

**SECRET**

**Nº 101**

**ECONOMIC INTELLIGENCE REPORT**

**TRANSPORTATION**  
**IN THE FUKIEN COASTAL REGION**  
**OF COMMUNIST CHINA**  
**1959**



CIA/RR ER 60-15

June 1960

**CENTRAL INTELLIGENCE AGENCY**

**OFFICE OF RESEARCH AND REPORTS**

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**W A R N I N G**

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FOREWORD

This report is essentially an economic analysis of the basic transportation facilities in the Fukien coastal region of Communist China. The region selected for study consists of Fukien Province and certain other important transportation centers outside Fukien -- the rail center of Ying-t'an in Kiangsi Province to the northwest and the seaports of Wenchow in Chekiang Province to the northeast and of Swatow in Kwangtung Province to the southwest. No discussion of civil aviation is included, because civil air operations in the region are insignificant. Statistical data not given in terms of point-to-point capability of various transportation routes are for Fukien Province. The detailed information contained in the appendixes constitutes a transportation handbook for this region that should be of continuing value for both economic and logistic intelligence.

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Communist China: Transportation Facilities of the Fukien Coastal Region inside back cover



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TRANSPORTATION IN THE FUKIEN COASTAL REGION  
OF COMMUNIST CHINA\*  
1959

Summary

Transportation in the Fukien coastal region of Communist China is rendered difficult by both terrain and climate. Because of the difficulties in both construction and maintenance of the overland transportation networks, the region was oriented to the sea until the Chinese Communists constructed the first railroad in Fukien Province.

The railroad system serving the Fukien coastal region consists of the single-track Ying-t'an - Amoy line and its branch line to Foochow.\*\* The Ying-t'an - Amoy line, 694 km in length, was completed in 1956, and the branch line from Nan-p'ing to Foochow was completed in late 1958. When additional rail lines and feeder spurs currently under construction or planned are completed, almost all points in the province will be within 75 km of railroad facilities. It is estimated that the tonnage carried by the existing rail lines in Fukien Province increased from 30,000 metric tons\*\*\* in 1954 to 2.4 million tons in 1958. Timber† is the largest single commodity moving by rail, accounting for 50 percent of the tonnage carried in 1958, and coal ranks second, accounting for about 37.5 percent of such tonnage. The movement of timber was largely out of the province, whereas coal was moved into and within the province. Other commodities moved by rail included cement and other construction materials as well as various agricultural and forest products.

The estimated current capability†† of the Ying-t'an - Amoy - Foochow Railroad††† is about nine trains each way per day (EWPD), or a net

\* The estimates and conclusions in this report represent the best judgment of this Office as of 1 April 1960.

\*\* In this report the branch line to Foochow is referred to as the Nan-p'ing to Foochow line, although the actual junction point is at Wu-k'eng, about 24 kilometers (km) southwest of Nan-p'ing.

\*\*\* Tonnages are given in metric tons throughout this report.

† The term timber is used in this report as a collective word applying to finished as well as partly finished wood products.

†† For a precise definition of the term capability, see II, C, p. 10, below.

††† Hereafter referred to as the Ying-t'an - Amoy Railroad or line.

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load of 7,300 tons EWP. This tonnage is the amount of tonnage that could be carried on the restricting sector of the line from Ying-t'an to the junction point at Wu-k'eng. From Wu-k'eng, each section is capable of handling five trains EWP, or a net load of 4,300 tons EWP to both Foochow and Amoy. The entire railroad is capable of carrying about 5.3 million tons of through traffic annually,\* or 2.2 times the planned tonnage for 1958, if sufficient locomotives and cars are made available. If traffic increases as fast as the national average, however, the line could reach maximum capability by 1961. The new lines currently under construction or projected are necessary for further economic development and will increase military capabilities in the region.

In 1959 the highway network of the Fukien coastal region is estimated to have included 7,300 km of motorable roads, or more than three times the figure for 1950. These highways are utilized for the movement of economic traffic by more than 4,000 motor trucks, of which about one-half are under the control of state-owned transport groups and the remainder are controlled by government agencies or industries. Motor trucks probably carried about 2.8 million tons in 1958, and it seems likely that primitive highway transport carried substantially more tonnage. Grain, timber, coal, and mineral ores probably account for a large portion of the total tonnage carried by motor trucks. Most of the movement occurs from the producing areas toward the railroad or waterway systems.

Before the advent of the railroad and the substantial increase in the construction of roads, waterways provided the major means of communication and travel in the Fukien coastal region in terms of both local and interprovincial movement. Fukien Province contains more than 4,000 km of waterways that are navigable to powered vessels and has about 487 nautical miles of coastal shipping routes. The major inland navigation route is the Min River, and the major coastal route is between Foochow and Shanghai. In 1958, modern inland water transport carried about 1.7 million tons on the rivers of Fukien Province, and primitive transport carried about 5 million tons. The major commodities that move on the rivers of Fukien are timber, agricultural goods, and other products. Coastal shipping carried less than 2 million tons, about evenly divided between primitive craft and modern vessels. The major commodities involved are coal and industrial raw materials moving into the region and timber moving out of the region to Shanghai and Canton.

The total tonnage carried by all forms of transport in the Fukien coastal region amounted to 15.5 million tons in 1957 and increased to

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\* This estimate assumes that all traffic would consist of freight trains. This figure would be lowered in direct ratio to the number of passenger and work trains operated on the lines.

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about 22 million tons in 1958. It is estimated that the economy of the Fukien coastal region required the transportation of about 24 million tons in 1959, or an increase of 9 percent in 1959 compared with 42 percent in 1958. There appears to have been enough unutilized capability in the system to absorb the demands for 1959.

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I. Introduction

The very nature of the Fukien coastal region of Communist China renders transportation difficult. Much of the region is mountainous, with elevations of 3,000 to 5,000 feet; the mountains tend to parallel the coast, making transportation inland difficult; and most east-west routes follow river valleys. The region has from 60 to 80 inches of rainfall per year, principally during the summer months, resulting in roads and railroads becoming temporarily impassable because of washouts and landslides and waterways becoming impassable because of flooding and silting. The construction of many expensive bridges, fills, cuts, and tunnels has been necessary for railroad and road development. Before the construction of the Ying-t'an - Amoy Railroad, the major link with the rest of China was by sea. By the end of the First Five Year Plan (1953-57), the Communists had completed both railroad and road connections with the industrial centers of Shanghai, Canton, and Wu-han, thus providing what probably was the first really effective overland link of economic importance with the rest of the country.

The announced tonnage carried by the transportation system of the Fukien coastal region increased from 15.5 million tons in 1957 to 22 million tons in 1958,  $\frac{1}{*}$  or about 42 percent. The tonnage carried during 1959 may have been about 24 million tons, an increase of about 9 percent. Although military cargo may be included in these totals, the nature of available statistical data prevents determination of the portion of the tonnage represented by military supplies.

Much of the development that has been undertaken in Fukien Province is the result of strategic as well as economic considerations. Faced with hostile Chinese Nationalist forces less than 150 km away on Formosa and at their very doorstep on Quemoy and Matsu, the Chinese Communists doubtless realized the necessity of defending the region not only by military action but by the integration of its economy with that of the rest of the Chinese mainland and by a shift in its traditional reliance on the sea for transportation.

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## II. Rail Transport

### A. Railroad Network\*

The railroad network serving the Fukien coastal region of Communist China consists of the Ying-t'an - Amoy line and its branch line from Nan-p'ing to Foochow.\*\* Construction of the Ying-t'an - Amoy line was started in October 1954 by the Railroad Engineering Corps of the Peoples Liberation Army and completed on 9 December 1956. 2/ Freight traffic was handled as far as Nan-p'ing by August 1956 and to Yung-an by November 1956. 3/ The total length of this line is 694 km, 4/ excluding the 24-km section connecting the branch line at Nan-p'ing with the main line at Wu-k'eng and an 11-km spur leading to Chang-chou (Lung-chi). 5/ The roadbed of the Chang-chou spur reportedly was completed in February 1957, 6/ but the construction of a bridge 1,286 feet long over the Chiu-lung River 7/ delayed completion of this spur until June 1958. 8/

The 24-km section from Wu-k'eng to Nan-p'ing was completed in 1956. 9/ In April of that year the Chinese Communists announced that a 211-km line from Nan-p'ing through Foochow to Kuan-t'ou was under construction. 10/ Tracklaying reached the vicinity of O-yang by the end of 1957, 11/ and temporary freight service to that point was begun in February 1958. 12/ The line was completed to Foochow on 26 November 1958, 13/ and regular freight service was begun on 7 December 1958. 14/

In 1958 the Chinese Communists began construction of a 253-km railroad between Chin-hua and Wenchow in Chekiang Province. 15/ Eventually this line will extend south from Wenchow through Fu-ting, Hsia-p'u, and Pa-tu to Foochow. 16/ The southern section of this line from Foochow north to Pa-tu is currently under construction and may be completed in 1960.\*\*\* Construction began in January 1959 on a 550-km rail line from Yu-shan to Foochow, which will run roughly parallel to the Ying-t'an - Nan-p'ing - Foochow line, approximately 50 to 150 km northeast of the existing railroad. The new line will pass through P'u-ch'eng, Sung-ch'i, Pa-tu, and Lien-chiang, 18/ thus

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\* For the graphic location of the railroad network serving the Fukien coastal region, see the map, inside back cover. For listings of railroad stations, facilities, and yards, see Tables 7 and 8, Appendix A, pp. 28 and 35, respectively, below.

\*\* Unless otherwise specified, references to the Ying-t'an - Amoy Railroad include both the Ying-t'an - Amoy line and the branch line.

\*\*\* On 29 January 1959 the Communists announced that the construction of bridges and tunnels on the Foochow - Ma-wei section was completed. 17/

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enhancing Communist military capabilities in the Formosa Strait area and providing a railroad line to several economically important population centers.

Two other lines under construction eventually will become a part of the projected line linking Fukien and Yunnan Provinces, which will be a major east-to-west railroad when completed. These lines run from Chang-p'ing to Lung-yen and from Chang-p'ing to Ch'uan-chou (Chin-chiang). Construction of the 58-km line from Chang-p'ing to Lung-yen\* began in April 1958 and was scheduled to be completed in March 1959, 20/ although no evidence of its completion is available. When completed, this line will provide access by rail to coal and mineral reserves in the Lung-yen area. Construction is underway on the 150-km line connecting the Ying-t'an - Amoy line just south of Chang-p'ing with the port of Ch'uan-chou. 21/ This line traverses a region reportedly rich in mineral reserves, and although the completion of this line will not greatly increase Chinese Communist military capabilities, it will provide access to an area with poor communications facilities and will facilitate the economic development of this portion of Fukien Province.

Construction also is underway on a 246-km extension of this line from Lung-yen through Nan-yang-pa, K'an-shih, and Yung-ting to Hsing-ning in Kwangtung Province. 22/ The large bridges on this route are reported to be constructed for eventual double-tracking. 23/ Surveying was begun in May 1958 on a 350-km railroad to connect Lung-yen with Kan-hsien in Kiangsi Province. This railroad is scheduled for completion under the Second Five Year Plan (1958-62), 24/ but construction has not yet begun. Surveying also has begun on a railroad to run along the coast between Foochow and Amoy. 25/

Some emphasis has been placed on feeder lines to the existing railroad facilities. In 1958 a 7-km forest spur was constructed from Wang-t'ai to Ch'i-hou near Nan-p'ing, 26/ as was a 1.7-km spur to the T'ai-ku shipping company wharf in Amoy. 27/ The Chinese Communists claim that 13 spur lines totaling 270 km in length 28/ are under construction or being surveyed. In 1959 they planned to complete 120 km of spur lines, 29/ including a line traversing the San-ming industrial base 30/ from Mei-lieh to Weng-tun, 31/ a spur to the Chang-p'ing coal mines, 32/ probably about 13 km long, 33/ and a 96-km forest spur near Chien-ou. 34/

When the railroad lines currently under construction or projected and the planned feeder spurs are complete, Fukien Province will possess an improved railroad network, with almost all points

\* The actual starting point is Cho-tse, which probably is a small station located just north of Chang-p'ing. 19/

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less than 75 km from railroad facilities. This network will increase considerably the Chinese Communist capabilities to support military action in the Formosa Strait area, will enhance greatly the economic development of the province, and will decrease costs of transportation. Highway and water-borne freight may decline as a percentage of total freight (although not in absolute terms) as the railroad network expands. Highway transport will become less important for long hauls and more important as a feeder to the railroad system.

