Country	: Kingdom of Thailand
Project	: (1)Railway Cars Procurement Project (2)Train Dispatcher Telephone Improvement & Passenger Coaches Project (3)Passenger Coaches Procurement Project (4)Project for State Railway of Thailand
Borrower	: State Railway of Thailand (SRT)
Executing Agency	: State Railway of Thailand (SRT)
Date of Loan Agreement	: (1)April 1981 (2)September 1984 (3)September 1987 (4)September 1991
Loan Amount	: (1)¥8,300 million (2)¥6,401 million (3)¥3,987 million (4)¥10,711 million
Local Currency	: Baht
Report Date	: March 1998 (Field Survey: June and September, 1997)

Stamp for Centennial Anniversary of the State Railway of Thailand

(Diesel Locomotive procured by OECF Loan)

[Terminology]

1.Locomotive: Power car that pulls passenger or freight cars, and divided into steam locomotives, diesel locomotives, and electric locomotives. Thailand's locomotives are almost all of the diesel type. Depending on their use, these locomotives are further divided into main track locomotives that pull main track passenger cars and freight cars, and shunting locomotives used to configure trains in rolling stock yards and freight yards.

2.Diesel locomotive: Diesel locomotives are divided into two types, electric locomotives and hydraulic locomotives. In Thailand diesel electric locomotives are employed. In diesel electric locomotives, the power generated by the diesel engine is linked to a generator to generate electrical energy, which is used to turn the motor. This type is suitable for locomotives with a large engine output, and is easier to maintain and control than the diesel hydraulic locomotives.

3.Rail car: This is a diesel car, a car provided with passenger rooms and freight rooms for transporting passengers and freight. Rail cars include control trailers with a driver's cab and trailers without an engine. These cars are combined to form one set (formation).

4.Passenger car: Car for transporting passengers. They are pulled by a locomotive and form passenger trains<Note>. Passenger cars include coaches, sleepers, and diners. Coaches and sleepers are divided into 1st, 2nd, and 3rd class.

5.Freight cars: Car for transporting freight. They are pulled by a locomotive and form freight trains. Freight cars have either 4 or 8 wheels. Freight cars come in various types, depending on the cargo, including box cars, container cars, oil tank cars, and hopper cars.

Note: Freight cars and passenger cars may also be combined to form mixed trains.

1. Project Summary and Comparison of Major Plan and Actual Result

1.1 Project Location

1.2 Project Outline and ODA Loans

Railways in Thailand branch out in a radial pattern from Bangkok as Northern Line, Northeastern Line, Eastern Line, and Southern Line. At the end of fiscal 1996, Thailand had 4,041 km of railway lines (see 1.1 Project Location). These railways are managed by the State Railway of Thailand (hereafter called SRT). The predecessor of this organization was the Royal Railway Office, which changed into a state-owned enterprise in 1951.

During the period from 1981 to the present time (1997), 12 ODA loans, totaling ¥95,265 million, were continuously implemented. Out of these 12 projects, 6, accounting for approximately half of this amount, or ¥50,539 million, were for the purchase of railway cars.

【Table-1　Outline of Railway Cars Procurement by SRT with ODA Loans】

	Project	Type of Car	Quantity	Remarks
I	Railway Cars Procurement Project	Rail car	20 sets	13 sets of replacement cars, 7 sets of new cars
		Box car	158 cars	
		Container freight car	60 cars	Remodeled to oil tank cars
		Caboose car	20 cars	Additionally procured
		Oil tank car	60 cars	Additionally procured
		Container freight car	40 cars	Additionally procured
		Second-class sleeping car	21 cars	
	Railway Commuter Traffic Reinforcement Project	Rail car	38 sets	
II	Passenger Coaches Procurement Project [Note]	Second-class sleeping car with an air conditioner	36 cars	Every car is new
III	Passenger Coaches Procurement Project (II)	Second-class sleeping car with an air conditioner	31 cars	Every car is new
IV	Project for State Railway of Thailand	Diesel locomotive	22 cars	13 replacement cars, 9 new cars
		Oil tank car	180 cars	Every car is for replacement
		Container freight car	132 cars	Every car is new
	Project for State Railway of Thailand (II)	Diesel locomotive	38 cars	
		Container freight car	99 cars	

Note: Rail cars in the above table consist of 1 diesel motor car and 1 control car forming 1 set.

【Table-2　Number of Cars by Type Owned by SRT (Based on Registration) 】

(Unit: 1 Car)

Type of car		1980	1985	1990	1995	1996
Steam locomotive		37	7	7	7	7
Diesel locomotive		243	280	279	295	331
Rail car		58	114	161	180	242
Passenger car		1,081	1,117	1,155	1,164	1,176
	First-class passenger car	49	39	33	33	33
	Second-class passenger car	158	181	256	271	269
	Third-class passenger car	852	876	801	798	812
Freight car		9,140	8,923	8,751	9,072	9,169
	Four-wheeled car	6,347	5,918	5,612	5,626	5,626
	Eight-wheeled car	2,793	3,005	3,139	3,446	3,543

Source：State Railway of Thailand

Of these railway cars procurement projects, this report evaluates 4 projects for which post-evaluation has not been performed and results for three fiscal years following the date of purchase can be verified. In the following, these 4 projects are called the "4 projects" .

Railway Cars Procurement Project (here in after refered 'Project Ⅰ')

This project was a plan to procure cars that could fulfill two purposes. The first purpose was to procure cars to replace obsolete cars on existing lines. 13 rail cars were purchased for this purpose. The second purpose was to procure some of the cars required for a new line under construction at the time of the appraisal from Chachoengsao and Sattahip (hereafter called 'Sattahip Line'). Originally, the plan was to procure 9 rail cars and the rest freight cars, all for the Sattahip Line.

Train Dispatcher Telephone Improvement & Passenger Coaches Project
(here in after refered 'Project Ⅱ')
Passenger Coaches Procurement Project (here in after refered 'Project Ⅲ')

Train Dispatcher Telephone Improvement & Passenger Coaches Project was to procure 36 stainless steel second-class sleepers with air conditioners and spare parts for them. The Project Ⅲ was to ① procure the remaining 14 cars as the Project Ⅲ was to procure only 36 cars out of a total of 50 cars by a request of the Project Ⅱ, due to the 11th total loan amount, and ② procure 17 cars, thus a total of 31 cars, as well as the spare parts required for these cars which were changed from third-class passenger cars with a loan from France to second-class cars with air conditioners under directions by the Thai Government. The specifications of the passenger cars of the Project Ⅲ were basically the same as those of the second-class cars with air conditioners of the Project Ⅱ.

Project for State Railway of Thailand (here in after refered 'Project Ⅳ')

This project was to procure 22 diesel locomotives and 312 freight cars as a replacement of the obsolete existing cars and purchase of additional cars dealing with new demand. 13 diesel locomotives and 180 oil-tank freight cars were purchased to replace existing railway cars, and 9 diesel locomotives and 132 container cars were purchased as additional railway cars.

1.3 Background

1.3.1 Significance of Projects within Five-Year Investment Plan of SRT

The Thai government has established a Five-Year Economic and Social Development Plan and based on this economic plan, SRT has established its own Five-Year Investment Plan. The Five-Year Investment Plan of SRT began in 1962, and the Eighth Investment Plan was initiated in fiscal 1997. The procurement of railway cars is also being implemented basically along the Five-Year Plan, and of the 4 projects, Project Ⅱ,Ⅲ,Ⅳ are being implemented along the Five-Year Plans of SRT.

【Table 3 Five-Year Plan of SRT (the 5th~7th budget base) 】

(Unit: million Baht)

Project	Fifth Plan 1982-1986	Sixth Plan 1987-1991	Seventh Plan* 1992-1996	Eighth Plan 1997-2001
Railway cars procurement	4,752.54	2,130.82	6,335.16	18,824.00
Railway cars repairs	306.34	769.26	806.37	51.00
Factories repairs	258.95	232.36	434.41	1,351.00
Railways repairs	788.08	2,416.20	10,363.11	13,354.40
Double track	--	--	7,064.00	37,045.00
Construction of new lines	--	7,541.53	2,981.38	53,083.00
Signals・Telephones	3,509.42	19.91	280.54	4,550.00
Railway operating equipment	--	24.19	10.70	10.00
Offices・Buildings	7.40	16.65	161.45	133.00
Others	81.19	321.39	358.30	4,400.00
Total	9,703.92	13,472.31	28,795.42	132,801.40

Source: State Railway of Thailand

【Table 4 Purchase of Railway Cars (the 5th to the 7th are actual results base, and the 8th Plan, plan base) 】

(Units: car, set, Figures in the parenthesis are for OECF portion)

Type of car		Fifth Plan 1982-1986	Sixth Plan 1987-1991	Seventh Plan 1992-1996	Eighth Plan 1997-2001
Diesel locomotive		20 cars	22 cars (22 cars)	38 cars (38 cars)	44 cars
Rail car		38 sets (38 sets)	-	80 sets	83 cars
Passenger car	Second-class sleeping car with an air conditioner	84 cars (67 cars)	-	-	189 cars
	Second-class sleeping car	21 cars (21 cars)	-	-	-
Freight car		124 cars	312 cars (312 cars)	99 cars (99 cars)	432 cars
Shunting locomotive		10 cars	-	-	24 cars
Train		-	-	-	53 cars

Source: State Railway of Thailand

Project Ⅰ

1) Necessity of procuring for rail cars replacement

Of the 58 sets of rail cars already owned by SRT at the time of appraisal, 6 sets had reached the age of 20 years, 3 sets with the age of 18 years, and 7sets with the age of 15 years. In Japan, rail cars are replaced every 25 to 30 years as a rule of thumb, and among the rail cars owned by SRT, it was judged necessary to replace all six 20-year old sets, all three 18-year old sets, and four particularly damaged sets out of the seven 15-year old sets. Thus replacement of 13 sets in total was judged necessary.

2) Procurement of cars for new Sattahip Line

At the time of appraisal, the Thai government was implementing the Eastern Coastal Zone Development Plan. This plan was a national project that included reinforcement of harbors and the construction of industrial estates in the eastern zone of the Thai Gulf. Large-scale passenger and freight transport demand was predicted between the Sattahip Port and Bangkok, or the North upon completion of this project. To satisfy this transport demand, the new Sattahip Line was laid from Chachoensao Station on the existing Eastern Line to the Sattahip Port down south on the Thai Gulf. The construction of this new line was a national project promoted under the initiative of the Thai government, which drafted the plan for the new line and made the financing arrangements. SRT was then put in charge of the new line construction and all technical and operational aspects of railway cars procurement, etc. It was decided that the Project Ⅰ would procure the cars necessary for passenger and freight transport on the Sattahip Line, and the types and number of cars was fixed based on projected demand figures of the Sattahip Line at that time.

Project Ⅱ,Ⅲ

The Project Ⅱ,Ⅲ were both part of the passenger cars procurement plan of the Fifth Five-Year Plan of SRT, and were to procure second-class sleepers to handle increasing demand for long-distance passenger transport.

At the time, third-class passengers accounted for the greatest part of passenger traffic revenue of SRT. Nevertheless, by class, the growth rate in the number of second-class passengers was steadily rising, as was the travel distance per passenger, so that a large rise in demand for second-class long-distance transport was foreseen. Moreover, compared to third-class passengers, who had a shorter travel distance per passenger, second-class long-distance passenger transport unit prices were higher both in terms of distance and class. In this context, SRT sought to raise demand for the more expensive second-class travel while handling rising demand and improving its profitability through the Project Ⅱ,Ⅲ.

Project Ⅳ

The Project Ⅳ forms part of the Sixth Five-Year Plan of SRT. At the time, SRT was in the process of laying a railroad spur from Shiracha Station, located midway on the Sattahip Line, to the commercial port of Laem Chabang, using ODA loans. The plan was to use the cars procured through the Project Ⅳ for the Shiracha - Laem Chabang Line when it would enter full operation, and particularly the freight cars for freight transport on the Laem Chabang -Bangkok segment.

