

N
420

84-65

F8 THE UNITED STATES NAVAL WAR COLLEGE

1965

No. 84

NAVAL WARFARE COURSE

RESEARCH PAPER



INTERNAL TRANSPORTATION IN THE PEOPLE'S REPUBLIC OF CHINA

by

Frank W. Rhea

Lieutenant Colonel, United States Army

This paper is a student thesis prepared at the Naval War College and the thoughts and opinions expressed in this paper are those of the author, and are not necessarily those of the Navy Department or the President, Naval War College.

Material herein may not be quoted, extracted for publication, reproduced or otherwise copied without specific permission from the author and the President, Naval War College in each instance.

Class of 1965

U. S. NAVAL WAR COLLEGE

Newport, Rhode Island

INTERNAL TRANSPORTATION IN THE PEOPLE'S REPUBLIC OF CHINA

by

Frank W. Rhea

Lieutenant Colonel, United States Army

March 1965

ABSTRACT

The development of transportation is intertwined with the history of man's social organization and his economic activities. This profound historical influence is apparent in the fact that all large concentrations of people are grouped about navigable seas and inland waterways. Transportation's importance is perhaps even more significant today, as a fundamental of modern industrial society is the geographical division of labor according to patterns of natural advantage, a condition which manifestly generates a requirement for effective and efficient transport.

The slow development of transportation in China has prevented effective political control from Peking and, together with an aversion to technology, has inhibited industrial growth in a nation which is rich in resources. The result was that when the Communists took control in 1949, China was a backward agricultural country carrying on an early iron-age economy founded on cottage handicrafts.

Immediately, the Communists embarked on vigorous programs to change China from this backward agricultural status into a modern industrial nationally-integrated society. As a part of this change, they invested heavily to restore existing transportation systems and to extend and expand the nation's transport capacity. A considerable part of this expansion was directed towards the interior regions of China, which have assumed an increased importance because of new discoveries of resources and because of desires to disperse and to duplicate the industrial base to meet the requirements of national security.

The Communists have achieved a measure of success in improving transportation, particularly in extending the railway net. Russian assistance was a prime factor in new railroad construction, and since the withdrawal of the Russians in 1960 there has been a marked reduction in progress. Even with Russian assistance and fifteen years of effort, railroad trackage falls far short of meeting requirements. New highways have been built into Tibet, Sinkiang and along the Southwest borders, but modern truck transport is severely limited due to the meagre network of first class inter-city highways and an acute shortage of trucks. A further glaring deficiency is the almost total absence of pipelines. The most important means of movement in China is native transport, using man-porters, hand carts and beasts of burden. This inherent waste of manpower speaks volumes regarding the state of Chinese industrialization.

China today is still a vast nation lacking effective transport for the present degree of industrialization, without considering the increased requirements to support a continuing high level of economic growth. Lack of transportation hinders economic progress and serves to limit application of China's power to areas contiguous to her borders. However, with prospects for continued central government attention to solution of this problem and an improving Chinese technology there is no room for complacency in the Free World.

TABLE OF CONTENTS

CHAPTER		PAGE
	ABSTRACT.	ii
	INTRODUCTION.	v
I	IMPORTANCE OF TRANSPORTATION IN MODERN SOCIETY. . .	1
	Brief History of Transportation's Effect on Social Development	1
	Economic Effects of Better Transportation	5
	Need for an Integrated and Balanced System. . . .	8
II	TRANSPORTATION REQUIREMENTS IN THE PEOPLE'S REPUBLIC OF CHINA	16
	Influence of Expanding Industrialization.	17
	Geographic Survey of Natural Resources and Industrial Complexes.	21
	Politico - Military Requirements.	29
III	TRANSPORTATION ASSETS IN CHINA.	32
	Railroads	32
	Highways.	40
	Waterways	46
	Airways and Pipelines	48
	Native Transport.	51
IV	CONCLUSIONS	53
	BIBLIOGRAPHY	57
	FIGURE 1, MAP OF CHINA	Inside Rear Cover
	FIGURE 2, RAILROAD MAP OF UNITED STATES.	Inside Rear Cover

INTRODUCTION

Whatever man does entails movement, mentally or bodily. Movement is, in fact, the mainspring of his evolution and of the civilization which this evolution engenders; consequently, in the economic growth of movement must be sought the direction of all progress, both physical and psychological.

--Colonel J.F.C. Fuller.¹

The basic essentials for development into a modern industrial nation-state -- educated population, mineral resources, sufficient land area, good soil, favorable climate -- have existed in China² since the first industrial revolution began in England in the early nineteenth century. Yet, this great potential remained dormant until aroused by the Communist Chinese after their take over of the mainland in 1949. Even after fifteen years of prodigious efforts by the Communists, the People's Republic of China is still many years away from becoming a first rank world power.

In 1956, Japan had an industrial growth rate more than twice that of China, with an absolute production of twice as much steel, twice as much cement and approximately four times as much electricity. As China has seven times as many people as Japan, these figures equate

¹Colonel J.F.C. Fuller, Pegasus, (New York: E.P. Dutton and Company, 1926), p. i.

²Throughout this paper, the use of the words China and Chinese refer to the People's Republic of China (Communist China) and the inhabitants thereof.

to a per capita productivity in Japan of the selected items from fourteen to twenty-eight times that in China.³

An attempt will not be made in this paper to prove that low per capita productivity and slow industrial development in China are attributable solely to an inadequacy of internal transportation. However, an attempt will be made to show that the transport sector of the economy is a very important element, which, even if not handled in the preferable pre-development manner, must be developed concurrently with the other sectors, else attempts to transform a nation from the traditional stage described by Rostow⁴ into a modern industrial society will be met with frustration and failure. An interesting observation in this regard is that all the rich industrial nations have highly developed internal transportation systems based on the railroad, the motor truck, the powered tug and the airplane, whereas all the poor non-industrial nations have antiquated internal transportation systems with great reliance on the porter, the cart, the bicycle, and the draft animal. This, perhaps, is yet another chicken and egg mystery, but the fact remains that industrial power depends upon high per capita output, and this is difficult indeed to achieve if an abnormal amount of the available effort is used in accomplishing the required movements of people and goods.

³Harold Archer VanDorn, A Decade of Communist Rule, (New York: Pageant Press, 1963), p. 92.

⁴W.W. Rostow, The Stages of Economic Growth, (Cambridge: University Press, 1960), pp. 4-6.

The Chinese Communist rulers appear to have an appreciation of the importance of efficient transportation, as evidenced by the fact that during the economic rehabilitation period (1949-1952) and the First Five Year Plan (1953-1957), they spent twenty per cent of their total economic investment on transport facilities and equipment.⁵ This compares favorably with the twenty-four per cent invested by the Russians during the period 1918-1929 and the 1959 investment rate of 9.9 per cent in the U.S.S.R.⁶

In this paper, the social, economic and military importance of transportation in China will be explored, with particular emphasis placed on the recent attempts of the Communists to expand, integrate and modernize their various transportation systems. Appropriate conclusions will be drawn as to the adequacy of their efforts and the limiting effects, if any, that transportation has on the Chinese threat to the free world. It must be admitted that the absence of official government statistics since 1959 and the suspect nature of Chinese official figures up to that time have complicated this effort and made it more difficult to arrive at reliable conclusions. It is hoped that these difficulties have been overcome.

⁵ Trevor J. Hughes and D. E. T. Luard, The Economic Development of Communist China, 1949-1960, (London: Oxford University Press, 1961), p. 108. Also see Stanley Karnow, "How Communist Economics Failed in China," Fortune, July 1963, p. 228.

⁶ Dorothy A. King, "Soviet Transportation," Unpublished Study, U.S. Army Field Detachment "R", Oberammergau, Germany: 1961, p. 8.

INTERNAL TRANSPORTATION IN THE PEOPLE'S REPUBLIC OF CHINA

CHAPTER I

IMPORTANCE OF TRANSPORTATION IN MODERN SOCIETY

Brief History of Transportation's Effect on Social Development.

The history of man is intimately linked with the history of transportation. This is as true today as it was before the discovery and development of the wheel in 3000 B.C. As Charles E. Landon says in his book, Transportation, "The movement of commodities, services, people and ideas makes modern civilization possible."¹

An example of the importance of transportation as a prime determinant in man's social development is evident in the fact that almost all the large cities in the world are located on navigable water--either on the sea or on natural inland waterways. An interesting exception is Berlin, which has been described as an artificial city, because it was not on natural trade routes nor near important resource deposits, but was made into a great city by the rulers of Prussia and Germany as a national symbol. The influence of water transportation is still evident today. For instance, the largest city in the United States that is not located on a navigable waterway is Dallas, Texas, whose population of 679,684 places it fourteenth in rank in the U.S.²

¹Charles E. Landon, Transportation, (New York: William Sloane Associates, 1951), p. 3.

²Conrad Taeuber, "United States--Population," Encyclopaedia Britannica, (Chicago: 1962), XXII, p. 816.

The fact that a few of the waterways are no longer used for significant transportation does not lessen the importance of this means of transport for the cities involved throughout a long period of their development.

Another manifestation of the influence of the lack of efficient transportation is seen in the proximity which man has maintained between himself and his supporting resources, particularly food producing areas. It is only in recent times that man has developed the ability to live in relatively large numbers in areas that are remote from the sources of fuel, clothing and food. A more recent influence is the change in society brought about by the mass automobile in the United States. Land development, employment patterns, recreational activities, and many other facets of American life have been revolutionized by this phenomenon.

To offset the limitations imposed by navigable water, man has continued to seek improvements in land transport. First, man carried goods on his back; then about 8,000 years ago he trained animals and used them for carrying burdens and pulling sleds.³ In about 3000 B.C. he developed the wheel, which is generally regarded as one of the greatest discoveries of all time. There were only gradual improvements down to the time of the Romans, who made a quantitative contribution by constructing an excellent road net throughout their empire. After the Romans there was no improvement, and perhaps some backsliding,

³Ernest W. Williams, Jr., "Transportation," World Book Encyclopedia, (Chicago: 1960), XVII, p. 312.

until Richard Trevithick, in England in 1804, combined the steam engine with the steel wheel on steel rails. Modern transport began at that moment.

This modern means of transport, the steam railway, provided the means whereby man could move away from sea coasts and rivers and develop the large continental interiors. Cheap, fast, dependable transportation provided by the railways started this interior development,⁴ which lately has been aided and accelerated by the motor truck, the airplane, and the pipeline.

