12. 4. Freight and Passenger Transport Plan on Cai Lan Line

12.4.1 General

Since Route 18 will be improved by 2000, the railways will face very severe competition with road transport concerning passengers and freight. It will make the competition be more difficult.
Demand on the Lao Cai Line is large and it will be necessary for VNR to make efforts to develop the railway market.
Improvement in management are also necessary in order to maintain railway operation with reduced cost.

12.4.2 Cai Lan Port Cargo Transport Plan

The Cai Lan Port Construction Project is under way and international shipping is planned to be inaugurated in around 2000.

The demand for whole operation cargo at the port estimated by the JICA Cai Lan Port Construction Study and the share for rail transport is assumed to be as follows:

Import cargo (Unit 1,000 ton)

	2000 Total	2010 Total	Share for rail	Rail 2000 ton	Rail 2010 ton
Coal	10	31	-		
Other Ore	-	204	-		
Scrap	287	854	-		
Fertilizer	103	124	5%	5	5
Chemicals	89	525	-		
Asphalt	30	120	-		
Wheat	240	1,001	5%	12	50
Container	312	3,509	*		
Total ton	1,071	6,368		17	56

Export cargo (Unit 1,000 ton)

	2000 Total	2010 Total	Share of rail	Rail 2000 ton	Rail 2010 ton
Ore	-	545	-		
Metal	-	71	-		
Rice	200	513	5%	10	25
Maize	300	316	5%	15	16
Wheat	30	125	5%	2	6
Cement	240	2,060	-		
Container	131	1,550	*		
Total	901	5,180		27	47

(Source: JICA Feasibility Study for Cai Lan Port Construction Project, November 1994)

Assumption of container transport by rail:
Case 1 and Case 2 are formulated as alternatives. In either case, it is necessary that VNR make efforts to develop the railway market and negotiate hard to obtain contracts with shippers. Shippers have the casting vote for deciding whether or not goods are to be transported by road or by rail.

Case 1 -VNR develops the shipping market aggressively
-VNR establishes a modern cargo transport system
-VNR succeeds in obtain contracts with shipping companies to transport containers by rail.

Case 2 Addition to the conditions above the following is carried out
-The government promotes container transport by rail in order to use the railway system efficiently and to reduce road traffic(Traffic Demand Management policy).
-Railway facilities situate at in favorable location in the port area.
-The government recommends for shippers to use the railway.

*The railway share of container transport is assumed to be 10% in Case 1 and 30% in Case 2.

The demand forecast for rail container transport is as follows;

(Unit:TEU/year)

		2000		2010	
		Case 1	Case 2	Case 1	Case 2
Import	Loaded TEU	2,100	6,300	23,400	70,200
Export	Loaded TEU	750	2,300	8,900	26,600
	Empty TEU	1,350	4,000	14,500	43,600

TEU: Twenty(20) feet Equivalent Unit)

The demand of general cargo for rail transport is not large and it would be better to transport it with the conventional rail transport system.

Most cargo imported/exported is estimated to be consumed/produced in Quang Ninh and Bai Chay according to the demand forecast of the JICA Cai Lan Port project study. Grain exported and imported will be transport by a bulk cargo transportation system.

General cargo will be stuffed using pallets and folk lifts. Since it will be difficult for VNR to both modernize and reduce cost by 2000, little of the above mentioned port cargo will come to the railway.

Container transport will be a profitable business and will become a large-scale market by 2010. Therefore, it is necessary for VNR to establish a container transport system by 2000. Most shippers will invest to establish their own transport systems such as, a container depots, offices, and communication system. It is important that rail transport is combined into their transport system by 2000. If VNR does not correspond to their demand, shippers will establish their own transport systems and invest to their own ICDs, truck fleets and loading machines. Consequently containers will never come to rail.

It should be kept in mind that most shippers are global transport companies and their transport systems are modern and there is hard competition with each other. VNR needs to modernize its business activities in order to be combined in their systems.

The following system and facilities should be established to achieve them:

-A market development group to promote marketing for shippers.
-A temporary ICD(Inland Container Depot) by 2000 at Yen Vien station.
-Container handling machines;
1 top lifter (35ton), 10 yard chassis, 1 yard tractor, 2 forklifts (6 ton, 2 ton), etc.
-A freight information system connected with shippers
-Railway track between Ha Long station and Cai Lan port.

If VNR can not recruit experts who have sufficient experience and knowledge on international shipping, it is better to leave it marketing and operation business in charge of private sectors composed with customers, shippers and developers of industry zone. Because an ICD will join 'Shipping Conference' and needs densely connection with worldwide shippers and ports.

The handling volume of containers until 2010 is so small for an ICD management and handling facilities that VNR needs to expand its container transport market to Hai Phong port and China(Nanning).

12.4.3 Inland Container Depot

(1) General

The inland container depot(ICD) will generate substantial economic benefits for the economy of northern part of Viet Nam and significantly improve the attractiveness and efficiency of Cai Lan Port.

The large investment for an ICD is considered to seek cost-recovery over a relatively long period, therefore, the ICD will be viable to be considered as a part of the Cai Lan Port and Red river delta area development.

Since, ICDs are a link in the chain of the Cai Lan and Hai Phong ports and the northern part development, it is recommended that the government of Viet Nam formulate the following plans of an ICD:

(a) Location

Since, Yen Vien Station is a better knot of railways and roads to and from Cai Lan port, Hai Phong port and China territory, an ICD is better to be constructed close to the current Yen Vien Station.

Yen Vien, Co Loa and Dong Anh stations have wide area for railway facilities. The following condition and functions should be taken in consideration to select suitable location for a temporary and full scale of ICD.

(i) Convenience for railway network knot and disturbance for railway knot

Yen Vien has junctions and is the good railway connection for Dong Dang, Hai Phong and Cai Lan. On the other hand, shunting works of freight trains go to/from the freight yard will disturb train operations on main lines. Freight trains to the Southern line should detour through the west ring line.

Co Loa is convenient to go to any direction and has no junction, so there are little disturbance due to shunting.

Dong Anh has junctions and is good connection for Lao Cai, Thai Nguyen, south and Yen Vien. On the other hand, shunting works of freight trains will disturb train operations on main lines.

(ii) Land area for ICD

Yen Vien has enough land for railway facilities at present, but there are many candidates to need to be located at Yen Vien, e.g. expansion of freight station, removing of Hanoi rolling stock depots(removing from Hanoi station will be necessary in near future), a mechanized track maintenance depot, a cement terminal, terminal of passenger trains and shunting of freight trains in the future. Therefore, it is said the land is not sufficient

Co Loa has enough land for ICD and other related facilities including coal terminals.
Dong Anh: Condition of Dong Anh station is in between Yen Vien and Co Loa.

(iii) Land for shipper's depots related to ICD

Yen Vien: Land for shipper's depots is not sufficient or price of land and compensation are expensive.

Co Loa: There are enough land for depots and price of land and compensation may be cheap.

Dong Anh: There are enough land for depots and price may be cheap.

(iv) Sufficient siding track length for shunting

Yen Vien has not sufficient track length for trains going in and out from ICD. It will be necessary to shunting on main tracks.

Co Loa has sufficient length of track for going in and out.

Dong Anh is same to Yen Vien.

(v) Connection with main road

Yen Vien has good approach for road but far from industry area

Co Loa needs to constructed road to the main road

Dong Anh has good approach with main road and near to industry area.

(vi) Temporary and permanent ICD

Yen Vien has not sufficient land for a permanent ICD including shipper's depots, therefore, it is necessary to remove to an another place after 2010.

Co Loa has sufficient land around the station to expand into a permanent ICD.

Dong Anh has not sufficient land for a full scale ICD.

(vii) Recommendation

When it is necessary to reduce an initial investment cost due to uncertain demand for railway transport, it is better to construct a temporary ICD at Yen Vien station.
When many shippers and customers join to an ICD project from the beginning and demand is clear and large, it is better to select Co Loa station for a permanent ICD.

(b) A temporary ICD

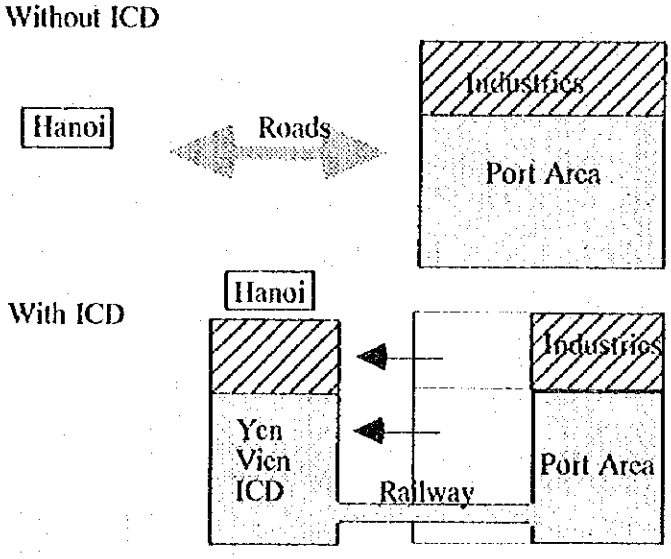
As the amount of containers transported by rail is not so much in 2000s, a permanent ICD will not be necessary until 2010. It is better to install a temporary facilities as a temporary ICD at the idle yards of Yen Vien or Co Loa stations taking into consideration above mentioned comparison and future location of railway facilities.

(c) Study on an ICD

A study to establish a container transport system by rail to/from the Cai Lan Port and others is recommended to execute as soon as possible.

When once an ICD is constructed, it is necessary to expand its market area to the Hai Phong Port and others.

The railway connections between Viet Nam and China will be reopened soon. Not only marine containers but a lot of containers of the China Railways standards(L=1,968mm, W=2,438mm, H=2,438mm, 5 tons in weight) will come through the Dong Dang corridor. If VNR develops a new competitive route to Hong Kong via Fang Cheng Port in China, the railways will obtain more customers.



(2) Purposes of ICD

Development of Yen Vien ICD will significantly improve the prospects and performance of the Cai Lan Port, which is essential for the development in international trade. A modern well-equipped freight terminal at an ICD, close to the greater Hanoi and recent industrial development, will provide shippers with all the facilities of a port at convenient distance from their premises. The ICD will provide low-cost transport to and from the port, and the other user's benefits listed below:

- When an ICD is not constructed, consignees, forwarding agents and shippers must go to Cai Lan port or must have offices and depots at Cai Lan. Exporters of LCL(less than container load, several exporters stuff their small lot of cargo in one container) or shippers who have not any depot near Hanoi need to carry cargo to Cai Lan.

- When an ICD is constructed, consignees can stuff cargo into a container and execute forwarding procedures in Hanoi(ICD).
- The ICD will be complementary to the development of the Cai Lan Port facilities.
- The ICD will improve port access facilities for the Red river delta industrial zone.
- There will be better access by rail, so that cargo can avoid the congestion of roads and restrictions of road transport and improve environment, such as road congestion, accidents and air pollution.
- It will reduce congestion at the Cai Lan Port in stuffing/unstuffing containers, thus, the port can make better use of its valuable quay-side area. Land at Cai Lan is limited.
- The ICD will provide opportunities for public and private sector to invest in major industrial development in the Red river delta area.
- It will provide opportunities for VNR to invest in the Cai Lan Line improvement and to increase their operating revenue by a larger capture of traffic from road haulage.

(3) Functions of an ICD

Though the ICD is far remote from the Cai Lan Port, the ICD composes a part of the port functions. Stuffing and unstuffing, customs clearance, and forwarding procedures are executed at the ICD as same as the port.

A computer information system connected the ICD and the Cai Lan Port together is essential in order to transport information and data.

The following operations will be executed at the ICD:

-Stuffing and unstuffing of cargo

-Customs clearance

-Deposit of containers

If the management of the marine terminal, transport of containers and the ICD is operated comprehensively, the following advantages will be created:

-Reducing of procedures cost

-Reducing of transport time and cost by unified transport

-Introducing of an unified computer information system

-Scale merits for using manpower and loading machines

-Prompt providing of freight information

(Refer: Fig 12.4.1 Functions of Yen Vien ICD)

(4) Facilities at an ICD

The following facilities will be installed:

- Container freight station(CFS); cargo stuffing and unstuffing is executed.
- Container yard(CF); containers are loaded and unloaded to/from wagons, customs inspection is executed..
- Office buildings for management, operation, maintenance, forwarder, agents and customs.
- Maintenance facilities for container repair and cleaning.
- Parking for truck and loading machines.
- Railway and road.

Necessary loading machines:
Top-lifter(capacity 10-35tons)
Yard tractor
Yard chassis
Mobile carne
Forklift
(Refer: Fig 12.4.2 Layout and Facilities of ICD)

(5) Management and operation of ICD

Marine container is transported with the most modernized transport systems in the world. Modernized freight information systems, loading and unloading system, stuffing and unstuffing method and facilities are essential functions for an ICD.
Standards of ICD will be applied that of the Shipping Conference(Shipper's union). Therefore, cooperation with experts of shipping business will be inevitable.
Efficiency and competition with other international ports should be introduced in order to reduce time, cost and man power.

Urgent actions to find investment fund for the container transport is necessary by 2000.
Private sectors have enough knowledge and can move promptly.
Private sectors are better to be composed with the following members in order to obtain railway share:
Customer(industries located in Hanoi)
Shippers who intend to join Vietnamese sea line
Developers who develop industry area and zone
Public(VNR, port authority and others)

Generally, infrastructure is constructed and owned by the public, and operation and maintenance of ICD are executed by privates.

The following alternatives are proposed to share built, own and operation of container transport:

Built, own & operation	Alternative 1	Alternative 2	Alternative 3
Railway track for ICD	G	G	G
Shunting yard for ICD	G	G	G
Container yard	G	P	P
Communication	G	P	P
Wagons	G	P	P
Locomotives	G	G	P
Train operation	G	G	P
Loading machines	P	P	P
Land that public has	G	G	G
Additional land acquisition	P	P	P
Approach roads	G	G	G

* G: Government(public), P: Private sectors

(6) International linkage of container transport

The container transport is standardized and unified world wide. There is container transport by rail through 'Siberian Land Bridge'(SLB) from East Asia to Europe. Its cost by rail is lower than by ship and travel time by rail is shorter than shipping. A new transit route through China (China Land Bridge, CLB) was established recently. As the China railways and shippers composed a container transit agent, a stable, faster and cheaper cost container transport by rail will be operated soon.

It is viable to establish a land bridge by rail from Hanoi to Europe through China and to compete with shipping.

A new ICD will play an important role as a 'Hub' from ASEAN to deep China, CIS countries and Europe through railway land bridges.

(Refer: Fig 12.4.3 Linkage between Asia and Europe)

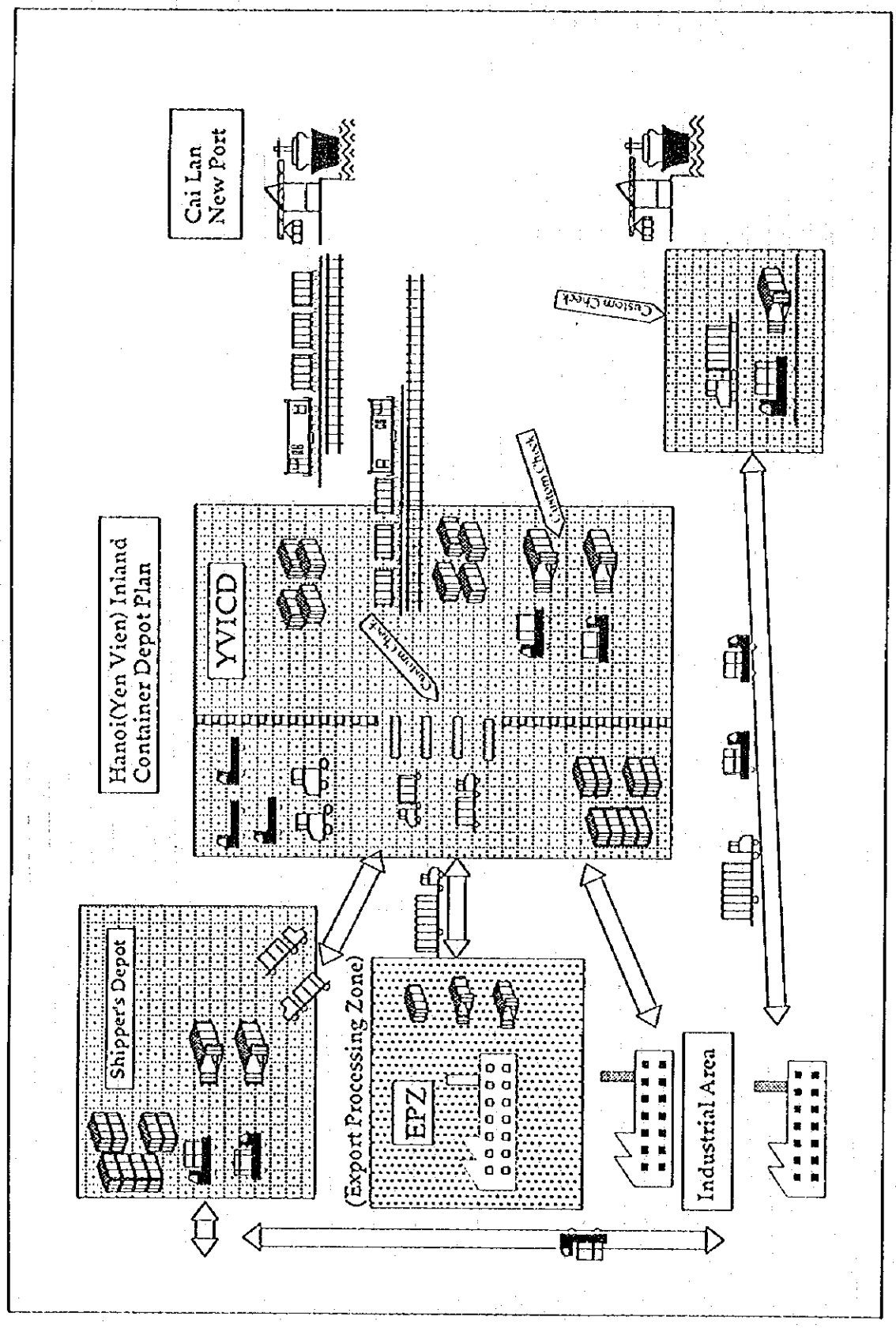


Fig 12.4.1 Function of Yen Vien ICD

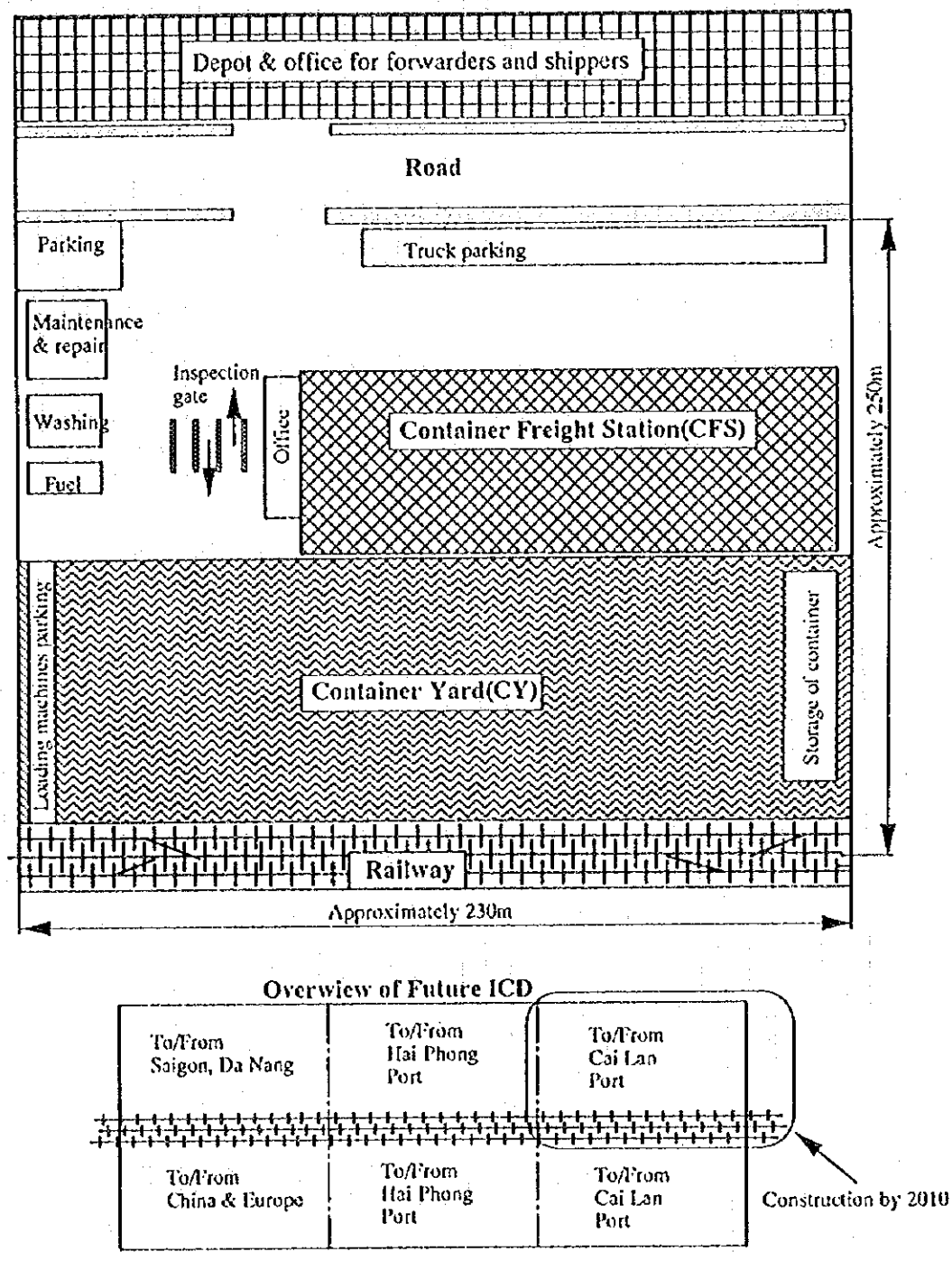


Fig. 12.2.2 Layout and Facilities of ICD

Existing Possible Land Bridge Between Asia and Europe

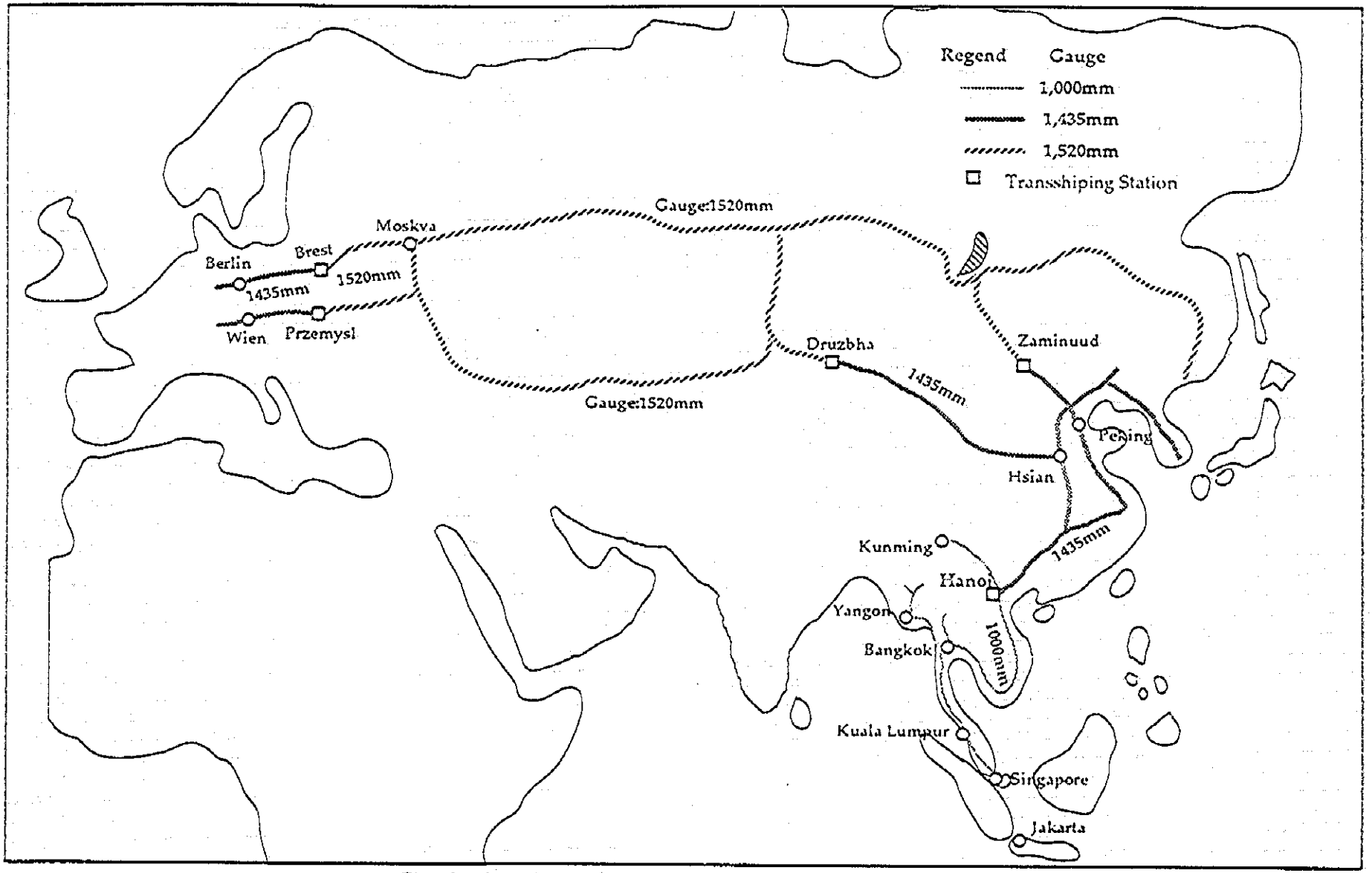


Fig 12.4.3 Linkage between Asia and Europe

12.4.4 Cement Transport Plan

The demand for cement is mainly to the major cities and is increasing annually. Currently, cement is transported by inland water-ways, roads and railways. There is severe competition between the three modes. Cement is delivered to consumers in bags(50kg in weight). The bag transport system has following problems that:

-Costs are high due to the transport using of small unit and the high cost for paper bags
-Loss from broken bags.
-A Manual loading and unloading

If the current transport system, which involves the manual loading of bags onto covered wagons is replaced with a cement tank wagon system, packing costs, loses from broken bags and loading and unloading costs will be reduced.

