

China

“Fujian Province Zhang Quan Railway Construction Project”

Project Summary

Borrower	Ministry of Finance, Government of P.R.C.
Executing Agency	General Corp. of Zhang Quan Railway Development, Fujian Province
Exchange of Notes	August 1993
Date of Loan Agreement	August 1993
Final Disbursement Date	September 1998
Loan Amount	¥6,720 million
Loan Disbursed Amount	¥6,711 million
Procurement Conditions	General Untied
Loan Conditions	Interest Rate: 2.6% Repayment Period: 30 years (10 years for grace period)

<Reference>

(1) Currency: Yuan (RMB)

(2) Exchange Rate: (IFS annual average market rate)

Year	1991	1992	1993	1994	1995	1996	1997	1998
Yuan/US\$	5.3234	5.5146	5.7620	8.6187	8.3514	8.3142	8.2898	8.2778
Yen/US\$	134.71	126.65	111.20	102.21	94.06	108.78	120.99	119.83
Yen/Yuan	25.31	22.97	19.30	11.86	11.26	13.08	14.60	14.48
CPI ^(Note)	104	110	126	157	183	198	204	202

(Note) 1990=100

(3) Rate at the time of appraisal: 1US\$ = ¥121 1 yuan = ¥20.9

(4) Fiscal Year: January 1 ~ December 31

(5) Abbreviations

- [1] Zhang Quan Corp. “General Corp. of Zhang Quan Railway Development, Fujian Province” (executing agency)
- [2] Quanzhou Corp. “Quanzhou Railway Corporation” (operating agency)
- [3] Regional Corp. “General Corp. of Regional Railway Construction Development”
- [4] At the time of survey February 25, 1999 ~ March 6, 1999 (JBIC Evaluation Mission)

(6) Terminology

- [1] Transport volume (tons or persons)
The volume of freight or number of passengers carried, expressed in tons or persons. The transport volume only shows the volume of freight or number of passengers carried in a purely volumetric form without consideration for distance.
- [2] Transport volume (ton-km or person-km)
The volume of freight or number of passengers carried, expressed as the weight of freight or number of people multiplied by the distance carried. The result gives a more realistic representation of actual transport volume.
- [3] Effective track length
The length of track secured in a yard where a train stops, such that trains passing on the diverged, adjacent line will not be blocked.

- [4] Track capacity
The maximum number of trains that may pass on a given stretch of track in one day.
- [5] Culvert
Tunnel-like structures to allow passage beneath the track. They range from small concrete pipe structures to large reinforced concrete structures. Their applications include drainage pipes, passages for electricity cables and water pipes, and passages for pedestrians and automobiles.
- [6] Lining
The internal concrete lining of a tunnel.
- [7] Gauge
The shortest distance between the tops of the rails. In Japan the gauges used are 1,067MM for conventional tracks and 1,435MM for Super-Express Shinkansen ("bullet") trains. In China 1,435mm is the standard gauge.
- [8] Points
An apparatus where one track diverges from another.
- [9] PC sleeper
An abbreviation for pre-stressed concrete sleeper. A material such as piano wire is embedded in the concrete and placed under tension so that it constantly pulls the concrete together, preventing cracking.

Foreword

This project (Fujian Province Zhang Quan Railway Construction Project) is a region-led infrastructure project in which the provincial government of Fujian and the municipal government of Quanzhou played central roles in its realization.

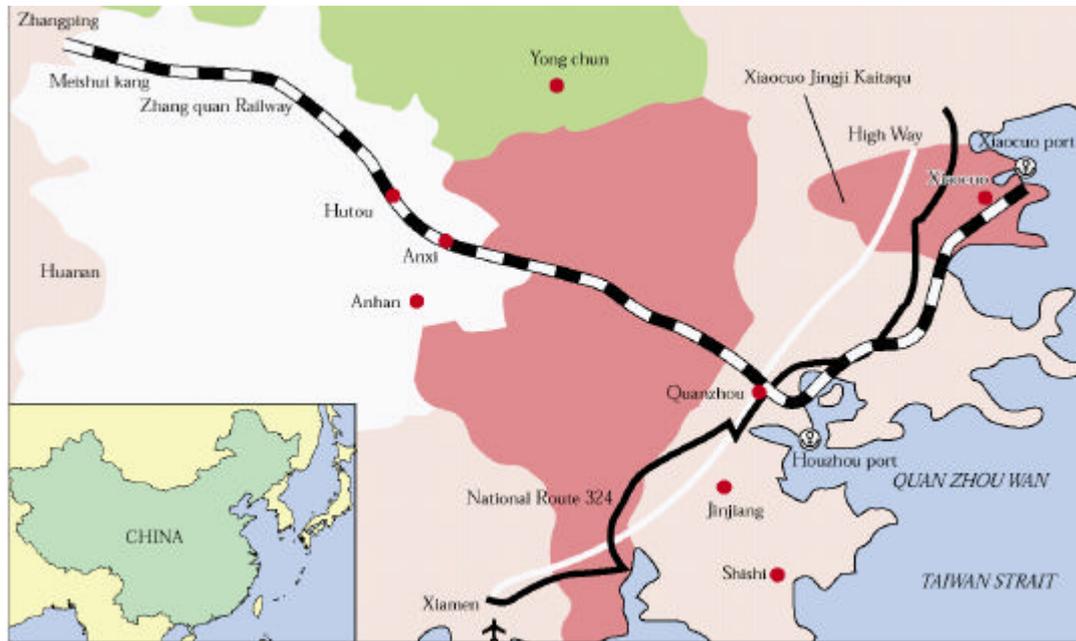
The origin of this project can be traced back to 1958 when tensions across the Straits of Taiwan and shortage of funds led the state (Ministry of Railways) to only open the railway between Zhangping, Meishuikeng and Jiantou. It had stayed so until 1981, and was eventually opened as far as Hutou by 1994.

Then the provincial government of Fujian and the municipal government of Quanzhou to plan the construction of a regional railway from Hutou to Xiaocuo (to Shanyao station at the time of the appraisal) via Quanzhou. After repeated representations to the Central government, they succeeded in having the project included under the third ODA loan. They raised the fund on their own to make up the shortfall and completed the project largely as planned. The Ministry of Railways is providing its full backup for the operation scheme, and the two regional governments have shown remarkable skill in coordinating the bodies involved. Their project executive ability is noteworthy.

Directing an attention to this point in addition to the usual evaluation of the project, JBIC will focus on evaluating the implementation ability of the executing agency, under the theme of "the ability of Chinese local government".

1. Project Summary and Comparison of Original Plan and Actual

1.1 Project Location



1.2 Project Summary and ODA Loan Portion

The volume of freight handled in Quanzhou City, Fujian province¹, China, was increasing in line with the city's economic growth. This project was intended to build a new railway to the city, which had had no rail connection before, in order to meet the demand for freight handling and to ship freight more efficiently, as a means of encouraging further economic development.

The project was designed to construct a total of 145.7km of single-track unelectrified railway line consisting of 128.2km of main line from Hutou to Xiaocuo and two branch lines, one of 10.5km from Xiaocuo to Xiaocuo Port and one of 7.0km from Quanzhou to Houzhu Port.

The ODA loan covered the entire foreign currency portion of the project.

1.3 Background (at the time of appraisal)

1.3.1 Necessity of the Project

Quanzhou ranks with Fuzhou and Xiamen as one of the cities in Fujian Province achieving the steadiest development. Its freight handling volume reached seven million tons in 1991. However, the lack of a railway in the Quanzhou area meant that there was no alternative but to use trucks to carry approximately 3.5 million tons of freight as far as the nearest station at Xiamen for long-distance overland transportation. As a result there often was severe congestion on the approximately 100km of non-highways between Quanzhou and Xiamen, and the need for a rail link to carry freight directly from the Quanzhou coastal area to the interior had become urgent.

Around 1990 Fujian province and Quanzhou foresaw steady economic progress at the level shown in Table 1 continuing under a free and open economy. This led Quanzhou to draw up improvement plans for Xiaocuo and Houzhu Ports, that involved the construction of branch lines under this project (Table 2). The municipality predicted an annual growth rate of 6% in freight handling volume, building on the recorded volume for 1991, as shown in Table 3.

¹ There are three categories of cities in China, as follows:

- [1] Municipalities Cities at the same level as Provinces. There are only four in this category: Beijing, Shanghai, Tianjin and Chongqing.
- [2] Regional cities Central urban areas with permanent non-farming populations of 200,000 or more. They are under the jurisdiction of Provinces and hold jurisdiction over district cities. This class includes Quanzhou, Fuzhou and Xiamen.
- [3] District cities Cities at the district level with permanent non-farming populations of 60,000-200,000. Shishi, Jinjiang and Nan'an are in this class.

Table 1 Comparison of Year-on-year GNP Growth Rates

	1986	1987	1988	1989	1990	1991	1992	Average growth rate(%)
Quanzhou (100 million yuan)	31.65	36.71	51.40	57.49	65.93	83.96	133.89	
Year-on-year growth rate (%)		16%	40%	12%	15%	27%	59%	28%
Fujian Province (100 million yuan)	224.01	280.70	385.78	461.46	528.64	630.27	795.18	
Year-on-year growth rate (%)		25%	37%	20%	15%	19%	26%	24%
China (100 million yuan)	10,201.4	11,954.5	14,922.3	16,917.8	18,598.4	21,662.5	26,651.9	
Year-on-year growth rate (%)		17%	25%	13%	10%	16%	23%	17%

(Source) Prepared from appraisal materials

Table 2 Berth Improvement Plan of Houzhu Port and Xiaocuo Port

	Houzhu Port			Xiaocuo Port		
Under operation	Foodstuff berths	5,000 tons	1	Crude oil berth	100,000 tons	1
	Miscellaneous cargo berth	5,000 tons	1	Miscellaneous cargo berth	10,000 tons	1
	Product oil berth	3,000 tons	1			
	Miscellaneous cargo berth	3,000 tons	1			
	Miscellaneous cargo berth	1,000 tons	1			
	Miscellaneous cargo berth	500 tons	2			
Under planning	Miscellaneous cargo berth	5,000 tons	2	Container berth	50,000 tons	1
				Miscellaneous cargo berth	10,000 tons	1
Annual handling capacity at the time of construction completion	6,030,000 tons			1,556,000 tons		

(Source) Prepared from appraisal materials

Table 3 Actual (1991) and Projection (1992~) of Cargo Handling Volume in Quanzhou City

	(Unit: 1,000 tons)						
	1991	1992	1995	1996	1997	1998	2000
Annual handling volume	7,000	7,420	8,837	9,368	9,930	10,525	11,826
Via Xiamen	3,500	3,745	4,588	180	197	209	240
This project portion	-	-	-	4,729	5,056	5,411	6,195

(Source) Prepared from appraisal materials

1.3.2 History

The origin of this project shall be traced back to 1958 when tension across the Straits of Taiwan and shortage of funds led the state (the Ministry of Railways) to open the railway only between Zhangping, Meishuikeng and Jiantou. It had stayed so until 1981, and was eventually opened as far as Hutou by 1994. This situation led the provincial government of Fujian and the municipal government of Quanzhou to plan the construction of a regional railway from Hutou to Xiaocuo (Shanyao station at the time of the appraisal) via Quanzhou. After repeated representations to the Central government, they succeeded in having the project included under the third ODA loan.

When this project is completed it will have a longer rail route of 263km (including branch lines) which comes from Zhangping in the west, and crosses the mountains of Fujian Provinces to reach the Straits of Taiwan (see Table 4). It is expected to make a large contribution to the

economic development of the Fujian Province, as well as to expand trade with Taiwan.

