proposed by the Hopewell side.

ii) Central refuge track at Yommarat junction

Smooth operation of trains from Hua Lamphong toward the Eastern Line and to Hua Lamphong from the Northern Line which mutually interfere requires the central refuge track on the Hua Lamphong side of Yommarat junction. If not, in the future the latter will operate so frequently that the former will become difficult to operate.

iii) Third track at Makkasan

The proposed Eastern Line will have only two main tracks without auxiliary main tracks extending a long section from Makkasan beyond Hua Mak, and in the east side there will be complicated junction with at-grade crossings. For smooth train operation of the Eastern Line, especially for avoiding to stop trains out of stations, an additional (auxiliary) main track will be desirable.

2.1.5 Work Plan of the Feasibility Study

(1) The projects to be the subject of the Feasibility Study

Out of all the projects in the Master Plan Study described in the preceding paragraph, the following projects are to be taken up as the subject of the Feasibility Study.

Railway improvement for commuter service including airport access service

Railway facilities	
Step I	Hua Lamphong - Khlong Luang Phaeng
	Lat Krabang - SBIA North Terminal
Step II	Khlong Luang Phaeng - Chachoengsao
Rolling stock	Electric railcars for the service of the above section

Implementation period

Railway facilities	
Step I	1996 - 2000
Step II	2001 - 2005
Rolling Stock	1999 - 2010 Successively, depending on demand

Railway improvement for intercity express service

Railway facilities	Hua Lamphong - Map Ta Phut
Rolling stock	Diesel railcars for the service of the above section

Implementation period

Railway facilities	1996 - 2010
Rolling stock	1996 - 2010 Successively, depending on demand

The projects to be the subject of the Feasibility Study and related projects in the future and their implementation period are shown in Fig.2.1.4. as the project list.

(2) Matters to be taken into account

(a) Other related projects

Some other projects which might be affected by / compete with this project are under consideration. One of them is the HSR project and the others are the MRT projects in the Bangkok Metropolis. Especially the HSR project might compete with the SBIA branch line and intercity express service.

(b) Examination of fare level

The existing fares of the SRT are restricted to an extremely low level, which hinders the SRT expanding its services and raising the quality of services.

Although subsidies and value capture are to be proposed for implementation, the operation should be managed without subsidy. Therefore, fare level is an important item of the Study and it is to be examined.

(c) Importance of outgrowth from convention

The proposed railway improvement is based on modernized technology and management of the railways. It should not be based on the extension of the existing railways. This requires outgrowth from the convention of the policy on railways.

Project/Contents of project	Implementation period			Projects in future
	1996-2000	2001-2005	2006-2010	2011-
The projects to be the subject of the Feasibility Study				
Commuter service Step I				
Railway facilities Yommarat - Khlong Luang Phaeng Lat Krabang - SBIA North Terminal	——			
Rolling stock	——	——	——	- -→
Intercity Express Service				
Railway facilities Hua Lamphong - Map Ta Phut	——			
Rolling stock	——	——	——	- -→
Other Projects to be examined in the Study				
Commuter service step II				
Railway facilities Khlong Luang Phaeng-Chachoengsao Others		——		
Rolling stock		——	——	- -→
Projects in future (Out of this Study)				
Track quadrupling Hua Mak - Chachoengsao (or alternative)				
Track doubling / electrification Chachoengsao - Map Ta Phut (or alternative)				

Remarks: Procurement of rolling stock: Successively, dependent on demand

Fig. 2.1.4 Project List of Railway Improvement on BKK-ESB Corridor

(3) Work flow

Work flow of the Study on railway improvement is shown in Fig.2.1.5.

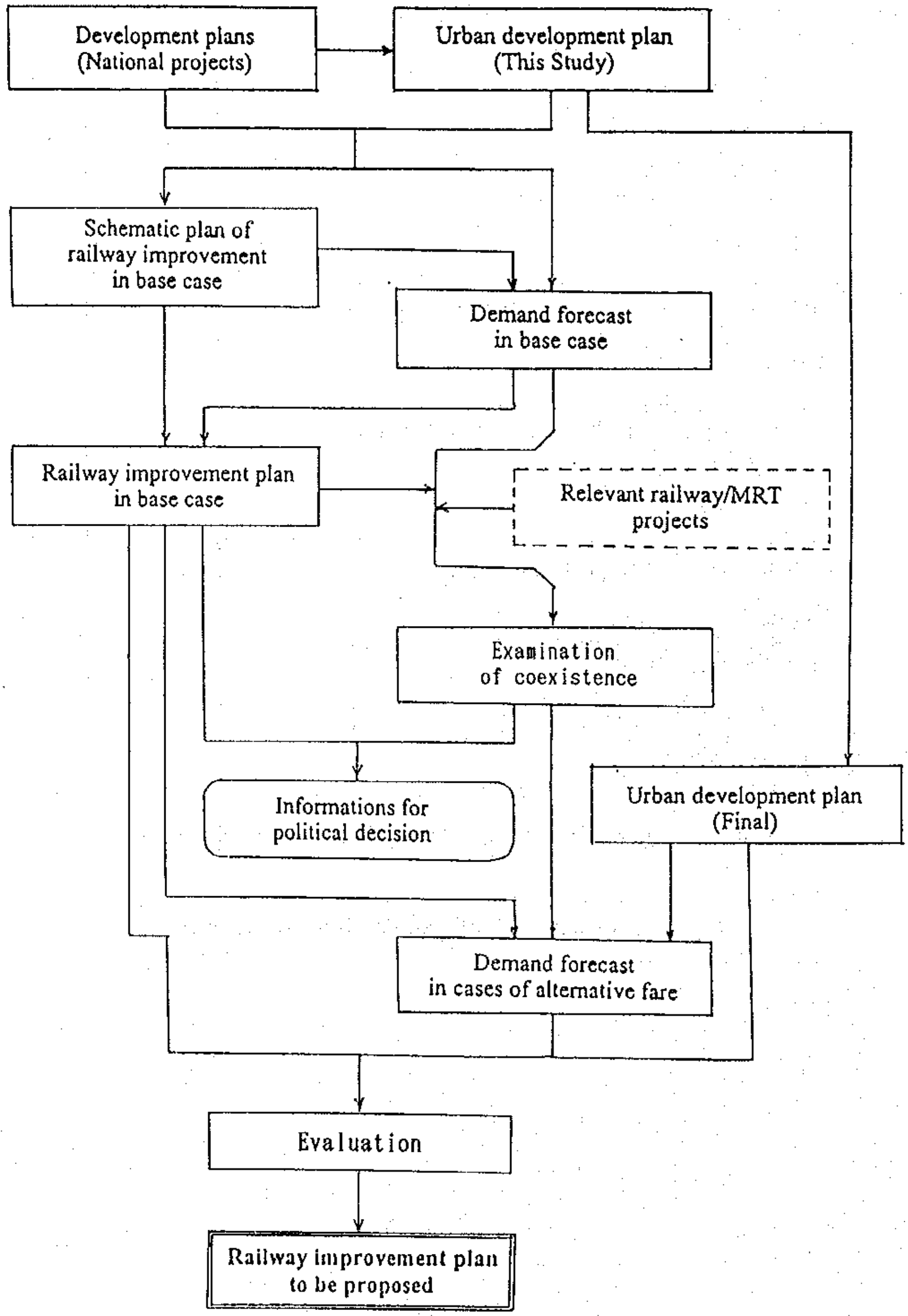


Fig. 2.1.5 Work Flow of Railway Improvement Planning

2.2 Demand Forecasting

2.2.1 Task for Demand Forecast

The major purpose of demand forecasting in feasibility study stage is to simulate the passenger ridership conditions for with/without of improvement alternatives.

It is important to above unnecessary output to increase the accuracy of the results. To examine above mentioned impact, it is necessary to forecast with following parameters.

1) Total ridership per day	→	For general consideration
	→	Chapter 2.2
2) Peakhour ridership	→	For operational plan which become input to Number and size of Rolling stock and Right-of-way (Civil) plan
	→	for Chapter 2.3
3) Boarding/alighting passenger	→	Station Improvement Plan
	→	for Chapter 2.5
4) Converted passenger from other modes and time savings	→	Economic Evaluation
	→	for Chapter 2.15
5) Passenger km	→	Financial Evaluation
	→	for Chapter 2.6
6) Fare-Demand Analysis	→	Financial Evaluation
	→	for Chapter 2.16

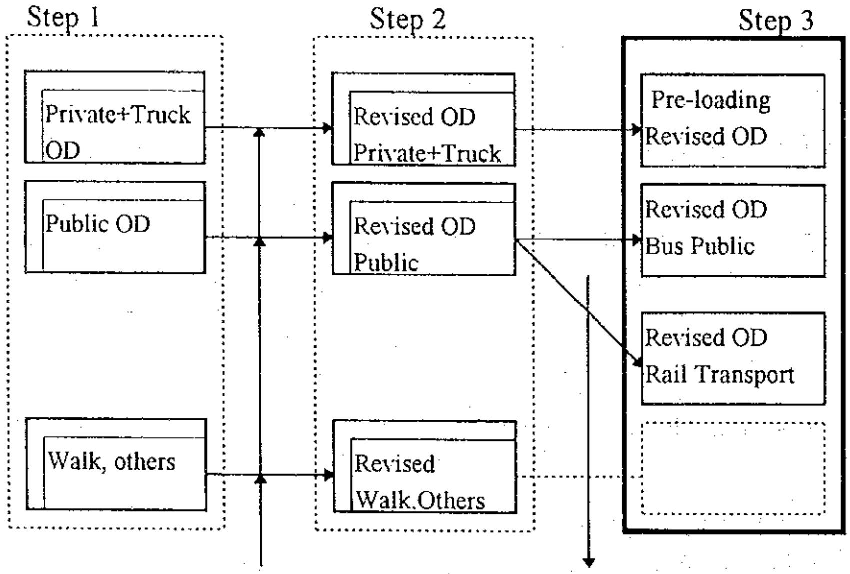
2.2.2 Demand Forecasting Flow

The method which has been in Master Plan was applied. Major steps for demand forecasting were as follows.

1) Examination of existing OD tables
2) Updating existing OD tables in consideration with Urban Development
3) Pre-loading of private and truck traffic on road, and diversion of public mode into bus and rail

The method is summarized in Fig. 2.2.1

Estimation of the rail passenger volume for commuter train and regional train for Bangkok 200 km area in the process, while the diversion volume from private mode to public mode is not examined in detail, in consideration with data availability and hugeness of the study coverage area.



Consideration of Urban Development

Mode Choice

$$P2 = \frac{\exp(-u2)}{\exp(-u1)+\exp(-u2)}$$

$Ui = Ci + W*Ti + aj$ (1:Bus,2:Rail)

Ci :Expenses for Mode i

Ti :Travel Time of Mode i

Wi :Time Value

aj :Dummy for Node j

Fig. 2.2.1 Demand Forecasting Flow

2.2.3 Description of the Concept for Good Urban Transport Environment

This study is focused on outside Hopwell project area. However, the concept for the project is necessary improvement of the feeder service in BMA to provide service and enhance the railway passengers.

In following figure, catchment areas of stations and stops within walking distances differ in size with three levels of public transport. It was supposed that potential passengers would accept longer walking distances to stops with faster transport modes than with slower alternatives such as e.g. feeder services.

Public transport of the third level normally is adjusted to changing travel patterns by the operators themselves because of the flexibility of services. Bus transport, however, needs a planned adjustment. New bus lines have to be designed, bus companies have to be licensed to operate the new lines and licenses for old lines no longer to be served have to be withdrawn.

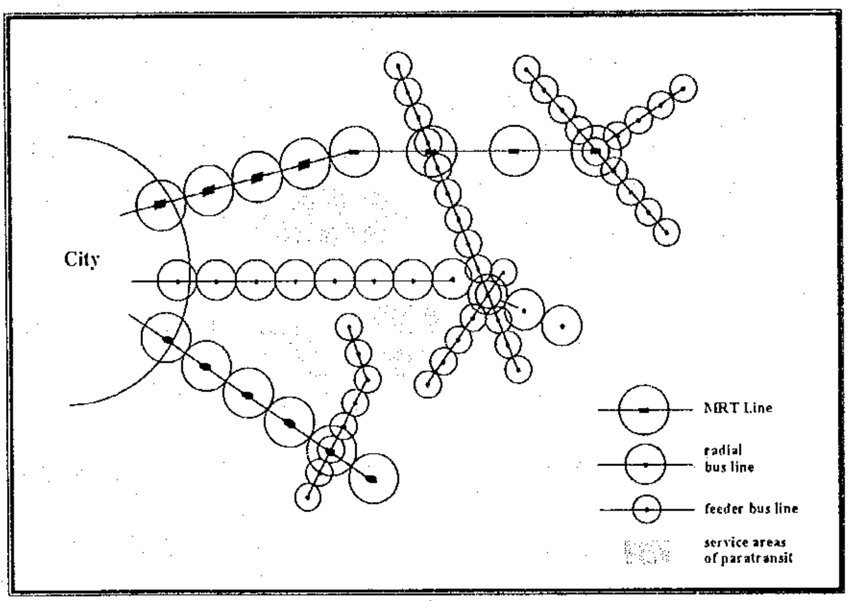


Fig. 2.2.2 Hierarchically Composed Public Transport System

(1) Bus transport

The implementation of urban railway system need adjustment of existing public transport. This includes the rerouting of existing bus lines and the introduction of feeder bus services.

1) Concept rerouting existing bus lines

After implementing a system, the optimization of the bus line network is absolutely necessary to avoid duplication of services which causes financial losses and results in competition between service suppliers.

The importance of streamlining the bus network and the complexity of this task is apparent when one turns to the Singapore example. Rerouting of the bus network is still incomplete and remains to be further optimized together with the introduction of a new integrated ticketing system.

Upon the existence of the public transport system will be hierarchically composed. The first level will consist of serving the high demand corridors. The second level will be bus transport including different types of buses providing feeder services and buses serving long distance corridors lower demand. The third level will consist of remaining means of public transport such as paratransit, normally used for short distance trips, minibus feeder services, and with taxis.

Major objectives for the appropriateness of an adjusted bus line network in an hierarchically composed public transport system are :

* passenger catchment area of Urban Transport stations is enlarged by feeder bus services;

* duplication of services by buses and Urban Railway is minimized;

* direct bus services between suburban areas and the city center area provided where Urban Railway-links either do not exist or where the combined transport of feeder buses and Urban railway is not competitive with direct bus lines regarding travel time (because of necessary detours);

* as the proposed Urban railway network, which consist of Mass Transit and SRT commuter line for the metropolitan area of the city will be radial, bus services are provided for connecting neighboring suburban areas;

* reliable feeder services in the inner city area are provided for distributing passengers arriving by Urban rail system to the final destinations. Inner city bus lines should be short. Timetables must be designed with appropriate layover times and short headways. Buses should travel on bus ways or lanes wherever it is possible to allow them to operate reliably according to their schedule. The number of buses per line must be sufficient to avoid overloading.

(2) Feeder bus services

Feeder buses transport passengers from their point of trip origin to an SRT or MRT station and from another rail station to their point of destination. Feeder services enlarge the catchment area of railway stations which would otherwise be limited to walking distances. They are of special importance for stations outside city centers where the density of the railway network is low. Without feeder services of railway would not reach potential riders and its economy would not suffer.

SRT and MRT stations served by feeder buses should be connected to their surrounding by radial bus lines. Especially during those times of day when the rail operates with longer headways, e.g. during early morning or late evening hours timetables of feeder buses have to be adjusted to the railway timetable to allow smooth passenger interchanges.

Ideally, the use of feeder services should be possible with railway tickets without additional fare payment. However, feeder services are provided by railway-independent bus companies ticket revenue accounting will then become complicated. Therefore, independent fare collection by all public transport service supplier is proposed for the initial phase of railway urban service operation. In a later phase transfer tickets should be issued.

(3) Interchanges between private and public transport

In addition to adjusting existing public transport to the new urban rail system, interchange facilities between private transport and urban railway have to be provided also especially to commuter transport. Those facilities are Park and Ride and Kiss and Ride-stations.

1) Park and Ride

Park and Ride (P&R) will be an important element of the future urban rail system. Including Park and Ride, trips are no longer composed of public transport modes only - e.g. MRT, feeder bus, including walking at trip's start and end - but of a combined transport system which includes private transport as well. For example, a trip to work starts at home by car and is continued by SRT and/or MRT, and possibly includes feeder service to the final destination.

P&R consists of spacious parking areas located out-side the congested zones of the town which are served by a fast, comfortable and high capacity mass transport system. P&R provides an opportunity to influence the modal split in the city center by favoring public transport and to improve the ridership of public transport also.

With P&R, public transport passengers are no longer captive passengers but users who have the alternative of completing their journey by private car. Therefore, special efforts have to be made to provide attractive P&R facilities and, as a result, to make P&R successful. Success can only occur if the combined transport chain offers comfortable and reliable public transport services.

Furthermore, using P&R has to offer advantages to its users outweighing those offered by use of private vehicle. If traffic congestion in inner city areas occurs frequently as it happens in Bangkok, if private traffic is restricted by the some congestion pricing and limited inner city parking spaces, chances for acceptance of the P & R facilities are good. But nevertheless, certain requirements on location, design and dimension of the P&R installations have to be fulfilled because otherwise the transport chain will be too unattractive to change the behavior of private car owners.

Requirements concerning the location of P&R stations are :

- they have to be located outside both the congested city centers and in areas where private transport has been restricted;

- excellent car access to the parking areas has to be provided by locating the P&R facilities near to or on connecting major roads coming from and heading to suburban areas;

- parking areas have to be located within walking distance to SRT stations (total walking distance from car to station platform and vice versa less than 300 m);

- P&R stations have to be located within walking distance to urban rail network where short headways are operated to avoid long waiting times for interchanging users.

