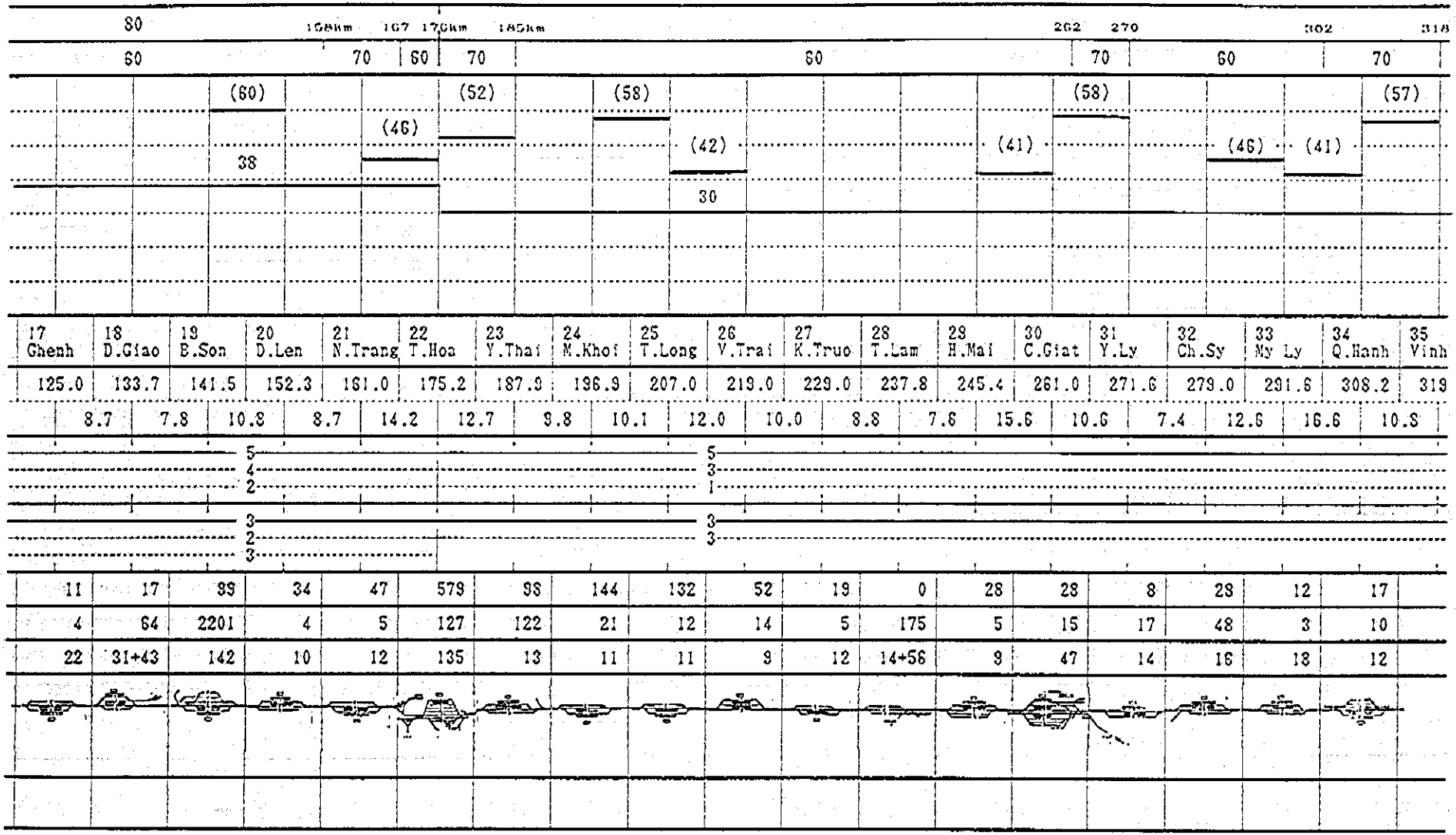
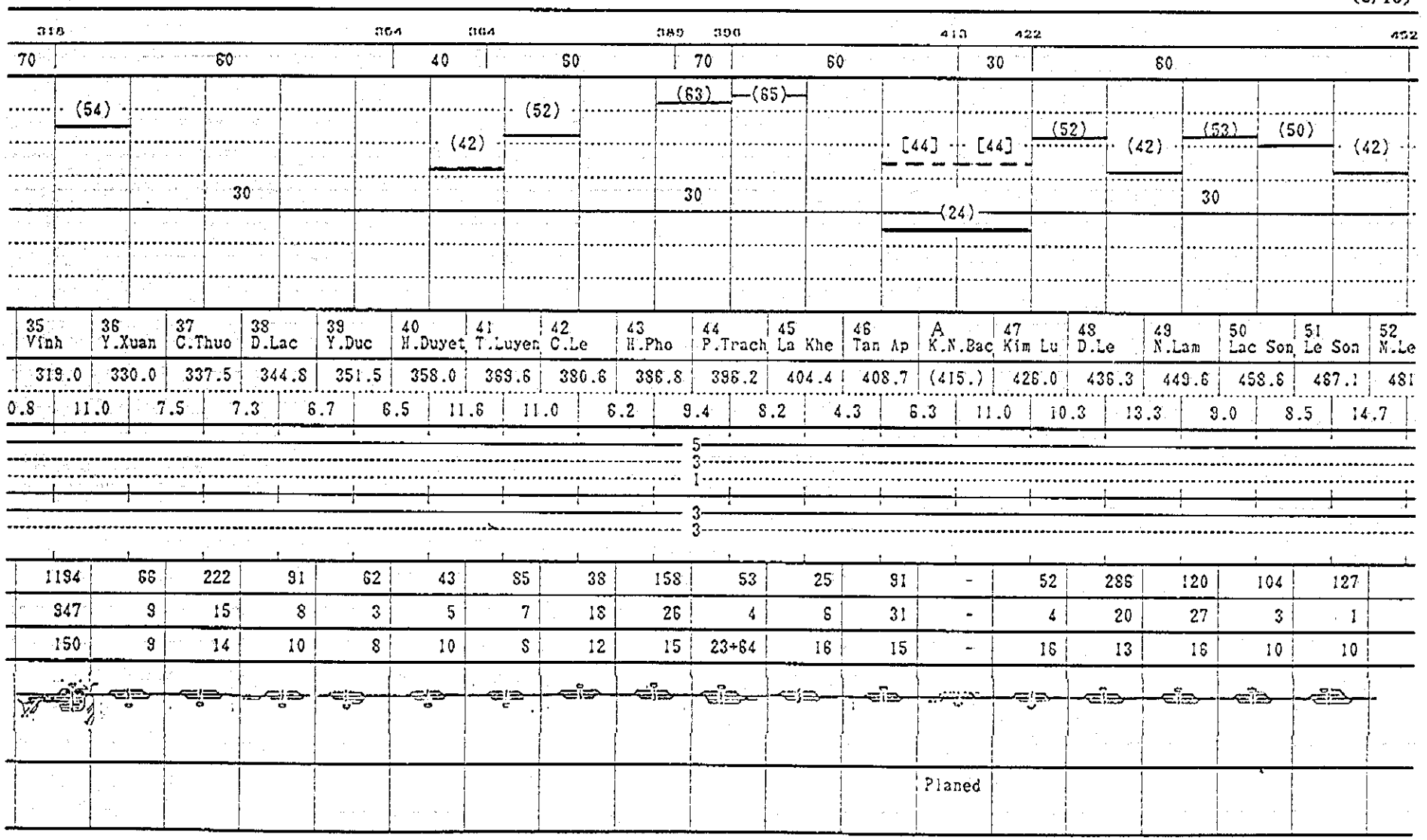
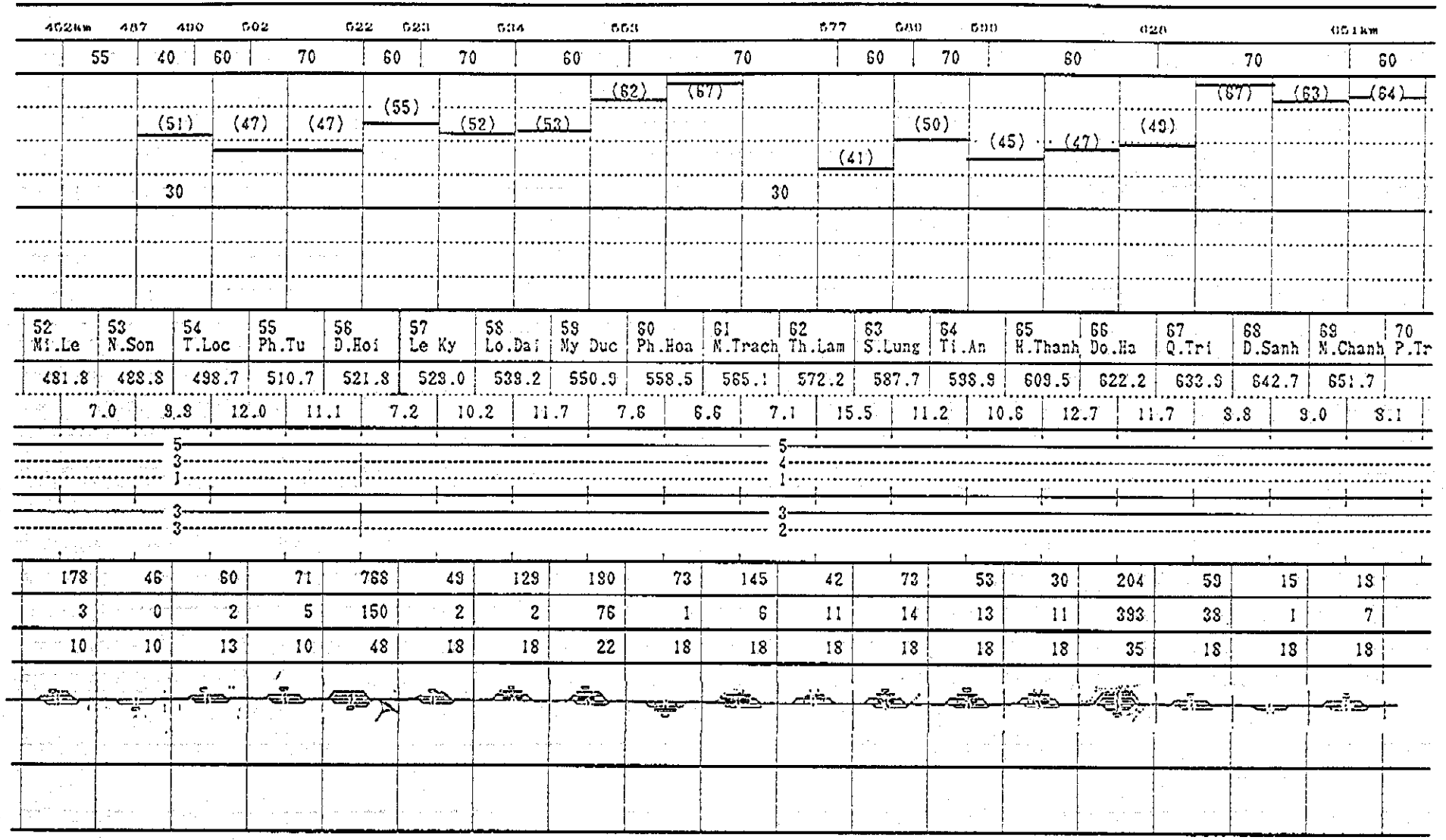
Appendix 8.3.1 Rough drawing of Track Layout and Capacity, etc. (Hanoi～Ho Chi Minh)

Max.Sp.2000		60	0km	10km	80km/h													
Max.Sp.1995		30	0km	50	80km/h													
Track Capasity (2000)	60													(50)				
	50																	
	40		44		48					42							38	
No. of Trains (2000) (up& down)	30																	
	20																	
	10	14																
Station		1 Hanoi	2 G.Bat	3 V.Dien	4 T.Tin	5 C.Tia	6 P.Xuyen	7 D.Van	8 P.Ly	9 B.Luc	10 Cau Ho	11 D.Xa	12 N.Dinh	13 N.Goi	14 C.Dang	15 N.Binh	16 C.Yen	17 Chenh
Distance(km)		0	5.2	8.9	17.4	25.5	33.3	44.7	55.9	66.5	72.9	81.0	86.8	100.8	107.6	114.6	120.4	125.0
Section (km)			5.2	3.7	8.5	8.1	7.8	11.4	11.2	10.6	6.4	8.1	5.8	14.0	6.8	7.0	5.8	4.6
Train Operation Plan (2000)	L.Ex		5	5							5							
	I.Ex		2	4							4							
	Loc.			5							2							
	T.F.			3	3						3						3	
	I.F.			2							2						2	
	Loc.			5	5						5						3	
Pass.(p/day)		2,850	38	-	45	43	37	73	183	116	60	22	745	54	22	87	1	
Carg.(ton/日)		-	534	388	8	8	10	17	21	8	2	8	38	7	1	434	154	
No.of Staff		447	246	49	15	15	20	16	64	12	12	11	115	18	11	50	16	
Rough drawing of the Station																		
Remarks																		

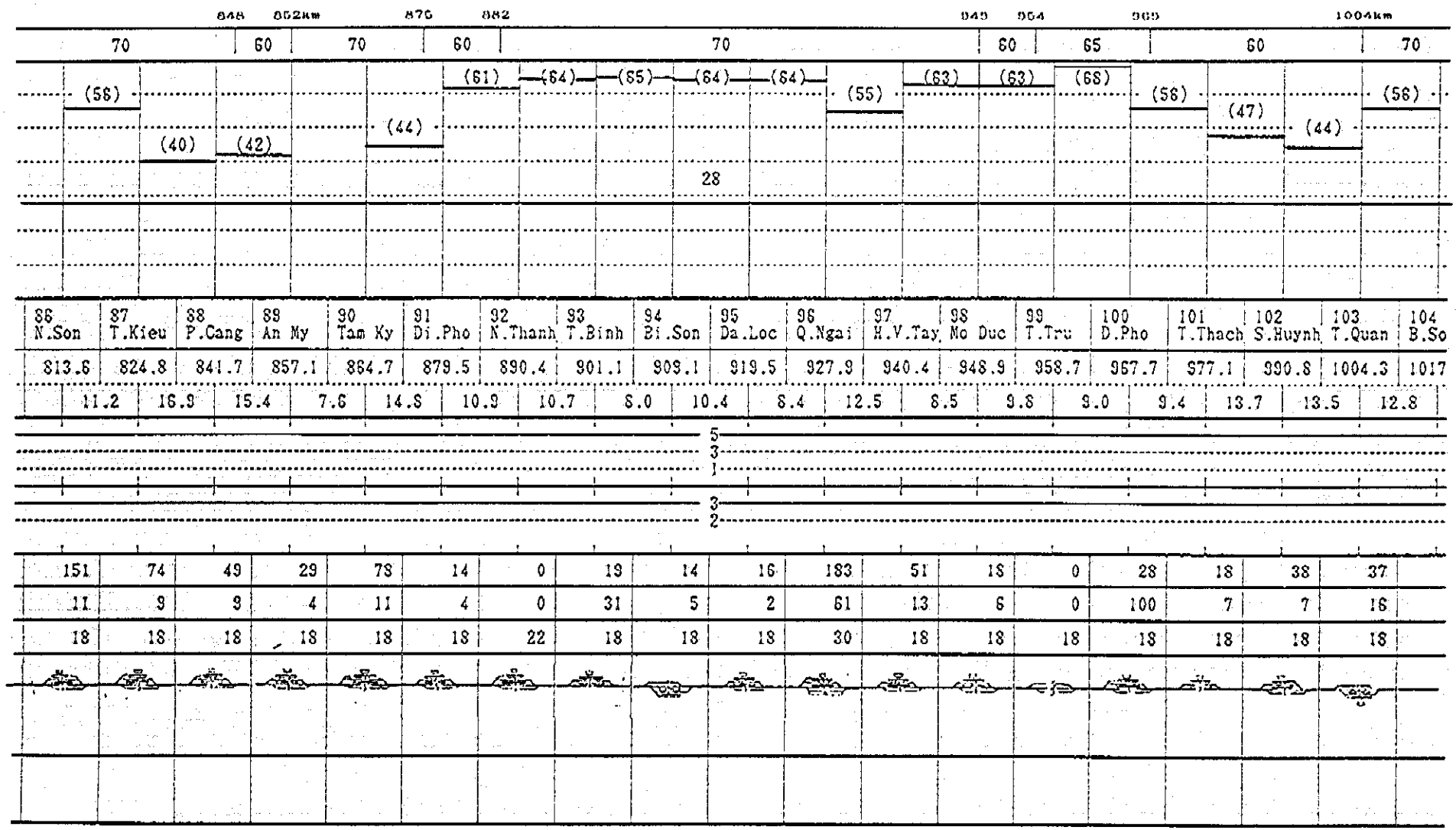

80
158Km
167
170Km
185Km
262
270
302
318
60
70
60
70
60
70
60
70
(60)
(52)
(58)
(58)
(57)
(46)
(42)
(41)
(46)
(41)
38
30
17 Ghenh
18 D.Giao
19 B.Son
20 D.Len
21 N.Trang
22 T.Hoa
23 Y.Thai
24 M.Khoi
25 T.Long
26 V.Trai
27 K.Truo
28 T.Lam
29 H.Mai
30 C.Giat
31 Y.Ly
32 Ch.Sy
33 My Ly
34 Q.Hanh
35 Vinh
125.0
133.7
141.5
152.3
161.0
175.2
187.9
196.9
207.0
219.0
229.0
237.8
245.4
261.0
271.6
279.0
291.6
308.2
319
8.7
7.8
10.8
8.7
14.2
12.7
9.8
10.1
12.0
10.0
8.8
7.6
15.6
10.6
7.4
12.6
16.6
10.8
5
4
2
5
3
1
3
2
3
3
3
11
17
99
34
47
579
98
144
132
52
19
0
28
28
8
28
12
17
4
64
2201
4
5
127
122
21
12
14
5
175
5
15
17
48
3
10
22
31+43
142
10
12
135
13
11
11
9
12
14+56
9
47
14
16
18
12

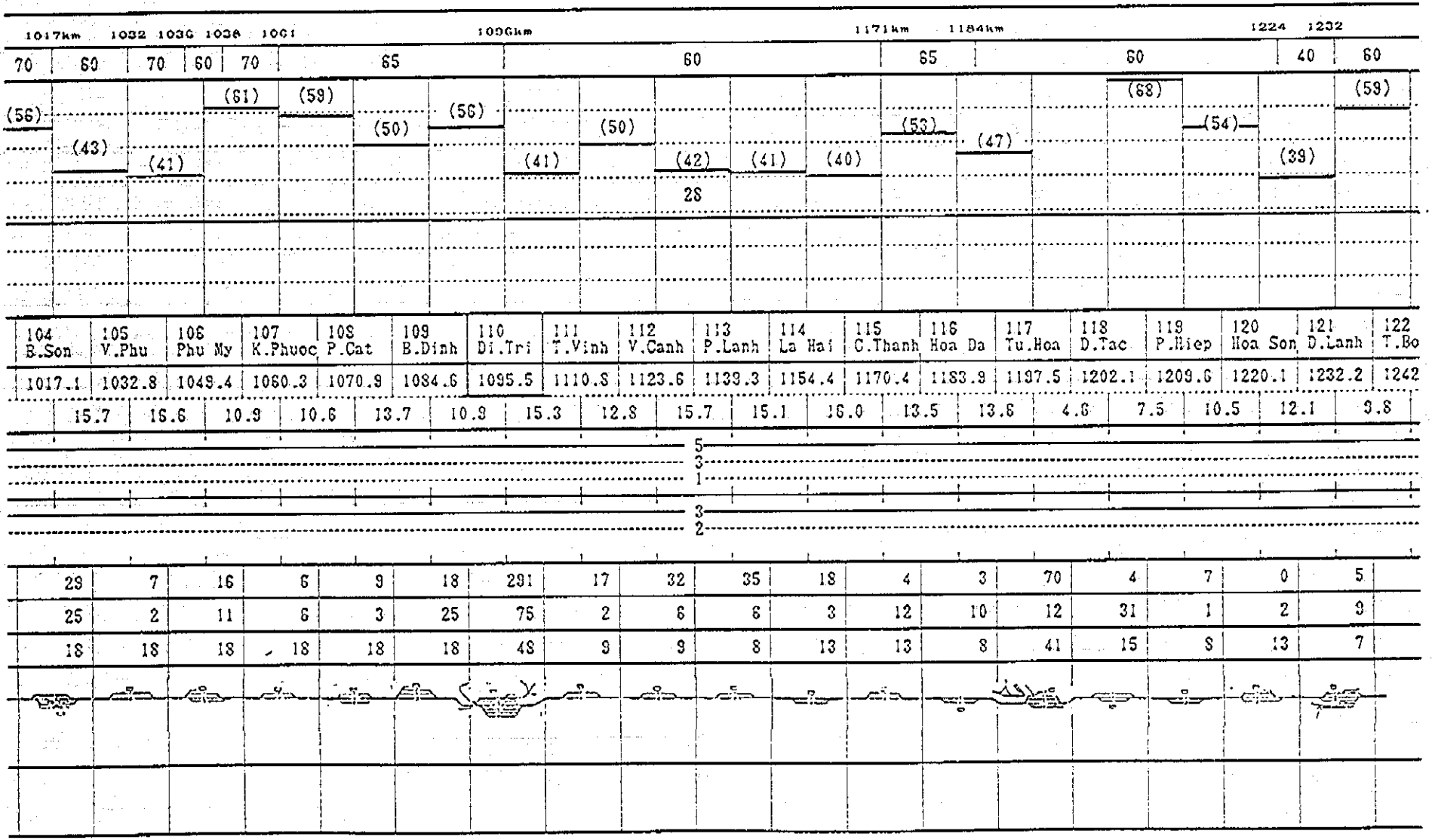

318
364
364
389
396
413
422
432
70
60
40
50
70
60
30
60
(54)
(42)
(52)
(63)
(65)
[44]
[44]
(52)
(42)
(53)
(50)
(42)
30
30
30
(24)
35 Vinh
36 Y.Xuan
37 C.Thuo
38 D.Lac
39 Y.Duc
40 H.Duyet
41 T.Luyen
42 C.Le
43 H.Pho
44 P.Trach
45 La Khe
46 Tan Ap
A K.N.Bac
47 Kim Lu
48 D.Le
49 N.Lam
50 Lac Son
51 Le Son
52 N.Le
319.0
330.0
337.5
344.8
351.5
358.0
369.6
380.6
386.8
396.2
404.4
408.7
(415.)
426.0
436.3
449.6
458.6
467.1
481
0.8
11.0
7.5
7.3
6.7
6.5
11.6
11.0
6.2
9.4
8.2
4.3
6.3
11.0
10.3
13.3
9.0
8.5
14.7
5
3
1
3
3
1194
66
222
91
62
43
85
38
158
53
25
91
-
52
286
120
104
127
947
9
15
8
3
5
7
18
26
4
8
31
-
4
20
27
3
1
150
9
14
10
8
10
8
12
15
23+64
16
15
-
16
13
16
10
10
Planed

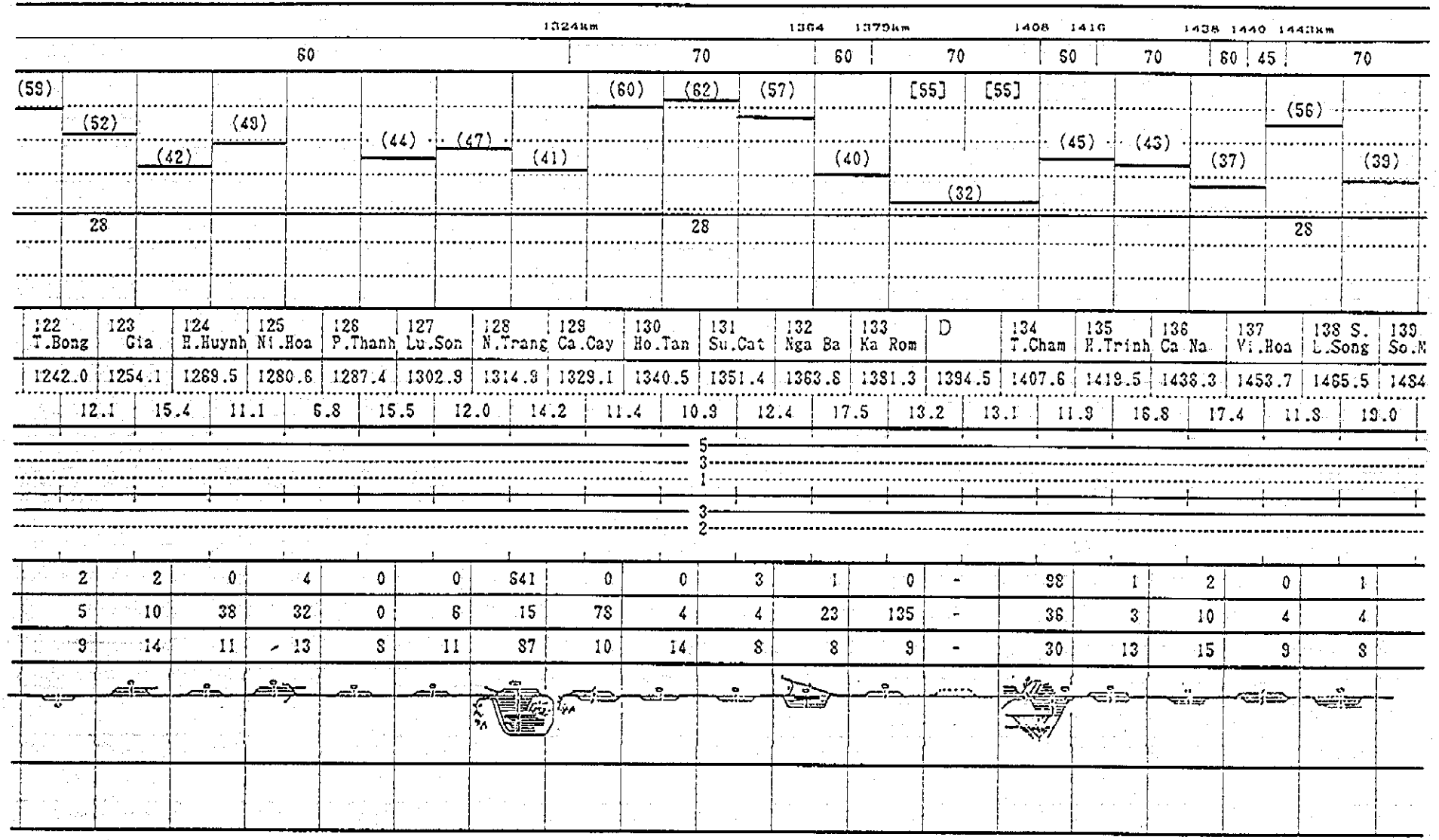

402km 487 490 502 522 523 534 553 577 590 599 620 651km
55 40 60 70 60 70 60 70 60 70 80 70 60
(51) (47) (47) (55) (52) (53) (62) (67) (41) (50) (45) (47) (49) (67) (63) (64)
30 30
52 Mi.Le 53 N.Son 54 T.Loc 55 Ph.Tu 56 D.Hoi 57 Le Ky 58 Lo.Dai 59 My Duc 60 Ph.Hoa 61 M.Trach 62 Th.Lam 63 S.Lung 64 Ti.An 65 H.Thanh 66 Do.Ha 67 Q.Tri 68 D.Sanh 69 M.Chanh 70 P.Tr
481.8 488.8 498.7 510.7 521.8 523.0 538.2 550.9 558.5 565.1 572.2 587.7 598.9 609.5 622.2 633.9 642.7 651.7
7.0 9.8 12.0 11.1 7.2 10.2 11.7 7.6 6.6 7.1 15.5 11.2 10.6 12.7 11.7 8.8 9.0 8.1
5 3 1 3 3 5 4 1 3 2
178 46 60 71 768 49 129 180 73 145 42 73 53 30 204 59 15 18
3 0 2 5 150 2 2 76 1 6 11 14 13 11 393 38 1 7
10 10 13 10 48 18 18 22 18 18 18 18 18 18 35 18 18 18