1988	Apr.	Completion of Feasibility Study (the 4th Survey of Design Institute, Ministry of Railways)
	May	Establishment of General Corp. of Zhang Quan Railway Development, Fujian Province
1990	Oct.	Completion of environmental impact assessment report on this project
1992	May	Final approval on project by Central government
	Jul.	Start of civil works (land acquisition etc.)
	Nov.	Official request for FY1993 ODA loan
1993	Feb.	China/Japan governmental consultation
	Mar. ~ Apr.	JBIC Appraisal Mission
	Jun.	Prior Notification
	Aug.	Exchange of Notes
	Aug.	Loan Agreement signing
1994	Aug.	Design modification and additional budget for local currency portion decided - Effective extension of railway tracks: 450m (650m in future) 650m (850m in future) - Locomotive: Steam locomotive Diesel locomotive DF4 - Local currency funds: 55.629 yuan 112,885 yuan
1996	May	Start of trial operation between Hutou and Quanzhou (cargo)
1997	Dec.	Start of trial operation between Quanzhou and Xiaocuo (cargo)
	Dec.	Establishment of Quanzhou Railway Corporation
1998	Mar.	Start of trial operation between Quanzhou and Jingu (passenger)
	Jul.	Implementation of pre-inspection for 128.02km main line by Ministry of Railways, provincial government and municipal government
	Dec.	Start of cargo/passenger operation

Table 4 Zhang Quan Railway Construction Plan

		Section	Extension distance	Operation starting year
Under jurisdiction of Ministry of Railways	Main line	Zhangping Meishuikeng	19.6km	1958 (a part of Ying-Xia Railway)
	Main line	Meishuikeng Dashen	12.25km	1959
	Main line	Dashen Fude	23.10km	1970
	Main line	Fude Jiandou	22.04km	1981
	Main line	Jiandou Changji	5.52km	1991
	Main line	Changji Hutou	13.74km	1994
	Branch line	Changji Xiayang	23.25km	1991
	Sub-total			119.50km
Main project portion	Main line	Hutou Quanzhou	87.04km	1998 (Actual)
	Main line	Quanzhou Xiaocuo	40.31km	1998 (Actual)
	Branch line	Xiaocuo Xiaocuo Port	9.31km	1999 (Plan)
	Branch line	Quanzhou Houzhu Port	6.32km	2000 (Plan)
	Sub-total			142.98km
Sub-total			262.48km	

(Source) Prepared from appraisal materials

1.4 Comparison of Original Plan and Actual

1.4.1 Project Scope

Project Scope	Plan	Actual	Difference
Main line			
Hutou ~ Xiaocuo	128.2km	127.35km	-0.85km
No. of stations	9	9 stations	-
Tunnel (length)	6,628m	6,617m	-11m
Tunnel (No.)	9	9	-
Culvert (length)	8,722m	10,874m	2,152m
Culvert (No.)	455	552	97
Bridge (length)	6,185m	6,478m	293m
Bridge (No.)	63	61	-2
Rolling stocks-Passenger train	42	60	18
-Freight train	53	53	-
Locomotive	0	10	10
Branch line			
Xiaocuo ~ Xiaocuo Port	10.5km	9.31km	Under construction
Quanzhou ~ Houzhu Port	7.0km	6.32km	Land acquisition procedures under way

1.4.2 Implementation Schedule (excluding branch line portion)

		1992				1993				1994				1995				1996				1997				1998				Note
		I	II	III	IV																									
Land acquisition	Plan																													24 months delay
	Actual																													
Railway bed	Plan																													9 months delay
	Actual																													
Bridges, Culvert	Plan																													9 months delay
	Actual																													
Tunnel	Plan																													3 months delay
	Actual																													
Rail laying	Plan																													3 months delay
	Actual																													
Signal and communication system	Plan																													19 months delay
	Actual																													
Power supply system	Plan																													15 months delay
	Actual																													
Buildings	Plan																													21 months delay
	Actual																													
Other facilities	Plan																													Start of operaiton 26 months delay
	Actual																													

Note 1) Branch line (Xiaocuo Port) is planned to be completed in October 1999.

Note 2) Branch line (Houzhu Port) is planned to start construction within 1999 and to be completed within 2000.

1.4.3 Project Cost

	At the time of appraisal (A)		Actual estimate (B)		Difference (B-A)	
	Total		Total		Total	
	Foreign currency (¥ million)	Local currency (10,000 yuan)	Foreign currency (¥ million)	Local currency (10,000 yuan)	Foreign currency (¥ million)	Local currency (10,000 yuan)
1 Land acquisition cost (including compensation for relocated residents)	0.0	7,386.0	0.0	11,709.0	0.0	4,323.0
Evacuation cost	0.0	953.2	0.0	1,070.0	0.0	116.8
2 Railway bed	111.7	11,390.2	114.9	21,606.0	3.2	10,215.8
3 Bridge/Culvert	672.5	3,840.2	731.2	11,329.0	58.7	7,488.8
4 Tunnel	469.4	3,100.1	486.1	8,955.0	16.7	5,854.9
5 Rail laying	2,158.1	2,122.7	2,239.2	14,314.0	81.1	12,191.3
6 Communication system	96.7	1,227.6	70.0	2,728.0	-26.7	1,500.4
7 Power supply system	32.6	519.9	59.4	1,104.0	26.8	584.1
8 Buildings	610.3	1,328.9	621.6	3,594.0	11.3	2,265.1
9 Operational facilities	0.0	1,004.6	0.0	4,830.0	0.0	3,825.4
10 Rolling stocks	1,833.5	660.0	2,003.2	0.0	169.7	-660.0
11 Construction machinery etc.	335.9	0.0	385.5	0.0	49.6	0.0
12 Others	0.0	12,516.3	0.0	30,426.0	0.0	17,909.7
Sub-total	6,320.7	46,049.7	6,711.0	111,665.0	390.3	65,615.3
13 Escalation	267.9	4,986.0	0.0	8,467.0	267.9	3,481.0
14 Contingency	131.7	4,593.2	0.0	273.0	131.7	4,320.2
Grand total	6,720.3	55,628.9	6,711.0	120,405.0	9.3	64,776.1

Breakdown of actual estimate:

For 1999 portion of branch line (Xiaocuo Port) and 1999-2000 portion of branch line (Houzhu Port), budgetary amount allocated to the executing agency are used.

	Main line		Branch line (Xiaocuo Port)		Branch line (Houzhu Port)	
	Total		Total		Total	
	Foreign currency (¥ million)	Local currency (10,000 yuan)	Foreign currency (¥ million)	Local currency (10,000 yuan)	Foreign currency (¥ million)	Local currency (10,000 yuan)
1 Land acquisition cost (including compensation for relocated residents)	0.0	11,133.0	0.0	373.0	0.0	203.0
Evacuation cost	0.0	1,000.0	0.0	50.0	0.0	20.0
2 Railway bed	111.6	19,021.0	3.4	1,224.0	0.0	1,361.0
3 Bridge/Culvert	672.6	10,506.0	58.6	459.0	0.0	364.0
4 Tunnel	486.1	8,300.0	0.0	0.0	0.0	655.0
5 Rail laying	2,158.0	13,109.0	81.2	455.0	0.0	750.0
6 Communication system	70.0	2,575.0	0.0	120.0	0.0	33.0
7 Power supply system	59.4	1,024.0	0.0	80.0	0.0	0.0
8 Buildings	610.3	3,360.0	11.3	173.0	0.0	61.0
9 Operational facilities	0.0	4,750.0	0.0	80.0	0.0	0.0
10 Rolling stocks	2,003.2	0.0	0.0	0.0	0.0	0.0
11 Construction machinery etc.	385.5	0.0	0.0	0.0	0.0	0.0
12 Others	0.0	30,221.0	0.0	120.0	0.0	85.0
Sub-total	6,556.6	104,999.0	154.4	3,134.0	0.0	3,532.0
13 Escalation	0.0	8,000.0	0.0	321.0	0.0	146.0
14 Contingency	0.0	0.0	0.0	151.0	0.0	122.0
Grand total	6,556.6	112,999.0	154.4	3,606.0	0.0	3,800.0

* Exchange rate: At the time of appraisal: 1 yuan = ¥20.9
Actual (average at the time of loan disbursement) : 1 yuan = ¥12.98

2. Analysis and Evaluation

2.1 Evaluation on Project Implementation

2.3.1 Project Scope

The main line, from Hutou to Xiaocuo via Quanzhou, was constructed largely according to plan.

The branch lines have not yet been completed, as all facilities are expected to be completed by 2000, which is largely as planned.

Under the plan the locomotives were to be 33 steam locomotives provided by the Ministry of Railways, however, because the steam engines in China became out of production, problems with maintenance in the future was considered. As a result, ten diesel locomotives were added to the plan and purchased with the loan funds. The plan also called for the purchase of 42 passenger carriages, but further 18 carriages were added to the purchase. These changes can be evaluated all appropriate steps involving slight changes to the L/A.

Although it falls outside the project scope, the track equipment beyond Hutou, which adjoins this project, had become superannuated in places, causing safety and operational problems. Therefore the Shanghai Railway Office Fuzhou Sub-office of the Ministry of Railways worked on a series of repairs and improvements, including bridge reinforcement, widening of ventilation shafts and installation of ventilation fans in tunnels, installation of new lighting, track reinforcement and rail replacement. These works cost a total of 30 million Yuan, all of which was covered by the Ministry of Railways.

2.1.2 Implementation Schedule

The plan called for the line to start its operation in October 1996, however, it formally began operating in December 1998, over two years late. It should be noted, however, that parts of the line began temporary operation from 1996 and have been producing some profits since then. The branch lines have not yet been completed, but the one between Xiaocuo and its port is expected to go into service from October 1999, followed by the other between Quanzhou and Houzhu Port within 2000.

The main reason for the delay, as will be mentioned later, is that because the local currency cost increased, it took extra time to make the necessary funding arrangements. The improvements to equipment on the linking line to the west of Hutou, and the time required for coordination with the Ministry of Railways concerning new operation routes and the numbers of trains on them, appear to have had a significant time impact.

2.1.3 Project Cost

The foreign currency portion was funded largely as planned, although some additional purchases of locomotives and carriages were made, which were necessary additions for the sake of future operation.

The local currency cost more than doubled compared to the plan, with a cost overrun of

approximately ¥9.4 billion at 1998 exchange rates. However, the cost largely matched the revised plan, which was the product of major alterations made a year after the L/A was signed. The initial plan cost was prepared by the executing agency in 1987 and then approved by Fujian Province and the central government, but six years passed before the JBIC appraisal in 1993. In that interval prices rose by a large margin, and it is natural that a revision was required.

However, it was necessary to obtain the approval of Fujian Province and the central government again, and that was not received until 1994, after the appraisal, causing a further delay to the project.

Period	Original plan (1993)	Modified plan (1994)	Actual estimate (1998)
Local currency fund	556,290,000 yuan	1,128,850,000 yuan	1,204,050,000 yuan

While there were some procedural problems, the efforts of the executing agency in obtaining nearly 560 million Yuan of additional funding (ultimately rising to 650 million) were commendable.

2.1.4 Implementation Scheme

Executing agency	General Corp. of Zhang Quan Railway Development, Fujian Province
Construction supervision	General Corp. of Zhang Quan Railway Development, Fujian Province

(1) Executing Agency

General Corp. of Zhang Quan Railway Development, Fujian Province (referred to below as the “Zhang Quan Corp.”) was established in May 1988 with investment from the Fujian provincial government, the Quanzhou municipal government and the Ministry of Railways to serve as the executing agency for this project. The plan was for the Zhang Quan Corp. to become the operating agency without further change, but in December 1997 the Quanzhou Railway Corporation (“the Quanzhou Corp.”) was founded to serve as the operating agency. The Zhang Quan Corp. still exists, but a majority of its staff have been transferred to the Quanzhou Corp.

The executing agency had to coordinate with Fujian provincial government, the Quanzhou municipal government and the Ministry of Railways and a number of other related agencies and arrange the procurement of a very large amount of local currency funding. Although there were delays in construction, the project can now be expected to reach completion largely as planned, and the implementation ability of the executing agency can be regarded as adequate.

Table 5 Changes of Number of Employees for Zhang Quan Corp.

