

(14)  
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# Port of KONAN

OFFICE OF THE CHIEF OF NAVAL OPERATIONS  
DIVISION OF NAVAL INTELLIGENCE  
NAVY DEPARTMENT

WASHINGTON, D.C.

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OP-16-FE 26-45

MARCH 1945



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Op-16-FE 26-45  
March 1945

PORT OF KOMAN

Based on interpretation  
of Aerial photograph:  
Sortie 4 MR44-468 BG, 21  
December 1944; AMS city  
plan - Hungnam; and  
various intelligence data.

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Appendix A - Climatic Table

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Figure 1. Mosaic of Konan showing port facilities and main industrial concentration. (Constructed from aerial photographs of Sortie 4MR 44-468 BG, 21 December 1944).

PORT OF KONAN

(39-50 N., 127-37 E.)

IMPORTANCE

Konan is one of the most important industrial centers of Korea and of the Japanese Empire. A bustling port of a region devoted to the extensive development of basic chemical industry, light metal production, and hydro-electric power, it is the Chemical Industrial Center of Korea, one of the largest producers of ammonium sulphate in the world, the largest producer of nitric acid, glycerine, and sulphuric acid in the Japanese Empire, and has one of the most extensive of Japan's Magnesium Plants (producing 25% of Japan's capacity).

The 4 important industrial plants of Konan are the Chosen Nitrogen Fertilizer Plant, the Chosen Nitrogen Explosives Plant, the Motomiya Plant and a new plant located east of the Chosen Nitrogen Explosives Plant. Because of this industrial activity, in a few short years the city has grown to an estimated population of 140,000 (1941).

The port was built to accommodate the commerce of the new industrial region. The terminal facilities are mechanically well-equipped to handle large quantities of cargo; however, the alongside docking capacity is small (12 berths), and it is reported that the roadstead is overcrowded with vessels awaiting their turns at the docks. It is believed that most of the vessels unable to come alongside when the docks are crowded, anchor in the roadstead rather than in the harbor proper because of the small anchorage space available within the harbor.

PHYSICAL FEATURESGEOGRAPHY

Konan (39-50 N., 127-37 E.) is located on Seikoshin-wan (See Port-Plan) at the head of Kanko-wan, an extension of the Sea of Japan that is guarded by Gaiyoto-tan on the northeast and Eigyo-tan on the south. It lies in the northeast corner of the large lowland that diminishes toward Genzan, where it meets the Taihaku-sammyaku, and reaches north to Kankō at the foot of the Rorin-sammyaku, the partly forested foothills of which bound the lowland on the west, north, and northeast.

The area is drained by the Josen and Seisen Rivers, which originate in the Rorin-sammyaku, and the Koho-ko. The swampy plains of these three rivers are devoted largely to rice culture.

Rail distances from Konan to important points in Korea are 84 miles to Genzan, 225 miles to Keijo on the west coast and 338 miles to Antung on the Manchurian border. Genzan lies 50 nautical miles away. Vladivostok and Yokohama are 271 and 969 miles respectively by sea.

SHORELINE

South of Konan a low sandy beach extends 12 miles to the Eigyo-tan - elevated south of Ka-to, a small island having steep cliffs on its south and east faces and connected with the coast by more than a half mile of shallows. A fresh-water river, the Kinshin-sen, flows into the southwest corner of Kanko-wan; and an irregular-shaped lagoon, roughly 6 miles by 2 miles empties just north of Ka-to. The lagoon-like Kinshin-sen is navigable only for small craft. One to 3 miles to the northeast are the braided, marshy mouths of the Seisen and Josen Rivers which flow into the bay via Kanko. Vegetation on this coastal plain is scattered - trees are concentrated around the lagoon and paddy fields in the river swamps.

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Low hills, partly wooded (Figure 6), surround Kōnan, but a half mile long plain connects the city with the main coastal plain. The 190-foot hill directly back of the pier, surmounted by two smokestacks of the Electrolysis Plant and Lead Smelter (Figures 4 and 6), is the most conspicuous landmark.

Between Kōnan and Gaiyōtō-tan 2 1/2 miles southeast, there are three shallow water fishing harbors; Shinjō-ri, Seikoshin and Jakuto-ri. Gaiyōtō-tan is fronted by small islands and can be recognized by its several reddish cliffs.

The coast curves from Gaiyōtō-tan to Taichō-wan forming an open bay. The southern half has a low sandy beach, and the upper coast is alternately rocky and sandy with several shallow inlets. The entire coast through Anjō-kō, 11 miles northeast of Gaiyōtō-tan, is paralleled by a mountain range several miles inland with spurs running down to the coast. Between Taichō-wan and Anjō-kō the coast is highly irregular and fronted by several small islands.