1.4.1 Project Scope

Project Scope	Plan (at time of Loan Aagreement)	Actual Result	Difference
Project I			
Rail car	20 sets	20 sets	-
Box car	158 cars	158 cars	-
Container freight car	60 cars	60 cars	-
Caboose car	40 cars (4-wheeled)	20 cars (8-wheeled)	-20 cars
Spare parts	1 Set	1 Set	-
Oil tank car (addition)	-	60 cars	＋60 cars
Container freight car (addition)	-	40 cars	＋40 cars
Second-class sleeping car (addition)	-	21 cars	＋21 cars
Spare parts (addition)	-	Set	-
Consulting service (addition)		6.25M/M	＋6.25M/M
Project II			
Second-class sleeping car with an air conditioner	36 cars	36 cars	-
Spare parts	1 Set	1 Set	-
Consulting service	18M/M	15.75M/M	-2.25M/M
Project III			
A second-class sleeping car with an air conditioner	31 cars	31 cars	-
Spare parts	1 Set	1 Set	-
Project IV			
Diesel locomotive	22 cars	22 cars	-
Oil tank car	-	180 cars	＋180 cars
Container freight car	-	132 cars	＋132 cars

1.4.2 Implementation Schedule

	Plan (at the time of appraisal)	Actual Result	Difference
Project Ⅰ			
For originally planned projects			
Bidding - Contract	Jun., 1981 ~ Mar.1982	Nov., 1981 ~ Oct., 1982	+7 months
Manufacturing	Apr., 1982 ~ Mar., 1983	Sept., 1982 ~ Aug., 1983	+5 months
Delivery	Mar. ~ Jun., 1983	Apr. ~ Aug., 1983	+1~2 months
For additional projects (fright cars)			
Selection of consultant		Oct., 1982 ~ Dec., 1983	
Bidding- Contract		Feb., 1984 ~ Jul., 1984	
Manufacturing		Jul., 1984 ~ May., 1985	
Delivery		May 1985	
For additional projects (Second-class sleeping car)			
Bidding- Contract		Jun., 1985 ~ Mar., 1986	
Manufacturing		Mar., 1986 ~ Feb., 1987	
Delivery		Feb., 1987 (Mar., 1987)	
Project Ⅱ			
Selection of consultant	Sept., 1984 ~ Nov., 1984	Apr., 1985 ~ Apr., 1986	+17 months
Preparation of bidding	Dec., 1984 ~ Apr., 1985	Feb., 1986 ~ Mar., 1986	+11 months
Bidding- Contract	May., 1985 ~ Feb., 1986	Apr., 1986 ~ Mar.,1987	+13 months
Manufacturing			
Delivery	Jan., 1986 ~ Dec., 1986	Mar., 1987 ~ May 1988	+17 months
Project Ⅲ			
P/Q	Aug., 1987 ~ Nov., 1987	Aug., 1987 ~ Mar., 1988	+4 months
Bidding - Bidding evaluation	Dec., 1987 ~ Apr., 1988	Jun., 1988 ~ Oct., 1988	+6 months
Contract	-		
Manufacturing	Aug., 1988 ~ Sept., 1989	Jan., 1989	-
Delivery	Aug., 1989 ~ Oct., 1989	Jan., 1989 ~ Jan., 1990	+4 months
		Feb., 1990	+4 months
Project Ⅳ			
Diesel locomotive			
Bidding— Contract	Apr., 1990 ~ Nov., 1991	Apr., 1990 ~ Nov., 1991	0 month
Manufacturing	Dec.,1991 ~ Sept., 1993	Oct., 1991 ~ Nov., 1993	+2 months
Delivery	Apr., 1993 ~ Dec., 1993	Jun., 1993 ~ Dec., 1993	0 month
Freight car			
Bidding— Contract	Apr., 1990 ~ Nov.,1991	Aug., 1990 ~ Mar., 1992	+4 months
Manufacturing	Dec., 1991 ~ Oct., 1992	Jul., 1992 ~ Aug., 1993	+10 months
Delivery	Sept., 1992 ~ Nov., 1992	Dec., 1992 ~ Sept., 1993	+10 months

1.4.3 Project Cost

Item	Plan (at the time of appraisal)		Actual result [Note]		Difference	
	Foreign Currency (million yen)	Local Currency (million Baht)	Foreign Currency (million yen)	Local Currency (million Baht)	Foreign Currency (million yen)	Local Currency (million Baht)
Project Ⅰ						
Rail car	3,840	53	3,150	52	-690	-1
Box car	2,370	32	1,415	21	-955	-11
Container freight car	600	8	417	6	-183	-2
Caboose car	360	4	299	4	-61	0
Spare parts						
Rail car	384	5	315	9	-69	-4
Box car・container freight car, caboose car	-	-	73	1	+73	+1
Contingency	746	10	-	-	-	-
＜Additional＞						
Oil tank car	-	-	444	7	+444	+7
Container freight car	-	-	283	7	+283	+7
Second-class sleeping car	-	-	1,851	51	+1,851	+51
Spare parts						
Oil tank car・Container car	-	-	19	1	+19	+1
Consulting service	-	-	34	0	+34	0
Total	8,300	112	8,300	159	0	+47
Total foreign & local currencies	9,324		9,938		+614	
Project Ⅱ						
Second-class sleeping car with an air conditioner	3,780	67	4,189	149	+220	+67
Spare parts	189	3				
Reserve fund	615	11			-615	
Consulting service	46	1	14	-	-32	
Total	4,630	82	4,203	149	-427	+67
Total foreign & local currencies	5,458		5,708		+250	
Project Ⅲ						
Second-class sleeping car with an air conditioner	3,749	123	2,428	81	-1,509	-48
Spare parts	188	6				
Total	3,937	129	2,428	81	-1,509	-48
Total foreign & local currencies	4,647		2,874		-1,773	
Project Ⅳ						
Diesel locomotive	10,399		7,589		-2,810	
(For spare parts of DEL)			(557)			
Freight car	3,191	474	1,900	350	-1,291	-
(For spare parts of freight cars)			(40)			138
	407	14			-407	
Contingency	13,997	488	9,489	350	-4,508	-138
Total foreign & local currencies	16,583		11,354		-5,239	

Note: Excluding the portion of charge

Exchange rates: Project Ⅰ: 1Baht＝¥10.3
Project Ⅱ: 1Baht＝¥10.1
Project Ⅲ: 1Baht＝¥5.5
Project Ⅳ: 1Baht＝¥5.3

2. Analysis and Evaluation

2.1 Evaluation of Project Implementation (Project Scope/Implementation Schedule/Project Cost/Implementation Scheme)

2.1.1 Transportation strategy of SRT

Freight transport currently accounts for 29% of SRT's business, and passenger transport for the remaining 71%. There are two important issues with regard to passenger transport, namely ① the expansion of trains for work and school commuters, and ② first-class and second-class upgrades. Issue ② will be handled by increasing the number of limited express and express trains. As will be described later, SRT has balance statements broken down by segment as internal documents, and according to these documents, limited express and express trains are the only profitable railway segments. In other words, increasing the number of second-class limited express trains will establish a pillar of railway revenues. SRT aims to generate greater demand for train travel among the middle class through time reductions achieved by further reducing the number of stop stations, and by raising the level of services, such as air conditioners.

SRT is also aiming to raise its profitability in the area of freight transport. There are two types of freight transport, general freight transport of various commodities for various customers, and freight transport for specific customers. Currently, old-style box cars are used for general freight transport, which stop at many stations, where they are loaded and unloaded manually, resulting in slow transit. One modernization plan is to raise the efficiency of general freight transport. Compared to such general freight cars, freight transport for specific large customers could be the modern form of freight transport. Petrochemicals, LPG, and container transport are the most typical examples. Expanding these fields will directly lead the modernization of freight transport. Moreover, one of the weaknesses of railroad transport is that it stops short of delivery to the customer by only transporting passengers and freight from one station to another. To handle this limitation, SRT is planning to offer sets that include delivery from the station to the customer. Additionally, SRT plans to increase the number of large fixed customers by increasing the number of freight cars for large-capacity transport of a single kind of commodity for specific customers.

2.1.2 Project scope

The total number of cars and car types established for each project during the initial planning stage were procured. Furthermore, since project costs turned out to be lower than estimated, an additional number of cars were purchased as a part of the Project IV.

The specifications of the cars that were procured are shown in the following table 5. Examined as a whole, except for the initial plan for the Project I it could be recognized that SRT selected and procured cars based on current management strategies (described later).

【 Table 5 Outline of Specifications for Procured Railway Cars (Actual Result) 】

Project Title	Project I						
	Initially planned projects				Additional projects		
	Rail car	Box car	Container car *	Caboose	Oil tank car	Container freight car	Second-class sleeping car
Quantity	20 sets	158 cars	60 cars	20 cars	60 cars	40 cars	21 cars
Car number	THN1101 ~1140	BCG25001 ~25158	BOT442069 ~442118, BOT542027 ~542036	BBV50001 ~50020	BOT446001~ 446020, BOT545001 ~545005, BOT245001 ~245035	BCF50061 ~50100	BNS1101 ~1121
Total length (mm)	20,800	14,000	13,300	12,300	14,000	13,300	22,800
Width (mm)	2,815	2,400	2,450	2,030	2,400	2,450	2,808
Height (mm)	3,730	3,380	3,165	3,800	3,165	3,601	3,765
Max. axle load (ton)	12	10.5	15.0	10.5	15.0	15.0	12
Highest speed (km/h)	100	70	70	70	80	80	100
Max.loadage(ton)		25.85	37.8/37.5	5.0	37.7/38.35	45.6	-
Carrying capacity	- -	-	-	-	-	-	36 (18 persons each for upper and lower beds)

Project Title	Project II	Project III	Project IV		
	Second-class sleeping car with an air conditioner	Second-class sleeping car with an air conditioner	Diesel electric locomotive	Container car	Oil tank car
Quantity	36 cars	31 cars	22 cars	132 cars	180 cars
Car number	ANS1001 ~1036	ANS1037 ~1067	HID4501 ~4522	BCF50201 ~50332	BOT248001~248032, BOT342101~342133, BOT449001~449096, BOT550001~550019,
Total length (mm)	23,170	23,170	19,900	15,000	15,800
Width (mm)	2,810	2,810	2,780	2,450	2,820, 2,812
Height (mm)	3,765	3,765	3,870	1,009.5	3,022, 3,077, 3,320
Max. axle load (ton)	12.0	12.0	15	15.0	15.0
Highest speed (km/h)	120	120	100	100	100
Max. loadage (ton)	-	-	-	43.5	31.2, 36.7, 37.2
Carrying capacity	40 (20 persons each for upper and lower beds)	40 (20 persons each for upper and lower beds)	-	-	-

Source: State Railway of Thailand（figures from the list of Railway Cars）

- The initial plan for the Project I was to procure 60 container freight cars, but halfway, they were all converted into oil tank freight cars. The figure in the table indicates the number of converted oil tank freight cars.

Project I

Almost all the types of cars in the initial plan were procured according to the plan. The only change was that solely 20 caboose cars were procured, instead of the 40 that were planned. This

is due to the fact that while 40 four wheel caboose cars were planned to be purchased, this figure was changed to 20 eight-wheel caboose cars capable of higher speed. Moreover, although the Makkasan Plant, which is the major workshop of SRT, can produce spare parts for passenger cars and freight cars other than rail cars, which makes their purchase by ODA loans unnecessary, spare parts for freight cars were actually procured.

When bidding for the cars of the above initial plan was performed, ¥2.631 million contingency for the Loan Agreement amount resulted. Incidentally, SRT submitted an application for the use of this contingency to OECF and procured additional cars as a result. When use of this contingency was decided, the cars whose procurement was planned as the additional procurement lot consisted of 24 second-class sleepers, 40 container freight cars, and 60 oil tank cars. These cars were planned to be procured through a program of the Fifth Five-Year Plan of SRT, but at the same time the necessity of procuring additional cars became evident, as described below. In any case, the necessity for these procurements was recognized, and the procurement of cars using contingency is deemed to have been performed in a suitable as well as timely manner.

① Second-class sleepers
Need to handle rapid rise in demand for sleepers, and to increase number of express trains consisting of 8 cars on the Southern Line, where travel time is particularly long.

② Container freight cars:
Use these cars for container transport on the Sattahip - Bangkok segment, establishing a system of two trains per day through combination with the 60 container freight cars of the original plan.

③ Oil tank freight cars:
Earmarked for start of transport of LPG of state-owned oil companies planned for 1984. This plan aims for 176.4 million litles yearly, with trains consisting of 24 cars, for transport from stations lying midway on the Sattahip Line to the Northern Line and the Northeastern Line.

A review of results shows that the purchase of these additional cars was implemented almost exactly according to the plan when use of contingency was decided. The only difference lies in the number of cars procured: procurement of 24 second-class cars was originally planned, whereas 21 cars were actually procured. However, with regard to these figures, slight variations in the costs of oil tank freight cars, container freight cars, and consultant fees are predicted, and it can be said that no particular problem exists.

On the other hand, part of contingency was used to employ consultants who were not part of the scope of the initial plan. These consultants were hired in October 1983 with the approval of the OECF in order to prepare bidding documents, perform coordination with the OECF, and assist with operations.

Project II

36 second-class sleepers with air conditioners were procured according to the initial plan.