End of FY	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
No. of employees	18	23	30	45	59	67	80	104	116	116	25

(Note) 108 temporary staff (at the time of peak) have been employed since 1996 for the trial operation in addition to the above.

(Source) Prepared from interviews with Zhang Quan Corp.

(2) The status of design and construction

Overall the design and construction were carried out with due regard for the principles of railway construction and there were no significant problems. The main track from Hutou to Xiaocuo via Quanzhou was designed as a grade three line. The portion between Quanzhou and Xiaocuo will become part of the Fuzhou - Quanzhou - Xiamen line in the future, and as such the possibility of designing it as a grade two line was considered, but the final decision was to design it as a grade three line. However, upgrading the line later, while it is in service, would take large amounts of time and money, so longitudinal gradients and radii of curvature were designed to grade two standards (with a maximum design speed of 100km/h). All the stations between Quanzhou and Xiaocuo are above ground, so if it becomes necessary later to extend the effective length of the pass-by track equipment, the extension works would be relatively easy. Therefore the grade three standard effective length of 650m was used. These design criteria were appropriate, as they cut down initial investment while giving consideration to future railway construction plans.

For reference, Tables 6 and 7 compare track grades in China with those of the former Japan National Railways. The Chinese grades set longer track effective lengths and larger curve radii than those used by the former Japan National Railway, but there is little difference overall.

Table 6 Track Grades in China

	Grade one line	Grade two line	Grade three line
Characteristics of line section	Main line	Connection line of main line	Local line
Transport volume 10,000 tons/year	1500 or more	750 1500	Less than 750
Full speed km/h	120	100	80
Track effective lengths	1050/850/750/650		850/750/650/550
Smallest curve radii m			
General section	1000	800	600
Difficult section	400	350	300
Most steep incline ‰			
General section	6	12	15
Difficult section	12	15	20
Curvature radii of intermediate station m			
General section	1000	800	600
Difficult section	600	600	500

(Source) Prepared from interviews with Zhang Quan Corp.

Table 7 Track Grades in Japan (the former Japan National Railway)

	Grade one line	Grade two line	Grade three line	Grade four line
Characteristics of line section	Depend on the number of tractions in the line section regardless of track grades			
Transport volume 10,000 tons/year	2000 or more	1000 2000	500 1000	200 500
Full speed km/h	120	110 120	105	95
Track effective lengths	Depend on the number of tractions in the line section regardless of track grades			
Smallest curve radii m				
General section	800	600	400	300
Difficult section	400	300	250	200
Most steep incline %				
General section	10	10	20	25
Difficult section		25	25	35
Curvature radii of intermediate station m				
General section	800	600	500	400
Difficult section	500	500	400	300

(Source) Prepared from interviews with people concerned with the former Japan National Railway

[1] Railway bed construction

Cutting and embankment sides are protected with vegetation, stone facing, concrete facing or lattice, as appropriate for local conditions. In particular, on long cuttings there are drainage channels around 1m wide built along the outer edge of the cut face, so that surface runoff from the mountainside cannot flow onto the cut face. The construction of earthworks is thoroughly supervised.

Some crossing paths for local residents have been made in cutting slopes, but none were large enough to damage the slopes, and they do not appear to pose any significant problem.

[2] Bridges and culverts

The bridges use PC concrete beams for long spans and steel-reinforced concrete for short spans. Culvert structures are used for even shorter spans. The beams were of standardized types and were precast at a bridge factory adjacent to Hutou Station before being lifted into place on site.

Inspections of supports are the most important aspect of bridge maintenance, but the inspections are dangerous operations which must take place in high or cramped places. Adequate attention is given to safety in inspections, as each support has an inspection platform around it with an access ladder and a guard rails.

Compared to the plan, the total length of bridges rose to approximately 300m, while the number of bridges was cut by two. These changes were appropriate responses to local conditions, as detailed investigations found that some small bridges could be replaced by culvert constructions.

The number and length of culverts increased due to additional passages and water channels, which were added to increase convenience for local communities in response to their demands. It appears that the wishes of local people have been given due consideration.

[3] Tunnels

The nine tunnels on the line were of single-track size in cross section. The openings and linings were finished to good standards. Efforts were made to minimize tunnel lengths in order to save construction costs. Retaining walls and other structures were built around tunnel entrances to prevent landslides while reducing tunnel lengths. Inspection platforms have been constructed to allow safe inspections of high places at the tops of retaining walls around tunnel entrances, and due consideration is given to maintenance work in tunnels. However, some doubts have recently been expressed regarding the lifespan of concrete used in tunnel linings, which indicates the necessity of a regular inspection and maintenance system.

[4] Tracks

The standard track gauge is 1,435mm and the train weight per axle is 22 tons. The tracks are designed to meet this standard, with a weight of 50kg/m and PC concrete sleepers. Wooden sleepers are used at points. Anti-derailment rails are installed on high or curved bridges, but these areas also use wooden sleepers. Ballast is crushed rock with a depth of 35cm under the sleepers. Junction devices were developed by the Chinese Ministry of Railways.

The PC concrete sleepers were developed by the Ministry of Railways. The PC cables protrude from the end of the sleepers, which are not finished to smooth ends as they are in Japan (see Photo 3), but these sleepers are widely used in China with no problems.

Ballast packing, sleeper arrangement and junction of junction devices were of high quality and posed no problems.

[5] Stations

Nine new stations were constructed, as planned. Xiaocuo Station was named Shanyao Station in the plan, but the name was later changed to Xiaocuo Station.

The station buildings are constructed in areas relatively isolated from the town centers and most have ample room for development around them. In particular, Anxi Station (Anxi Pref., population 1.03 million), Nanan Station (Nanan City, population 1.47 million), Huian Station (Huian Pref., population 1.26 million) have large station buildings to allow for future expansion of demand. They are equipped with spacious approach roads. Quanzhou Station (Licheng District, population 630,000) is now operating from temporary buildings, but a new building befitting the starting station of the line is to be built soon.

[6] Rolling stock (diesel locomotives, passenger carriages, freight cars)

International competitive tenders were held for all rolling stock, with Chinese companies selected. These companies had adequate experience in the construction of rolling stock, and there were no technical problems. Labor costs make up a high proportion of rolling stock manufacture, and Chinese manufacturers had an advantage in price competition, which has meant that there have been almost no cases of such orders for railways projects in China going

to foreign companies.

(3) Environmental impact

The environmental impact assessment report for the project was prepared by the Ministry of Railways Scientific Research Institute and the Ministry of Railways the 4th Survey of Design Institute Environmental Impact Assessment Center, and was approved by the National Environmental Protection Office in January 1991.

To counteract noise and vibration, schools and hospitals within 30m of the tracks were relocated, and in scenic areas, areas of greenery were planted for 30m around the track. In urban areas, noise measurements are to be taken in residential zones within 30m of the track after the completion of the project. According to the reports of the Zhang Quan Corp., noise investigations have been conducted in residential areas in the presence of staff from the National Environmental Protection Office and have revealed no major problems. No noise measurements are being taken now. The Corporation explained that there had been no strong complaints from residents along the tracks between the start of operation and the present.

The plan considered countermeasures against particulate emissions from locomotives, but the change from steam to diesel locomotives has reduced the environmental impact. The storage facilities for coal in transit have been located in Quanzhou West Station and Jingu Station, which are away from the built-up areas, as one of the measures taken to reduce the problem posed by coal dust. The marshalling yard for rolling stock is at Quanzhou Station and it is equipped with water treatment facilities to treat oil-contaminated water.

Overall the route of the line for this project was chosen at the planning stage to avoid built-up areas, which means that the stations are not necessarily convenient for passengers, but the choice has served to diminish environmental problems.

(4) Relocation of residents

The residents affected by the implementation of this project received compensation under People's Republic of China National Land Management Act. In this case, Zhang Quan Corp. asked the regional governments of each region to conduct compensation negotiations with residents on their behalf.

In principle, monetary compensation is provided for relocation, but the regional governments can help to find places for residents to move to. Some were provided with alternative homes that were prepared for them by the regional government in Huian Pref. During the field survey for this evaluation, we were shown the buildings by Huian prefectural government. They had shops on the first floor and homes on the second and third floors, and were of a very high standard.

For agricultural land, compensation is also monetary, in principle, but the regional governments of each area can make arrangements to give relocated residents priority in allocations of replacement farmland where necessary. In such cases, many farmers want to take the opportunity to move to the cities to take paid jobs, and those that wished to do so were given priority for change of domicile. In China today, change of domicile is restricted and farmers cannot freely move away from the land to seek paid employment in the cities. Therefore this exceptional measure was warmly welcomed by the farmers.

Table 8 Comparison of Original Plan and Actual on Relocation of Resident

	Unit	Plan	Actual	Actual/Plan
Residential land area	m ²	84,300	128,744	1.53
No. of homes relocated	home	589	824	1.40
No. of people relocated	person	3,000	4,132	1.38

Table 9 Actual Results by Region

	Unit	Anxi	Nanan	Licheng	Huian	Total
Area of residential land acquired	m ²	49,052	34,311	30,629	14,752	128,744
No. of homes relocated	household	424	163	162	75	824
No. of people relocated	persons	2,120	868	732	412	4,132
Area of agricultural land acquired	m ²	1,440,273	1,170,000	1,370,993	1,210,226	5,191,492
No. of farmers changing domicile	persons	1,711	1,891	2,341	2,027	7,970

(Note 1) The "number of people relocated" is the number who required relocation to different homes.

(Note 2) The "Number of farmers changing domicile" includes those who received compensation for agricultural land, not just those who were relocated.

(Source) Prepared from interviews with Zhang Quan Corp. regarding Tables 7 and 8.

2.2 Evaluation on Operation and Maintenance

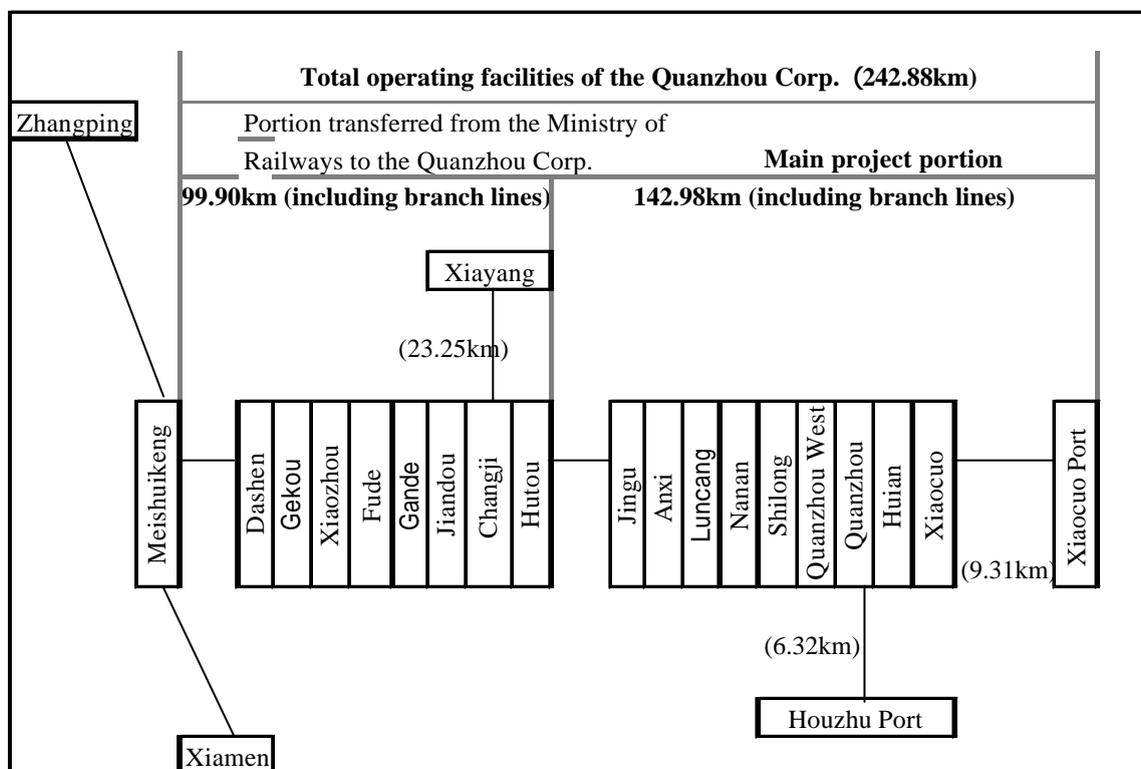
2.2.1 Operational Scheme

(1) Operational base

The plan was for the Zhang Quan Corp. to become the operating agency without further change, but in December 1997 the Quanzhou Corp., Inc. was founded to serve as the operating agency.

