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Photo VII-1. Mixed coniferous and deciduous forest at east edge of Kaima Plateau. Looking north.

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VIII. RIVERS, LAKES AND SWAMPS

A. GENERAL

The Korean peninsula has an intricate network of large and small rivers. In general, the large, navigable rivers are located along the west coast. Most east coast rivers are short and very rapid. The majority of Korean rivers are not fordable during most of the year, but many streams can be forded during the low water season from November to March.

Four principal river systems drain extensive areas of Northern Korea. In the north are the Yalu River and the Tuman-gang (river), the only major eastward flowing stream in Korea. On the west are the Taedong-gang and Ch'ongch'on-gang.

Except for the Yalu, Korean rivers are relatively short. Generally they are swift in their upper reaches and slow in their middle reaches, and except for those along the eastern coast, they have built up fairly large flood plains. With minor exceptions the drainage pattern follows the relief of the peninsula. Few of the rivers could be utilized as waterways, but their valleys are important as routes for movement.

The larger rivers range in width from four miles to about 50 yards. Most have a normal width of one-fourth to one-half mile. Many smaller streams range between 100 and 200 yards in width. The average normal depth is 2 to 3 feet in the upper reaches and about 6 to 9 feet in the lower reaches. Flash floods occur during high water season, and many streams become raging torrents, forming major barriers to movement.

Many streams, in their upper courses, flow through narrow valleys with cliffs 30 to 50 or more feet high. In the lower courses, especially near the west and south coasts, the river banks are low. In lowlands areas, river banks are generally sand and gravel and are gradual in slope.

Rivers in northern Korea are frozen from 3 to 4 months a year and those in the central part 2 to 3 months. Many frozen streams and irrigation canals in the western lowlands can be crossed by foot troops and light equipment. Rivers in southern Korea are open all year.

Extensive irrigation canals along the banks and near the mouths of west coast rivers would hamper military movement during the growing season.

For the purposes of description, the river systems of Korea are divided into the following five regions: Northeastern Korea, East Coast, Southern Korea, South Coast, and West Coast. The main rivers and their tributaries are described in detail, and important smaller streams included where information is available.

B. RIVERS OF NORTHEASTERN KOREA

1. Tuman-gang

The Tuman-gang, one of Korea's widest rivers, is the only major river of Korea which flows eastward. With its tributaries, the largest of which are the Sodu-su, Hun-ch'on Ho, and Oryong-ch'on, it drains an area of more than 15,000 square miles. The Tuman forms the northeastern boundary of

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Korea, bordering Manchuria and for the lowest ten miles, Siberia. It is nearly 300 miles long and flows through a deep, winding, flat floored valley of variable width.

The Tuman has an average width of 700 to 800 yards at the spit which partly blocks the river mouth, and a width of one mile, directly behind the spit. About 8 miles up stream at Shang-so, Manchuria, the width is more than one-half mile, and beyond this point, for 10 to 15 miles upstream to Koup-tong, the average width is one-fourth to one-half mile. Further upstream, near Ho-yang-tao at the junction with the large Manchuria tributary, Hun-ch'on Ho, the Tuman narrows to a width of 250 to 350 yards. It then gradually narrows to a width of 100 to 200 yards for most of its remaining upper course. In the narrow gorges of the upper Tuman, the width of the river is only 20 to 50 yards.

The depth of the Tuman is about 6 feet at the mouth and 3 to 8 feet in the middle course. The river is generally shallow except during the spring thaws and summer rains, when it is swollen to flood stage.

The western (Korean) bank of the Tuman is very low for a distance of about one mile from its mouth, and the eastern bank for the same distance is a low marshy plain. Upstream from this lower section, the banks of both main stream and tributaries are dominated by hills and ridges which border the river throughout most of its upper course. Where deeply entrenched tributaries flow into the main river, there are small lowland areas, and near the tributary mouths the banks are sand and gravel. Cliffs bordering the valley bottom are generally 100 to 300 feet high. Further upstream, rock ledges and cliffed outcrops are common.

The river bottom is sand and gravel in the lowest reaches. For much of the upper course, the riverbed is rocky and there are many rapids. The channel is divided by numerous islands, especially where the river flows southward from Hunyung and the valley broadens into a large plain.

The Tuman is navigable by ocean going vessels near its mouth, by small steamers for about 15 miles, by junks for 60 miles, and by small craft for approximately 180 miles. During the winter traffic is halted by ice for 3 to 4 months.

Two important areas are located along the lower Tuman. The Kyongwon-Hunyung area is a junction point for roads and trails; here two roads and one railroad cross the Tuman into Manchuria. The second area is opposite the Manchurian town of Tu'men; a railroad crosses the Tuman here, but no roads.

2. Sodu-su

This main southern tributary of the Tuman has its headwaters in the plateau region of northern Korea. There the stream valley is partly swampy and is bordered by mountains which rise on each side to altitudes of 5,000 to 7,000 feet. At its confluence with the Tuman, near Musan, the Sodu-su is 50 yards wide and normally 3 to 5 feet deep, and the current is described as moderate. High cut banks are predominant along much of the upper course.

3. Oryong-ch'on

This river rises in the highlands near Haengyong in north-eastern Korea, and flows generally northeast into the Tuman River near Kogonwon. In the lower course it is approximately 50 yards wide and normally more than 3 feet deep, and the current is said to be moderate. Throughout the middle course the banks are generally stony and the river bottom is stone and gravel.

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4. Hoeryong-ch'on

The Hoeryong-ch'on rises in the highlands near Murung-dong and flows generally north, entering the Tuman River near Hoeryong. Near this junction the Hoeryong-ch'on is 40 to 70 yards wide and normally more than 3 feet deep, and the current is described as moderate. In the middle course it is 30 to 50 yards wide and normally less than 3 feet deep, and the current is said to be swift to moderate. Along the lower reaches the banks are generally stony and the river bottom is stone and gravel.

5. Sohongdan-su

This river rises in the highlands east of Samjiyon and flows generally east-northeast to its confluence with the Tuman. In its middle course the Sohongdan-su flows through canyons and deep narrow valleys, and in the lower course through narrow plains bordered by rugged hills. In the middle course it is 10 to 20 yards wide and normally less than 3 feet deep, and in the lower course it is about 50 yards wide and several feet deep, and has a moderate current.

C. EAST COAST RIVERS

In general, all east coast rivers are practically unnavigable, but are fordable in numerous places except possibly at the mouth and during high water periods. Most of these rivers are short, torrential streams flowing in restricted valleys down the steep slopes of the eastern mountain ranges which lie a short distance inland from the coast. Most of the valleys provide very poor routes into the interior.

From their source to the foot of the mountain slopes, the streams have very steep gradients, rocky beds and banks, and usually many rapids and falls. In their lower courses they flow through steep, narrow valleys, carrying a vast amount of debris. In their extreme lower courses, they flow across small lowlands which are usually intensively cultivated.

East coast rivers are mostly very shallow, with normal depths only 2 to 3 feet at two miles inland, and 1 to 2 feet at points 3 miles inland.

Stream beds along the upper reaches, where rapids and falls occur, are mostly rock; downstream, where the heavy load of sediment is deposited, the beds are mostly sand and gravel. Banks along the upper reaches are mostly cliffs 50 to 100 feet or more high. Along the lower course, banks gradually decrease in height and are largely bluffs of sand and gravel. Where streams cross the coastal lowlands, banks are only 5 to 10 feet high.

Detailed data on individual east coast rivers are given in Table VIII-1.

D. WEST COAST RIVERS

The principal rivers along the west coast from the Manchurian border to Mokp'o are the Yalu, Ch'ongch'on-gang, Taeryong-gang, Taedong-gang, Han-gang, Yesong-gang, Imjin-gang and Kum-gang.

1. Yalu River (Amnok-gang)

The Yalu is Korea's largest river, nearly 500 miles long. It rises on the southern slopes of the Paektu-san and flows generally southwest into the Yellow Sea, forming the natural Korea-Manchuria boundary. Main tribu-

TABLE VIII-1. EAST COAST RIVERS

Name of river	Approximate length (miles)	Location of mouth	Fordable stretches	Location or bridges
Susong-ch'on	35	Ch'ongjin	Upper course	North of Ch'ongjin
Nabuk-ch'on	20	Kyongsong	Upper and middle course	North of Kyongsong
Chuuron-ch'on	2 branches 25 each	Chuuronjang	Upper and middle course	South of Shuuronjang
Myonggan-ch'on	50	Odaejin	Upper course	West of Odaejin
Namdae-ch'on	50	Songjin	Upper course	South of Kilchu
Puktae-ch'on	35	Hach'on	Upper and middle course	T'aptong-ni
Namdae-ch'on	45	Tanch'on	Upper course	Tanch'on (3 bridges)
Yamdae-ch'on	10	Iwon	Upper course	Iwon (2 bridges)
Namdae-ch'on	2 branches 35 each	Sinch'ang	Upper course	North of Sinch'ang Pukch'ong
Songch'on-gang	65	Yonp'o	Upper course	Hamhung (2)
Yanghung-gang	30	Chinhung-ni	Upper course	Yonghung (2)
Tokchi-gang	30	Chinhung-ni	Upper course	Kowon (2)
Namdae-ch'on	20	Wonsan	Upper course	Wonsan (2)
Nam-gang	20	Kosong	Upper course	Kosong (2)

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taries on the Korean side are the Ch'ungman-gang, Tongno-gang and Changjin-gang.

At its mouth the Yalu has an average width of 3 to 4 miles, but 30 miles upstream at Sinuiju the river is only one-half mile wide. Beyond this point, the channel is about 3 miles wide but it is divided by several large islands. Farther upstream, near the Sup'ung dam, the river is only 300 to 400 yards wide. In the narrow gorges of the upper reaches, the width varies from 50 to 100 yards.

The depth at Sinuiju is 27 feet. Along the lower course the river bottom is fine sand, and the channel depths change abruptly. Between Sinuiju and Uiji, the channel is divided by many islands, and the river depths range between 9 and 18 feet. In the vicinity of the Sup'ung reservoir, near the junction of the Ch'ungman River, the depths increase to 14 feet. Above the reservoir the depths range between 6 and 9 feet.

The banks of the lower Yalu are sand and gravel. They are mostly low or moderately steep, but at places bluffs more than 100 feet high border the river closely and form narrow gorges for short distances. Uiji, about 12 miles above Sinuiju, is the upper limit of tide water. The banks in this section are mud and sand, with a marshy strip marking the limits of tidal influence.

Vessels drawing 18 feet are able to reach San-Tao-Langt'ou at springtide, and vessels drawing 14 feet can reach this point at other times. Vessels of 14-foot draft reach Sinuiju and Antung at springtides, but only those of 9-foot draft or less, at other times. Junks ascend approximately 200 miles, and smaller craft are able to navigate 435 miles.

2. Ch'ungman-gang

The Ch'ungman-gang rises in the highlands of northwestern Korea and flows generally northwest to join the Yalu River. The main channel of the Ch'ungman is 100 to 200 yards wide and is usually more than 3 feet deep at low water. This river is characterized by numerous rapids, but the current is generally of moderate velocity. In the upper and middle reaches, the banks and bottom are gravel. Along the lower course this river flows through several steep-walled valleys. The Ch'ungman is probably fordable only upstream from P,anp,yong-dong where the depth decreases gradually.

3. Tongno-gang (Also Hwaggyong-ch'on)

The Tongno-gang, one of the longer tributaries of the Yalu River, rises in the highlands of northern Korea and flows generally northwest to its junction with the Yalu. The many channels are approximately 100 to 200 yards wide and are normally more than 3 feet deep at low water. The current is generally of moderate velocity, although there are numerous rapids. There are narrow, steep-walled, flat-bottomed valleys at several points along the river. Cabled ferries traverse the Tongno at several sites.

4. Changjin-gang

The Changjin-gang (river) branching from the Choshin and the Fusen reservoirs in northern Korea, flows generally northeast to its junction with the Yalu River at Singalp'ajin. The two upper branches extending from the reservoirs join and form a single channel below Hudong-ni. The main channel of the Changjin is 100 to 150 yards wide along its lower course, and is normally more than 3 feet deep. The current is said to be relatively

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swift along the entire length of the river. Steep-walled, narrow valleys are characteristic along most of the Changjin course. The middle section of this river is traversed by several cable operated ferries.

5. Taeryong-gang

The Taeryong-gang rises in the Pukto highlands of northwestern Korea and flows generally south to enter the Ch'ong-ch'on estuary below Pakch'on. The lower course is 100 to 200 yards wide, is several feet deep, and has low gravel banks. The river bottom along this section is sand and gravel. Near the mouth the river is one-fourth mile wide and is bordered by extensive mud flats. Along the upper course, the banks and bed are gravel, and the banks are relatively high. The Taeryong is not fordable below Taech'on.

6. Ch'ongch'on

The Chongch'on rises on the southern slopes of the northern Korean Highlands and flows generally southwest through wide, alluvial, flat-bottomed valleys, emptying into the Yellow Sea below Anju. The largest tributary is the Kuryong-gang, and others are the Paeksan-ch'on and Huich'on-gang. The main river is about 125 miles long and falls from an elevation of about 3000 feet.

The Ch'ongch'on is almost a mile wide at its mouth, but about 5 miles upstream it narrows to about 200 yards. At the railroad crossing near Anju, it is about 300 yards wide. For 6 to 8 miles above Anju the channel is divided by several wide islands. Above the confluence with the Kuryong, at the road crossing about 3 miles above Sinhong-dong, there is a single channel averaging 150 yards. Beyond the Huich'on confluence, where the railroad crosses to follow that tributary, the main river is about 250 yards wide, but is divided by an island.

The Ch'ongch'on is shallower that the other major rivers along the west coast, and is fordable in many places at normal water level. At the sharp curve about 5 miles from its mouth the river is about 10 feet deep, and at the road crossing near Anju it is 6 to 7 feet deep. Below the junction of the Kuryong, the braided channel has a depth of about 6 feet. Upstream near Sinhung-dong at the road crossing, the river is 3 feet deep. Where the railroad crosses near the junction of the Huich'on, depths are 3 to 6 feet. In the upper reaches where the river is narrower, the depth is 9 to 12 feet.

Cliffs, generally 100 to 200 feet high, are numerous along the upper Ch'ongch'on. Below the confluence of the Huich'on there are several stretches of cliffs more than a mile long. In the lower section of the Ch'ongch'on as far downstream as Anju, the banks are low and of moderate slope. Below Anju, however, the banks are steep, and cultivated fields extend to the river. The banks along the lower course are generally sand and gravel partly mixed with mud.

Boats of 3-foot draft can navigate about 15 miles upstream, and smaller boats can go 95 miles above the river's mouth.

7. Kuryong-gang

The Kuryong-gang, largest tributary of the Ch'ongch'on, rises in the Pukto highlands and flows generally southwest to its junction with the Ch'ongch'on near Piho-san. The lower and middle course is 50 to 140 yards wide, and normally not fordable. The upper reaches flow through flat valleys and are probably fordable during periods of normal water level.

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8. Taedong-gang

The Taedong-gang rises in the highlands of the Yangnim Range and flows southwest past P'yongyang and Kyomip'o, reaching the Yellow Sea 20 miles downstream from Chinnamp'o. It is nearly 250 miles long, and with its tributaries, of which the Chaeryong-gang is the largest, drains an area of approximately 7,500 square miles. In the upper reaches the Taedong follows a tortuous course through canyons, while in the lower reaches it winds through flat valleys.

In the mountainous sections of the upper Taedong are many rocky cliffs 200 to 300 feet high, most of which are on the outside of bends. Where the course is straighter, the banks are steep, but consist chiefly of sand and gravel. Many of the steep banks overhang the water's edge and crumble rather easily. Along the lower course, banks are 10 to 20 feet or more high, but inside banks of numerous curves are lower. Tributary streams wind through the rice fields of the lower valley.

At Chinnamp'o, the Taedong is about a mile wide, and from that point downstream it gradually widens toward the mouth. Upstream at the junction of the Hwangju-gang, near Kyomip'o, the width averages one-half to three-fourths mile. At the road crossing at P'yongyang the river is about 450 yards wide, and above P'yongyang, at the railroad crossing near Sunch'on it is some 200 yards wide. Where the Taedong cuts through the steep slopes of Changan-san and Husonyu-bong, it has an almost constant width of about 150 yards. In the upper reaches, at Tokch'on, the river is 150 to 200 yards wide.

The estuary above Chinnamp'o is 30 to 50 feet deep. The tidal current attains a velocity of 3.7 knots at the estuary entrance, and the tidal range is 20 feet. At P'yongyang, where the bridge crosses the river, the normal depth is about 18 feet, and 7 or 8 miles upstream, depths are 3 to 6 feet. In the next 6 or 8 miles upstream, depths are relatively shallow, but then increase to 9 to 18 feet. At Sunch'on, between the road and railroad crossings, the river is 6 to 7 feet deep. At the railroad crossing at Tokch'on, the depth is about 7 feet. These depths change greatly during floods.

The main channel of approach to Chinnamp'o on the Taedong is from the west between two large shoals, Chung-ju and Ha-ju; here the width is not less than one mile between the 5-fathom contours.

The Taedong is fordable in numerous places above P,yongyang, but not downstream from this point. The best terrain for cross-country movement is ¼ to 2 miles away from the streams, along the higher edges of the valleys, near the hills. Terrain in the hills is not entirely suitable for cross-country movement, but numerous tributary valleys provide small, narrow passageways. In winter, the main river and its tributaries are frozen for 2 to 3 months.

The Taedong has a rather strong current along its entire course, and it constitutes a considerable obstacle to north-south movement.

9. Chaeryong-gang

The Chaeryong-gang has two upper branches which are controlled by reservoirs. The branches join near Chaeryong to form a single channel 50 to 100 yards wide, which flows northward and enters the Taedong estuary northwest of Sanwon. Cut banks several feet high are characteristic of the upper reaches of the Chaeryong, while those of the lower course are low and of stone and gravel. The Chaeryong is navigable for approximately 3 miles above its mouth by vessels drawing 6 feet. Small boats can ascend 15 miles further upstream.

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10. Hwangju-gang

The Hwangju-gang, a tributary of the Taedong, rises on the western slopes of Puindang-san and flows generally westward, entering the Taedong estuary near Kyomip'o. The lower course is 100 to 200 yards wide and several feet deep, and the current is described as sluggish. Water level near the mouth is influenced by the tide.

11. Nam-gang

The Nam-gang rises in the highlands north of Simp'yong and flows westward to join the main channel of the Taedong. In the middle and lower course the river is 50 to 100 yards wide, and normally more than 3 feet deep. The current is described as moderate. In general the banks and bottom are stony. The Nam is probably not fordable over much of its course. Three railroads span the lower course and there are numerous ferry crossings along the middle and upper reaches.

12. Namdae-ch'on

The Namdae-ch'on is a short, narrow stream, which has its headwaters in the highlands near Samga. It flows generally west and enters a small estuary near Sokkyo-ri which later empties into the Yellow Sea. The Namdae-ch'on is normally less than 3 feet deep and has a moderate current over much of its course. It has cut banks along the middle course, and in the lower course it has largely low gravel banks and bed which open to mud flats.

13. Yesong-gang

The Yesong-gang, about 110 miles long, rises on the southern slopes of the northern Taebaek Range and flows generally southwest, entering the Han estuary south of T'osong-ni.

In the middle course the Yesong is approximately 50 yards wide and generally more than 3 feet deep, and the current is moderate. The lower course widens to ½ mile, is several feet deep, and the current is described as sluggish.

In the upper and middle reaches the banks are gravel and several feet high, while along the lower course they are sandy and much lower. The riverbed also is gravel in the upper and middle reaches and sandy in the lower reaches.

Irrigation canals along the lower course are relatively wide and form an obstacle to mechanized movement during periods of high water.

14. Imjin-gang

The Imjin-gang, rising on the southern slopes of the northern Taebaek Range, follows a tortuous course through narrow valleys and empties into the Han estuary near Munsan. One of the larger tributaries of the Imjin is the Hant'an-ch'on, which drains the Wonsan-Seoul Corridor. The Imjin has a total length of nearly 160 miles.

In its middle course the Imjin is 50 to 100 yards wide and normally more than 5 feet deep; the current is moderate, but rapids are common in several places. In the lower course the river widens to nearly ¼ mile, is several feet deep, and has a sluggish current. Near its junction with the Han estuary, it widens to more than a mile. Many sand bars in the mouth hamper navigation. High stony banks and gravel bottom are characteristic of

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the upper reaches of the Imjin, while in the lower reaches the banks and bed are sand.

The Imjin is navigable by small boats for approximately 78 miles upstream. Along the lower course, irrigation canals, more than 15 feet wide and diked above the level of the plain, are obstacles to northeast-southwest movement of mechanized equipment.