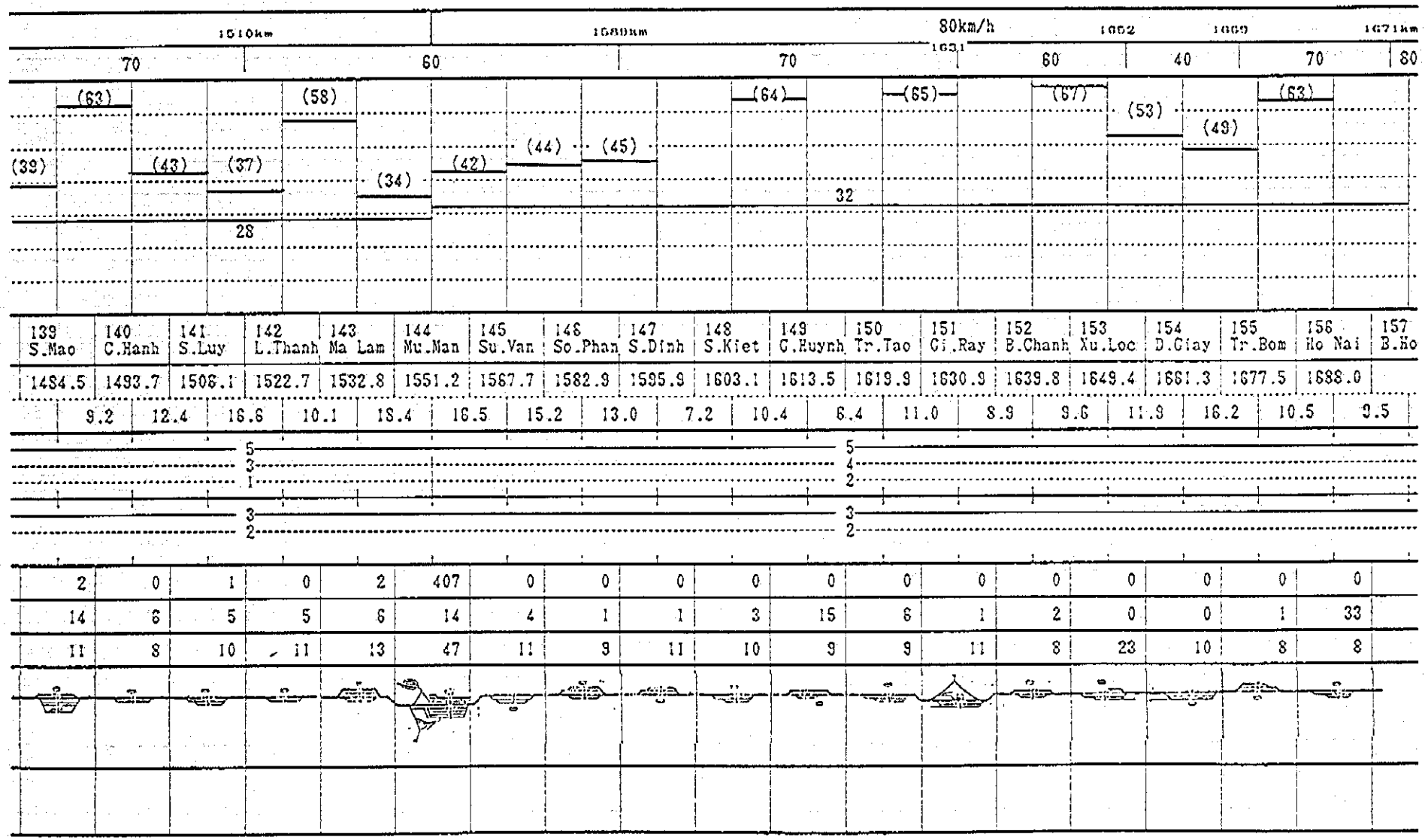
659	670	685	693	725	730	745	750	770	788	792	794	801
60	70	60	50	70	50	70	50	30	60	40	40	50	60	70

	70 P.Trach	71 Hi.Sy	72 Van Xa	73 Hue	74 H.Thuy	75 Truoi	76 Ca.Hai	77 Th.Luu	B	78 La.Co	79 H.V.Bac	C	81 H.V.Nam	82 K.Lien	83 Th.Khe	84 Da Nang	83 Th.Khe	85 L.Trach	86 No.S
	659.8	669.8	678.1	688.3	698.7	715.3	729.4	741.6	(748.3)	755.4	760.7	785	771.6	776.9	788.3	791.4	(788.3)	804.1	813
		10.0	8.3	10.2	10.4	16.6	14.1	12.2	6.7	7.1	5.3	4.3	6.6	5.3	11.4	3.1	(3.1)	12.7	9.5
		5							5									5	
		4							5									3	
		1							1									1	
		3							3									3	
		2							3									2	
	17	19	18	1198	21	50	88	39	-	190	0	-	0	56	29	1670	-	35	
	3	2	15	177	46	9	5	9	-	45	0	-	0	58	0	312	-	2	
	18	18	18	70	18	18	18	18	-	35	15	8	15	15	15	193	-	18	
									Planed			Planed							


848
852km
876
882
949
964
969
1004km
70
60
70
60
70
60
65
60
70
(56)
(40)
(42)
(44)
(61)
(64)
(65)
(64)
(64)
28
(55)
(63)
(63)
(68)
(56)
(47)
(44)
(56)
86 N.Son
87 T.Kieu
88 P.Cang
89 An My
90 Tam Ky
91 Di.Pho
92 N.Thanh
93 T.Binh
94 Bi.Son
95 Da.Loc
96 Q.Ngai
97 H.V.Tay
98 Mo Duc
99 T.Tru
100 D.Pho
101 T.Thach
102 S.Huynh
103 T.Quan
104 B.So
813.6
824.8
841.7
857.1
864.7
879.5
890.4
901.1
909.1
919.5
927.9
940.4
948.9
958.7
967.7
977.1
990.8
1004.3
1017
11.2
16.9
15.4
7.6
14.8
10.9
10.7
8.0
10.4
8.4
12.5
8.5
9.8
9.0
9.4
13.7
13.5
12.8
5
3
1
3
2
151
74
49
29
78
14
0
19
14
16
183
51
18
0
28
18
38
37
11
9
9
4
11
4
0
31
5
2
61
13
6
0
100
7
7
16
18
18
18
18
18
18
22
18
18
18
30
18
18
18
18
18
18
18


1017km 1032 1036 1036 1061 1095km 1171km 1184km 1224 1232
70 60 70 60 70 65 60 65 60 40 60
(56) (43) (41) (61) (59) (50) (56) (41) (50) (42) (41) (40) (53) (47) (68) (54) (39) (59)
28
104 B.Son
105 V.Phu
106 Phu My
107 K.Phuoc
108 P.Cat
109 B.Dinh
110 Di.Tri
111 T.Vinh
112 V.Canh
113 P.Lanh
114 La Hai
115 C.Thanh
116 Hoa Da
117 Tu.Hoa
118 D.Tac
119 P.Hiep
120 Hoa Son
121 D.Lanh
122 T.Bo
1017.1 1032.8 1049.4 1060.3 1070.9 1084.6 1095.5 1110.8 1123.6 1139.3 1154.4 1170.4 1183.9 1197.5 1202.1 1209.6 1220.1 1232.2 1242
15.7 16.6 10.9 10.6 13.7 10.9 15.3 12.8 15.7 15.1 16.0 13.5 13.6 4.6 7.5 10.5 12.1 9.8
5
3
1
3
2
29 7 16 6 9 18 291 17 32 35 18 4 3 70 4 7 0 5
25 2 11 6 3 25 75 2 6 6 3 12 10 12 31 1 2 3
18 18 18 18 18 18 48 9 9 8 13 13 8 41 15 8 13 7


1324km
1364
1379km
1408
1416
1438
1440
1443km
60
70
60
70
60
70
60
45
70
(59)
(52)
(42)
(49)
(44)
(47)
(41)
(60)
(62)
(57)
(40)
[55]
[55]
(32)
(45)
(43)
(37)
(56)
(39)
28
28
28
122 T.Bong
123 Gia
124 H.Huynh
125 Ni.Hoa
126 P.Thanh
127 Lu.Son
128 N.Trang
129 Ca.Cay
130 Ho.Tan
131 Su.Cat
132 Nga Ba
133 Ka Rom
D
134 T.Cham
135 H.Trinh
136 Ca Na
137 Vi.Hoa
138 S. L.Song
139 So.N
1242.0
1254.1
1269.5
1280.6
1287.4
1302.9
1314.9
1329.1
1340.5
1351.4
1363.8
1381.3
1394.5
1407.6
1419.5
1438.3
1453.7
1465.5
1484
12.1
15.4
11.1
6.8
15.5
12.0
14.2
11.4
10.9
12.4
17.5
13.2
13.1
11.9
16.8
17.4
11.8
19.0
5
3
1
3
2
2 2 0 4 0 0 841 0 0 3 1 0 - 98 1 2 0 1
5 10 38 32 0 6 15 78 4 4 23 135 - 36 3 10 4 4
9 14 11 13 8 11 87 10 14 8 8 9 - 30 13 15 9 8


1510km
1580km
80km/h
1652
1669
1671km
70
60
70
60
40
70
80
(63)
(58)
(64)
(65)
(67)
(53)
(63)
(49)
(39)
(43)
(37)
(34)
(42)
(44)
(45)
32
28
139 S.Mao
140 C.Hanh
141 S.Luy
142 L.Thanh
143 Ma Lam
144 Mu.Man
145 Su.Van
146 So.Phan
147 S.Dinh
148 S.Kiet
149 G.Huynh
150 Tr.Tao
151 Ci.Ray
152 B.Chanh
153 Xu.Loc
154 D.Giay
155 Tr.Bom
156 Ho Nai
157 B.Ho
1484.5
1493.7
1506.1
1522.7
1532.8
1551.2
1567.7
1582.9
1595.9
1603.1
1613.5
1619.9
1630.9
1639.8
1649.4
1661.3
1677.5
1688.0
9.2
12.4
16.6
10.1
18.4
16.5
15.2
13.0
7.2
10.4
6.4
11.0
8.9
9.6
11.9
16.2
10.5
9.5
5
3
1
3
2
5
4
2
3
2
2 0 1 0 2 407 0 0 0 0 0 0 0 0 0 0 0 0
14 6 5 5 6 14 4 1 1 3 15 6 1 2 0 0 1 33
11 8 10 11 13 47 11 9 11 10 9 9 11 8 23 10 8 8

1684 1606km	80km/h					60	
80	60	55			1722	30	
32	38		28				
157 Bi.Hoa	158 Di An	159 S.Than	160 Th.Duc	161 B.Trieu	162 Go Vap	163 Saigon	
1697.5	1706.7	10.6	1713.5	1718.3	1722.1	1726.2	
5	9.2	3.9	2.9	4.8	3.8	4.1	
5			5				
4			4				
2			5				
	3						
	2						
2	1	0	0	3	0	2040	
0	34	433	0	1	0	123	
34	19	71	14	23	37	180	4,552 Person
							Union1: 2,267# # 2: 1,261# # 3: 1,024#

Appendix 8.3.2 Operating Accidents and Train Delays

(1993)

Area	1	2	3	4	5	6	Total	Operation Delay
Stations			6		10	111	127	96H37'
Locomotives			2		5	360	367	533H28'
Track			12		1	43	56	68H22'
Rolling Stock			4		1	713	718	464H59'
Telecommunication			–			28	28	9H17'
Bridges			4		2	16	22	37H54'
External		1	25	201	1	331	559	789H14'
Unknown			2				2	114H43'
Total	–	1	55	201	20	1,602	1,879	2,128H30'

(1994)

Area	1	2	3	4	5	6	Total	Operation Delay
Stations			5		2	72	79	61H06'
Locomotives			3		7	354	364	503H00'
Track			9		1	29	39	58H23'
Rolling Stock			9		2	656	666	430H43'
Telecommunication			1		–	20	22	4H26'
Bridges			3		2	6	11	72H30'
External	2	1	24	214	2	217	460	758H21'
Unknown			7		–	–	7	293H46'
Total	2	1	61	214	16	1,354	1,647	2,181H21'

Appendix 8.3.3 Operation Regulations (JR case example)

1. Operation Regulations for Heavy Rain

Lines and sections that may be vulnerable to damage from heavy rain are designated in advance, and rain alarms are installed in necessary areas.

The rain alarms go off in the following manner according to the type of rain alarm installed in each operation regulation section, and operation regulations are implemented in response to these alarm operations.

Table 1 Alarm Displays and Regulation Speeds, etc.

Type	Alarm Display	A Section	B Section	C Section
Security ringing	White lamp on and buzzer sounds	Security	Security	Security
Caution ringing	Yellow lamp on and buzzer sounds	45 km/h or less	35 km/h or less	25 km/h or less
Alarm ringing	Red lamp on and buzzer sounds	35 km/h or less	25 km/h or less	No running

In cases where rain alarms go off as a result of accumulated rainfall, operating speed on all sections is to be 25 km/h or less.

Moreover, in cases where lines are flooded and the rails are inundated to a certain depth, train operations shall be suspended depending on the type of rolling stock.

(Example) 25 mm or more : Electric railcar
50 mm or more : Electric and diesel engines
80 mm or more : Passenger cars and diesel cars
200 mm or more : Freight cars
250 mm or more : Steam locomotives

There are five types of rain alarm (A-model to E-model), and they sound off (with different ringing types) according to the set rainfall level.

Fig. 1 illustrates an example of a rain alarm installation.

Incidentally, hourly rainfall refers to the amount of rainfall in the past hour, whereas continuous rainfall refers to the amount of rain that falls from the start until the end of the rain. (Anything within 24 hours is seen as a rainfall series).

When a rain alarm goes off, the designated maintenance section chief (line maintenance, power, signaling and telecommunication section chiefs, etc.) shall patrol the problem site and contact the operation dispatching center depending on the type of alarm, and the dispatching center shall alert the train drivers and conductors to make sure that the train operation regulation is carried out.

Trains can be alerted either through train wireless, etc. or through station masters.

Regulations shall be released in the same manner when the hourly rainfall drops below the alarm line and after a certain amount of time has elapsed.

2. Operation Regulations for Strong Winds

In the case of strong winds, as in the case of heavy rain, wind alarms are installed in necessary areas and the operation regulations indicated in Table 2 shall be carried out when the alarms go off.

Table 2 Wind Alarm Displays and Operation Regulations, etc.

Wind Velocity	Alarm Type	Regulation Speed
Between 20 m/s and 25 m/s	Alarm ringing	25 km/h or less
Over 25 m/s	Stop ringing	Suspension of train operation.

The same regulations shall apply to cases where there is no wind gauge and it is thought that the wind velocity has reached the regulation value.

Moreover, station masters at stations that are installed with wind gauges shall, in cases where the wind velocity has reached 10 m/s, continue to make measurements.

Implementation of the operation regulations is basically the same as in the case of heavy rain, however, station masters shall be able to impose regulations on their own initiative and then contact the related areas.

3. Operation Regulations for Earthquake

Earthquake alarms operate in the manner shown in Table 3.

Table 3 Earthquake Alarm Alarms and Displays and Operation Regulations, etc.

Acceleration Rate	Alarm Type	Alarm Display	Regulation Speed
Between 40 gal and 80 gal (equivalent to level 4 on Japanese scale of seismic intensity)	Alarm ringing	Yellow light on and buzzer sounds	25 km/h or less
Over 80 gal (equivalent to level 5 on the Japanese scale of seismic intensity)	Stop ringing	Red light on and buzzer sounds	Suspension of train operation

In cases where an earthquake alarm goes off (receives a report), the transportation dispatching officer shall give commands in accordance with the above operation regulations.

Train drivers shall stop their trains and avoid risk areas in cases where they sense an earthquake and consider the train to be at risk, or in cases where have received a command to that effect.

Maintenance section chiefs shall immediately patrol the designated sections and report back to the dispatching officers on the necessity of the regulations, and so on.

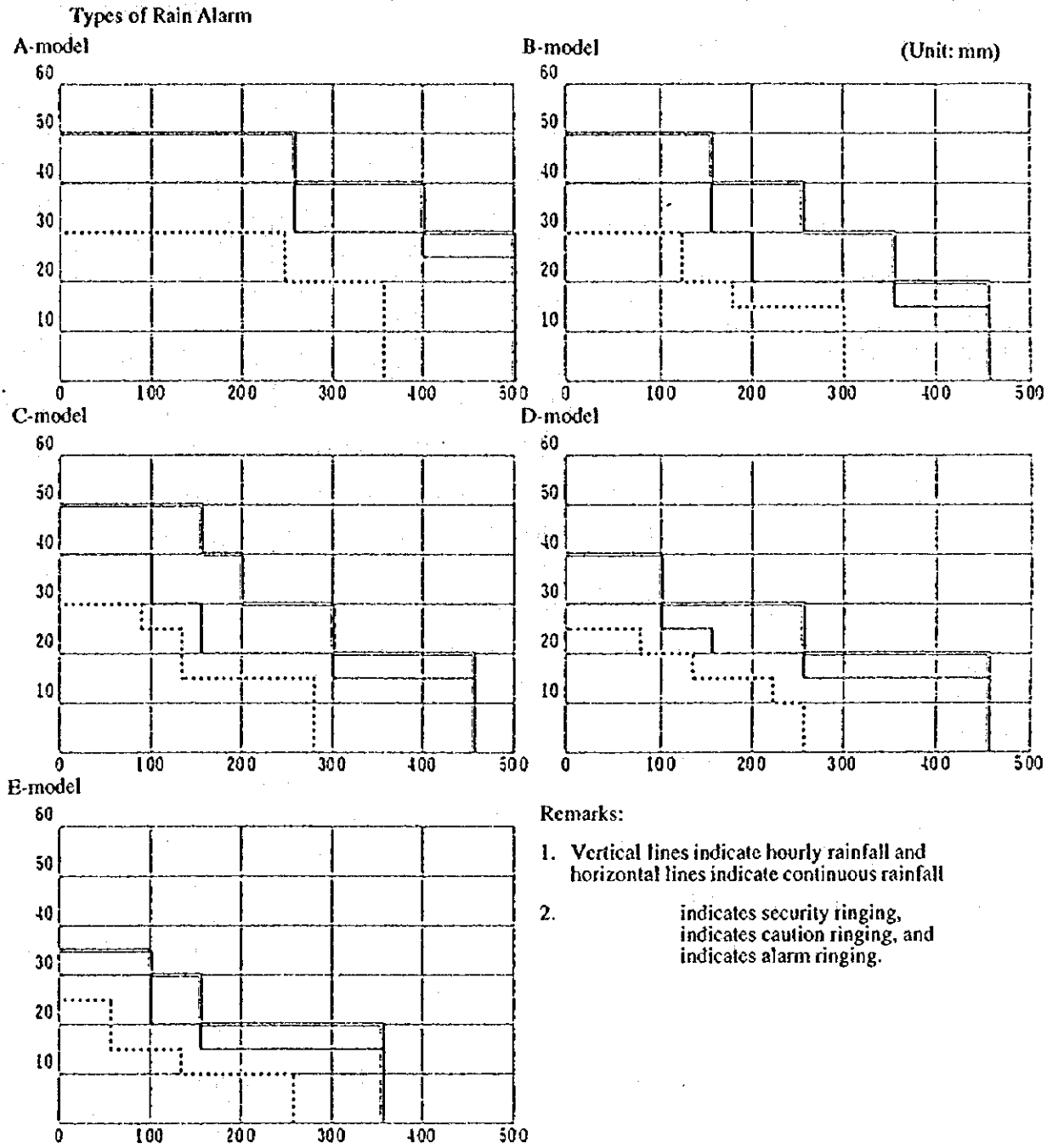


Fig. 1 Types of Rain Alarm and Settings

Appendix 8.3.4 Operating Performance of Locomotives and Running Resistance, etc.

1. Operating Performance of Main Locomotives

The running curves of locomotives and traction engines are indicated in Fig. 1.

2. Running Resistance, etc.

The running resistance for each type of locomotive is calculated through the following expressions.

(1) Running Resistance (rr)

DL :	Acceleration	r_{rE}	$= 1.72 + 0.0084\ V + 0.0369\ V^2/W$	(kg/ton)
	: Coasting	r_{re}	$= 2.45 + 0.0500\ V + 0.0481\ V^2/W$	(kg/ton)
PC :		r_{rp}	$= 1.74 + 0.0069\ V + 0.000313\ V^2$	(kg/ton)
FC :		r_{rf}	$= 1.60 + 0.00077\ V^2$	(kg/ton)

However, V: Operation speed (km/h)
W: Locomotive or train weight (kg)

(2) Gradient Resistance (rg)

The acceleration and deceleration gradient correction (βr) on a gradient section (r‰) is obtained by the following expression.

$$\beta\gamma = \beta L \pm 0.033\,\gamma \qquad \text{(km/h/sec)}$$

However, βL: Acceleration and deceleration (km/h/sec) on flat line.

(3) Curve Resistance

The curve resistance on a curve radius Rm is obtained by the following expression.

$$r_c = 800/R \qquad \text{(kg/ton)}$$

3. Haulage Capacity and Train Formation, etc.

The haulage capacity and train formation, etc. are calculated by means of the following expression.

$$A = 0.7\,X\,(17 + 32 \times 0.85) + 0.3X \times 17$$

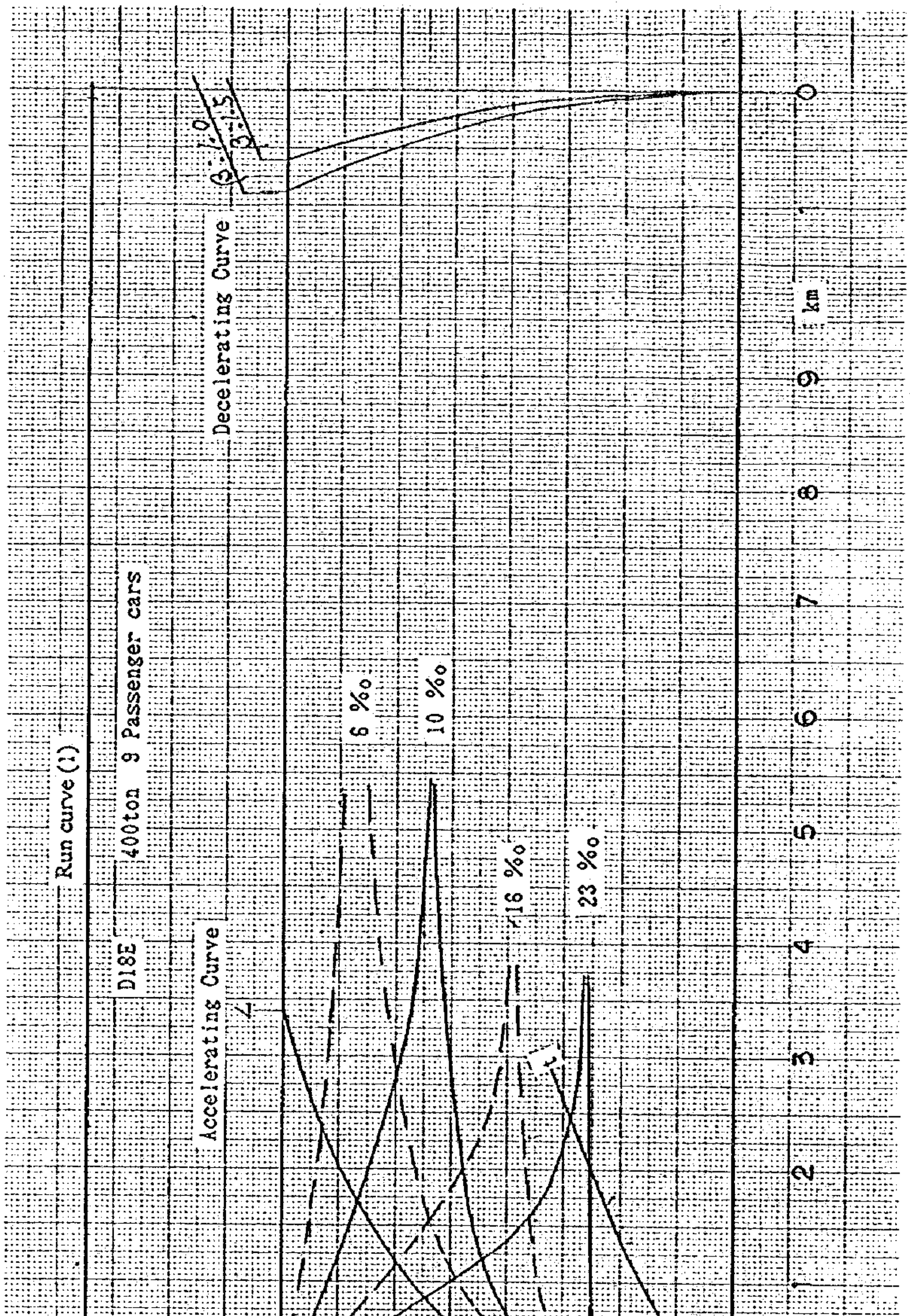
$$X = A/36$$

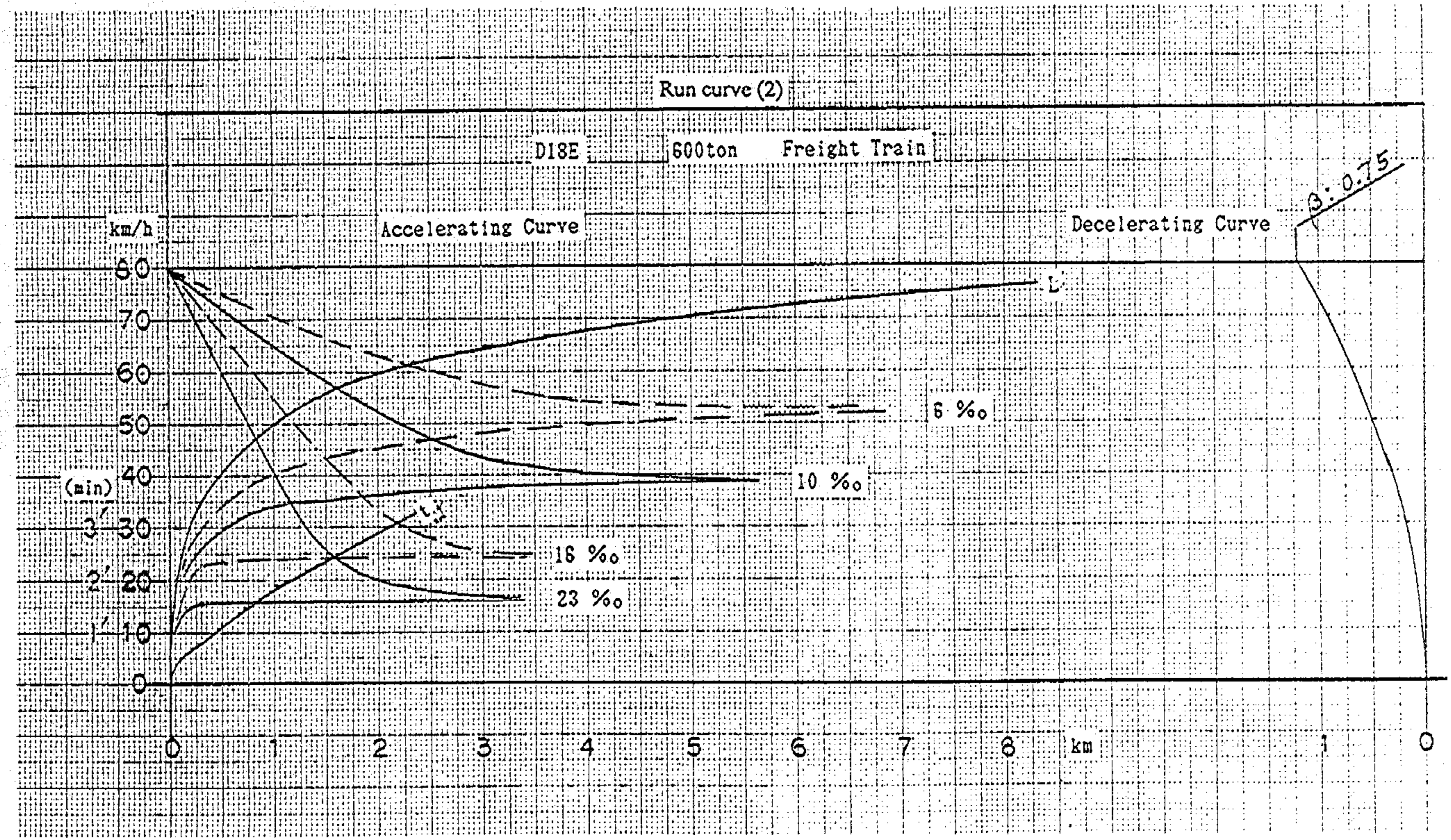
A	:	Haulage capacity (ton)	0.7	:	Loaded car ratio
X	:	Formation cars (cars)	0.85	:	Load factor
17	:	Car tare weight (ton)	0.3	:	Empty car ratio
32	:	Net weight (ton)			