The design of the P&R station itself has to meet the following requirements :

- access and egress roads connecting the parking area to the adjacent street network have to be wide enough to accommodate the peak demand traffic without obstructing traffic flow in surrounding streets;

- inside the parking area drivers have to be guided to unoccupied spaces either by staff or by automated systems to guarantee smooth flow of cars; access and egress to/from parking spaces should be one way roads wide enough to allow for entering parking spaces without hampering others;

- as walking distances between parked cars and the station platform have to short, multistory parking structures instead of street-level parking areas are necessary if high capacity is required;

- the capacity of parking areas has to be high enough to guarantee that regular users always find a space to park their car; if demand surpasses the supply, regular users have to have a possibility to rent a parking space from the operator of a P&R facility on a monthly basis;

- walkways between the cars and platform have to be safe, attractive, weather protected (against rain and sun), and lighted; street crossings at grade level must be avoided.

- for dimensioning of parking areas the number of parking spaces provided in inner city areas has to be considered in order to assess the possible amount of participating car owners. Furthermore, costs of the two alternatives have to be compared : either using the private car only and paying for fuel, road use, parking in inner city areas, or using the P&R and paying less for fuel and parking, paying nothing for road use but paying for the public transport ride in addition. To make P&R attractive, the second alternative has to be cheaper and, if possible, faster than the first.

2) Kiss and Ride

Kiss and Ride is a special form of P&R where long term parking is substituted by short stops only for delivering passengers at the railway station of for picking them up respectively. Kiss & Ride is possible only with fellow passengers in cars for drop off or pick up purpose.

Requirements concerning their location are in general very similar to those mentioned for P&R. However, only a small number of spaces (e.g. 10) has to be provided for short term parking, These spaces should be very conveniently located to station entrances to reduce walking to a minimum.

Crossing of streets should be avoided. In general, Kiss and Ride can be combined with P&R stations but because of smaller space requirements it can be provided more frequently throughout the railway network.

3) Ticketing system-transfer tickets from/to feeder services

During the initial phase of the new rail system's operation, the introduction of a closed SRT tariff-and ticketing-system where tickets would be valid for SRT trips only is proposed. In later step, combined journeys including ride on buses should be made possible with one ticket to enhance numbers of rail riderships.

To promote the SRT system and to increase ridership it is useful to include feeder bus services into an integrated ticketing system to avoid double or triple payment of fares. However, as feeder services could be operated by other services suppliers than the SRT the distribution of fare revenues among the different companies involved becomes a major obstacle. One company collects the fare for the complete journey and therefore has to compensate for the services supplied by others.

Until today , integrated ticketing systems with several participating service suppliers only exist in Germany and Switzerland. Transfer discount have been introduced in Japan.

2.2.4 Passenger Demand Forecasting for Eastern Line

(1) General consideration

Considering the concept, which describes in chapter 2.3, how to increase the railway passenger volume totally, Bangkok Eastern area transport condition is summarized as follows.

- An improvement of railway system such as operation speed (traveling time for passenger), frequency (waiting time) comparing to the fare level and its alternative mode of transport
- An improvement of total utility from railway traveling, which means both case of single mode of railway traveling and multi transport mode by commuter railway, mass transit, bus system and others.
- To strengthen the railway catchment area by means of spatial expansion which is achieved by feeder service improvement and additional new stations, and promotion of immigrant of population into the area.

(2) Socio-economic framework of the area

As a result of socio-economic framework projection in "URBAN DEVELOPMENT SECTOR" of this study, night time population are given as Table 2.2.1

Table 2.2.1 Nigth Time Population of Study Area

ESB Region

Year 2010

Changwat	1990	MRSP	HST		JICA	
			Trend	Optimistic	M/P	F/S
Chachoengsao	552,108	887,951	747,500	911,000	1,047,504	1,051,504
Chonburi	847,796	1,224,164	1,404,000	1,483,000	*1	*1
Rayong	450,646	798,825	488,500	560,500	*1	*1
Total	1,850,550	2,910,940	2,640,000	2,954,500	3,070,493	3,074,493
Total exclusive of changwat Chachoengsao	1,298,442	2,022,989	1,892,500	2,043,500	2,022,989	2,022,989

M/P Area around SBIA

Ampors	1990	MRSP	SBIA M/P		JICA	
					M/P	F/S
Bangkok *2	1,955,714	2,925,609	3,148,000		2,735,458	2,961,458
Samut Phrakan *2	769,822	1,364,115	1,538,000		1,289,564	1,339,564
Pathum Thani *2	75,604	165,012	149,000		272,784	272,784
Chachoengsao *2	307,576	487,164	814,000		705,275	709,275
Total	3,148,716	4,941,900	5,649,000		5,003,081	5,283,081
Chachoengsao (Ampors outside of the M/P SBIA area)	244,532	400,787	400,787		342,229	324,229
Total of Changwat Chachoengsao	552,108	887,951	1,214,787		1,047,504	1,051,504
Total inclusive of Changwat Chachoengsao	3,393,248	5,342,687	6,049,787	6,049,787	5,345,310	5,625,310
Eastern Corridor Total	4,691,690	7,365,676	7,942,287	7,368,299	7,368,299	7,648,299

*1 : Same as with MRSP Estimate

*2 : Summation of population projection of ampors belonging to M/P area around SBIA, Not all ampor of each Changwat

*3 : Assumption : Same as with MRSP Estimation

(3) Assumption of transport access condition for demand forecasting

Access and egress condition from/to station are assumed as Fig. 2.2.3.

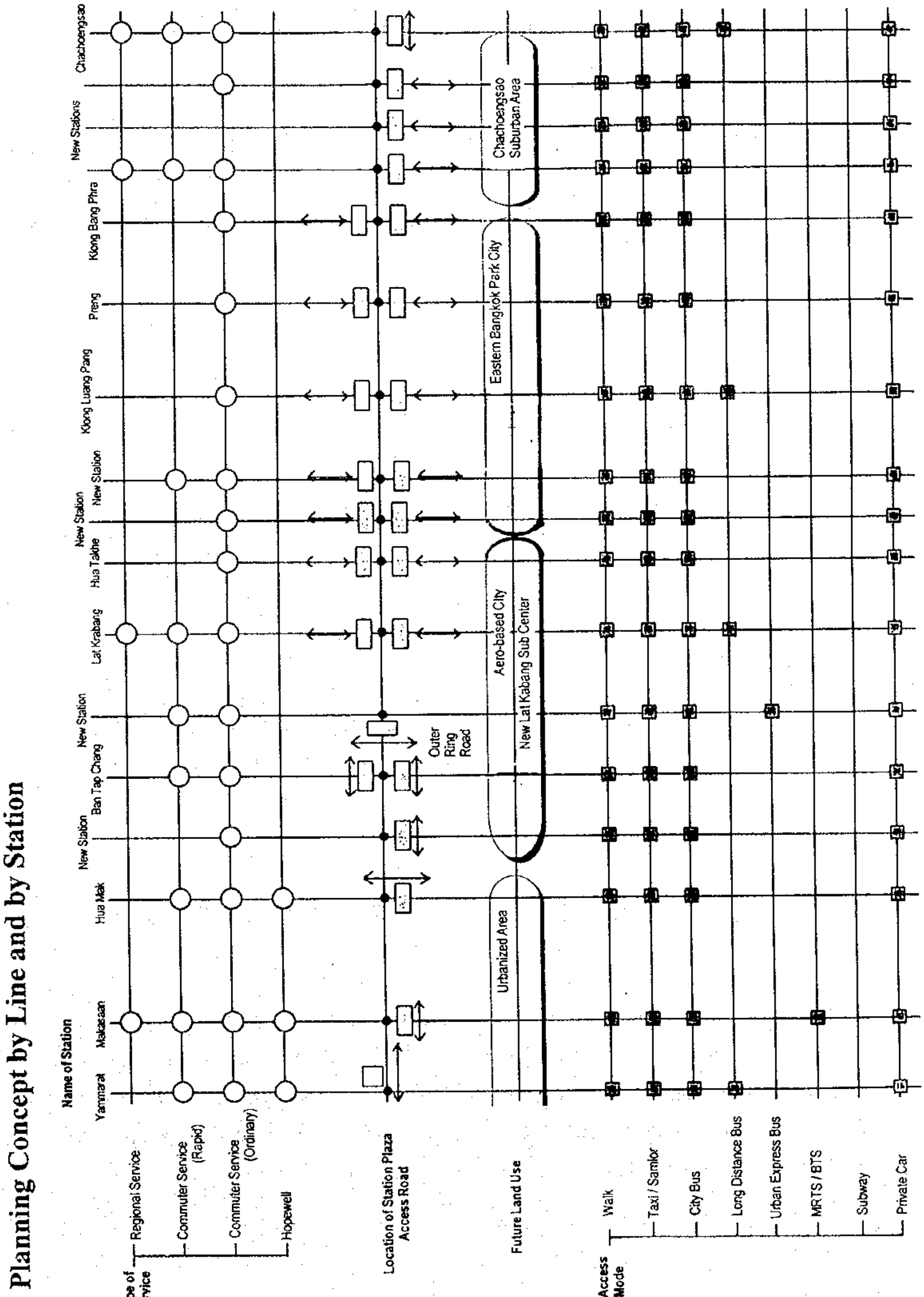


Fig. 2.2.3 Planning Concept by Line and Station

(4) Consideration for type of developing urban new town

The number of generated trips are depending upon the size of planning new town. The distribution of trips, the condition of commuting in other word, will be affected by the type of new town to be created.

The type of the new town mainly can be classified into two categories. One is regional core satellite town which is relatively independent to the mother town (type 1 in Fig. 2.2.4) and the other one is bedtown of the Bangkok Metropolitan Area (type 2).

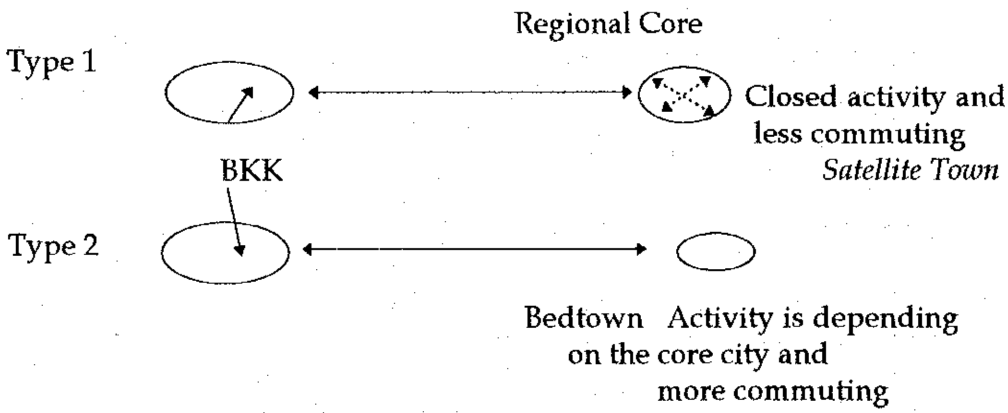


Fig. 2.2.4 Types of New Towns and Generated Commuting Trip

In this study, type 2 bedtown development is assumed to be created. Therefore it is assumed that the population composition will be quite similar to present BKK are migrant population will be mainly transferred from BKK area. Following this assumption, the new town population composition and generated commuting trips to BKK are estimated in Table 2.2.2 and Table 2.2.3 respectively.

Table 2.2.2 New Town Population Composition by Job

Primary	Secondary	Tertiary*	Service**	Student	Housewife	Others
0.8%	10.8%	19.6%	16.0%	29.8%	11.9%	11.1%

*Tertiary: excluded service worker in the new town.
**Service: Works who serve in the new town.

Table 2.2.3 Composition of Generated Commuting Trips

Intra-twon	To BKK
34.5%	65.5%

(5) General transport condition

1) Trip movement in the study area in the year 1990

Total number of trips in the study area are estimated 20 million day including 11.2 million public trips. Here, 8.8 million trips including private car trips and intra-small zone trips which include not more than one station.

Table 2.2.4 Regional Trip Movement in the Year 1990

Area	Number of Trip
Inside BMA	8.05 mil.
Inside BMR	9.05 mil.
Others	2.18 mil.

(JICA Study Team)

2) Trip movement in the study area in year 2010

Total number of trips in the study area are estimated 28.5 million per day including 15.7 million public trips. While , 12.75 million trips including private car trip and intra-small zone trips which include not more than one station.

Table 2.2.5 Regional Trip Movement Year 2010

Area	Number of Trip	2010/1990
Inside BMA	10.61 mil.	1.31
Inside BMR	12.95 mil.	1.43
Others	2.80 mil.	1.28

(JICA Study Team)

(6) Preloading railway transport volume for eastern line section

1) Nationwide passenger rail movement

Under assumptions that made choice by the project will be made between Commuter Line or Regional Line and other transport mode such as bus and private car, present and future nationwide rail passengers are assigned as preloading volume on existing rail network.

Table 2.2.6 Present Nationwide Railway Passenger Volume for IURD Section

(Year 1990)

O/D	Central	North-E	North	South	Total
Central	23,200	2,100	2,200	1,500	29,000
North-E	2,000	0	0	0	2,000
North	2,200	0	0	0	2,200
South	1,500	0	0	0	1,500
Total	28,900	3,000	2,200	1,500	34,700

(Trip/Day)

Table 2.2.7 Future Nationwide Railway Passenger Volume for IURD Section

(Year 2010)

O/D	Central	North-E	North	South	Total
Central	80,800	3,100	3,800	5,800	93,500
North-E	3,200	0	0	0	3,200
North	4,300	0	0	0	4,300
South	5,500	0	0	0	5,500
Total	93,800	3,100	3,800	5,800	106,500

(Trip/Day)

Table 2.2.8 Comparison Nationwide Railway Passenger Volume
Year 2010/1990

O/D	Central	North-E	North	South	Total
Central	3.48	1.48	1.72	3.87	3.22
North-E	1.60	0	0	0	1.60
North	1.95	0	0	0	1.95
South	3.67	0	0	0	3.67
Total	3.25	1.48	1.72	3.87	3.07

(2010/1990)

2) Major freight transport volume

Major freight transport volume had examined based on the present on going improvement plan proposed by SRT Master Development Plan Study 1993. Future freight transport policy are summarized as follows.

(a) Oil product (unit: mil. litters)

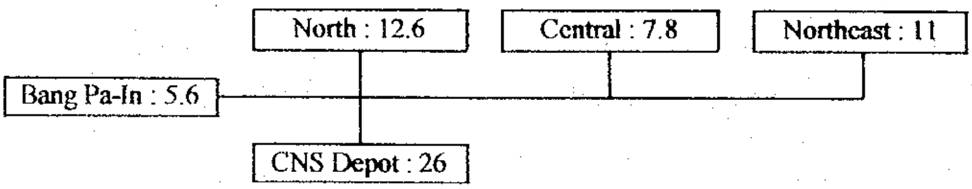


Fig. 2.2.5 Oil Product

(b) Rice

Table 2.2.9 Rice Transport

(Unit:Tons)

O/D	North	North-E	Central-BKK	South
North	29	-	-	-
North-E	-	-	8	-
Central-BKK	150	826	-	8
South	341	1,104	295	71

(c) Bulk cement

Table 2.2.10 Bulk Cement

(000 tons)

O/D	Nakjonsawan	Saraburi	Pechaburi	Thungsong
North	-	-	-	-
North-E	-	-	-	-
Central	-	-	-	-
BKK	3.3	32.7	0.4	-
South	-	-	-	1.5

(d) Bagged cement

Table 2.2.11 Bagged Cement

(000 tons)

O/D	Nakjonsawan	Saraburi	Pechaburi	Thungsong
North	0.3	0.08	-	-
North-E	-	3.35	-	-
Central	-	6.76	0.23	0.23
BKK	0.72	3.05	0.26	0.20
South	-	-	0.05	2.32

(e) Container

Table 2.2.12.a Container

(Unit:tons)

O/D	North	North-E	Central
BKK Port	875	-	-
Laem Chabang	9,458	1,246	6,391
Southern	-	-	-

Table 2.2.12.b

(Unit:tons)

O/D	North	North-E	Central
North	-	-	6
Northeast	473	187	45
Central	-	-	-

(7) Integrated urban and railway development plan-alternatives

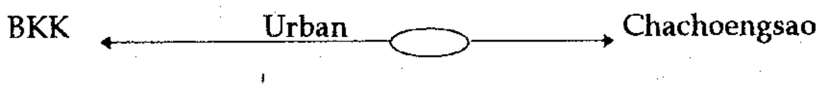
There are several proposed project plans for Eastern line. The number of the alternatives which obtain as a results of combination of these plans are unanimous. To examined the project carefully and make suitable proposals alternatives are set as follows.

Do minimum: Base case

Minimum railway project will be implemented.

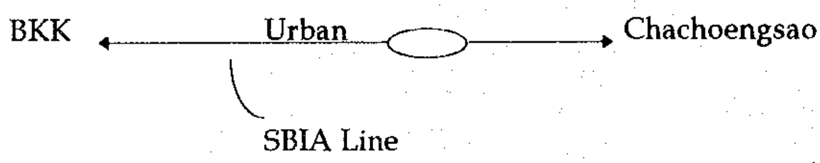
Alternative 1

Commuter railway improvement with urban development



Alternative 2

Alternative 1+ SBIA Line



Alternative 3

Alternative 2 + Regional Line

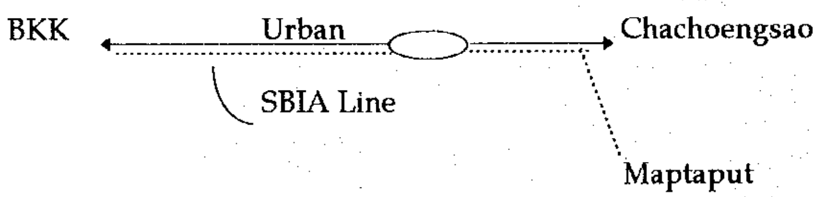


Fig. 2.2.6 Alternatives

(8) Passenger demand

1) Transport service level

A set of transport service level which is used for demand forecasting are shown in Fig. 2.2.7

a. Route

BKK	Lat Krabang	Chachoeng Sao	Chon Buri	Si Racha	Phattaya	Mapta Phut
0km	26km	61km	108km	131km	155km	200km

b. Service Level (Estimated by 1994 price)

	Rail	Regional Bus
Fare	0.77 Baht/km	0.4 Baht/km
Speed	**80km/h(Ave.)**	49.5 km/h (from traffic assignment model)
Frequency	1 train/hour	4 buses/hour
Access	Bus Fare 0.25 Baht/km Waiting Time 5 min.	(if necessary same as rail)
Time Value	Business and Work Purpose: 48.5 Baht/hour Other Purpose : 16.4 Baht/hour (Not for Economic Evaluation)	

Fig. 2.2.7 Transport Service Level

The rail passenger demand is carefully examined for following cases:

(a) Do minimum case;
(b) Railway improvement without urban development case;
(c) Railway improvement and feeder transportation improvement without urban development project case; and
(d) Railway, feeder and urban development case.