When the new corporation was founded, the Ministry of Railways transferred 99.90km of its own track, from Hutou to Meishuikeng (not including Meishuikeng Station) as part of its investment in the new corporation. This investment increased the Quanzhou Corp.'s capital and broadened its revenue base.

Table 10 Operating Facilities of Quanzhou Railway Corporation



(Source) Prepared from interviews with Quanzhou Corp.

Table 11 Capital of Quanzhou Railway Corporation (as of end of December 1998)

Total capital		1.55 billion yuan
Ministry of Railways (58%)		900 million yuan
	Money invested from Ministry of Railways	55 million yuan
	Transferred equipment assets	815 million yuan
	Transferred capital for equipment build-up	30 million yuan
Fujian Province (42%)		650 million yuan
	Money invested from provincial government	600 million yuan
	Money invested from Quanzhou municipal government	50 million yuan

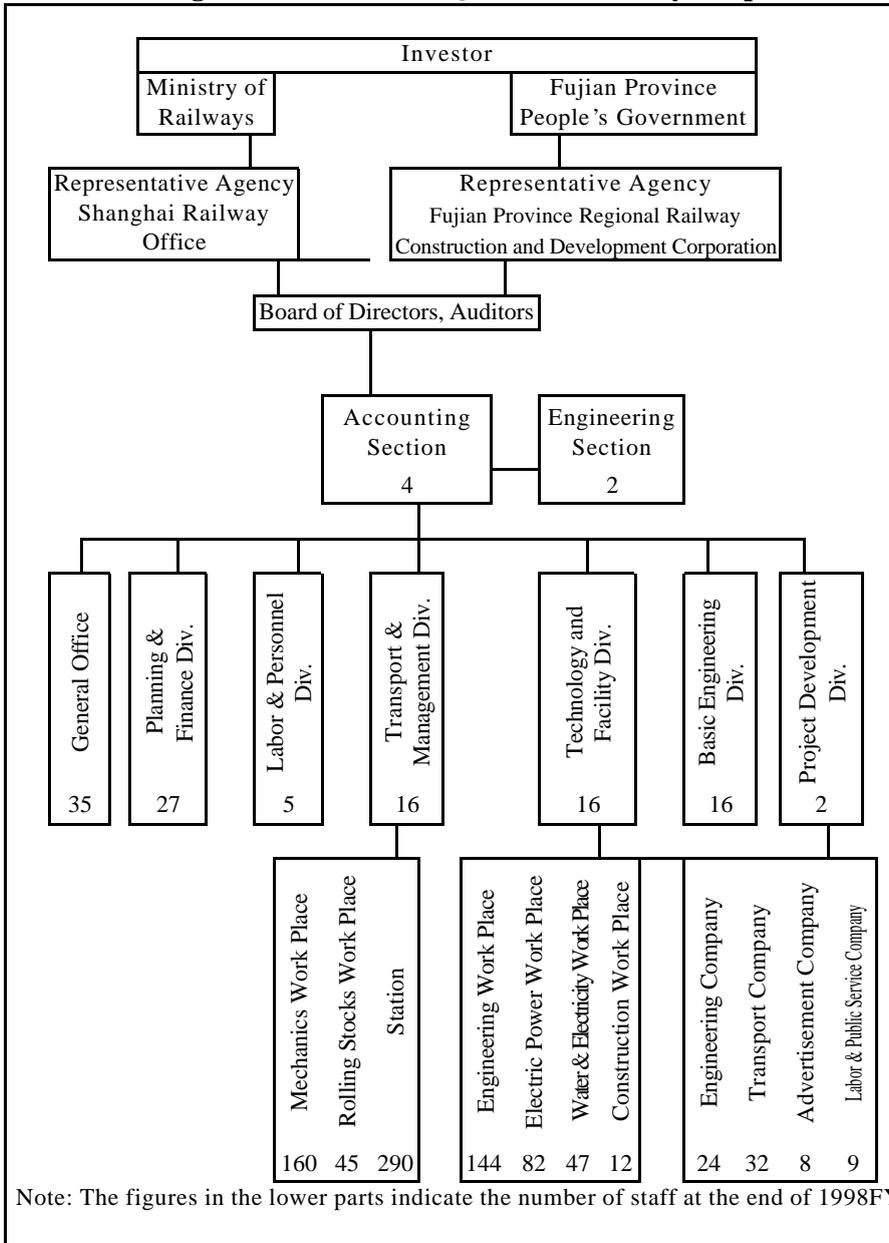
(Source) Prepared from interviews with Quanzhou Corp.

(2) Overview of the organization

The organization of the new corporation is as shown in Table 12.

The board of directors has nine members, of whom 5 are seconded from the Shanghai Railway Office and four are from the Fujian Province Regional Railway Construction and Development Corporation. The chairman of the board of directors is proposed by the Shanghai Railway Office, and each of the Shanghai Railway Office and the Fujian Province Regional Railway Construction and Development Corporation proposes one vice chairman.

Table 12 Organization Chart of Quanzhou Railway Corporation



(Source) Prepared from interviews with Quanzhou Corp.

The Quanzhou Corp.'s staff now number 976, but that number is planned to rise to a final workforce of 1,612. Table 13 compares the Quanzhou Corp. and the Ministry of Railways in terms of the number of staff per operating kilometer. While this is only a simple comparison, it suggests that the Corporation is considerably more efficient than the Ministry of Railways. There are no problems with the technical level of the operation and maintenance, because the vast majority of the Quanzhou Corp.'s staff previously worked in the Ministry of Railways.

Table 13 Comparison of Staff Numbers

	Operating kilometers (A) (km)	Staff numbers (B) (person)	B/A
Ministry of Railways	57,566.30	2,238,000	38.9
Quanzhou Corp. (at present)	244.88	976	4.0
Quanzhou Corp. (plan)	244.88	1,612	6.6

(Source) Prepared from China Traffic Yearbook (1998) and Quanzhou Corp. materials

The Quanzhou Corp. has also established Project Development Division and is working enthusiastically on development into related projects.

Table 14 Contents of Operations for Project Development Division

Name of organization	Content of operations	Earnings in 1998 (10,000 Yuan)
Project Development Division		1,284
Engineering Company	Civil works contracting	235
Transport Company	Cargo handling	999
Advertisement Company	Advertising in carriages	17
Lobar & Public Service Company	Sales in carriages	33

(Source) Prepared from interviews with Quanzhou Corp.

(3) Fujian Province Regional Railway Construction and Development Corporation

In 1993 Fujian provincial government established and fully funded (with 186 million Yuan) the Fujian Province Regional Railway Construction and Development Corporation (referred to below as "the Regional Corp.") as a development investment company to promote regional railway construction in the province. All investment from the provincial government to regional railway companies in the province is delivered through the regional corporation. At present the company has 88 employees, one third of whom were previously employed by the Ministry of Railways.

The provincial government collects a special tax to serve as one of its revenue sources for investment in railway construction (this project and the Heng-Nan Railway). For freight shipped within the province, the government collects 0.01 Yuan per ton-kilometer in addition to normal freight charges. This is called a surtax, and the provincial government has been granted permission by the central government to levy it for a period of ten years from 1st April 1991. Table 15 shows actual and anticipated tax revenues from this surtax.

Table 15 Value of Surtax Collected in Each Financial Year

FY	1991	1992	1993	1994	1995	1996
Surtax (100 million Yuan)	0.62	1.00	1.60	1.64	1.71	1.71

FY	1997	1998	1999	2000	End of Mar. 2000	Total
Surtax (100 million Yuan)	1.64	1.18	1.10	1.10	0.30	13.60

(Source) Prepared from interviews with Regional Corp.

Table 16 lists the project now being implemented by Fujian provincial government.

Table 16 Regional Railway Development Plans for Fujian Province

Section	Length within the province (km)	Total length (km)	Progress	Investors
This Project	242.88	-	Operation started in Dec. 1998	Ministry of Railways, Fujian Province
Heng-Nan Railway	195.6	251	Operation started in Dec. 1998	Ministry of Railways, Fujian Province
Meizhou (Guandong Province) ~ Kanshi (Fujian Province)	48	152	To be completed in 2000	Ministry of Railways, Fujian Province, Guandong Province
Xiamen Jimeiqu ~ Hailunzhen (branch line)	17.3	-	Operation to be started in Dec. 1999	Ministry of Railways, Xiamen
Ganzhou (Jiangxi Province) ~ Longyan (Fujian Province)	166	287	Planned to start construction in 1999	-
Wenzhou (Zhejiang Province) ~ Fuzhou (Fujian Province)	263	360	Under prior investigation	-
Chaozhou (Guandong Province) ~ Zhangzhou (Fujian Province)	152	220	Under consideration	-
Xiamen ~ Fuzhou	275	-	Under consideration	-

(Source) Prepared from interviews with Regional Corp.

2.2.2 Service and Fare/ Charge Systems

(1) Train timetable and number of trains running

Tables 17 and 18 show the numbers of trains running each day and their timetable. At the time of the survey, services had only just started and restrictions on running at full speed were still in place, reducing the number of trains per day and making the timetable very simple to manage.

There did not appear to be any problem with the service timetable, as far as we could see at the time of the survey from riding the special express bound for Wuyishan between Quanzhou and Anxi. That train departed from Quanzhou and arrived at Anxi on time.

The Quanzhou Corp. plans to run 36 return services per day by 2020. In China the upper limits on track capacity in return services per day appear to be 40 for single tracks and 120 for multiple tracks. However, in the section covered by the project the intervals between stations are long, so roughly calculating the line capacity as shown in Table 19 gives the lowest capacity figure as 25 return services per day between Quanzhou and Meishuikeng. This calculation was based on assumptions of average speed as shown in Table 19 and stops at every station. With clever timetable arrangements and investment in equipment such as sidings for trains to pass on long track sections, it should be possible to boost the capacity of the line. Therefore the goal of 36 return services per day appears to be realistic. At that stage transfer of technology from Japan would be effective in assisting the setting of more efficient timetables.

Table 17 Table of Numbers of Services Run

FY	Section	Freight (return)	Passenger (return)	Total (return)	Note
1998	Quanzhou ~ Zhangping	4		4	
	Quanzhou ~ Hutou	1		1	
	Quanzhou ~ Longyan		1	1	
	Quanzhou ~ Wuyishan		0.5	0.5	Every other day
1999	Quanzhou ~ Zhangping	5		5	
	Quanzhou ~ Xiayang	1		1	
	Quanzhou ~ Longyan		1	1	
	Quanzhou ~ Wuishan		0.5	0.5	Every other day
	Quanzhou ~ Zhengzhou		1	1	
2000	Quanzhou ~ Zhangping	6		6	
	Quanzhou ~ Xiayang	1		1	
	Quanzhou ~ Ningbo		1	1	
	Quanzhou ~ Longyan		1	1	
	Quanzhou ~ Shenzhen		1	1	
	Quanzhou ~ Zhengzhou		1	1	
	Quanzhou ~ Nanjing		1	1	
2005		11	8	19	
2010		14	9	23	
2015		20	13	33	
2020		23	13	36	

(Source) Prepared from interviews with Quanzhou Corp.