# CLIMATE

The climate of Kōnan is slightly milder than that of Genzan.<sup>1</sup> The rainy season is from July to September. In winter both rain and snow are slight. A west wind prevails throughout most of the year, but an east wind prevails in summer. When a rare southeast wind blows, anchorage in the roadstead is difficult for ocean-going vessels. In winter, only a thin surface of ice freezes in the harbor. Fog occasionally occurs in summer, and becomes thick enough to prevent vessels from entering the harbor about twice a year. More detailed climatic data, recorded at the Meteorological Observatory in Genzan, will be found in Appendix A.

# HARBOR

## GENERAL DESCRIPTION

Physical Characteristics. Kōnan Harbor is situated at the head of Seikoshin-wan, bounded on the northwest by a combination pier-and-breakwater with a total length of 5,110 feet. The harbor area north of this combination pier-and-breakwater and a line extending from the breakwater lighthouse to So-ho comprises approximately 402 acres with depths up to 32 feet.

Summary of Docking Berths. Berthing capacity in terms of vessel tonnages are given in the discussion of each main docking facility. The following table gives the berthing capacity of the docking facilities in terms of vessel lengths and their distribution throughout the waterfront. In addition, approximately 4,150 feet of quayage and two boat harbors are available to smaller craft.

Berths Available	Vessel Lengths (feet)	Allowable Drafts (feet)	Location by Reference Number <sup>2</sup>
1	500	30	1
2	500	26 1/2	1
1	385	25	3
2	360	22	3
2	300	18-20	2
3	300	20	4
1	225	16	1
12			

<sup>1</sup> Port of Genzan, Op-16-FE 6744; Dec., 1944.

<sup>2</sup> References are encircled numbers on the Port-Plan - attached to the end of this study.

ENTRANCE CHANNEL

The entrance channel between the end of the breakwater and Taichin-to is approximately 1,000 yards wide. A channel dredged to 32 feet leads in a northwesterly direction along the breakwater to the pier and wharves where the bottom has been dredged to depths ranging from 18 to 30 feet.

From the east entrance of the bay at Gaiyoto-tan to the harbor entrance, navigation presents no difficulty. Existing dangers are adequately covered in pilots and sailing directions.

HYDROGRAPHY

The mean high-water interval in Seikoshin-wan is 2 hours, 45 minutes; both springs and neaps rise .98 of a foot; the mean level above datum is .65 of a foot. Tidal currents in the region are negligible.

HARBOR IMPROVEMENTS

Recent harbor improvements (Figure 1 and Port-Plan) comprise the following: (1) an area of approximately 65 acres, in the northern part of the harbor, is in the process of reclamation and, upon completion, will provide about 2,800 feet of additional wharfage<sup>3</sup>; (2) an area of approximately 75 acres, contiguous to the area being reclaimed, is being dredged to greater depths and will probably be completed with the reclamation project; (3) a triangular piece of land, approximately 2,600 feet by 700 feet, has been reclaimed along a line from the middle of the southwest side of Dock No. 1 southwest to the small boat harbor; and (4) 1,750 feet has been added to the breakwater connected to Dock No. 1, giving the breakwater an overall length of 2,850 feet.

ANCHORAGES

Within the harbor, 8 anchorage berths comprise 7 third-class anchorages and 1 second-class anchorage<sup>4</sup>. Anchorage outside the harbor at Konan is not considered good, due to the wide exposure of Seikoshin-wan to the south, southeast, and southwest.

DOCKING FACILITIES

The docking facilities at Konan Harbor comprise one large pier 2,260 feet long, 3 quays over 600 feet long, 1 large wharf, a fishing harbor, 2 boat basins and 2 jetties. The transit sheds and mechanical handling and railroad facilities on Dock No. 1 are entirely adequate and a large number of warehouses are situated on or near almost all of the other docking facilities. For the tabulation of docking facilities there will be a two-heading breakdown: general-cargo terminals, and miscellaneous docking facilities.

General-Cargo Terminals

Docks Nos. 1, 2, 3, and 4 comprise the general-cargo terminals. Dock No. 1 is of primary importance and is the largest pier in Korea (Figures 1 through 5). These 4 terminals provide docking space for 12 ocean-going vessels over 300 feet long and drawing 18 to 30 feet. Tabulated Data on Dock No. 1 follows:

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<sup>3</sup>This estimate does not include Dock No. 4 which has already been put into use.

<sup>4</sup>Second-class anchorage is a 400-yard diameter circle with depths of 25 to 35 feet; third-class anchorage is a 300-yard diameter circle with depths of 15 to 25 feet.