The two main points in the specifications of the cars procured through this project are as follows: ① made of stainless steel and ② equipped with air conditioners. Concerning ①, the aim was to prevent corrosion of the car bodies, a particularly important problem in Thailand due

to its high temperature and humidity levels. Concerning ②, the aim was to raise the quality of service for passengers.

As described earlier, limited express trains and express trains represent but a small percentage of total SRT revenues, and second-class trains, which have high price per customer, represent the segment targeted by SRT for future expansion. The decision to procure second-class sleepers with air conditioners in order to provide higher level services for this group of travelers is considered to have been a judicious choice.

Changes in specifications include upgrading the carrying capacity of the cars from 32 passengers (16 on upper level and 16 on lower level) to 40 passengers (20 on upper level and 20 on lower level). This change in specifications was the result of SRT's wish to increase as much as possible the customer unit price of second-class travelers. The procured cars were all for use as additional cars to fill new demand for second-class travel, and none were used for replacement of existing cars.

At the request of SRT, the same consultant employed for consulting service as for the Project I was contracted. Moreover, the procurement method employed for passenger cars was changed from international bidding as originally planned (ICB) to international bidding with P/Q (In October 1985, OECF agreed to Procurement Method).

Project III

Per the initial plan, 31 second-class sleepers with air conditioners and spare parts were procured. The break-down of these 31 sleepers is as follows: ① 14 cars corresponding to the number of cars that could not be procured during the Project II due to the limited 11th ODA loan amount (36 cars were purchased instead of the 50 originally requested.), and ② 17 cars whose purchase was originally planned with a loan from France, and whose specs were changed from third-class passenger cars to second-class sleepers with air conditioners under directions of the Thai government.

Evaluation on the type of the cars procured were the same as those for the Project II described above.

Since the second-class sleepers with air conditioners that were purchased through this project were the same type as the 36 cars purchased through the Project II, consultants have not been hired in particular.

Project IV

Under the initial plan, this project envisioned only the procurement of diesel locomotives using an ODA loan. However, in the end it was decided to purchase both diesel locomotives and freight cars.

Bidding for diesel locomotives and freight cars was performed prior to applying for the ODA loan. At the time, SRT petitioned the Japanese government for application of the loan to the procurement of both diesel locomotives and freight cars. However, in order to reduce the total loan amount when the ODA loan policy would be determined, the Japanese government decided that the loan would be applicable only for the foreign currency amount necessary for the procurement of diesel locomotives. On September 18, 1991, when the Loan agreement for this project was signed, the loan was approved only for diesel locomotives, and freight cars were

excluded.

However, as a result of bid opening, the contract price for diesel locomotives was lower than the amount estimated at the time of appraisal, and the total amount for diesel locomotives and freight cars could fall within the Loan agreement amount. Thereupon, SRT petitioned the Japanese government to the effect that it wanted to add freight cars to the scope of the Loan agreement. The Japanese government consented to this demand, and thus the OECF modified the Loan agreement on February 1992 to include 312 freight cars in the loan project.

The diesel locomotives procured through this project had the following characteristics: ① high horsepower of 2900 Hp, and ② twin engines. Compared to diesel hydraulic locomotives, diesel electric locomotives are easy to maintain and control, and this type can be used for large engines of 2000 Hp or more. Moreover, the reason for using twin engines was to enable prompt recovery in the event of engine problems on main lines of SRT, which are mostly single-track lines, and keep the problem occurrence rate low. SRT later introduced a dual system for all locomotives to be procured in the future.

With regard to freight cars, freight transport is made available to all major customers on specific segments, in keeping with the aim of SRT project to achieve modern freight transport operations.

No consultants were hired for this project.

2.1.3 Implementation schedule

All four projects were procurement projects for material (railway cars), and their implementation schedule was divided in terms into two periods: the period until the contract, and the period for the railway car makers to manufacture and deliver the ordered railway cars.

A review of all four projects reveals no particular problems with regard to manufacturing delays proper. However, the time taken for procurement tasks including bidding procedures was drawn out in some cases. Such delays are considered to have been caused mainly by the slowness of decision-making inside SRT. As a countermeasure, the OECF recommended hiring consultants and other measures that resulted in speeding up procedures. Moreover, through the efforts of contractors during the manufacturing period, the delays that occurred in the phase up to the contract were recovered in many cases. However, rely each time on the efforts of contractors to make up for previous delays cannot be said to be a preferable method, and the best approach is clearly to raise the clerical ability of SRT.

Project I

A look at the project's initial plan shows that the bidding start was delayed by 5 months compared to the original schedule. SRT attributes this delay to the fact that bidding documents require many official approvals. This project was the first time SRT dealt with an ODA loan, and delays occurred in internal procedures as each step requiring the approval of the OECF had to be followed up. However, in the end, the project was completed with a delay of only 2 months compared to the original schedule, thanks to efforts to speed up internal processing that could reduce the delay at each stage, and the cooperation of the contractors, who were able to promptly deliver the equipment following its manufacture.

Project II

Hiring consultants took time, so that the project started with more than 1 year of delay. As a result, the entire plan was also delayed, and the purchase of passenger cars was completed with a delay of 17 months.

Project III

The actual delivery by the contractor was completed on January 31, 1990, behind the January 4, 1990 shipping deadline specified by the contract. This delay was due to the fact that a subcontracting plant under the main contractor suffered a strike, and a penalty was imposed on the contractor. However, the delay in the implementation schedule for the overall project was only 4 months, and the 31 cars that were procured entered commercial operation between February and March 1990.

Project IV

Apart from the delay of approximately 2 months in the manufacture of diesel locomotives, there were practically no delays, and as the locomotives were delivered one after another when they were completed, were shipped by December 1993 per the original plan.

On the other hand, with regard to freight cars, use of an ODA loan was rejected once, and thus its funds was not raised even after the bidding start. In the end, use of an ODA loan for the procurement of freight cars was accepted in February 1992, but due to the delay by this stage, the schedule until the actual contract became delayed by 4 months compared to the original plan. However, following the contract, the schedule was kept without delays from the plan made at the time of the contract. Per the schedule set in the contract, counting from February 26, 1992, the first lot (36 cars) was to be shipped within 9 months, the second lot (138 cars) within 13 months, and the third lot (138 cars) plus spare parts within 18 months, and all lots were actually shipped within these periods.

2.1.4 Project cost

In all four projects, the actual contract price has tended to be considerably lower compared to initial estimates by SRT. Two of the four projects have made additional car purchases using contingency after the purchase of the cars originally planned to be bought. This is considered to be attributable to increasing competition among bidders participating in the international bidders under the general untied bidding process. Considering the devaluation due to the obsolescence of old car models and the intensification of competition among bidders, the fact that actual purchase figures tend to be lower than estimates is unavoidable to some degree.

The estimate for the procurement of new cars was prepared based on the cost of similar cars directly purchased by SRT, factoring in price increases in the intervening period and changes in specifications. This method is eminently valid, and thus the cause of the low actual prices can only be attributed to factors on the side of the bidders.

Project I

With regard to the cars to be purchased according to the original plan, competition among

international bidders under the general untied bidding system resulted in the contract amount being significantly lower than the original estimate. The most remarkable factor underlying this result is that the cost of Korean-made box cars was only 59.7% of the estimated amount.

As a result, when the actual purchase price of the number of cars under the original plan was finally fixed, a contingency of ¥2.631 billion resulted against the Loan agreement, and SRT used this contingency to procure additional cars.

On the other hand, with regard to local currency, estimates of import duties and customs duties, port fees and inland transportation costs turned out to be higher than estimated, so that local currency costs slightly exceeded estimates. With regard to the increase in the local currency cost for spare parts for locomotives, 7 sets for the Chachoengsao-Sattahip Line under national policy were procured by the Thai government, and the remaining 13 sets based on the investment plan of SRT were purchased by SRT. With regard to the increase in local currency for the additional cars, procurement was done by utilizing the budget of SRT for fiscal year from 1982 to 86.

Project II

During the appraisal phase, unit prices were assessed based on the CIF cost (cost including freight insurance) of similar cars purchased in 1983. In the Project II the base cost was calculated to be ¥104.83 million, including 30% price increase for a stainless steel body and 5% price increase for inflation. Furthermore, vis-a-vis this base cost, 5% price increase for spare parts, 5% for contingency for the cost, and 10% for a physical contingency were added.

Thus the total estimate per car was ¥115.25 million, which exceeded the base cost price per car of the estimate, but was within the allotted budget including contingency.

Project III

During the appraisal phase, the unit price of cars was estimated to be ¥120.94 million, taking into consideration actual figures used for two previous procurements: second-class sleepers with air conditioners purchased through the Project II and the 1983 purchase of cars, which served for calculations of the Project II purchase. 5% was also added for spare parts. Local currency costs were estimated at 18% of foreign currency, taxes including import duties at 17.54%, and other charges at 0.46%.

As a result of bidding, actual figures turned out to be considerably lower than these estimates, and a Korean company was contracted to supply cars for ¥80.5 million per unit. However, as mentioned earlier, deliveries were not completed by the dates set in the contract, so that a penalty was imposed on the contractor. This penalty amounted to 10% of the contract price, so that the total amount paid was reduced to ¥182.4 million instead of the total contract amount of ¥249.55 million to be normally paid upon delivery. As a result, cars were procured at 64.8% of the original estimate, which made it possible to procure second-class sleepers with air conditioners.

Project IV

This project was to procure 22 diesel locomotives and 312 freight cars, but as mentioned earlier, during the appraisal phase, it was decided that the ODA loan could only be applied

toward the procurement of diesel locomotives. However, international bidding for diesel locomotives had already started prior to the E/N as part of this project, and as a result, the contract for diesel locomotives was awarded to a manufacturer who could provide them at a price that would enable the purchase of freight cars for the total cost originally planned for the project. Incidentally, the actual contract price for the diesel locomotives was ¥7.589 billion (¥345 million per locomotive) as opposed to an estimated price of the diesel locomotives at the time of the survey of ¥10.399 billion (¥472 million per locomotive), or just 72.9% of the estimated amount.

As a result, it was possible to procure 312 freight cars within the Loan agreement amount. As for freight cars, an estimated price per car is ¥10.2 million. The actual contract price for the freight cars was ¥6 million, or just 58.8% of the original estimate, and the actual contract price for the oil tank cars was ¥5.9 million, just 57.8% of the original estimate.

2.1.5 Implementation scheme

(1) Executing agency

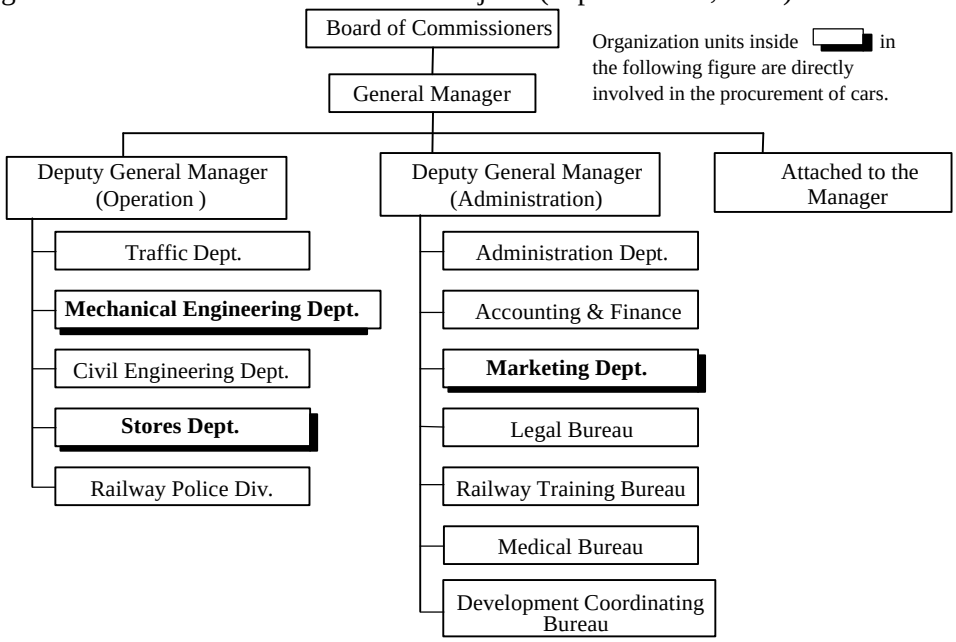
The borrower and executing agency in these projects was SRT. National Economic and Social Development Board had the power of decision with regard to the car procurement plan and modifications thereof, but the types of cars to be procured and detailed specifications were to be decided by SRT. Within SRT, three administrative units, the Marketing Department, Mechanical Engineering Department, and the Stores Bureau were principally in charge of car procurement. The following procedural flows were adopted for the purchase of new cars and the purchase of cars to be used as replacements.