Table 18 Train Timetable

266 Super express	960 Local	4492 Freight	4494 Freight	4496 Freight	4498 Freight	4482 Freight	4486 Freight	4490 Freight	5012 Freight	4518 Freight	Name of station	265 Super express	959 Local	4491 Freight	4493 Freight	4495 Freight	4497 Freight	4481 Freight	4485 Freight	4489 Freight	5013 Freight	4517 Freight
12	14	59	33	21	22	21	19	56			Zhujie	2.26	8.43	18	0.00	9.49	14.1	21.40	2.55	12.5		
20.04	5	48	23	11	0.11	10	8	43			Luzhi		52						3.06	57		
	17	35			51			37				34	54	12	9	58	22	50	12	13		
58	55	27	18	16	43	6.02	19	29			Makeng		9.02							13		
	49					56						40	4	18	15	10	28	57	21	23		
49	38	18	12.1	55	34	43	50	17.2			Wahai		15	28								
	36											49	17	52	24	13	37	22.1	32	36		
32	17	6:00	49	37	16	5.18	18.3	16.5			Dashen		40	19.1				30		58		
	16.2					29	59					3.06	42	36	42	31	55	23.2	53			
17	59	45	34	22	23	4.10	40				Gekou		57				15.10					
19.16	57	43	26	20	59	59	38					19	59	51	56	45	16	34	4.03			
59	40	25	9	3	42	36	15				Yan		10.2			11						
58	38	23	11.1	15	40	28	17.1					34	18	20.1	1.13	11	19	54	28			
39	16	5.03	47	42	22	3.05	50				Fude		38	26	31	30	37	0.17	51		13.1	
38	15.1	28	10.10	14	40		16.1		53			49	40	21	2.01	12	17.1		5.21			
22	57	4.06	51	45	20		48		12.28		Gande		57			22			53		37	
	55	58			21.1							4.04	59	18	18	37	22		6.03		47	
18.01	32	3.29	9.34	13.2	44		15.10		11.50		Jiandou		11.2	44	44	13	48		40		14.20	
	14.30	50	45	58	23							27	26	22.20	3.00	45	18.20					
49	16	37	32	45	20						Changji		40			14						
	14.1											39	42	34	14	20	34					
32	55	2.19	8.12	12.3	50						Hutou		12	54		41	54				13.6	
	53		40	56	19.2					11.20		57	4	23.20	33	15	19.3					
17.11	30	58	7.13	35	59					58	Jingu		27								14.2	
	13.3											5.18	29	44	55	26	49					
43	59	31	49	11.1	18					30	Anxi		45	57	0.12	4.23		20.2			49	
39	50		32		52					10:00		50	13.10	36	5.20	53					15.1	
19	29	1.11	6.11	49	32					40	Lancang		30			16.1						
	27	50	34									6.09	32	56	40	50	35				34	
16:00	7	30	5.14	30	12					9.20	Nanan		28	52							54	
58	12.1				17.1					47		32	54	1.15	59	17.10	54				16.2	
41	47	14	58	14	49					30	Shilong		14.1								42	
	45											49	14	31	6.15	28	21.10				51	
29	31	0.02	46	10	37					18	Quin ret		28								17.1	
	29											7.01	30	43	27	40	22				18.00	
15.12	11.1	23.4	4.28	9.44	16.2					8:00	Quin		19	49	2.00	44	57	39			19	

(Note) At the time of the survey, there were only spot freight services and no regular freight services running between Quanzhou and Xiaocuo.

(Source) Prepared from interviews with Quanzhou Corp.

Table 19 Approximate Calculation Sheet for Line Capacity

Name of station	Distance (km)	Distance between stations (km)	Train speed (km/h)	Travel time (minutes)	Stoppage time (minutes)	Line capacity (return)
Meishuikeng	0					
Dashen	12.249	12.249	35	21	3	32
Gekou	19.498	7.249	35	12	3	51
Xiaozhou	27.701	8.203	35	14	3	46
Fude	35.352	7.651	35	13	3	49
Gande	45.041	9.689	35	17	3	39
Jiandou	57.392	12.351	35	21	3	31
Changji	62.91	5.518	35	9	3	65
Hutou	76.65	13.74	35	24	3	28
Jingu	90.573	13.923	40	21	3	32
Anxi	108.471	17.898	40	27	3	25
Luncang	121.098	12.627	40	19	3	35
Nanan	133.488	12.39	40	19	3	35
Shilong	144.692	11.204	40	17	3	39
Quanzhou West	152.863	8.171	40	12	3	52
Quanzhou	163.691	10.828	40	16	3	40
Huian	184.118	20.427	40	31	3	22
Xiaochuo	203.998	19.88	40	30	3	22

(Source) Prepared from interviews with Quanzhou Corp.

(2) Train configuration

Special express to Wuyishan (passenger train)

The train configuration was one diesel locomotive, one baggage car, one generator car, one dining car, one soft sleeper carriage², three hard sleeper carriages³ and eight hard seat⁴ carriages, for a total of 15 carriages.

² Soft sleeper - Equivalent to Japanese A-class sleeping cars, with two two-tier (upper and lower) bunk beds for four passengers per compartment.

³ Hard sleeper - Equivalent to Japanese B-class sleeping cars, with two three-tier bunk beds (upper, middle and lower) facing in pairs, without compartments.

⁴ Hard seat - Equivalent to Japanese ordinary trains, with wooden benches for seating.

Local train to Longyan (passenger train)

The train configuration was one diesel locomotive, one baggage car and 12 hard seat carriages, for a total of 13 carriages.

Freight train

The train configuration was a total of 19 carriages, but as the service had only just begun, the longest freight trains actually running were of 15 carriages. Freight trains were scheduled to reach the full 19-carriage length within 1999.

(3) Fare systems

[1] Passenger fares

Passenger fares are as shown in Table 20. They are determined according to consistent nationwide rules laid down by the Ministry of Railways. The Quanzhou Corp. is not allowed any discretion in setting its fares.

Table 20 Table of Passenger Fares

Table of fares for the Quan-Wu New Special Express with Air Conditioning

(Unit: Yuan)

Station	Distance (km)	266		265		Hard seat	Hard sleeper			Soft sleeper		
		Arr.	15:12	Arr.	7:19		Upper	Middle	Lower	Upper	Lower	
Quanzhou	0	Arr.		Arr.								
	30	Arr.		Dep.		Full fare	9.0	55.0	60.0	63.0	80.0	86.0
Nanan		Dep.		Arr.		Half fare	4.5	32.5	35.0	36.5	45.0	48.0
	Anxi	55	Arr.	16:39	Dep.	50	Full fare	11.0	57.0	62.0	65.0	86.0
Zhangling		184	Dep.	43	Arr.	5:45	Half fare	5.5	33.5	36.0	37.5	48.0
	Yong'an	288	Arr.	20:12	Dep.	26	Full fare	28.0	74.0	79.0	82.0	113.0
Sanming		337	Dep.	24	Arr.	2:14	Half fare	14.0	42.0	44.5	46.0	61.5
	Laizhou	412	Arr.	22:36	Dep.	56	Full fare	43.0	89.0	94.0	97.0	135.0
Nanping		440	Dep.	50	Arr.	23:44	Half fare	22.0	50.0	52.5	54.0	72.5
	Jianwa	496	Arr.	23:51	Dep.	44	Full fare	50.0	96.0	101.0	104.0	146.0
Jianyang		542	Dep.	0:06	Arr.	22:32	Half fare	25.5	53.5	56.0	57.5	78.0
	Wuyishan	594	Arr.	3:14	Dep.	21:01	Full fare	62.0	110.0	114.0	117.0	166.0
Jianwa		496	Dep.	25	Arr.	44	Half fare	31.5	60.5	62.5	64.0	88.0
	Jianyang	542	Arr.	58	Dep.	8	Full fare	64.0	115.0	119.0	122.0	175.0
Wuyishan		594	Dep.	4:06	Arr.	20:00	Half fare	32.5	63.0	65.0	66.5	92.5
	Jianwa	496	Arr.	5:12	Dep.	46	Full fare	72.0	129.0	132.0	136.0	197.0
Jianyang		542	Dep.	30	Arr.	18:38	Half fare	36.5	70.0	71.5	73.5	103.5
	Wuyishan	594	Arr.	6:18	Dep.	43	Full fare	75.0	133.0	138.0	142.0	205.0
Jianwa		496	Dep.	26	Arr.	17:36	Half fare	38.0	72.0	74.5	76.5	107.5
	Jianyang	542	Arr.	7:43	Dep.	16:32	Full fare	81.0	144.0	148.0	154.0	222.0
Wuyishan		594	Dep.		Arr.		Half fare	41.0	77.5	79.5	82.5	116.0

Table of Local Train Fares

	Distance (km)	Hard seat
Quanzhou	0	
Quanzhou West	11	1.0
Shilong	19	1.0
Nanan	30	2.0
Luncang	43	3.0
Anxi	55	3.0
Jingu	73	4.0
Hutou	87	5.0
Changji	99	6.0
Jiandou	107	6.0
Gande	120	7.0
Fude	129	8.0
Xiaozhou	136	8.0
Gekou	144	9.0
Dashen	151	9.0
Meishuikeng	164	10.0
Yikeng	172	11.0
Zhangling	184	11.0
Suban	206	14.0
Banwei	218	14.0
Yanshi	224	15.0
Longyan	247	16.0

(Source) Prepared from Quanzhou Corp. materials

(Note) Full fares are for adults, half fares are for children.

[2] Freight charges

Freight charges are as listed in Table 21. Special charges are permitted for freight, and for each type of freight the rates are set at around double the rates charged on the older sections owned by the Ministry of Railways (between Xiamen and Meishuikeng). The Quanzhou Corp. is also allowed to vary the base charge within a range of plus or minus 10%.

Table 21 Table of Freight Charges

Section Type of freight	Quanzhou - Meishuikeng	Xiamen - Meishuikeng	Quanzhou - Meishuikeng (A) 161km	Xiamen - Meishuikeng (B) 164km	(A)/(B)
	(Unit: Yuan/ton)		(Unit: Yuan/ton · km)		
1 Edible salt, industrial salt	21.32	14.34	0.13	0.09	<i>1.5</i>
2 Food, chemical fertilizers, building stone, textbooks, agricultural machinery etc.	22.96	14.99	0.14	0.09	<i>1.5</i>
3 Cotton, honey, synthetic fibers etc.	27.88	15.75	0.17	0.10	<i>1.7</i>
4 Coal (large fragments), processed coal, crude steel, frozen meats etc.	29.52	16.60	0.18	0.10	<i>1.7</i>
5 Rails, structural steel, cement, timber etc.	31.16	17.43	0.19	0.11	<i>1.8</i>
6 Pigmented metals, foods and beverages, woven textiles etc.	32.80	18.37	0.20	0.11	<i>1.8</i>
7 Oil, tiles, ceramics etc.	34.44	19.42	0.21	0.12	<i>1.7</i>
8 Industrial machinery, electrical and electronic machinery etc.	36.08	20.61	0.22	0.13	<i>1.7</i>
Average charge for freight types 1~8	29.52	17.19	0.22	0.11	<i>2.1</i>
9 Locomotives, railway carriages, rail machinery	295.20	262.08	1.80	1.63	<i>1.1</i>
10 Small lots	42.64	17.47	0.26	0.11	<i>2.4</i>
11 Containers	49.20	12.90	0.30	0.08	<i>3.7</i>

(Source) Prepared from Quanzhou Corp. materials

2.2.3 Maintenance

(1) Maintenance of facilities

Tracks are maintained by workers using small-scale track maintenance machinery and tools to pack ballast manually. The track structure is layered and the volume carried is not great, so there appears to be little track damage and no problem with track maintenance. The workers who are central to track maintenance were transferred from the Ministry of Railways, and their track maintenance skills are not in doubt.

The utility poles for electricity supply are marked in paint with their management serial numbers and the date of installation. The positions of underground communications cables are marked with concrete markers. Bridges are equipped with inspection platforms and guard rails for shoe inspection and other equipment to make maintenance easier. There are no problems with maintenance of facilities.