Cement loaded into tank wagons will be directly transported from the factory to consumers via an exclusive direct operation train. A cement terminal will be constructed at Yen Vien Station. It will include cement silos, unloading equipment by air, and a ready-mixed concrete plant. If VNR succeeds in attracting a cement terminal, the business to transport sand and gravel will be generated.
The ready mixed concrete plant covers the market of whole over Hanoi city, a large consumer, for a while.

The cement terminal will supply cement to other concrete plants and cement packers via bulk tank trucks. When other cement makers want to use the facilities, it will be possible to join the bulk transport system via rail. The following facilities will be built:

Investment by the railway
-Railway track at Yen Vien Station

Investment by a cement company or an other sector
-Cement silos
-Unloading plant by air
-Aggregate stock-yard
-Ready-mixed concrete plant

12.4.5 Coal Transport Plan

The Pha Lai thermal steam power station is now under construction to increase its capacity from 40MW to 100MW by 1999, which will result in coal consumption increasing from the current 1 million tons per year to 2 million tons.
Coal is supplied from the Uong Bi and Hong Gai coal mines.
Coal from Uong Bi is transported by rail and ship, and Hong Gai coal is transported by ship. Rail transport costs from Uong Bi are competitive with ship transport costs and the mine wants to transport all of its coal by rail.
If the Uong Bi coal mine invests in constructing a new railway (28km long) all coal consumed at the thermal station will be transported by rail.
It is recommended that VNR cooperate with the mine to expand the transport market of the mine and to develop rail transport market for coal.

Postscript: An additional production of 1 million tons will create jobs for about 10,000 people. It is recommended that VNR employees who relieved from their position because of rationalization switch to the mining.

12.4.6 Ha Long Bay Tourist Transport Plan

Ha Long Bay is one of the most attractive resorts in Viet Nam. About 400,000 tourists visited Ha Long Bay in 1994 and 1 million in 2000. However, the approach roads and railways are in very bad condition now. Good transport and services to the resort are essential to further develop the tourist industry. The railway needs to contribute to the development of the tourist resort.

The following improvements for tourists using rail are recommended:

-Operating of 3 round-trip trains per day using comfortable passenger cars.
-Innovation of Ha Long Station
-Installation of a seat reservation system at Ha Long station.
-Operation of a steam locomotive to attract foreign tourists.
-In the case of the standard gauge, Gia Lam or Yen Vien Station will be improved and buses to pick up tourists in the center in Hanoi to bring them to the a station will be used.

Chapter 13. Current Conditions, Problems and Countermeasures

13.1 Management

13.1.1 Situation of Management and Contestability of Railway

Hanoi-Cai Lan Line belongs to Union I and is suffering from managerial deficit. Main reasons for the deficit are that traffic volume is small as a whole, train speed is slow with average speed ranging from 20 to 30 km/h, transport capacity is shortened and maintenance cost is increasing. Besides, it is negative factor for management that there are many free riders on trains.

Few frequency train for passenger is operated as only one time per day and the most passengers are occupied by farmers to sell their agricultural goods. This line is their life line in fact. Freight train specified in coal owned by mining company is operated only two or three times per day between mining area and Pha Lai power station. Passenger train takes six hours between Kep and Ha Long (110km) because it stops 10 to 30 minutes at each station for descending and ascending of passengers, handling and sales of their luggages on the platform. Trains for tourists are temporally operated but very few in number. Most of tourists comes by bus and helicopter.

There is cement factory alongside the line and about 80,000 tons of cement (1992) are transported by train. Coal mine is situated at Uombi and Mao Khe. Train operation for coal transportation is operated and controlled by VNR and coal company must pay to VNR for their operation and control of train. Coal is transported through two routes . One route is from Uombi to river port (by railway owned by coal company) and the other one is from Mao Khe to Pha Lai (by railway). There is a plan of construction of railway to be owned by coal company between Uombi and Mao Khe (28km) until the year of 2000. When this line is completed, total demand of coal of two million tons for Pha Lai power station will be transported by from Uombi coal mine by railway.

The following are indispensable and urgent tasks to improve the management of VNR.

13.1.2 Policy for Increasing Revenue

(1) Passenger

Cai-Lan Line has railways of 200 to 300km which are suitable distance for the best use of railway characters. As policies for increasing passenger revenue, speeding up of train by strengthening track, improvement of accommodation for passenger coaches and strengthening transport capacity should be carried out. Platforms are crowded by sales of agricultural goods, descending and ascending of passengers and luggage handling. Various devices are requested to shorten time for train to stop at station. These devices include leveling floor of coaches and platform and introducing new handling machines to stations.

There is a famous Ha Long Bay which was assigned as a world heritage by UNESCO near Ha Long station on Cai Lan Line. If market pioneering by operating high speed through train and packaging hotel reservation and round trip of attractive points is conducted, drastic increase of tourists can be expected. Furthermore, the short cut line through Yen Vien, Pha Lai and Chi Linh is completed, many tourists will come into Ha Long than ever before by railway.

(2) Freights

For the purpose of increasing revenue from freights, as mentioned already with regard to directions for managerial improvement of VNR, in the market of general cargoes, it is indispensable that thorough efficiency oriented devices should be conducted by introducing container suitable for rail transportation, adopting pallets, positive investment of handling machines and integrating cargo stations so that VNR would be able to overcome fierce competition with other modes. Furthermore, it is also necessary to promote freight forwarder service to play important role for door-to-door service.

In the market of bulk cargoes(coal, cement, apatite and so on), railway has advantages in transportation from inland to sea ports, but ship has advantages in transport for long distance because of its low transport cost. VNR is required to set cheaper fare than ship by thorough reduction of transportation cost and to promote container transportation by constructing inland container depots (ICD). Particularly, as big increase of coal and cement production is predicted in Quang Ning province, positive market pioneering must be developed by the strategic establishment of fare toward generating railway traffic demand.

Besides, when Cai Lan port will be opened and Ha Long station will be connected with Cai Lan port by railway, transport of cargoes is expected to increase.

13.1.3 Management Diversification

First of all, the promotion of new business can be considered on the basis of multi-functionalization of station facilities by making use of its attracting power of users of railway services. The station should have the function for breathing place for local residents in future. The multipurpose use of station will induce traffic deinand so that revenue will increase which is called "synergy effect".

We recommend that the most of stations must be facilitated with equipment for luggage handling, restaurants and resting room for farmers to come to stations to sell their agricultural products so that not only many passengers but residents will be attracted to stations.

Besides, hotels in front of stations, telephone boxes, wider space of waiting room and simple sports equipment like table tennis are needed to be facilitated with local cities.

Expansion and promotion of new business by multi-functionalizing stations should be carried out and multipurpose use of function of characteristic station closely related to the local area is required to be progressed by taking account of needs and seeds of local residents.

In Transport Block, door-to-door service of freight by truck, and passenger transport service by taxi between station and company or home by contract between station and taxi company as well as hotel construction. These terminal transport service must be strongly promoted as complementary function for railway transport because it leads to save transport time in total.

13.1.4 Rationalization of Personnel and Saving Expenditures

Rationalization of personnel and saving expenditures are also tasks to be urgently tackled. Idle facilities must be withdrawn and for the leveling up of productivity should be implemented by reviewing allocation and work efficiency of personnel and making the first priority for reduction of personnel belonging to unnecessary or inefficient sections for the purpose of 10% reduction. Besides, it is expected that the Government will actively conduct financial support to secure the living of retired personnel.

13.1.5 Policy for Abolishment of Non-Profitable Branch Line

Section between Kep and Bai Chay on Lao Cai line was decided by VNR in 1992. Main reasons of abolishment is the shortage of transport capacity and the increase of maintenance cost. But now the line as infrastructure is owned by the Government and

then final decision for the abolishment is depending on the Government policy. When the short cut line will be completed, the problem of abolishment will be reviewed again.

13.1.6 Revision of Cost Accounting System

Transport cost is a basis for setting up rational fares. The works for dividing transport cost into passenger transport cost and freight transport cost is conducted by each union. The study is necessary toward establishment of more rational criteria for separating transport cost because criteria for separating the common cost to passenger and freight in particular is not always reasonable. The study in detail for cost accounting system not only by line but by train are also necessary to be done

13.2 Railway Transportation Market

(1) Current status & problems

Passenger transport on the 164km section of the Cai Lan Line between Yen Vien (Hanoi) and Ha Long is less in volume than on the north-south line. Since the section between Yen Vien and Kep (58km) is shared with the Dong Dang Line and trains make four round trips on this section daily, and since transport volume between Kep and Ha Long (107km) is as low as one round trip daily, transportation density (passengers per kilometer of commercial track), at 235 passengers per kilometer, is but one-tenth that of the north-south line.

Travel time for passenger trains on this Yen Vien-Ha Long section is seven hours and fifty minutes, and the posted speed of 21kmh makes for a very slow transport service. And since the Cai Lan Line takes a roundabout route through Kep, the transport distance is longer than by road (National Highway 18). The transport conditions may not be termed favorable.

The volume of freight transport on this section is some 600,000 tons annually, of which coal departing Mao Khe accounts for 80%. Other freight consists of mineral products, cement, quarrying and the like. Coal is carried to such places as Co Thanh, which has an electricity plant. A local freight train makes one round trip and a coal train makes two round trips between Mao Khe and Co Thanh for these deliveries.

(2) Measures for improvement

This section could be considered a rather inactive one with a high weighting of freight transport. Currently most stations are small and see 100 or fewer passengers embarking or disembarking daily, and most, the exceptions being such as Mao Khe, handle less than 100 tons of freight a day. It is therefore necessary to implement rationalization measures on each section of track. However, since this line includes a major resource for tourism in Vietnam in Ha Long Bay and this will be a valuable region in the future development of tourism in Vietnam, it is also necessary to raise running speeds in order to schedule high-speed trains providing comfortable tourist travel and attracting tourists as progress is made developing the Ha Long region for tourism and recreation.

Mao Khe, Uong Bic, Bac Giang and Cai Lan, which is undergoing consolidation as a future container port, shall be the main stations reconfigured for handling freight, and freight facilities shall also be intensified at other small and medium-sized stations. It is thus necessary to plan an effective reinvigoration of the entire line for both passengers and freight.

Estimated Transport Volume on the Cai Lan Line

Passenger transport (unit: thousands)

Year	National		Kep - Ha Long				Hanoi - Dong Dang			
	Ps/year (A)	Ps-km/year (B)	Ps/year (C)	Index (C/A)	Ps-km/year (D)	Index (D/B)	Ps/year (C)	Index (C/A)	Ps-km/year (D)	Index (D/B)
1989	11,768	2,109,341	130	1.1	6,257	0.3	1,399	11.9	99,514	4.7
1990	10,443	1,912,957	165	1.6	7,342	0.4	941	9.0	64,435	3.4
1991	9,158	1,767,060	207	2.3	9,720	0.6	787	8.6	50,032	2.8
1992	8,719	1,751,660	214	2.5	11,005	0.6	511	5.9	32,557	1.9
1993	7,793	1,720,984	178	2.3	9,211	0.5	469	6.0	30,709	1.8

Freight transport (unit: thousands)

Year	National		Kep - Ha Long				Hanoi - Dong Dang			
	Ton/year (A)	Ton-km/year (B)	Ton/year (C)	Index (C/A)	Ton-km/year (D)	Index (D/B)	Ton/year (C)	Index (C/A)	Ton-km/year (D)	Index (D/B)
1989	2,432	743,320	478	19.7	28,697	3.9	221	9.1	45,538	6.1
1990	2,341	847,023	447	19.1	25,674	3.0	180	7.7	52,428	6.2
1991	2,567	1,103,309	427	16.6	24,334	2.2	194	7.6	69,783	6.3
1992	2,774	1,076,879	396	14.3	25,331	2.4	275	9.9	86,718	8.1
1993	3,187	978,132	415	13.0	29,758	3.0	244	7.7	85,767	8.8

N.B. Based on documents provided by VNR and VRDI.

13.3 Transportation Plan

13.3.1 Current Conditions of Train Operating, etc.

(1) Train operating conditions

The line between Hanoi and Ha Long (175.1 km) is a tourist line linking the capital Hanoi to east coast scenic spot of Ha Long City.

Passenger transportation amounts to 650,000 passengers per year, including the passenger transportation on the Dong Dang Line, and the total for between Kep and Ha Long is 200,000 passengers per year. This represents 10% of the total passenger transportation volume of VNR of approximately 8,000,000. The passenger kilometers on the line amount to roughly 40,000,000 passenger-km, which accounts for around 3% of the total passenger kilometers on all VNR. The average trip distance is roughly 60 km, which is short compared to the national average of 220 km, and the line can be said to be characterized as one for supporting the daily lifestyles of the residents living along it.

The Hanoi - Ha Long section is relatively flat, however, from Yen Cu (160 km), the line has a continuous curve radius of R = 100 m. Maximum operating speeds on the line currently range from 30 km/h to 60 km/h, and mixed trains (2057/8) run the line in around seven hours at an extremely slow commercial speed of approximately 16 km/h.

Freight transportation on the line (again, including the Dong Dang Line) amounts to 650,000 tons per year, accounting for approximately 20% of the total freight transportation of VNR, and this freight load is similar to that on the Lao Cai Line. Transportation ton kilometers amount to 120,000,000 ton kilometers, which is represents a roughly 10% share of the national total.

The average freight transportation distance is 175 km, which is approximately half of the national average of 300 km.

Freight transportation between Mao Khe and Yen Vien is mainly based around coal and cement and is carried out by temporary freight trains making one return trip per day. These trains are traction pulled by small D8H locomotives or SL and it is estimated that the commercial speed is below 20 km/h. The main freight transportation is carried out by exclusive freight trains making two return trips per day between Mao Khe and the power station at Pha Lai via Chi Linh Station.

In all, when the temporary service freight trains are included, between two and eight upward and downward trains operate on the line daily. The line consists of single track standard gauge, and the section between Kep and Yen Vien consists of meter gauge and three track mix gauge.

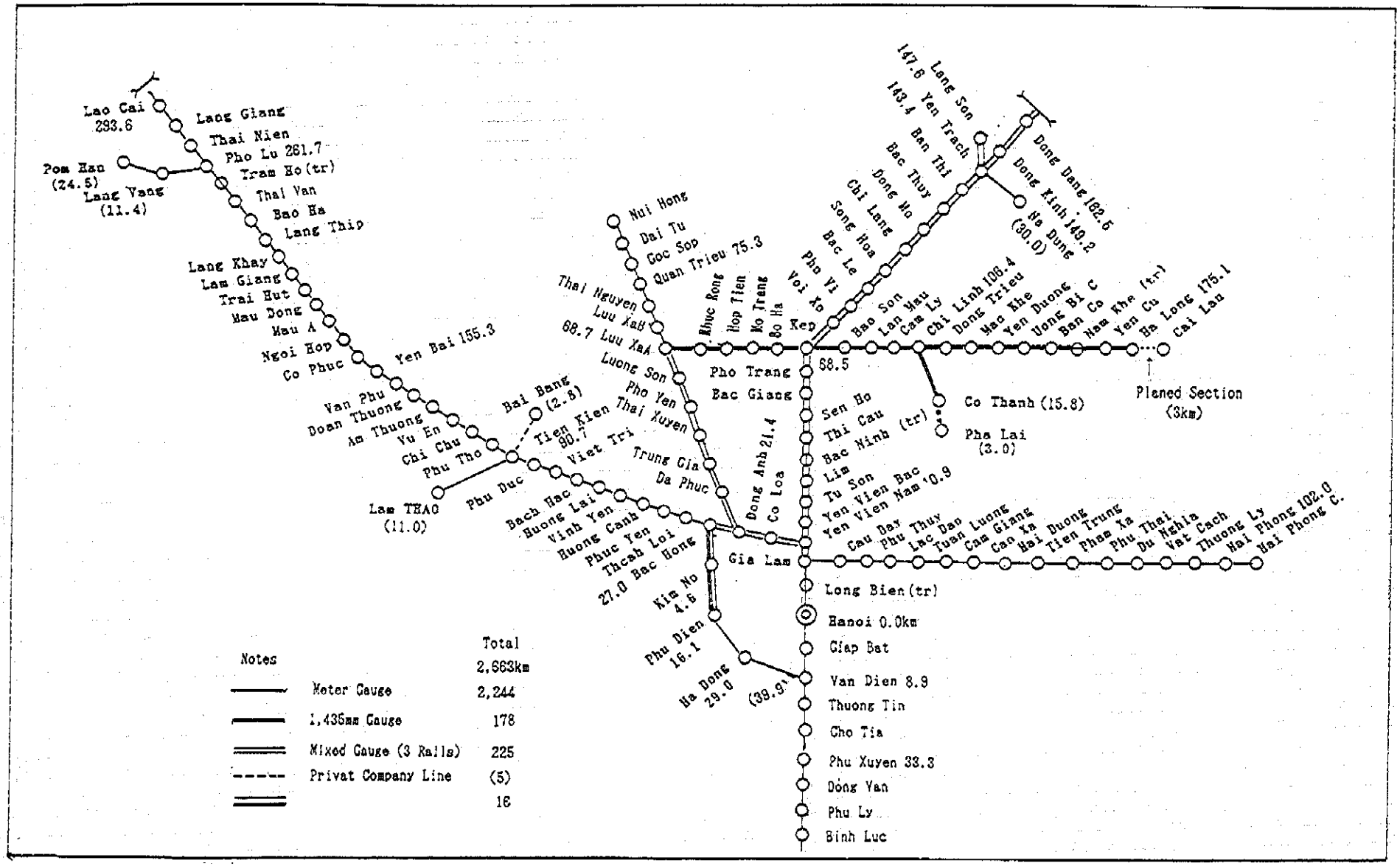


Fig. 13.3.1 Railway Route and Commercial Distance (VNR)

Table 13.3.1 shows the operating conditions of trains on these line sections.

The average distance between stations is approximately 7.6 km, and the small number of operating trains means that the interchange facilities are hardly utilized at all.

Appendix 13.3.1 gives an outline of the line by showing rough drawing of track layout and track capacity, and so on.

Table 13.3.1 Train Operating Conditions (1995)
(Cai Lan Line: 175.1 km)

Train Type (Passenger)	Yen Vien 10.9 km		Kep 68.5 km		Ha Long 175.1 km	Operating time (hours:minutes)	Commercial Speed (km/h)	Remarks
2057/8	05:30	→	08:30	→	13:20	07h50	21.0	8-car formation
(mixed trains)	22:00	←	17:44	←	14:50	07h10	22.9	+ 1 FC

Train Type (Freight)	Y. Vien 10.9	Kep 68.5	C. Linh 106.4	M. Khe 126.9	Operating time (hours:minutes)	Schedule Speed (km/h)	Remarks
2301/2	○ - ○				06h00	19.3	(Coal, cement)
3301/2 (2p)	(C. Thanh: 15.8 km) - - - - -	○	- - - - -	○	01h00	36.3	(Coal: 20 cars)

Note 1: All freight trains are temporary services.
Note 2: Between Hanoi and Kep, Dong Dang Line trains (PC: 3p, FC: 1p) are operating.
Note 3: Moreover, between Hanoi and Gia Lam, Hai Phon Line trains (PC: 4p, FC: 2p) are operating.

The formations and nominal passenger capacities of the trains are as follows.

[2057/8] Mixed Trains

- Formation : 2HS + 3B + 3C + 1Hc + G ..... 9 cars
- Capacity : Luggage car 78 Long seat Cafeteria car Luggage car
- Total : 234 240- ...../474 -

(2) Operation control system

As well as the railway facilities such as track, etc. and the operating rolling stock, train operation management and safety systems are indispensable to the operation of trains on a railway.

Operation control on the Hanoi - Cai Lan Line is the same as for the other lines in that it is carried out by the VNR Head Office and the Union 1 Operation Dispatching Room. In this sense, the method of operation control is the same as that adopted in other countries of the world.

The dispatching telephones, which are used as the dispatching-related equipment, are in a deteriorated state, however, the renewal of them is being carried out on a successive basis.

Regarding the contents of the dispatching work, examination is being made on the utilization of train diagrams in line with the expected increases in train services towards the year 2000. This issue is further described in the sections on problem points and countermeasures.

(3) Operation safety system

The same as Item 9.3 of Chapter 9.

(4) Passenger and freight handling volumes at each station and transportation staffing setup

Table 13.3.2 indicates the transportation staffing setup.

Appendix 13.3.1 shows the passenger and freight handling volumes at each station as well as the staff deployed between the stations.

Regarding passenger volumes, many of the stations on the line handle between 30 and 300 boarding and alighting passengers per day. With just one mixed rain return trip per day added to the fact that there is much hand luggage carried for daily miscellaneous activities, the single return mixed trains tend to become extremely crowded.

Table 13.3.2 Transportation-related Staffing Setup (1993)

The same as Table 9.3.2 of Chapter 9.

(5) Current situation and analysis of operation accidents, etc.

The same as Item 9.3 of Chapter 9.

13.3.2 Problem Points and Direction of Countermeasures

The same as Item 9.3 of Chapter 9.

13.3.3 Transportation Plan

(1) Basic conditions

The final products within all transportation bodies are train diagrams. In this Project, it is the duty of the rail transportation body to ensure that accurate (by the day), safe and fast transportation, based on timetables set in accordance with the Train Operation Plan, is carried

out. For this reason, in the compilation of plans for improvement, the rail transportation body should place emphasis on this point and should be suited to the needs of residents and other users and act as a basis for the economic development of Vietnam in the future.

Based on this fundamental thinking, the Transportation Plan shall contribute to the improved reliability of transportation, aim to achieve more frequent services and contribute to the improved business management of the railway.

With this in mind, the following items shall be made the basic conditions in compilation of the Transportation Plan for 2000.

1) Project sections and line conditions

The Project line shall be that between Hanoi and Cai Lan (178.1 km). However, the section between Ha Long and Cai Lan shall be constructed in 2000.

In the F/S, priority transportation capacity strengthening and business management improvement measures shall be carried out together with the provision of more frequent services, in consideration of providing greater convenience for local residents and tourists. The line currently uses the standard gauge, however, it is planned to renew this to the meter gauge by 2000. The maximum train speed on this line shall be raised from the current 60 km/h to 80 km/h as a result of the improvements.

2) Operation safety systems

The operating security systems, which form the basic factor in train operation, shall be designed to increase safety levels and shall also allow modernization to be easily carried out in the future by giving consideration to the actual conditions and demand levels, etc. on the line.

(a) Blocking system

Currently, the tablet block system is in use, however, this shall be replaced and improved with the tokenless block system (as in the case of the Lao Cai Line) as a means of improving train operation and transportation reliability levels.

(b) Signaling system

The existing signaling system is a two-position, two-aspect, mechanical semaphore system, and there are many stations that are not installed with departure signals. Through installing

departure signals, the handling of passing trains will become easy and the reliability of train operation will be vastly improved.

Moreover, in those stations where the visual confirmation of in-station signals is difficult, distant signals shall be installed, and the aspects of all signals shall be unified to the three-aspect system.

In line with the improvements to the blocking system, electric colorlight (multiple colorlight) signals shall be adopted in order to again raise reliability and also improve efficiency.

This signaling system is the same as that to be introduced on the Lao Cai Line and is illustrated in Figure 13.3.2.

Figure 13.3.2 is the same as Fig. 9.3.2 of Chapter 9.

(c) Interlocking system (see M/P)

The same as Item 9.3 of Chapter 9.

(d) Others

The same as Item 9.3 of Chapter 9.

3) Business management improvement

Through carrying out marketing improvement measures, freight stations with only minor handling loads shall be absorbed into nearby major freight stations. Moreover, in the implementation stage, it is considered as necessary to simplify operation handling at stations with few pass-byes (as a result of the timetable setting) by provisionally suspending the use of sidings, carefully looking into the effectiveness of remaining turnouts and using spring points.