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No. 1 Dock (Reference 1 and Figures 1 through 5)

<u>Location on waterfront:</u>	W. side of Harbor	
<u>Purpose for which used:</u>	Handling supplies and products for Chosen Nitrogen Fertilizer Company.	
<u>Type of construction:</u>	Earth fill type; reinforced concrete and iron sheet piling. Mooring bollards at 65-foot intervals.	
<u>Description:</u>	<u>Face</u>	<u>NE Side</u>
Dimensions	260'	2,260'
Depth of water:	19' - 31'	18' - 30'
Berthing Capacity:	One 1,200-ton freighter drawing 16'.	Three 10,000-ton freighters drawing 26' - 30'.
Width of apron:	170'	45'
<u>Capacity (lbs. per sq. ft.):</u>	Unlimited.	
<u>Storage facilities:</u>	Three 490' x 150' concrete transit-sheds are connected to cover a 225,000 sq. ft. area. 2 loading wells between sheds are each 110' long. The roof of the inner shed may be rolled back to facilitate loading and unloading. 7 smaller sheds cover 76,000 sq. ft. Four 46' diameter oil tanks are located at base of breakwater.	
<u>Cranage:</u>	A possible total of 12 cranes. One 40-ton crane at E. corner of dock. Four 10-ton traveling bridge-cranes cantelevering 75' over NE side of dock and shipping; overall length of each is 252' (Figures 4 and 5). Cranes unload into hoppers (Figure 5). Seven 3-ton cranes reported. These are probably mounted on RR cars and jointly serve Docks Nos. 1, 2, and 3.	
<u>RR and road connections:</u>	An extensive narrow-gauge RR system on the dock serves transit sheds. Additional standard gauge lines enter the area from N. and W., joining at a point opposite the middle of the transit sheds. Concentrated network is noted opposite the westernmost transit shed. At least 10 tracks parallel each other at this point. Steam, gasoline and electric locomotives reported in use. Possible engine-shed and RR repair shop just SW of the dock.	

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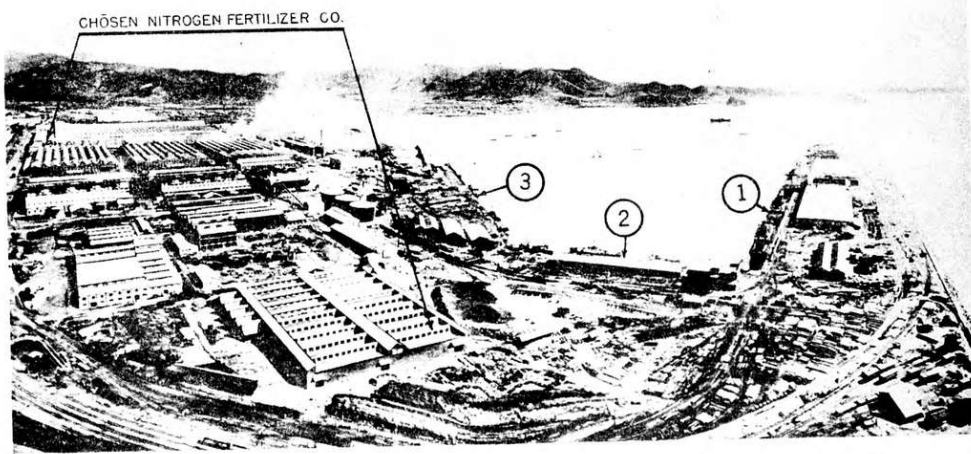


Figure 2. View of harbor looking southeast before recent improvements east of Dock No. 3. Reference 1 is Dock No. 1, Reference 2 is Dock No. 2, and Reference 3 is Dock No. 3.



Figure 3. View of Dock No. 1 (Reference 1) and Dock No. 2 (Reference 2) showing large, crane-equipped warehouses. Looking southeast.

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Water: 6" and 3" water mains on dock.  
Six 3" hydrants, each capable of  
supplying 30 tons of water per  
hour.

Estimated unloading capacity: 3,600 LT per day.

Remarks: Small transformer station on  
newly reclaimed area. Pier is  
lighted.

Dock No. 2 is the smallest component of the general-cargo terminals at  
Konan. Tabulated data follows:

No. 2 Dock (Reference 2 and Figures 1 through 4)

Location on waterfront: W. side of harbor.

Purpose for which used: Handling supplies and products  
for Chosen Nitrogen Fertilizer  
Company.

Type of construction: Earth fill type; iron sheet  
piling.

Description: Face

Dimensions: 620'

Depth of water: 18' - 20'

Berthing capacity: Two 3,000-ton vessels drawing  
18' - 20'.

Width of apron: 35'

Capacity (lbs. per sq. ft.): Unlimited.

Storage facilities: 1 shed along quay covering a  
30,000 sq. foot area.

Cranage: Probably served by travelling  
cranes mounted on RR cars.

RR and road connections: Narrow-gauge spurs parallel  
both sides of shed.

