THE BUILDING OF THE BURMA ROAD

By TAN PEI-YING

Formerly Managing Director of the Yunnan-Burm
Highway Engineering Administration

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To
our colleagues and workers
who gave their lives in
building and maintaining the Burma Road

PREFACE

The purpose of this book is to give an idea of how the Burma Road was built, telling within the framework of the engineering project the story of an achievement by my countrymen. For the sake of the narrative many of the technical details have been omitted. It is to be hoped, however, that both my brother engineers and the general public will find the book of interest.

This work represents only one of the many achievements of the Chinese for the war. Without adequate nourishment and equipment they nevertheless got the job done through their spirit of devotion and self-sacrifice which is the precious heritage from our ancestors, and through the persevering determination and foresight of the government.

To many people the country through which the Road passes is now only a place on the map, but they will become familiar with it in months to come. For that reason, whatever has seemed colorful and unique in the way of customs and background has been set down. In order to make the job and the people who did it as real and alive as possible, little anecdotes of no other consequence have been included.

This plain account has been written in all humility while the experience is still fresh in my memory, in the hope that Western readers will derive from it a better understanding of the true spirit of the Chinese people.

TAN PEI-YING

New York, N. Y.
July, 1945

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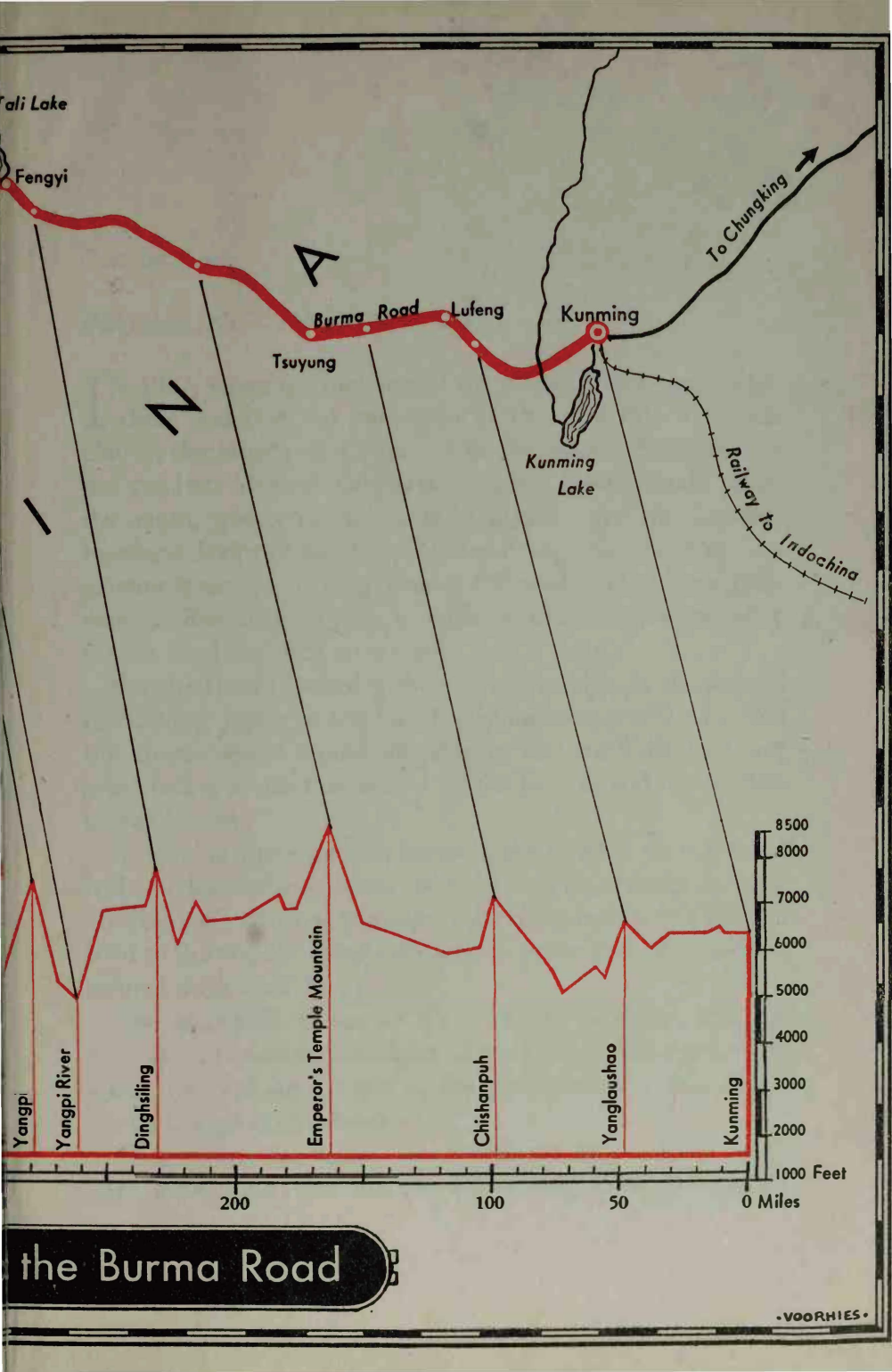


the Burma Road

Chapter One

BEGINNINGS IN KUNMING

IN 1937, when the building of the Burma Road was begun, there had been no indication of the vital role it was to play in the history of China and of the world. Shanghai was not yet lost. Most of the ports were still in our hands. From the south, goods moved steadily inland over the Canton-Hankow Railway to the provisional capital, and a smaller amount was also flowing over the French Indo-China Railway to Kunming. There seemed, at the moment, no very urgent need for such an artery.

But the future looked grim. China was already committed to resisting Japan to the last. Everyone was well aware that this course would require all patience and resolution, that we were facing a war that would be the longest and the hardest in our history.

In view of the uncertain outlook, the Central Government had concluded that it would be only wise to open up as many "back-door" roads as possible. Of the several possibilities, a road to Burma, affording connections to the port of Rangoon, seemed most desirable.

The government was at that time in Hankow, and the Minister of Communications, Mr. Chang Kia-ngau, had asked me to make a study of the problems of transport between Rangoon and Kunming.

There were two routes over which the Burma Road could have been built. One ran from Kunming through Paoshan

and Tungyueh to Bhamo and from that point it might have been connected by the Irrawaddy River to Rangoon.

A British firm, the Irrawaddy Flotilla, could have made available more barge capacity than the Burma Railway and carried goods at a lower cost; according to the treaty signed between the British and the Manchu government (now expired) this capacity might have been augmented by our own vessels, should necessity arise.

Furthermore, the Flotilla barges could have loaded in Rangoon direct from any seagoing ship without going through the congested wharves and storage warehouses.

The other way was to build the Burma Road from Kunming to Lashio in Burma, where it would connect with the railway from Rangoon. It had the additional advantage that cargoes could also be moved by boat from Rangoon to Bhamo and thence to the Burma Road over a short feeder highway.

The latter route was decided on, and a barely passable Road was opened in 1938.

The distance between Kunming, capital of Yunnan Province, to Lashio is 320 miles as the crow flies. But the length of the Road, with its many curves and difficult terrain that necessitate a roundabout route, is 717 miles.

General Lung-yun, governor of Yunnan, got his orders in November, 1937, to start immediately to build the Burma Road. The Commissioner of the Yunnan Provincial Highway Bureau, General Lu Kao-fan, and his assistant, Mr. Yang Wen-ching, were given responsibility for the work. At the same time the National Economic Council of China, the organization charged with all highway construction, sent two experienced engineers to assist. Although it is called the Burma Road because it links China to that country, all but 117 miles of it lie within China's borders. The Chinese were to build the Road as far as Wanting, on the Burma-China

border. This segment included most of the geographical and geological obstacles. The Road from Wanting to Lashio was to be built by the British.

With the railway connecting Rangoon and Lashio and another road, the Southwest Highway, connecting Kunming with Chungking, a through route would thus be opened from the sea to what was to become the capital of Free China.

General Lu was a good soldier and knew how to carry out orders. But he encountered many obstacles. Yunnan is sparsely populated. Workers were hard to get. He dealt with laborers only through the local magistrates, holding them responsible and jailing them under military law when things went wrong.

One morning in Chungking in September, 1938, the Minister of Communications informed me that he had decided to go to Kunming to inspect the functions of all organizations under the direction of the Ministry and to see how the road construction was getting on. I was asked to be ready to go with him within a few hours.

The Minister did not say exactly what was expected of me, but I was apprehensive from the first that he wanted me to undertake the building of the Road.

I say apprehensive, because, from my impressions, derived from reading history and geography, I did not see how I could possibly make a success of it.

To begin with I had been trained not as a civil engineer, but as a mechanical engineer specializing in marine work. This part of the country was totally unfamiliar to me. I knew no one and had no connections and no one who could advise me. Coming from the coast, I had the notion that the people here, being more or less isolated from the rest of the country because of poor communication facilities, would be strange and difficult to deal with. As a further complication,

the Road was to pass through a country inhabited by various simple and primitive Border races, each with its own traditions and customs, each requiring long study and special treatment.

A large number of trained assistants would be needed to carry out a job like this. Where could they be obtained? These were the thoughts that passed through my mind during the first few days in Kunming.

We stayed at the government guest house near the Governor's office on a hill in the northern part of the city called Wuwhashan. The office had been a school before the revolution but had since been transformed into a Western-style administration building.

The administration headquarters were plain and simple, but there were picturesque touches. One was a big garden filled with rare trees and flowers, deer and peacocks, a sort of a combination zoological and botanical garden. The other was the huge reception and dining hall, capable of seating 200 people, which had been designed by a Chinese architect who had studied in France and had embodied in the hall the principle of French elegance rendered abstractly in modern design. Here we were entertained at official banquets with Chinese food served Western style, accompanied by both Chinese and European wines.

As I came to know the Governor better, my apprehension decreased. He was a plain, sturdy old soldier, simple in his tastes, given to working hard. He knew military affairs and was equally skilled in civil administration.

He never wasted a word. He was short, sharp, and concise, coming directly to the heart of any matter and making his decisions quickly. There was no detail of the difficulties with respect to the Road that he did not know thoroughly.

Above all, the Governor was resolute. And he had around him many subordinates of unusual capacities.

To my surprise, I was finding myself very much at home in Kunming. Although I was thousands of miles from my native city, which is near Nanking, the customs and the language were more familiar to me than those no more than 100 miles from my birthplace. The people had the same manner of speaking, very slowly, with the accents pronounced clearly, much like Mandarin.

As I walked through the streets, I observed old-fashioned wedding and funeral processions, practically the same as those at home. I discovered that salted duck, a delicious dish that I had thought was peculiar to the vicinity of Nanking and that was highly prized there, was also to be had in Kunming. There were many other similarities.

Gradually apprehension gave way to an excited enthusiasm for undertaking the Burma Road job, and the more apparent the troubles involved became, the more my enthusiasm grew. Although the job ahead was filled with difficulties, such excellent cooperation was assured that there seemed to be no obstacles that could not be overcome. One night the Minister called me to come and have a talk.

"Tan," he said, "you are not a civil engineer. Nevertheless I believe you are competent to undertake this work, and I wish you to do so. I wish you good luck."

When my friends heard about this undertaking and saw how hard it was going to be to handle, they gave me their personal advice.

"You are too direct," they told me. "If you go straight ahead as is your custom, you will hit many obstacles and hit them hard. If you go around when necessary, you will reach the same goal without so much trouble, and you will save time in the long run."

I had reason to remember this advice, for I saw it translated into physical terms. I always hated the zigzag curves of the Road. My own standard would have been a road as

straight as an air line. But we had to compromise with nature. And eventually we did approach our own goal, an asphalt-surfaced road with most of the hairpin turns and sharp gradients smoothed out.

Several days later, I received an official document from Chungking. It was my appointment as managing director of the Yunnan-Burma Highway Engineering Administration of the Ministry of Communications.

We went right to work. For the first few weeks, the staff consisted of myself and one clerk. Later the administrative group alone grew to several hundred.

Our first office was set up November 16, 1938, in an old photographic studio in the city proper by the side of Chrysopraz Lake. This is one of the loveliest sections in Kunming. Around the lake are situated many of the villas of the rich, and the foreign consulates, including the American consulate, which occupies a beautiful mansion belonging to General Tang, a former governor of the province.

It was a fine place to work. Kunming's climate is just about perfect. It is like spring the year round. Its citizens take pride in the fact that neither fans nor stoves are ever sold in any of the stores.

But there was no time to enjoy the beauty of the surroundings. From the very first the problems were too pressing.

We took over the existing staff of engineers and increased their pay according to the pay-roll standards approved by the Ministry. We always selected the man for the job. We never tried to find a job for any particular person. In making the selection, we paid no attention to the province from which a man came or to whether he was American- or European-trained. We put loyalty to the work above everything else. This policy made a very favorable impression on the staff.

We began by making a thorough study of the geographi-

cal and geological background. We had to proceed from one stage to the next, steadily but continuously, just as one cannot jump from the heat of summer into the cold of winter but must first gradually pass through autumn. So our program was roughly this: to get the Road open, never mind whether it was good or bad; then to improve the Road as much as possible and surface it with gravel; and finally to put in the refinements, such as straightening the line, eliminating the sharper curves and deeper gradients, improving the drainage, and constructing the bridges so that they could carry a minimum load of at least 10 tons.

But there were a myriad of things that had to be attended to. We had to find the workers, both the laborers and the skilled engineers; get the tools for them to work with; arrange to get rice for them; provide doctors and supplies for their medical care; start the building of machine shops, workshops, and garages; open training schools for drivers; and arrange for road signs according to the Geneva regulations.

All these things had to be done immediately and all at the same time. Now our troubles began. We needed right away many, many trained men. Where were we ever going to get enough of them to fill the required positions?

The Burma Road was only one of many projects in the highway- and railroad-building program. China is young in highway construction. The lack of experienced engineers was already acute before the war. As the conflict developed, the shortage grew steadily worse.

Most of the good men were already employed on other government jobs. Since it was not our policy to take workers from anyone else, we had to try to find our own.

Hundreds of letters and telegrams were sent out, but the men we wanted proved hard to find. Many of them lived in areas that had been bombed, attacked, or occupied. They had moved again and again. In some instances, their homes

had been destroyed and there was no way of finding their new addresses.

Some had reestablished themselves in new locations where they were prospering and did not feel free to leave their families.

Furthermore, the "poisonous gases" of the Border provinces, which convey the picture of deadly malaria, are well known and dreaded throughout China. Many Chinese do not realize that malaria comes from the bite of a mosquito. They believe it is contracted from "poison gas," which is actually the miasmic mist that hovers in a thick blanket above the streams, ponds, swamps, and jungles of the Shan country. Thus it is small wonder that the reputation of the country through which the Road was to be built proved a deterrent to the engineers as well as the workers.

The job of assembling the trained engineering staff went on over a period of months. At times it seemed almost hopeless. But one after another they were reached and they came, giving up comfortable lives and lucrative positions to share in the unavoidable hardships of this vital work.

It had become apparent that, lacking modern equipment, it was going to be necessary to rely on the handwork of hundreds of thousands of laborers. But these laborers needed tools, and that was another matter demanding immediate attention.

To build the Road properly in the time allotted, we should have had all kinds of heavy equipment and up-to-date machinery, from pneumatic rock drills and dynamite to big Diesel rollers.

But, because of time and the swift course of the war, we were able to get none of these things at first. All the initial work of construction had to be done by hand by the primitive methods, many of them centuries old, to which the local workers were accustomed.

Some of the native instruments were very interesting. Probably the most widely used in construction was the bamboo basket. In some districts, these were carried by a thong across the forehead; in others, they were suspended by long cords from a horizontal yoke carried across the shoulders.

These baskets were handy for carrying earth or crushed rock, and they were plentiful. Bamboo is everywhere, and anybody can make them.

Another useful product made from bamboo was the workmen's shoes, which were cut so as to take full advantage of the strength of the fiber. They were light, lasting, well ventilated, and comfortable. When the shoes of our own engineers wore out, they adopted the bamboo shoes and found them satisfactory.

It was necessary to make use of old wooden Chinese water pumps to pump water in the way that Chinese farmers have employed for thousands of years. These pumps consist of a series of wooden buckets on an endless wooden chain, kept moving by a foot treadle. Some fifty of these pumps were located in Kunming, and arrangements were made to transport them by truck. But they were so light and fragile, and at the same time so big and clumsy, that only ten of the fifty arrived unbroken.

After that they were transported by mules. The pumps were too big for one mule to carry; but, by using two mules, one at each end, it was possible to bring them in without further mishap.

Thousands of hammers were needed for breaking stones. The best way to break a stone is to use a hammer with a long elastic handle that gets a certain amount of snap into the operation. There were some suitable hammers available in Burma. Hammers and chisels of a good type imported from either Sheffield or Solingen were used on the Burma side.

But the Yunnan workmen could never be persuaded to use

the long-handled hammers. Their hammers were made to specifications set by the village blacksmith. They brought these along and would use no other. As a result, some 50 per cent of the rock was wasted by being crushed to chips instead of broken to the required size.

Chinese road construction has traditionally been of a type known as "water-bound macadam," which is in truth only a gravel road held together with water and earth. The sole exception was asphalt, which had been used only on streets within a few cities. Naturally the Burma Road was planned to be of macadam.

To roll the freshly prepared Road, heavy rollers were consequently needed. But time would not allow us to get the machines required. In later years, when we had to have extra heavy rollers for the asphalt resurfacing, a number were ordered under Lend-Lease. But, after Pearl Harbor, the means of getting them in was cut off.

There was no alternative then but to use primitive rollers that could be pulled by hand. These were ordered through the magistrate of each district.

The rollers had to be cut by hand with hammer and chisel from limestone that was both hard and free from fractures. This made it very difficult, for the harder the limestone the more likely it is to contain fractures. Yet the finished product was always of a remarkable smoothness and uniformity.

The size of the rollers was an index of the strength of the people in the district that furnished them. Districts where rice was plentiful supplied the heaviest rollers, for that meant that the people living there were strong, well nourished, and able to pull heavy weights. Some districts, in which rice was of a poor quality and the inhabitants were consequently small and weak, produced rollers so small that they could be drawn by a single water buffalo.

The rollers stood as much as 6 feet high and weighed any-

where from 3 to 5 tons each. About 100 of them were needed. Sometimes, when there was a limestone quarry near by, they could be turned out close to the Road. But more often they had to be made far from the place where they were to be used. In such instances, the undertaking of getting them to the Road was an epic in itself. Many of them had to be hauled by hand through jungles, up and down mountainsides.

If there was a tree in the path, it had to be cut down. If there was a big boulder, the boulder would have to be removed. Sometimes it took weeks of this kind of hard travel to get the roller to its destination.

It took as many as 50, 60, or 100 men to pull the heaviest rollers on the upgrade. To ease this heavy toil, the workers employed a system of singing, taking each step in cadence with the music.

The No. 1 man always walked behind holding a bar that was attached to the roller by side rods. The bar served as a rudder. When the roller was moving fast, the man at the helm could guide its course quite effectively.

It was the No. 1 man who led the singing. He would give the key phrase to a refrain. Then the men, all singing in unison, would finish it. This method gave a sort of rhythm to the work and helped to kill fatigue. It was very effective.

On the upgrade, there was little trouble; the rollers were easy to handle. But going downgrade the momentum gained on the steep gradients too often turned the great smooth masses of inert stone into terrible juggernauts.

There were many horrifying accidents in which workers who were unable to get out of the way of these rollers were flattened to death. This also occasionally happened to the little children who delighted in running downhill ahead of the great unleashed beasts; for, childlike, they like to play while working.

Sometimes the rollers themselves would plunge on down a steep precipice and be lost to us. We worked out a simple homemade brake that helped to reduce this danger somewhat. This consisted of a log of wood attached to the axle by ropes. As the roller gained speed, two men moving alongside would drop the log in its path. This slowed its progress slightly. Then they would pick it up and drop it again and go on, repeating the process. It required great skill and alertness to manipulate, but it did help a little in retarding runaways.

Finally we became so revolted by the cruelty of these accidents and by the sheer inefficiency and waste that we placed an urgent order for ten Diesel rollers to come from England via Rangoon, although we were trying our best not to spend foreign currency. This type of roller was chosen because it was tough and uncomplicated. It had a simple one-cylinder engine, was practically foolproof, and couldn't get out of order very easily. Able mechanics came along with them. But it took between 6 and 8 months to get delivery. And then the Diesels could be used only in certain easily accessible districts.

Imported tools of all kinds were very scarce. Most of the workers were farmers and brought their own implements with them. Most widely used was a kind of scoop, on a long handle, with which they pulled the earth into baskets. After we were able to get shovels, we showed them how much more efficient those implements were and tried to persuade the workers to use them instead of their ancient scoops. But as soon as we left them they would drop the shovels and go right back to the ones to which they were accustomed.

In our geological studies, we found that the Road would have to be cut for many miles through rock of the hardest type and that there would be many hairpin turns to be carved out of sheer cliffs.

This meant that plenty of blasting powder would be required. We should have used dynamite; but there was none available at that time, and so we had to rely on Chinese black gunpowder of the sort used for firecrackers. We had to drill many holes, for this gunpowder blew only a little rock with each charge. We should have had pneumatic drills to cut the holes for lodging the powder charge. Those were out of the question too. Without pneumatic drills, we had to use the hammer and steel rod, another laborious method.

When we were building the highway through China's northwest before going to work on the Burma Road, we benefited by the foresight of a general who had passed that way long ago and thoughtfully left for us all the gunpowder we needed, although, of course, he did not anticipate the use we were to make of it.

The story is worth repeating here, for it illustrates the foresight and anticipation of future needs on the part of our distinguished forebears.

In 1875, the Empress of the Tsing dynasty appointed a great general, Tso Chong-tang, to quiet a Mohammedan uprising that broke out in rioting all the way from Sian, the capital of Shensi, through Kansu province, extending as far as Singkiang.

As soon as he had conquered a region, his next step was always to build a great road of standardized width that could accommodate five trucks driving abreast.

Tso Chong-tang realized there was danger that the road might be destroyed by future uprisings or that the farmers might cut into it to extend their land.

In order to forestall any such eventualities, he marked the route with a triple row of willows, which he declared were monuments to God. He so thoroughly convinced the natives of the holy nature of these trees that they not only left the road undisturbed but also when they were ill came and

prayed to the willows. We found the trees intact as we passed through. They had attained such size that in many instances their trunks measured more than 3 feet in diameter.

Tso Chong-tang had also noted in his journal that he had left caches of crystallized gunpowder at strategic points along the way, both for the guns of his own armies and for the guns of those who might be fighting through that territory in years to come.

Every so often he had placed a series of supply stations, all built in the style of an old European burg, with slots for rifles in case they had to be defended.

Stored in each tower were great numbers of pottery jars containing the gunpowder. Each jar was marked by number and bore the date of manufacture. They were piled conically around a pool of water that could be helpful in extinguishing fires, and were carefully covered with concrete. Mindful of every detail, he also left a liberal supply of saltpeter in white crystals of a very high quality.

As a result of his long-range planning, we were provided with plenty of powder for blasting the Northwest Road, although such a need for it could hardly have been foreseen half a century ago.

The General was an inspiration to us. A great scholar, he was neither a mechanical nor a civil engineer, and he knew nothing about surveying. Yet he had built an excellent highway nearly twice as long as the Burma Road. I have always regretted that the Burma Road was not as fine as General Tso's Broadway.

In Yunnan, there was no such ready supply of gunpowder on which to draw. By one method or another, however, we were able to get as much as we needed. The essential saltpeter was another matter. There was very little in this province. In one region, they could make a little of inferior quality by burning the ashes of grass and straw. In another region, a

little white saltpeter was made from local bricks. To assure even a minimum supply, however, it was necessary to requisition the output of one whole factory for a year in advance; and, even so, there was never enough.

Then there was the matter of road signs. Every danger spot on the road, every curve, narrow pass, deep gradient, bridge, crossing, sudden rise or fall, or uneven stretch had to be marked in accordance with rules laid down at the International Road Sign Conference in Geneva.

As it turned out, the road-marking plan was not very useful, because there is hardly a spot on the Road that is not dangerous in one way or another. When the drivers saw so many signs to which they were supposed to pay attention, they simply disregarded them all.

Furthermore, the drivers were of different nationalities—Burmese, Chinese, Europeans, and Indians—and we had to find symbols that all would understand. There were so many curves, following each other in such close succession, that to mark them all would simply have caused confusion.

It was decided to mark only the places where it was absolutely essential for a driver to sound his horn. These places were marked, not at all according to the International Convention, but by a symbol that was familiar to all—the old-fashioned rubber-bulb horn, well known in India and Burma and easily recognized by all drivers.

The only other marking was a cross for side roads, with an arrow below. When the British blockade was lifted in October, 1940, and the Road was reopened, we were warned that whole convoys might be machine-gunned by the Japanese. To provide emergency cover for the drivers, side roads had to be built every 5 or 10 miles all through the open country, where traffic was clearly visible to Japanese airmen.

With the symbols agreed upon, the next task was to find sign painters. However, the only skilled men to be had were

all in Shanghai. They were reached and in time reported for work.

The Burma Road Administration at that time, in addition to building the Road, was charged with responsibility for transportation of such materials as were required by the Ministry of Communications, including equipment for telegraph and telephone lines, railway materials, and fuel for Diesel-powered radio stations. While all the other matters were being attended to, a corps of competent drivers had to be found and trained.

Only experienced applicants were considered. All were given a rigid examination for health; general intelligence; ability to maintain cars as well as drive them, to make minor repairs, and to be able to diagnose reasons for failure; and for honesty. Honesty was put ahead of everything else. In spite of every precaution, however, dishonest drivers did slip through.

A school in Kunming was established, which turned out finished drivers in 3 months' time.

They were taught first the gas system: feed line, carburetor, compression, and fuel pump.

Next, chassis: springs, tires, axles.

Next, the cooling system: radiator, water pump, etc.

Next, the electric line: battery, switchboard, distributor, condenser, lamps, focusing adjustment, spark plugs.

Next, the mechanical side: steering, brake lining, and gears.

And finally, lubrication.

The drivers were mostly young men, and they came from all provinces. Those who did not have the intelligence to qualify for drivers were trained as car washers.

I always found the drivers the most difficult of all classes to deal with. Most of them were clever, and those who were dishonest would play every kind of dirty trick. If they didn't feel like working, they would simply break up the cars.

They cared for nothing and would take all kinds of chances. Some made a great deal of money aside from the wages. Almost everything that could be picked up was in demand somewhere else along the Road and could command high prices. The drivers, therefore, had plenty of chances to make money. But they never saved anything, always spending every cent that came their way.

A man had to have absolutely no nerves to be able to drive the Road.

There was one Indian driver I remember who came down the gorge of the Salween for the first time. He was in no trouble, but he suddenly cried out in terror at the sight and sound, completely lost control, and plunged over the cliff to his death. I came along right afterward. It took me several minutes to see anything at all. At last I detected the shattered frame that was all that was left of his truck. It looked about as big as a child's toy dog.

But some of the drivers were very good indeed; and, whatever their faults, they got the materials through. To do that job, what other kind of men could they be but hardened, reckless, and devil-may-care?

Many other problems of all kinds arose to plague us. Consider the single matter of the rice price. Our budget was approved by the Central Government at a time when the price of rice was 10 cents per 16-ounce caddy, enough to supply one laborer for one day. Later it went up, up, up, tens and hundreds of times, with many variations between districts.

It fluctuated so rapidly and varied so greatly from one place to the other that we had to receive the prices every day from our engineering sections by radio to make our calculations.

This caused a great many complications, because the wages paid per work unit were based on the current quotation plus

a coefficient factor. To show how it affected even the cost of skilled help, in 1938 the pay of our engineers averaged an amount equal to $50 a month in United States currency. As inflation went on, their salaries had to be increased in numerical value many times, yet they had less purchasing power than before.

The rice problem became so complicated that it was necessary to set up a special section of dozens of experts who did nothing but try to solve this one puzzle. It was the coefficient factor that saved the situation. By adjusting it, a reasonable formula could be worked out. Although it changed every week, everyone was satisfied. It also assured the main objectives, which were to make sure that each worker got enough rice, vegetables, and meat, smoking tobacco, some pocket money, clothing, and enough for a bath when he had an opportunity to take one.

The problem of supplying our people with an adequate living perplexed me continually. There were, for one thing, never less than 20,000 laborers on the Road all the time. If we had ever been more than 2 or 3 days late with their pay, they would have lost confidence and gone away, and they could not have been expected to return.

Besides the laborers, there were about a thousand staff members and engineers, many with families requiring seven indispensable household items: rice, vegetable oil (fat was considered a luxury), Chinese sauce, vinegar, salt, tea, and fuel, which was much more expensive than rice. New clothing for them was out of the question. As it was, they sold their personal effects, one piece after another, which was one explanation why the auction shops flourished in Kunming.

All this time, the staff members and engineers could have grown rich overnight by becoming merchants or operators of trucks on the Road. They are deserving of praise for their steadfastness and enthusiasm for the job in the face of such

temptations. They realized that the government was doing everything in its power to provide us with a minimum living. But the increases in salary and allowances that we did get could not begin to keep pace with the increases in prices.

It was very hard on them. Not a few staff members and engineers who had left their families in occupied areas had to remit money for their support, yet none of them really had any funds to spare for that purpose.

The situation was brought home to me when one engineer showed me a photograph of his wife. I was deeply shocked. She was so thin and drawn from undernourishment that I was hardly able to recognize her. She had been able to buy only enough rice to make a thin soup, which had nothing in it except some starch. I knew other families were suffering equally. I could have asked for a further increase in their salaries, even requesting that the budget be doubled or tripled. But I knew that the government also had many thousands of other urgent items on which money must be spent. The more we asked for, the more notes would have to be printed and the higher inflation would go.

All this time, examples of those who had grown rich were before our eyes. One day when I came to the office I saw two brand-new 1940 Buicks in the yard. I couldn't remember anyone among my friends who would be so rich as to own two cars. Presently the gentleman came in to say, "How are you?" and tell me how rich he had become. I recognized him as a man who had once been on my staff in Shanghai. One car belonged to him, and the other he was planning to sell at an unbelievable profit. Instead of offering a return courtesy call, I asked him to leave the office immediately lest he endanger the morale of our men.

Nevertheless, some had already heard about him and no longer worked with the same enthusiasm as before. I reminded them that those war profiteers who were making

money so fast at the expense of others were like so many soap bubbles that had expanded quickly with a slight puff but could collapse even more quickly.

This man, I said, might be rich for a matter of months or a year, but he would never derive any benefit from his money, because it would always make him uneasy. Since he had come by it with so little effort, he would be inclined to speculate more and more on a bigger and bigger scale until the bottom dropped out. Some on the staff were skeptical, thinking I was talking in too philosophical a manner, like a fortuneteller. But in a little over a year the man was in hiding, fearing arrest by his creditors.

Meanwhile, the Administration office had been moved from the side of the lake to a three-story office building in downtown Kunming. Here were up-to-date facilities of every kind: interdepartmental telephones throughout the building, and a system of radiogram and radio-telephone communication by which the administrative staff was able to maintain the closest contact with section engineers at even the most isolated points on the Road.

Now the face of Kunming was changing. This calm and peaceful repository of the old Chinese culture was to become the busiest, and the most modern, prosperous, and cosmopolitan city in Free China. The transmutation was already beginning to take place. There came pouring in a flood of Chinese from all provinces, as well as Americans, British, Burmese, French, Greeks, and Indians. From Shanghai came commercial people to establish modern stores, restaurants, and motion-picture theaters. Everywhere on the street were Western clothes, the latest fashions—high-heeled shoes, silk stockings, smart hats, and dresses.

The influx had its effect on the work of the staff. The office was located in the very center of Kunming's downtown section, which was becoming very much like New York's Times Square, with all the distractions of theaters,

restaurants, and auction shops. The cost of living was becoming the highest of any place in China.

Friends and relatives of the staff members kept arriving from all parts of the country. Every time a visitor came, that was so much time lost. Then the call had to be returned. More time lost. In addition to returning the call, it is also the custom to issue another invitation to the guest. More time lost. Any man in a position of authority had to attend several of these affairs every evening.

Such entertaining took at least 10 per cent of a man's income. Every time a friend had a birthday, a wedding, a funeral, or a new baby in the family, it was customary to offer a present. There went 50 per cent of the salary.

The families of the staff men began to arrive, too. Most of them, coming from the coastal provinces, had been accustomed to European accessories. When they saw such luxuries on sale in Kunming stores, the wives felt they had to have them. The women met at parties; and, when they saw other women well dressed while they were poorly dressed, they would give their husbands no rest until they were similarly outfitted. By this time, the poor engineer would have nothing at all left out of his salary.

The situation grew so bad that we decided to move the administrative headquarters out of Kunming to a place that would be more convenient to the construction, where the engineers would be able to carry on their work under more normal and less disquieting conditions.

In December, 1940, the head office was removed to Hsaikwan, which is just about the mid-point of the Road. Here we were able at last to enjoy peace and quiet. Ironically, the wives who had bought high-heeled shoes now had to throw them away, because the roads around Hsaikwan were so rough and rocky that they couldn't possibly walk in them.

The life in Hsaikwan is described more fully in Chapter Four.

Chapter Two

BACKGROUND AND SURVEY

IT MAY now be well to tell something of the background and history of the country through which the Road passed, and also of the extraordinary surveying work that preceded actual construction.

Paradoxically, although the people of this region were isolated from the rest of the world because of inadequate communications, the country had been a thoroughfare over which our ancestors had passed to Burma for many thousands of years. As is usually the case in China, the military had blazed the way; then commerce followed.

The names of towns and villages on the Road have their roots in the old campaigns. Here and there, walls and ramparts of the old forts and ruins of military encampments remain to intrigue the traveler.

Most famous of the many campaigns conducted in this vicinity was that of the great Chinese general, Tsukao Liang, who lived in the third century B.C., during the Han dynasty. General Tsukao's achievements are pertinent to this account, for it was his wisdom and foresight that made it possible for us, so many centuries later, to enlist the cooperation and support of the Border races, without which the Road could not have been built.

Tsukao is one of the most revered figures in Chinese history, not alone because of his genius as a military strategist but also because of his mastery of psychology and his exemplary personal conduct. A hall erected in his memory is one

of the famous sights of Chengtu. More Chinese dramas have been based on his campaigns than on those of any other general, and no theater can exist in China without having at least one actor who can interpret his part. Indeed, were it not for him, many Chinese actors would be jobless.

His story goes like this: In the year 221 B.C., the old Emperor had died, and Tsukao came into the service of the young Emperor, who was something of a ne'er-do-well. China at that time was divided into three strong countries. One of them, under the rule of the Han dynasty, was confined to Szechwan Province, with Chengtu as the capital. The other two countries were its enemies, and it was Tsukao's ambition to conquer them and so to unify China.

But he had annoying and troublesome enemies at his back door among the Border races. Wise enough to realize that these enemies must be subdued once and for all before he could devote full attention to conquering the other two countries, he also perceived that, if he overcame the Border races by force, they would rise against him again and again. To be permanently suppressed, they would have to be conquered psychologically.

Aware that the campaign would be long and arduous, he made preparations for being away from home for a long time. Before leaving, he wrote down his advice to the young Emperor, precepts that have taken their place in Chinese literature from the standpoint of both wisdom and fine writing. His letters are widely read today, and many of the principles are still applicable.

Setting out from Chengtu, he proceeded to Tali and Hsaikwan. A clever and wily Border chieftain named Mong Hwak had already invaded northern Yunnan almost as far as the border of Szechwan.

General Tsukao captured the Border chief seven times. Where he caught him the first and second times is not re-

corded, but in Hsaikwan today is a stone tablet marking the spot where he was apprehended for the third time.

I have studied this terrain carefully. Here is a natural stone arch bridge over running water from Tali Lake, with deep gorges on either side, difficult for attack and easy to defend. If an army were surrounded here, however, it would be almost impossible to escape.

After releasing his adversary again, the General followed his trail across the Salween. He knew that the malaria district was on the other side of the river, and he and all his soldiers knelt down and prayed before going across.

It is also recorded that he devised some very powerful medicines to protect his troops against malaria. His formulas are still manufactured and popularly sold today as "Tsukao's Marching Medicines." I tried some among our workers, but the prescription must have been altered considerably. They proved effective with colds and bronchial ailments but were no good against malaria.

At one time, Tsukao passed from Hsaikwan west to Paoshan, and a big camp bearing his name is still to be found there. Apparently he always traveled by cart, whether because of some infirmity or for reasons of dignity, we do not know. For this reason he had to build a fairly wide road, a remarkable engineering feat in that country at that time. Traces of this road can still be seen.

He wore a blue silk coat embroidered with many geometrical designs and was never without his fan made of eagle's feathers, which he used both winter and summer, evidently as an aid to concentration.

Everyone was surprised that the General was spending so much time capturing the rebel chief and letting him go again when there were so many pressing affairs to be attended to at home, especially when he could have been so easily disposed of the first time. But Tsukao knew that, though he

A typical section showing hairpin turns on the Burma Road.

Workers on the Burma Road.