15. Hant'an-ch'on

The Hant'an-ch'on, a tributary of the Imjin, flows through the hilly district of the Wonsan-Seoul Corridor in a narrow flat-bottomed valley, and joins the Imjin south of Yonch'on. Here the Hant'an-ch'on is spanned by a highway and railroad bridge. The lower course is 50 to 100 yards wide. The current is moderate and the river is probably fordable at many places.

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PLATE VIII - 1

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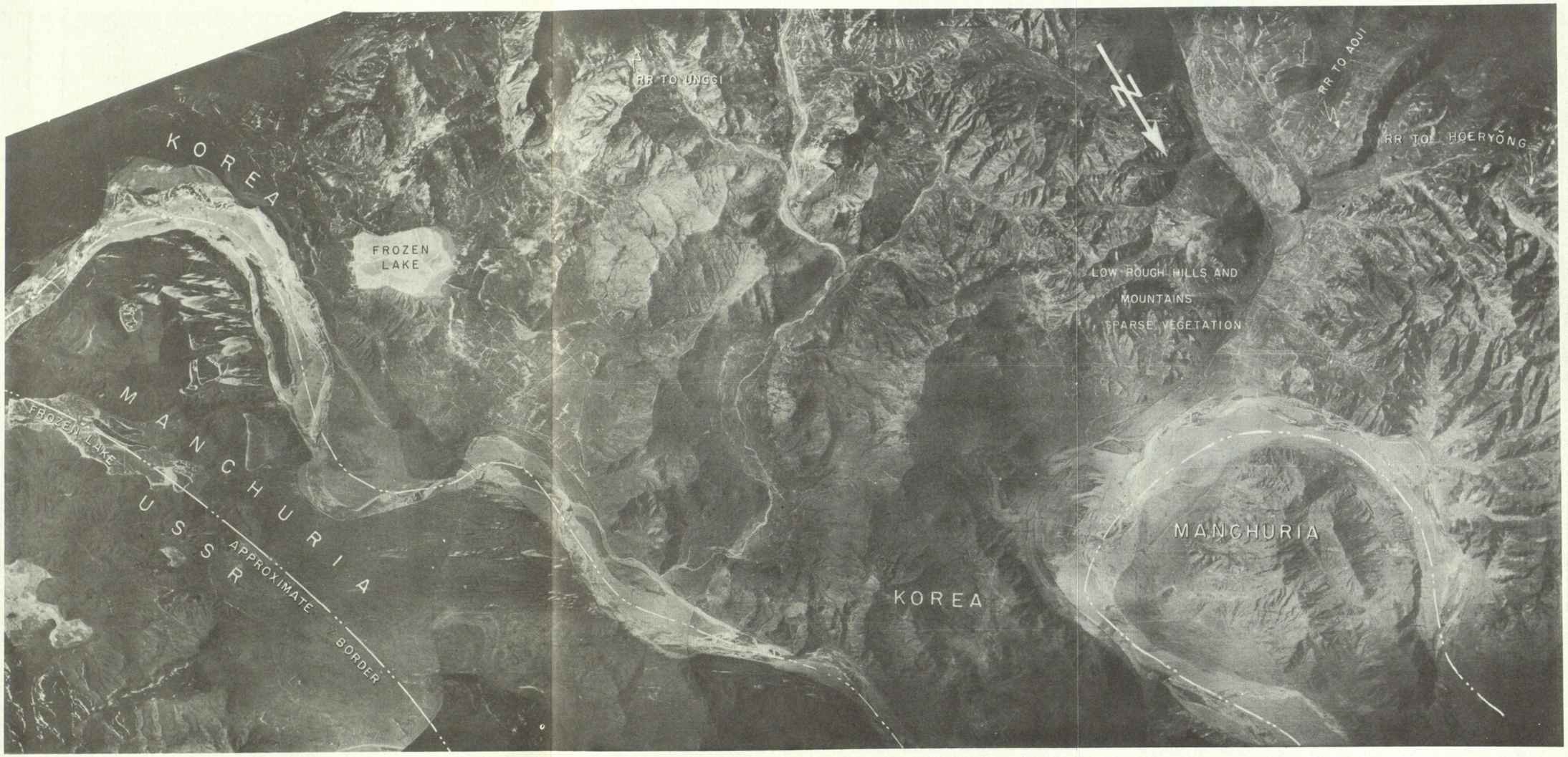

Photo VIII-1. Lower Tuman River. Vicinity of Korea-Manchuria-USSR border. Dec. 1944.

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Photo VIII-2. Lower Yalu River at Sinuiju. 1945.

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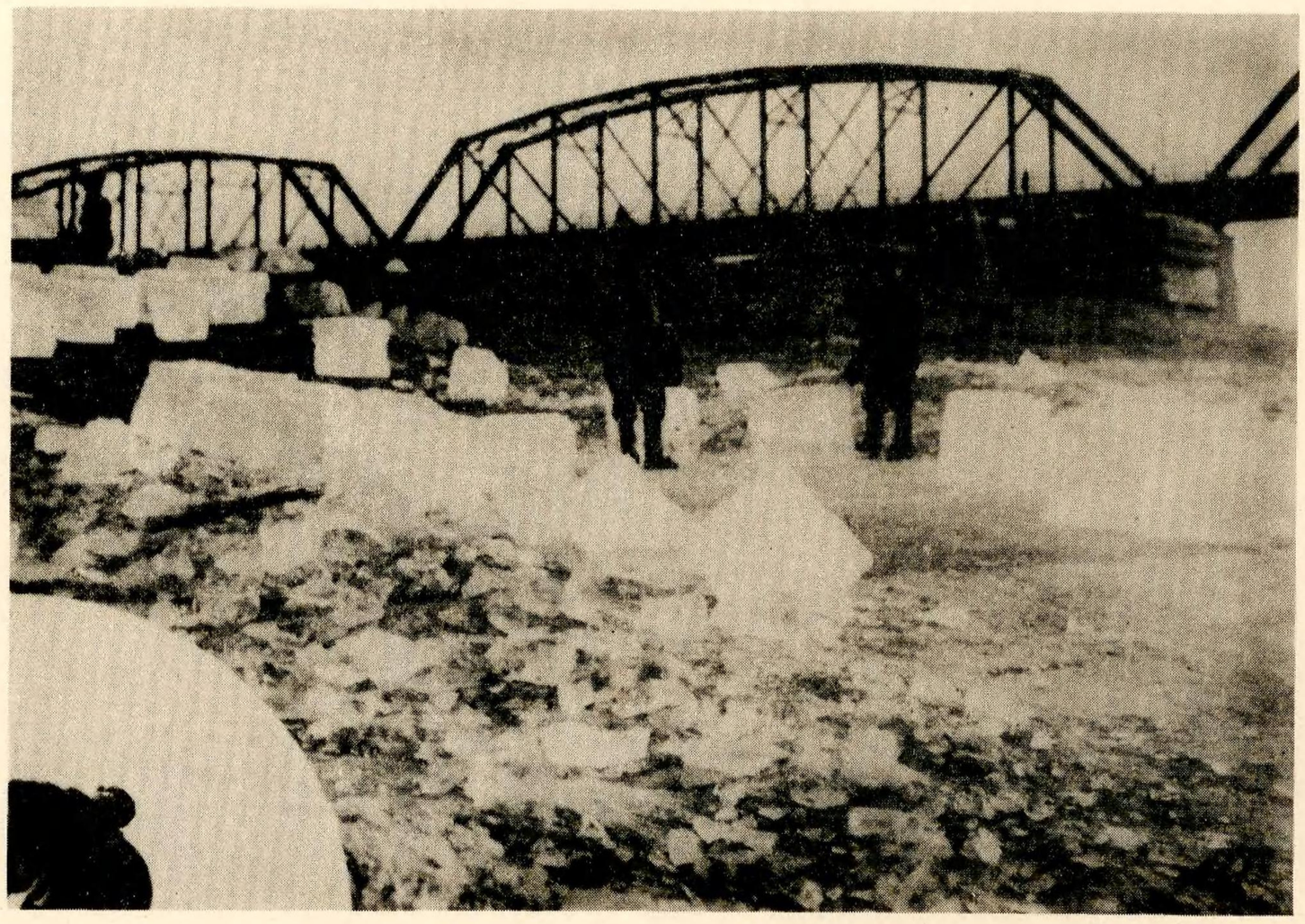

Photo VIII-3. Cutting ice on Yalu River at Sinuiju.

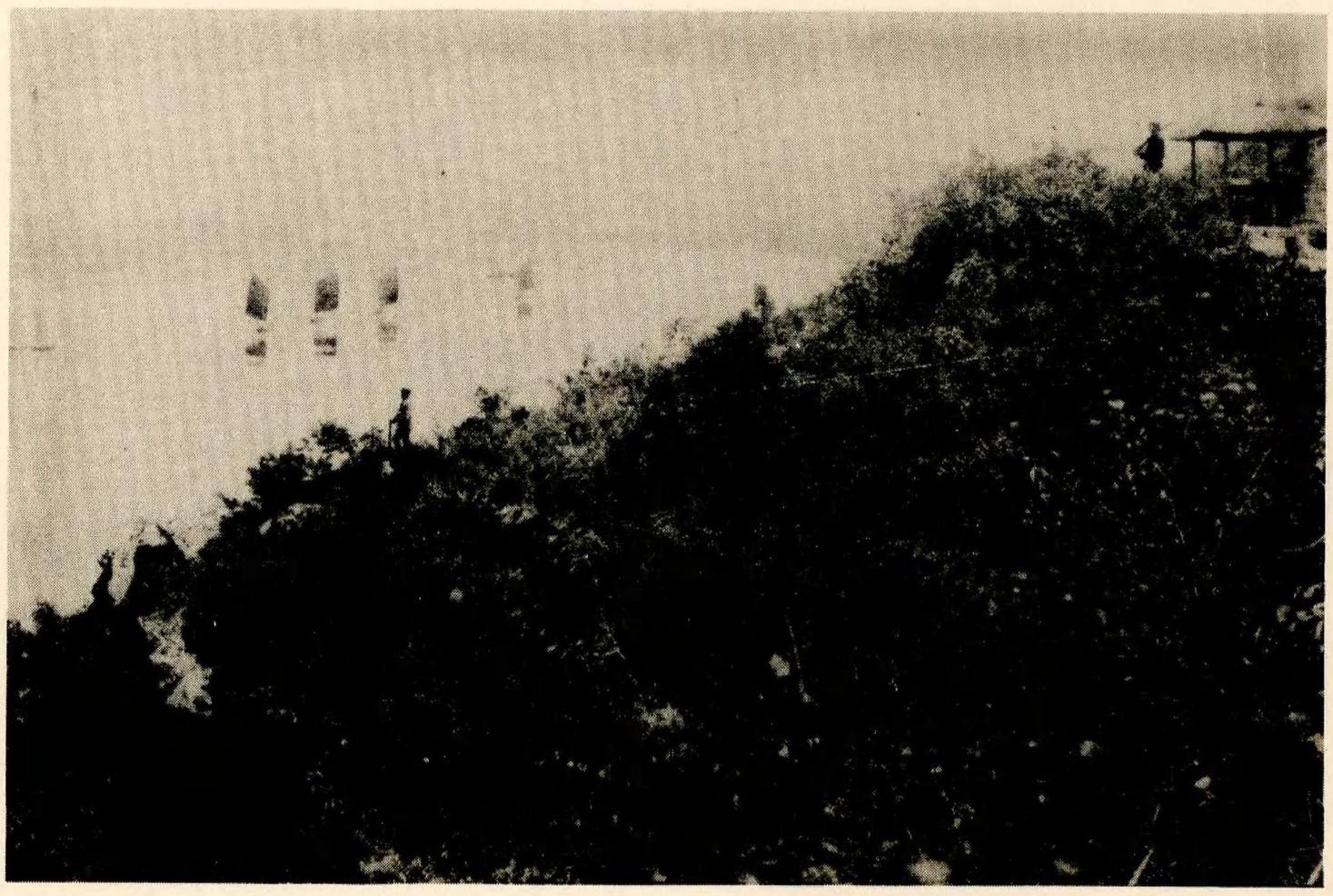

Photo VIII-4. Yalu River at Uiju. Former Japanese border guard post.

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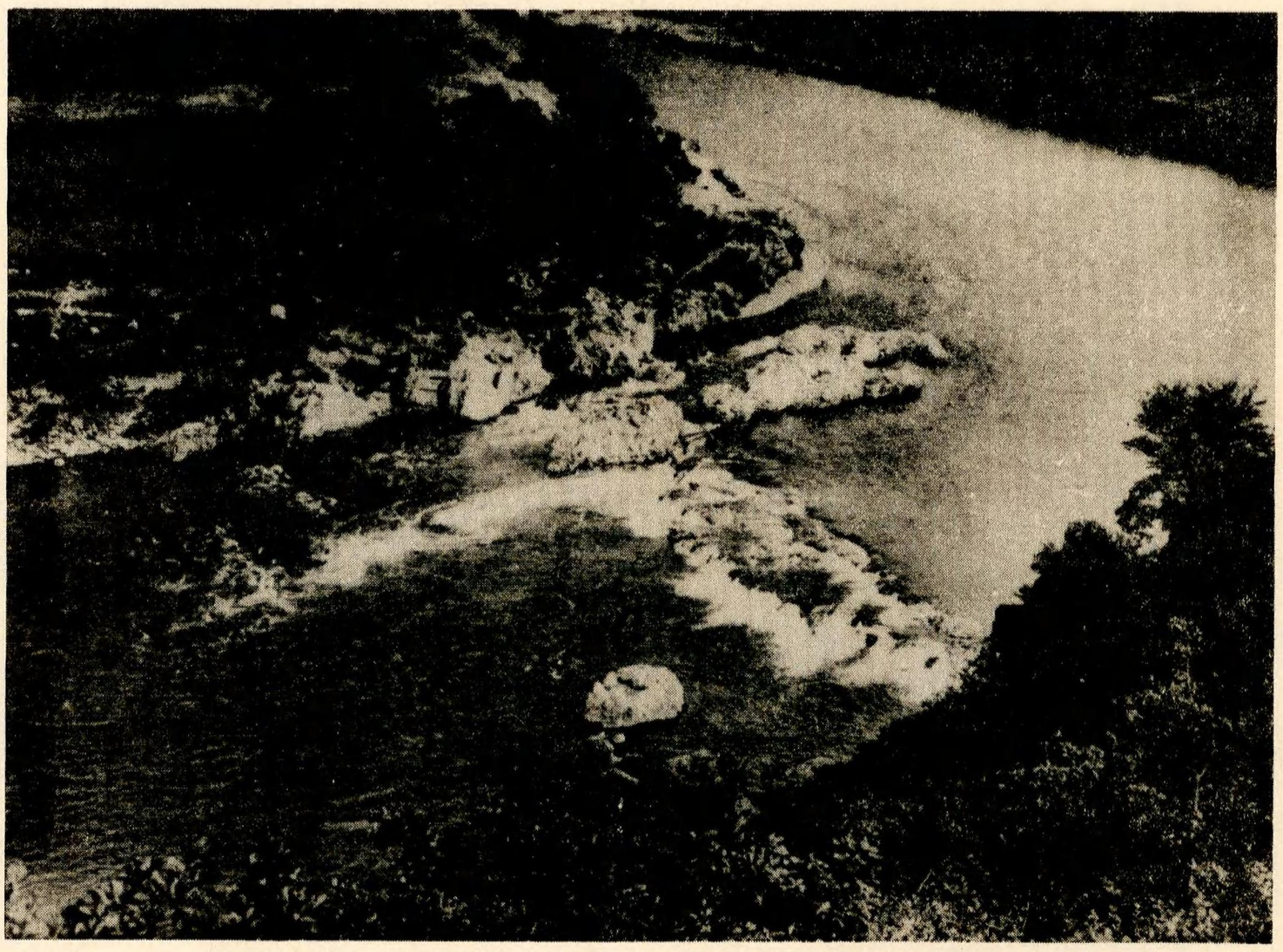

Photo VIII-5. Nahwonbo Falls on upper Yalu River.

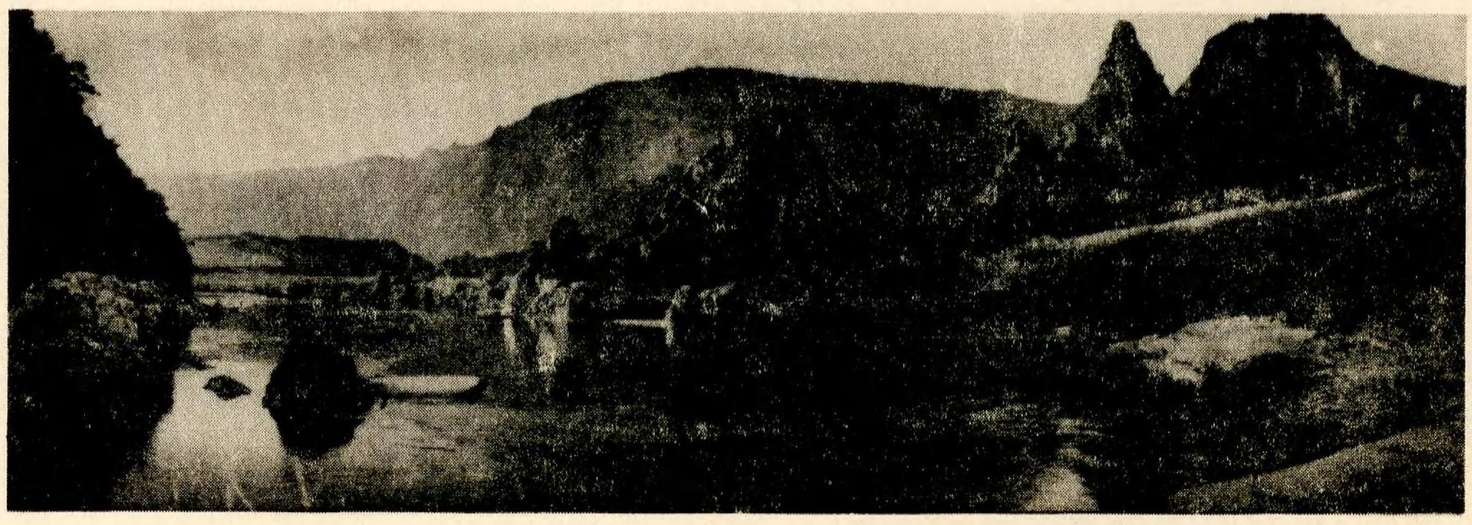

Photo VIII-6. Scene on upper Yalu River.

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Photo VIII-7. Tongno-gang. South of Kanggye.

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Photo VIII-8. Taedong-gang. In central mountains.

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Photo VIII-9. Taedong-gang. North of Kyomip'o.

X. ROADS OF NORTHERN KOREA

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X. ROADS OF NORTHERN KOREA

A. GENERAL

Aside from improved cart trails between cities and towns the roads of northern Korea have largely been constructed to serve as supplemental and feeder routes for the Japanese built railroads. The trafficability and maintenance of a given section of road has generally been based on the volume of traffic between local cities, seaports, and rail junctions rather than on the basis of any through peninsular traffic. Existing through routes have largely been constructed for military purposes.

Road construction in North Korea has been severely hampered by the rugged central mountain mass. Several major through routes skirt these mountains. One route extends north from Seoul through P'yongyang to Sinuiju. Another runs northeast from Seoul to Wonsan and along the coast to the northeastern tip of Korea. Reports indicate that the southern reaches of both of these routes were considerably improved prior to the invasion of South Korea. Road construction was especially marked along the Seoul-Wonsan corridor and along roads deploying eastwest immediately north of the 38th parallel. Both these routes were used extensively in feeding troops and supplies for the South Korean invasion. Another important route cuts across the peninsula from P'yongyang to Wonsan. A major route runs along the Manchurian border generally paralleling the Tuman and Yalu Rivers.

In this report the road network of nothern Korea is described as it existed just before the end of World War II. The information is based on Japanese sources collated by three Japanese highway engineers with long experience in Korea. Information of more recent date is appended wherever available, but such information is scanty and often contradictory.

B. CLASSIFICATION AND TRAFFIC TONNAGE FLOW

In this study the roads of northern Korea are presented in the following four classifications: those which are all-weather and well maintained, are generally 18 to 25 feet wide, and permit speeds of 18 to 45 miles per hour; those which are trafficable 300 days a year, are well maintained, have a width of 16 to 25 feet, and permit speeds of 15 to 30 miles per hour; those which are not all-weather, are poorly maintained, have a width of 16 to 25 feet, and permit speeds of 15 to 25 miles per hour; and wagon and cart trails that are generally impassable to vehicular traffic.