4) Train types and train operation, etc.

(a) Train types

The following table shows the types of trains that will be operating in 2000.

Table 13.3.7 Set Train Types and Operating Speeds

Train Type		Maximum Operating Speed	Remarks
Passenger Trains	Express train	80 km/h	D12E traction
	Local train	70 km/h	D4H-S improved model
Freight Trains	Ordinary freight train	80 km/h	D12E-S traction
	Exclusive freight train	70 km/h	D12E-W traction

Note 1: D12E-W is multiple connected and D12E-S, etc. is single locomotive.
Note 2: D4H includes D5H.

(b) Train operation

Passenger trains shall be manned by engineers and conductors, while freight trains shall basically be manned only by drivers (including assistance drivers).

5) Rolling stock and rolling stock performance

The same as Item 9.3 of Chapter 9.

6) Boarding efficiency

The same as Item 9.3 of Chapter 9.

(2) Transportation plan

1) Formation and Hauling Capacity, etc. By Train Type

(a) Passenger trains

The formation of passenger trains shall be set upon giving consideration to providing more frequent services, and so on.

Table 13.3.8 Formations and Boarding Capacities of Passenger Trains (2000) (Hanoi - Lao Cai)

Train Type, etc.		Seating Cars			Cafeteria, Luggage and Mail Car	Total
		3rd	2nd	1st		
Express (D12E-S)	Cars	–	2	1	1	4
	Capacity		65	50		180
	Weight					180 ton
Local (D4H)	Cars	4			1	5
	Capacity	80				320
	Weight					220 ton

Note: The D4H locomotives shall be improved models.

(b) Freight trains

The same as Item 9.3 of Chapter 9.

2) Train operating times, etc.

The operating times and allowance times by train type are as indicated in the following table.

Table 13.3.9 Estimated Operating Times for Each Main Train Type
(Hanoi - Cai Lan: 178.1 km)

Station	Distance (km)	Express Passenger		Ordinary Passenger (DL)		Exclusive Freight	
		Standard time	Stopping time	Standard time	Stopping time	Standard time	Stopping time
Hanoi							
	2.0	8'					
L. Bien			5'		–		
	3.5	17'		17'			
G. Lam			5'		3'		
	5.4	11'		11'		15'	
Y. Vien			5'		3'		–
	57.6	56'		1h 25'		1h 05'	
Kep			5'		10'		30'
	37.9			1h 03'		55'	
Chi Linh			–		3'		–
	20.5	2h 03'		26'		25'	
Mao Khe			–		3'		–
	48.2			1h 18'			
Ha Long						1h 15'	–
	3.0						
Cai Lan							
Total		217'	20'	280'	24'	235'	30'
Allowance time		33'		56'		65'	
G. Total	178.1	4h 30'		6h 00'		5h 30'	

Note 1: Times in the diagram are standard times and allowance times (maintenance, pass-by allowance) are added.
Note 2: Ordinary trains have been assumed to stop at all stations (3').

3) Philosophy behind train setting and train operation plan

(a) Setting of passenger trains

The setting of passenger trains shall be done through setting transportation capacities to match with the number of Persons passing through the section obtained from demand forecasts (see Appendix 13.3.6).

Hereafter, the same as Item 9.3 of Chapter 9.

b) Setting of freight trains

In the case of freight trains, choices do exist in wagon grade (including small loads), the use of containers and piggy-backs, etc., however, there is no useful data relating to preferences in these areas and so the planning shall be advanced with consideration mainly being given to operating as many exclusive freight trains as possible. Moreover, in the event of greater use of containers in the future, some direct freight trains shall be converted to container trains.

Based upon the above considerations, the Train Operation Plan shall be as indicated in Fig. 13.3.3 and Fig. 13.3.4.

Fig. 13.3.3 and Fig. 13.3 4 are the same as Fig. 9.3.3 and Fig. 9.3.4 of Chapter 9.

4) Train kilometers and rolling stock kilometers

Train kilometers, etc., based on the Train Operation Plan, are as indicated in Table 13.3.10.

Table 13.3.10 Train Kilometers and Rolling Stock Kilometers (2000)

(Cai Lan Line) (Unit: km/day)

	Train Kilo meters (km)	Rolling Stock Kilometers (km)				Remarks
		D4H, etc.	D12E	PC	FC	
Express	1,050	-	1,050	4,200	-	D12E + PC: 4
Ordinary	1,050	1,050	-	5,260	-	D4H + PC: 5
Subtotal	2,100	1,050	1,050	9,460	-	
General freight	350	-	350	-	3,500	D12ES + FC: 10
Exclusive freight	130	-	260	-	1,850	D12EW + FC: 14
Subtotal	480	-	610	-	5,350	
Total	2,580	1,050	1,660	9,460	5,350	

5) Required rolling stock

The required rolling stock, based on the estimated train kilometers, etc. and outline train diagram setting, is as indicated in Table 13.3.11.

Table 13.3.11 Required Rolling Stock (2000)

(Cai Lan Line) (Unit: cars/wagons)

Train Type	D4H or D5H	D12E	PC				FC	Remarks
			Number of Trains	Cars/Wagons		Total cars		
				Passenger cars	Luggage cars			
Express	–	(S) 3	3	9	3	12	–	PC: 4-car formation
Ordinary passenger	(S) 4	–	4	16	4	20	–	PC: 5-car formation
General freight	–	3	–	–	–	–	143	
Exclusive freight	–		–	–	–	–	60	Exclusive coal wagons: 14-car formation
Reserve cars	1	1	1 1	3 4	1 1	4 5	17	For express use For local use
Total	5	7	9	32	9	41	220	

Note 1: D4H shall be used for local passenger rains.
Note 2: D4H (50 km/h) shall be the locomotives used for rolling stock shunting (4 or 5 locomotives).

6) Examination of improvements to be made in line with the train operation plan

Based on the Transportation Plan, compiled in accordance with transportation demand, it is imagined that the following kinds of improvements will be necessary.

① Yen Vien station

It is estimated that no problems should exist regarding the handling of passenger and freight trains in 2000, however, following 2000, in line with the flow of freight (mainly containers) to and from Cai Lan Port and the transportation of coal, etc. on the Lao Cai Line, it will become necessary to examine the installation of freight handling facilities that include ICD based around Yen Vien B. Station.

② Kep station

Kep Station requires turn-around functions for the operation of trains on the Cai Lan Line. In setting the express trains, depending on the numbers of boarding and alighting passengers at this station, treating the station as a pass-through one may be a possible measure. The construction of a short route would be necessary if it was treated as a pass-through station.

③ Provision of passenger train storage tracks at Ha Long station

It is planned to make Ha Long Station into a terminal station for passenger trains and, in the case where three return express trains and three return ordinary trains are set, it will be necessary for the station to be able to accommodate three trains (including their locomotives).

Thus, in addition to the two existing tracks, one storage track, one engine turn-around track and one engine storage track will be necessary. Moreover, examination needs to be given to the storage of the traction engines for trains operating to and from Cai Lan Port and also changeover engines when considering the engine storage track. (Accommodation facilities for train personnel are also included).

(3) Standard gauge (SG) transportation plan

In the event where the line is not converted to the meter gauge by 2000, the transportation plan shall be as described below.

1) basic thinking

① train operations shall be minimized, however, enough trains to satisfy the transportation demand will be set.

② A certain degree of more frequent services shall be aimed for. Thus, the formation of the local trains shall be around seven cars, including luggage cars. Express trains shall not be set.

③ The setting of freight trains shall be based around the current transportation capacity.

2) Transportation plan

a) Passenger transportation

Boarding capacity: 460 persons/train

Train weight: 460 tons/train

As for the maximum operating speed, this shall remain at the existing 60 km/h.

b) Freight transportation

The engine performance of the D8H traction locomotives shall be made roughly the same as the D9E.

Freight wagon pay-load, and so on, is as described below.

- Tare: 20 ton
- Pay load: 50 ton
- Load factor: 0.85 (same as for the North-south Line).
  However, exclusive freight wagons shall be 50 tons.

Haulage capacity and transportation capacity (net ton) shall be as follows.

○ General freight: $A = 0.7X (20 + 50 \times 0.85) + 0.3X \times 20$

$X = A/50$ (A: Haulage capacity, X: Number of wagons)

○ Exclusive freight: $A = X (20 + 50)$

$X = A/70$

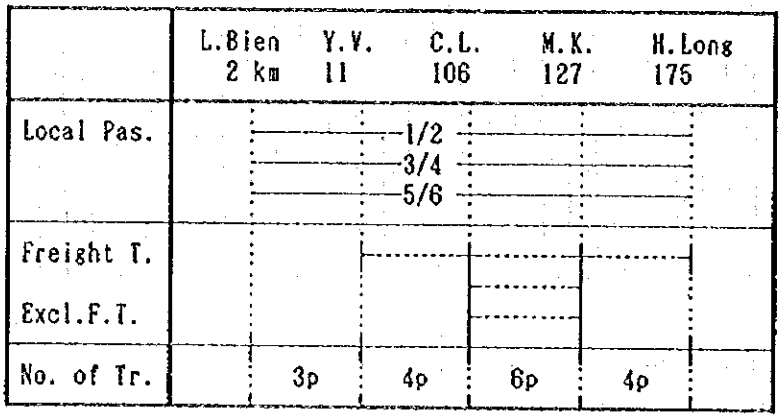
(See Appendix 13.3.4)

Making an overall judgment from the above, the formation of freight trains on the Cai Lan Line shall involve single locomotive traction with maximum speeds of not more than 50 km/h, in order to minimize the number of locomotives.

- General freight: Gross: 360 tons, Net: 220 tons.
  (FC: 7 cars, Loaded car: 5 cars)
- Exclusive freight: Gross: 770 tons, Net: 550 tons.
  (FC: 11 cars, Loaded car: 11 cars)

c) Train Operation Plan

Table 13.3.12 Train Operation Plan (2000)



d) Train Kilometers, etc.

Table 13.3.13 Train Kilometers on SG

	Train Kilo meters (km)	Rolling Stock Kilometers (km)			Remarks
		D8H	PC	FC	
Ordinary passenger	990	990	6,930	–	D8H + PC 7 cars, Max. Sp. = 60 km/h
General freight	570	570	–	3,990	D8H + FC 7 cars, Max. Sp. = 50 km/h
Exclusive freight	90	90	–	990	D8H = FC 11 cars, Max. Sp. = 50 km/h
Subtotal	660	660	–	4,980	
Total	1,650	1,650	6,930	4,980	

e) Required rolling stock

Table 13.3.14 Required Rolling Sock on SG

Train Type	D8H	PC				FC	Remarks
		Number of Trains	Cars/Wagons		Total cars		
			Passenger cars	Luggage cars			
Ordinary passenger	3	3	18	3	21	–	PC: 7-car formation
General freight	1	–	–	–	–	56	
Exclusive freight	1	–	–	–	–	22	Exclusive coal wagons: 11-car formation
Subtotal	1	1	6	1	7	12	
Total	6	4	24	4	28	90	

(4) Proposed plan for container transportation in 2010

1) Preconditions

Regarding the transportation of containers in line with export and import activities at Cai Lan Port, the following basic conditions shall be presumed in compiling the plan.

① Transportation volume: 500 TEU/day (20 ft containers: Max. 20 ton) is supposed.
(500 TEU/day is from the JICA Study Report)

② Train loaded number: 2/wagon (Koki 103 and 104 models are supposed).

③ Transportation section: Cai Lan Port - Yen Vien ICD (178 km)

④ Weight/wagon: Container weight shall be 80% of the maximum, i.e. 16 tons each.

⑤ Work time: In consideration of work time in the case of JR, etc., time shall be as follows:

Arrival →	Line transfer →	Unloading (including loading inspection) →	Line transfer →	Departure :	Total
	(30 minutes)	(3 hours)	(30 minutes)		4 hours

2) Transportation plan

① The maximum container train operating speed shall be 80 km/h (D18E traction).

② The operation time between Cai Lan Port and Yen Vien ICD shall be four hours.

③ The work time between arrival and departure at either Cai Lan Port or Yen Vien ICD is 4 hours.

The time for container loading or unloading is that for the case of a 20-car train, and will be roughly one hour if three fork lifts are used. (5 ton containers: 5 containers per car).

④ Transportation Capacity

If 500 TEU of containers are transported uniformly over 24 hours, the required number of cars will be reduced and the train diagram setting will be as follows.

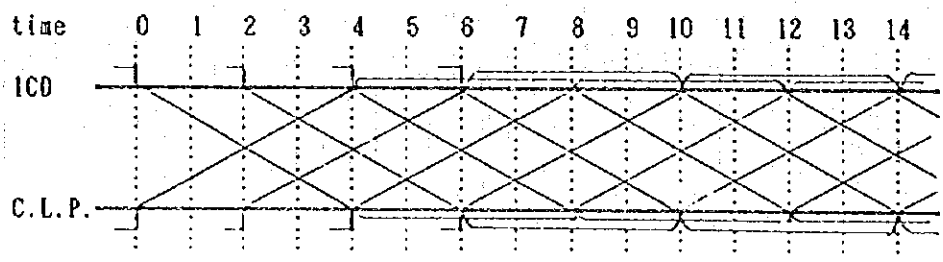


Fig. 13.3.5 Operation Plan of Container Train

Table 13.3.15 Number of Operating Container Trains and Transportation Capacity

Number of Trains (trains/day)	Formation (cars/train)	Haulage Capacity (ton)	Transported Containers (containers/day)	Number of Locomotives	Total Number of Freight Cars
12	21	1,100	504	20 16 + (4)	185 168 + (17)

Note 1: Figures in parentheses indicate reserve cars.
Note 2: Traction engines shall be multiple linked D18E.
(D18E multiple linked + 1,100 tons: Max. speed: 80 km/h)

(Reference)

① Types of marine container

Marine containers are standardized by ISO (International Organization for Standardization) and range in length from 40 ft to 9 ft. Container types are shown in Appendix 13.3.8.

② Freight handling facilities, etc.

The ICD and Cai Lan Port will require 20 ton fork lifts, etc. to be able to carry out the loading and unloading of containers.

The following kinds of semi-trailers will also be required for the road transportation of containers.

- 20 ft container trailers
- 30 ft container trailers

Moreover, for the shunting of rolling stock, D4H and other shunting engines will be deployed.

The freight handling machinery and systems will be as follows.

- Chassis system: Containers are directly unloaded onto chassis by crane, etc., hauled to the marshaling yard by tractor and arranged in the trailer form.
- Straddle carrier system: Containers are directly unloaded from ship onto the apron and then carried by straddle carrier (2-layer piling).
- Transfer crane system: Containers landed onto chassis are carried to the marshaling yard and then piled three to five layers high by transfer crane.

The following gives an example of a container wagon (car). (Koki 103, 104 model)

- Pay load: 40.5 tons
- Tare: 18.7 tons
- Speed: 110 km/h
- Wagon length: 20 m
- Types and numbers of loaded containers

JR 12 ft (5 ton):	5 containers
JR 20 ft (10 ton):	3 containers
ISO 20 ft (20 ton):	2 containers
ISO 30 ft (25 ton):	1 container
ISO 40 ft (30 ton):	1 container

13.4 Track and Station

13.4.1 Track Standards

(1) General

The Cai Lan Line between Hanoi and Kep was constructed in 1901. The section between Kep and Ha Long was built in 1967 on the meter gauge but was converted into the standard gauge in 1978.

Separate track standards are upheld for the standard gauge and meter gauge.

Ha Noi - Gia Lam Railway is using the meter gauge.

Gia Lam - Kep Railway is using the mix gauge.

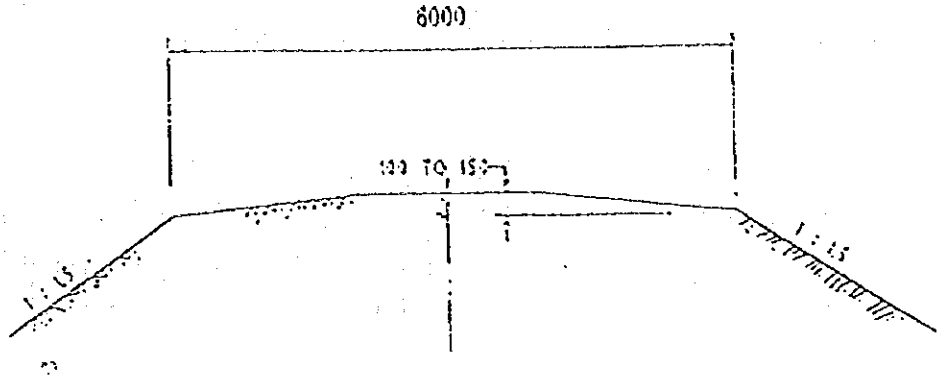
Kep - Ha Long Railway is using the standard gauge and details of the line standards are given below.

- Maximum Speed : 60 km/h
- Gauge : 1,435 mm
- Minimum Radius Curve : 150 m
- Speed Limit at Curve : $V = 4.0\sqrt{R}$
- Super-Elevation : $h = \frac{7.5 \times V^2_{Max}}{R}$
- Maximum Cant : 125 mm
- Maximum Slack : 15 mm
- Maximum Grade : 5‰
- Vertical Curve Radius : 5,000 m or 3,000 m inserted at grade change over 4%

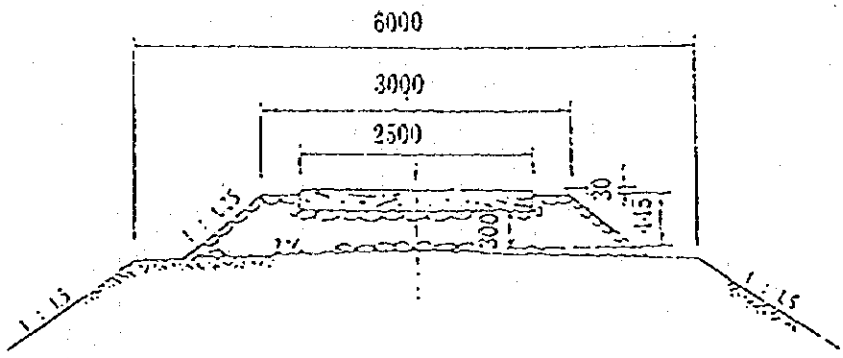
(2) Roadway diagraph

The roadway diagraph for the Kep - Cai lan Railway is shown in Fig. 13.4.1.

Embankment



With Wooden Sleepers



With Mono Block Concrete Sleepers

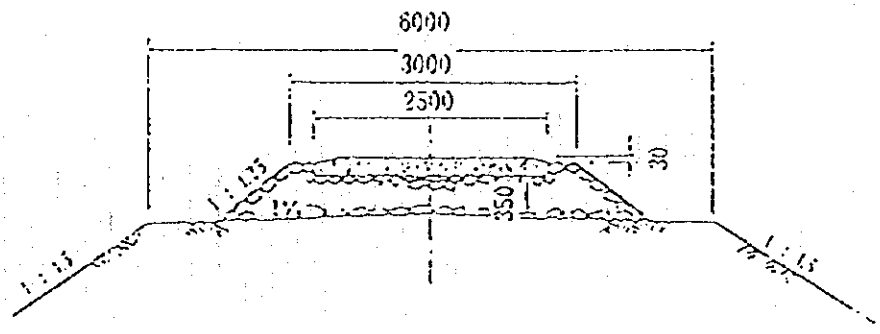


Fig. 13.4.1 Typical Profile of Formation

13.4.2 Track

(1) Current conditions and problem points

1) Track maintenance

Maintenance of the Cai Lan Line between Hanoi and Ha Long (175 km, 100 m) is carried out by two management enterprises. Together with the improvements to Port Cai Lan, a new line of approximately 5 km is planned for between Ha Long and Cai Lan, and the land for Cai Lan Station has already been acquired with part of the roadbed works already completed.

It is also planned to carry out gauge conversion from standard gauge to meter gauge on the section between Kep and Ha Long.

Details concerning the management enterprises are as shown in Table 13.4.1.

Table 13.4.1 Railway Management Entterprises

Union	Name of Enterprises	Section in Charge			Remarks
		From (km)	To (km)	Extension	
Union 1	Ha Noi	0.0	13.6	13.6	
	Ha Long	13.6	175.1	161.5	

Part of the track maintenance work is performed using poor machinery and tools, however, almost the work is carried manually.

Line maintenance is done on foot or on bicycle and motor cars are used in the inspections and the carrying of materials. Much of the line lies adjacent to a road.

Track inspection and maintenance (gauge, level, line, surface) and other inspections and measurements are manually performed.

The line stretches for 68.5 km along a plain to Kep Station in the north-east and from there continues east over a plain located close to a tableland on to Ha Long Station. For this reason, the line gradient is gentle and, except for some minor curves, there is good alignment with almost no curve radius.

2) Track, level crossings and others

The current types of rail, turnout and sleeper by section are as shown in Table 13.4.2.

Table 13.4.2 Existing Main Material Types by Section

Item \ Section	Ha Noi - Gia Lam	Gia Lam - Kep	Kep Ha Long	Remarks
Gauge	Meter Gauge	Mix Gauge	Standard Gauge	
Rail & Turnouts	43kg/m (12.5m/rail)	43 km/m (12.5 m/rail)	43 kg/m (12.5 m/rail)	
Sleepers (Main)	2-Block Concrete (1,440 sleepers/km)	Wood (1,760 sleepers/km)	Mono block Concrete (1,760 sleepers/km)	

The rails and turnouts between Kep and Ha Long are 17 years old and have relatively minor abrasion, however, the rails and turnouts between Hanoi and Kep have been in use for more than 25 years and show a bad degree of abrasion.

The length of the 43 kg/m rails is 12.5 m and is a weak point of the track, and there are many joints where the maintenance work rate is high.

The only area of slow speed due to turnout is at Dong Tneu (49 km 600 m) where there is a flat intersection.

The fastening used (K3 type) consists of a tie plate placed on the rubber pad, with the actual fastening being performed by a T bolt, stopper, spring washer and nut, however, elasticity is poor and warps are apt to appear.

Because ballast is manufactured by hand, its grading is not uniform. If quality control in the area of ballast grading distribution is not carried out, the amount of track maintenance will increase in future in line with the faster train speeds and increased passing tonnage.

The average ballast thickness ranges between 20 cm and 25 cm, however, there are areas where the thickness is less than this.

There are currently some 100 level crossings between Kep and Ha Long and, although the busy ones are manned by guards who operate the cutout devices, the other ones are unmanned and are not even fitted with alarm systems, and so on.

The level crossings on national roads which are traversed by automobiles are paved, however, all other crossings are unpaved.

(2) Countermeasures

1) Track maintenance

Track mechanized maintenance gangs shall be deployed at roughly 30 km intervals and maintenance machines and tools shall be provided between Hanoi - Ha Long. Table 13.4.3 gives details of the track mechanized maintenance gangs.

The maintenance machinery and tools to be provided are as indicated in Table 13.4.4.

If gauge conversion from standard gauge to meter gauge is carried out between Kep and Ha Long, it will be possible to operate the high speed track inspection car which is planned to be introduced on the Hanoi - Ho Chi Minh Railway.

Of the machinery and tools to be provided to the track mechanized maintenance gangs and to be used in the execution of works, that required for training and education purposes shall be provided to the training centers, and higher technical levels among personnel shall be aimed for through the implementation of education and training in theory and handling.

However, the budget for machinery and tools for the training center is given in the plan for the Hanoi - Ho Chi Minh Line.

Table 9.4.5 shows the machinery and tools planned for provision.

Table 13.4.3 Track Mechanized Maintenance Gang

Union	Name of Enterprise (Section in Charge)	Mechanized Maintenance Gang	Kilometre	Remarks
Union-1	Hanoi (13.6 km) (0.00 - 13.60 km)	Yen Vien Nam	10.9	
	Ha Long (161.5 km) (13.60 - 175.10 km)	Lim	23.6	
		Kep	68.5	
		Bao Son	77.2	
		Chi Linh	106.4	
		Yen Duong	137.4	
		Ha Long	175.1	

Table 13.4.4 Machinery and Tool for Maintenance

Machine and Tool	Unit	Number	Remarks
Truck	Set	1	
Track Motor Car	Set	1	
Tie Tamper	Set	2	
Engine Generator	Set	2	
Rail Jack	Set	4	
Rail Saw	Set	1	
Rail Drill	Set	1	
Push Car	Set	1	
Track Irregularity Measurement	Set	1	Gauge measure, Alignment and Level measure, etc.

2) Track, level crossings and others

Turnouts, sleepers, ballast and level crossings shall be revised according to the gauge conversion.

The length of the 43 kg/m rails shall be doubled from the current 12.5 m to 25 m by welding two rails together at a time on the track site.

The improvement plan units and quantities are indicated in Table 13.4.5.

It is better to execute the rail welding, too, in line with the gauge conversion plan.

Improved elastic fasteners (see Appendix 9.4.3) shall be used.

The plate spring manufacturing equipment at Dong Anh Railway Material Engineering Factory is being remodeled and used in the manufacture of double elastic fasteners for the Hanoi - Ho Chi Minh Line plan.

Ballast making facilities and hopper cars shall be introduced to the Dong Mo rock crushing plant and the quality control of ballast grading, etc. shall be carried out.

Appendix 9.4.1 gives an outline of a ballast making facilities.