Many levels one above the other like this made the road vulnerable to landslides.

might kill a great many of the Border people, they would attack again as soon as he had gone back to fight on the northern front.

Mong Hwak was captured for the fifth and sixth times near Bhamo and for the seventh and last time in the vicinity of Mandalay. When he discovered that Tsukao was not going to kill him this time, he concluded that anyone so forbearing must be a god, and he swore everlasting obedience. From that time on, the Border chief caused no further trouble. When our engineers went up among the head-hunters to recruit workers, they found images of Tsukao in the tribal huts. He was still being worshiped as a deity.

According to a story I have heard, some years ago a missionary went to the head-hunters, hoping to convert them to Christianity. He wasn't getting anywhere with them at all, until he got the inspiration of telling them that Jesus Christ was the brother of Tsukao. After that he did not lack for converts.

With Mong Hwak subdued, Tsukao was able to return to Chengtu, now freed from trouble at his back door. Eventually he tried to conquer the other two countries as he had planned, but he did not live to see the fruition of his dreams.

Other exploits of his are also famous in history, as, for example, the occasion when he destroyed 800,000 enemy soldiers at one stroke by setting fire to their wooden ships in the Yangtze River. He must have known some astronomy, for he was able to foretell the direction of the wind and accomplished this feat by planning to set his fires in advance on the windward side.

If General Tsukao had followed a more shortsighted policy of using force against the Border races, we should still have had enemies to contend with in addition to the obstacles of nature, and it would have been impossible to complete the Road in so short a time. He well understood that to kill a

people does not diminish their resistance; that the way to permanent peace is to treat them with generosity and finally to absorb them. It is a basic characteristic of the Chinese that, if they are treated well, they never forget it; and, if they are treated badly, they never forget that either. This is something that foreigners may well bear in mind with profit.

Many years later, more or less over the same path as the military campaigns, a great commercial traffic artery was opened. This is the so-called "Silk Road" to Burma.

The Silk Road has remained in use even after the opening of the Burma Road, for the cargo is carried by animals, and mechanized modern traffic is a danger to them. For years and years, the valuable traffic of the great and wealthy Chinese transportation companies—cargoes of silk and tea and other commodities—has moved from China to Burma over the Silk Road.

It is not a road at all, really, but is instead more a narrow trail winding circuitously over the mountains and through the jungles. Where the road crosses the gorges and streams, there are numerous suspension bridges made of hand-wrought iron chains. The bridges are so flexible that the traveler must synchronize his steps with the wave of the chain during the crossing. If he moves either too slowly or too fast, there will be trouble. Even such bridges are an improvement introduced in the last several hundred years. Before that, the suspension bridges were made of bamboo rope and were even more unreliable.

Traffic on the Silk Road is a life unto itself. Cargoes are carried on the backs of horses or mules, which are very special animals, not ordinary beasts of burden. They are trained by the Mongols, who are highly skilled in the art of horse and cattle raising.

Most of the Silk Road is surfaced with big boulders, which are so slippery that I was unable to walk over them in leather

shoes without falling. Yet these beasts, iron-shod, walk over the road with never a misstep, traveling in caravans of 100 to 300 to a group.

The lead animal is always a mule, because, being a hybrid, he is never attracted or diverted by other animals. He is selected for his intelligence and toughness, and the others follow him faithfully. He is decked out in full panoply. Around his neck he wears bands of brightly colored rings that jangle as he moves. On a staff rising from his back flies a pennant bearing the trade-mark of the transportation company whose cargo is carried by the caravan.

Above his head flutters a bright red feather on a stick to serve as a visual guide to the animals behind. But, since this feather cannot always be seen when passing through thick undergrowth, he also wears a ring of many small brass bells around his neck. The others can hear the bells when they cannot see the feather.

The men who accompany the caravan are tough individuals. They always walk, never ride. Naturally there are many dangers in transporting such rich cargoes through such wild country. They go armed against attack and are accompanied by big Tibetan dogs that resemble huge chows. They make wonderful watch dogs, for they never lie down to sleep, taking their rest sitting on their haunches.

In spite of such precautions, one would expect that the caravans would be attacked often. As it happens, they have very little trouble. Strangers passing that way would doubtless be robbed and plundered in no time. I suspect that the men have established a basis of understanding with the local gangsters.

They have some special language of their own that they use in guiding the animals. They talk very little, but the slightest grunt, unintelligible to a human being, seems to have a special significance to the horses and mules.

Although picturesque, the Silk Road route was of no practical value to us. It was so crooked, narrow, and roundabout that an entirely new line had to be marked out for the Burma Road, as though it had never been there.

Travelers and visitors have often commented on the fine gradients and other characteristics that were the result of the general excellence of the surveying work for the Burma Road. This was remarkable, for it was all done, owing to the pressure of events, in a fraction of the time customarily allotted and in a way as contrary to usual procedure as though one were to start a day with a heavy dinner and end up with breakfast.

Ordinarily, engineers travel over a projected route, making detailed topographical maps of all the surrounding terrain. Then they return to comfortable, well-lighted offices and drafting rooms; and, after exhaustive study of the maps, they select the best possible line to be followed.

By this method, the surveying of the Road alone would have taken at least 2 years. Instead, it was completed within 7 months, the latter part of the work being carried on concurrently with the building of the roadbed. Afterward it was resurveyed and improved. But it had been done so well the first time that only a minimum of change was necessary.

Its excellence was due entirely to the superb intuitive judgment of the men in charge. They included Mr. Hsu Yi-fang, later assistant chief engineer of the Road, formerly in charge of a section of the Highway Bureau of the Chinese National Economic Council in Nanking, and several assistants from the Yunnan Highway Administration. They seemed to know instinctively when to sacrifice a shorter distance for the sake of a better route and when to take the construction crews through hard rock so that landslides might be avoided later on.

The survey was done by no more than thirty men in all.

Their only tool was the ordinary spirit level. They had no time to make detailed topographical maps or to return to the office for study and revision. Their map making was done each night after the day's work was ended, usually in some native hut by the faint and flickering light of a vegetable-oil lamp.

They made their survey on the run, forming judgments with the naked eye and by the feel of the ground underfoot, pushing through unmapped jungles or clambering around the edges of some precipice. Not all of them came back; there was never any way of knowing whether they had suffered fatal falls or had been attacked by some wild animal.

In places where the almost impassable mountain trails were too difficult to be negotiated on foot, they had to rely on sedan chairs. This method has its advantages, for a man sitting in a chair is higher above ground and can see better; and, not having to worry about where his next step is taking him, he is free to concentrate on his work.

The humble heroes of the surveying job were the chair carriers. These Yunnan country people, who also served us as a means of communication between engineering sections, were the descendants of chair carriers who had come from Szechwan Province generations ago. They had the technique of chair carrying in the soles of their feet.

The topography of Szechwan is like that of Yunnan, so mountainous that it has inspired the proverb, "If you are old, don't go to Szechwan!" Long series of steps are carved into the steep hillsides. They are cut slanting and are often slippery, and the chair carriers must be very agile to keep their footing. Those of Szechwan have always been the most famous in China, with the one exception of the former royal chair carriers in Peiping.

In the old days, the Emperor was borne through the streets

by no less than sixty-four men. Because he would not tolerate the slightest jolt, his bearers were especially trained, with highly developed shoulder muscles. They practiced carrying a heavy pottery jar filled to the brim with water until they could carry it without so much as a drop spilling over the edge. When the revolution came, those specialists had to find other employment.

Chair carrying has a long, dignified, and poetic tradition. Only the front carrier can see where he is going; the man in the rear sees nothing. Therefore they must exchange information, and they communicate with each other constantly in a sort of singsong blank verse, with a very musical quality and high literary character, containing classical and beautiful figures of speech.

The man in front keeps telling of what he sees ahead, while the man behind returns a comforting and pleasing answer, calculated to hearten his companion. This delightful interplay goes on continuously, often interspersed with exchanges of sharp wit.

The carriers are clever and astute: They make it a point to pick up some information about the person they are transporting and then address complimentary remarks to him in terms of his profession. In that way, they assure themselves of better tips.

In their job of helping to survey the Road, they never lost their footing for a moment on the slipperiest rock or the most brittle and crumbling limestone. Without their great professional dexterity, the Road could never have been surveyed so quickly or so well.

We discovered many instances of the sound but seemingly unorthodox judgment of the surveyors. At one point, they had charted the course of the Road over the muddy mountains of the Shan states, instead of going around through the jungles at the base. Frequent landslides occurred in this sec-

tion, and I thought the Road should have been cut through the jungle. Later I tried to do so, sending a detail of my toughest engineers to do the surveying. But the malarial mosquitoes were so bad that our crew all got sick before they could complete the job. The only alternative would have been to set fire to the jungle and burn it down. We did not wish to do that and so had to abandon the idea. The surveyors had been right after all.

Many other obstacles remained to be overcome before we were ready to go ahead with construction.

When the site for the Road was being selected, the Governor gave us these admonitions: the Road should be built with hairpin turns rather than in a straight line where a shorter route would involve the destruction of rice paddies, for rice is very scarce in Yunnan, and every paddy is valuable. We should also avoid, as far as we could, disturbing the old monuments, temples, and cemeteries.

But it was necessary to move a great number of graves. This is a very old land, and the suburbs of the cities were often thick with them. The resting place of a very rich man was sometimes as big as the house in which he had lived.

The preservation of graves is very important in China, for they are symbolic of the respect in which ancestors, both living and dead, are held. They are repaired and reconditioned during the spring and thus are made secure against the ravages of the rainy season that follows.

The spring festival is an appropriate time for the performance of this duty, because then there are nearly always light rains and overcast skies to provide an atmosphere of melancholy, which has inspired some of the finest classics in Chinese poetry.

At the time of floods and other disasters, everyone, whether he is educated or not, must give first thought to pro-

tecting the burial places of his family. Concern for personal property is secondary.

The location of grave sites is believed to influence the fortunes of the descendants, and the matter of moving coffins is one of the troublesome obstacles encountered in the building of any highways, railroads, or canals in China. Customarily, the administration pays the costs while the descendants are responsible for removing the remains.

The site to which they are to be removed is determined not by either party but by a species of fortuneteller who makes that his profession. The fortune tellers are known as "wind and water" experts since those forces of nature are likely to prove most destructive to burial places. Selections are made with the aid of a compass. Originally any compass was used to pick out a place that was protected from the prevailing winds and rains and that would get the most sunshine. Later "Ten Celestial Stems" and "Twelve Horary Characters" were added around the magnetic needle in order to make the instrument seem complicated and mystical and thus to create a monopoly for the profession.

If the premise on which fortunetellers proceed were really true, there would be no poor men in China, and they themselves would become prosperous by selecting the most suitable grave sites for their own ancestors. As it happens, the "wind and water" expert is very poorly paid.

In our work, since there was neither time nor opportunity to hunt up the proper soothsayers, the engineers had to take the responsibility of finding new burial places without so much as a compass to aid them and with no more ceremony than wishes of good luck to the descendants.

Engineers in China must be able to do anything. If one has been trained abroad as a mechanical engineer, his relatives and friends will have a very poor opinion of him if he cannot repair a watch or a refrigerator.

As it happened, the "lucky place" selected by the engineers was usually the site that was nearest at hand and involved the least expenditure of time and money.

For the most part, we had little trouble. The people well understood that the Japanese pressure was increasing and that this road might one day be China's salvation. But in some localities the inhabitants served formal notice on us that, having moved the ancestral graves without duly consulting an expert, the Administration would be held strictly accountable for any ill fortune that might befall the household, not only in the immediate future but for generations to come.

One extensive and elegant cemetery belonging to the "Young" family could not be moved at all, and we had to build the Road around it. But I fear that this did them no good, for the slumber of their dead was disturbed thenceforth by the unfamiliar roar of passing trucks.

Although we did move the graves, we managed never to disturb a temple, a monument, or a mark of historic interest; on the contrary, our engineers in their spare time restored and reconditioned as many as their time permitted.

Perhaps the most numerous of these along the Road were the widows' monuments.

Not only those bereaved after marriage are considered widows in China, but also those whose prospective husbands die while they are still betrothed. If her fiancé dies, the girl either remains as a daughter in her own family or, dressed in white as a symbol of mourning, goes to be married to her fiancé's memory, represented by a tablet.

Usually she is conducted there in a sedan chair decorated with white silk and mica lamps holding white candles, while a band precedes her. Another band, playing sad, soft music, follows her steps into her new home. Now she begins to worship heaven and earth, then the dead ancestors, then the new father- and mother-in-law. After that she kneels in reverence

to her fiancé's tablet, which is separated from his coffin by a white screen. In front of the screen is a table on which are set white candles, incense, and sacrificial dishes. She first burns the incense, then serves dish after dish to her husband, together with rice wine.

The poor girl cries so bitterly that it is almost impossible for any relative or friend to help her follow such a complicated ritual. Yet every movement must be carefully synchronized and timed to music, so she is aided at every step by professional experts.

After this, the wedding is finished, and she lives as a daughter-in-law to her husband's parents for the rest of her life. She may regard the son of a brother-in-law as her stepson. If there is only one boy in the family, he must be son both to his own parents and to his widowed aunt; and he is entitled to marry two wives. Some girl widows, instead of going through the marriage ceremonies, cut their hair and become Buddhist nuns.

In any event, a widow never marries again. There is no statute to forbid it; that is simply the custom that still prevails except among the moderns and the Westernized Chinese in the settlements.

If a widow has been correct in her deportment and faithful to the memory of her husband all her life, it is customary to pay tribute to her virtue with a monument. After her death, the husband's family, relatives, friends, and the village chiefs meet in solemn conclave like a parliament.

When they are all agreed that her conduct throughout her life has been beyond reproach, her family may go to the magistrate and make application for a monument. The request, in the form of an official document, is passed from the magistrate to the Governor, from the Governor to the Emperor or, today of course, to the President. Then it is stamped with the square jade seal of high authority and sent back

once more through the Governor and the magistrate to the widow's family.

The approved document now carries with it the permission to have the great seal reproduced in lasting stone, limestone, marble, or granite. The family receives the document at an impressive ceremony. In the days of the Emperor, they all knelt down. Since the Republic, no one kneels; and they receive it standing.

The monument consists of two stone uprights and a crossbar, topped by a small pagoda that encloses and protects the replica of the seal. On the uprights is always inscribed poetry by some literary man of high repute, describing the circumstances of the widow's life on one side and paying tribute to her exemplary character on the other.

This monument means everything to the widow's family. They pay for its erection and will sell everything they own or mortgage their land for the sake of it. Thus, centuries later, there remain in China these enduring testimonials to a steadfast love, love of an unwavering and selfless devotion that is not so often encountered in the Western world.

The most prominent men in China, incidentally, are often the children of widows. The progeny of the rich do not so frequently become great scholars, for their place in the world is secure. But the children of widows are insecure. Their lives are hard, uncertain, and exciting. They feel the need to justify themselves and often compensate for early deprivations by making themselves outstanding in their professions.

The widows' monuments are known as "Chen Chi Fong," "Chen" meaning virtuous, "Chi" meaning firm, "Fong" meaning memory; or, translated freely, "In memory of one who was able to control herself."

There were also other monuments of general historical interest—stone tablets inscribed by some long dead scholar extolling the accomplishments of his ancestors, such as the

installation of a good irrigation system; or markers commemorating the site of a historic battlefield.

Among the latter was the so-called "ten-thousand-man grave" at Hsaikwan, dating back to the Tang dynasty. At that time, a great general had come out to this province to conquer the Border races. He was trapped with his entire army between the two gorges, and all died of starvation. The scene of the tragedy is still marked by a temple and a great stone. Wherever possible, we tried to restore these monuments and make them even more permanent so that they would last for hundreds of years yet to come.

Chapter Three

THE PEOPLE WHO BUILT THE ROAD

FOR the entire distance of 600 miles from Kunming to Wanting, in a strip 23 feet wide and varying from 7 to 10 inches in depth, depending on the condition of the ground, the Burma Road was laid with crushed stones.

All the stones were either broken down from boulders or blasted from the hillside and cut to specified sizes, big ones for the foundation, then a layer of small ones, and finally a top layer of 1-inch stones for the wearing course, constituting the so-called "water-bound macadam." The earth removed totaled 36,000,000 cubic yards, and the amount of rock cut was 3,860,000 yards.

Every one of the stones was set in place, one at a time, by hand. The majority of workers were farmers, and they planted the stones by the same method they were accustomed to using in transplanting the rice seedlings in the paddies, setting them in position vertically, moving backward in a bending position.

The picture of these millions upon millions of stones all put in place individually conveys more clearly than anything I can think of the tremendous mass effort on the part of hundreds of thousands of obscure toilers that went into the construction. Only their endless patience and devotion, their magnificent endurance of hardships and hazards of all kinds —fatigue, illness, accidents, and death—made it possible for China to have her life line.

One of our first important tasks was to locate the laborers

to do this work and bring them to the Road. Naturally we began by seeking to enlist those living in the closest proximity—the farmers of western Yunnan and, in more remote districts, the Border races. We were reluctant to make use of the latter, both because it had been the policy of the government never to put any kind of pressure on them and because they were not likely to prove very competent.

Yunnan is sparsely populated. In some instances, entire districts each embracing an area of a hundred miles or so would be unable to furnish the needed number of workers. Then the responsibility would be passed to the district lying beyond, and the working force would have to travel as much as 100 or 200 miles in order to reach the place where they were to be employed.

The province, wholeheartedly behind China's cause, had already sent the cream of its man power to the Army. Not enough strong young men remained to work the farms, and the production of rice is a critical matter here. In many districts, no one was left but the very old, the women, and the children. No matter. They all volunteered for service on the Road, every member of the family down to the smallest child. Sometimes whole villages were completely emptied of their population and left silent and deserted without so much as a wisp of smoke rising from the chimneys.

Our arrangement was to set a quota of laborers to be drawn from each district after consultation with the magistrate. Exhaustive statistics had been compiled on local resources. But, in order to avoid any feeling that the people were being ordered to work under a forced-labor draft, the engineer in charge of the section always held a preliminary discussion with the magistrate attended by all the village chiefs under his jurisdiction. This was the democratic way, with everybody consulted from the bottom up in accordance with the principle laid down by Confucius, "If your people

are with you, you will succeed; otherwise you will fail." This principle was venerated and strictly observed throughout the entire course of construction.

As a result of these conferences, all conclusions reached were realistic and practical rather than theoretical. They revealed some astonishing discrepancies, not always shown by statistics alone. For example, the amount of work that laborers could perform varied in a marked degree from district to district. In one, where rice was nourishing and plentiful, a man might be able to move 4 cubic yards of earth a day; while a man from another district, where the quality of nourishment was poor, could move hardly more than 1 yard.

At a subsequent conference with the magistrate, every detail would be settled and agreed upon, the price that was to be paid per unit of work, the number of laborers to be supplied, the rice price, and the duration of the job.

In determining how long the work would take, we made a practice of adding 30 per cent to the magistrate's estimate of the time required to complete the job. Then, if it took longer than that, they had no excuse and had to finish it without further compensation.

After each conference, which included about twenty districts, every item was set down in the greatest detail, and plans were submitted to the governor of the province and the Minister of Communications for approval. Copies were given to the magistrates, who in turn provided each village chief with a list of what was expected of him—the number of workers, the tools required, everything, so that there could be no misunderstanding.

Then began the great migration. In bands ranging anywhere from a handful to one or two thousand, these people left their homes and set out for their assigned place on the Road.

This could well have resulted in great confusion. Some-

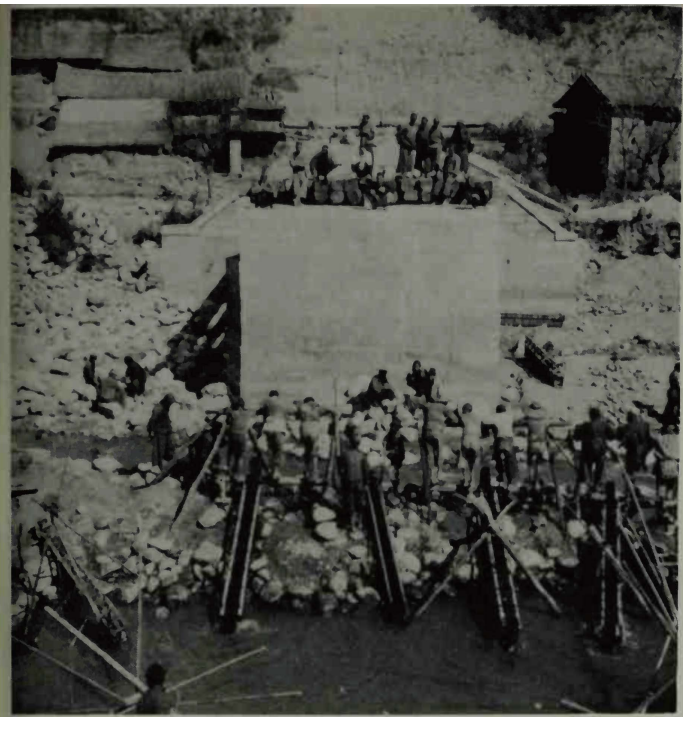
times they could follow the roads. Sometimes they had to travel across country. Fortunately the people of Yunnan, even though they are considered to be backward in many respects, had an extraordinary talent for organization. This was true even in the most primitive sections.

There are a number of sound reasons for this. For thousands of years, they have been surrounded by hostile Border races and have had to organize constantly for their own protection. Having frequently been occupied by one army after another coming from the northern provinces to subdue the Border races, they have also had to organize to assist in military operations.

Ever since the British ruled Burma, the people of Yunnan have been accustomed to go to that country every year in the dry season, traveling 400 miles or so on foot to work mostly in the factories or in the Namtu silver mines. This work was a great attraction to them, for they were paid good wages, far more than they could earn on their farms. But the money never did them any good, for the majority of them spent it in Burma, in gambling or in other ways, and returned home empty-handed. Because of this experience, however, they were used to organizing themselves for travel.

Each group had to be given a banner of identification for the journey so that they would not be repeatedly stopped to answer questions and would be given help if needed while passing through strange country. They were provided each with a linen strip on which was noted their number, the village or district they had come from, and the destination for which they were bound. Each strip was stamped with the seal of the local magistrate in indelible ink.

These seals are worthy of comment. Only persons in the direct line of permanent political channels are permitted to use the square seals, which are graduated in size and qual-



The native water pumps used in building bridge foundation.

Shan girls at a native market.

Shan girls carrying baskets.

Children helping to remove a landslide.

ity from the humblest to the highest according to the rank of the officer using them.

The Sawbwas, or Shan rulers, who rank below a magistrate, use iron seals. The magistrates use a somewhat larger brass seal. Others of next rank above a magistrate use bronze and silver seals. Gold seals were used by the princes and also by the Tibetan and Mongolian kings.

The Emperor had a very large seal of the finest white jade. Many years were spent in locating such a rare precious stone suitable for the Emperor. It was finally found in the southern part of Sinkiang Province at Hotien, the only place where this type of jade exists. After the revolution, the system of square seals was modified, but only slightly. It is still used by civil officers today.

According to the old custom, dating back through many dynasties, the seal was always kept by the official's wife, as the person most intimate to him. Now it is usually kept by the clerk who has the fullest confidence of his chief.

Officers of temporary organizations or those outside the direct political line, such as the customs house, railway, and highway administrations, or the military, are not permitted to use the square form but must use a rectangular one.

No civil documents are legal without the seal, which, besides being signed by the person who has affixed it, must also be countersigned by a person who has read the document thoroughly and can testify to the authenticity of its contents.

Personal seals or stamps are still used for signatures. They are legally valid on contracts and in commercial agreements. For some time, the stamp alone was sufficient on a document without the signature, a custom that dates back 700 years to the Mongol occupation. Since the Mongols did not know how to write Chinese, it was much more convenient for them just to put their seal on a document. In recent years, however, the signature has been required as well as the stamp. Those

who have no stamp and cannot write may sign with a cross, which is also considered legal. But Chinese still prefer the verbal agreement, which is more carefully observed than any number of complicated clauses.

Now, equipped with their identifying banners bearing the magistrate's official stamp in indelible ink, the Yunnan farmers and villagers set out on their long trek to the Road. They made a strangely assorted procession marching along in their native clothes of blue cotton—a handful of strong men in their prime; women and old men; and many, many children, bringing their household pets, their dogs and chickens and parakeets or, in some of the Shan states, little monkeys.

The journey was often a hard one. The country was wild and rough, and they had to clamber up and down steep gorges or fight their way through thick jungles full of snakes and insects where the wild beasts howled at night. Only a people accustomed to living close to the earth, inured to the privations of a hard simple life, and never having known real comfort could have undergone such an ordeal.

In the mountains, particularly, there are drastic changes in temperature. The thermometer drops from around 75 to 90 degrees in the heat of the day to around 50 or 35 degrees at night.

We found that many of the men were getting bronchial ailments, colds, and pneumonia. The women did not suffer so much. They evidently made it a point at night to find shelter for themselves and the children. But the men just dropped where they were, in ditches, by the side of the road.

There was no good wood in this district to make satisfactory campfires. They would gather brush, straw, whatever they could find, and make hot, quick fires to cook their rice. Then the fires would go out, leaving them perspiring and soon more chilled than before.

The diseases became so prevalent that we conducted an

investigation to determine the cause. We found that the men, in Yunnan tradition, all wear very short pants that provide little protection against the chill.

When I heard that they were sleeping in ditches without any covering at all, I couldn't understand why they did not take better care of themselves. I was not long in learning the reason: they were so poor that they seldom had more than one or two bedrolls to a family. If anyone had been left at home, a wife or a grandmother, the bedroll had been left with them. If the wife had come on the journey, the chances were that she needed the bedroll for herself and the children; therefore the husband would have to sleep on the ground. I was filled with remorse when I heard this and ashamed of myself for not having been more understanding.

Intestinal ailments were also contracted from the water. Even when they well knew the dangers of drinking unboiled water, they could not refrain from it.

One man always went ahead to locate a camping place for the night, usually by the side of a stream. This was their only chance to get a drink; one can imagine their thirst after marching all day in the dry heat and dust of the mountains. Unreasonably or not, they felt that raw water quenched their thirst better than boiled, and they were willing to take the risk.

In this raw water were not only ordinary dangers such as dysentery but also others peculiar to this country. Most of the streams came down from mountaintops far away, and as they passed through the rocks and soil they picked up chemicals detrimental to the human system.

At one point on the Road, our great general Tsukao Liang left an inscription on a stone that has been well protected by our engineers. The inscription reads, "Whoever drinks the water here will be unable to speak." I had previously read the story of the "Dumb Spring" in our history books.

Again and again I cautioned the workers to boil their water. But some drank it nevertheless. And the warning came true. They became so hoarse they could hardly speak. As far as it can be explained scientifically, one of the chemicals in the water must have some kind of paralyzing effect on the vocal cords. The condition lasted anywhere from a few days to several months.

The journeys were tragic. There were many deaths on the way. Many arrived seriously ill and required considerable nursing to be restored to health. But none turned back.

Their spirits were high. They had not been conscripted. They came voluntarily, in full knowledge of how important the Road might some day be to China. There were some who refused any wages. Others insisted on bringing their own rice. They were filled with patriotism and enthusiasm.

During the course of the work on the Road, I had many chats with both chiefs and workmen. I found their speech highly polished and in the classical tradition, marked by the ancient Chinese morality and spirit. No matter how hard the conditions under which they lived and worked, I never heard them utter a single complaining word. I never heard anyone ever say that he was tired.

Many of them are not able to read or write. But the classical means of expression, the high precepts, have been handed down from father to son through many generations, without the benefit of a written language. These are the people who have kept China great over the centuries; they are her most valuable and productive element, the nation's backbone.

Their minds are so flexible that they can absorb all the scientific and mechanical ideas from the Western world without losing their traditional way of thinking.

As soon as the workers reached their assigned locations, the section chief or his associates would be waiting to receive them. Their documents were checked and the number listed

on their banners counted off to see how many were missing. Insurance was paid to the families of those who had died.

Work was started immediately; and, in their off hours, like pioneers, they set about making temporary homes for themselves in the wilderness. It had been impossible to provide housing for them, and they had to build their own crude lean-to huts out of branches and straw. They took what time they could find at the end of every day to cultivate little vegetable gardens.

They lived a life that would seem very hard by Western standards. There was nothing in their days but toil; and, unlike the people of other countries who have also worked very hard for the war, they enjoyed no weekly holiday.

The matter of trying to arrange holidays for the workers was very perplexing to the Administration. About 50 years ago China adopted the "Sunday" system, applicable mostly to government offices, schools, factories, and some public organizations. But the 80 per cent or so of our population who are farmers never had the opportunity to enjoy that system.

Since they were an agricultural people, they were used to living by the old Chinese, or lunar, calendar. They farmed by it. To them the Western one is "imported," or "ocean." And there are no weekly days of rest in the lunar calendar.

For them, there are only nine holidays a year that are universally observed. These include the first five days of the Chinese New Year, when even housewives will do no cooking lest they disturb the kitchen god (I am sure this system must have been invented by a very clever Chinese lady), and the four seasonal festivals. Some also observe the three monthly "bath days" of the ancient Chinese, that is, the first, tenth, and thirtieth days of every month, which are set aside for bathing and relaxation, in addition to their usual baths.

Since a human being cannot work efficiently without the

rest and stimulus of occasional relaxation, we agreed that, if the workers wished, they could take every tenth day for a holiday. However, we could seldom persuade them to take advantage of this offer. They were too anxious to get on with the work. The only days that most of them took off were the seasonal festival days or an occasional holiday to celebrate the birth dates of their ancestors.

Their work began about eight in the morning, as soon as the mists had cleared. They would stop for the noon meal, then work on again until five o'clock, when they went home for dinner.

If there were any old people in the family too feeble to work on the Road, they would stay at home and prepare dinner. Families who were not so fortunate had to do the cooking after they had finished the day's work.

During the first week that the labor force was on the Road, all calculations as to the amount of rice required to feed them were upset. They ate almost twice as much as had been allowed for. It turned out that they were so poor that many of them had not had very much rice at home, and they ate their fill of what was to them something rare and wonderful. After they became accustomed to it, rice consumption dropped back to normal.

Their meals consisted mostly of rice and a few vegetables, liberally seasoned with paprika, which in this part of the world is considered as essential for flavoring as salt is elsewhere.

There are six paprika provinces, Yunnan, Kweichow, Szechwan, Kiangsi, Kwangsi, and Hunan. The people in Hunan like it so much that they do not even mind the weeping that results from its acrid flavor. Claims are made that it is both a disinfectant and an aid to the appetite, which may sometimes be true.

Now and then it was possible to provide the workers with

a delicacy that they highly prized. This was a kind of cake made from goat's milk. They liked it best when it was rich with mold like Roquefort cheese.

Because they were doing such hard manual work, it was also necessary to see that they were provided with meat. Cows are not killed in China, because they are valuable work animals, and pork was the only meat obtainable.

Procuring the pigs caused us a great deal of trouble, for they had to be transported from far away. Pigs in China are not like those in Europe or America, fat and soft and lazy. They are rather tall and lean. Their legs are not short and weak, because they are not confined in sties but are allowed to run at large. This makes them very athletic, and they can run and jump as quick as lightning.

When I first came to America, I saw pigs everywhere and wondered why America imported so many Chinese pig bristles. Then I realized that, because Chinese animals were sturdier and less domesticated, they also grew longer and tougher bristles.

We tried driving the pigs in herds to the camps. But most of them would run away and be lost en route. Then we tried tying their feet and bringing them in trucks. But the vibration of the trucks made them seasick, and they often died.

At last a system was devised of fashioning crates or cages out of bamboo. The pigs were loaded on the trucks, one to a crate. The bamboo absorbed the vibration, and the pigs arrived without injury.

There was not much to be done in the way of amusement in the few brief hours that remained before dark. The men would squat in front of their huts, talking and puffing on their long bamboo pipes. The women would busy themselves with the family mending. The boys often brought their schoolbooks and would study as long as they could see.

Then they would all go to bed, for there was no petroleum

available for illumination even if they had wanted to stay up. The workers had found a strange kind of very oily branch growing in the neighborhood that would burn slowly and give off a feeble sputtering light. But there had been so many accidents caused by these torches igniting the straw huts that we had to make a strict rule against lights of any kind. Thus nights were a real blackout.

The workers were nearly all Buddhists; and each family erected its crude, improvised temple close to the straw hut that was home. On the fifteenth and thirtieth of each month, they went to the temple to worship; but they went always early in the morning and then only for a few minutes so that they did not take time from their work.

The engineers, many of whom had come from the coastal provinces and were accustomed to good and easy living, had no more comforts than the laborers. They, too, lived in the same sort of straw huts that they had built themselves, and they ate the same food.

But not all went smoothly by any means. Some of the gangs provided by the less energetic magistrates were under the impression that they had fulfilled their obligation when they had worked 2 weeks, and they would then pack up and go home. Another gang would come from the same district, stay their 2 weeks and leave. And so with another and another.

They simply did not understand, and we could not seem to make them understand. There were long delays, with a great deal of time lost between the departure of one crew and the arrival of another. Just about the time we were beginning to get them trained to the work and familiar with their jobs, well nourished, and in good health from competent medical care, they would disappear.

Eventually I had to complain to the Governor, who established strict regulations that no one was permitted to leave

until the allotted work was done. I said, "The Administration tries to be fair. But money does not come from water. Wasted time and wasted money mean unfaithfulness to the country."

At the same time, we took more pains to explain the situation to the workers. We told them, "The quantity of work is constant. That cannot be changed. The number of days required for the completion of each job has been carefully calculated in advance with a liberal allowance for delays. So, unless you are extraordinarily lazy, you will get through well ahead of the scheduled date. The more diligently you work the more you will be paid, and the quicker you can return home. If you do not finish on time, then any members of your family who are still at home must also come to the Road and help us until the work is done."

Naturally there was a considerable variation in accomplishment from district to district and between one individual and another. The intelligent and conscientious laborers became angry at those who were doing so much less and yet getting substantially the same pay.

So we had to institute our ancestors' system of rewarding the worthy and depriving the negligent. We awarded extra pay to those who worked well and also gave them little presents. Those who persisted in being slothful were paid at such a low rate that they had to work whether they wanted to or not in order to get just enough rice to subsist.

Some tension and strain were noticeable at first between the laborers and the engineers. The former, because of the isolated lives they had led and their lack of formal education, had an abiding fear of any official of the government. Some of the staff members, on the other hand, despised the workers for their inferiority and did not try to disguise their contempt, making the laborers constantly miserable.

When this condition became apparent, the engineers were

made to understand that the people whom they regarded as so lowly were actually their equals in nature, that only the circumstances of their lives over which they had no control had prevented them from acquiring polish and education.

Once this principle had been grasped, the attitude of the engineers changed entirely. They began working side by side with the laborers on an equal basis, quickly learning that a few warm words would get more work out of the force than better pay. Enthusiastic cooperation could not be bought, but it would be bestowed freely. The better the engineers came to know the workers, the more their respect and appreciation mounted.

Within 30 days from the time of arrival, the workers were settled and construction was well under way. Everything was clearly marked out with signs. A big wooden board was placed near each settlement, bearing the number of laborers, the name of the town or village from which they had come, the amount of work to be done, the time by which it was to be finished, and the price that was to be paid per unit.

In addition, a kind of town crier walked up and down among the workers ringing a bell and reciting the facts that had been recorded on the signboard for the benefit of those who couldn't read.

Everybody worked—even the children. The brighter ones helped with the rock cutting. Others carried stones or earth, doing the many light, quick jobs that did not require much strength.

The width of the road and the path it was to follow were marked out with either wooden pegs or branches planted in the earth with signs on them. Only the engineers could read the blueprints. But the village chiefs actually directed the work. The engineers taught the foreman in charge of each job how to read a plan, and he in turn explained it to the workers so that everybody understood. Every day the course

of the work was also marked with a sign so that they would know how much they had accomplished. The laborers soon caught on, and shortly they knew just what had to be done wherever we put up a sign. They were primitive, these people, but they were by no means stupid.

First the path of the road had to be cleared, every tree chopped down, and the roots pulled out of the way. The roots were pulled up by hand, according to the time-honored method, with a crowbar and a rope. Two or three men would work the crowbar to provide leverage; and five, ten, fifty, as many as were needed, would haul on the rope. The whole operation was synchronized by singing, which was led by the chief. On the accented beat, they would all push on the crowbar and pull on the rope, as one man.

There were naturally many minor accidents and constant small irritations in this work of clearing the right of way: cuts and bruises, scratches, and myriad bites from strange insects. But the men were farmers, well accustomed to such discomforts, and they paid no attention to them. As soon as the right of way had been cleared, the official pile, a post that had been planed, polished, and branded with Chinese characters, was driven into place and the permanent route of the Road was marked out.

Then the laborers set to work with their old-fashioned agricultural implements, picks and hoes and mattocks, to loosen the ground. The impressions of those many strokes still remain in some places for travelers to remark.

The earth was also carried away by hand in bamboo baskets, which were about half the size of those used elsewhere in China. In some provinces they used one basket, in others a pair of baskets suspended from a yoke across the shoulders. This method was laborious, but no amount of persuasion could ever get them to change it.