(2) Inspection and repairs of rolling stocks

Rolling stock is maintained with inspections and repairs according to rules laid down by the Department of Railways. The rules include inspection and repair intervals as listed in Table 22.

Table 22 Rolling Stock Inspection and Repair Intervals

Type of rolling stock	Major inspection	Medium inspection	Minor inspection	Supplementary inspection
Locomotive East Wind Type 4	750,000-850,000km	300,000km	40,000km	20,000km
East Wind Type 5	9 years	3 years	6 months	3 months
	Major repair	Medium repair	Supplementary repair	
Passenger carriage	6 years	18 months	6 months	
Freight carriage	9 years	18 months	6 months	

(Source) Prepared from Quanzhou Corp. materials

(Notes)

Major inspection: Regular in-depth inspection of a locomotive involving removal and detailed examination of all major devices, replacement or repair of components as required with the aim of restoring the locomotive as close as possible to its original state.

Medium, minor and supplementary inspection: Inspection and repair of important components as specified for each level.

Major repair: Inspection and repair of passenger and freight carriages. This takes place in the rolling stock factory and is equivalent to the major inspection conducted on locomotives.

Medium and supplementary repairs: Inspection and repair of important components as specified for each level.

Intervals for inspection and repair are specified for each type of rolling stock and are determined on the basis of that type's reliability and record of service and breakdowns. Even among similar diesel locomotives, the intervals may differ according to the time of design and manufacture and the types of engine and chassis. The intervals for the East Wind Type 4 is based on distance traveled, while those for the Type 5 are based on time in service. These intervals are based on the Ministry of Railways' experience and are appropriate.

A rolling stock yard is situated adjacent to Quanzhou Station. It is used for inspection and minor repairs of locomotives and the storage and supply of diesel oil for the locomotives. It is also equipped with a track maintenance center which carries out maintenance and repairs of track maintenance machinery and tools. At the time of the survey we observed locomotive inspection and diesel oil supply. On the other hand, the track maintenance had some equipment in place, but it had not been used, and the buildings and equipment were not well maintained.

Inspection and repair (minor and sub-services) are carried out at Quanzhou, but medium and higher grades of service are at Meishuikeng, which is better equipped. Inspection and repair of passenger carriages are carried out at Xiamen. All freight carriages are the property of the Ministry of Railways, which carries out their inspection and repair. These rolling stock maintenance systems are appropriate as they do not oblige small-scale railway organizations to own large-scale repair equipment, and they leave repair tasks that require advanced skills to specialist workshops.

(3) Land management

Land is managed by placing concrete boundary posts to mark land boundaries. The posts are not always arranged in straight lines, which indicates that the land was acquired according to the plots used by the previous land users, rather than by mechanically setting a uniform width back from the center of the track. There does not appear to be any serious problem with land management, as the boundaries are marked properly with posts.

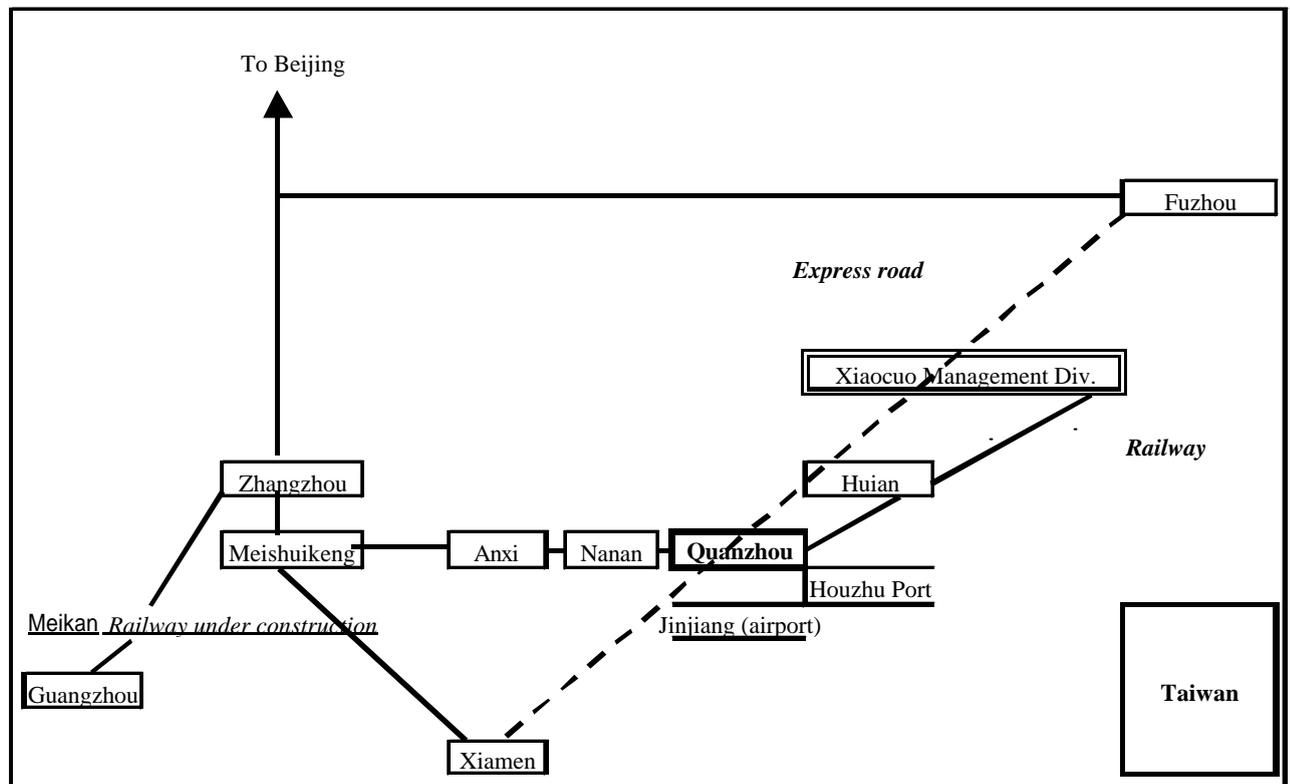
2.2.4 Awareness of the ODA Loan Among Its Beneficiaries

On 5th March 1996 a trial ride on this railway was held as one of the events to commemorate Quanzhou's elevation to city status. The event was attended by 1,000 invited guests from related central and regional agencies, the media and various local groups, and Japan was represented by a member of the consular staff from the Japanese consulate in Guangzhou. During the ride, announcements on the train explained the history of the railway's construction and offered repeated thanks for the provision of the ODA loan. Therefore the Chinese side appears to be well aware of the role of the ODA loan in this project.

2.3 Project Effects and Impact

2.3.1 Ripple Effects on the Regional Economy

Figure 23 Positional Relationships of Major Cities in Fujian Province



(1) Fujian Province and Quanzhou City

Fujian province lies on China's Southeast Coast and adjoins the provinces of Zhejiang to the north, Jiangxi to the west and Guangdong to the south. It also faces Taiwan to the east, across the straits. Mountains and hills cover approximately 80% of the province's area and its Rias coast accounts for around one fifth of China's coastline.

After the foundation of the People's Republic of China in 1949, no major construction project was authorized for Fujian Province leaving it the most underdeveloped province on the coast. However, the implementation of liberalization reforms brought about a change. In 1980, Xiamen was designated as a special economic zone and in 1984 Fuzhou was designated as a Coastal Open City. In 1985, Xiamen, Quanzhou and Zhangzhou were designated as a Coastal Open Zone, which stimulated investment from overseas Chinese and from Taiwan. Fujian's economic growth has become among the most remarkable in China.

Quanzhou is situated in the Southeast of Fujian Province, facing the Straits of Taiwan. It has a land area of 10,866 km² (for comparison, the area of Gifu Prefecture is 10,598 km²) and a population of 6,501,300 (for comparison, the population of Saitama Prefecture is 6,894,000). Three cities in the province exceed one million in population.

As Tables 25 and 26 show, the economy of Quanzhou has been growing faster than that of anywhere else in Fujian. It was provided with an airport at Jinjiang (the fourth airport in Fujian) in 1996. In October 1999 the full length of the expressway that links the city to Fuzhou in 90 minutes and to Xiamen in 60 minutes was opened.

The building of port at Xiaocuo is proceeding, and with the completion of this railway project the province's transport infrastructure will be largely complete. Therefore the province's rapid economic growth can be expected to continue.

Quanzhou is one of the main places of origin of overseas Chinese who are spread throughout the world, and particularly around Southeast Asia, and it has a university for overseas Chinese. Nearly half of those who migrated to Taiwan⁵ are said to be originated from Quanzhou. Therefore the city is quick to attract overseas Chinese and Taiwanese capital. The development of joint ventures and "homecoming" business startups is remarkable. This trend is expected to accelerate in the future.

Trade with Taiwan is obliged to rely on indirect routes via Hong Kong or elsewhere, with the wake of greater relaxation in tensions across the Straits, however, the first test flight was made in April 1997 and container shipping has started between the ports of Fuzhou and Xiamen and Gaoxiang port. There is growing momentum towards direct trade. Meizhou bay in Quanzhou (Xiaocuo Port) is a good natural harbor, and is closer to the main island of Taiwan than Xiamen Port is. Therefore Quanzhou has the potential to develop into the dominant port on the Chinese side for trade with Taiwan.

Table 24 Comparison of Population Data for Each Administrative Zone

Name of area	Fujian Province	Fuzhou	Xiamen	Putian	Sanming	Quanzhou	Zhangzhou	Nanping	Lonyang	Yude
Land area (km ²)	95,968	11,968	1,516	4,079	22,959	10,886	12,607	26,301	5,652	3,545
Population in 1997 (10,000 people)	3,282	574.85	124.67	289.10	263.62	650.13	438.76	298.11	281.39	316.50
Name of area	Quanzhou City	Licheng	Shishi	Jinjiang	Nanan	Huian	Anxi	Yongchun	Dehua	
Land area (km ²)	10,886	530	159	649	1,965	987	3,013	1,469	2,114	
Population in 1997 (10,000 people)	650.13	62.71	29.07	99.46	147	126	103	52.93	29.97	

(Note) Licheng, Nanan, Huian, Anxi are administrative zones for the main project.

(Source) Prepared from Fujian Statistics Yearbook (1998), Chengshi Statistics Yearbook (1995) and Quanzhou map.

⁵ This term refers to people of Taiwanese descent born on the mainland. Those born on Taiwan are referred to as native Taiwanese. As of 1st August 1999, 85% of the population were native Taiwanese, 13% (estimated) were overseas Taiwanese and 2% were others (of Malay and Polynesian descent).

Table 25 Comparison Table of Year-on-Year Growth Rates for GNP (nominal)

	1990	1991	1992	1993	1994	1995	1996	1997	Average growth rate (%)
Zuanzhou (100 million Yuan)	65.93	83.96	133.89	247.48	394.51	531.08	644.55	762.51	
Year-on-year growth rate (%)		27%	59%	85%	59%	35%	21%	18%	44%
Fujian Province (100 million Yuan)	528.64	630.27	795.18	1,144.89	1,696.74	2,176.67	2,628.49	3,051.33	
Year-on-year growth rate (%)		19%	26%	44%	48%	28%	21%	16%	29%
China (100 million Yuan)	18,598.4	21,662.5	26,651.9	34,560.5	46,670.0	57,494.9	66,850.5	73,452.5	
Year-on-year growth rate (%)		16%	23%	30%	35%	23%	16%	10%	22%

(Source) Prepared from China Statistics Yearbook (1998), Fujian Province Statistics Bureau etc.