Table 13.4.5 Improvement Plan for Track

Item	Unit	Number	Remarks
Rail Welding	Thousand Share	8.4	

13.4.3 Stations

(1) Current conditions and problem points

Appendix 13.4.1 shows the station kilometer and distribution diagram.

There are 20 stations between Yen Vien Lam and Ha Long and the average distance between stations is 8.6 km, with the minimum distance being 1.6 km and the maximum distance being 17.1 km.

(2) Countermeasures

As a marketing improvement measure, improvements shall be made to the station plaza of Ha Long Station as a means of developing the access to Ha Long Bay as a tourist center. Table 13.4.6 shows the contents of the station plaza improvements.

A new storage track shall be provided at Ha Long in line with the Train Operation Plan described in 13.3.3. Table 13.4.7 outlines the provision of the new storage track.

Table 13.4.6 Outline of Station Plaza Improvements

Item	Unit	Number	Remarks
Seat reservation counter	Set	1	
New paving	m^2	100	
New fencing	m	30	

Table 13.4.7 Outline of New Storage Track Provision

Item	Unit	Number	Remarks
Track	m	250	
Turnout	Set	7	

13.5 Other Civil Engineering Structures

(1) Current situation of this line

Yen Vien - Cai Lan line had been constructed with 1 meter and 1435 mm (mixed) gauge (Yen Vien- Kep) and 1435 mm (standard) gauge (Kep- Ha Long). There are some weak bridges and soft road bed. The current structures of Kep - Ha Long line are consisted with 1.0 % of bridges and 99.0 % of earth structures such as cutting and embankment. There are 4 bridges on where train speed is restricted to 15km/h or 30km/h. On the cutting and embankment sections, some disasters caused by heavy rain occur every year. Efforts are made to prevent flood disaster in advance through fixed precaution watchers at several sites and patrols.

(2) Countermeasures

Government of Vietnam has a plan to convert from 1435 mm gauge to 1 meter gauge. The standard of 1 meter gauge is smaller than that of 1435 mm gauge. Every facilities of current Hanoi - Cai Lan line have some margin for 1 meter gauge standard. Up to 2000, there is no necessity to improve in hurry.

On current situation of Kep - Ha Long line, a few trains are operated and traffic demand remains low. According to the role and the situation of Cai Lan line, it had better to avoid large investment and only to make indispensable improvement for stable and safe train operation

The similar countermeasure as Lao Cai line is necessary for Cai Lan line.

In the line with the introduction of operation regulation system, the necessary rain gauges and wind velocity gauges shall be installed. Table .13.5.1 shows the sites where rain gauges and wind velocity gauges are to be installed.

Table 13.5.1 List of Rain Gauge and Wind-velocity Gauge

Enterprise	Number	Installation Site
Ha Long	2	Kep(68.5km), Ha Long(175.1km)

13.6 Signaling

13.6.1 Description of Existing System and Problems

(1) Block system and blocking devices

Automatic block system with color light signals and tokenless block system are installed in some tracks between Hanoi - Kep. The tablet block system is adopted in the Cai Lan Line.

(2) Controlling line for the tablet blocking device

1 bare wire is used, hanging on poles and ground earthing circuit is substituted for one more wire as a return circuit. This circuit will be operated in less power source, for instance in batteries, but supervision, of earthing resistance, battery conditions and insulation state of overhead wire is essential. We are afraid of malfunction owing to such change as lowering the insulation resistance of wire to the ground and varying the earth resistance of return circuit. This implies to have such disadvantages as more manpower for maintenance.

(3) Signals

Semaphore signals are used in this line. As starting signals are not installed, train operation is executed through transferring a token from a driver to a station master, and vice versa.

(4) Power source

AC power source are equipped in Co Loa and Viet Tri, but there are some stations with no power source or low power capacity in this line. Change of signaling system should be, therefore, taken into consideration together with improvement of power source for signaling devices.

13.6.2 Countermeasures

(1) Change of block system

1 passenger trains a day and 1 freight one every day or two are operated in this line at present, and by 2000 train operation more than 10 will be planned. Block devices and interlocking devices are superannuated and lack their repair parts. Worse is forecast to progress year by year. Therefore, in this project investment to replace current block system with tokenless block system should be executed by 2000.

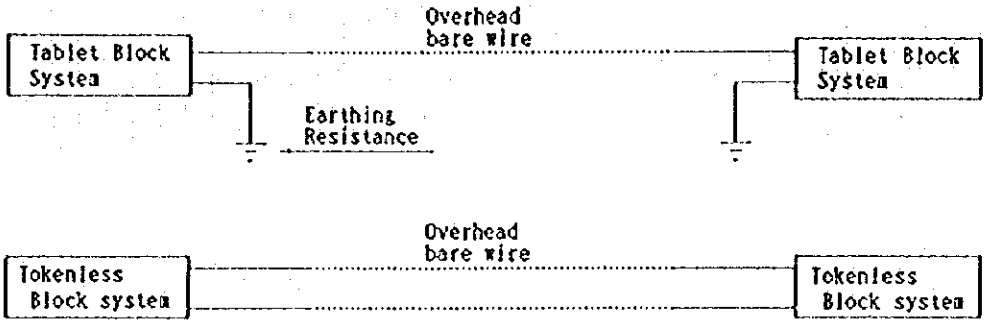


Fig.13.6.1 Controlling Line for the Block System

As for 2 kinds of the block system, their schematic diagram of the controlling line for the block system is shown above. As 2 wires are laid between stations in tokenless system, conditions of lines are improved and malfunctions are also removed.

(2) Power supply and color light signal

Anew installing power source, renewal of power source and increase in its capacity will be needed at the same time as electrification of signals. Replacement of semaphore signals with electric color light signals should be, therefore, excuted in an adequate timing. If necessary, distant signals will be also added in some stations.

(3) Change of the station layout and improvement of tracks

At the same time as modernisation of signaling system, the improvement of some stations should be execute. As traffic in Cai Lan Line is so small that station layout should be simplified. 2 tracks are remained and another unused track should be eliminated except some exception. Spring point devices are installed to both turnouts and then, point men will be deleted. As a result, saving manpower, increased train operation efficiency and simplicity of signal operation will be achieved.

(4) Interchange station

Owing to increase of the number of train operations, it is necessary to prepare about 6 stations for trains to pass each other.

(5) Others

Some items for safe train operation are required from train operating division. They are:

- Automatic warning device for railway crossing
- Warning system in much rainfall

As for execution, it is necessary to decide adequately which item to execute and which section of line to select.

(6) New project

There are two new projects in this line. One is to change gauge from 1435 mm to 1000 mm, and another is to construct new track to Cai Lan.

13.7 Telecommunication

(1) Current Conditions

(a) Communication line

Bare wire line is in use on most of the line between Hanoi and Ha Long, and cable is used on the section between Hanoi and Yen Vien.

The contents of the facilities and equipment are the same as indicated in Section 9.7 (1) (a).

(b) Transmission facilities

The contents of the facilities and equipment are the same as indicated in Section 9.7 (1) (b), however, in line with the installation of new wireless equipment at the end of 1995 in line with this, the facilities between Hanoi and Kep will be renewed.

(c) Exchange facilities

Exchange units are installed at Yen Vien, Bac Giang, Mao Khe and Uong Bi, and the unit at Yen Vien is the step-by-step exchange.

The contents of the facilities and equipment are the same as indicated in Section 9.7 (1) (c).

(d) Terminal source facilities

The contents of the facilities and equipment are the same as indicated in Section 9.7 (1) (d).

(e) Power source facilities

The contents of the facilities and equipment are the same as indicated in Section 9.7 (1) (e).

(f) Maintenance system

The maintenance of the telecommunication-related facilities is carried out by the maintenance companies that belong to Union 1. There are two companies located in Hanoi and Bac Giang, and maintenance staff are deployed at each station.

(2) Countermeasures

The large part of the telecommunication facilities will need to be renewed by 2010. The target for investment into equipment and facilities for up to 2000 was examined according to the following principles.

Firstly, equipment investment that satisfies the demand for telecommunications in terms of both quality and quantity shall be carried out.

Secondly, the equipment investment shall match with the objectives of securing greater safety, greater income and improved service by 2000.

Thirdly, consideration shall be given to 2010 by investing in equipment that does not eventually prove to be wasteful or surplus to requirements by that time.

(a) Communication line

The communication line between Hanoi and Yen Vien shall be renewed in the manner described in Section 9.7 (2) (a) Regarding the section between Yen Vien and Kep, as it is planned to introduce small capacity wireless incidental to the digital microwave system currently being installed by VNR, no renewal will be carried out here. As for the section between Kep and Cai Lan, as there is a plan for short routing, there is a risk that some facilities will become useless, so this section shall be examined after 2000.

(b) Transmission equipment

The existing transmission equipment was described in Section 13.7 (1) (b). Because a digital micro radio system will be completed between Hanoi and Kep by the end of 1995 and as renewal is scheduled in the manner described in 9.7 (2) (b), it will be possible to secure maintenance components. However, in the event where new demand arises between Kep and Cai Lan by 2000, it will become necessary to extend the digital microwave system this section.

(c) Exchange facilities

As was previously stated in Section 13.7(1) (b), the current switching network does not allow the smooth flow of marketing information beneficial to ticket sales, and so on. In order to

remedy this situation, as well as replacing transmission equipment, the method of widening the range of subscription to Hanoi as described in Section 9.7 (1) (c) shall be strengthened up to 2000, and following 2000, exchanges shall be replaced and repeater radio stations increased in order to make regional non-delay service switching possible. Moreover, following conversion to digital exchanges, automatic information services for train and travel information, etc. shall be provided at main stations.

(d) Terminal facilities

Station compound telephones are directly related to the safe and stable operation of trains. It is therefore necessary to form a long-term plan and carry out successive renewal of such telephones before they become too deteriorated, in order to preserve system maintenance. However, as there are other higher priority replacement plans, this shall be carried out after 2000.

(e) Power source facilities

As was indicated in Section 9.7 (2) (e), renewal must take place at the same time as renewal of the transmission and exchange facilities.

(f) Auxiliary facilities

As was indicated in Section 9.7 (2) (f), preparation must be carried out at the same time as renewal of the transmission and exchange facilities.

(3) Maintenance system

This is the same as indicated in Section 9.7 (3).

13.8 Rolling Stock

The following two cases are examined.

-Cai Lan Line still remains in standard gauge upto 2000.

-Cai Lan Line is converted to meter gauge before 2000.

13.8.1 Case of Standard Gauge

(1) Collected data and information on current conditions

Table 9.8.1 Locomotive (1993)

Table 9.8.2 Number of Locomotives by Situation in Dec. 1993 and Dec. 1994

Table 13.8.1 Number on Book of PC and FC (1435mm)

Table 13.8.2 PC and FC by Manufacturing Year (1435mm)

Table 13.8.3 Declining Tendency of D8H

(2) Some findings, current problems and countermeasures

1) Standard gauge SLs are very decayed. If Cai Lan Line remains in standard gauge in 2000, VNR will be obliged to restore these SLs.

2) D8H

(a) According to Table 13.8.3, declining tendency of D8Hs is not remarkable, because of their young age.

(b) Spare parts for only 3 usable D8Hs are in difficulty of obtaining.

(c) One D8H which was seriously damaged by collision accident was completely stripped, and its equipment are used for family D8Hs.

(d) It is found that another one D8H is being cannibalized.

3) Existing number of PCs (1435mm) in 2000 is zero, assuming that their life is 30 years old.

4) Cai Lan Line should be converted to meter gauge as soon as possible.

(3) Possible existing number in 2000 of rolling stock (1435mm)

1) Locomotive

(a) SL

According to Table 9.8.2, 10 SLs could remain as an optimistic forecast reliant on VNR's capability of SL restoration

Table 13.8.1 No. on Book of PC and FC (1435mm) (Dec31 '93)

Jan. 10, 94 VNR

	TOTAL	UNION 1						UNION 2						UNION 3						Total
	Dec. 31,92	R	P	TOTAL	D	I	Dec.93	R	P	TOTAL	D	I	Dec.93	R	P	TOTAL	D	I	Dec.93	Dec.31, 93
PC (1435) TOTAL	29	7	22	29	8		21													21
Coach (1st)	1	1		1			1													1
Coach (2nd)	12	2	10	12	3		9													9
Coach (3rd)	15	4	11	15	5		10													10
Baggage	1	1		1			1													1
Wagon(1435)TOTAL	598	300	298	598	24		574													574
Covered	53	19	34	53	2		51													51
Open (High Side)	383	281	102	383	6		377													377
Open (Low Side)	94		94	94	16		78													78
Open (Flat)	60		60	60			60													60
Tank	1		1	1			1													1
Conductor	7		7	7			7													7
Special Car TOTAL	64	9	21	30	2		28		6	6			6	13	15	28	5		23	57
1000	58	9	15	24			24		6	6			6	13	15	28	5		23	53
1435	6		6	6	2		4													4

[Remarks]

R : Roller Bearing
P : Plane Bearing
D : Decrease (Condemnation or to Another Union)
I : Increase (from Another Union)

Table 13.8.2 PC and FC by Manufacturing Year (1435mm)
(Dec.31,1993,Revised: Aug.1995)

Kind \ Year		R	P	R										Total	
Kind		Before1970		1978	1979	1980	1984	1986	1987	1988	1991	1992	1993 1994		
P	A_R(1st class)	1												1	France Mfg.
C	B_R(2nd class)		9											9	China Mfg.
	C_R(3rd class)		10											10	China Mfg.
	H_R(Baggage)		1											1	China Mfg.
TOTAL		1	20											21	1R + 20P
F	G_R(Covered)		32		19									51	19R + 32P
C	H(High Side)		96	100	100	81								377	281R + 96P
	N(Lowow Side)		78											78	0R + 78P
	M(Fiatat)		60											60	0R + 60P
	P(Tanank)		1											1	0R + 1P
	XT(Conductor)		7											7	0R + 7P
TOTAL			274	100	119	81								574	300R + 274P

[Remarks] (1) R : Roller bearing car
P : Plain bearing car
(2) Roller bearing FCs are imported from Rumania
Plain bearing FCs are imported from China

Table 13.8.3 Declining Tendency of D8H (Yen Vien Loco. Depot)

Year	No. on Book	Available Number	Waiting Repair	Waiting Condemnation	Remarks
1986	5	3	2	0	
87	5	3	2	0	
88	5	3	2	0	
89	5	2	3	0	2003 collision
90	5	2	3	0	
91	5	2	3	0	
92	5	2	2	1	2003 waiting condemnation
93	5	3	1	1	
94	5	3	1	1	2001 Engine damaged
95	5	3 2002 2004 2005	1	1	Bogie of 2003 ->2004

(b) D8H

D8H may be kept only by cannibalization. According to Table 9.8.2, therefore, 2 D8Hs will remain in 2000 as a pessimistic forecast.

2) PC (1435mm)

According to Table 13.8.2, existing number of PCs in 2000 is zero. However, it is obliged to recommend to use the actually existing PCs by regular or temporary maintenance as long as possible. Then, it is estimated that the existing number of PCs in 2000 is as follows.

A_R	B_R	C_R	H_R
1	9	10	1

3) FC (1435m)

By same reason as case of PC, it is recommended to use the actually existing FCs by regular or temporary maintenance as long as possible. Then, it is estimated that the existing number of FCs in 2000 is as follows.

G_R	H	N	M	P	XT
51	377	78	60	1	7

(4) Necessary number of rolling stock in 2000 for Cai Lan Line given by JICA Transportation Planning Team is shown in Table 13.8.4. No express passenger train is planned and the configuration of local passenger train is assumed as follows.

(SL or DL) +6 (A and/or B and/or C)+1×S

(5) Rolling stock plan upto 2000

Based on Table 13.8.4 and possible existing number of rolling stock in 2000 as before-mentioned, rolling stock plan upto 2000 for Cai Lan Line (1435mm) is shown in the following table along with the investment cost. Rolling stocks to be procured are only 7 secondhand PCs.

	Unit Price		Number	Price		Total
	F	D		F	D	
Procurement of secondhand PCs	0.05		7	0.4		0.4

Remarks:

The price of new PC (1435mm) is assumed to be 150% of that of new PC (1000mm). If the price of secondhand one is assumed to be 30% of that of new PC, the price will be 45% of new PC (1000mm). Namely, the price per car is estimated to be 0.45×US$0.11 = US$0.05.

13.8.2 Case of Conversion to Meter Gauge

(1) General

As for rolling stock of meter gauge, almost all of the description in the Clause "9.8 Rolling Stock of this Volume 3" are applicable. Therefore, only the specific matters for Hanoi - Cai Lan Line will be described.

(2) Existing number of rolling stock in 2000 (1000mm) for Hanoi - Cai Lan Line is completely zero, because this line is actually standard gauge line.

(3) Necessary number of rolling stock in 2000 for Hanoi - Cai Lan Line given by JICA Transportation Planning Team is shown in Table 13.8.5. The maximum speed of express passenger train on Hanoi - Cai Lan Line (1000mm) is planned to be 80km/h. Therefore, D12E is recommendable for express passenger and freight trains, and D4H is used only for local passenger trains.

(4) Rolling stock plan upto 2000 for Hanoi - Cai Lan Line (1000mm)

The following table shows the plan along with investment cost.

(Million US$)

	Unit Price		Numbe r	Price		Total
	F	D		F	D	
D12E (New)	0.98		7	6.9		6.9
PC (New)		0.12	41		4.9	4.9
Total				6.9	4.9	11.8

As for FC, existing number of FCs for Hanoi - Lao Cai Line in 2000 is surplus for the necessary number. 60 high side wagons and 160 other wagons necessary to Hanoi - Cai Lan Line (1000mm) can be covered by the surplus wagons of Hanoi - Lao Cai Line use, as mentioned in Table 9.8.15 of this volume.

13.9 Rolling Stock Maintenance

Same as Clause 9.9

Table 13.8.4 Necessary Number of Rolling Stock in 2000 for Hanoi-Cai Lan Line (1435mm)

		No. of trains	Loco	PC	FC		
					H	Others	
PT	Local	4	5 1*	28			Including one reserved train
FC	Coal train	3			22 3*		
	Others					56 9*	
Total			6	28	25	65	

Remarks PT : Passenger train

FT : Freight train

* : Reserved locomotives or cars

Table 13.8.5 Necessary Number of Rolling Stock in 2000 for Hanoi-Cai Lan Line (1000mm)

		No. of trains	DL		PC			FC		Remarks
			D12E	D4H	A	B	S	H	Others	
PT	Express (Middle distance)	4	6 1*	4 1*	4	8	4			Including reserved train
	Local	5			—	20	5			Including reserved train
FT	Coal train							60		Including reserved cars
	Others								160	Including reserved cars
Total			7	5	4	28	9	60	160	

Remarks PT : Passenger train

FT : Freight train

* : Reserved locomotives

13.10 Natural Conditions

Ha Noi - Cai Lan line had no serious problems on natural disasters in this line. The line had suffered small natural disasters; collapse and settlement of banks, slope failure, cutting slope failures and erosion (banks and structural foundations).

There are no submergence problems of railway facilities, but a freeboard of bridge shall be studied when superstructure of bridge will be planned replacement.

Seismography

Map of seismic intensity distribution is shown in. The classifications of seismic intensity in Viet Nam is adopted the seismic criteria of Mercalli scale. There is no earthquake recorded in Viet Nam, during last fifty years.

13.10.1 Current Problems of Natural Disasters and Recommended Priorities of Countermeasure

Cai Lan line is separated following two sections on study of natural disasters.

Ha Noi - Kep (68.6km, union I)	0km+000 - 68km+600
Kep - Cai Lan (106.6km, Union I)	68km+600 - 175km+200

There are no current problems on submergence of railway facilities, but freeboard of bridge will be studied when superstructure of bridge will be planned replacement.

1) Ha Noi - Kep (68.6km, Union I); 0km+000 - 68km+600

The line of this section had suffered natural disaster; collapse and settlement and of banks. The current problems of natural disaster in this section are shown as follows:

Collapse and settlement of banks

Recommended priority of countermeasure	Program 2000 Project	Program 2000 Study	Up to 2010 Study	Future Study
17km+000 - 17km+200		*		
17km+300 - 17km+550		*		
17km+800		*		
25km+085 - 25km+810		*		
34km+465 - 34km+765		*		

2) Kep - Ha Long (106.6km, Union I); 68km+600 - 175km+200

The line of this section had suffered natural disaster, slope failure, cutting slope failure, collapse and settlement of banks and erosion (banks and structural foundations). The current problems of natural disasters in this section are shown as follows:

Slope failure

Recommended priority of countermeasure	Program 2000 Project	Program 2000 Study	Up to 2010 Study	Future Study
77km+300			*	
86km+600			*	
169km+800			*	

Cutting slope failure

Recommended priority of countermeasure	Program 2000 Project	Program 2000 Study	Up to 2010 Study	Future Study
98km+000 - 101km+500			*	
104km+100			*	
113km+600			*	
178km+000 - 178km+500			*	

Collapse and settlement of banks

Recommended priority of countermeasure	Program 2000 Project	Program 2000 Study	Up to 2010 Study	Future Study
74km+100 - 75km+100			*	
76km+000 - 77km+200			*	
78km+550 - 79km+100			*	
88km+500 - 91km+000		*		
108km+925 - 109km+550			*	
110km+350 - 110km+830			*	
119km+085 - 119km+200			*	
128km+740 - 128km+805			*	
129km+030 - 129km+475			*	
130km+210 - 130km+572			*	
175km+743 - 177km+425			*	

Erosion (banks and structural foundations)

Recommended priority of countermeasure	Program 2000 Project	Program 2000 Study	Up to 2010 Study	Future Study
101km+378 - 101km+390			*	
105km+881 - 105km+938			*	
114km+085 - 114km+097			*	
140km+233 - 140km+245		*		
141km+060 - 140km+072			*	
158km+200			*	
168km+553 - 174km+422			*	

13.10.2 Advises for Planning Countermeasure Against the Natural Disasters

The countermeasures of natural disaster shall be planned by each civil engineer, however advises for planning countermeasure shall be suggested based on keep safety train operation. Advises on each kinds of countermeasure for preventing natural disaster are shown as follows:

(1) Collapse and settlement of banks

Settlement of banks had occurred by soft ground usually. Countermeasure for protecting settlement of banks shall be suggest following measures.

1) Reform of bank

- Replacement of soft soil
- Compacting
- Selected soil materials

2) Soil stabilization

- Soil improvement
- Grouting
- Reinforced earth

3) Prevention of lateral flow

- Counter weight fill
- Installation of pile stake with gabions
- Soil improvement

(2) Erosion (structural foundations)

Erosion of structural foundations had occurred by flash flood usually. Countermeasure for protecting erosion of structural foundations shall be suggest following measures.

1) Protection of structural foundations as follows:

- Gabion
- Retaining wall
- Wet masonry

(3) Erosion (banks)

Erosion of banks had occurred by river water rising and flash flood. Countermeasure for protecting erosion of banks shall be suggest following measures.

1) Installation of side and cross drainage

2) Installation for protecting of slope surface as follows:

- Vegetation
- Gabion
- Retaining wall
- Wet masonry

(4) Slope failure and cutting slope failure

Slope failure and cutting slope failure had occurred by heavy rain usually. Construction gauge should be keep for safety train operation. Countermeasure for preventing slope failure shall suggest following measures.

1) Reform slope gradient

2) Installation for protecting of slope surfaces as follows:

- Vegetation
- Gabion
- Retaining wall
- Wet masonry

13.11 Existing Environmental Conditions

13.11.1 Environment and Natural Resources

(1) Climate

The climate of Viet Nam belongs to tropical climate type. It is influenced by the monsoon. The monsoon is also influenced by topographic conditions and others. Generally, the climate of Viet Nam can be divided into two periods as follows:

- Southwestern monsoon summer season
  from May to September
- Northeastern monsoon winter season
  from October to April

The southwestern monsoon blows from the Bay of Bengal and the South Pacific. It brings hot air and humid air. As a result, amount of rainfall is concentrated this season. End of this season, there is heavy rain and typhoon season. However, amount of rainfall and rainfall pattern depend on location and topographic conditions.

The northeastern monsoon blows from the northern Pacific, and brings comparative warm and humid air, and also rain initially. It brings dry air after that . It is dry season from November to March.

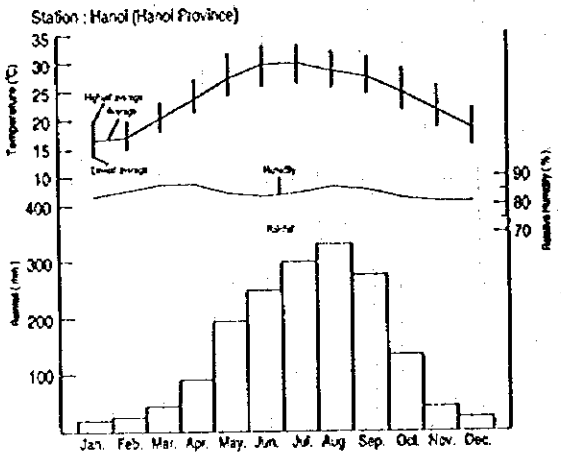
There is not any weather station in Cai Lan area. Therefore, we collected climate data at Hai Phong weather station in Phu Lien Province that is the same as Cai Lan area. Monthly climate data is shown in Table 13.11.1 and Fig. 13.11.1.