According to the above expression, the net tonnage of a freight train with a haulage capacity of 800 tons will be:

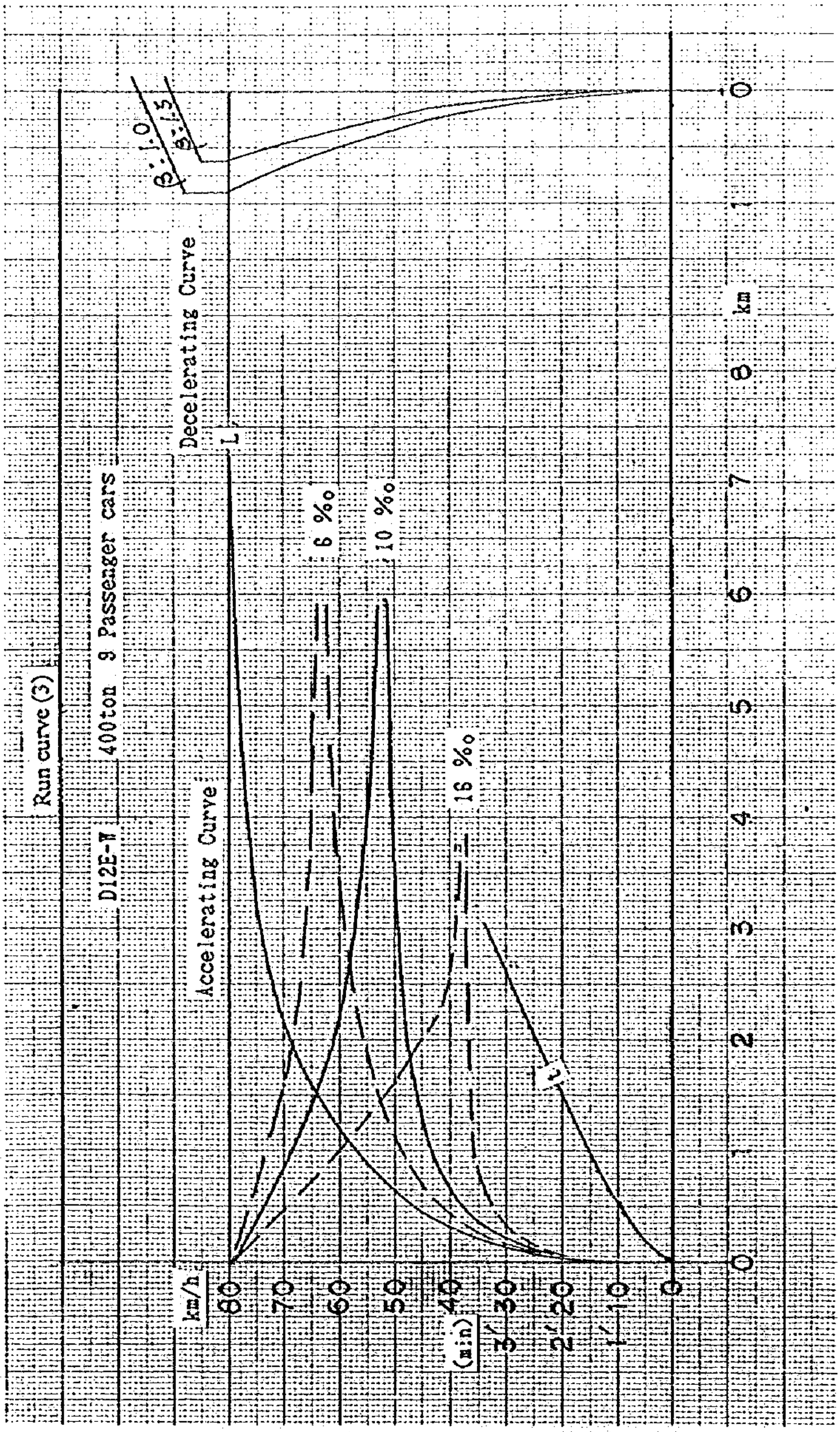
X = 22 cars, Loaded cars = $22 \times 0.7 = 15$ cars. Therefore:

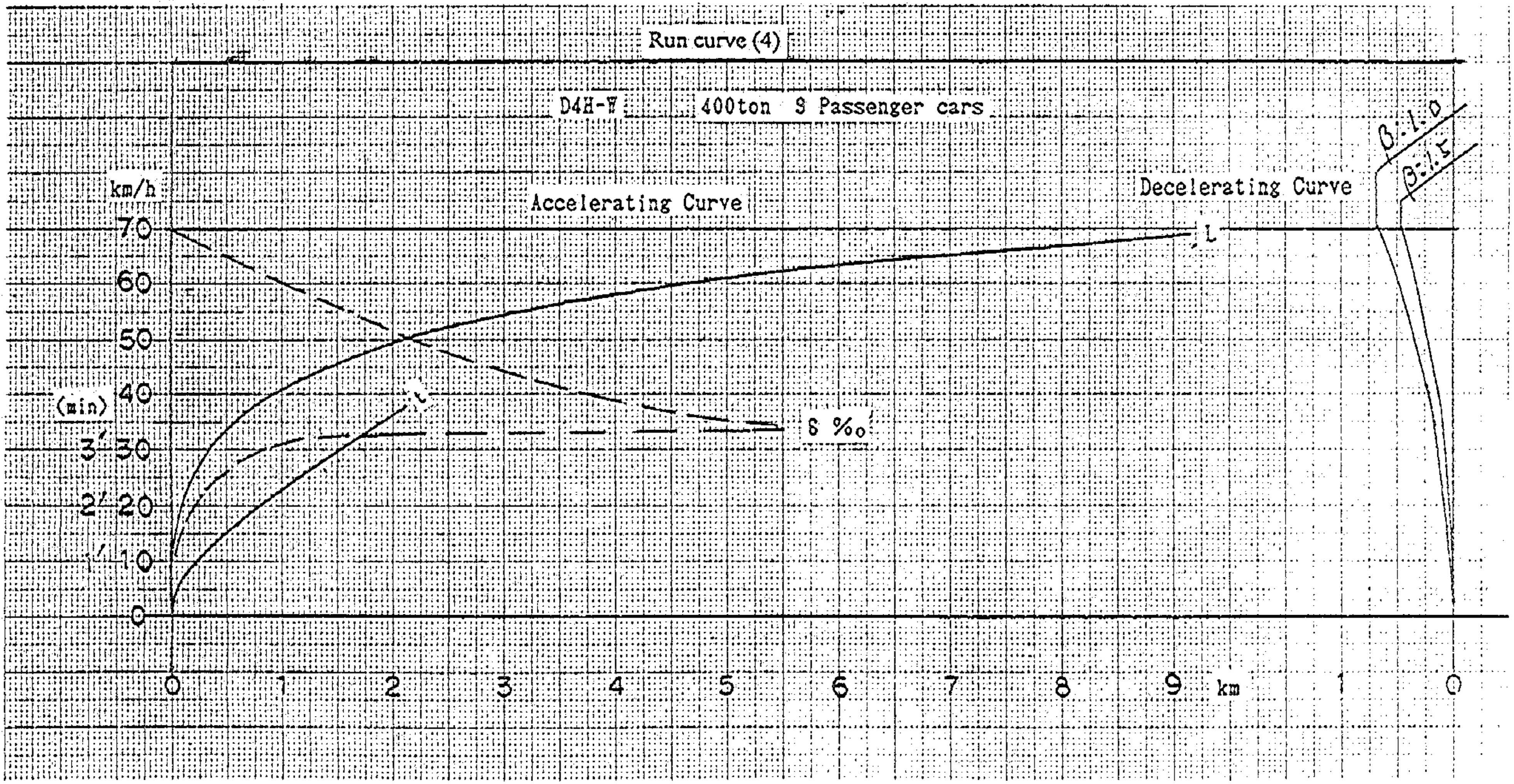
Net tonnage = $15 \times 32 \times 0.85 \fallingdotseq 410$ tons


Run curve (1)
D18E
400ton 9 Passenger cars
Accelerating Curve
Decelerating Curve
6 ‰
10 ‰
16 ‰
23 ‰
km/h
(min)
km



Run curve (2)
D18E
600ton Freight Train
Accelerating Curve
Decelerating Curve
3: 0.75
km/h
80
70
60
50
40
30
20
10
0
(min)
3′
2′
1′
L
t.X
6 ‰
10 ‰
16 ‰
23 ‰
0
1
2
3
4
5
6
7
8
km
1
0


Run curve (3)
D12E-W 400ton 9 Passenger cars
Accelerating Curve
Decelerating Curve
L
6 ‰
10 ‰
16 ‰
t
β: 1.0
β: 1.5
km/h
80
70
60
50
40
30
20
10
0
(min)
3'
2'
1'
0
1
2
3
4
5
6
7
8
km
1
0


Run curve (4)
D4H-W 400ton 8 Passenger cars
Accelerating Curve
Decelerating Curve
β:1.0
β:1.5
km/h
70
60
50
40
(min)
3′ 30
2′ 20
1′ 10
0
L
t
8 ‰
0
1
2
3
4
5
6
7
8
9
km
1
0

Appendix 8.3.5 Hauling Capacity and Train speed by Gradient

1. Passenger Trains (km/h)

Loco	T.W.	Gradient (‰)								Transport Capa.		
	ton	L	6	8	10	13	16	17	23	Tra.	For.	Par.
	300	80	80	72	64	56	47	45	35	Exp.	7	420
D18E	350	80	77	67	59	50	43	41	30	〃	8	S420
	390	80	72	62	55	47	39	37	27	〃	9	S400
	430	80	67	59	52	43	36	34	25	〃	10	S470
	480	80	62	55	48	39	32	30	22	〃	11	
	520	80	60	52	45	37	30	28	21	〃	12	
D 12	220	80	66	57	51	44	38	36	28	Loc.	4+1	320
S	260	80	61	52	50	43	37	36	28	〃	5+1	400
	300	67	51	44	38	32	27	26	23	〃	6+1	480
W	300	80	72	68	63	54	47	45	36	Exp.	7	S290
	350	80	70	65	58	49	43	41	32	〃	8	S400
	390	80	67	61	53	46	40	38	30	〃	9	S450
	430	80	66	57	50	43	38	36	28	〃	10	S570
	480	80	63	53	47	41	35	33	26	〃	11	
	520	80	60	52	45	38	33	31	25	〃	12	
D13E	220	80	80	78	72	65	57	54	44	Loc.	4+1	320
S	260	80	78	64	57	48	41	39	31	〃	5+1	400
	300	80	66	60	52	43	37	35	27	〃	6+1	480
W	300	80	80	78	72	65	57	54	45	Exp.	7	420
	350	80	80	75	68	60	52	50	41	〃	8	S400
	390	80	78	72	65	56	49	47	38	〃	9	S450
	430	80	76	70	62	53	47	45	36	〃	10	S570
	480	80	73	65	58	50	44	42	32	〃	11	
	520	80	71	63	55	48	42	40	30	〃	12	
D11H	220	80	63	56	48	40	37	36	28	Loc.	4+1	320
S	260	80	58	50	45	38	34	33	25	〃	5+1	400
	300	79	53	46	40	35	30	29	20	〃	6+1	480

Note: Locomotive-S: Single Loco. -W: Double Loco. operation.
T.W. : Train Weight(ton)
For. : Train Formation. S400: Including sleeping cars.
4+1 : 4 Passenger cars and 1 Baggage car.

(Passenger Trains)

Loco	T.W.	Gradient (‰)								Transport Capa.		
	ton	L	6	8	10	13	16	17	23	Tra.	For.	Par.
D9E	220	80	62	55	49	42	37	36	27	Loc.	4+1	320
S	260	80	57	52	45	38	33	32	24	Exp.	5+1	400
	300	80	53	47	41	35	30	28	20	〃	6+1	480
W	260	80	78	71	63	55	48	47	39	〃	6	370s
	300	80	74	65	56	51	45	43	36	〃	7	420s
	350	80	69	60	53	47	42	40	32	〃	8	510s
	390	80	65	57	50	44	39	37	30	〃	9	560
	430	80	61	54	48	42	37	36	28	〃	10	720
	480	80	57	50	46	40	35	33	25	〃	11	
	520	80	55	48	44	38	33	31	23	〃	12	
D4H	130	50	47	43	37	30	-	-	-	Loc.	3	240
S	180	50	41	34	28	22	-	-	-	〃	4	320
	220	50	35	28	23	19	-	-	-	〃	5	400
	260	50	30	24	20	16	-	-	-	〃	6	480
W	260	50	48	44	37	28	-	-	-	Exp.	6	S370
	300	50	46	40	32	25	-	-	-	〃	7	
	350	50	42	34	27	22	-	-	-	〃	8	
	390	50	37	30	24	20	-	-	-	〃	9	
	430	50	35	27	23	19	-	-	-	〃	10	
D4H	130	70	55	48	34	27	-	-	-	Loc.	3	240
Imp.	180	70	35	32	26	20	-	-	-	〃	4	320
S	220	68	32	29	21	15	-	-	-	〃	5	400
W	300	70	42	37	30	24	-	-	-	〃	7	S420
	350	70	37	31	26	20	-	-	-	〃	8	
	390	70	33	28	21	15	-	-	-	〃	9	

Note: Imp. : Improved Locomotive.
370s : Only Seat cars

2. Freight Trains

Loco	T.W.	Gradient (‰)								Transport Capa.		
	ton	L	6	8	10	13	16	17	23	Tra.	For.	Par.
D18E	600	80	52	45	40	32	26	25	18	17	12	330
S	650	76	50	43	37	30	24	23	17	18	13	350
	700	75	47	40	35	27	23	21	-	19	14	380
	800	70	43	37	30	24	20	18	-	22	15	410
	900	67	40	32	27	21	18	17	-	25	18	490
	1000	65	37	30	25	19	-	-	-	28	20	540
	1200	60	31	25	20	-	-	-	-	33	24	650
D12E	300	78	51	45	38	32	27	26	22	8	6	160
S	330	72	50	44	37	32	27	25	20	Ex.7	7	210
	340	72	50	44	37	32	27	25	20	9	7	190
	350	71	48	43	37	32	27	25	20	10	7	190
	400	70	45	38	33	27	-	-	-	11	8	220
W	400	78	65	61	51	44	39	38	29	11	8	220
〃	450	77	60	54	48	41	36	34	27	13	9	240
〃	500	76	57	51	45	39	33	32	25	14	10	270
〃	550	75	55	47	43	36	31	30	23	15	11	300
〃	600	73	52	45	41	34	29	28	21	17	12	330
〃	650	72	50	44	39	32	27	26	20	18	13	350
〃	700	71	47	42	37	31	26	25	18	19	14	380
〃	750	70	45	40	35	29	24	23	17	21	15	410
〃	800	69	44	38	33	27	23	22	16	22	16	430
D13E	400	77	53	47	41	35	30	28	22	11	8	220
S	450	75	50	44	38	32	27	26	19	13	9	240
	500	70	47	41	36	30	25	24	17	14	10	270
	600	68	42	36	32	26	21	20	-	15	11	300
W	600	80	62	55	50	43	37	36	27	17	12	330
〃	700	79	57	51	45	38	33	31	24	19	14	380
〃	800	77	53	47	42	35	30	28	21	22	15	410
〃	900	75	50	44	38	32	27	25	18	25	18	490
D11H	300	74	50	45	39	35	31	29	21	8	6	160
S	400	68	43	38	34	29	23	22	-	11	8	220
W	500	79	57	50	43	38	34	33	25	14	10	270
〃	600	75	52	43	40	35	30	29	20	17	12	330
〃	700	72	46	41	37	32	27	25	15	19	14	380

Note: Ex. : Exclusive freight train

(Freight Train)

Loco	T.W.	Gradient (‰)								Transport Capa.		
	ton	L	6	8	10	13	16	17	23	Tra.	For.	Par.
D9E	300	74	50	45	40	35	30	28	20	8	6	160
	350	71	47	41	36	31	26	24	16	10	7	190
W	500	79	54	48	43	38	33	32	24	14	10	270
〃	550	77	52	46	42	36	31	30	22	15	11	300
〃	600	74	49	44	40	34	29	26	20	17	12	330
D4H	300	50	45	38	32	25	-	-	-	8	6	160
W	350	50	42	32	25	20	-	-	-	10	7	190
	400	50	37	29	24	20	-	-	-	11	8	220

◎ Exclusive Freight Train

Gross ton	Net ton	No. of Cars
330	210	7
380	240	8
420	270	9
470	300	10
520	330	11
560	360	12
610	390	13
660	420	14
700	450	15
750	480	16
800	510	17
850	540	18
900	570	19
940	600	20

Appendix 8.3.6 (1) Number of persons passing through the section and train operation plan

			1 - 6	6 -12	12-15	15-22	22-35	35-44	44-56	56-66	66-75	75-84	84-96	96-110	-117	-128	-134	-144	-P	142-154	-165	
No.-sec.	Down		3005	2885	2954	2859	2449	2547	2530	2876	2768	3449	2835	2614	2479	2510	2685	2611	480	3047	3055	
-(A)	Up		2929	2876	2884	2773	2377	2410	2393	2750	2842	3381	2507	2511	2353	2566	2556	2468	484	2527	2916	
Get on	Down	3005	9	553	42	470	838	211	1083	92	1166	740	143	205	65	484	89	207	-	9	-	
	Up	-	89	485	148	855	684	223	681	188	466	1545	146	344	40	275	159	88	484	1	2916	
Get off	Down	-	129	485	137	880	740	228	737	200	485	1553	164	340	33	289	165	88	480	1	3055	
	Up	2929	16	493	38	456	718	205	1019	101	1204	672	150	186	53	463	91	217	-	4	-	

No.-sec.L.Ex.-			898	898	917	919	1055	1287	1330	1484	1507	1766	1766	1739	1632	1615	1482	1287	-	1370	1370	
	Ex.		1425	1427	1566	1581	1182	1259	1068	1222	1249	1683	756	802	842	850	1173	1135	-	1283	1282	
	Total		2323	2324	2484	2500	2237	2547	2398	2706	2755	3449	2522	2541	2474	2465	2655	2522	0	2653	2652	
	others-		682	581	470	359	212	0	133	170	13	0	115	72	4	45	30	89	480	394	405	
No.-sec.L.Ex.-			889	889	905	907	1065	1250	1289	1428	1451	1705	1705	1677	1582	1543	1424	1315	-	1297	1297	
	Ex.		1408	1410	1525	1538	1118	1160	970	1144	1170	1678	703	756	786	786	1105	1167	-	1229	1229	
	Total		2298	2299	2430	2444	2181	2410	2259	2572	2620	3381	2408	2434	2368	2330	2530	2482	0	2527	2526	
	others-		632	577	453	329	196	0	133	158	22	0	101	77	5	36	27	6	484	0	301	

Passenger Train Operation Plan

No. of	S.Exp.		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	
Train	S.Exp.		4	4	4	4	4	4	3	4	4	4	4	4	4	4	4	4	0	4	4	
	L.Exp.		1	1	1	1	1	2	2	2	2	2	1	1	1	1	1	1	0	1	1	
	L.Exp.		3	3	3	3	2	1	1	2	2	3	2	2	2	2	2	2	0	3	3	
	Local		5	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	2	2	5	
	Total		14	11	11	11	9	9	9	10	10	11	9	9	9	9	9	9	2	11	14	
Transp.	S.Exp.	420	352	352	352	352	352	352	352	352	352	352	352	352	352	352	352	352	0	352	352	
Capa.	S.Exp.	420	1376	1376	1376	1376	1376	1376	1376	1376	1376	1376	1376	1376	1376	1376	1376	1376	0	1376	1376	
	Total		1728	1728	1728	1728	1728	1728	1728	1728	1728	1728	1728	1728	1728	1728	1728	1728	0	1728	1728	
	L.Exp.	460	368	368	368	368	368	736	736	736	736	736	368	368	368	368	368	368	0	368	368	
	L.Exp.	360	864	864	864	864	576	288	288	576	576	864	576	576	576	576	576	576	0	864	864	
	Total		1232	1232	1232	1232	944	1024	1024	1312	1312	1600	944	944	944	944	944	944	0	1232	1232	
Exp.C.	Total		2960	2960	2960	2960	2672	2752	2752	3040	3040	3328	2672	2672	2672	2672	2672	2672	0	2960	2960	
	Local	320	1088	512	512	512	256	256	256	256	256	256	256	256	256	256	256	256	512	512	1088	
(B)	C.Total	240	4048	3472	3472	3472	2928	3008	3008	3296	3296	3584	2928	2928	2928	2928	2928	2928	512	3472	4048	
(B)/(A)%			1.35	1.20	1.18	1.21	1.20	1.16	1.19	1.15	1.19	1.04	1.11	1.12	1.18	1.17	1.09	1.12	1.07	1.14	1.33	
			1.38	1.21	1.20	1.25	1.23	1.25	1.26	1.21	1.25	1.06	1.17	1.17	1.24	1.24	1.15	1.18	1.06	1.37	1.39	
Train	S.Exp.	10	67	107	56	121	288	154	251	201	132	206	273	335	204	235	185	287	0	293	57	3452
	S.Exp.	9	266	428	222	485	1150	618	1005	803	529	825	1092	1341	816	939	742	1140	0	1170	230	13810
km	L.Exp.	9	67	107	56	121	288	309	502	402	264	412	273	335	204	235	185	287	0	293	57	4307
	L.Exp.	6	200	321	167	364	575	154	251	402	264	619	546	670	408	470	371	574	0	878	172	7406
	Local	5	333	214	111	242	288	154	251	201	132	206	273	335	204	235	185	287	47	585	287	4572
	Total		932	1177	612	1333	2588	1390	2261	2008	1322	2268	2457	3017	1836	2113	1669	2585	47	3219	804	33637
Loco.	S.Exp.	0	67	107	56	121	288	154	251	201	132	206	273	335	204	235	185	287	0	293	57	3452
	S.Exp.	DEC1.2	266	428	222	485	1150	618	1005	803	529	825	2184	2682	1632	1878	1483	2298	0	2341	459	21288
km	L.Exp.	DEC1.2	67	107	56	121	288	309	502	402	264	412	546	670	408	470	371	574	0	585	115	6267
	L.Exp.	DEC1	200	321	167	364	575	154	251	402	264	619	546	670	408	470	371	574	0	878	172	7406
	Local	DEC1	333	214	111	242	288	154	251	201	132	206	273	335	204	235	185	287	47	585	287	4572
	Total		932	1177	612	1333	2588	1390	2261	2008	1322	2268	3822	4685	2856	3287	2596	4021	47	4882	1001	42085
Car	S.Exp.	10	666	1070	556	1212	2876	1544	2512	2008	1322	2062	2730	3352	2040	2348	1854	2872	0	2926	574	34524
	S.Exp.	9	2398	3852	2002	4365	10354	5558	9043	7229	4759	7423	9828	12067	7344	8453	6674	10339	0	10534	2066	124286
km	L.Exp.	9	599	963	500	1091	2588	2779	4522	3614	2380	3712	2457	3017	1836	2113	1669	2585	0	2633	517	39575
	L.Exp.	6	1199	1928	1001	2182	3451	926	1507	2410	1586	3712	3276	4022	2448	2818	2225	3446	0	5267	1033	44435
	Local	5	1465	1070	556	1212	1438	772	1256	1004	661	1031	1365	1676	1020	1174	927	1436	236	2926	1263	22480
	Total		6327	8881	4615	10060	20707	11580	18840	16265	10708	17059	19656	24134	14688	16906	13349	20678	236	24286	5453	265308

Note : No.-sec.: Number of persons passing through the section

Appendix 8.3.6 (2) Number of cargo passing through the section and train operation plan

O - D	Chart	Cargo	F/S (2000) Including Cal Lan																						
Station			1 6	6 12	12 15	15 22	22 35	35 43	43 56	56 66	66 73	73 84	84 96	96 110	110 117	117 128	128 134	134 144	144 F	144 157	157 163				
Grade			6%	6%	12%	13%	8%	17%	17%	7%	7%	23%	8%	8%	10%	10%	13%	13%	0	16%	6%				
No.-sec.	Down		1572	1570	1570	1558	2164	2048	1089	1840	1844	1536	795	709	478	491	448	473	0	467	432				
(A)	Up		3728	3775	3965	3292	2265	2087	2078	2052	1840	1800	1814	1760	1799	1800	1760	1750	0	1738	1738				
Send out	Down	1572	0	21	96	1278	122	45	66	226	6	88	60	3	42	41	42	46	-	2	-	3779			
	Up	-	0	5	645	1457	285	18	84	250	86	94	37	15	14	45	11	14	0	1	1738	4756			
Arrive	Down	-	1	21	108	872	238	104	245	222	315	830	146	234	79	84	18	46	0	37	432	3779			
	Up	3728	47	134	33	438	87	7	38	38	55	100	13	23	16	4	1	2	-	0	-	4756			
D.F.T.-ton		DEC	350	350	350	350	350	350	350	330	330	330	350	350	350	350	350	350	-	350	350				
F.T.-ton		DEC	540	540	430	490	410	380	380	540	510	330	410	410	410	410	410	410	-	410	410				
Exclu.F.-ton		Coal	390	390	390																				
Exclu.F.-ton		Cement	420	420	420																				
Total(ton)			1700	1700	1590	1260	760	730	730	870	840	660	760	760	760	760	760	760	0	760	760				
No.of D.F.T.			3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	-	3	3				
No.of F.T.			2	2	2	2	3	3	3	2	2	3	2	2	2	2	2	2	-	2	2				
No.of Exclu.F.T		Coal	2	2	2																				
No.of Exclu.F.T		Cement	3	3	3																				
Total			10	10	10	8	6	6	6	5	5	6	5	5	5	5	5	5	0	5	5				
Transp.Capa.-D.F.			1050	1050	1050	1050	1050	1050	1050	990	990	990	1050	1050	1050	1050	1050	1050	0	1050	1050				
Transp.Cap.-F.T.			1080	1080	860	980	1230	1140	1140	1080	1020	990	820	820	820	820	820	820	0	820	820				
Transp.Cap.-Exc		Coal	780	780	780	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
Transp.Cap.-Exc		Cement	1260	1260	1260	1260	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
Tr.Cap.-Total		(B)	4170	4170	3650	3290	2280	2190	2190	2070	2010	1980	1870	1870	1870	1870	1870	1870	0	1870	1870				
No.-sec-T.C.	Down		-2598	-2600	-2380	-1732	-116	-142	-201	-230	-166	-444	-1075	-1161	-1392	-1378	-1422	-1397	0	-1405	-1436				
No.-sec-T.C.	Up		-442	-395	-46	-2	-15	-105	-112	-16	-170	-171	-58	-80	-71	-70	-110	-120	0	-132	-132				
(B)/(A)			2.7	2.7	2.5	2.1	1.1	1.1	1.1	1.1	1.1	1.1	2.4	2.6	2.5	2.5	2.7	2.7	0	2.7	2.7				
			1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.1	1.1	1.0	1.0	1.0	1.0	1.1	1.1	0	1.1	1.1				
Train-km			666	1070	556	970	1726	814	1620	1004	681	1237	1365	1676	1020	1174	927	1436	0	1463	287	19671			
	D.F.T.		266	321	167	364	863	407	810	502	387	619	819	1006	612	704	556	862	0	878	172	10357			
	F.T.		133	214	111	242	863	407	810	502	294	619	546	670	408	470	371	574	0	585	115	7804			
	Exc.T.	Coal	133	214	111	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	458			
	Exc.T.	Cement	266	321	167	364	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1051			
Loco.-km	Total		666	1070	556	970	1726	814	1620	1004	681	1237	2730	3352	2040	2348	1854	2872	0	2926	574	29019			
	D.F.T.		266	321	167	364	863	407	810	502	387	619	1638	2011	1224	1409	1112	1723	0	1756	344	15966			
	F.T.		133	214	111	242	863	407	810	502	294	619	1092	1341	816	939	742	1149	0	1170	230	11543			
	Exc.T.	Coal	133	214	111	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	458			
	Exc.T.	Cement	266	321	167	364	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1051			
Car-km	F.T.		7226	11770	6005	12605	34512	15052	29970	21486	13881	21032	26754	32850	19902	23010	18169	28146	0	28675	5625	356859			
	Exc.T.		4520	7276	3781	5096	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	20678			
D.F.T.-No.of Cars			18	18	18	18	18	16	18	17	17	17	18	18	18	18	18	18	-	18	18				
F.T. - No.of Cars			28	28	27	25	22	19	19	28	27	17	22	22	22	22	22	22	-	22	22				
Exc.T. -No of cars			15	15	15																				
Exc.T. -No of cars			14	14	14	14																			
Revision Car-km			-1090	-1565	-94	11	-159	-518	-1122	-135	-831	-1306	-564	-992	-537	-605	-754	-1273	0	-1431	-282	-13248				