Since the earth was being dug out with picks and mattocks

and carried away in baskets, it might have been hard to know from how great a height the Road had originally been cut. To eliminate this uncertainty, at a point every 50 to 100 feet along the way we left a little mound with the original grass on top as a guide to the depth on which correct calculations could be based.

The cubic yardage of each job was estimated by the captain of the workers, moving well ahead of the engineers and using a Chinese reckoning board on which he was able to figure more accurately and quickly than could have been done with a slide rule.

When enough dirt and rock had been removed to bring the roadbed down to the level desired, the next step was tamping down the loose earth to a suitable firmness. This was done by a primitive instrument called a "hang" after the sound made by its impact on the earth. The "hang" is not a full, round pile, for it would be impossible to get a grip on it. The top and bottom are full sections of round timber, but they are joined together by four strips by which the two men who operate it can get a solid hand grasp.

The two men on the same "hang" must of necessity be from the same district, for this work, too, is synchronized by singing. First one sings, then the other—little, simple phrases, spurring each other on, something like this: "Work hard [hang] . . . Grit your teeth [hang] . . . Pull now [hang] . . . Fear nothing [hang] . . ."

There were often several hundred men working together at the tamping in a small area, all singing, in their own dialects, all tamping down the earth. High above them all came the voice of the No. 1 man, leading them like a choral conductor. It was a curious sight and an even more curious sound.

After the Road had been tamped, it should have been left to settle through one or two rainy seasons before the surface

was put on. But there was no time. It had to be surfaced immediately, and that was a cause of much subsequent trouble.

A great many stones, large and small, had to be used in constructing the roadbed. But, in a number of districts, particularly around the muddy mountains in the Shan states, they were very hard to find and sometimes had to be carried one by one from river beds far away.

Everybody, women, old people, and children, took part in this work, each carrying according to his strength.

In this matter as in all others, we adhered to the old Chinese proverb, "To accomplish anything, it doesn't matter if you go slow, so long as you never stop."

You could see them stretching out over the hills, resembling so many ants carrying eggs. They moved like an endless chain, in a synchronized motion that the Chinese have used for many centuries to ease the labor of building great temples and old city walls.

All the native workers were not unskilled laborers by any means. Among them were craftsmen such as carpenters and stonemasons, highly skilled in their trades.

The stonemasons in particular fascinated me, because of the many individual ways they had of doing things, ways that were thousands of years old, contrary to all modern methods and yet immensely effective for the job in hand. Like the carpenters, they were all old men, for there had been no construction in this region since the revolution, and no younger men had had any opportunity to practice the trade.

These men earned their living by farming. Masonry work was their secondary occupation, just as all professional musicians in some parts of China are barbers by trade.

Masons abound in every district; for each has its city walls, its temples, and its stone-arch bridges. Every house, too, is

set on decorative stone pillars, and every grave has its monument of carved stone.

What a debt China owes in its present struggle to the masons of antiquity! Today, with everything in upheaval, schools, emergency hospitals, administration units, and military headquarters are all housed in the great temples built by their clever hands.

For us, the masons built many miles of retaining walls. They knew how to cut stones to the most precise squares or rectangles by hand with hammer and chisel. They worked entirely with their own instruments. Among these were a special kind of concave hammer that had been handed down by their ancestors. It called for great deftness in wielding, for they had to strike the head of the chisel precisely in the middle. But when they did, it brought much more force to the blow.

Each mason also brought with him his own little brazier for heating his chisel. I did not understand this at first, and so they explained it to me. When a chisel comes in constant contact with rock, it gets warm; and, when it gets warm, it gets soft and loses some of its cutting edge. It is heated red hot in the brazier and then plunged into a pan of vegetable oil to restore its temper.

We had intended to use cement for our retaining walls. But the masons would have none of it and insisted on using their own materials. They had two kinds, a special and amazingly efficient Chinese mortar of limewater, sand, and mud for use in dry places; and a mortar made of red soil burned at a high temperature with charcoal in a kiln built in any convenient hillside and then mixed with lime and sand so that it will last a long time under water.

On further study, this proved to be chemically sound, for the red earth of the district has a high content of both iron

and aluminum oxide that lasts well under water. But it must be absolutely dry when prepared to be any good.

These doughty old artisans were put to a severe test. At some places we had to build retaining walls along very steep banks and they had to work swung over space on platforms held by ropes, or on rickety wood and bamboo scaffoldings as much as 250 feet high. The heavy stones and the mortar were lowered down to them in boxes.

Working aloft usually requires long experience, but the only job above ground that these men had ever done was the building of pagodas, which are seldom more than from 70 to 130 feet in height. They had to learn it all from the first day.

Naturally there were a great many accidents and deaths from falling. But the danger of it never seemed to disturb them. They were paid well, of course. They could make much more in a few weeks of this work than in years of farming; and they would take their money and go a little more often to the tea house, drink a little more Chinese wine, or buy a little more land for farming.

As I have said, we tried to use principally Chinese workers; but there were a number of places along the Road where it was essential to use the people of the Border races. Strange and picturesque peoples, who had lived for centuries in complete isolation from the outside world, thus made their contribution, too, to the opening of the great modern traffic artery. They included Shans, Lolos, Tibetans, and head-hunters.

All the Border races must have come originally from the Tibetan highlands, several thousands of years ago, following the course of the great rivers. The Shan people probably came down along the Mekong, the Salween, and the Irrawaddy. Some Lolos and Mohammedans seem to have followed the Yangpi. Their descendants live not far from the banks of these rivers today. Where the Border races have

intermarried with the Malays, they are somewhat changed. In other districts, they have remained of pure stock, and the characteristics of their forefathers are easily distinguishable.

The Lolos are a simple, hardy people living mostly in the inaccessible heights of the mountains. They have no written language, but they possess a distinctive culture nevertheless, and they particularly love singing. Among this race, women occupy an important position. Their counsels are highly respected. Most of the men were busy hunting or farming, and so the women worked at the road building.

The Lolo women are very strong. They are short and stocky and so sturdily built that any one of them could easily lift a 150-pound rock by means of a thong across the forehead. Making a fetish of cleanliness, they wore snowy white singlets with beautiful native embroidery on the sleeves and collars. All of them also wore elaborately wrought native jewelry trimmed with silver. No matter how thick the mud and muck in which they had worked, they would always appear next time spotlessly clean.

They preferred to work on the Road at night, for in the daytime they had to be at home looking after their households. It was a beautiful sight to see them toiling in the moonlight in their clean white clothes, singing their old traditional songs as they worked. These were mostly nature songs, verses to the sun, the moon, and the river; but they sang some simple little love songs, too.

Wild animals, including leopards and tigers, were plentiful in this district. The Chinese workers were afraid of them, but not when the Lolo women were around, since the latter were dead shots with the bow and arrow.

The Lolo women were very timid and shy with us in the beginning. Once we had gained their confidence, though, they turned out to be some of our most dependable workers. They were particularly skilled at rock cutting, using their

own method, and they had the knack of cutting rock exactly according to blueprint.

Stones for the wearing course had to be of uniform size, which raised the question of how to make clear to the Lolos the specifications that were desired. Measurements in terms of inches or centimeters were totally incomprehensible to them. It seemed feasible that the specifications could best be conveyed in terms with which they were familiar, by using the analogy of an egg; but they pointed out with irrefutable logic that there were eggs of many sizes: quite big ones and small ones.

Next we tried painting thousands of standardized stones in red and distributing them among the workers to be worn on a string so that they would have them constantly in front of them to serve as models. But that method didn't work very well either. Every time they broke a stone they spent so much time comparing it with the model and discussing its size that they didn't get much work done. Also, the colored stones began to disappear, and we found that they were taking them home to give to the children as playthings.

Finally I got the idea of telling them to make a circle of the thumb and forefinger, explaining that any stone that could be passed through that circle would be entirely acceptable. The principle was so simple that they grasped it immediately, and from that time on they cut rocks with the same uniformity as those turned out by a stone crusher.

For all their simplicity, they were very shrewd. Although they couldn't grasp the idea of an inch or a centimeter, they understood a cubic yard perfectly, for that was the unit by which they were paid.

In road building, we used a rectangular form, half as wide and twice as long as the standard cubic yard. We built the forms with the help of the Lolo women, in order to gain their confidence, explaining to them that this was the stand-

ard by which their work would be measured. When it was finished, we stamped it to make it official. Even the children understood this unit of measurement.

Some workers elsewhere on the Road cheated us by putting the big stones, which didn't require so much breaking, on the bottom, just as hucksters put bad cherries or strawberries at the bottom of a basket. As soon as this was discovered, they were severely punished.

But the Lolo women, when presenting their stones for measurement, always cut them to complete uniform size from top to bottom. They refused to let the small stones and chips count for payment. They would gather those in a little pile at one side and present them to the staff as a gift.

They were fast workers. One woman or child could produce as much as a cubic yard of broken rock in a day. They would start by attacking big boulders with a heavy hammer. Then they would break up the pieces with smaller hammers until they got down to the size required.

It was not a satisfactory method. As much as 50 per cent of the rock went to waste. There were many small but painful accidents, many fingers smashed by these hammers. It got so bad that we had to do something about it. We contrived a homemade vise by heating a strip of bamboo until it could be bent into a curve, with springlike elasticity. Then, instead of holding the rock to be broken in their fingers, they held it in the vise of bamboo. We had trouble getting them to use it, but they finally saw its advantages, and many fingers were kept whole as a result.

There was one stretch of the Road 160 miles from Kunming where the nearest available Chinese workers lived down in the valley. When we did the construction job, we brought them all to live in a camp by the Road. But, when it came to maintenance, it meant they would have had to move there permanently or climb up five or six thousand feet each day

to get to the job. Instead we used the Lolo women who lived in the vicinity for maintenance work on the Road, and they did just as good a job as they had done elsewhere on construction.

The high quality of the maintenance in this section was also due to the ability of the engineer, who was an able and hard-working man. In his spare time, from materials available on this remote mountaintop, he built a European-style office building and living quarters for the staff with polished wooden floors at a total cost of $200. It was the most perfectly constructed building anywhere on the Road, and I was always regretful when I had to leave there.

The wildest, although the most loyal and dependable of all the Border peoples, were the head-hunters. There are many different tribes of this race, known by different names. Some are called Kachins by the British. Some who live in Burma are called Nagas.

The head-hunters had lived in their mountain fastnesses for thousands of years with almost no contact with civilization. Among these people, a man's social standing is judged by the number of skulls that adorn the walls of his hut.

Each is given a knife in early boyhood, which he must learn to keep sharp and to temper until he is able to bend it into a complete circle. Short and tough, they can climb like monkeys and have eyes that gleam in the dark like a cat's.

The head-hunters wore blue cotton clothing with red embroidery. Both men and women had bright red lips from the betel nuts they were fond of eating. The younger ones also had bright red teeth from eating these nuts; but, as they grew older, it turned their teeth brown and finally black.

Around the waist and around the leg between ankle and knee, they wore a succession of tightly placed rings of black rattan. This custom aroused my curiosity. From talking to them and consulting General Tsukao's history, I concluded

that many years ago the style had been adopted as a primitive kind of armor and had survived as a decoration. The bands also had their usefulness, for they contributed to buoyancy when the head-hunters, as they often did, wanted to swim across the river to rob the Shans.

As to the Shan people, the problems in which they were involved were so difficult and complex that they are treated at greater length in Chapter Five.

Chapter Four

NEW HEADQUARTERS

WE HAD already decided to move the administrative offices out of Kunming, which had grown too noisy, too crowded, and too expensive, and offered too many distractions.

The next question was where to go. We had to find some place already built that could be adapted to our purpose, since we could not afford to erect new offices. In the mountain city of Hsaikwan, near the central section of the Road, were extensive stables for horses and mules. At one time, we had planned to use horse-drawn carts as an economical method of transportation, just as had been done in building the highway to the northwest. But the Yunnan horses were extremely small—no more than a quarter horsepower could be expected of them—and would have been crowded off the Road by the wild truck drivers. Therefore the plans had been abandoned. The stables, which were standing empty, seemed well suited to our needs; so we decided to set up our headquarters there.

In January, 1939, the staff moved to Hsaikwan. The insides of the stables had been completely torn out, and only the mud walls and tile roofs retained; walls were replastered, new flooring laid, and large windows put in to assure good lighting. The horses would not have recognized their old quarters.

Wherever we went, we installed the basic equipment necessary for scientific and efficient management and the

good health of the staff, including electricity for both light and power, a water plant, radio-telegram and telegraph facilities, and interoffice telephones. The new office was landscaped with trees and flowers to give the staff the benefit of pleasant surroundings.

These details involved some extra cost, but they brought return in increased working efficiency. It was my responsibility to look after the health and comfort of the staff and to find ways to minimize their fatigue. For this, they nearly always repaid me by doing better work.

One of the hardest jobs was keeping the office clean, a matter that required particular patience. The house master, who had been with me more than 10 years, had the task of training the native boys to do the cleaning, teaching them to walk fast, to speak politely, and, most important of all, to keep themselves clean.

We couldn't get the boys to understand the necessity for cleaning the windows. They thought that, as long as enough light came in so you could see across the room, that was enough and anything beyond that was ridiculous. When they were told that all the corners had to be cleaned, and not just one spot polished in the middle, that was too much, and they resigned. They were always leaving. As soon as we had any of them well trained, they would go elsewhere for better pay, because many other organizations were waiting for their graduation.

In addition to the offices, we also built foundries and machine shops, an electric welding plant, a carpentry shop, garages and parking lots, and some high-pressure car washers. These attracted a great deal of attention, for it was not customary for trucks to be washed regularly.

Hsaikwan is more of a town than a city but is scattered over such a wide area that it covers more ground than many cities. The name signifies a pass betwen two gorges. "Hsai"

means lower, and "kwan" means pass. As a key point in military strategy, it has quite a history.

It is a spot both unique and beautiful in many respects, possessing in particular four distinctive characteristics. The first of these is the wind. There is a joke to the effect that the wind blows only once a year in Hsaikwan—from January to December. The gale blows especially hard at night, making a wild roaring sound in the trees. When we first came there, we found the sound so disturbing we couldn't sleep. Yet it has such a quality of monotony that once we became accustomed to it we could sleep much more soundly than if there were no wind at all.

I have been blown right off my feet on the city streets. The wind blows continuously and nearly always in one direction, yet only a few miles away there is perfect stillness. This condition interested me so much that I gave it considerable study. The only explanation I could arrive at was that the air above Tali Lake, filled with vapor from the water, was lighter than that of the surrounding atmosphere and, because of the juxtaposition of the lake to the opening of the series of gorges, the lighter atmosphere served to draw the wind through them in a rush, as through some vast tunnel.

We put the wind to work for us by building a windmill that we used to generate current for charging storage batteries, and it worked very well. It was my intention later to build another windmill large enough to run a generating plant that could furnish electric light, but that plan was frustrated by the Japanese invasion.

The second characteristic of Hsaikwan is the abundance of rare and enormous flowers. The climate is so favorable that all flowers grow to be two or three times as big as they do anywhere else, and the red tea flowers are as big as dinner plates. In addition to rare blooms seldom seen in other localities, there are the more usual varieties, such as red and white

roses. The specialty here is the white or yellow-gold orchid, which in both fragrance and beauty compares favorably with the nationally famous specimens of Fukien.

The third characteristic is the snow on Changsan Mountain, which remains the year round, providing an appropriate setting for all this loveliness.

The fourth is the moon. For some reason, perhaps because of the atmosphere, the moon seems altogether different at Hsaikwan. The moon is full, in the Chinese calendar, on the fifteenth day of every month. Each night, for about a week around that time, the moon rises gradually from beyond the black abyss of the gorge to be reflected, round and clear, in the still dark waters of Tali Lake. It is a sight that is never forgotten by those who have witnessed it.

The country roundabout is ideal for hunting. Besides the ordinary species of duck, there is a special yellow-colored variety in such abundance that if anyone goes hunting he can hardly miss. They weighed at least 5 pounds each. The natives made a practice of taming one of the female yellow ducks as a decoy and using her to lure others into a net. They sold them in town for about 40 cents apiece. Also plentiful were the whistle geese, and their plaintive honking was a familiar sound in the sky.

There were wild buffalo and wolves aplenty in the countryside. In winter, the wolves came right down to the doors of our kitchens and sniffed hopefully at the garbage pails. The cooks for the most part had come from Shanghai and, never having seen a wolf before, thought they must be nice amiable dogs and tried to feed them and pet them. When they discovered what their visitors really were, they were badly frightened; and thereafter we had to provide escorts to see the girl staff members to their homes at night.

Our engineers found time to make a number of civic improvements, including the installation of an air-raid alarm

system for the entire populace as well as for the administrative force. This proved to be a rather complicated undertaking. Hsaikwan was not within the defense net of the Chinese Air Force, and the local authorities were therefore left to their own devices. Our administration was asked to supply information regarding approaching planes by means of a radio station erected for that purpose, and also to work out an alarm signal. Both compressed air and electricity were available, but there was no powerful siren.

The first method attempted was to hang large black bamboo balls from a flagpole, as is done in Chungking. One ball signified that Japanese planes were leaving their base; two balls indicated they were 40 to 50 minutes away. Before the planes were overhead, the balls had to be hauled down lest they accentuate the target. A green flag was raised to indicate the "all clear." This was all very well, except that no one paid any attention to it.

That method had to be abandoned. We found an antiquated cannon in the town. It was fired once as a warning that the planes were on their way, twice when they were about 150 miles off, and three times to indicate an urgent alarm. However, the roaring of the wind around Hsaikwan greatly reduced the transmission of sound, and the charge in the old muzzle-loader had to be hammered home to increase the explosion. This took about 5 minutes to do. If the alarm was urgent, the planes were often already overhead before the last shot was fired. The situation was further confused by a townsman who fired one warning shot at 8 A.M. and another for the all clear at 5 P.M., whether there was a raid or not.

Casting about for some solution, I remembered seeing in the catalogue of a Rangoon munitions firm an advertisement for a "salute gun" mounted on steel wheels that would give a report that could be heard for 2 miles. A rush order was sent off for two of them. To my great disappointment, when they

arrived, I discovered that they were toy guns. Still I did not give up hope, expecting something from their "powerful shells." In order to avoid frightening my staff, I took the gun 2 miles away from the office to try it out. To my regret, I found it made a report not half so loud as a shotgun. We gave up the toy gun as a total failure and went back to the old cannon. We were eventually able to get some more; and, crude as the method was, it saved hundreds of lives in Hsaikwan when a flight of twenty-one bombers blasted the town.

As the war drew closer, air-raid warnings became a daily occurrence, and we found staff members were losing several hours a day in going to the fields when the planes came over. Presently it became necessary for us to move our offices once more.

In choosing the new location, I took a leaf from the book of General Tsukao. He had once instructed his officers, "Whenever you establish a camp, always select a location where there is water in front and a mountain behind. In this way, you will be well defended." When I read this, the principle seemed not only sound but completely applicable to attack from the air, and I kept it in mind when we began our search.

On the far side of Tali Lake was an abandoned settlement of small mud huts. The lake was in front, and Changshan Mountain rose just behind. It was remote yet accessible and seemed to me to possess all the necessary qualifications. In we moved.

We tore out the insides of the huts altogether and made everything modern and up to date. Yet anyone looking at the settlement from the outside would have thought that here was a sleepy little village. Outbuildings and fences were left just as they were. Although the cannon boomed its warning in Hsaikwan, the staff members never so much as looked up from their desks, and no more time was lost. Tsukao's adjura-

tion had been written centuries before the airplane was dreamed of, but it worked equally well for us.

Some months afterward, we had comforting confirmation of our foresight in making this move. One afternoon Japanese planes came over Hsaikwan in force, bombed the administration building, and almost demolished it. But it was of no consequence; the staff had long since moved away.

Life was very lonely there for those staff members who did not have their families with them. They were thousands of miles from their homes. The work was exacting, and they had no means of relaxation, not even radios or gramophones. About their only pleasure was looking at the scenery, but they enjoyed that to the full.

We were concerned about the poor health conditions in Hsaikwan. The first year we were there, we asked our medical men to make a statistical survey of the most prevalent diseases, to prepare specific medicines to combat them well in advance, and to be ready to treat not only the staff and workmen but also the rest of the populace.

They found that the principal scourge was dysentery, with a kind of fever transmitted by fleabite next, and malaria the third.

In the center of the city was a large public well where everybody came to get drinking water. Water for the well came from streams flowing down from the highlands above, which were dotted with villages. Investigation showed that village people were not differentiating between water for drinking and water for drainage. It all come down together to Hsaikwan.

We got agreements from the villages to share in the cost of putting in drainage systems, but there seemed to be no way of building conduits. However, many broken and dented gasoline drums had been left around by the transportation companies. With these we built separate drainage

and water-supply systems, and the public well was at last supplied with relatively pure water.

The streets were also a menace because they were made of boulders and were very slippery. We had to tear up the streets to put in the water and drainage pipes, and that gave us an excuse to repave them. We made an arrangement for reconstructing them with broken-stone macadam. The city authorities were to supply the stone, and we supplied the workmen. After that the city took on an entirely different appearance.

With the improvements and the opening of traffic, Hsaikwan became a bustling, interesting cosmopolitan center. It grew to be an important stopover point. At the peak, from 500 to 800 trucks would be lined up in the parking lots at once.

Here were people of different nationalities, customs, and traditions all thrown into intimate contact but all getting along very well. They would joke with each other volubly and at great length although neither could understand a word the other was saying. There was never any thieving or fighting.

Each group created special problems. Modern hotels had been built for the travelers. But the Indian drivers, who were mostly Mohammedans from the northwest, didn't like to sleep indoors. They insisted on cooking their own food over campfires and sleeping in bedrolls that they rented for the night from speculators.

With all this hubbub and confusion, we were doubly glad that our offices were now far away on the edge of the lake where we could still enjoy quiet and solitude.

Chapter Five

MUD AND MALARIA

FROM the outskirts of Lungling, extending westward to the edge of Burma for a distance of 85 miles, lies the Border territory of the Shan states. Here, in this deceptively beautiful country, we encountered every torment that nature could devise: rain unending for months at a time; stifling heat and humidity; mountains of the slipperiest mud; and worst of all, malaria.

Malaria, wherever it exists, can be a serious nuisance. But here it is of a peculiarly fatal variety. In the earlier stages of the work when we had no medicine or sanitation, more than half of those who were bitten by malaria-infected mosquitoes died. Later, even under the very best of conditions, in one 5-month period in the dry season, with good sanitation and adequate facilities for medical treatment, some 500 out of 8,000 perished from disease.

The work in itself was hard enough here with the slippery mud and the shortage of good limestone. The principal obstacle was a mountain called Santaishan, or "Three Step Mountain," consisting entirely of mud. The drivers hated it. Their trucks were often mired above the hubcaps on the steep grades; and they particularly dreaded a breakdown in this wild locality because there was no place to eat or sleep.

The mountain caused us so much trouble that the Generalissimo wanted us to consider digging a tunnel underneath it. That proved to be impractical, and it took a labor force

of 3,000 working for 5 months to cut the Road over the mountain in many hairpin turns.

Quite aside from the job itself, the other complications, the malaria, the rain and the heat, the difficulty in getting workers and in transporting materials made this the most troublesome section in the entire Road.

The soil of the Shan states is unbelievably rich; it has not known fertilizer for hundreds of years. There is no need for building ditches and dams for irrigation as elsewhere in Yunnan, because the rains of the monsoon provide all the moisture required. Rice, the chief crop, grows easily and is of even better quality than the famous Soochow rice.

For these reasons, the Shan people have never had to work very hard for a living and are soft and leisure-loving. They were not very well suited to the arduous toil of road building. Furthermore, the men had to work in the rice fields, and the women had to look after their homes. The only workers available to us were the girls between the ages of about twelve and twenty.

The Shan girls, with light skins, bright cheeks and lips, and figures well developed from having done light work in the fields from childhood, are extraordinarily lovely. Good-natured and high-spirited, they were nevertheless very much in earnest about the job and tried their best to please. But, not having known the discipline of hard work, they could never perform any task to satisfaction.

Because it is the local habit to eat twice a day, at 9 A.M. and 5 P.M., and the girls preferred to take their meals with their families, they wouldn't come to work before 10 and always insisted on leaving at 4. We were able to use them only for light work such as breaking stones and carrying light baskets of dirt for surfacing.

As time went on, we purposely mixed Chinese laborers in with them. These people, who worked hard and well, would

grin, and thrust out a forefinger, saying "Ding Hao," which means, "I am very good." This incidentally is the first expression every American learns on coming to China, just as every Chinese learns to say "O.K." from first contact with Americans.

The effect of this gesture on the Shan people was galvanic. They were ashamed to appear so weak, began carrying double and triple loads, and eventually abandoned altogether their practice of coming late and leaving early.

Because of the ineffectiveness of the Shan girls, 10,000 Chinese workers had to be brought out to perform the heavy tasks. This entailed further difficulties, which will be described presently.

Arrangements for procuring the labor force were all made with the Sawbwas, or local rulers, just as they were made elsewhere with the magistrates—with this difference: the Sawbwas could command the workers at will, for the Shans were, in fact, a slave people. All the rice in the district is paid in tribute to the Sawbwa, who then redistributes it to the populace as he sees fit. The redistribution must have been fairly equitable, for there were no rich and no beggars. But it left the people little freedom of action.

The Sawbwas are in effect little kings. They are Chinese, the descendants of former conquerors, and they hold office by heredity. Their rank is lower than that of magistrate, and like the magistrates they are responsible to the Governor of Yunnan.

There were wise, diplomatic, and scholarly Sawbwas, and lazy and incompetent ones. Our negotiations took me often to their homes, and I was struck by the curious mixture of Oriental culture and Western convenience that marked their manner of life. The Sawbwas are required by their parents to pass rigid examinations, and they therefore spoke excellent Mandarin, wrote good Chinese, and were also well versed in

all ceremonial observances as required by the Chinese political system.

They lived in large, opulent houses, filled with beautiful art objects handed down by their ancestors. Yet they wore the latest European fashions and drove new European cars, and many had iceboxes and similar modern appliances.

Their exposure to Western methods probably came about because, before the Road was opened, it was easier to travel to Rangoon than to Kunming. Also, they intermarried only with the families of other Sawbwas, including those on the Burma side; therefore the Chinese Sawbwas copied ways from the Burma Sawbwas, which they in turn had copied from the British.

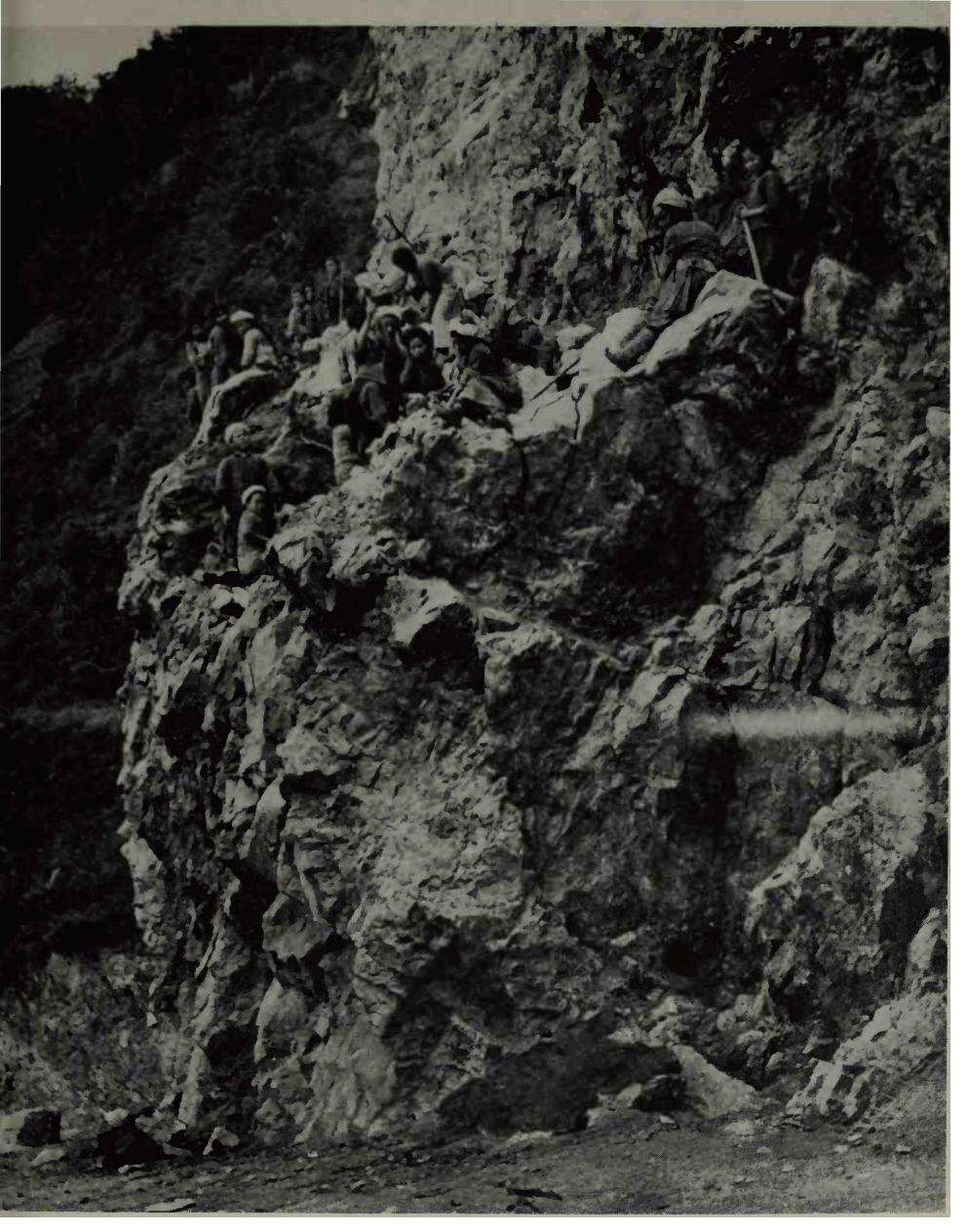
Many bizarre mannerisms came about in this way, such as the wearing of a tuxedo on frequent occasions, whether appropriate or not.

I remember an incident when two of us were guests at the house of a Sawbwa. He had just procured a handsome new gold dinner gong mounted on ivory and was anxious to show it off. With great ceremony, he went into the dining room and struck the gong to summon us to dinner. We had to explain to him that such a gong was suitable only for large and formal gatherings, and that this was a rather elaborate procedure for only two guests.

Work on the section of the Road in the Shan states had been started in the fall of 1937 and carried on with the Chinese labor force all through the dry season, although progress was slow and unsatisfactory.

Late in April of 1938 came the spring festival that marks the official beginning of the rainy season. On the eve of the spring festival, the 10,000 Chinese workmen, to the last man, ran away, and work came to a full stop.

Carved on a stone monument near the city of Paoshan is the proverb, "Even the birds will not fly low over the Shan



Workers cutting a way for the road through rock.

The Mekong Bridge before and after bombing.

country in monsoon time." This refers to the menace of malaria, the monsoon being the season in which the malarial mosquito flourishes. The legend is testimony to the tradition, unbroken for thousands of years, that no Chinese will venture to remain in the Shan country during the rainy season. There is sound sense behind it, for our people have always been unusually susceptible to the deadly disease. The monument was such a forceful reminder that, in order to improve morale, since we were not permitted to destroy monuments, we turned it around so that it could not be read from the road. Nevertheless, the tradition was so deeply rooted that the workers obviously had no intention of breaking with it, and it looked as if work in the area would be confined to the dry months.

At the time, we were still coping with urgent problems at headquarters in Kunming. But this section had developed into one of the sorest spots on the entire Road; and in November, 1938, I came out to see what could be done to speed construction.

The Road through there was then hardly more than a crude trail. But trucks were already moving over it—in a thin trickle to be sure—and they had to be kept moving. Through that winter we managed to get along, never doing enough, always behind schedule, in spite of the great need, but making some progress.

There were problems to be met on every hand. There was nothing to work with—no heavy machinery, not enough tools, not even adequate means of housing and feeding the workers.

The Shan houses were already crowded; the Shan people and the Chinese were then strangers to each other, and there was no possibility of finding billets for the workers. Nor did there seem to be any possibility of building suitable quarters for them. To bring materials in from the outside was beyond

question, and in all that country there was no man who knew how to make a brick or a tile.

At the beginning, the Chinese workers slept on the ground, greatly increasing the dangers of contracting malaria, pneumonia, skin diseases, and insect bites.

In time, they built their own crude huts out of straw or bamboo, but they could hardly be called comfortable. They were never waterproof; the thatch made an ideal haven for insects, and the bamboo branches kept up a constant rustling sound that made it almost impossible to sleep.

The food problem was equally complex. Rice for the workers had to be procured by arrangement with the local Sawbwa, and he seldom had more than just enough to feed his own people.

Furthermore, what rice could be had was all in the kernel, and we had no machinery for polishing it. The Shan people polished their rice with a primitive contrivance of weights counterbalanced by a stream of water. But this device could polish no more than a cupful or so at a time—hardly enough to feed one family for a day. The problem was not solved until many months later, when we were able to procure our own rice-polishing machine.

Then came the spring festival once more, reminder of the ancient tradition and the specter of disaster repeating itself. This time not all the workers ran away, but enough of them departed to curtail our labor force seriously. Then the battle against malaria began in earnest.

I had sent out the call for doctors and nurses, but only a few had yet arrived. The medicine we had was limited, a feeble weapon with which to combat the scourge that was weakening, discouraging, and killing our workers.

The very sight of those miasmic vapors hovering over the jungles and the swamps, strangely colored in the hot sunshine between rains, is enough to fill the heart with dread.

I have stood in those mists which hover for about 6 feet above the ground and have found them so heavy and choking that one can scarcely breathe. "Poisonous gases" is a suitable name for them.

The vapor is at its height between five and seven in the morning and the same hours in the evening, the time when the malaria-poisoned mosquitoes are most active.

There are all kinds of mosquitoes in this district, including the usual large black ones that are found in many places in the world and the yellow ones, also large, which spread ordinary malaria. Besides these, our doctors told me they had so far found more than six different kinds of small mosquitoes, yellow in color, with white dots on their bodies, whose bite can cause the fatal type of the disease. The first two kinds of mosquitoes make the familiar loud hum; the little ones make a very slight sound and hover head-on over any surface instead of alighting on it.

The danger from the small yellow insects depends upon whether or not they have previously been infected themselves. If they have not, their bite is harmless.

This is shown by an incident involving one of our doctors. He was in the process of giving an intravenous injection to a malaria victim when one of the small yellow mosquitoes lighted on his wrist. He could not brush it away without risk to his patient, because the intravenous must be given very slowly and he was using both his hands, one to press home the plunger and the other to hold the syringe. He could only allow himself to be bitten. Happily, that mosquito was not infected, for the doctor suffered no aftereffects.

We also found that the danger from mosquitoes is not confined to the rainy season. As a matter of fact, malarial mosquitoes are even more active just after the end of the rainy season, when they swarm around the rice roots that still retain the dampness, and there is no rain to wash them away.

Some of those who took every precaution, sleeping under mosquito nets and burning mosquito coils, got the disease, while others who were utterly careless did not. Sometimes only one man in a hut would come down with malaria, while his bunk mates remained untouched.

Incidentally, our doctors found that taking quinine as a preventive measure often did more harm than good in the case of fatal malaria, simply making it more difficult for the germs to be detected in microscopic examination without rendering them any less virulent. Nevertheless, quinine, taken in conjunction with atabrin, is an essential part of the treatment once malaria has been contracted. It would seem advisable, in view of the experience of our doctors, that anyone traveling through this region be equipped with both quinine and atabrin.

The forms that malaria takes in this district are so strange and so deadly that both the Rockefeller Foundation and the League of Nations established posts there to make a study of it. The peculiar attendant symptoms, often resembling those of other diseases, defy diagnosis. Frequently a man would seem to be suffering from some minor ailment when he was, in fact, a victim of this deadly malady. The suddenness with which the malaria sometimes struck also made it difficult to combat.

There was no way of knowing when a man had been bitten by an infected mosquito. In some acute cases, when the germs became active in the early evening, he might be so sleepy as not to realize it. Then his fever would mount so rapidly that he was likely to lose consciousness before he could tell anyone about his condition. In the morning, we would find him dead.

Often the workers, feeling just a fatigue, a headache, a general lassitude, or perhaps an aching in the joints, would think they were suffering from some trivial ailment and

would be ashamed to report it. If it happened to be malaria, there was nothing to be done for them, unless they received an intravenous injection of atabrine immediately.

It was especially hard to get the Shan girls to tell us when they were afflicted. They thought only God could help them, and the first inkling we got that they were sick was when we saw them holding out their hands in supplication, crying pitifully and calling on God to relieve them. Even after medical supplies arrived, it took months to persuade the girls that any measure other than divine intercession would have any efficacy whatever.