Japanese sources maintain that as of 1945 the maximum tonnage capacity of most roads in northern Korea, including through routes, was 4 tons. This limitation was generally based on the presence of many wooden bridges spanning the smaller streams. It is evident from the recent flow of heavy equipment that the North Koreans have either found these streams fordable or have reinforced or rebuilt many of the bridges.

C. CONSTRUCTION AND MAINTENANCE

With the exception of one concrete and asphalt highway between Chongjin and Nanam all roads were gravel surfaced with open drainage as of 1945. During the rainy season they became flooded in many sections and frequently wash out. However, at the end of 1945 there was sufficient maintenance to render the major through routes passable throughout the year. Between 1942 and 1945 the provincial governments were responsible for roads and an inspector was assigned to a given section with responsibility for its mainte-

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nance. The road crews were composed of government employees and farmers residing in the vicinity. Gravel for road construction was obtained from mountain streams in the vicinity; when this source was lacking, large rocks were crushed for road surfacing. (1) Current intelligence indicates that the North Korean Government has followed the same general system of conscripting labor to build and repair roads. One source states that all adults are required to work 5 days a month on public works. Two other reports of conscripted labor used in road construction state that all adults were required to work from 20 to 25 days on road construction. (2)

D. BRIDGES AND FERRIES

Within the last 30 years a considerable number of bridges have been built. The first large bridges were generally of steel through-truss construction with rather narrow roadways. Many of these have since been supplemented by reinforced concrete bridges. According to Japanese sources, as of 1945, most bridges have a carrying capacity of 3 to 5 tons, and few can carry more than 10 to 15 tons. There are four combination road and railroad bridges: one at Sinuiju over the Yalu River, one west of Kaesong on road 42A, one at Ch'ongsong over the Tuman River, and one over the Yalu River due south of Lin-chiang, Manchuria.

Ferries are used at many of the river crossing and are usually limited in carrying capacity to one 4-ton truck.

E. DESCRIPTIONS OF MAIN ROUTES

Route 1. Seoul to P'yongyang

Route 1, branching northwest from Seoul, is the northern extension of the longitudinal state highway connecting Pusan with Sinuiju. It was first developed by the Japanese as an overland route to the interior of Manchuria, and was later improved upon by the Koreans. After World War II USSR engineers supervised reconstruction projects converting this road into an all-weather, two-lane gravel surface throughfare.

In general, Route 1 follows the west coast of Korea, connecting several important railroad and highway centers. This route and its alternates were used extensively by the NKPA for movement of troops and materiel to the southern combat area. Aerial reconnaissance pilots have reported sighting several large vehicular convoys moving along this route during the Korean conflict.

Seoul to P'yongyang

Length: 146 miles
Width: 25 feet
Surface and drainage: Gravel, open drainage

Trafficability and maintenance: Traffic possible throughout year. Road in good condition. Maximum speed 37 mph.

Grade and curvature: No sharp curves or steep grades. Maximum gradient 1:20. Minimum radius of curvature 82-98 feet.

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(1) Oral Statements of civil engineer serving in Governor General's Office in Korea, June 1948.

(2) XXIV Corps G-2 W/S No. 142; 317th Headquarters Intelligence Detachment Interrogation, 7 Sept 48; Air Intelligence Information Report, Sept 49.

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P'yongyang to Sinanju

Length: 44 miles

Width: 25 feet

Surface and drainage: Gravel, open drainage

Trafficability and maintenance: Considered all-weather before end of war and was well maintained. Average speed 35 mph.

Grade and curvature: No steep grades or curves.

Sinanju to Chongju (via Pakch'on)

Length: 28 miles

Width: Very narrow. Neither trucks nor jeeps can travel on it.

Trafficability and maintenance: Improvement had not been completed at end of World War II.

Chongju to Sinuiju

Length: 84 miles

Width: 23-26 feet

Surface and drainage: Gravel, open drainage

Trafficability and maintenance: Not always trafficable during July-August rainy season. Maintenance comparatively good throughout rest of year. Maximum speed 25-30 mph.

Route 1A. Kaesong to P'yongyang

(via Haeju, Changyon, Chinnamp'o)

Route 1A is a circuitous road linking Kaesong, Haeju and Chinnamp'o with P'yongyang, generally paralleling the west coast. It is an all-weather gravel surface road, and was used as an alternate route to Seoul by convoys of the NKPA. At Haeju a shorter, more direct route branches north to connect with the main highway south of Chinnamp'o.

Kaesong to Chinnamp'o (via Haeju)

Length: 128 miles

Width: 23-25 feet

Surface and drainage: Gravel, open drainage

Trafficability and maintenance: Passable throughout year. Road in good condition. Maximum speeds 30-35 mph.

Grade and curvature: No steep grades or sharp curves. Maximum gradient 1:20 and minimum radius of curvature 82 feet.
(Section between Kaesong and Haeju was reportedly being widened and improved under Soviet direction. GHQ, G-2 Intelligence Summary, 28 June 1948)

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Haeju to Chinnamp'o (via Chaeryong)

Length: 64 miles

Width: 23-25 feet

Surface and drainage: Gravel, open drainage

Trafficability and Maintenance: Passage possible throughout year. Road in good condition. Maximum speed 30-40 mph.

Grade and curvature: Maximum gradient 1:20. Minimum radius of curvature 98 feet.

Route 1B. Pakch'on to Sinuiju
(via T'aech'on and Uiju)

Route 1B, branching northwest from Pakch'on, provides an alternate route to Sinuiju. It has been reported in good condition and passable by vehicles throughout most of the year.

Pakch'on to Kusong (via T'aech'on)

Length: 26 miles

Width: Approximately 21 feet

Surface and drainage: Gravel, open drainage

Trafficability and maintenance: Considered all-weather, except for a ferry that may not operate during rainy season. Maintenance reported good. Maximum speed 30 mph.

Grade and curvature: No steep grades or sharp curves.

Kusong to Sinuiju

Length: 45 miles

Width: Approximately 20 feet

Surface and drainage: Gravel, open drainage

Trafficability and maintenance: Considered all-weather and was well maintained. Average speed 30 mph. Four-ton trucks can probably pass along entire route.

Grade and curvature: Maximum gradient 1:20; no sharp curves.

Route 2. Kangnung to Onsong

Route 2 tends to parallel the east coast of the Korean peninsula, providing passage from Pusan to the Manchurian border at Onsong. In general, Route 2 is of sufficient width to permit passage of two 10-ton American type vehicles, and is open throughout the year; however, during periods of heavy rainfall wash-outs may occure, temporarily impeding traffic.

The NKPA utilized Route 2 for the deployment of their army and movement of supplies during the initial drive on South Korea. Owing to its proximity to the coast Route 2 was later rendered impractical for convoy movement because of its vunerability to UN naval gunfire, and the NKPA was forced to utilize alternate routes which proved unsatisfactory.

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Several strategic communication centers are located along Route 2. Wonsan, Hamhung, Ch'ongjin and Unggi, all of which are also ports.

Kangnung to Wonsan

Length: 139 miles

Width: 18-25 feet

Surface and drainage: Gravel, open drainage

Trafficability and maintenance: Passage is possible throughout year. Road in comparatively good condition. Maximum speed 18-24 mph.

Grade and curvature: No steep grades. Many curves with minimum radius of cuvature 49-66 feet.
(NK prisoners of war who traveled from Wonsan to Kangnung in early July 1950 report this section of Route 2 in good condition although bridges had been destroyed. ATIS Interrogation No. 408)

Wonsan to Hamhung

Length: 60 miles

Width: Generally 25 feet

Surface and drainage: Gravel, open drainage

Trafficability and maintenance: Trafficable throughout year. Road in good condition. Maximum speed 30-35 mph.

Grade and curvature: Comparatively level with no sharp curves. Maximum gradient 1:30.

Hamhung to Kilchu

Length: 202 miles

Width: 25 feet

Surface and drainage: Gravel, open drainage

Trafficability and maintenance: Passage difficult during rainy season. Road in fairly good condition. Maximum speed 25-30 mph.

Grade and curvature: Minimum radius of curvature 49 feet.

Kilchu to Nanam

Length: 72 miles

Width: Generally 25 feet; in mountains 18 feet

Surface and drainage: Gravel, open drainage

Trafficability and maintenance: Sometimes during rainy season vehicular traffic is impossible, as wooden bridges are destroyed by floods. Road in fairly good condition. Maximum speed 25-30 mph.

Grade and curvature: Several steep mountain passes along route. Maximum gradient 1:15. Minimum radius of curvature 66 feet.

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Nanam to Ch'ongjin

Length: 10 miles

Width: Approximately 98 feet (including sidewalk)

Surface and drainage: Asphalt and concrete. Underground drainage system with L-type gutters.

Trafficability and maintenance: Passage possible throughout year. Road in very good condition. Maximum speed 60 mph. Passage of 10-ton trucks possible.

Grade and curvature: Road very flat with no sharp curves.

Ch'ongjin to Unggi

Length: 58 miles

Width: Average 25 feet

Surface and drainage: Gravel, open drainage

Trafficability and maintenance: Passage possible throughout year. Road in good condition. Maximum speed 35 mph.

Grade and curvature: Maximum gradient 1:20-1:15. Minimum radius of curvature 98 feet.

Unggi to Onsong

Length: 58 miles

Width: 25 feet

Surface drainage: Gravel, open drainage

Trafficability and maintenance: Passage possible throughout year. Road in good condition. Maximum speed 30-35 mph.

Grade and curvature: Maximum gradient 1:20. Minimum radius of curvature 98 feet.
(Intelligence Summary, Hq XXIV Corps, reports new first-class gravel route to Krasavo, crossing Tuman-gang in vicinity of Korea-Manchuria-USSR Common boundary. Road branches off Route 2 approximately eight miles north of Unggi.)

Route 3. Seoul to Wonsan
(via Kumhwa)

The Wonsan-Seoul Corridor, passing through the Taebaek Mountain Range, is the only major trans-continental passage in this section of Korea. Route 3 tends to follow the southern fringes of the corridor. Improved by the Japanese during their occupation, it was designed as an overland route connecting the administration center at Seoul with the large east coast sea port of Wonsan. After World War II the NKPA with the aide of Russian supervisors converted this highway into an all-weather gravel surface road capable of supporting heavy traffic. During the present military conflict Route 3 was used extensively by the NKPA for the movement of troops and supplies.

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Length: 131 miles

Width: Generally 23-25 feet, but in places 16-18 feet

Surface and drainage: Gravel, open drainage

Trafficability and maintenance: Passage is possible throughout year in south section; north section may be difficult during rainy season. Maximum speed 20-30 mph.

Grade and curvature: Maximum gradient 1:15 to 1:20. Minimum radius of curvature 66 feet.

Route 4. P'yongyang to Wonsan

The second important trans-peninsular roadway, Route 4, traverses the northern Taebaek Range between P'yongyang and Wonsan. This route was also developed by the Japanese and used extensively by the NKPA during the present hostilities.

Route 4 has very little strategic value for the northward movement of troops; its strategic value is attributed to the east-west connection of the industrial port city of Wonsan with the political, administration city of P'yongyang. Traversing the Korean peninsula at its narrowest point, Route 4 joins the two principal north-south arteries, Routes 1 and 2, at P'yongyang and Wonsan.

P'yongyang to Wonsan

Length: 106 miles

Width: Generally 23-25 feet, but in some places only 18 feet

Surface and drainage: Gravel, open drainage

Trafficability and maintenance: Passage possible throughout year. Road in good condition. Maximum speed 30-40 mph.

Grade and curvature: Maximum gradient 1:15 to 1:20 and minimum radius 66 to 90 feet.
(NK prisoners of war who traveled from P'yongyang to Wonsan on 5 July 1950 reports this road badly gutted by bombs and/or rockets. Road sections stretching 40 miles east of P'yongyang and 15 miles west of Wonsan in especially poor condition. All bridges reportedly destroyed, but streams all fordable. ATIS Interrogation Report No. 408)

Route 5. Sinanju to Hamhung

Route 5, important as a trans-peninsular road connecting Hamhung with Sinanju, Traverses the northern Taebaek Range. Not as strategically important as the previously described routes, it is of military value as an alternate short route across the mainland of Korea. NKPA truck convoys were observed several times on this road but few foot troops.

Sinanju to Yongwon (via Kaech'on)

Length: 42 miles

Width: 20-23 feet

Surface and drainage: Gravel, open drainage

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Trafficability and maintenance: Top layer of gravel very thin in some places; road not considered all-weather. Maintenance comparatively good. Average speed 25 mph.

Grade and curvature: No steep grades or sharp curves.

Yongwon to Hamhung

Length: 76 miles

Width: Generally 25 feet, but only 16-18 in mountains

Surface and drainage: Gravel, open drainage

Trafficability and maintenance: Vehicular passage difficult during rainy season. Road in comparatively good condition. Maximum speed 20 mph.

Grade and curvature: Two or three very steep mountain pass. Maximum gradient 1:12 to 1:15, and minimum radius of curvature 49 feet.

Route 6. Sinuiju to Onsong

Although sections are reported under construction and impassable, Route 6 is considered important because it is trans-continental and close to the Manchurian-USSR-Korea border. Several roads branch from this route into the interior of Manchuria and USSR. The east and west sections of Route 6 are considered usable in their present state, but passage along the entire route can be made only by utilizing alternate routes and detours.

Sinuiju to Hyesanjin

Length: 283 miles

Width: 25 feet except in mountains where it is only 18 feet.

Surface and drainage: Gravel, open drainage

Trafficability and maintenance: Trafficable except during July-August rainy season. Frequent landslides in mountains during wet season makes passage very difficult, but road was comparatively well maintained. Maximum speed 20-30 mph.

Grade and curvature: 100 feet except in mountains where it is 50 feet.

Hyesanjin to Musan

Length: 96 miles

Width: 20-23 feet

Trafficability and maintenance: Vehicular passage difficult between Pot'ae-ri and Nongsa-dong because surface is partly volcanic ash. Remainder of road passable for vehicles. Maximum speed 20 mph.

Grade and curvature: Maximum gradient 1:15 to 1:20 and minimum radius of curvature 66 to 82 feet.

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Musan to Onsong

Length: 83 miles

Width: 25 feet

Surface and drainage: Gravel, open drainage

Trafficability and maintenance: Passage of vehicles possible throughout year. Road in fairly good condition. Maximum speed 25-30 mph.

Grade and curvature: Maximum gradient 1:25 and minimum radius curvature 66 feet.

Route 7. P'yongyang to Huch'angganggu

(via Kaech'on)

Although Route 7 is not considered a primary road and is probably not open throughout the entire year, it is considered strategically important as an alternate route to the Manchurian border.

There is no indication that the NKPA utilized the route for vehicular traffic, but the highway is probably capable of supporting heavy traffic.

P'yongyang to Kaech'on

Length: 38 miles

Width: 25 feet

Surface and drainage: Gravel, open drainage

Trafficability and maintenance: Highway generally well maintained and all-weather except for section north of Sunch'on. Average speed 35 mph.

Grade and curvature: Maximum gradient 1:25 and minimum radius of curvature 100 feet.

Kaech'on to Kanggye

Length: 140 miles

Width: 23 feet, except in mountains where it is only 16 to 18 feet

Surface and drainage: Gravel, open drainage

Trafficability and maintenance: Frequently impassable during rainy season, not only on poor stretch near Kaech'on, but also throughout rest of route, since there are several fords and at least one ferry. Road comparatively well maintained. Average speed 15-25 mph.

Grade and curvature: Maximum gradient 1:12 and minimum radius of curvature 50 to 80 feet.

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Kanggye to Huch'angganggu

Length: 80 miles

Width: Generally 21 feet; narrows in places to 18 feet

Surface and drainage: Gravel, open drainage

Trafficability and maintenance: Difficult for vehicular passage in rainy season because of steep mountain passes. Road in fairly good condition. Maximum speed 20 mph.

Grade and curvature: Maximum gradient 1:12 to 1:15 and minimum radius of curvature 66 feet.

Route 8. Hamhung to Hyesanjin

Route 8, like Route 7, is strategically important only as a northward connection with Route 6 on the Manchurian border. Passage over this route may be difficult during the rainy season, and mountain passes may hinder the movement of vehicles.

Hamhung to Hwangsuwon-ni

Length: 73 miles

Width: Generally 21 feet; in some places 16 to 18 feet

Surface and drainage: Gravel, open drainage

Trafficability and maintenance: Vehicular passage difficult during rainy season. Road in comparatively good condition. Maximum speed 15-18 mph.

Grade and curvature: Many steep mountain passes. Maximum gradient 1:5 and minimum radius of curvature 49 feet.

Hwangsuwon-ni to Hyesanjin

Length: 63 miles

Width: Generally 21 feet; some sections 17 feet

Surface and drainage: Gravel, open drainage

Trafficability and maintenance: Impassable during rainy season. Road generally not in good condition. Maximum speed 15-20 mph.

Grade and curvature: Maximum gradient 1:12 to 1:15. Minimum radius of curvature 49 feet.

Route 8A. Pukch'on to Hwangsuwon-ni

Route 8A is an alternate route branching northwest from the east coast highway, Route 2, and connecting with the main route at Hwangsuwon-ni. Passage over this route is very difficult during the rainy season.

Length: 40 miles

Width: Generally 21 feet; in some places 16-18 feet

Surface and drainage: Gravel, open drainage

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Trafficability and maintenance: Vehicular passage difficult during rainy season. Road in comparatively good condition. Maximum speed 15-18 mph.

Grade and curvature: Many steep mountain passes. Maximum gradient 1:15, Minimum radius of curvature 49 feet.

Route 9. Ch'ongjin to Hoeryong

Trafficable throughout the entire year, Route 9 offers a passage from the east coast port cities to interior cities on the Manchurian border. This is a relatively short route.

Length: 44 miles

Width: 25 feet

Surface and drainage: Gravel, open drainage

Trafficability and maintenance: Trafficable throughout year. Road in good condition. Maximum speed 20-30 mph.

Grade and curvature: Maximum gradient 1:15 to 1:20. Minimum radius of curvature 66 to 82 feet.

Route 10 Highway Network in Northeastern Corner of Korea

Several short connecting highways are located in the northeastern corner of Korea. They radiate out from Chongsan to all important communication centers in northeastern Korea, and provide numerous alternate passages from the coast to interior cities on the Manchuria-USSR border.

Width: 21-25 feet

Surface and drainage: Gravel, open drainage

Trafficability and maintenance: Passage generally possible throughout year, except during periods of heavy rain. Roads in fairly good condition. Maximum speed 25-30 mph.

Grade and curvature: Maximum gradient 1:15 to 1:20. Minimum radius of curvature 66 to 98 feet.

F. DESCRIPTION OF ALTERNATE AND CONNECTING ROUTES

In general, these alternate and connecting roads, which supplement the main through routes, are all-weather gravel surfaced roads, passable troughout the year. Some of them, because of rugged mountain terrain and frequent wash-outs, may be passable only by foot troops or light vehicles; they are included in this study because of their strategic importance as alternate routes for deployment. Increasing UN air activity forced the NKPA to utilize many of these back roads for movement of their military equipment and supplies.

Route A. Seoul to Kansong
(via Ch'unch'on)

Route A, branching generally northeast from Seoul, provides passage to Ch'unch'on, the important communications center in central Korea. Ch'unch'on lies south of the 38th parallel and lends itself favorably to the dispersion of forces northward. Route A continues northeast from Ch'unch'on to connect with the east coast highway at Kansong.

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Seoul to Ch'unch'on

Length: 50 miles

Width: Generally 23-25 feet

Surface and drainage: Gravel, open drainage

Trafficability and maintenance: Passable Throughout year. Maximum speed 30-35 mph.

Grade and curvature: Maximum gradient 1:15 to 1:20. Minimum radius of curvature 66 feet.

Ch'unch'on to Kansong

Length: 65 miles

Width: 18-23 feet

Surface and drainage: Gravel, open drainage

Trafficability and maintenance: Vehicular passage sometimes difficult during rainy season. Road in fairly good condition. Maximum speed 15-20 mph.

Grade and curvature: Maximum gradient 1:12 to 1:15 and minimum radius of curvature 66 feet.

Route B. Ch'unch'on to P'yongyang

Route B, extending generally northwest from Ch'unch'on, provides passage to P'yongyang through the central section of northern Korea. Traversing the rugged Taebaek Range, this route connects several large important cities which are highway junction points, providing passage to various other sections of northern Korea.

Prior to their invasion of South Korea, NKPA forces were transported to the vicinity of the 38th parallel over this route. In the initial drive across the parallel Ch'unch'on was one of the prime objectives. Few supply convoys were observed moving along Route B during the war.

Ch'unch'on to P'yongyang

Length: 151 miles

Width: Generally 20-25 feet, but in some places 16-18 feet

Surface and drainage: Gravel, open drainage

Trafficability and maintenance: Vehicular passage sometimes difficult during rainy season. Roads in fairly good condition. Maximum speed 20-25 mph.