B. Performance

1. Tonnage Carried

Estimates of the tonnage carried by the Ying-t'an - Amoy Railroad in Communist China in 1954-58 are shown in Table 1.

Table 1

Estimated Tonnage Carried by the Ying-t'an - Amoy Railroad  
in Communist China  
1954-58

<u>Year</u>	<u>Tonnage Carried*</u> <u>(Million Metric Tons)</u>	<u>Annual Increase</u>	
		<u>Million Metric Tons</u>	<u>Percent</u>
1954	0.03 <u>a/</u>	N.A.	N.A.
1955	0.61 <u>a/</u>	0.58	1,933
1956	1.37 <u>a/</u>	0.76	125
1957	1.85 <u>b/</u>	0.48	35
1958	2.4 <u>b/</u>	0.55	30

a. The announced figure of 3.86 million metric tons carried during the period of "provisional operation" in 1956-57, less estimated tonnage carried in 1957. 35/ This total, less performance in 1957, would indicate 2.01 million metric tons carried in 1956. It is assumed, therefore, that the 3.86 million metric tons refers to 1954-57. The figure for 1957 has been subtracted from 3.86 million metric tons, giving a figure of 2.01 million metric tons for the period October 1954 - December 1956. This total has been distributed by monthly weights in arithmetic progression from October 1954 to December 1956 to arrive at estimates for 1954-56.

b. The announced goal of 2.4 million metric tons for 1958 given as a percentage increase above the level of 1957. 36/

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2. Commodity Composition of Traffic

The commodity composition of traffic on the Ying-t'an - Amoy Railroad in Communist China in 1958 is shown in Table 2.

Table 2

Estimated Commodity Composition of Freight Carried  
by the Ying-t'an - Amoy Railroad in Communist China  
1958

<u>Commodity</u>	<u>Tonnage Carried (Million Metric Tons)</u>	<u>Percent of Total</u>
Timber	1.2 <u>a/</u>	50.0
Coal	0.9 <u>b/</u>	37.5
Cement	0.1 <u>c/</u>	4.2
Other	0.2 <u>d/</u>	8.3
Total	<u>2.4</u>	<u>100.0</u>

- a. Plan. 37/  
b. Estimated; see also p. 8, below.  
c. Estimated; see also p. 9, below.  
d. Residual.

Timber is the most important single commodity hauled on the Ying-t'an - Amoy Railroad, accounting for about 50 percent of the total tonnage carried in 1958. 38/ The amount of timber shipped out by rail also accounted for more than one-half of the total shipments of timber from Fukien Province. In 1957 the province planned to ship out about 1.3 million tons, of which 800,000 were to be moved by rail.\* 39/ Estimates of the tonnage of timber carried by the Ying-t'an - Amoy Railroad in 1954-58 are shown in Table 3.\*\* Nearly all of this timber originated in Fukien Province.

The economic importance of the railroad for timber exploitation is illustrated by an announcement that production of timber in Fukien Province in 1957 was to be increased from 0.87 million

\* A factor of 0.727 has been applied to cubic meters to convert them to metric tons.

\*\* Table 3 follows on p. 8.

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tons to 1.5 million tons, 40/ or more than 72 percent. During 1957, Yung-an Hsien planned to double the amount of timber produced in 1956, 41/ principally because of better transportation. Most, if not all, of this movement of timber is from Fukien Province to other parts of Communist China.

Table 3

Estimated Tonnage of Timber Carried by the Ying-t'an - Amoy Railroad  
in Communist China  
1954-58

Year	Total Tonnage Carried <u>a/</u> (Million Metric Tons)	Tonnage of Timber Carried	
		Million Metric Tons	Percent of Total
1954	0.03	N.A.	N.A.
1955	0.61	N.A.	N.A.
1956	1.37	0.43 <u>b/</u>	31.4
1957	1.85	0.80 <u>c/</u>	43.2
1958	2.4	1.2 <u>c/</u>	50.0

a. Obtained from Table 1, p. 6, above.

b. Planned absolute amount of timber hauled during the last half of 1956. 42/

c. Plan. 43/

It is likely that little movement of timber by rail occurs south of Yung-an. Nan-p'ing, the principal shipping point for timber in Fukien Province, accounts for more than 60 percent of all the timber moved by rail. 44/ Other important timber shipping points include the Yung-an area, which planned to produce more than 60,000 tons of timber in 1957, 45/ most of which probably was shipped out by rail.\* Timber also accounts for 47.2 percent of the railroad traffic between Nan-p'ing and Foochow. 46/

Coal is the second most important commodity moved on the Ying-t'an - Amoy Railroad. In 1958, Fukien Province produced about 750,000 tons of coal, but this amount is far below the level of

\* This figure would represent 7.5 percent of all the timber hauled by rail in 1957.

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consumption. Total production of coal at the Chang-hua complex\* in 1958 is unknown. It is probable, however, that this area produced enough to supply local demands, including the requirements for railroad coaling stations, and also shipped nearly 300,000 tons to Amoy.\*\* Planned production of steel at Lung-yen in 1959 would require about 300,000 tons of coal, but the increased production of coal probably provided a surplus of more than this amount to be shipped out, probably to Amoy, in 1959. Coking coal from Hunan and Kwangsi also is shipped to Amoy 48/ and presumably to Foochow. It is estimated that more than 900,000 tons of coal were hauled on the Ying-t'an - Amoy Railroad during 1958.\*\*\* This figure would account for about 38 percent of total freight traffic or about 75 percent of freight traffic excluding timber. The portion represented by military supplies of the remaining traffic is unknown.

The movement of cement accounted for about 4.2 percent of the total tonnage carried on the Ying-t'an - Amoy Railroad in 1958. This movement occurred mainly on the Nan-p'ing - O-yang section of the Nan-p'ing - Foochow branch line. Nan-p'ing is the only major source of cement in Fukien Province, accounting for production of 100,000 tons in 1958, 49/ and providing about 80 percent of all the cement consumed in the province. Of the 100,000 tons of cement produced in 1958, it is estimated that about 50,000 tons probably were shipped from Nan-p'ing to O-yang for transshipment to the hydroelectric stations under construction near Ku-t'ien, that about 8,000 tons were shipped to Foochow for construction of the rail line north,† and that the remainder probably was shipped to other consumers in Fukien (possibly primarily to San-ming, Lung-yen, and Amoy).

The "other" category shown in Table 2†† comprises about 200,000 tons, or 8.3 percent of the total tonnage carried on the Ying-t'an - Amoy Railroad. Incoming commodities included in this

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\* This complex is circumscribed by Chang-p'ing, Lung-yen, and Hua-an.

\*\* This estimate is based on a Communist announcement. 47/

\*\*\* This estimate was derived by applying the proportion of the total tonnage originated by rail that was represented by coal in all of Communist China in 1958 (38.4 percent) to the total tonnage of freight scheduled to be carried by the Ying-t'an - Amoy Railroad (2.4 million tons).

† This estimate was based on the assumption that about 100 km of this line were under construction in 1959. An average consumption of 80 tons per kilometer has been used, based on the average consumption on the Ying-t'an - Amoy line. 50/

†† P. 7, above.

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group are machinery and other finished steel products, petroleum products, flour, small amounts of cement, various manufactured consumer goods, fertilizer,\* and military supplies. Outgoing cargoes included salt, 52/ charcoal, dried bamboo shoots, 53/ sugar, fruits, 54/ rosin, turpentine, native paper, 55/ bamboo poles, 56/ barley from Chang-chou for the Shanghai breweries,\*\* 57/ tea leaves, 58/ other agricultural goods, and small amounts of pig iron.\*\*\* 59/ Most of these outgoing shipments apparently are destined for Shanghai either for consumption or for distribution to other parts of Communist China.

C. Estimated Through Capability<sup>†</sup>

The estimate of through capability of the Ying-t'an - Amoy Railroad in Communist China is based on the best information available on physical facilities, equipment, and operating practices. Variations in any one or all of these components could influence the estimated capability to a considerable extent.<sup>††</sup> Improvements in all or any one of the components could increase considerably the capability of a railroad. Because of the dynamic nature of transportation, therefore, an estimate of capability can be regarded at best as providing only an approximate order of magnitude.

The through capability of the Ying-t'an - Amoy Railroad is restricted by the Ying-t'an - Wu-k'eng section to an estimated nine through trains each way per day (EWPDP), or 7,300 tons EWPDP. The sections of the railroad from the junction at Wu-k'eng to Foochow and to Amoy are estimated to have about equal capability, five through trains EWPDP, or 4,300 tons EWPDP. The principal classification yard, located at Lai-chou, is estimated to be capable of handling 6.4 trains per 24-hour day for complete classification, but the low capability of this yard will not restrict the line capability for through movements. Moreover, as long as most of the total traffic consists of timber moving out of Fukien Province and coal moving into or within the province, requiring practically no classification en route, the capability of the Lai-chou yard will not restrict economic rail traffic. It also is believed that the Chinese Communists are capable of expanding this yard in a short time if necessary. Other yards on the line are believed

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\* A portion of this fertilizer is imported as "yen-fei" (tobacco fertilizer) coming from Shanghai to Chang-chou. 51/ This movement probably is in proportion to the amount of barley exported from Chang-chou to the Shanghai breweries.

\*\* There probably also are small movements of grains out of the province for milling purposes being returned as flour.

\*\*\* Movement of ores from Fukien Province probably ceased in 1959 as processing centers at San-ming and Lung-yen and other points were completed and came into production.

† For detailed methodology, see Appendix B.

†† See Table 12, Appendix B, p. 54, below.

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to be used chiefly as small gathering or setting out points or for relay purposes in through movement, and it is estimated, therefore, that yard capability would not restrict line capability. Nor would repair and servicing facilities restrict line capability.

In November 1958 the Chinese Communists announced that the number of freight trains had been increased from 4 to 8 EWPD and that passenger trains had been increased from 1 to 2 EWPD, 60/ thus indicating a total of 10 trains EWPD. All of these trains, however, probably were not through trains. In June 1959 the Chinese also announced that through train service between Foochow and Amoy had begun 61/ and, in January 1960, that 12 extra passenger trains had been added for holiday traffic. 62/ Because the Chinese method of counting trains is unknown and because some are probably not through trains, these announcements are not considered inconsistent with the present estimates of through capability of the line.

It is estimated that, as of 1959, through line capability of the Ying-t'an - Amoy Railroad was about 5.3 million tons annually,\* or 2.2 times the tonnage scheduled to be carried in 1958. If the tonnage hauled on this railroad increases annually as fast as the national average for 1959 (about 42 percent), through capability could be reached during 1961. The total capability of the system exceeds its through capability because of the limitations placed on the through capability of the system by the Ying-t'an - Wu-k'eng section. Therefore, the system actually could carry additional tonnage even after through capability is reached. The expansion of mining activities in the Chang-p'ing area should eliminate the need for much of the coal being imported by rail into Fukien Province and, together with the additional lines planned or under construction, should relieve somewhat the present heavy burden on the Ying-t'an - Wu-k'eng section.

The feasible completion dates of currently projected lines and the estimated date when the present line will approach the present estimate of through capability appear almost to coincide. In addition to underlining the urgency of expanding current railroad capability in the Fukien coastal region, this coincidence of dates also suggests a good deal of sophistication in planning by the Chinese Communists.

### III. Highway Transport

#### A. Highway Network and Additions\*\*

As shown in Table 4,\*\*\* the Chinese Communists have made significant improvements in the motorable highway network of Fukien

\* See the footnote on p. 2, above.

\*\* For the graphic location of the highway network serving Fukien Province, see the map, inside back cover. For listings of locations, descriptions, and estimated capabilities of highway routes, see Tables 9 and 10, pp. 37 and 44, respectively, below.

\*\*\* Table 4 follows on p. 12.