Those were trying times. We never knew who would be the next to go, whether a cold was really a cold or some manifestation of fatal malaria. Many irreplaceable engineers and mechanics were lost and many faithful workers, both Shan and Chinese. No matter how anxious we were to get on with the work, we always took the time for a simple ceremony for those who had died far from their homes.

There was no opportunity to go to the temple, as we would have preferred; but we did manage a few simple funeral dishes and a bow to the departed, which was always pleasing to the relatives and friends. And insurance benefits were always provided for the families.

The situation grew steadily worse, reaching its very lowest ebb in the month of July. The ranks of our Chinese workers had been thinned by malaria, dysentery, and other afflictions until at that time only 25 or so remained. Then, within a very short time, about half of those died in a sudden flare-up of the disease. One night, in the darkness, the others, no longer able to cope with the unseen terror forever at their elbows in the huts and the undergrowth, ran away.

The rainy season was at its height. In the face of this experience and the ancient traditional dread of the Shan country, it did not seem within the realm of possibility that we

could get other workers to come out to replace them. Yet we could not give up. China's affairs were growing steadily more critical. The traffic had to be kept flowing.

Looking back over the whole history of the job, in spite of the many other critical situations, this remains the darkest moment. I was beset with so many perplexing dilemmas that I hardly knew which one to attack first. Traffic was getting heavy, and there were any number of rough spots on the Road to be attended to.

Alarms were coming in of landslides taking place here and there over the entire length of the Road, of bridges and retaining walls washed out. There were in addition the usual administrative problems to be handled. But this job could not wait. We had to proceed, and we could not proceed without workers.

It was hopeless to think of trying to get more Chinese workers at this time. The Shan men were busy in their rice fields, and if we took them there would be no rice crop and no food. The Shan girls were not equal to the strenuous job.

In this extremity, we hit on one possible solution. High up in the mountains above the Shan country lived the head-hunters, who have been mentioned in an earlier chapter. Because they were great robbers and the Shan people lived in mortal terror of them, I was reluctant to bring them down to work on the Road, but now we had no recourse. One of my aides was dispatched to lay the case before their chief and see what he could do to help us out.

The man was a Chinese from Lungling who had somehow become mixed up with the head-hunters years ago and had eventually been chosen as chief. He spoke a rather sketchy Yunnan dialect that made it a little easier to explain things to him.

When he was told about the Road and how badly his people were needed, he caught fire immediately. He sent out

the call for his tribesmen; and, when they had all gathered, he said to them, in substance, "Here is a matter so important that officers have come here from the Central Government to enlist our aid. We must help them. Now you must understand that these men are your friends. You are not to kill them or molest them in any way. You must be kind to them. But you are at liberty to steal all the pigs, cows, and chickens you want, as usual."

As a result of his plea, we were supplied with 300 men, hardy, diligent, and skillful. With their help, we were now able to get construction moving again, in spite of the rains and in spite of the malaria.

At first the head-hunters were wary and shy. Each morning they came silently down from the villages to work on the Road; each night they melted back into the hills. But as soon as they found out they were going to be well treated, they became the most tractable and dependable of workers.

There was never any discord or incident of any kind. Once a week, a station wagon was sent in over the mountain trails to their villages loaded with greenbacks for their weekly pay. It was more money than they had ever seen before in their lives, yet the pay wagon was never robbed.

As time went on, straw huts were built for them close by the Road to save them the daily trip back and forth. The engineering office was right in the middle of their encampment. But everybody got along together, and there was never any disturbance of any kind.

Besides being good workers, they seldom got sick. Most of them seemed to enjoy an immunity from malaria, perhaps because their systems were already so full of the germs that they acted just like a vaccination, perhaps because they had learned to avoid exposure to mosquito bites.

A few did fall sick and die. But they were perfectly fatalistic about it and quite unperturbed. To them death only

meant that God had called them a little before their expected time, and that was a matter for rejoicing rather than for grief.

Bit by bit the situation began to improve. Thousands of yards of mosquito netting had been obtained from Paoshan. Mosquito coils to be burned in the huts arrived from Shanghai. The doctors also began to arrive in greater numbers from the occupied areas, each carrying ampoules of precious atabrine concealed on his person.

Word had been brought back to Paoshan that Chinese engineers were at work in the Shan country during the monsoon, defying the old tradition. Moved by this example, the men of Paoshan, good sturdy fellows who knew how to construct a road, began to come back; and before long we had a sizable crew once more.

I considered it my duty to get rid of their strange feeling and to make them as much at home as I could. Heretofore the Shan people and the Chinese had had little close contact. The former were considered to be of so much lower caste that in the days before the Republic even a Sawbwa had to abase himself upon meeting a Chinese officer, even of the lowest rank. Traditionally, they never intermarried. Now I set out to break the tradition by encouraging marriages between the Chinese workers and the Shan girls.

In doing so, I took into account three practical objectives: first of all, such a move would create better understanding between the two peoples; second, the workmen would be better housed and better fed; third, they would have many relatives among the Shans from whom they could help us recruit workers. I preferred such a method of obtaining workers, which was more democratic, than getting them through the Sawbwas.

Marriage, according to the Chinese custom, is by arrangement between the families of the couple who are to be wed. The bride and groom never see each other until the cere-

mony. In fact, the bride is required to keep her eyes closed throughout the nuptial night and is permitted to open them only in the morning.

This convention has a certain human wisdom in it. There is a natural glamour about that which is unseen and unknown. Love, instead of culminating in marriage, as in the Western countries, begins with marriage. It is perhaps due to this approach that the word "divorce" does not exist in the Chinese dictionary.

In the Shan states, however, the custom is more informal. The young people are afforded opportunities to become acquainted with each other, and then they may make their wishes known to their parents.

Such opportunities occur to a limited extent in the normal course of daily life, particularly in encounters at the market, where everybody goes to buy and sell produce. They occur more frequently at the four seasonal festivals of the ancient Chinese observed by the Shans. At this time, the boys and girls may go with their families into the forest, celebrating the holidays in song and ritual, and they may also have the chance to become acquainted with the youngsters of other families.

But some of them may have had no opportunity for meetings in the market place; and during the religious festivals many families celebrate by feasting at home.

Once a year on a religious holiday which is Buddha's bath day boys and girls are expressly given the chance to get to know each other. It is designated as the "splash-water" festival. Each boy and girl is given a bucket of water and a bundle of branches. If a boy sees a girl he likes, he is at liberty to splash water on her to his heart's content. If the girl wishes to reciprocate his attention, she will splash water on him in turn. The happiest girl is the one who looks like a drowned chicken at the end of the day, for her condition is evidence of

her attractiveness to many males. When a young couple has splashed each other, conversation naturally follows, and it is only a short step from acquaintance to courtship.

Thus there is much merriment and hilarity on this day, all at the expense of Buddha. This may seem primitive and childish to Westerners. But it must be borne in mind that in this part of the world there is absolutely no social life in the ordinary sense, and parents realize they must allow their daughters freedom for romance, for at least one day out of the year.

The Chinese workmen had ample chance to meet the Shan girls in the ordinary course of daily life. One popular meeting place was the market where the girls came to trade vegetables, eggs, chicken, and pork for piece goods, salt, and tea. Others were along the banks of the streams where both went to do their laundry, or the wells where they drew water. One such well, where drivers and workmen stopped to wash their hands, was located in front of our hospital. It was always a busy place, a regular "Times Square" of Mangshih. Sometimes acquaintance ripened under dramatic circumstances, as, for example, when the workmen saved the girls from landslides or from speeding trucks on the Road.

When a courtship had developed so that a marriage could be negotiated, we had to arrange an elaborate ceremony. Since a ritual was needed that would be satisfying to both parties, we devised a civil ceremony similar to the rites observed in modern China.

From miles around, all members of the bride's family, down to the most distant relative, gathered to attend the event. The weddings were marked by great feasting, of course, with innumerable native dishes, most of which I found unpalatable. They consisted usually of pork cooked in many different ways, but always with a strange sour taste, and of bitter native vegetables.

The *pièce de résistance* was a bowl of large ants' eggs, served in oil and looking somewhat like white caviar, a dish that was highly regarded and was available only to the nobility. It was usually served by a Sawbwa as a token of particular respect for distinguished guests. The ants' eggs were bitter to the taste, and I cannot say I found them much of a delicacy. But the local people seemed to relish them.

The Shans have a very wise practice. Immediately after the ceremony, about 4 P.M., a patriarch, selected from among the bride's relatives, comes forward to instruct the young people in the tenets for a happy and successful marital relationship. At our ceremonies, however, the instructions also had to be translated into Chinese for the benefit of the groom, and this gave rise to frequent misinterpretations and amusing and embarrassing situations.

The bride must take four essential steps in connection with the wedding ceremony, no one of which can be omitted. She must have her hair cut in a certain way; she must dress Chinese style; she must put on silk stockings; and she must wear high-heeled shoes.

These observances present attendant complexities. Since the girls go barefoot from childhood until the time of marriage, the soles of their feet become so rough and horny that the prized new silk stockings are usually torn to shreds in a few hours.

They also have a hard time trying to walk in the unfamiliar high-heeled shoes without losing their balance. Nevertheless, convention prescribes that they must never be without these shoes, and it is not uncommon to see a new bride walking along the Road barefoot with her wedding shoes slung from her shoulders.

Every stage in a Shan girl's life is marked by a new hair-do. As very young children, they wear their hair down their backs in braids. When they are about twelve or fourteen,

they coil these braids around on top of their heads to indicate that they are now ready to accept proposals of marriage. On the second day after the wedding ritual, they put on turbans to be worn henceforth as a sign to all that they are now matrons and are to be treated with due respect.

I came to learn about another of their postmarital customs in an odd way. I was awakened one night by a low, mournful, monotonous singing and murmuring near my window. I thought it must be some young men who had been roughly treated on the job and had come to register their complaints. I couldn't afford to have my rest disturbed, because, with so much sorrow and strain to bear and with such poor nourishment, the only way I could keep up my strength was to get plenty of sleep. I called a doctor who knew a little of the dialect and asked him to find out the source of the trouble.

He explained to me that this was simply a local tradition. A Shan girl often has numerous suitors. When she finally marries one, the others feel aggrieved and serenade the house of the bride on the first night after the wedding, singing mournfully, "I am so handsome. I am so brave. I cannot understand why you did not marry me, why you chose that worthless one instead."

This practice, which never does them any good, indicated to me the inherent weakness of the Shan people. Instead of fighting with all their might to win a girl before marriage, they let someone else get ahead of them and then take out their disappointment in wailing and bemoaning their fate.

As I have already observed, the Shan girls were beautiful and well proportioned, lively, healthy, and intelligent. They made excellent wives. They were also proud to be able to marry a Chinese, and the unions by and large were very happy ones.

As a rule, the Chinese husbands went to live with the brides' families. One of our doctors who had married a Shan

girl took up his residence for a time at her home. I visited them there and had the opportunity to see something of native life.

Everything is primitive but neat and well ordered. Their houses are rather well made, in native style, with bamboo walls held together by plaster. The floors consist of a mixture of plaster and cow dung, made through a process known only in this locality, by means of which they can be polished to a surface as hard and high-finished as linoleum.

Cows and pigs live right in the house with the family. They are animals of extraordinary intelligence. Each morning they are let out, the pigs to run through the streets, the cows to forage on the hills some distance away. Every night they return at exactly the same hour, without being called, making their way through the tortuous, winding streets and picking out their own house from all the others, which look exactly like it. With no word spoken to them, they amble placidly through the living quarters into the stalls for the night.

The doctor, incidentally, later went back to Kunming with his bride and lived there very happily.

The affairs that I have mentioned were only pleasant brief interludes in the business of grappling with myriad day-to-day troubles. Slowly one obstacle after another was surmounted and conditions gradually improved.

The food bottleneck was broken by arranging to pay the Sawbwas $30,000 in advance for enough rice to feed 6,000 workmen over a period of 4 years. It was to be sold to us at the same price without regard for the scarcity. As each lot was delivered, it was stored in the new headquarters. A modern mechanical rice polisher arrived and was installed, operated by a 10-horsepower Diesel engine. From that day on, the crew never lacked for rice, which was essential; for without it the laborers would not have been well fed and work on the section could never have been completed.

Gradually the old, crude straw and bamboo huts were replaced by modern quarters for the workmen, with elevated concrete floors; walls of bamboo plastered with concrete on both sides; hardwood window frames; screens on both doors and windows; and a corrugated-iron roof covered with straw affording maximum coolness in summer and warmth in winter. They looked just like any up-to-date bungalow.

By the time regular bus service had been put in operation from Kunming, we were ready with hotels and restaurants, embodying the best of accommodations—screened windows; good baths; and comfortable beds—which we built under contract to the China Travel Service.

When the Japanese attacked, we already had our instructions from the Ministry to open modern schools for the children of both Chinese and the Border races, as an addition to our anticipated construction program.

The modern world had come to the Shan states. In a few months' time we had literally spanned the period from the Middle Ages to the modern era. Contact with the outer world changed the outlook of the people completely. They were no longer content to live like slaves. Before we came to Mangshih, they had to kneel and bow their heads as the Sawbwas passed. People now knew that their ruler was just an ordinary creature like themselves. They began to insist on certain rights, and the Sawbwas realized they had no alternative but to grant them. To me this proves that human nature always inclines in the direction of freedom.

The building of the Road thus became more than an engineering achievement. Here was a human laboratory, demonstrating that, through methods of honesty and fair dealing, the constricting traditions and prejudices of thousands of years' standing can be dissipated almost overnight and a firm foundation laid for future social as well as technological progress.

Chapter Six

LANDSLIDE!

DURING the rainy season everywhere along the Road, we had to contend with landslides of all kinds from isolated washouts to the sort of overwhelming avalanche that carried with it the whole side of a mountain.

Some were like the gabble of a petty politician—not really serious, yet troublesome—and occurring with irritating frequency, often in more than a hundred places within a distance of 20 miles.

Others reminded one of the wrath of a great statesman. The mountain lies there, looking so peaceful, with his eyes closed as though he is very tired. But all the time he is working, working, behind your back. The moment comes when he opens his eyes and stretches like a cat; then he roars like a lion, and fatal disaster follows immediately.

One such threatening mountain lay near Lufeng, 70 miles west of Kunming. The Road in that locality led through a deep valley, and every time I passed through I noticed a number of big boulders with sharp and jagged corners, indicating that they had slid down from not far away. Neither our engineers nor the natives could trace their source. Here was a signal of impending danger, and a special crew and a bulldozer were assigned there in readiness for any emergency.

One night in October, 1941, the mountain stirred and shivered. With a noise as of thunder, the side gave way, crushing and burying houses in its path and taking many

lives. An avalanche of earth and large and small boulders smothered the Road.

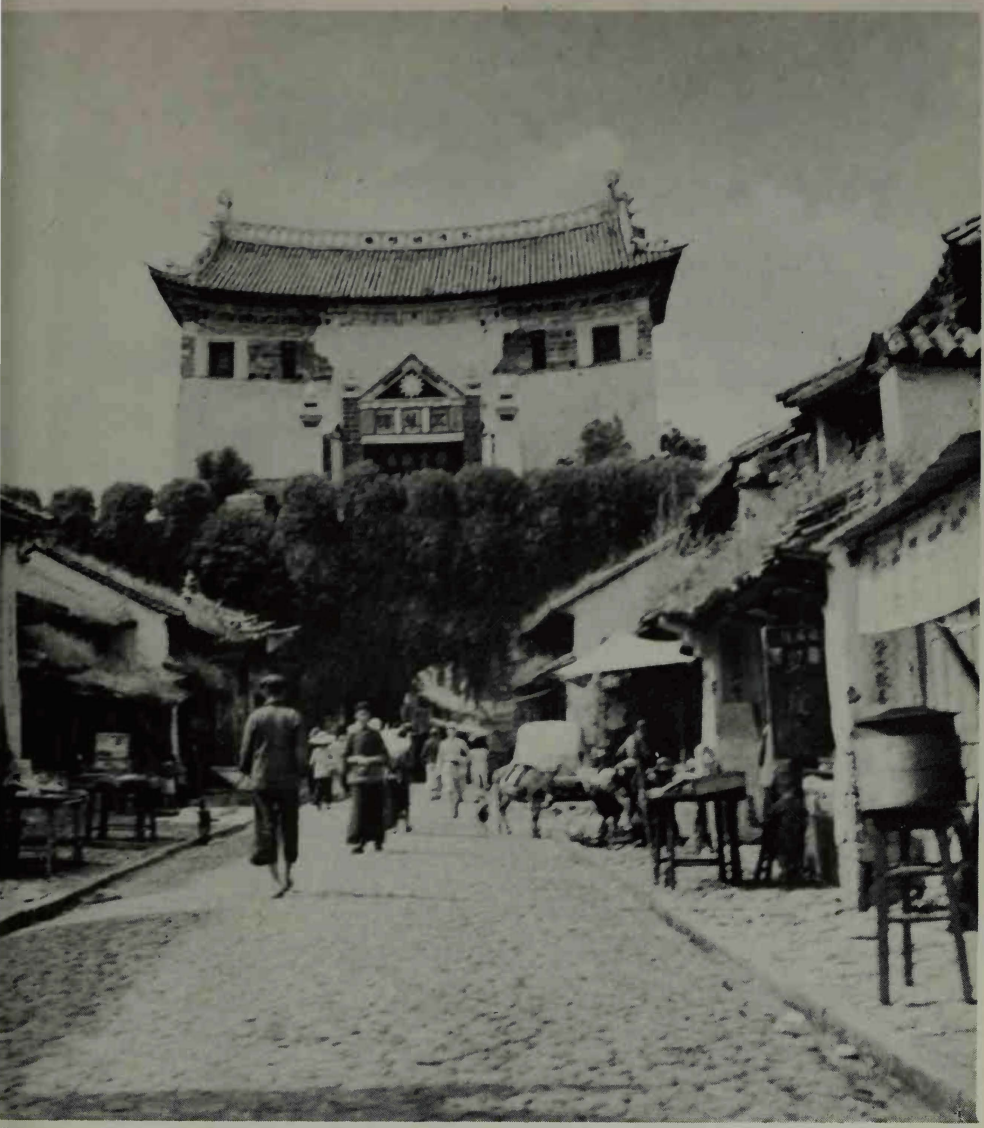
All traffic was blocked. Some 700 trucks had accumulated on either side of the impediment in spite of warnings to the drivers to remain either in Yipinglang or Kunming.

The bulldozer and the emergency crew swung into action, working around the clock. A serious setback was narrowly avoided when the bulldozer tackled one big boulder with such force and speed that boulder, bulldozer, and driver all tumbled together down a 30-foot embankment. But no one was hurt; the machine was hauled back up the slope with the help of a truck crane, and the work went on. A few of the drivers pitched in and helped, but most of them remained in their cabs, taking out their impatience over the delay in shouting at the workers. In 3 days and nights of continuous work, some 120,000 cubic yards of rock were cleared away, and the trucks came through once more.

On many of the mountains, the Road wound round and round like the threads on a screw. If the top segment was washed away, it would fall on the one below, and sometimes the two together would fall on the one below that. Conversely, if the retaining wall on the lowest stretch fell away, it would often take with it all the levels of the Road directly above.

Landslides constituted a threat to drivers. In one section near Yongping, where the rock was of a fine laminated brittle limestone, the fragments falling down from hundreds of feet above were as deadly as snipers' bullets. No one knew when or where to look for them. They struck silently, and sometimes fatally, right out of the air.

There were other inexplicable accidents, too. Once, on a muddy hillside in the Shan states, a great tree, its roots loosened by the rain, fell athwart the cab of a truck at the precise moment it was passing underneath, crushing the driver to



Tali City showing the city gate in background.

Lolo women who worked on the road.

death. If anyone had attempted to contrive such an accident, it would have been impossible. It was so mysterious that the head-hunters were convinced it was a sign that God had visited his wrath on the hapless driver. It could, however, be explained more logically. The vibrations of the approaching truck must have been just enough to give the final jar to the already loosened roots that brought the tree tumbling down.

Clearing away the fallen rock was the most discouraging kind of work, for it seemed to be without end and was often no sooner done than it was undone. This was so hard on the morale that I puzzled long over finding some way to put heart into the workers. I finally presented the situation to them in the following terms: "You must examine this job with both a microscope and a telescope simultaneously. If you look at it through a microscope, you will get it done with the utmost thoroughness, letting no detail escape you. But you will also be very discouraged. So at the same time you must regard it with the long-range view, knowing that we cannot exist forever in the dark night of hopelessness, that the bright morning is bound to dawn."

Most of the landslides came in the night, when the rains were at their heaviest. A central alarm system was established so that we would be notified immediately at headquarters wherever one took place. Time was vital, and whenever possible removal was begun while the slide was still in motion. On some nights, these alarms poured in one after the other.

Emergency crews were organized and placed under the direction of each of the 26 section chiefs so that there could be no confusion of authority. They were all equipped and ready to go to the scene at a moment's notice.

The matter of getting the laborers was more complicated. We could not keep a full crew on the pay roll all the time, because nobody could begin to foresee when or where a landslide might occur or how serious it would prove to be.

Therefore it was necessary to enlist the cooperation of the people who lived near the Road.

They were mostly farmers, however, and farmers in that country are very busy in the rainy season, when the landslides were most frequent. The majority of the rice fields are on the hillside, except for a small area in the flatlands. They need water all the time, entailing the building of many dams and ditches. When the water pours down from the mountains in the heavy rains, the dams are in danger of being washed out and ruining the fields and must be constantly watched and repaired. It was asking a great deal for these people to leave their urgent work to fight the landslides; but they arranged it among themselves, with one farmer looking after another's dams as well as his own.

The laborers, too, had to be summoned in the middle of the night because of the time factor, and much thought had to be given to devising a suitable landslide alarm. At first we considered using the bronze gong that is standard in Chinese towns and villages for calling out the volunteer fire brigade. But this would have led to confusion, because no one would have known whether many were needed to remove a landslide or only a few to put out a blaze. Five-gallon tins were available, and we considered thumping on them as a signal but were afraid of causing too much excitement.

We also had access, however, to a number of whistles like those used by air-raid wardens, which were shrill enough to awake the sleepers and had a distinctive sound that could not be confused with anything else. We decided to adopt them.

Whenever a landslide struck, our engineers went out to the villages and hamlets nearest the Road, accompanied by the magistrate or village chief. Then the engineer would blow his whistle, and the magistrate or chief would sing out, "How many workers from this village? How many from this village?"

Whole families, including the old men and old women and little children, voluntarily left their warm beds and the shelter of their homes to set out for an unknown destination, facing unpredictable dangers, in the cold and the wet to clear the obstructions from China's life line.

They had to feel their way in the dark, which is depressing enough to the spirit, because the rain did not permit the carrying of any torches. In that part of the world, it is not like going out in any ordinary rain. The heavens come down in torrents; at night it is cold, the wind comes up and blows the water sideways and no part of the body can be kept either warm or dry. The extremes of change from the daytime heat drain away all energy and physical stamina, leaving an enormous lassitude.

Yet they trudged off to work, a cheerful, determined army, over slippery, treacherous native roads and paths, unable to see where they were going or what was ahead, not knowing whether they would be back home within a few hours, a few days—or ever. And they did this night after night.

Some of the landslides took place miles and miles from the nearest settlement, which meant a long and arduous hike before the work itself was tackled. The trouble was hard to locate. Often the mountains, hills, and valleys had no name, and the place where a landslide had struck could be identified only by the milestone on the Road.

The only tools that the workers had were primitive agricultural implements, for the most part a kind of long-handled mattock used in cultivating the rice fields that they brought along themselves—and their two hands.

One of the hardest trials, particularly during the first year, was the trouble in preparing hot food. They had rice, supplied either by themselves or by the Administration. But

there was no way for them to cook it out there in the open country where everything was soaked from the rains.

Except for the times when we were able to send out emergency trucks with hot rations, sometimes in the beginning they went without hot food for the duration of the job. Sometimes they managed to get a little fire going under an umbrella. After we saw how hard this was for them, we prepared bundles of dry faggots tightly bound together and stored them under cover at strategic places, to provide them with cooking fuel. The sole exception was in certain parts of Yunnan Province, where there were caves underneath the hills in which they could sleep and do their cooking.

The only kind of clothing they had for protection against the elements was the straw hats, capes, and shoes that they fashioned with their own hands. Such flimsy garments did not do much to keep the wearer dry; and, since shelter of any kind was equally lacking, there were an alarming number of pneumonia cases.

All these discomforts were quite aside from the removal job, which in itself was dangerous and hard. The workers would line up along the Road and begin hacking away with their mattocks at mounds of earth and rock, proceeding with the utmost caution, for no one could tell when the next stroke would bring a fresh slide down on top of them, smothering them. For this reason they were always spaced far apart so that the fewest possible would be lost in any one slide.

While the stronger loosened the earth with their mattocks, the others carried it away. Some used wicker baskets supported by a thong across the forehead. The older women who were too weak to handle a basket carried earth and stones in their aprons, and the children bore away what they could hold in their hands, climbing up and down slippery, rocky banks with such depths yawning below them that one

misstep meant death. By this work of many hands mountains were moved a few cubic inches at a time.

Often in a rocky district the landslides filled the Road so that there was left only a narrow space in which the laborers could operate, balanced precariously above a precipitous edge. That was bad enough for the men who had to swing their implements under such conditions. But it was particularly tragic for the older women whose feet had been bound from childhood and who therefore had trouble keeping their balance under any unusual circumstances. More than a few of them fell over the cliffs.

One could never know when the next slide was coming, and some workers were buried under masses of earth and rock. Attempts at rescue were strenuous but too often futile. A man could not live for long, particularly in the all-pervading muck, which was almost like liquid.

One of our engineers told me what it was like to be buried in this fashion. He had gone out to inspect a fresh slide on one of the muddy mountains. The checkup had just been completed when he heard the warning cry; another and greater slide was just coming tumbling down. The official in charge on such projects always carried a long bamboo pole, topped with a red flag, signifying that he was the man to whom to turn for instructions. That pole proved to be his salvation. The new slide was not deep, and the others knew at once right where to dig for him.

Almost immediately, he was extricated, but already there had been time for him to experience at least some of the sensations of suffocation. At first, he said, there is a rather bad shock. Then, as breath is cut off and one begins to lose consciousness a rather soothing drowsiness sets in, followed by total blackout. It relieved me somewhat in thinking of the poor workmen who had lost their lives to know at least that

the horror of this manner of dying was not so great as might be imagined.

As a rule the laborers worked barefoot, exposed to the bites of myriads of little-known insects infesting the roots, rocks, and newly turned earth, bites that were painful, dangerous, and unpredictable.

While making an inspection trip along the Road from Mangshih to Paoshan, I learned just how serious such apparently trivial bites could be. I was wearing open-topped boots, and the mud splashed into them freely, but I paid no attention to it. After the day's work had been finished, when I was getting ready to leave, I learned that two doctors were going my way up the Road to the hostel where we planned to spend the night, and I offered to give them a lift.

That coincidence undoubtedly saved my life. By the time we arrived at the hostel, I was feeling cold all over and had begun to ache in every joint. Then came the fever, and by night grave illness had set in.

There was no clue to the trouble. The doctors began to examine me and saw that one foot was red and swollen from the bite of one of those poisonous insects. I laughed, thinking that was nothing at all. But they told me the poison had entered my bloodstream, causing a serious infection. All night long they worked over me, and it was not until morning that they could assure me I was going to live. From that time on, I never again took a light view of insect bites.

After the first year, when we had become aware of the dangers from pneumonia, insect bites, and infections, we ordered 1,000 pairs of rubber boots. When they arrived, it was found they were not well assorted as to sizes, and a good many workers had to wear two boots for the right foot or two for the left in order to get their proper sizes.

With all these discomforts and hardships, I never heard anyone utter a complaint. When I stopped to chat with the

workers, they never said to me, "I am tired," "I am so wet," or "I am so cold." Rather, they invariably declared, "I am ashamed that I have been able to do so little," "I am afraid you will not be very well satisfied with my work," or "I wish I could have more to show you."

In spite of the conditions calculated to put a severe strain on the best of tempers, there was never any quarrel, any dispute or sharp words. It made me realize that the Chinese are a people filled with resolution and enthusiasm for difficult tasks.

The full measure of the handicaps under which our people labored was brought home to me by a comparative situation, several years later. In New York, there had been a moderate snowfall. I went up Fifth Avenue from Washington Square to Central Park. Within that distance, I counted twenty-five Diesel-driven bulldozers and many, many dumping trucks. Talking with the men who were clearing away the snow, I noticed that they were all suitably dressed for outdoor work, with thick jackets, woolen sweaters, and heavy leather gloves. I estimated it must have cost at least $50 to outfit one of them, a sum that could equip no fewer than thirty Chinese workers. Yet, with all this modern machinery and well-equipped labor force, working on a smooth level surface, it took some hours to get the Avenue clear.

Think for a moment of a Fifth Avenue, smothered not with snow, but with a torrent of boulders and mud. Think of it not as a level surface but as a steep and uneven highway winding above the edge of a rocky precipice. Think of what it would mean to clear this all away without bulldozers, without trucks, but with men using hoes, women and children carrying off the dirt in their hands. Think of workers who had walked miles through the mud to get there, who had gone with little rest, who had to cook their own food if they could find a way to do so, after they were through for

the day, and who had slept for the night on the sidewalk. Multiply this several hundreds of times to equal the length of the Road, and you have roughly the equivalent of what our workers achieved.

But in time, as I had predicted when I asked the workers to look at this job through a telescope, the morning of accomplishment did dawn. As the years passed, all the mountains that had it in mind to slide down did so. Those which had not yet slid, but looked as though they intended to do so, we pulled down before they could start of their own accord. Thus, by 1943, landslides were no longer a major concern.

Statistics of the amount of earth cleared away tell this story better than words:

1939	475,000 cubic yards
1940	180,000 cubic yards
1941	291,500 cubic yards
1942	95,060 cubic yards
1943	29,460 cubic yards

In the fifth year, the total amount of landslides had fallen to some 6 per cent of the total in the first year.

We had come through from the first bitter period when everything was new to us, when we had no experience, no equipment, few laborers, and few facilities, to the sweet period of little difficulty that we hope our successors will be able to enjoy henceforth.

Chapter Seven

TROUBLESOME ROCK

FOR some 250 miles, or a little more than a third of the total distance, the path of the Road lay through solid rock and had to be cut to a depth of 10, 20, or 30—and at some points over 100—feet. We had only a few rock drills; the Chinese workmen did not understand how to operate them, and in places the rock was so hard the drills could scarcely make a dent in it.

Except for the sections where it crossed the flatland, the Road, with its innumerable hairpin and corkscrew turns, had to be hewn from this rock and in some places cut right into the face of vertical gorges.

We had no dynamite, as I have noted, and could use only gunpowder of a very mediocre quality. For that reason, we could not drill the holes for blasting very deep, not more than 1½ or 2 feet, at the most. If we had drilled any deeper, the weak charge would have gone straight up like a rocket, without causing any dislocation. Therefore we had to make thousands of small blastings, averaging at least 5,000 a day.

All this was so tedious and troublesome that it worried us for 4 years. We never had enough men or enough money. Construction was never up to standard and always behind schedule. Even with the heartbreakingly slow pace, though, we never stopped and never let ourselves become discouraged. At the end of the 4 years, it was done, at an expenditure of more than a million dollars.

There were several spots that presented their own particu-

lar difficulties. One of these was a stretch near Hsaikwan where the rock—granite, sandstone, limestone, and white quartz—was of the peculiarly hard type usually only found in geological museums. Another was a vertical cliff of hard gray limestone about 200 feet high at Yipinglang, about 80 miles west of Kunming, that required the most delicate treatment. The cliff had many fractures within and was interlaced with frequent mud veins. Because of these fractures and veins, we would sometimes blast loose a big piece of rock weighing 40 or 50 tons, which would go hurtling down onto the Road below, killing workmen and smashing the Road itself; or if it missed, it would often break the even outer edge, also ruining the Road.

When we were cutting through rock, the first step was to mark out the course to be followed. The next step was to chart the holes to be drilled for the blasting charge.

This is a science in itself, for the area to be blasted can be calculated according to the placing of the holes, which are always arranged geometrically in relation to the nature of the rock. By proper calculation, a large area can be loosened in five or six blastings.

The great master of this science was an old chief of a small village in the neighborhood of Paoshan who had retired but came to lend us his help simply out of good will. We used him then mostly for cutting rock for the foundation stones and surfacing. When we later had to destroy the Road to keep it from falling into the hands of the Japanese, as will be described in a later chapter, this patriarch again volunteered his help and supervised the setting of the charges under gunfire.

He had had a good deal of experience on the construction of the Indo-China Railway. Whether he knew schoolbook geometry or not I couldn't say. He seemed to make his calculations only by eye and with great rapidity, but they were

faultless. He was a very courteous gentleman with a rich literary background and was greatly appreciated by the engineers. He used to say to us, "If you people who work in good offices and live in elegant houses can come out here and do this hard work, the least we can do is to apologize to you by performing to the best of our capabilities." That he always did, in good measure.

Next came the drilling of the holes, which was done with repeated blows of the 5-pound hammer. One man held the iron bar, surrounded by straw to protect his hands from the shock and vibration when the hammer struck. Two men hit the rod with the hammers in alternate strokes. Then after each blow the man holding the rod would give it one turn so the hole would go down evenly.

In blasting, serious complications ensue if the dust and chips are allowed to accumulate in the hole. When a modern pneumatic drill is used, the air stream blows the dust away as it cuts. This does not take place in hand cutting; but these artisans had their own way of getting the dust out, which was to use a homemade contrivance built around a Chinese coin. It was primitive and tedious in the extreme, but it worked for them.

The Chinese coin had a slot in the middle so that it can be carried on a string. The native method was to run a bamboo stick through the slot and bind the loose ends over the edge of the coin to form a crude but sturdy plunger. After every forty blows of the hammer, the accumulated dust was lifted out of the hole with this plunger, almost grain by grain. The holes naturally had to be kept dry. In blasting during the rainy season they were drilled under an umbrella tall enough to allow for swings of the hammer.

Once the hole was drilled to the specified depth, the fuse, encased in bamboo to ensure against its being broken when

the powder charge was inserted, was set in the hole and gunpowder was tamped down around it.

Setting the fuses was a ticklish business. They were never more than 2 feet long, which meant the spark would reach the powder charge in something less than a minute, for they were like the fuse on a firecracker and burned just as rapidly.

Multiple charges had to be set off at once or the pattern would be incomplete, and there was no chance to go back, for as soon as one charge went off the air was filled with flying rock.

When a hole had been prepared for blasting, it was covered with straw, both to protect the powder from moisture and to serve as a signal to the man who was to set the fuse. It took sharp eyes to detect that heap of straw in the midst of grass or underbrush around it.

All the powder men came from Paoshan and knew their trade thoroughly. We kept four gangs working, of five men each. One man in particular was a virtuoso. I have seen him touch off as many as thirty of these short, sputtering fuses in a batch, in terrain so rough and slippery that I could scarcely walk over it, let alone run. He scrambled nimbly on all fours from one hole to the other, covering them all in a matter of seconds, never missing a hole, never making a single misstep, for just one would have meant the end of him. This remarkable proficiency earned him a bonus of 40 cents a day.

The most trying of all the rock-cutting jobs was in the gorges running back from the Salween, where we had to cut one hairpin turn after another out of the sheerest cliffs, taking the Road up from 2,000 feet above sea level to 6,800 feet within a distance of 18 miles. The climate was bad the year around, either unbearably hot or miserably wet. Meat spoiled just in being brought down from the top of the gorge to the

level of the river. All materials had to be transported from far away, and there were never enough.

Since the work had to be carried on at so many points simultaneously, we had to employ a large labor force, using ten, fifteen, or twenty thousand workers at a time. Consequently we had to far outrun our small supply of skilled workmen and use many untrained laborers for this exacting task.

Aside from the experts from Paoshan, the workers were largely unknown to us. A wide differential existed as to both hazard and difficulty in the jobs to be done, depending on whether the rock was to be cut near the top of the gorges at dizzying heights or lower down where the terrain was wide and even enough to assure a foothold. The workers themselves also varied in capability; some, who had come from districts where life was easy, were soft; others were weak, owing to their poor nourishment; still others, whose rice fields were on the mountainside and who had lived hard lives, were tough. It would have taken us months to get to know all their individual merits and to assign them properly.

They all simply distributed themselves, in perfect agreement—without any argument or dissatisfaction—the soft and the weak content to work on the easy places, the rugged people taking pride in the fact that they were assigned to the danger spots. They trained each other. The experienced rock cutters taught their skills to those who had no knowledge, and they in turn passed the lore on to their followers.

Working aloft calls for special experience, which these workers had never had the opportunity to absorb. Even the trained men who had built pagodas had seldom worked more than 130 feet above the ground, and they also had to acquire the knack as they went along.

Special qualities of temperament are likewise needed—good judgment, imagination, initiative, and at the same time abso-

lutely no nerves. I am a pretty good athlete, but just to climb around the gorges was about all I could do. If I had been one of those workmen, I doubt if I could have earned so much as a grain of rice a day. Skilled as they were, they could easily have had much better paid and safer jobs, but they remained voluntarily, for the sake of China.