Train.km	Loco.km D18E	Loco.km D12E	Car-km
19671	10323	18696	3642B7
D.F.T. 10357	D.F.T. 4748	D.F.T. 11218	
F.T. 7804	F.T. 4085	F.T. 7478	
Exc.T. 1510	Exc.T. 1510	Exc.T. 0	

D18E	10323
D12E-W	18696
Loc.km	29019

Total 8535

No.of Cars 2529 (8535/27-8)

8535

Coal

O - D Chart Cargo F/S (2000) Coal Includ Cal Lan

Station			1 6	6 12	12 15	15 22	22 35	35 43	43 56	56 66	66 73	73 84	84 96	96 110	110 117	117 128	128 134	
Grade			6%	6%	13%	13%	8%	17%	17%	7%	7%	23%	8%	8%	10%	10%	13%	
No.-sec.	Down		0	0	0				0	0	0	0	0	0	0	0	0	
	Up		882	882	882				1	0	0	0	0	0	0	0	0	1588957
Get on	Down		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Up	-	0	0	845	0	0	0	0	0	0	0	0	0	0	0	0	845
Get off	Down	-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Up	882	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	882
Excl.T. ton		DE18E	390	390	390													
	or	DEL-W																
Total ton			390	390	390	0	0	0	0	0	0	0	0	0	0	0	0	
No.of Excl.T.			2	2	2	0	0	0	0	0	0	0	0	0	0	0	0	
			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Total			2	2	2	0	0	0	0	0	0	0	0	0	0	0	0	
Transp.Cap.-Excl.T.			780	780	780	0	0	0	0	0	0	0	0	0	0	0	0	
			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Total			780	780	780	0	0	0	0	0	0	0	0	0	0	0	0	
No.-sec.-T.C.		Down	-780	-780	-780	0	0	0	0	0	0	0	0	0	0	0	0	
No.-sec.-T.C.		Up	-118	-118	-118	0	0	1	0	0	0	0	0	0	0	0	0	
Train-km		Total	135	214	111	0	0	0	0	0	0	0	0	0	0	0	0	458
	Excl.T		135	214	111	0	0	0	0	0	0	0	0	0	0	0	0	458
			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Loco.-km			135	214	111	0	0	0	0	0	0	0	0	0	0	0	0	458
	Excl.T		135	214	111	0	0	0	0	0	0	0	0	0	0	0	0	458
			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Car-km			1732	2782	1446	0	0	0	0	0	0	0	0	0	0	0	0	5959
Excl.T. No.of Cars/			13	13	13					17	17	17	17	17	17	17	17	
										22	22	17	22	22	22	22	22	
										21	21	11						

DI2E-W*-2
DI8E

Train-km	Loco.-km	Car-km
458	458	5959
Excl.T. 458	DI8E 458	

645 No.of Freight Car Gross ton:600.13cars

645/30=4 86

Cement

O - D Chart Cargo F/S (2000) Cement Includ Cal Lan

Station		1 6	6 12	12 15	15 22	22 35	35 43	43 56	56 66	66 73	73 84	84 96	96 110	110 117	117 128	128 134	
Grade		6%	6%	13%	13%	6%	17%	17%	7%	7%	23%	8%	8%	10%	10%	13%	
No.-sec.	Down	54	54	54	53	760	855	848	510	383	207	134	61	0	0	0	
	Up	1013	1013	1013	1013	5	5	5	5	1	1	6	6	6	6	6	
Get on	Down	54	0	0	0	758	7	0	10	5	6	0	0	0	0	0	841
	Up	-	0	0	0	1011	0	0	0	4	0	0	0	0	0	0	1022
Get off	Down	-	0	0	2	51	112	7	148	132	182	73	72	61	0	0	841
	Up	1013	0	1	0	3	0	0	0	0	0	5	0	0	0	0	1022
D.F.T.-ton																	
F.T. -ton																	
Exclu.T.-ton		420	420	420	420												
Total(ton)		420	420	420	420	0	0	0	0	0	0	0	0	0	0	0	
No.of D.F.T.																	
No.of F.T.																	
No.of Excl.	Cement	3	3	3	3												
Total		3	3	3	3	0	0	0	0	0	0	0	0	0	0	0	
Transp.Cap.-D.F.T.		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Transp.Cap.- F.T.		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Transp.Cap.-Excl.		1260	1260	1260	1260	0	0	0	0	0	0	0	0	0	0	0	
Total		1260	1260	1260	1260	0	0	0	0	0	0	0	0	0	0	0	
No.-sec.-T.C.	Down	-1206	-1206	-1206	-1207	760	855	848	510	383	207	134	61	0	0	0	
No.-sec.-T.C.	Up	-247	-247	-247	-247	5	5	5	5	1	1	6	6	6	6	6	
Train-km		200	321	187	364	0	0	0	0	0	0	0	0	0	0	0	1051
	D.F.T.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	F.T.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Excl.	200	321	187	364	0	0	0	0	0	0	0	0	0	0	0	1051
Loco.-km		200	321	187	364	0	0	0	0	0	0	0	0	0	0	0	
	D.F.T.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	F.T.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	Excl.	200	321	187	364	0	0	0	0	0	0	0	0	0	0	0	
Car-km		2797	4494	2335	5090	0	0	0	0	0	0	0	0	0	0	0	14717
D.F.T.	No.of cars																
F.T.	No.of cars																
Excl.	No.of cars	14	14	14	14												

Train-km	Loco.-km	Car-km
1051	1051	14717
D.F.T. 0	D.F.T. 0	
F.T. 0	F.T. 0	
Excl.T. 1051	Excl.T. 1051	

Cement	No.of Freight Car
1260	168 (/30.4 days)
#	373 (/27.8 days)

Appendix 8.3.7 Train Over-running Accident Prevention Measures

With regard to this subject, description shall begin with the fundamental thinking in the JR train operation system.

1. Train Operation System and Safety Facilities

The train operation system, when divided into operation controls, is shown in the following table.

Operation Control	Control Content	Basic and Auxiliary Facilities		Modernization Facilities
Route control	Route setting	Interlocking devices		Automatic interlocking, ARC, PRC, CTC, etc.
Interval control	Coordination of intervals between trains and operating time intervals	Blocking equipment, Signaling equipment	# ATS	ATO
Drive control	Stop control, deceleration control, acceleration control, set position stop control, etc.	(Depending on driver handling)	ATC	
Operation surveillance control	Obstruction detection control, etc.	Various alarms		CTC, PRC, COMTRAC, etc.
Trains management control	Operation management control	Information communication equipment		

Note 1: The # sign indicates equipment to be installed as auxiliary equipment with regard to interval and drive control.

Note 2: ATO is based on ATC with automated acceleration control, etc.

Note 3: ARC and other abbreviations are as follows:

ATS: Automatic Train Stop
ATC: Automatic Train Control
ARC: Automatic Route Control
PRC: Programmed Route Control
CTC: Centralized Traffic Control
COMTRAC: Computer Aided Traffic Control

ATS is an auxiliary system used by blocking and signal drivers and does not require great skill for operation. However, there are cases where the ATC is used as a basic facility (on special sections such as commuter sections, etc.).

2. Train Overrunning Protection Measures

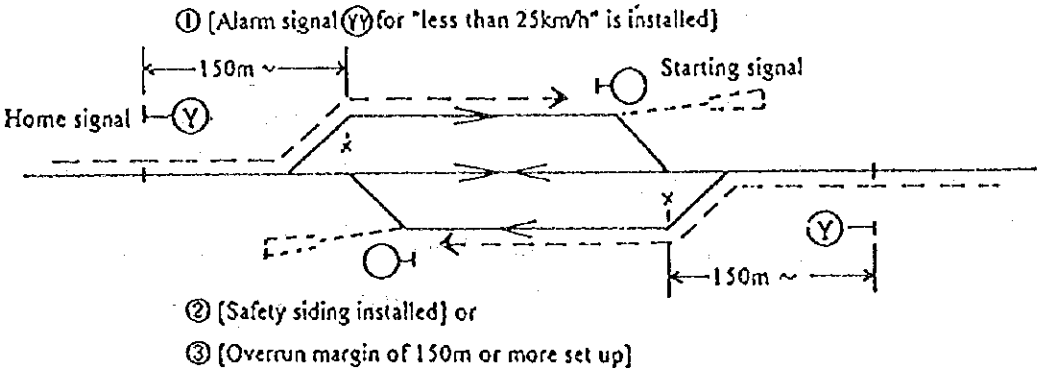
Leaving cases such as driver losing consciousness aside, if brake handling is mistaken due to poor weather conditions, etc., the overrunning of the stopping set position could hinder the operation of other trains. The following measures are adopted to prevent such an occurrence.

① With regard to stop signals, operate at low speed (25 km/h or less) and stop the train.

② Install safety sidings on the inner side of stop signals. (In this case, trains run at 45 km/h or less and stop on the outer side of the signals).

③ Provide an overrun allowance section of at least 150 m on the inner sides of stop signals. (The operation speed in this case will be the same as in " above).

Based on the above, the interlocking system shown in the diagram below is installed at a station to prevent the simultaneous entry or entry and exit of trains to and from a station. At the same time, either of the above-mentioned measures is adopted in areas where simultaneous entry is required.



Note: An overrun margin section of more than 150m is set up inside of the home signal for the case when the signal indicated stop.

Fig. 1 Facilities for Handling Simultaneous Train Entry, etc.

3. Routing of Interchange Station Planned for Construction on Hai Van Pass

Fig. 2 pass-by station to be constructed on Hai Van Pass.

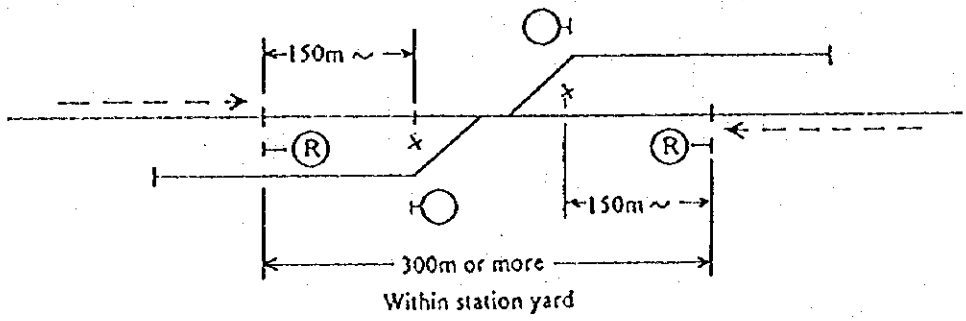


Fig. 2 Interchange Station to be Constructed on Hai Van Pass

In this case, it is considered that overrun accidents can be prevented through the following measures.

① Select facilities that do not allow simultaneous entry. (Add mutual locks to home signals).

② A 150 m overrun protection section is provided to handle cases where approaching trains have mutually overrun. (Separate signals by at least 300 m within the station yard).

③ Approaching train speed is basically low at 35 km/h or less.

Moreover, with regard to train pass-by at this station, the train schedule shall be planned to provide an allowance time of at least three minutes.

Appendix 8.3.8 ISO: Container

Container types		Height (H)		Width (W)		Length (L)	
		(mm)	(ft - in)	(mm)	(ft - in)	(mm)	(ft - in)
Standard	1A	2438	8 - 0	2438	8 - 0	12192	40 - 0
	1AA	2591	8 - 6				
	1B	2438	8 - 0			9125	30 - 0
	1C					6058	20 - 0
	1D					2991	9 - 9.75
	1E					1968	6 - 5.5
	1F					1460	4 - 9.5
	2A	2100	6 - 10.5	2300	7 - 6.5	2920	9 - 7
	2B			2100	6 - 10.5	2400	7 - 10.5
	2C			2300	7 - 6.5	1450	4 - 9
	3A	2400	7 - 10.5	2650	8 - 8.75	2100	6 - 10.5
	3B			1325	4 - 4.15		
	3C						
Non - standard	40ft	2743	9 - 0	2438	8 - 0	12192	40 - 0
	45ft	2896	9 - 6			13716	45 - 0
	48ft			2591	8 - 6	14630	48 - 0
	53ft					16154	53 - 0
		2946	9 - 8				
	20ft	2591	8 - 6	2438	8 - 0	6058	20 - 0

Appendix 8.3.9 Examination of Hanoi-Saigon High Speed Train Operating Times (2000)

— Trial Calculations —

(Preconditions)

① High speed train shall be the push-pull type. The performance curve is shown in Fig. 1, 2.

② The track speed limits shall be according to the VNR speed limit booklet (summarized in Table 1). However, the speed limit on priority sections shall be 80 km/h.

③ The bridge speed limits shall be as follows (for all bridges).

- The speed limit on improved bridges shall be 80 km/h or more.
- The speed limit on bridges between Hanoi and Da Nang shall be the current speed + 30 km/h.

  Currently the maximum weight of the locomotive acting between Hanoi-Da Nang is 84 tons (D18E). New locomotive for high speed train shall weigh 66 tons. The new locomotive shall reduce bridge burden about 20%.
- The speed limit on bridges between Da Nang and Saigon shall be as now, though, priority shall be given to the sectional speed limits of the speed limit booklet (VNR). (Where speeds are lower than those shown on the speed limit table, the speed limit table shall be given priority).

  The weight of locomotives acting between Da Nang -Saigon D13E (72t), D12E (56t) are similar to the new one.

④ Tunnel speed limits shall be according to the speed limit booklet (VNR).

⑤ For speed limits on curve sections, the speed limit booklet (VNR) shall be given priority, and other speed limits shall be calculated according to the following equation:

$$V = 3.64\sqrt{R}$$

⑥ Turnout speed limits shall also be according to the speed limit booklet (VNR), however, the turnouts on priority sections shall be improved to allow speeds of 80 km/h.

⑦ Speeds on all other speed limit sections shall also be according to the speed limit booklet (VNR).

⑧ The estimation of times from preparation of the operating curve shall be made in units of 30 seconds.

(Estimation Results)

The results of the examination made according to the above conditions are as follows.

- The operating time between Hanoi a.d Saigon is 32 hours (including an about 40 minute allowance).
- There shall be seven intermediate stopping stations including Vinh, etc. (see Table 2: Operating Timetable)

(Examination)

In order to enable 28 hour operation, it is necessary to further raise the sectional speed limits.

① Plan to expand the 80 km/h operating sections

② Plan to establish 110 km/h operating sections

Plan No. 1 involves examining the difference with 24 hour operation based on the operating timetable shown in Table 2. If the speed on the Vinh - Hue (370 km) and Da Nang - M. Man (760 km) sections is raised to 80 km/h, operating time can be reduced by approximately four hours to 28 hours (32 hours - 4 hours = 28 hours).

However, all the slow speed (less than 80 km/h) areas on these sections need to be improved.

Conducting improvement of the above approximately 1,130 km of line in addition to the priority improvement sections would require large investment.

In order to implement Plan No. 2 (the establishment of 110 km/h sections), it is essential to take level-crossing countermeasures, especially the improvement of transport morals of citizens (once stops, etc.) and raising public awareness of train speeds, in addition to the execution of tests on train speed increase.

Table- 1 Places of limited speed (Hanoi-Ho Chi Minh Line)

V km/h =		15	20	30	40	45	50	Total
Bridge	OECF:Complete	6		1	2			9
	2000 Complete	13		25	2			40
	2001-Improve	—		43	4			47
	Total	19		69	8			96
Tunnel	2000 Complete	4 +(2)						4
	2001-Improve	4		1				5
	Total	8 +(2)		1				+(2) 9
Turn-out	2000 Complete			1				1
	2001-Improve	1		9			3	13
	Total	1		10			3	14
Curve	2000 Complete							
	2001-Improve		1	5	5	5	3	19
	Total		1	5	5	5	3	19
Others	2000 Complete							
	2001-Improve	1		3		1		5
	Total	1		3		1		5
Grand Total	2000 Complete	23		27	4			+(2) 54
	2001-Improve	6	1	61	9	6	6	90
	Total	29	1	88	13	6	6	143

Notes. Tunnel(2):Not mentioned in the limited speed list.

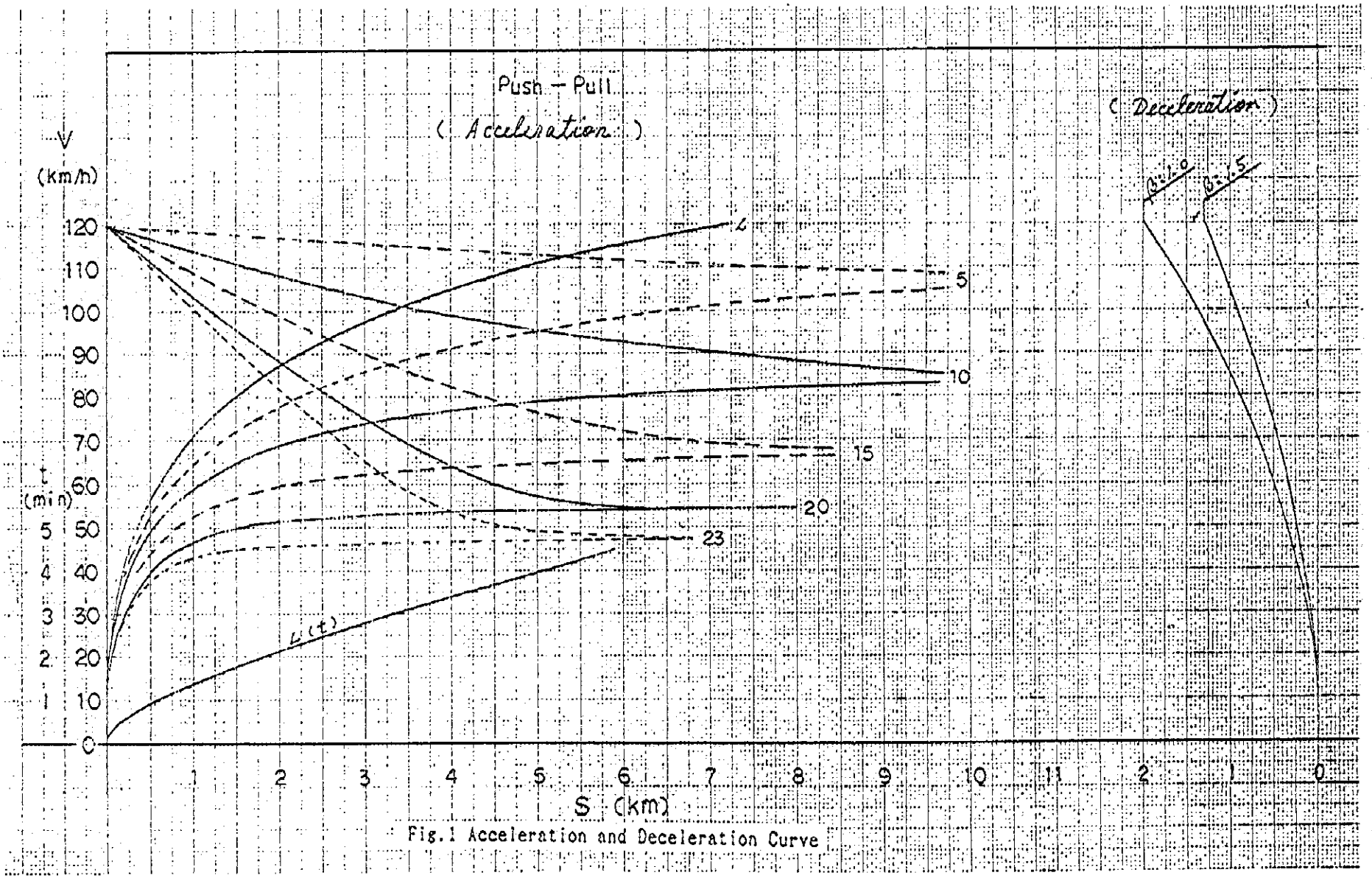


Fig.1 Acceleration and Deceleration Curve

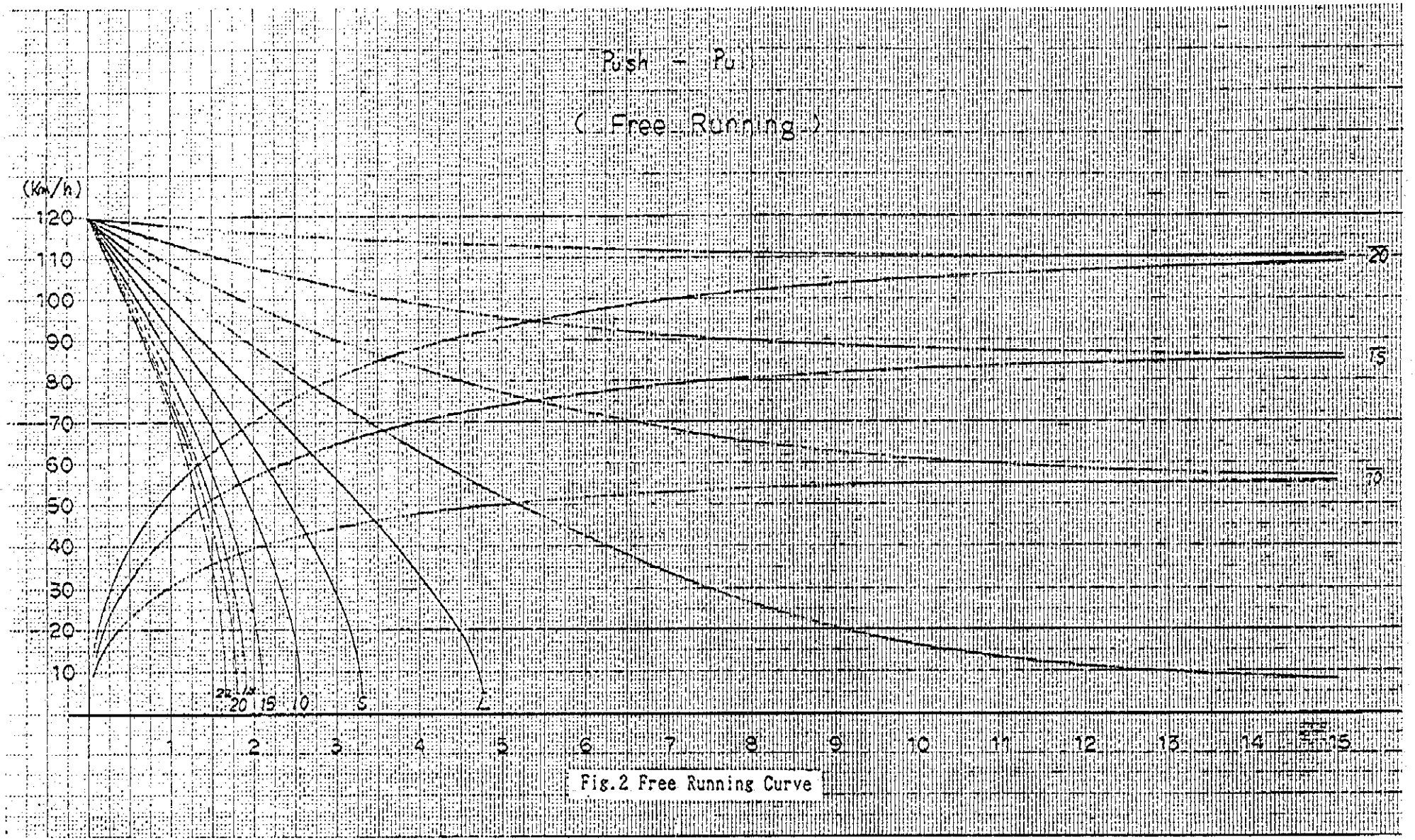


Fig.2 Free Running Curve

Table-2 Train Operation Time

			A			B			C			1	2	3
			L.Exp. (2000)			S.Exp. 1-1 (2010)								
Train hour	Vet.1		80km/h:Push-Pull			110km/h:PC Alt.1			A-B	80km/h		C-A	C-A	C-A
No.	km	(km)	Min.	stop	T.hour	Min.	stop	T.hour		Min.				
1 Hanoi	0.0	-	-	-	0	-	-	0	-	-		-	-	-
2 G.Bat	6.2	6.2	7		7	7		7	0					
3 V.Dien	8.9	2.7	3		10	3		10	0					
4 T.Yin	17.4	8.5	7.5		17.5	7.5		17.5	0					
5 C.Tia	25.5	8.1	6.5		24	6		23.5	0.5					
6 P.Xuyen	33.3	7.8	8		32	8		31.5	0					
7 D.Van	44.7	11.4	9.5		41.5	9.5		41	0					
8 P.Ly	55.9	11.2	9		50.5	8.5		49.5	0.5					
9 B.Luc	66.5	10.6	9		59.5	7.5		57	1.5					
10 Cau Ho	72.9	6.4	5.5		65	4		61	1.5					
11 Dang Xa	81.0	8.1	6.5		71.5	6		67	0.5					
12 Nam Dinh	85.8	5.8	5.5		77	5.5		72.5	0					
13 N.Goi	100.8	14.0	12		89	11		83.5	1					
14 Cat Dang	107.6	6.8	5.5		94.5	4.5		88	1					
15 Ninh Binh	114.6	7.0	6.5		101	5		93	1.5					
16 Cau Yen	120.4	5.8	5		106	4.5		97.5	0.5					
17 Chenh	125.0	4.6	4		110	4		101.5	0					
18 Dong Giao	133.7	8.7	8		118	8		109.5	0					
19 Bim Son	141.5	7.8	7.5		126.5	7.5		117	0					
20 Do Len	152.3	10.8	9.5		135	9.5		126.5	0					
21 N.Trang	161.0	8.7	8		143	8		134.5	0					
22 Thanh Hoa	175.2	14.2	13.5		156.5	12.5		147	1					
23 Yen Thai	187.9	12.7	12.5		169	8		155	4.5	10.5				-2
24 M.Khoi	196.9	9.0	9.5		178.5	6		161	3.5	7				-2.5
25 Thi Long	207.0	10.1	11		189.5	6		167	5	8				-3
26 Van Trai	219.0	12.0	15		204.5	8		175	7	10.5				-4.5
27 K.Truong	229.0	10.0	10.5		215	7		182	3.5	8.5				-2
28 T.Lam	237.8	8.8	10.5		225.5	7.5		189.5	3	7.5				-3
29 H.Mai	245.4	7.6	8		233.5	6		195.5	2	6.5				-1.5
30 Cau Giat	261.0	15.6	17		250.5	13		208.5	4	12.5				-4.5
31 Yen Ly	271.6	10.6	11.5		262	6.5		215	5	9				-2.5
32 Cho Sy	279.0	7.4	8		270	4.5		219.5	3.5	6				-2
33 My Ly	291.6	12.6	14.5		284.5	8.5		228	6	10.5				-4
34 Q.Hanh	308.2	16.6	17		301.5	15		243	2	15				-2
35 Vinh	319.0	10.8	11	5	312.5	8.5	5	251.5	2.5	10.5				-0.5
36 Yen Xuan	330.0	11.0	12.5		12.5	8		8	4.5	10			-2.5	
37 Cho Thuong	337.5	7.5	8		20.5	6		14	2	6.5			-1.5	
38 Duc Lac	344.8	7.3	8		28.5	5		19	3	6			-2	
39 Yen Duc	351.5	6.7	7		35.5	5.5		24.5	1.5	6			-1	
40 Hoa Duyet	358.0	6.5	9.5		46	7.5		32	2	7.5			-2	
41 T. Luyen	369.6	11.6	16		61	14		46	2	13.5			-2.5	
42 Chu Le	380.6	11.0	12		73	9.5		55.5	2.5	10			-2	
43 H.Pho	386.8	6.2	6.5		79.5	6.5		62	0	6			-0.5	
44 P.Trach	396.2	9.4	9		88.5	6.5		68.5	2.5	8			-1	
45 La Khe	404.4	8.2	9		97.5	5		73.5	4	7			-2	
46 Tan Ap	408.7	4.3	4.5		102	3		76.5	1.5	4			-0.5	
47 Kim Lu	426.0	17.3	29		131	20		96.5	9	20.5			-8.5	
48 Dong Le	436.3	10.3	12		143	10.5		107	1.5	11.5			-0.5	
49 N.Lam	449.6	13.3	14		157	12		119	2	12			-2	
50 Lac Son	458.6	9.0	12		169	9.5		128.5	2.5	11.5			-0.5	
51 Le Son	467.1	8.5	13.5		182.5	9.5		138	4	12			-1.5	
52 Minh Le	481.8	14.7	16.5		199	12		150	4.5	13			-3.5	
53 N.Son	488.8	7.0	9		208	8.5		158.5	0.5	8.5			-0.5	
54 Tho Loc	498.7	9.9	12.5		220.5	7.5		166	5	10.5			-2	
55 Phuc Tu	510.7	12.0	11.5		232	7		173	4.5	10.5			-1	
56 Dong Hoi	521.8	11.1	11	5	243	8	5	181	3	10.5			-0.5	
57 Le Xy	529.0	7.2	8		8	5.5		5.5	2.5	7			-1	
58 L.Hai	539.2	10.2	10.5		18.5	7.5		13	3	8.5			-2	
59 My Duc	550.9	11.7	12.5		31	7.5		20.5	5	9.5			-3	
60 P.Hoa	558.5	7.6	8		39	6		26.5	2	7.5			-0.5	
61 My Trach	565.1	6.6	6.5		45.5	4		30.5	2.5	5.5			-1	
62 T.Lam	572.2	7.1	6.5		52	5		35.5	1.5	6			-0.5	
63 Sa Lung	587.7	15.5	16		68	10		45.5	6	13			-3	
64 Tien An	598.9	11.2	11		79	7		52.5	4	10			-1	
65 Ha Thanh	609.5	10.6	11		90	7.5		60	3.5	10			-1	
66 Dong Ha	622.2	12.7	13.5		103.5	7.5		67.5	6	11.5			-2	
67 Q.Tri	633.9	11.7	11.5		115	7.5		75	4	10			-1.5	
68 D.Sanh	642.7	8.8	8		123	5.5		80.5	2.5	7.5			-0.5	
69 My Chanh	651.7	9.0	8.5		131.5	6		86.5	2.5	8			-0.5	
70 P.Trach	659.8	8.1	8.5		140	7		93.5	1.5	7			-1.5	
71 Hien Sy	669.6	10.0	9.5		149.5	7.5		101	2	8.5			-1	
72 Van Xa	678.1	8.3	9		158.6	6		107	3	7.5			-1.5	
73 Hue	688.3	10.2	12.5	5	171	8.5	5	115.5	4	10			-2.5	
74 H.Thuy	698.7	10.4	9.5		9.5	9		9	0.5					
75 Truoi	715.3	16.6	13.5		23	11.5		20.5	2					
76 Cau Hai	729.4	14.1	13		36	11		31.5	2					
77 T.Luu	741.6	12.2	11		47	9.5		41	1.5					
78 Lang Co	755.4	13.8	19.5		66.5	18.5		59.5	1					
79 H.V.Bac	760.7	5.3	16.5		83	10		69.5	6.6					
80 Dinh Deo	766.0	5.3	13.5		96.5	10		79.5	3.5					
81 H.V.Nam	771.6	5.6	15		111.5	10.5		90	4.5					
82 Kim Lien	778.9	5.3	15		126.5	9		99	6					
83 T.Khe	788.3	11.4	10		136.5	9		108	1					
84 Da Nang	791.4	3.1	6.5	20	143	4.5	20	112.5	2	4.5	-2			