The results are shown in Table 2.2.13 and Table 2.2.14.

Table 2.2.13 Passenger Demand for IURD Commuter Line -Eastern

Item/Alt.	Do Minimum	Railway Imp.	Railway Imp+ Feeder
W/O Urban	73,000	138,000	201,000
With Urban			289,000

(Trip / Day)

Table 2.2.14 Trip Movement of IURD Commuter Line

O/D	North	South	BKK	IURD	Eastern N	Total
North	0					
South	0	0				
BKK	0	0	0			
IURD	62,000	5,000	120,000	51,000		
Eastern N	7,000	2,000	2,000	40,000	0	
Total	69,000	7,000	120,000	93,000	0	289,000

(IURD-Easter 200km Trips such as Preng-Chonburi are excluded)

Trip distribution condition in Eastern Area are shown in Fig. 2.2.8 and examination of mode choice possibility are shown in Fig. 2.2.9.

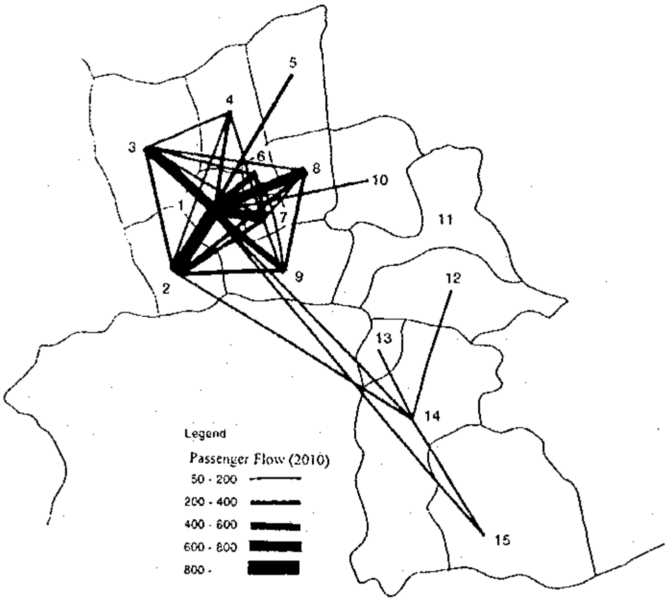


Fig. 2.2.8 Trip Distribution

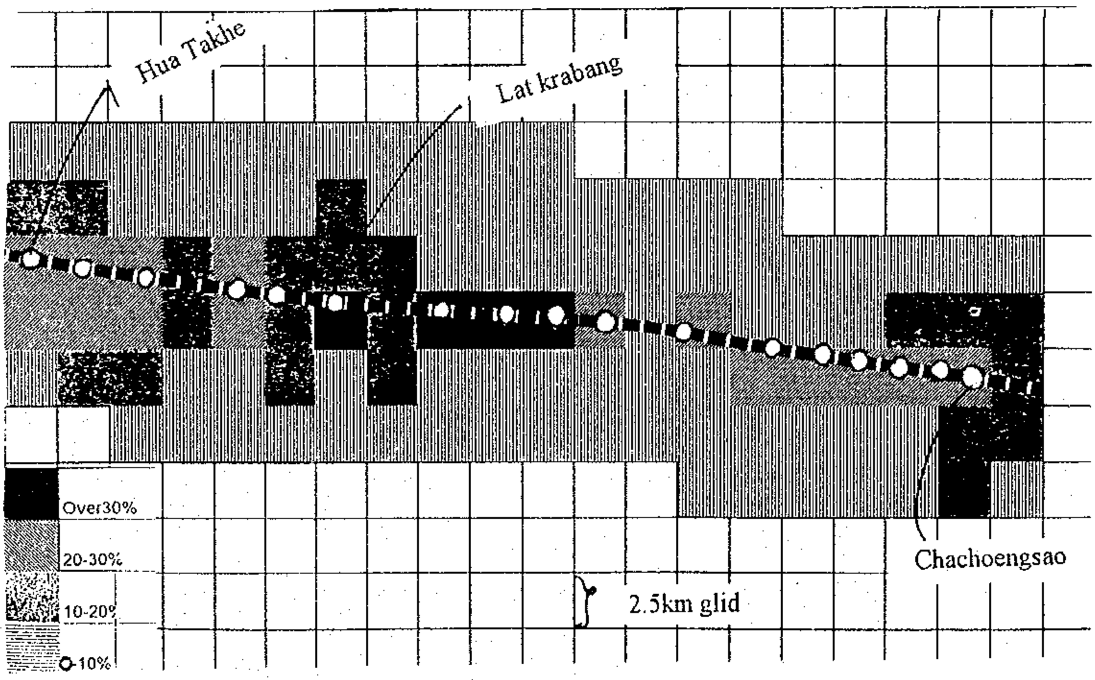


Fig. 2.2.9 Rail Mode Share

2) SBIA line

Railway passenger volume are given in SBIA ground access plan. Here in this study, the possibility to apply same number for SRT's SBIA access line are examined by reviewing available relationships between airport and railway.

Fig. 2.2.10 shows relationship between city-airport distance and railway mode share. Existing airport can divided into two categories. One (type A) is airports which has user friendly facilities such as city check-in and direct escalator from station to airport lobby etc. , and the others (type b) are airport which has no such facilities.

To avoid over estimate, if SBIA is categorized to type b, rail mode share will be between 10 to 20 percent and this value is quite suitable from SBIA Ground access plan.

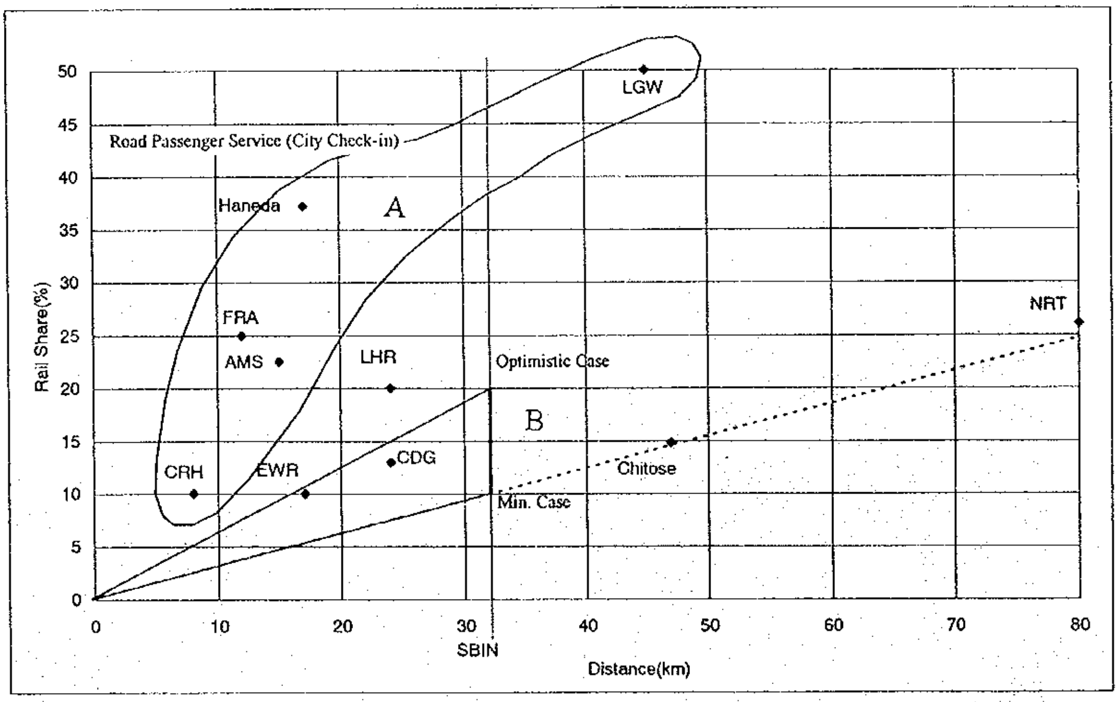


Fig. 2.2.10 Mode Share of Airport - Railway Trip by Distance

Table 2.2.15 SBIA Ground Access Plan

Classification	Year 2000		Year 2020	
Airline User	15,138	18.4%	78,653	47.8%
Worker	5,760	9.0%	15,910	12.6%
Total	20,898	14.3%	94,563	32.5%

3) Eastern regional train

Table 2.2.16 Passenger Demand Eastern Regional Line

Item/Alt.	**Do Minimum**	**Railway Imp.**	**Railway Imp. Feeder**
Trip / Day	**20,000**	**26,000**	**28,000**

Table 2.2.17 Trip Movement for Eastern Regional Train 200 km Line

O/D	**BKK**	**IURD**	**200 km**
BKK	**0**		
IURD	**0**	**0**	
200 km	**18,000**	**6,000**	**4,000**

(IURD include Makkasan)

2.3 Service and Transport Plan

2.3.1 Service Plan

This Study is a feasibility study to improve the SRT Eastern Line between the Center of Bangkok and the ESB so as to be an up-to-date railway which can provide high level services integrated with urban development, which anticipates that railways will play the role of the main transport means.

Therefore, the required service is not a mere extension of the existing service. In particular, factors of service such as speed, frequency, reliability, safety, comfort and cleanliness should be innovated.

Aimed service criteria for each item have been described previously outline of the service plan is as follows.

(a) Commuter service including SBIA access service

This service will be carried out on the Eastern Line between Yommarat and Chachoengsao and the SBIA branch line between Lat Krabang and SBIA North Terminal. Between Yommarat and Hua Mak, the service will be provided on the elevated double track line to be constructed in the Hopewell Project as the Green Line (East-west alignment).

The Hopewell Green Line will connect the Eastern Line with the Southern Line and make through operation. The scope of this Study is in the portion of the Eastern Line. So the Study is to be executed within the Eastern Line. Provisional countermeasures for the intermediate stage concerning the Hopewell Project are to be described in the Appendix.

The service is to be provided utilizing a fleet of commuter-transport type high performance electric railcars making up a train of 5-10 (15 in the future beyond the target year of 2010) cars which have multiple doors (proposed to be four on one side) and air-conditioners, by electrifying the section including the Hopewell Project area.

Frequency of the commuter trains is to be 6 rapid and 6 local trains in one hour with a rapid-local-combining operation pattern (in the future 2×6 rapid, 6 local) in the main section. For the SBIA access, rapid trains between the Airport and the CBD connecting within 30minutes are to be offered every 20minutes except late at night.

Elevated platforms and overbridges connecting platforms and the station entrance are to be prepared in order to prevent passengers from entering the tracks, which is very dangerous for them when high speed and high frequency trains are in operation.

For the airport access service, facilities/equipment for passengers with large, heavy baggage such as elevators/escalators, carts and porches for station building for secondary access by automobiles should be prepared.

Stations and their functions for commuter service and airport access service are as follows:

- Stations in the CBD of Bangkok
  - Yommarat (The station at the boundary of the Eastern Line and the Southern Line)
  - Makkasan
  - Hua Mak (Connection with Hopewell CT)

- Major stations located at the strategic positions of the urban development (Rapid trains will stop here)

Lat Krabang West	(Connection with Outer Ring Road) (Because of the station disposition, rapid trains in 1 rapid 1 local every 10min. operation do not require stopping.)
Lat Krabang	(Junction of the Eastern Line and the SBIA access line)
Lat Krabang East	
New Chachoengsao	
Chachoengsao	

- Other stations

- Stations in the SBIA

  SBIA North Terminal

  (SBIA South Terminal) (Second phase of the SBIA construction beyond 2010)

- Existing stops at flood retention areas

  Khlong Udom Cholajan

  Khlong Khaeng Klan (Only a limited number of local trains will stop because of no urban development around them.)

(b) Intercity express service

This service will be carried out in the Bangkok-ESB corridor between Hua Lamphong and Map Ta Phut. Extension to Rayong is now under consideration in the SRT but a concrete decision has yet to be made. Therefore, it is not included in this improvement plan for the target year of 2010.

The service is to be provided utilizing a fleet of high performance diesel railcars with high grade accommodations making up a train of 3 to 15 cars depending on increasing passenger demand.

The service aims to attract passengers from air-conditioned buses and private automobiles by the merits of fast, reliable, safe, comfortable service. The aimed-for schedule speed is near to 100km/h with a maximum speed of 120km/h.

Because of the small capacity of the single track line beyond Chachoengsao competing with freight service on the line, operation of one hour headway is the limit but extending trains consisting of up to 16 cars makes it possible to deal with increasing demand.

Full-scale service will be commenced in the year 2000 after completion of improvement of facilities and equipment and procurement of a sufficient fleet of diesel railcars. But in order to create earlier ridership for such intercity express service trains, it is proposed to start the service provisionally in 1997 with a small-scale fleet and at available speed without full-scale improvement of facilities/equipment.

Station service is to be limited to main stations in the center of Bangkok and regional centers which are as follows:

Hua Lamphong (Or Bang Sue)
Makkasan
Lat Krabang (Connection with SBIA access service)
New Chachoengsao
Chachoengsao
Chon Buri
Si Racha
Phatthaya
Khao Chi Chan (Near to Sattahip)
Map Ta Phut

2.3.2 Fare and Ticketing System

Currently the fare rate of the SRT is relatively low. The 3rd class passenger fare rate is 0.215 baht/km. The SRT should operate with the self-supporting accounting system to establish its individuality. The SRT fares should cover its expense. Commuter electric trains will be equiped with air-conditioning and give rapid service, so the fare for the commuter service will be on level similar to the 2nd class fare of 0.44 baht/km. The fare level is an important factor of this Study, so that it will be examined further at a successive stage. Not only the fares of the railway service but also that of access means will be examined.

It is important to capture revenue from passengers. It is difficult to seize all passengers with the existing ticket examining system. For the commuter service, there are a great crowd of passengers in a train, so the conductor can hardly check all the passengers' tickets. It is efficient to examine the tickets at the station wickets. At the commuting station, passengers should be restricted coming in and going out through only gates. Ticket selling counters and wickets should be installed. Both to secure passengers and to capture fares, passengers should be prohibited from getting off the platform without going through the wickets.

2.3.3 Interface with Access Means

A railway can carry people only from one station to another, so a passenger needs to move from his origin to a station and a station to his destination. To serve as a mode of public transport, a railway has to link the stations with roads and provide inter-modal facilities that will assure passengers of an easy transfer between both modes. To promote the efficiency of the transport system, feeder services must be consolidated with station facilities and public services.

The most convenient means of transport is walking. An area within 500m is considered to be walking distance because of the climate. (This is not so long.) Outside this area, passengers need to use some public transport means or private car, motor bike, bicycle, etc. Anyway some access facilities between those transport means and railways are necessary.

The following are some considered modes of transport.

i) Mass transit system
   railway
   subway
   mono-rail
   new transit system

ii) Public road transport
   intercity bus
   local bus
   taxi

iii) Other public transport
   airway
   ship

iv) Private transport
   personal car
   bicycle/motorcycle
   walking

To connect with other transport means, it is necessary to reduce the distance and time for transferring and especially to minimize the distance between the largest volume transport means.

In case of transferring to another mass transit system, it is possible to shorten the transfer distance by connecting a platform directly to another platform with a corridor or stairs. This is effective for commuter passengers who already have through-tickets. The transfer stations of mass transit systems should be set as closely as possible to each other, and provided with enough passage.

On the other hand, it is essential to provide a station plaza for smooth transfer for passengers who use road transport. Of course, an access way from a station to a main road is necessary. The bus is the principal mode of public transport in the Bangkok area. The inter-modal facilities at present are insufficient to facilitate easy transfers between buses and railways. Currently, bus operation is not provided with halts nor routes for railway passengers. If bus-rail inter-modal facilities are not provided, the level of railway service will remain low. The provision of inter-modal facilities will generate a variety of benefits, including reduction of passenger travel time and human resources.

It is convenient to transfer to an intercity bus at a station, but intercity bus terminals require large facilities and are usually situated away from the station plaza.

Taxis or tuktuks also need stopping places and car pools, according to the scale of the station. As for private cars, motor bikes and bicycles, either only stopping places or parking places may be provided, according to the circumstances of the land around the station. The parking charges of those areas may be borne by car owners.

It is considered that those facilities be constructed as the railway's burden, though in Japan a station plaza is considered as a part of road facilities to supplement road transport. In many cases they are constructed with the railway and road administrators agreeing to share the construction cost.

2.3.4 Application of Demand Forecast

(1) Demand forecast for the proposed service

In order to make a service and transport plan (which is to be the base of improvement plan), based on the urban development plan, the existing state of the area and a basic service plan, the demand forecast is to be carried out. (Forecasted demand should be fed back to the basic service plan.) The result of the demand forecast is described in the preceding chapter ("2.2 Demand Forecasting").

Assumption of demand for commuter service, airport access service and intercity express service for planning railway improvement is shown in Tables 2.3.1 and 2.3.2, which is based on the demand forecast and modified to be suitable for planning.

As for the peak ratio for commuter service, the following are applied.

Morning rush hour (bound for the CBD)

7:00 - 8:00 30% (Demand for planning capacity of facilities)

Evening rush hour (bound for suburbs)

16:00 - 17:00 17%

As for the ratio on holidays, for the commuter service the following is applied.