The climate of Hanoi and Hai Phong is almost the same climate conditions. The mean annual temperature of Hanoi and Hai Phong is 23.5 °C and 23.0 °C respectively. Monthly mean humidity ranges from 81 % to 87 % in Hanoi, and from 79 % to 91 % in Hai Phong. The annual rainfall of Hanoi and Hai Phong is 1,676 mm and 1,808 mm respectively. Rainfall pattern of Hanoi and Hai Phong is almost same. However, climate of Hai Phong is influenced by coast weather so that humidity and rainfall of Hai Phong are higher than Hanoi.

(2) Geology/Topography

As you know, Viet Nam is S-shaped in the north and south. It stretches from 8° 30' N and 23° 22' N. Land of Viet Nam is long and narrow. Length of land is 3,260 km long, and total land area is approximately 331,000 km^2.

Proposed Cai Lan Station is located on the Bai Chay Peninsula. Proposed railway crosses narrow area from proposed Cai Lan Station to Halong station. Route of proposed Halong Cai Lan Line is almost flat. In part of the Bai Chay Peninsula, however, proposed railway goes through flat area that lies between hilly and coast.



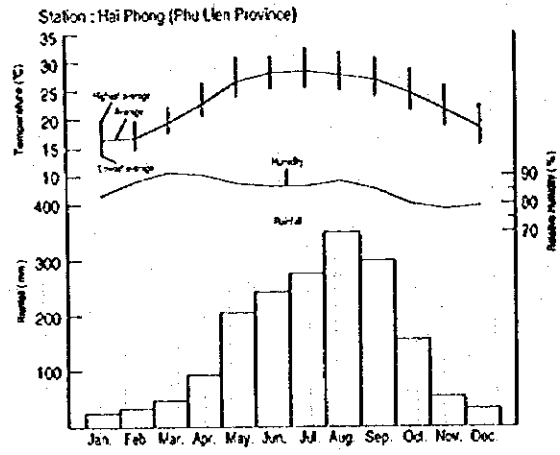


Fig. 13.11.1 Monthly Climate Data on Hanoi - Cai Lan Line

Table 13.11.1 Monthly Climate Data on Hanoi - Cai Lan Line

Station: Hanoi (Hanoi Province) Elevation: 5 m

Parameter	unit	January	February	March	April	May	June	July	August	September	October	November	December	year
Temperature														
Monthly ave.	C	16.4	17.0	20.2	23.7	27.3	28.8	28.9	28.2	27.2	24.6	21.4	18.2	23.5
Monthly highest ave.		19.3	19.9	22.8	27.0	31.5	32.6	32.9	31.9	30.9	28.6	25.2	21.8	27.0
Monthly lowest ave.		13.7	15.0	18.1	21.4	24.3	25.8	26.1	25.7	24.7	21.9	18.5	15.3	20.9
Relative humidity	%	83	85	87	87	84	83	84	86	85	82	81	81	84
Rainfall	mm	18.6	26.2	43.8	90.1	188.5	239.9	288.2	318.0	265.4	130.7	43.4	23.4	1,676.2
Rainy day	days	8.4	11.3	15.0	13.3	14.2	14.7	15.7	16.7	13.7	9.0	6.5	6.0	144.5
Wind														
Average wind Speed	m/sec.	1.5	2.4	2.3	2.5	2.4	2.1	2.1	1.8	1.8	1.8	1.9	2.0	2.0

Rainfall: year means total amount of a year

Station: Hai Phong (Phu Lien Province) Elevation: 5 m

Parameter	unit	January	February	March	April	May	June	July	August	September	October	November	December	year
Temperature														
Monthly ave.	C	16.3	16.7	19.1	22.6	26.4	28.0	28.2	27.7	26.8	24.5	21.3	18.1	23.0
Monthly highest ave.		19.5	19.5	22.0	26.1	30.7	31.8	32.1	31.4	30.5	28.5	25.4	22.0	26.6
Monthly lowest ave.		13.7	14.7	17.6	20.8	24.0	25.2	25.7	25.0	24.0	21.6	18.6	15.4	20.5
Relative humidity	%	83	88	91	90	87	86	86	88	85	80	78	79	85
Rainfall	mm	25.4	34.3	48.2	92.9	203.1	240.1	274.0	348.6	299.1	156.2	54.4	31.9	1,808.2
Rainy day	days	8.8	13.8	16.4	13.8	13.1	14.7	15.1	17.8	15.4	10.3	7.3	6.5	153.0
Wind														
Average wind Speed	m/sec.	3.3	3.3	3.4	3.8	4.0	3.6	3.7	3.3	3.4	3.7	3.7	3.5	3.6

Rainfall: year means total amount of a year

(3) Air quality

We have only limited information on air quality. In recent years, it can be said that air quality of urban areas is deteriorating in Viet Nam, because load of emission gas from motor vehicles such as motorbike and car are rising. Examples of the existing ambient air quality in Hanoi are shown in Table 13.11.2.

Table 13.11.2 Conditions of Ambient Air Quality in Hanoi

Hanoi

Station	CO mg/m3	SO2 mg/m3	NH3 mg/m3	Dust mg/m3	Date of Survey
Kham Thien - Le Duan Cross	8.6	0.01008	0.02766	5.09	Oct. 5, 1993
O Cho Dua	16.4	0.02206	0.05794	3.37	Oct. 5, 1993
Nguyen Thai Hoc - Ton Due Thang Cross	7.5	0.01623	0.03526	5.31	Oct. 5, 1993
Tran Nhat Duat Street	2.9	0.0058	0.03986	2.26	Oct. 5, 1993

Station	CO mg/m3	SO2 mg/m3	NH3 mg/m3	Dust mg/m3	Date of Survey
Kham Thien - Le Duan Cross	8.6	0.01008	0.02766	5.0879	Oct. 5, 1993
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Tran Nhat Duat Street	2.9	0.0058	0.03986	2.26	Oct. 5, 1993

Source: Center for Control and Management of Atmospheric and Water Environment

(4) Noise

The JICA Study Team has surveyed noise level of traveling train along railway around Hanoi Station and Halong Station, and background noise level on proposed railway between Halong Station and proposed Cai Lan Station. Result of noise survey is shown in Table 13.11.3, 4, and location of survey points for background noise level is shown in Fig. 13.11.2.

Obtained noise level on railway extension is compared with Maximum Permitted Noise Level (Viet Nam's Standard TCVN No. 5949, see Table 13.11.5). Although noise level of St. 4 and St. 7 excesses Maximum Permitted Noise Level, other points are the same or below Maximum Permitted Noise Level (residential area: 60 dB).

Table 13.11.5 Maximum Permitted Noise Level

No.	Types of Area	Time		
		6:00 - 18:00	18:00 - 22:00	22:00 - 6:00
1	area requiring special quietness area: hospitals, library, resort place, kindergarten, school	50	45	40
2	residential area, hotel, houses, offices	60	55	45
3	commercial area	70	70	50
4	production area: workshop, factory	75	70	50

Viet Nam's Standard TCVN No. 5949, 1995

Table 13.11.3 Result of Noise Level Survey on Hanoi - Cai Lan Line

Location: Hanoi — Date: August 4 , 1995

No. of Survey		1	Background	2	Background	3	Background
Survey Time		13:15	13:20 - 13:25	14:02	14:10 - 14:15	15:00	15:05 - 15:10
Type of Train		D4H(93)		D5H(YB1)		D4H(HYP)	
Noise Level dB(A)	St. 1	97	49	93	52	98	52
	St. 2	103	67	108	67	103	67
	St. 3	93	57	97	59	105	58
	St. 4	95	60	93	61	98	62
Data of Train							
Direction		Hanoi→Thai Nguyen		Hanoi→Yen Bai		Hanoi→Hai Phong	
No. of cars		Locom.+7cars		Locom.+7cars		Locom.+8cars	
Use		for passenger		for passenger		for passenger	
Train speed (km/h)		14		18		12	

Location: Halong — Date: No.1-August 2, No.2-August 3, 1995

No. of Survey		1	Background	2	Background
Survey Time		14:48	14:55 - 15:00	13:28	13:35 - 13:40
Type of Train		D8H		D8H	
Noise Level dB(A)	5 m	88	42	87	44
	10 m	84	39	84	40
	20 m	81	41	80	40
	40 m	-	-	72	40
Data of Train					
Direction		Halong→Yen Bien		Yen Bien→Hanoi	
No. of cars		Locom.+7cars		Locom.+6cars	
Use		for passenger		for passenger	
Train speed (km/h)		17		35	

Table 13.11.4 Result of Noise Level Survey on Halong - Cai Lang Extention

Location: — Date: August 3, 1995

No. of Survey	St. 1	St.2	St. 3	St. 4	St. 5	St. 6	St. 7
Survey Time	8:50 - 8:57	9:02 - 9:07	9:20 - 9:25	9:55 - 10:00	10:20 - 10:25	11:17 - 11:22	11:58 - 12:03
Noise Level dB(A)	44	43	57	63	53	46	62

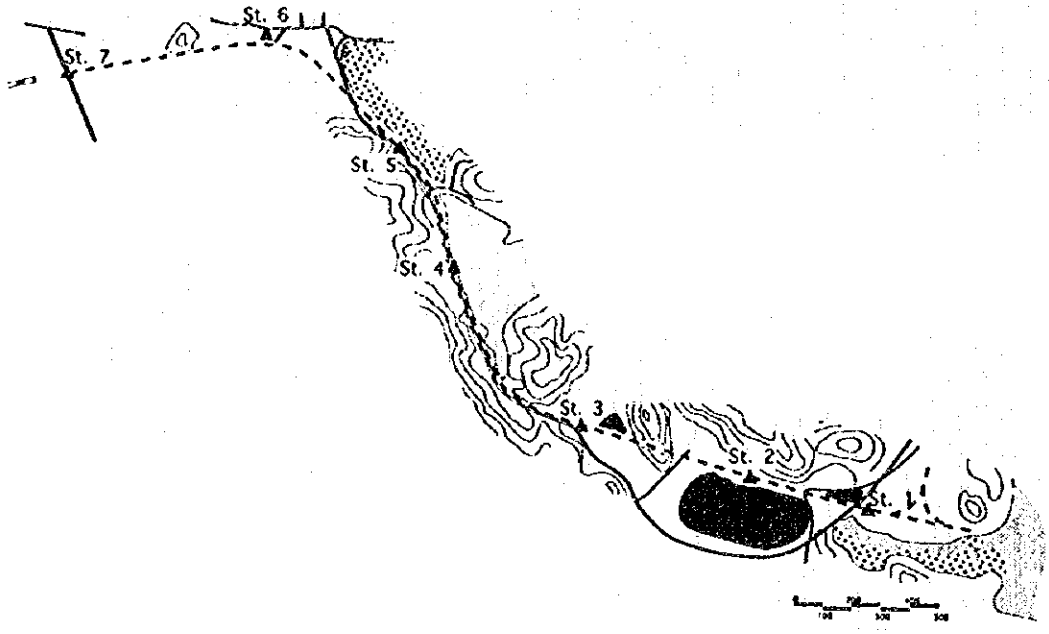

Fig. 13.11.2 Location of Noise Level Survey on Ha Long - Cai Lan Section

13.11.2 Biological Resources and Ecosystems

(1) Flora

There is mangrove in the swamp area around proposed Cai Lan Station. This mangrove, however, does not cover widely, and it is not yet grown.

In the part of the Bai Chay Peninsula, proposed railway line passes like a valley and the foot of the hells. Trees are planted at mountains and hills sides. There is mangrove area on the coast where connection between the Bai Chay Peninsula and Halong side on the proposed railway line.

(2) Fauna

According to Viet Nam Environmental Program and policy Priorities for a Socialist Economy in Transition (World Bank, 1995), there are many species of fauna as follows:

mammals	275	species
birds	800	species
reptiles	180	species
amphibians	80	species
fish/invertebrates	2,500	species

Some species of fauna are facing and extinct, for example, 28 % of the mammals, 10 % of the birds, and 21 % of the amphibians and reptiles are listed as endangered species.

13.11.3 Quality of Life

(1) Population and Community

Population change of Viet Nam is shown in Fig. 13.11.3 and Table 13.11.6. Population of Viet Nam's is 70.8 million and annual population growth between census year of 1979 and 1989 has been 1.6 %. According to Statistical Yearbook (General Statistical Office, 1947), population of urban area accounts for about 20 % of total population since 1970.

The proposed railway belongs to Quang Ninh Province. Population of Quang Ninh Province is 834,800 by 1989 census, and population density is 141 persons/km^2. The west part of the proposed railway line is residential area In the Bay Chay Peninsula, houses are distributed along proposed railway line and Road No. 18. There is not any high density population area.

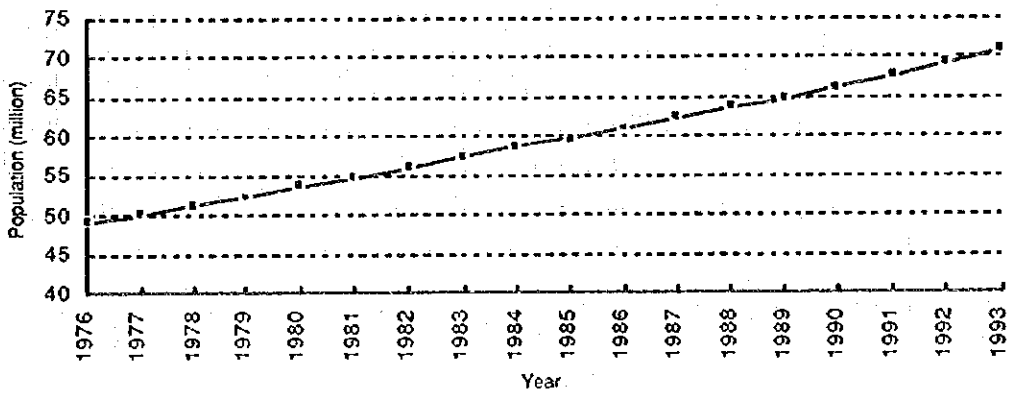

Fig. 13.11.3 Population Change, 1976 - 1993
Source: ADB, Key Indicators of Developing Asian and Pacific Countries

Table 13.11.6 Population Change, 1976 - 1993

Unit: Million

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984
Population	49.16	50.41	51.42	52.46	53.72	54.93	56.17	57.37	58.65

Year	1985	1986	1987	1988	1989	1990	1991	1992	1993
Population	59.87	61.11	62.45	63.73	64.77	66.23	67.68	69.31	70.8

Source: ADB, Key Indicators of Developing Asian and Pacific Countries, 1994

(2) Economic Activities

The Gross Domestic Product (GDP) of Viet Nam is 170,258 billion dongs in 1994 (at current price). The Gross Domestic Product by sectors is shown in Table 13.11.7. Growth rate of GDP is 24 % per annual between 1992 and 1994. Composition of GDP in Viet Nam, primary sector (agriculture, forestry, fishery) was the highest rank with 40 % of total GDP in 1991.

However, rate of primary sector is decreasing, primary sector is second rank since 1992. On the other hand, service sector is increasing. Rate of service sector accounts for 42 % of total GDP in 1994.

Table 13.11.7 Gross Domestic Product by Sectors

(at current prices) (unit: Billion Dongs)

Year	1991	1992	1993	1994
Total	76,707	110,535	136,571	170,258
Agriculture,Forestry, Fishery	31,058	37,513	40,796	48,865
Industry, Construction	18,252	30,135	39,472	50,481
Service	27,397	42,887	56,303	70,912

source: General Statistical Office, Statistical Yearbook, 1994

(3) Land use

Land use along proposed railway between Halong Station and proposed Cai Lan Station is shown in Fig. 13.11.4.

The west of proposed railway line is used as residential area. This residential area is between Halong Station and crossing at Road No. 18. From the east of Road No. 18, proposed railway goes along Road No. 18. This area lies between mountain and hilly areas, and houses are distributed along Road No. 18. Around proposed Cai Lan Station is in space between mountains and pond connected the sea with water gate. There is Cai Lan Port in the north of proposed Cai Lan Station.

(4) Traffic

There will be three railway crossings on the proposed line between Halong and Cai Lan. First, the proposed railway crosses road with two lanes that is connected with Road No. 18, in the east of Halong station. Secondly, crossing is located at Road No. 18 where is between the Bay Chay Peninsula and Halong station side. Finally, the proposed railway crosses road that came from Cai Lan Port to Road No. 18. The crossing point is located on between proposed Cai Lan Station and marshaling yard. In the future, it is predictable that traffic volume on the railway from Cai Lan Port will increase especially container track.

(5) Public Facilities

There are several public facilities along Ha Long - Cai Lan Section as follows:

- Transformer stations 2 sites
- High voltage line
- Oil depot center 1 site

Location of above facilities is shown in Fig. 13.11.6.

(6) Cultural property/Archaeology site

Survey of cultural property and archaeological site have been entrusted to Viet Nam's local consultant. According to this survey, there is not cultural property and archaeological site along proposed railway line.