Grade and curvature: Maximum gradient between Ch'unch'on and Ich'on 1:12 to 1:15, and minimum radius of curvature 66 feet, with many steep mountain curves. Between Ich'on and P'yongyang, maximum gradient is 1:20 and minimum radius of curvature is 82 feet.

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Route C. Haeju to Yongwon

Extending generally northeast from Haeju, Route C provides passage through the central Taebaek Range of northern Korea.

Length:

Total	132 miles
Haeju to Namch'onjom	46 miles
Namch'onjom to Sin'gye	15 miles
Sin'gye to P'aup	55 miles

Width: Generally 23-25 feet

Surface and drainage: Gravel, open drainage

Trafficability and maintenance: Vehicular traffic sometimes difficult during rainy season. Road in comparatively good condition. Maximum speed 25-30 mph.

Grade and curvature: Maximum gradient 1:15 to 1:20. Minimum radius of curvature 66 to 82 feet.

Route D. Sunch'on to Yonghung
(via Maengsan)

Branching east from Sunch'on, Route D offers an alternate trans-peninsular passage to the east coast. The road is generally open throughout the year, but passage may be difficult during periods of heavy rain. North-South movement on Route D is limited by lack of good connecting highways.

Sunch'on to Maengsan

Length: 44 miles
Width: 16 -18 feet
Surface and drainage: Gravel, open drainage

Trafficability and maintenance: Vehicular passage difficult during rainy season. Road in comparatively good condition. Maximum speed 18-25 mph.

Grade and curvature: Many mountain passes. Maximum gradient 1:15 and minimum radius curvature 66 feet.

Route E. Hamhung to Chasong
(via Hakalwoo-ri)

Route E, although not a primary road and reported in poor condition, is important as a through route connecting Hamhung with the northwest section of Korea. Continual maintenance would be necessary before heavy traffic could traverse this road, and during the rainy season the road is impassable for all vehicular traffic.

Length: 108 miles
Width: Average 21 feet, except in mountains where it is 16 feet
Surface and drainage: Gravel, open drainage

Trafficability and maintenance: Passage difficult for vehicular traffic in bad weather because of steep mountain passes. Road in bad condition from Kasan-dong to Changjin. Maximum speed 20-25 mph.

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Grade and curvature: Maximum gradient 1:15 and minimum radius of curvature 49-65 feet.

Route F. Kilchu to Hyesanjin
(via Hapsu)

In general, Route F is in poor condition, but improvement was started prior to the present conflict and with maintenance the road is capable of supporting heavy traffic throughout the year.

Length: 81 miles

Width: Generally 21 feet; from Hapsu to Songdok 16-18 feet.

Surface and drainage: Gravel, open drainage

Trafficability and maintenance: Vehicular passage is difficult from Songdok to Hapsu because improvement not completed. Road generally in poor condition. Maximum speed 20 mph.

Grade and curvature: Maximum gradient 1:15 and minimum radius of curvature 49 feet.

Route G. Pugo-dong to Musan
(via Puryong)

This route is reportedly in good condition and is strategically important as a route from the east coast of Korea to Musan, and important communications center having highway connections with Manchuria.

Length: 48 miles

Width: 21-25 feet

Surface and drainage: Gravel, open drainage

Trafficability and maintenance: Road in fairly good condition and generally trafficable throughout the year. Maximum speed 15-25 mph.

Grade and curvature: Maximum gradient 1:12 to 1:15 and minimum radius of curvature 66 feet.

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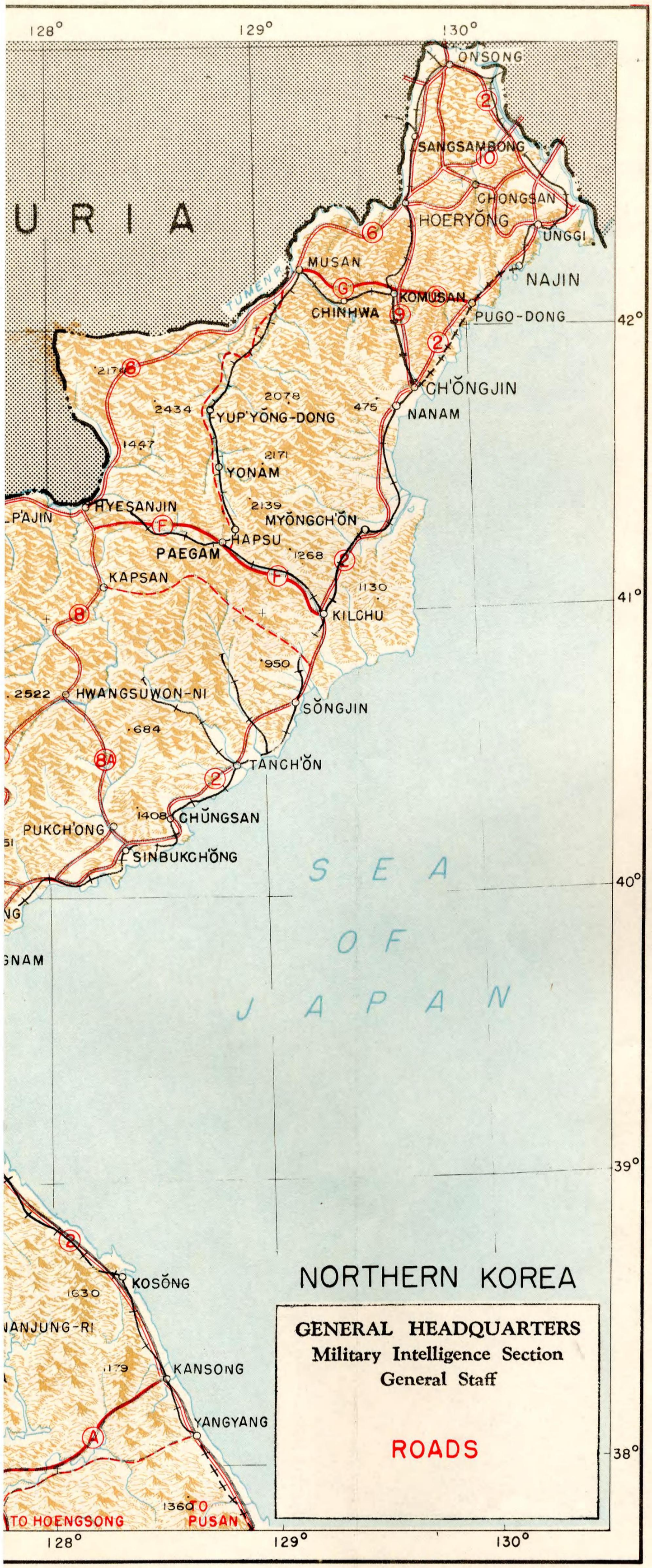

PLATE X-1

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PDM SPECIAL MAP NO.8 8 JULY 50

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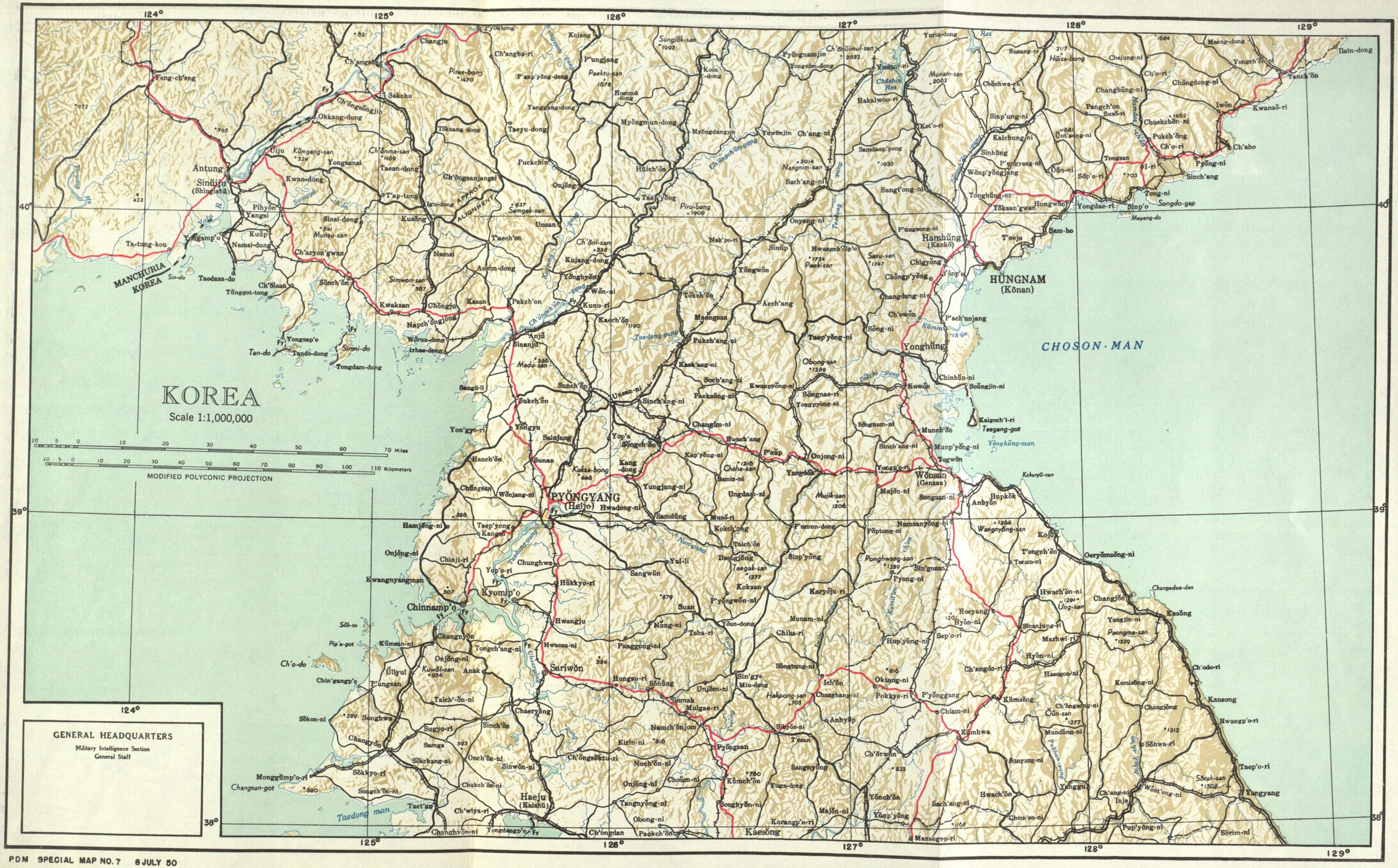

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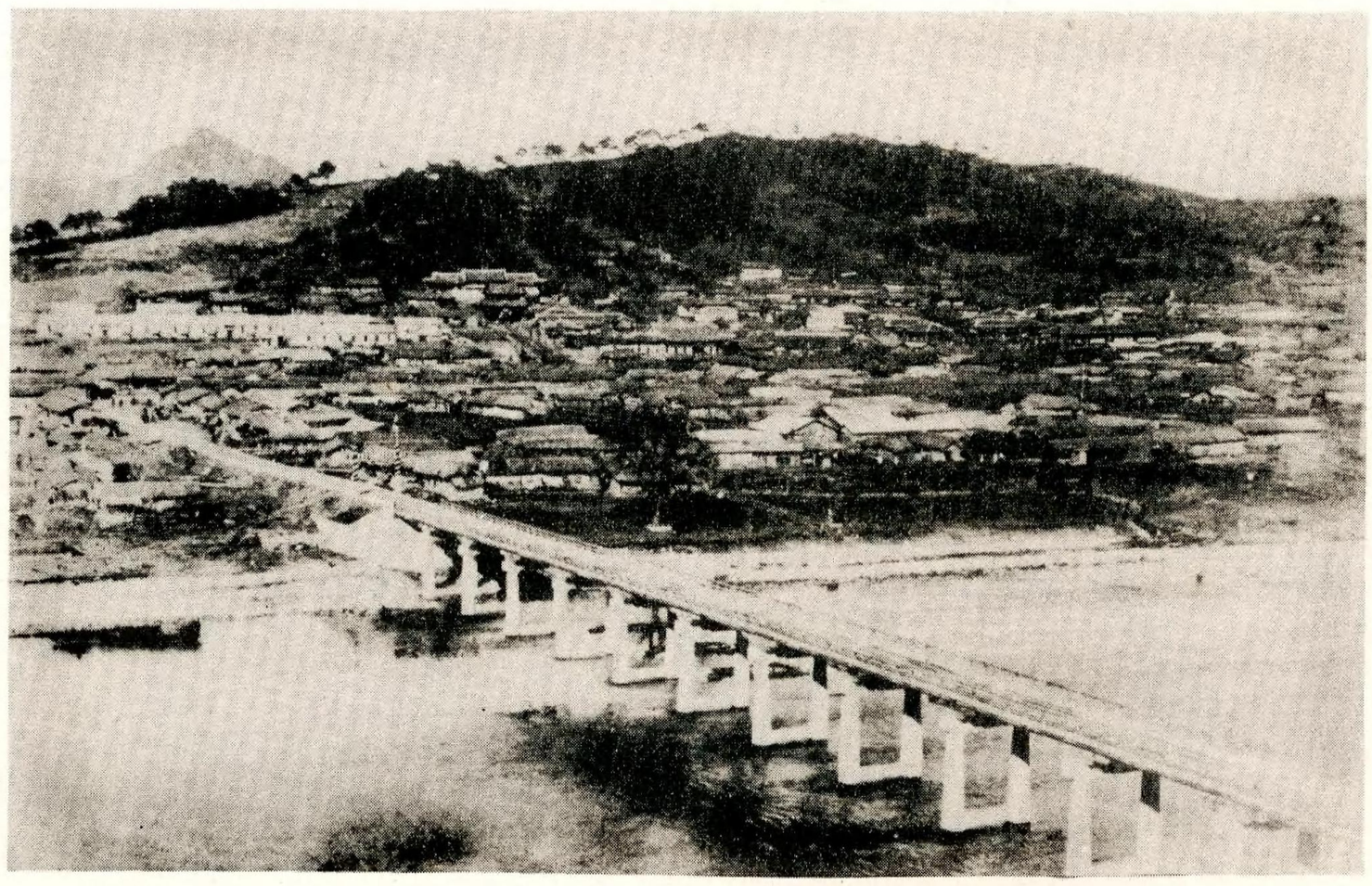

Photo X-1. Bridge over P'yongwon-ch'on at Huich'on on Route 7.

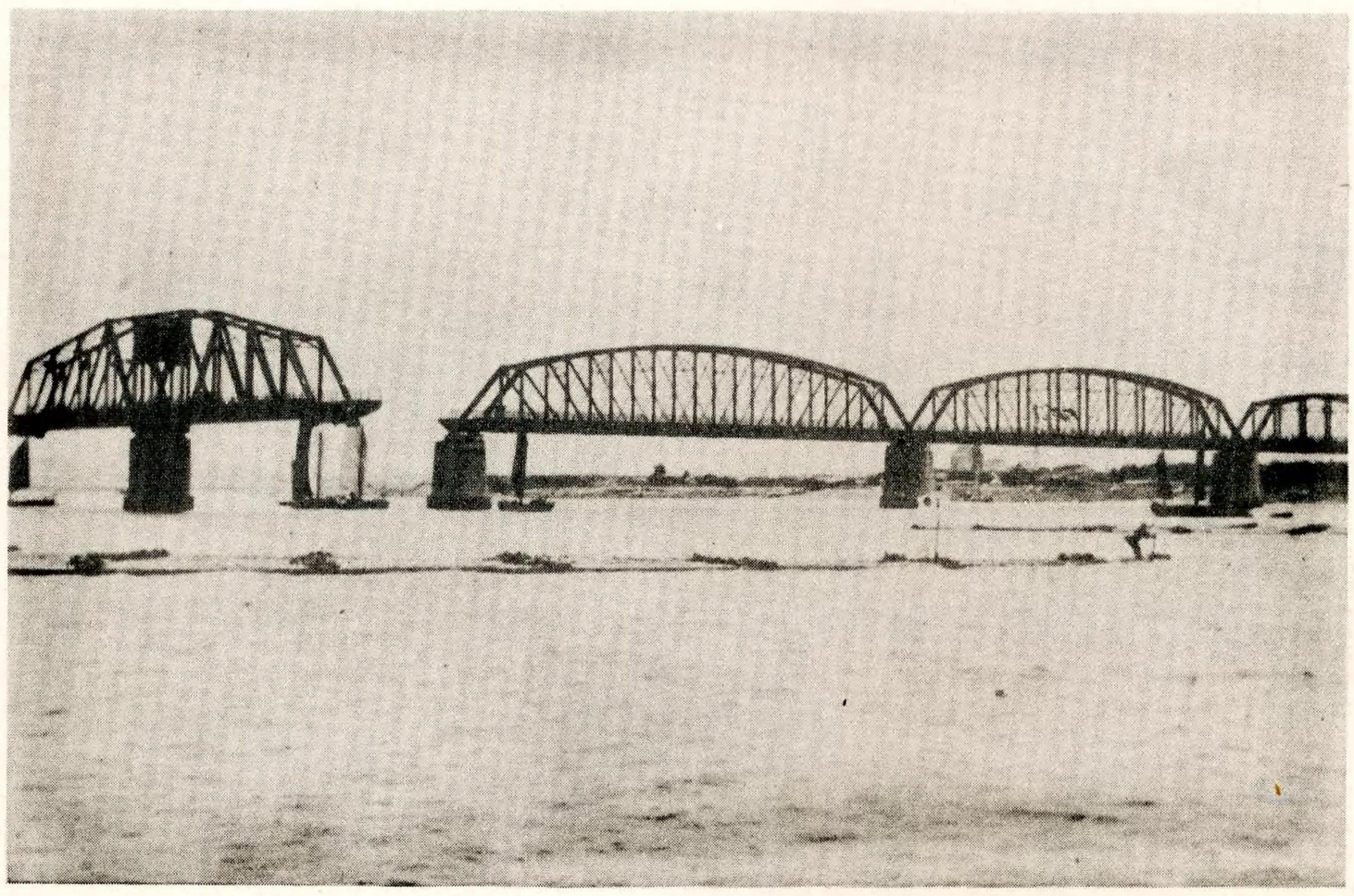

Photo X-2. Old railway-highway bridge between Sinuiju and Antung (Manchuria). Facing downstream.

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Photo X-3. Railway-highway bridge over Tuman River at Sansambong.

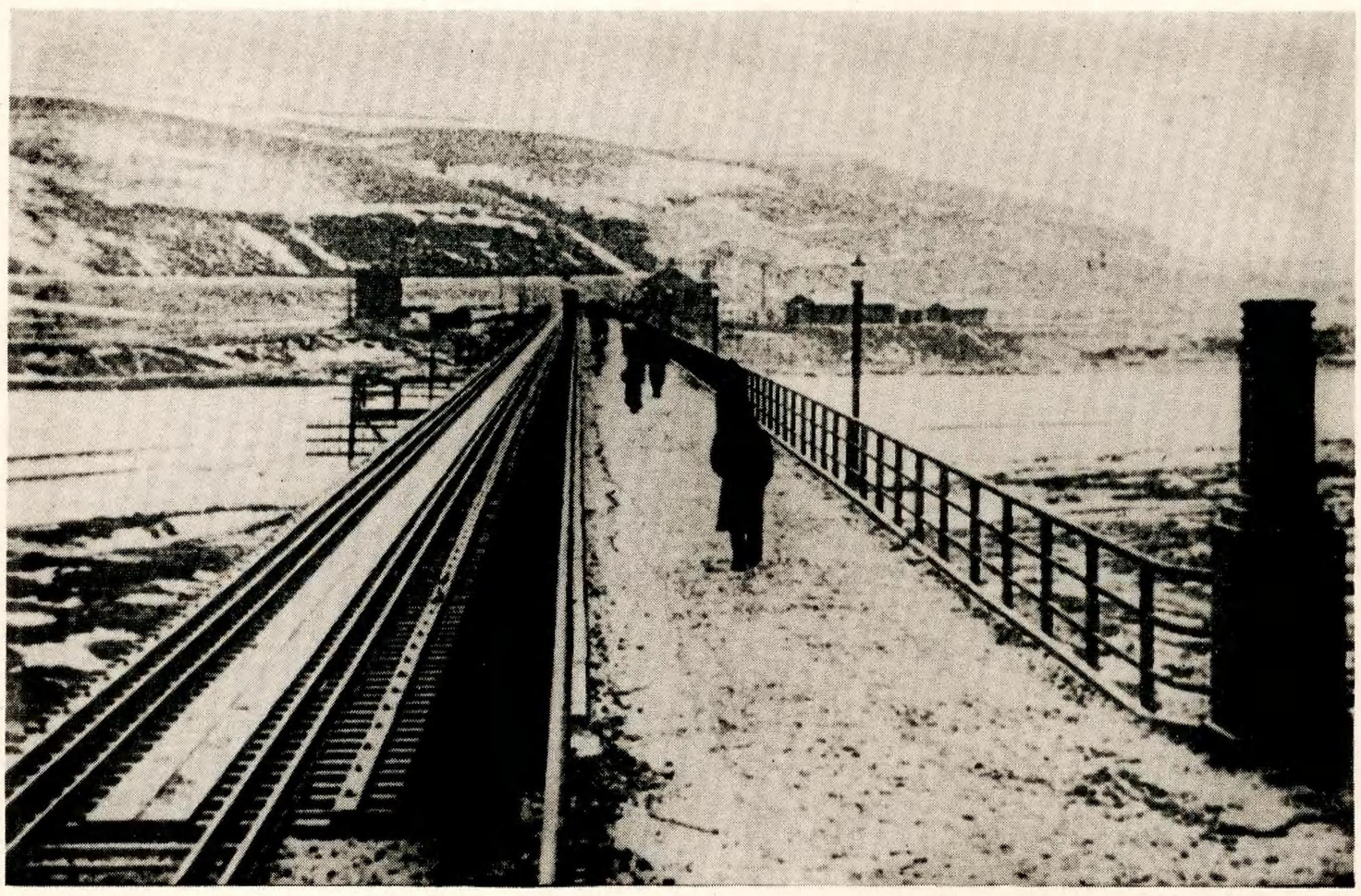

Photo X-4. Railway-highway bridge over Tuman River between Namyang and T'u-men (Manchuria).