- In the case of procurement of new cars, the Marketing Department first determined which type of car is required. At this time, the Marketing Department bases its decision on a demand forecast it conducts once every year. Following approval of the budget needed for the purchase of the cars, the proposal is reviewed by SRT, and details including specifications are determined principally by the Mechanical Engineering Department. The ultimate power for the selection of detailed car specs lies with the Mechanical Engineering Department, and this department also prepares engineering drawings for the cars. On the other hand, the Stores Bureau is responsible for procurement-related tasks ranging from the preparation of bidding documents to the conclusion of the contract.
- In the case of procurement of cars to be used as replacements, demand forecasts are not required, and the Mechanical Engineering Department determines specs by itself.
- Bid evaluation is performed by Bidding Committee. This Bidding Committee is headed by the Director of the Mechanical Engineering Dept., and includes one person each of the rank of general manager from the Mechanical Engineering Department, Stores Bureau, and Accounting & Finance Department, for a total of 5 members. The committee reports the evaluation results to the President and Board of Directors, and after obtaining approval, the contract price is decided.

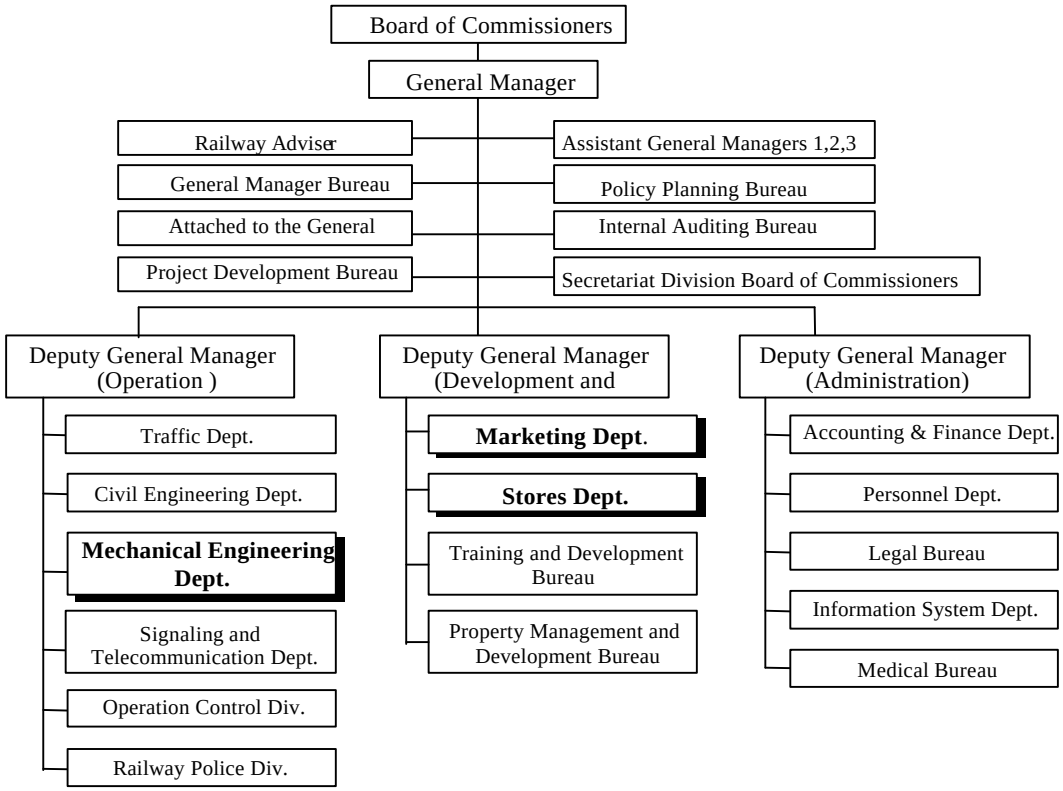
In this way, Marketing Dept. takes an initiative for responsibility for the selection of cars, purchasing procedures, and future project plans of overall SRT, and their technical decisions are made by the Mechanical Engineering Dept., in keeping with the organizational structure of SRT.

【Figure 1　　Organization Chart of SRT】

(1) Organization Chart of SRT at Start of 4 Projects (September 30, 1981)



(2) Organization Chart of SRT at Completion of 4 Projects (September 30, 1993)



Source: SRT Information Booklet (published annually)

(2) Consultants

Currently the general criterion used by SRT in deciding whether to hire consultants for railway car procurement projects is whether or not it will be the first time that railway cars of this type will be purchased. In other words, when it is the first time that that particular type of railway cars will be purchased, consultants are hired, but if SRT already owns railway cars similar to that which will be purchased, the procurement is done by SRT on its own without hiring consultants.

A look at the four projects shows that the executing agency hired consultants for the Project Ⅰ and Project Ⅱ projects, and that in both cases the contracted consultants were from Japan.

Since the Project Ⅰ was to procure railway cars of a type already owned by SRT, it was at first decided that no consultants would be hired, but later, this decision was reversed and consultants were hired. The reason for this was that there were areas in which SRT may have lacked experience with regard to procurement procedures (particularly bidding evaluation) for the number of cars initially planned to be purchased through the Project Ⅰ, which was SRT's first ODA loan project. The aim was to speed up the procedures of SRT, which tended to be slow.

In the Project Ⅱ, it was decided from the beginning to hire consultants, and the same consultants who worked in the Project Ⅰ were hired through a direct contract. At the time of the appraisal for this project, SRT already owned second-class sleepers with air conditioners, but this was the first time that it would purchase stainless steel cars, and thus consultants were needed for bidding evaluation, price estimation, etc.

The Project Ⅲ and Project Ⅳ were to procure cars of types that SRT already owned, and thus consultants were not hired for either project.

(3) Contractors

The cars procured through the four projects, with the exception of one case, all had superb performance characteristics, and no problem occurred. The only exception consisted of China-made container cars for the Project Ⅳ. Due to a design error, it was difficult to load empty containers on the freight cars. This design error is being repaired by the maker at his own expense. Moreover, there were also problems in the welding of the floor plates of the same freight cars, which caused deep rust corrosion to occur in a relatively short time.

Among the cars procured through the Project Ⅰ, the contract for rail cars was awarded to a Japanese trading company, and three Japanese railway car makers were subcontracted for manufacturing. The contract for second-class sleepers went to a Japanese trading company, and two Japanese railway car manufacturers were subcontracted for manufacturing box cars, container cars, and caboose cars were all contracted to Korean makers.

In the Project Ⅱ, as the result of international bidding with P/Q, a Japanese trading company also won the railway car contract, and four Japanese railway car makers were subcontracted to manufacture a total of 36 cars.

In the Project Ⅲ, the same international bidding with P/Q used for the Project Ⅱ was employed, and as a result, the same Korean freight car makers who were used for the Project Ⅰ were taken on as the contractors and manufacturers.

For the diesel locomotives of the ProjectⅣ, international bidding without P/Q was performed prior to the Loan agreement due to the need to obtain the railway cars for the opening of the Laem Chabang Port, and a Japanese trading company was selected as the contractor, with a single Japanese manufacturer subcontracted to manufacture all the locomotives. Moreover, the rail cars for which problems arose (described above) went to a single Chinese company that was the only one to pass the technical assessment for both oil tank cars and container cars out of a total of six bidders. Although this manufacturer successfully passed the technological assessment on paper, design errors and improper soldering caused various problems, a situation that is difficult to comprehend. It goes without saying that this company was made to repair the design errors free of charge.

2.2 Evaluation of operations and maintenance

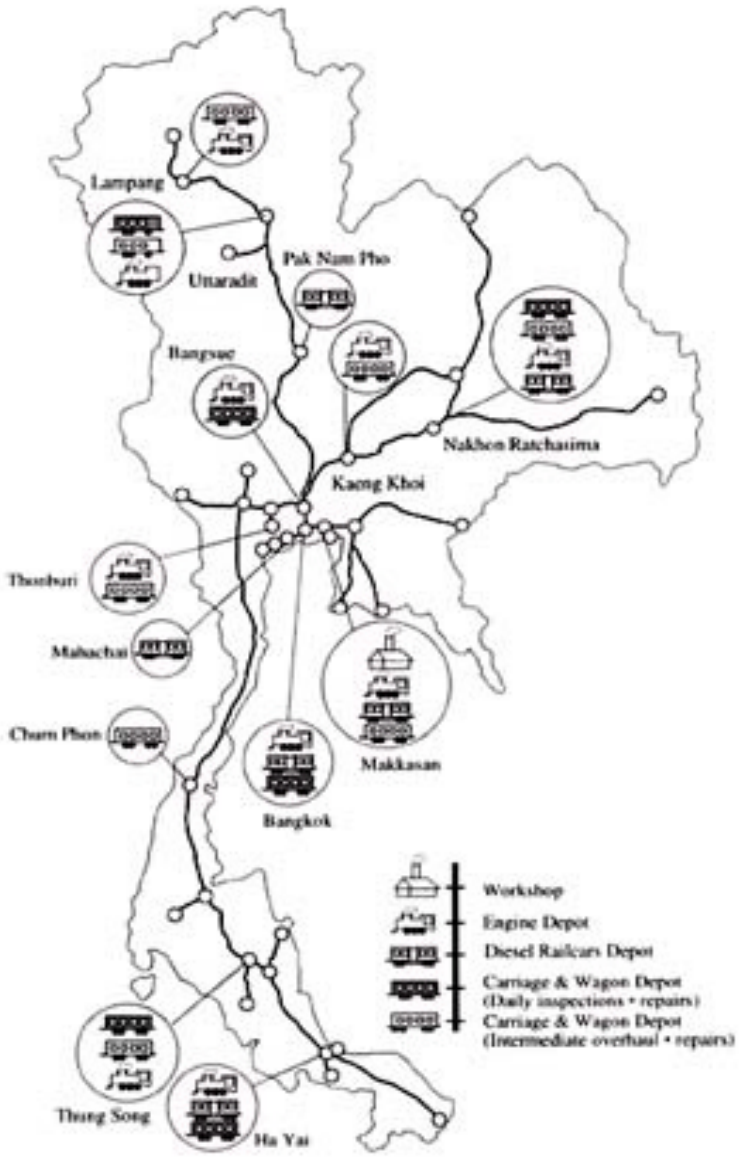
2.2.1 Operations and maintenance scheme

Currently, in addition to the Makkasan depot located in Bangkok, which is its major depot, SRT also has regional depots in Uttaradit, Nakhon Ratchasima, and Thuhg Song[1].

The Makkasan depot used to perform a wide array of works ranging from the manufacture of cars including passenger cars to the repair of freight cars, but it has stopped the manufacture of passenger cars and light and medium repairs for all types of cars. As will be described later, periodic inspections are divided into several levels, but the Makkasan depot now specializes as a repair plant particularly in large-scale maintenance that require a high technological level, such as heavy-duty repair and overhaul of locomotives and passenger cars and the repair of cars that have been in accidents. The other three regional depots can perform periodic inspections for locomotives, light and medium repairs of passenger cars, overhauls of freight cars, etc. These three depots have gradually taken over tasks formerly done by the Makkasan Depots as it has become too small to keep on performing them.

In addition to these depots, SRT also owns depots throughout the country. Some depots perform light and medium periodic inspections and repairs. The types of cars that can be inspected and repaired by these depots differ depending on the base (see Figure 2).

【Figure 2　Maintenance Stations of SRT】



Source: SRT (Partly Modified by Author)

[1] These depots perform medium inspections and repairs among the locomotive depots and railway depots. These facilities provide medium inspection and repairs among the railway depots, and can perform medium repairs for passenger cars as well as overhauls for freight cars.

Among these depots, the most important ones are the Bangsue depot, which services 70% of all locomotives, and the Bangkok Rail Car Center (comprehensive railway depot), which handles close to 70% of all rail cars as well as passenger cars. The railway cars purchased through the four projects enter the Makkasan depot only when exhaustive inspections or repair of accident-caused damage (see Table 7). At all other times, diesel locomotives are serviced at the Bangsue Locomotive depot, and most rail cars and passenger cars are assigned to the Bangkok Rail Car Center[2].

These maintenance facilities are all attached to the Mechanical Engineering Department (see Figure 3). The Mechanical Engineering Department is divided into three sections, and the Makkasan Plant forms a section of its own. The Makkasan depot comprises five major departments: the Locomotive Repair Department, the Passenger Car Repair Department, the Freight Car and Rail Car Repair Department, and the Spare Parts Manufacturing Department.