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Table 4

Estimated Length of Motorable Highway Network in Fukien Province  
of Communist China  
1950-59

	Kilometers	
<u>Year</u>	<u>Total Network</u>	<u>Annual Additions</u>
1950	2,300 <u>a/</u>	N.A.
1951	2,800 <u>b/</u>	500
1952	3,200 <u>c/</u>	400
1953	3,600 <u>c/</u>	400
1954	4,000 <u>d/</u>	400
1955	4,600 <u>e/</u>	600
1956	5,000 <u>f/</u>	400
1957	6,100 <u>g/</u>	1,100
1958	6,600 <u>h/</u>	500
	(10,200) <u>i/</u>	
1959	7,300 <u>j/</u>	700

a. 63/

b. 64/

c. Interpolated between 1951 and 1954 by applying the average annual rate of increase of 12.5 percent.

d. 65/

e. 66/

f. 67/

g. 68/

h. The addition of 500 km to motorable highways was derived by estimating the average annual addition for the period 1950-57.

i. Total announced network, including 3,600 km of Class VI-B roads. (See p. 13, below.) 69/

j. 70/

Province. These improvements have included both the renovation of existing roads and the extension of the network through new construction. Until 1955, when the network reached 4,600 km, 71/ construction appears to have consisted chiefly of the renovation, restoration, and improvement of the network that had existed in 1949.\* By January 1959 the total motorable highway network reached 6,600 km. It was

\* Because restoration and new construction were carried on simultaneously, the figure announced for 1955 would include some new construction and some restoration. [footnote continued on p. 13]

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announced that 4,100 km had been added during 1958, but, of this increase, 88 percent is believed to have resulted from the reclassification of 3,600 km of "simple highways" to Class VI-B highways.\* Thus only about 500 km of motorable roads were added in 1958. The large increment during 1957 also could be the result of the many roads that were begun during 1956 in an attempt to keep pace with the economic upsurge during that year. Announced plans for 1959 included the building of 1,672 km of new highways, 6,366 km of second-class roads, 73/ and 130 km of roads to forest, industrial, and mining areas. 74/ These totals probably include an unknown amount of renovation of the existing network. Four bridges also were begun during 1959 at An-ch'i, Shao-wu, Shun-chang, and Nan-p'ing. 75/

B. Performance

1. Motor Trucks

Reliable figures on the tonnage carried by highway transport in Fukien Province are almost nonexistent. In 1957, motor trucks reportedly carried 1.94 million tons of freight, 76/ representing slightly more than the estimated 1.85 million tons carried by rail in the province and about 12.5 percent of announced total tonnage carried by all forms of transport in 1957. 77/ If this same percentage is applied to the total performance in 1958, 78/ then motor transport carried about 2.8 million tons in 1958 compared with 2.4 million tons carried by rail.

2. Primitive Highway Transport

Primitive highway transport accounted for about 75 percent of the total tonnage carried on highways in Communist China during 1958. 79/ Because the highway system in Fukien Province is above the average, however, primitive highway transport probably accounts for less than 75 percent of the total tonnage carried by highway in that province. It is estimated that during 1958 the upper limit of primitive highway transport may have been 8.4 million tons carried in Fukien Province.\*\* The Communists recently announced that

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Taking 5 to 6 years to regain the 1949 figure appears comparable with nationwide performance.

\* A Class VI-B highway is designed for speeds of 16 miles per hour, has one lane 10 to 15 feet wide, a roadbed of 15 to 21 feet, a minimum radius of curve of 49 feet, unobstructed vision when stopping of 82 feet, and a maximum grade of 5 percent on level land and 8 percent on mountainous land. 72/ There probably would be little or no surfacing, poor drainage, and few if any bridges. These roads are in fact large cart roads, passable by jeep in fair weather.

\*\* The upper limit is estimated to be three times the modern highway performance of 2.8 million tons carried.

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70,000 "vehicles" were engaged in "short-distance" transport on an average day. 80/

C. Motor Truck Inventory

The civilian motor vehicle park of Fukien Province is estimated at more than 4,000 vehicles, most of which are trucks.\* About one-half of the park probably is under the control of the state-owned transport groups, the remainder being owned and operated by functional government agencies or enterprises. The military park in the province is estimated at about 7,500 trucks. The transport park probably is controlled by the Provincial Transportation Bureau, which has its principal depot at Foochow and four other major depots located at Amoy, Ch'uan-chou, Chang-chou, and Nan-p'ing. 81/

the areas of operation as follows 82/:

50X1

<u>Depot</u>	<u>Area of Operation</u>
Foochow	East Fukien area up to Wenchow in Chekiang Province
Amoy	Amoy
Ch'uan-chou	South Fukien Province up to Yung-an
Chang-chou	West Fukien down to Swatow in Kwangtung Province
Nan-p'ing	North Fukien area

These five main depots probably have extensive repair capabilities, and they control about 17 additional substations scattered throughout the province. 83/  substations at P'u-t'ien, Yun-hsiao, Lung-yen, Lien-ch'eng, Yung-an, Shao-wu, Kuang-tse, Ch'ung-an, Ku-t'ien, Chou-ning, and Fu-an. 84/ Other substations, controlled by civilian transport groups, may exist at such places as P'u-ch'eng, Chien-yang, Chien-ou, Yung-ch'un, An-ch'i, or T'ung-an, which are located at the hubs of road intersections. Military parks also exist at approximately 32 locations in the Fukien coastal region.\*\*

50X1

\* For detailed methodology, see Appendix B.  
\*\* For exact locations, see source 85/.

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D. Major Routes and Commodity Movements

1. Major Routes\*

The highway network of the Fukien coastal region has been described as forming a ladder, the upright portions of this ladder being formed by routes 1 and 3. Route 1, which runs along the narrow coastal plain from Canton through Swatow, Amoy, and Foochow to Wenchow, is of major economic and military significance.

Route 3 runs parallel to the coast, about 100 miles inland from Canton, through Mei-hsien, Yung-an, Nan-p'ing, Chien-ou, Chien-yang, and P'u-ch'eng to Chiang-shan on the Shanghai - Chu-chou Railroad. The middle portion of this route, from Yung-an to Nan-p'ing, parallels the Ying-t'an - Amoy Railroad. Because the railroad and river provide transport arteries along the middle portion, the sections of this route of major economic and military significance are the sections from Canton to Yung-an and from Nan-p'ing to Chiang-shan.

A third road, route 5, runs parallel to route 3 about 200 miles inland, west of the Fukien provincial border, from Shao-kuan (Ch'u-chiang) on the Hankow-Canton Railroad. Route 5 is connected with route 3 by three lateral highways, routes 6, 402, and 404. Because a major ridge line running along the western border separates route 5 from Fukien, this road is of marginal economic significance to the extreme western portion of Fukien Province, and because of the nature of the terrain, the road also is of limited military significance. In the event of war, however, this route could provide alternate highway connections with route 3 and with the Ying-t'an - Amoy Railroad.

\* For a description of routes and estimates of capability, see Table 10, Appendix A, p. 44, below. To facilitate discussion, the major highways of the Fukien coastal region have been assigned arbitrary numbers that bear no relation to actual Communist or Nationalist highway numbers. Generally the most important routes have been assigned one-digit designations and those of lesser importance, three-digit designations. Routes running roughly north and south have odd numbers, whereas those running east and west have even numbers. The numbering begins at the coast for odd numbers and in the north for even numbers. The three-digit numbers have been assigned on the basis of the location of the routes. For example, route 103 would be a highway of secondary importance, running roughly north and south, located west of route 1 but east of route 3. For the graphic location of these routes, see the map, inside back cover.

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The most northerly rung of the ladder is formed by route 2. This highway connects Chin-hua on the Shanghai - Chu-chou Railroad with the port city of Wenchow and is of little or no economic significance to Fukien Province. Under normal conditions, very few, if any, commodities shipped in or out of the province would move along this route.

Of major economic and military significance is route 4. Beginning at Shang-jao on the Shanghai - Chu-chou Railroad, this road passes through Ch'ung-an, Chien-yang (intersection with routes 3 and 402), Chien-ou (intersections with routes 3 and 103), Kuo-pu, and Ku-t'ien and runs on to Foochow. This road provides the central lateral link between routes 1 and 3 and connects the Shanghai - Chu-chou Railroad with the city of Foochow.

Route 6 provides a lateral link between routes 1, 3, and 5 in southern Fukien Province. Beginning at Yu-tu (the intersection with route 5), this route passes through Jui-chin, Ch'ang-t'ing, P'eng-k'ou (the intersection with route 3), and Lung-yen to intersect with route 1 west of Amoy at Chang-chou. At present, route 6 probably is of more economic than military importance because of the exploitation of coal and ferrous ores. When completed the railroad under construction from Lung-yen to Ch'uan-chou via Chang-p'ing will appreciably lessen the economic importance of route 6.

Economically the Chinese Communists claim that route 3 from Nan-p'ing north to the railhead at Chiang-shan is the most important route for commodities moving into or out of Fukien Province. Within the province the most important road is route 1, 86/ which traverses the coastal region occupied by one-third of the population and also is of primary military significance. 87/

Other highways of primary economic importance are routes 4, 6, and 406. 88/ A newly completed highway (route 202) from P'u-ch'eng through Sung-ch'i, Cheng-ho, Chou-ning, and Fu-an to Sai-ch'i will be of major economic importance until the projected rail line is completed between P'u-ch'eng and Sai-ch'i. 89/ The Chinese Communists have stated 90/: "The completion of this highway completes the highway network of this province linking the vast hilly area in north and east Fukien with coastal ports. It has specially important significance in the construction of Fukien's communications lines."\*

\* This last sentence probably refers to the use that will be made of this highway in the construction of the projected P'u-ch'eng - Sai-ch'i Railroad.



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This statement seems to imply that the basic road network in Fukien Province is completed and that future construction will be concentrated on short feeder roads to the existing highway, railroad, and water systems. Although the highway network has been expanded rapidly, many areas of the province still are inaccessible by motor trucks. The Communists probably will concentrate on feeder routes to these points and on improvement of the existing system in the next 5 to 6 years.

## 2. Commodity Movements

Sufficient data are not available to estimate the composition of motor truck transport in Fukien Province, but it appears that grain, timber, coal, and mineral ores account for a very large portion of the total tonnage carried by civilian motor trucks. Most of the movement occurs from the producing areas toward the railroad or waterway systems. Generally the movement of goods by motor truck is restricted to short hauls to and from the population centers and railroad or waterway systems, with raw materials moving primarily from the interior toward the coastal areas and finished goods and materials moving inland in smaller quantities.

Route 1 north of Foochow is used for a variety of commodities. A 40-km dirt road from just north of Lien-chiang to Foochow is used to transport produce, paper, timber, and charcoal to Foochow. 91/ The complex of dirt roads west of the Foochow - P'u-t'ien section of route 1 is used to haul coal in addition to other materials. 92/ The road complex that is centered on routes 406 and 408 has a dirt road extending west from Yung-ch'un that traverses a region said to be rich in ore and coal reserves. The movement of these two commodities toward the coast probably accounts for the major portion of motor truck transport in the region. Paper, grain, and other commodities move down route 6 toward Chang-chou and Amoy. 93/ Tobacco and presumably other commodities move from the area south of Chiu-feng (P'ing-ho) toward Swatow. 94/

The movement of commodities on route 402 probably is toward the rail line at Shao-wu and Kuang-tse. The Chinese Communists have announced that a new road from Hsing-ts'un to Mu-sha will allow the movement of timber toward Shao-wu. 95/ Rice and other materials move along route 404, either westward to route 5 or eastward to Sha-ch'i-k'ou, with the dividing line probably between T'ai-ning and Chien-ning. A feeder to route 3 from Ching-liu allows the eastward movement of bamboo and other native products. 96/ The newly constructed road from Yu-ch'i to Sha-hsien is used primarily for grain, timber, and paper shipments toward the railroad and river to the northwest. 97/ Bamboo and rice move south from Ning-hua to

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Lien-ch'eng. 98/ Routes 3 and 6 between Yung-an and Lung-yen are used to transport paper and food products in addition to other commodities. 99/ Timber and agricultural products are the principal commodities transported between Shang-han and Kuo-ch'e.