XI. RAILROADS

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XI. RAILROADS

A. GENERAL

The orientation of terrain in North Korea and the geographical location of the Korean peninsula as a land route between Japan and Manchuria have resulted in development of railroads in mainly north-south direction along the east and west coastal lowlands. The Kyongui line to Sinuiju, the Hamkyong and North Korea lines to Sangsambong and Namyang, and the Manp'o line to Manp'o are strategic routes to Manchuria. Other government and private railroad lines running north-south exploit timber power, and mineral resources in the highlands of North Korea.

There are two transpeninsular lines, the P'yongyang line from Sop'o to Kowon, and the Kyongwon line from Yongsan in Seoul to Wonsan on the east coast. Both are strategic arteries, and are electrified in sections of track which have steep grades and numerous tunnels.

Merger of private lines in North Korea by the government railway bureau has not been officially confirmed, though government control is to be expected. Total mileage of government lines confirmed as of 1945 is estimated at 2,031 miles. Private line mileage exceeds 450.

Strategic points in the North Korean railroad system are P'yongyang on the west coast and Wonsan on the east coast. Large railroad workshops and marshalling yards are located at both points.

B. PATTERN AND ALIGNMENT

1. Pattern

The Kyongui line, 308.6 miles from Seoul to Sinuiju on the west coast, and the Hamkyong and North Korea lines on the east coast, totalling 506.7 miles from Wonsan to Najin via Sangsambong and Unggi, are the two main north-south routes.

Other railroad lines striking in a generally north direction to the Manchurian border include the P'yongpuk, Manp'o, Hyesan, and Musan lines, of which only the Manp'o line is of strategic importance.

Bridge connections with Manchurian and Siberian railroad lines over the Yalu and Tuman rivers are to Sinuiju, Manp'o, Sangsambong, Namyang, and possibly at Hunkae and Sahwae on the North Korea line.

Two transpeninsular routes, the P'yongwon line from Sop'o to Kowon, and the Kyongwon line from Yongsan (Seoul) to Wonsan, connect the P'yongyang and Seoul regions on the west coast with the Wonsan region on the east coast. The Kyongwon line runs through the Wonsan-Seoul Corridor and serves as the main transpeninsular route connecting northeast Korea with areas south of Seoul. The Uijongbu-Yongsan (Seoul) section runs south of the 38th parallel. The North Tonghae line running from Anbyon south to Yangyang along the east coast also affords southward movement from northeastern Korea via the Wonsan region.

The Hwanghae group of narrow gauge lines serves the Ongjin peninsula.

Construction and possible completion of a by-pass route north of the 38th parallel connecting Chorwon on the Kyongwon line with Kumch'on on the Kyongui line has been reported.

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Total mileages of government and private lines confirmed as of 1945 are 2031 and 451 miles respectively.

Government and private lines in North Korea are listed below. Differentiation is as of 1945, pending definite confirmation of accession of private lines by the North Korean Government.

Government railroad lines (1945)

Main line	Line No.	Line	Terminii	Mileage
Kyongui	1.	Kyongui trunk	Seoul-Sinuiju	308.6
	1a.	Yongsan	Yongsan-Tanin-ni	4.2
			Sokang-Sinch'on	1.0
	1b.	Hasong	Sariwon-(Ku) Hasong	25.9
	1c.	Kyomip'o	Hwanghae-hwangju-Kyomip'o	8.1
	1d.	P'yongyang colliery	Taedong-gang-Sinsongch'on	57.0
	1e.	P'yongnam	P'yongyang-Chinnamp'o	34.3
	1f.	Pakch'on	Maengjung-ni-Pakch'on	5.8
	1g.	Namsi (or Yangsi)	Namsi-Namsinuiju	17.8
	1h.	Sinuiju shore line	Sinuiju-Sinuiju shore	1.1
Hwanghae	*2.	Tohae	Tosong-ni-Tonghaeju	49.2
	*2a.	Onghae	Tonghaeju-Ongjin	26.6
	*2b.	Haeju	Tonghaeju-Haeju-budo	4.6
		Chongdo	Tongp'o-Chongdo	0.7
	*2c.	Sahae	Tonghaeju-Samgang	36.7
	*2d.	Hasong	Sinwon-Hasong	3.5
	*2e.	Naet'o	Hwasan-Naet'o	1.3
	*2f.	Changyon	Sariwon-Changyon	50.8
P'yongwon	3.	P'yongwon trunk	Sop'o-Kowon	131.9
			(P'yongyang-Sop'o	6.6)
Manp'o	4.	Manp'o	Such'on-Manp'o	186.2
	*4a.	Kaech'on	Sinanju-Kaech'on	18.3
	4b.	Yongdung (or Kujang)	Kujang-Yongdung	4.6
	4c.	Yongmun colliery	Oryong-Yongmun colliery	4.4

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Kyongwon	5.	Kyongwon trunk	Yongsan-Wonsan	138.8
			(Seoul-Yongsan	2.0)
Hamkyong	6.	Hamkyong trunk	Wonsan-Sangsambong	433.1
	6a.	Chonnae-ri	Yongtam-Chonnae-ri	2.7
	6b.	Pukch'ong	Sinbukch'ong-Pukch'ong	5.8
	6c.	Iwon-cholsan	Nahung-Iwon-cholsan	1.9
	6d.	Chaho	Chungsan-Chaho	3.0
	6e.	Kangdok	Kangdok-Chongjin	4.2
			Chongjin-Susong	5.6
	6f.	Chongjin Wharf	Chongjin-Chongjin wharf	1.7
	6g.	Chongna (?)	Panjuk-Chongam	5.6
	6h.	Hoeryong colliery	Hoeryong-Sinkaerim	7.3
North Korea	7.	North Korea trunk	Sangsambong-Unggi	64.2
	7a.	Tuman	Namyang-Tuman bridge	0.7
	7b.	Ungna	Unggi-Najin	9.4
Hyesan	8.	Hyesan	Kilchu-Hyesanjin	88.0
	8a.	Paektu	Hyesanjin-Chunganjin	
Paekmu	*9.	Paekmu	Paegam-Musan	119.1
Musan	10.	Musan	Komusan-Musan	37.5
North Tonghae	11.	North Tonghae	Angyong-Yangyang	119.7
			Total	2031.0

* Narrow gauge, 2′6″.

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Private railroad lines (1945)

No.	Ownership and line name	Terminii	Mileage
**101.	Seoul Elec Co, Kumgangsan Elec Railway	Chorwon-Changdo-ri	42.0
102.	Pyongan Railway	Chinnamp'o-Yonggang-onch'on	21.5
103.	West Korea Central Railway	Sinsongch'on-Tokch'on	32.5
103a.	West Korea Central Railway	Kujong-Chadong	2.7
104.	Pyongpuk Railroad, trunk	Congju-Sup'ung-dong	78.9
104a.	Same, Chongsu Branch	Pup'ung-Chongsu-ri	4.2
104b.	Same, Sup'ung Dam	Pup'ung-Sup'ung Dam	3.0
105.	Tasado Railroad	Yangsi-Tasado (Taedasa-do)	15.0
*106.	Pukchin Railway	Myohyang-Pukchin	(est 30.0)
107.	Korean Anthracite Co, Wonsan North Port Line	Munch'on-Wonsan (Pukhang North Port)	6.4
*108.	Sinhung Railroad, Changjin line	Hamhung-Sasu	46.9
*108a.	Same, Songhung line	Oro-ri-Pujon-hoban	47.8
*108b.	Same, Hungnam line	Hamhung-Soho-ri	26.4
109.	Tanpung Railroad	Tanch'on-Hongkun	49.9
**110.	Korean Magnesite Co, Mamnam line	Yohaejin-Yongyang	37.1
*111.	Hojugoup Timber Line	Hojugoup-?	
112.	Kaganwon line	Sinkon-dong-Kaganwon	?
113.	Hoeam line	Aoji-dong-Paeam (Obong-dong)	6.5

* Narrow gauge, 2′6″.
** Partly or completely electrified.

2. Organization

Prior to 1945, the Japanese Government Railway Bureau exercised a certain amount of control and supervision over Korean railway management and operation. New construction projects were subject to the decision and direction of the former Japanese governor-general and the Japanese War Department. Lines in the extreme northeastern part of Korea were leased indefinitely to the South Manchuria Railway Co.

Despite the complete withdrawal of Japanese administrative and technical personnel, the basic pattern of management and operation under former Japanese rule is presumably maintained.

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Though conclusive information is unavailable, regional railroad bureau headquarters in North Korea are presumably located at P'yongyang and Hamhung, with the main bureau office in P'yongyang. Sub-regional or district offices are probably maintained at Kanggye under the P'yongyang bureau, and at Wonsan, Songjin, and Chongjin under the Hamhung bureau.

The North Korea line, formerly leased to the South Manchuria Railway Co, is now under Russian control.

The railroad bureau operates a training school in P'yongyang, and a number of hotels in key cities.

3. Trackage

Double tracking of the Kyongui line was reportedly completed prior to 1945. Under the North Korean Government administration, sections of one track have reportedly been removed for rehabilitation and construction of lines in northeastern Korea. Construction of a second track between Chongjin and Komusan on the Hamkyong line was projected in 1945.

4. Gauge

All government lines, disregarding postwar government accession of private lines, are standard 4′8½″ gauge except for the Hwanghae and Paekmu lines. All private lines as of 1945, except for a few timber and mining lines, were converted from the 2′6″ narrow gauge to the 4′8½″ standard gauge by 1945.

Conversion of the Kaech'on line to standard gauge is reportedly under way. Conversion of the Paekmu line was projected prior to 1945, but its realization is not to be expected in the near future.

The total mileage of standard gauge lines in North Korea exceeds 2,000 miles, and narrow gauge lines more than 460 miles, including sections of the Kyongui, Kyongwon, and Hwanghae lines south of the 38th parallel.

5. Grade and curvature

Grades are generally steeper in North Korea than in South Korea. The Kyongui trunk line is the only one in North Korea with a maximum grade of one percent and a minimum radius of curvature of 1,312 feet. All other main lines in North Korea have a maximum grade of 1.25 to 2.5 percent, and minimum radius of 820 feet, except Manp'o line, which has a minimum radius of 657 feet.

Branch lines running into the Northern Taebaek mountain range have maximum grades averaging 2.5 to 3.3 percent. Cabled sections have grades as steep as 45 to 70 percent.

The Hwanghae group of narrow gauge lines is generally low in elevation, and has grades generally under 1.67 percent and minimum radius greater than 660 feet.

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6. Electrification

The Kumgangsan Electric Railway was the first in Korea to be electrified. The 42-mile Chorwon-Changdo-ri section is known to be in operation. Construction and electrification of the extension from Changdo-ri to Kumgangsan was in its initial stages in 1945. The Hamnam line 37.1 miles from Yohaejin to Yongyang, with a projected extension to Sinbukchang, is the other private, electrified line in North Korea.

Electrification of steep grade and tunnel sections of three government lines, the P'yongwon, Kyongwon, and Manp'o, was projected and under construction in 1944-1945. Completion and current operation are reported.

Power is derived from both steam and hydroelectric power plants. Cable voltage is either 1,500 or 3,000 volts.

Electrified lines in North Korea are listed below:

Line No.	Line name	Interval	Mileage	Remarks
3	P'yongwon	Yangdok-Chongsong	29.8	Reported completed and in operation, Jan 49.
4	Manp'o	Kaeko-Koin		Reported completion, 1949.
5	Kyongwon	Pokkye-ri-Songsan		Reported completed and in operation.
101	Kumgangsan Elec Railroad	Chorwon-Changdo-ri	42.0	
110	Hamnam	Yohaejin-Yongyang	37.1	

C. CONSTRUCTION AND MAINTENANCE

1. Roadbed and ballast

Main line roadbeds are well built, and are basically well maintained by roadgangs formerly trained and supervised by the Japanese. Current standard of maintenance, however, has retrogressed because of lack of mechanical equipment and withdrawal of Japanese supervisory and technical personnel. Frequent mishaps from disorganized operation and maintenance have been reported. Washouts recur every several years during the summer rainy months. Flood control measures and reinforcement of cuts, instituted formerly by the Japanese, have served to alleviate this damage. Repair and maintenance of roadbed and track are slowed mainly by lack of mechanical equipment, but mobilization of local untrained labor under the North Korean Government has expedited repair and construction work to some degree with possible serious limitations in maintenance standards.

Ballast on the majority of lines in North Korea is screened gravel, with crushed rock second in use, in depths from 5 to 15 inches.

2. Rails

The majority of main standard gauge lines use 75 pounds-per-yard rails; these have been gradually replaced by 100 pound 33- or 66-foot length rails on the Kyongui and Hamkyong lines. The 60 and 75 pound rails are common on all other standard gauge lines.

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The 30, 34, and 44 pound rails are commonly used on narrow gauge lines, though heavier rails are used on the Sinhung line.

The flat-bottom T-rail is standard.

Rails are attached directly to ties by either screw or dog spikes. Joints are secured by 6-hole fishplates on the main lines and by 4-hole fishplates on the other lines.

3. Ties

Both main line, siding and switch ties normally number 14 to 20 per 33 feet of track. On the Kyongui line, 32 to 38 ties are frequently used. The standard dimensions of ties are 8 feet by 6 by 8 inches. Switch ties are generally 7 by 9 inches with length and spacing depending on axle load conditions.

Ties are made of an assortment of locally-procurable hardwoods, Japanese hardwoods and Japanese red oak. Treated ties are only used throughout on the Kyongui trunk line because of shortage of chemicals and lack of treating plants.

4. Signal

Train operation is based primarily on the Japanese tablet block or train staff system. Sectional route locking is used where traffic is heavy. Automatic block signals were installed on 53.8 miles of track between Tosong-ni and Sariwon on the Kyongui line in 1944. On other sections of the Kyongui line, semi-automatic semaphore signals are employed.

D. BRIDGES

Railway bridges are permanent structure, well engineered and generally of steel truss and/or plate girders on masonry or reinforced concrete piers and abutments. The larger bridges, especially on the Kyongui line, are usually a combination of multiple 60-foot plate girder and 200-foot truss spans. The 200-foot spans are usually 7 or 8 panel Warren or Parker type through truss.

Bridges on the Kyongui line as well as on other newly developed or improved lines are either reconstructed bridges or newly built bridges parallel to the old with the object of decreasing their vulnerability and increasing their individual load.

Bridges on the main arterial north and south routes on both coasts of North Korea are well guarded against both ground and air attack. The more recently built parallel bridges on the Kyongui line have piers and abutments of bomb-resistant design.

Data on main railroad bridges are shown in Table XI-1.

E. TUNNELS

Tunnels are numerous on all lines in North Korea which pass through mountainous terrain. Construction materials are glazed or hard brick impervious to water, or masonry bricks and sometimes concrete. Approaches to tunnels, usually through long cuts, are well drained and faced with turn or masonry.

Data on tunnels are shown in Table XI-2.

Table XI-1 - **Main Railroad Bridges in North Korea**

Line and bridge No.	River	Location	Description
1-1	Imjin-gang	37°53′N, 126°43′E. 63.2 mi from Seoul, N of Munsan sta.	Two parallel bridges, single track; total length 2303′; 10x60′ girder, 8x200′ truss; width 15′; 17 piers, concrete; load L-22 (girder); L-25 (truss); height above mean water level 20′, stream depth 15′, velocity 6′/sec; weight 2,587 short tons.
1-2	Yongjin-gang	73.9 mi from Seoul between Kumkyo and Hanp'o stations.	Two parallel bridges, single strack; total length 1011′, 6x60′ girder, 3x200′ truss.
*1-3	Taedong-gang	161 mi from Seoul between Taedong-gang and P'yongyang stations.	Two parallel single track bridges divided by midstream island into No. 1 (S) and No. 2 (N) bridges. **No. 1 (S) bridge:** Total length 1577′, 4x60′ girder, 6x200′ truss, width 31′; 9 piers and 2 abutments, concrete with stone facing; weight 3445 tons. **No. 2 (N) bridge:** Total length 1436′, 3x60′ girder, 6x200′ truss, width 31′; 8 piers and 2 abutments, concrete with stone facing; weight 2847 tons; load L-22 (girder), L-25 (truss).
1-4	Ch'ongch'on-gang	39°38′N, 125°36′E. 210.3 mi from Seoul between Sinanju and Maengjung-ni stations.	**Old bridge:** (1937) Single track; total length 3930′, 19x20′ plate girder, 13x200′ truss, width 17′; weight 4020 tons; 31 piers; load L-22 (girder), L-25 (truss).

* Another Japanese source gives the following specifications: No. 1 (S) bridge: Total length 1495′, 4x60′ plate girder, 6x200′ truss, width 30.5′. No. 2 (N) bridge: Total length 1287′, 4x60′ plate girder, 5x200′ truss, width 30.5′.

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1-5	Taeryong-gang	214.5 mi from Seoul between Maengjung-ni and Yongmi stations.	**Old bridge (N-bound):** (1940) Single track; total length 3,095′, 22x60′ plate girder, 7x200′ truss, width 17′; 28 piers, weight 2,682 tons; load L-22 (girder), L-25 (truss).
		500′ west of old bridge.	**New bridge (S-bound):** (1945) Single track; total length 3119′, 22x60′ plate girder, 9x200′ truss, width 17′; 30 piers; weight 2,469 tons; load L-22 (girder), L-25 (truss).
1-6	Yalu	40°07′N, 124°23′E. 308.8 mi from Seoul between Sinuiju and Antung.	**Old bridge:** Single track; total length 3107″; 6x200′ and 6x300′ truss, 1x300′ swing span, width 36′; 12 piers; 10′ width roadway.
			New bridge: (1943) Double track; total length 3097′, 6x200′ and 6x300′ truss, width 30.5′ with 10′ roadway, weight 9,360 tons, load L-25.
2-1	Yesong-gang	38°58′N, 126° 24′E. W of Yesong-gang sta on Tohae line.	Single track, narrow gauge; total length 2,045′, 10x200′ Warren truss; roadway on both sides; load L-18 (track), 6 tons for roadway.
3-1	Taedong-gang	30.8 mi from Sop'o on P'yongwon line.	17x80′ plate girder spans.
3-2	Fuyu-gang No. 2	60.4 mi from Sop'o on P'yongwon line.	9x60′ plate girder spans.
3-3	Fuyu-gang No. 1	61.9 mi from Sop'o on P'yongwon line.	8x60′ plate girder spans.