Has the development of Chinese civilization exhibited any marked exceptions to the close relationship between man and transportation? No, as expected China has followed the pattern, particularly as regards the influence of water transport. Present day China occupies almost the same amount of land area as the United States and has a population of 700 million. Ninety-six per cent of this population lives in the eastern one-half of the country, concentrated along the sea coast and in the navigable river valleys. For instance, over 200 million people, one-tenth of the world's population, live in the valley of the Yangtze River, a waterway navigable by 4,000 ton steamers all the way to Ichang, some 1,000 miles from the sea.⁵

Also, the wheel came early to China, a system of roads was built as early as 2700 B.C.⁶ and the railroad was introduced in the late 1800's.

⁴Ibid., p. 316.

⁵Rhoads Murphey, "China--The Land," Encyclopaedia Britannica, (Chicago: 1962), V, p. 509.

⁶Williams, p. 314.

Until 1912, when Dr. Sun Yat-sen made a plan based on his concept of economic geography, the railroad development was carried out by foreign powers for economic exploitation, with little effective effort by the Chinese rulers to control and channel this development so that it would help to build a nation.⁷

Transportation has been slow to develop in China, particularly in consideration of the advanced state of its civilization in early times. One reason is that the natural routes do not converge in an important economic center. In addition, wide rivers, swampy rice lands and irrigation canal systems have impeded construction.⁸

The China the Communists took over from the Nationalists was not a modern state in the western sense and had hardly begun the journey on the road to industrialization. The conditions in China at that time are described by Hughes and Luard as follows:

When the Communists came to power in 1949, by far the greater part of the country carried on as for the last 2000 years, an early iron age economy. Agricultural techniques were backward and yields low. The greater part of industry consisted of handicrafts. A sprinkling of modern industry had developed, mainly in the ports and the eastern seaboard. A small, efficient, but now largely plundered nucleus of heavy industry had grown up in Manchuria. The main task of industrial development in China had barely begun.⁹

⁷Kuei-Sheng Chang, "The Changing Railroad Pattern in Mainland China," The Geographical Review, October 1961, pp. 534-537.

⁸Landon, p. 28.

⁹Hughes and Luard, p. 16.

It has been said of the United States that "our growth as a nation is directly linked with the development and progress of our transportation."¹⁰ It can be said that the failure of the growth of China as a nation is directly linked with the failure to develop its transportation. There is every indication that this fact is understood by the Chinese Communists.

Historically, control by the central government in China has been quite loose, and more or less in inverse ratio to the square of the distance from Peking. Again the Communists have studied their history. Their efforts to establish a widespread industry, to secure a greater exchange of goods, and to develop the transport and communications required to make these innovations possible have, in addition to a solid economic base, a strong political under-tone, founded on a realization that these measures are essential to eliminate local autonomous areas.¹¹ The Chinese Communists have linked all parts of the country firmly with all others in one integrated unit and, thus, have truly unified China for the first time in its long history.

Economic Effects of Better Transportation. So far the effects of transportation on social organization have been discussed only in general terms. It is appropriate to examine briefly some of the

¹⁰Harry B. Yoshpe and Fred R. Brown, Transportation: The Nation's Lifelines, (Washington: Industrial College of the Armed Forces, 1962), p. 1.

¹¹Hughes and Luard, p. 110.

specifics of the interplay between transportation and the broad spectrum of economics. This interplay came to the front during the struggle for supremacy between the Communists and the Chinese Nationalists. The breakdown of the transportation system throughout China after World War II contributed to inflation by preventing the distribution of consumer goods and by cutting off factories from natural resources. Since the Communists believed that inflation would hasten the overthrow of the Nationalists, they spent considerable guerrilla and regular military effort on cutting rail lines. This broke up economic units, in addition to severing administrative control and impeding Nationalist troop movements.¹²

The most obvious economic effect is that more efficient transport reduces the cost of goods and services and thus promotes general economic efficiency.¹³ This is so because transportation costs are a significant part of the total cost of production. Iron-ore has to be brought to the fuel and the labor source, completed structural steel members have to be hauled to fabrication plants, components must be moved to the final assembly plant, and assembled items must be distributed to consumer areas. The overall impact in the United States is that transportation is about 10% of the cost of goods produced. An example of raising the costs of goods occurred in the 1930's during a severe famine in the interior of China. Wheat from the United States

¹²Yuan-Li Wu, An Economic Survey of Communist China, (New York: Bookman, 1956), p. 341.

¹³Landon, p. 7.

could be put on the docks in Shanghai at one dollar per bushel, but as it would have cost eleven dollars more to transport the wheat to the needed area, it was not sent.¹⁴

A related and more significant effect is that efficient transport promotes specialization and a high degree of geographical division of labor according to patterns of natural advantage.¹⁵ Without this benefit communities tend to establish and maintain self sufficiency, which has been the pattern in China for many centuries. With effective transportation however, production can be concentrated on one item, such as steel; the market for the plant is enlarged, large scale efficient plants and industries develop in mutually supporting complexes, and these complexes are fed by agricultural and raw material centers many miles away. This is exactly what the Chinese Communists have been attempting to establish since they came to power. Concentrations of people generate volume movements which engender greater transport efficiency, thus promoting more and more concentration. Transport and economic development are completely intertwined.

Of more immediate interest to the Chinese Communists is that improved transport, especially improved railways, is an instigator and sustainer of industrial takeoff. One way this occurs is by encouraging the export of extractive products, thereby generating capital to pay

¹⁴Ibid., p. 7.

¹⁵ Wu, p. 341 and Landon, p. 7.

for internal development. Another aspect is that the technology required to build and operate a railway system often overlaps into other parts of the economy. The requirement for good cheap rails was the incentive that started the modern steel industry in many nations. Plentiful supplies of good steel then led to better boilers, modern ships, machine tools, pipelines, and different forms of urban construction. This has been the history in the United States, Great Britain, France, Germany, Russia and Japan.¹⁶

Need for an Integrated and Balanced System. This sub-topic leads into a brief but necessary discussion of the various transportation modes. Obviously, the relative importance of the modes varies in different countries around the world and with respect to time. The railroads' share of the freight ton-miles in the United States is less than 50 per cent, in sharp contrast to the 80 per cent plus in the Soviet Union and in China, and the railroads' share of the business in the U.S. only a few years ago. Pipelines presently occupy an important place in the U.S. economy, but they are only now being developed extensively in the Soviet Union, and are practically non-existent in China. Modern forms of transport are grossly predominant in the U.S. and western Europe, but today in China the most important means is old fashioned native transport by animal and human carriers.¹⁷ Highways, pipelines and air-ways exist in Communist China,

¹⁶Rostow, pp. 17-62.

¹⁷K. C. Yeh, Communist China: Petroleum Situation, (Santa Monica, California: The Rand Corporation, 1962), p. 49.

but according to Yuan-Li Wu, "As far as long distance transportation is concerned, railways and shipping are the only two major factors in China."¹⁸

The different countries in the world have something in common--the need for all the different modes. Each form has its advantages and disadvantages, and each tends to specialize in traffic for which it is the superior agency. Attempts to eliminate an agency or to regulate it without proper regard for its peculiar features results in undue investment and operating expense and a net loss in total productive power. There is a general tendency in this field, as in others, to resist change, and to attempt to secure economic advantages through government manipulation. This trap should be avoided to achieve full national potential, as any kind of transportation that tries to operate beyond its proper economic limits is wasteful.¹⁹ It would appear that the Communist nations, with their absolute central planning and execution apparatus, have an advantage as regards building, operating and adjusting an integrated transport net. However, as a counter argument, there is the difficulty in training and educating individuals experienced and knowledgeable in all forms of transport, yet free from bias in favor of or against a particular mode. Too, the absence of a free market system complicates the determination of actual costs of

¹⁸ Wu, p. 345.

¹⁹ Landon, pp. 41-82.

goods and services, one of the foundations for sound economic planning. This is a complex issue beyond the scope of this study, so let us examine the various modes and the movement of freight.

Freight comes in many sizes, shapes and densities, consequently, it is difficult to generalize as to its most efficient movement. In general however, railways and inland waterways are favored for heavy, bulky, low value commodities and for long hauls. Typical commodities are coal, iron-ore, grain, lumber, and automobile subassemblies. High value, short haul moves should be divided between the railway and the truck. Items involved here are such things as manufactured goods, frozen foods, fresh fruits, and vegetables. Trucks also play a great part in logging, oil well drilling and laying pipelines. High value items that are of low weight, or are perishable, bring the airplane into preeminence. Examples are critical repair parts and fresh flowers. Of course in many areas, such as parts of Alaska and the Congo, the airplane is all important because it is the only means available. Liquids and gases favor the use of pipelines, then tankers, barges and railroads, in that order.²⁰ In the United States, 75 per cent of the crude oil and 45 per cent of the finished petroleum products are moved by pipeline.²¹ Crude and finished products are transported at only a fraction of rail costs, resulting in an estimated \$3,200,000 a

²⁰ Ibid., p. 81.

²¹ "Industry," Time, 20 November 1964, pp. 58-63.

year savings in deliveries to U.S. Air Force Bases, and it is now cheaper, by one dollar per ton, to move coal by pipeline rather than rail from West Virginia to New York.²² For comparison, the following table shows relative times and costs for movement of one ton of general freight from New York City to San Francisco:²³

<u>MODE</u>	<u>TIME</u>	<u>COST</u>
Airplane	12 hours	\$400
Truck	5 days	90
Railroad	7 days	35
Ship	15 days	30

From the above it is possible to make some summary statements. The railroad remains as the backbone of efficient long haul transport and the one mode which can handle major movements with minimum need of resources that are scarce in wartime. Highways offer flexibility, are the basic feeder for other modes, and offer opportunities for efficiency in optimum utilization and door-to-door service that reduces handling. Inland water transport is low in cost and can handle volume and bulk, but it is long in transit time and limited more than the other modes by geography. For instance, rivers do not connect the coal and steel centers in the U.S.S.R.²⁴ and their general east-west orientation in China limits their utility because of large north-south movement

²²Yostpe and Brown, pp. 37-39.

²³Williams, p. 308.