Motor truck transport in Fukien Province is confined to a "trade area" roughly circumscribed by Yun-hsiao, Shang-hang, Tai-ning, Shao-wu, Ch'ung-an, P'u-ch'eng, and Fu-an. Within this area, two major transport axes for truck transport exist -- Yung-an to Nan-p'ing and Amoy to Foochow. Motor truck transport is oriented toward the population centers within this area, most commodities moving generally eastward toward the coastal area.

IV. Water Transport

Until very recently, water transport was the major means of communication and travel in the Fukien coastal region of Communist China. Water provided not only a connection with the rest of China but much of the local transport as well. Fukien Province contains more than 12,000 km of inland waterways, of which about 4,000 km are navigable to modern powered vessels. Coastal shipping in the region is served by the ports of Swatow, Amoy, Foochow, San-tu-ao, and Wenchow as well as by numerous smaller ports. Approximately 487 nautical miles, or 50 to 60 hours sailing time, separate Wenchow in the north from Swatow in the south. Much of the area is of limited use to the Communists because of the Chinese Nationalist control of Formosa, Quemoy, and Matsu.

A. Inland Waterways

Inland waterways in the Fukien coastal region serve primarily as routes of local transport along which products move to and from the railheads and seaports. The major route for inland water transport is the Min River and its tributaries.\* The Min River is navigable to modern powered ships from Nan-p'ing to Foochow, a distance of about 200 km that has been dredged and marked with navigational aids for both day and night sailing. Transportation on most other rivers is limited to smaller craft and to much shorter distances. The Chiu-lung River is the only one of importance in the Fukien coastal region that is not tributary to the Min River. As can be seen from the map,\*\* all other rivers in the region are navigable to small native craft, and although the tonnage in any given area is small, it is important to the area. The aggregate tonnage moved in the Fukien coastal region

\* For a listing of characteristics of the Min River System, see Table 11, Appendix A, p. 48, below.

\*\* Inside back cover.

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by the junks and sampans probably exceeds that moved by any other single form of transportation and all the forms of modern transport combined.

Data on the performance of water transport on the rivers of the Fukien coastal region are very limited. It is estimated that junks and other primitive craft carried approximately 5 million tons in 1957 and approximately 7 million tons in 1958, whereas modern water transport carried only about 1 million tons in 1957 and 1.7 million tons in 1958. In spite of the relative decline in water transport since the advent of the railroad and the improvement of highways, the inland waterways of the Fukien coastal region were still the largest single carrier of cargo in 1958, and inland water alone carried nearly 40 percent of the total cargo moved in that year by all forms of transport, both primitive and modern.

The major commodity that moves on the rivers of the Fukien coastal region is timber. 100/ Other commodities include coal, tea, bamboo, paper, citrus fruit, and other agricultural products. 101/ These products move down the river to Foochow, where they are transshipped to railroads or ocean ships for shipment to Shanghai or other industrial areas. Commodities originating on the upper reaches of the tributary streams may be transshipped at Nan-p'ing, P'u-ch'eng, Chien-ou, or Shao-wu. Commodities moving into the province include coal, industrial raw materials, fertilizer, and machinery.

The capability of river transport is limited by three factors: (1) the width, depth, and navigational aids of the river system; (2) the number, size, and suitability of the craft available; and (3) the availability and degree of development of ports. In assessing the capability of inland water transport in the Fukien coastal region, a distinction must be made between requirements for local transport and requirements for modern economic development or for logistic support of military movements. Local transport, such as the movement of agricultural commodities to collection points or of sand and other materials to construction sites, utilizes ships of native construction with capacities of 1 to 50 tons and speeds of 10 to 40 km per day that require few, if any, unloading facilities. It is estimated that many more than 5,500 such ships operate in Fukien Province. 102/ On the assumption of an average capacity of 15 tons and an average speed of 20 km per day, these ships would be capable of carrying more than 15 million tons annually and, with an average length of haul of 40 km, could account for 600 million ton-kilometers annually. In the complete absence of any inventory of the modern fleet, it is almost impossible to arrive at any meaningful estimate of the capability of modern water transport alone. It is estimated that the capability of the major inland ports in the Fukien coastal region

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exceeds 5 million tons annually. Native craft require few, if any, port facilities.

The aggregate capability of both primitive and modern river transport in the Fukien coastal region is therefore estimated to be at least 20 million tons annually. This estimate is gauged in terms of utilization for normal economic activity. If the Chinese Communists wish to divert sufficient suitable craft to the region, the capability of the waterways would be increased significantly.

#### B. Coastal Shipping

The modern oceangoing fleet of Communist China consists of more than 110 ships of 1,000 gross register tons (GRT)\* or larger, totaling more than 400,000 GRT. Only a small portion of this fleet is engaged in operations along the Fukien coast, and major Chinese ships do not call at that portion of the coast between Swatow and Foochow. Western ships occasionally call at Amoy, however, and large junks (50 to 400 GRT) provide a bridge for the gap created by Chinese Nationalist control of Quemoy. The Chinese Communists have sufficient shipping strength to deliver more products into the region than the ports could possibly handle, and thus the capability of ocean transport in the region is limited by the capability of the ports. The estimated capability of major ports of the Fukien coastal region is shown in Table 5.\*\* Each of several other ports not shown in Table 5 -- such as Aochiang, the estuary of the Ao River -- would have a capability of several hundred tons per day. Thus the aggregate port capability would be more than 6 million tons per year. The ports could not sustain their maximum capability for any extended period, however, because of the inability of land transport to clear the ports at the necessary rate.

Little definite information is known about the performance of coastal shipping in the Fukien coastal region. It is believed, however, that less than 2 million tons\*\*\* were moved in 1958 and that this movement was nearly evenly divided between primitive and modern transport. Thus less than one-third of the existing port capability was used in 1958. The ports of Amoy and Foochow were utilized to only a small fraction of their capability because of the risk of Chinese Nationalist interference. Commodities moving by ocean transport are very similar to those moving on the inland waterways. Timber and certain agricultural products move from the Fukien coastal region to Shanghai and Canton. Coal, industrial raw materials, and some manufactured

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\* Gross register tonnage is the cubic capacity of the cargo space of a ship in long tons at the rate of 1 ton per 100 cubic feet.

\*\* Table 5 follows on p. 21.

\*\*\* This figure is the residual left after deducting other forms of transport from the total performance.

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Table 5

Estimated Capabilities of Major Ports  
in the Fukien Coastal Region of Communist China  
1959

<u>Port</u>	<u>Metric Tons a/</u>
Wenchow	6,000 <u>b/</u>
Foochow	1,000 <u>c/</u>
San-tu-ao	1,000 <u>d/</u>
Amoy	8,000 <u>e/</u>
Swatow	3,000 <u>f/</u>
Total	<u>19,000</u>

a. Loaded and unloaded per 20-hour day.

b. 103/

c. 104/

d. 105/. San-tu-ao is potentially the best port site in the region, and its development may be expected to follow closely the accomplishment of projected rail connections to the area.

e. 106/

f. 107/

goods move into the region, coming, for the most part, from Shanghai and Dairen.

C. Capabilities

In assessing the capability of water transport in the Fukien coastal region of Communist China, the frame of reference was economic need rather than military necessity. The navigable water routes of the Fukien coastal region have an almost unlimited capability. 108/ Thus the limits to the amount of cargo that can be moved on the waterways are set by the number of ships available in the case of primitive transport and the number of ships and port facilities in the case of modern transport.

If the Chinese Communists were willing and able to provide a sufficient number of ships capable of operating in relatively shallow water and of unloading their cargo on beaches instead of wharves, they could move almost any amount of cargo into the region that they deemed necessary. The question of the Chinese ability to

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supply such ships is complex and not easily answered. Fukien Province contains numerous yards capable of building junks of up to 50 tons, but these yards could produce only a few dozen ships a year. Canton and Shanghai, however, have sufficient shipbuilding facilities to produce as many ships as the Chinese Communists could reasonably expect to need in the Fukien coastal region, and tens of thousands of junks could be moved in from other regions. In brief, if the utilization of water transport had a sufficiently high priority, the Chinese could move along the rivers and coast of Fukien Province a sufficient volume of commodities to meet nearly any reasonable objective.

V. Conclusions

A. Transportation Facilities

The extension of railroad facilities to Amoy and Foochow has provided the Fukien coastal region with transportation adequate to support present economic activity in addition to providing greatly improved logistic support to the coastal region opposite Taiwan. Rail transport, because of its unique capabilities, is the most important means of transportation in the region, but the railroad network suffers from several important weaknesses.

One major weakness of railroad facilities of the Ying-t'an - Amoy Railroad is the limitation to through capability imposed by the Ying-t'an - Wu-k'eng section. When completed, the Yu-shan - Pa-tu section should help to eliminate some of this weakness, although the character of the terrain and the heavy seasonal rainfall make the railroad susceptible to seasonal damage. The combination of long distances between passing tracks and short sidings constitutes another major weakness. Nevertheless, the railroad appears capable of hauling a good deal more tonnage and should be adequate to support economic expansion until the new lines that are projected or under construction can become operational.

The highway network of the Fukien coastal region is generally of good quality, although a number of one-way bridges limit the route capabilities. This network appears adequate to support economic activity in the region by providing feeder service to the rail and waterway systems. It is probable that a mixed park and limited capability for making repairs are the chief weaknesses of the highway system.

The waterways of the Fukien coastal region are adequate to meet present transportation requirements and are constantly being improved. The capability of inland water transport will continue

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to improve, but the volume of coastal and ocean shipping will continue to depend on the presence or absence of Chinese Nationalist forces.

The composition of traffic consists primarily of timber moving out of and coal moving into or within Fukien Province. The major transportation centers appear to be Foochow, Ch'uan-chou, Amoy, and Chang-chou along the coast and P'u-ch'eng, Chien-yang, Chien-ou, Nan-p'ing, Lai-chou, Yung-an, Chang-p'ing, Lung-yen, Ch'ang-t'ing, Lien-ch'eng, Shao-wu, An-ch'i, and Yung-ch'un inland. The most dense inland transport traffic may occur between Yung-an and Nan-p'ing, where railroad, highway, and waterway transport exist and between Nan-p'ing and Foochow along the railroad and the Min River.

The Chinese Communists announced that the transportation centers of Nan-p'ing, Shao-wu, Lai-chou, and Chang-p'ing were badly congested during late 1958. To coordinate the different sectors of transport and to help ease the congestion, a "unified command" over all modes of transportation in Fukien Province was established in December 1958 109/ and may still be functioning. Under normal circumstances the railroad is operated by the Foochow Railway Bureau, and highway and water transport are operated by the Provincial Ministry of Communications. Although no absolute figures concerning performance have been given, the Communists announced that in the first 9 months of 1959 freight transport\* increased 80.9 percent in comparison with the corresponding period of 1958. 110/

The Fukien coastal region of Communist China will continue to expand and improve all forms of transportation. The railroad network is being steadily expanded, the highway network also is expanding, and a number of bridges are being improved. 111/ Waterways will continue to be improved, and the planned construction of a large powerplant on the Chien Hsi River near Chien-ou 112/ may cause considerable change in water and highway transport in that area.

B. Transportation Requirements

The estimated production of selected commodities in Fukien Province that represent most of the economic commodities requiring transportation is shown in Table 6.\*\*

Although the commodities listed in Table 6 do not comprise all of the commodities transported in Fukien Province, it is believed that a comparison between the figures shown in this table and

\* The term was not defined in the announcement.

\*\* Table 6 follows on p. 24.