Table 26 Comparison Table of Economic Data by Region

		Population (10,000 People)	GNP (10,000 million Yuan)	GDP (10,000 million Yuan)	GNP per person (Yuan)	GDP per person (Yuan)	Regional financial income (10,000 million Yuan)	Regional financial expenditures (10,000 million Yuan)
Quanzhou	1991(A)	591.71	83.96	79.32	1,426		7.47	7.24
	1997(B)	650.13	762.51	746.28	11,514		23.24	25.37
	(B)/(A)	1.1	9.1	9.4	8.1		3.1	3.5
Fuzhou	1991(A)	541.11	128.88	141.01	2,381		12.00	9.50
	1997(B)	574.85	795.58	752.53	13,764		35.05	35.67
	(B)/(A)	1.1	6.2	5.3	5.8		2.9	3.8
Xiamen	1991(A)	113.45	70.16	72	6,102		11.84	10.35
	1997(B)	124.67	356.07	370.03	27,185		28.80	33.04
	(B)/(A)	1.1	5.1	5.1	4.5		2.4	3.2
Fujian	1991(A)	3,079	630.27	547.42		1,803	57.1	68.5
	1997(B)	3,282	3,051.33	3,000.36		9,173	162.9	224.4
	(B)/(A)	1.1	4.8	5.5		5.1	2.9	3.3
Guangdong	1991(A)	6,439		1,780.56		2,823	131.0	150.7
	1997(B)	7,051		7,315.51		10,400	543.9	682.7
	(B)/(A)	1.1		4.1		3.7	4.2	4.5
Zhejiang	1991(A)	4,202		983.54		2,310	101.6	80.2
	1997(B)	4,435		4,638.24		10,400	157.3	240.2
	(B)/(A)	1.1		4.7		4.5	1.5	3.0
Jiangxi	1991(A)	3,865		465.10		1,212	40.6	50.8
	1997(B)	4,150		1,715.18		4,155	88.4	150.2
	(B)/(A)	1.1		3.7		3.4	2.2	3.0
China	1991(A)	115,823	21,662.5	21,617.8		1,879.0	3,149.5	3,386.6
	1997(B)	123,626	73,452.5	74,772.4		6,079.0	8,642.0	9,197.1
	(B)/(A)	1.1	3.4	3.5		3.2	2.7	2.7

(Source) Prepared from China Statistical Yearbook (1993/1998), China Statistical Summary (1998), Fujian Statistical Yearbook (1992/1998), China Information Handbook (1998), Fujian Province Statistics Bureau materials etc.

(2) Quanzhou Port

Quanzhou port consists of twelve smaller ports, including Xiaocuo and Houzhu. It currently handles the third largest volume of freight among the ports of Fujian Province. Its handling volume is growing far more rapidly (Table 27) than at any of the other ports. It is only a matter of time before Quanzhou outstrips Fuzhou to become the port handling the second largest freight volume in the province.

Table 27 Comparison of Volumes of Freight Handled (units: 10,000 tons)

		1991(A)	1997(B)	(B)/(A)
Fujian Province	Quanzhou Port	125	1,006	8.0
	Fuzhou Port	670	1,371	2.0
	Xiamen Port	570	1,754	3.1
Others	Shanghai Port	14,679	16,397	1.1
	Guangzhou Port	4,668	7,518	1.6

(Source) Prepared from China Traffic Yearbook (1992/1998), Quanzhou Port Management Office materials.

[1] Xiaocuo Port (Tables 29,30)

Xiaocuo port, which is located in Meizhou Bay has great development potential with naturally good conditions (wide, deep, calm).

Therefore the Quanzhou Xiaocuo Economic Development Management Committee (with city-level authority) was founded on March 1996 with the approval of Fujian Province. The Xiaocuo Economic Development Zone (land area 325 km², population 360,000) has been made independent of Huian district to pursue development. The committee has divided the area of 112 km² around Xiaocuo port into four zones (port, industrial, green and living zones) and is working on the development of a petrochemical complex. They plan to develop the area into one of the largest petrochemical industrial zones in China.

The infrastructure improvements include the railway built by this project and the six-lane road between Fuzhou and Xiamen, which are already complete. The four-lane expressway between Fuzhou and Xiamen is also scheduled for completion in October 1999. The new expressway is to have two interchanges in the Xiaocuo Development Zone. Electricity supply is now provided by power stations in other places. There are also three transformer stations in the area and their supply is adequate (the construction of a coal-fired power station nearby is planned). Water supply capacity is 72,000 tons/day for residential and industrial applications combined. Water pumping works with capacity for a further 600,000 tons/day are also being completed with investment of 350 million Yuan from the central government.

Table 28 lists companies which have moved into the area. Tax breaks and various other preferential systems are provided to attract foreign companies. The town mayor also actively promotes foreign direct investments and sometimes makes overseas trips to meet foreign companies.

Table 28 List of Companies Entering into the Area

Situation	Type of business	Investor	Note
Under operation	Oil refining plant (4 million tons)	Chinese government	3,000 people employed
	Chemical plant (70,000 tons)	Domestic company	100 people employed
	Chemical plant (10,000 tons)	Singapore, domestic company	200 people employed
	Gas plant (50,000 tons)	UK (Taiwan)	80 people employed
	Leather products manufacturing plant	Hong Kong	500 people employed
Under construction	Chemical plant (4 million tons)	Domestic company	Operation in Oct 1999
	Foodstuff storage base	Chinese government	Operation in Dec. 1999
	Coal transit base	Chinese government	Operation in Mar. 2000
Under planning	Oil refining plant (4 million 12 million ton)	USA/Chinese governments	
	Chemical plant (600,000 tons)	USA/Chinese governments	
	Chemical plant (100,000 tons)	Domestic company	
	Chemical plant (100,000 tons)	Domestic company	
	Coal thermal power plant (1.8 million kW)	Chinese government	
	Beer bottle plant	Domestic company	

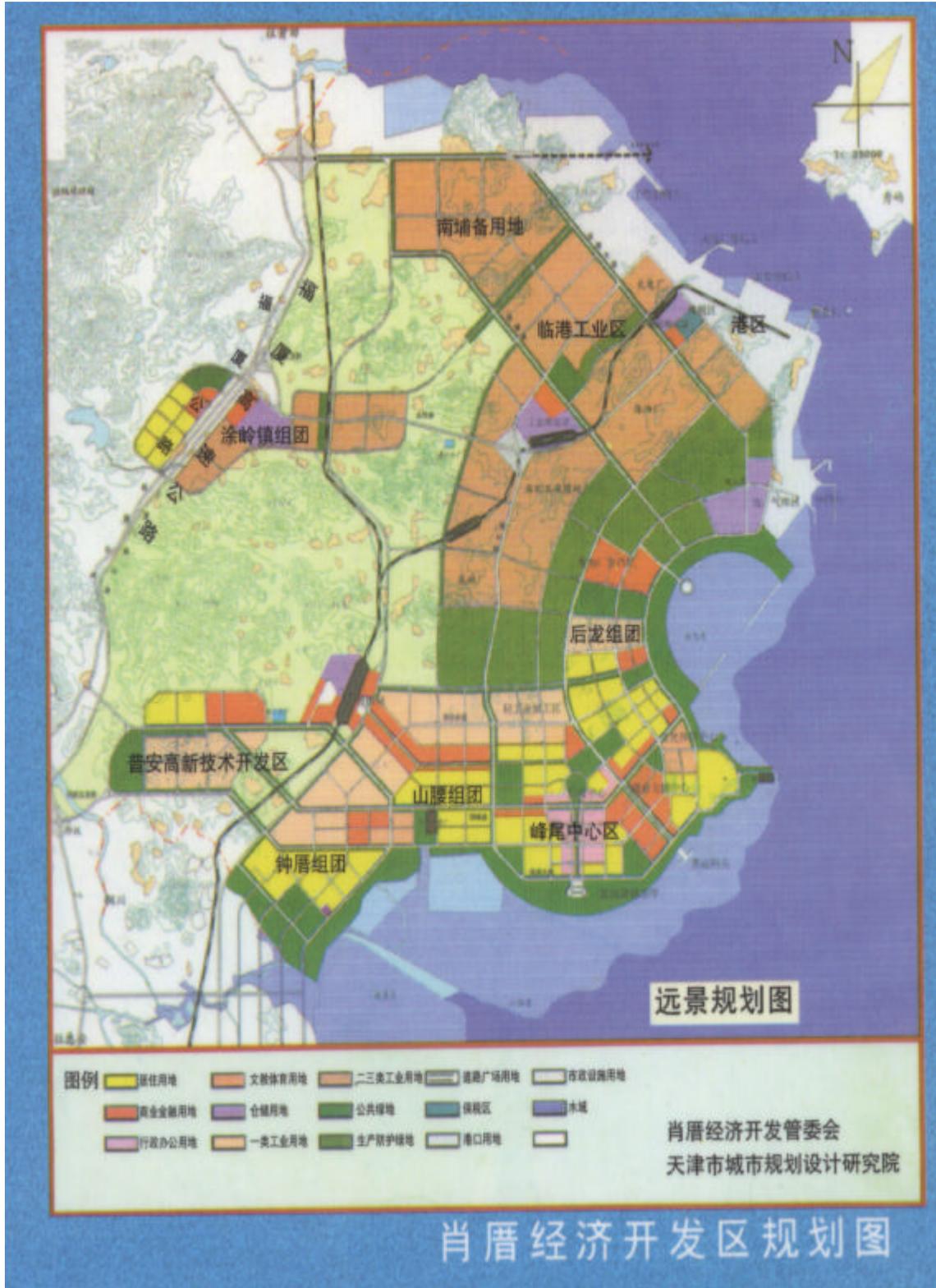
(Source) Prepared from interview with Xiaocuo Economic Development Management Committee

Table 29 Xiaocuo Economic Development Zone Map



(Source) Xiaocuo Economic Development Management Committee materials.

Table 30 Map of Plan for Xiaocuo Economic Development Zone



(Source) Xiaocuo Economic Development Management Committee materials.

[2] Houzhu Port

Houzhu is the closest port to the center of Quanzhou (Licheng district). Its freight handling volumes are shown in Table 31. Houzhu exports building stone to Japan and elsewhere. The volume of freight passing through Houzhu is expected to go on increasing steadily as the economy of Quanzhou develops.

Table 31 Freight Handling Volume by Houzhu Port in 1996 (Unit: 10,000 tons)

	Coal	Oil	Construction materials	Cement	Chemical fertilizer	Food	Salt	Others	Total
Arrival	56.1	3.5	8.2	11.4	0.2	13.6	11.2	8.9	113.1
Shipping			20.2				3.7	5.6	29.5

(Source) Prepared from Quanzhou Port Management Office materials.

Table 32 Berth Construction Plan of Xiaocuo Port and Houzhu Port (see Photos 7 and 8)

	Houzhu Port			Xiaocuo		
Under operation	Food berth	5,000 tons	1	Crude oil berth	100,000 tons	1
	Miscellaneous cargo berth	5,000 tons	1	Miscellaneous cargo berth	10,000 tons	1
	Product oil berth	3,000 tons	1	Coal berth	50,000 tons	1
	Miscellaneous cargo berth	3,000 tons	1	Product oil berth	5,000 tons	1
	Miscellaneous cargo berth	1,000 tons	1	Product oil berth	3,000 tons	1
	Miscellaneous cargo berth	500 tons	2	Product oil berth	1,000 tons	1
	Container berth	5,000 tons	2			
	Miscellaneous cargo berth	1,000 tons	1			
Under construction		5,000 tons	2	Multipurpose berth	50,000 tons	1
		1,000 tons	1	Multipurpose berth	10,000 tons	1
Under planning		5,000 tons	7	Crude oil berth	250,000 tons	1
		3,000 tons	13	Food berth	100,000 tons	1
		1,000 tons	3	Container berth	100,000 tons	1
				Chemical fluid berth	20,000 tons	1
				Building materials berth	5,000 tons	1
				Business operation berth	5,000 tons	1
Annual handling capacity at the time of completion of construction	7.13 million tons			33.5 million tons		

(Note) Bold type is used for new berths built since the appraisal was made.

(Source) Xiaocuo Economic Development Management Committee materials.

2.3.2 Demand Absorption

The volume of freight handled in Fujian Province is growing steadily as shown in Table 33, backed by the economic situation described above. In Quanzhou the volume is increasing more rapidly than was anticipated at the time of the appraisal.