Estimated unloading capacity: 800 LT per day.

Remarks: Lighted.

Tabulated data follows concerning Dock No. 3, the third largest of the  
general-cargo terminals at Konan.

No. 3 Dock (Reference 3 and Figure 3)

Location on waterfront: W. side of harbor.

Purpose for which used: Handling supplies and products for  
Chosen Nitrogen Fertilizer Company.

Type of construction: Earth fill type; iron sheet piling.

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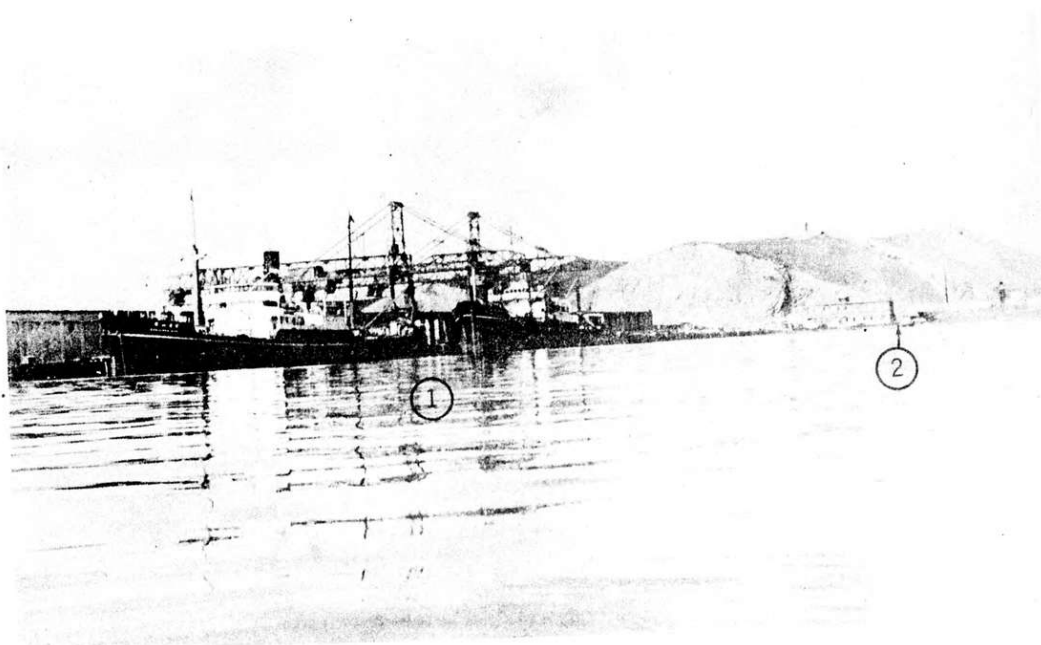


Figure 4. View of Dock No. 1 (Reference 1), showing traveling bridge-cranes, and Dock No. 2 (Reference 2). Looking west. About 1935.