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Table 6

Estimated Production of Selected Commodities in Fukien Province  
 of Communist China  
 1957-59

Commodity	Thousand Metric Tons		
	1957	1958	1959 <sup>a/</sup>
Grain	4,400	5,000	5,000 <sup>b/</sup>
Timber	1,988	2,108	2,908
Coal	82	750	820
Marine products	265	476	1,000
Ferrous metals			
Iron	Negligible	209	200
Steel	Negligible	16	80
Ferrous materials	Negligible	Negligible	50
Subtotal	Negligible	<u>225</u>	<u>330</u>
Salt	140	175	175 <sup>b/</sup>
Cement	53	100	130
Sugar	94	104	104 <sup>b/</sup>
Vegetable oil	24	25	25 <sup>b/</sup>
Fruit	94	118	118 <sup>b/</sup>
Fibers	12	15	15 <sup>b/</sup>
Tea leaves	7	9	9 <sup>b/</sup>
Total	<u>7,159</u>	<u>9,105</u>	<u>10,634</u>

a. Unless otherwise indicated, figures represent planned production.

b. Because of floods in June and typhoons later in the year, production is estimated not to have exceeded the level of 1958.

figures on transportation will indicate that production of these commodities reflects to some extent the requirements for transportation of the province. Production of the commodities listed in Table 6 increased from about 7.2 million tons in 1957 to about 9.1 million tons in 1958, a gain of about 26 percent. At the same time, it was announced that the total tonnage carried by all forms of transportation in the province increased from 15.5 million to about 22 million tons, or about 42 percent. In 1957, each ton produced was associated with



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2.15 tons carried by the transportation system.\* By 1958, each ton produced was associated with 2.42 tons carried, thus reflecting wider distribution of products, better statistical coverage of the various types of transportation, or perhaps increased production and transportation of commodities such as construction materials that are not included in Table 6. The application of the average between 2.15 and 2.42 (2.28) to the estimate of total production of about 10.6 million tons in 1959 would indicate a transport load of about 24 million tons, an increase of about 9 percent compared with 1958.

Although these figures are intended only as rough approximations of transportation requirements and are by no means complete or definitive, they may reflect the increased magnitude of such requirements. The extensions and gradual improvement of the entire system and the additions to inventory, however, should have made requirements less difficult to meet in 1959 than in 1958. If the transportation system of Fukien Province was able to absorb an increase of 42 percent during 1958, an increase of about 9 percent during 1959 probably was absorbed with greater ease.

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\* These figures mean that each ton produced was hauled by more than two forms of transportation and that each ton produced was counted as a ton carried as it moved from one form of transportation to another.

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APPENDIX A

STATISTICAL TABLES

The tables that follow represent a compilation of data necessary to estimate the capabilities of the transportation system of the Fukien coastal region. Railroad stations and facilities on the Ying-t'an - Amoy Railroad in 1959 are given in Table 7.\* The estimated capabilities of yards on this railroad in 1959 are given in Table 8.\*\* The location of individual highway routes in the Fukien coastal region in 1959 are given in Table 9.\*\*\* Descriptions and estimated capabilities of these highways are given in Table 10.† Characteristics of the Min River system affecting water transport in the region are given in Table 11.††

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\* Table 7 follows on p. 28.

\*\* Table 8 follows on p. 35.

\*\*\* Table 9 follows on p. 37.

† Table 10 follows on p. 44.

†† Table 11 follows on p. 48.

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Table 7

Railroad Stations and Facilities on the Ying-t'an - Amoy Railroad  
 in Communist China a/<sup>\*</sup>  
 1959

<u>Line and Station</u>	<u>Number of Kilometers</u>	
	<u>From Ying-t'an</u>	<u>From Amoy</u>
Ying-t'an - Amoy line		
Ying-t'an	0	694
Service and repair <u>b</u> / Turning wye <u>b</u> / Yard <u>b</u> / Water <u>c</u> / Coal <u>c</u> /		
Yu-chia-pu	9	685
Shang-ch'ing-kung	26	668
Yard <u>b</u> /		
Ch'uan-shang	36	658
Water <u>c</u> / Coal <u>c</u> /		
Erh-k'ou	41	653
Jao-ch'iao	56	638
Kao-fu	65	629
Tzu-ch'i	73	621
Yard <u>b</u> / Water <u>b</u> / Coal <u>b</u> /		
Yuan-tai	88	606
Yard <u>b</u> /		

\* Footnotes for Table 7 follow on p. 34.

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Table 7

Railroad Stations and Facilities on the Ying-t'an - Amoy Railroad  
 in Communist China a/  
 1959  
 (Continued)

<u>Line and Station</u>	<u>Number of Kilometers</u>	
	<u>From Ying-t'an</u>	<u>From Amoy</u>
Hsia-yuan (Ta-yuan-ts'un)	105	589
Water <u>b/</u>		
Kuang-tse	117	577
Yard <u>b/</u>		
Water <u>b/</u>		
Coal <u>c/</u>		
Ho-shun	127	567
Shao-wu	147	547
Service and repair <u>b/</u>		
Turning wye <u>b/</u>		
Yard <u>b/</u>		
Water <u>b/</u>		
Coal <u>b/</u>		
Wu-chia-t'ang	169	525
Na-k'ou	187	507
Water <u>d/</u>		
Wei-min	195	499
P'u-shang	219	475
Yard <u>b/</u>		
Water <u>b/</u>		

S-E-C-R-E-T

S-E-C-R-E-T

Table 7

Railroad Stations and Facilities on the Ying-t'an - Amoy Railroad  
in Communist China a/  
1959  
(Continued)

<u>Line and Station</u>	<u>Number of Kilometers</u>	
	<u>From Ying-t'an</u>	<u>From Amoy</u>
Shun-ch'ang	238	456
Yard <u>b/</u>		
Water <u>c/</u>		
Coal <u>b/</u>		
Yang-k'ou	253	441
Yard <u>b/</u>		
Hsia-yang	266	428
Lai-chou	285	409
Minor repair <u>b/</u>		
Turning wye <u>b/</u>		
Yard <u>b/</u>		
Water <u>b/</u>		
Coal <u>b/</u>		
Wu-k'eng	289	405
Yard <u>b/</u>		
Junction <u>b/</u>		
Ch'ing-chou	298	396
Yard <u>b/</u>		
Sha-hsien	334	360
Water <u>b/</u>		
Coal <u>b/</u>		
Mei-lieh	360	334

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Table 7

Railroad Stations and Facilities on the Ying-t'an - Amoy Railroad  
 in Communist China a/  
 1959  
 (Continued)

<u>Line and Station</u>	<u>Number of Kilometers</u>	
	<u>From Ying-t'an</u>	<u>From Amoy</u>
Ching-hsi	371	323
Water <u>d/</u>		
Kung-ch'uan	392	302
Yung-an	409	285
Service and repair <u>b/</u>		
Turning wye <u>b/</u>		
Yard <u>b/</u>		
Water <u>b/</u>		
Coal <u>b/</u>		
Hsi-yang	430	264
Yard <u>b/</u>		
Water <u>b/</u>		
Ling-t'ou	443	251
Yard <u>b/</u>		
Ch'eng-kou	459	235
Water <u>b/</u>		
Coal <u>b/</u>		
Mai-yuan	470	224
T'an-ping	494	200
(Ch'ien-pan)		
Water <u>d/</u>		

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Table 7

Railroad Stations and Facilities on the Ying-t'an - Amoy Railroad  
 in Communist China a/  
 1959  
 (Continued)

Line and Station	Number of Kilometers	
	From <u>Ying-t'an</u>	From <u>Amoy</u>
Chang-p'ing	513	181
Yard <u>b/</u>		
Water <u>b/</u>		
Coal <u>b/</u>		
Mei-shui-k'eng	533	161
Hua-an	567	127
Water <u>d/</u>		
Ch'i-nan-pan	592	102
T'an-k'ou	620	74
Water <u>d/</u>		
Kuo-k'eng	639	55
Locomotive service <u>b/</u>		
Turning wye <u>b/</u>		
Yard <u>b/</u>		
Water <u>b/</u>		
Coal <u>b/</u>		
Spur to Lung-ch'i <u>b/</u>		
Chiao-wei	658	36
Ch'ien-ch'ang	670	24
Water <u>d/</u>		
Chi-mei	680	14

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Table 7

Railroad Stations and Facilities on the Ying-t'an - Amoy Railroad  
 in Communist China a/  
 1959  
 (Continued)

<u>Line and Station</u>	<u>Number of Kilometers</u>	
	<u>From Ying-t'an</u>	<u>From Amoy</u>
Amoy	694	0
Service and repair <u>b/</u>		
Turning wye <u>b/</u>		
Yard <u>b/</u>		
Water <u>b/</u>		
Coal <u>b/</u>		
	<u>From Wu-k'eng</u>	<u>From Foochow</u>
Wu-k'eng - Foochow branch		
Wu-k'eng	0	192
Nan-p'ing	24	168
Service and repair <u>d/</u>		
Turning wye <u>d/</u>		
Yard <u>b/</u>		
Water <u>c/</u>		
Coal <u>c/</u>		
An-chi	35	157
Hu-lu-shan <u>e/</u>	N.A.	N.A.
Chang-hu-fan	67	125
Water <u>d/</u>		
O-yang	88	104
Turning wye <u>c/</u>		
Yard <u>c/</u>		
Water <u>c/</u>		
Coal <u>c/</u>		

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S-E-C-R-E-T

Table 7

Railroad Stations and Facilities on the Ying-t'an - Amoy Railroad  
in Communist China a/  
1959  
(Continued)

<u>Line and Station</u>	<u>Number of Kilometers</u>	
	<u>From Wu-k'eng</u>	<u>From Foochow</u>
Shiu-k'ou	104	88
Water <u>d/</u> Coal <u>d/</u>		
Mei-p'u <u>e/</u> Pai-sha	N.A. 153	N.A. 39
Water <u>c/</u>		
Kan-che Tu-wu <u>e/</u> Foochow	164 N.A. 192	28 N.A. 0
Service and repair <u>c/</u> Turning wye <u>c/</u> Yard <u>c/</u> Water <u>c/</u> Coal <u>c/</u>		

a. For the graphic location of the railroad stations and facilities on the Ying-t'an - Amoy Railroad, see the map, inside back cover.

- b. Confirmed.
- c. Probable.
- d. Possible.
- e. Unlocated.

## S-E-C-R-E-T

Table 8

Estimated Capabilities of Yards on the Ying-t'an - Amoy Railroad  
in Communist China a/\*  
1959

<u>Yard</u>	<u>Total Trackage b/ (Feet)</u>	<u>Operational Capability c/ (Cars)</u>	<u>Clearance Points d/ (Units)</u>	<u>Maximum Storage Capability e/ (Cars)</u>
Ying-t'an	36,000 <u>f</u> /	480	N.A.	800
Shang-ch'ing-kung	9,300	124	5	196
Tzu-ch'i	1,600	21	2	31
Yuan-tai	2,400	32	2	49
Kuang-tse	2,500	33	4	47
Shao-wu	12,000	160	15	233 <u>g</u> /
P'u-shang	2,800	37	3	56
Shun-ch'ang	2,400	32	4	44
Lai-chou	14,000	187	14	280 <u>g</u> /
Ch'ing-chou	1,800	24	2	36
Sha-hsien	1,800	24	2	36
Yung-an	9,700	129	11	191 <u>g</u> / <u>h</u> /
Hsia-yang	4,000	53	5	78
Ling-t'ou	3,500	47	3	71
Chang-p'ing	2,800	37	4	53 <u>g</u> / <u>i</u> /
Hua-an	1,700	23	2	33
Kuo-k'eng	8,600	115	9	171
Amoy	12,000	160	15	233 <u>g</u> / <u>j</u> /
Chang-chou	2,800	37	4	53
Nan-p'ing	8,000	107	11	153 <u>k</u> /
Ta-chou	1,900	25	2	38 <u>l</u> /
Chang-hu-fan	2,800	37	3	56
O-yang	2,600	35	4	49
Foochow	N.A.	N.A.	N.A.	N.A.

\* Footnotes for Table 8 follow on p. 36.

Table 8

Estimated Capabilities of Yards on the Ying-t'an - Amoy Railroad  
in Communist China a/  
1959  
(Continued)

- a. For purposes of this analysis, a yard is defined as any point along the line where more than a single passing or meeting siding exists. The total trackage of yard thus equals all the tracks less the main line and one track for passing or meeting. For the graphic location of yards on the Ying-t'an - Amoy Railroad, see the map, inside back cover.
- b. Unless otherwise indicated, estimates are based on trackage
- c. Total trackage times a reduction factor of 0.6 multiplied by an efficiency factor of 1 and divided by 45 feet (ft) per car.
- d. Points where two tracks converge. An allowance of 100 ft for each clearance point has been subtracted from the total trackage to arrive at the maximum storage capacity.
- e. Total trackage, less 100 ft for each clearance point, divided by 45 ft per car.
- f. An announcement of 29 September 1959 stated that this yard has been expanded to 31 tracks capable of parking 800 cars. The total trackage has been estimated by using 800 cars times 45 ft per car. The Chinese Communists claim that this yard is the largest south of the Yangtze River and now handles 58 trains every 24 hours. 114/ This yard also is used for traffic on the Shanghai - Chu-chou Railroad.
- g. Excluding storage space provided by locomotive servicing or fueling tracks.
- h. Excluding 2 spurs 15,000 ft long and capable of storing 333 cars.
- i. Excluding 3 spurs southeast of Chang-p'ing 2,100 ft long and capable of storing 40 cars.
- j. A supplementary yard is under construction at Kao-ch'i at the northern tip of Amoy Island. 115/
- k. Excluding a storage and servicing area 2.6 miles southwest of Nan-p'ing and capable of storing 69 cars.
- l. Excluding a spur to an island in the Min River with 2 tracks on the island and capable of storing 120 cars.