²⁴Kenneth R. Whiting, The Soviet Union Today, (New York: Praeger, 1962), p. 220.

requirements. Pipelines are excellent for liquid products, with an added advantage over coastal shipping as regards security and dependability in wartime. Airplanes sometimes are the only means available and are the indicated carrier when high cost critical commodities are involved.²⁵

Absolute efficiency in passenger traffic is important to a nation's well-being, but perhaps not as important as in freight traffic. However, there are passenger problems around the world, all primarily centered on the problem of getting workers to their jobs in large urban complexes. In the United States this problem increases daily, aggravated by less use of common carriers as a result of the mass automobile. Four-fifths of passenger travel in the United States is by automobile, with the remainder divided about equally between airplanes, trains and buses.²⁶ Mass transportation systems employing the bus and train still have major significance, particularly in Russia, Japan, and to a lesser extent, China, and it appears that improved mass transportation systems are a must for United States metropolitan areas. Medium distance traffic still is handled efficiently by the railroad and the bus, but the airplane is coming more and more into use for medium and long distance moves.²⁷ This is economically sound

²⁵Yoshpe and Brown, pp. 2-46.

²⁶Williams, p. 308.

²⁷Yoshpe and Brown, p. 48.

in modern technological societies because of the high value of man's time in comparison to the slight extra expense for the premium transportation. The Soviets have placed great emphasis on passenger air transport, the government airline hauling six million passengers as early as 1958. This mode is preferred for the long haul across Siberia, where the Soviets recently have used both jets and turbo-propeller aircraft, with an announced goal of reducing the cost of air transport to that of rail service.²⁸

One thing is clear in any examination of the various modes -- they all have their function and they should be mutually supporting and inter-connected so that traffic is transferred smoothly from one mode to another. This latter calls for efficient operating terminals, designed and located to serve all means, and society in general. This is one area where the Chinese, and indeed most all presently underdeveloped nations, have a potential advantage in that they can profit from the experience of the nations that have already been through the process. This is similar to eliminating the costs of researching and developing equipments and operating techniques, another benefit of not being the trail blazer.

The question properly might be asked, "What does this general discussion of transportation modes have to do with China and its attempts to become a modern world power?" Throughout this chapter, the general importance of transportation in a nation's economy has been stressed.

²⁸Whiting, p. 233.

Until the time of the Communists, the Chinese paid little attention to development of this section of the total economy, and relied unduly on porters, draft animals and carts, and on their junks plying the inland rivers and the coasts. It will be evident later that the Communists apparently understand this basic weakness and have taken measures to correct it. The relative success of their efforts must be judged on the basis of their proper attention to developing a balanced system which maximizes the advantages of the different modes. An efficient and highly developed railway net needs truck transport to feed and support it, and pipelines should criss-cross the nation, interconnecting oil fields, refineries and industrial centers. Failure to develop substantial motor truck capacity with its inherent mobility and flexibility could lead to disaster in time of war, because of the relatively fixed nature of railway, waterway and pipeline installations. In short, a modern industrial power needs all modes in a good mix, with some built-in redundancy and reserve capacity.

While the Chinese and other less industrialized societies attempt to catch up, the industrial nations will continue to press forward in their efforts to evolve better and better ways of moving goods, people, and services. Transportation developments have moved rapidly since the beginning of World War II, and this pace undoubtedly will continue during the next twenty-five years, with expected variations by country and region according to the state of technology. Some of the expressed ideas for improvements and refinements involve

such concepts as transporting people in coach-containers that would be smoothly passed back and forth between trucks, trains, and large pneumatic tubes, somewhat similar to the way written messages are handled in many office buildings today. Another interesting proposal envisages trucks hauling their cargo to the outer rim of the city and then disgorging it onto conveyors that interlace the underside of the city in a moving grid.²⁹ Improved airline progress is now in process with larger volume and cheaper movement for both local and trans-continental traffic as the objectives. Increased use of bigger and more efficient pipelines seems to be a certainty, with this mode expanding to a greater importance with respect to commodities other than petroleum. However, for the foreseeable future, the wheel on steel continues to offer more lift for less power, and will remain as the primary internal medium and long distance bulk mover.

²⁹Vincent Caputo, "The Year 2000, the Future of Transportation," Vital Speeches, 15 October 1964, pp. 11-15.

CHAPTER II

TRANSPORTATION REQUIREMENTS IN THE PEOPLE'S REPUBLIC OF CHINA

In attempting to assess transportation requirements in China there is considerable danger that too much will be transposed from the American scheme of doing things. In their period of violent industrial revolution, the Chinese do not require the same amount of transport that Americans do in order to achieve the same industrial power. This is true because the Communists have placed all human and natural resources under state control and have an official policy of keeping living standards at a minimum so that capital formation will be accelerated.¹ A twofold effect is produced in that this eliminates the transportation of raw materials required for production and at the same time eliminates need to distribute manufactured goods. An analogy exists in the in-being military power of the U.S.S.R., which is generally considered to be almost equivalent to that of the United States, yet is based on an industrial capacity about one-half that of the United States. In addition, much of the passenger travel in the United States is entirely for pleasure which, while in the main making life more enjoyable, adds nothing to the economy other than perhaps a conjectural slight increase in output due to favorable worker morale.

Any researcher attempting to determine transportation requirements in China faces a serious obstacle placed before him because the Peoples'

¹Chu-Yuan Cheng, Communist China's Economy 1949-1962, (Philadelphia: Seton Hall University Press, 1963), p. 1.

Republic stopped publishing figures on its economy in 1959. Planning and predicting such requirements are quite difficult even when a great mass of official detail is available. Therefore, in this paper these requirements will be examined on a qualitative and geographical basis, with quantitative assessments attempted where appropriate figures are available to substantiate these assessments.

Influence of Expanding Industrialization. It is obvious that one of the prime goals of the Communists is to make China into an industrial power. The specific target for the present is to outstrip Great Britain within the fifteen year period commencing in 1957, in output of iron, steel, and other major industrial products.²

Changing from a basically agricultural society to an industrial one will generate more movement of goods, primarily related to the elimination of self-sufficiency, without counting the effects of an expanded economy. Establishment and development of new manufacturing complexes and natural resource areas has set a new pattern for major movements in China which is expected to continue and to grow. All of these forces and influences support each other in a growing spiral of industrialization. Progress in industrialization is reflected by the following table:

² Ibid., p. 166.

Peoples' Republic of China
 First and Second Five-Year Plans: Main Industrial Products
 (Million tons)

Product	Highest Pre-Communist Output	1952 Output	Target 1957	1957 Output	1962 (draft plan)
Coal	61.9	63.4	113.0	124.0	190 - 200
Steel	0.9	1.3	4.1	5.2	10.5 - 12
Electric Power (billion KWH)	5.96	7.26	15.9	19.01	40 - 43
Crude oil	0.32	0.44	2.0	1.42	5 - 6
Cement	2.3	2.9	6.0	6.7	12.5 - 14.5

Sources: Chinese State Statistical Bureau: Proposals for Second Five-Year Plan, 1957 - see Hughes and Luard, p. 200, 217.

Examination of the above figures shows that by 1952 recovery and rehabilitation from the long Sino-Japanese War and the Nationalist-Communist struggle had been completed. Then, in the First Five-Year Plan (1953-1957), the Chinese planned and achieved an across the board two-fold increase in output of these commodities. Another two-fold increase was programmed in the original Second Five Year Plan (1958-1962), but there is a general consensus that the 1962 goals were not reached.

Regardless of some ambitious over-programming and unrealistic economic theorizing during the Second Five Year Plan, the figures do indicate a rapid growth in the Chinese economy, which would tend to support a 100 per cent increase in freight movement requirements during each five years. The reduced effect on freight movements of the smaller increases that are required in agricultural production are approximately balanced by the extensive movements of construction materials and other commodities that are necessary to support the large

investments in infra-structure during this early phase of Chinese industrialization. After social overhead investments level off, freight movement growth will tend to be more in agreement with the growth in commodity gross national product, which was about 60 per cent in the First Five Year Plan and was programmed at 65 per cent in the Second Five Year Plan.³ Growth in freight movement requirements of about 100 per cent each five years appears to be warranted if the Chinese are to achieve their objectives. This was the history in the early Communist period when railway freight traffic increased from 38.6 to 74.8 billion ton-kilometers between 1950 and 1954.⁴ In a similarly intensive development period in the United States between 1890 and 1930, freight transportation almost doubled every ten years.⁵ Comparably, the volume of freight traffic on railroads in the Soviet Union grew 82 per cent in the period 1928-1933.⁶

Further evidence of Chinese desires in industrial output are contained in the following estimates, which Chu-Yuan Cheng describes as the upper limits of the Communists' Third Five Year Plan:

<u>Product</u>	<u>Unit</u>	<u>1967 Estimated Production</u>
Coal	Million Tons	510
Steel	Million Tons	36.8
Electricity	Billion KWH	120
Cement	Million Tons	24

³ Hughes and Luard, p. 64.

⁴ Wu, p. 363 as compiled from New China Monthly, Peking People's Daily, and New China News Agency.

⁵ Williams, p. 317.

⁶ King, p. 8.

The 1967 estimates are more than double their counterparts in the 1962 draft plan, listed herein, but in view of the setbacks during the Great Leap Forward and the subsequent return to emphasis on agriculture, the real plan as of now is much lower.⁷ Even with reductions, however, these estimates support a transport growth requirement as previously discussed.

What appears to be a dissenting view is inferred by Donald S. Zagoria in his statements that industrial growth in China depends upon quantum increases in agricultural production, and that the estimated 1964 gross national product of 40 billion dollars is expected to grow in the immediate future at a rate of three or four per cent.⁸ Similar assessments are expressed by O. Edmund Clubb as follows:

China's extravaganzas in domestic and foreign affairs have set back economic development about ten years. To resume increases in industrialization, to regain a strong foreign trade and to have the base for a dynamic foreign policy, China must first greatly strengthen her agriculture. This strengthening of agriculture requires capital investment, more technical and managerial skills, and the expansion of transport facilities.⁹

It is reasonable to conclude that even if future industrial output does not expand at the violent rates planned by the Communists, and is more in line with the views of Zagoria and Clubb, there was a growth

⁷Cheng, p. 140.

⁸Donald S. Zagoria, "Communist China is a Paper Dragon," The New York Times Magazine, 18 October 1964, p. 111.