In cutting the turns into the side of the steep and vertical gorges, the men were suspended on platforms from the top of the cliff. Just to sit there, hanging out in space, in the midst of that vast and weird silence is an ordeal in itself. Anyone whose nerves were less than iron would hurl himself to the rocks below.

Imagine then, not only sitting there, but holding a steel rod against the cliff to chisel the hole for blasting or swinging a 5-pound hammer with both hands. After the hammer strikes, there is naturally a recoil, to which a man has to learn to adjust himself, or he will be quickly toppled off balance.

The blasting operation was, of course, even more precarious. Here, on the side of the gorge, many holes had to be blasted at once, all in a geometrical pattern, just as on the ground. Not one operation, but many, were involved. The gunpowder had to be tamped in, the fuses set, lighted, and fired. All these things had to be done on the perpendicular.

The men learned to move sideways with their feet braced against the cliff just as nimbly and quickly as though they were on level earth. Everything had to be done in split seconds. As soon as the fuses were all ignited, the man who had set them tugged on his rope, and the others at the top of the gorge would give a quick turn on the hand winch to jerk him upward out of the path of the blast.

In spite of the narrow margin of time, it was usually successful, because a blast ordinarily goes off downward. But sometimes, because of an unpredictable fissure in the rock,

the charge goes off upward. Then there was emptiness at the end of the rope.

The carving of the turns in the gorges above the Salween was the masterpiece of the Road, from the standpoint not only of rock cutting but of engineering as well.

Another condition that had to be overcome was less spectacular but even more exasperating. Some of the terrain was neither rock nor soft earth, but somewhere in between, a kind of hard mud with the consistency of India rubber, as smooth and unyielding as a diplomat.

No less than 60 miles of the Road were cut through this mud to an average depth of 100 feet, calling for the greatest amount of handwork in the entire construction, even more than the cutting of the rock.

We tried at first to get an excavator; but we found that it would have taken one of at least 100 horsepower to be effective against this earth; and, since one of such size would have been too heavy for the bridges to bear, nothing remained but to hack out the earth with picks. Anyone traveling over the Road today can still see the evidence of this job in the millions upon millions of pick strokes still visible in the embankments, especially in the rainy season, when they are wet and shiny.

We thought at first that the mud would be fairly easy to dig out after the rains. Our surmise proved true of only a few inches at the surface. It was so compact as to be practically waterproof beyond that depth. It must be very rich in iron or aluminum oxide.

Here was no chore for women and children. The picks could be swung with effect against this stubborn earth only by the strongest of men, and even then it would yield at the most no more than half a cubic foot at each stroke.

Remember, too, that this was done not at ground level but against banks 100 feet high. A series of stepbacks was cut

into the cliff, and from the stepbacks in turn were erected tall bamboo ladders. Those ladders were so flimsy, with so much play in them, that anyone who was unaccustomed to them could hardly keep his footing on the rungs, let alone swing a pick. Yet the laborers, working barefoot, managed to strike hard enough blows to gouge the way for the Road out of the rubbery earth.

The mud did have its consolations. Once it had been dug out, it was ideal, because of its stickiness, for mixing with stones for the surfacing; and it never gave us any fear of landslides.

Chapter Eight

BUILDING OF THE BRIDGES

THREE towering mountain ranges, projections of the Tibetan highland, lay across the path of the Road, causing us endless complications because the ranges ran east and west and we had to weave the Road around them, with many curves and turns and gradients.

Between the ranges were three great rivers—the Salween, the Mekong, and the Yangpi—and to span those was no less challenging. All the rivers had unusual drawbacks to bridge-building. To begin with, they are all so relatively close to the source that they are inordinately swift, the current running from 5 to 12 or more miles an hour. In all places, they are either too deep or too shallow to be suitable for construction; and, in the Salween and the Mekong, the river bottoms are all of solid rock, consisting of layers of hard limestone, with the strata lying at different angles.

The quickest way to bridge these rivers would have been to set piles. Because of all the obstacles, however, there was no chance of it. We had no pile-driving equipment, for one thing; and, even if we had been able to set piles, the swollen tide of the river in the rainy season carries huge roots, tree trunks, and boulders hurtling along with it, which would have smashed the piles to splinters in no time at all. We were left with no recourse but to build single-span suspension bridges, the longest of which was 410 feet. In this remote section, that prospect posed serious problems. Aside from

these, the Salween presented hazards of its own, of a psychological as well as a physical nature.

The Salween, to my mind, is one of the strange places of the world. It casts an eerie spell over the spirit, so intangible as to elude analysis but so real it fills one with an uncontrollable impulse to leap from the cliffs into the swift waters.

Height in itself does not as a rule terrify me. But standing on the banks of the Salween, I have scarcely been able to resist the desire to hurl myself to destruction. It affected the workers; it even affected the truck drivers as they passed through.

The spell of the Salween is compounded of sight and sound and atmosphere. Strangest of all is the sound. The roar of the river in itself grates on the nerves. It comes not in a soothing monotone like Niagara Falls; but, owing to the bends and turns and the unevenness of the river bed, it rises and drops, ever changing in tempo and intensity, until it resembles the threatening snarl of some aroused beast. Its name in Chinese is Luchiang, which means "Angry River."

At the same time, because of some curious acoustical quality of the gorge, one can hear from far away the tiniest sound, a bird singing in a distant treetop, or the snapping of a twig. By the time those noises reach the ear, they have been magnified out of all proportion and are no longer familiar, comforting, and natural but have been transmuted into such unnatural echoes that one grows tense, with all senses alert, feeling the impulse to cry out, "Listen! What was that?"

The very sight of the region is disturbing. Except for a short period at noon when the sun penetrates deep into the gorge, it is in perpetual twilight. The predominating color is black—the black of the jutting limestone rock. Everywhere the eye meets striking vistas—on either side, cliffs reaching toward the sky, studded with trees growing horizontally out into space, and unexpected patches of luxuriant jungle;

below, the gleaming waters of the river, bright blue in the dry season, yellow and muddy during the monsoons. Over everything is the moist and sticky blanket of tropic heat, the vapor always hovering in soft steaming clouds above the water.

After experience with these phenomena, it is easy to understand why the Tibetans are so deeply religious. Here a human being seems as small as a grain of rice. Whether a man believes in God or not, in such surroundings he cannot help coming to full realization of the overpowering mystery and magnificence of nature.

Although the Mekong River differs from the Salween in many respects, the terrain on both banks is so curious and the cliffs are so high and overpowering that the same atmosphere of mystery is dominant. During the many afternoons spent on its banks, pondering the possibilities for bridge construction, I could not help but feel it. Suddenly, out of nowhere, a cold wind would come up, making one shiver. That wind and the roaring of the river combined to create an eerie sensation.

The butterflies and the crying birds that abound here are also peculiarly affecting to a Chinese. These are the two symbols of departed souls that are traditionally used to decorate funeral screens. The butterfly is the visual representation. According to the old Chinese belief, the butterfly is the soul forever dreaming, dreaming of his home, thinking of how to get back there. The profusion of red and yellow flowers growing wild and the blossoms in the vegetable gardens attracted the bright-colored butterflies in swarms, so that sad reminder was always before me.

The crying bird is the representation of the departed soul in sound. A species of partridge, it gives one anguished cry after another, mounting steadily in intensity, until it is exhausted. That mournful cry is likewise an allegorical expres-

sion of the yearning of the lost soul to come home again. It is often heard in the middle of the night.

One can easily imagine the effect of such sights and sounds with all their connotations ingrained from childhood on any man who was far from his family in that lonely wilderness and bearing a heavy burden of worry. Believe me, it created a homesick feeling of a very special kind.

Because of the pressure of time, Mr. Hsu Yi-fang, the engineer in charge of bridge construction, had decided to build all three bridges simultaneously. It would have been a much easier task to erect one bridge at a time, but that was not possible. The urgency to get traffic moving was too great.

Mr. Hsu had nothing, no materials, no blueprints. He had to start from the very beginning with the first step, the drawing of the plans. Departing for Rangoon, he made his way on foot and with the help of a sedan chair over the mountains and through the jungles to Wanting, whence he was able to proceed by car.

At Rangoon, he moved right into the factory and made his living quarters there. A bed was set up for him in the office, and he was served his meals in the plant. He never left the premises. He drew, drew, drew, day and night. When he returned to the bridgehead, we found that he had not even had time to learn the name of Rangoon's main street.

His earnestness and devotion made such a profound impression on the Chinese at the factory that they went out of their way to give him everything he asked, charging him the lowest price for blueprints, filling all orders in the shortest possible time. Their impression of a Chinese officer, gained from contact with the expatriate Chinese, was that of a person who lived in luxury. Here was a man who worked ceaselessly with no thought for his personal comfort. It opened their eyes. Hsu had never had the advantage of education abroad, but he knew his job better than many returned Chi-

nese students; he was a great diplomat and expert in human relations as well as an engineer.

Months went by, and at last the materials began to pour forth from the factory, all designed by him, all cut to exact specifications, a multiplicity of parts—beams, steel rods, wire ropes, cables, etc. It was easy enough to transport the materials from Rangoon to Lashio by rail, but there remained a distance of some 300 miles of rough country between Lashio and the bridgehead to be negotiated.

They could only be carried over the rough jungle paths by workmen on foot. Hundreds of laborers made the journey bearing the lighter beams and the rods, and pulling the cables along after them like a snake.

The big I beams, being too heavy for humans to carry, were loaded on the backs of mules all lashed together to keep them in position. The trail, however, was rough and steep, and many of the poor animals, seasoned though they were, slipped and fell to their death. Accidents befell the men as well as the animals. Nevertheless, after many days on the road, the sorely needed materials reached the bridgeheads.

To build the bridges even in the face of the natural obstacles that confronted us would have been no great trick in America or Europe, where we could have had the use of all kinds of equipment for every special purpose. Here it had to be done without any such advantages.

At the very least we needed trained bridgebuilders for the job. The only experienced bridgebuilders in Free China were a few groups living near the Yellow River who had built the railroad bridges there and some Shanghai engineers who had built a famous bridge over the Chientang River for the Shanghai-Ninpo railway. How to locate them, round them up, and get them out here without losing valuable time?

We had decided to make a try, anyway. But obviously the work could not wait on their arrival. It was necessary to pro-

ceed without further delay. A few skilled workers were finally found and brought out in time to help build the last of the bridges, fine modern structures, up to date in every respect. But many months before they came, the rivers were spanned and trucks poured over the bridges.

Endless discussions were held between the engineers and the village chiefs and old men of the neighboring districts as to the best methods of bridgebuilding. Many deadlocks were encountered with heartbreaking delays.

We started the bridge construction by building high embankments and foundations for the suspension-bridge towers. First of all, deep holes were dug in the river bed for the foundations. To do this we had to build a cofferdam around the place where we were going to dig and pump the water out.

The pumping was unique. Of course there were no modern implements. We used such a collection as has probably never been seen before, of every conceivable description—old, hand-operated bamboo plunger pumps of the kind they used on the farm to pump out the rice fields; pumps consisting of a series of wooden buckets on an endless chain operated by a foot treadle; antique bronze pumps borrowed from the fire brigades of the old cities like Paoshan. All of them together were still not sufficient, and we had to organize a bucket brigade to pass the water from hand to hand.

It was a queer sensation to look down on this pumping operation from the top of the embankment; the workmen looked like so many ants, busily constructing an anthill. The cofferdam was of necessity crude, because we had no suitable materials, and it leaked water in almost as fast as we could get the water out using every means. The work of pumping had to be kept up day and night without cessation. Having no modern illumination, we burned vegetable oil, which shed about as much light as the end of a cigarette, and the work

went on, nearly invisibly. The men had to perform their tasks almost by feel. All sight was drowned in the dark; all sound was drowned by the roar of the river. The engineers worked steadily, shift after shift, supervising from the bank at the top of the dam. The pumping had to be kept up to the very last minute, even after the foundation had been poured and while it was settling. We had no cranes or other equipment, and every rock for that foundation had to be laid in place by hand. Because of the slanting walls of the dam, there was no chance to use pulleys, and every rock was also carried to the base by a workman making his way barefoot down the slippery sides. Some of them lost their footing and suffered fatal falls.

As soon as the foundations were completed, the building of the masonry bridge towers was begun. At the top they were capped by grooved saddles over which the cables would be passed.

Now we faced the most puzzling dilemma of all, the business of getting the cable across the river. It was not so hard to transport the workmen and engineers, for at some distance up- or downstream there were places where the current was gentle, not more than 2 miles an hour, and they could be rowed over in bamboo ferries. But at those points the river was naturally very wide. In order to avoid building a long span that would have called for scarce and precious materials, the bridges had to be built at the places where the river was narrowest, but at the same time the swiftest and most dangerous.

First of all, a thin, strong hempen cord would have to be brought across the river. It could be used to haul the cable over from the other side. Theoretically, workmen could have ridden over on a bamboo raft, guided by a rudder set on the diagonal, with the component force of the current acting on the rudder to push the raft across. However, this component

force in that fierce current would prove so strong that the boat was likely to strike the opposite bank with such force as to dash the boat to pieces, or at the very least, knock the men overboard into the water.

Nothing remained, then, but to use the method employed by the local people for years in the building of iron-chain suspension bridges, which was for a man to swim the river with the cord.

The engineers conferred with the magistrate of the district. He sent out the call for volunteers for this suicide work, and he did not lack for candidates.

Most of the workers were farmers by trade; but there were some villagers among them who, brought up near the river, were experienced in handling themselves in its tricky current. They would start out far, far upstream and would be swept a long distance down with the current to make a little headway across.

Their burden, a cord over 300 feet long, had a swimming area greater than that of a man. Furthermore, as it paid out it became wet and a dead weight. Now, how to hold this rope? The Western method would have been to bind it around the body. That would make swimming harder, though; and, if the swimmer got into trouble, he could make no progress. So these men held the cord between their teeth. When matters got beyond control, they could let go and fight for their lives.

Nevertheless, in spite of this precaution, one swimmer after another was swept away by the current. The most dangerous moment came at the very end, when the swimmer faced the peril of being hurled on the jagged rocks of the opposite bank by the powerful current. Many failed before they reached the bank; some were dashed to death on the rocks.

As fast as one failed, another would step up to take his

place, not out of daredeviltry, but simply convinced that his predecessors had made some unnecessary mistake and that he could succeed where they had failed.

The engineers became greatly concerned when they saw how hard this task was proving to be and offered their suggestions. But the old man of the village sat imperturbably on the bank, watching the swimmers, shouting out his directions. He simply said to the engineers, "Don't disturb me. Bridgebuilding, *you* understand. But this *I* know. I was doing it before you were born. Just leave everything to me."

Eventually the cord was brought safely across the river, and after that it was comparatively easy to pull the cables over. Then it was possible to proceed with the construction of the bridge itself. The first thing needed was planks for the flooring. But these had to be of good hardwood. The only wood that abounded in the district was pine.

These pines always grew crooked, bent by the winds of many years. There was a twist in the grain, which is very bad in a suspension bridge; for when the planks turn they will twist the rods also, and an unequal stress will be produced.

We decided to seek a good hardwood and settled on using chestnut. But nobody, not even the natives, had any idea where such trees were to be found. The Yangpi district is famous for its chestnuts, but that was too far away and too inaccessible to be of any help.

We dispatched search parties to go out and look for the trees, equipped only with a knife for protection against wild animals and with an ax. Some were gone for many days. Some never returned. But presently a few began to drift back, bringing trees along.

They accomplished it all by being clever enough to use the force of gravity. Only the trees that grew in high places were chosen. Trimmed of their branches, the trunks were

rolled down the mountainsides near enough to the bridgehead so we could go out and bring them in. The timber next had to be cut to uniform planking, with only a handsaw. When I passed over the bridge for the first time, I was impressed by the planks, which were as smooth and polished as a parquet floor. When I was told that they would not float, I couldn't believe it; but when the bridge was later bombed they sank like so many stones. I believed it then. After that, the bridgebuilding proceeded rapidly. Many cables were brought across, and the rods that were all ready and cut to size were installed.

The bridges were built convex so that they would level out under the weight of a truck, and all were strong enough to carry a load of 10 tons. For the sake of safety, only one truck was allowed to pass over them at a time.

As soon as construction was finished, I took it on myself to make every preparation possible for future bombing. This was early in 1938, and everybody laughed at me for being overapprehensive.

"How," they said, "can Japanese planes fly far enough from their bases off in Canton or Siam to bomb bridges here?"

At that time, it was beyond expectation that France would be forced out of the war so soon and the French Indo-China Railway be so quickly cut off. However, I believe in the old Chinese proverb, "If everything is well prepared in advance, you will have no worry in the future." Then in June, 1940, France fell and the railway was cut. China now depended on the Burma Road. The trickle of trucks grew to a torrent, carrying the vital goods of war. If the bridges were bombed now, and traffic interrupted for any length of time, the consequences would be serious indeed. We were ready. We had prepared complete sets of all parts, which were, in effect, many complete duplicate bridges.

Because there were a number of different crews each speaking their own dialect and we had to make certain that they would be able to assemble new bridges in a hurry, a number, keyed to a master blueprint, was painted on every part so that any worker could tell at a glance where it was to go. Then the spare bridges were stored away in crannies and gullies along the gorge out of sight of the Japanese.

Every important nut or bolt that was to go into either suspension or pontoon bridges was precision-cut to a fine degree of accuracy in machine shops, which were erected near by for that particular purpose, and all metal parts were well coated with grease. Any study of human nature shows that, when a man is in a hurry, he will get nervous; the slightest impediment will enlarge into a serious obstacle, and confusion will follow.

Our men were working in such a hurry to get the bridges restored that any difficulty in turning a bolt might have become serious and blocked the rest of the job.

Special emergency corps were organized for each bridge with mobile units that were really machine shops on wheels and contained complete repair equipment as well as generating sets to provide their own power and light.

All preparations were made on the assumption that every raid would demolish a bridge entirely. If the bombing accomplished anything short of it, that was our good fortune.

Auxiliary suspension bridges were also built over the Mekong. One of these was an old-style, hand-wrought iron-chain bridge; the other was an up-to-date steel-tower suspension bridge 410 feet long.

The latter was erected by the experienced bridgebuilding gang that had put up the Chientang River Railway Bridge. This was one of the groups we had been trying to locate for so long, and we had finally been able to bring them out to help us. They were a great crew, northerners all, lusty and

brawny and fearless, but at the same time rather wild and hard to control.

This bridge had been designed and constructed by Mr. Chien Chang-kan, an American-trained Chinese engineer, and it was a master work. Not long after its completion, it was bombed and almost totally destroyed. Chien was in Chungking at the time. As soon as word reached him, he boarded a plane to fly to Kunming to supervise repairs. Unfortunately, his plane was shot down en route by the Japanese, and he was killed. Thereafter the restored structure was named "Chang-kan Bridge" in his honor.

The first bombing came on October 20, 1940. Between that date and February 12, the Mekong bridges alone were bombed fourteen times.

The Japanese always dropped their bombs between noon and one o'clock. There were a number of reasons for this. It took the planes several hours to reach the bridgeheads from their bases in Indo-China. The cliffs rose very high and steep on both sides of the river, and it was only for an hour or so around noon when the sun shone straight down into the gorge that the fliers had a chance to pick out their targets. At other times, the bridges were shrouded in mist and shadow.

Thus it was possible to anticipate the attacks. Every day we were prepared—the staffs of engineers, both mechanical and civil, assembled; the foremen and the workmen at hand; the mobile repair units and even mobile kitchens to provide hot food all ready to roll. Sometimes they did not even wait for the attackers to pass but were out on the bridge and at work while the bombs were still falling. It was a highly dangerous undertaking; but all through the period of the bombing, in spite of the hazards and the losses, we were able to keep the suicide bridge-repair gang up to the full strength of

about 200 men. They were mostly the hardy gang from the region of the Yellow River.

Such swift repair work would have been impossible without the system of numbering materials. The engineers, like the workmen, spoke different dialects. Technical terms are not standardized in China, varying from one part of the country to the other. It might have taken hours simply to explain what parts were needed. By referring to the numbers, the storekeepers could pick out the parts immediately and without any risk of making mistakes.

The shortest time for getting a bridge repaired was just 1 hour; the longest was 5 days, 10 hours, and 50 minutes. In the long period, we built almost a whole new structure, including foundations. Once, when the Salween bridge was knocked out completely, the Tokyo radio announced that it had been damaged beyond repair and went on to exult that the Burma Road would now certainly be closed for 3 months at the very least. The Ministry in Chungking was perturbed by the broadcast and dispatched an urgent telegram asking that everything possible be done to get the bridge rebuilt and traffic reopened. By the time the message was received, trucks were already moving once more across the river. The bridge, after having been almost totally destroyed, was restored in exactly 1 day, 11 hours, and 35 minutes.

Then came the blow. The first truck to pass over the bridge after it was reopened was not carrying war goods at all. It was a private truck loaded down with a valuable cargo belonging to a war profiteer. To see this, after the expenditure of such unstinted energy, made the section engineer in charge of bridge repair sick at heart. The morale of all the workers was affected.

Not long afterward, the Generalissimo, in recognition of their accomplishment, sent a reward of $30,000 to be dis-

tributed among both engineers and workmen. There was much pleasure and appreciation.

Life was hard for everybody, aside from the dangers. The engineers, after supervising the repair work during the day, had to make out long, detailed, and accurate reports. This was just as well, for they were young, tough, and active and had no means of amusement. With eighty units on the Road, the Administration couldn't afford to supply them with radios or phonographs. Nor could they be expected to sit quietly in their huts of evenings with nothing to do. When they had finished their reports, I gave them one engineering problem after another to work out just to keep them busy and out of mischief.

Any little treat meant a great deal to them. One time we managed to locate a few pigs and sent them off to the workers at the Mekong to be cooked at the bridgehead. After the pigs had been dispatched, we suddenly remembered that we had forgotten to send any salt, and without salt their feast would have been incomplete. A workman was summoned, and the situation was explained to him. Evidently it was impressed on him too deeply, for he ran all the way, a distance of several miles, with the salt in his hands. By the time he arrived, it had all dissolved in the heat and perspiration. He was deeply distressed. After that, when we sent any pigs, we took special pains to see that the salt was included.

The bombing of the bridges brought one small blessing in its wake. The men had always assumed that there were no fish in the Salween. After the attacks, though, many strange fish appeared on the surface of the water, killed or stunned by the detonation.

Among them was a kind of streamlined trout, with very long, narrow heads, some weighing as much as 100 pounds. The fish were the same yellow color as the muddy waters and flecked with yellow and white spots like bubbles; hence it

was no wonder that they were hard to see. Their flavor was delicious, not unlike lobster. Fishing was now added to the slender store of possible amusements, and we encouraged it as a worth-while relaxation. The poor men had no fishing gear, but they had learned to be resourceful. Going up the river into a quiet water in a pool or underneath a falls, they would tie up the ends of their clothing and catch fish with the improvised nets.

All this time, traffic had been increasing steadily on the Road. In spite of the precautions taken to be ready, there were still too many interruptions because of the bombings. It soon became plain that we would have to take other measures as well, and to ensure a more continuous flow of trucks we decided to build a pontoon ferry.

Building any ferry out in this wilderness was something of a trick. We had a few naval architects who could prepare the designs, but there were no shipbuilders and no chance to get the materials for building a boat of the usual kind. The steel plates necessary for ordinary construction would have to be brought from far away, and they were too big to be carried on a truck. There wasn't even any wood that could be used. The pine would twist, and the chestnut was too heavy and was hard to get.

Not far from the bridge, however, there was a dump of hundreds of empty gasoline drums that had been abandoned by a transportation company. We had been looking for some way to get rid of that dump, for it was a potential magnet to draw the attention of Japanese bombing squadrons, who, after all, from that great height, had no way of knowing whether the drums were empty or full. Here, then, was our answer. We would use the drums to build our ferry and kill two birds with one stone.

The drums were arranged in a wooden frame, bolted into a shape like a boat, with a sharp prow at either end. The

next problem was how to propel the ferry across that turbulent river. The current was not only unusually swift; it swirled and eddied unpredictably along the banks. We had neither marine engine nor cast propellers; and a rudder would have been ineffectual against the force of the current.

We had, however, several Diesel tractors. We stretched 1½-inch cable across the river, suspending the ferry from it by lighter cables passed over pulleys to allow free movement. The current was so strong that the pulleys often jammed, and we finally had to resort to ball bearings.

Another cable was attached from either end of the ferry to a tractor on either bank. Because there was no space in which a tractor could move directly away from the river, a narrow stretch was cut along the bank, and the traction cable was passed over pulleys so that the tractors could pull the ferries moving at right angles to the river.

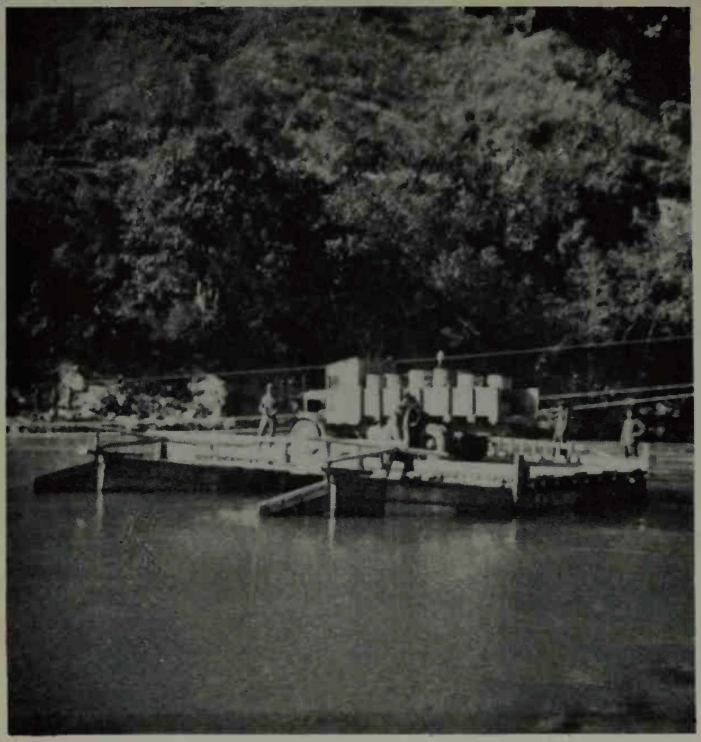
It took two tractors, one on either bank, to do the job. Their movements had to be carefully synchronized; while one pulled, moving the ferry across, the one on the opposite bank followed just fast enough to keep from being an extra drag on the tractor straining at the load, and slow enough so as not to allow any slack to come in the cable. Once the ferry had crossed the river, the process was reversed, and the other tractor did the pulling.

Our homemade ferry worked very well. The Diesel tractor had a high tractive force, and the ferry had a buoyancy of some 8 tons, which meant that we could carry two trucks at a time. The trip took 12 minutes each way. On days when the bridges were being repaired and the ferries were closed between the hours of ten and four because of the danger of enemy attack, we were still able to move 240 trucks across the Salween by this auxiliary transport.

The ferry ran all night long. The way for the trucks was

The clearing of a landslide with a bulldozer near Mangshih.

An asphalt road, suburb of Kunming.



A pontoon ferry on Mekong River made of gasoline drums.

Shan girls doing maintenance work near Mangshih.

brightly lighted by a Diesel generating set, mounted on a truck, which disappeared every morning before 8 A.M.

Even at this rate, traffic was not moving across the river fast enough. There was only one thing to do and that was to build an auxiliary pontoon bridge. The plan was to utilize the same principle employed in constructing the ferry. Again there was the question of materials. The obvious course was to use the empty oil drums, since there were plenty available. The engineers built pontoons out of the drums in the usual double-bow formation, suspending them downstream from a 2-inch cable. It worked all right for a few days; then the cable suddenly broke. Although a cable could support a single ferry, the weight of all the pontoons together in that swift current was obviously too much for it.

A number of cables together might have supported the pontoons, but there were none to spare, since they were all needed for the bridges. Any solution would have to come out of our own heads. I had been away on a trip to Chungking. Upon my return I pored over this problem for many hours without getting anywhere. Then, abruptly, there came to mind a picture I had once seen in *Popular Mechanics Magazine*. It was a diagram of the streamlined form, the basic principle of aerodynamics, which has a minimum of resistance.

In the office at Hsaikwan were stacks of old scientific magazines. A few hours' search brought its reward. There was the diagram, just as I had remembered it.

There was no tank in which to conduct experiments. But out in front of the building was a small stream, swift and turbulent like the Salween, at the historic spot where General Tsukao Liang had captured Mong Hwak, chief of the headhunters.

A collection was made of all the empty cigarette tins that could be found around the administration office. Then two miniature pontoons were built to scale, with the tobacco tins

in place of oil drums. One was built according to accepted principles, with the double bow; the other on the aerodynamics principle, in other words with a round head and a long tapering tail like an airplane.

The two pontoons were made fast to a cable across the stream. We tested the old-style pontoon first. Using only a small spring scale, I measured the pull. It registered 9½ pounds. Next we applied the same test to the pontoon built according to aerodynamics. This time the pull was only 6 pounds. On this small scale, it represented more than the necessary differential.

We had our answer. On the basis of this evidence, we went ahead with the construction of the new-type pontoon bridge. It worked. The use of the aerodynamics principle had lessened the strain sufficiently so that the 2-inch cable could be used with perfect safety.

As soon as this bridge was in successful operation, we started to build another one over the Mekong about a mile from the main bridgehead. But here the banks were so perpendicular and the malaria so deadly that it cost the lives of fifty workmen to build the branch road leading down to it.

With the duplicate bridges carefully hidden away, with the techniques perfected and enough empty drums constantly on hand so that a new ferry or pontoon bridge could be built within a day's time, we were now prepared for every contingency. Eventually the Japanese saw the futility of trying to interrupt traffic by destroying the bridges and abandoned their bombing attacks altogether.

At the Yangpi River, we had another kind of problem. Here, after traffic had been opened, the old stone arch bridge was smashed by roots in the height of the rainy season. The engineers were nearly baffled. The only possibility was to build a temporary suspension bridge with wooden towers. This they accomplished in 10 days, working the clock

around, soaked to the skin, getting the cables across the turbulent waters at flood tide with the help of suicide swimmers, just as had been done at the Salween and the Mekong.

Soon another permanent wooden bridge was built parallel to it. The bed of the Yangpi was of moving sand. Two Diesel excavators had arrived and been used as pile-driving machinery with a 1-ton hammer, capable of delivering 30 strokes a minute. Thus this job was accomplished with the high efficiency of modern machinery, at about one-tenth the cost of building it by man power alone, aside from the cost of materials. It was done with a consumption of only $80 worth of Diesel oil. The whole work was finished in 2 months.

This gave our engineers valuable firsthand knowledge of the use of Diesel-operated pile-driving machinery. Before the war, the only up-to-date pile drivers were used in Shanghai to build foundations, and these were steam-operated, clumsy, and inefficient. The rigs we used had the advantage of caterpillar treads; they were portable and handy. Such equipment should have an attractive future for all kinds of highway and railway construction and civil engineering work.

The bridges that have been mentioned so far were only the more spectacular high lights in a large-scale construction program, every aspect of which presented its own particular challenge. Consider culverts, for example. The engineers were inclined to look on the building of culverts as of secondary importance. But during the rains in this part of the world, the water comes down in pillars, and the drainage problem had to be attacked just as vigorously as the landslides.

While staying at Mangshih during the first rainy season after the Road was opened to traffic, I observed that, owing to inadequate drainage, great grooves were being formed in the Road from the rush of water, which also increased the danger of landslides.

Stone culverts could not be built at that time because of

the continuous rain and the shortage of suitable materials. Some sort of culverts had to be built immediately. There was nothing to do but resort to bamboo, using trunks that were about 6 inches in diameter. Not sturdy enough by themselves, they had to be laboriously shored up with bamboo twigs and branches. As soon as we had the opportunity, we replaced them with culverts made of stones and discarded gasoline drums. Eventually we were able to get corrugated sheet metal, which proved to be most satisfactory and was adopted as standard for all future construction on the Road. Altogether we built 4,558 culverts.

Besides the three big rivers, there were countless gorges and small streams to be traversed, which necessitated the building of 460 smaller bridges of all different types, totaling 9,500 feet in length. Among them were 142 stone-arch bridges of the kind one sees so often in Chinese paintings, always built in semicircular instead of elliptical arches. The semicircular arch is standard construction in the building of gates for cities and temples. It is never used in homes, because it is not considered lucky.

This type is known as "camel back." Even the railings are made of stone and often elaborately and artistically decorated, usually with carved lions' heads. The semicircular form was evidently selected because it is able to withstand the greatest pressure. We had to build the bridges to considerable height to accommodate the arches, but it was the only method the stonemasons knew.

A study of the history of stone-arch bridge construction brings to light the fact that the Chinese were accustomed to using mass-production and standardization methods centuries ago. Every city had to build a wall according to the size specified by the Emperor's government, and every stone was cut to a certain size. High expert officials were sent by the Emperor, either to carry out or to supervise the construc-

tion. They seldom used blueprints, usually working from models; and they built not only city walls but also temples and palaces, city-wall gates and pagodas, all precisely to scale. To every piece of construction material was attached a sheet of yellow paper bearing the dimension, the kind of material to be used, and the number of pieces required. In this way, with every part standardized and easily replaceable by another, the present method used in mass production of machinery was anticipated by at least 2,000 years.

This is shown by the fact that the Great Wall of China, built by Emperor Chin in 255 B.C., was completely standardized in construction over its entire length of 2,000 miles, the bricks at the eastern end being of exactly the same size as those at the western extremity.

The bridges were built with all the energy of which we were capable. But we were aware that our forebears had done even a better job, and one of their accomplishments is worth mention here. In 1908, a Manchu, General Shen Yuen, who was military governor of the provinces of Shensi and Kansu, built a modern steel bridge of cantilever type across the Yellow River at the northern gate of Lanchow.

It was all done within a budget of $400,000, which had accumulated from the income of the province. The long beams and the structural steel were transported from Hankow to Chengchow on the Peiping-Hankow Railway. For the last 900 miles, however, the materials had to be carried on camel back through mountain passes, with as many as sixty camels used to carry one beam. The bridge was 3 years in the building.

Governor Shen encountered endless trouble and opposition. The Mohammedans in the province opposed the project instead of supporting it, for they enjoyed a ferry monopoly on the Yellow River. The Governor left a stone tablet at the bridgehead on which he recorded the difficulties he had

encountered and his great disappointment. On that tablet, he wrote, "I hope that in the future the people will find this bridge of great use. At present my work is not appreciated."

As it happened, appreciation for his efforts came years after his death. At the beginning of the war when it was necessary to get munitions from Russia, the bridge was there for the country's use. It was in perfect condition after all those years, so thoroughly had it been constructed, without so much as a loose rivet. We praised his memory, for he had done a better job of bridgebuilding than we had, and not under pressure, but only out of his own devotion and consideration for the future.

But to return to our own bridges. At either end of every old, important bridge in most districts, there is a small temple to the bridge god. It is the custom for travelers to ring a bell as they pass and pay their respects to the god both before and after crossing over. Those who live near by also come to pay their respects on the occasion of the bridge god's birthday.

This system must have been devised by men of great wisdom, for through it the bridges are protected by the people themselves. It is the method the Chinese have always used when they want anything revered and guarded by future generations. That is the way the old padogas and the old monuments and temples have been preserved intact to this day.

Our ancestors were wise enough to realize that the use of force will never bring about this perpetuation. Once the force is released, the object that they seek to preserve will be destroyed by the people in their anger. Only by making them objects of reverence can they be maintained through so many generations. This is true not only of structures, but of customs, which is the reason why so many customs have survived over the years without any modification whatever.

Our men abided by this custom, paying respect to the

bridge gods as they passed over and also restoring old temples and monuments, many of which had fallen into a poor state of repair.

Looking at the matter from an engineer's point of view, I surmise that there must have been a great many accidents on the bridges, particularly on bamboo-rope suspension bridges, which are so flexible that one must walk at a certain speed, neither too slow nor too fast, in order to avoid trouble. That would explain why the bridge gods were held in such reverence. Perhaps it was easier to pay respect to them than to bring the state of the bridges up to safety standards.

An odd incident occurred, involving these bridge gods, which could not be explained by modern science. On the western bank of the Mekong, there had gradually grown up a small settlement, comprised of a market, houses for workers, a bridge guards' camp, and an administration office.

In its midst, there was an ancient bridge gods' temple. Repeated bombing raids completely wiped out the settlement. The temple too was entirely obliterated—roof, walls, sturdy tile, and masonry smashed to rubble.

The engineers went up afterward to examine the ruins; and there were the three bridge gods in the midst of all this destruction, absolutely untouched.

The incident made a profound impression on these men, modern, well educated, and scientifically trained though they were. They paid their respects to the bridge gods, then, not out of conformity to a custom, but with awe in their hearts.

I wonder how many travelers who will pass over these bridges in months and years to come, speeding on their way with modern comforts and conveniences at their command, will pause to ponder these rich traditions of the past, or the toil and effort that went into making the crossings smooth and safe for them?