Holiday: 60% of weekday

Effect of fare level on commuter service is assumed as follows:

Third class (0.215baht/km)	100%
Second class (0.44baht/km)	90%
Upper limit (1baht/km, average 0.7baht/km)	70%

(1baht/km is applied within the first 15km not to make it too expensive for long distance ride, which are estimated to be 0.7baht/km on the average)

(2) Demand for related service

The scope of this project aims at commuter service and intercity express service. However,

Table 2.3.1 Profile Demand of Commuter Service and SBIA Access Service

All Day (Week Day)

[1,000passengers/day·direction]

Section / Year	Yommarat – Lat Krabang	Lat Krabang – Khlong Luang Phaeng	Khlong Luang Phaeng – New Chachoengsao	New Chachoengsao – Chachoengsao	Lat Krabang – SBIA North Terminal
2000	30 (10)	12			(10)
2005	66 (13)	41	17	11	(13)
2010	**90 (17)**	**65**	**45**	**30**	**(17)**
2015	101 (19)	75	56	38	(19)
2020	112 (21)	82	62	42	(21)
2025	123 (23)	92	68	46	(23)

Remarks: ( ); SBIA Access, not included in the other figures

Demand in a holliday; 58% of a week day

Peak: Morning Rush Hour bound for the CBD

[1,000 passengers/hour·direction]

Section / Year	Yommarat – Lat Krabang	Lat Krabang – Khlong Luang Phaeng	Kholong Luang Phaeng – New Chachoengsao	New Chachoengsao – Chachoengsao	Lat Krabang – SBIA North Terminal
2000	9 (0.3)	4			(0.3)
2005	20 (0.3)	12	5	3	(0.3)
2010	**27 (0.4)**	**20**	**14**	**9**	**(0.4)**
2015	30 (0.5)	23	17	11	(0.5)
2020	34 (0.5)	25	19	13	(0.5)
2025	37 (0.6)	28	20	14	(0.6)

Remarks: ( ); SBIA Access, not included in the other figures

Table 2.3.2 Profile Demand of Intercity Express Service

All Day

[passenger/day·direction]

Year	Lat Krabang ~ Chachoengsao
1997	2,000
2000	5,000
2005	7,000
2010	**10,000**
2015	11,000
2020	12,200
2025	13,500

other services such as freight services and trunk line passenger service to/from Aranyaprathet and local service in the ESB should be taken into consideration. Those related services will compete in utilizing the railway line. Demand for such related services are considered and reflected as follows:

(i) Freight transport

i) Freight transport between Makkasan and Chachoengsao

Freight transport for this section is mainly for shuttle trains for marine containers between the Inland Container Depot (Hua Takhe) and Laem Chabang Port (Si Racha). Other freight trains are few because of the completion of the Kaeng Khoi - Khlong Sip Kao new line and the pipeline system. Therefore, these will not affect a plan for the section.

ii) Freight transport between Chachoengsao and Si Racha

This section is the main passage between the all land of Thailand and the industrial area including the deep sea port of Laem Chabang in the ESB. Therefore, the demand for freight will be large and improvements for both intercity express and increasing freight should be executed.

iii) Freight transport beyond Si Racha

Beyond Si Racha branching off to Laem Chabang Port, not much freight transport is expected. The section will be able to treat both without large improvements.

iv) Applied freight demand

Future freight demand will depend on the minds of both the SRT and shippers, which are not clear at present. The existing concrete data is that of the SRT marketing department for the year 2000. This Study applies it in the freight demand for the year 2000 and takes into consideration general growth.

Applied freight demand is as follows:

(In 2000)

Hua Takhe - Chanchoengsao	10 trains/day• direction
Chanchoengsao - Si Racha	21 trains/day• direction
Si Racha - Map Ta Phut	1 trains/day• direction

To make a transport plan, some leeway should be taken into account. Beyond Si Racha, more than one train may be required.

(ii) Passenger transport

i) Passenger transport from/to the direction of Aranyaprahtet

This passenger demand can be dealt with by the proposed rapid trains which are to be operated three per hour. For some passengers who hope for through-operation because of the troublesome transferring, a small number of through-trains are to be considered, which will not affect the planning. As described previously, for the improved commuter service a higher fare level will be proposed. If the existing low third class fare level remains as a social welfare measure, such trains might have to remain to a certain extent.

ii) Local passenger transport between Chachoengsao and Map Ta Phut

Local passenger demand for this section is very small now. At present only one round trip train operates with few passengers, having been reduced from two.

Taking into consideration the location of stations and the conditions of road traffic (not as crowded as in Bangkok and travel distance is not as long), demand will not increase so much, because the time of main haul is not so much compared with the access time at both stations and the time-saving obtained by diverting from automobiles/buses can not be expected. If improvement for such local passenger demand such as frequent operation of local trains, an increase of a certain number of passengers will take place. However, it will not be enough to return the investment made in double tracking and so on.

The Study proposes to execute intercity express service taking into account increasing freight transport.

2.3.5 Transport Plan

(1) Outline of transport plan

Based on the service plan and forecasted demand, transport planning is carried out. As described previously in "service criteria" and "service plan", in this project for both commuter service and intercity express service, the frequency/headway of trains is essential. Therefore, for transport planning, at first, operation diagrams suitable for proposed headway in the service criteria will be prepared, and then the numbers of cars making up trains will be calculated based on the forecasted demand. Unless the number of cars making up trains exceeds the limit of train length or falls below the number which is economically unapplicable, for example one or two, this transport plan will be applied as the base case.

(2) Train operation plan (Diagram)

Standard pattern diagrams for each conditions of the following are shown in Figs. 2.3.1, 2.3.2 and 2.3.3.

i) Yommarat - Lat Krabang - Chachoengsao and Lat Krabang - SBIA North Terminal
(Hua Lamphong)

Rush hours (An express train per hour is inserted.)

Off peak (An express train, a freight train and a diesel-locomotive-hauled passenger train per hour are inserted.)

ii) Chachoengsao - Si Racha

Day time :	A round trip of intercity express and a round trip of freight per hour
Day time :	Modified by changing *an express of one direction to a train stopping at each station
Others :	Two round trips of freight per hour

*Remarks: The capacity of this section is limited because of the single track and signalling system not allowing successive train operation, so additional local passenger trains are difficult to be inserted and two or more express trains are made to stop at each station beyond Chachoengsao. Not so many stations are provided in this section and high performance diesel railcars are used so it will not take so much additional time, but supplemental charges for the express can not be charged.

In this section a diagram of the necessary number of trains is to be made up taking into account the least investment. Three signal stations are to be constructed and at three stations additional refuge tracks loops are to be installed, which are shown in Fig. 2.5.4.

iii) Si Racha - Map Ta Phut

Day time :	A round trip of intercity express per hour and a round trip of freight every 2 hours
Day time:	Modified by changing an express of one direction to a train stopping at each station
Others :	One round trip of freight per hour

In this section, freight transport demand will be much less than the section above, the diagram is made based on the existing facilities. An additional refuge track at a station is to be installed for smooth and flexible train operation, which is shown in Fig. 2.5.4.

Assumptions for drawing up standard diagrams are as follows:

i) Commuter service

a) Performance of electric railcars

Maximum operation speed (on service) 120 km/h

Acceleration (0 - 40 km/h)	3.0 km/h sec
Deceleration (on service)	3.5 km/h sec

For drawing up diagrams, some leeway is taken into consideration.

b) Capacity of electric railcars

Normal accommodation capacity	170 passenger/car
Maximum boarding rate	180 %

c) Stoppage time

Lat Krabang	1 min.
Others	30 sec.

d) Stations for rapid-local-connecting, passing by/waiting

Lat Krabang	
Lat Krabang East	
New Chachoengsao	
Preng	(Mainly for freight trains to wait for electric railcar/diesel railcar trains)

e) Stations where trains can turn back

Lat Krabang	
Lat Krabang East	(Only on the Chachoengsao side for going out of/stabling in Khlong Luang Phaeng Depot)
Khlong Luang Phaeng	

f) Storage Tracks

Khlong Luang Phaeng Depot	
Chachoengsao (East)	Leading/storage tracks 5cars×4×2, 5cars×3 ×1
Storage at stations at night	
Hua Lamphong	(Last 2 trains - First 2trains; taking into consideration of guarding at night coming into/going out of Hua Lamphong Depot)
SBIA NT	(Last 2trains - First 2trains; convenient for guarding because of underground and airport area)
Chachoengsao	Storage in east storage tracks

g) Coupling/uncoupling

Khlong Luang Phaeng (Station and Depot)

Lat Krabang

Chachoengsao

Coupling additional cars for peak transport and uncoupling are to be carried out at these stations.

h) Through-operation with the Southern Line

Diagrams of commuter service are drawn up on the assumption of through-operation with the Southern Line.

i) Rapid train at Lat Krabang West

Lat Krabang West is a station at a strategical urban development area, but rapid trains will not stop here in peak hours in order to keep the boarding rate of both trains balanced when each rapid train and local train is operated at a 10-minute headway. Local trains bound for CBD will stop at only 2 more stations so they do not require so much additional time. For eastward trips at the next station, Lat Krabang, local trains will be connected with rapid trains. On the other hand, if a rapid train stops at the adjacent station to the station where it overtakes a local train, the local train must wait longer to have the headway required for 2 trains both of which stop at the station. At off peak hours, rapid trains which do not connect with local trains at Lat Krabang will stop at Lat Krabang West.

j) Flood retaining area

The area between Khlong Luang Phaeng and Khlong Bang Phra is specified to be a flood retaining area. In this section no integrated urban development and no related stations are planned. However, the section is very long, 14.5km, requiring a refuge track for freight trains which operate so slowly. Preng is the existing station for the broad surrounding area. The station will be included in this project. Two other stops will be out of this project, but some trains can stop, if necessary, as at present. If in the future urban development is planned in this area, it is possible to create some stations within the system.

k) Option on SBIA access service

SBIA access service is planned to operate penetrating the CBD through the Hopewell East-West alignment. The travelling time is short (less than 30 minutes) and the service can be included in the urban transport system for the commuter service. The same electric railcars as the commuter service will be used without grouping. However, if necessary, the following option will be possible;

- To offer special accommodation and seat reservations

  SBIA access trains can consist partially of special accommodation. However, it makes car-use efficiency a little low because other trains in the system do not require such service. One means is to partially make seat reservations only on the SBIA access service. Accommodation in such parts of a train will be useable both for the reserved seat service and general commuter service, which will have to furnish at least lateral comfortable benches.

- To operate into Hua Lamphong as a suitable access station with the CBD

  A limited number of trains can operate into Hua Lamphong through the Northern Line, unless the Northern Line is too crowded. It may be possible for SBIA access trains which operate 3 per hour to go into / come out of Hua Lamphong. In this case, commuter service in the area of the Southern Line will be reduced and the car-use planning for providing the special service above will be easier.

ii) Intercity express service

a) Performance of diesel railcars

Maximum operation speed (on service)	120 km/h
Acceleration (0 - 60km/h)	2.0 km/h sec
Deceleration (on service)	3.5 km/h sec

For drawing up diagrams, some leeway is taken into consideration.

b) Capacity of diesel railcars

70 seats/car

c) Stoppage time (excluding waiting time for crossing with an opposing train)

Lat Krabang	1 min.
Chachoengsao	2 min.

Others	30 sec.

d) Coupling/uncoupling

Phatthaya	Dependent on demand (approx. 1/3)

e) Storage tracks

Depot (Hua Lamphong)

Storage at night

Khlong Luang Phaeng EC Depot	2 trains
Map Ta Phut	3 trains

f) Local passenger trains between Chachoengsao and Map Ta Phut

Because the section is single track and the intervals between crossable stations are so long, local trains can hardly operate in addition to intercity express trains of 1-hour headway and necessary freight trains. Therefore, two (or a few) round trips of intercity express trains stop at each station in this section.

(3) Number of railcars making up each train

Based on demand forecast, the necessary number of railcars making up each train is planned as follows (in the target year of 2000):

i) Commuter service / SBIA access

Rush hours	(6:00 to 9:00 at Yommarat morning westward and 15:30 to 18:30 at Yommarat evening eastward)
Rapid	10 cars, 10min. headway (To/from Chachoengsao and SBIA one after the other)
Local	5 cars, 10min. headway (To/from Chachoengsao or Khlong Luang Phaeng)
Off peak	
Rapid	5 cars, 10min. headway (To/from Chachoengsao and SBIA one after the other)
Local	5 cars, 20min. headway

ii) Intercity express service

12 cars, 1 hour headway (6:00 to 20:00 at each starting station)

(4) Trial diagrams

i) Yommarat - Chachoengsao

Based on the standard pattern diagrams explained previously, a trial diagram of all day on weekdays between Yommarat (Hua Lamphong) and Chachoengsao is drawn up, which is shown in Fig. 2.3.4.

ii) Intercity express service

A trial diagram of intercity express trains between Hua Lamphong and Map Ta Phut is drawn up and shown in Fig. 2.3.5.

iii) Number of railcars required for the service

Based on trial diagrams, the number of electric railcars required for the commuter service and diesel railcars required for the intercity express service are estimated. The scale of fleets of electric railcars and diesel railcars in the target year of 2000 will be approximately 160 cars and 72 cars respectively.

(5) Consideration for the future

From the commencement of the service until the target year of 2010, the number of railcars making up each train is to be increased step by step in accordance with demand. After the year of 2010 to the end of project life in 2025 (30 years from 1996), the number of railcars will still be increased in accordance with demand to the extent that it will not require large-scale investment of facilities/equipment such as extension of platforms, improvement of signalling system and track-quadrupling, which will be beyond the limit of the capacity of this project. These investments will be considered in other projects in the future. However, the future possibility of such investment should be taken into consideration to the extent that they do not require much in the way of costs as a prior investment.

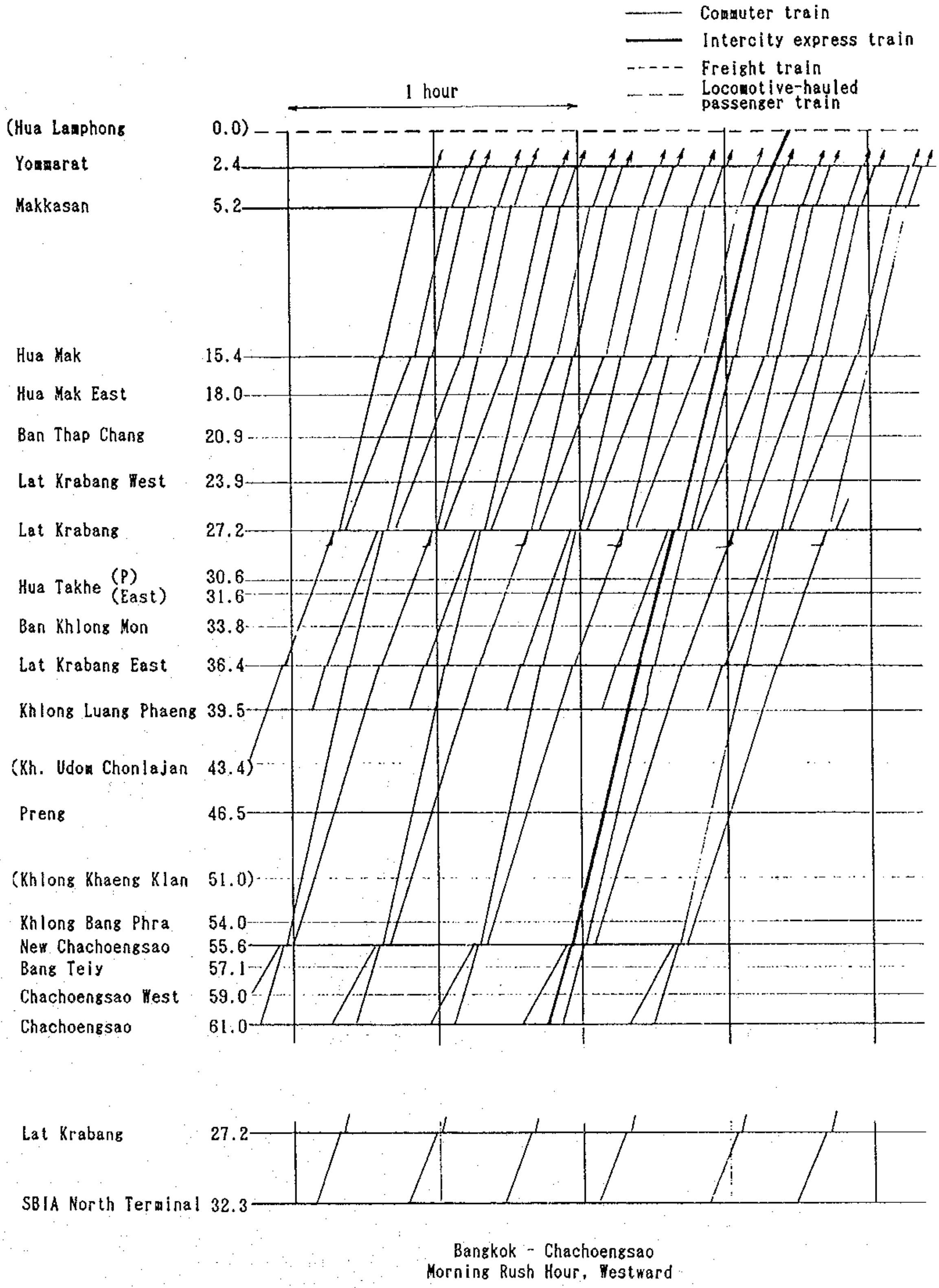


Fig. 2.3.1 (1) Standard Operation Pattern (1)