⁹O. Edmund Clubb, Twentieth Century China, (New York: Columbia University Press, 1964), p. 422.

in transport requirements in the order of 100 per cent per five year period between 1952 and 1962 and a growth in capacity on the order of 60 to 100 per cent each five years should be continued in the future. This continued growth is essential to insure that transport capacity is available as needed to support rapid industrial expansion, when the other necessary factors, such as improved agriculture, technology, and extraction of minerals are developed. Available economical transportation would free labor and resources that otherwise would be needlessly consumed, and thus could serve as a catalyst to the economy. The general practice in developing countries has been to build more than adequate transportation capacity in advance of the need.¹⁰ Or as Rostow has written, "In pre take-off societies--and for the take-off as well--it is clear that a very high proportion of the total investment must go into transport and other social overhead outlays."¹¹

Geographic Survey of Natural Resources and Industrial Complexes.

In addition to the influences of an expanding industrialization, movement routes and volumes are affected by the physical juxtaposition of resources, industry, and consumption centers. These last three elements are linked together in a dynamic pattern. Changes in resources, such as the discovery of major new iron-ore reserves, affect industry, and similarly changes in industrial technology, such as the advent of

¹⁰Whiting, p. 212.

¹¹Rostow, p. 24.

atomic power or space exploration, affect resources. Both types of changes produce shifts in population centers and in some cases change the nature of private consumption. All of these changes influence transportation, and the availability of transportation can influence these developments. Discovery of important resources, as for example oil in Tsinghai or uranium in Sinkiang, generates a requirement for more and improved transport so that these resources can be integrated into the economy.

Major resource and industrial areas in China are shown on the map (Figure 1) inside the rear cover. Comparison of this map with a similar one for 1949 reveals considerable differences, particularly as regards the industrial centers. The Treaty of Nanking in 1842 opened China to western trade and influenced the subsequent economic development. Similarly, following the Treaty of Shimonoseki of 1895, additional ports were opened and foreign factory equipment was brought into China. Shanghai was the center of the ensuing light industrial development featuring textile mills. About this time a meagre network of railways was built in eastern China to link the main parts of the country. The most important of these railway systems were built by the Russians in northern Manchuria and the Japanese in southern Manchuria.¹² Presence of railroads in combination with known deposits of coal and iron-ore provided the means for the Japanese to develop Manchuria into a prime workshop. Indeed, almost all the heavy industry of Greater China—in

¹² Hughes and Luard, p. 11.

coal, iron and steel--was concentrated in Manchuria and adjacent North China as late as 1945.¹³ Since that time the Communists have altered the pattern.

One of the first steps of the Communists was to institute a massive geological survey within China. A part of the survey was the preparation of geologic and topographic maps of potential routes, but the central purpose was to discover additional resource deposits. Known coal and iron-ore reserves were fairly adequate and spread throughout the country, but the lack of adequate transportation intensified early efforts to discover new sources of iron-ore in proximity to existing manufacturing centers.¹⁴ Reserves of coal and iron-ore as calculated by the Nationalist Government in 1947 were:

<u>Region</u>	(In million metric tons)	
	<u>Coal</u>	<u>Iron</u>
Northeast (Manchuria)	22,395	3,575
North, including Inner Mongolia	300,968	814
Northwest	106,267	120
East	3,356	228
Central-South	11,871	504
<u>Southwest</u>	<u>9,192</u>	<u>192</u>
<u>TOTAL</u>	<u>454,049</u>	<u>5,433</u>

Source - Wu, p. 26.

To support the highly optimistic production rates in 1967 of 500 million tons of coal and 36 million tons of steel, these 1947 known

¹³ Ronald Hsia, "Changes in the Location of China's Steel Industry," The China Quarterly, January-March 1964, p. 133. Also see Hughes and Luard, p. 15.

¹⁴ John A. Berberet, Science and Technology in Communist China, (Santa Barbara, California: General Electric Company, 1960), p. 66.

reserves are sufficient to last approximately 1,000 years and 70 years, respectively. The Chinese have not published complete details on the results of their massive geological surveys, but in 1957, before the statistical fiascos of the Great Leap Forward, they claimed deposits of more than 12,000 million metric tons of iron-ore.¹⁵ More important, the newly discovered deposits are distributed throughout the country--in the Northwest, in Szechwan, in Kwangtung, and in Hainan. These new iron reserves, in conjunction with previously known deposits and the widely scattered coal deposits, allow for development of new industrial centers, with their contributing effects on new transportation routes and greater industrial intensity.

China's position in non-ferrous metals--tin, lead, molybdenum, antimony-- is quite good, but these minerals are concentrated in the Southwest,¹⁶ which again generates extra freight movements due to the lack of dispersed deposits.

A natural resource producing a more striking effect on transportation is petroleum. For one thing, it appears that an overall petroleum deficiency is a serious limiting factor on the economy in general, and on truck transportation in particular.¹⁷ In addition,

¹⁵Hughes and Luard, p. 9. Also Berberet, p. 78.

¹⁶Hughes and Luard, p. 9.

¹⁷Yeh, p. 55.

all the major oil fields that have been discovered are in the western part of the country, in mountainous or semi-arid regions, and are thus quite far away from industry and population centers. Major fields are near Yumen in Kansu, in the Karamai area in extreme northern Sinkiang, in the Tsaidan basin in Tsinghai, and in central Szechwan.¹⁸ The extreme remoteness of these crude producing areas in relation to existing industrial plants, to other natural resources, and to rich agricultural lands introduces a requirement for transport of the great majority of the crude, or refined product, for distances averaging 1800 miles. As we shall see later, this requirement is not being met economically. An indication of the importance of improved transport of petroleum is given by the following -- after a 147 kilometer pipeline linking the Karamai oil fields with the Tushantzu refinery was completed, the Chinese announced that previously the oil had been transported by truck at a cost of 44 Yuan per ton, as compared to an estimated cost of 4 Yuan per ton by the pipeline.¹⁹ Similarly, before the Lanchow refinery was opened, crude was shipped from Yumen to Shanghai by rail at a cost of 33 Yuan per ton, one-half the cost of the crude at the well-head.²⁰

Another significant determinant of movement patterns was the

¹⁸ Ibid., p. 32.

¹⁹ New China News Agency, Urumchi, 4 May 1958.

²⁰ Yeh, p. 32.

discovery of uranium near Urumchi in Sinkiang early in the Communist regime.²¹ The resultant mining and processing activities, plus other economic and military considerations, intensified Chinese desires to build the Lanchow-Sinkiang railroad.

As mentioned before, natural resources and industrial centers are closely related. There are indications, however, that the selection of new manufacturing localities was not based entirely on economics. One can infer a degree of xenophobia in the way the Communists have concentrated on developing new centers that were not begun by either Europeans or Japanese. On this matter, Hughes and Luard say that during the First Five Year Plan "a big feature was the downgrading of Shanghai, perhaps because it was a symbol of the semi-colonial past."²² More to the point was the Chinese desire to eliminate the necessity of relying so much on Manchuria for heavy industry, a matter brought keenly to mind by the threat to this area during the Korean war. Thus, the Communists have emphasized a regional concept, with manufacturing centers close to raw materials and consumption centers, because of national security influences.²³ These considerations and policies have already produced a shift to the west away from the ultra concentrations in Manchuria and along the eastern coast.

²¹Chalmers Johnson, "China's Manhattan Project," The New York Times Magazine, 25 October 1964, p. 117. Also Berberet, p. 112.

²²Hughes and Luard, p. 104.

²³Hsia, p. 125.

The following chart on steel production vividly portrays this change.

Regional Distribution of Ingot Steel Output

<u>Economic Region</u>	<u>Per Cent</u>			
	<u>1945</u>	<u>1954</u>	<u>1957</u>	<u>1961</u>
Northeast	65.3	65.9	67.8	20.7
North	30.5	25.4	10.7	17.9
East	1.7	5.5	14.7	29.5
Central-South	0.6	2.1	4.1	15.4
Northwest	---	---	---	9.5
Southwest	<u>1.9</u>	<u>1.1</u>	<u>2.7</u>	<u>7.0</u>
	100.0	100.0	100.0	100.0

Source: Ronald Hsia, "Changes in the Location of China's Steel Industry," The China Quarterly, January-March 1964, p. 125.

When one notes Mr. Hsia's statement that there was an absolute increase in production in the Northeast between 1957 and 1961, the percentage geographic changes are even more significant, particularly the 16.5 per cent of ingot output in the Northwest and Southwest in 1961. This means, off hand, a substantial increase in freight movements within and to and from these areas by 1961, and more to come in the future as these regions continue to develop.

Anshan in Manchuria is still one of the largest steel processing centers, but by 1956, the Chinese, with major Russian help, had put into operation large steel centers at Paotow in Inner Mongolia and Wuhan in Hupeh Province. The latter two localities have a capacity in excess of two million tons per year each.²⁴ Other new heavy industry centers are being developed at Hankow in central China, at Kunming in the Southwest,

²⁴Berberet, p. 78.

and at Lanchow on the railroad to Sinkiang.²⁵ While major heavy industries and light industries such as cotton mills and electrical goods plants continue in the east, the trend of heavy industries is to the interior, based on a combination of sound economics and defense policy.

These winds of change as regards location have already introduced transport requirements where none existed before and expanded those requirements that did exist before. In summary of this discussion on economic geography, a few generalizations on movements are appropriate. Heavy industrial products are needed from the Northeast and North to support expanding mineral extractions and manufacturing growth in the Northwest and Southwest. Minerals, particularly oil and non-ferrous metals, from these latter areas must be moved to the eastern half of China. Dry cereals have to flow from North China to the other regions and rice from the Yangtze valley to the North and Northeast. Cotton moves from the North to the mills around Shanghai to be made into cloth for distribution throughout the country.²⁶

It is essential to distribute the meagre suppliss of consumer goods as widely as possible to reduce discontent, provide incentives and restrain agricultural hoarding. All of these movements so vital for an economic revolution, must grow and grow at an ever increasing

²⁵ Hughes and Luard, p. 105.

²⁶ Ibid., p. 106. Also, see Wu, pp. 382-383

tempo if China is to achieve anything approaching industrial parity with the U.S.S.R. or the United States.