The other regional plants and railway depot belong to different systems, and are divided by region into four divisions (District Mechanical Engineering Divisions 1 to 4, which control the Metropolitan Area, the Northeastern Line, the Northern Line, and the Southern Line; see Figure 3).

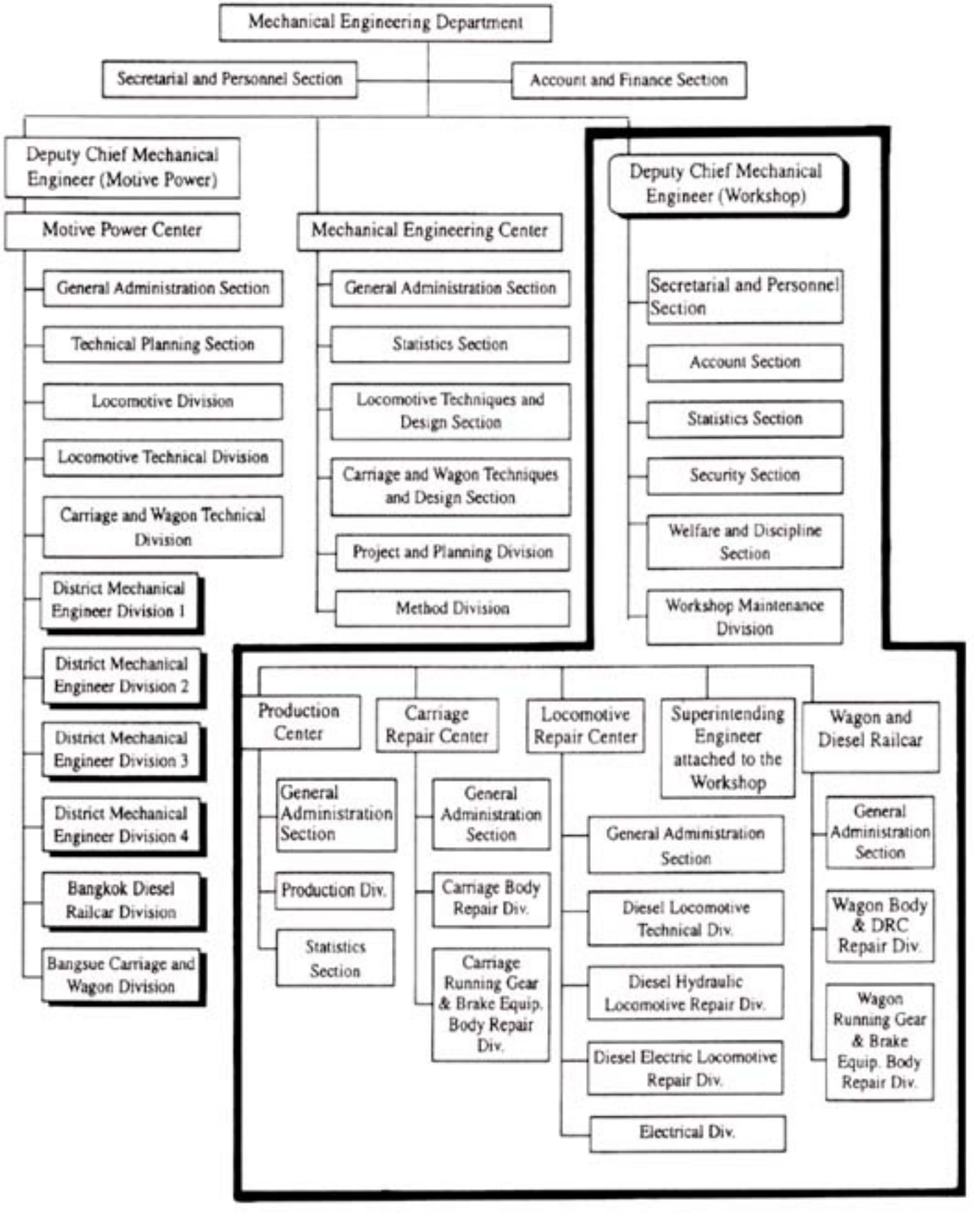
[2] Many freight cars are based at the customers', and their operations and maintenance scheme differ from those of locomotives, rail cars, and passenger cars.

【Figure 3 Organization Chart of Mechanical Engineering Department】

The divisions corresponding to ① and ② in the figure below are responsible for car maintenance.

① Area enclosed in ▭ indicates Makkasan Plant

② Areas enclosed in ▭ indicate regional plants and other divisions in charge of railway car bases



A look at the type of railway car each facility is in charge of shows that the Bangsue Locomotive depot, located 7 km north of Bangkok, where close to 70% of the traffic consists of diesel locomotives, performs periodic inspections (levels A to D checks). The Bangsue Locomotive Base also performs partial intensive checks (level E checks) for locomotives that are assigned to regional locomotive depots (see Table 6).

On the other hand, most rail cars and passenger cars are assigned to the Bangkok Rail Car Center. The Bangkok Rail Car Center is adjacent to Hualamphong Station within the city of Bangkok, and most passenger trains start from and arrive at this station. This makes the Bangkok Rail Car Center a convenient location for periodic inspections.

The two major problems in the car maintenance system are that the equipment of the Makkasan depot and the Bangsue Locomotive depot, which are the two major plants, is becoming obsolete and that both plants are running out of space. Currently, light work such as removal of interior fixtures carried out at the beginning of periodic inspections is also performed outdoors in the case of the locomotive and freight car repair depot. Therefore, there have been depots for some time to move these two facilities, and presently consultants have been hired to perform concrete studies including the use of the land after the plants are transferred to new locations.

【Table 6　System for Each of Maintenance Divisions】

Competent Division	Places	Number of workers (person)	Number of railway cars (car)		
			Diesel locomotive	Rail car	Passenger car
District Mechanical Engineer Division 1	Bangsue Locomotive depot	1,143	221	-	-
	Thonburi Locomotive・Railway Car depot	206	10	-	12
District Mechanical Engineer Division 2	Nakhon Ratchosima depot	470	20	30	5
	Kaeng Khoi Railway Car depot	207	N.A.	N.A.	N.A.
District Mechanical Engineer Division 3	Uttaradit depot	320	1	9	4
	Pak Nam Pho Railway Car depot	190	-	3	4
	Lampang Locomotive depot	137	1	-	-
District Mechanical Engineer Division 4	Thuhg Song depot	391	10	-	80 ~85
	Chum Phon Railway Car depot	188	1	-	
	Ha Yai Locomotive・Rail Car depot	225	22	-	
Bangkok DRC Center		776	17	160	1,205
Bang Sue Carriage & Wagon Division	Bangsue Freight Car depot	190			
	Thonburi Freight Car depot	86			

Note: Prepared by OECF based on documents from SRT.
The numbers of employees listed include both full-time employees and temporary workers.

2.2.2 Maintenance

The maintenance of railway cars is performed following the maintenance manuals prepared by the manufacturers. Maintenance schedules are determined by SRT based on the type of railway cars and the running time, as shown in Table 7.

Currently, the operation time of each type of railway car is managed by computer for every car number, and a car that has run for a given number of hours is systematically sent to a base, where it is inspected and maintained. There are no problems in particular with regard to operations and maintenance.

【Table 7　Periodical Maintenance of Railway Cars】

Locomotive	
	Facility
Trip Inspection	Each locomotive depot
Periodical inspection Every 500 hours (Level A) Every 1,500 hours (Level B Checks) Every 3,000 hours (Level C Checks) Every 6,000 hours (Level D Checks)	Each locomotive depot
Partial intensive check: Level E Checks Every 12,000 hours	Bangsue locomotive depot
Intensive repair (overhaul) Every 4 years (DEL), Every 5 years (DHL)	Makkasan depot
Rail car	
	Facility
Daily inspection	Each rail car depot
Monthly inspection	Each rail car depot
Every 3-month inspection	Each rail car depot
Every 6-month inspection	Each rail car depot
Every 18-month inspection	Each rail car depot
Intensive repair	Makkasan depot
Passenger car	
	Facility
Daily inspection	General stations
4-month periodical inspection	Railway car depot
8-month periodical inspection	Railway car depot
12-month periodical inspection	Railway car depot
20-month periodical inspection	Passenger car base・local depot
Intensive repair・overhaul 2 years or 40 months	Makkasan depot
Freight car	
	Facility
Daily inspection	General stations
8-month periodical inspection	Railway car depot
16-month periodical inspection	Railway car depot
2-year periodical inspection	Railway car depot・local depot
Intensive repair・overhaul	Makkasan depot・local depot

Source: Prepared based on SRT, "Maintenance Repair Rolling Stock"

2.2.3 Operations

(1) Railway cars ownership

At the end of 1996, the railway cars owned by SRT included 331 diesel locomotives[3], 242 rail cars, 1,176 passenger cars, and 9,169 freight cars. The railway cars that were procured through the four projects consisted of 22 diesel locomotives (7.5%), 40 rail cars (16.5%), 88 passenger cars (7.8%), and 650 freight cars (7.1%)[4], and except for one car, all this procured railway cars still exist[5]. Some of the railway car employing complex systems such as locomotives and rail cars have been in serious accidents that resulted for example in broken cockpits, but SRT performs repairs in such cases at its Makkasan depot, and these units are still in operation.

【Table 8 Number of Railway Cars by Type Owned by SRT】

(Unit: Car)

Number of railway cars procured with ODA loans (4 projects)						
		1980	1985	1990	1995	1996
Project I	Rail car	-	40	40	40	40
	Box car	-	158	158	158	158
	Container freight car	-	25	60	60	60
	Oil tank freight car	-	60	60	60	60
	Caboose car	-	20	20	20	20
	Container freight car (additional)	-	40	40	40	40
	Second-class sleeping car	-	-	21	20	20
Project II	Second-class sleeping car with air conditioner	-	-	36	36	36
Project III	Second-class sleeping car with air conditioner	-	-	31	31	31
Project IV	Diesel locomotive	-	-	-	22	22
	Freight car	-	-	-	312	312
Total number of railway cars owned by SRT						
Locomotive		280	287	286	302	338
	Diesel electric locomotive	176	215	206	222	258
Rail car		49	101	181	223	242
Passenger car		1,081	1,117	1,155	1,164	1,176
	First-class car	49	39	33	33	33
	Second-class car	158	181	256	271	269
	Third-class car	852	876	801	798	812
	Others	22	21	65	128	62
	(Of second-class cars) Second-class sleeping car with air conditioner	-	16	83	100	100
	Second-class sleeping car	86	93	108	107	105
Freight car		9,140	8,923	8,751	9,072	9,169
	4-wheeled freight car	6,347	5,918	5,612	5,626	5,626
	8-wheeled freight car	2,793	3,005	3,139	3,446	3,543
	Box car	483	647	647	646	646
	Container freight car	100	149	209	439	538
	Oil tank car	1,121	1,259	1,311	1,481	1,479
	Caboose car	-	20	20	20	20
	Others	1089	930	952	860	860

Source: Document prepared by SRT

[3] SRT also owns 7 steam locomotives, but they are not used for actual railroad operations.

[4] The railway cars procured with ODA loans, including the 76 rail cars procured through the Railway Commuter Traffic Reinforcement Project and the 38 diesel locomotives and the 99 container freight cars procured through the Project for State Railway of Thailand (II) represent a share against the total SRT rolling stock of 18.1% for diesel locomotives, 47.9% for rail cars, and 8.2% for freight cars.

[5] Of the 21 second-class sleepers procured through the Project I, only one has been scrapped as unrecoverable following a collision accident in 1990.

(2) Operations [6]

The division that controls operations at SRT is the Traffic Department. The railway time-table frequently undergoes minor modifications in addition to major changes as needed. The operation range of passenger trains is fixed, and they basically operate within their assigned zone except for inspection and repair the period. Freight cars are classified into dedicated cars for specific customers, and general freight cars not reserved for particular customers. Freight cars reserved for particular customers follow a regular service.

On the other hand, the operation of diesel locomotives is determined by the Traffic Department and the Mechanical Engineering Department: these two departments get together several times a year for consultations on which type of locomotive pulls which kind of car. The assignment of locomotives is determined through these consultations, for example, "The Japanese-made 2900Hp locomotive shall be used to pull the No. 5 train on the Northern Line between Bangkok and Chiang Mai, and one of car numbers 4501 to 4522 shall be selected for this purpose." With regard to the selection of this locomotive, new locomotives are assigned in the following order of priority: ① Express passenger trains, ② Limited express passenger cars, ③ coach passenger trains, and ④ freight trains. New high-quality locomotives are used intensively. As a result, the effective degree of contribution of each locomotive varies greatly depending on the type.