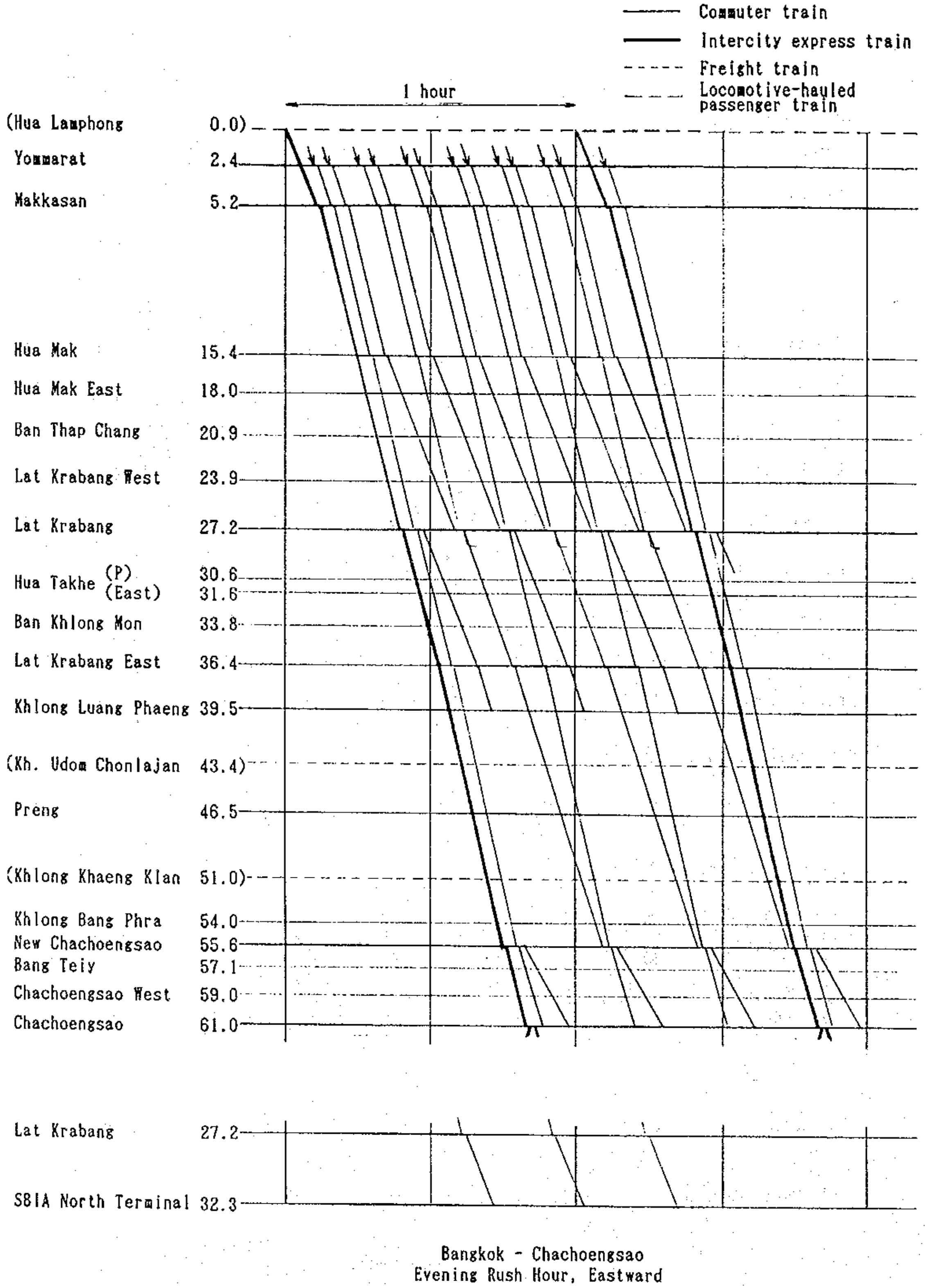


Fig. 2.3.1 (2) Standard Operation Pattern (2)

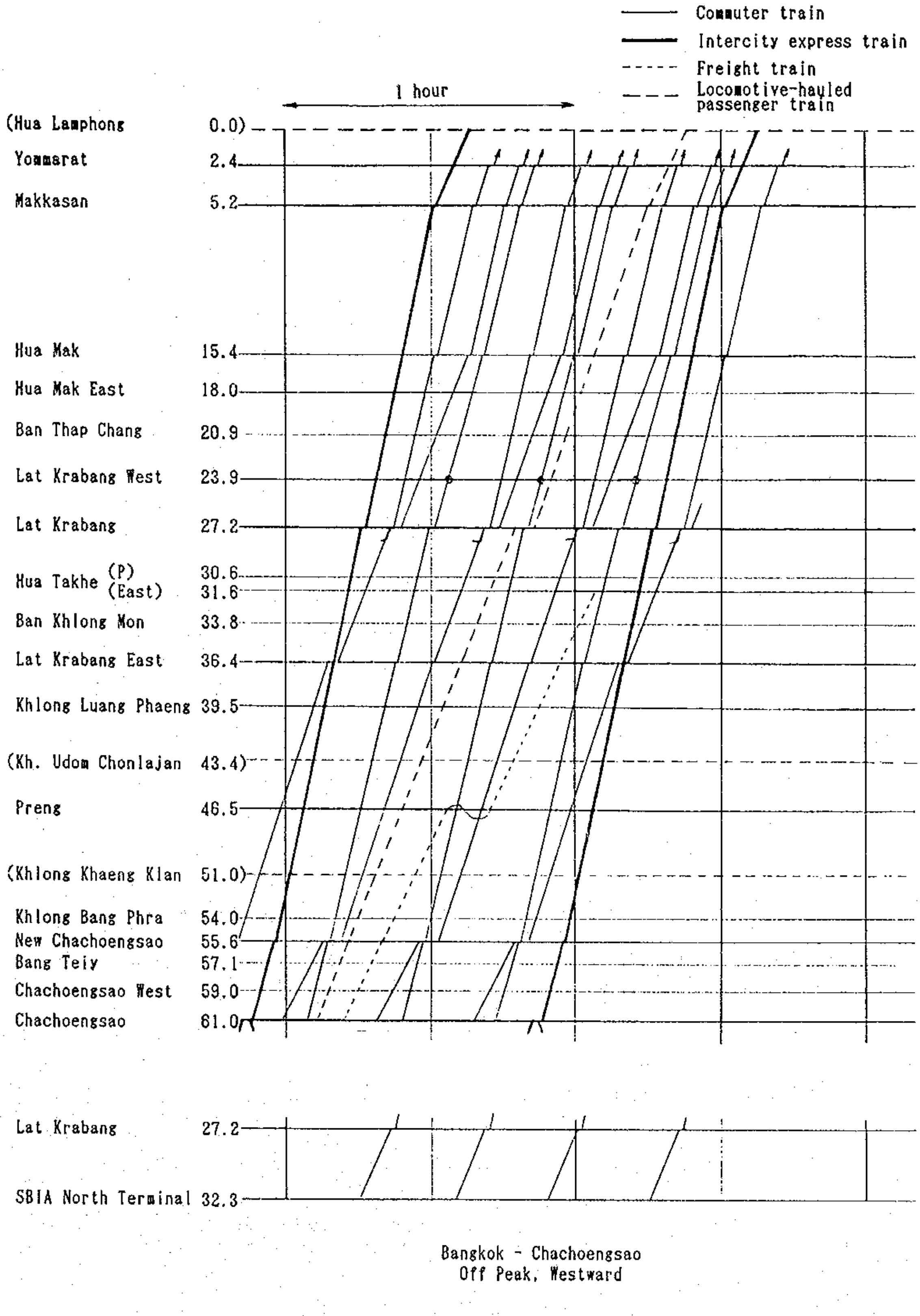


Fig. 2.3.1 (3) Standard Operation Pattern (3)

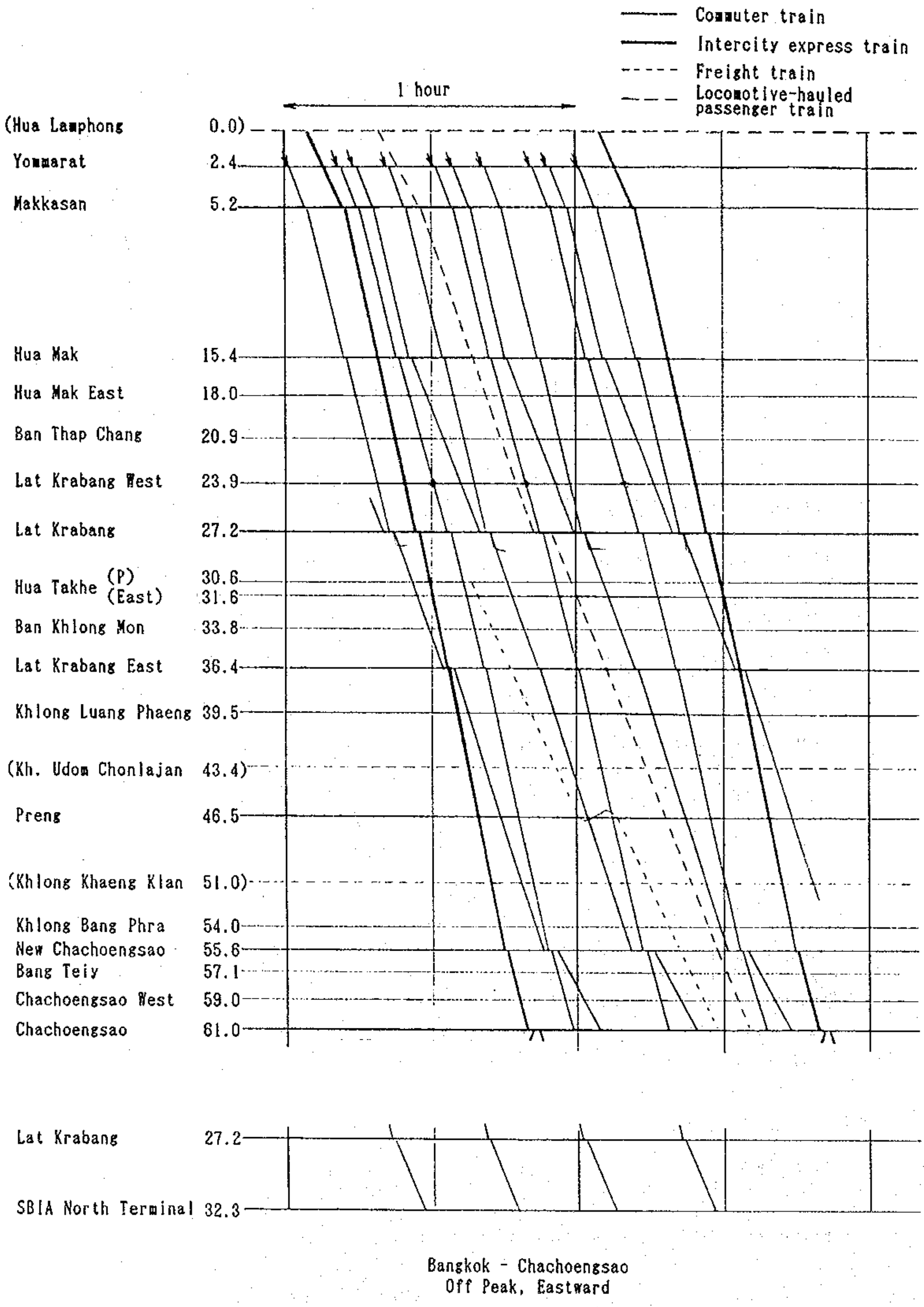


Fig. 2.3.1 (4) Standard Operation Pattern (4)

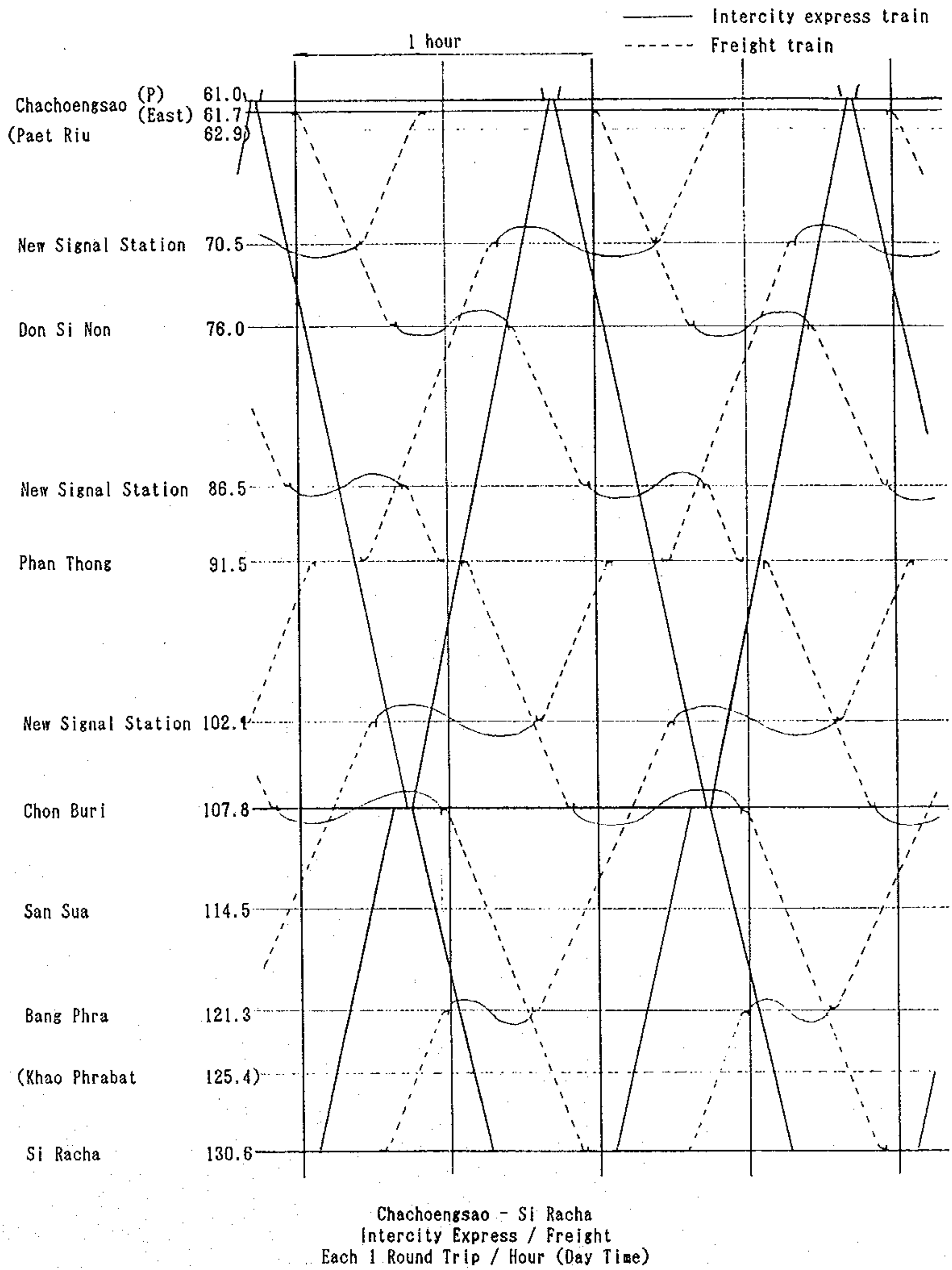


Fig. 2.3.2 (1) Standard Operation Pattern (5)