Politico-Military Requirements. Some aspects of these requirements were mentioned in the prior discussion regarding uranium activities in Sinkiang and the trend to interior industrial development. Also noted was the part that improved communications have played in bringing all regions of Greater China, including Sinkiang and Tibet, under Peking's control, with the consequent unification of China for the first time in history. Of concern at the moment is the impact of internal transportation on China's ability to project her power and influence beyond her borders.

Hansen Baldwin wrote in 1951 that "lack of adequate communications-- particularly with her neighbors in Southeast Asia--would attenuate Chinese military effort beyond her frontiers; we have seen in Korea that the farther south of the Yalu the Chinese advanced the more difficult it was for them to supply themselves."²⁷ There was speculation during the Sino-Indian border conflict in 1962 that China stopped the advance of her forces because of logistic support difficulties.

From a purely defensive viewpoint there is the obvious need to concentrate forces in the area of attack. Now that the split with the U.S.S.R. is rather serious, Chinese military planners cannot afford the luxury of forgetting about the northern border. The opinion has been

²⁷Hansen W. Baldwin, "China as a Military Power," Foreign Affairs, October 1951, p. 52.

expressed that military mobility is not of great importance inside China because the Communists maintain very large forces in all strategically important parts of the country.²⁸ Considering the limited land threat in the area this perhaps is partially true, but it is unrealistic to assume that China has such overwhelming forces that she would not need to move large concentrations of troops to meet an attack in Manchuria, or from Taiwan, or from Southeast Asia. Extensive efforts in the middle 1950's to improve the railways into Fukien Province opposite Taiwan give testimony to the Chinese concern on this issue.²⁹

More significant is the requirement for transportation as a means of projecting Chinese influence, if not outright dominance, to bordering nations. As China is blocked at the moment on the north and west by Russia, and on the east by the lack of seapower with which to contest the United States, this reduces to a consideration of South and Southeast Asia. For all this vast area, railroad, highway and air communications are required if the Chinese are to expand their political control, as is apparently their desire. Military forces may have to be moved into these areas and maintained, or as an alternative, this capability could be exploited by threat. A third use of this transport power would be to support native forces in

²⁸ "Is Red China a Paper Tiger?", U.S. News and World Report, 19 October 1964, p. 77.

²⁹ Chang, p. 545.

"wars of liberation." This "projection" requirement has been summarized as follows: "The Tibetan massive is no longer an unassailable barrier, but, as the Chinese invasion of the North East Frontier Agency so dramatically revealed, a potential springboard for aggression. Southeast Asia is no longer remote from China but in close and intimate contact with it."³⁰

³⁰ Denis Warner, "China's New Roads: Where Do They Lead?" The Reporter, 26 September 1963, p. 33.

CHAPTER III

TRANSPORTATION ASSETS IN CHINA

Railroads. The extreme importance of railways in Communist China relative to the other modern carriers is not only representative of the pre-Communist state of affairs but also is the result of deliberate government policy.¹ Evidence of this is a decision made by the Planning Bureau of the Economic and Financial Commission in 1950 not to stress highways and waterways, but instead to emphasize rehabilitation and construction of railroads.² Other evidence of this official policy is given by the fact that during the period 1950-1957, 10.9 per cent of the total investment in capital construction was in railways, as compared to 5.6 per cent in all other forms of transport, including postal and telecommunications facilities.³ There has been speculation that one of the reasons why the Communists adopted this position was because they felt they did not have sufficient oil reserves to support modern truck transport.⁴ Results of the Government's attitude are apparent today in the very high proportion of goods moved by rail.

Early efforts were concentrated on rehabilitating and improving the existing rail lines, but at the same time the Communists made

¹ Wu, p. 346.

² Ibid., p. 347.

³ Francis P. Hoesber et al, The Economic Potential of Communist China, (Menlo Park, California: Stanford Research Institute, 1963), I, p. 26.

⁴ Hughes and Luard, p. 112.

an early start on new construction. In 1948 there were 26,448 kilometers of main line in China, some of which was damaged, such that 21,715 kilometers were in operation at the time the Communists took control.⁵ At the end of 1952, trackage in operation had been increased to 24,232 kilometers, including 1,346 kilometers of new line, and 9,991 kilometers that reportedly had been restored or repaired.⁶

By the end of 1954 the new construction figure had grown to 2,304 kilometers,⁷ by the end of 1957 to more than 5,000 kilometers,⁸ and in September 1964 the Chinese claimed to have 35,000 kilometers in operation.⁹ This last figure appears to be reasonable, as most authorities credited China with about 32,000 kilometers at the end of 1958.¹⁰ Accepting the 35,000 kilometers would mean that the Communists have constructed approximately 10,000 kilometers of new track in fifteen years. Also of importance was the completion in 1957 of a 3,760 foot combined road and railway bridge over the Yangtze River at Wuhan.¹¹

⁵Chang, p. 539.

⁶Ibid., p. 349.

⁷Ibid., p. 360.

⁸Chang, p. 541.

⁹"Railway Construction in China Has Expanded Rapidly," Chung-Kuo Hsin-wen (Canton), 15 September 1964, p. 4.

¹⁰N. A. Shackleton, "Communist China's Potential," Military Review, September 1964, p. 44. Also, Hughes and Luard, p. 108.

¹¹Joseph E. Spencer, "Yangtze," Encyclopaedia Britannica, (Chicago: 1962), XXIII, p. 875.

This permits passage of through trains on the Peking - Canton line and eliminates delays incident to ferrying the trains across the river. Another vital link was the construction of a double-track rail bridge over the Yangtze at Chungking.¹² Certainly these all are significant accomplishments and indicate an appreciation of the importance of rail transport, but these efforts and the status of trackage should be reviewed in light of some comparisons.

The United States, with about the same area as China, had reached a peak of 400,000 kilometers of main line in 1916, had 48,000 kilometers in 1860, and laid over 17,000 kilometers in the construction year of 1882.¹³ Similarly, France, about one-twenty-fifth the size of China, has 39,000 kilometers of main line and Japan, one-fortieth the size of China, has 27,000 kilometers. Hughes and Luard wrote in 1961 that "there are large areas in China where there are no railways at all,"¹⁴ and the same idea was expressed recently by Shackleton in his statement that "At present millions of people [in China] live more than 160 kilometers from a railway."¹⁵ Examination of the map (Figure 1) inside the rear cover vividly reveals the truth of these observations. For instance, at present there are only two north-south lines in the first 500 miles inland from the east coast (three in the Peking area), and it is another 500 miles inland to the next north-south line, which at

¹² Hughes and Luard, p. 111.

¹³ Thomas C. Shedd, Jr., and Robert B. Spark, "Railway," Encyclopaedia Britannica, (Chicago: 1962), XVIII, p. 928.

¹⁴ Hughes and Luard, p. 207.

¹⁵ Shackleton, p. 46.

this time is not complete to the southern border. Similarly, excluding consideration of Manchuria, there are but three east-west rail lines in the entire expanse from Peking to Canton. All of the cited area is in China Proper and is one of the most densely populated regions in the world. For comparison, note the rail density in the United States as shown on Figure 2. The facts support a conclusion that China is woefully short of the trackage needed to become a modern industrial power.

In addition to showing the total length of railways Figure 2 also depicts progress in new construction and double tracking since 1949, and plans for the future. The close integration of the recently completed and planned lines and the new interior industrial centers discussed in the previous chapter is apparent. Thus, it can be seen that interior economics was a major factor in the decision to proceed with all new construction, except perhaps the Yingtai-Amoy line opposite Taiwan, the extension from Litang to the North Vietnamese border, and the Chinese portion of the broad-gauge route through Outer Mongolia, which joins the Trans-Siberia Railway at Ulan Ude.¹⁶ This Mongolian line and the extremely important Lanchow-Sinkiang route have major strategic significance in that they greatly shorten the distance between Peking and Moscow, while at the same time effecting a move away from the far more exposed routes through Manchuria. It should be noted, too, that the railways in the Southwest and planned construction in Tibet have marked strategic implications.

¹⁶
Chang, pp. 545-546.

Before leaving the subject of railway construction it would be well to take note of the assistance in this endeavor provided by the Russians. This assistance was similar to the program through which the Russians supplied complete sets of equipment and technical aid for construction of large industrial projects. There is sound basis for concluding that the 154 of these projects finished by 1960 constitute the heart of China's industrialization program and are significantly responsible for the progress to date in increasing modern industrial output.¹⁷ Following this trend, Soviet help played a prominent part in the construction of many of the new rail lines. This help consisted of three parts -- aerial surveys and designs, provision of special construction equipment, and construction supervision.¹⁸ An example of the magnitude of this assistance was contained in a communique of 12 October 1954, which announced that Communist China and the Soviet Union had decided to build the railroad from Lanchow through Urumchi to Alma-Ata, and that the section inside China would be built by China with all-round Soviet assistance.¹⁹

The sudden withdrawal of the Soviet experts in the summer of 1960 is listed as an important factor in bringing the Great Leap

¹⁷Choh-Ming Li, "China's Industrial Development 1958-63," The China Quarterly, January - March 1964, pp. 30-31.

¹⁸Chang, p. 542.

¹⁹Ma Tse-Ching, "Railway Construction in People's China," People's China (Peking), 1 November 1954, pp. 18-25.

Forward to an end.²⁰ Long delays in completing the Lanchow-Tsinghai railway and the Neichiang-Kunming line, both of which were begun in 1956, indicate that the withdrawal has had the same effect on railway construction. This view is corroborated by Stanley Karnow in his statements that "railroad building has been minimal recently except for minor lines for hauling timber from the forests," and "the line into the Sinkiang oil fields is not finished yet, three years after the scheduled completion date."²¹ Withdrawal of the Soviets removed not only their direct aid in designing and building the railroads, but also was a factor in bringing about a relapse in the economy in general, reducing the capacity to sustain high investments in railway construction. Thus, the evidence available supports the conclusion that the substantial progress made in extending the rail net since 1949 was largely due to the technical and material assistance furnished by the Russians.

In contrast to the situation with respect to trackage, it appears at this time that the Communists have no major problems regarding rolling stock. Yuan-Li Wu cites postwar railway construction plans of the Nationalists wherein average rolling stock requirements on Chinese railways were determined to be 200 engines and 2500 freight cars for each 1,000 kilometers of railway lines.²² For the previously

²⁰ Li, p. 32.

²¹ Karnow, p. 135.