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4-1	Chonch'on-gang	63.3 mi from Sunch'on on Manp'o line.	12x60′ plate girder spans.
4-2	Yalu	N of Manp'o on Manp'o line. 41°08′N, 126°12′E.	Single track, total length 1,925′, 17x80′ plate girder, 3x150′ truss, 21 piers, load L-22, weight 1,308 tons.
6-1	Kumjin-gang	52.8 mi from Wonsan on Hamkyong line. S of Sinsang sta.	21x60′ plate girder spans.
6-2	Songch'ong-gang	75.8 mi from Wonsan on Hamkyong. line. S of Hamhung.	28x60′ plate girder spans.
6-3	Pukchin-namdae-ch'on	149.2 mi from Wonsan on Hamkyong line. S of Sinbukch'on.	28x60′ plate girder spans.
6-4	Tanch'on-namdae-ch'on	193 mi from Wonsan on Hamkyong line. S of Tanch'on.	28x60′ plate girder spans, width 8′, L-18.
6-5	Pukdae-ch'on	200 mi from Wonsan on Hamkyong line. N of Yohaejin.	18x60′ plate girder spans.
6-6	Chuul-ch'on	307.5 mi from Wonsan on Hamkyong line. S of Chuul station.	30x40′ plate girder spans.
6e-1	Susong-ch'on	S of Susong on Hamkyong line.	21x60′ plate girder spans.
6e-2	Sinsusong-ch'on	S of Susong on Hamkyong line.	8x60′ plate girder spans.
6-7	Tuman	42°36′N, 129°32′E. 0.7 mi NE of Sangsambong, terminus of Hamkyong line.	12-14x60′ plate girder spans; reinforced concrete piers on rockbed foundation; one auto roadway on east or downstream side; guardhouses on both approaches.

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7-1	Oyong-ch'on	E of Sinkon on North Korea line.	23x60′ plate girder spans.
7a-1	Tuman	Branches W of Namyang on North Korea line.	Est total length 1,500′, 20-21 x 60′ plate girder spans.
11-1	Muliu-ch'on	Between Naksansa and Taep'o stations on North Tonghae line.	17x40′ plate girder spans.
11-2	Hangsong-ch'on	Between Naksansa and Taep'o stations on North Tonghae line.	16x20′ plate girder spans.

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Table XI-2 - **Main Railroad Tunnels in North Korea**

Line and tunnel No.	Name of tunnel	Location	Station Interval	Length
1-1	Opa	188.4 mi from Seoul	Opa-Sukch'on	S-bound 1707′ N-bound 2166′
1-2	Sonch'on	258.4 mi from Seoul	Naha-Sonch'on	S-bound 1287′ N-bound 1624′
1-3	Paekma	300 mi from Seoul	Paekma-Sokha	1782′
2c-1	Yanghyon	16.6 mi from Samgang	N of Yanghyon	1451′
2c-2	Hakhyong	32.3 mi from Samgang	Hakyong-Tonghaeju	2805′
3-1	Tongpuk	10.8 mi from Sop'o	Mapum-Paesanjom	1155′
3-2	Wontok	48.4 mi from Sop'o	Sutok-Sinsongch'on	2428′
3-3	Kichang	53.0 mi from Sop'o	E of Sinsongch'on	3708′
3-4	Sokchang	60.9 mi from Sop'o	Changnim-Tongwon	1490′
3-5	Pyolch'ang No. 1	62.9 mi from Sop'o	Changnim-Tongwon	2264′
3-6	Pyolch'ang No. 2	63.3 mi from Sop'o	Changnim-Tongwon	427′
3-7	Oyu	83.3 mi from Sop'o	Naedong-Soktong-onch'on	2582′
3-8	Chinsokki	87.6 mi from Sop'o	Soktongonch'on-Kokcha	5020′

(In 31-mile stretch from Yangdok to Ch'onsong on P'yongwon line are 29 tunnels totalling approx 6.3 mi or averaging 1,068 feet per mile.)

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Line and tunnel No.	Name of tunnel	Location	Station Interval	Length
3-9	Kokcha	91.9 mi from Sop'o	Kokcha-Chonu	3806′
3-10	T'oyong	103.7 mi from Sop'o	Kwanpyong-Chonsong	909′
3-11	Paekson	117.7 mi from Sop'o	Inhung-Chukjon	1969′
3-12	Chanhung	125.5 mi from Sop'o	Miton-Puraesan	1476′
4-1	Chosang No. 1	75.8 mi from Sunch'on	S of Chosang	2205′
	Chosang No. 2		N of Chosang	1493′
4-2	Tongcham No. 2	79.8 mi from Sunch'on	S of Myongmun	1506′
4-3	22 tunnels	150 mi from Sunch'on	Kaeko-Kuhyon	Total length 6.8 mi. Largest 8860′. Average, more than 4000′ per mi.
4-4	Sangsimyong	183.2 mi from Sunch'on	S of Manp'o	8022′
4-5	Manp'o	187.5 mi from Sunch'on	N of Manp'o	2559′
5-1	?	141.5 mi from Yongsan	S of Songsan	644′
5-2	9 tunnels	154.5-161.5 mi from Yongsan	Saep'o-Sambang	Total length 8648′. Average 2010′ per mi.
6-1	Soyong	120.8 mi from Wonsan	34 mi N of Hungnam, or directly N of Majon.	2739′
6-2	?	103.8 mi from Wonsan	N of Saep'ori	2277′
6-3	Hoeyong	132.9 mi from Wonsan	N of Sinp'o	2870′

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6-4	Yanghwa	137.6 mi from Wonsan	N of Yanghwa	2442′
6-5	Kosan	155.8 mi from Wonsan	S of Kosan	4534′
6-6	Yuyong	162.7 mi from Wonsan	S of Nahung	2508′
6-7	Changwon No. 2	182.6 mi from Wonsan	N of Kokku	2766′
6-8	Ilsin No. 2	209.3 mi from Wonsan	N of Ilsin	2246′
6-9	Yedong	210.2 mi from Wonsan		3484′
6-10	Puye No. 1	211.1 mi from Wonsan		2526′
6-11	Manch'un	213.4 mi from Wonsan	N of Manch'un	3148′
6-12	Wonp'yong	238.2 mi from Wonsan	N of Wonp'yong	3492′
6-13	Kojom	255.9 mi from Wonsan	S of Kojom	5280′
6-14	P'ichayong	260.2 mi from Wonsan	N of Kojom	2970′
6-15	Kalom	284.2 mi from Wonsan	S of Ponggang	2152′
6-16	Yompunjin No. 2	301.8 mi from Wonsan	S of Yonghyong	4185′
6-17	Yompunjin No. 3	302.6 mi from Wonsan	S of Yonghyong	1889′
6-18	Sankiryong	312.1 mi from Wonsan	N of Sankiryong	2682′

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6-19	Musan Nos. 1-7	363 mi from Wonsan	About 30 mi N of Susong. Total length approx 13,000′ or 2.5 mi. Averages more than 3,240′ per mile. Longest tunnels: Musan No. 1, 3,033′; No. 5, 2,292′; No. 7, 4,343′.	
7-1	Myong	N. Korean line	Sinasan-Songhak	2428′
7b-1	Unggi	Unga line	E of Unggi	12,632′
8-1	Hapsu No. 1	36.3 mi from Kilchu		2756′
8-2	Hapsu No. 2	37.9 mi from Kilchu		3068′
8-3	Namnyongyong	45.9 mi from Kilchu		7261′
8-4	Ilkyom	70.5 mi from Kilchu		5158′

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F. VULNERABILITY

The greatest vulnerability of railroads in North Korea lies in the fact that there are few alternate routes to the strategic trunk lines running parallel to the east and west coasts and the transpeninsular connecting lines. Several large bridges along the west coast on the Kyongui line and numerous tunnels on all lines running through mountainous terrain enhance the vulnerability. Heavy concentration of railroad traffic at junctions of main lines and large centers of population, administration, and industry, cannot be avoided. Seoul, Sariwon, P'yongyang, and Sinuiju on the Kyongui line, and Wonsan, Hamhung, Hungnam, Songjin, and Chongjin on the Hamkyong line are typical vulnerable points in the North Korea railroad system.

Vulnerable bridges on the Kyongui line include the Imjin-gang, Taedong-gang, Ch'ongch'on-gang, Taeryong-gang, and Yalu River bridges. There are four bridges on the Hamkyong line on the east coast, namely the Kumjin-gang near Sinsang, the Sonch'ong-gang south of Hamhung, the Pukchin-namdae-ch'on south of Sinbukch'on, and the Tanch'on-namdae-ch'on south of Tanch'on, the destruction of which would appreciably affect railroad traffic.

Tunnels of more than 3,000 feet in length are fairly numerous in North Korea. The heaviest concentration of tunnels is between Yangdok and Ch'ongsong on the P'yongwon line, between Kaeko and Kuhyon on the Manp'o line, between Saep'o and Sambang on the Kyongwon line, and in the vicinity of Musan on the Hamkyong line. North of Unggi is 12,632-foot tunnel.

Heavy concentration of rolling stock is found at P'yongyang, which has the largest railroad workshop in North Korea, and at Wonsan, Hamhung, and Chongjin, which all have large marshalling yards, and important workshops and/or engine houses.

G. REPAIR FACILITIES

1. Workshops

The main railroad workshops north of the 38th parallel are located at P'yongyang, Wonsan, and Chongjin. The former two undertake construction of a limited number of locomotives as well as cars. All are equipped for major repair work and manufacture of parts and equipment. Medium to small scale repair facilities are available at Sariwon, Sinanju, Sinuiju, Chorwon, Pokkye-ri, Najin, Sunch'on, Haeju, and Songjin. No detailed information is available on the postward condition of workshops in North Korea, except for the Wonsan shop, which was inspected by a member of the Pauley Mission in June 1946.

The Wonsan workshop undertakes repair and maintenance of locomotives and rolling stock, and construction of narrow gauge locomotives and freight and passenger cars. The shop was reportedly operating under Soviet management and supervision, with 900 to 1,000 employees in June 1946, of which one-fourth were Japanese. The plant is well designed and equipped, and operation is above average. The foundry shop has two 3-ton cupola furnaces and an electric furnace for melting non-ferrous metals. Main products are brake-shoes and general railway castings of iron and bronze. The forge shop, the locomotive repair shop capable of building only narrow gauge locomotives, two car shops (one incompleted), and other installations are well equipped and compare favorably with the better and more important locomotive repair shops in the United States.

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2. Enginehouses

Enginehouses are located every 40 to 100 miles. Servicing of motive power is probably conducted at every two sections for passenger trains and at every section for freight trains.

H. MARSHALLING YARDS

P'yongyang has the largest classification yard in North Korea. It is located 4 to 5 miles north of the main station, and was developed during 1940-1945 to handle transient and converging traffic on the Kyongui, Manp'o, P'yongnam, and P'yongyang colliery lines.

Other fairly large yards are located at Sariwon, Tonghaeju, Sinanju, Sinuiju, Wonsan, Hamhung, Songjin, Chongjin, Unggi, and Najin, which represent major railroad junctions, terminii, or industrial concentrations.

I. ROLLING STOCK

1. General

An estimate of the rolling stock in use in North Korea, based primarily on inventory of rolling stock in South Korea at the time of the division of the country in 1945, totals 300 usable locomotives and less than 5,000 cars. The condition of rolling stock in South Korea during the postwar years indicates that no more than the original number of locomotives can be in operable condition at any one time in North Korea, even with full operation of the Wonsan and P'yongyang workshops. No definite information has been available since 1946 on the replenishing of motive power and cars from Manchurian workshops, the possibility of which should not be overlooked.

2. Locomotives

Types of locomotives in the general order of their use in Korea are as follows:

Standard 4′ 8½″ gauge:	
4-8-2 (Mountain type) 4-6-2 (Pacific type)	These 2 types, used on fast passenger trains, probably number no more than 100 together. The 4-6-2 type was supplied formerly by Darien shops of S Manchuria RR.
4-6-0 2-8-2 (Mikado) 4-4-0 2-8-0	These 4 types are used generally on 2nd-class passenger, freight, and mixed trains. The 2-8-2 and 4-6-0 class probably number no more than 250-300. There were 308 of the 4-8-2 and 2-8-2 heavy type locomotives in Sept 1945. The 4-6-0 and 2-8-0 type were built by Darien shops, which may continue to supply North Korean railroads.
2-6-2 2-6-0 4-6-4	Tank type used primarily for local service and shunting. The 2-6-2 outnumbers other types.
Narrow 2′6″ gauge:	
2-8-2	No definite information available on specific types of narrow gauge locomotives; the 2-8-2 type is known to operate on Hwanghae line.

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3. Freight cars

Freight cars commonly in use on Korean railroads normally have rated capacities of 20, 26, and 30 tons, and are bi-axle types; 50-ton cars are known to be in use only in limited numbers; 30- to 40-ton cars, either bi-axle or stock equipped with 4-wheel trucks, are also in wide use.

Box and open type cars are about evenly divided in number. By 1941 nearly all box cars were converted to steel type, but steel shortage later caused readoption of wooden-built bodies as temporary replacements.

Box cars used a stroop cars, with shelves installed, can accommodate up to 60 men for short runs, or about half this number of long distances requiring sleeping accommodations.

There are few refrigerator cars in Korea and they are not adequately equipped to haul perishables for any appreciable distance or length of time.

4. Passenger cars

All passenger cars on standard gauge lines have 4-axle trucks. Carriages are of center aisle type, without compartments, and are electrically lighted. Third-class cars, used most commonly on all lines in Korea, are equipped with straight-backed wooden seats and center aisle; they accommodate 80 to 100 men when used as troop cars. Sleepers, mostly third-class with three tiers of bunks on one side, are available on all main lines. A few second-class and possible first-class American style sleepers are uesd, primarily on the Kyongui through line to Mukden via Sinuiju.

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J. Details of individual railroad lines

Line 1. Kyongui trunk: Seoul-Sinuiju, 310.3 miles

Gauge:	4′8½″
Trackage:	Double (Seoul-P'yongyang section completed 1942; P'yongyang-Namsi section completed 1945; sections of one track removed during 1946-1950, rails used possibly for construction work in northeastern Korea.)
Maximum grade:	1.0 percent, sometimes 1.25 percent
Minimum radius of curvature:	1312′
Rail length and weight:	33′ and 66′, 85 and 100 lbs/yd
Number of ties per 33 ft rail:	15-20 and 32-38
Ballast, type and height:	Screened gravel, 13″
Roadbed load and bridge load:	L-20, LS-22
Distance between clearance points:	1476′
Platform length:	984′
Maximum allowable velocity:	43 mph
Signal:	Semi-automatic block signal. Automatic signals installed on 53.8 miles of track between Tosong-ni and Sariwon in 1944.
Engine house:	Sinmak, P'yongyang, Sop'yongyang, Chongju, and Sinuiju; branch engine houses at Tosong-ni, Sariwon, and Namsinuiju.
Marshaling yards:	P'yongyang
Traffic capacity:	Estimated freight haulage capacity per annum by Korean Government RR Bureau in 1945 (unit: short tons per annum):

	1945	After improvement
Seoul-Tosong-ni	550,000	3,080,000
Tosong-ni-P'yongyang	770,000	2,860,000
P'yongyang-Sinuiju	2,640,000	5,280,000

Line 1a. Yongsan: Yongsan-Tanim-ni, 4.2 miles
Sokang-Sinch'on, 10 miles

Gauge:	4′8½″
Trackage:	Double between Yongsan and Sokang; single otherwise.
Maximum grade:	2.5 percent

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Minimum radius of carvature:	656′
Rail length and weight:	30′ and 33′, 60 and 75 lbs/yd
Number of ties per 33 ft rail:	14-16
Ballast, type and height:	Screened gravel, 7″
Road bed load and bridge load:	L-18, LS-18
Distance between clearance points:	493′
Platform length:	328′
Maximum allowable velocity:	37 mph
Signal:	Semi-automatic and automatic
Engine house:	Yongsan
Marshaling yards:	Yongsan
Miscellaneous:	Steam and gasoline cars operated

Line 1b. Hasong: Sariwon-(ku) Hasong, 25.9 miles

Gauge:	4′8½″ (Also rptd as 2′6″ gauge to coincide with Hwanghae group of lines.)
Trackage:	Single
Maximum grade:	1.67 percent
Minimum radius of curvature:	790′
Rail length and weight:	33′, 34 and 44 lbs/yd if narrow gauge; 75 lbs/yd if standard gauge.
Number of ties per 33 ft rail:	15-18
Ballast, type and height:	Screened gravel, 4½″
Roadbed load and bridge load:	L-16, LS-16
Distance between clearance points:	650′
Maximum allowable velocity:	25 mph
Signal:	Train staff
Engine house:	Sariwon
Marshaling yards:	Sariwon

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Miscellaneous:	Steam traction

Line 1c. Kyomip'o: Hwanghae-Hwangju-Kyomip'o, 8.1 miles

Gauge:	4′8½″
Trackage:	Single
Maximum grade:	2.5 percent
Minimum radius of curvature:	525′
Rail length and weight:	30′, 60 and 75 lbs/yd
Number of ties per 33 ft rail:	14-18
Ballast, type and height:	Screened gravel, 13″
Roadbed load and bridge load:	L-14, LS-15
Distance between clearance points:	984′
Platform length:	197′
Maximum allowable velocity:	36 mph
Signal:	Tablet block and semi-automatic block signal
Miscellaneous:	Steam traction

Line 1d. P'yongyang Colliery: Taedong-gang-Sinsongch'on, 57.0 miles

Gauge:	4′8½″
Trackage:	Single
Maximum grade:	1.0 percent
Minimum radius of curvature	1190′
Rail length and weight:	30′, 60 and 75 lbs/yd
Number of ties per 33 ft rail:	14-18
Ballast, type and height:	Screened gravel, 12″
Roadbed load and bridge load:	L-18, LS-18
Distance between clearance points:	984′
Platform length:	230′
Maximum allowable velocity:	43 mph

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Signal:	Tablet block
Engine house:	Sungho-ri
Traffic capacity:	660,000 short tons per annum
Miscellaneous:	This colliery line formerly from Taedong-gang to Sungho-ri, 14.5 miles. The Sungho-ri-Sinsum-ch'on section was later constructed by the West Korea Central Railway Company and accessed by the government.

Line 1e. P'yongnam: P'yongyang-Chinnamp'o, 34.3 miles

Gauge:	4′8½″
Trackage:	Single (Double on approaches to both terminii.)
Maximum grade:	1.67 percent
Minimum radius of curvature:	1312′
Rail length and weight:	33′ and 66′, 75 lbs/yd
Number of ties per 33 ft rail:	16-17
Ballast, type and height:	Screened gravel, 12″
Roadbed load and bridge load:	L-18, LS-18
Distance between clearance points:	1150′
Platform length:	236′
Maximum allowable velocity:	43 mph
Engine house:	Chinnamp'o

Line 1f. Pakch'on: Maengjung-ni-Pakch'on, 5.8 miles

Gauge:	4′8½″
Trackage:	Single
Maximum grade:	1.0 percent
Minimum radius of curvature:	990′
Rail length and weight:	30′, 60 and 75 lbs/yd
Number of ties per 33 ft rail:	14-18
Ballast, type and weight:	Gravel, 10″

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Roadbed load and bridge load:	L-16, LS-18
Distance between clearance points:	592′
Platform length:	164′
Maximum allowable velocity:	37 mph
Engine house:	Pakch'on

Line 1g. Yangsi or Namsi: Namsi-Namsinuiju, 17.8 miles

Gauge:	4′8½″
Trackage:	Single
Maximum grade:	1.5 percent
Minimum radius of curvature:	1321′
Rail length and weight:	33′ and 66′, 75 lbs/yd
Number of ties per 33 ft rail:	15-17, 18 for curve rails
Ballast, type and height:	Screened gravel and crushed rock, 5″
Roadbed load and bridge load:	L-20, LS-22
Distance between clearance points:	1321′
Platform length:	1321′
Maximum allowable:	43 mph

Line 1h. Sinuiju shoreline: Sinuiju-Sinuiju-kanggan, 1.1 miles

Gauge:	4′8½″
Trackage:	Single
Maximum grade:	1.0 percent
Minimum radius of curvature:	990′
Rail length and weight:	33′ and 66′, 75 lbs/yd
Number of ties per 33 ft rail:	16 for straight rails, 17 for curved rails
Ballast, type and height:	Crushed rock, 20″
Roadbed load and bridge load:	L-16, LS-18

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Maximum allowable velocity:	43 mph

Line 2. Husanghae: Tohae: Tosong-ni-Tonghaeju, 49.2 miles

Gauge:	2′6″
Trackage:	Single
Maximum grade:	1.25 percent
Minimum radius of curvature:	657′
Rail length and weight:	34′, 44 lbs/yd
Number of ties per 33 ft rail:	13 for straight rails, 14 for curve rails
Ballast height:	4½″
Roadbed load and bridge load:	L-16, LS-16
Distance between clearance points:	886′
Maximum allowable velocity:	25 mph
Engine house:	Tonghaeju
Marshaling yards:	Tonghaeju
Traffic capacity:	550,000 short tons per annum

Line 2a. Onghae or Haeong: Tonghaeju-Ongjin, 26.6 miles

Gauge:	2′6″
Trackage:	Single
Maximum grade:	1.6 percent
Minimum radius of curvature:	984′
Rail length and weight:	33′, 44 lbs/yd
Number of ties per 33 ft rail:	15 for straight rails, 16 for curved rails
Ballast height:	4½″
Roadbed load and bridge load:	L-16, LS-16
Distance between clearance points:	331′
Maximum allowable velocity:	28 mph