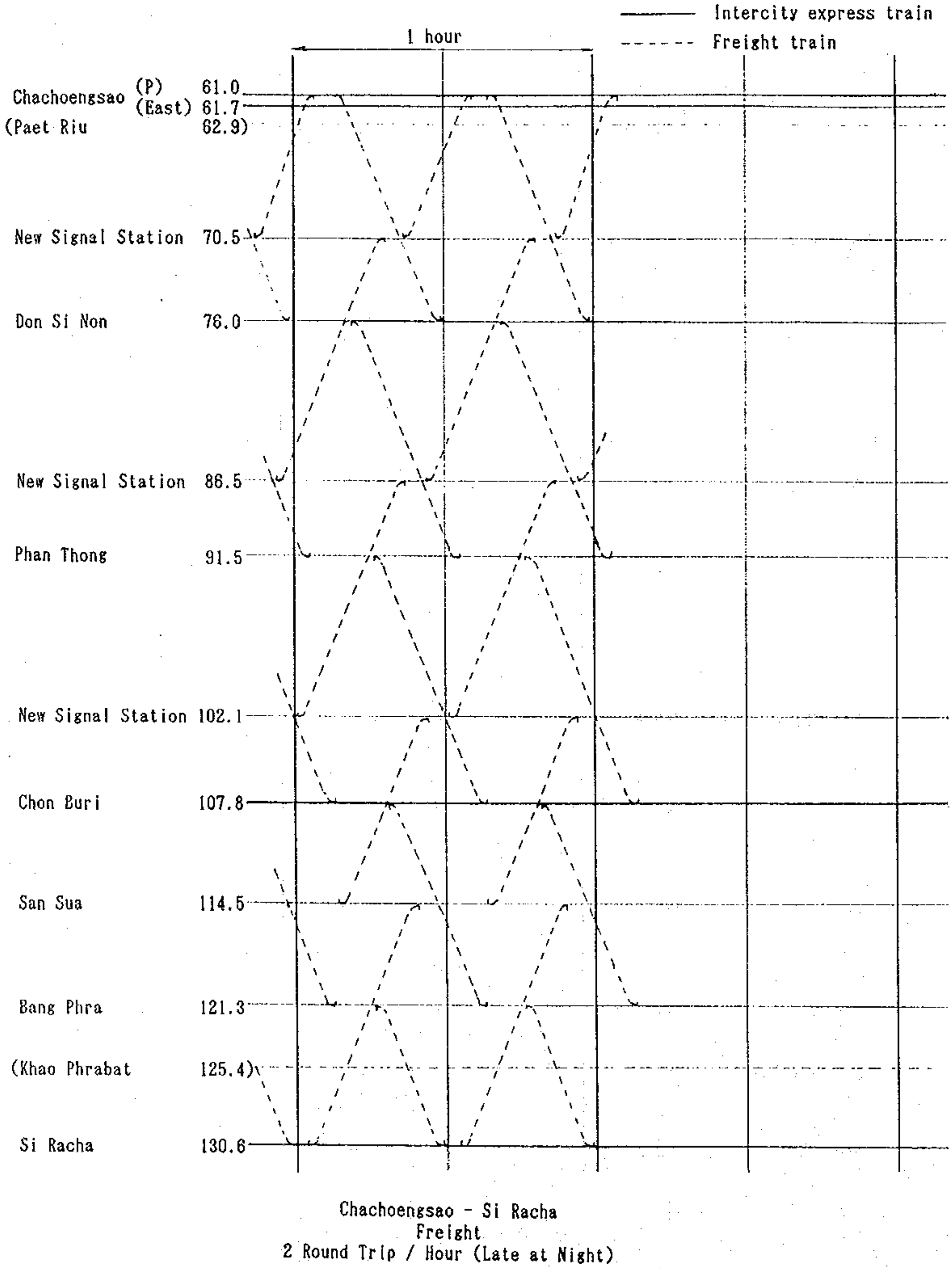
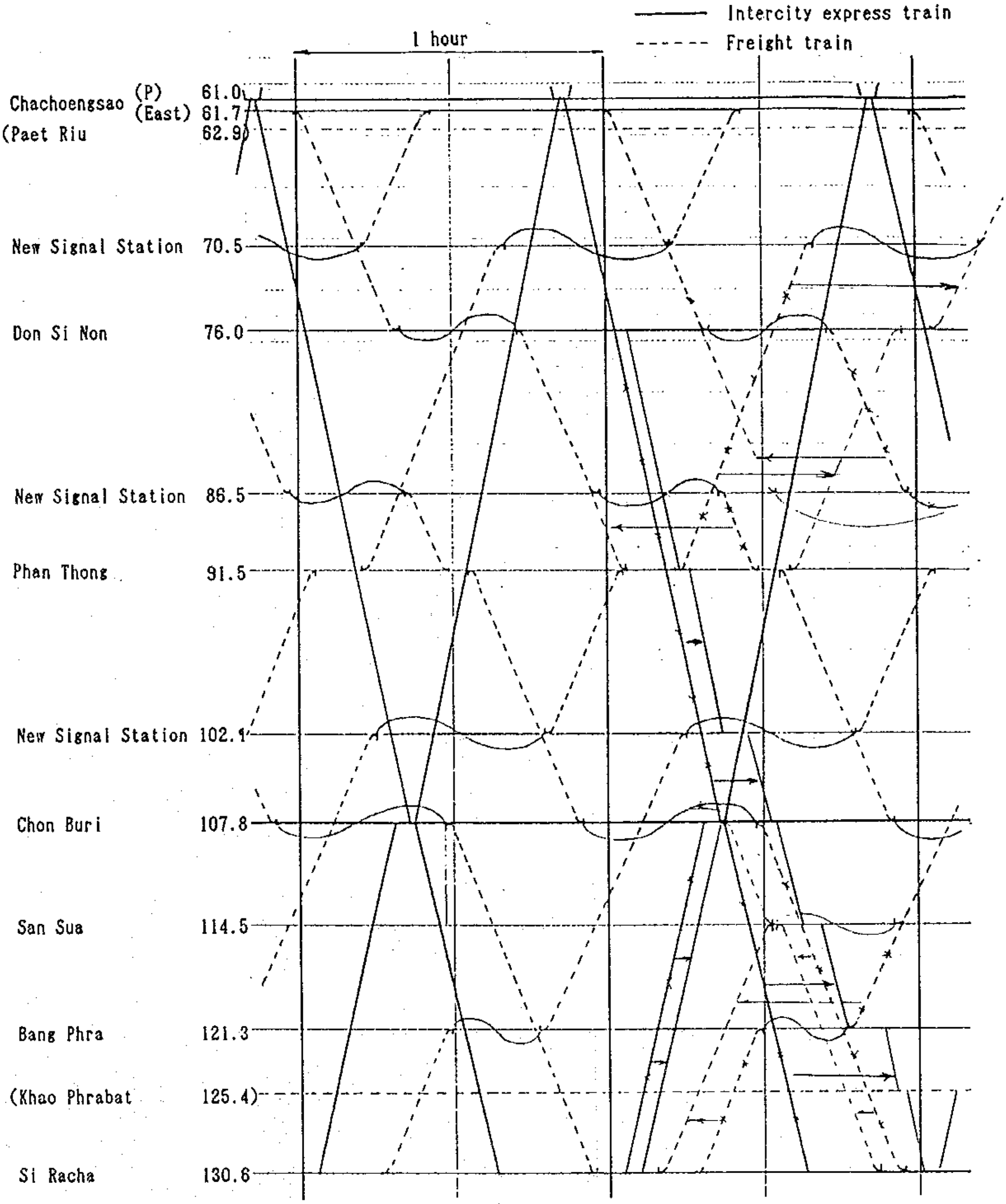
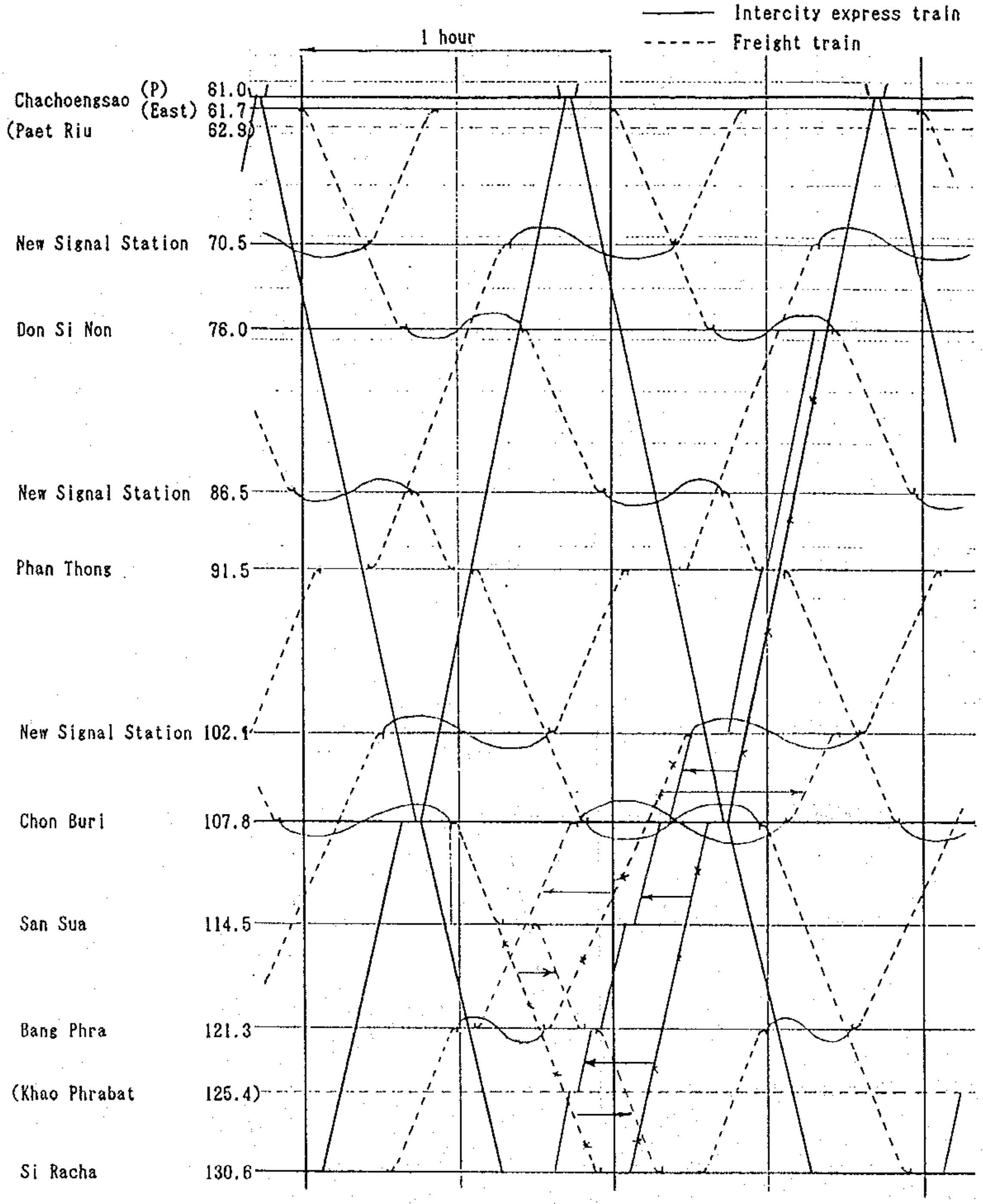


Fig. 2.3.2 (2) Standard Operation Pattern (6)



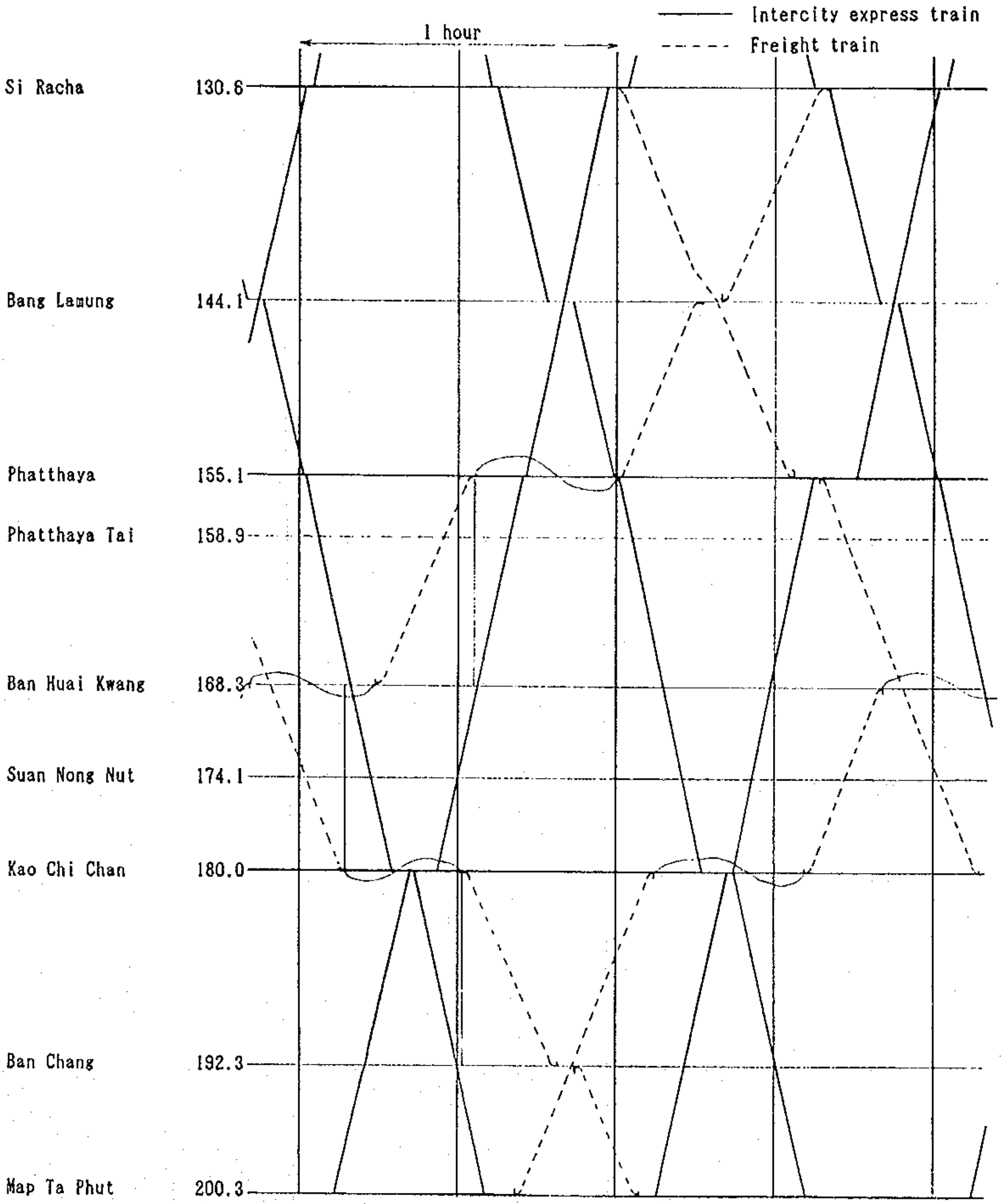
Chachoengsao - Si Racha
Intercity Express / Freight
Each 1 Round Trip / Hour (Day Time)
(1 southward express changed to stop each station.)

Fig. 2.3.2 (3) Standard Operation Pattern (7)



Chachoengsao - Si Racha
Intercity Express / Freight
Each 1 Round Trip / Hour (Day Time)
(1 northward express changed to stop each station.)

Fig. 2.3.2 (4) Standard Operation Pattern (8)



Si Racha - Map Ta Phut
Intercity Express / Freight
2(Ex), 1(Fr) Round Trip(s) / 2 Hours (Day Time)

Fig. 2.3.3 (1) Standard Operation Pattern (9)

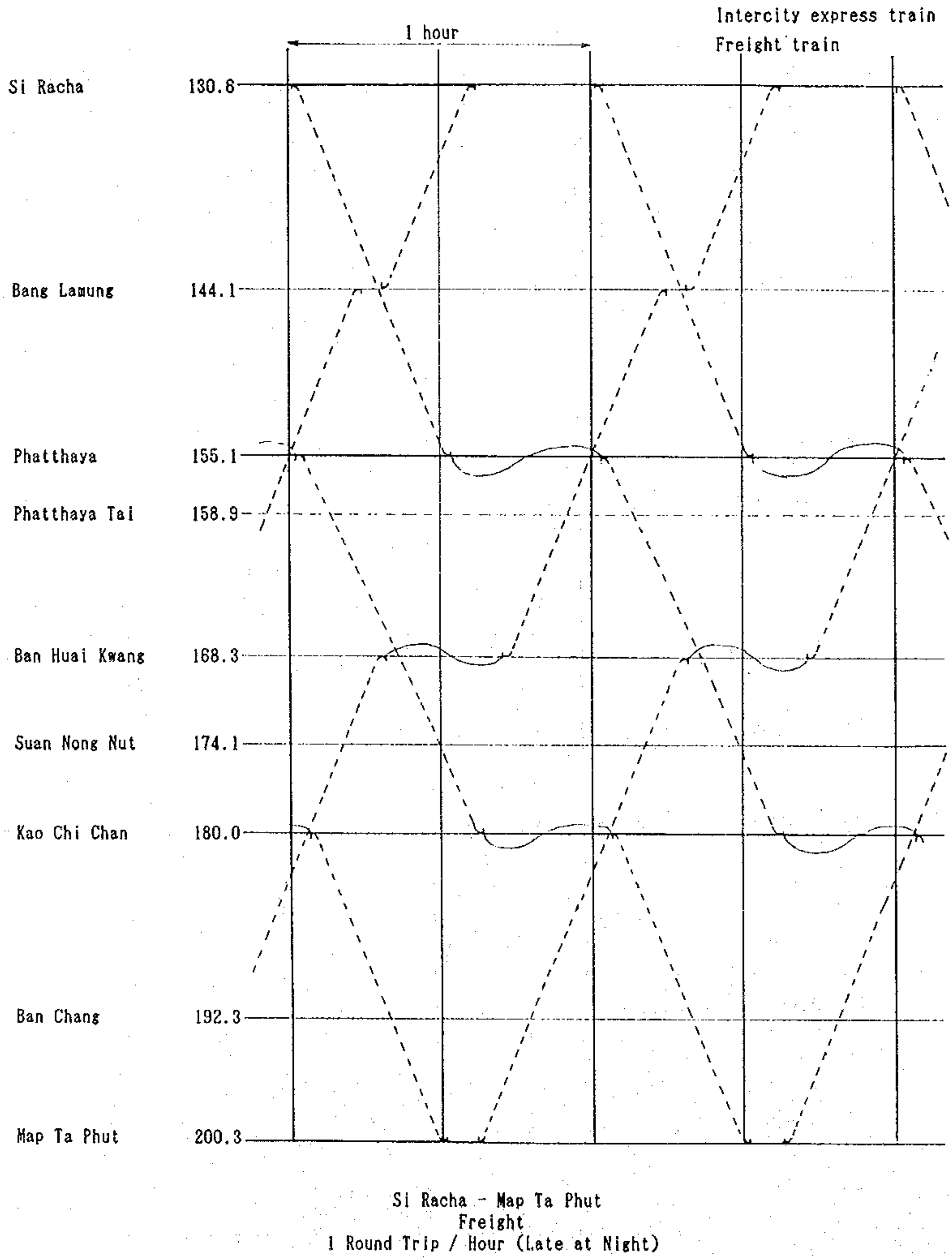
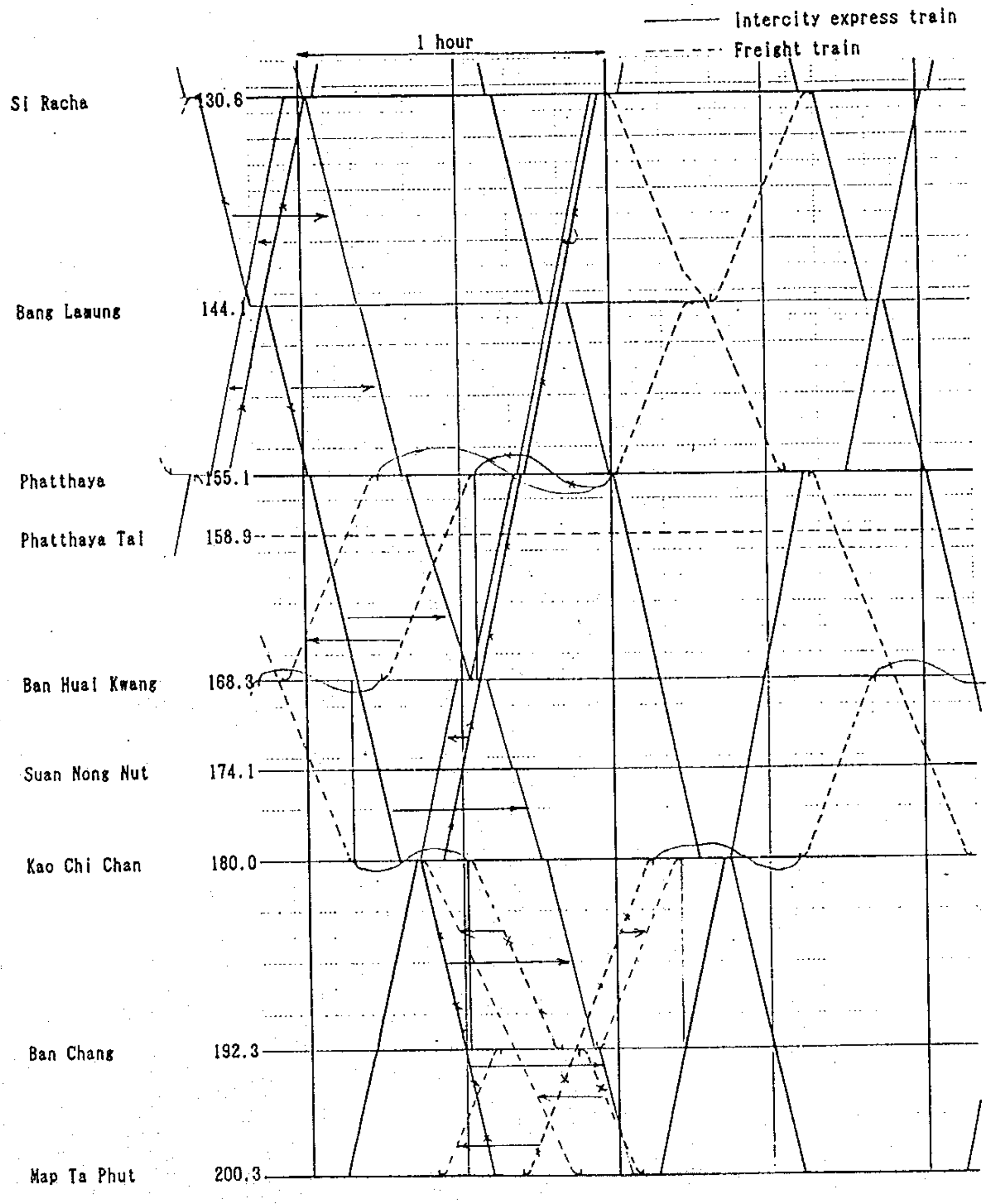
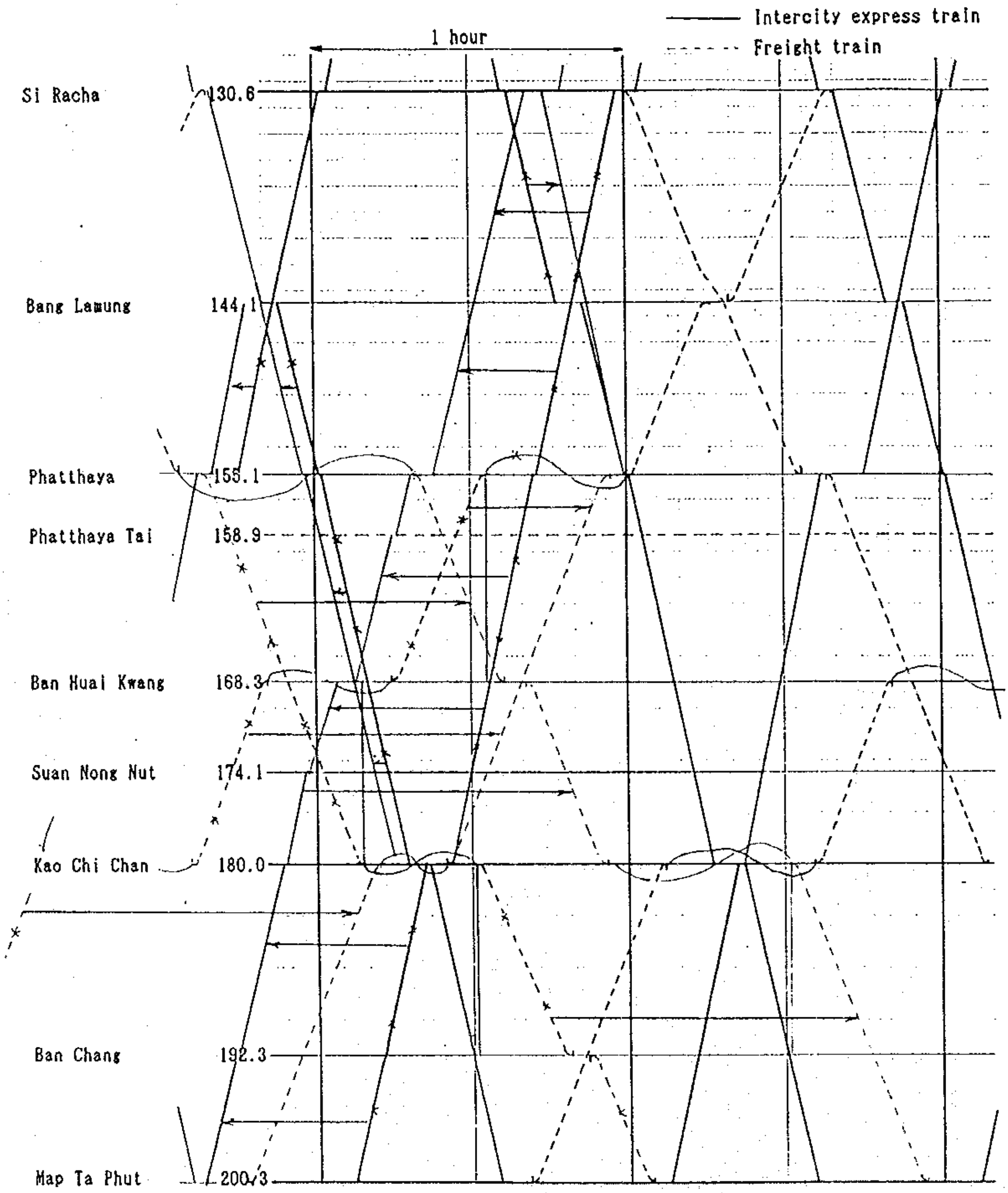