²² Wu, p. 364.

accepted figure of 35,000 kilometers, this translates into a requirement for 7,000 locomotives and 87,500 freight cars. Wu credited the Chinese with 3,355 locomotives and 48,500 cars at the end of 1952, and with the capacity to manufacture 2,000 cars per year as early in their industrialization process as 1952.²³ The first locomotive was completed in China on 9 August 1952,²⁴ and in addition to a projected growth in internal production, undoubtedly there have been imports from other Communist countries. As of now, the Communists claim that the majority of rolling stock in operation was produced in China and that they have exported some freight cars.²⁵ With the gains from internal production and imports, and the losses due to attrition, the availability figures today are on the order of 6,000 locomotives and 150,000 freight cars.²⁶ Though some of this equipment may be ageing, all indications are that sufficient rolling stock is available for the present. Production in the future should meet the demands of track expansion, though an unlikely revolutionary increase in trackage might introduce a requirement to import locomotives in quantity.

Not much is known about railway operation, but it appears that management and utilization of available facilities and equipment have been good.

²³ Ibid.

²⁴ Ibid., p. 391.

²⁵ "Railway Construction in China Has Expanded Rapidly," Chung-kuo Hsin-wen (Canton), 15 September 1964, p. 4.

²⁶ "Is Red China a Paper Tiger?" U.S. News and World Report, 19 October 1964, p. 77.

Early in their regime the Communists increased the average speed of freight trains from 20.9 to 25.6 kilometers per hour, increased daily engine runs from 337 to 436 kilometers, reduced freight car turn-around times, and increased the number of cars pulled per engine. All of these improvements point to intense utilization of available equipment, which in large measure accounts for the doubling in railway freight ton-kilometers in the period 1950-1954.²⁷ There is no evidence available indicating any reduction in attention to operating efficiencies in recent years.

As inferred above, track utilization in China is very high, somewhat similar to the situation in the U.S.S.R., where freight carried per unit length of track is 3.4 times that in the United States.²⁸ This is not necessarily a good situation, for in addition to leaving little capacity in reserve for emergencies, the resultant slow and undependable service has a tendency to promote hoarding of supplies and materials by industrial managers, thereby producing excessive investment in idle inventories.²⁹ The present track utilization in China is such that increases in capacity with the existing lines will be difficult.³⁰

A problem related to high track utilization is the almost complete absence of double-track lines. The fact that nearly all lines are

²⁷ Wu, pp. 363-364.

²⁸ King, p. 9.

²⁹ Ibid.

³⁰ Yeh, p. 50.

single-track is a severe limitation which was recognized by the Government some time ago.³¹ Plans have been announced by the Communists to double track about 5,000 kilometers of line in the heavy industrial and population concentrations in the eastern one-half of the country, but to date only about 2,000 kilometers of this effort is known to have been completed.³² Double tracking of the Peking-Mukden line was finished in 1954, and a portion of the Peking-Hankow line has been done, but little other progress is apparent.³³ The planning figure of 5,000 kilometers as announced by the Communists is quite modest, for because of the approximate three-fold increase in capacity provided by double-tracking, there is apparent justification for building all the lines in the eastern one-half of China to this standard. Here again, performance has been minimal in consideration of the needs.

Highways. Modern highway transport using motor trucks and buses has been rather well ignored in China even up to the present day. The relative unimportance of this form of transport and the lack of interest in developing it can be deduced from the following comparative freight rates at the time immediately prior to World War II:³⁴

³¹ Hughes and Luard, p. 105.

³² Chang, p. 538.

³³ Ibid.

³⁴ Wu, p. 344, as taken from Chin Chia-fung, Transportation Development and Trends in China, Shanghai: 1937, pp. 146-147.

<u>Type Transport</u>	<u>Average Pre-World War II Freight Rates (In Chinese Nationalist \$ per Ton-Kilometer)</u>
Railway	0.01327
Junks	0.07000
One-animal carts	0.11700
Mules, donkeys, and horses	0.19100
Human carriers	0.32000
Motor vehicles	0.40000

The above figures are indicative of a lack of a well-engineered road net, a lack of the technical capability to build, operate, and maintain motor vehicles effectively, and high costs of vehicular fuels. These three factors are still evident today, though the Communists have paid more attention to motor transport than their predecessors.

An obvious manifestation of this increased attention is the effort on expansion and improvement of the road net. Communists' claims and attitudes on this subject are given by the following quote from a recent Chinese newspaper: "Highway facilities in Fukien increased more than ten times and the number of vehicles several tens of times in the last fifteen years. Roads now connect all major towns and cities in the Province and link Fukien with Kwangtung, Kiangsi, and Chekiang."³⁵ Further, today Peking claims in excess of 6,000 miles of motor highway in Kwangsi Province, as against only 135 miles in 1949, and claims to

³⁵"Fukien Highway Communication - Transportation Network Expanded," Chung-kuo Hsin-Wen (Canton), 27 September 1964, p. 8.

have built 87,000 miles of road in Sinkiang in 1958.³⁶ It is not possible to determine exactly how many miles of new roads have been constructed by the Communists, but the total net in operation today is on the order of 400,000 kilometers.³⁷ This net connects all the major cities in China, a situation which existed as early as 1954.³⁸

Of perhaps more significance than the total road mileage is the quality of these roads with respect to modern truck traffic. Evidence of extremely poor quality is available from a detailed report on road maintenance issued by the Ministry of Communications in 1964. This report (1) stresses the need for better construction and better maintenance, (2) points out that most secondary roads have a dirt surface and are in inferior condition and (3) discusses problems with risky bridges that are not strong enough to carry required loads. Further, the report contains the following revealing statement:

"Under conditions where supply of tar is convenient and its price is not too high, it is rational and economical to pave the road with tar so the road will gradually make a transition to possess an advanced or secondary road surface."³⁹ Similar indications of the low quality of Chinese roads are given by Kuo's assertion that China has only 30,000 miles of real motor highway and his remark, "For everyday travel and

³⁶ Warner, pp. 32-33.

³⁷ Shackleton, p. 44.

³⁸ Wu, p. 387.

³⁹ "1963 Work Report on Nationwide Highway Maintenance," Kung-lu (Peking), No. 7, 20 July 1964, pp. 2-4.

transport the masses depend on age-old dirt roads, rivers, lakes and canals. But since the old roads are not more than five feet wide, overland traffic is carried mainly by wheel-barrow."⁴⁰

The evidence is strong that only a small part of the roads in China are suitable for modern inter-city truck traffic. Even if all 400,000 kilometers were so suitable, however, this system would be dwarfed by the 5,600,000 kilometers of inter-city highways in the United States and the 1,425,000 in the Soviet Union. Similar to the situation with respect to railroads, China's inter-city road net is extremely inadequate, both in quantity and quality.

Even though the over-all situation is not impressive, there have been substantial improvements in the roads in the Southwest, and into Tibet. Lacking effective rail communication into these areas, the Chinese seem to have concentrated their road building efforts there for strategic reasons. Major routes in this part of China are shown on Figure 1.

It will be noted that three arteries now link China with Tibet, namely Chengtu - Lhasa, Lanchow - Lhasa, and the Sinkiang-Tibet Highway. This latter route cuts across disputed Jammu-Kashmir territory and, according to Indian Government officials, is graveled and capable of carrying heavy traffic.⁴¹ Of further interest are the forward

⁴⁰ Ping-chia Kuo, China, (London: Oxford University Press, 1963), p. 15.

⁴¹ "Communist China: Roads to the South," Military Review, September 1964, p. 106.

extensions off the Tibetan highway to the borders of Kashmir, Nepal, Bhutan, and Sikkim. At the same time, improvements and additions have been made on roads connecting Yunnan Province with Burma, Laos, and North Vietnam, and the Chinese have built 265 miles of roads for the Burmese Government.⁴² All of these developments show that the Communists appreciate the function of land communications in extending political control and influence.

Added to the limited availability of first class highways in China is an acute shortage of trucks. Perhaps this is the result of considered decisions, for on balance it seems reasonable to assume that a nation that can produce and explode a nuclear device can make motor trucks in quantity. However, China presently has only about 200,000 trucks, both military and civilian.⁴³ This is an insignificant number in comparison with the more than 12,000,000 trucks in operation in the United States, and there is not much prospect for violent change.⁴⁴

Perhaps urban transport is in slightly better condition, for recently the Chinese stated that there are 400 buses in Canton which can transport more than 500,000 passengers daily, double the number of buses and five times the passenger capacity existing prior to the

⁴² Warner, p. 33.

⁴³ "Is Red China a Paper Tiger?" U.S. News and World Report, 19 October 1964, p. 77.

⁴⁴ Hughes and Luard, p. 111.

"liberation."⁴⁵ This claim is substantiated by a recent visitor to China who reports, "In Shanghai some 1400 new electric buses--all manufactured in China--glide quietly through the main avenues, carrying workmen to and from their jobs for fares of less than a penny."⁴⁶ Conflicting evidence is presented by the same observer, however, in his pictures of almost empty streets in Shanghai and the accompanying statement that in pre-Communist days these streets were the scenes of massive traffic jams. Other indications of present gross inadequacies of the vehicular fleet are given by this reporter as follows: "Machinery is still scarce and most heavy earthmoving depends upon thousands of workers lugging buckets of stone, sand and clay," and "In Yen-Po People's #1 Commune, there are no vehicles except bicycles. Shops serving 15,000 farm families are in the Commune."⁴⁷ Similar reports from other recent visitors to China confirm the acute shortage of motor vehicles.

Another factor in the development of modern motor vehicle transport is the petroleum supply situation. Hughes and Luard state that motor transport is inhibited by shortage of petrol and suggest that this was the reason that Po I-po, in a speech to the National People's Congress

⁴⁵"Urban Transportation Facilities Greatly Expanded," Chung-kuo Hsin-wen (Canton), 23 September 1964, p. 8.

⁴⁶Jorgen Bisch, "This Is the China I Saw," National Geographic, November 1964, p. 605.

⁴⁷Ibid., pp. 637-638.

in 1957, called for more development of native transport.⁴⁸ For years it was thought that China did not have sufficient petroleum reserves to support modern industry, but due to the intensive efforts of the employees of the Institute of Geological Prospecting, K. C. Yeh now estimates that her oil and shale reserves are adequate.⁴⁹ He points out, however, that imports of petrol from the U.S.S.R. provided 30 per cent of 1962 consumption, and that recent reports in Chinese newspapers indicate a shortage of refined products.⁵⁰ Yeh concludes that the present tight situation is primarily related to lack of technology and is such that minor production lags or import reductions would seriously affect both truck transportation and mechanized agriculture, but that the prospects for the long run are for self-sufficiency, provided adequate investments are made in equipment, refineries, and education and training.⁵¹ Temporarily, supply of petroleum products will inhibit the growth of truck transport, but this influence is expected to lessen in the future.