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Line 2b. Tonghaeju-Haeju-budo, 4.6 miles

Gauge:	2′6″
Trackage:	Single
Maximum grade:	1.0 percent
Minimum radius of curvature:	529′
Rail length and weight:	34′, 44 lbs/yd
Number of ties per 33 ft rail:	13 for straight rails, 14 for curved rails
Ballast, height:	4½″
Roadbed load and bridge load:	L-16, LS-16
Distance between clearance points:	328′
Maximum allowable velocity:	28 mph

Tongp'o-Chongdo, 0.7 miles

Gauge:	2′6″
Trackage:	Single
Maximum grade:	1.0 percent
Minimum radius of curvature:	657′
Rail length and weight:	34′, 44 lbs/yd
Number of ties per 33 ft rail:	15 for straight rails, 16 for curved rails
Ballast height:	4½″
Roadbed load and bridge load:	L-16, LS-16
Distance between clearance points:	739′
Maximum allowable velocity:	28 mph

Line 2c. Sahae: Tonghaeju-Samgang, 36.7 miles

Gauge:	2′6″
Trackage:	Single
Maximum grade:	1.67 percent
Minimum radius of curvature:	660′

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Rail length and weight:	34′, 44 lbs/yd
Number of ties per 33 ft rail:	15 for straight rails, 16 for curved rails
Ballast height:	4½″
Roadbed load and bridge load:	L-16, LS-16
Distance between clearance points:	677′
Maximum allowable velocity:	28 mph
Engine house:	Samgang, Sinwon

Line 2d. Hasong: Sinwon-Hasong, 3.5 miles

Gauge:	2′6″
Trackage:	Single
Maximum grade:	1.67 percent
Minimum radius of curvature:	792′
Rail length and weight:	34′, 44 lbs/yd
Number of ties per 33 ft rail:	15 for straight rails, 16 for curved rails
Ballast height:	4½″
Roadbed load and bridge load:	L-16, LS-16
Distance between clearance points:	677′
Maximum allowable velocity:	28 mph

Line 2e. Naet'o: Hwasan-Naet'o, 1.3 miles

Gauge:	2′6″
Trackage:	Single
Maximum grade:	3.03 percent
Minimum radius of curvature:	398′
Rail length and weight:	34′, 44 lbs/yd
Number of ties per 33 ft rail:	14 for straight rails, 15 for curved rails
Ballast height:	5″

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Roadbed load and bridge load:	L-16, LS-16
Distance between clearance points:	430′
Maximum allowable velocity:	28 mph

Line 2f. Changyon: Saniwon-Changyon, 50.8 miles

Gauge:	2′6″
Trackage:	Single
Maximum grade:	1.67 percent
Minimum radius of curvature:	660′
Rail length and weight:	34′, 44 lbs/yd
Number of ties per 33 ft rail:	14 for straight rails, 15 for curved rails
Ballast height:	5″
Roadbed load and bridge load:	L-16, LS-16
Maximum allowable velocity:	28 mph

Line 3. P'yongwon: Sop'o-Kowon, 131.9 miles

Gauge:	4′8½″
Trackage:	Single
Maximum grade:	2.0 percent
Minimum radius of curvature:	820′
Rail length and weight:	33′ and 66′, 75 lbs/yd
Number of ties per 33 ft rail:	15-16
Ballast, type and height:	Screened gravel and crushed rock, 4″
Roadbed load and bridge load:	L-18, LS-18
Distance between clearance points:	820′, 263′
Maximum allowable velocity:	43 mph
Engine house:	Sunch'on, Singsongch'on, Yandok
Traffic capacity:	Sop'o-Sunch'on, 220,000 tons; Sunch'on-Sinsunch'on

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770,000 tons; Sinsunch'on-Kowon, 220,000 tons (to be increased to 550,000 tons with improvement of right-of-way.)

Line 3a. P'yongyang yard line, 6.2 miles

Gauge:	4′8½″
Trackage:	Double
Maximum grade:	1.0 percent
Minimum radius of curvature:	1321′
Rail length and weight:	33′ and 66′, 75 lbs/yd
Number of ties per 33 ft rail:	17 for straight rails, 18 for curved rails
Ballast, type and height:	Screened gravel and crushed rock, 10″
Roadbed load and bridge load:	L-20, LS-22
Distance between clearance points:	1321′
Platform length:	984′
Maximum allowable velocity:	43 mph
Engine house:	P'yongyang
Marshaling yards:	P'yongyang

Line 4. Manp'o: Sunch'on-Manp'o, 186.2 miles

Gauge:	4′8½″
Trackage:	Single
Maximum grade:	2.5 percent
Minimum radius of curvature:	657′
Rail length and weight:	33′, 75 lbs/yd
Number of ties per 33 ft rail:	15-18
Ballast, type and height:	Screened gravel and crushed rock, 3-6″
Roadbed load and bridge load:	L-18, LS-18
Distance between clearance points:	788′
Platform length:	263′
Maximum allowable velocity:	43 mph

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Engine house:	Sunch'on, Kaech'on, Yongdung, Hich'on, Kangye, Manp'o
Traffic capacity:	To be increased from 220,000 to 770,000 tons per annum with improvement right-of-way

Line 4a. Kaech'on: Sinanju-Kaech'on, 18.3 miles

Gauge:	2′6″ (conversion to standard gauge planned prior to 1945; currently under reconstruction; estimated completion 1952.)
Trackage:	Single
Maximum grade:	2.0 percent
Minimum radius of curvature:	332′
Rail length and weight:	28′, 30 lbs/yd
Number of ties per 33 ft rail:	14-16; 15 standard for curved rails
Ballast, type and height:	Gravel, 5″
Distance between clearance points:	394′
Platform length:	115′
Maximum allowable velocity:	19 mph

Line 4b. Yongdung (Kujang): Kujang-Yongdung, 4.6 miles

Gauge:	4′8½″
Trackage:	Single
Maximum grade:	3.0 percent
Minimum radius of curvature:	525′
Rail length and weight:	60′, 75 lbs/yd
Number of ties per 33 ft rail:	14-16; 15 standard for curved rails.
Ballast, type and height:	Gravel, 4″
Roadbed load and bridge load:	L-16, LS-18
Distance between clearance points:	492′
Platform length:	131′
Maximum allowable velocity:	37 mph

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Line 4c. Yongmun Colliery: Oryong-Yongmun Colliery, 4.4 miles

Gauge:	4′8½″
Trackage:	Single
Maximum grade:	2.5 percent
Minimum radius of curvature:	984′
Rail length and weight:	33′, 75 lbs/yd
Number of ties per 33 ft rail:	15 for straight rails, 16 for curved rails
Ballast, type and height:	Gravel, 4″
Roadbed load and bridge load:	L-16, LS-18
Distance between clearance points:	558′
Platform length:	131′
Maximum allowable velocity:	37 mph

Line 5. Kyongwon trunk: Yongsan-Wonsan, 138.8 miles

Gauge:	4′8½″
Trackage:	Single, electrified between Pokkae and Songsan
Maximum grade:	2.5 percent
Minimum radius of curvature:	990′
Rail length and weight:	33′ and 66′, 75 lbs/yd
Number of ties per 33 ft rail:	15-18, 16 standard for curved rails
Ballast, type and height:	Screened gravel, 7-9″
Roadbed load and bridge load:	L-18, LS-18
Distance between clearance points:	1321′
Platform length:	657′
Maximum allowable velocity:	43 mph
Signal:	Tablet block system
Engine house:	Yongsan, Sobbingo, Chongmyang-ni, Chonwon, Pokkae, and Wonsan

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Traffic capacity:	Yongsan-Pokkae, to be increased from 110,000 to 440,000 tons per annum with improvement of right-of-way; Pokkae-Tongka-ri to be increased from 110,000 to 880,000 tons; Tongka-ri-Anbyon, 1,100,000 tons.

Line 6. Hamkyong trunk: Wonsan-Sangsambong, 433.1 miles

Gauge:	4′8½″
Trackage:	Single; double track projected and/or under construction from Chongjin to Musan and further north.
Maximum grade:	2.0 percent
Minimum radius of curvature:	820′ (possibly 650′)
Rail length and weight:	33′, 75 and 100 lbs/yd
Number of ties per 33 ft rail:	15-17 for straight rails, 16-19 for curved rails
Ballast, type and height:	Screened and ordinary gravel, 7-9″
Roadbed load and bridge load:	L-18, 20, LS-18, 22
Distance between clearance points:	1280′
Platform length:	591′
Maximum allowable velocity:	50 mph
Signal:	Tablet block system
Engine house:	Wonsan, Kowon, Hamhung, Sinbukchong, Chongsan, Tanch'on, Songjin, Kilchu, Myong-ch'on, Chongjin, Komusan, and Hoeryong.
Marshaling yards:	Wonsan, Kowon, Hamhung, Songjin, and Chongjin.
Traffic capacity:	Kowon-Hamhung, 990,000 tons; Hamhung-Kilchu, 880,000 tons; Kilchu, 330,000 to be increased to 880,000 tons with improvement of track; Chongjin, to be increased from 660,000 to 880,000 tons; Chonjin-Hoeryong-Sangsambong, 1,100,000 tons.

Line 6a. Chonnae-ri: Yongtam-Chonnae-ri, 2.7 miles

Gauge:	4′8½″
Trackage:	Single
Maximum grade:	1.0 percent
Minimum radius of curvature:	1190′
Rail length and weight:	33′, 75 lbs/yd

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Number of ties per 33 ft rail:	13-16
Ballast, type and height:	Gravel, 4″
Roadbed load and bridge load:	L-16, LS-18
Distance between clearance points:	984′
Platform length:	936′
Maximum allowable velocity:	37 mph

Line 6b. Pukch'ong: Singbukch'ong-Pukch'ong, 5.8 miles

Gauge:	4′8½″
Trackage:	Single
Maximum grade:	1.25 percent
Minimum radius of curvature:	385′
Rail length and weight:	33′, 75 lbs/yd
Number of ties per 33 ft rail:	15 for straight rails, 16 for curved rails.
Ballast, type and height:	Screened and unscreened gravel, 7″
Roadbed load and bridge load:	L-16, LS-18
Distance between clearance points:	984′
Platform length:	296′
Maximum allowable velocity:	37 mph

Line 6c. Iwon-Cholsan (iron mine): Nahung-Iwon-cholsan, 1.9 miles

Gauge:	4′8½″
Trackage:	Single
Maximum grade:	2.5 percent
Minimum radius of curvature:	660′
Rail length and weight:	33′, 75 lbs/yd
Number of ties per 33 ft rail:	14-16
Ballast, type and height:	Screened and unscreened gravel, 7″

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Roadbed load and bridge load:	L-16, LS-18
Distance between clearance points:	525′
Platform length:	197′
Maximum allowable velocity:	37 mph

Line 6d. Chaho: Chungsan-Chaho, 3.0 miles

Gauge:	4′8½″
Trackage:	Single
Maximum grade:	3.0 percent
Minimum radius of curvature:	591′
Rail length and weight:	33′, 75 lbs/yd
Number of ties per 33 ft rail:	15 for straight rails, 16 for curved rails
Ballast, type and height:	Screened and unscreened gravel, 7″
Roadbed load and bridge load:	L-16, LS-18
Distance between clearance points:	493′
Platform length:	164′
Maximum allowable velocity:	37 mph

Line 6e. Kangdok: Kangdok-Chonjin, 4.2 miles
Chongjin-Susong, 5.6 miles

Gauge:	4′8½″
Trackage:	Single
Maximum grade:	1.5 percent
Minimum radius of curvature:	1321′
Rail length and weight:	33′ and 66′, 100 lbs/yd
Number of ties per 33 ft rail:	16 for straight rails, 17 for curved rails
Ballast, type and height:	Screened and unscreened gravel, 9″
Roadbed load and bridge load:	L-20, LS-22

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Distance between clearance points:	1640′
Platform length:	656′
Maximum allowable velocity:	50 mph
Miscellaneous:	Nanam-Chongjin, 4.7 miles rptd completed in 1941.

Line 6f. Chongjin wharf: Chongjin-Chongjin wharf, 1.7 miles

Gauge:	4′8½″
Trackage:	Single
Maximum grade:	1.0 percent
Minimum radius of curvature:	1321′
Rail length and weight:	60 and 75 lbs/yd
Number of ties per 33 ft rail:	14-15 for straight rails, 15-16 for curved rails
Ballast, type and height:	Crushed rock, 7″
Roadbed load and bridge load:	L-16, LS-18
Distance between clearance points:	1346′
Platform length:	656′
Maximum allowable velocity:	43 mph

Line 6g. Chongna: Panjuk-Chongam, 5.6 miles

Gauge:	4′8½″
Trackage:	Single
Maximum grade:	3.0 percent
Minimum radius of curvature:	1321′
Rail length and weight:	33′, 75 lbs/yd
Number of ties per 33 ft rail:	15-17
Ballast, type:	Screened gravel

Line 6h. Hoeryong Colliery: Hoeryong-Sinkaerim, 7.3 miles

Gauge:	4′8½″
Trackage:	Single
Maximum grade:	2.27 percent

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Minimum radius of curvature:	656′
Rail length and weight:	33′, 60 and 75 lbs/yd
Number of ties per 33 ft rail:	11-17
Ballast, type and height:	Screened and unscreened gravel, 5½″
Roadbed load and bridge load:	L-16, LS-18
Distance between clearance points:	296′
Platform length:	263′
Maximum allowable velocity:	37 mph

Line 7. North Korea: Sangsambong-Unggi, 64.2 miles

Gauge:	4′8½″
Trackage:	Single
Maximum grade:	1.25 percent
Minimum radius of curvature:	821′
Rail length and weight:	75 and 80 lbs/yd
Number of ties per 33 ft rail:	15-17 for straight rails, 17-19 for curved rails
Ballast, type:	Screened and unscreened gravel
Engine house:	Sangsambong
Miscellaneous:	Branch line to coast from Unggi approximately 2.5 miles long, total track length about 5 miles.

Line 7a. Tumen: Hunkae-Tumen bridge, 0.7 miles

Gauge:	4′8½″
Trackage:	Single
Maximum grade:	0.8 percent
Minimum radius of curvature:	Infinity
Rail length and weight:	75 lbs/yd
Number of ties per 33 ft rail:	13-16
Ballast, type:	Gravel

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Roadbed load:	L-18

Line 7b. Ungna: Unggi-Najin, 9.4 miles

Gauge:	4′8½″
Trackage:	Single
Maximum grade:	1.0 percent
Minimum radius of curvature:	1321′
Rail length and weight:	65 lb and 80 lb type B rails
Number of ties per 33 ft rail:	15-16
Ballast, type:	Screened gravel, crushed rock, and sand
Miscellaneous:	Najin wharf line, 1.5 mile; Namnajin branch line, 0.7 mile, both branch from Najin.

Line 8. Hyesan: Kilcho-Hyesanjin, 88.0 miles

Gauge:	4′8½″
Trackage:	Single
Maximum grade:	3.3 percent
Minimum radius of curvature:	821′
Rail length and weight:	65 lbs/yd
Number of ties per 33 ft rail:	15-19, 16 standard for curved rails
Ballast, type and height:	Screened gravel, 7″
Roadbed load and bridge load:	L-16, LS-18
Distance between clearance points:	755′
Platform length:	296′
Maximum allowable velocity:	43 mph
Engine house:	Paegam, Hyesanjin

Line 8a. Paekto: Hyesanjin-Chungangjin, 10 miles

Miscellaneous:	Japanese completed as far as Chungangjin by 1945. To extend to Paektu-san; current construction unknown.

Line 9. Paekmu: Paegam-Musan, 119.1 miles

Gauge:	2′6″

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Trackage:	Single
Maximum grade:	3.3 percent
Minimum radius of curvature:	230′
Rail length and weight:	60 lbs/yd
Number of ties per 33 ft rail:	13 for straight rails, 14 for curved rails
Ballast, type and height:	Screened, unscreened gravel, 4″
Roadbed load and bridge load:	L-16, LS-16
Distance between clearance points:	1321′
Platform length:	263′
Maximum allowable velocity:	25 mph
Engine house:	Yonam, Yup'yongdong
Miscellaneous:	Yonsa-Musan section, 34.1 miles completed in 1944. Planned to be converted to standard gauge in future.

Line 10. Musan: Komusan-Musan, 37.5 miles

Gauge:	4′8½″
Trackage:	Single
Maximum grade:	1.5 percent
Minimum radius of curvature:	1321′
Rail length and weight:	100 lbs/yd
Number of ties per 33 ft rail:	16 for straight rails, 17 for curved rails
Ballast, type and height:	Screened and unscreened gravel, 9″
Roadbed load and bridge load:	L-20, LS-20
Distance between clearance points:	1321′
Platform length:	328′
Maximum allowable velocity:	50 mph
Engine house:	Chinhwa, Musan

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Line 11. North Tonghae: Anbyon-Yangyang, 119.7 miles

Gauge:	4′8½″
Trackage:	Single
Maximum grade:	1.4 percent
Minimum radius of curvature:	984′
Rail length and weight:	75 lbs/yd
Number of ties per 33 ft rail:	15-16 for straight rails, 16-18 for curved rails
Ballast, type and height:	Screened, unscreened gravel, 6″
Roadbed load and bridge load:	L-18, LS-18
Distance between clearance points:	855′
Platform length:	492′
Maximum allowable velocity:	43 mph
Signal:	Tablet block system
Engine house:	Kosong and Yangyang
Traffic capacity:	Current 990,000 tons; to be increased to 1,320,000 tons with improvement of right-of-way.

PRIVATE RAILROAD LINES:

Line 101. Kumgangsan Electric Railway, Seoul Electric Company: Chorwon-Changdo-ri, 42.0 miles

Gauge:	4′8½″
Trackage:	Single, electrified; completed 30.5 miles from Changdo-ri to Naekumgan, rails removed in 1945.
Maximum grade:	2.5 percent
Minimum radius of curvature:	463′
Rail length and weight:	60 and 75 lbs/yd
Number of ties per 33 ft rail:	13-15
Ballast, type:	Gravel
Roadbed load:	L-12
Signal:	Staff
Engine house:	Chorwon, Changdo-ri

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Line 102. Pyongan Railroad: Chinnamp'o-Yongang-onch'on, 21 miles

Gauge:	4′8½″
Trackage:	Single, steam and gasoline car traction
Maximum grade:	1.2 percent
Minimum radius of curvature:	984′
Rail length and weight:	60 lbs/yd
Number of ties per 33 ft rail:	14-17
Roadbed load:	L-18
Signal:	Train staff-ticker
Engine house:	Chinnamp'o and Yongang-onch'on

Line 103. West Korea Central Railways: Sinsongch'on-Tokch'on, 132.5 miles

Line 103a. West Korea Central Railways: Kujang-chadong, 2.7 miles

Gauge:	4′8½″
Trackage:	Single; construction planned to connect Tokch'-on and Yongdong
Maximum grade:	2.0 percent
Minimum radius of curvature:	984′
Rail length and weight:	70 lbs/yd
Number of ties per 33 ft rail:	15-18
Roadbed load:	L-18
Signal:	Train staff
Engine house:	Sinsongch'on

Line 104. Yongpuk Railroad, trunk: Chonjo-Sup'ung-dong, 178.9 miles

Gauge:	4′8½″
Trackage:	Single; steam and gasoline cars operated
Maximum grade:	1.6 percent
Minimum radius of curvature:	984′
Rail length and weight:	65 and 75 lbs/yd
Number of ties per 33 ft rail:	14-16
Roadbed load:	L-22

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Signal:	Train staff
Engine house:	Pup'ung and Sunch'on

Line 104a. P'yongpuk Railroad, Chongsu branch line: Pup'ung-Chongsu-ri, 4.2 miles

Gauge:	4′8½″
Trackage:	Single
Maximum grade:	0.6 percent
Minimum radius of curvature:	1321′
Rail length and weight:	75 lbs/yd
Number of ties per 33 ft rail:	14-15
Roadbed load:	L-22
Signal:	Train staff
Engine house:	Chongsu

Line 104b. P'yongpuk Railroad, Dam branch line: Pup'ung-Dam, 3.0 miles, total

Gauge:	4′8½″
Trackage:	Single
Maximum grade:	2.5 percent
Minimum radius of curvature:	886′
Rail length and weight:	75 lbs/yd
Number of ties per 33 ft rail:	14-15
Roadbed load:	L-18
Signal:	Train staff

Line 105. Tasado Railroad: Yangsi-Tasado (Taedasado), 15.0 miles

Gauge:	4′8½″
Trackage:	Single, branches from Namsi: line at Yangsi; both steam and gasoline car traction.
Maximum grade:	1.0 percent
Minimum radius of curvature:	886′
Rail length and weight:	65 and 75 lbs/yd
Number of ties per 33 ft rail:	16

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Roadbed load:	L-18
Signal:	Train staff
Engine house:	Tasado

Line 106: Pukchin Railway: Myohang-Pukchin, est 30 miles

Gauge:	2′6″
Trackage:	Cabled in sections; single track
Miscellaneous:	Primarily used for logging and mining.