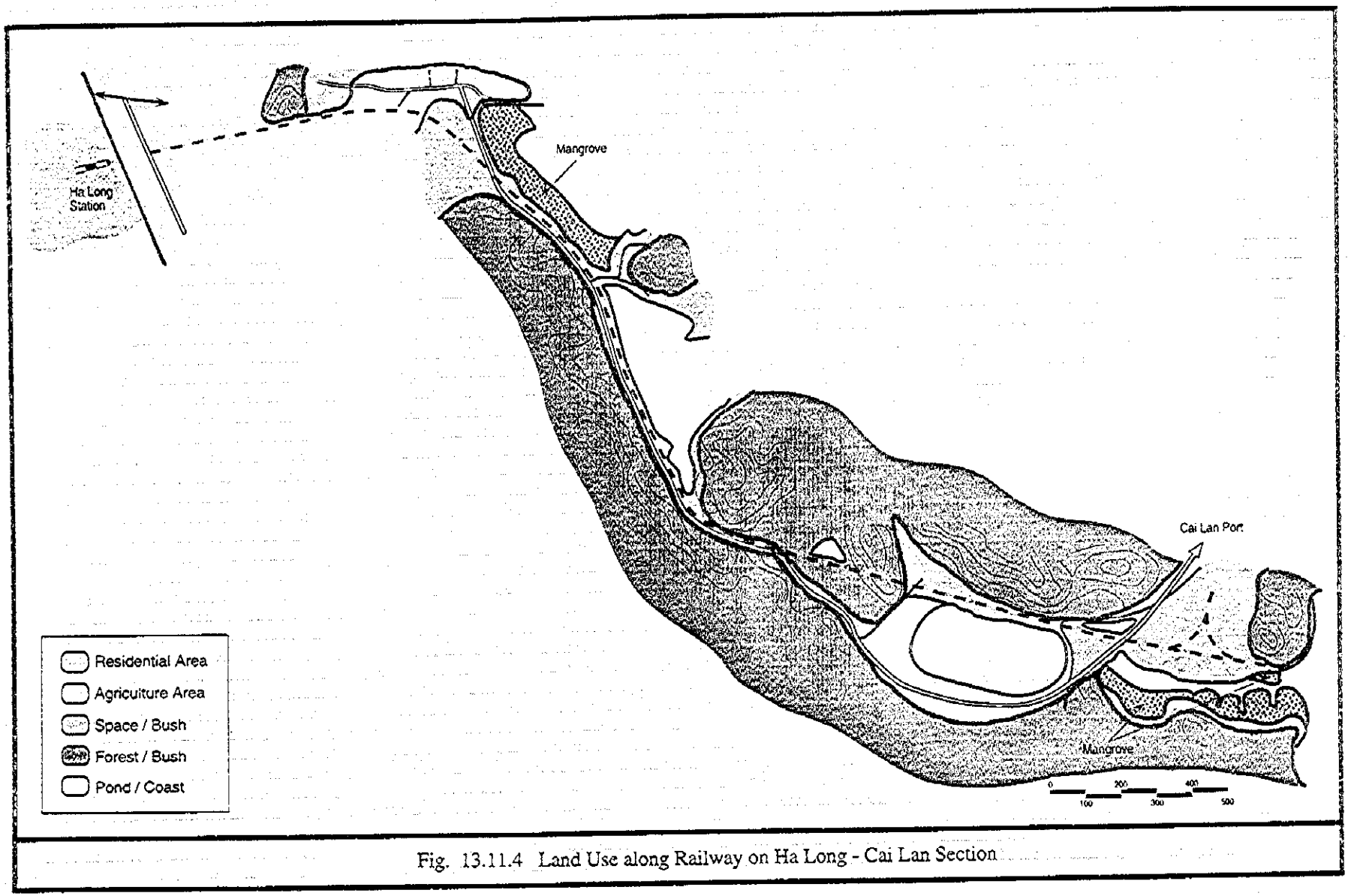

Fig. 13.11.4 Land Use along Railway on Ha Long - Cai Lan Section

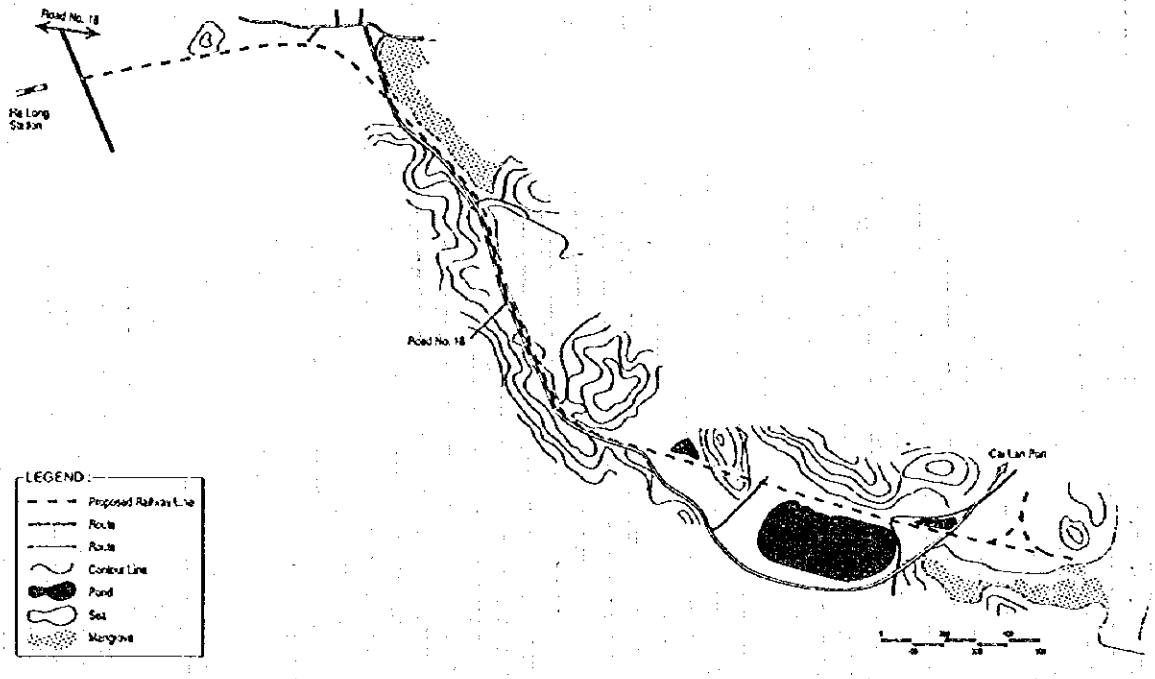

Fig. 13.11.5 Transportation Network along Ha Long - Cai Lan Section

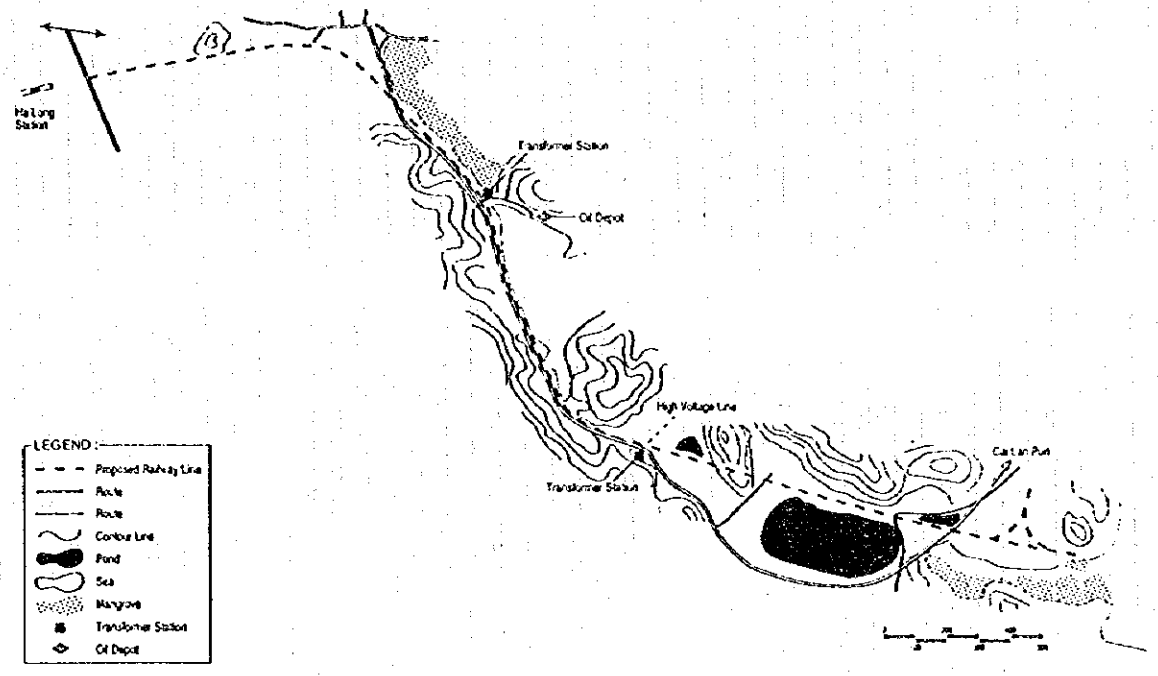

Fig. 13.11.6 Location of Public Facilities along Ha Long - Cai Lan Section

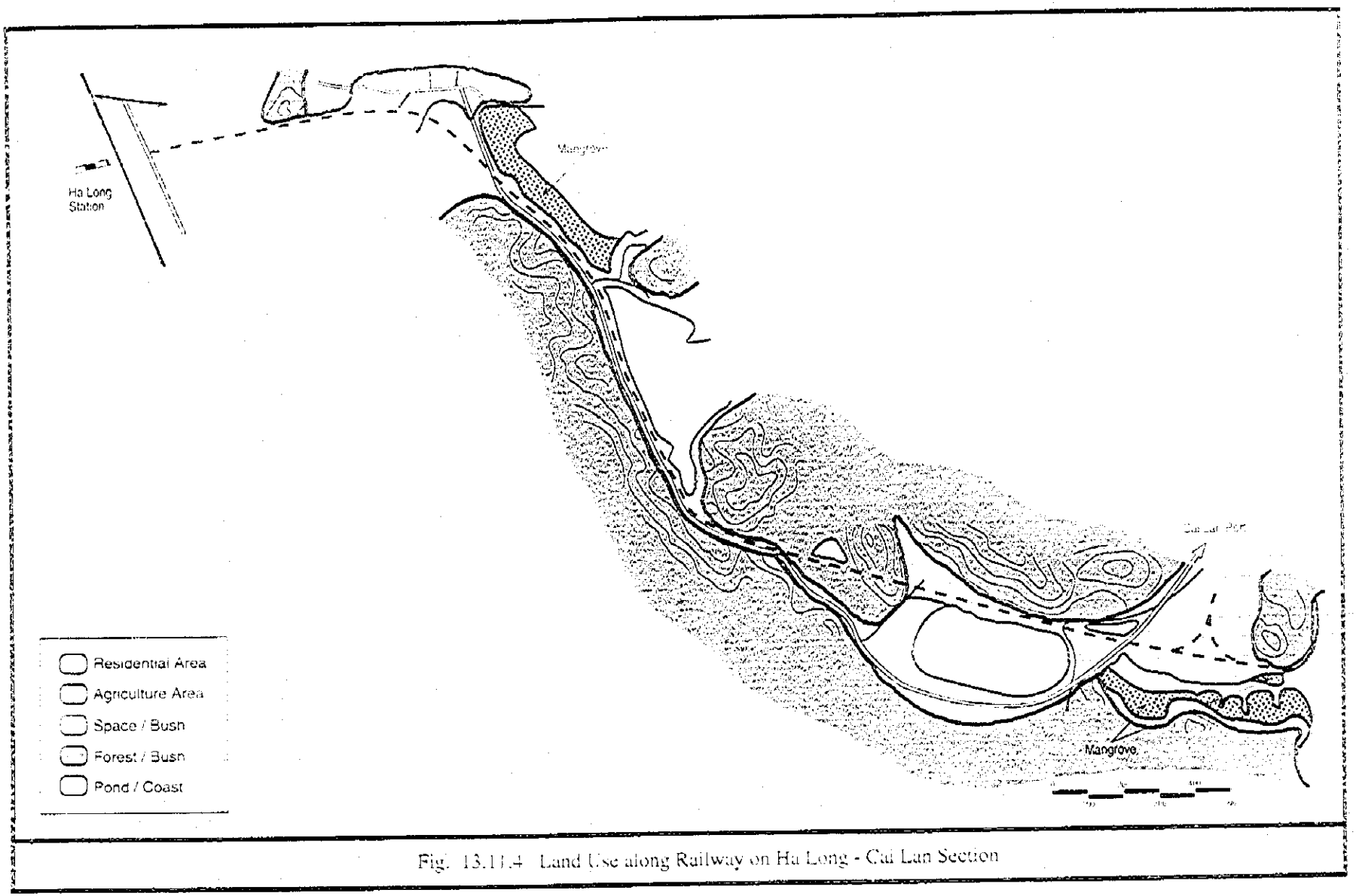

Fig. 13.11.4 Land Use along Railway on Ha Long - Cai Lan Section

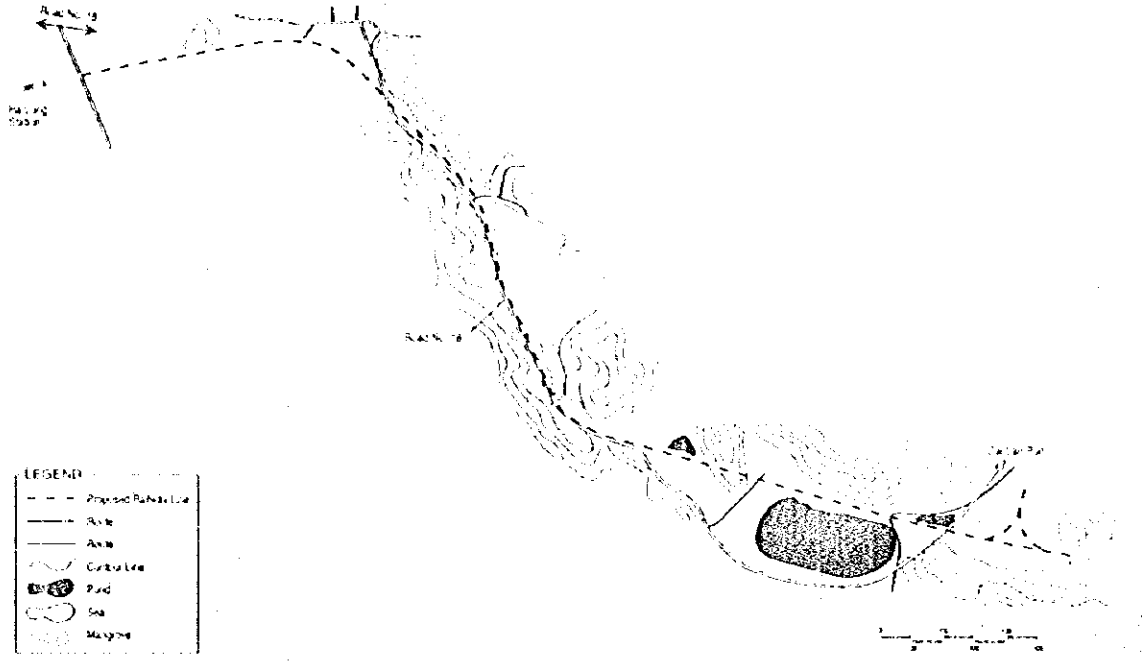

Fig. 13.11.5 Transportation Network along Ha Long - Cai Lan Section

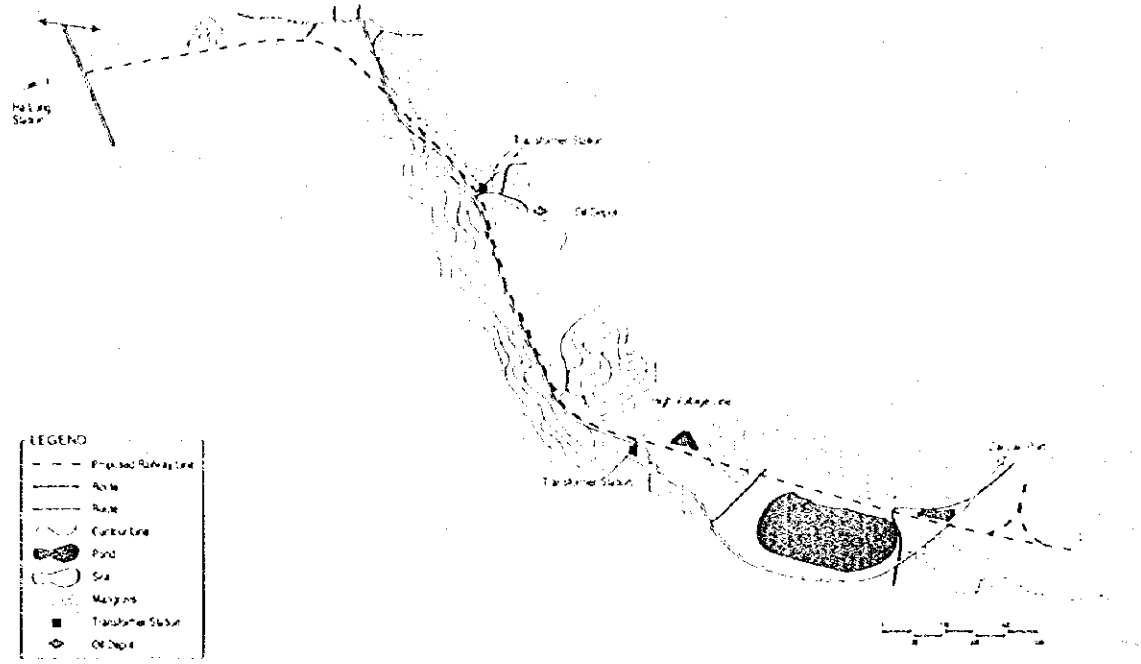

Fig. 13.11.6 Location of Public Facilities along Ha Long - Cai Lan Section

13.12 Selection of Best Timing of Meter Gauge Conversion

(1) General

There are 3 kinds of gauge in the northern part of VNR as shown in Fig. 13.12.1.
- 1,000mm gauge
- 1,435mm gauge
- Mixed gauge for 1,000 and 1,435mm gauges

Due to much inconvenience in train operation and track maintenance, Viet Nam decided to unify with the meter gauge.

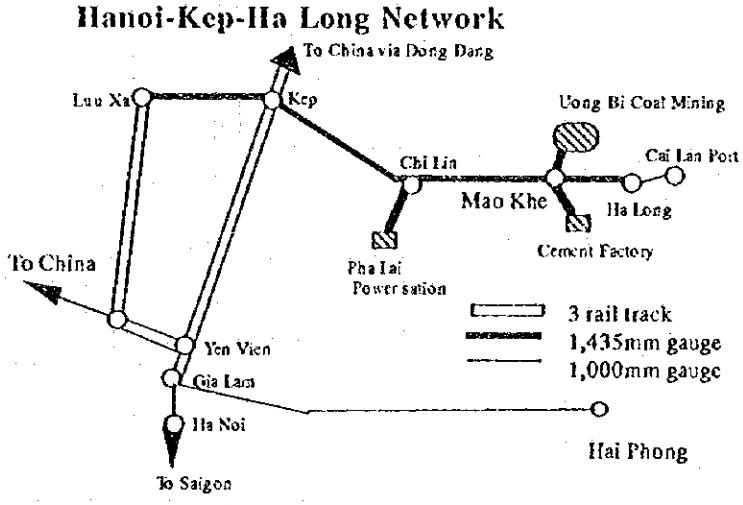

Fig. 13.12.1 Railway network in northern part of Viet Nam

(2) Work methods for gauge conversion

There are conceived 3 methods for converting the track gauge:

Method 1:

Train operations are stopped for several months and the gauge is converted on dead track(no train running)

Method 2:

Train operations are not stopped, and a mixed gauge track(with 3 rails) is constructed. Meter gauge and standard gauge rolling stock are operated for some time.

Method 3

Gauge conversion is executed section by section. Passengers and cargo are transshipped during the conversion work. This method is actually impossible because the main transport on Cai Lan Line is heavy and mass bulk cargo and containers. It is very difficult work to transship coal, cement and containers at the border of a section or to covert such cargo for transport by ship or truck. Consequently, method 3 is not considered.

(a) Method 1: Dead track method

Dead track method conversion(with no trains running) is to be preferred, if the gauge conversion work to meter gauge must be finished by 2000, because the conversion work by method 1 is easy work and the cost is the cheapest excluding rolling stock cost. There is no worry for train operation safety.

Passenger and cargo transport are stopped during the final stage of the conversion for several months (6-12 months).

If the conversion work to meter gauge is executed after 2000, method 2 should be selected. Although coal, cement and Cai Lan Port cargo will stay low before 2000, such transport demand will increase after 2000.

Each customer, especially shippers at Cai Lan Port will establish their own transport systems around 2000. If trains stop running, shippers will abandon railway and never come back, establishing their own non-rail transport systems while trains are stopped on the railway. Other means of transport will be formulated.

Critical elements of method 1 are the production of concrete sleeper, ballast and fastening and delivery of track material to the site. These require approximately 3 years for preparation, and the material will be stocked for 1 or 2 years.

The tentative implementation schedule is as follows;

- 1996 Project and budget approval
- 1997 Construction of sleeper, ballast and fastening factories
- 1998 Commencement of track material production and stock
- 1999 Delivery of track material to the site
- 2000 Stop train operation and replace of track with meter gauge sleepers

The following work methods will be applied:

-Concrete sleeper is produced by post-tension pre-stressed method, because the post-tension production system is favorable for short term mass production with low investment and does not require heating system.
-Heavy track maintenance machines such as MTT, ballast scrapers, ballast hopper wagons, shovel cars, bulldozers are necessary.
-Existing rail is re-used.
-Number of sleepers is 1776 pieces/km, because an interval of sleeper is better to minimize in order to support heavy cargo load with thin 43kg/m rail.
-Existing ballast is used as sub-ballast.
-Sleepers and ballast are stocked near work sites.

All standard-gauge rolling stock will be replaced with meter-gauge rolling stock for reopening.

(b) Method 2: 3-rail track construction

If the conversion work to meter gauge extends beyond 2000, the railway cargo transport system to Cai Lan Port will be combined in the shipper's delivery system. Therefore, it is impossible to stop train operation. Method 2 does not stop train operation.

Existing PC sleepers of standard gauge are manually replaced with wooden sleepers of standard gauge specification one by one. And one more rail is installed for the meter gauge.

-Sleepers are replaced with economical speed. This will take over 3 years.
-Number of sleeper is 1776 pieces/km, because an interval of sleeper is better to minimize in order to support 43kg/m rail for heavy cargo load.
-Some ballast will be added when sleepers are replaced.
-Care should be taken for safe of train operation, especially, to prevent derailment.

Existing standard-gauge rolling stock are used until their life-time expires. When new rolling stock is needed to replace aged cars or to increase transport capacity, meter-gauge rolling stock is supplied.

(3) Alternatives for timing of gauge conversion

Three(3) alternatives have been established for timing of gauge conversion as shown in Fig. 13.2.2.

In establishing three alternatives, the following preconditions have been assumed:

(a) Extension of track between Ha Long-Cai Lan will be implemented by 2000 in dual gauge or in meter gauge. Cost for the extenstion is as follows:

Cost for Extension by Meter Gauge (Unit: US$ million)

	Local Currency	Foreign Currency	Total
Rail & Turnout Construction	0.18	0.46	0.64
Laying of Sleeper	1.82	0.45	2.27
Earth Work	0.10		0.10
Installation of Signal	0.04	0.12	0.16
Track Layout	0.16	0.04	0.20
Total	2.30	1.07	3.37

Cost for Extension by Mixed Gauge (Unit: US$ million)

	Local Currency	Foreign Currency	Total
Rail & Turnout Construction	0.25	0.44	0.69
Laying of Sleeper	2.06		2.06
Earth Work	0.13		0.13
Installation of Signal	0.04	0.12	0.16
Track Layout	0.16	0.04	0.20
Total	2.64	0.60	3.24

(b) Short-cut line, if it is to be constructed, will be in meter gauge.

Three alternatives will be described as follows:

Alternative 1:

Ha Long-Cai Lan extension by 2000:	Dual gauge
Kep-Ha Long existing line by 2000:	No gauge conversion(namely standard gauge)
Kep-Ha Long by 2010:	Gauge will be converted firstly to dual gauge, and finally to meter gauge without stopping train.

Alternative 2:

Ha Long-Cai Lan extension by 2000:	Meter gauge
Kep-Ha Long existing line by 2000:	Dual gauge
Kep-Ha Long by 2010:	Convert to meter gauge

Alternative 3:

Ha Long-Cai Lan extension by 2000:	Meter gauge
Kep-Ha Long existing line by 2000:	Convert to meter gauge by stopping train

(4) Cost for each alternative

Cost for each alternative is shown in the following table:

Alternative / Item		Alternative 1			Alternative 2		
		Local	Foreign	Total	Local	Foreign	Total
Gauge Conversion	by 2000				17.76	2.77	20.53
	by 2010	17.76	2.77	20.53			
Purchase of Rolling Stock	by 2000						
	by 2010	22.30	47.90	70.20	22.30	47.90	70.20
Total	by 2000				17.76	2.77	20.53
	by 2010	38.06	50.67	88.73	22.30	47.90	70.20

Alternative / Item		Alternative 3		
		Local	Foreign	Total
Gauge Conversion	by 2000	7.73	10.37	18.10
	by 2010			
Purchase of Rolling Stock	by 2000	6.90	4.90	11.80
	by 2010	22.70	20.00	42.70
Total	by 2000	14.63	15.27	29.90
	by 2010	22.70	20.00	42.70

With respect to gauge conversion work, method 2 described in (2) above will be used for Alternative 1 or 2, and method 1 will be used for Alternative 3.

With respect to rolling stock, new standard gauge rolling stock will be purchased after the lifetime of existing standard gauge rolling stock expires in case of Alternative 1. For Alternative 2 or 3, new meter gauge rolling stock will be purchased after gauge conversion.

(5) Selection of optomal alternative

Each alternative has been evaluated from the various points of view as shown in Thable 13.12.1:

Table 13.12.1 Selection of optimal alternative

	Alternative 1	Alternative 2	Alternative 3
E.I.R.R.	9.3	9.4	9.7
Net Present Value(US$ mil.)	28	30	31
Convenience of direct operation to Hanoi	X	O	O
Disturbance to train operation during the conversion work	Δ	Δ	X
Easiness for operation and maintenance	X	X	O
Comprehensive evaluation	X	Δ	O

O: good, Δ: Less good, X: bad

As the result of overall evaluation, Alternative 3 is recommended as the optimum alternative for timing of converting of gauge to meter gauge.

With respect to Table 13.12.1, attention should be drawn to the fact that sensibility analysis of E.I.R.R. of each alternative shows that, if the benefit decrease by 10-20%, each alternative becomes economically unfeasible. It means that if the economic growth rate decreases by some amount compared with high growth rate assumed in the Report, gauge conversion become only feasible after 2010. In this regard, it is suggested that gauge conversion program be carefully planned with due consideration on future economic growth rate of the country.

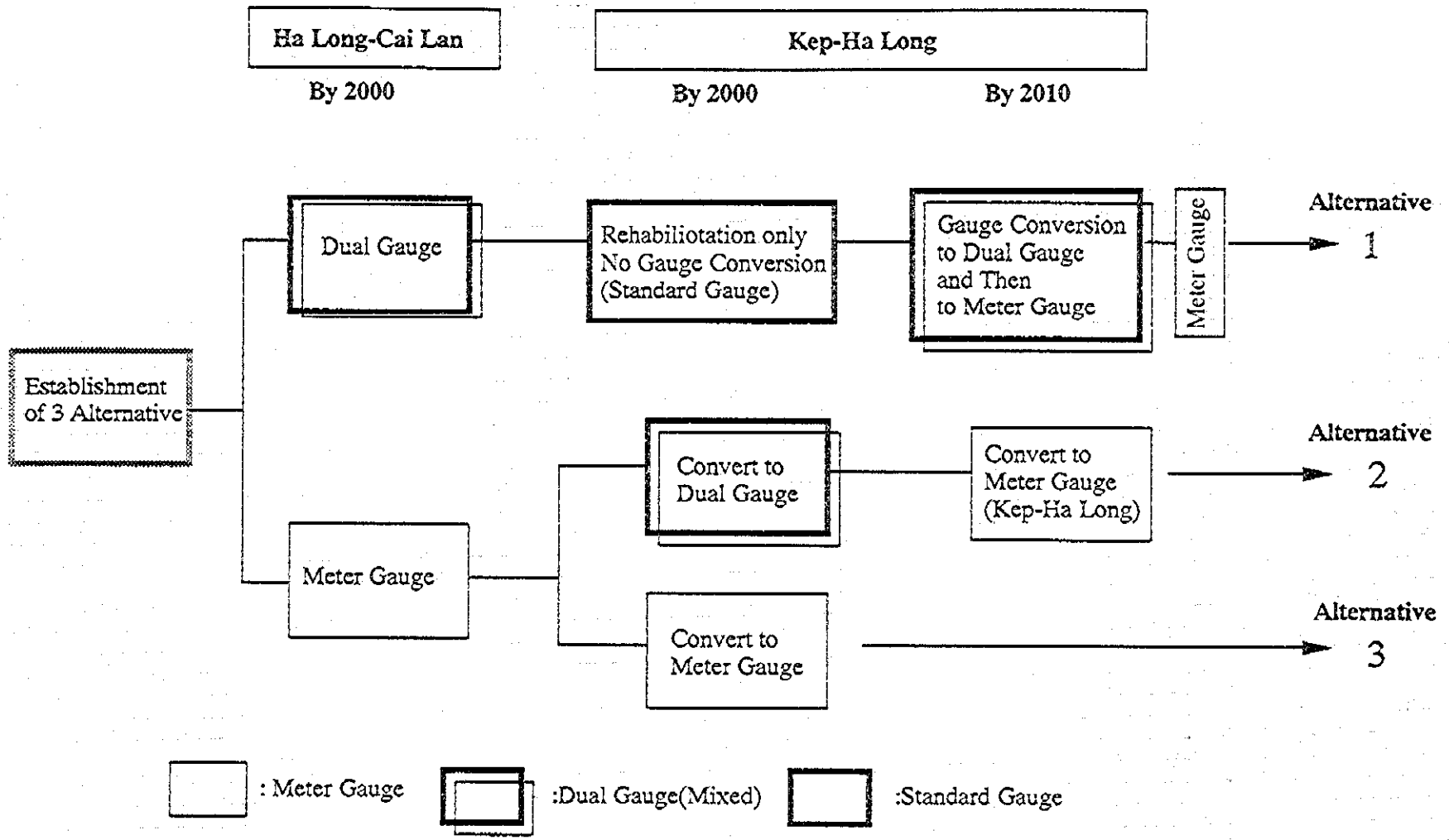

Fig. 13.12.2 Alternatives for Timing of Gauge Conversion

13.13 Shortcut Route Examination

13.13.1 General

The current railway route from Yen Vien to Ha Long takes round about via Kep. This current route takes 35km longer than the direct distance from Yen Vien to Ha Long. It was considered some shortcut route alternatives. One short cut route would be selected prior to carrying out a comprehensive feasibility study. Short cut route alternatives are considerable as follows,

Alternative 1 : from Yen Vien to Co Thanh(Pha Lai)

Alternative 2 : from Lim to Co Thanh

Alternative 3 : from Tien Trung(on Hai Phong line) to Sao Do (on Pha Lai - Chi Linh line)

Alternative 4 : from Tien Trung to Dong Trieu (on Kep - Ha Long line)

13.13.2 Comparison among Alternatives

Table 13.13.1 Comparison in Length

	Construction length	Operation length from Yen Vien to Ha Long
Alternative 1	42km	128km
Alternative 2	33km	131km
Alternative 3	26km	166km
Alternative 4	24km	150km

Alternative 1 and Alternative 2 separate from Hanoi- Lang Son line at Yen Vien station, Lim station, respectively and pass through the paddy field and reach to the other side of Pha Lai across Thai Binh river. It is necessary to construct a big bridge to cross Thai Binh river and to connect to Chi Linh - Pha Lai line at Co Thanh station in Pha Lai.

Alternative 3 separates from Hai Phong line at the other side of Tien Trung station across Rang river and passes paddy field and reaches to Sao Do on Chi Linh - Pha Lai line. It needs to construct a big bridge to cross Kinh Thay river. Alternative 4 separates from Hai Phong line at Tien Trung station and passes paddy field to Dong Trieu on Kep - Ha Long line. It is necessary to construct 2 big bridges to cross Kinh Mon river and Kinh Thay river.