Waterways. As mentioned earlier, traffic along the coasts and along rivers and canals has been important in China for centuries. This importance continues, though it is limited by the general east-west orientation of the rivers, and by the fact that navigable waterways are non-existent in the North and Northwest provinces. The silt-laden

⁴⁸Hughes and Luard, p. 112.

⁴⁹Yeh, p. v.

⁵⁰Ibid., pp. 48-55.

⁵¹Ibid., p. vii.

Yellow River, which penetrates well into Kansu and Tsinghai in the Northwest, has not been developed and controlled so that it can be used for major transport. Work on this latter undertaking is now in progress, however.⁵² In addition to this basin development proposal, in 1959 the Communists announced an ambitious ten-year plan to develop a continuous line of navigable rivers and canals from the Amur River in Manchuria to the Yangtze,⁵³ but to date there is no evidence of any progress on this massive scheme. As compared to the railroad and the road situation, there has been a noticeable lack of publicity pertaining to major accomplishments in waterway facilities, additions and improvements.

China does have extensive waterway routes, totaling some 150,000 kilometers, about 30,000 kilometers of which is considered to be navigable by steamers.⁵⁴ There are numerous small local systems, but the principal waterways are (1) the Yangtze and its tributaries serving the East, Central-South and Southwest provinces, (2) the Amur-Sungari system serving northern Manchuria, and (3) the Pearl River system extending from Canton throughout Kwangtung and Kwangsi.

The Chinese have claimed significant increases in both inland water transport and coastal traffic, but exact figures for recent years are not available.⁵⁵ However, Wu states that there was an increase in

⁵² Hughes and Luard, p. 114.

⁵³ Ibid., p. 115.

⁵⁴ Shackleton, p. 44.

⁵⁵ Hughes and Luard, p. 112.

traffic on the Yangtze from 3.9 million tons in 1952 to 6.6 million tons in 1954,⁵⁶ and Hughes and Luard quote a Ministry of Communications claim that 4.7 times more ton-kilometers were moved by cargo ships and tug-drawn barges in 1956 than in 1952.⁵⁷

The Chinese have claimed to have launched freighters of 5,000 tons and over, and have the capability to build small ships, but there is nothing to indicate much of a change from the 1956 conditions, when about one-half the total freight on inland waterways was carried by junks.⁵⁸ There is intensive use of all available craft such that the real limitations on use of this form of transport are the geographical facts of the waterways net, perhaps some shortage of large vessels, and the lack of capacity in the other modes, particularly trucks, to integrate the waterways with the surrounding agricultural and industrial regions.

Airways and Pipelines. The Chinese have civil air routes connecting all the major cities and totaling approximately 20,000 miles, but because of a shortage of aircraft and jet fuel air transport is of minor consequence.⁵⁹ There has been some speculation as to whether the Chinese are manufacturing their own aircraft, but the general estimate on this matter was recently summarized as follows, "With Russia's help, Red China was on the verge of developing its own aircraft industry in 1960. But when the Russians pulled out, the project stalled, and the

⁵⁶ Wu, p. 373.

⁵⁷ Hughes and Luard, p. 112.

⁵⁸ Wu, p. 371.

⁵⁹ Hughes and Luard, p. 112 -- Also, Yeh, p. 50.

Chinese have not been able to get it going since that time."⁶⁰ Similar conclusions are made by Zagoria with respect to military aircraft and as an indication of the lack of production capability he asserts that because the Soviets stopped sending repair parts in 1960, about one-sixth of the three thousand obsolescent military aircraft have been grounded or dismantled to obtain parts.⁶¹ The Communists have purchased six Vickers Viscounts from the British, primarily for communication with Albania, Africa, and Cuba, but these aircraft could be used internally to support operations along the borders if necessary.⁶² However, confirmation of the relative unimportance of air transport can be deduced from recent Chinese announcements concerning new air service from Shanghai to major cities in the Southwest and schedule changes on flights from Peking, Shanghai, and Canton to other important cities. In all cases, flights are listed on the basis of two or three times a week, such as Mondays, Wednesdays, and Fridays, or Tuesdays and Thursdays.⁶³ As the flights involved connect the prime industrial and population areas of China, this certainly indicates a shortage of

⁶⁰ "Is Red China a Paper Tiger?" U.S. News and World Report, 19 October 1964, p. 77.

⁶¹ Zagoria, p. 112.

⁶² "Red China Air Expansion Seen," Aviation Week, 9 September 1963, p. 39.

⁶³ "Changes in Civil Airline Flight Schedules," People's Daily (Peking), 30 October 1964, p. 6.

aircraft. New airfields are nearing completion at Canton and Shanghai according to the Communists,⁶⁴ and a lavish airport has been constructed near Peking.⁶⁵ However it is obvious that air transport occupies a minimal segment of the Chinese economy.

The pipeline transport situation is worse than that of airlines. The only known pipelines are the 147 kilometer line in northern Sinkiang and another line from the Yumen oil field to the refinery town of Lanchow (See Figure 1). As discussed earlier, the big producing oil fields are in the West and Northwest, far from the large consumption centers. Therefore this deficiency is quite significant, as it adds more of a burden to the railroads, particularly the one long single track route into Sinkiang. The absence of waterways in the area of concern further magnifies the pipeline deficiency.

In spite of an acute need, there has been no mention in official publications of any proposed plans to correct this matter, so that petroleum can be transported by pipelines over long distances.⁶⁶ The only logical explanation appears to be that Chinese technology has not developed sufficiently to produce large diameter high quality pipe and the equipment for pumping stations. There have been difficulties in manufacturing these items in the U.S.S.R. in the quantities and

⁶⁴"Aviation," The China Quarterly, April - June 1964, p. 233.

⁶⁵Hughes and Luard, p. 112.

⁶⁶Hoeber, et al, p. 116.

qualities needed to support the Russians' pipeline expansions. This gives a measure of the state of technology required, and also means that the Russians have no pipeline equipment available for export.⁶⁷

Native transport. The continued great reliance on this form of transport gives strong testimony to the inadequacy of modern carriers in China. As listed earlier, Yeh asserts that native transport is still the most important means in China. Hughes and Luard express the same idea by stating, "By far the greater part of Chinese road transport at the moment, for example for the transport of building materials and for local trade, is by such primitive means as donkeys, mules, camels, and even hand-carts."⁶⁸ More evidence along this line is contained in a report of a trip from Hong Kong to Canton, in which the author writes that, "There were almost no cars nor buses in Canton, presumably a Communist show place." The author further observes that there were no motor vehicles along the way, but that he did see a few water buffalo carts and many hand carts.⁶⁹ These old-fashioned carriers absorb tremendous quantities of man-power and as they are suitable only for small loads and short distances they are inefficient and inappropriate for a nationally integrated modern industrial economy.⁷⁰ The Communists, while admitting in 1958 that transport had become

⁶⁸Hughes and Luard, p. 111.

⁶⁹"Train to Nowhere," Newsweek, 31 July 1961, p. 44.

⁷⁰Yeh, p. 50.

inadequate to dispose of the products of the commune industry and was now the key to the success of their future production plans, stressed the importance of this native transport.⁷¹ Continued reliance on such a consumer of manpower will inhibit an increase in net productivity per person and thus retard total economic growth. After returning recently from one of his many visits to China, Roland Berger, Director of the British Council for Promotion of International Trade, wrote an article very favorable to the Communists in which he says that consumer goods are available in the stores appropriate to the present stage of economic development. He further argues that China is now stronger by virtue of the tempering effect of the natural disasters of 1959, 1960 and 1961, but emphasizes in this favorable article that China is a vast country with a relatively undeveloped system of communications.⁷²

⁷¹Hughes and Luard, p. 72.

⁷²Roland Berger, "China Today: Walking on Two Legs," The Nation, 16 November 1964, pp. 352-354.

CHAPTER IV

CONCLUSIONS

It is concluded that:

Transportation has exerted a strong influence upon social development and organization in the past and this influence continues today. Efficient, economical transportation is the sine quae non of a modern industrial economy. Preferably the required transport capacity should be developed prior to its need. With this capacity in existence, plus technology and efficient agriculture, a nation is ready for the "take-off" from the traditional stage to the industrial stage. Without it a nation is doomed to relative economic obscurity. A nation's transport system should consist of a balanced and integrated mix of the various modes, with built-in redundancy and reserve capacity for protection against natural and man-made disasters.

In the immediate future, China needs a growth in transport capacity approximating 60 - 100 per cent each five years if she is to achieve her announced objective of becoming a first rate industrial power. The changing pattern of industrial development in China - characterized by regional development and a move to the interior - has been brought about by discoveries of new resources and national security influenced decisions to move away from exposed coastal areas and to disperse and duplicate the industrial base for survivability. This change introduces greatly expanded movement requirements in areas not previously developed.

Railroads are the dominant modern carrier in China. With strong Russian assistance, noteworthy progress has been made in expanding the railway capacity; however, since the withdrawal of Russian assistance in 1960 this progress has slowed appreciably. Railway expansion has been carefully planned in consonance with the requirements of economic growth and national security. However, considering China's size, population and industrial growth aspirations, accomplishments to date fall far short of meeting the needs, with the result that China is seriously lacking in railroad trackage.

Modern highway transportation has been ignored in China until recently. The Communists have emphasized improvement and development of this form of transport, particularly in the Southwest, in Tibet and in Sinkiang where railways and waterways do not exist, but their overall efforts are considerably short of providing adequate truck transportation even for the present state of Chinese industrialization. An acute shortage of trucks and the meagre network of first class highways combine to limit truck transport for the present. Petroleum products are in short supply at this time, but due to recently discovered reserves and improving technology, prospects are that petroleum supplies will have less of an inhibiting effect on truck transport in the future.

Waterways are an important transport mode in China, but their use is limited by their general east-west orientation and their non-availability in large areas of the country. The Communists have made excellent use of available waterways and operating equipment, but have not expanded nor improved the waterways network.