Chapter Nine

A TRIP OVER THE BURMA ROAD

LET us take a trip over the Burma Road, so that the reader will have a more integrated impression of this region of contrasts in people and customs, in climate and landscape.

We shall start at Kunming, which is the eastern terminal of the Road. But first of all, let us get a more detailed picture of the city itself.

As has been noted in an earlier chapter, life in wartime Kunming bore no resemblance to the life in the old city. In all its years of history, it had never known anything like this.

Walking through the downtown district, one might think he was in Shanghai. Everywhere were men in Western clothes, women wearing silk stockings, high-heeled shoes and permanent waves, although the latter were expressly forbidden. The three items that everyone was most eager to possess were Omega watches, Parker "51" pens, and Max Factor make-up.

Some Shanghai people brought with them the so-called "modern" customs from the foreign settlements, which from my point of view are largely the bad habits of Westerners, distorted by having been copied incompletely. For example, according to the modern concept, Chinese wedding and funeral ceremonies, instead of being conducted to traditional music, now had to have a brass band. This practice led to extremes of incongruity and ridiculousness. The same sort of band played the same stereotyped, silly tunes whether at a wedding or a funeral. The bandsmen had their own distinc-

tive richly colored uniforms with no particular point to them. One band wore helmets of the sort that German soldiers used to wear in the First World War, not for any reason, just as a sort of professional curiosity.

As has been noted, there were people of all races: Americans, who were for the most part automobile merchants and radio men, and later an Air Forces unit; Annamese, who operated small restaurants and tailor shops, but most of whom were banana sellers; Burmese and Indians, who were largely truck drivers; a few French, who operated hospitals and a few hardware shops; and the Greeks, who ran hotels, restaurants, and bars.

And everywhere were the Chinese truck drivers. They were so distinctive in appearance you could recognize them a mile away. They all went hatless and wore chamois jackets—which they had bought in Rangoon if they were wealthy, in Tali if they were poor—and yellow khaki pants. In their trousers were big hip pockets, always bulging with bank notes below the short jackets. Nearly every driver wore an ivory ring on the third finger of his right hand, with his name on it. He was forever having to sign something, and this was his "chop," or personal seal.

Under the influx of the outsiders, the old Kunming, with its quiet leisurely life, marked by politeness and respect for the old Chinese spirit, requiring little struggle to make a living, had all but disappeared. The Kunming of the past, to me at any rate, was infinitely more appealing.

Physical characteristics of the old city, however, still remain. For instance, there is a "gold" palace outside the city, roofed with bronze tiles which are given some sort of coating so that they gleam like gold. There are also many pagodas built after the style of the Tang dynasty, 2,500 years ago, to preserve the bibles that were brought from India and Tibet for the Buddhist temples. Two distinctive kinds of

trees are found here. One is the plum tree, which goes back to about 700 A.D. and is so old that only a few branches still live, although the trees bear flowers and plums every year. The other kind is the very large cypress, planted about 1000 A.D.

In a northern suburb stands the remarkable Chungchushih temple. Few foreigners know it, for it is somewhat out of the way, and it is necessary to get government permission before one can enter.

Here are 500 statues of Buddha, named "Lohan," with no two faces resembling one another. They were all done by one man, a famous sculptor, without any model or basic design, entirely from his imagination. Yet they are all very well proportioned. He did no other work in his lifetime except this temple and another one in Chengtu. Yet scholars say that even this extraordinary work is inferior, that to see the best statues of Buddha, which were executed during the Tang dynasty, one must visit the country near the Kangsu oil fields.

Two lakes do much to enhance the scenic beauty of Kunming. One within the city itself, Chrysopraz Lake, has already been described. The other is Kunming Lake, just outside the town. This lake, which gave the city its name, is one of the most beautiful in China, with the blue mountains in the background, the fine old trees, and the soft mists rising from the water.

On one side are modern factories, the power plant and radio station; on the other are the old temples.

The lake also has a sad and significant historical interest, for it was responsible for China's losing our war with Japan 50 years ago. The Manchu Empress Dowager had long admired the lake and became so entranced with it that she ordered a replica built at the summer palace in Peiping, calling the imitation also Kunming Lake. To have it made,

she used the budget that had been set aside to build up our navy for the defense of the country against Japan, canceling a contract with a well-known British shipyard. As a result, when the time came, we had no strong naval defense.

Instead of building the needed warships, the Empress had a marble ship built on the lake with intricately carved paddle wheels and a mosaic tile floor. It was so accurately executed that it must have been designed by a skilled naval architect. I'm sure the Empress can't have had much fun out of it, for its speed was zero, and in summer the lake was alive with mosquitoes. But the poor country suffered for her extravagant whim.

Four miles from the city is the base for an American Air Forces unit. In the early days of its installation, the road leading to the airfield was slippery and rough. Whenever the alarm sounded, the American aviators and ground crew would drive over this road at top speed, unmindful of its perils, to get to the field and their planes as quickly as possible.

As a consequence, there was a disturbing number of accidents. In 1942, the Administration was therefore instructed to pave this road with asphalt, although it was quite outside our jurisdiction. The asphalt had to be brought from our supply at Hsaikwan, which was being used to surface the Burma Road. The gasoline to haul it to Kunming was so scarce that it could ill be spared, but this need was so urgent that we took it anyway. This road was paved within 2 months. It was of very shallow construction, owing to the limited amount of asphalt available, but it ought to last for at least 3 years.

Now we are ready to start out on our journey. We pass the zero milestone on the Road just outside the west gate and two pillars bearing the inscription, "Yunnan Burma Highway, Ministry of Communications." We drive along on a good asphalt road, which proceeds westward around Kunming

Lake to the hills beyond. A new suburb has sprung up in this district, since people of wealth have built bungalows to escape the bombing, and new hospitals have also been located here. The smooth asphalt road makes it possible for the residents of this district to travel back and forth between their homes and their places of business downtown in a minimum amount of time.

The country to the west of Kunming is relatively flat; rice paddies line both sides of the thoroughfare. The scenery is superb; there are many twisted pine trees, and the mountains tower in the distance. So far, it all seems like a quiet pleasure trip.

The first station that we reach on the Road is Anning, 20 miles to the west. The name, Anning, means "No more disturbance henceforth." In ancient times, this was the old suburban fort erected for the protection of Kunming. From Anning, a branch road runs off 3 miles westward to a beautiful nook in the mountains surrounded by forests where there is a hot spring, which has become a popular resort spot. A number of beautiful villas of modern design, including one example of Spanish architecture, have been built here. One of the most impressive is the home of General Lu-hang, Commander of the Yunnan Army, which has a huge hot-spring bath like a big indoor swimming pool with hot water from the spring running through it. It is all inlaid with white mosaic and surrounded with marble benches. The house, which is plain and simple, has a broad veranda looking out on a beautiful garden with many rare fruit trees. Near by is a great modern hotel with hot-spring baths and every modern convenience, run by a famous and energetic widow who also operates other hotels and a motion-picture theater.

It is a perfect place for relaxation, with a wonderful climate and beautiful surroundings, but unfortunately I never had

the opportunity to take advantage of its elegance even for one night.

Sixty-five miles farther west we come to Lufeng. This was once a military camp. A short distance beyond Lufeng is an almost perpendicular gorge by a small river. In this neighborhood the terrain is old hard gray limestone that cracks easily and caused us a lot of trouble in building the Road. Before the war, the highway was impassable here for at least 2 months out of every year because of mountain slides. In 1941, there was the big and disastrous landslide previously described.

The next town to the westward is Yipinglang, meaning "Undersea" in Chinese. Yipinglang is the most important center of salt production in Yunnan, providing salt also for Kwangsi and Kweichow provinces. The salt monopoly, incidentally, belongs to the government and is one of the biggest sources of revenue. Here are big modern salt refineries housed in brick buildings with steel windows and high chimneys, the most elegant structures to be found anywhere in the western provinces. There is plenty of coal available close by for boiling the brine, which is produced some 20 miles away by pouring water into deep holes reaching down into the salt veins. The brine is then pumped into a pipe line of giant bamboo joined with clay and wrapped with bamboo strips to prevent cracking, which carries the brine to the evaporating plant. Here the water is boiled off, and soda and other by-products are also derived. The solution is poured into open tubs, where it dries into half-round cakes as big as a man can carry. These cakes, each weighing about 150 pounds, are then strapped to the backs of runners, who carry them to Kunming about 70 miles away.

For some distance west from Yipinglang, the road is all soft weathered stone and mud. We soon pass over a moun-

tain—Chishanpuh—which causes a great deal of trouble every year in the rainy season because it is so slippery.

This is indeed a wild district, infested with savage animals and bandits. The road was originally built over the mountains for the military so that they could battle the local gangsters without being surrounded in the gorges. This was all right for their needs but not for the needs of modern construction.

The first overnight stopping point is the city of Tsuyung, 120 miles from Kunming, named after the hero of the Tsu dynasty who conquered the district at that time. It was a strategic military point in the old days, and vestiges of the old city still remain.

Today, there are up-to-date guest houses here that have been provided by the Road Administration. They are comfortably equipped, and the climate is good. Tsuyung provides a pleasant stopover. Here are shops, a garage and parking lot, and an airfield as well.

Going on, we come shortly to the highest peak on the Road. Known as the Emperor's Temple Mountain, it towers 8,200 feet above sea level. The building of this section of the Road remains graven on the memories of the engineers. All the water had to be brought up in tanks because there is none in the neighborhood. The earth near here is useless, and all the rock had to be carried out of the valley below in wooden drums suspended from workers' backs. The nearest Chinese labor force also lived in the valley, and so we established a temporary camp for them. If they had lived at home, it would have taken them almost a full day of mountain climbing to get to the job. For that reason, the Lolos who live near by were employed for the continuing maintenance work.

Twenty miles to the westward is another high mountain, Dinghsiling, which translates freely into "After this moun-

tain has been conquered, it is easy to exercise control over the west." The Road is better now, for the land is of good limestone.

As we go down the far slope of Dinghsiling, a breath-taking panorama unfolds before us. Far off to the westward, the rugged peak of Changshan shoulders out above a tableau of mountains and rivers, with lovely Tali Lake sparkling like a sapphire at its base.

We usually made this descent in the late afternoon. We would be facing the sun, low in the sky, which transmitted a magnificent rose coloring to the clouds. Then, as it went down behind the black mountaintops, all the colors would change again.

The descent ends on a high plateau, about 6,200 feet above sea level. Some distance along this plateau lies the city of Fengyi. Fengyi is named after the lucky bird of China, a special kind of phoenix that no longer exists, although there are many reproductions of it in Chinese art. Next to the dragon, the national symbol of the old regime, the phoenix has been our most popular decorative device.

This district, though small, has produced some very learned men; and it is not hard to understand why that should be. Here is everything that a scholar needs for development—the leisure that comes from the prosperity of the region; a pleasant climate; and beautiful surroundings in gentle, pine-crowned hills, so essential for contemplation.

Near the Road is a fine old building that was once a gathering place for scholars. It is typical of the schools of old China, a good building, located in an isolated spot in a quiet and beautiful setting where all elements are conducive to creating the atmosphere necessary to advanced study.

On the walls are fine paintings, illustrating Chinese proverbs. For example, here is a painting of a tree with very large branches and small roots. It illustrates the point that the tree

that grows the highest is the first to catch the force of the wind; therefore it is advisable for a man, like a tree, to grow slowly and make sure his roots are firm, so that when the wind blows hard he will be able to withstand it.

We come now to Hsaikwan, where the administrative headquarters were located for some time. Hsaikwan, about 260 miles from Kunming, is a traditional market place for importers and exporters and abounds in restaurants and guest houses. Even more picturesque is the city of Tali, which lies about 10 miles away on a branch road.

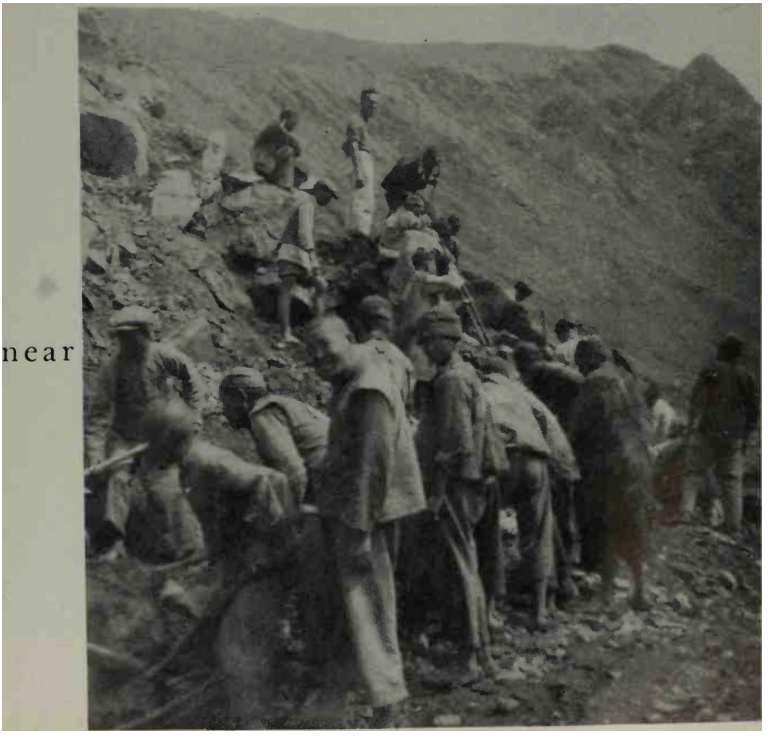
Tali has been for many years the central market for the exchange of goods between the Border races and the Chinese, and it has always been exceptionally prosperous. Here the picturesque customs of the past still prevail. People still dress in elaborate loose garments, richly embroidered with gold thread, a fashion many centuries old. With similar artistry, they make beautiful pillows. It was the ambition of every traveler to buy at least two of them, and my European friends kept me busy dispatching these pillows to them by post after they had passed through here.

Every day, the local people gather to drink and exchange gossip on the sidewalk in front of the tea houses. The tea here has a very special flavor. When the natives entertain distinguished guests, they roast the tea leaves fresh, imparting a particularly delightful flavor to the brew.

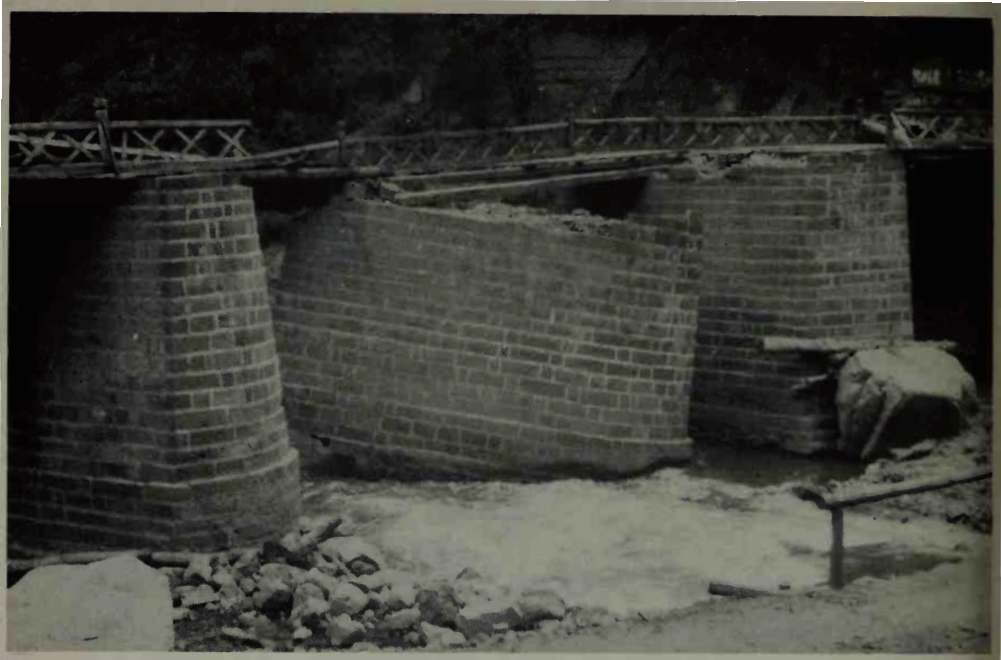
Every shopkeeper has a very beautiful flower that he keeps on the counter at all times. The flowers are very large and lovely here because of the propitious climate, and the shopkeepers can well take pride in their blooms. There is sharp rivalry among them as to whose is the most beautiful.

Seeing the quaint and attractive customs that have survived with little alteration from our yesterdays made me realize that, although their lives were simple and quite without the benefit of such mechanized devices as the cinema

A pontoon bridge built on streamlined principle.



A landslide near Hsiakwan.



A bridge washed out by swift water.

The building of the Yangpi Bridge with a Diesel pile-driver machine.

and the radio that we enjoy today, nevertheless the natives had contrived many pleasing and satisfying ways of passing the time.

Tali is famous all over China for its marble; in fact the Chinese name for marble is Tali stone. It is considered one of the best decorations, and in every old family the hardwood chairs must have a piece of Tali stone in the middle.

Marble, geologically speaking, is amorphous stone that has been changed from limestone under high pressure at high temperature and without air, conditions usually brought about by earthquakes and volcanoes. That is why there is such fine marble in Italy. The limestone that abounds in this region presumably has been altered by great earthquakes of the past at Tali. The earthquakes, indeed, still continue.

The quarries are located about 5 miles out from the city. In the future, if these quarries are operated mechanically instead of by hand as in the past, Tali stone could become one of the most important resources of this area for export to all parts of China.

Many objects made from the marble are sold in the shops of Tali. There was one really remarkable creation that a shopkeeper used to display for sale. It was a mosaic-like painting, carved in colored marble with a brilliant green landscape executed against a background of pure white. When I first saw it, the proprietor was asking only $10 for it. I tried to buy it, but he put me off. During the time I was there, I watched the price go up to over $1,000. He had offers even at that price. However, the marble had some fascination for him; he would bargain and discuss it, but when it came to the selling point, he could never bring himself to part with it.

Every year for a period of 5 days in late April and early May, the Mongols and Tibetans come down from their mountain homes hundreds of miles away to hold their big market. At this time, one hears many strange dialects and

sees many curious things. They offer for sale or barter the most unusual sort of items.

The Tibetans, although they are a primitive people, are remarkably talkative, fluent, and clever. The best talkers in China come from Szechwan and Tientsin, but the Tibetans can outtalk them all. I learned that this fluency stems from the fact that they are trained from early youth to argue endlessly about the fine points of the Buddhist Bible. They love to haggle, and it is very hard to get the best of them in a bargain. They always begin a transaction by asking about a hundred times as much for an article as they actually hope to receive.

The Mongols, on the other hand, are monosyllabic and uncommunicative. They speak in guttural grunts that are not clear to anyone else. Their great gift is in the raising and selling of horses and mules, about which they know practically everything there is to know. They seldom sell animals for money, preferring to trade them for merchandise, tea, or salt.

But it is impossible to do business with them. They always get the better of you in a horse trade. When we were constructing the highway through the northwest, I used rubber-tired carts drawn by horses to good advantage. It seemed logical to repeat the practice in the building of the Burma Road, and we tried to buy some horses from the Mongols. They sold us animals that looked very big and strong because they had such big bellies. Afterward we found out that their big bellies were a sign that they were not strong at all, but sickly. The really strong ones have small bellies and very big rumps.

When the market is over, the Mongols and Tibetans enjoy themselves with horse racing and dancing, racing their horses for speed and also doing all kinds of tricks on their backs, just like circus acrobats. They offer their horses for sale after-

ward, but somehow you find that the animals they want to sell you are never the ones that performed in such spectacular fashion.

The dancing that goes on hour after hour is odd and weird. The men and women dance by themselves, never with each other, moving in a slow rhythm with simple steps to the eerie music of their bamboo flutes and the heavy beat of skin drums, a sound that is quite unlike anything I have ever heard.

The customs seen at these markets have gone on with little variation for thousands of years. To a Westerner they might seem merely foreign; but looking on them for the first time was an extraordinary experience to a Chinese with a background of classical literature.

In a suburb outside of Tali is Tali Lake, about 30 miles long and 10 to 15 miles wide. It is also called Eurhai Lake, which means that it is shaped like an ear. All around the lake are beautiful white marble pagodas built about 1,000 years ago in the Song dynasty. I surmise that then, when the lake area was probably bigger, there must have been frequent floods, causing a great deal of trouble and heavy loss of life. The pagodas were built on high ground to mark the places where the people could take refuge. Inside them are stone tablets inscribed with the story of the measures taken for flood control, with suggested precautions for the benefit of the descendants. This was an ancient Chinese trick. When they wanted parts of an engineering system to be preserved permanently, they built them as a sign from God so that nobody would disturb them. The ostensible purpose of the pagodas was to preserve the holy writ. But they were also intended to be of service to succeeding generations.

At the edge of Tali Lake is a resort, situated in the middle of a very famous garden named Sen Luh Garden, after the great gorge that is just behind it. I have traveled all over

the world, and I have never seen any place that can compare with it, not even the loveliest parts of Switzerland.

Sen Luh Garden is located on a gentle plateau sloping down to the lake. The climate is perfect, the air dry and stimulating, and the sunshine brilliant and intense. Everywhere there is something on which to feast the eye, immediately in front, the bright blue of the lake, beyond the snow-capped crags of Changshan.

There is always the soothing sound of running brooks near by, and now and then one can hear a bird singing far off with a very high, thin, sweet sound. The wind comes down cold and bracing off the snow on the mountain, always gentle, never rough as in Hsaikwan. Before it reaches the garden, it is scented by the pine forests and tempered by passing over the water of the lake.

The garden house is built with granite walls in semi-Western style. It includes a great dining hall and sleeping quarters. Through the grounds runs a path paved with bits of white marble all inlaid by hand like a Brazilian mosaic sidewalk.

The garden itself, containing about every flower known in China, and all of an exaggerated size, is an ingenious contrivance. It is divided like a puzzle by walls within walls. In each wall there is a circular doorway framing its own charming segment, so that the eye absorbs only one charming vista at a time, instead of being surfeited with too much beauty all at once. Over the entrance hangs a most appropriate quotation from a Chinese poem, "Don't ever allow spring to go away." This echoes the sentiment of every visitor.

I still recall with pleasure the many Sunday afternoons I spent there. After the war, it could very well be built up as a year-round resort. In summer, Tali Lake is perfect for sailing, motorboating, swimming, and fishing. In wintertime,

there is good hunting—wolves, wild buffalo, chamois, some foxes, and above all the big, fat, and tasty yellow wild ducks.

I often had occasion to be host to travelers and often invited them to stay at this house by the garden. Usually a visitor would come with the intention of staying only one night. I would suggest that he stay one day more, partly because this is the courteous custom, partly because if he pushed right on without getting proper rest there was greater danger of accident, for which I would have felt personally responsible. Since this was the mid-point on the Road, whichever way they were going, they had several days of strenuous driving behind them and several more ahead. If they went on without pause, the chances for mishap would be increased.

After having requested that the guests remain, I would ask them to let me know their plans immediately, because bed covering and food had to be brought from the office 10 miles away. The cooks and waiters had to have advance notice so they could make the proper preparations.

The guests would invariably reply, "Thank you very much, but I cannot stay. I have urgent work to do and I must go on."

I learned in time to instruct the cooks and waiters to prepare everything for a second day's stay. Invariably, after one night in that charmed spot, they would say to me, "I have had such a wonderful rest. The scenery here is so beautiful, the air is so bracing, that I have decided to stay on one day more, if it won't cause you too much inconvenience."

Then I would joke with them, telling them that everything was in readiness for their departure as they had requested. I never let them know that I had made everything ready for them to stay.

When the American Ambassador, Mr. Johnson, was our guest, he refused to sleep in a bed. He insisted on passing the night in his sleeping bag out on the veranda so that he

could enjoy the reflection of the moon on the lake, which is one of the great sights of Hsaikwan.

On one occasion, we wanted to serve another distinguished guest a few bottles of beer that we had been saving. There was no ice in Hsaikwan, but the spring water from the melted snow behind the garden was so cold that we simply submerged the bottles in it on a string and were able to serve the beer delightfully chilled.

Hsaikwan offers attractive opportunities for investment after the war. There is a region along the bank of the lake where cotton mills and weaving mills could be established.

There is ample power available from the swift river that runs out of the lake, and the lake itself provides a reservoir that would assure a constant flow of water the year round.

The people of these regions, Tibetans, Mongols, and those of the Border races, as well as the residents of Yunnan, are great consumers of cotton piece goods. Except for a small district beyond the lake where a little cotton is produced for local household use, none is grown near here.

Every year, horses, mules, and men leave Hsaikwan laden with yellow silk, tea, salt, and medicines destined for Burma or other provinces of China 1,000 miles or so away.

They all return carrying cotton yarn. Coming from these vast distances, it must command a very high price, for it shows how badly cotton is needed here.

A power plant of at least 10,000-kilowatt output could be built here, to serve a big and certain market. Before the war, the Germans sent engineers to Hsaikwan to make a survey of the potential hydraulic power. The Yunnan Provincial Economic Council has in its files the preliminary estimate from Siemens Schuckert of Berlin, the firm that 40 years ago supplied the water-power plant in Kunming. Here might be one of the interesting electric power projects to be planned in China after the war.

After leaving Hsaikwan, we soon get into the hard rock country.

Shortly we come to the Yangpi River, its waters swift and clear and very cold from the mountain snow. The Yangpi is about 291 miles from Kunming. Before crossing the suspension bridge above the river, we pass through the city of Yangpi, named after the river, which is a small, very hilly city of the third rank. Here are many rice mills, operated by water power in the native way. Yangpi is famous for its chestnuts, for its honey, and for its duck eggs, which are especially delicious.

Its inhabitants are most colorful. Predominantly Chinese Mohammedans, tall and muscular, they still observe most of the old Turkish rituals, wear the red fez, and read the Mohammedan Koran.

The country roundabout is very poor. The people who live outside the city are undernourished and therefore small and weak. Goiter is widely prevalent, and leprosy is known to exist. These people are all of a peculiar greenish-yellow color, perhaps from chronic malaria, from kidney trouble, or possibly only from the bad food.

Going on from Yangpi, there are a great many curves in the Road. The rock is of poor quality, and one must drive very slowly. Because of all these factors, both building and maintaining the Road caused a lot of headaches through here. The section engineer was energetic, though, and did a fine job in spite of all the handicaps.

We now pass the second highest point, where the Road reaches 7,800 feet above sea level as it runs down to the city of Yongping. Yongping means "After the conquest, forever peaceful."

No doubt, because of the thick forests and the cold mountaintops, it took the old commanders a long time to conquer this territory, and that is why they gave the city its name.

Yongping has a geological oddity known as "the iron nuts' nest." Here there are small bits of magnetized iron ore lying all over the ground.

From this point on, we pass through a hilly country, going up and down the sides of many gorges. The gradients were once long and steep, the Road was not well maintained, and it was hard for the truck drivers, because the radiators always boiled climbing the hills. That condition was due to the inability of the local magistrate to supply the number of laborers that were needed. Afterward he was replaced by a more energetic one. The gradients were smoothed out, and the curves were made less abrupt.

Before long, we reach the banks of the Mekong with its two suspension bridges, one for eastbound, one for westbound traffic. The scenery here is moving in its beauty, with its thick forests of wonderful trees growing down close to the river gorge.

The banks of the river are badly pitted now, with holes from Japanese shells and with many crevices that the engineers cut from the rock to accommodate storage warehouses, power units, etc. After following the Mekong for a time, we come out on the level land on which is situated the city of Paoshan. Paoshan is the second largest city on the Road, with a population of about 280,000 for the district. It is 416 miles from Kunming and about 5,500 feet above sea level.

The city is very old. It was renamed Paoshan after the coming of the Republic; before that time it was known as Yongchangfu.

Paoshan was rebuilt 600 years ago, with its streets laid out according to the compass, running at right angles straight north and south, east and west, instead of all zigzag, like most of the cities in this part of China.

This is according to the Peiping style. Peiping was built that way because the Emperor, passing through the streets

with his large retinue, always wanted to be able to proceed in a straight line without having to make many turns. Paoshan reflected the influence of northern invasions in this plan.

There is an old standardized city wall around Paoshan, so wide that two-way truck traffic was opened on top of it. A number of buildings are built on top of the city gate itself. They were formerly used to house the guard. When the radio-communication system was set up for the Road, the top of the gate was taken over for the radio-telephone station in Paoshan. There was room enough there for offices and dormitory and for a garden and recreation yard as well. This was one of the seven radio sets used for road-construction purposes. They were acquired to establish the system of efficient communication used by the engineering sections.

Paoshan took its new name from the hill at the northern end of the city, which is the loveliest spot inside the city itself. From it, one can see all the suburbs spread out below.

Here, in a grove of great pine trees, are beautiful buildings that were constructed by the wealthy as a gathering place or a kind of club for learned men. The buildings are artistically decorated with rare and valuable paintings.

The district has always been noted for its scholars. Educational standards are still high here, and there are a large number of schools.

Today one of these clubs is used as a guest house for travelers. It is a two-story structure with 26 rooms, supplied with pure cold water from a near-by spring. The climate here is even better than Kunming, and the city makes another attractive stopover point.

On my first visit here, I noted the influence of Kiangsu Province in the forms and decorations, which one sees only in Nanking. During the Ming dynasty, when the capital of the Empire was in Nanking, the Emperor sent a large army

to conquer the Border races. Most of the people of Paoshan are descended from those soldiers.

The district is famed for its amber and jade and unusual black lacquer. The people have their own secret trick in the making of this lacquer that gives it great resistance to heat. No one else has ever been able to master the technique.

Paoshan underwent a complete change with the opening of traffic. More than twenty-five organizations had their offices here. There were seldom less than 500 cars a day in the parking lots. Local carpenters had built for the Highway Administration a big garage, a workshop, a bus station, and a service station all in the most modern and artistic way.

The noise and clangor of the city were compounded by the presence of many parrots that run wild in the jungles outside the city and were kept by many people as pets. One hears them through the doorways, speaking in many languages.

There was never a bed to be had in a hotel or a table free in a restaurant. The city was always bright with the light of kerosene lamps. Yet the native people were never influenced by this contact with modern life and always retained their old customs.

Paoshan is the last outpost before no man's land. From here on everything is strange. The rock is hard, the gorges deep, the climate bad, with suffocating heat in the lowlands, and malaria rampant.

Before long the Salween bridge draws near. One can see it from afar, and it seems very small indeed. At the top of the Salween gorge, just before the Road plunges downward, is a wilderness called "The Dragon Hole."

Leaving the Dragon Hole, we drop down from 6,400 feet above sea level to 2,000 feet within a distance of 27 miles. We are driving now along a fearful and terrible road, with steep gradients, many hairpin and corkscrew turns, and al-

ways on one side the cliff sheering straight off down to the Salween, hundreds of feet below. The descent is so abrupt that one's ears ring as they do when landing in an airplane or when coming down from the top of a skyscraper in an elevator. It takes a steady hand to guide a car here. Anyone who loses his nerve for one second will be immediately seized with vertigo and will drive right over the edge.

The change in temperature, too, is sharp and sudden. While going through the mountains above, it has been necessary to put on extra clothing. Now we must shed almost every outer garment, for at the bottom of the gorge we are in stifling, tropical heat.

We cross the Salween, and the Road climbs even more steeply up the other side of the gorge, reaching 6,800 feet within a distance of 18 miles. Now it is cold once more. The Indian and Burmese truck drivers in particular hated this part of the trip. As a rule, they had but one set of clothes, and it was almost impossible for them to keep from getting chilled by the sudden change.

The region at the top of the gorge on the other side, known as Lahmong, had also been a no man's land. But it was such an attractive spot for the location of maintenance, being high, cool, and free of mosquitoes, that the Administration built quite a colony there, with houses, garages, service stations, stores, and hospitals. The Shan people moved in and began to raise vegetables and pigs to accommodate the new demand, and the former no man's land became busy and prosperous. It was still isolated and could easily have been robbed, although it never was.

Descending the mountain gradually, we approach the Chinese city of Lungling, which is 523 miles from Kunming. Lungling, with an altitude of 4,500 feet, has a good climate and is free from malarial mosquitoes, yet it has some of the heaviest rains in the world during the rainy season, even

heavier than in the Shan states. Lungling means "The Dragon's Home." The old Chinese theory was that clouds were the breath of the dragon; therefore, the dragon lived where the rains were heavy.

The Road here is in good condition. The maintenance work was all done by Chinese girls, some of whom were students. The rice production is good in this region, and the girls were strong and able workers. Two miles to the west of Lungling is the boundary between the districts that are under the magistrates and the lands that are ruled by the Sawbwas. From here on the climate is semitropical, which leads me to believe that the boundary line was picked arbitrarily, not by any geographical determination, but only on a basis of climate.

We proceed now through a series of mountains and deep gorges, emerging on the western side at the village of Nantienmen, which overlooks a flat land beyond. "Nantienmen" means "Gate of the Southern Heaven." Situated high above a deep gorge, this old stronghold could easily be defended by a handful of soldiers against any attack.

The terrain here was not very favorable for road building. It was all of weathered limestone and sandstone, and the roadbed would slide right away as soon as it was finished. In the end, we had to give up that route entirely. The asphalt-surfaced road was built on an altogether new line.

Nantienmen overlooks the flatlands stretching away to the west. Nothing can be seen very clearly because of the mists, the famous "poisonous gases" that hover above the jungles, the small creeks, and myriad ponds.

On the edge of the flatland is the village of Fangmahchang, which means "Cavalry Horse Station." There is not a horse to be seen around here. The name comes from the fact that the basin was once conquered by men on horseback. They

used their horses afterward both for getting food and for relaxation.

The city of Mangshih marks the border line of the Shan states. From this point on, everything is very strange. It is neither quite like China nor altogether like a foreign country.

The people look like the other Chinese, but everything in the landscape is just slightly different. The hats they wear, having the appearance of giant mushrooms bobbing about, are something like Chinese hats, but not quite the same. Even the cows are of a small tropical variety, unlike the ones we have at home.

The Shan girls, instead of carrying their loads suspended by long cords from a bar across their shoulders, bear them at shoulder height. This is a most illogical way to carry anything, and to keep their balance they must sway constantly from side to side as they go.

Formerly the Chinese called all foreigners "Yi" people; the Shans were called "Bai-yi," "Bai" meaning pendulum. I could not understand the reason for this and so went into the matter at some length with Mr. Fang, the local Sawbwa. We finally concluded that it was this swaying movement they made when carrying anything that was responsible for their being called pendulum people.

We tried to get the girls to change their method, particularly in carrying water. But they protested to us that, if they carried the water suspended from long cords, they couldn't sway, and if they couldn't sway they couldn't work. We finally convinced them of the logic of our way.

There were many psychological oddities that had to be mastered. If the girls were asked to carry a light load, for example, they would work very slowly; but, if they were given a heavier load, they moved fast in order to get rid of it more quickly.

Mangshih is the richest and largest of all the Shan states.

In Mangshih, only the houses of nobility are made of brick and tile built by Chinese stonemasons from Paoshan; the rest are all of straw. Mr. Fang, whose full name is Fang Yu-tze, is the regent acting for his underage nephew, who will be the real ruler. His house was just as it had been built by his ancestors. However, in his garden he had built a villa, Burma style, with modern baths, gardens, and a garage that he used as his office.

After Mangshih became prosperous, one of the engineers suggested that he build a better villa. He erected one with a beautiful veranda and modern furniture, running water, and an icebox run by petroleum. He called this "Eda's house" in honor of his wife and made his home there after that. He was a good diplomat. When the boom brought opportunities to Mangshih, he suddenly branched out as a very successful businessman. He became an important truck operator, contractor, and rice exporter. He had plenty of raw material and plenty of cheap labor available, and it was easy to prosper. He never built a road or market place inside the town for the benefit of his own people, but he was faithful in building the Road for us.

Beyond the Mangshih basin lie the muddy mountains inhabited by the head-hunters, then another flat country in the state of Chefang. This district is comparatively small and thinly populated but very rich indeed. In front of Chefang runs a swift, deep river called Lungchwanchiang. On the other side of the river in the mountains lives a most savage tribe of head-hunters. They were always descending on the plains, robbing and killing, and then escaping across the river to the mountains by swimming or in small canoes.

Now the road turned southwest to Haishanmen, which means "Black Mountain Gate." Here the stone is brittle and easily crushed, and most of it is useless for road building. This

was one of the points where we had to bring stone from miles away.

From here the road runs zigzag into Wanting, with never a straight line anywhere. Wanting marks the boundary line between Burma and China. It is 600 miles from Kunming. It also marks the end of the Chinese construction of the Road. Here it is very hot. It was formerly unpopulated except for a few head-hunters. Once a customs house was set up in a small hut as a check on smuggling, but the head-hunters promptly burned it down. They were great smugglers and didn't fancy the idea of any interference.

There wasn't a level spot to be found in Wanting. When it became the head office of the organization in order to facilitate import and truck registration, houses, banks, and government offices all had to be erected here. They could be built only on the hillside. At night, from across the river, with the buildings alight, it looked like a miniature Hongkong.