The volume of freight handled by this project could not be ascertained from recorded figures at the time of the field survey for this evaluation, because the project had only been in operation

for less than three months. The demand predictions (potential demand) presented by the Quanzhou Corp. are as shown in Table 34. This project will go on to absorb this potential demand in future.

Table 33 Major Transport-related Data for Fujian Province

Item	Fujian Province			Nationwide (for reference)		
	1991(A)	1997(B)	B/A	1991(A)	1997(B)	B/A
National railways (operating distance: km)	1,015	1,068	1.1	53,415	57,566	1.1
Regional railways (total length: km)	0	0	0	4,411	5,339	1.2
Roads (total length: km)	41,745	47,680	1.1	1,041,136	1,226,405	1.2
Expressways (total length: km)	0	94	-	574	4,771	8.3
Waterways (total length: km)	3,888	3,725	1.0	109,703	109,827	1.0
Numbers of locomotives owned	286	277	1.0	14,295	15,747	1.1
Steam	146	53	0.4	6,250	3,213	0.5
Internal combustion	33	73	2.2	6,236	9,713	1.6
Electric	107	151	1.4	1,809	2,821	1.6
Numbers of passenger carriages owned	427	585	1.4	27,612	34,346	1.2
Numbers of automobiles owned	121,247	221,808	1.8	6,061,149	12,190,902	2.0
Numbers of passengers (units: people x 10,000)	32,221	57,914	1.8	806,048	1,325,364	1.6
National railways	1,235	1,401	1.1	94,208	91,919	1.0
Regional railways	0	0	0	872	659	0.8
Roads	29,016	55,468	1.9	682,681	1,204,583	1.8
Waterways	1,849	729	0.4	26,109	22,573	0.9
Airlines	121	316	2.6	2,178	5,630	2.6
Passenger circulation (units: person-km x 100 million)	177	297	1.7	6,178	10,019	1.6
National railways	41	60	1.5	2,825	3,544	1.3
Regional railways	0	0	0	3	5	1.5
Roads	133	235	1.8	2,872	5,541	1.9
Waterways	3	2	0.7	177	156	0.9
Airlines	-	-	-	301	774	2.6
Freight volume (units: tons x 10,000)	13,211	31,332	2.4	970,216	1,259,801	1.3
National railways	1,988	2,373	1.2	147,898	161,880	1.1
Regional railways	0	0	0	4,995	7,854	1.6
Roads	8,924	25,398	2.8	733,907	976,536	1.3
Waterways	2,297	3,555	1.5	83,370	113,406	1.4
Airlines	2	6	3.1	45	125	2.8
Freight circulation (units: ton-km x 100 million)	294	617	2.1	27,366	37,633	1.4
National railways	113	143	1.3	10,948	13,046	1.2
Regional railways	0	0	0	24	51	2.1
Roads	74	151	2.0	3,428	5,272	1.5
Waterways	107	323	3.0	12,956	19,235	1.5
Airlines	-	-	-	10	29	2.9

(Source) Prepared from China Statistics Yearbook (1992/1998), Fujian Statistics Yearbook (1992, 1998), China Traffic Yearbook (1992, 1998)

Table 34 Forecast for Freight Handling Volumes at Quanzhou

	Quanzhou City freight handling volume (10,000 tons)				Xiaocuo Port freight handling volume (10,000 tons)			Houzhu Port freight handling volume (10,000 tons)			Quanzhou Corp. freight handling volume (10,000 tons)	
	Total	Via Xiamen	Rail usage	Others	Total	Rail usage	Others	Total	Rail usage	Others	Volume of freight handled (10,000 tons)	Volume of passengers (10,000 persons)
1991	700	350	0	350	6	0	6	62	0	62	0	0
1992	950	360	0	590	80	0	80	72	0	72	0	0
1993	1,235	380	0	855	275	0	275	110	0	110	0	0
1994	1,346	390	0	956	288	0	288	144	0	144	0	0
1995	1,456	390	0	1,066	392	0	392	140	0	140	0	0
1996	1,488	400	12	1,076	444	0	444	143	0	143	12.4	0
1997	1,516	380	48	1,088	552	0	552	142	0	142	48	2.2
1998	1,825	340	91	1,394	534	0	534	171	0	171	91	9
1999	2,200	320	320	1,560	560	50	510	200	0	200	320	68
2000	2,630	320	400	1,910	570	100	470	220	5	215	400	100
2001	3,105	330	500	2,275	650	100	550	230	10	220	500	125
2002	4,585	340	700	3,545	750	300	450	240	20	220	700	162
2003	8,500	360	900	7,240	870	350	520	280	40	240	900	230
2004	11,200	390	950	9,860	920	380	540	315	40	275	950	270
2005	13,400	420	1,050	11,930	1,000	500	500	350	70	280	1,050	300
2006	15,000	450	1,150	13,400	1,000	500	500	350	70	280	1,150	350
2007	17,000	450	1,200	15,350	1,000	500	500	350	70	280	1,200	375
2008	18,500	450	1,250	16,800	1,000	500	500	350	70	280	1,250	400
2009	20,000	450	1,380	18,170	1,000	500	500	350	70	280	1,380	425
2010	20,900	450	1,450	19,000	1,000	500	500	350	70	280	1,450	450
2011	20,900	450	1,600	18,850	1,000	500	500	350	70	280	1,600	475
2012	20,900	450	1,600	18,850	1,000	500	500	350	70	280	1,600	475
2013	20,900	450	1,600	18,850	1,000	500	500	350	70	280	1,600	475
2014	20,900	450	1,600	18,850	1,000	500	500	350	70	280	1,600	475
2015	20,900	450	1,600	18,850	1,000	500	500	350	70	280	1,600	475
2016	20,900	450	1,600	18,850	1,000	500	500	350	70	280	1,600	475
2017	20,900	450	1,600	18,850	1,000	500	500	350	70	280	1,600	475
2018	20,900	450	1,600	18,850	1,000	500	500	350	70	280	1,600	475
2019	20,900	450	1,600	18,850	1,000	500	500	350	70	280	1,600	475
2020	20,900	450	1,600	18,850	1,000	500	500	350	70	280	1,600	475
2021	20,900	450	1,600	18,850	1,000	500	500	350	70	280	1,600	475
2022	20,900	450	1,600	18,850	1,000	500	500	350	70	280	1,600	475
2023	20,900	450	1,600	18,850	1,000	500	500	350	70	280	1,600	475

(Source) Prepared from interviews with Quanzhou Corp.

2.3.3 Quantitative Effects

(1) Financial Internal Rate of Return (FIRR)

The FIRR for this project at the time of the appraisal was 9.02% with a project life of 25 years. The recalculated FIRR for this evaluation in 1998, based on data presented by the operating agency is 4.13% (also with a project life of 25 years).

The FIRR declined even though the operating agency now has a broader revenue source because of the transfer of 99.90km of line between Hutou and Meishuikeng (not including Meishuikeng

Station) from the Ministry of Railways. This is because the construction costs and the operation and maintenance costs have been larger than they were expected at the time of the appraisal. In particular, operation and maintenance costs appears to have been increased by the dilapidation of equipment on the line transferred from the Ministry of Railways and an increase in costs that was unforeseeable at the time of the appraisal.

When we consulted the operating agency and investors as to future operation, we heard the opinions listed below. It will be important to watch closely the ways these views are reflected in the operation of the project, and, above all, in its income and expenditures.

[The operating agency (Quanzhou Corp.)]

- The corporation is well aware that it is running at a loss, and it is covering the less by borrowing from domestic banks (National Development Bank, China Construction Bank).
- Less than three months have passed since the line began full operation, and the corporation is aware that there is capacity for more services on the line. It is diligently pursuing negotiations with related agencies towards increasing the number of services.
- The corporation believes that once the branch lines to the ports and the private lines to link each company are connected, demand for freight shipments will increase enormously, and in some cases it may be possible to increase freight charges etc. It remains optimistic that it can stabilize its business in the medium and long term through its own efforts.
- The contract between the Quanzhou Corp. and the China Import Export Bank, which handles the sub-lending of the ODA loan, calls for the corporation to make repayments on the ODA loan to the China Import Export Bank. However, the Fujian provincial government is the guarantor for the loan, so the corporation does not regard the repayments as a problem.

[Investors (Ministry of Railways 52%, Fujian Province 48%)]

- The investors feel that business position of the Quanzhou Corp. does not appear to present a particularly severe problem when compared to other regional railways, and therefore they are not considering any further support, such as additional investment. However, they continue to fully support the project and they will act responsibly as investors to give additional support, in line with their shares of the initial investment, should the business situation demand it.

(2) Economic Internal Rate of Return (EIRR)

EIRR was calculated according to the assumptions listed below on the basis of data submitted at the time of the survey (1998) by the operating agency. The result was 11.47% for a project life of 25 years, which indicates that this project is socio-economically feasible. In this calculation, we did not include the cost of expanding the ordinary road to Xiamen, which would have been required if the railway had not been built. The cost was omitted because the ordinary road would have been expanded and the expressway built regardless of whether or not the railway was built.

[Assumptions and preconditions]

1. The calculation was based on the With-Without approach.
2. In the case in which the railway was built, the costs were taken to be the construction cost

of this project's portion of the line and the operating cost.

3. For the case in which the railway was not built, the costs were taken to be the cost of automobile transport on the ordinary road as far as Xiamen and reloading costs, as well as the cost of rail transport from Xiamen to Meishuikeng.
4. The project life was set at 25 years.
5. Road transport costs, rail transport costs and reloading costs were set as below, with the road and rail transport costs excluding taxation (10%) and profit (5%).

Item		Section transport charge	Section distance (km)	Charge per km
Railway (passenger)	Quanzhou ~ Meishuikeng	10 Yuan/person	164	0.06 Yuan/person · km
	Xiamen ~ Meishuikeng	10 Yuan/person	161	0.06 Yuan/person · km
Railway (freight)	Quanzhou ~ Meishuikeng	29.52 Yuan/ton	164	0.18 Yuan/ton · km
	Xiamen ~ Meishuikeng	17.71 Yuan/ton	161	0.11 Yuan/ton · km
Road (passenger)				
Highway	Quanzhou ~ Xiamen	28 Yuan/person	107	0.26 Yuan/person · km
Ordinary	Quanzhou ~ Xiamen	15 Yuan/person	107	0.14 Yuan/person · km
Road (freight)				
	Quanzhou ~ Xiamen	42.8 Yuan/ton	107	0.40 Yuan/ton · km
Loading cost	Xiamen	2 × 3.5 Yuan/ton		3.50 Yuan/ton · km

(Source) Prepared from interview with Quanzhou Corp.

(3) Overall evaluation

The alleviation of congestion on ordinary roads between Quanzhou and Xiamen, which was one of the objectives of the project, is attained, because the future increase in freight handling demand will be absorbed by this project and because the expressway between Quanzhou and Xiamen has already been completed. Demand for freight traffic on this project can be expected to grow with future development in the Xiaocuo Economic Zone. It will surge also once the branch lines to the ports are completed (together with the private lines to link companies to the branch lines). Furthermore, the line passes through three cities with populations of one million people, and the stations in those cities have been built away from the main centers in areas with ample development space. Spacious access roads are being built and the formation of new urban areas around the stations is being encouraged. If the number of trains operations increases, the line will be able to absorb considerable amounts of extra demand from the sizable populations. Thus the other project objective, i.e. contribution to the economic development of Quanzhou, can be expected to be attained, with appropriate operational work from the operating agency in aspects such as timetable setting.

Furthermore, as Table 16 showed, as the construction of regional railways in Fujian Province and its surroundings proceeds and the rail network expands, it will induce additional demand. In particular, when the line between Meizhou (Guangdong Province) and Kanshi (Fujian Province)

is completed (now under construction, scheduled for completion within FY2000), Quanzhou and Guangzhou will have a rail link that takes approximately 22 hours, which is expected to make a great contribution to Quanzhou's economic development.