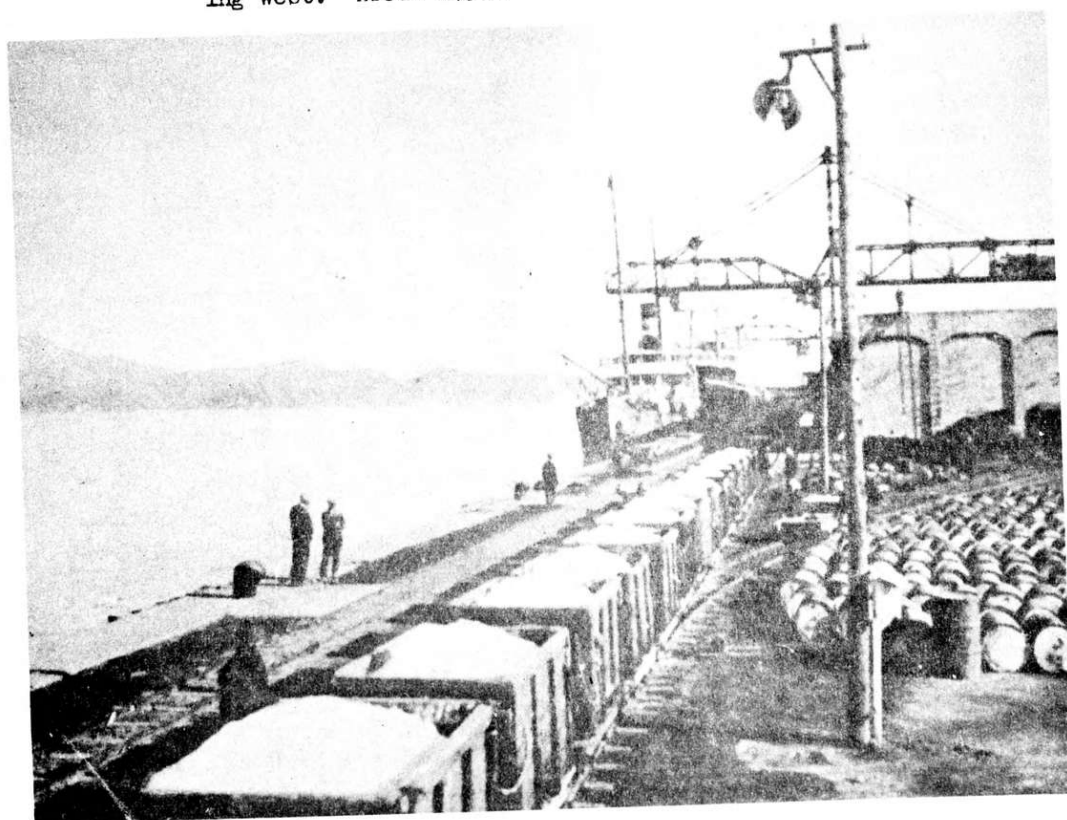


Figure 5. View of Dock No. 1 showing loaded hoppers. Looking east.

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<u>Description:</u>	<u>Face</u>
Dimensions:	2,000'
Depth of water:	22' - 26'
Berthing capacity:	Two 4,000-ton vessels drawing 22' and one 5,000-ton vessel drawing 25'.
Width of apron:	30'
<u>Capacity</u> : (lbs. per sq. ft.)	Unlimited.
<u>Storage facilities:</u>	2 sheds along quay covering a total area of 52,000 sq. ft.
<u>Cranage:</u>	Probably served by travelling cranes mounted on RR cars.
<u>RR and road connections:</u>	Narrow-gauge spurs parallel both sides of sheds.
<u>Estimated unloading capacity:</u>	2,400 LT per day.
<u>Remarks:</u>	Lighted.

Dock No. 4 is the most recently completed of the general-cargo terminals at Konan. Tabulated data follows:

No. 4 Dock (Reference 4 and Figure 1)

<u>Location on waterfront:</u>	W. side of harbor.
<u>Type of construction:</u>	Rock or cement wall retaining earth fill.
<u>Description:</u>	<u>Face</u>
Dimensions:	1,000'
Depth of water:	12' - 15' previously. Has since been dredged to probable depths of 22' or more.
Berthing capacity:	It is believed that depths are sufficient to accommodate three 2,600-ton vessels drawing 20'.
<u>Capacity</u> (lbs. per sq. ft.):	Unlimited.
<u>RR and road connections:</u>	A RR spur is probably under construction on this quay.
<u>Estimated unloading capacity:</u>	1,200 LT per day.
<u>Remarks:</u>	It is believed that the bottom alongside has been dredged to depths sufficient to accommodate vessels of medium draft. However, aerial coverage showed only lighters alongside. A shed or a wharf covering a 75' x 140' area is under construction on the quay wall of dock.

Miscellaneous Docking Facilities

The Taisei Company Mole, the Fishing Harbor, the Seikoshin Jetties, and two boat-basins comprise the miscellaneous docking facilities. These facilities can be used for unloading by lighter and are estimated to have a total unloading capacity of 7,500 long tons per day. All of these facilities serve small craft. Tabulated data on these facilities, in the order named, now follow:

Taisei Company Mole (Reference 5)

<u>Location on waterfront:</u>	N. side of harbor at village of Shinjo-ri.	
<u>Owned and operated by:</u>	Taisei Company.	
<u>Type of construction:</u>	Earth fill.	
<u>Description:</u>	<u>Face</u>	<u>E. Side</u>
Dimensions:	1,600'	150'
Depth of water:	7' - 9' previously. May have been dredged to greater depths.	
<u>Capacity (lbs. per sq. ft.):</u>	Unlimited.	
<u>Storage facilities:</u>	6 small storage sheds, near unloading boom, cover an area of approximately 10,000 sq. ft.	
<u>Cranage:</u>	2 unloading booms on W. end.	
<u>RR and road connections:</u>	1,500' from Kankyo Main Line. Road connection.	
<u>Remarks:</u>	1 small landing pier 30' by 10' extends from the face. Unidentified industry occupies fenced-in area 270' x 300' in approximately the center of the mole. Steam Plant. Unidentified group of 15 buildings occupies fenced-in area 160' x 500' at E. end of the mole.	

Fishing Harbor (Reference 8).