83 T.Khe	783.3	-3.1	6.5		6.5	4.5		4.5	2	4.5	-2				
85 Le Trach	804.1	12.7	12.5		19	8.5		13	4	8.5	-4				
86 Nong Son	818.6	9.5	10		29	7		20	3	7.5	-2.5				
87 Tra Kieu	824.8	11.2	12		41	8.5		28.5	3.5	9.5	-2.5				
88 P.Cang	841.7	16.9	17.5		58.5	12		40.5	5.5	12.5	-5				
89 An My	857.1	15.4	17		75.5	11		51.5	6	12	-5				
90 Tam Ky	864.7	7.6	7		82.6	5		56.5	2	6.5	-0.6				
91 Diem Pho	878.6	14.8	15.5		98	9.5		66	6	12	-3.5				
92 N.Thanh	890.4	10.9	10.5		108.5	8.5		74.5	2	8.5	-2				
93 Tri Binh	901.1	10.7	10		118.5	8		82.5	2	8.5	-1.5				
94 Binh Son	909.1	8.0	9		127.5	6		88.5	3	6.5	-2.5				
95 Dai Loc	919.5	10.4	9.5		137	7.5		96	2	8.5	-1				
96 Q.Ngai	927.9	8.4	9		146	5.5		101.5	3.5	6.5	-2.5				
97 H.V.Tay	940.4	12.5	11.5		157.5	8		109.5	3.5	10	-1.5				
98 Mo Duc	948.9	8.5	9.5		167	6.5		116	3	7	-2.5				
99 T.Tru	958.7	9.8	10		177	6.5		122.5	3.5	8	-2				
100 Duc Pho	967.7	9.0	9		186	6		128.5	3	7.5	-1.5				
101 T.Thach	977.1	9.4	12		198	6.5		135	5.5	7.5	-1.5				
102 Sa Huynh	990.8	13.7	14.5		212.5	12		147	2.5	12	-2.5				
103 Tam Quan	1004.3	13.5	15.5		228	13.5		160.5	2	13	-2.5				
104 B.Son	1017.1	12.8	11.5		239.5	8.5		169	3	10	-1.5				
105 Van Phu	1032.8	15.7	16.5		256	13.5		182.5	3	11	-2.5				
106 Phu My	1049.4	16.6	17		273	12		194.5	5	13.5	-3.5				
107 K.Thuoc	1060.3	10.9	10		283	7		201.5	3	8.5	-1.5				
108 Phu Cat	1070.9	10.6	10.5		293.5	7		208.5	3.5	8.5	-2				
109 B.Dinh	1084.6	13.7	13.5		307	10.5		219	3	11	-2.5				
110 Dieu Tri	1095.5	10.9	11.5	5	318.5	9.5	5	228.5	2	10	-1.5				
111 Tan Vinh	1110.8	15.3	17		17	10		10	7	13	-4				
112 Van Canh	1123.6	12.8	13.5		30.5	9		19	4.5	10.5	-3				
113 P.Lanh	1139.3	15.7	17		47.5	11		30	6	12.5	-4.5				
114 La Hai	1154.4	15.1	17		64.5	12.5		42.5	4.5	13	-4				
115 C.Thanh	1170.4	16.0	17.5		82	13		55.5	4.5	13.5	-4				
116 Hoa Da	1183.9	13.5	12.5		94.5	10.5		66	2	11	-1.5				
117 Tuy Hoa	1197.5	13.6	15		109.5	8		74	7	11	-4				
118 D.Tac	1202.1	4.6	5.5		115	3.5		77.5	2	4	-1.5				
119 P.Hiep	1209.6	7.5	8.5		123.5	5		82.5	3.5	6	-2.5				
120 Hoa Son	1220.1	10.5	12		135.5	8		90.5	4	9	-3				
121 D.Lanh	1232.2	12.1	18		153.5	11		101.5	7	11.5	-6.5				
122 Tu Bong	1242.0	9.8	10.5		164	6.5		108	4	8	-2.5				
123 Gia	1254.1	12.1	13		177	7.5		115.5	6.5	9.5	-3.5				
124 Hoa Huynh	1269.5	15.4	16.5		193.5	9.5		125	7	12.5	-4				
125 Ninh Hoa	1280.6	11.1	13		206.5	7		132	6	9	-4				
126 P.Thanh	1287.4	6.8	7.5		214	4		136	3.5	5.5	-2				
127 L.Son	1302.9	15.5	16.5		230.5	11.5		147.5	5	12.5	-4				
128 Nha Trang	1314.9	12.0	14	5	244.5	10.5	5	158	3.5	11.5	-2.5				
129 Cay Cay	1329.1	14.2	17		17	12		12	5	14	-3				
130 Hoa Tan	1340.5	11.4	10.6		27.5	8		20	2.5	9	-1.5				
131 Suoi Cat	1351.4	10.9	10		37.5	6.5		26.5	3.5	8.5	-1.5				
132 Nga Ba	1363.8	12.4	11.5		49	9		35.5	2.5	10	-1.5				
133 Ka Rom	1381.3	17.5	15		67	14.5		50	3.5	15	-3				
134 T.Chan	1407.6	26.3	24		91	17		67	7	20.5	-3.5				
135 Hoa Trinh	1419.6	11.9	14.5		105.5	7		74	7.5	9.5	-5				
136 Ca Na	1436.3	16.8	15		120.5	9.5		83.5	5.5	13.5	-1.5				
137 Vinh Hoa	1453.7	17.4	18.5		139	15.5		99	3	16	-2.5				
138 S.L.Song	1465.5	11.8	11		150	9.5		108.5	1.5	10	-1				
139 S.Mao	1484.5	19.0	17.5		167.5	11		119.5	6.5	15	-2.5				
140 C.Hanh	1493.7	9.2	10		177.5	5.5		125	4.5	7.5	-2.5				
141 S.Luy	1506.1	12.4	16.5		194	8		133	8.5	18	-6.5				
142 L.Thanh	1522.7	16.6	19		213	10		143	9	18.5	-5.5				
143 Ha Lam	1532.8	10.1	11		224	6.5		149.5	4.5	8	-3				
144 H. Man	1551.2	18.4	20.5	5	244.5	12	6	161.5	8.5	15	-4.5				
145 S. Van	1567.7	16.5	14.5		14.5	12.5		12.5	2						
146 S.Phan	1582.9	15.2	15		29.5	14.5		27	0.5						
147 S.Dinh	1595.9	13.0	12		41.5	12		39	0						
148 S.Kiet	1603.1	7.2	6		47.5	6		45	0						
149 Gia Huynh	1613.5	10.4	8.5		56	8.5		53.5	0						
150 T.Tao	1619.9	6.4	5		61	4		57.5	1						
151 Gia Ray	1630.9	11.0	8		69	7.5		65	0.5						
152 Bao Chanh	1639.8	8.9	7		76	6		71	1						
153 Xuan Loc	1649.4	9.6	7.5		83.5	7.5		78.5	0						
154 Dau Giay	1661.3	11.9	10		93.5	8.5		87	1.5						
155 T.Bon	1677.5	16.2	18.5		107	12		99	1.5						
156 Ho Nai	1688.0	10.5	8.5		115.5	7		106	1.5						
157 B.Hoa	1697.5	9.5	7.5		123	6.5		112.5	1						
158 Di An	1706.7	9.2	8		131	8		120.5	0						
159 S.Than	1710.6	3.9	3.5		134.5	3.5		124	0						
160 Thu Duc	1718.5	2.9	2.5		137	2.5		126.5	0						
161 B.Trieu	1718.3	4.8	4		141	3		129.5	1						
162 Go Vap	1722.1	3.8	3		144	2.5		132	0.5						
163 Saigon	1726.2	4.1	4.5		148.5	4		136	0.5						
Total	1726.2	1723.1	1825.5	50.0		1344.5	50.0		481.0	110.0	-178.0	-62.0	-34.0		
Allowance time			44			45									
Grand Total			1869.5	50	31.991	1389.5	50	23.991	8.02	18.50	-2.97	-1.03	-0.57		
					Hour			Hour	Hour		Hour	Hour	Hour		

Appendix 8.4.1 Comparison of Maintenance Costs for 40 kg/m Rails and 50 kg/m Rails

Fig. 1 was prepared by JNR with the aim of determining the optimum track structure to minimize the combined investment and maintenance costs.

Table 1 shows the track structure and maximum train speeds (currently used by the JR Group) obtained based on the thinking behind the optimum track structure

In Table 1, track structure coefficient is obtained from the track structure, and in Fig. 1, maintenance cost and passing tonnage are obtained from the track structure coefficient. The annual maintenance cost per ton of passing tonnage is 20% less for the 50 kg/m rails compared to the 40 kg/m rails.

The above contents are ordered in the manner displayed in Table 2.

Table 2 Comparison of Maintenance Costs

Track Structure	Track Structure Coefficient	Maintenance Cost (Thousand US Dollar/Year)	Passing Tonnage (Million Ton)	Maintenance cost (US $/Ton)	Ratio
40N W39 C200	1.782	12.7	8.8	1.44	1.00
50N W39 C200	1.375	14.1	12.4	1.14	0.79

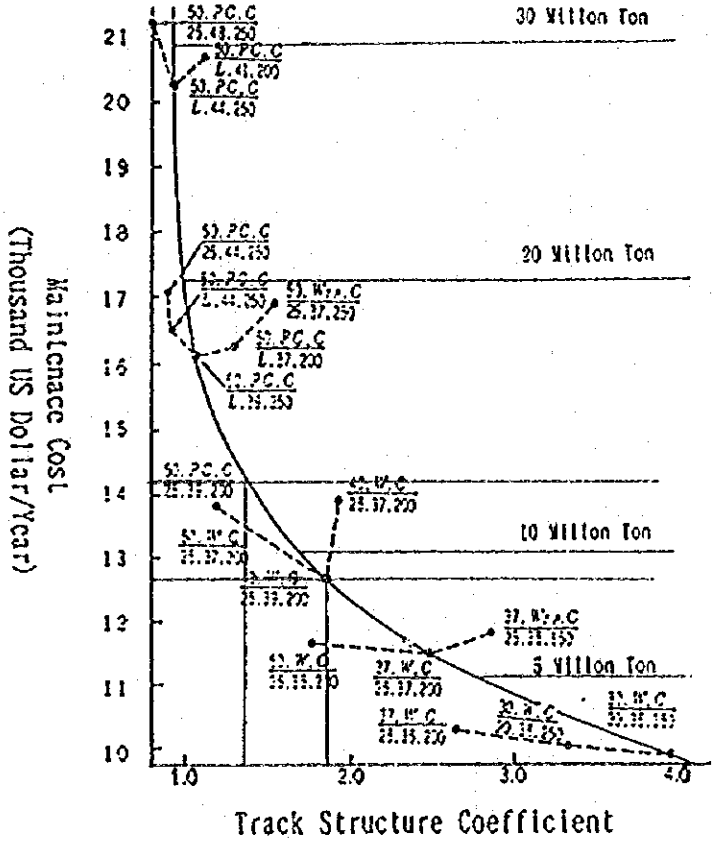


Fig. 1 Optimum Track Structure

Table 1 Maximum Speed by Track Structure for Each Train Type (JR Group)

Track Structure Coefficient	Train Type: Annual Passing Tonnage (million ton) / Track Structure	Train(A) T≥20	Train(A) 10≤T<20	Train(A) 5≤T<10	Train(A) T<5	Train(B) T≥20	Train(B) 10≤T<20	Train(B) 5≤T<10	Train(B) T<5	Train(C) T≥20	Train(C) 10≤T<20	Train(C) 5≤T<10	Train(C) T<5
6.716	30 W34 S120	65	65	65	75	65	65	65	75	45	45	65	65
6.418	30 W34 S150	65	65	75	75	65	65	75	75	45	45	65	65
6.217	30 W37 S120	65	65	75	75	65	65	75	75	45	45	65	65
5.900	30 W39 S120	65	65	75	75	65	65	75	75	45	45	65	65
5.742	30 W37 S150	65	65	75	75	65	65	75	75	45	45	65	75
5.452	30 W39 S150	65	65	75	75	65	65	75	75	45	65	65	75
4.833	37 W34 S120	65	75	75	75	65	75	75	75	65	65	65	75
4.538	37 W37 S120	65	75	75	80	65	75	75	80	65	65	65	75
4.337	37 W34 S150	75	75	75	85	75	75	75	80	65	65	75	75
4.243	37 W39 S120	75	75	75	85	75	75	75	80	65	65	75	75
4.136	37 W37 S150	75	75	75	85	75	75	75	80	65	65	75	75
4.031	37 W34 S200	75	75	75	95	75	75	75	90	65	65	75	90
3.925	37 W39 S150	75	75	75	95	75	75	75	90	65	65	75	90
3.825	37 W37 S200	75	75	75	95	75	75	75	90	65	65	75	90
3.630	37 W39 S200	75	75	80	95	75	75	80	90	65	65	75	90
2.793	37 W34 C150	75	80	95	95	75	80	85	95	75	75	80	90
2.631	37 W37 C150	75	85	95	100	75	80	85	95	75	75	85	90
2.516	37 W39 C150	75	85	95	100	75	80	85	95	75	75	85	90
2.466	50 W37 S200	80	85	95	100	80	80	85	95	75	75	85	90
2.340	50 W39 S200	85	85	95	105	80	85	90	95	75	75	85	95
2.214	50 W41 S200	85	95	95	110	80	85	95	100	75	80	90	95
2.144	40N W34 C150	85	95	100	110	80	85	95	100	75	80	90	100
2.034	40N W37 C150	85	95	100	115	85	85	95	105	75	85	90	100
1.930	40N W39 C150	95	95	100	120	85	85	95	105	80	85	95	100
1.878	40N W37 C200	95	95	105	120	85	90	95	110	80	85	95	105
1.782	40N W39 C200	95	95	110	125	85	95	100	110	85	85	95	105
1.686	40N W41 C200	95	95	110	130	85	95	100	110	85	90	95	105
1.581	50 W37 C200	95	100	115	130	90	95	105	115	85	90	100	110
1.500	50 W39 C200	95	100	120	130	95	95	105	120	90	95	100	115
1.419	50 W41 C200	100	100	125	130	95	100	110	120	90	95	105	120
1.375	50N W39 C200	100	100	125	130	95	100	110	120	90	95	105	120
1.158	50 PC39 C200	110	120	130	130	100	110	120	120	95	100	115	120
1.050	50 PC39 C250	120	125	130	130	105	110	120	120	100	105	120	120
0.963	50N PC39 C250	125	130	130	130	110	120	120	120	105	110	120	120
0.901	50 PC44 C250	130	130	130	130	110	120	120	120	105	115	120	120
0.826	50N PC44 C250	130	130	130	130	120	120	120	120	115	120	120	120
0.691	60 PC39 C250	130	130	130	130	120	120	120	120	120	120	120	120
0.592	60 PC44 C250	130	130	130	130	120	120	120	120	120	120	120	120
	Slab Track etc.	130	130	130	130	120	120	120	120	120	120	120	120

Train(A) Train Should be Consisted of the Rolling Stock Having the Following Characteristics.
1. Unsprung Mass Should be Less Than 2 ton.
2. Maximum Axle Weight Loaded with Passengers Should be Less Than 13 ton.
3. Electric Car or Diesel Car Having Good Running Performance.
4. Air Cushion Spring or Equivalent be Equipped.

Train(B) Train Should be Consisted of Electric Car or Diesel Car Excluding Such Rolling Stock as Mentioned in the Train(A) Above.

Train(C) Train Pulled by Locomotive.

Appendix 8.4.2 Long Rail (CWR) Laying Conditions in Japan

Item			Laying condition
Line conditions	Curve		• R ≥ 600 m
	Reverse curve		• R ≥ 1,000 m if laying continuously
	Gradient change points		• Vertical curve radius R ≥ 3,000 m
	Roadbed		• Roadbed must be good. • For newly laid roadbed, there must be little danger of depression
	Other		• Non-ballast bridges of more than 25 m in length must not intervene
Track construction	Rail		• 40 Kg/m or more
	Double end joint construction		• Expansion joints or expansion adjusting rails
	Sleepers		• PC sleepers (for 40 Kg/m rails, 1,140 per km)
	Ballast		• Crushed stone or non-ballast construction
	Fasteners		• Double flexible fasteners
Laying conditions	Setting temperature	Maximum	• Minimum forecast temperature + 40°C
		Minimum	• Maximum forecast temperature + 35°C
	Ballast lateral resistance		• 400 kg/m or more
Expansion fasteners			• Do not install on transition curves

Appendix 8.4.3 Outline of the Plate Spring Manufacture Process and Example of a Double

Elastic Fastener

Fig. 1 gives an outline of the plate spring manufacture process.

Fig. 2 illustrates an example of a double elastic fastener.

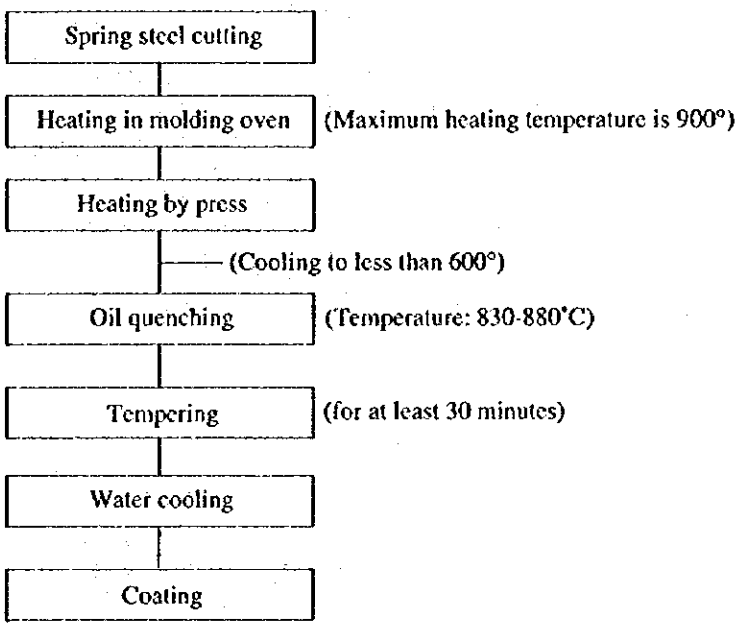
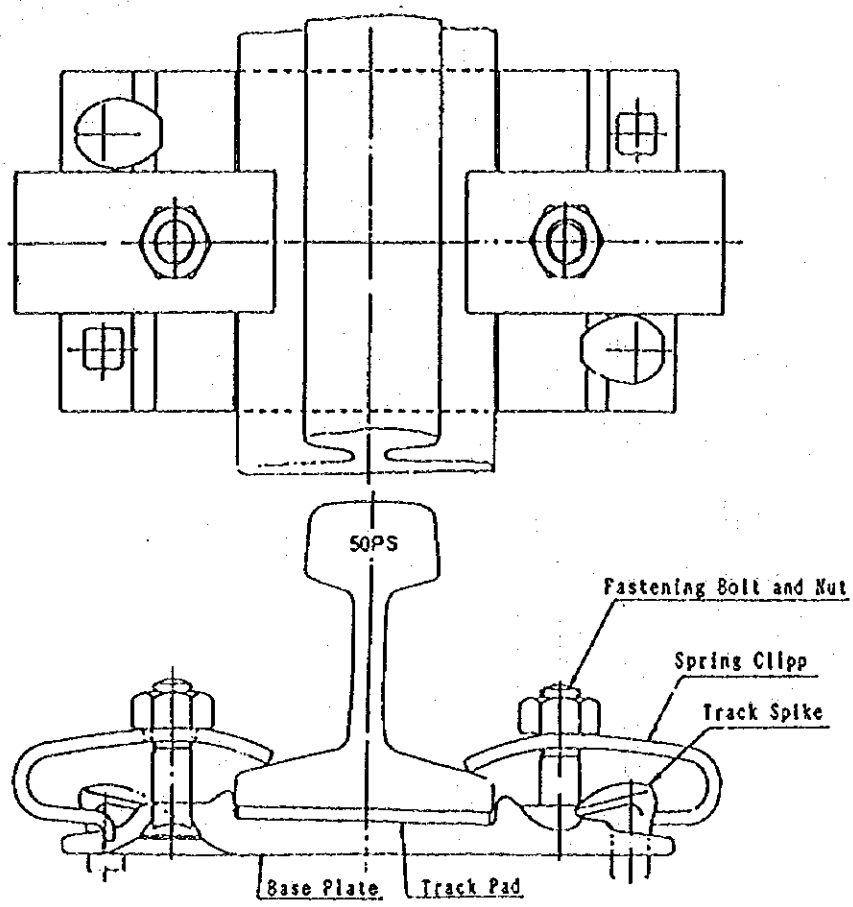
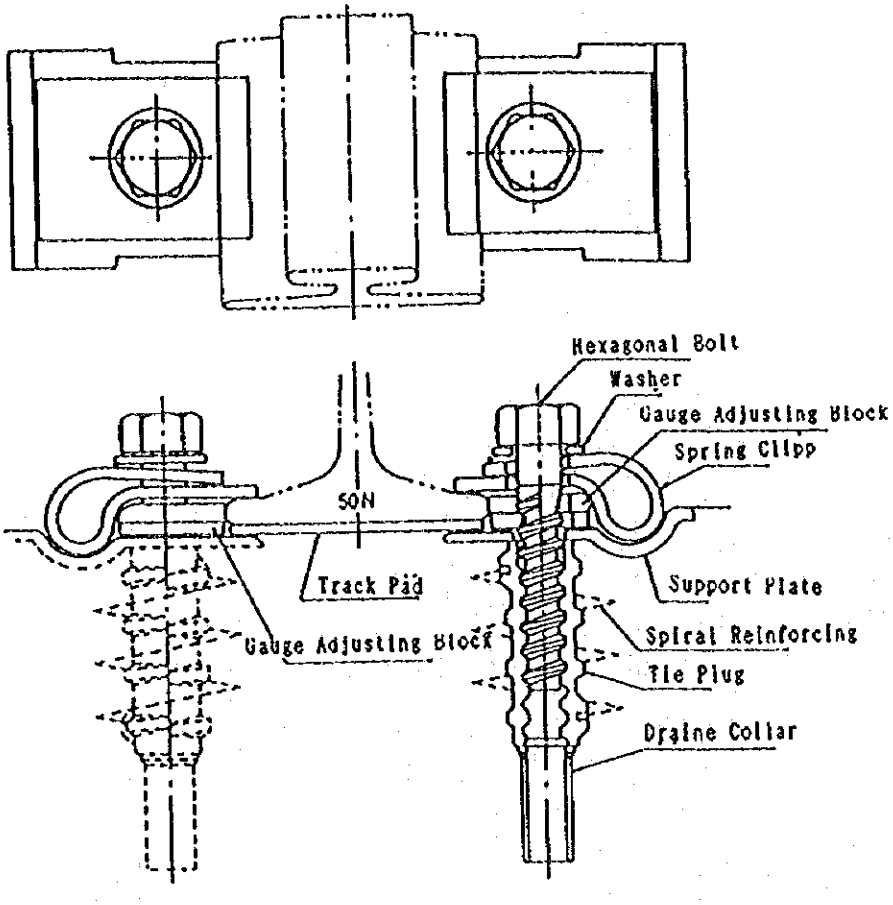


Fig. 1 Plate Spring Manufacture Process


50PS
Fastening Bolt and Nut
Spring Clipp
Track Spike
Base Plate
Track Pad


Hexagonal Bolt
Washer
Gauge Adjusting Block
Spring Clipp
50N
Track Pad
Support Plate
Gauge Adjusting Block
Spiral Reinforcing
Tie Plug
Draine Collar

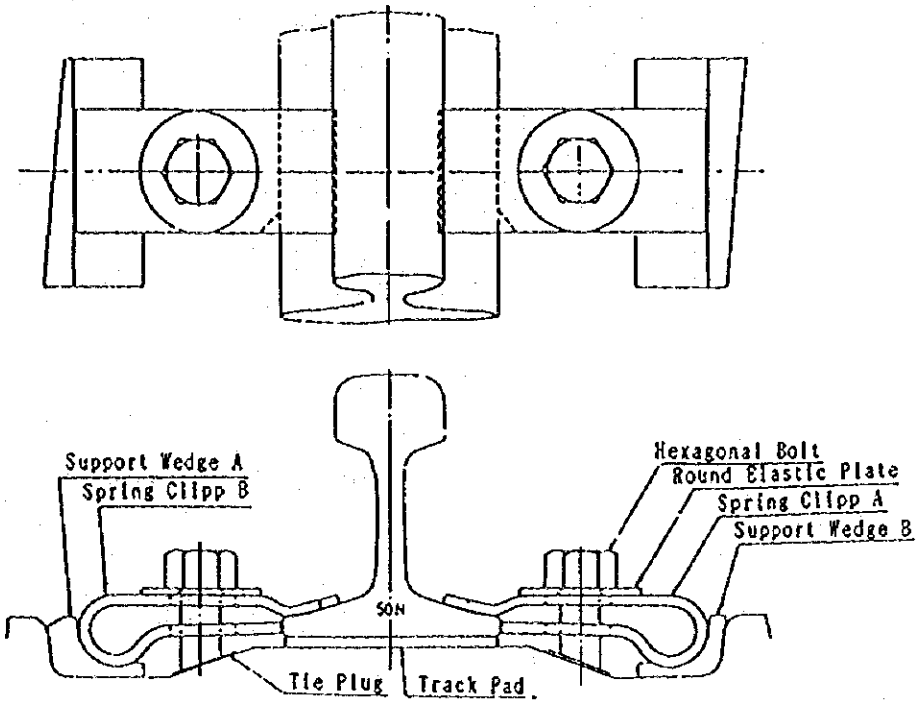


Fig. 2 Double Elastic Fastening

Appendix 8.4.4 Summary of Ballast Making Facilities

The ballast making process and facilities are as shown in the flow chart. This can be summarized as follows. The solid lines indicate the process and facilities under consideration for this project.