Civil air routes connect all major cities in China, but due to a shortage of aircraft and fuel, air transport is minimal. A very serious deficiency is the failure of the Communists to install pipeline systems to move petroleum supplies from the remote oil fields in the West to the heavily populated consumer areas in the East. Practically no pipelines exist, and there is no evidence of any work underway or in prospect to correct this deficiency.

Primitive transport, employing man-porters and hand and animal carts is still the most important means in China. Continued use of this inefficient means reveals the true state of the development of Chinese technology and industry. The manpower consumed by this inefficient system of transport is needed in the agricultural and industrial sectors of the economy.

The Communists have shown an awareness of the necessity to introduce efficient transportation into China and with Russian assistance, they have made some progress toward this end. Overall, however, their accomplishments are not impressive and China today is still a vast country lacking sufficient modern transport for the present degree of industrialization. The existing systems are out of balance in that truck transport and pipelines are not developed to carry their optimum share of freight. The Chinese have accomplished required movements of goods and people only by intense application of manpower, denying this effort to other endeavors where it could be used more beneficially for maximum growth of the Chinese industrial base.

Presently, the lack of transportation is a drag on the Chinese economy and limits application of her impressive land military power to peripheral regions. However, prospects for continued governmental attention to solution of this problem coupled with an improving Chinese technology leave no room for complacency in the Free World.

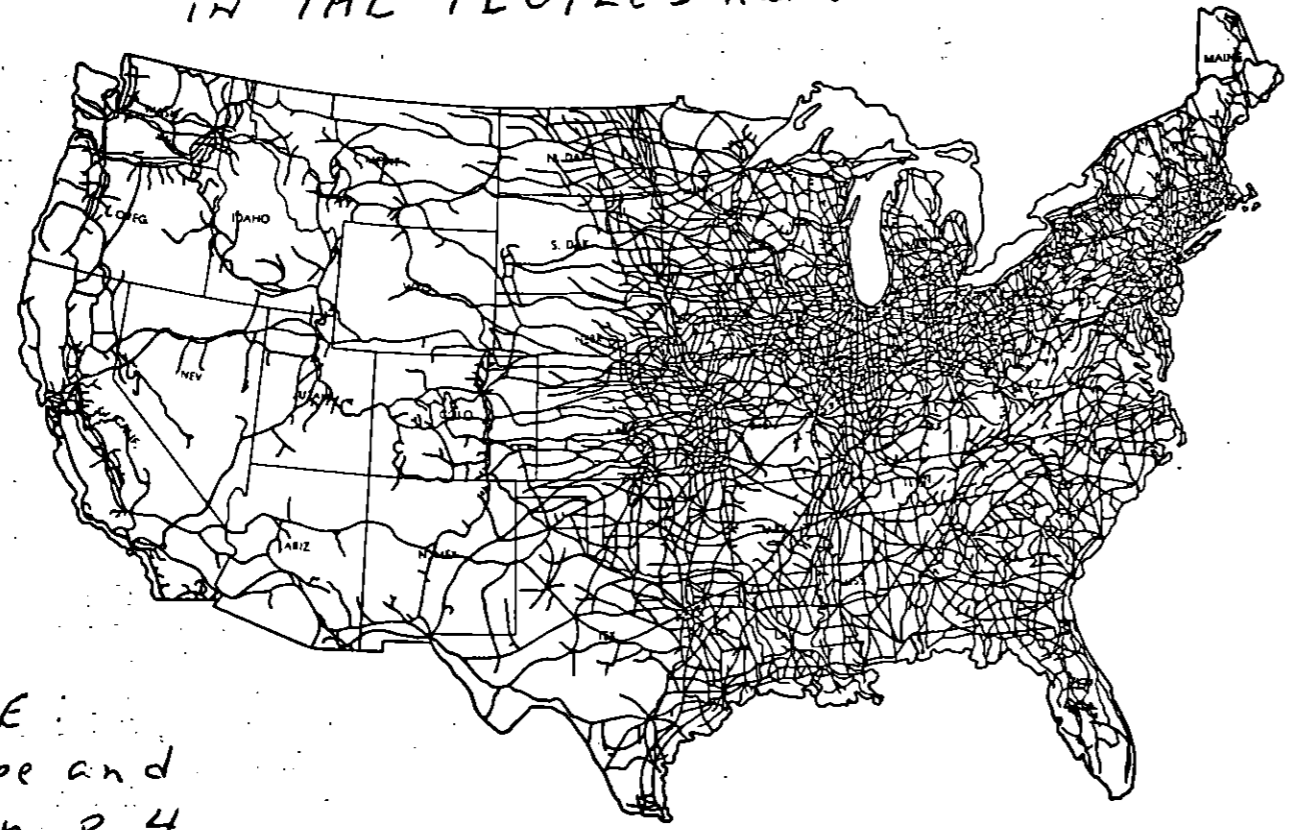
BIBLIOGRAPHY

1. "Aviation." The China Quarterly, April-June, p. 233.
2. Baldwin, Hansen W. "China as a Military Power." Foreign Affairs, October 1951, p. 51-62.
3. Berberet, John A. Science and Technology in Communist China. Santa Barbara, Calif.: General Electric Company, 1960.
4. Berger, Roland. "China Today: Walking on Two Legs." The Nation, 16 November 1964, p. 352-355.
5. Bisch, Jorgen. "This Is the China I Saw." National Geographic, November 1964, p. 591-638.
6. Caputo, Vincent. "The Year 2000, the Future of Transportation." Vital Speeches, 15 October 1964, p. 11-15.
7. Chang, Kuei-Sheng. "The Changing Railroad Pattern in Mainland China." The Geographical Review, October 1961, p. 534-548.
8. "Changes in Civil Airline Flight Schedules." People's Daily (Peking), 30 October 1964, p. 6.
9. Cheng, Chu-Yuan. Communist China's Economy, 1949-1962. Philadelphia: Seton Hall University Press, 1963.
10. Clubb, O. Edmond. Twentieth Century China. New York: Columbia University Press, 1964.
11. "Communist China: Roads to the South." Military Review, September 1964, p. 106.
12. "Fukien Highway Communications - Transportation Network Expanded." Chung-Kuo Hsin-wen (Canton), 27 September 1964, p. 8.
13. Fuller, J.F.C. Pegasus. New York: Dutton, 1926.
14. Hoerber, Francis P., et al. The Economic Potential of Communist China. Menlo Park, Calif.: Stanford Research Institute, 1963.
15. Hsia, Ronald. "Changes in the Location of China's Steel Industry." The China Quarterly, January-March 1964, p. 125-133.
16. Hughes, Trevor J. and Luard, D.E.T. The Economic Development of Communist China. 2d ed. London: Oxford University Press, 1961.

17. "Industry." Time, 20 November 1964, p. 58-63.
18. "Is Red China a Paper Tiger?" U.S. News and World Report, 19 October 1964, p. 77.
19. Johnson, Chalmers. "China's Manhattan Project." The New York Times Magazine, 25 October 1964, p. 23, 117-119.
20. Karnow, Stanley. "How Communist Economics Failed in China." Fortune, July 1963, p. 154-157, 228-238.
21. King, Dorothy A. Soviet Transportation. Unpublished Study, U.S. Army Field Detachment "R," Oberammergau, Germany: 1961.
22. Kuo, Ping-chia. China. London: Oxford University Press, 1963.
23. Landon, Charles E. Transportation. New York: Sloane, 1951.
24. Li, Choh-Ming. "China's Industrial Development 1958-63." The China Quarterly, January-March 1964, p. 3-38.
25. Murphey, Rhoads. "China -- The Land." Encyclopaedia Britannica, 1962. v. V, p. 509-512.
26. New China News Agency. Urumchi, 4 May 1958.
27. "Nineteen Sixty-Three Work Report on Nationwide Highway Maintenance." Kung-lu (Peking), No. 7, 20 July 1964, p. 2-4.
28. "Railway Construction in China Has Expanded Rapidly." Chung-kuo Hsin-wen (Canton), 15 September 1964, p. 4.
29. "Red China Air Expansion Seen." Aviation Week, 9 September 1963, p. 39.
30. Rostow, W.W. The Stages of Economic Growth. Cambridge: University Press, 1960.
31. Shackleton, N.A. "Communist China's Potential." Military Review, September 1964, p. 39-48.
32. Shedd, Thomas C. Jr., and Spark, Robert B. "Railway." Encyclopaedia Britannica, 1962. v. XVIII, p. 927-950.
33. Spencer, Joseph E. "Yangtze." Encyclopaedia Britannica, 1962. v. XXIII, p. 875-876.
34. Taeuber, Conrad. "United States -- Population." Encyclopaedia Britannica, 1962. v. XXII, p. 814-818.

35. "Train to Nowhere." Newsweek, 31 July 1961, p. 44.
36. Tse-Ching, Ma. "Railway Construction in People's China." People's China (Peking), 1 November 1954, p. 18-25.
37. "Urban Transportation Facilities Greatly Expanded." Chung-kuo Hsin-wen (Canton), 23 September 1964, p. 8.
38. Van Dorn, Harold A. A Decade of Communist Rule. New York: Pageant Press, 1963.
39. Warner, Denis. "China's New Roads: Where Do They Lead?" The Reporter, 26 September 1963, p. 31-33.
40. Whiting, Kenneth R. The Soviet Union Today. New York: Praeger, 1962.
41. Williams, Ernest W. Jr. "Transportation." World Book Encyclopedia, 1960. v. XVII, p. 305-321.
42. Wu, Yuan-Li. An Economic Survey of Communist China. New York: Bookman, 1956.
43. Yeh, K.C. Communist China: Petroleum Situation. Santa Monica, Calif.: Rand Corporation, 1962.
44. Yoshepe, Harry B. and Brown, Fred R. Transportation: The Nation's Lifelines. Washington: Industrial College of the Armed Forces, 1962.
45. Zagoria, Donald S. "Communist China is a Paper Dragon." The New York Times Magazine, 18 October 1964, p. 40-41, 111-115.

FIGURE 2, RESEARCH PAPER "INTERNAL TRANSPORTATION
IN THE PEOPLE'S REPUBLIC OF CHINA."



RAILROAD TRANSPORTATION

SOURCE:
Yoshpe and
Brown, p. 4.

SOURCE: Association of American Railroads.
The Nation's railroad net today.