Fig. 2.3.3 (2) Standard Operation Pattern (10)



Si Racha - Map Ta Phut
Intercity Express / Freight
2(Ex), 1(Fr) Round Trip(s) / 2 Hours (Day Time)
(1 southward express changed to stop each station.)

Fig. 2.3.3 (3) Standard Operation Pattern (11)



Si Racha - Map Ta Phut
Intercity Express / Freight
2(Ex), 1(Fr) Round Trip(s) / 2 Hours (Day Time)
(1 northward express changed to stop each station.)

Fig. 2.3.3 (4) Standard Operation Pattern (12)

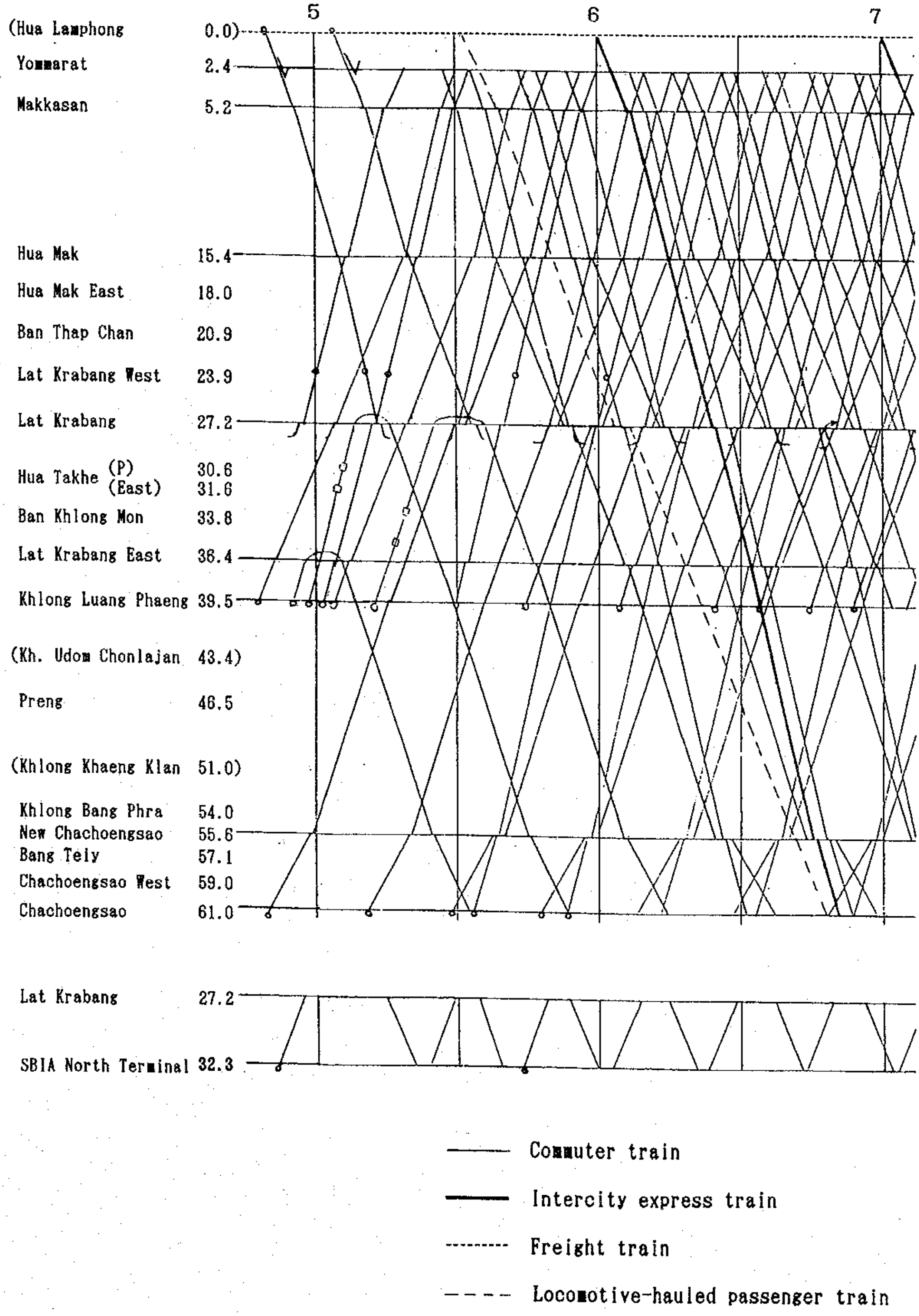
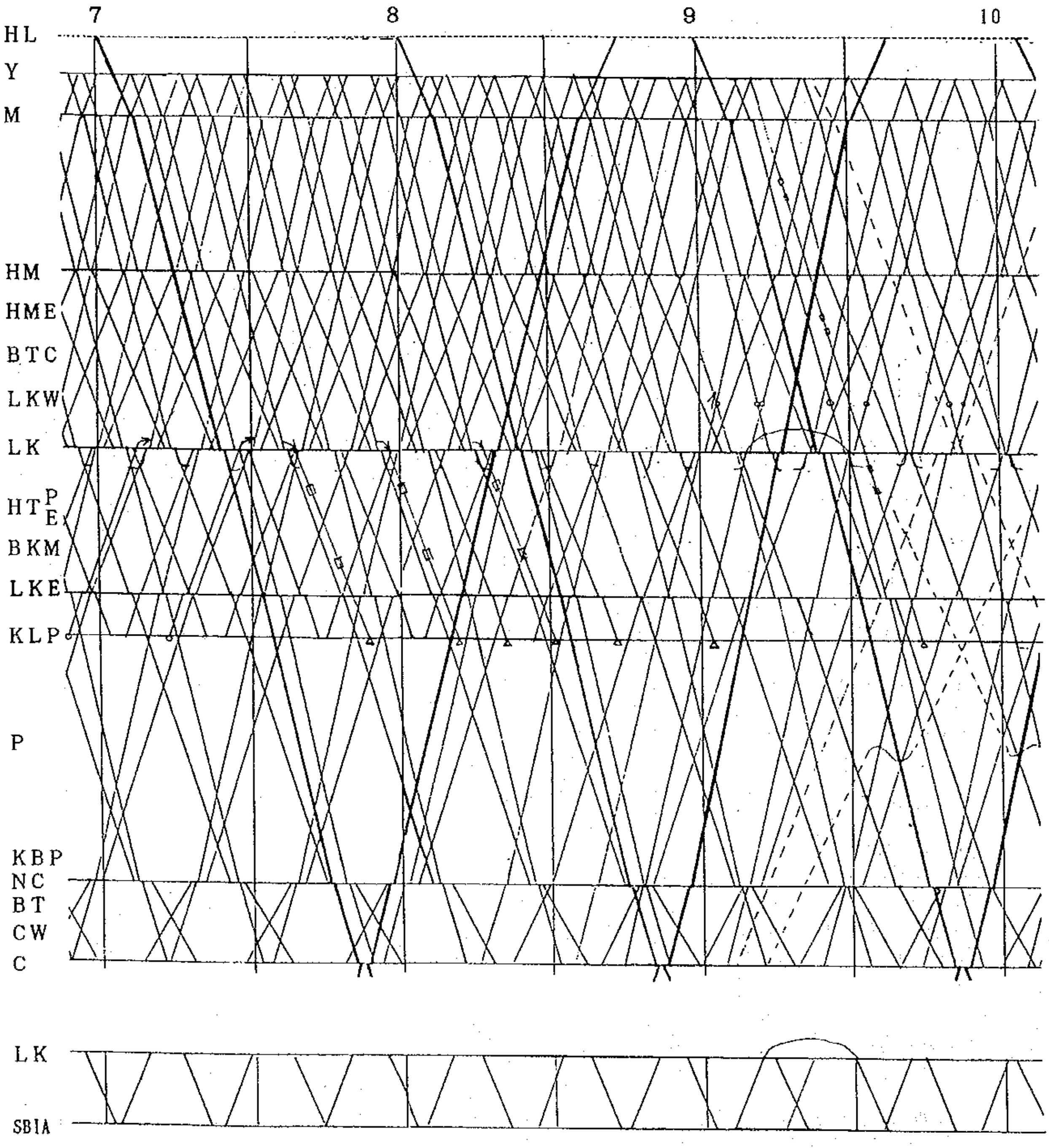


Fig. 2.3.4 Trial Diagrm (Yommarat - Chachoengsao)