Assuming that crushed stone are used for 24-26 mm ballast:

1. Put appropriately broken rocks into the rock hopper ①.

2. Separate rocks (to ③) and soil (to a) in the feeder ②.

3. Crush separated rocks from A in the initial crusher ③. Then carry the rocks to ④ by the conveyor belt.

4. Separate 63 mm or bigger rocks (to ⑤), 24-63 mm rocks (to c) and 24 mm and smaller rocks (to b) by the initial screen ④.

5. Put rocks of 63 mm or bigger through the secondary crusher ⑤ (with shaping function) and return to ④ by conveyor belt.

6. ⑧ is the dust collector.

7. ⑦ is a supplementary hopper for unshaped rocks.

8. ⑧ and beyond is possible for making rocks of 24 mm or smaller and crushed rocks for concrete etc., if a secondary crusher (with shaping function), screen, conveyor belt and dust collector are prepared.

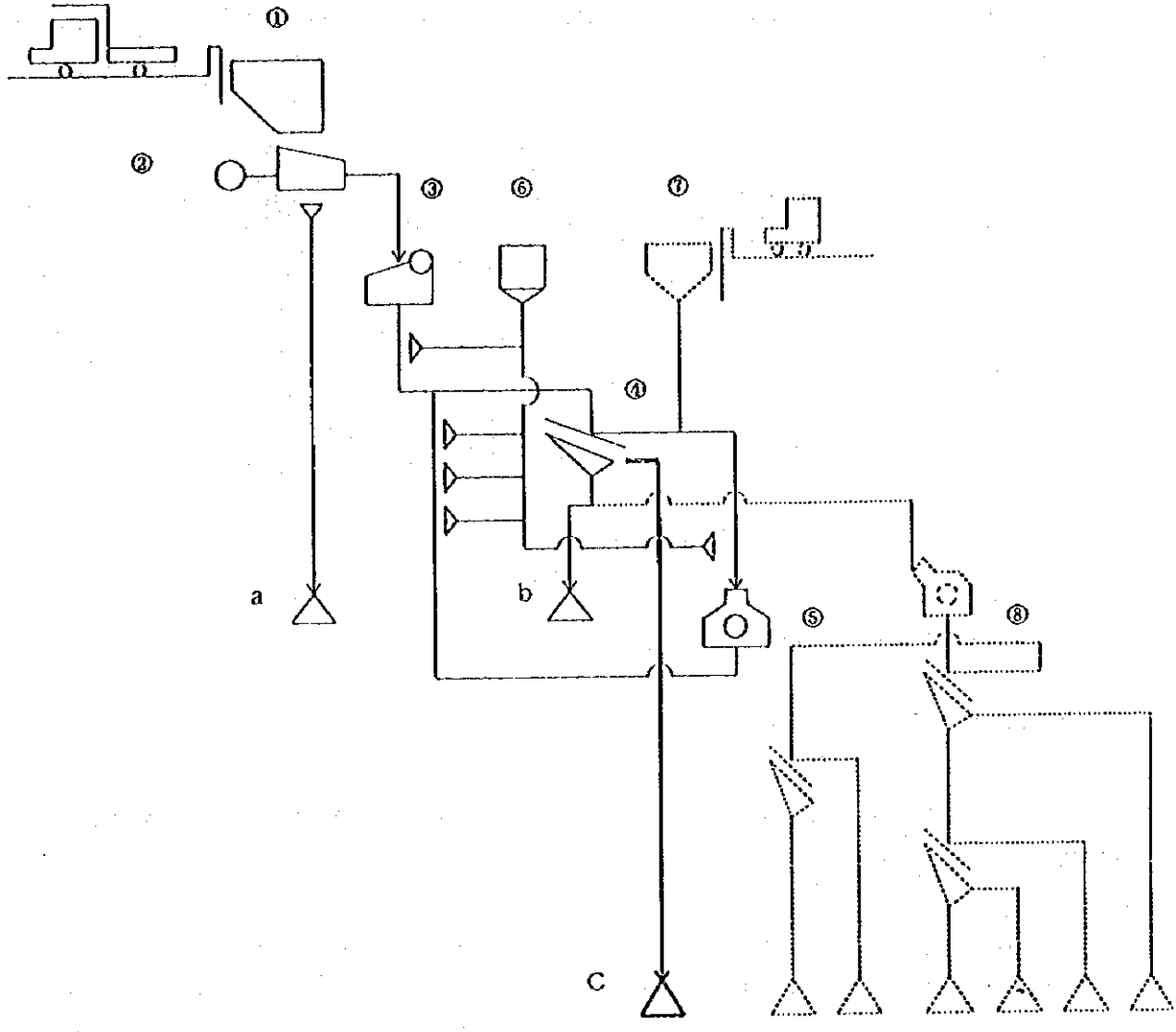


Fig. 1 Flow-Chart of Stone Crushing Facilities

Appendix 8.4.5 Summary of High Speed Track Inspection Cars

Currently in JR, practical maximum speeds are 110 km/h on conventional lines and 210 km/h on Shinkansen lines. Figure 1 shows an example of those types and measurement device arrangement.

The track irregularity measurement positions and irregularity detection points are shown in Figure 2. They can be summarized as follows.

1) is an undulation irregularity detection point and ① - ① are measurement points (10 m chord).

2) is a line disorder detection point and ② - ② are measurement points (10 m chord).

3) is a water level irregularity detection point.

4) is a gage irregularity detection point.

5) is a kilometer detection point.

As well as the above, measurement of flatness and car oscillation acceleration (vertical and horizontal) is carried out.

The above data is fed into an operational amplifier and track irregularity is automatically printed out on a record chart. All data is then sent to the central processing unit and recorded on magnetic tape by sample. After the run, the measured data from the run can be reproduced as charts by processing done on the above ground unit.

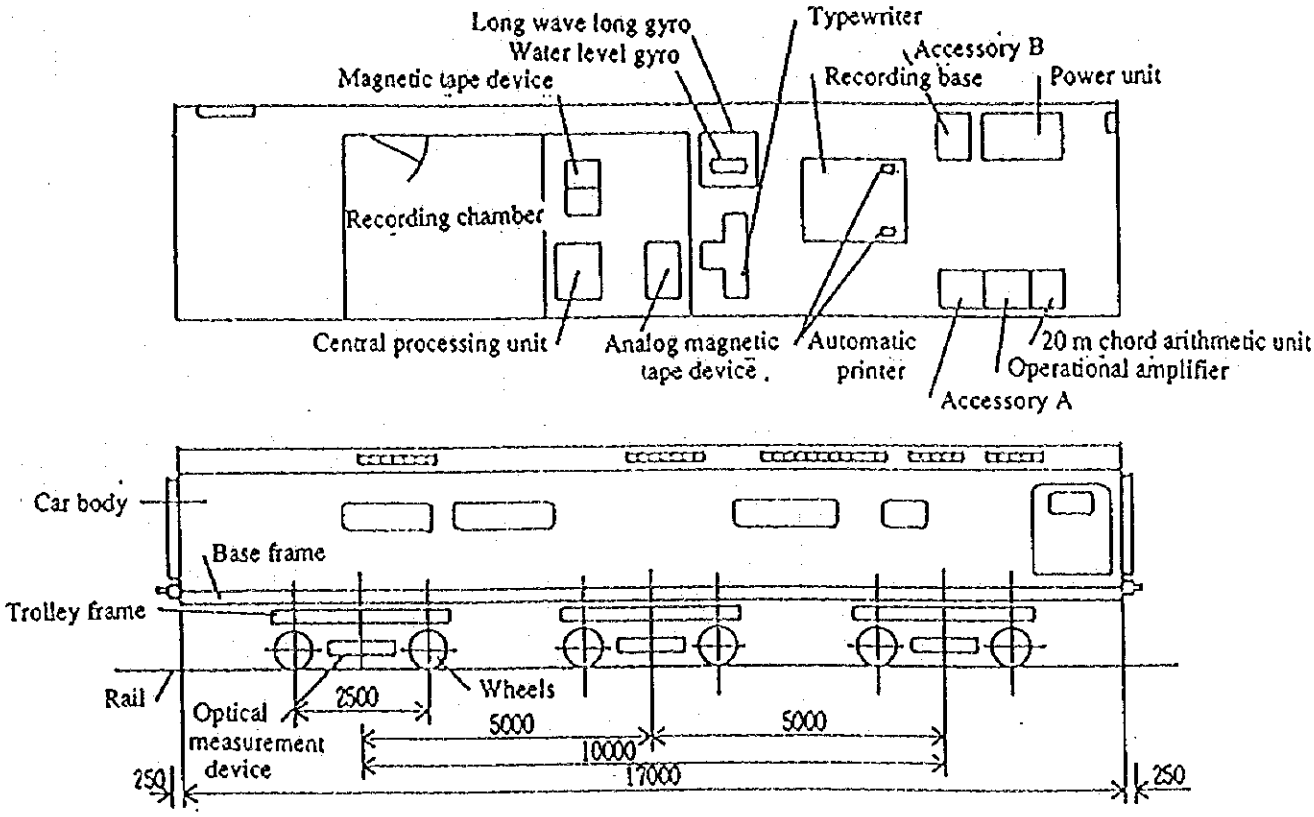

Long wave long gyro
Water level gyro
Magnetic tape device
Typewriter
Accessory B
Recording base
Power unit
Recording chamber
Central processing unit
Analog magnetic tape device
Automatic printer
20 m chord arithmetic unit
Operational amplifier
Accessory A
Car body
Base frame
Trolley frame
Rail
Optical measurement device
Wheels
2500
5000
5000
10000
17000
250
250

Fig. 1

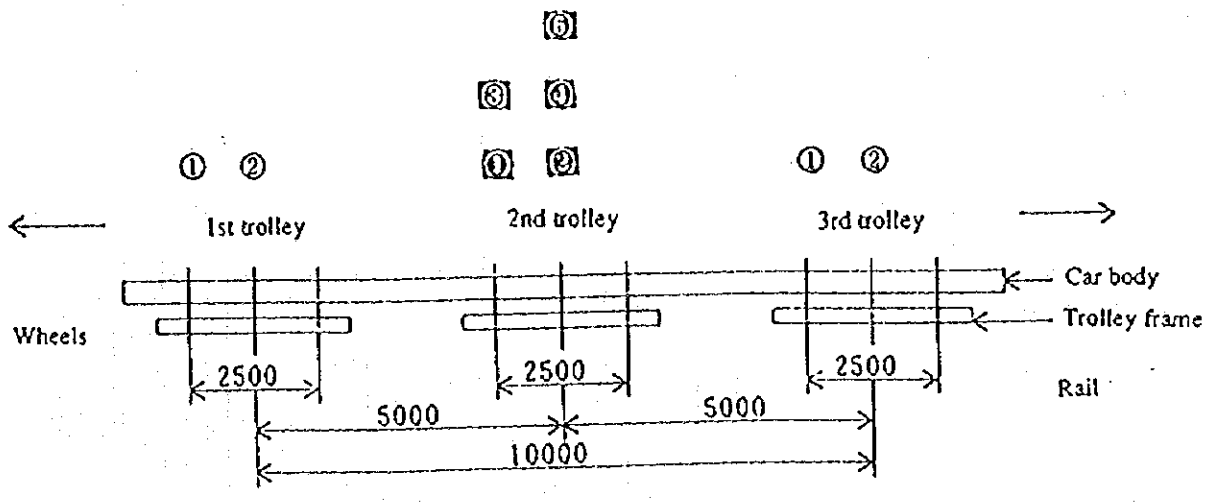
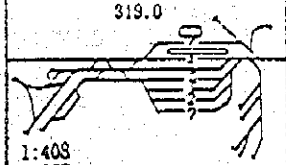
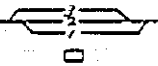
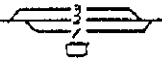
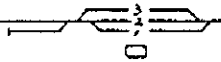
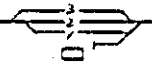
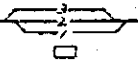
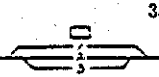
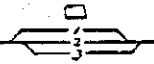
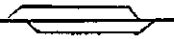
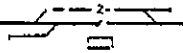
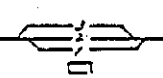
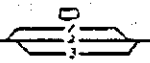
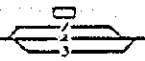
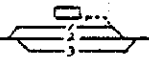
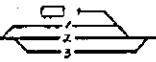
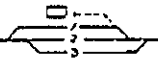
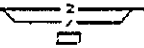
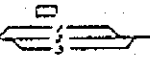
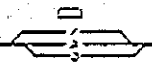
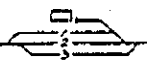
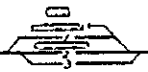
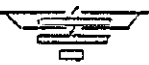
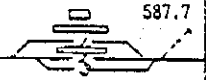
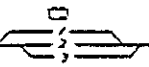
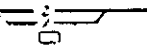

⑤
③ ④
① ② ① ② ① ②
1st trolley
2nd trolley
3rd trolley
Car body
Trolley frame
Wheels
Rail
2500
2500
2500
5000
5000
10000

Fig. 2

1 HA NOI	2 Giap bat	3 Van dien	4 Thuong tin	5 Cho tin	6 Phu xuyen	7 Dong van
0.0km 1:480 2:400	5.2 1:454 2:441	8.9 1:413 2:374 3:371	17.4 1:250 2:328	25.5 2:384 1:384	33.3 1:393 2:367 3:388	44.7 3:392 2:371 1:392
8 Phu ly	**9 Binh luc**	**10 Cau ho**	**11 Dang xa**	**12 Nam dinh**		**13 Nui goi**
55.9 4:447 3:434 2:450 1:450	66.5 1:295 2:375 3:479	72.9 1:367 2:367 3:452	81.0 3:293 1:368 2:349	86.8 1:375 2:373 3:460		100.8 3:382 2:365 1:401
14 Cat dang	**15 Ninh binh**	**16 Cau yen**	**17 Ghenh**	**18 Dong giao**	**19 Bim son**	**20 Do len**
107.6 1:436 2:436	114.6 2:390	120.4 1:503 2:443 3:413	125.0 3:421 2:350 1:384	133.7 1:402 2:482 3:450 4:450	141.5 3:411 2:411 1:432	152.3 1:477 2:466 3:476
21 Nghia trang	**22 Thanh hoa**	**23 Yen thai**	**24 Minh khoi**	**25 Thi long**	**26 Van trai**	**27 Khoa truong**
161.0 3:395 2:381 1:414	175.2 1:362 2:367 5:586	187.9 1:532 2:340 3:374	196.9 3:478 2:446 1:473	207.0 3:549 2:576 1:546	219.0 1:444 2:444 3:489	229.0 1:503 2:419 3:460
28 Turong lam	**29 Hoang mai**	**30 Cau giat**	**31 Yen ly**	**32 Cho sy**	**33 My ly**	**34 Quan hanh**
237.6 1:601 2:540 3:540	245.4 1:420 2:420 3:365 4:365	261.0 1:473 2:488 3:571 4.593	271.6 1:522 2:445 3:445 Nghia Dan	279.0 1:501 2:434 3:458	291.6 1:510 2:474 3:507	308.2 3:464 2:440 1:464

35 VINH	36 Yen xuan	37 Cho thuong	38 Duc lac	39 Yen due	40 Hoa duyet	41 Thanh luyen
319.0 	330.0 	337.5 	344.8 	351.5 	358.0 	369.6 
1:408 2:287 3:508	3:532 2:473 1:503	3:500 2:470 1:502	3:500 2:467 1:500	3:400 2:470 1:500	3:500 2:470 1:500	3:500 2:470 1:500
42 Chu le	**43 Huong pho**	**44 Phuo trach**	**45 La khe**	**46 Tan ap**	**(Khe net bac) Plan**	**47 Kim lu**
380.6 	386.8 	396.2 	404.4 	408.7 	415.0 	426.0 
1:503 2:502 3:500	1:503 2:470 3:500	1:500 2:493 3:525 4:474		1:430 2:400 3:430	2:400 1:400	3:430 2:401 1:432
48 Dong le	**49 Ngoc lam**	**50 Lac son**	**51 Le son**	**52 Minh le**	**53 Ngan son**	**54 Tho loc**
436.3 	449.6 	458.6 	467.1 	481.8 	488.8 	498.7 
1:452 2:422 3:452	1:425 2:395 3:425	1:416 2:388 3:416	1:400 2:370 3:400	1:422 2:392 3:422	2:400 1:400	1:415 2:483 3:415
55 Phuo tu	**56 Dong hoi**	**57 Le ky**	**58 Long dai**	**59 My duc**	**60 Phu hoa**	**61 My trach**
510.7 	521.8 	529.0 	539.2 	550.9 	558.5 	565.1 
1:402 2:370 3:400	4:400 3.400 2.417 1.400	1:415 2:362 3:415	1:420 2:420	1:400 2:385 3:420	1:400 2:400	1:400 2:400
62 Thuong lam	**63 Sa lung**	**64 Tien an**	**65 Ha thanh**	**66 Dong ha**	**67 Quang tri**	**68 Dien sanh**
572.2 	587.7 	598.9 	609.5 	622.2 	633.9 	642.7 
1:400 2:400	1:400 2:370 3:400	1:400 2:368 3:398	1:400 2:368 3:358	7:432 4:400 3:464 2:392 1:392	1:459 2:429 3:459	2:400 1:400

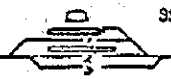
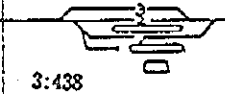
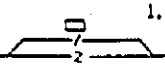
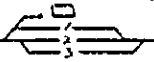
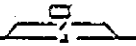
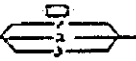
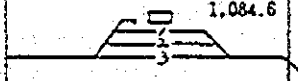
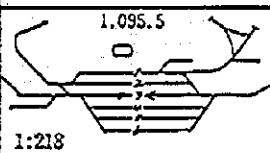
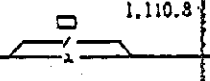
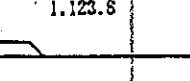
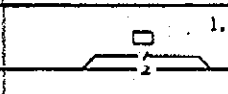
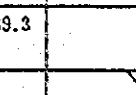
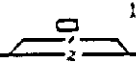
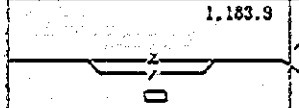
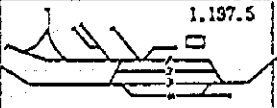
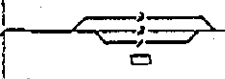
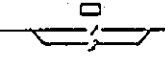
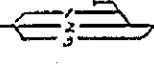
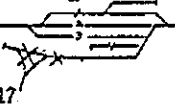
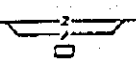
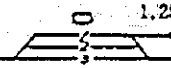
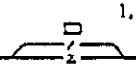
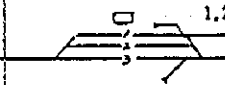
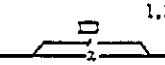
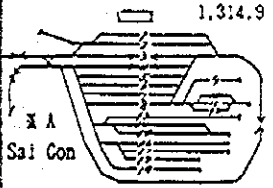
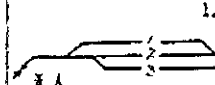
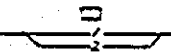
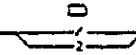
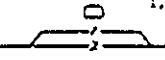
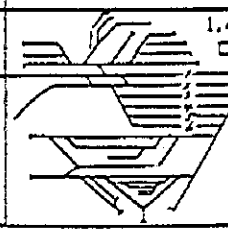
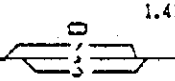
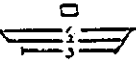
68 My chanh	70 Pho trach	71 Hien sy	72 Van xa	73 HUE	74 Huong thuy	75 Truoi
651.7	659.8	669.8	678.1	688.3	698.7	715.3
1:437 2:407 3:437	1:402 2:373 3:408	1:406 2:406	1:441 2:410 3:441	1:350 2:350 3:350 4:350 5:235 6:235 7:270	1:456 2:430 3:456	1:392 2:370 3:392

76 Cau hai	77 Thua luu	78 Lang co	79 Hai van bac	80 Dinh deo	81 Hai van nam	82 Kim lien
729.4	741.6	755.4	760.7	766.0	771.6	776.9
1:420 2:395 3:420	1:419 2:390 3:414	1:450 2:450 3:450 4:400	2:400 1:400		2:340 1:359	3:400 2:400 1:454

83 Thanh khe	84 Da nang	83 Thanh khe	85 Le trach	86 Nong son	87 Tra kieu	88 Phu cang
788.3	791.4	788.3	804.1	813.6	824.8	841.7
Sai Goo X A		X A 1:420 2:420 3:402 4:370 5:340 6:291 7:245	1:404 2:374 3:404	1:410 2:408 3:438	1:410 2:408 3:438	1:410 2:408 3:438

89 An my	90 Tam ky	91 Diem pho	92 Nu thanh	93 Tri binh	94 Binh son	95 Dai loc
857.1	864.7	879.5	890.4	901.1	909.1	919.5
1:404 2:374 3:404	1:410 2:408 3:438	1:404 2:374 3:404	1:410 2:408 3:438	1:387 2:387	3:433 2:403 1:405	1:404 2:374 3:404

96 Quang ngai	97 Hoa vinh tay		98 Mo duc	99 Thach tru	100 Duc pho	101 Thuy thach
927.9	940.4		948.9	958.7	967.7	977.1
1:405 2:399 3:428	1:404 2:374 3:404		1:404 2:374 3:404		1:410 2:408 3:438	1:402 2:402

102 Sa huynh	103 Tam quan	104 Bong son	105 Van phu	106 Phu my	107 Khanh phuoc	108 Phu cat
990.8	1,004.3	1,017.1	1,032.8	1,049.4	1,060.3	1,070.9
						
1:410 2:408 3:438	3:469 2:438 1:459	3:438 2:408 1:410	1:322 2:322	1:374 2:360 3:384	1:321 2:321	1:322 2:322
109 Binh dinh	110 Dieu tri	111 Tan vinh	112 Van canh	113 Phuoc lanh	114 La hai	115 Chi thanh
1,084.6	1,095.5	1,110.8	1,123.6	1,139.3	1,154.4	1,170.4
						
1:300 2:300 3:—	1:218 2:305 3:289	1:300 2:300	1:332 2:332	1:310 2:310	1:290 2:290	1:290 2:290
116 Hoa da	117 Tuy hoa	118 Dong tac	119 Phu hiep	120 Hao son	121 Dai lanh	122 Tu bong
1,183.9	1,197.5	1,202.1	1,209.6	1,220.1	1,232.2	1,242.0
						
2:270 1:270	1: 2:268	3:307 4:307	3:331 2:331 1:171	1:388 2:388	1:310 2:310	1:317 2:294 3:280	2:297 1:297
123 Gia	124 Hoa huynh	125 Ninh hoa	126 Phong thanh	127 Luong son	128 Nha trang	129 Cay Cay
1,254.1	1,269.5	1,280.6	1,287.4	1,302.9	1,314.9	1,329.1
						
1:242 2:267 3:328	1:350 2:350	1:195 2:246 3:269	1:350 2:350	1:274 2:274	Sai Con	1:314 2:314 4:396 3:414 5:280
130 Hoa tan	131 Suoi cat	132 Nga ba	133 Ka rom	134 Thar cham	135 Hoa trinh	136 Ca na
1,340.5	1,351.4	1,363.8	1,381.3	1,407.6	1,419.5	1,436.3
						
1:210 2:210	1:265 2:265	1:240 4:118 2:276 5:271 3:118 6:255	1:332 2:332	1:623 2:482 3:367 4:253	5:179 6:179	1:305 2:303 3:136

137 Vinh hao	138 Song long song	139 Song mao	140 Chau hanh	141 Song luy	142 Long thanh	143 Ma lam
1,453.7	1,465.5	1,484.6	1,493.7	1,506.1	1,522.X (.5)	1,532.8
	1:324 2:277 3:277 4:	1:300 2:276 3:238 4:201	1:350 2:350	1:310 2:243 3:121	1:353 2:353	1:217 2:217 3:290 4:191
144 Muong man	**145 Suoi van**	**146 Song phan**	**147 Song dinh**	**148 Suoi kiet**	**149 Gia huynh**	**150 Trang tao**
1,550.8	1,567.7	1,582.9	1,595.9	1,603.1	1,612.5	1,619.9
1:250 3:310 2:250 4:500	3:251 2:251 1:120	1:220 2:308 3:308 4:141	3:192 2:317 1:345	1:331 2:302 3:159	3:317 2:317 1: 80	1:340 2:294 3:121
151 Gia ray	**152 Bao chanh**	**153 Xuan loc**	**154 Dau giay**	**155 Trang bom**	**156 Ho nai**	**157 Bien hoa**
1,630.9	1,639.8	1,649.4	1,661.3	1,677.5	1,688.0	1,697.5
1:300 2:300 3:211	1:332 2:296 3:164	1:393 2:397 3:103	2:384 1:384	3: 80 2:351 1:351	1:334 2:324 3:104	3:112 5:121 2:338 4:125 1:376
158 Di an	**159 Song than**	**160 Thu duc**	**161 Binh trieu**	**162 Go vap**	**163 Saigon**	
1,706.7	1,710.6	1,713.5	1,718.3	1,722.1	1,726.2	
3:250 1:397 2:397	3:570 2:550 1:570	3: 59 1:329 2:329	1:471 2:410 3:333 4:333	3:427 2:262 1:262	(Depot) 1:322 4:356 2:368 5:333 3:356 6:288	

Appendix 8.8.1 Countgermeasure for Submerged Railway Section

(1)