Which locomotive among locomotives of the same type that have been selected beforehand will be used is determined by the Bangsue Locomotive depot staff.

Project **I**

The railway cars procured through this project was originally planned to be used for the Chachoengsao-Sattahip Line, but due to delay in the start of this line's operation, they were put to use on different lines without waiting for the Chachoengsao-Sattahip to start operating. Since the Sattahip Line was not completed, the rail cars were assigned for school and work commuter trains on suburban lines[7]. The additional contingent of second-class sleepers was originally planned to be assigned to the Bangkok-Sungaikolok segment of the Southern Line, but from March 1987, the No. 5 and No. 6 limited express trains were assigned to the Bangkok-Chiang Mai segment of the Northern Line.

Current operations are as described below. Second-class sleepers continue to be employed in limited express sleeper trains on the Bangkok- Chiang Mai segment. However, due to the objective of SRT to raise customer service levels, air-conditioned cars are gradually becoming the majority for limited express trains.

On the other hand, construction of the Chachoengsao-Sattahip Line fell behind schedule, and the line was opened for service on July 14, 1989. The current usage status of the Sattahip Line south of Chachoengsao is as follows: ① Passenger train (1 round trip per day) from Bangkok to Ban Plu Ta Luang, which is the terminus passenger station one station before Sattahip; ② freight trains running on railway from commercial port and industrial district of Laem Chabang to Bangkok or Kaeng Khoi (and also in reverse direction) via Si Racha spurt line, and ③ spurt line from Sattahip Line to Map Ta Phut Industrial Estate has been opened, and two trains run each day from Map Ta Phut to Bangkok (planned to be increased to 4 trains during 1997).

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[6] The Project**III** is not described here due to lack of data.

[7] SRT designates school and work commuter lines as lines located within 150 km.

【Table 9　Operation Status (at present) 】

Type	Number of cars	Line	Operation zone	Distance (km)
Rail car	20 sets	All the suburban lines	N.A.	
Box car	158	All the lines		
Container freight car*	35	Northeastern Line	Ban Pokpaek ~ Northeastern direction	
	5	Northeastern Line	Ban Pokpaek ~ Northeastern direction	
	20	Northern Line＋ Eastern Line	Bang Lamung ~ Bung Phra	517
Container freight car	40	Eastern Line	Bangsue~ Laem Chabang	146
		Eastern Line	Lat Krabang ~ Laem Chabang	118
Oil tank car	10	Northern Line	Ban Pokpaek ~ Khon Kaen	
	50	Northern Line＋ Eastern Line	Bang Lamung ~ Bung Phra	
Caboose car	20	-	All the lines	
Second-class sleeping car	21		N.A.	

Source: Document prepared by SRT.

Note: Container freight cars* were converted into oil tank cars.

Project **II**

The railway cars procured through this project consisted entirely of new cars, which were initially assigned for additional runs in each zone, as shown in Table 10-1. Each train was a passenger train for long distance use and featuring excellent characteristics, as planned. This operation policy has basically remained unchanged since the start of operation, and even now, as shown in Table 10-2, these cars are being used for long-distance passenger trains, where they serve as the main constituents.

【Table 10-1　Operation Status (Date of start for business) 】

Type	Number of cars	Date of start for operation	Line	Operation zone	Distance (km)
Second-class sleeping car with an air conditioner (XI-9)	8	88/4/8	Southern Line	Bangkok ~ Ha Yai	945
	4	88/4/8	Southern Line	Bangkok ~ BW	1,160
	14	88/4/7	Northern Line	Bangkok ~ Chiang Mai	751
	4	88/6/1	Southern Line	Bangkok ~ Sungaikolok	1,159
	6	88/6/1	Southern Line	Bangkok ~ Ha Yai	945

【Table 10-2　Operation Status (at present) 】

Type	Number of cars	Line	Operation zone	Distance (km)
Second-class sleeping car with an air conditioner (XI-9)	7	Northeastern Line	Bangkok ~ Ubon	575
	4	Northeastern Line	Bangkok ~ Nong Khay	624
	4	Northern Line	Bangkok ~ Chiang Mai	751
	4	Southern Line	Bangkok ~ Trang	845
	4	Southern Line	Bangkok ~ Nkhon Si Thammarat	832
	6	Southern Line	Bangkok ~ Ha Yai	945
	2	Southern Line	Bangkok ~ Sungaikolok	1,159
	4 (under repairs)			
	1 (spare)			

Project**Ⅳ**

Of diesel locomotives procured through this project, the higher-quality locomotives are operated in an intensive manner as described earlier, mainly for long-distance limited express and express passenger trains. A look at detailed operation zone data as of January 1997 shows that 12 locomotives were assigned for passenger trains, with 6 among them assigned to pull limited express trains departing from Bangkok and bound for the terminus station on the Southern and Northern Lines, while the remaining 6 locomotives pull express trains departing from Bangkok and similarly bound for the terminus station of the Southern and Northern Lines (see Table 11). Moreover, 8 locomotives have been assigned for freight trains carrying LPG and cement, which run on routes that are relatively short compared to the long-distance runs of the aforementioned locomotives. Since their operation zones have a somewhat mountainous topography, locomotives with a high horsepower are required.

On the other hand, freight cars are all assigned to large customers, of a total of 180 cars, 96, 19, and 33 oil tank cars were assigned to foreign affiliated oil companies, and 32 oil tank cars were assigned to the state-owned oil company. Moreover, 132 container cars have been assigned to foreign affiliated transportation companies.

A look at the operation zones as of January 1997 shows that container freight cars were used for container transport from the commercial port of Laem Chabang to the Bangsue Freight Car depot, and to container routes connecting to the Lat Krabang Container depot. Connection up to the commercial port of Laem Chabang is provided by the Sriracha- Laem Chabang spur line (constructed with the 14th ODA loan) laid from Sriracha Station midway on the Sattahip Line. The majority of oil tank cars are being used on the Northern Line and the Northeastern line. Map Ta Phut Station is also the terminus station of the Sattahip Map Ta Phut Line (constructed with the 14th ODA loan) laid as a spur line of the Sattahip Line up to the Map Ta Phut Industrial Estates. This spur line also uses oil tank cars procured through the Project**Ⅳ**.

【Table 11 Operation Status (at present) 】

Type	Number of cars	Line	Operation zone	Traction train by type	Distance (km)
Diesel locomotive	2	Northeastern Line	Bangkok ~Saurong	Freight (LPG)	930
	2	Northeastern Line	Bangkok ~Map Kabao	Freight (Cement)	254
	4	Northeastern Line	Bangsue ~ Hin Rap	Freight (Cement)	272
	2	Northeastern Line	Bangkok ~ Ubon Ratchathani	Passenger (Limited express)	1,164
	2	Southern Line	Bangkok ~ Ha Yai	Passenger (Limited express)	1,872
	2	Northern Line	Bangkok ~ Chiang Mai	Passenger (Limited express)	1,516
	4	Southern Line	Bangkok ~ Ha Yai	Passenger (Express)	1,872
	2	Northern Line	Bangkok ~ Chiang Mai	Passenger (Express)	1,516
Type	Number of car	Line	Operation zone		Distance (km)
Oil tank car (180 cars)	96	Northern Line	Bangkok ~ Nakhon Ratchasima		569
		Eastern Line	Map Ta Phut ~ Khon Kaen		571
	33	Northern Line	Ban Pokpaek ~ Nakhon Ratchasima		569
	19	Northeastern Line	Ban Pokpaek ~ Ubon Ratchathani		1,159
	32	Northern Line	Chiang Rak Noi ~ Chuang Mai		705
Container freight car (132 cars)	132	Eastern Line	Bangsue ~ Laem Chbang		146
		Eastern Line	Lat Krabang~ Laem Chbang		118

Source: SRT

Note: Operation status of diesel locomotives as of January 1997

2.2.4 Financial Status of Executing Agency

As seen until now, there were no major problems in the implementation of the four projects, they have solid operations and maintenance schemes, and are making an important contribution to railroad transportation in Thailand. However, it is a regrettable fact that when the four projects started, SRT was already in the red, and that the four projects, far from improving its financial situation, on the contrary have further worsened it.

SRT has been running a continuous deficit from the end of 1978 to fiscal 1996, not only in terms of recurring profit, but also operating profit. When losses are incurred at the operational profit stage, there are three reasons: ① flat sales due to stagnating traveler and freight transport, ② fares and charges stuck at a low level, and ③ operating expenses that cannot be covered by low income resulting from ① and ②. In order to improve such situation, three things are indispensable: (1) sales effort to expand number of users and freight volume, (2) raising of fares and charges, and (3) cost reductions through restructuring. Let us examine each issue individually in the following section.

(1) Increase in number of users and freight volume

As described above, the long-term trend for passenger transport and freight transport measured in kilometers per person and kilometers per ton has been gradually rising. However, in Thailand, compared to other means of transport, there is no competition in the railway sector, and in recent years, growth in the number of passengers and freight volume has been sluggish. The current line capacity must be reassessed, and the possibility of increasing the number of trains by shortening block sections[8], etc., needs to be studied.

(2) Increase in fares and charges

Passenger fares charged by SRT consist of basic fares divided among first class to third class (based on distance), and additional charges for limited express, express, air conditioner charges, sleeper charges, etc.

Among these fares, additional charges such as charges for first-class cars, limited express and express, air conditioner charges, and sleeper charges are determined internally by SRT. However, the determination of basic fares for second-class and third-class cars requires the approval of the Thai Cabinet. Therefore, while additional charges are frequently revised, basic fares are relatively inflexible and difficult to change. Moreover, while additional charges can be set freely by SRT, competition with other means of transportation naturally sets limitations on charge levels.

On the other hand, SRT is basically free to set freight charges. However that may be, while the unit price for container and oil products is good, large customers have bargaining power, and since prices are fixed based on comparisons with other means of transportation, prices are influenced by the prices of competitors, and profitability is not necessarily always high. With regard to income by segment of SRT, freight transport for large customers is precisely calculated

[8] To prevent front and back collisions of trains, only one train is allowed to enter one line section. The train switching technique whereby other trains are not allowed to enter a line section already containing a train is called “block system”, and the corresponding line section is called “block section”.

by each item, but still there are some trains that are deeply in the red, for the reasons described above.

(3) Cost reduction

Since, as described in sections (1) and (2) above, increasing revenues is difficult, operating profits cannot be increased unless operating expenses are reduced, and ordinary losses cannot be reduced unless non-operating expenses are curtailed. Personnel expense, amortization cost, and financial expense (non-operating expenses) percentages against sales were studied (see Table 17). According to the figures obtained, SRT's interest cost is not very high. The largest pressure point is personnel expenses, which represents 63% of net sales (fiscal 1996 level). Furthermore, an analysis of personnel expenses comparing personnel expenses per employee and net sales per employee shows the level of personnel expenses per employee to be conspicuously high.

【Table 12 Cost Ratio Analysis】

(Calculated for Each Yearend)

	1991	1992	1993	1994	1995	1996
Personnel expenses as percentage of net sales (%)	57.5	61.6	65.0	54.2	64.9	63.1
● Personnel expenses per employee (Baht)	117,953	135,866	155,680	157,735	186,694	189,545
○ Net sales per employee (Baht)	205,214	220,464	239,528	290,862	287,866	300,445
Amortization cost as percentage of net sales (%)	9.3	9.2	10.3	10.1	11.7	12.6
● Annual amortization rate (%)	3.0	3.0	3.0	3.0	2.9	2.9
○ Depreciable cost capital turnover rate (%)	32.0	32.7	29.3	29.4	24.6	23.3
Financial expenses as percentage of net sales (%)	7.4	8.3	9.2	9.9	10.5	8.5
● Degree of indebtedness (%)	37.9	43.7	46.1	47.7	40.3	42.8
● Interest on borrowed interest bearing debt (%)	4.4	4.2	3.9	4.3	4.6	3.8
○ Total capital turnover (%)	22.6	22.3	19.9	20.5	17.8	19.2

Note: The larger figures indicated by ○ become, the more the expense ratio goes down (=expense reduction)
The larger figures indicated by ● become, the more the expense ratio goes up (=expense increase)

2.3 Projects Effects and Impacts

2.3.1 Transportation Results

The effect of the railway car procurement projects are most conspicuous in the transport results achieved with the procured railway cars. However, transportation results differ depending on the type of railway cars, and in some cases accurate data cannot be obtained. The formula data provided inside the boxes below describe the methods that were employed to measure the effect of the railway car procurement projects. Furthermore, the appropriate methods used to accurately calculate transportation figures for each railway car type, and the reason why these methods were not used in this report, are described in footnotes.

The method described inside the boxes are used below to measure transportation results for each type of railway cars.