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Table 9

Location of Highway Routes in the Fukien Coastal Region  
 of Communist China a/\*  
 1959

Route and Location	Number of Kilometers	
	From Wenchow	From Swatow
Wenchow-Swatow (route 1)		
Wenchow	0	1,010
Jui-an	40	970
Fu-ting	110	900
Fu-an	190	820
Sai-ch'i	210	800
Ning-te	260	750
Lo-yuan	300	710
Lien-chiang	340	670
Foochow		
Intersection with route 4	390	620
Yu-ch'i	460	550
P'u-t'ien	500	510
Wu-ts'o		
Intersection with route 408	520	490
Feng-t'ing	540	470
Hui-an	560	450
Ch'uan-chou		
Intersection with route 406	590	420
An-hai	620	390
T'ung-an	650	360
Amoy	690	320
Chang-chou		
Intersection with route 6	730	280
Chang-p'u	790	220
Chao-an	890	120
Swatow	1,010	0

\* Footnotes for Table 9 follow on p. 43.

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Table 9

Location of Highway Routes in the Fukien Coastal Region  
 of Communist China a/  
 1959  
 (Continued)

Route and Location	Number of Kilometers	
	From Wenchow	From Chin-hua
Wenchow - Chin-hua (route 2)		
Wenchow		
Intersection with route 1	0	220 <u>b/</u>
Li-shui		
Intersection with route 101	110 <u>b/</u>	110 <u>b/</u>
Chin-hua		
Railhead	220 <u>b/</u>	0
	From Chiang-shan	From Canton
Chiang-shan - Canton (route 3)		
Chiang-shan		
Railhead	0	1,190
P'u-ch'eng		
Intersection with route 101	140	1,050
Shui-chi		
Intersection with route 103	210	980
Chien-yang		
Intersection with routes 4 and 402	240	950
Chien-ou		
Intersection with routes 4 and 103	290	900
Nan-p'ing		
Intersection with Ying-t'an - Amoy Railroad	350	840
Sha-ch'i-k'ou		
Intersection with route 404	370	820
Sha-hsien		
Across the river from the highway	410	780
San-ming (San-yuan)	440	750
Yung-an		
Intersection with route 406	480	710

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Table 9

Location of Highway Routes in the Fukien Coastal Region  
 of Communist China a/  
 1959  
 (Continued)

Route and Location	Number of Kilometers	
	From Chiang-shan	From Canton
Ch'iang-chiao	530	660
P'eng-k'ou		
Intersection with route 6	590	600
Shang-hang	680	510
Chiao-ling	750	440
Po-tu-hsu	770	420
Mei-hsien	790	400
Hsing-ning	840	350
Lung-ch'uan (Lungchun)	900	290
Teng-t'a	950	240
Ho-yuan (Hoyun)	990	200
Tseng-ch'eng (Tsengshing)	1,120	70
Canton	1,190	0
	From Shang-jao	From Foochow
Shang-jao - Foochow (route 4)		
Shang-jao		
Railhead	0	410
Ch'ung-an	110	300
Chien-yang		
Intersection with route 402	170	240
Chien-ou		
Intersection with routes 3 and 103	210	200
Ku-t'ien	300	110
Hsia-sh'i-k'ou	370	40
Foochow		
Intersection with route 1	410	0

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Table 9

Location of Highway Routes in the Fukien Coastal Region  
 of Communist China a/  
 1959  
 (Continued)

Route and Location	Number of Kilometers	
	From Canton	From Nan-ch'ang
Nan-ch'ang - Canton (route 5)		
Nan-ch'ang	990	0
Fu-chou	900	90
Nan-ch'eng		
Intersection with route 402	840	150
Nan-feng		
Intersection with route 404	800	190
Yu-tu		
Intersection with route 6	550	440
Ta-yu	420	570
Nan-hsiung	380	610
Ch'u-chiang		
Railhead	290	700
Canton		
Intersection with routes 1 and 3	0	990
	From Yu-tu	From Amoy
Yu-tu - Amoy (route 6)		
Yu-tu		
Intersection with route 5	0	470
Ferry crossing	20	450
Hsi-chiang-hsu	50	420
Jui-chin	80	390
Ch'ang-t'ing	130	340
P'eng-k'ou		
Intersection with route 3	200	270
Hsin-ch'uan	230	240
Lung-yen	300	170
Chang-chou		
Intersection with route 1	410	60
Amoy	470	0

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Table 9

Location of Highway Routes in the Fukien Coastal Region  
 of Communist China a/  
 1959  
 (Continued)

Route and Location	Number of Kilometers	
	From <u>P'u-ch'eng</u>	From <u>Li-shui</u>
P'u-ch'eng - Li-shui (route 101)		
P'u-ch'eng		
Intersection with route 3	0	160 <u>b/</u>
Lung-ch'uan	70 <u>b/</u>	90 <u>b/</u>
Li-shui		
Intersection with route 2	160 <u>b/</u>	0
	From <u>Shui-chi</u>	From <u>Chien-ou</u>
Shui-chi - Chien-ou (route 103)		
Shui-chi		
Intersection with route 3	0	60
Ching-hou	20	40
Chien-ou		
Intersection with routes 3 and 4	60	0
	From <u>P'u-ch'eng</u>	From <u>Fu-an</u>
P'u-ch'eng - Fu-an (route 202)		
P'u-ch'eng		
Intersection with routes 3 and 101	0	220
Sung-ch'i	60	160
Cheng-ho	80	140
Chou-ning	150	70
Fu-an	220	0



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Table 9

Location of Highway Routes in the Fukien Coastal Region  
 of Communist China a/  
 1959  
 (Continued)

Route and Location	Number of Kilometers	
	<u>From Nan-ch'eng</u>	<u>From Chien-yang</u>
Nan-ch'eng - Chien-yang (route 402)		
Nan-ch'eng		
Intersection with route 5	0	230
Kuang-tse		
Intersection with Ying-t'an - Amoy Railroad	120	110
Shao-wu		
Intersection with Ying-t'an - Amoy Railroad	160	70
Mu-sha		
Ferry crossing	200	30
Chien-yang		
Intersection with routes 3 and 4	230	0
	<u>From Nan-feng</u>	<u>From Sha-ch'i-k'ou</u>
Nan-feng - Sha-ch'i-k'ou (route 404)		
Nan-feng		
Intersection with route 5	0	270
Chien-ning	80	190
T'ai-ning	130	140
Chiang-lo	180	90
Shun-ch'ang		
Intersection with Ying-t'an - Amoy Railroad	220	50
Sha-ch'i-k'ou		
River port, railroad station, and intersection with route 3	270	0

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Table 9  
 Location of Highway Routes in the Fukien Coastal Region  
 of Communist China a/  
 1959  
 (Continued)

Route and Location	Number of Kilometers	
	From Yung-an	From Chin-chiang
Yung-an - Chin-chiang (route 406)		
Yung-an		
Intersection with route 3 and Ying-t'an - Amoy Railroad	0	250
Po-chuang	20	230
Ta-t'ien	80	170
Te-hua	140	110
Yung-ch'un		
Intersection with route 408	170	80
Hung-lai	210	40
Ch'uan-chou		
Intersection with route 1	250	0
	From Yung-ch'un	From Wu-ts'o
Yung-ch'un - Wu-ts'o (route 408)		
Yung-ch'un		
Intersection with route 406	0	70
Hsien-yu	50	20
Wu-t'so		
Intersection with route 1	70	0

a. To facilitate discussion, the major highways of the Fukien coastal region have been assigned arbitrary numbers that bear no relation to actual Communist or Nationalist highway numbers. Generally the most important routes have been assigned one-digit designations and those of lesser importance, three-digit designations. Routes running approximately north and south have odd numbers, whereas those running east and west have even numbers. The numbering begins at the coast for odd numbers and in the north for even numbers. The three-digit numbers have been assigned on the basis of the location of the routes. For example, route 103 would be a highway of secondary importance, running approximately north and south, located west of route 1 but east of route 3. For the graphic location of these routes, see the map, inside back cover.

b. Estimated.

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Table 10

Description and Estimated Capabilities of Highway Routes in the Fukien Coastal Region  
of Communist China a/\*  
1959

Description of Route <u>b</u> /	Vehicles EWPB <u>c</u> /	Metric Tons EWPB <u>d</u> /
Wenchow-Swatow (route 1)		
a. Wenchow-Foochow.		
A limited all-weather gravel and earth road about 20 feet (ft) wide. Bridging is not complete, and there are ferry crossings north of Ning-te across the Shihyang, at Sai-ch'i across the Chiao ch'i, and at Jui-an across the Fei-yun. Bridging and incomplete road sections may limit the road capacity by 50 percent and the load per truck to 5 to 7 metric tons.	48	1,440
b. Foochow-Amoy.		
A limited all-weather road about 18 ft wide, gravel (surfaced with sand), hilly, and in fair condition. Bridging probably is similar to that of the Amoy-Swatow section (see below), although some 15-metric-ton loads have been observed in the Foochow region. A ferry crossing exists across the Min River just south of Foochow.	41	1,230
c. Amoy-Swatow.		
A limited all-weather road with a broken stone base, crushed rock, and gravel surface, about 18 ft wide, in fair condition, but hilly. There are four ferries, of which three cross the multiple mouths of the Han River just north of Swatow and one crosses the Kang-ch'i just west of Chao-an. Bridging is good and generally capable of taking a 10-metric-ton load, but at least three bridges (just north of Chao-an) are single lane.	38	1,140
Wenchow - Chin-hua (route 2)		
Wenchow - Chin-hua.		
A limited all-weather earth and gravel road about 15 ft wide, possibly one-way in places. The route is hilly but well maintained and carries a regular bus service. Several one-way bridges exist.	30	900
Chiang-shan - Canton (route 3)		
a. Chiang-shan - Chien-ou.		
This section of the route probably is similar to the Chien-ou - Yung-an section (see below).	41	1,230

\* Footnotes for Table 10 follow on p. 47.