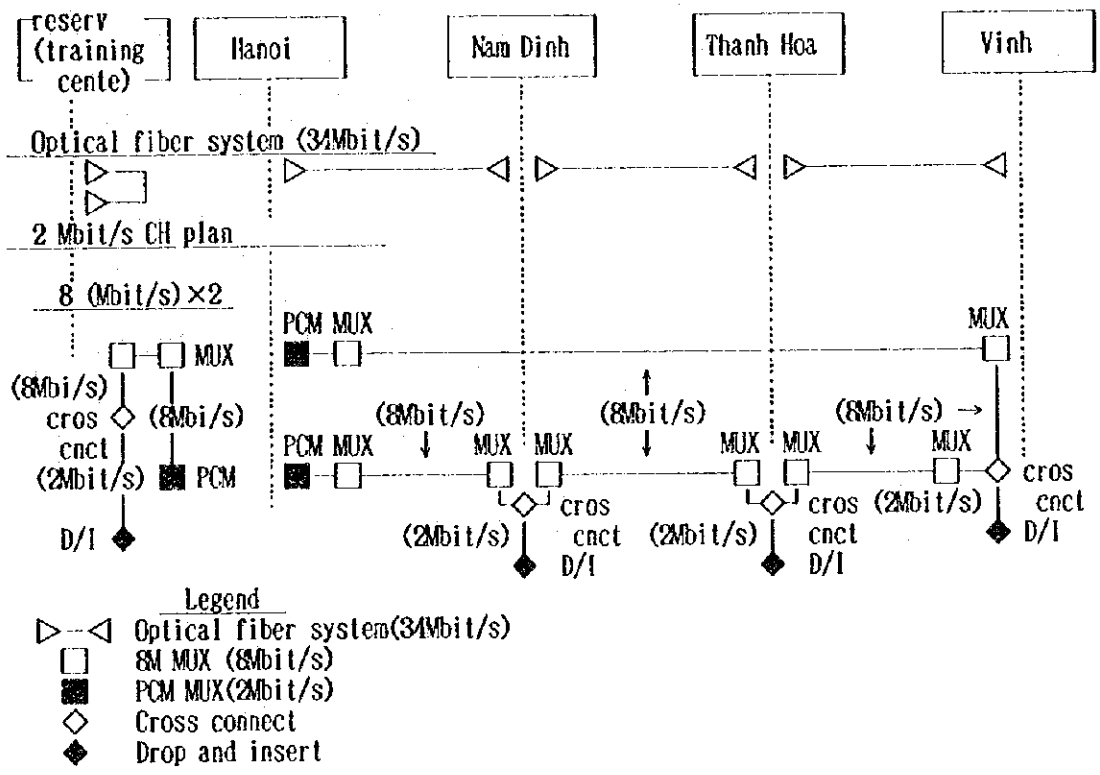
Location		Bridge, Ga, Minimum Curve Radius Included	Rerouting		Track Raising		Crossing Waterway		Note
			Track Length (km)	Height to Raise (m)	Track Length (km)	Height to Raise (m)	Track Length (km)	Nomber of Field (place)	
1. Vinh - Dong Hoi (319.0 km - 521.8 km)									
(1)	331.0 - 338.4	Yen Xuan Bri.l = 436.8 m Cau Han Bri.l = 38.9 m Lo Vang Bri.l = 25.2 m Cho Thuong Bri.l = 259.0 m GaChoThung (337.5 km) R= 100 m	7.4	2.0					Related to No. 9 Bridge that OECF selected
(2)	349.0 - 355.9	Ga Yen Due (351.5) R=150 ~ 290 m 6 Place	6.9	1.0					
(3)	357.7 - 364.5	Cau358k7Bri.l = 35.8 m Cau Rao Bri. l = 170.9 m Ga Hoa Duyet (358.0km) R =140~220m 11place	6.8	2.0					Related to Bri. Improvement
(4)	364.5 - 371.0	Thanh Luyen Bri. l = 59.4 m. Ga Thanh Luyen (369.6km) R = 300 m			(0.4)	(1.1)	6.5	3	( ) is Thanh Luyen Bri. reference
(5)	375.8 - 385.1	HuongTan Bri.l = 46.4m Ga Chu Le (380.6km) R = 290 m					9.3	4	
(6)	385.7 - 389.3	Loc Yen Bri.l = 88.6 m Ga Huong Pho (386.8km) R = 300 m			(0.5)	(1.5)	3.6	2	( )is Loc Yen Bri. reference in & outway
(7)	391.1 - 397.5	Khe Ac Bri. l = 27.2 m Cau394 km7Bri. l = 27.9 m Ga Phuc Trach (396.2km) R = 1,000 m			6.4	2.1			
(8)	424.0 - 428.0	Kim Lu-1 Bri.l = 31.0m Kim Lu-2 Bri.l = 57.2m Ga Kim Lu (426.0km) R = 300 m	4.0	5.6					in Bridge, R = 400 m
(9)	429.5 - 436.8	Khe Be Bri. l = 37.8 m Do Vang Bri.l =176.9m Dong Le Bri. l = 49.3m R = 150 m, 200 m	7.3	3.7					in KheBeBri. R= 500.Inway R=150.outway R=200 of Do Vang Bri.
(10)	448.9 - 454.0	Ngoc Lam Bri.l= 37.4m Dap Lang Bri.l = 32.0m Ga Ngoc Lam (449.6km) R = 400					5.1	3	
(11)	463.0 - 461.5	R = 500					1.5	2	
(12)	473.0 - 478.0	R = 500					5.0	4	
Sub Total		18 Bridge 1,637.7m Length	32.4	5 Section	6.4	1 Section	31.0	6 Section	

(2)

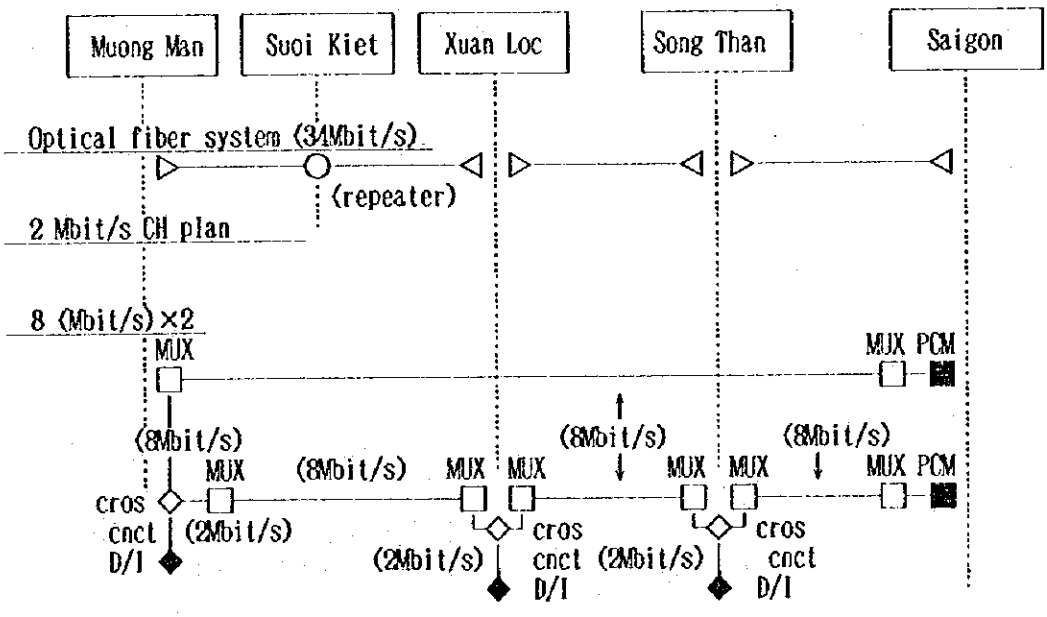
Location		Bridge, Ga, Minimum Curve Radius Included	Rerouting		Track Raising		Crossing Waterway		Note
			Track Length (km)	Height to Raise (m)	Track Length (km)	Height to Raise (m)	Track Length (km)	Nomber of Field (place)	
2.	Da Nang - Dieu Tri (791.4 km - 1,095.5 km)								
(1)	815.0 - 816.5	Ky Long Bri. l =72.6m R = 600 m			1.5	2.4			
Sub Total		1 Bridge 72.6m Length			1.5	1 Section			
3.	Union 3								
3-1	Dieu Tri - Muong Man (1,095.5 km - 1,551.2 km)								
(1)	1,463.2 - 1,465.3	Long Song Lam Bri. l = 160 Long Song Nho Bri. l = 31.0 R=400 m			2.1	1.9			Related to Bri. Impruvement
(2)	1,490.3 - 1,491.1	Ma Hy Bri. l = 62.3 none					0.8	1	
(3)	1,527.2 - 1533.8	Ga Ma Lam (1,532.8km) R = 600 m					[6.6]		
Sub Total		3 Bridge 253.3m Length			2.1	1 Section	0.8 [6.6]	1 Section [1]	
3-2	Muong Man - Sai Gon (1,551.2 km - 1,726.2 km)								
(1)	1 710.8 - 1,714.0	Ga Thu Duc (1,713.5km) R = 500					[3.2]		
Sub Total							[3.2]	[1]	
Total		2ᵢ Bridge 1,963.6m Length	32.4	5 Section	10.0	3 Section	31.8 [9.8]	7 Section [2]	

Note; in [ ] ; Side Drain

Appendix 8.11.1 2M bit/sec CH Plan

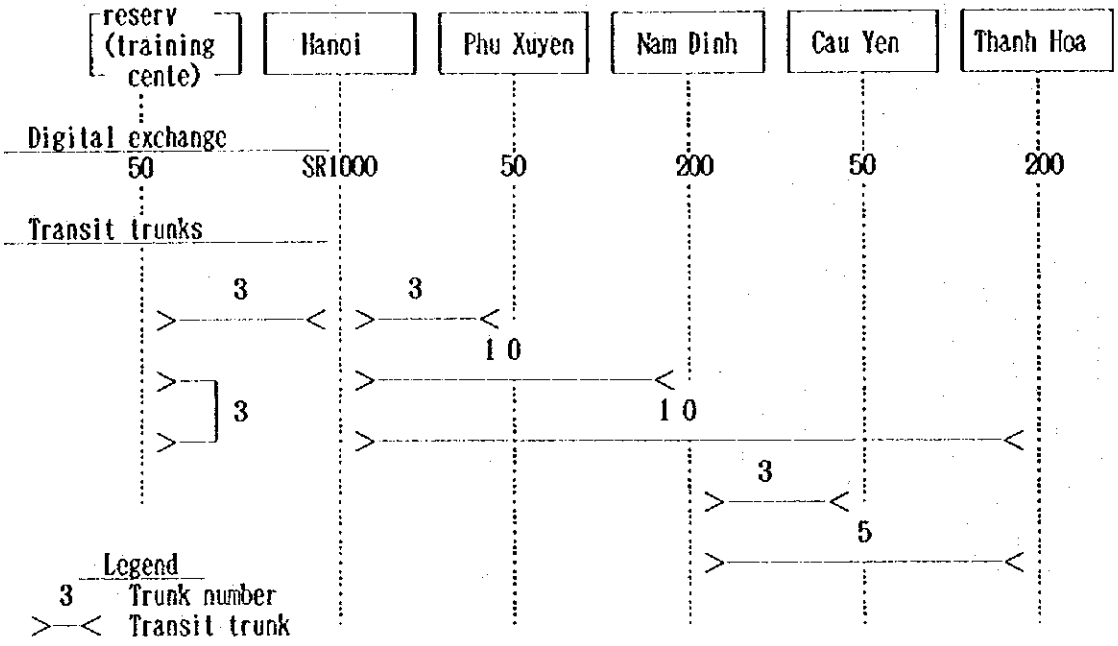


Appendix 8.11.1 (1) 2 Mbit/sec CH Plan U1

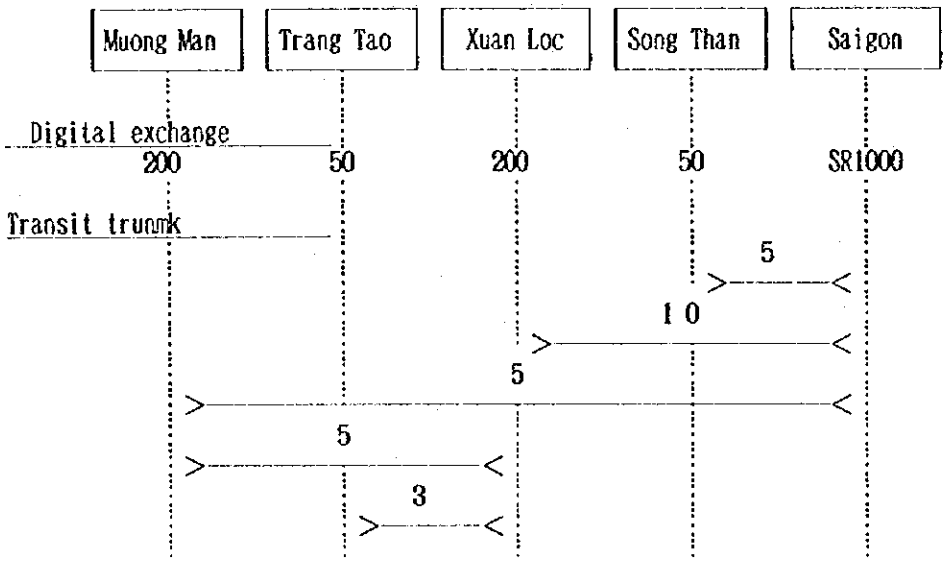


Appendix 8.11.1 (2) 2 Mbit/sec CH Plan U3

Appendix 8.11.2 Transit Trunk Network Plan



Appendix 8.11.2 (1) Transit Trunk Network Plan U1



Appendix 8.11.2 (2) Transit Trunk Network Plan U3

Appendix 8. 12. 1 New High Speed Train

1. Train Configuration (Total length: 228 m)

   DEL+B+B+Bx+Bx+Bx+B・D+Ax+Ax+A+A+DEL

   DEL : Diesel Electric Locomotive

   B : 2nd Coach

   Bx : 2nd Sleeping Car

   B・D : Baggage and Dining Car

   Ax : 1st Sleeping Car

   A : 1st Coach

2. DEL

   Output power : 1450CV

   Wheel arrangement : B-2-B

   Weight : 66 tons

   Axle weight : 11tons

   Maximum speed : 120km/h

3. Passenger Coach

   (1) All air-conditioned

   (2) Seating capacity

   Ax 24

   Bx 42

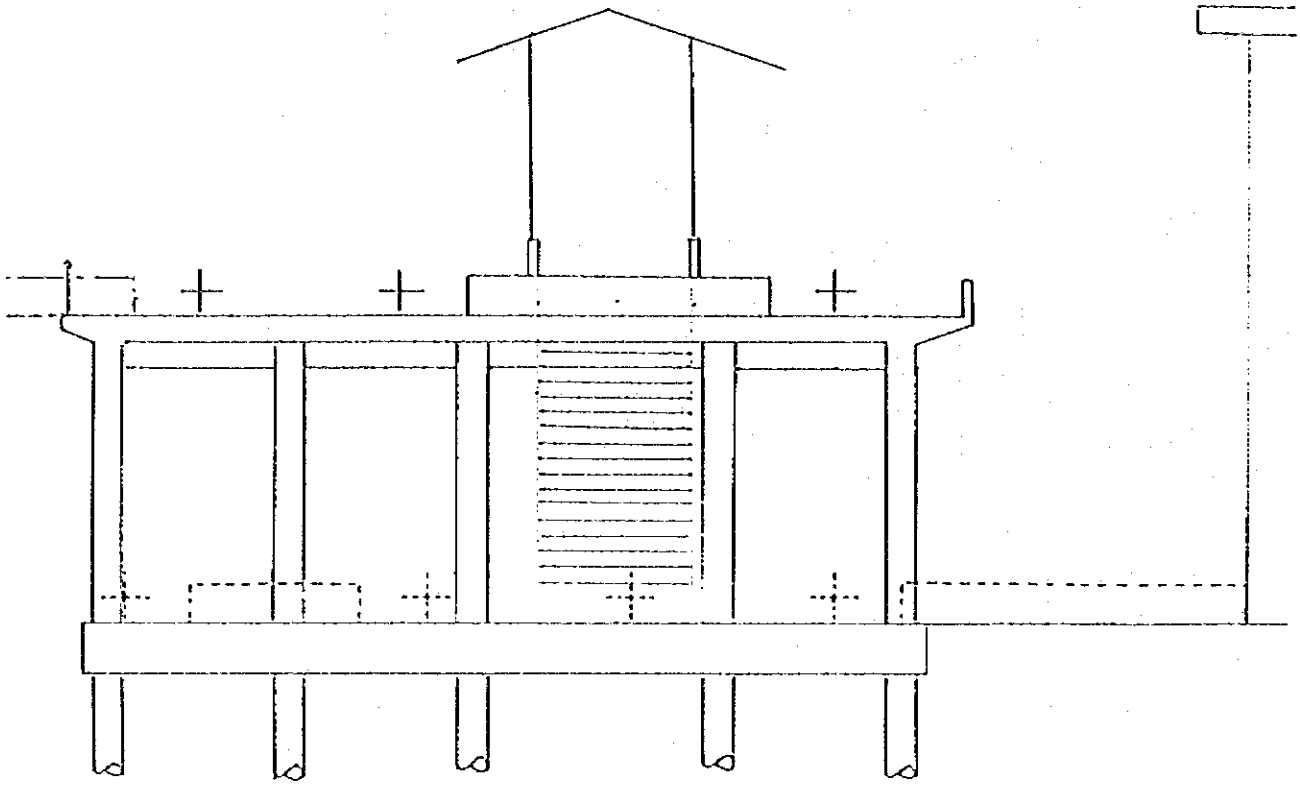
   A 64

   B 72

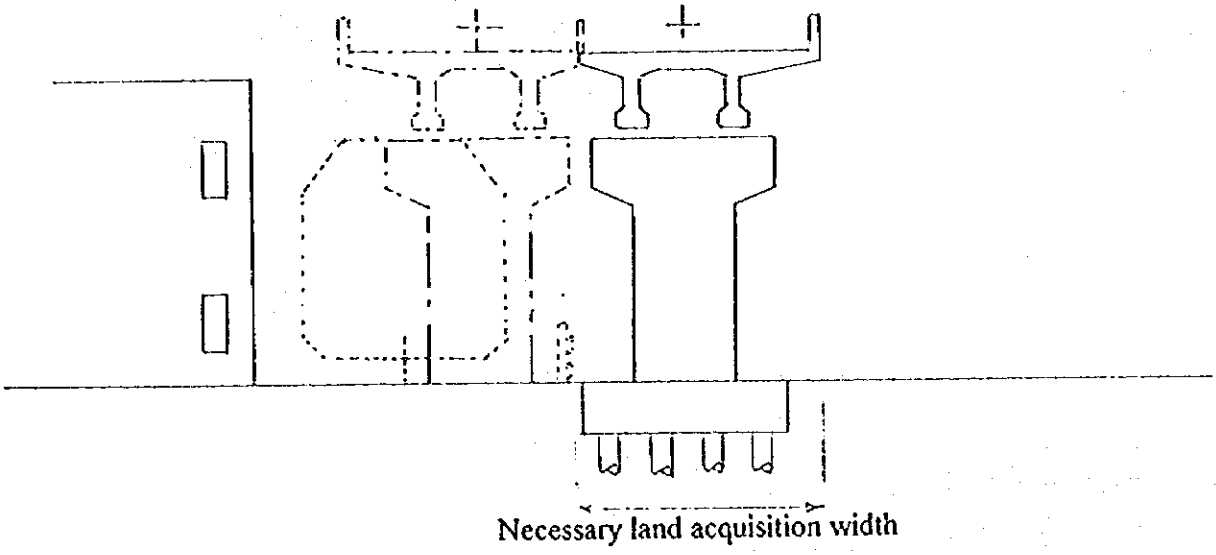
4. Performance Curve (Tractive Effort-Speed Curve)

   See attached figure

5. DEL will be imported, but passenger coach will be domestically manufactured importing necessary equipment such as air-conditioner and bogie set.



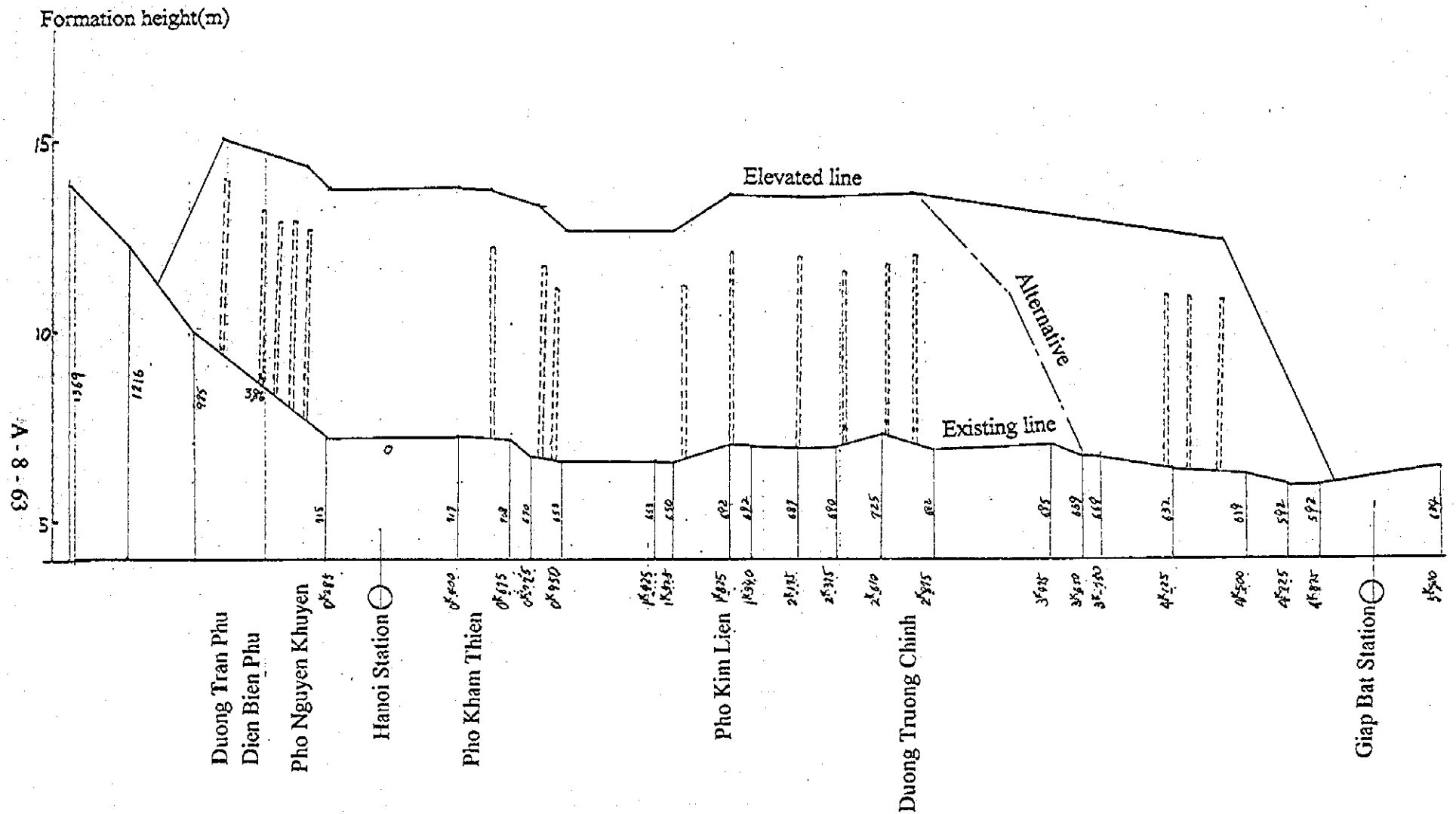
Hanoi station section



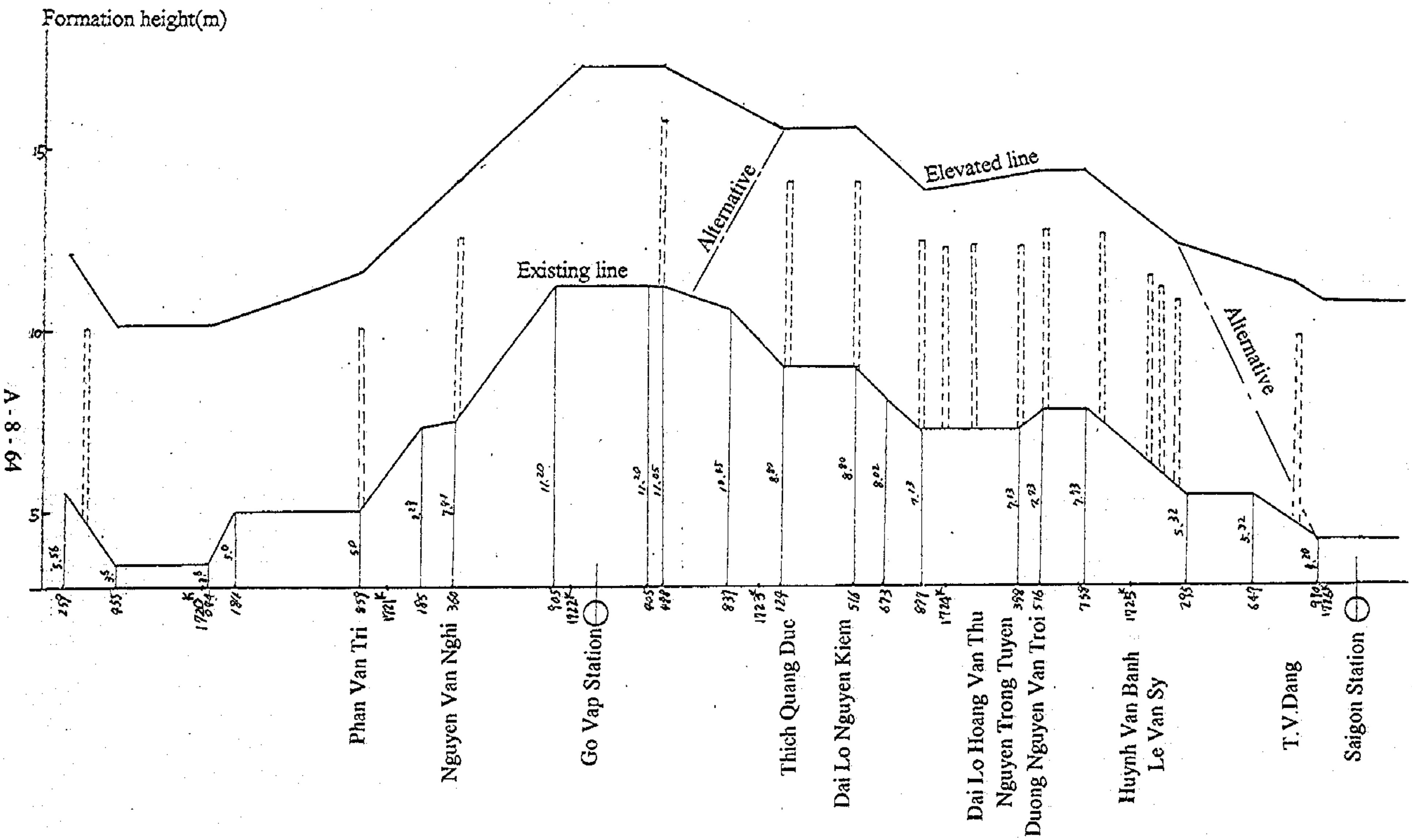
Midway section

——— Elevated line
— · — Adding line
– – – – Existing line

Appendix 8.17.1 An Example Profile of Viaduct



Appendix 8.17.2 Vertical Profile of Hanoi Viaduct



Appendix 8.17.3 Vertical Profile of Saigon Viaduct

Appendix 9.14 Gia Lam Rolling Stock Workshop Improvement

9.14.1 Foreword

At present, the maintenance for the DELs of VNR is executed in the depots that do not have adequate facilities for DEL repair. But, Gia Lam Workshop has also no facilities to overhaul DEL and has inadequate facilities to overhaul DHL.

In order to concentrate diesel locomotive overhaul and repair in Gia Lam Workshop, the facilities for overhaul and repair for DEL will be created and upgraded in Building 3B, which had been used for overhaul and repair of steam locomotives.

With the present method for overhaul and repair of rolling stock, when other conditions are improved and speed rises, rolling stock will be unable to adjust to the changes, raising the possibilities of a major accident. Therefore, adjustments must be made for the faster train services by the establishment of inspection and performance testing systems as well as application of apparatus which can identify interior damage which is not discovered through visual inspection.

More uniform quality of labor and parts can be achieved by mechanization of repair work, almost all which is now carried out by hand. Quality upgrade is also an important factor in adjusting for higher speeds by reviewing work methods and conducting quality control checks.

9.14.2 Number of Diesel Locomotives overhauled at Gia Lam Workshop

(1) The Number of Diesel Locomotives belonging to each Union

Table 9.14.1 Number of DLs by Union

Type	Union 1	Union 2	Union 3	Total
D4H	165	57	4	226
D5H	13	0	0	13
D11H	0	9	1	10
D8H	5	0	0	5
DHL Sub Total	183	66	5	254
D9E	0	0	39	39
D12E	15	25	0	40
D13E	0	0	15	15
D18E	16	0	0	16
DEL Sub Total	31	25	54	110
Total	214	91	59	364

The number of Diesel Locomotives (DLs) belong to each Union in September, 1995 is shown as Table 9.14.1.

Gia Lam Workshop takes charge of all the diesel locomotives belonging to Union 1 with the exception of the five D8H locomotives . So these overhauls are carried out at Gia Lam Workshop.

Besides the DLs mentioned in the above table, engines and main machinery (traction motors, main generators, etc.) of all the DLs of VNR are to be overhauled at Gia Lam Workshop.