<u>Location on waterfront:</u>	E. side of harbor at village of Jakuto-ri.
<u>Purpose for which used:</u>	Fishing harbor.
<u>Description:</u>	
Dimensions:	Formed by 2 breakwaters. N. breakwater, 800' long and 100' wide at base, narrows to 60' width in last 250'. S. breakwater is 1,300' long and about 50' wide. Greatest N-S length, 1,600'. Greatest E-W width, 1,200'.
Depth of water:	1' - 13' previously. However, it is believed that the shallow areas

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have been recently dredged.

Berthing space available: About 2,700 feet of quayage available to fishing vessels.

Storage facilities: Estimated 50,000 sq. ft. of storage in 10 sheds near waterfront. 20 other buildings in vicinity of waterfront contain an additional 70,000 sq. ft. of possible storage space.

RR and road connections: Possible spur to Kankyo Main Line is 200 yards N. of Jakuto-ri. Road connection.

Sohojin Jetties (Reference 7)

Location on waterfront: NE side of harbor at village of Seikoshin.

Purpose for which used: Docks for small boats.

Description:

Dimensions: Two 110' jetties.

Depth of water: 3' - 7'

Storage facilities: 12 or more sheds covering approximately 65,000 sq. ft.

RR and road connections: Narrow-gauge spur from Kankyo Main Line to Jetties. Road connection.

Boat Basin No. 1 (Reference 6)

Location on waterfront: NE side of harbor at village of Seikoshin.

Purpose for which used: Harbor for small boats.

Description:

Dimensions: Formed by 250' breakwater extending S. on W. side of reclaimed land between Seikoshin and Shochin-to. Length and width at extreme points - 410' x 190'.

Depth of water: 3' - 7'

Berthing space available: Possible 200-foot unloading-wall.

RR and road connections: Road to Konan just E. of basin.

Boat Basin No. 2

Location on waterfront: SW of Main Docks outside harbor.

Purpose for which used: Small boat harbor.

Description:Dimensions:

Formed by rocky point on NE (extending 150') and 180' breakwater on SW. Underwater structures indicate possible construction of breakwater continuing 50' beyond rocky point.

Depth of water:

4' - 7'

RR and road connections:

Located on the Konan Railroad Line which runs between Konan and Kankyo via the village Kyuryo-ri

HARBOR CRAFT

In 1932, there were 12 lighters totalling 242 tons and 11 motor tugs totalling 19 tons at Konan Harbor.

STORAGE FACILITIES

The following table gives the data on known storage facilities at Konan. It will be noted that the warehouses located on, or in the immediate vicinity of any of, the main terminals are re-presented here. Warehouses for industrial products located within the various plant compounds, have not been included.

<u>Refer- ence No.</u>	<u>Location</u>	<u>No. of Ware- houses</u>	<u>Approximate Width and Length</u>	<u>Total Area in Square Feet</u>	<u>Remarks</u>
1	Dock No. 1	3	150' 490'	255,000	Area given in- cludes connect- ing loading- wells. Accessi- ble on each side by rail.
		7	- -	76,000	RR
2	Dock No. 2	1	- -	30,000	RR
3	Dock No. 3	2	- -	52,000	RR
5	Taisei Co.				
	Mole	6	- -	10,000	
7	Jetties	12 or more	- -	65,000	RR
8	Boat Basin	30	- -	120,000	
	Totals	61 †		608,000	

CLEARANCE AND CAPACITY

Actual Annual Traffic. In 1929, when Konan Harbor was still under construction, vessels entering Seikoshin-wan were handled at Seikoshin Port and included 270 steamships and 40 sailing vessels with an overall tonnage of 296,148 tons and 342 tons respectively. There are no statistics available on the traffic since Konan has become a highly developed industrial port, but its major commodities include ammonium sulphate, ammonium phosphate, superphosphate, caustic soda, sulphuric acid, carbide acid, hardened fish oils, amophoska, cyanamide, and butyl alcohol.

Unloading Capacity<sup>5</sup>. The estimated unloading capacity for Kōnan Harbor is 15,500 long tons per day, of which 8,000 long tons is discharged alongside the docks and 7,500 long tons is worked in the stream by 15 liberty ships. Few working days should be lost on account of inclement weather conditions.

### INDUSTRY

The Kōnan Region is the Far East's most extensive, integrated development of basic chemical plants, light metal production and hydro-electrical power. It is the chemical industrial center of Korea, the second largest producer of ammonium sulphate in the world, and is believed to be one of the largest producers of nitric acid, glycerine and sulphuric acid in the Japanese Empire. The sulphuric acid is used in processing pyrites from which pyrites sinter is obtained. This in turn is used in the production of sponge iron and electric steel. Also, the second largest Japanese magnesium plant is located here.

This industry is, for the most part, carried on in plants belonging to the Japan Nitrogen Fertilizer Company and its subsidiary companies. This company was established in 1906, and made hydro-electric power the foundation of its industrial network.