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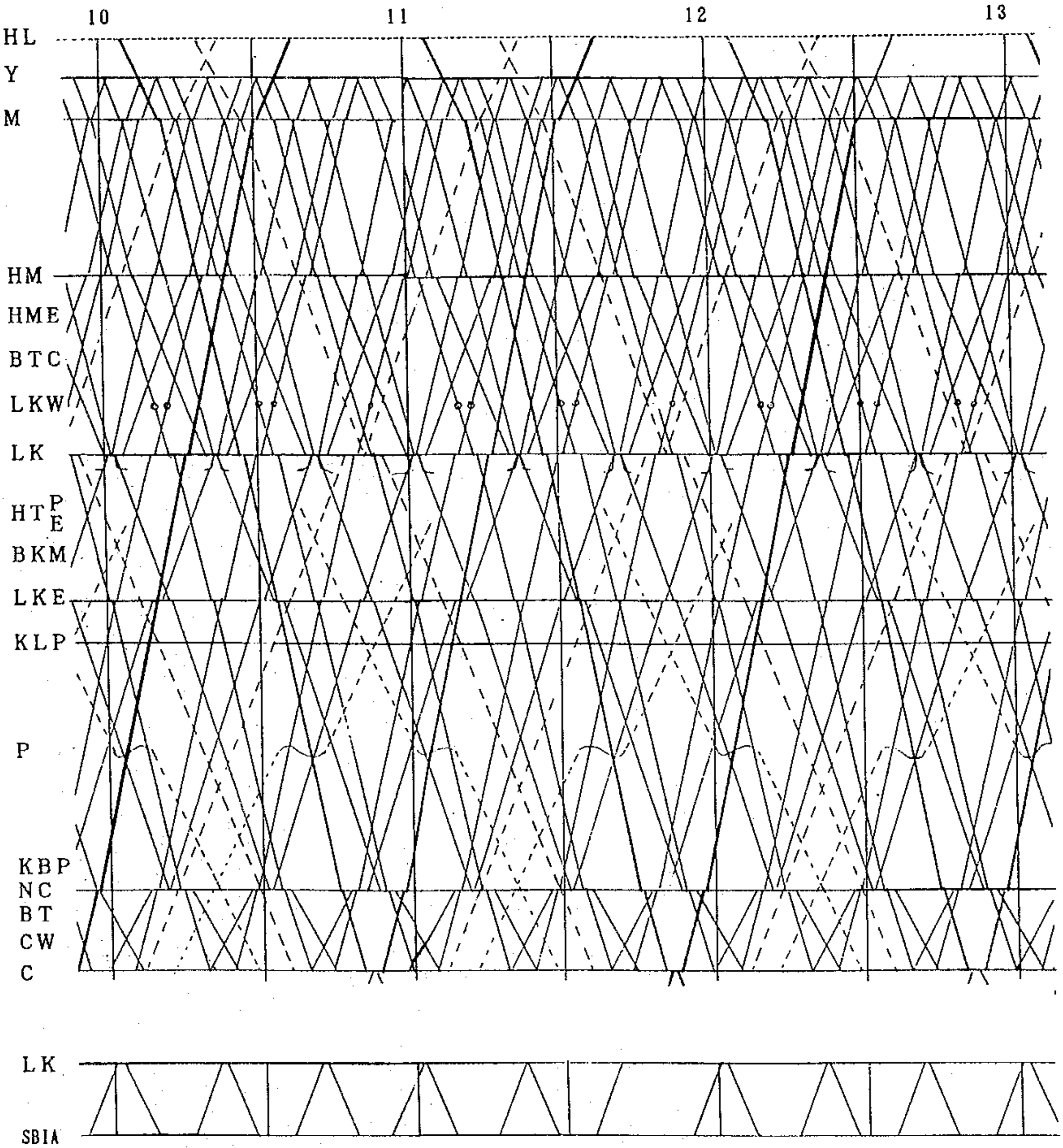
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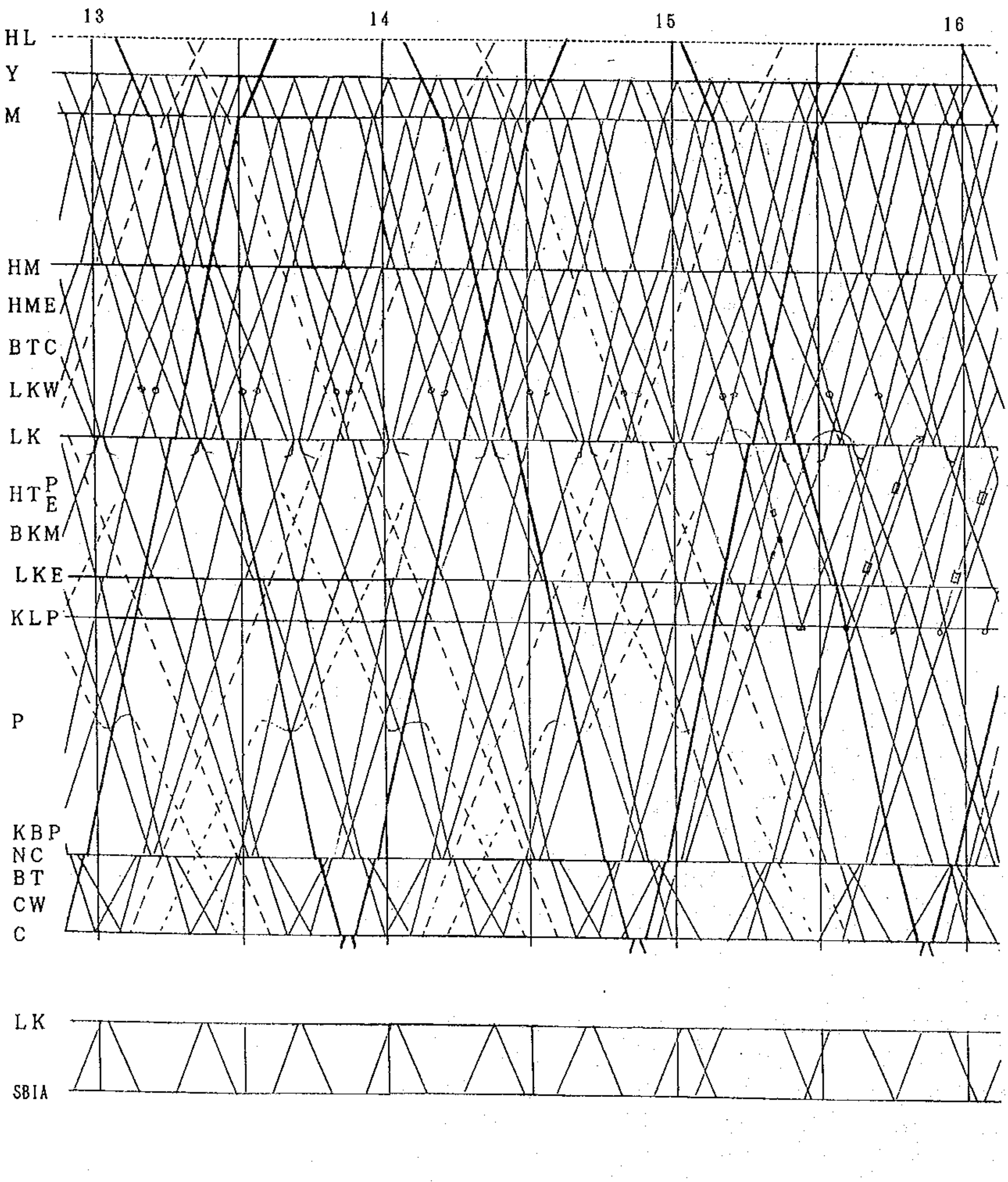
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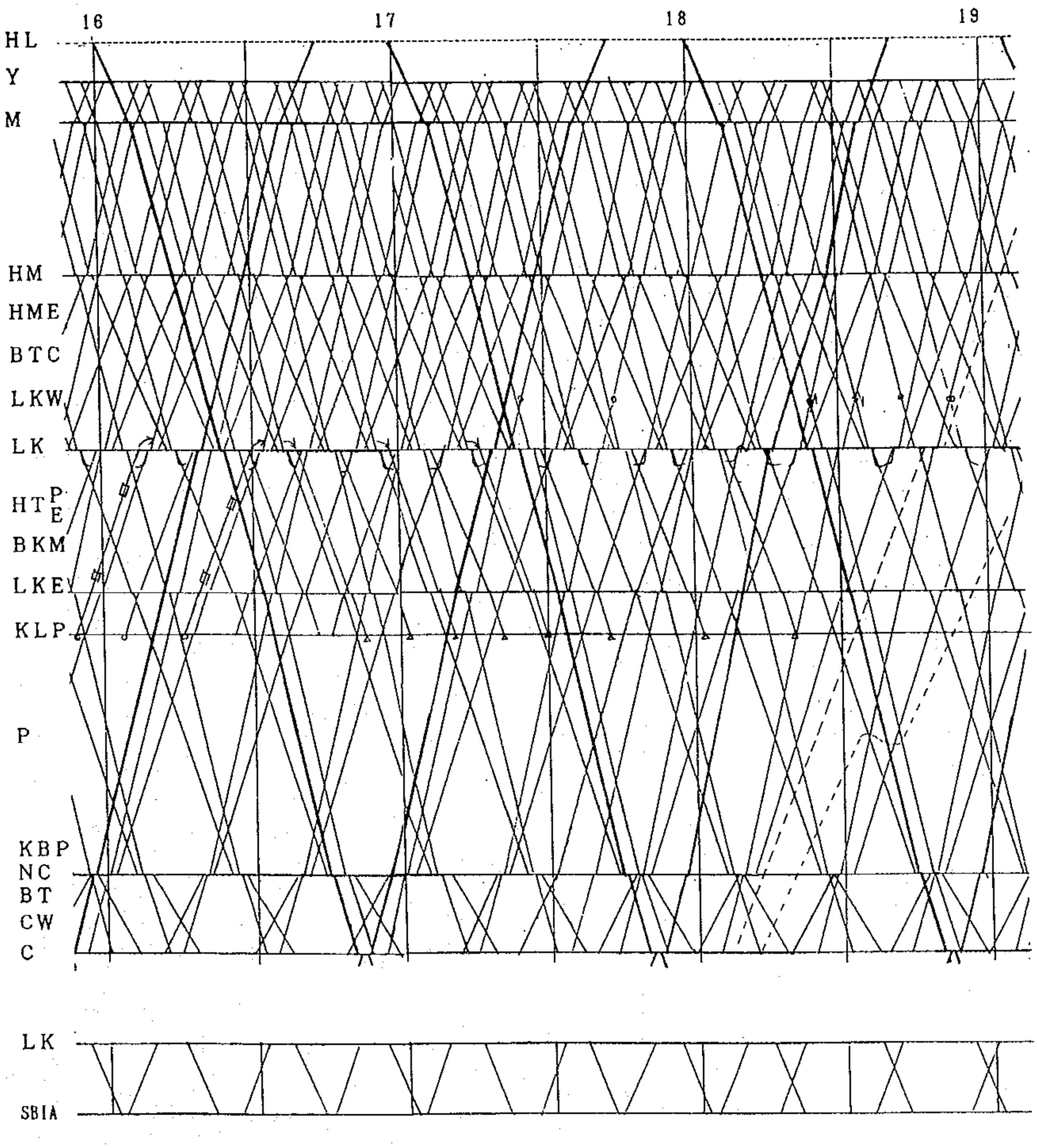
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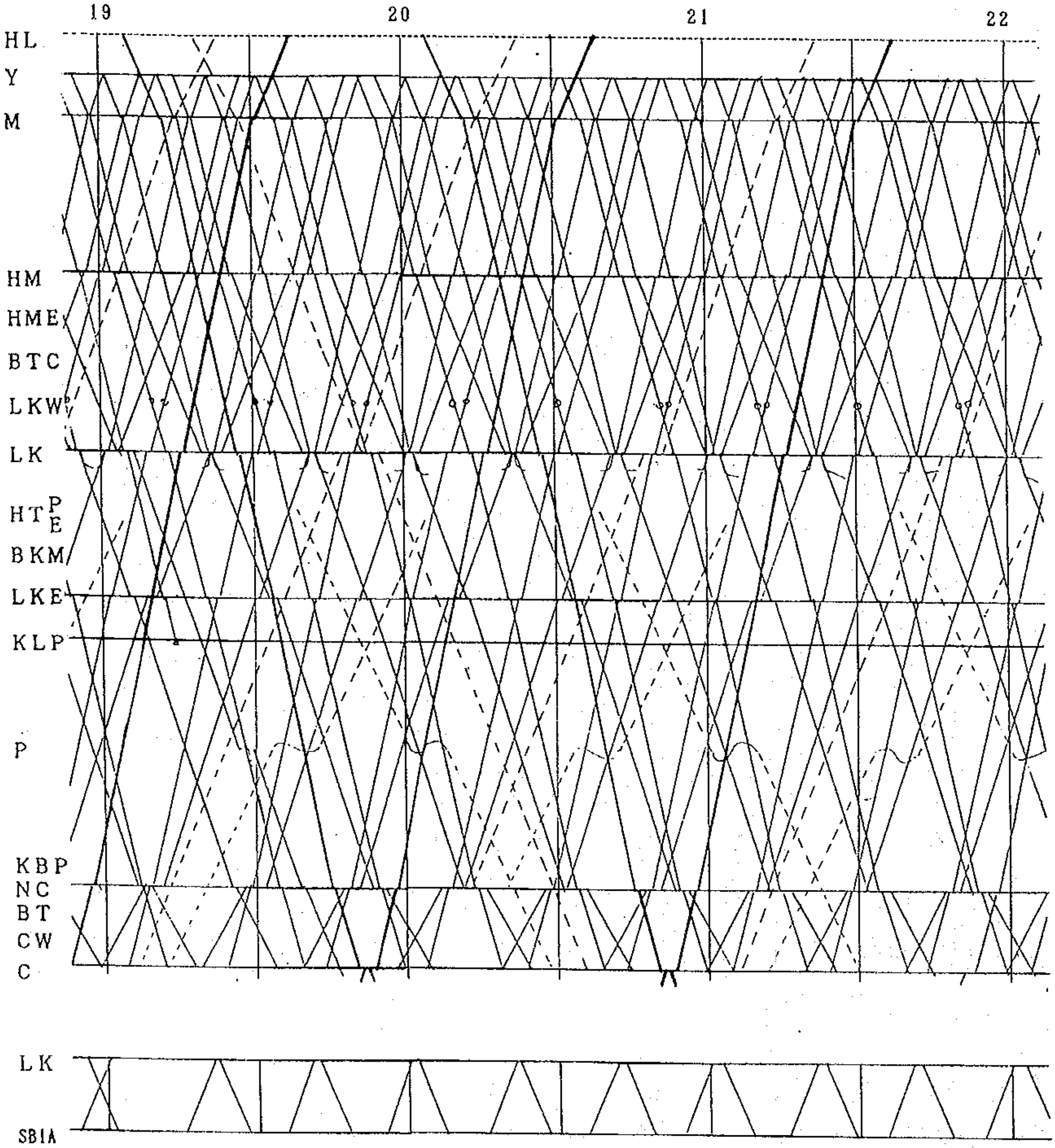
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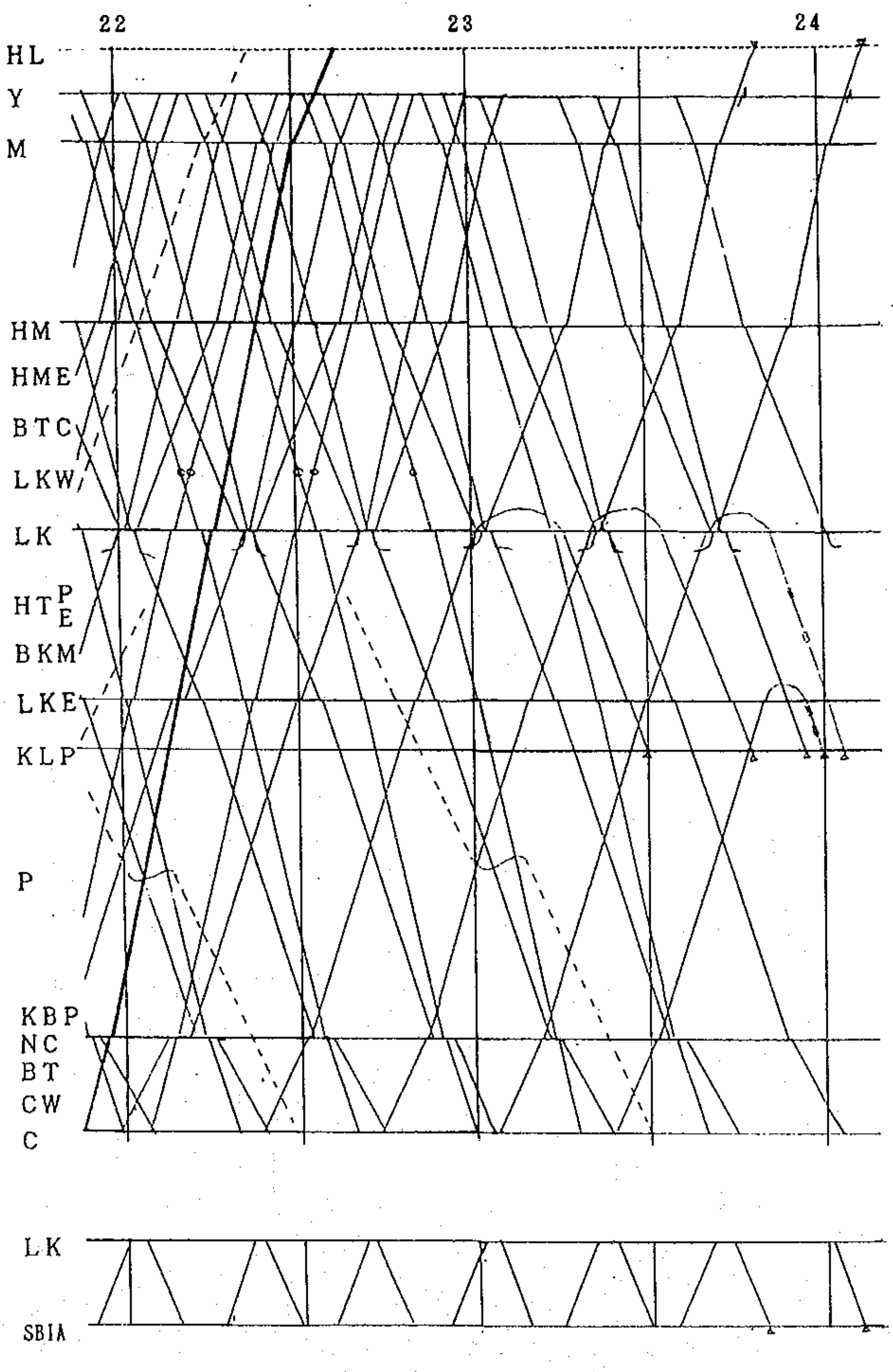

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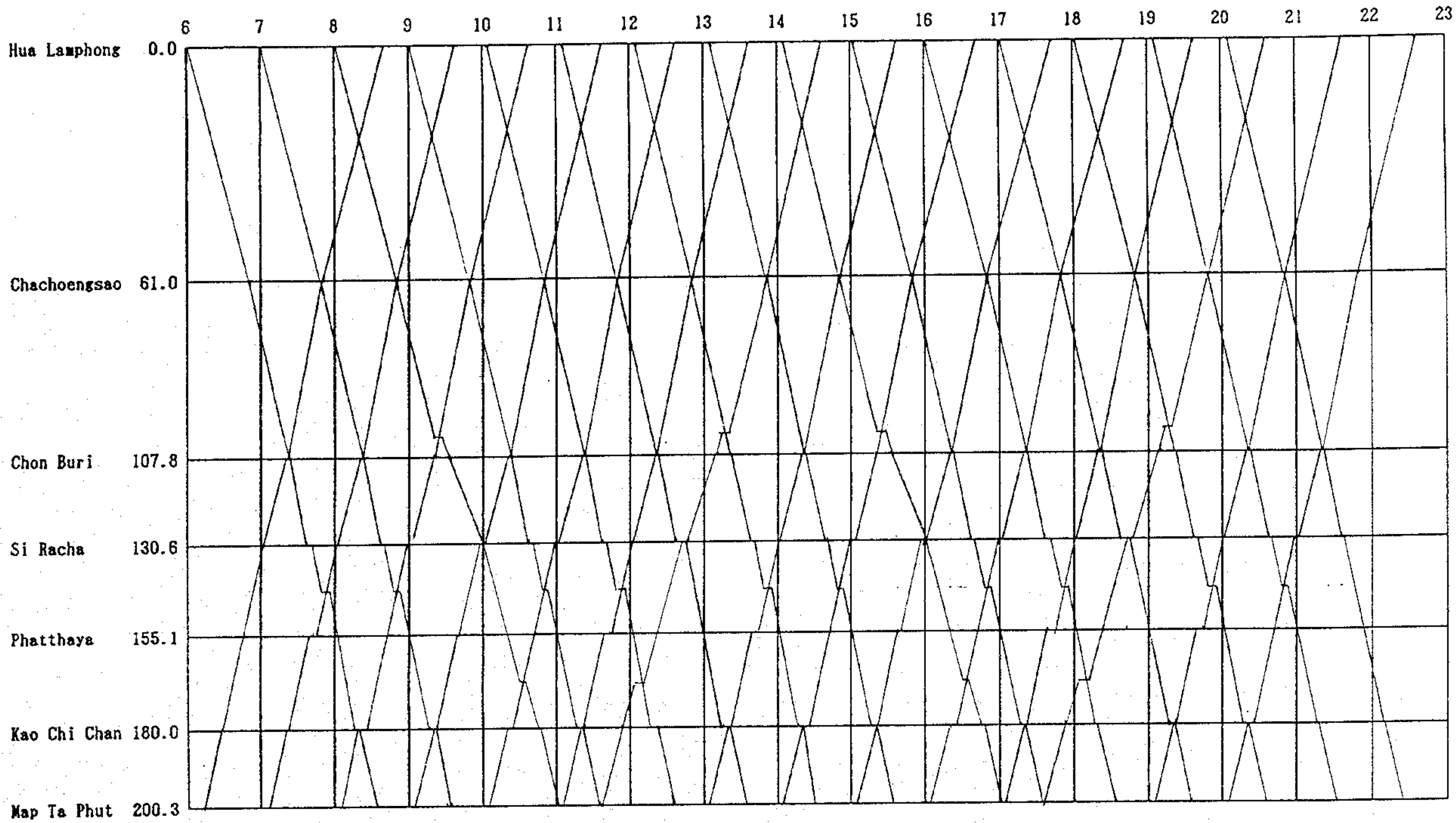

Fig. 2.3.5 Trial Diagram (Intercity Express)