The construction length are longer in Alt. 1, Alt.2, and also construction cost are expensive, but operation length are shorter. In Alt.3, Alt.4 the construction cost are cheaper, but the operation

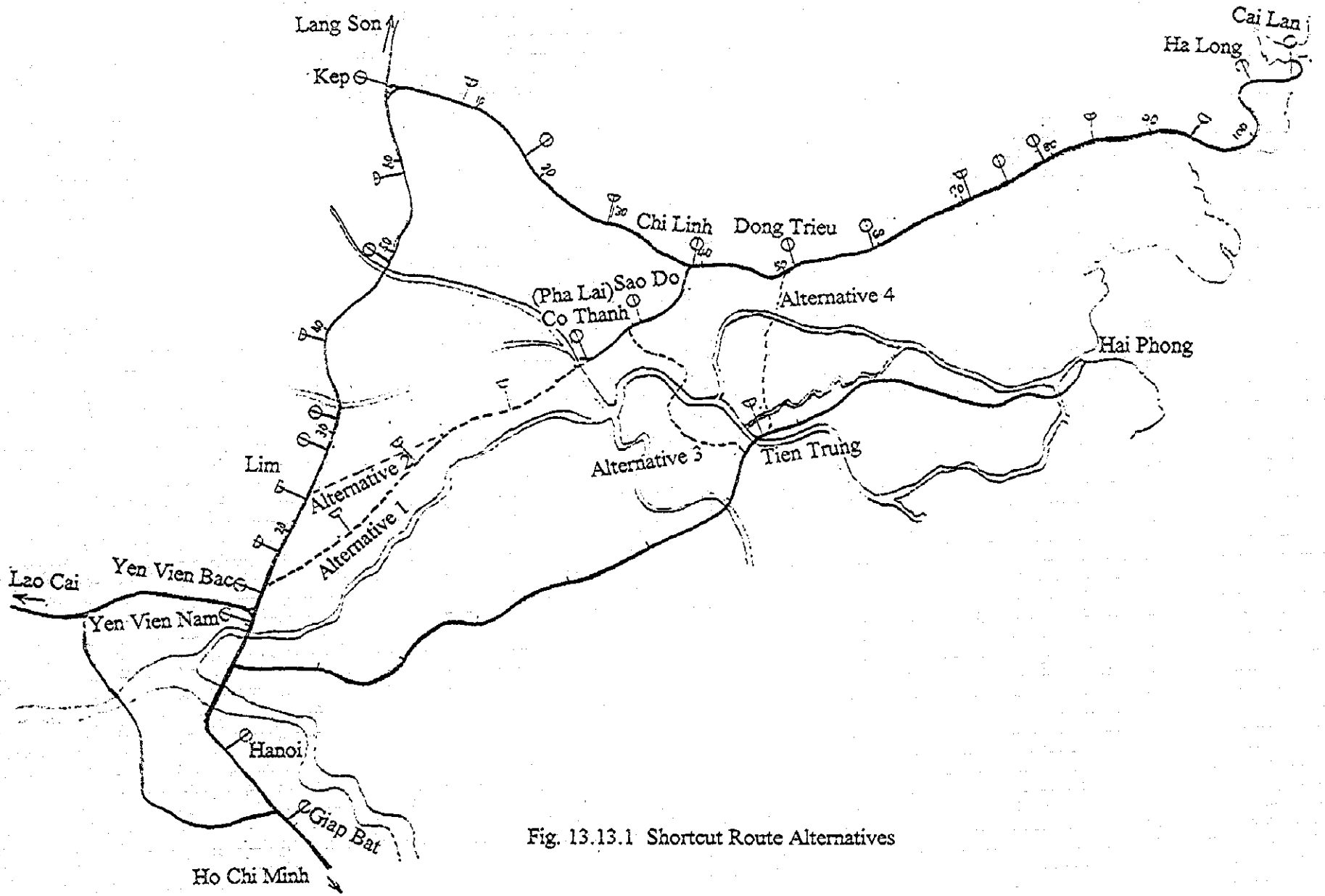

Fig. 13.13.1 Shortcut Route Alternatives

cost are expensive according to the operation length. Furthermore, transport capacity of Hai Phong line is tight with the transport demand of the line. Additional investment to improve traffic capacity shall be necessary in near future.

At the point of scramble for the line capacity, Alt.2 competes with Lang son line and Alt.3, Alt.4 compete with Hai Phong line.
At the point of travelling time, Alt.1 can make best time to reach to Ha Long because the line length is shortest.
At the point of the development along the railway, Alt.1, Alt.2 have much possibility, because there is wide plain area along the line. The corridor of Alt.4 is divided by 2 rivers and the development seems difficult.

To connect Lao Cai line to Cai Lan line, the shortcut route should be pass the shortest way. With comprehensive evaluation about alternatives, at the time to construct the line to connect Cai Lan to Lao Cai, Alt.1 is the best route.

Table 13.13.2 Comparison of alternatives

	Construction cost	Operation cost	Scramble with other line	Travelling time	Development possibility	Compre-hensive evaluation
Alt.1	×	○	○	○	○	○
Alt.2	△	○	△	△	○	△
Alt.3	○	×	×	×	△	×
Alt.4	○	△	×	×	×	×

13.13.3 The Shortcut Route Specification

The best shortcut route to connect Lao Cai line to Cai Lan line is the line that separates from Lang Son line at Yen Vien station and connects at Co Tanh with Pha Lai - Chi Linh- Ha Long line.
The Study of this line had executed by TEDI (MOTC, TEDI No.854DS 1993).
In our Study, we review and adjust the former Study.

The gauge shall be adjusted to 1 meter, so the shortcut line shall be constructed with 1 meter gauge and assumed to be able to pass through to Cai Lan in 1 meter gauge.
The specification of Yen Vien - Pha Lai shortcut route is as follows;

1) Gauge : 1,000mm
2) Minimum curve radius : 800m
: 600m(special case)
3) Maximum gradient : 6‰
4) Rail : 50kg/m 25m length
5) Sleeper : monoblock PC sleeper 70cm space
6) Ballast depth : 25cm
7) Turnout on main line : 1:10 with 50kg/m rail
8) Railway formation width : 5.0m
9) Design live load : 14tons/axle
10) Design frequency : 1%
11) Locomotive : D18E- 1800hp
12) Signal : Color light signal, Electric lock, Tokenless block system
13) Communication : Under ground cable
14) New station : 3
15) Rehabilitation of station : 2

13.13.4 Construction Volume and Cost Estimation

The construction volume and cost are estimated as follows;

Table 13.13.3 Construction Volume and Cost

Items	Unit	Quantity	Cost(mil.US$)
Track	km	58.61	14.82
Banking earth	1000m3	3,416	33.24
Land occupation	ha	163	0.49
Big bridge	m	560	11.20
Medium, small bri.	m	519	5.19
Culvert	m	1,001	0.50
Communication	km	60	0.82
Signalling	station	5	0.98
Station facilities	station	4	0.83
Contingency		15%	10.21
Total	km	42.5	78.28

Chapter 14 Project Profiles for Cost-Benefit Analysis in the Feasibility Studies

14.1 General

The Viet Nam government has strong intention for converting the gauge from standard into meter gauges and constructing a short cut route line to Cai Lan. Therefore, almost projects are formulated on the line of Vietnamese policy.

However, the results of economical evaluation of Cai Lan Line improvement shows that both the gauge conversion and short-cut route construction projects are far from feasibility and realization.
It is necessary to confirm a program to convert the gauge prior to the commencement of project procedures related to the Cai Lan Line.

When the gauge conversion project is not included, economical and financial evaluation of the improvement projects is very high, therefore, Ha Long Bay tourist transport, Cai Lan cargo transport and rehabilitation projects is better to be implemented as soon as possible. Above-mentioned 3 projects is better to be implemented together because 3 projects give full play to each other.

Projects described in this chapter are formulated base on the precondition that gauge conversion will be executed into meter gauge by 2000.

If gauge conversion is postponed beyond 2000 or 2010, projects proposed needs to be revised. Since, the standard gauge has more competitive potential, more attractive improvement projects will be formulated.

Improvement plan of the line between Hanoi-Kep is not included in these studies and projects because they should be implemented in Dong Dang Line improvement plan.

14.2 Ha Long-Cai Lan Section Track Installation

(1) Project Title: Ha Long-Cai Lan Section Rail Installation

(2) Priority: A

(3) Location: Ha Long-Cai Lan(4.3km)

(4) Cost

Cost for Extension by Meter Gauge (Unit: US$ million)

	Local Currency	Foreign Currency	Total
Road bed repair	1.09	-	1.09
Track installation	1.11	0.95	2.06
Staion building	0.06	-	0.06
Installation of Signal	0.04	0.12	0.16
Total	2.30	1.07	3.37

(5) Objectives:

The Cai Lan Port Construction Project is under way and international shipping will be inaugurated around 2000.
Therefore, the railway needs to be extended its line from Ha Long to Cai Lan Port with meter gauge.

(6) Implementation Schedule:

Implemet Year	1997	1998	1999
Approval of Project			
Detailed Design			
Manufacture of materials			
Construction & Installation			

(7) Components:
The components of the project are as follows:

- To construct a track and yard between Ha Long Station and Cai Lan Port.

(8) Investment Efficiency

The demand for rail containers and general cargo to and from Cai Lan Port is so small that cargo transport from the port will not be profitable until 2010. However, if the railway does not invest in port cargo transport, VNR will miss a chance to participate in the profitable market after 2010.

(9) Relations with Other Projects:

- Selection of best timing of Gauge Conversion
- Short-Cut Route Construction
- Inland Container Depot Construction
- Ha Long Bay Tourist Transport

(10) Others:

14.3 Ha Long Bay Tourist Transport Improvement

(1) Project Title: Ha Long Bay Tourist Transport Improvement

(2) Priority: B

(3) Location: Line between Hanoi and Ha Long

(4) Cost:

Cost (in case of meter gauge) (Unit: US$ million)

	Local Currency	Foreign Currency	Total
Rolling Stock	1.90	4.90	6.80
Station Improvement	0.11		0.11
Seat Reservation System		0.03	0.03
Total	2.01	4.93	6.94

(5) Objectives:

Ha Long Bay is one of the most attractive resorts in Viet Nam. About 400,000 tourist visited Ha Long Bay in 1994 and 1 million tourists are forecast for 2000. However, the approach roads and railways to Ha Long Bay are in very bad condition now. Good transport and services to the resort are essential to further develop of the tourist industry. The railway needs to contribute to the development of the tourist resort.

The following improvements for tourists using the rail are planned:

-Operation of 3 round trip trains every day using comfortable passenger cars.
-Improvement in amenities at Ha Long Station
-Installation of a seat reservation system at Ha Long Station.
-In case of meter gauge, new rolling stock is necessary to be procured.

(6) Implementation Schedule:

Implemetation Year	1997	1998	1999
Approval of Project	—		
Detailed Design	—		
Fixed Facilities Improvement		—	—
Procurement of Cars		—	—

(7) Components:

The components of the project are as follows:

- Installation of a seat reservation system at Ha Long Station
- Improvement of station front plaza
- Procurement of comfortable passenger cars

(8) Investment Efficiency:

VNR will develop a profitable tourist market.

(9) Relations with Other Projects:

- Ha Long-Cai Lan Section Rail Installation
- Selection of best timing of Gauge Conversion
- Short-Cut Route Construction
- Inland Container Depot Construction
- Cement Transport Improvement

(10) Others:

14.4 Rehabilitation of Kep-Ha Long Line

(1) Project Profile: Rehabilitation of Kep Ha Long Line

(2) Priority: B

(3) Location: Kep-Ha Long

(4) Cost:

(Unit: US$ million)

	Local Currency	Foreign Currency	Total
Rail Welding	0.46	0.22	0.68
Crushed Stone Machines	0.03	0.80	0.83
Ballast Hopper Wagons	0.09	0.01	0.10
Track Maintenance Machines		0.46	0.46
Road Bed Improvement	0.11		0.11
Rainfall Gauge		0.03	0.03
Signal Improvement	0.56	1.46	2.02
Installation of Siding	0.04	0.01	0.05
Total	1.29	2.99	4.28

(5) Objectives:

Improving and modernization of the fixed facilities and maintenance system are necessary for high-speed and stable train operation. The following improvements will be implemented in the line with the rationalization and modernization of management and facilities:

- Modernization of track maintenance

Track maintenance machines and equipment will be purchased in order to improve work efficiency and to reduce manpower.

Tie-tampers, trucks and motor cars, track measure device, rail cutting machines, track jack, etc.

-Rail welding

Two(2) pieces of rail are welded together. A rail welding machine by gas heating and pressure method and other equipment will be installed.

-Ballast manufacturing machines will be installed, but the ballast adding plan will be included in the gauge conversion project.

-The necessary rain-gauge and wind velocity gauges will be installed in order to prevent disaster-caused train accidents from occurring.

-Replacement of signals with color light signals and the installation of electric power sources.

-Replacement of existing token blocking system with tokenless.

(6) Implementation Schedule

Implemetation Year	1997	1998	1999	2000
Approval of Project				
Detailed Design				
Manufacturing machines				
Fixed Facilities Improvement				
Rail Welding				

(7) Component:

Investment Item	Unit	Quantity
Rail Welding	spot	8,400
Track Maintenance Machines	set	7
Ballast Manufacturing machines	set	1
Tokenless Blocking System	station	12
Color light Signals	station	12
Electric Power Sources	station	12
Rainfall Gauges	set	2
Station Sidings at Ha Long Station	set	1
Station Plaza at Ha Long Station	set	1

Track maintenance machines will be installed at Yen Vien Nam, Lim, Kep, Bao Son, Chi Linh, Yen Duong and Ha Long depots.

(8) Investment Efficiency:

The maintenance of the line will be modernized and rationalized: as a result, VNR will reduce manpower and operational cost.

Maximum speed will be increased to 80km/h.
However, the maximum speed can be raised more in the next stage accompanying the following measures being essential for safety:

- Safety measures at level crossings and for resident
- Upgrading of track maintenance technology
- Upgrading of rolling stock maintenance.

(9) Relations with Other Projects:

- Selection of best timing of Gauge Conversion
- Inland Container Depot Construction
- Ha Long Bay Tourist Transport

14.5 Gauge Conversion

(1) Project Title Gauge conversion on Cai Lan Line

(2) Priority A

(3) Location Track between Kep and Ha Long

(4) Cost

Cost for Gauge Conversion by Meter Gauge (unit: US$ million)

Item	Local Currency	Foreign Currency	Total
Track	8.94	9.16	18.10
Rolling Stock	3.00	2.00	5.00
Total	11.94	11.16	23.10

(5) Objectives

1) General

There are 3 kinds of gauge in the northern VNR;

- 1,000mm gauge
- 1,435mm gauge
- Mixed for 1,000mm and 1,435mm gauges

Due to much inconvenience in train operation and track maintenance, Viet Nam decided to unify with the meter gauge.

2) Gauge coversion method

Passenger and cargo transport are stopped during the final stage of the conversion for several months (6-12 months).

Critical elements of this method are the production of concrete sleeper, ballast and fastening and delivery of track material to the site. These require approximately 3 years as of preparation, and the material will be stocked for 1 or 2 years.

The tentative implementation schedule is as follows;

- 1996 Project and budget approval
- 1997 Installation of sleeper, ballast and fastening factories
- 1998 Commencement of track material production and stock
- 1999 Delivery of track material to the site
- 2000 Stop train operation and replace of track with meter gauge PC sleepers, existing rails will be re-used.

All standard-gauge rolling stock will be replaced with meter-gauge rolling stock for reopening.

(6) Implementation Schedule

Alternative I

Implement Year	1996	1997	1998	1999	2000
Approval of Project	▬				
Construction of Factories		▬			
Production Track Materials			▬	▬	▬
Delivery of Materials				▬	▬
Conversion of Gauge					▬
Procure Rolling Stock					▬

(7) Component

- Construction of a concrete sleeper factory
- Construction of a crushed stone factory
- Procurement of ballast hopper wagons, shovel car and bulldozer
- Renewal of track with meter gauge
- Procurement of new meter-gauge rolling stock

(8) Investment Efficiency

Gauge conversion is the policy of the government.

(9) Relation with Other Projects

Meter-gauge track will be extended from Ha Long Station to Cai Lan Port at he same time as another project.

(10) Others

Chapter 15 Profile for Other Recommendation Projects

15.1 General

Projects in this chapter are not included in the feasibility study on the improvement of Cai Lan Line executed by JICA team, because intention to implement 3 projects of this chapter are unclear to implement and further study is necessary.

Feasibility of "short-cut route construction" is far from realization. It is recommended that efficient and cheap short-cut routes to Cai Lan Line is better to be studied again after 2000.

15.2 Shortcut Route Construction

(1) Project Title : Shortcut route construction

(2) Priority : To be constructed after 2010

(3) Location : Yen Vien - Pha Lai

(4) Cost : Foreign currency 30.46, Local currency 47.82
Total 78.28 mil. US $

(5) Objectives

1) Existing condition

The current railway route from Yen Vien to Ha Long takes round about via Kep. This current route takes 35km longer than the direct distance from Yen Vien to Ha Long.

2) Purpose

To get effective transportation, the shortcut line from Yen Vien to Pha Lai is necessary after 2010.

(6) Implementation schedule

Item	1st year	2nd year	3rd year	4th year	5th year
Design	----------	----------			
Land acquisition	----------				
Banking	----	----------	----------	---	
Big bridge			----------	----------	------
Other bridge				----------	------
Track				-------	----------
Communication					----------
Signal					---------
Building					----------

(7)Components :

1) Frame work

Construction of 42.5 km new line with 1 meter gauge single track. Including big bridge to cross Thai Vien river.

2) Benefit

To shorten operation time and save operation/ maintenance cost between Yen Vien to Cai Lan.

(8) Investment Efficiency : Saving time and operation cost

(9) Relation with Other Project : Converting track gauge to 1m between Kep - Ha Long

15. 3 Inland Container Depot

(1) Project Title: Inland Container Depot

(2) Priority: B

(3) Location: Yen Vien(Hanoi)

(4) Cost:

Cost for Port Cargo Transport and Temporary ICD (Unit: US$ million)

	Local Currency	Foreign Currency	Total
Temporary ICD & Others	0.40	0.10	0.50
Loading Machines		1.10	1.10
Digital Micro Radio System	0.23	1.37	1.60
Consulting Service		0.60	0.60
Freight Information Device	0.03	0.62	0.65
Container Wagon	0.90	0.90	1.80
Total	1.56	4.69	6.25

(5) Objectives:

Part 1 Temporary ICD and Cai Lan Port cargo transport

The Cai Lan Port Construction Project is underway and international shipping will be inaugurated around 2000.

The demand for rail transport from general cargo is assumed to be as follows:
(a) Import: 17,000 tons/year in 2000 and 56,000 tons/year in 2010.
(b) Export: 27,000 tons/year in 2000 and 47,000 tons/year in 2010

Assumption of container transport by rail:
Case 1 and Case 2 are formulated as alternatives. In either case, it is necessary that VNR make efforts to develop the railway market and negotiate hard to obtain contracts with shippers. Shippers have the casting vote for deciding whether or not goods are to be transported by road or by rail.

Case 1 -VNR develops the shipping market aggressively
-VNR establishes a modern cargo transport system

-VNR succeeds in obtain contracts with shipping companies to transport containers by rail.

Case 2 In addition to the conditions above the following is carried out
-The government promotes container transport by rail in order to use the railway system efficiently and to reduce road traffic (Traffic Demand Management policy).
-Railway facilities situated at in favorable location in the port area.
-The government recommends for shippers to use the railway.

The railway share of container transport is assumed to be 10% in Case 1 and 30% in Case 2.

The demand forecast for rail container transport is as follows;

(Unit:TEU/year)

		2000		2010	
		Case 1	Case 2	Case 1	Case 2
Import	Loaded TEU	2,100	6,300	23,400	70,200
Export	Loaded TEU	750	2,300	8,900	26,600
	Empty TEU	1,350	4,000	14,500	43,600

TEU: Twenty(20) feet Equivalent Unit)

The demand by general cargo for rail transport is not large and it would be better to transport it with the conventional rail transport system.

The following system and facilities should be installed to achieve them:
-A market development group to promote marketing for shippers.
-A temporary ICD(Inland Container Depot) used by 2010 at Yen Vien Station.
-Container loading wagons
-Container handling machines;
1 top lifter (35ton), 10 yard chassis, 1 yard tractor, 2 forklifts (6 ton, 2 ton), etc.
-A freight information system connected with shippers
-Railway track between Ha Long Station and Cai Lan Port.

The handling volume of containers until 2010 is so small for an ICD and handling facilities that VNR needs to expand its container transport market to Hai Phong Port and China(Nanning and Fang Cheng Port).

Since a container transport lot by rail is a whole container of a ship, therefore, it is necessary to transport 100-150 TEUs in one or two days, when a container ship arrives at Cai Lan Port.

Part 2 A study on (full scale) ICD

Study on ICD

The following study subjects will be studied:

- Selection of appropriate scale for land acquisition and tentative layout of ICD
- Outline design and cost of ICD
- Recommendation for ICD management organizations
- Economic, financial and environmental evaluation

(6) Implementation Schedule:

Implementation schedules for part 1 are as follows:

Implemet Year	1996	1997	1998	1999
Approval of Project		—		
Establish Marketing Group	—			
Negotiation with Shippers				
Detailed Design		—		
Manufacture of Machines			—	
Construction & Installation			—	—
Procurement of Wagons				—

Tentative implementation schedules for part 2 are as follows:

Items	1996-2000	2001-2005	2006-2010
Feasibility Stusy	—		
Developing Market	—	—	—
Land Acuisition		—	
Construction of ICD			—

(7) Components:

The components of the project are as follows:

- To establish a freight marketing group
- To construct a temporary ICD(inland container depot) at Yen Vien Station

- To procure container handling machines: 1 top lifter (35ton), 10 yard chassis, 1 yard tractor, 2 forklift (6 ton, 2 ton), etc.
- To install digital micro radio system between ICD and Cai Lan Port for the freight information system.
- To construct a track and yard between Ha Long Station and Cai Lan Port.
- To procure 30 container wagons and 1 locomotive. To innovate wagons for general cargo.
- To implement a feasibility study on full scale ICD

(8) Investment Efficiency

The demand for rail containers and general cargo to and from Cai Lan Port is so small that cargo transport from the port will not be profitable until 2010. However, if the railway does not invest in port cargo transport, VNR will miss a chance to participate in the profitable market after 2010.
Management and operations improvement on the Cai Lan Line will be realized by integrating investment for port cargo, Ha Long Bay tourism, and cement and coal transport.

(9) Relations with Other Projects:
- Selection of best timing of Gauge Conversion
- Short-Cut Route Construction
- Inland Container Depot Construction
- Ha Long Bay Tourist Transport
- Cement Transport Improvement

(10) Others:

15.4 Cement Transport Improvement

(1) Project Title: Cement Transport Improvement

(2) Priority: C

(3) Location: Line between the Yen Vien and Mao Khe and Yen Vien stations

(4) Cost:

(Unit: US$ million)

	Local Currency	Foreign Currency	Total
Modification of tank Car		2.50	2.50
Siding track installation	0.20	0.10	0.30
Freight yard construction	0.20	0.10	0.30
Electric facilities		0.10	0.10
Total	0.40	2.80	3.20

(5) Objectives:

The demand for cement transport has been increasing rapidly in Hanoi city. When the rail transport system is replaced with a cement tank wagon system, customers can realize savings through reducing in packing costs, loses from broken bags and lower loading and unloading costs. As a result, the railways will hold a dominant position in cement transport.

A cement terminal will be constructed at Yen Vien Station. It will include cement silos, unloading equipment by air and a ready mixed concrete plant. Stockyards for sand and gravel will also be built.

There are many idle cement tank cars in Viet Nam. These cars will be modified for new unloading system and they will be used in this project.

Exclusive direct operation trains will be operated between Yen Vien and Mao Khe stations.

(6) Implementation Schedule:

Implemetation Year	1996	1997	1998
Negotiation with Cement Makers			
Approval of Project			
Detailed Design			
Manufacturing of Machines			
Construction of Terminal			
Modification of Tank Car			

(7) Components:

The following facilities and equipment will be built/installed:

Investment by the railway

-Railway sidings and a freight yard at Yen Vien Station

Unused freight yard will be converted.

-Modification of 50 cement tank cars.

Investment by cement companies or another sectors

-Cement cilos: If another cement maker wants to join, several silos will be constructed.

-Unloading plant by air

-Aggregate stockyard

-Ready mixed concrete plant, if necessary.

(8) Investment Efficiency:

VNR will expand its market share in cement and aggregate transport, and this will result in road traffic of heavy cargo such as cement, sand and gravel being reduced.

(9) Relations with Other Projects:

- Ha Long-Cai Lan Section Rail Installation
- Selection of best timing of Gauge Conversion
- Short-Cut Route Construction
- Inland Container Depot Construction
- Ha Long Bay Tourist Transport

(10) Others:

A cement factory on Hai Phong line can join to this project at Yen Vien. It is recommended that one more cement terminal be built at Giap Bat or Van Dien Station for the cement from Lam Son.

Chapter 16 Economic and Financial Evaluation

16.1 Economic Evaluation

16.1.1 Method of Economic Evaluation

(1) Purpose of Economic Evaluation

This study aims at evaluating the rehabilitation project for the Hanoi - Lao Cai Line, and rehabilitation project on the Hanoi - Cai Lan Line with the gauge exchange project, and the feasibility of the short-cut line is also evaluated.

Economic evaluation is defined as an evaluation of project investment efficiency in terms of national economy. And this evaluation clarifies how efficiently the national resources are allocated by means of the project, and indicates how superior (or inferior) the project is in comparison with other competing projects.

Analytical frame of economic evaluation shows a sharp contrast from that of financial analysis since the latter is an analysis in terms of one investment entity such as a company or entrepreneur. In financial analysis, there is no relation with any project's impact on national economy.