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Table 10

Description and Estimated Capabilities of Highway Routes in the Fukien Coastal Region  
of Communist China a/  
1959  
(Continued)

Description of Route <u>b/</u>	Vehicles EMPH <u>c/</u>	Metric Tons EWFD <u>d/</u>
b. Chien-ou - Yung-an. A limited all-weather road with a gravel and crushed rock surface 18 to 20 ft wide. The road is hilly and in good condition, with all water gaps presumably bridged.	41	1,230
c. Yung-an - Mei-hsien. A limited all-weather road with a gravel and crushed rock surface, 18 to 20 ft wide. A section of the route south of Hsin-ch'uan is dirt, but a cutoff from K'uo-ch'e to Shang-hang provides an alternate dirt route. The dirt section would not restrict the capability except during periods of inclement weather. The section from P'eng-kou to Hsin-ch'uan is utilized by both routes 3 and 6, making it impossible to utilize both routes to capacity simultaneously.	38	1,140
d. Mei-hsien - Canton. A limited all-weather stone and sand road with a fair-weather section about 18 to 20 ft wide in hilly country in good condition. A section of the road (about 40 kilometers) southwest of Mei-hsien is dirt.	30	900
Shang-jao - Foochow (route 4)		
a. Shang-jao - Chien-ou. A limited all-weather road with a crushed rock and gravel surface, 18 to 25 ft wide, that is mountainous, particularly on the Chien-yang - Shang-jao section, and in fair to good condition.	29	870
b. Chien-ou - Foochow. A limited all-weather road surfaced with sand and gravel, about 15 ft wide, hilly, with sharp curves, in fair to good condition, and with bridges with a capacity of 7 to 10 metric tons. All water gaps are believed to be bridged. Routes 3 and 4 utilize the section from Chien-yang to Chien-ou, and although an alternate approach to Chien-ou by route 3 is provided by route 103, routes 3 and 4 to Chien-ou could not be utilized to capacity simultaneously.	33	990

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Table 10  
Description and Estimated Capabilities of Highway Routes in the Fukien Coastal Region  
of Communist China a/  
1959  
(Continued)

Description of Route <u>b/</u>	Vehicles EWPB <u>c/</u>	Metric Tons EWPB <u>d/</u>
Yu-tu - Amoy (route 6)		
Yu-tu - Chang-chou.		
A limited all-weather road of crushed rock and gravel surface about 16 ft wide that probably is fully bridged with bridges having a capacity of 7 to 10 metric tons. This road is hilly and probably in fair to good condition. Routes 3 and 6 both utilize the section from P'eng-kou to Hsin-ch'uan, and both routes could not be utilized to capacity simultaneously.	33	990
P'u-ch'eng - Li-shui (route 101)		
P'u-ch'eng - Li-shui.		
A limited all-weather route except for a dirt section about 70 kilometers long east from P'u-ch'eng. The width of this road is estimated to be 15 ft or less in hilly terrain. The road probably is in fair condition.	22	660
Shui-chi - Chien-ou (route 103)		
Shui-chi - Chien-ou.		
A limited all-weather route from Chien-ou to Ching-hou which becomes a fair-weather route from that point to Shui-chi, estimated to be about 15 ft wide, hilly, and in fair to good condition, with all water gaps bridged.	22	660
P'u-ch'eng - Fu-an (route 202)		
P'u-ch'eng - Fu-an		
A newly constructed fair-weather route, estimated to be 15 to 20 ft wide, hilly, and in fair condition, with some water gaps possibly not bridged.	22	660

## S-E-C-R-E-T

Table 10

Description and Estimated Capabilities of Highway Routes in the Fukien Coastal Region  
of Communist China <sup>a/</sup>  
1959  
(Continued)

Description of Route <sup>b/</sup>	Vehicles EWPH <sup>c/</sup>	Metric Tons EWPD <sup>d/</sup>
Nan-ch'eng - Chien-yang (route 402) <sup>e/</sup> Nan-ch'eng - Chien-yang. A limited all-weather route from Chien-yang to Mu-sha, but the road surface west from Mu-sha is unknown. The road is estimated to be 15 to 20 ft wide, mountainous from Kuang-tse to Shao-wu and hilly on other portions, and in fair condition. Ferries exist at Mu-sha and Shao-wu.	20	600
Nan-feng - Sha-ch'i-k'ou (route 404) Nan-feng - Sha-ch'i-k'ou. A limited all-weather route from Sha-ch'i-k'ou to Chiang-lo, with a dirt surface (for an undetermined distance) from that point. The road is estimated to be 15 to 20 ft wide, mountainous from Chien-yang to T'ai-ning and hilly on other portions, and in fair condition.	15	450
Yung-an - Chin-chiang (route 406) Yung-an - Chin-chiang. A fair-weather route, estimated to be 15 ft or less in width, hilly, and in fair condition, with all water gaps probably bridged.	20	600
Yung-ch'un - Wu-ts'o (route 408) Yung-ch'un - Wu-ts'o. A fair-weather route, estimated to be about 15 ft wide, undulating, in fair condition, with all water gaps probably bridged.	23	690

- a. Estimates refer to traffic on the highways under moist conditions, a term that refers to subsoil moisture and not to seasonal weather conditions. For the graphic location of highway routes in the Fukien coastal region, see the map, inside back cover.
- b. To facilitate discussion, the major highways of the Fukien coastal region have been assigned arbitrary numbers that bear no relation to actual Communist or Nationalist highway numbers. Generally the most important routes have been assigned one-digit designations and those of lesser importance, three-digit designations. Routes running approximately north and south have odd numbers, whereas those running east and west have even numbers. The numbering begins at the coast for odd numbers and in the north for even numbers. The three-digit numbers have been assigned on the basis of the location of the routes. For example, route 103 would be a highway of secondary importance, running approximately north and south, located west of route 1 but east of route 3.
- c. Each way per hour.
- d. Each way per day, assuming a 3-metric-ton average load and a 10-hour day.
- e. Estimates are based on the assumption that this route is limited all-weather its entire length.

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Table 11

Characteristics of the Min River System Affecting Water Transport in the Fukien Coastal Region  
of Communist China a/\*  
1959

<u>River and Sector</u>	<u>Length (Kilometers)</u>	<u>Maximum Load Per Vessel (Metric Tons)</u>	<u>Remarks</u>
<b>Min River</b>			
East China Sea to Ma-wei	20	3,000 <u>b/</u>	Limiting depth of 20 feet at high tide <u>c/</u>
Ma-wei to Foochow	18	500 <u>d/</u>	Limiting depth of 10 feet at high tide <u>e/</u>
Foochow to Shui-k'ou	102	100 <u>f/</u>	
Shui-k'ou to O-yang	18	40 <u>g/</u>	
O-yang to Nan-p'ing	70	40 <u>h/</u>	Facilities exist for night navigation to this point <u>i/</u>
<b>Sha-ch'i River</b>			
Nan-p'ing to Yung-an	148	40 <u>j/</u>	
<b>Fu-t'un-ch'i River</b>			
Nan-p'ing to Shao-wu	204	40 <u>k/</u>	

\* Footnotes for Table 11 follow on p. 49.

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Table 11

Characteristics of the Min River System Affecting Water Transport in the Fukien Coastal Region of Communist China a/  
1959  
(Continued)

River and Sector	Length (Kilometers)	Maximum Load Per Vessel (Metric Tons)	Remarks
Chien-ch'i River			
Nan-p'ing to Chien-ou	69	40 <u>l/</u>	
Chien-ou to P'u-ch'eng	150	40 <u>m/</u>	

a. Characteristics are indicated by the maximum load of the largest ship that can be accommodated by a water route. Although this method is not consistent with that employed in evaluating highway and railroad facilities; the resulting figure is believed to be more meaningful than one indicating route capabilities that exceed the foreseeable needs of the Chinese Communists.

- c. 116/
- d. 117/
- e. 118/
- f. 119/
- g. 120/
- h. 121/

- i. 122/
- j. 123/
- k. 124/
- l. 125/
- m. 126/

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APPENDIX B

METHODOLOGY

1. Through Capability of the Ying-t'an - Amoy Railroad

An estimate of the through capability of this railroad can be made in two different ways. The first would be to consider the line as one unit and the section from Wu-k'eng to Ying-t'an as limiting the capability of the line. The combined capability of the sections from Wu-k'eng to Amoy and from Wu-k'eng to Foochow is greater than that of this limiting section. For this reason, a second estimate of through capability by sections has been made.

In estimating the length of trains that could be operated on the line, it is assumed that the maximum length is limited by the shortest siding. An estimated length of 120 feet (ft) for locomotive and tender, of 45 ft per car, and of 75 ft clearance at each end of the siding have been used. On the basis of national performance in 1959, the ratio of loaded to empty cars is estimated to be 2.33 to 1, and net tonnage per loaded car is estimated to be 39.4 tons. It should be noted that the application of these factors results in an estimate of maximum capability for the movement of economic traffic. Because military items would not load so heavily as the bulk economic commodities hauled,\* the net tonnage per train for military items would be less.

a. Estimated Capability, Entire Line

- (1) Shortest siding: Hsia-yang, 1,600 ft
- (2) Maximum distance between sidings: Wei-min to P'u-shang,  
24 km
- (3) Estimated speed: 30 kilometers per hour (km/h)
- (4) Maximum train length:

Siding:	1,600 ft
Less	
Locomotive and tender 120 ft	
Clearance at both ends 150 ft	270 ft
Length available for cars	<u>1,330 ft</u>

\* Timber, coal, and cement account for an estimate of 91.7 percent of total economic traffic.

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- (5) Maximum number of cars (at 45 ft per car): 29 cars
- (6) Empty cars per train (at 2.33 loaded to 1 empty): 9 empty cars
- (7) Loaded cars per train: 20 cars
- (8) Net load per train (at 39.4 tons per loaded car): 800 tons
- (9) Maximum number of trains per day:

$$N = \frac{1,440}{RT + 7} \times 0.7$$

Where

- N is density in number of trains per day
- 1,440 is minutes in 24 hours
- RT is running time between sidings at 30 km/h
- 7 is delay time in minutes for meeting trains from the opposite direction
- 0.7 is efficiency factor

$$N = \frac{1,440}{48 + 7} \times 0.7$$

N = 18.33 trains both ways per day (BWPD)

- (10) 18.33 trains with a net load of 800 tons each give a line tonnage of about 14,664 tons BWPD, or about 7,300 tons each way per day (EWPD)

b. Estimated Capabilities, by Section

- (1) Ying-t'an - Wu-k'eng: 7,300 tons EWPD
- (2) Wu-k'eng - Amoy:
  - (a) Shortest siding: T'an-kou, 1,600 ft
  - (b) Maximum distance between sidings: Ch'ing-chou to Sha-hsien, 36 km
  - (c) Estimated speed: 25 km/h
  - (d) Maximum length of train (same as Ying-t'an - Wu-k'eng section): 29 cars
  - (e) Maximum number of trains per day:

$$N = \frac{1,440}{86 + 7} \times 0.7$$

N = 10.84 trains BWPD

- (f) 10.84 trains with a net load of 800 tons each give a line tonnage of 8,672 tons BWPD, or 4,300 tons EWPD.

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(3) Wu-k'eng - Foochow:

The complete data necessary to compute the capabilities of this section are not available, but the capability is tentatively estimated to be not more than that of the Wu-k'eng - Amoy section, or about 4,300 tons EWP.

Although there are several formulas that may be used to compute the capability of a given railroad line, it is difficult, if not impossible, to reduce the multitude of factors affecting a transportation system to a satisfactory mathematical computation. The formula employed in b, above, was chosen as the best available means of measuring the capability of railroad line. The various factors used, especially regarding speed and efficiency, are subject to some limitations and are based for the most part on subjective judgment. As shown in Table 12,\* a small variance in the various factors involved can change the results obtained.

Table 12 demonstrates the estimates that can be obtained by varying the factors of speed and efficiency in the formula only slightly. Inasmuch as some of the information used in this report regarding line facilities is almost 2 years old, it is possible that the distance between sidings has been reduced or that the length of the sidings has been increased to allow longer trains, or both. Such improvements could change four factors in the formula used to determine through capability. Actual ability to deliver commodities to the coastal area during an emergency also would depend on the method of operation used on the line (for example, the fleeting of trains in one direction). All of these variables tend to detract from the accuracy of the estimates. Although the estimates of tonnage are considered the best available, they should be regarded as reflecting an order of magnitude only and subject to variations, depending on several factors.

c. Yard Capabilities

Estimates of the operational capabilities of yards on the Ying-t'an - Amoy Railroad\*\* were derived by applying a factor of 0.6 to the total trackage, dividing this figure by 45 ft per car, and multiplying the result by an efficiency factor of 1.\*\*\*

The major classification yard on the Ying-t'an - Amoy Railroad is located at Lai-chou, just north of Wu-k'eng, the junction point for

\* Table 12 follows on p. 54.

\*\* See Table 8, Appendix A, p. 35, above.

\*\*\* This efficiency factor may vary from 0.8 for a rudimentary flat yard to 2 for a hump yard with automatic facilities.