(1) Effects and impacts of locomotives

Locomotives (22 diesel locomotives procured through ProjectⅣ):

Here, the impact of the project is measured using the following method.[9]

Contribution of locomotives procured through ProjectⅣ (%)

= Travel km of ProjectⅣ diesel locomotives÷Total travel km of all diesel locomotives owned by SRT used on main tracks

With this method, one obtains the percentage of distance pulled by diesel locomotives procured through the ProjectⅣ compared to the total travel distance of all trains (except rail cars) of SRT.

The total cumulative travel km of diesel locomotives procured through the ProjectⅣ was 14.568 million km from 1993 to the end of fiscal 1996. Since the travel km of main track locomotives owned by SRT was a total of 120.544 million km, ProjectⅣ locomotives accounted for 12.1% of this total. Since SRT is not electrified, this means that approximately 12% of all the trains running in Thailand (except rail cars) were pulled by locomotives procured through the ProjectⅣ.

Using cumulative statistics from the time all 22 locomotives were in operation, from 1994, this percentages is 16.0%. Since the percentage of these 22 locomotive against the total number of main track locomotives was 8.9% in 1994, 9.0% in 1995, and 8.0% in 1996, the locomotives procured through the ProjectⅣ can be said to be "considerably more used than the average main track locomotive."

[9] Locomotives themselves do not carry passengers and freight, it is the passenger cars and freight cars pulled by the locomotives that carry passengers and freight. Therefore, in order to grasp the transport volume for a given locomotive, the total number of passenger cars and freight cars pulled by that locomotive must be taken into account, and the transportation volumes of these passenger cars and freight cars must be added up. However, the time-series transportation statistics for all the freight cars pulled by the diesel locomotives procured through the ProjectⅣ could not be obtained.

【Table 13 SRT Locomotive Travel km】

(Unit: 1,000 km)

	Cumulative locomotive km				
	1993	1994	1995	1996	
Diesel locomotive: procured portion though ProjectⅣ	125	4,627	5,159	4,657	14,568
(Ratio to all the locomotives)	(0.4%)	(15.2%)	(17.3%)	(15.6%)	(12.1%)
Diesel locomotive (for main tracks)[10]	30,392	30,453	29,801	29,898	120,544
Diesel locomotive (total)	31,340	31,199	30,507	30,611	123,657

Source: State Railway of Thailand

Moreover, as described in section 2.3.2(2), these locomotives are characterized by their high horsepower, and to make the most of their power, they are assigned to long-distance limited express trains and other higher profitable trains. Based on this fact, the effect of the procured locomotives on a money basis is assumed to be higher than indicated by the figures reported here.

(2) Effects and impacts of rail cars

Rail cars (20 sets of rail cars procured through the Project Ⅰ)

Here, the impact of the project is measured using the following method. [11]

Contribution of rail cars procured through Project Ⅰ (%)

= Travel km of Project Ⅰ rail cars÷total travel km of all rail cars owned by SRT

With this method, one obtains the percentage of total student and worker commuter transportation distance accounted by rail cars procured through the Project Ⅰ.

The total travel distance of the 20 sets of rail cars procured through the Project Ⅰ from 1983 to the end of fiscal 1996 was 103,200 km, or 24.6% of the 419,400 km run by all rail cars in Thailand during the same period. This means that the rail cars procured through the Project Ⅰ accounted for approximately 24.6% of the total student and worker commuter distance worked by rail cars in Thailand.

The percentage worked by the rail cars procured through the Project Ⅰ as compared to the figure for all rail cars in Thailand is gradually declining. The main reason for this is that, as the number of rail cars owned by SRT has almost doubled, the total number of km run by SRT rail cars has also risen.

[10] Main tracks refer to the railways tracks of the project location on Page 167.

[11] In order to grasp the transportation volume for a given rail car, it is necessary to calculate the total number of passengers (unit: passenger) and the total number of passenger kilometers (unit: passenger km). However, the number of passengers and kilometers accounted for by the rail cars procured through the Project Ⅰ could not be obtained as time series statistics, and thus the above-described measurement method was employed here.

【Table 14 Rail Car km】

(Unit: 1000km, annual average except cumulative railway car km)

	Cumulative railway car km (FY83 ~ 96)				
	Annual average for 83~85	Annual average for 86~90	Annual average for 91~95	Annual average for 96	
Rail car: Procured portion through Project Ⅰ (Ratio to all the rail cars)	3.8 (30.4%)	8.4 (27.8%)	8.7 (23.1%)	6.2 (14.3%)	103.2 (24.6%)
All the rail cars	12.5	30.2	37.7	42.3	419.4

Source: State Railway of Thailand

(3) Effects and impacts of passenger cars

Passenger cars (sleepers procured through the Project Ⅰ, and second-class sleepers with air conditioners procured through the Project Ⅱ and Project Ⅲ):

Here, the impact of the above projects is measured using the following method[12].

Cumulative transportation revenues of each project (baht)

= Σ{second-class passenger receipts for n fiscal year × (number of second-class passenger cars procured through each project ÷ total number of second-class passenger cars at end of n fiscal year)}

This method calculates the revenue generated by second-class sleepers procured through each project. This cumulative transportation revenue figure, when contrasted against total passenger receipts of SRT, allows one to grasp the percentage of railway passenger transportation in Thailand, and when contrasted against transportation revenues, it allows one to grasp the percentage of transportation of SRT, in both cases in revenue terms. [13]

The second-class sleepers procured through the Project Ⅰ, Ⅱ and Ⅲ represented 7.4%, 13.4%, and 11.5% of the total second-class passenger cars owned by SRT at the end of fiscal 1996. Assuming that the second-class sleepers procured through each project have the same rate of contribution as the second-class passenger cars for the same fiscal year means that the railway cars for each project transported the equivalent of 71.6 million Bahts, 128.9 million Bahts, and 110 million Bahts in passengers transportation revenues in fiscal 1996. Moreover, employing the method described in the box above, calculating the cumulative total for each project against second-class passenger revenue from the year the railway cars was put in operation, the 21 second-class sleepers procured through the TVIII-I project accounted for a cumulative total of 548.3 million Bahts in revenues, the 36 second-class sleepers with air conditioners procured through the Project Ⅱ for 910.4 million Bahts in revenues, and the second-class sleepers with air conditioners procured through the Project Ⅲ for 669.3 million Bahts in revenues. In the end, total receipts generated by all the railway cars procured by the

[12] In order to grasp the transportation results of a particular passenger car, one can calculate the transportation results generated by that passenger car alone. The transportation results of passenger cars can be expressed either as number of passengers (unit: passenger) and the total number of passenger kilometers (unit: passenger km). However, time series statistics about the number of passengers and kilometers accounted for by the rail cars procured through the Project Ⅰ could not be obtained (FY1996 data was used for second-class sleepers with air conditioners an for transportation results by car type).

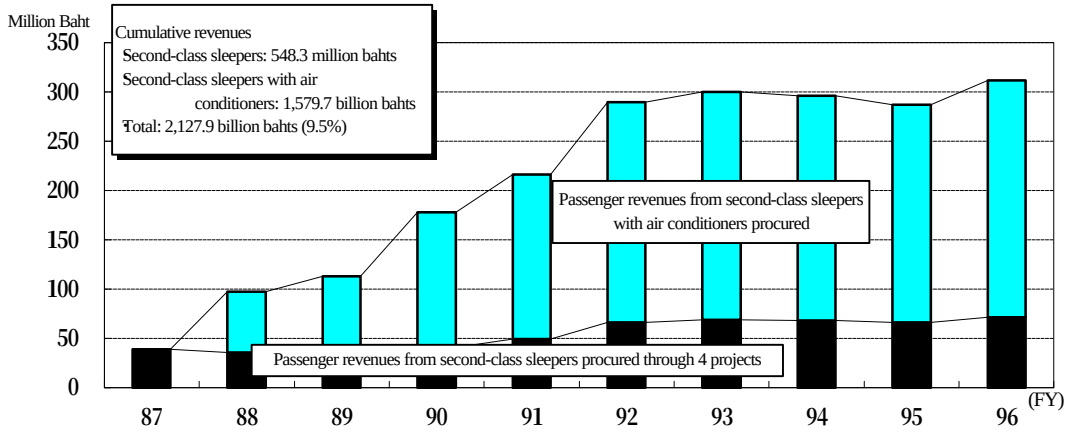
[13] However, combination with the transportation record locomotives results in double counting transportation results.

four projects combined is roughly calculated to be 548.3 million Bahts for second-class sleepers, 1,579 million Bahts for second-class sleepers with air conditioners, thus a total of 2,127 million Bahts (corresponding to 9.5% of total SRT passenger receipts from 1987) (see Figure 4).

A common issue to all the projects is the issue to increase second-class passengers. A look at total SRT passenger receipts by class shows that third-class travelers continued to account for the bulk of revenues in fiscal 1996. However, while second-class passenger revenue were a mere 20.9% of total passenger revenue in 1985, they had grown to 34.5% in 1995, showing a gradual increase from the latter half of the 80's to the first half of the 90's. This fact demonstrates that the issue of increasing second-class passengers has been handled through these procurement projects.

Adding to the fact that unit prices for second-class passengers are higher than for third-class travelers, the average number of kilometers traveled by second-class passengers is about five times greater than that traveled by third-class travelers[14], so that two factors are at work to increase revenue in the case of second-class passengers. In particular the passenger cars procured through the three projects were assigned for service in trains generating higher profits such as long-distance limited express trains. Assigning passenger cars for service in such trains enables each such car to produce additional charges such as sleeper charges and limited express charges whose price fixing does not require the approval of the Thai Cabinet. (The charge system will be described later.) As in the above, the three projects have been shown to generate revenues and have the impact shown by the figures obtained with the above measurement method.

【Figure 4 Passenger Revenues from 4 Projects】



Note: Cumulative receipts shown in the figure above are passenger receipts from the four projects.
The percentage In parentheses indicates cumulative passenger receipts from 4 projects ÷ Total cumulative passenger receipts of SRT from FY1987

[14] The average number of passenger kilometers per traveler was 758.7 km for first-class passengers, 637.7 km for second-class passengers, and 147.3 km for third-class passengers.

【Table 15 Overall Passenger Transportation Volume and Transportation Revenues by Class of SRT】

(Transportation volume unit: Million passenger kilometers; Transportation revenue unit: Million Baht)

Passenger transportation volume by class					
Class	1980	1985	1990	1995	1996
First-class passenger	60 (0.7%)	47 (0.5%)	28 (0.2%)	44 (0.3%)	41 (0.3%)
Second-class passenger	1,027 (11.6%)	1,059 (11.6%)	1,671 (14.8%)	2,803 (21.6%)	2,852 (23.4%)
Third-class passenger	7,776 (87.7%)	8,015 (87.9%)	9,608 (85.0%)	10,129 (78.1%)	9,314 (76.3%)
Total	8,862(100.0%)	9,121(100.0%)	11,307(100.0%)	12,975(100.0%)	12,208(100.0%)
Passenger transportation revenues by class					
Class	1980	1985	1990	1995	1996
First-class passenger	18 (1.7%)	24 (1.6%)	18 (0.9%)	30 (1.2%)	30 (1.2%)
Second-class passenger	193 (18.5%)	311 (20.9%)	523 (26.5%)	893 (34.5%)	963 (37.6%)
Third-class passenger	830 (79.7%)	1,154 (77.5%)	1,435 (72.6%)	1,664 (64.3%)	1,569 (61.2%)
Total	1,040(100.0%)	1,489(100.0%)	1,975(100.0%)	2,587(100.0%)	2,562(100.0%)

Source: SRT

Note: Others "mail and parcel transportation charges" are excluded.
Figures in parentheses in above table indicate percentage of total.

(4) Effects and impacts of freight cars

Freight cars: The project effects and impacts of freight cars is measured with the following methods[15].

Cumulative transportation revenues of box cars

= Σ{transportation revenues for agricultural and other products for n fiscal year × (number of procured box cars ÷ total number of box cars and other freight cars at end of n fiscal year[16])}

Cumulative transportation revenues of container cars

= Σ{container car transportation revenues for n fiscal year × (number of procured container cars ÷ total number of container cars at end of n fiscal year[17])}

Cumulative transportation revenues of oil tank cars

= Σ{transportation revenues for petrochemicals for n fiscal year × (number of procured oil tanks÷ total number of oil tanks at end of n fiscal year)}

These methods allow a rough calculation of the revenues generated by each type of car that was procured. By contrasting these cumulative transportation revenue figures with the freight revenues of SRT, it is possible to grasp on a monetary base to which extent the procured freight cars are contributing to railway freight transportation, and by contrasting these cumulative transportation revenue figures with transportation revenues, it is possible to grasp to which extent the procured freight cars are contributing to railway transportation in Thailand.[18]

[15] In order to grasp the transportation results of a particular freight car, one can calculate the transportation results generated by that freight car alone. The transportation results of freight cars can be expressed either as freight (unit: ton) or freight kilos (unit: ton kilo). In the case of SRT, time series statistics about the tons and ton kilos transported by the freight cars procured through each project could not be obtained, so that the method described above was employed instead.