Economic analysis is utilized by the policy makers in selecting the best policy among many competing alternatives. In formulating the national policy, numerous projects will be given a priority by the policy makers. Economic analysis aims at providing one of the best information in screening the projects.

Economic analysis adopts economic prices and economic benefit instead of nominal price and return. Economic cost is set equivalent to real productivity of the inputs and excludes non-productive monetary transfers such as tax, subsidy. Economic benefit is any preferable effect to the whole national economy and is measured as a improvement in productivity.

(2) Method

Evaluation itself is carried out by comparing economic benefit with economic cost. Economic benefit is calculated as a net benefit between "without project case" and "with project case." In this analysis, direct tangible effects are quantified, and indirect and non-tangible effects are not involved in the benefit calculation.

Economic internal rate of return (EIRR) is adopted in this analysis as a evaluation indicator. This is defined as a rate at which the present value of net benefit becomes zero, and its position suggests in comparison with opportunity cost of capital in Vietnam how efficient the project is.

[Combination of Rehabilitation Projects]

Figure 6.1.1 shows all the project combinations. Major factors are (a) the installation of track between Ha Long and Cai Lan, (b) the project of gauge conversion into meter one, and (c) the construction of short-cut route construction. Those are incorporated with the rehabilitation works on track, rail, signal and telecommunication and so on.

Feasibility of the short-cut line can be evaluated by comparing Cases 1 and 2, Cases 3 and 4, and Case Cases 5, 6 and 7. These clarify how much the impact of the short-cut line construction lessens EIRRs of the cases without the short-cut line.

Feasibility of the meter gauge installation can be evaluated by comparing with Cases 1,3 and 5. All these cases are free from the impact of short-cut line construction.

16.1.2 Economic Cost

(1) Total Economic Cost

Table 16.1.1 summarizes total economic cost of the project by alternative. Nominal financial cost is converted into economic cost by utilizing the shadow prices about working compensation and all the domestic materials. The former relates with the actual productivity of labor forces, while the latter relates with the tax structure in Vietnam. In this Study, we set the shadow prices by reducing turn-over tax from prices of all domestic material.

(2) Calculation of Economic Cost (= Shadow Pricing)

1) Working Compensation of Domestic Work Forces

Income tax is not incorporated in this analysis. This is because income tax is a subject of high income classes with more than 650,000 dongs per month as of September 1994. Table 16.1.2 shows the structure of income tax ratios by income class. Average level of working compensation (from one source) is estimated far less than 500,000 dong, and thus the majority of people is exempted from the income tax.

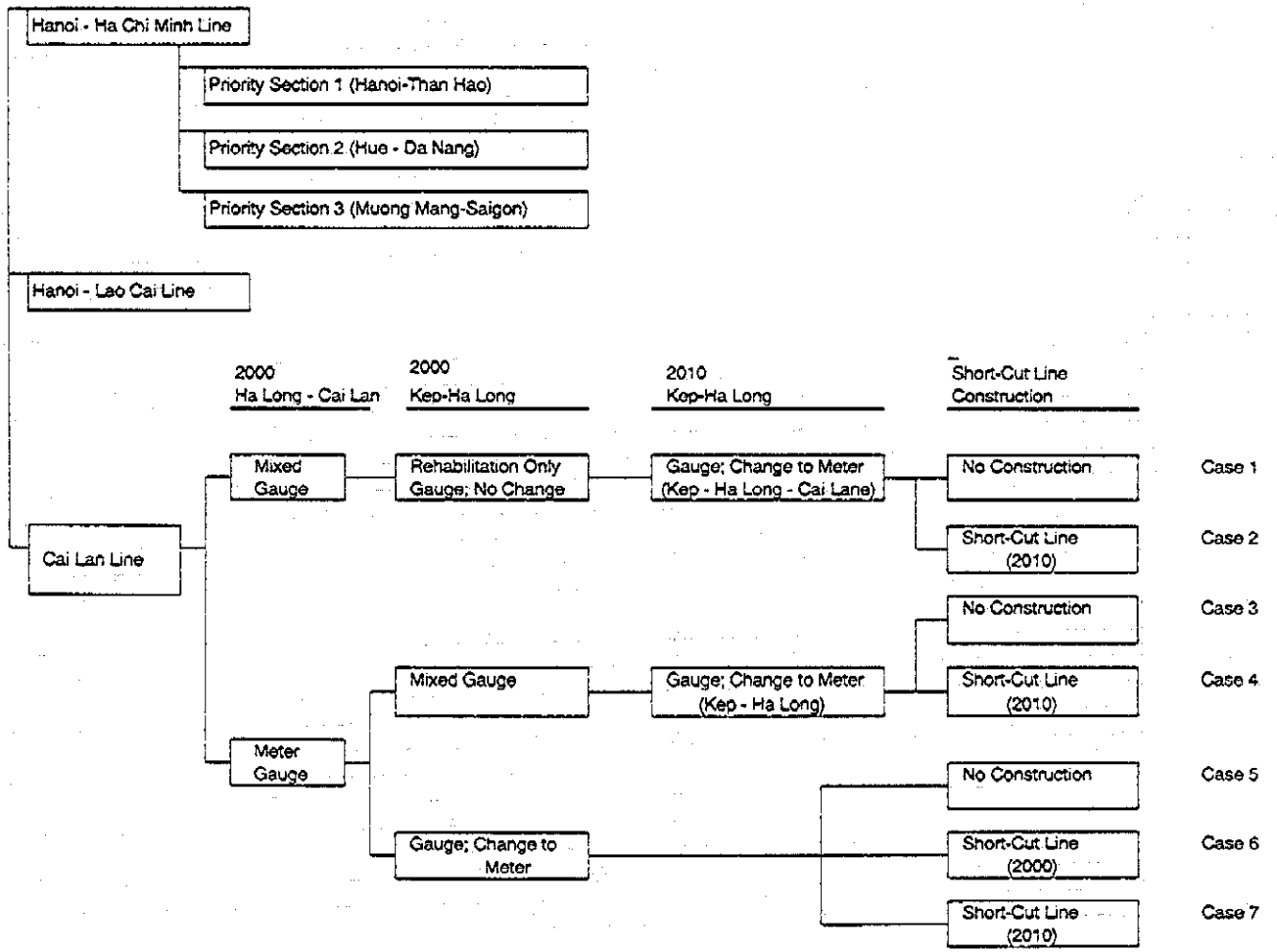

Figure 16.1.1 Cases of All the Rehabilitation Projects

Table 16.1.1 Total Economic Cost

		Local Portion	Freign Portion	Total up to 2000	Total up to 2010
Hanoi-Lao Cai Line		7.80	21.44	29.24	-
Hanoi-Cai Lan Line	(Case 1)	3.70	3.96	7.66	67.82
ditto	(Case 2)	3.70	3.96	7.66	126.45
ditto	(Case 3)	25.31	13.70	39.01	81.71
ditto	(Case 4)	25.31	13.70	39.01	147.99
ditto	(Case 5)	15.35	21.31	36.66	79.36
ditto	(Case 6)	15.35	21.31	36.66	145.33
ditto	(Case 7)	15.35	21.31	36.66	145.64

Table 16.1.2 Structure of Income Tax

Average Monthly Income	Tax Ratio
less than 650,000	0%
650,000 - 1,300,00	10%
1,300,000 - 1,900,000	20%
1,900,000 - 2,900,000	30%

Table 16.1.3 Structure of Turn-Over Tax

Sector	Tax Ratio
Manufacturing Sector	1 - 10%
Construction Sector	3 - 5%
Transportation Sector	1 - 4%
Commercial Sector	1 - 16%

Table 16.1.4 Life of Project Property

Kind of Property	Tax Ratio
Bridge	more than 50 years
Tunnel	more than 50 years
Rail	35 years
Ballast and Concrete Sleeper	more than 50 years
Bommunicaiton Equipment	20 years
Signalling Equipment	20 years
New Rolling Stock	25 years
Rehabilitated Rolling Stock	25 years
Workshop Sepot	20 years

However, productivity of work forces is adjusted because enormous number of un-employment and under-employment apparently exist in Vietnam. "Un-employment ratio is estimated 20% of total population of work forces and this reaches 27-28% if under-employment is included" explained the Party's Secretary Mr. Do Muoi. In this analysis, real average productivity of labor forces is set 80% of nominal wage.

2) All Domestic Materials

All the domestic materials are subject of shadow pricing. However, the structure of subsidies and tax are so complicated and difficult to seize its actual magnitude in price structure. This is partly attributable to a lack of clear record of subsidies and a perplexing system of a pricing procedure. In this system, the most clear tax item (= turn-over tax) is adopted in reckoning the shadow prices. And it should be noted that this is a preliminary result and there is a large room to improve in the shadow price calculation.

State government imposes a turn-over tax in Vietnam and all the transactions of manufacturing sector, construction sector, transport sector, commercial and other service sectors are subject of this turn-over tax. Table 16.1.3 shows a structure of turn-over tax.

Nominal financial prices of construction materials are converted into economic prices by reducing this turn-over tax ratio. Its ratio is set 3%, and 97% of nominal price is set as a economic price.

3) All the Foreign Materials

All the prices of the foreign materials are used as economic prices. This is because foreign exchange rate is decided in the free market, and because a few items are subject of import tax concerning the materials of railway projects as a public infrastructure project.

Shadow price of foreign exchange ratio is not calculated in this analysis. This is because (a) there is no direct control of the foreign exchange market by the government, and (b) sufficient data is not available concerning volume and value of traded commodities.

Vietnamese government replaced a fixed foreign exchange system with a floating exchange system in 1989, and established a foreign exchange market in Hanoi and Ho Chi Minh City in 1991. No durable exchange ratio is prevailing in Vietnam. It is judged that foreign exchange ratio is completely dependent on the market mechanism.

Furthermore, price distortion attributable to import and export taxes on the materials for the pubic infrastructure project, especially for railway project, is negligibly small. Import tariff

table ("Export and Import Tariff for Commercial Goods" in effective in 1993) shows that there is few taxable items in the materials of the railway project.

4) Replacement Cost

Construction materials and operation equipment are all replaced with a new property when property life is over. Property life is set according to VNR standard, and is shown in Table 16.1.4.

Replacement cost is set as same as the original one. It is assumed that the rehabilitated rolling stocks can be operated for a full life period of new rolling stock.

5) Residual Value

Residual value of property was incorporated in the analysis. Every properties are depreciated year by year, and there remains some value of property when the project life is over before its depreciation period is expired. This residual value is listed as a negative cost of each investment item at the very last year of the project life.

However, residual value is incorporated only when property concerned can be utilized for other project. This study limits a scope of residual value to four items: rail, signal and communication equipment, rolling stocks, and equipment in workshop and depots.

6) Operation and Management Cost

This cost is converted by adjusting working compensation from financial cost concerned.

16.1.3 Economic Benefit

(1) Total Economic Benefit

This project expects eight (8) items of tangible economic benefit to generate and contribute to national economy. Of these economic items, five (5) items are measured in this project. Figure 16.1.2 shows eight items of economic benefits and an actually measured five items are listed in Table 16.1.5.

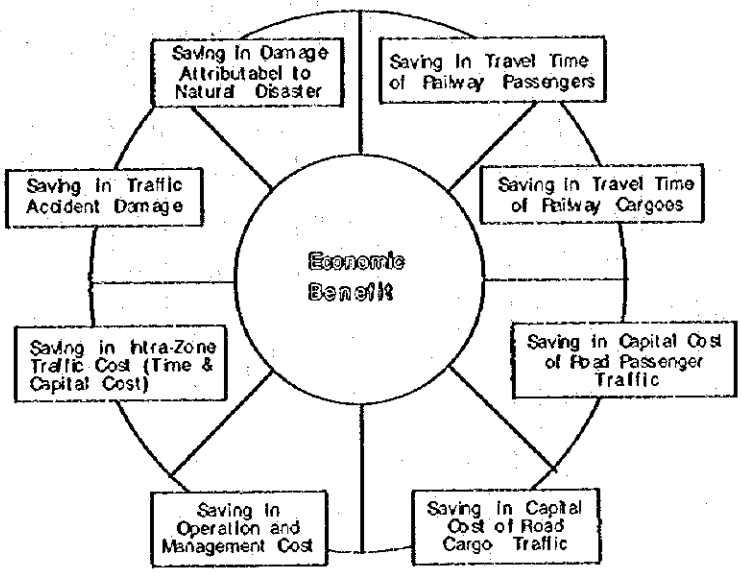

Figure 16.1.2 Eight Items of Econmic Benefits

Table 16.1.5 Summary of Economic Benefit

(unit; million US$)

Benefit Items	2000	2010
Hanoi - Lao Cai Line		
1. Saving in Tavel Time, Passenger	0.47	4.55
2. Saving in Travel Time, Cargo	0.01	7.24
3. Saving in Road Transport Vehicle; Passenger	3.10	12.80
4. Saving in Road Transport Vehicle; Cargo	2.05	2.60
5. Saving in O & M	3.20	1.40
Total	8.83	28.59
Hanoi - Cai Lan Line		
1. Saving in Tavel Time, Passenger	0.65	4.63
2. Saving in Travel Time, Cargo	-0.01	-0.65
3. Saving in Road Transport Vehicle; Passenger	1.30	7.20
4. Saving in Road Transport Vehicle; Cargo	0.70	5.00
5. Saving in Cargo	1.30	1.20
Total	3.94	17.38

There is actually one more benefit items that is attributable to flood mitigation measures. This is included in each benefit item since flood-free operation of railway can guarantee each benefit generated in a full scale. A full scale of economic benefit attributable to flood mitigation measures are incorporated in this study since average duration of railway inundation is not clear. Even with the improvement plan in this study, there remains about 100 km (out of 150 km) of flood prone railway section. To be accurate, this negative benefit should be reduced from the result of this section.

(2) Calculation of Economic benefit

In calculating the economic benefit, a safety operation of the train at the designed speed would be assured after the rehabilitation works.

1) Saving in Travel Time of Railway Passengers

Each alternative guarantees the operation of passenger coaches at higher speed and results in saving in travel time. Railway passenger can enjoy this benefit, and a part of bus passengers also prefers this shorter travel time and diverts their transport mode from a long distance bus to the railway. It is assumed that the saving time will be assigned for additional production activities and contribute to the total GDP by means of increase of productivity. Scale of this contribution is quantified into saving in travel time of railway passengers.

Table 16.1.6 shows a calculation process of this benefit. Time value is estimated by dividing GDP by total number of labor forces.

2) Saving in Travel Time of Railway Cargo

Higher speed of freight cars can contribute to save the total transport time of cargo. This also affect the demand of railway cargo, and diverts a part of cargo transportation from truck to railway. It is assumed that saving in cargo transport time can make it possible to collect bills of cargoes and save a total amount of interest payment according to a difference of duration.

Table 16.1.7 shows whole process of calculation of this benefit. Saving in interest is calculated by (1) dividing present interest rate by total hours per year, and (2) multiplying it with average value of cargo.

Table 16.1.6 Saving in Travel Time ; Passenger

	Traffic Volume by Railway (mil. person-km/year)			Average Speed of Travel (km/h)			Saving of Travel Time (million hours)			Time Value	Saving of Time Value (million US$/year)		
	Railway Volume (with)	Railway Volume (without)	Traffic Converted from Road	Bus	Railway (with)	Railway (without)	Traffic Converted from Road	Residual	Total	Unit (US$/hr)	Traffic Converted from Road	Residual	Total
Year 2000													
Hanoi-Lao Cai Line	409	331	78	30.00	32.60	29.00	0.21	1.26	1.47	0.3232	0.07	0.41	0.47
Hanoi-Cai Lan Line	196	127	69	45.00	38.90	23.00	-0.24	2.26	2.02	0.3232	-0.08	0.73	0.65
Year 2010													
Hanoi-Lao Cai Line	665	348	317	30.00	39.00	29.00	2.44	3.08	5.52	0.8249	2.01	2.54	4.55
Hanoi-Cai Lan Line	444	160	284	45.00	58.00	23.00	1.41	4.20	5.61	0.8249	1.17	3.46	4.63

Note: bus = 45 hours (Hanoi-HCMC) = 38.44 km/h
train = 24 hours (Hanoi-HCMC) = 72.00 km/h
train = 31 hours (Hanoi-HCMC) = 55.80 km/h
train = 36 hours (Hanoi-HCMC) = 48.06 km/h

Table 16.1.7 Saving in Travel Time ; Cargo

	Cargo Volume by Railway (mil. ton-km/year)			Average Speed of Cargo Travel (km/h)			Saving of Travel Time (million hours/Year)			Cargo Value	Time Value	Saving of Time Value (million US$/year)		
	Total Traffic Cargo (with)	Total Traffic Cargo (without)	Traffic Converted from Road	Road	Railway		Traffic Converted from Road	Residual	Total	(US$/ton)	Unit (US$/hr)	Traffic Converted from Road	Residual	Total
					with	without								
Year 2000														
Hanoi-Lao Cai Line	339	271	68	41.19	32.60	30.60	-0.44	0.54	0.11	27	0.00288	-0.03	0.04	0.01
Hanoi-Cai Lan Line	64	48	16	50.00	32.60	30.60	-0.17	0.10	-0.07	28.8	0.00288	-0.01	0.01	-0.01
										21.6				
Year 2010														
Hanoi-Lao Cai Line	374	295	79	41.19	42.20	30.60	0.05	2.65	2.70	933.0	0.00288	0.1	7.1	7.24
Hanoi-Cai Lan Line	177	52	125	55.00	42.20	30.60	-0.69	0.47	-0.22	1,018.3	0.00288	-2.0	1.4	-0.65

Note;

truck = 42 hours (Hanoi-HCMC) = 41.19 km/h
train = 41 hours (Hanoi-HCMC) = 42.20 km/h
train = 54 hours (Hanoi-HCMC) = 32.04 km/h

time value = 25.2%/(365*24) = 0.00288%
cargo value = freight revenue x 20

Time value of cargo is set constant between the period 2000-2010.

3) Saving in Capital Cost of Road Passenger Traffic

A diversion of passengers from bus traffic to railway will result in reduction in number of bus fleet and will lessen capital cost of buses. This saving of bus capital is estimated by multiplying capital cost of bus by total saving in passenger volume.

Value of bus is calculated at a base of vehicle-kilometer. Basic data are the imported price of bus and the average travel distance during its life. Table 16.1.8 shows a whole calculation flows.

4) Saving in Capital Cost of Road Cargo Traffic

Concept of this benefit is quite similar to "Saving in Capital Cost of Bus." A diversion of cargo transport mode form truck to railway will results in reduction in number of truck fleet and contribute to save capital cost of truck. Unit value of capital cost is derived by taking the same procedure as the capital cost of bus.

Table 16.1.8 shows this calculation procedure together with that of bus.

5) Saving in Operation and Management of Railway

This saving is attributable to increase in productivity of management and operation sector. Financial figures were converted into economic cost by adjusting working compensation.

Tabel 16.1.9 Saving in Operation and Management Cost

	Hanoi-HCM Line	Hanoi-Lao Cai Line	Hanoi-Cai Lan Line
(million VN Dong)			
1994	183,000	35,200	14,157
2000	169,377	25,734	13,370
2005	141,866	20,077	14,493
2010	135,455	15,017	13,261
(Million US$)			
1994	16.64	3.20	1.29
2000	15.40	2.34	1.22
2005	12.90	1.83	1.32
2010	12.31	1.37	1.21

Table 16.1.8 Saving in Capital Cost of Road Traffic

	Items	mil.veh-km			mil. pcu-km	Saving in Passenger Vehicle
		with	without	w-w/o		
2000	Passenger Vehicle Related;					
	Hanoi - Lao Cai Line	1,461	1,545	-84	0.0367	3.08
	Hanoi - Cai Lan Line	2,318	2,354	-36	0.0367	1.32
	Cargo Vehilce Related;					
	Hanoi - Lao Cai Line	1,515	1,591	-76	0.0262	1.99
	Hanoi - Cai Lan Line	2,021	2,049	-28	0.0262	0.73
2005	Passenger Vehicle Related;					
	Hanoi - Lao Cai Line	2,632	2,805	-173	0.0367	6.35
	Hanoi - Cai Lan Line	3,624	3,724	-100	0.0367	3.67
	Cargo Vehilce Related;					
	Hanoi - Lao Cai Line	2,208	2,307	-99	0.0262	2.59
	Hanoi - Cai Lan Line	2,954	3,045	-91	0.0262	2.38
2010	Passenger Vehicle Related;					
	Hanoi - Lao Cai Line	4,058	4,407	-349	0.0367	12.81
	Hanoi - Cai Lan Line	5,625	5,820	-195	0.0367	7.16
	Cargo Vehilce Related;					
	Hanoi - Lao Cai Line	3,190	3,290	-100	0.0262	2.62
	Hanoi - Cai Lan Line	4,356	4,548	-192	0.0262	5.02

16.1.4 Economic Evaluation

(1) Assumptions

1) Investment period ; 1996 - 2010

2) Evaluation period ; a period which covers construction period and 30 years of benefit flow (1995-2030)

3) Opportunity cost of capital ; 8.4%

This is equivalent to a interest rate of "Capital Formation Loan" offered by Industrial and Commerce Bank of Vietnam. In addition, a general standard of World Bank for developing countries (12%) is also taken into consideration.

4) Benefit generation during construction period;

First year of benefit generated is set at 2001. Scale of benefit is reduced according into the share of investment amount up to the year concerned against a total project cost.

(2) Evaluation Indicators

EIRRs for all case are summarized in Table 16.1.10 together and the results of the sensitivity analysis.

(3) Conclusion

[Hanoi - Lao Cai Line]

Rehabilitation projects for the Hanoi - Lao Cai Line is the smallest rehabilitation project in the investment size. This project shows 11.3% of EIRR, and can be judged feasible to implement. However, priority of this line is relatively lower than that of the Hanoi - Ho Chi Minh Line, which shows larger volume of railway demand. Its relatively priority is higher than that of the Hanoi - Cai Lan Line since the latter shows 10.1% of EIRR (Case 5).

[Hanoi - Cai Lan Line and Meter Gauge Installation]

Service extension between the Ha Long station and a new Cai Lan station is an indispensable component to activate this line. And it is recommended that this track extension project be implemented by the year 2000 prior to the opening of the Cai Lan Port and a completion of the National Road 18 rehabilitation works. All other rehabilitation projects on this line assumed that the railway service between Ha Long and Cai Lan would commence by the year 2000.

Table 16.1.10 EIRR and Results of Sensitivity Analysis

Case	EIRR											NPV (mil.US$) (disc. rate=8.4%)	B/C
Benefit =	+- 0%	+- 0%	+- 0%	+- 0%	+- 0%	- 20%	- 10%	+ 10%	+ 20%	- 10%	- 20%		
Cost =	- 20%	- 10%	+ 10%	+ 20%	+- 0%	+- 0%	+- 0%	+- 0%	+- 0%	+ 10%	+ 20%		
Hanoi - Lao Cai Line	15.8	13.3	9.4	7.8	11.3	7	9.2	13.1	14.9	7.5	3.8	27	1.16
Hanoi - Cai Lan Line													
Case 1	14.9	12.1	8.0	6.4	9.8	5.7	7.8	11.9	13.9	6.1	2.7	8	1.08
Case 2	12.3	9.8	6.1	4.7	7.8	4.1	6.0	9.6	11.4	4.4	1.5	-4	0.97
Case 3	13.2	11.4	8.4	7.1	9.8	6.5	8.2	11.3	12.6	6.8	3.7	11	1.1
Case 4	11.1	9.2	6.1	4.8	7.5	4.3	6.0	9.0	10.4	4.6	1.7	-7	0.95
Case 5	13.6	11.8	8.6	7.3	10.1	6.7	8.5	11.6	13.0	7.0	3.9	13	1.12
Case 6	8.1	6.8	4.7	3.8	5.7	3.4	4.6	6.7	7.6	3.6	1.4	-35	0.77
Case 7	11.3	9.4	6.4	5.1	7.8	4.5	6.2	9.3	10.7	4.8	2.0	-5	0.96

Conversion of gauge into meter one (with various rehabilitation works) is at the marginal level to justify its implementation. This result is very dependent on the growth rate of Vietnamese economy. The highest rate of EIRR reaches 10.1% if the gauge will be changed with other rehabilitation works at the year 2000 (Case 5). However, the results turns into non-feasible if the benefit will decrease by 20%, which is realistic in case that the Vietnamese economy can not attain its accelerated growth as the SPC projected for the period 1996-2010 and will follow th elow growth scenario.

The judgment on feasibility of the project is much dependent on the growth performance during a period 1996 - 2010. It is recommended that the policy planners should carefully examine the economic growth scenario in the future.

Rehabilitation of existing line alone without change in gauge was also analyzed, and showed far high figure of EIRR. This fact is well worth consideration especially for the policy planners.

[Short-Cut Route Construction]

This project can not turn to be feasible up to the year 2010. This study adopted a high growth scenario during a period 1996-2010 as the SPC and the Vietnamese Steering Committee requested. However, all the cases with a short-cut route construction project show EIRRs lower than opportunity cost of capital, ranging from 4.1% (Case2) to 7.5% (Case 6). It is recommended that new feasibility study be conducted again in due course, targeting on the construction period envisaged according to the actual growth performance of passenger and cargo demand in the future.