On the Burma side of the river was the small village of Kiukok. The British moved their customs offices here from Lashio and posted military guards who were mostly Indian soldiers. Before Pearl Harbor, the guards made big white crosses out of pebbles all along the hills. There was a considerable mystery regarding these crosses for some time. People had heard of the Red Cross, but they had never heard of the White Cross. It was explained that these were installed so that in case of an air raid Japanese pilots would know they had come to the Burma border. After Pearl Harbor, all these crosses quickly disappeared.

A big market grew up here and likewise many shops. It was the market place for many drivers who used to buy goods here and sell them in Kunming for much greater prices. It was the end of the Road for most of the drivers. A big garage

had been built by us here to handle 500 trucks, but it was still unfinished when the Japanese came in.

From Kiukok onward the terrain is not so difficult. On the British side, the road had been built with an asphalt surface 10 feet wide, which is all right for single traffic but too narrow for heavy traffic. In the rainy season, there was plenty of trouble on both sides of the road.

We go southwest through Hsinwei, one of the British northern Shan states, which is rich in rice and famous for its oranges. The landscape through here is beginning to have a British flavor, for the houses are mostly bungalows built in British style with corrugated sheet-metal roofs painted red.

The Sawbwa here is the descendant of an old Chinese conqueror. To all guests he likes to display the iron seal that was given to his ancestors by the Emperor in the Ming dynasty 500 years ago. He is an eccentric. Although he has a free hand in controlling his own territory, he is closely supervised by the British superintendent of the northern Shan states.

We arrive at last at Lashio, the highway terminus, which is 117 miles from Wanting. Lashio was once just a sleepy native village, but now it hums with new-found prosperity. It is divided into two sections. On one side is New Lashio with its impressive government buildings, electric lights, water works, hotels, restaurants, offices, big bazaars, and English stores. The residential section is very pleasant; the houses are all set in wide smooth green lawns, surrounded by big trees bright with red flowers.

Old Lashio is still a backward native village with no improvements, where Shans, Indians, and Burmese all live together, governed by the Sawbwa of Hsinwei.

In time, the Chinese built offices and a large transshipment center in old Lashio for moving goods from the Rangoon railhead to the trucks bound for Kunming. For a while,

life was complicated for the Chinese in Burma. Formerly no passports had been required of them, but after the opening of the Road they had to show passports to go anywhere. This was a very uncertain business. Sometimes a great nuisance was made over it; sometimes they were never requested at all; one never knew what to expect. In 1942, when the Chinese soldiery came in to cooperate with the British, the practice was abandoned altogether.

Now we go down the main line from Lashio to Rangoon. There are good highways and narrow-gauge railroads connecting the two cities; but to travel on that railroad is not precisely comfortable. It is in a class by itself. The cars seem often to be overcrowded. There is no linen and no mosquito nets. Even in a first-class car there is no communication between one compartment and another because there is no corridor. There are no dining cars. The traveler buys his meal tickets at the station. Then the station master wires ahead to the restaurant in the next town to have food prepared. As soon as the train stops, the passengers jump off and rush to the restaurant in order to be served.

From the border to Rangoon all the shopkeepers are either Indians or Chinese. The farmers, laborers, factory workers, truck drivers, railway workers, station masters, cooks, and waiters are mostly Indians. The Burmese hate them but know that they are better workers and that there is nothing they can do about it. The Indians get the jobs.

Everywhere, from the train window, one sees the gold spires of the Burmese pagodas, all standardized in the way they are constructed, but of different sizes. One also sees the Burmese monks in their yellow robes.

These monks have a good time of it. They never have to cook a meal. They go around through the neighborhood with a big bowl and the people are required to give them the best of everything. The priest is never required to show any

appreciation. The people are simply fulfilling their obligation to Buddha. They believe that this offering will keep away disease and bring them good luck generally.

We come at last to Rangoon. It is extremely hot here and rather like India on a small scale. The city leaves certain sharp impressions that stand out above the others—the interminable cawing of the little black crows, the "clop-clop" of wooden shoes echoing on the sidewalks, and that indescribable tropic smell. It is a beautiful, colorful, and clean city with the large and lovely trees and the broad green lawns that the British create everywhere they go. The original Burmese customs and the language and religion have all been retained. The university at Rangoon and many high schools are evidence that the British have provided opportunities for higher education.

Here was the true terminus of the Burma Road. During critical months, China had no other seaport; and over its hustling wharves and through its noisy warehouses poured trucks and ammunition from the outside world—all the matériel that did so much to keep our nation in the war.

Since Rangoon has now been recaptured, its familiar hum of activity will return once more.

Chapter Ten

ASPHALT SURFACE AND MODERNIZATION

THERE are many things in life that can be learned only through experience. It was by observing the conditions under the actual operation of traffic, the multiplicity of little things that could not be anticipated, that we ascertained the right way to build the Burma Road, which was to surface it with asphalt. Of course the Road was all built by that time. Trucks and cars were roaring over it in a never-ending stream. There was nothing to do but start in to resurface it completely, and it had to be done without interrupting traffic.

The Road had been built according to the general practice in Chinese highway construction, with big stones at the foundation, graduating down to little ones on the surface, and all held together by a mixture of earth.

Such a highway is satisfactory only for a light load. It worked all right for most Chinese intercity arteries, where traffic almost never exceeds forty trucks a day. But it is no good for anything heavier.

When the Road construction was started, we had to use existing methods that were familiar to everybody. There seemed no reason to consider anything else, for it was looked on then as no more than an important auxiliary highway. Nobody could anticipate that France would fall so soon, that the French Indo-China Railway would be cut off, and that the Burma Road would become overnight China's only link with the outside world, with the enormous strain on it which that situation implied.

I was never satisfied at all, even while we were building it, with the profile of the Road, with the curves, or with the construction; and we intended to improve everything as time went on. The important consideration then was to get the Road open, any kind of Road at all, to have a thoroughfare ready in case of eventualities.

We could not then foresee how many kinds of vehicles would travel the Road or how many problems they would create.

Besides the thousands of trucks operated by the many government organizations, there were vehicles of all kinds operated by the private transportation companies, with such combinations of truck bodies and chassis as have never been seen anywhere else.

Between 300 and 400 cars came through in an average day, all overloaded, carrying the heaviest kind of cargo—ammunition, heavy machinery, drums of gas and oil, bales of merchandise—and all in a desperate, breakneck hurry to get to their destination.

Here is just one of the many unpredictable factors that caused damage. Some foreign firms preferred to use their own cars to transport their own cargoes. Among these was a type used by Indian firms known as "Gara" trucks, consisting of a standardized Indian-style body built on an ordinary Chevrolet chassis. The bodies were built to extra height so that they could carry an overload, and the vehicles all had dual wheels in the rear.

On the Burma side were a number of bridges that could support only 6 tons. The British authorities in Lashio wanted to avoid putting any undue strain on the bridges and, instead of strengthening them, took the roundabout method of ruling that no truck of any kind with dual wheels would be allowed on the Burma side. The extra wheel had to be removed before the border was crossed. We learned that the

drivers, deprived of the extra wheel, were using an extra-heavy-duty tire on the one wheel that enabled them to carry a load of 3 tons and did not put any less strain on the bridges.

We tried to explain to the British authorities that it was much more logical to allow the drivers to use the double wheels for which the car was designed and thus distribute the pressure more evenly, since they were determined to carry the heavy loads anyway. This would also save wear and tear on the Road. Eventually the local authorities in Lashio realized this condition, and the rule was finally relaxed.

I had a little light metal chair that had proved invaluable to me in my field work. I used to take it and sit unobtrusively by the side of the road whenever I could find the time, to watch what was going on.

I noticed that coming upgrade the trucks that were heavily overloaded always made a curious whining noise as though the engine were crying out, "I can't do it any more! I can't do it any more!" Oddly enough the Chevrolets cried like a woman, the Dodges deep like a man, and the Internationals gave a distinctive cry that could be recognized far away, I suppose because of the gear ratio or the type of carburetor. The single wheels under the heavy pressure were cutting deep ruts in our Road, especially on rainy days, although they didn't have much effect on the asphalt on the Burma side.

I roughly figured out that every truck sucked up at least 5 cubic yards of chips from the Road during the trip from Wanting to Kunming. Once they were loosened, they were soon blown away by the wind.

After every rainy season, all the chips and earth in the wearing course would be almost entirely washed out, and the Road would have to be repaved. No sooner was this done than the trucks would come right back over it while it was still fresh, ruining it once again. A road of this type was hard

on the drivers as well as the vehicles, for they were nearly always driving through either a sea of mud that spattered the windshield or a choking cloud of dust, and thus they never had very good vision. Accidents happened frequently, since they often tried to pass each other, not only on the straighter stretches, but even on the murderous curves, in spite of the faulty visibility.

To our great regret, we were totally unable to improve this condition, because we couldn't find any better method of maintenance. Some foreign experts trying to help us lick the problem offered the suggestion that night as well as day driving be put into effect. That would not have been practical, since the dust kicked up by a truck ahead was so thick no searchlight could penetrate it any more than it could penetrate the rain in the monsoon.

The trucks also suffered from unaccountable breakdowns. Parts gave out that weren't even listed in the spare-parts catalogue because no need for replacement had been anticipated. The life of a truck on this highway was shortened to one-fifth of its normal expectancy. Such breakdowns were critical, for every truckload was urgently needed in China; therefore every possible truck was needed at all times on the Road.

I would not admit that these unfortunate occurrences were due to the Road alone or to any lack of competence on the part of our engineers. The quality of the Road in any case had to be equal to the density of the traffic, and there seemed to be absolutely no chance of bringing it up to the necessary standard of quality. I have traveled in many countries, and I have never seen any kind of "water-bound macadam" road that could stand up under a load of more than 200 trucks a day.

The highway experts in Chungking never seemed able to grasp it. I received a great deal of advice, all offered in a co-

operative spirit. Some suggested that we use a salt solution, a cement wash, a mixture of lime and burned red soil, stabilized soil with cement, or cutback asphalt. All in all a dozen different methods were proposed. The ideas were excellent, but time would not allow us to carry out any experiments. I had my mind set on surfacing the Road with either concrete or asphalt. The former would have taken at least 10 days to dry, and so it was out of the question in our situation.

Matters were reaching such a stage that something had to be done. The regular maintenance gang had now reached a total of 3,000, not counting the emergency crews. And the best men kept leaving daily for better pay.

For 7 miles outside of Kunming there was a particularly troublesome stretch. No less than 200 trucks a day traveled over this section. Whenever an air-raid alarm occurred, the confusion was unbelievable.

The Road here had fallen into such a condition that even the drivers of oxcarts refused to travel on it, because the loose chips got wedged into the animals' toes and hurt them. This condition irked us deeply.

In China, there is no accurate name for highway. It is usually called "Horse Road." I still hear many of my countrymen speaking of Fifth Avenue in New York as "The Fifth Horse Road." One day I said to the engineer of that section, "This Road cannot properly be termed a highway at all. We might have called it a Horse Road, but now that even the horses and oxen are refusing to walk on it, what can we call it?"

He had done his duty to the utmost, and he felt as bitter about it as I did.

We decided now to take action. We might have gone through the routine formality in considering resurfacing. That would have entailed (*a*) submitting estimates; (*b*) discussion; (*c*) having the estimates returned for modification;

(*d*) resubmitting them, etc. All this would have taken about 6 months.

As it happened, we had sufficient funds in our own budget for the undertaking. We decided to tackle it as a laboratory experiment with the idea of demonstrating to the ministry what could be done.

The resurfacing was finished in a very short time. Then we watched the reaction in the drivers' faces as they came over this road. They were smiling and relaxed instead of all keyed up. Accidents no longer happened, even during air raids. Photographs were taken and statistics compiled. Armed with this tangible evidence, I went immediately to Chungking to present the idea of resurfacing the entire Road to the Central Government.

In presenting the case, I pointed out that the trucks then carrying their precious cargoes over the Burma Road were designed to run on smooth surfaces, never on a highway like ours. Furthermore, they hadn't been built to bear such overloads. Chinese buyers were used to bargaining for trucks according to the load they could haul, that is, at a rate of so many dollars per ton. Some dealers, in order to make more money on the sale, changed to heavy-duty coolers, put more leaves in the springs, and altered the designation from 1½ to 3½ tons. Then the owners loaded it with 4 tons, and the drivers put another additional ½ ton on. Everywhere from Chungking to Rangoon one heard such terms as "3-ton Chevrolet," "3-ton Ford," "3½-ton Dodge," or "4½-ton big International." I suggested to many truck owners that they spend 20 cents for a little booklet printed in the United States that showed the models of different manufacturers, advising them to take a look at the loads those trucks were designed to carry. Few of them paid any attention to me.

We faced two alternatives. Either we must ask the truck

builders to design vehicles to fit our conditions, or we must build the Road up to standards suitable for the trucks.

The first was quite out of the question. It would have been impossible in the face of prevailing world conditions for any manufacturer to design such trucks, put them into mass production, and deliver them to us in time to be of any use.

The second seemed, at first glance, equally impossible, for it would eat up a big budget, and I well knew the depleted state of the treasury at that time.

Yet, looking at it more closely from the strictly fiscal point of view, we had less to lose from the second plan than from the first. Although we would be saving money in Chinese currency by not rebuilding the Road, we would be spending more money in foreign currency for trucks, gasoline, tires, and spare parts, and foreign currency was very precious.

The Central Government went over the matter thoroughly and gave me these instructions, "China is financially poor, as you well know. Most of the coast has been cut off. Our national income is decreasing. Expenses are increasing. If there is something for which we must have money to spend, spend it. Spend it, but never waste it."

Shortly thereafter the large budget for asphalting the entire surface of the Road for a total distance of 600 miles was approved.

I hurried back to Hsaikwan, called the engineers together and told them, "We have all been complaining about the Road. We have kept saying that we could build a good road if only we had the money. Well, we have the money. Now it's up to us. We must expend more energy than we did in building the Road the first time. Circumstances will give us no leisure time. We must rush it. Yet the work must be fundamental throughout and never superficial. The misshapen nature of the Road has bothered us for a long time. At last

we have been given our chance to clear it up once and for all." They all responded with enthusiasm, and we got ready to start on it at once.

In Western countries, the building of such a high-grade surface would be taken as a matter of course, but in China it was regarded as something belonging to a new era. Everybody had a suggestion to offer. It was just like a poor man buying a fine suit of clothes; not only does he pay close attention to selecting the cheapest and best, but his family must go with him to make sure that he has the best fitting, commenting on this and that until the tailor loses his patience. Telegrams and letters arrived in wave after wave, saying, "Asphalt surfacing cannot be applied on the Burma Road because of its difficult terrain." "Fatal accidents will increase." "The gravel road when it is well maintained will withstand any amount of trucks." "You are requested to finish the new pavement within 6 months without equipment, also regardless of the rainy season."

This was no surprise to me. I had learned that anything new will draw criticism and opposition until it justifies confidence. When I introduced the first Diesel-engine ferry in Shanghai in 1928, a big mass demonstration was held in protest, because people were afraid that the Diesel engines would explode quickly or stop suddenly while the boat was in midstream. Some persons declared, "We will hold that man responsible for any lives lost!" as though they knew more about the engine than Rudolf Diesel, the inventor.

At that time, water traffic in Shanghai consisted of a few wooden ferryboats run by man power. They were often overloaded, and many fatal accidents took place. The ferries were owned by a few people who made a good profit out of them. Then I started the new Diesel ferries for the city, with modern boats and good wharves, keeping the fare the same.

The owners haled me into court for interfering with their livelihood.

When the case came up, hundreds of old women, obviously hired by somebody, appeared holding bunches of burning incense. This gesture signified their desire to have me give up the idea, but from the high degree of their emotion one would have concluded that they really wanted to burn me to death. When I did not appear that day, being represented by a subordinate, they went away deeply disappointed. The case was thrown out of court, but the incident demonstrates the public resistance to any innovation. After the new ferries became an established success, the public attitude changed to one of enthusiasm.

I learned from these experiences to remain cool and patient but firm under opposition and attack. We were not looking for praise in planning the new surfacing; our sole objective was to increase the flow of traffic three- or fourfold, and we were determined to let nothing deter us from reaching this goal.

All staff members and engineers were called into conference in the head office. Everyone was requested to express an opinion on how the project could be carried out in the most efficient way, regardless of his rank, for a workman in the field might have a more practical suggestion than a desk engineer. All their suggestions were carefully weighed and analyzed. But once a decision had been reached, it was regarded as law.

The cold process, using cutback asphalt, was adopted. After the road had been reconditioned, it was to be paved on the existing surface with a layer 16 feet wide and 3½ inches thick, of 1½-inch stones with proper camber. It was to be first rolled dry and then wet until rigid. The first coating was to be applied, then covered with a layer of chips. Finally it was to be rolled with a high-speed light roller to

make sure that all voids were filled; then a second coating was to be applied 2 weeks later. We estimated that, from the Burma border to Kunming, the surfacing would require 400,000 cubic yards of 1½-inch stones, 100,000 cubic yards of chips or coarse sand, 30,000 cubic yards of 1-inch stones for reconditioning the road, and 50,000 cubic yards of 6-inch stones for rebuilding the foundation where necessary.

We did not anticipate much difficulty in having the crushed rock prepared, because we had already worked out the pattern with the magistrates for the construction job. The principal difference was that this time we had to have the best of limestone, and most of the quarries were some distance away; but the crushed rock could be carried in baskets by the women and boys. As far as the asphalt was concerned, we ordered 12,000 tons from New York, and it arrived on schedule in a very short time.

Next came the procurement of rollers. The Administration had for some time been aware of the need for modern machinery of this type, but far from enough was available to us for such a rush job.

Some had been ordered under Lend-Lease, but we could hardly await their arrival, for the work had to be started at once.

We began to scour all of Free China for road-surfacing equipment but could not find nearly enough. Then I happened to recall that a number of units had been ordered some years before through Universal Trading Corporation, a Chinese organization for purchase and export in New York, as an exchange for tung oil and tungsten. The staff began to trace them, and parts of the units were found, still in their crates, scattered through warehouses in Lashio, Lungling, Paoshan, Kunming, and Chungking.

Our engineers fell on the crates like hungry lions. The parts were rushed to Wanting, where the work was to be

started and where a big, well-equipped assembly shop was already established. Piece by piece, the units were put together, like so many parts of a puzzle. When all were assembled, we had, including the equipment already procured, 26 rollers, 18 stone crushers, 8 air compressors for rock drills, 5 motor graders, 4 bulldozers, 2 excavators, 20 tractors, several sheep's-foot rollers, and some dumping trucks.

Though barely a drop in the bucket, it was much better than nothing. The equipment was simple in construction and easy to handle, but it would normally have taken several months to train a crew to operate the machines. However, we were fortunate in having plenty of mechanics who were experienced in running road- and bridgebuilding machines, and veteran engineers and foremen who had operated marine Diesel engines for me in Shanghai. So clever did these men prove to be that there was no trouble with any unit during the entire course of construction, even though the machines had to be run 24 hours a day. Any breakdown would have spelled disaster, for there were absolutely no spare parts to be had.

We were also able to get hold of a number of student mechanics who served as drivers on the rollers or tractors. Whenever they had an hour or two in which to relax, they spent that time learning the principles and functions of the machines they were handling. I treated them all like members of my own family, living and working right with them under the same conditions, and this contributed considerably to raising their working efficiency.

Now came the biggest headache of all, how to get 8,000 strong and able laborers in a hurry? The Shan states could provide 500 at the most, and perhaps 1,000 could be obtained from Lungling. All the rest would have to come from Paoshan, but that district had already been drained to supply

workers for building an airfield and the railroad, preparing broken stones, and reconditioning the Road.

I set out for Paoshan, which I had by now come to regard as my second native city, and consulted the Magistrate, a most energetic man. A conference of all the prominent people in the district, including the village chiefs, was held in his office. I explained to them that they would be embarking now on the beginning of the end. They were greatly heartened and agreed to supply the necessary labor force.

The success of the negotiations was due not to my oratory, however, but to the excellent relationship with the local people that had already been established by the Administration. It was necessary to get their cooperation, because this was an unusual request. Laborers had never been sent so far before.

On the first of October, 1941, we began to move with the tempo of a fire brigade. Our objectives were three, all of equal importance: security, continuity, and capacity. A smooth surface in itself would increase the capacity; but, unless the profile of the Road was improved, the increased speed that would now be possible would mean only greater danger to the drivers.

Thus, before the improvement work could be started, the roadbed had to be widened, all gradients had to be cut to below 8 per cent (some had been as high as 23 per cent), sharp curves had to be cut to a minimum radius of 45 feet, and the drainage had to be improved and foundations reinforced. All the wooden bridges had to be replaced with stone arch or reinforced concrete, for the jolts going onto those bridges were very hard on the springs and often resulted in injury to the drivers, who were likely to bump their heads on the top of the cab. The jungles had to be cut away on both sides of the road to afford better vision.

The force was divided into two crews, the civil gang and the resurfacing gang.

The civil gang was to go ahead, improving the profile, putting in more and better culverts, replacing the wooden bridges with stone ones, erecting garages for the roadbuilding equipment and houses for the workers, and at the same time preparing the supply of stone, chips, and sand. In this way, everything would be in readiness for the surfacing crew when they came along instead of their having to wait for the advance gang.

We began in five places at once with the intention of letting the strips meet. Because of this method, there was no chance to do the job in shifts. The men had to work straight through without rest, every skilled laborer doing another man's job in addition to his own. They never had time for so much as a haircut or a shave, let alone a bath.

The work started at eight in the morning as soon as the mist was off the mountains. The crew would barely take time out for lunch and dinner and would keep right at it into the night, working by the light of kerosene flares.

We gave particular attention to the welfare of the working force, paying them in advance, establishing an overtime scale for night work, making sure that there was rice for all and meat enough at least for those who were doing the heavy tasks.

It had long been evident that the thin and abbreviated clothing worn by the Yunnan farmers was not adequate for road work under varying climatic conditions. I designed a special garment to be worn by the laborers, a sort of overlength vest, reaching to below the knees and having no sleeves in order that their arms might be left free to swing a mattock or a hammer. Made of the standard blue cloth of the province, they were well lined with cotton padding that

served as protection against the cold. They could also be used as bedrolls at night.

Since the vests were mass-produced, they were made all in one size, which was of necessity rather large. The workers, however, were of all different sizes. On some, the vests came down to their ankles or billowed around their middles, creating odd effects. This was quickly corrected by adding a series of bands down the front, like the straps on a straitjacket, enabling them to be laced to a more appropriate size.

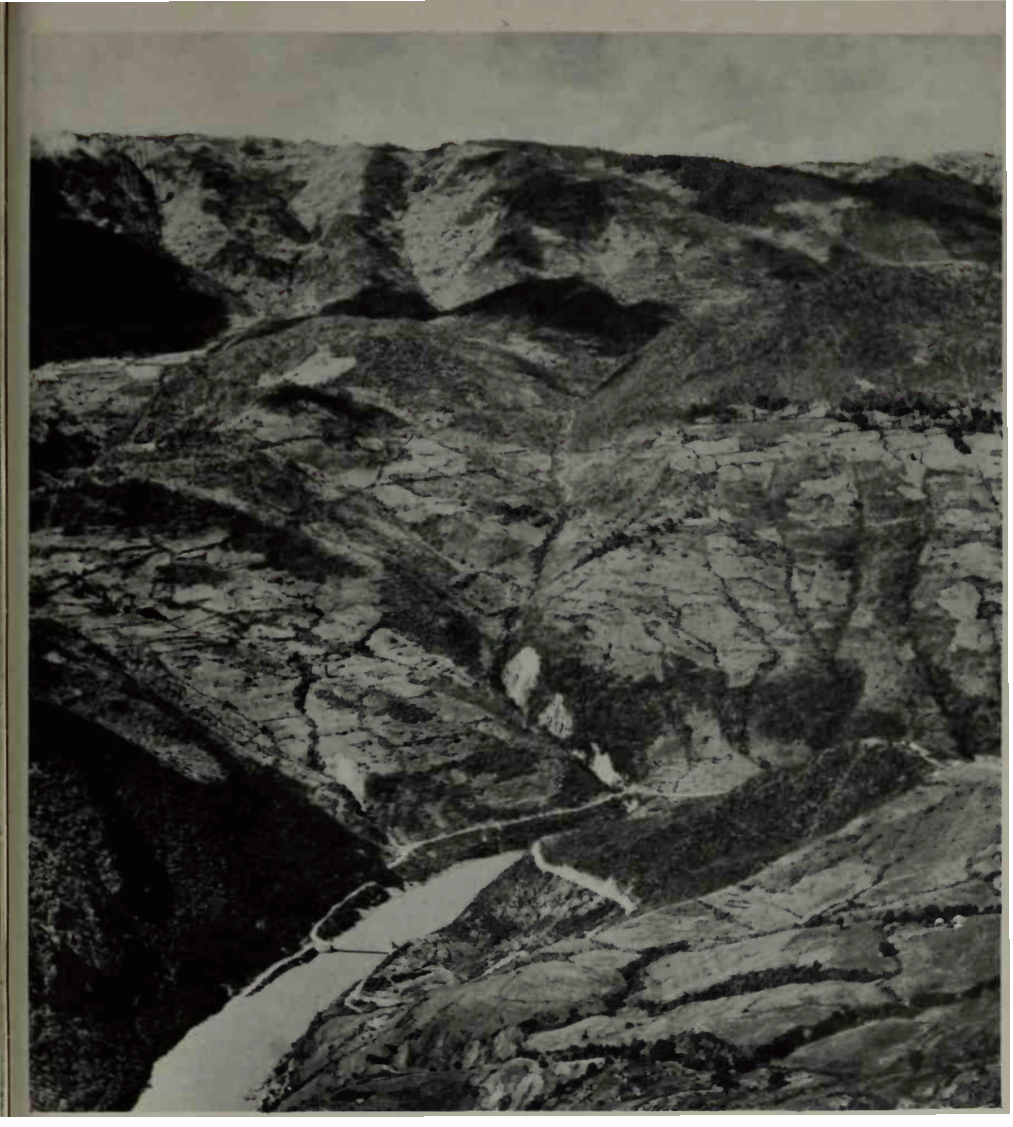
Our word had been pledged that the workers would be provided with a specified amount of pork each week. No matter what troubles we encountered, the pork had to be on hand; for, if we once broke our word, they would lose confidence in us altogether.

In the Shan country, no central source of supply existed. The pigs could be procured only one by one from farmers or village families. We had to scour the countryside for them, because the region near the Road was not as a rule very thickly populated.

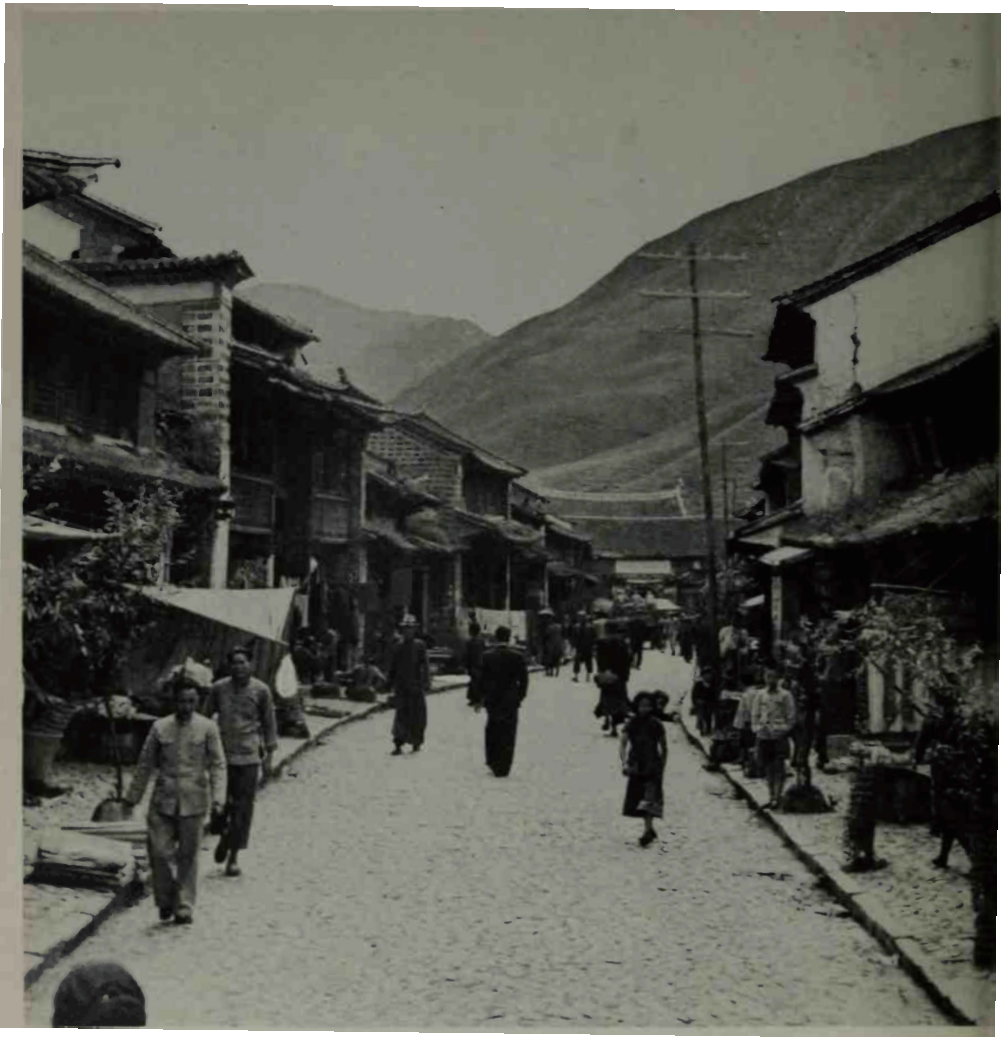
Not a single worker could be spared for this time-consuming task, and we had to ask the nurses to do it for us. They were cheerful girls and well prepared for anything, but I doubt if any of them ever imagined that her duties would include the purchase of pigs.

The Shan people were very reluctant to sell their pigs. Even when they could be persuaded to part with the animals, they refused to sell by weight but sold only by their own method of guesswork and bargaining. Endless negotiation was therefore entailed in the purchase of each pig. The nurses had picked up a little of the dialect and often went accompanied by the noble ladies of the Sawbwa's family who helped the transactions along considerably.

For all their effort, not enough pork could be had for both workers and the skilled mechanics and engineers. The latter,



Mountains towering above the Salween River showing the road and Salween Bridge.



Street scene in Hsiakwan after repaving.

of course, were considered as our own men and not as guests, but without meat, they had to get along on a rather skimpy diet.

Their meals consisted for the most part of the bitter native vegetables, made a little more palatable by vegetable oil. The men usually ate sitting cross-legged on the ground, and I often ate with them in this manner. Their life was not exactly easy, but their spirit and morale were of the best.

Many little complexities now arose to plague us. The rollers that we had been able to get were very light. They exerted only 140 pounds pressure to the linear inch, whereas we actually needed a pressure of 250 pounds. Consequently, the road had to be rolled many more times than should have been necessary. A man was assigned to walk alongside each roller, watching the stones on the Road. As long as a stone moved, the surface had to be rolled again. It was only when no stone stirred under the roller that we could consider the work completed.

The bituminous distributors that had been ordered—an essential part of equipment for an efficient job—had not yet arrived. There was nothing to do, then, but to contrive our own homemade methods. We punched holes in the bottom of kerosene tins, filled them with asphalt, and did the spraying by hand.

The stone crushers we had were small and could produce at a maximum only 5 cubic yards an hour. Since they had no screen attached, and there was neither excavator nor elevator to move along with them, a crew of some sixty men was needed to feed the rock to the machine. This method at best could only be called semimechanized. Then the jaw plates began to wear out, and to our great sorrow we were unable to locate any spare parts.

We had only a few compressed-air rock drills, and they were not suited to the ordinary Chinese stature. Furthermore,

the workers did not understand how to use them, and they had to be operated by our mechanics in their spare time. Only the biggest and strongest men did this work. The handles of a jackhammer are too short for four hands, and the men doing the drilling therefore had to have another man standing behind him and pressing down on his shoulders to give him extra weight.

In America, I have since seen the wagon drill with removable drill heads that operates automatically so that no special strength is required to work it. This type of drill should prove most practical for future Chinese highway construction and for the building of dams and tunnels as well.

All this time the struggle to get enough limestone of suitable quality for the crushed rock was becoming increasingly desperate. In building an asphalt road, a tremendous quantity of stone is needed and also an extra supply of chips to be left in piles for later patching. All through the muddy mountains of the Shan country, no satisfactory limestone could be found within a distance of more than 30 miles. Beyond the mountains in the flatland around Mangshih, the same condition prevailed.

We made it a rule that every truck going back empty, regardless of who the owner was, had to carry a certain number of baskets of stone from Lahmong, 60 miles away.

For this accommodation, each driver was paid an extra fee—moderate to be sure, but one that in our estimation seemed quite adequate for the Mangshih section. However, I soon discovered that the drivers were throwing their baskets of stone away as soon as they were out of sight of the loading depot, for they were finding it more profitable to sell the excess gasoline left in their tanks than to use it up in hauling the stone. In comparison with this revenue, the "tips" from the government meant nothing to them.

Some Indian and Burmese drivers flatly refused to haul any

stones, protesting that they had to tow in two other trucks whose engines were out of commission. This fooled our staff men at first. But the trick was soon copied by other drivers, and we saw many trucks coming back pulling two others. Our men learned in time that the other trucks weren't disabled at all; this was just another way of saving more gasoline to sell. We had no right to take them to task, for this was merely a good-will arrangement and not backed up by law.

The stone problem was getting more acute than ever, and there seemed to be nothing I could do about it. In desperation, I sent a detail of badly needed workers out to hunt for stone quarries on foot. To spur the search, a reward was offered to the man who would find the best and biggest quarry.

Several days later, one of them came in to the office to claim the reward. He had located a rich vein of the very finest black limestone, hard and brittle, no more than 4 miles away from the Road, in a village near Mangshih.

We could not have been more excited if he had discovered a gold mine. I paid the worker his reward, built a road into the quarry in 3 days and sent in four stone crushers and two compressed-air drills, together with a picked crew of a thousand laborers. Straw huts to accommodate them were built in 2 days.

Out of the face of this particular rock quarry flowed a fine fresh stream. To the simple Shan people of the vicinity, this fact had a great significance, for it meant that the dragon lived there. That is an old Chinese superstition. Wherever there is running water, heavy mists, or clouds, there is the home of the dragon.

The dragon, according to their belief, is a mighty being. He has great power to influence the fortunes of everybody in the neighborhood, particularly the farmers. I suppose the superstition stems from catastrophes associated with water,

floods, and sudden storms. In any event, the dragon is highly respected and greatly feared.

When the Shan people heard the sacred quarry echoing to the machine-gun rattle of the pneumatic drills, they grew alarmed. Their dragon had slumbered there peacefully and amiably for thousands of years. Now it seemed all too likely that he would be frightened and irritated by this hideous imported noise. If he didn't care for it, he would move away, and the stream would flow no more; they would have no more water for farming, and good luck would depart from the village with him.

This was a serious matter to us, as well, for we were using many of the Shan people for work on the Road, and we needed to retain their good will.

I asked our section chief, Mr. Wang, a good diplomat, to confer with Mr. Fang, the local Sawbwa, who was equally diplomatic and a wise and well-educated man. Wang explained to him that we had to have the rock from the quarry at all costs. But we were perfectly willing to follow any plan that would appease the people, and Wang informed the Sawbwa that if anything happened to the stream he would take full responsibility and would guarantee that the village would be well supplied with water.

What the plan was to be he left to Mr. Fang to suggest, for the Sawbwa knew the workings of the people's minds far better than we did.

Mr. Fang thought the matter over and then suggested a course of procedure that we followed. Outdoors, in that rough, limestone quarry, near the spring, we set up a formal altar, decked out with incense and red candles. On the altar was placed a sacrificial feast for the appeasement of the dragon: chickens, fish, roast pigs, every delicacy we could obtain. It must have made the mouths of the hungry engineers water to see such tasty food in front of them and not

to be able to touch it because it was all for the enjoyment of the dragon.

Paying their respects as my personal representatives, these hard-boiled engineers, all well educated, all scientifically trained, addressed the dragon with perfectly straight faces, something to this effect, "Please, Mr. Dragon, sir, if we have in any way disturbed you, we beg your most humble pardon. We want you to know that we did not do so deliberately. We came here only because we had most urgent work to do. But our stay is only temporary. If you can only stand the racket a little while longer, we will then be gone and you can enjoy your quiet life forever afterward."

The Shan people who were standing about looking on seemed to be very well satisfied. And I should think that the dragon must have been gratified too.

We thought then we could consider the dragon crisis settled. But a few days later, while cutting away in the quarry, our men brought down a sudden landslide, cutting off the stream.

Now the Shan people were completely convinced that the dragon couldn't stand the noise and had moved away to other quarters. It was no use explaining to them that the stream had just changed its course and was flowing out elsewhere. In their eyes, the fact that it wasn't coming out where it did formerly meant only one thing. The dragon had moved.