According to information released by the Japanese in 1944, the Japan Nitrogen Fertilizer Company had assets, at that time, of 214,000,000 Yen, securities worth 495,000,000 Yen, and had made loans of 213,000,000 Yen. The shares of subsidiary companies were 713,000,000 Yen, and were about three times the fixed assets of the company. In June 1943, there were 18 subsidiary companies directly related to the Japan Nitrogen Fertilizer Company, and the nominal capital of these was 597,000,000 Yen, of which 429,000,000 Yen was paid up.

The Korean development began with the establishment in January, 1925, of the Chosen Suiden, with a capital of 10,000,000 Yen. At first, the Chosen Suiden was in charge of the development of hydro-electric power, and the Chosen Nitrogen Fertilizer Company, which was established in May, 1927, was in charge of ammonium sulphate manufacture. As the development of hydro-electric power progressed, the Japan Nitrogen Fertilizer Company, through its Korean subsidiary companies, enlarged in scope the organic-and-synthetic chemical department, centering around Kōnan, expanded rapidly, the high grade fuel industry was strengthened, and the production and mining of light metals and non-ferrous metals was increased.

With the outbreak of the China Incident, and more so with the outbreak of the war with the United States, some changes were made in the management of the Japan Nitrogen Fertilizer Company, and it is now being operated completely under government control.

Known details of the plants located in Kōnan follow.

### PLANTS OF THE JAPAN NITROGEN FERTILIZER COMPANY

#### Plant 1

The main plant of the Japan Nitrogen Fertilizer Company in Kōnan (Port-Plan and Figures 6 through 17) runs approximately 11 1/4 miles northeast of the Kōnan pier, continues for more than 1/2 mile in a southeasterly direction,

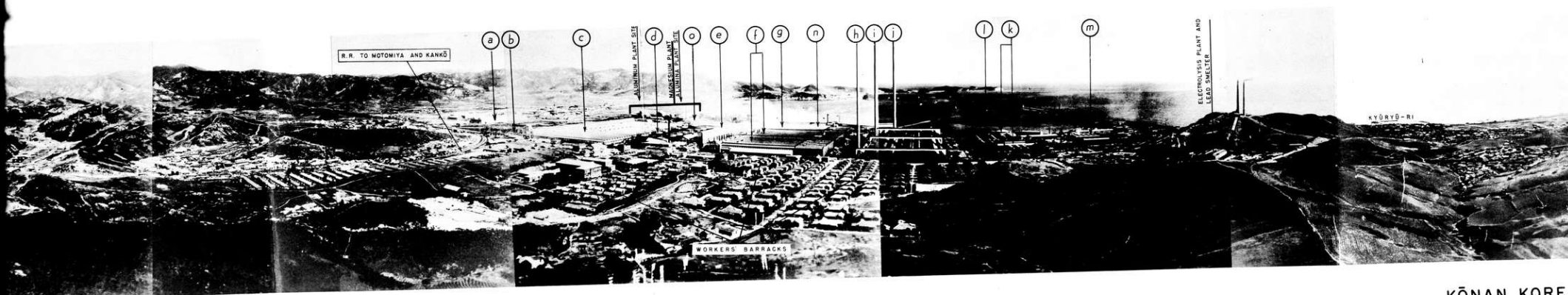
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<sup>5</sup>The estimated daily port-capacity is based upon the total number of vessels that can be continuously discharged alongside and in the stream multiplied by the total number of tons that can be discharged per ship per day.



Figure 6. Panorama of Kōnan, looking north-northwest through  
 (a) carbon electrode plant; (b) transformer station; (c) hydro-  
 and-nitrogen storage tanks; (d) ammonia synthesis plant; (e) m-  
 plant; (f) sulphuric acid plant; (g) nitric acid plant; (h) ph-  
 (i) fish-oil storage plants; (j) superphosphates plant; (k) s-

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KŌNAN, KOREA

Figure 6. Panorama of Kōnan, looking north-northwest through south-southeast. Letter references are as follows:  
 (a) carbon electrode plant; (b) transformer station; (c) hydrogen-and-oxygen electrolysis building; (d) hydrogen-and-nitrogen storage tanks; (e) ammonia synthesis plant; (f) main fertilizer-storage buildings; (g) air liquefaction plant; (h) sulphuric acid plant; (i) nitric acid plant; (j) phosphoric acid plant; (k) fish oil-and-glycerine plant; (l) fish-oil storage plants; (m) superphosphates plant; (n) steam plant; (o) machine shops.

covering a part of the new reclaimed area, and extends less than 1/2 mile inland. It is made up of a chemical plant - probably the largest in Korea; a magnesium plant with a rolling mill and an extrusion press, and producing approximately 25% of the total Japanese capacity; aluminum and alumina plants producing 6% of the total Empire capacity; and a metallurgical department with lead smelters, copper smelters, silver and gold smelters, and a copper electrolysis building. Also within the compound is a Standey Thermal plant of 14,000 kilowatts.