[16] Total number of freight cars excluding oil, cement, and container freight cars

[17] Since 4-wheel freight cars have a carrying capacity half that of 8-wheel freight cars, the figure was divided in half and added.

[18] The caboose cars procured through the Project Ⅰ are classified as freight cars, but their impact is not calculated here.

Let us examine the transportation revenues generated by the freight cars procured through the Project I and Project IV. The 60 oil tank cars (the lot corresponding to the original plan) procured through the Project I have generated a cumulative total of 299.7 million Bahts in petrochemical transportation revenues since 1985, when they entered service. Similarly, the procured 158 box cars generated 496.7 million Bahts, the 60 oil tank cars (additional procurement lot) 236.1 million Bahts, and the 40 container cars (additional procurement lot) 80.7 million Bahts in transportation revenues.

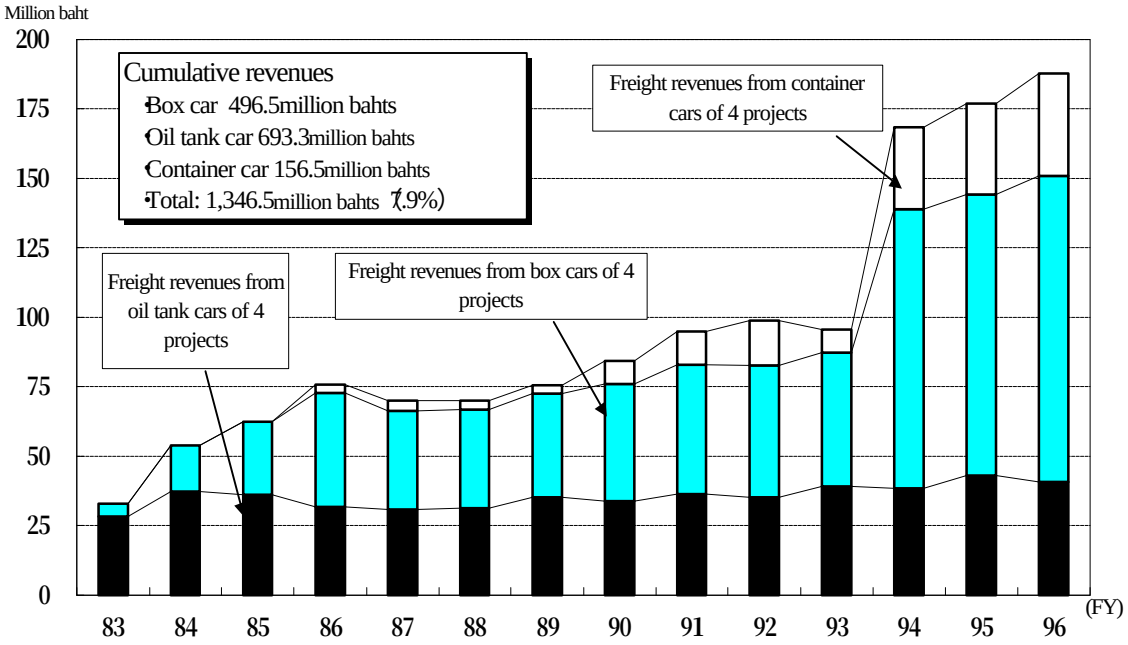
The 180 oil tank cars procured through the Project IV generated a cumulative total of 182.4 million Bahts counting since fiscal 1994 (as they entered service in September 1993), while the 132 container cars generated 75.8 million Bahts in transportation revenues.

Looked at Figure6 by product category, the freight cars procured through the two projects generated 4,967 million Bahts in transportation revenues for agricultural and other products, container cars 156.5 million Bahts in transportation revenues, and petrochemicals 693.3 million Bahts, for a total of 1,346 million Bahts in transportation revenues (equivalent to 7.9% of SRT freight revenues from fiscal 1983) (see Figure 5). This represents 2.4% of all container transport revenues, and 6.3% of petrochemical and LPG transportation revenues.

A look at total transportation volume by product category for SRT shows that petrochemicals account for the largest volume. Moreover, container volume, on a ton-kilo base, has been steadily rising since the second half of the 80's, and in 1996 rose to 9% to become the major freight transportation category of SRT (see Table 15). These two freight categories are representative ones of modern freight transportation for major customers, and represent an additional strategic pillar for SRT.

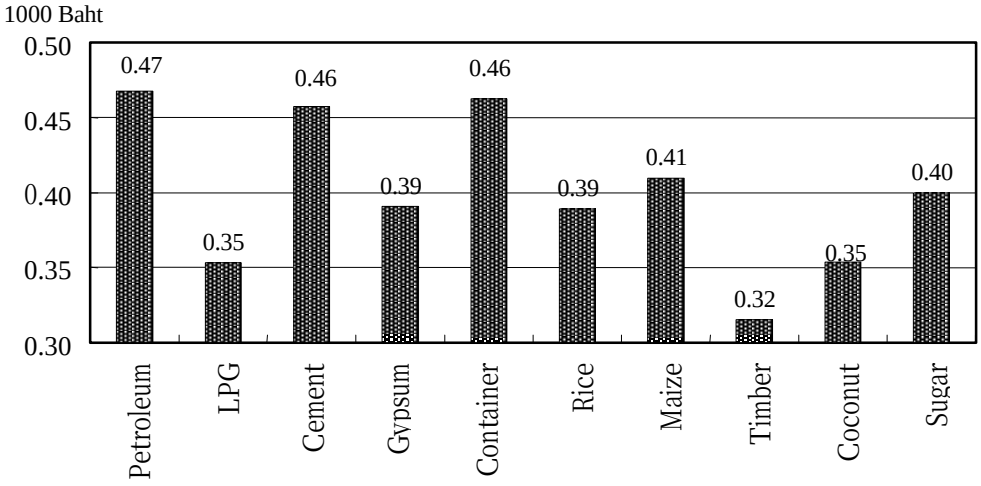
The reason containers and petrochemicals are important freight categories for SRT is that, in addition to the fact that there is customer demand for these categories, they command high unit transportation prices, and are thus profitable areas (see Figure 6). The cars procured through the two projects above, excluding the box cars and caboose cars procured through the Project I, serve for the transportation of containers and petrochemical products, and in this sense, the impact of these two projects can be considered to be high.

【Figure 5 Freight Revenues from 4 Projects (by Item)】



Note:The cumulative revenues in the figure above correspond to freight revenues from the four projects.
The percentage in parentheses indicates 'cumulative freight revenues from four projects/ Total cumulative freight revenues of SRT from FY1983'.

【Figure 6 Freight Charges by Product】



(Units: 1000 Baht/1 ton kg, actual results in 1996)

【Table 16 Total SRT Freight Transportation Volume and Transportation Revenues by Product Category】

(Transportation volume unit: million ton kilo Transportation revenues unit: million Bahts)

Freight transportation volume by product					
Product	1980	1985	1990	1995	1996
Petrochemicals, LPG	674 (32.3%)	1,160 (48.3%)	1,397 (48.5%)	1,317 (46.7%)	1,465 (47.5%)
Container	-	-	150 (5.2%)	168 (6.0%)	273 (8.9%)
Cement etc.	419 (20.1%)	280 (11.7%)	600 (20.8%)	711 (25.2%)	752 (24.4%)
Agricultural products	833 (40.0%)	902 (37.6%)	611 (21.2%)	501 (17.8%)	475 (15.4%)
Others	160 (7.7%)	58 (2.4%)	124 (3.7%)	122 (4.3%)	118 (3.8%)
Total	2,085(100.0%)	2,399(100.0%)	2,881(100.0%)	2,819(100.0%)	3,082(100.0%)
Freight transportation revenues by product					
Product	1980	1985	1990	1995	1996
Petrochemicals, LPG	218 (39.6%)	463 (51.9%)	513 (50.4%)	583 (47.7%)	651 (47.7%)
Container	-	-	54 (5.3%)	93 (7.6%)	126 (9.5%)
Cement etc.	105 (19.1%)	113 (12.7%)	226 (22.3%)	310 (25.4%)	338 (25.3%)
Agricultural products	182 (33.0%)	290 (32.5%)	186 (18.3%)	190 (15.6%)	184 (13.8%)
Others	45 (8.2%)	25 (2.9%)	38 (3.7%)	45 (3.7%)	36 (2.7%)
Total	551(100.0%)	891(100.0%)	1,017(100.0%)	1,121(100.0%)	1,335(100.0%)

Note: Main products only (covers approximately 80% in terms of ton kilos)
The percentages in parentheses in the table above are percentages against total amounts.

(5) Summary of effects and impacts of four projects

In summary of the above, the passenger and freight transportation revenues generated by the railway cars (passenger cars and freight cars) procured through the four projects amounted to a cumulative total of 3,474.5 million Bahts, which corresponds to approximately 7.6% of the total railway revenues of SRT from 1983. This cumulative total includes 2,127.9 million Bahts in passenger revenues and 1,346.5 million Bahts in freight revenues (see Table 16). Moreover, in addition to the above, this rolling stock also accounts for 24.6% of student and worker commuter transportation revenues.

A look at the results by each project shows that the Project Ⅰ generated a cumulative total of 1,636.5 million Bahts in passenger and freight revenues (corresponding to 3.6% of all transportation revenues from fiscal 1983). The Project Ⅱ generated 910.4 million Bahts in passenger revenue (corresponding to 2.8% of all transportation revenues from 1988), while the Project Ⅲ generated 669.3 million Bahts in passenger revenues (corresponding to 2.5% of all transportation revenues from 1990). The Project Ⅳ generated 258.3 million Bahts in freight revenues (corresponding to 2.1% of all transportation revenues from 1994).

【Table 17 Summary of Effects and Impacts of 4 Projects】

																Cumulative transportation revenues
		1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	(1983~)
Total of 4 projects		33.0	53.9	62.2	75.8	108.9	167.6	188.5	261.9	311.3	388.4	395.7	464.6	463.5	499.2	3,474.5
	Total passenger revenues	-	-	-	-	38.8	97.6	113.1	117.6	216.5	89.7	300.3	296.2	286.7	311.4	2,127.9
	Total freight revenues	3.0	53.9	62.2	75.8	70.1	70.0	75.5	84.2	94.8	98.7	95.4	168.3	176.8	187.8	1,346.5
	TVII-1 (Total)	33.0	53.9	62.2	75.8	108.9	106.0	117.1	125.0	144.6	165.3	164.4	158.4	156.9	164.9	1,636.5
	TVII-1 (Freight)	33.0	53.9	62.2	75.8	70.1	70.0	75.5	84.2	94.8	98.7	95.4	90.3	91.0	93.3	1,088.3
	TVII-1 (Passenger)	-	-	-	-	38.8	36.0	41.7	40.8	49.8	66.6	69.0	68.1	65.9	71.6	548.3
	TIX-9	-	-	-	-	-	61.7	71.4	73.5	89.6	119.9	124.3	122.6	118.7	128.9	910.4
	TXII-1	-	-	-	-	-	-	-	63.3	77.1	103.2	107.0	105.5	102.2	111.0	669.3
	TXVI-5	-	-	-	-	-	-	-	-	-	-	-	78.1	85.7	94.4	258.3
Total passenger revenues from the SRT		1,533.7	1,565.2	1,488.7	1,610.7	1,546.5	1,654.5	1,801.0	1,975.2	2,244.0	2,624.1	2,718.3	2,681.4	2,587.3	2,562.0	28,592.3
Total freight revenues from the SRT		967.8	1,015.8	1,061.9	995.6	990.2	1,005.1	1,106.1	1,229.5	1,324.2	1,311.8	1,364.5	1,420.3	1,525.4	1,626.3	16,944.4
Total transportation revenues from the SRT		2,501.5	2,581.0	2,550.6	2,606.2	2,536.6	2,659.5	2,907.1	3,204.7	3,568.2	3,935.8	4,082.8	4,101.7	4,112.7	4,188.3	45,536.7

Bangsue depot Periodical Inspection Scenery
Light inspection is conducted in front lines, and more precise inspection conducted in profound lines.
Railcars in this photo are the same type as ones procured by Project for State Railway of Thailand

Scenery of Chiang Mai Station