Many hours of earnest explanations followed. But they remained unconvinced until we got the water flowing again over its original course. After that, we took particular pains to see that the stream was well protected so that such an accident would not occur again.

Great care was taken with the feelings of the Shan people. The workers were rewarded with meat every week, and each one was given a specially tailored long Chinese-style garment for working and sleeping and two mosquito coils for

his hut. Doctors and nurses were in daily attendance. In spite of all these precautions not a few died from malaria.

The rock in the quarry proved to be so brittle and hard that it constituted a real danger. We had to get a mile or so away during blasting. I had set a minimum of 500 blastings a day, and they were going on all the time. I went there every day to count them.

On one occasion, I had a close call. We always set the fuses so that we could do as much blasting as possible during the noon hour. One day at lunch time, I was talking with one of the captains when a charge went off. We were some distance from the quarry and paying no attention. Suddenly a rock went whistling right past my ear and struck the captain with such force that it knocked him flat and broke his right arm.

A situation arose in the quarry that taught me a valuable lesson in dealing with those people and was also illuminating about human nature in general.

Since no suitable rock crushers were available, we had to dismount the portable ones, which were designed to take small stones and crush and scatter them along the Road, and set the machines up very high so that the rock would roll down a long homemade screen with 1-inch openings in it. The chips would fall through the screen, and the larger stones would roll on down into the truck.

The stone crushers were run by power from Diesel engines transmitted through V belts. I am sure the manufacturers never expected their machines to work together with the Shan people in front of a dragon's home.

A stock pile of big stones was accumulated on the high wooden platforms supporting the stone crushers, so as to avoid running out of materials. Each worker carried stones up the steps to the stock pile according to his strength. The Shan girls would carry only a small one in each hand, laughing and apologizing for their weakness. The stronger men

carried heavy basketloads on their backs. They would mount the steps, cross the platform, deposit their stones, and then go back down the way they had come. A man carrying a heavy load of stone has his head down and cannot see in front of him. With so many coming and going over the same path, they were forever bumping into each other. That would make them very angry; they would stop to argue and exchange accusations, and a great deal of time would be lost. I grew concerned over it and suggested the simple alternative that, instead of trying to go back down the same steps, they go on across and down the other side, thus avoiding colliding with each other.

I tried to make that clear to the workers, but they couldn't see any sense in it at all. They thought I was being unreasonable. They could prove to me conclusively that this would require twice as many steps as to do it their way.

I did not try to force them. But I finally persuaded them to give my way a trial. After they experimented with it and saw how much simpler it was and that there were no more collisions, they were satisfied.

This experience taught me once again that to bring primitive peoples around to the modern, scientific way of doing things takes time and patience and, above all, a careful and clear explanation. To force them is no use. They will do the job but do it grudgingly, still convinced that they are right and you are wrong. This has been recognized in a basic principle of high Chinese philosophy, "If a man performs a service for you willingly, he will give you a better job and his permanent loyalty besides."

The workers also had to be trained in the proper way to feed rocks into the hopper, to put them in gently, one rock at a time, standing close by. Their natural inclination was to throw the stones in from far away, and that would have damaged the jaw plates, for which we had no spares.

We taught them to listen to the noise, comparing the engine to a man who gets sick if he is not properly treated. If the sound goes along steadily, then the engine has nothing of which to complain. But, if it begins to gasp and choke and sputter as it does when rocks are thrown from far away, something is wrong.

Now that we had the limestone, the surfacing work went faster. We moved along, completing about three-quarters of a mile a day, always limited by the amount of stone we could get and the equipment we had to work with.

At eleven-thirty on the night of January 31, 1942, we passed through Lungling, exactly according to the schedule.

We had had good luck. We never broke a machine. We never had a rainy day. It was the most scientifically managed, efficient, and strenuous operation in the whole history of the Road. It embodied not only the asphalt surface but every fundamental improvement.

Credit for the achievement is due to the assistant chief engineers, Mr. Cheng Fu-hwa and Dr. Lee Weng-ping, to the section chief, Mr. Wang Yu-weng, and to their many assistants, particularly the mechanical engineers who had worked day and night.

Mr. Wang had a trying time of it. He had the misfortune to stutter, and the more excited he got the more he stuttered. The Shan girls used to laugh at him and make fun of him; the laborers and mechanics would purposely try to confuse and excite him, just to hear him. But he managed to give clear directions nevertheless and to keep his head in spite of his embarrassment.

The most difficult section was now behind us, and we all congratulated each other. Yet, looking back, we could see that it had not been done in the most efficient manner. Considering the lack of competent workers and supervisors, we now knew that the best way would have been not to start at

many points simultaneously but to proceed in one big group. That was the way we planned to surface the rest of the Road.

The asphalt strip was 16 feet wide, and we could already see the beneficial results. Cars could now go up the steep hills in high gear. Since many of the worst curves were straightened out, drivers could go as fast as 60 miles an hour. Comparatively few trucks broke down now since the roughness had been taken out of the Road. Because of these factors taken all together, the quantity of goods transported was already being increased threefold.

When the whole Road had been surfaced, I estimated that heavy trucks could make the journey from Lashio to Kunming in 4 or 5 days and light cars in 3 days, instead of the 12 to 15 days previously needed to cover the same distance.

I was also confident that, once the asphalt was down, we could inaugurate night traffic. As a matter of fact, there were a number of reasons why night driving would be much safer than day driving. A man driving at night is much more alert and pays much closer attention to the Road. He can see nothing except what lies in the path of his headlights, and he is therefore relieved of that fear of great heights which afflicts so many drivers. The asphalt also makes a ribbon of black across the countryside that is easily distinguished from the adjoining ground.

We shifted all our mechanical equipment farther east and got ready to continue the paving job. We had ordered a lot of fine new equipment, machinery, road-sign reflectors, etc. As soon as these came, we expected that we would be able to make at least 4 miles or more a day and calculated that we would be able to finish surfacing the entire Road by the end of 1942, taking into account the 5 months in the rainy season when we could do no work, except reconditioning.

Meanwhile, however, there had come the attack on Pearl

Harbor. Now our whole supply of asphalt, Diesel oil, and gasoline was cut off, and the work had to come to a stop.

All the fine equipment that we had ordered under Lend-Lease never arrived. From what I have been able to learn since, it eventually reached India and probably is still there. With this equipment, it should be much easier to complete the road surface and maintain it in the future.

The part we finished is now in its third or fourth year. On this stretch, the Road should give no more trouble. Even the landslides that had to be cleared away every year have been reduced to a small percentage of what they were in the days of the "water-bound macadam."

About 400 people out of the 8,000 and more who worked on this job gave their lives. Some died of malaria and dysentery in spite of the best medical care we had been able to provide.

But some were killed by the wild drivers speeding through without regard for the work going on. Road signs meant nothing to them. When we had just finished a fresh surface, we would blockade it at either end with empty drums to safeguard it. But they would drive right through the drums and spoil the surface while we were asleep.

We began to arrest them. We would say to these drivers, "Here we are, working as hard as we can, just to make easy riding for *you*. Why is it, then, that you come along before we are through and spoil everything? What is your idea?"

The drivers would simply shrug their shoulders and reply, "We thought asphalt was just like water and would dry off at once. How did we know that it was going to remain sticky for a while?"

We kept on arresting them, and even that didn't do any good. They cared nothing for the barricades of drums. But we knew that they would respect the rollers. Finally, we put a big heavy roller, carefully marked with a red lantern, at

each end of every fresh strip. If the drivers wished to carry their recklessness to the point of suicide, that was up to them. In spite of those precautions, a scarifier behind a roller was hit one night and the lever broken. By and large, however, we had no more trouble after that.

A working model of the Road was prepared by the Highway Bureau of the Ministry of Communications, with samples of some of the equipment and methods used, and was placed on exhibition at Chungking, where it attracted many visitors.

The Generalissimo was extremely busy at that time with the pressing matters of the war. But busy as he was, he found time to visit the display and became so interested in the mechanical demonstrations that he spent a quarter of an hour there.

The Burma Road experience has an important lesson for the future of China. This kind of work has made the Chinese aware of the difference between a really good highway and the ordinary one to which they have been accustomed.

The China of tomorrow will need good highways, the most logical method of transportation for us. The railroads in China are not well developed. The usual method for transporting goods is by water. But the rivers are becoming steadily more shallow, and some are now impassable. Furthermore, water transportation is too slow; it is all right for carrying agricultural products, but in moving industrial products more speed is necessary to catch the market.

In China, most goods are purchased on credit. They are therefore mortgaged to the bank from the moment they leave the seller's hands. But money is very expensive. Interest rates are high, about 1 per cent per month. For this reason, seldom considered, dependability of speed in transit, which involves both the route and the vehicle, is essential.

Much as our country will need highways, I cannot see how

she will be in a position to pay for them. It is my opinion that, if both the automotive and petroleum industries were to help in the financing of road systems, they would benefit by a much wider and more immediate sale of their products than could be achieved by any amount of advertising.

Motor-truck owners are not at all susceptible to the advertising approach. Because they have to count every fraction of a cent, they are very shrewd businessmen. Their point of view is well illustrated by their proverb, "When a man is trying to sell you a melon, if it has a bitter taste he certainly won't tell you."

All they ask of a product is a fair price, durability proved through experience, and assurance that they will not have to pay exorbitantly for spare parts. These characteristics I have observed time and again during my 10 years as chief of both land and water traffic for the city of Shanghai, from 1927 on.

From my road-building experience, I am convinced that China's future highways should be constructed by mechanized methods. Westerners generally seem to believe that our country's enormous man-power supply can be utilized very cheaply. But one has only to see this theory followed out in practice to realize its fallacy. It is much harder to train laborers by the hundreds of thousands than it is to train mechanics by the hundreds. Then there are all the difficulties of caring for masses of workers, providing them with food, housing, medical care, etc. Also, the Chinese are an agricultural people. A distinct boundary line exists between farming and engineering, and our laborers are never really professionals. True, the Chinese people have a natural mechanical aptitude, but it takes time and patience to teach them. Therefore, in modern road construction, machinery should be used that is provided with automatic speeds so that it cannot run either too fast or too slow. In this way, it is possible to get better results with less supervision.

The highways of tomorrow could be constructed of either asphalt or concrete, with the latter offering more attractive opportunities, because there will be plenty of cement factories in China that could supply materials.

People in foreign countries who wish to sell to the Chinese ought to reexamine their sales psychology if they wish to maintain thriving trade. The road must come first. After that, the people who buy must be given a chance to make a profit. During the war, the sale of every truck or automobile has been conducted as though it were the last. Nobody cared about maintaining good will as a basis for the next transaction.

All that should be changed. If the purchasers cannot make money out of a truck, how can they buy gas, oil, tires, spare parts, or their next car?

From our Burma Road experience, we learned that many trucks are owned by a family or by three or four partners. In this way, they can scrape the money together for the original investment. The truck then becomes the means of livelihood. If the good road is there on which they can operate and if payments are graduated so they can be met, the purchasers can continue as customers. That will stimulate more purchasers. It should be remembered that the large government orders are to be had principally during a war. For continuous business, one must deal with the people as individuals. This may mean only one or two cars to a sale, but all added together such sales can amount to a lot.

If the roads are built, if the principles suggested above are adhered to, we may see the dawn of a new era in Chinese transportation, indeed in all agricultural and industrial development and in international trade as well.

Chapter Eleven

INVASION AND RETREAT

IN MAY of 1942 came a dark time. The Chinese armies in Burma had begun to retreat. Encountering only slight resistance, the Japanese moved forward so fast that they had almost reached the west bank of the Salween before anyone could grasp what was happening.

The immediate disaster was great enough. The asphalt surfacing had just been completed between Wanting and Lungling, and the Road was thick with cars carrying military cargo. Most of them managed to get through to Paoshan, but many had to be destroyed by the transportation authorities to keep them from the Japanese, and valuable stores were lost.

Communication with Rangoon was totally disrupted. The railway had stopped running; the highway up to Lashio had been partly destroyed by the Burmese. A few drivers still tried to get their loads through, but the odds were against them. They were targets for bombs. They were shot at from the roadside, and traps were set to wreck their cars.

Ahead of the invading armies poured the flood of refugees, largely Chinese who had been dislodged from their homes in Singapore, the Malay States, and finally Burma, by the successive stages of Japanese occupation. Now they were all making a last frantic effort to reach security within the borders of their native land.

The confusion was indescribable. Although they did their best, neither military nor civil police could begin to cope

with such a heterogeneous and uncontrolled mass migration. The *émigrés* were not even able to make themselves understood; for, after many years away from home, during which they had evidently neglected to keep up their Mandarin as instructed, they spoke only a dialect of their own that sounded as unintelligible to Chinese ears as a foreign tongue.

They had, of course, left in haste, taking only the clothes that they had on their backs—garments designed for comfort in tropic heat, affording scant protection against cold nights on the mountains. Whenever they paused to rest in their headlong flight, they congregated in makeshift camps by the roadside. And then they became prey for bombers, for rifle bullets, and for disease.

Death threatened simultaneously from all directions: from planes in the sky, snipers in the underbrush, insects underfoot, and hunger and thirst within. They had no chance to bring any food with them and did not know where to find any safe water. Thirsty as they were, they drank from the streams, increasing the danger from disease.

The Burmese were no help. Some now began to show their true sympathies and turned on our hapless countrymen. Had they not been forbidden by the British to carry firearms, with the exception of high officers, who had special permits from the police commissioner, the loss of life would have been much higher. They had only knives or swords, but wreaked havoc enough with those weapons. Besides that, some acted as spies for the invading armies, leading them by way of little-known short cuts through the jungle, lighting signal fires on the hills, and resorting to all kinds of similar tricks.

Thus harried and threatened at every turn, the refugees straggled along the Road, a great inchoate mass. And as they came, they brought the cholera with them.

But a more immediate peril loomed. Forward units of the

Japanese armies were already penetrating as far as the west bank of the Salween. Should they be able to get over that formidable natural barrier, only the arrival of the reserve army could keep them from pressing on right up to Kunming.

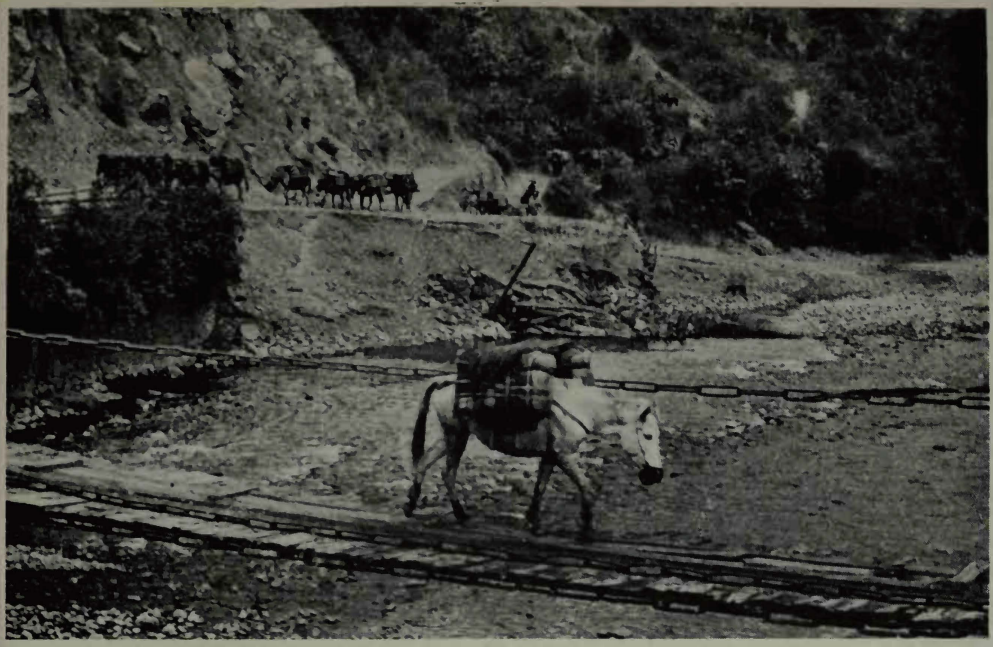
Here, in particular, with the hostile armies so close behind, traffic had become one vast snarl of confusion. There were wild scenes, with everybody shouting, gesticulating, and blowing horns at once. Those on foot clogged the way of motor vehicles. A number of the refugees had been able to get hold of trucks of their own, and many of them did not know how to drive, which added to the chaos.

Traffic on the Salween bridge had always been rigidly supervised. No more than one truck had ever been permitted on the bridge at a time, for the structure had been designed to support only 10 tons, and the gross weight of a single vehicle, loaded, was as much as 5 or 6 tons.

The situation was now beyond control. Trucks came streaming across the bridge almost fender to fender, with six or seven of them over the water at one time, putting a strain on the bridge of at least 30 tons. It whipped and undulated like an injured snake under the strain, while the engineers looked on, holding their breath. Yet it never broke, and thousands were borne to the eastern side. Without being able to foresee this exact situation, its construction had been calculated with a safety factor of several hundred per cent.

With such confusion and so many nervous, excited, and inexperienced drivers, there were many breakdowns. Among the hordes of refugees were not only spies and fifth columnists, but Japanese soldiers, and it was impossible to tell whether the breakdowns were accidental or deliberate.

Only decisive action on the part of the Chinese bridge garrison prevented a fatal congestion. They had no time to ask for orders, and so they took matters into their own hands.



An old-fashioned chain bridge.

Bulb–horn symbols used to mark sharp curves and other danger spots.

The Mekong River showing bridge in the foreground.

Whenever a car broke down, they simply commandeered the truck and jerked it off the Road. This resulted in the saving of hundreds of lives.

Japanese soldiers were beginning to show up in alarming numbers on the Chinese side of the river. Some had crossed by infiltrating among the refugees. Since the latter did not know one uniform from another, it had not even been necessary for the Japanese to assume a disguise. Furthermore, whole units were fighting their way across the bridge.

If they could get over in enough force to hold the bridge at both ends and prevent its destruction, the way would be open for the advance of the main army. No recourse remained but to destroy the bridge, which represented so many patient hours of labor.

It was now only a matter of minutes. If it had been necessary to place the charge, the bridge would have been lost. But the military had prepared for such a crisis long before, and dynamite for the demolition had been made ready. Nothing remained to be done but to set it off under military orders.

Even with all these preparations, it was touch and go. Units were coming up on the other side. Soldiers who had already crossed were attacking the bridge garrison, and fighting was going on at close range, both on the bridge and on the bank, while the switch was being pullled. At that moment came the explosion; and, with one tremendous roar, the bridge vanished into the air. The small force on the Chinese side was now isolated and easily disposed of.

Although the loss of the bridge was saddening to the engineers, its destruction had the desired effect. The Japanese thereafter never got beyond the Salween. All they could do now was to pick off the refugees with gunfire as the last of the trucks toiled slowly up the exposed sides of the interminable gorges into the protective cover of the mountains.

The tide of refugees swept on. Terrified by the bursting shells, many of them left their vehicles on the highway and took to the back roads or made their way cross-country through the jungle, carrying their children and clinging to the remnants salvaged from their household effects. Hot, thirsty, and inconceivably weary, they struggled over 30 miles of rock and underbrush into the city of Paoshan. It was a bitter business.

Most of the engineers got out in time. But one administrative unit was still at Lahmong under instructions not to leave until given the order to evacuate. Lahmong, on the western side of the river, was now well behind the Japanese lines, and presently they were taken prisoner by a Japanese patrol.

Mr. Chai, the engineer in charge of that section, and his five assistants were at once lined up by the Japanese along the top of a rather shallow gorge, about 25 feet deep. Then, one by one, the soldiers ran at them with bayonets, toppling their bodies over the precipice.

When Chai saw what his fate was to be, he did not wait to feel the impact of the bayonet, but jumped off just ahead of it into the gorge. He lay at the bottom without moving, all through the afternoon; and the Japanese, believing him dead, paid no further attention to him.

After darkness had fallen, he got up and began cautiously to make his way down the gorge through the Japanese-occupied territory back to his own lines. One leg had been twisted in the fall, and he was having a hard time of it. But he had the good luck to run into one of our truck drivers who offered his help, at the risk of impeding his own progress. Together they went on. After a day or so, they came to a farmhouse and were given clothes that served to disguise them as local residents.

The country was wild, and they had no compass. All they could do was to follow the winding gorges, hoping they were

going in the right direction. At length they came out on the banks of the Salween some distance above the bridge. There they stumbled on an abandoned native bamboo ferry in which they were able to cross to the eastern side.

After 3 days they arrived at a small station halfway to Paoshan. Chai tried to explain that he was chief of the section at Lahmong. But wearing those tattered farmer's clothes, haggard and thin from the journey, he couldn't get anybody to believe him. Under such conditions, people did not waste much time with those who could not give a satisfactory account of themselves. Fortunately just then one of the ambulance trucks of the Administration came by, searching for missing staff members along the Road, and the driver recognized him. He was given a warm welcome. Chai was in the hospital for 2 months on the verge of death as a result of his experience.

Another group under the direction of Mr. Cheng Fu-hwa also fell into the hands of the Japanese. They were captured by a unit of the main army that was under the direction of officers and were therefore not immediately put to death. They were assigned to hard labor, hauling water for the soldiers.

Although they were tough men, accustomed to hardship, they were not used to such heavy work, and it was very hard on them. One day when they were out away from the main camp, a Japanese soldier who was acting as one of their guards drew them aside and whispered to them, "Now is your chance to go."

They looked at the man in the Japanese uniform again, not knowing whether this might be a trap. He was a big fellow. And he had spoken in the Manchurian dialect! They concluded that he must be one of the many Manchurians who had been taken after the first occupation to fight for Japan and therefore might possibly be friendly to them.

The engineers decided to take a chance. They threw away their water pails and ran. Then began their long, slow trek feeling their way down the gorges. The gorges were all dry at that season of the year, and the men were nearly dying of thirst.

One morning they thought they heard the sound of running water but could hardly believe it was anything more than an illusion. Nevertheless, they followed the sound, which drew closer and closer. Then they saw its source—a cool spring in the side of the hill, genuine, real—but surrounded by Japanese soldiers.

Escaping meant more to them than slaking their thirst, and they had to continue without water.

They reached the banks of the Salween. Here was water at last, and they stopped for rest and refreshment. However, the Salween still remained to be crossed, a barrier between themselves and freedom. Only one of the three, Cheng the assistant chief engineer, was really an expert swimmer; one of the others was a fair swimmer; the third could hardly swim at all.

There was no boat or raft or ferry anywhere around. They sat down and considered. Under these conditions, how could they all get across the turbulent waters alive?

They approached the problem with engineers' ingenuity by organizing themselves into a human motorboat. They found a number of large stalks of bamboo, which has a high degree of buoyancy, and bound them together. The fair swimmer took his position at the bow, where he could guide the rude raft away from rocks. The poor swimmer took his place in the middle, so that all he had to do was hang on.

Cheng, the good swimmer, took his place at the stern, where he could serve as both human propeller and rudder. Buffeted by the current, carried far downstream, they managed to make their way to the other side without serious mis-

hap. Several days later, they turned up at Administration Headquarters totally exhausted.

In little groups, our workers straggled into Hsaikwan. Several thousand of them arrived safely. Only a few fell into Japanese hands.

The fleeing tide swept on into Paoshan, which was now swollen with people far beyond its capacity. Every hotel was packed. The residents freely threw open their homes to the refugees, without any regard whatever for the danger of the diseases that the stragglers brought with them.

Still there were many more than could be accommodated. The city was so crowded one could hardly walk through the streets. At night people slept where they dropped, in doorways, or on the sidewalks.

Then one market day, just at noon, when the congestion was most intense, the planes came over. They bombed the center of the town thoroughly and systematically. Because Paoshan had no air-raid warning signal, the loss of life was even worse.

The gutters ran with blood. So great was the confusion that many corpses lay untouched in the ruins for days. There were pitiful scenes as the people hurried through the streets searching with stricken eyes for their lost loved ones, or dug patiently at the mounds of wreckage.

And then came the cholera. It had already broken out on the Burma side, as was to be expected with so many thousands of people traveling, without water, without sanitary facilities. Other diseases were appearing increasingly also—malaria, influenza, and dysentery.

After the bombing, with so many bodies left unburied, so many people without homes, the cholera in particular became rampant. The tide of refugees, fleeing from the bombing, swept on eastward to Kunming, carrying the epidemic along.

They had no money, no food, no clothes, nothing. But the

Central Government reacted quickly to the emergency. Trucks were sent out to meet them in quantity, carrying foodstuffs, clothing, and plentiful medical supplies. By such prompt and concerted action a disastrous epidemic was averted there. The cholera began to diminish.

Meanwhile all schools and temples and every available public building was cleared for the emergency. In Kunming, everyone threw open homes to them as in Paoshan. In my own home there, 125 of them were accommodated.

With this sudden influx into the already overcrowded city, there could have been great confusion. But everything was so well organized and the local police force worked so efficiently that they were absorbed into the city life without undue disorder. Eventually the refugees either found places where they could stay or started out again on the long journey back to their homes.

About that time, we got our orders to destroy the Road for a distance of 15 miles back from the Salween River.

It was a heartbreaking assignment to be asked to undo the hard work of so many months. Under the circumstances, though, there was nothing to do but to dedicate ourselves to carrying out the order to the letter.

The staff had moved out of Paoshan after the bombing. Now we returned, hoping to set up offices there, taking along a full crew, complete down to storekeepers and radio operators.

I shall never forget our entry into Paoshan. Here was a city of the dead. No living creature was to be seen anywhere. On every hand were the ruins—and the silence. Our very footfalls echoed emptily on the paving stones. And over everything was the unforgettable smell.

Our old office building was totally destroyed. With no possibility of setting up headquarters there, we moved on to the westward, until we found an ordinary countryman's

house in a small village where we could establish ourselves.

This was the saddest experience of my life. Everywhere were the white clothes that the Chinese wear in mourning as the Westerners wear black. The air was filled with the soft sound of weeping. Even nature contributed to the melancholy mood, for the rainy season had begun.

Here the cholera had now spread back into the countryside, and we dared not drink the water from the streams. We dug our own well in front of the house, and the water came up muddy and white as milk. It was boiled and filtered through charcoal and sand. But in spite of all these precautions, the staff was afflicted with dysentery and malaria.

The engineers embarked on this difficult task so sick they hardly knew what they were doing. Nearly everybody was weak and running a fever, myself included. Looking back on that time, so much of it is a blur to me that it is hard to recall anything clearly.

We were to start demolishing the Road a little back from the bank of the Salween, which meant that the work had to be done within range of Japanese guns.

The gorges running back at right angles to the river could have made the workmen easy targets, at many points, and the Road could therefore be destroyed only at places where the cliffs and bends afforded cover. Our every move was watched by a Japanese observation post, probably located somewhere up in the hills, which directed the gunfire.

For this reason it was impossible to blast, because the sound would have guided their aim. The destruction close to the river had to be accomplished by hammer and chisel and crowbar. After the roadbed had been loosened, great chunks and boulders were pried out with a large bar, five men to a bar, and were sent hurtling into the gorge below. The crew had to work hugging the curves, ducking and scurrying to find shelter from the guns. Work at night had to be done in

the dark, for any light would have been a signal to the Japanese gunners.

In the beginning, the danger was not so great, because the light caliber guns were being used, and they did not seem to have the range. But as time went on, they evidently brought up heavier guns and found our range, because the trouble for us began in earnest.

Day and night we went back and forth from headquarters in the little village to the front line. At both ends, it was like being in a battle. The first floor of the house underneath our office had been turned into a hospital, and it was always filled with the moans of people dying there with cholera. The wounded workers were brought in to be operated on, and there were many heartbreaking scenes. I remember one old workman who had had a leg shot off by an enemy shell. The doctors tried to amputate; but he was too far gone, and there was nothing that could be done but to let him die.

The man who most distinguished himself at this time was our bravest engineer, Mr. Wang Han-chong. He had always been assigned the emergency jobs in the construction. Naturally, when this situation arose, he was called upon to play an important part. He often directed the work under Japanese gunfire and supervised the most difficult demolitions until he was struck in the arm by a shell fragment and had to be hospitalized.

The sections nearest the river offered the most difficulty for the reasons I have described. But, by the hard work of the skillful and devoted laborers and engineers, the Road here was cut away in some places back to the edge of sheer cliffs with not a trace remaining. It was done so thoroughly that it would have taken a long time to rebuild it.

It was not quite so difficult working back some distance from the river, for here it was possible to blast the Road out with gunpowder. We were lucky enough to have the services

of our powder experts from Paoshan, both the man who designated where the holes were to be drilled and the man who set the charges. They did not have to come. They well knew the dangers, for this section, too, was sometimes under shellfire. But they volunteered for duty and made it possible to blast out great craters in the Road.

At last everything was done. The Road was put into such a condition that it could not be used, all the bridgebuilding materials were moved to a safe place, the road-building equipment was checked, and the maintenance of the remaining section was arranged for.

We returned then to Hsaikwan. To our office had drifted back thousands of truck drivers, workers, staff engineers, having lost everything but their clothes, abruptly uprooted, their work disrupted, endangered by disease. And yet there was not the slightest excitement or confusion or disorder of any kind.

I paid them my respects.

Chapter Twelve

TRAFFIC CONGESTION

THE extreme congestion and many difficulties with traffic on the Burma Road have already been the subject of comment. In order to explain that these were to some degree unavoidable and not altogether merely the result of carelessness and inefficiency on the part of either the Transportation or the Road Administration, some of the reasons why these conditions existed are set down here. This is done not in the spirit of argument but rather in the hope of providing further illumination on the matter. Here are the reasons:

1. World events took place so rapidly that the situation changed almost from day to day. Therefore everything had to be done in a rush. There was no time in which to secure the road-building equipment essential to performing the work in the most efficient way.

2. Highways in China are very new. It was only a few years before the war that the first road construction of any importance was instituted by the Chinese National Economic Council. In all China, there were not a great many trucks. Transportation had always been by waterway, by rail, and by native carts.

3. Personnel was not available. In the whole of Yunnan province, there were not 100 experienced truck drivers. Most of them had to be brought in from some of the big cities such as Shanghai and Hankow. Even so, it was not possible to bring very many, for a good proportion of them, living in

occupied areas, felt that they had to stay and look after their families.

The drivers who did come had never known driving on such a road as this with its sharp curves and steep inclines. They hadn't been toughened and weren't accustomed to such long distances. They were used to driving only on good roads in cities.

There were few men experienced in handling traffic and few good automotive mechanics, and the transportation authorities had to set up their own schools to train mechanics as well as drivers. The only school for mechanics consisted of two classes held by the National Economic Council in Nanking, and the training here had not been very thorough.

4. It was not possible to buy all the equipment, facilities, and installations that were needed, because the government had many other expenses besides transportation facilities and time was too short to get delivery.

5. The Chinese have been farmers for thousands of years. Therefore they have never had reason to pay attention to any measurement closer than inches. They cannot readily grasp the concept of precision measurement. Training in the handling of high-precision internal-combustion engines requires many years. The change-over from the handling of crude agricultural implements is too big a jump for them to make all at once. Once they do grasp the concept of precision machinery, however, they make the best of mechanics.

6. The road surface wasn't suited to the handling of such a heavy load of traffic, and unlooked-for breakdowns therefore resulted.

7. Many parts became defective because of careless and hasty assembly in Rangoon. Rangoon is more a commercial and agricultural city than an industrial one. Rice mills and sawmills are its specialties. With only a limited amount of equipment available and a limited number of skilled workers

to do the job, the sudden need for truck assembly on such a large scale put a strain on the plants that they were unable to meet, and the cars were assembled under those conditions.

8. Trucks sometimes arrived in consignments of 1,500 to 2,000 and could hardly be expected to stand up very well. A proportionate amount of spare parts or repair tools and equipment was never provided. Many of the truck owners were amateurs who knew nothing about parts when things went wrong or even how to go about getting new ones.

Consider, for example, all the items involved in the operation of 1,000 trucks. The transportation authority would require 1,500 drivers, 1,000 garage compartments, at least 200 mechanics and engineers, a certain number of machine tools, a corresponding amount of spare parts, even storage room and dormitories for the increased personnel. This made it even harder to operate the trucks, in view of the shortage of trained men, money, and materials, than for the manufacturers to turn them out in mass production and ship them to us.

9. Everybody was so anxious to get as much material in as possible that all the trucks were overloaded. We installed a weighing scale on the border at Wanting, to check the load weights. This scale would register up to 10 tons. But as soon as the drivers had their weights checked, they would drive on a little way and overload all over again. This naturally shortens the life of the truck considerably.

10. It is a law of physics that, though an internal-combustion engine will run normally within 1,500 feet above sea level, it loses about 5 per cent of its power for every additional 1,500 feet above sea level at which it is called upon to operate. Therefore, at the high altitude on the Road, engines were delivering only about 75 per cent of their power. This was a fact that most drivers did not realize, and they would go right on putting heavier strains on the engine.

As time went on, the solution to many of these problems

was learned. And let us hope that, in the future, no one will ever have to face these difficulties again.

Speaking not on anyone's behalf, but purely from a technical point of view, I want to make these suggestions from what I have observed:

I hope that in the future the motor industries will not allow their trucks to be sold on the basis of so many dollars per ton, which creates the opportunity for customers to be misled.

After assuring good roads, the next most important thing is that the trucks sold in China be of a heavy-duty type that can carry at least 5 tons. A weight less than that is not practical, for most cargoes are in bulk and there are few fancy cargoes in China. An operator needs a truck of that capacity to be able to haul at a profit.

Personally, I prefer the Diesel tractor and trailer or semi-trailer, for the load is more evenly distributed and a heavier power plant can be used with a low piston speed that prolongs the life and necessitates less repair. On the Road, we had some Diesel tractors and eight-wheel trailers carrying a load of 6 to 8 tons, which gave satisfactory service. The ton-mile cost amounted to about one-fifth of the ordinary 3-ton gasoline-driven truck. The war has given the automotive industry much valuable experience that will be applied to the improvement of their postwar products. The Case and International tractors have served us for years and are still going strong. Even a better quality can be expected after the war, I am quite convinced.

It might well be worth while for automotive manufacturers to have available suggested plans for model local repair plants, represented in both blueprints and perspective views, of varying capacity, specifying impartially the makers' names and home addresses, the necessary machine tools, size, cost, and power required.

On each car, an extra plate should be screwed onto the frame stating the model number, year, engine number (some people take the casting series number of the cylinder block as the engine number), maximum load, tire pressure for both front and rear, and the number of grease nipples (many nipples underneath the chassis remain undiscovered).

It is strongly recommended that particular attention be given to heavy-duty shock absorbers for both front and rear. They can do much to prevent spring breakages, which were the headache of all truck owners on the Burma Road.

Sufficient attention has seldom been given to the matter of spare parts. They should be stocked and in readiness by the time the trucks are shipped out, just as one gets a hospital ready before the patients arrive, not afterward.

It is likewise advisable to print numbers on the spare parts, employing the system that we used so effectively with the spare parts of the bridges. As has been noted, Chinese technical terms vary greatly from place to place.

The Chinese name for jack in Shanghai, for example, is "ahfusah," meaning "you cannot crush that down." But to northerners the jack is "chien gin ding," meaning "the 1,000-pound erector." There are half a dozen other names for a jack in Shanghai itself.

Trucks should be sold with the steel body included, ready-made. This was one reason why on the Burma Road it was found that steel-bodied 2½-ton Chevrolet trucks obtained under Lend-Lease had given the best service and were generally popular with both car owners and drivers. If the ready-made body is not included, an oversize one is likely to be put on by either the dealer or the buyer, increasing the dead weight.

EPILOGUE

NOW the Burma Road, built under such strain and serious obstacles, at the cost of so many thousands of lives and many millions of dollars, involving so much patient toil on the part of so many hundreds of thousands of nameless workers, is once more in Allied hands. Again the trucks roll through from India to Kunming in unending stream.

It is the hope of those who built it that it will not only be useful for commerce after this war but that it will remain for generations, so that, if our descendants ever have need of it in years to come, the hard task of construction will not have to be repeated.

The Road has already done much to call attention to this part of the world. Before the war, it was relatively unknown, even to the people in neighboring provinces. Now it is familiar to millions living in distant continents.

These districts are rich in natural beauties that many will want to visit, in natural resources that only await exploitation. Yunnan Province alone has a wealth of tin, iron, coal, mercury, and many other resources as yet untapped. It also has the necessary water power for development.

The foundations for postwar prosperity have already been laid.

In this direction, the Burma Road, although it never was up to the standard we desired, is at least a first step in joining two of the great nations of the future in Asia. The next and final link has been the completion of the Ledo Road, requiring even more determination and energy to penetrate the jungles.

The two are linked now in one great thoroughfare. The modern age will come swiftly now to that region. And perhaps, while the memory of the building of the Burma Road is still fresh in human hearts, it would be no more than fitting to erect at either terminal—in Kunming and in Wanting—a lasting monument to the unnamed thousands who, by their endurance and devotion, built the highway over which future travelers will pass, more mindful of the scenery and thrills of the route than of the sacrifices that made their journey possible.