(2) Number of Diesel Locomotives Overhauled at Gia Lam Workshop

The number of diesel locomotives are predicted to change as in the following table:

Table 9.14.2 Number of Diesel Locomotives (DLs) in the Future

Type	1995	2000	2005	2010
P-P	0	10	90	104
D18E	16	49	55	62
D12E	82	123	157	224
DEL Sub Total	98	182	302	390
D4H	226	150	0	0
D5H	13	13	13	13
D11H	10	10	10	10
D8H	5	2	1	0
DHL Sub Total	254	175	24	23
Total	352	357	326	413

Note 1; The 82 locomotives of D12E in 1995 include utilizable 28 DLs of D9E and 14 DLs of D13E.
Note 2; P-P is newly procured high-grade rolling stock , and both DL and PC will have complete overhaul at Gia Lam Workshop.

(3) Number of Diesel Locomotives Overhauled at Gia Lam Workshop

The total number of Diesel Locomotives of VNR overhauled are expected to change as shown in Table 9.14.3. The number included in this table which are to enter Gia Lam Workshop are shown in Table 9.14.4.

Table 9.14.3 Number of Locomotives Overhauled on VNR in Future Years

Type	2000	2005	2010
P-P	2.7	26.7	34.2
D18E D12E	26.7	38.8	59.4
D9E D13E	7.9	9.2	10.5
D5H	2.4	2.8	3.2
D11H	1.9	2.3	2.7
D8H	0.4	0.2	0
D4H	28.5	0	0
Total	70.5	80.0	110.0

Table 9.14.4 Number of Locomotives Overhauled at Gia Lam Workshop in Future Years

Type	2000	2005	2010
P-P	2.6	26.7	34.2
D18E D12E	16.0	23.3	35.6
D9E D13E	0	0	0
D5H	2.4	2.8	3.2
D11H	0	0	0
D8H	0	0	0
D4H	17.1	0	0
Total	38.1	52.8	73.0

(4) Number of Diesel Locomotives under overhaul in the workshops and at depots

The average number of days required for overhaul (and temporary repair) is assumed 36 days (18 days) in the year 2000, 30 days (15 days) in the year 2005 and 24 days (12 days) in the year 2010. Therefore, the number of Diesel Locomotives under overhaul on VNR are calculated as Table 9.14.5, those in Gia Lam Workshop are calculated as Table 9.14.6. The numeral in ( ) is the number of days for heavy temporary repair.

The number of days required for overhaul (and temporary repair) is calculated according to actual time presently required and expected time decrease resulting from improved efficiency.

Table 9.14.5 Number of DLs under overhaul on VNR

Type	2000		2005		2010	
	Overhaul	Heavy Temporary Repair	Overhaul	Heavy Temporary Repair	Overhaul	Heavy Temporary Repair
P-P	0.37		3.15		3.23	
D18E D12E	2.26		4.57		5.6	
D9E D13E	1.11		1.08		0.99	
D5H	0.34		0.33		0.3	
D11H	0.27		0.27		0.25	
D8H	0.05		0.02		0	
D4H	4.03		0		0	
Total	8.43	2.4	9.42	1.87	10.37	1.51
The Total	11		12		12	

Note ; Figures in "The Total" column indicate the number of only engines under overhaul at the same time.

Table 9.14.6 Number of DLs stayed at the same time in Gia Lam Workshop

Type	2000		2005		2010	
	Overhaul	Heavy Temporary Repair	Overhaul	Heavy Temporary Repair	Overhaul	Heavy Temporary Repair
P-P	0.37		3.15		3.23	
D18E D12E	1.36		2.74		3.36	
D9E D13E	0		0		0	
D5H	0.34		0.33		0.3	
D11H	0		0		0	
D8H	0		0		0	
D4H	2.42		0		0	
Total	4.49	1.24	6.22	1.15	6.89	0.94
The Total	6		8		8	

Note ; The numeral of The Total is the number of car-bodies stayed at the same time. Therefore, Gia Lam Workshop needs to have a capacity for 8 locomotives or more at the same time.

(5) The Number of major machinery and equipment under overhaul in Gia Lam Workshop

The number of major machinery and equipment (engines, traction motors, main generators, etc.) stayed at the same time in Gia Lam Workshop are shown as Table 9.14.7.

Table 9.14.7 Number of major machinery and equipment overhauled at the same time

Major machine, equipment	2000	2005	2010
Engine	11	12	12
Traction Motor, Main Generator, etc.	6	11	12

Note ; The number of engines is the number of DELs and DHL under overhaul at the same time on VNR.
The number of Traction Motors, etc. is the number of DELs under overhaul at the same time on VNR.

(6) Number of PCs and FCs under overhaul at the same time in Gia Lam Workshop

Table 9.14.8 Number of PCs and FCs under overhaul at the same time at Gia Lam Workshop

Type	2000	2005	2010
PC	12	17	17
FC	24	27	24

Note 1; All PCs are high-grade rolling stock.
Note 2; The both PCs and FCs include the number of heavy temporary repairs.

9.14.3 Major Facilities and Details of Work at Each Work Shop

(Refer to Fig. App. 9.14.1)

(1) Building 3B (diesel locomotive overhaul shop)

1) Car-body Lifting/Lowering, Washing Area

A locomotive that enters the workshop has its engine and main generator dismantled at the start, removal of the bogies and taken to the washing shop. After washing, the body is placed in the body storage space. The engine and other parts are sent to their respective inspection and repair areas by platform vehicles.

Each component is replaced in the body lowering area after being overhauled in their respective workshops.

No.	Maintenance Work	No.	Maintenance Work
①	Shop-in	⑩	Engine etc. repair area
②	Body lifting, lowering, washing area	⑪	Engine performance test room
③	Bogie-frame, foundation brake parts repair area	⑫	Coupler repair area
④	Wheel set, roller bearing repair area	⑬	Wheel set repair area
⑤	Auxiliary rotating machine repair area	⑭	Body painting building
⑥	Traction motor etc. repair area	⑮	Final adjustment building
⑦	Electric parts, battery repair area	(a)	PC, FC overhaul area
⑧	Air-brake parts repair area	(b)	Air conditioning repair area
⑨	Radiator etc. repair area	(c)	Manufacturing area for carrige & wagon components

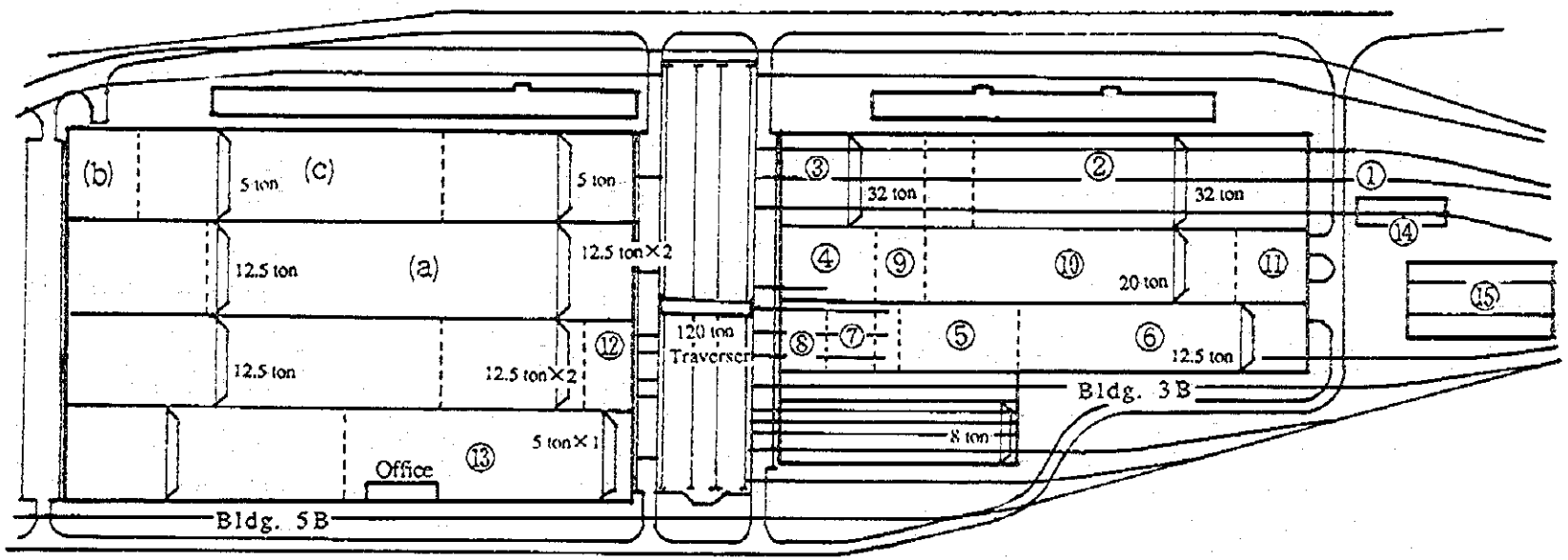


Fig. App. 9.14.1 Location of Deisel Locomotive Overhaul Shop

2) Bogie-frame Repair Area

The bogie-frame is disassembled, and its frame is washed at the bogie-frame washer newly installed in Building 5B (passenger car and freight car overhaul workshop), then inspected and repaired. The axle is inspected and repaired at the axle-repair line in Building 5B. Parts which have been inspected and repaired are gathered in the bogie-frame repair area where they are re-assembled and painted.

3) Roller-bearing and Axle Box Repair Area

Roller-bearing which is dismantled from the axle is inspected in an enclosed dust-free area.

4) Auxiliary Rotating Machine Repair Area

Auxiliary Rotating Machines are washed, inspected and repaired with magnetic flaw detector, etc.

5) Traction Motor, Generators, etc. Repair Area

Traction Motors, Generators, Auxiliary Generators, etc. are dismantled from the car-body, inspected and repaired. After repairs, these are tested for performance by suitable test apparatus.

6) Electrical Parts, Battery Repair Area

Each battery is inspected and repaired. All Electric-Pneumatic Valves, Speedometers and Other Measuring Devices are disassembled, cleaned, re-assembled and tested in an enclosed dust-free area

7) Air Brake Parts Repair Area

All types of air valves are washed, cleaned, repaired and re-assembled in a dustproof room; then inspected and tested by their respective test apparatus.

8) Radiator, Oil Damper Repair Area

Radiators and oil dampers have their interiors washed and are then pressure-tested.

9) Engine, Converter Repair Area

Engines, converters, and other auxiliary parts are disassembled, washed, inspected, and repaired.

10) Engine Performance Test Shop

The performance of engines and converters which have completed repairs are then tested and finally painted.

11) Coupler Repair Area

Couplers are disassembled, inspected, repaired and re-assembled. These work is conducted in the same area as PCs and FCs in Building 5B.

12) Axle Repair Area

Axles which have been dismantled from the bogie-frame are inspected on the axle inspection and repair line for interior faults in Building 5B, and they are repaired. Tires are dismantled at the tire-heating furnace and reassembled with a tire-attachment device.

(2) Space Required for Each Work Area of DL Overhaul

1) Building 3B

Calculating from the number of rolling stock under overhaul at the same time, the amount of area required for inspection and repair of body-work and various parts of DL is shown as Table 9.14.9.

Table 9.14.9 An Area Required for Inspection and Repair

Work Shop	Area in square meter
Body Washing Shed	192
Body Lifting/Lowering Area	384
Body, Hood Repair Shop	1,440
Sheet Metal and Pipe Work Area	288
Bogie-frame, Foundation Brake Parts Repair Area	864
Engine Performance Test Room	324
Engine and Transmission Gear Repair Shop	1,404
Engine Auxiliary Equipment Repair Shop	216
Roller Bearing and Axle Box Repair Area	432
Traction Motor, Generator Repair Shop	1,296
Air Brake Parts Repair Area	216
Battery Repair Area	108
Electric Parts Repair Area	216
Auxiliary Rotating Machine Repair Shop	540

2) Other Work Areas

(a) Outside of the body lowering shop of Line No. 6, a new body painting area (20 m x 6 m) will be provided. After lowering of the body, it will be pulled outside for painting.

(b) Building 44B remodeled as Final Adjustment Shop

A new pit of 20 meters in length will be made on Line No. 18 and No. 16 in Building 44B. Construction will be such that rain and dust cannot be blown in.

Locomotives which have been painted will be supplied with fuel oil and lubricating oil, and all parts will receive a final checkup before leaving the Workshop.

(3) Building 5B (PC and FC overhaul and new manufacturing)

At present, Building 5B is carries out overhaul and manufacture of passenger cars and freight cars, as well as overhaul of axles of all cars (including diesel locomotives) that enter the Workshop. In addition, a new steam-jet bogie-frame cleaner will be installed for the washing of all cars (DL, PC, FC) that enter Workshop, thereby simplifying the process of discovering damage through non-destructive inspection.

The unused Axle Presses in the Axle Repair Shop will be removed, and replaced with the Axle Press which can control the amount of pressure. Non-destructive investigator devices such as ultrasonic damage detector will be newly installed to establish an investigating and repairing system to match the technology required for higher speeds.

The Couplers are fixed and removed manually for the cars at present, but will be mechanized as a step in strengthening the check-up system.

Other improvements will be made as follows:

1) FC Overhaul Area

Air Brake Tester will be installed in the Freight Car Overhaul Area.

2) Air Conditioning Device Repair Area

Air Conditioning Device Repair Area will be set up in one corner of Building 5B to be used in high-grade passenger cars. Such Air Conditioning Devices will be washed, disassembled, re-assembled, adjusted and tested.

3) Manufacturing of New Cars.

Brake presses, etc. will be set up in the car manufacturing shop of Building 5B, to make easier the manufacture of parts. The manufacture of new passenger and freight cars will be mechanized to help deal with up-grade of cars.

(4) Miscellaneous

1) Effluent Treatment Plant

A facility to separate out oil, a water softening plant and a sewage treatment plant (which is presently disposed of in untreated form) will be set up.

2) Sewage Treatment Facility

A rolling stock that dumps toilet sewage as it is running not only spoils the railway environment, but sewage which becomes attached to the car itself is likewise a problem. To alleviate this problem, on-train tanks for retaining and treating toilet sewage will be employed.

3) Buildings

(a) New facility for car-body painting will be added. Final Adjustment Room will be remodeled.

(b) Rain leakage in the buildings is a major problem, so roof repairs will be made. Building 3B and 5B will be fixed and remodeled as follows:

- Improvement of natural lighting (windows)
- Floor repairs
- Painting of steel surfaces and walls

(c) Building 3B and 5B are to be paved with concrete, but a part of the Traction Motor Repair Shop will be paved with wooden tiles (bricks).

(5) Principal machinery and equipment in each shop

Table 9.14.10 Principal machinery and equipment

Work Shop	Location	Principal Machinery and Equipment	Unit
Car-body lifting, lowering, washing aria	Bldg. 3B	Metal fittings for lifting car-body	1
		Steam jet cleaner	2
		Fork-lift truck	2
		Overhead crane(exist)	2
		Working pit	45 m
Bogie- frame repair area	Bldg. 3B	Air blow cleaning equipment	1
		Shot blast	1
		Magnetic flaw detector	1
Roller bearing repair area	Bldg. 3B	Roller bearing washer	1
		Sealed roller bearing disassembly equipment	1
		Partition	1 set
Auxiliary rotating machine repair area	Bldg. 3B	Oil damper tester	1
		Spring tester	1
		Converter oil flushing device	1
Traction motor etc. repair area	Bldg. 3B	Armature automatic lathe	1
		Main motor tester	1
		Overhead crane(exist)	1
		Wood brick floor	1 set
Electric parts, battery repair area	Bldg. 3B	Switch tester	1
		Oil relay tester	1
		Partition	1 set
Air-brake parts repair area	Bldg. 3B	Air-brake tester	1
		Pressure gauge tester	1
		Partition	1 set
Radiator etc. repair area	Bldg. 3B	Radiator inner washer	1
		Radiator leakage tester	1
Engine etc. repair area	Bldg. 3B	Engine block washer	1
		Crank shaft grinder	1
		Overhead crane(exist)	1
Engine performance test room	Bldg. 3B	Engine performance test apparatus	1
		Overhead crane	1
		Sound proof partition	1 set
Coupler repair area	Bldg. 5B	Coupler disassembly / assembly equipment	1
		Hydraulic press	1
Wheel set repair area	Bldg. 5B	Wheel and axle press	1
		Ultrasonic flaw detector	1
Car-body painting building	Bldg. New	Painting equipment	1
		Height staging car	1 car
		Room with Dust-collecting	1 set
Final adjustment building	Bldg. 44B	Oil supply equipment	1
		Water supply equipment	1
		Working pit	45 m
Air conditioning repair area	Bldg. 5B	Air conditioning test equipment	1
		Air filter washer	1
Manufacturing area for carriage and wagon components	Bldg. 5B	Brake press	1
		Sheet metal shearing machine	1

9.14.4 Expense

Table 9.14.11 Expense

Unit; Million US$

Kind	Foreign Currency	Local Currency	Total
Principal machines			
Body Lifting, Lowering, Washing Area	0.57		0.57
Bogie-frame, Foundation Brake Parts Repair Area	1.54	0.03	1.57
Roller Bearing and Axle Box Repair Area	1.15	0.03	1.18
Auxiliary Rotating Machine Repair Area	1.22	0.02	1.24
Traction Motor, Generator Repair Area	3.24	0.03	3.27
Electric Parts, Battery Repair Area	0.90	0.01	0.91
Air Brake Parts Repair Area	0.50	0.01	0.51
Radiator etc. Repair Area	0.25	0.03	0.28
Engine and Transmission Gear Repair Shop	4.46	0.07	4.53
Engine performance test room	3.46	0.05	3.51
Coupler Repair Area	0.33		0.33
Car-body Painting Building	0.05		0.05
Final Adjustment Building	0.41	0.01	0.42
Passenger / Freight Car, Air Conditioning Repair Area	0.85	0.01	0.86
Power Supply	0.80	0.06	0.86
Subtotal	19.73	0.36	20.09
Repair of Buildings		6.04	6.04
Drainage and Waste Disposal Treatment	0.76	0.06	0.82
Engineering Fee	2.09		2.09
Car Spare Parts Cost	1.00		1.00
Subtotal	3.85	6.10	9.95
The Total	23.58	6.46	30.04

Appendix 10.8 Route Selection of The New Hai Van Tunnel

(1) The Geology of the Hai Van Pass

The geology of the Mountains is igneous rock granite. The valley runs parallel or perpendicular. They have clear cut valleys which draw a line over the mountain ridge. The granite joints have developed into valleys and a major fissure exists nearly parallel to the new railway route. The obtained strike at altitude of 20m figures such a straight line as illustrated in Fig. App. 1.

There is an alluvial fan at altitude 160m lower in the southern exit of the Tunnel.The fan might be formed from where a river flowed out of a valley exit from the mountain mass.

(2) Tunnel Cross Section and concept of new root

Tunnel cross section refers to the internal clearances for the tunnels on the Vet Nam Railways,and draws a smooth continuous outline of combined circular curves, as NATM (New Austrian Tunneling Method) theory avoids the edgy outline of tunnel cross sections. Thus, the shape of tunnel cross section is drawn as illustrated (Fig. App. 2).

Concept of a new tunnel is as follows;

• the minimum curve radius	:	1,000m
• the steepest gradient	:	9‰
• track structure	:	50kg rail ; and PC sleepers, in tunnel concrete slab track
• Tunnel length	:	7.8 ~ 9.0 km
• Tunnel cross section	:	electrified section of single line
• Geology of tunnel root	:	igid igneous rock granite with few joints
• Stations for overtaking and crossing	:	2 stations near entrance and exit of the tunnel

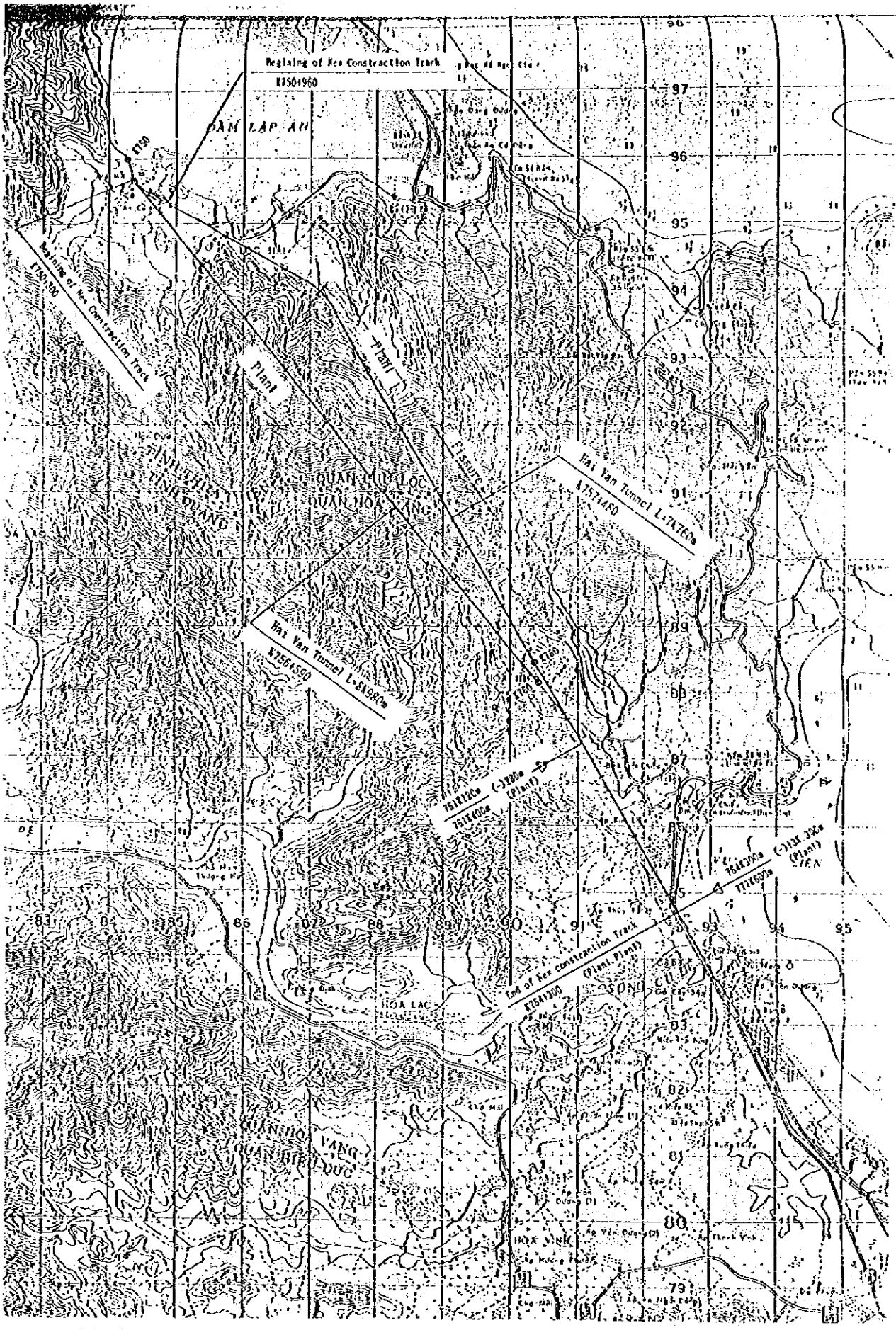


Fig. App. 1 New Railway Route near the Hai Van Pass

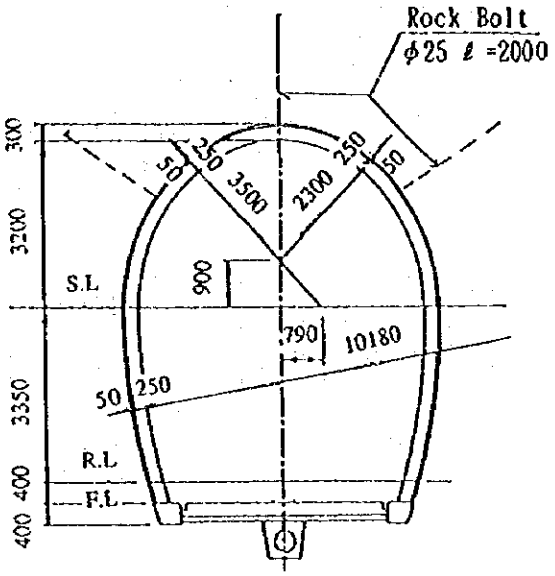


Fig. App. 2 Hai-Van Tunnel Section Design

(3) Railway route selection

(a) Location and direction of tunnel

The route should be selected to connect the south and north of the Pass in a straight line as nearly as possible. Furthermore, the tunnel length should be reduced so as to be as short as possible.

When the route is located in the valley through as long as possible, it is possible to fulfill the objectives. However, fissures may well exist in the valley and contain a volcanic debris deposits. But it is unknown whether the route will avoid unconsolidated layers of such debris. Hence, a geological survey will have to be made to provide detailed condition of the surrounding areas.

(b) Tunnel mouth

Spring water is a tunneling problem. In the north side valley, basement rock is exposed. Surface soil is so thin that plants do not grow and rock emerges from the thin surface soil.

On the contrary, in the south side valley a large scale fan has developed on the fissure deemed to be a geologically weak structure.

The tunnel route shall not touch this fan or fissure.

(4) Survey which the routing demands

Geography and geology are the vital data that affect route selection, planning, design and implementation. Therefore, various investigations of a geological survey must be carried out to study and obtain the basic data for tunnel location, construction timing, its cost, excavation method, its maintenance and repair.

When planning an enormously costly tunnel such as the Hai Van Tunnel, first an elastic wave exploration, then boring surveys and precise surveys must be carried out to increase survey accuracy and to determine the final route selection (Fig. App. 3).

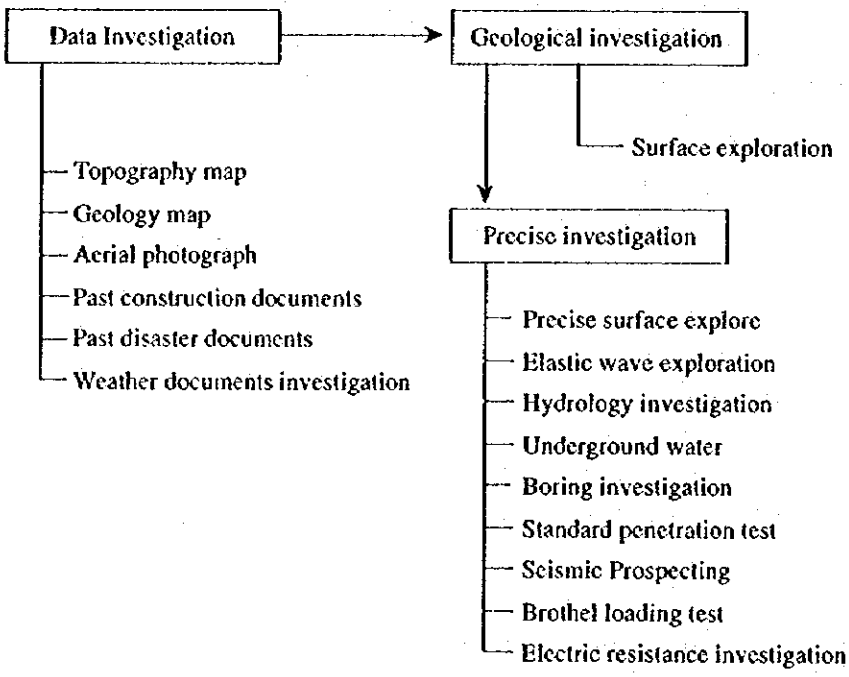


Fig. App. 3 Major Geological Investigation

(5) Concept of the new route

A study on timing of the Tunnel construction should be implemented as fast as possible. But VNR will need a vast sum of money to construct the Hai Van Tunnel. Therefore, it should compare between incomes and construction expenses.

Comparison of existing and new line are shown as Table App. 1. Major affairs relating to timing of the Tunnel construction are as follows;

- Maintenance cost
- Operation cost
- Business expenses
- Construction cost

Table App. 1 Comparison Of Existing and New Line

	Existing line	New line
Route length	27.3 km	13.7 km
Maximum speed	30 km/h	any speed
Speed restrictions	15 km/h	none
Maximum gradient	17‰	9‰
Minimum curve radius	100 m	1,000 m
Tunnel length	6 tunnels, tunnel length 2.6 km	7.8～9.0 km
Locomotive	Helper needed	No helper
Traveling time	65 minutes/average speed 25km/h	9 minutes/average speed 90km/h