Line 107 Wonsan-Pukhang (north port), Korean Anthracite Company: Munch'on-Wonsan-Pukhang, 6.4 miles

Gauge:	4′8½″
Trackage:	Single
Maximum grade:	1.0 percent
Minimum radius of curvature:	984′
Rail length and weight:	75 lbs/yd
Number of ties per 33 ft rail:	18
Roadbed load:	L-18
Signal:	Train staff
Engine house:	Wonsan-Pukhang

Line 108. Sinhung Railroad, Changjin Line: Hamhung-Sasu, 46.9 miles

Gauge:	2′6″
Trackage:	Single; 2 and 3 rail on cable section, Samke-Whangchoryong, 45 percent; Whangchoryong-Sasu, 1.7 percent.
Minimum radius of curvature:	394′
Rail length and weight:	24, 30, 34 and 60 lbs/yd
Number of ties per 33 ft rail:	14-16
Signal:	Electric and train staff
Engine house:	Oro-ri, Sangtong, Samke, Bochang, Whangchoryong, Kodo
Miscellaneous:	Samke-Whangchoryong, cable; Whangchoryong-Sasu, steam and gasoline cars

Line 108a. Sinhung Railroad, Songhung Line: Oro-ri-Pujon-hoban, 47.8 miles

Gauge:	2′6″

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Trackage:	Single except for 2 and 3 rail cable trackage between Hamnamsonghung and Pujonryong.
Maximum grade:	Oro-ri-Hamnamsonghung - 3.3 percent; Hamnamsonghung-Pujonryong - 170 percent (cable; Pujonryong-Pujonhoban 1.8 percent.
Minimum radius of curvature:	332′ except for 244′ curve on Hamnamsonghung-Pujonryong section.
Rail length and weight:	24, 30, 34, 44, and 60 lbs/yd
Number of ties per 33 ft rail:	15-16
Signal:	Electric and train staff
Engine house:	Sinhung, Songhung, Ch'onkuom, Hamchiwon

Line 108b. Sinhung Railroad, Hungnam Line: Hamhung-Soho-ri, 26.4 miles

Gauge:	2′6″
Trackage:	Single, steam and gasoline car traction
Maximum grade:	1.0 percent
Minimum radius of curvature:	494′
Rail length and weight:	30, 40, 44, 60, and 75 lbs/yd
Number of ties per 33 ft rail:	15-18
Signal:	Double train staff
Engine house:	Sinkuyang

Line 109. Tanpung Railroad: Tamch'on-Hongkun, 49.9 miles

Gauge:	4′8½″
Trackage:	Single
Maximum grade:	1.6 percent
Minimum radius of curvature:	821′
Rail length and weight:	60 lbs/yd
Number of ties per 33 ft rail:	13-15
Roadbed load:	L-18
Signal:	Train staff
Engine house:	Tanch'on and Hongkun
Miscellaneous:	Gasoline cars also operated

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Line 110. Hamnam Line, Korean Magnesite Company: Yohaejin-Yongyand 137.1 miles

Gauge:	4′8½″
Trackage:	Single
Maximum grade:	2.5 percent
Minimum radius of curvature:	984′
Rail length and weight:	75 lbs/yd
Number of ties per 33 ft rail:	14-15
Roadbed load:	L-18
Signal:	Train staff
Engine house:	Ch'onkok

Line 111. Hojugoup timber line: Hojugoup-?

Gauge:	2′6″
Trackage:	Single

Line 112. Kaganwon Line: Sinkondong-Kaganwon

Gauge:	4′8″
Trackage:	Single

Line 113. Hoeam Line: Aoji-dong-Paeam, 6.5 miles

Gauge:	4′8½″
Trackage:	Single, steam traction
Maximum grade:	1.8 percent
Minimum radius of curvature:	821′
Rail length and weight:	60 and 75 lbs/yd
Number of ties per 33 ft rail:	15-16
Roadbed load:	L-18

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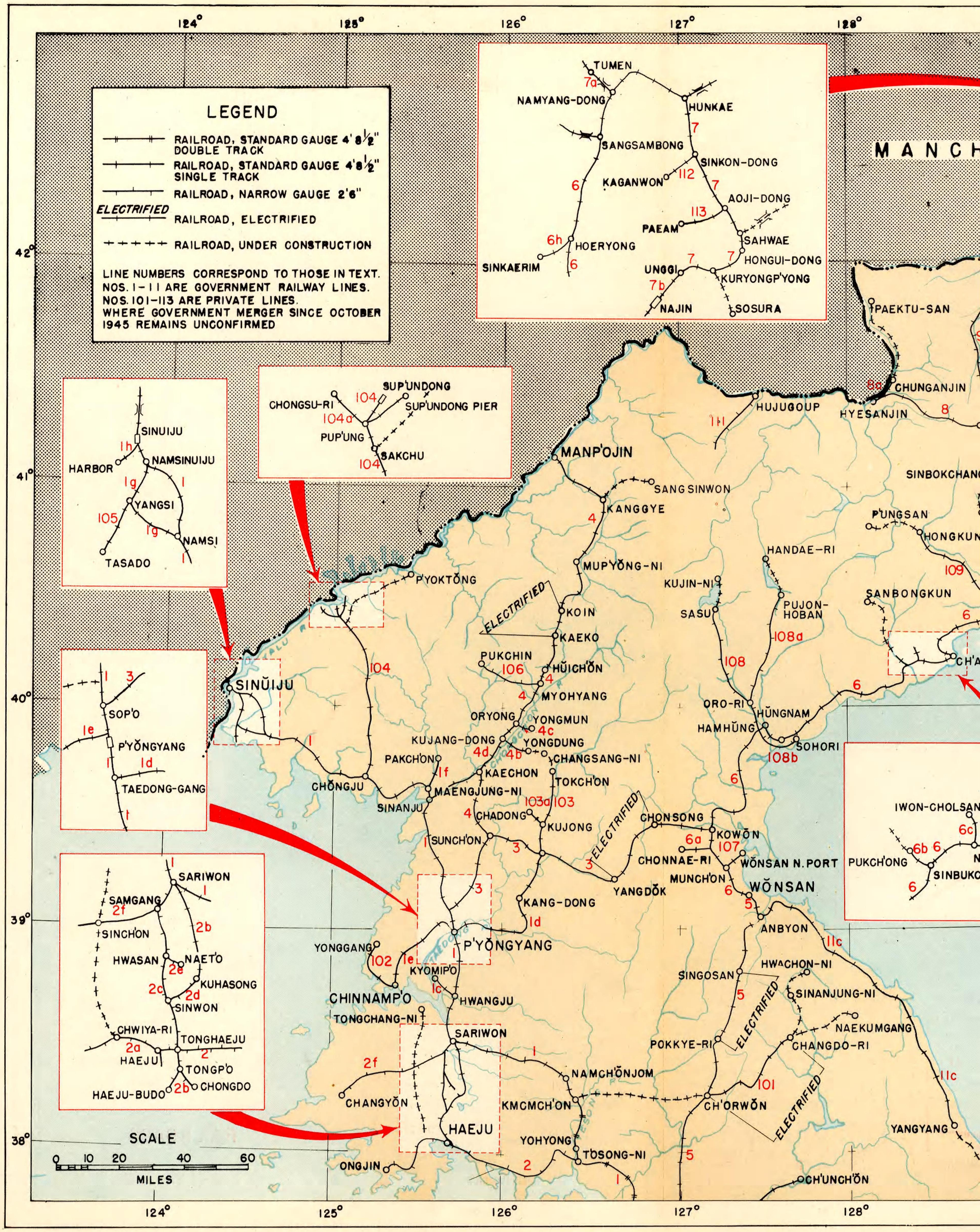

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PLATE XI-1

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PLATE XI-2

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PLATE XI-3

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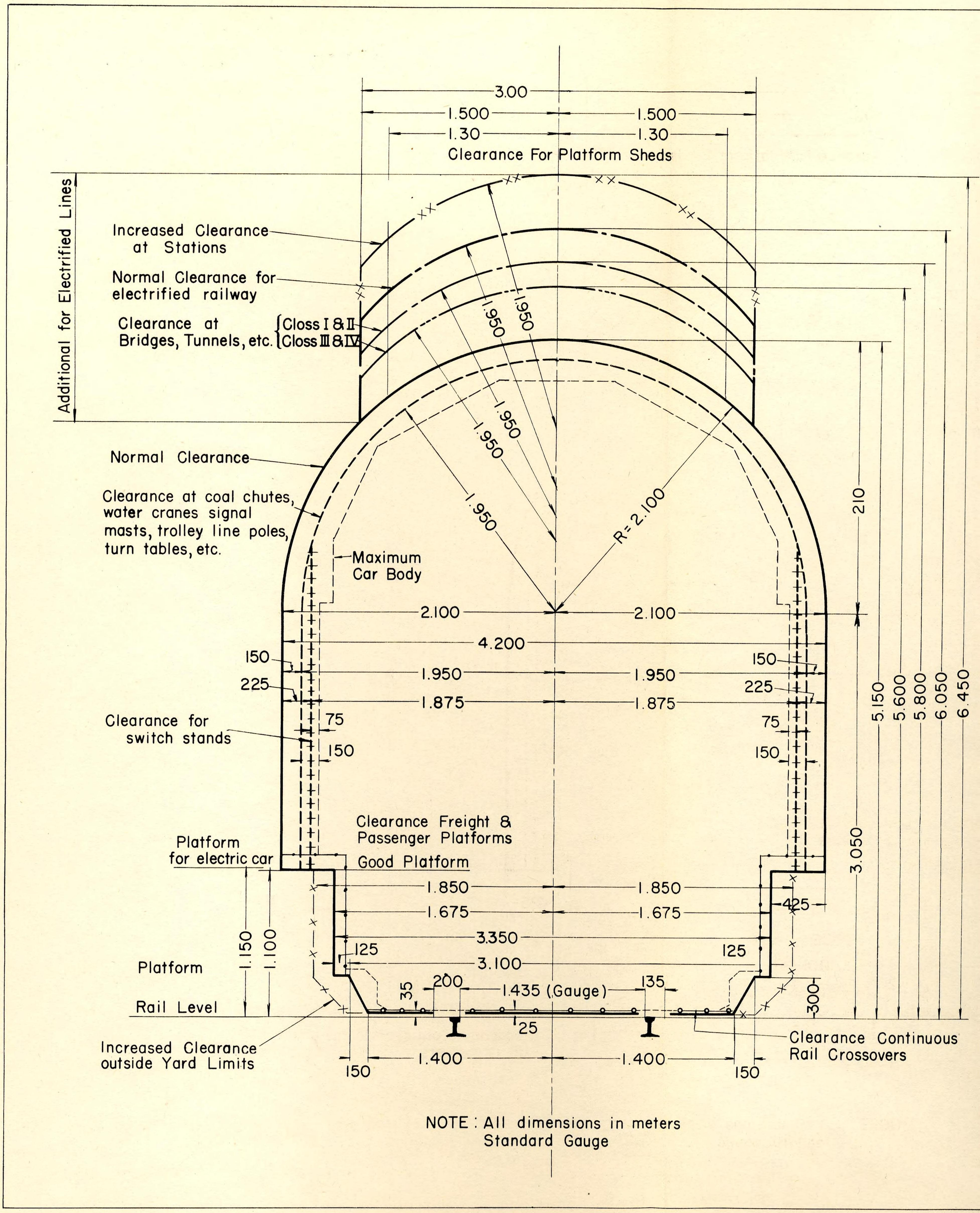

NOTE: All dimensions in meters
Standard Gauge

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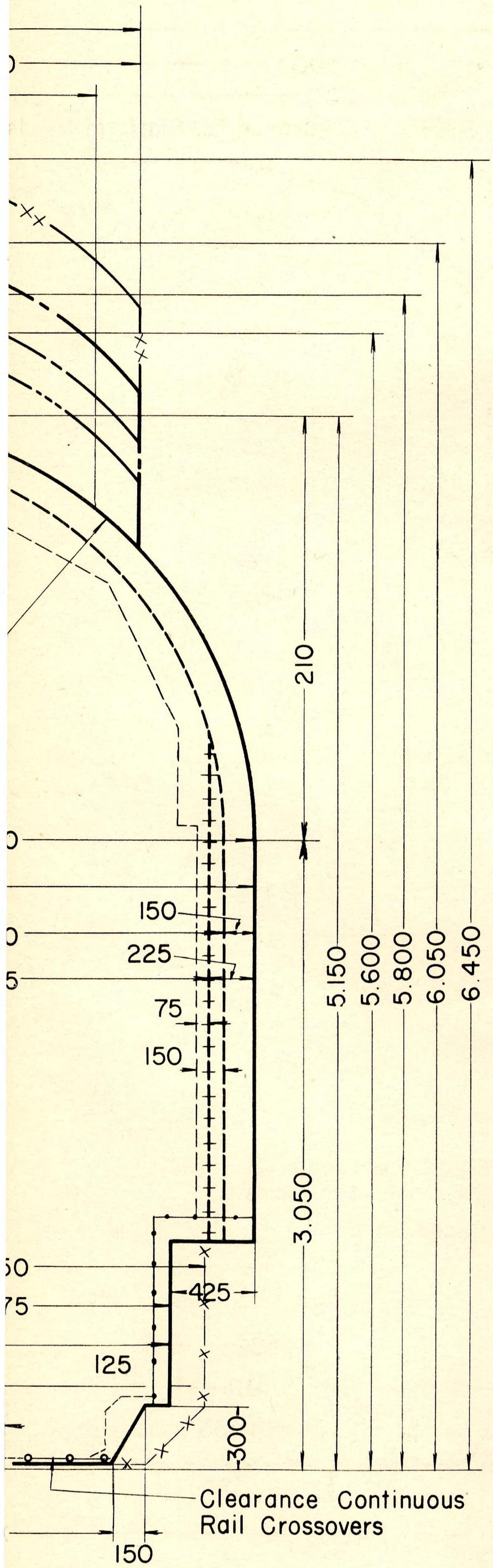

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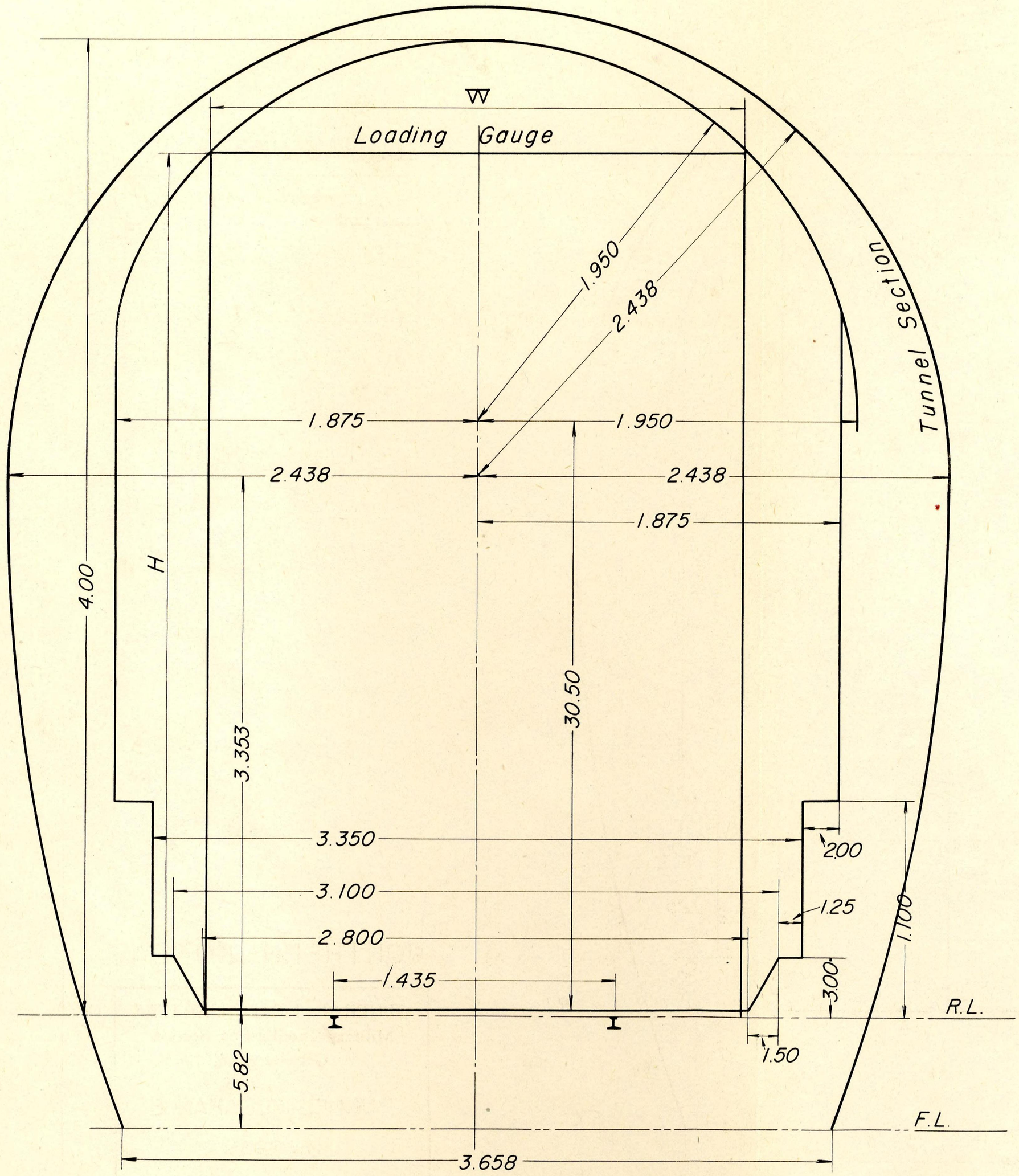

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M 2.74
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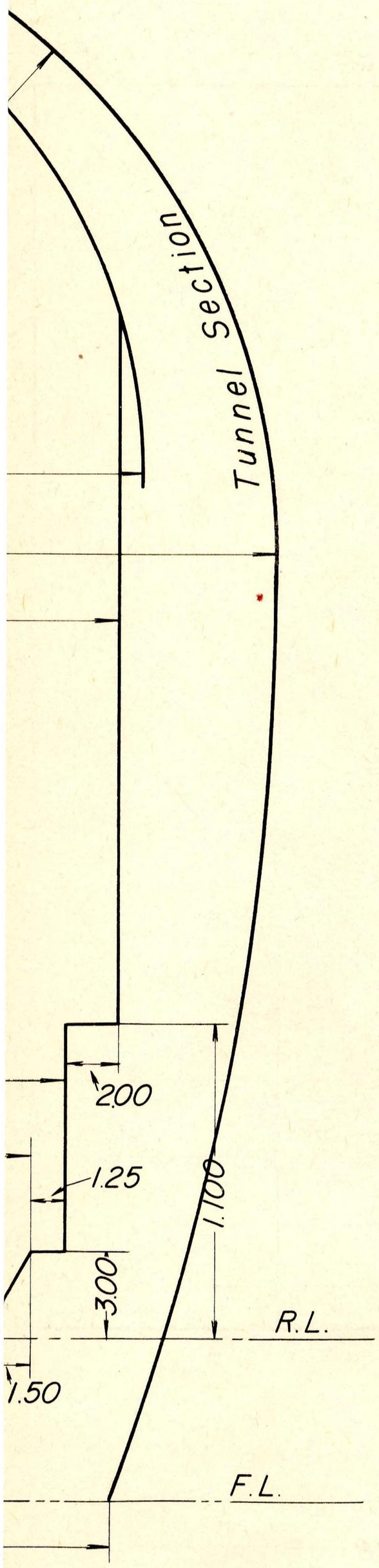

LOADING DIMENSION

LOAD WIDTH W	LOAD HEIGHT H
M 2.74 (8.99)	M 4.44 (14.57)
2.80 (9.19)	4.41 (14.17)
3.00 (9.84)	4.30 (14.11)
3.20 (10.50)	4.17 (13.68)
3.40 (11.16)	4.10 (13.16)
3.60 (11.81)	3.80 (12.47)
3.75 (12.30)	3.59 (11.78)

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TUNNEL CLEARANCE DIAGRAM

PLATE XI - 5

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Photo XI-1. Kilchu marshalling yards.

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Kilchu marshalling yards.

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Photo XI-2. Sunch'on marshalling yards.

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oto XI-2. Sunch'on marshalling yards.

XIII. SIGNAL COMMUNICATIONS

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