Table 12

Possible Estimates of Through Capability of the Ying-t'an - Amoy Railroad in Communist China  
Employing Various Factors  
1959

<u>Speed</u> (Kilometers per Hour)	<u>Time a/</u> (Minutes)	<u>Efficiency</u> <u>Factor b/</u>	<u>Trains</u> (Both Ways per Day)	<u>Metric</u> <u>Tons c/</u> (Both Ways per Day)	<u>Metric</u> <u>Tons d/</u> (Each Way Per Day)
Ying-t'an - Wu-k'eng Section					
30	55	0.7	18.33	14,664	7,300
30	55	0.6	15.71	12,568	6,300
30	55	0.5	13.09	10,472	5,200
25	65	0.7	15.51	12,408	6,200
25	65	0.6	13.29	10,632	5,300
25	65	0.5	11.08	8,864	4,400
Wu-k'eng - Amoy and Wu-k'eng - Foochow Sections					
30	79	0.7	12.76	10,208	5,100
30	79	0.6	10.94	8,752	4,400
30	79	0.5	9.11	7,288	3,600
25	93	0.7	10.84	8,672	4,300
25	93	0.6	9.29	7,432	3,700
25	93	0.5	7.74	6,192	3,100

a. Time in minutes required to cross the longest distance between sidings plus 7 minutes for delays. Figures represent the running time plus 7 shown in the formula (see 1, a, (9), p. 52, above).

b. This factor may vary between 0.5 and 0.75. A factor of 0.6 usually is considered the upper limit for single track lines. Ultimately, however, the factor must be determined by subjective judgment.

c. Number of trains times 800 metric tons per train.

d. Number of metric tons both ways per day divided by 2 and rounded to the nearest 100 metric tons.

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the sections extending to Amoy and to Foochow. This yard is estimated to be capable of completely classifying daily about 6.4 trains of 29 cars each. If the railroad were utilized to the estimated through capability of 18 trains BWPD (9 EWPD), 522 cars each day would pass through Lai-chou, and the yard would be capable of classifying only 36 percent of the total. If the line were utilized to maximum through capability and more than 36 percent of the cars required classification at Lai-chou, this yard would limit the through capabilities of the railroad.

From the nature of present operations, however, it appears quite unlikely that Lai-chou restricts the capability of the railroad. First, some of the cars leaving Ying-t'an would not arrive at Lai-chou but would terminate north of this yard. Second, most of the traffic arriving at Lai-chou is believed to be bulk commodities in carloads, which probably are destined for Foochow and Amoy and which require little or no classification, and most of the outgoing traffic is timber, which also requires little classification. Third, the railroad is not being operated at maximum capability. In any situation requiring such operation, complete trains made up at Ying-t'an for Amoy or Foochow could prevent Lai-chou from restricting the through capability of the line.

With the exception of Lai-chou, the other yards on the line probably are not utilized extensively for purposes of classification and probably would not restrict the line capability. In the unlikely event that the Wu-k'eng - Amoy segment were utilized to maximum capability and all loads terminated at Amoy, the Amoy yard would handle 10 trains of 29 cars each, or 290 cars, each day. The average time each car was in the yard thus would have to be 13.2 hours or less. With vast amounts of labor available the Chinese Communists are considered to be capable of handling this volume of traffic at Amoy and also at Foochow if that yard is comparable to the one at Amoy.

From this analysis it does not appear that yard capabilities would restrict the capability of the Ying-t'an - Amoy Railroad. Moreover, the Chinese Communists probably could expand the capability of the critical Lai-chou yard in a short time if necessary.

d. Equipment Servicing Facilities

Locomotive servicing points and the estimated number of stalls are located as follows: at Ying-t'an, 2; Shao-wu, 4; Lai-chou, service area only; Yung-an, 7; Kuo-k'eng, service platform only; Amoy, 2; and Nan-p'ing, 3 -- a total of 18 stalls available plus several service platforms. In addition, there may be a service platform at O-yang and some facilities at Foochow. 127/ At a turnover factor of 2 to 4 in 24 hours, the total capability for servicing would be 36 to 72 locomotives in 24 hours. This number would be sufficient to operate the line at

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estimated maximum through capability. Even if doubleheading were required on some sections of the line, it appears that servicing facilities are adequate to operate the line at maximum through capability.

e. Conclusions.

The maximum tonnage that could be moved into or out of Fukien Province by rail is 7,300 tons EWP, being limited by the Ying-t'an - Wu-k'eng section of the railroad. This figure represents the theoretical maximum through capability for economic traffic. The annual through capability of the railroad for freight moved in both directions would thus be about 5.3 million tons.\* The Chinese Communists announced that the 1958 plan for tonnage carried by rail was 2.4 million tons, or 45 percent of total estimated through capability. If the tonnage carried on the railroad increased as fast as the national average,\*\* utilization of total through capability probably amounted to about 62 percent in 1959 and may be expected to reach 85 percent in 1960 and 100 percent in 1961. In considering the limitations of the Ying-t'an - Wu-k'eng sector, however, the movement of freight within the province on the two lower segments of the railroad must be considered. It appears that this movement will occupy an increasingly larger percentage of the total tonnage carried by rail as the economic centers now planned in Fukien Province are developed. The resulting increase in traffic on the lower segments of the railroad may delay somewhat the time when the railroad will reach maximum through capability. The new line under construction from Shang-jao to Pa-tu and Foochow will relieve the Ying-t'an - Wu-k'eng section. The rapid development of rail transport capability may prevent the lack of transportation from severely curtailing the development of the Fukien coastal region. This fact indicates the importance of extending the railroad network and the very marked effect that any delay in expansion might have on the development of the region.

2. Capabilities of the Highway Network

In the estimates of the capability of the highway network of the Fukien coastal region, the capabilities of individual routes have been estimated separately.\*\*\* The condition of each route has been estimated on the basis of information from a variety of sources. This information was applied to the tables  to obtain the

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\* This estimate assumes that all traffic would consist of freight trains. The figure would be lowered in direct ratio to the number of passenger and work trains operated on the line.

\*\* About 37 percent in 1959.

\*\*\* For an explanation of the arbitrary system of numbering these routes, see the footnote to III, D, 1, p. 15, above.

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number of vehicles that the route could carry each way per hour. An operational day of 10 hours and an average vehicle load of 3 tons have been used to obtain the total tonnage that could be moved on the route. No attempt has been made to estimate roads other than those listed in Table 10.\*

### 3. Civilian Motor Vehicle Park

Data concerning the motor vehicle inventory in Fukien Province are extremely scarce. One ambiguous statement might indicate a park of about 500 trucks\*\* and an unknown number of buses in 1954, but this statement probably refers only to the state-owned transport park. The Chinese Communists have announced that 315 motor vehicles, formerly privately operated, were acquired by the state during 1956 and that 17 other motor vehicles were added to the park. On the basis of these data and on the assumption of an absolute rate of growth derived from the figures for 1956, estimates of the state motor vehicle park would be as follows: 1954, 500; 1955, 800, 1956, 1,100; 1957, 1,400; and 1958, 1,700 vehicles. The estimate of 1,400 motor vehicles in 1957 compares with an announcement that "Every day there are some 1,300 motor vehicles ... on roads." 130/ [redacted] in 1958 50X1 the Fukien Transportation Bureau had five main depots and that the Ch'uan-chou depot had about 300 vehicles, of which 200 were cargo trucks. 131/ On the assumption of a generally comparable park in the other four main stations, these figures would indicate a park of about 1,000 trucks and about 500 other vehicles in the five main depots.

[redacted] in 1956 there were approximately 20 50X1 branch offices scattered throughout Fukien Province. The P'u-t'ien office had about 80 vehicles, of which more than 70 were trucks. 132/ Credibility is added to this report by a press release in 1958 which stated that the Fukien Department of Communications has 22 operating units. 133/ A range of 50 to 100 vehicles for the 22 units would indicate a park of 1,100 to 2,200 vehicles. The five main depots, however, probably would have larger parks. The range of 50 to 100 used for the 17 branch offices would indicate 850 to 1,700 vehicles at the smaller offices. Again on the assumption of an average of 300 vehicles at each main station, the estimate of the state motor vehicle park would be 2,350 to 3,200 vehicles. These figures appear to be of the correct magnitude.

\* Appendix A, p. 44, above.

[redacted]

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In Fukien Province, as throughout Communist China, the civilian motor vehicle park is estimated to be divided approximately equally between those vehicles controlled by state-owned transport groups and those controlled by functional government agencies or enterprises. Because the range of 2,350 to 3,200 vehicles refers only to the state park, the estimate of the total civilian park would be 4,700 to 6,400 vehicles.\* Again these figures appear to be of the correct magnitude, although, because of the nature of the data employed, no firm estimate of the civilian motor vehicle park can be made. It does appear safe, however, to estimate the size of this park at more than 4,000 vehicles.

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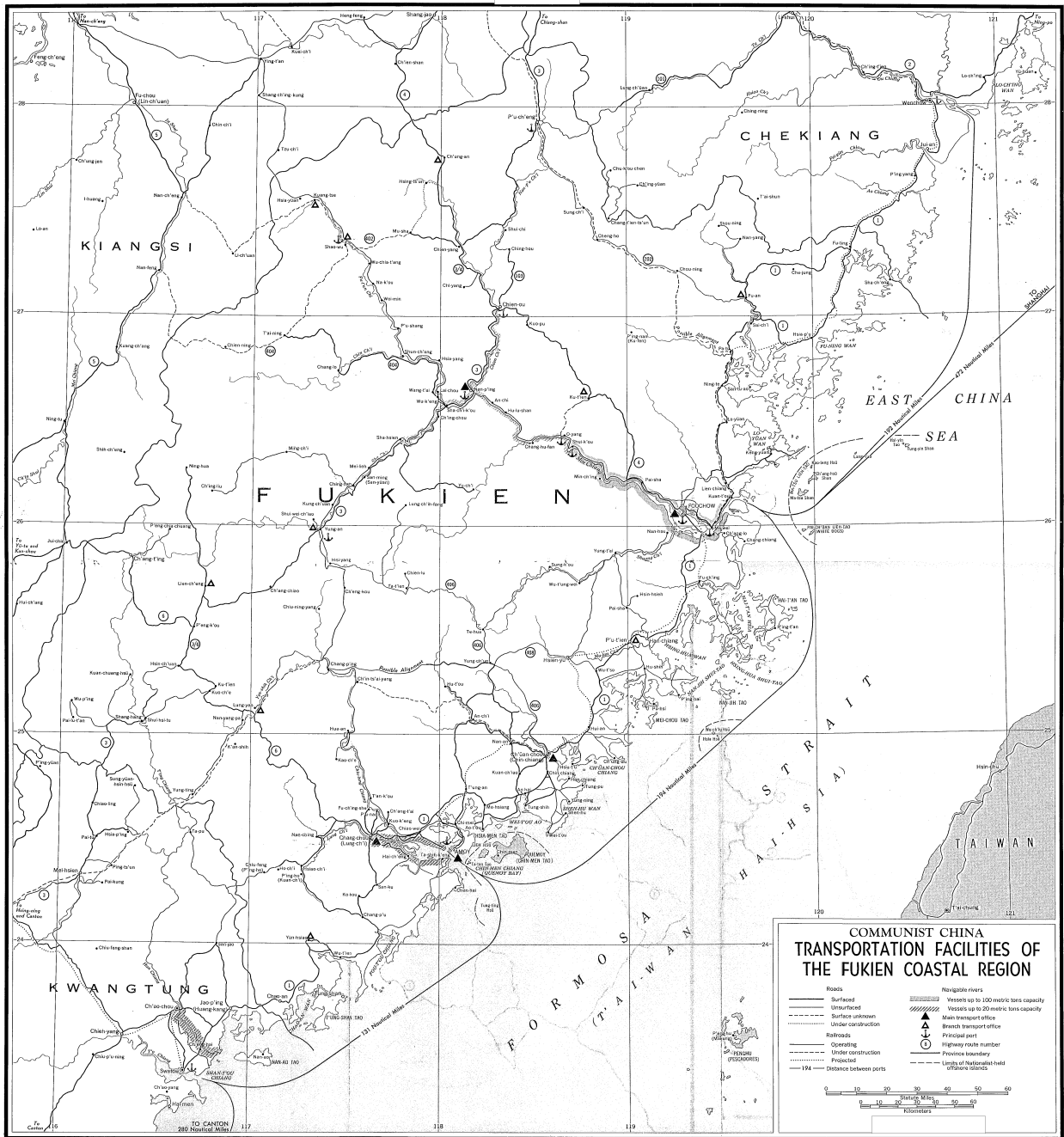
\* Based on the approximate national ratio of 1 to 1 for highway transport trucks to government agency and/or industry trucks.

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