#### Chemical Plant

The chemical plant includes at least 15 elements which are indicated by letters on the Port-Plant (with accompanying key) and on Figure 6. The elements are as follows: (a) Carbon-electrode Plant where the Chosen Nitrogen Fertilizer Company makes its own electrodes and special synthetic cryolite (Figure 7); (b) transformer station (Figure 8); (c) Hydrogen-and-Oxygen Electrolysis Plant (Figure 9); (d) hydrogen-and-nitrogen storage tanks (Figure 9); (e) Ammonia Synthesis Plant (Figures 10 and 11); (f) main fertilizer storage buildings; (g) Air-Liquefaction Plant; nitric acid; (h) Sulphuric-acid Plant (Figure 12); (i) Nitric-acid Plant which is possibly the largest in the Japanese Empire (Figure 12); (j) Phosphoric-acid Plant (Figure 12); (k) Fish Oil-and-Glycerine Plant (Figure 13); (l) Fish Oil storage tanks (Figures 13 and 14); (m) Superphosphates Plant (Figure 13 and 15); (n) Steam Plant (Figure 16); (o) Machine Shops (Figure 9). A small synthetic jewel plant is reported to be situated north of the aluminum plant, and east of the carbon electrodes plant. Its exact location, however, is undetermined.

#### Magnesium Plant<sup>6</sup>

The Magnesium Plant obtains its magnesite ore from a mine which is 150 miles north of Konan, presumably in the mountains west of Joshin. 300,000,000 tons are visible, and an estimated 1,000,000,000 tons of magnesite are available there. The deposit is at an elevation of about 3,500 feet, and the ore is hauled down the mountain by cable car to the main line of the Korean Railroad, over which it is shipped to Konan. Should this railroad be destroyed, it would be possible to ship the ore by boat from Joshin harbor. Stock piles of magnesite of about 10,000 tons are maintained at the plant. Reserve stock piles are located at the mine.

The Magnesium Plant (Figures 5, 9 and 17) as a whole occupies an area of approximately 300 by 400 feet, employs about 200 persons, and is composed of the following units: -

1. Rotary-Kilns Building (Figure 17). The Rotary Kilns Building is about 450 by 50 or 60 feet, and has a rotary kiln with a capacity of 50 tons of dead burned magnesite per day. It is reported that in 1940 the company planned to install additional shaft furnaces with a capacity of another 40 tons per day. In the same year 25 to 30 tons of this original capacity were known to have been sold as magnesite to steel mills in Osaka. The balance was used for making metallic magnesium, in ingot form, and was probably also shipped to Osaka.
2. The Grinding-Installations Building (Figure 17). The Grinding Installations Building is 4 stories high and about 50 by 70 feet in area.
3. The Reduction Furnace Building (Figure 17). The Reduction Furnace Building contains no floor levels, but is about the height of a 4 store building and about 60 by 150 feet in area. Each reduction furnace (number not known) has a capacity of 1,000 tons of metal per year.

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<sup>6</sup>Information concerning the Magnesium Plant was obtained from a confidential report on interviews with an Austrian citizen now interned in the U.S.A.

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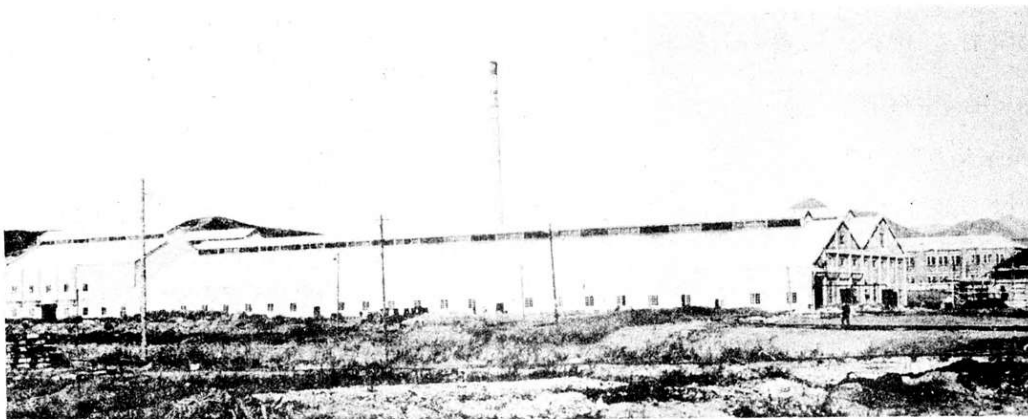


Figure 7. View of the Carbon-electrode Plant, Reference (a), looking north.

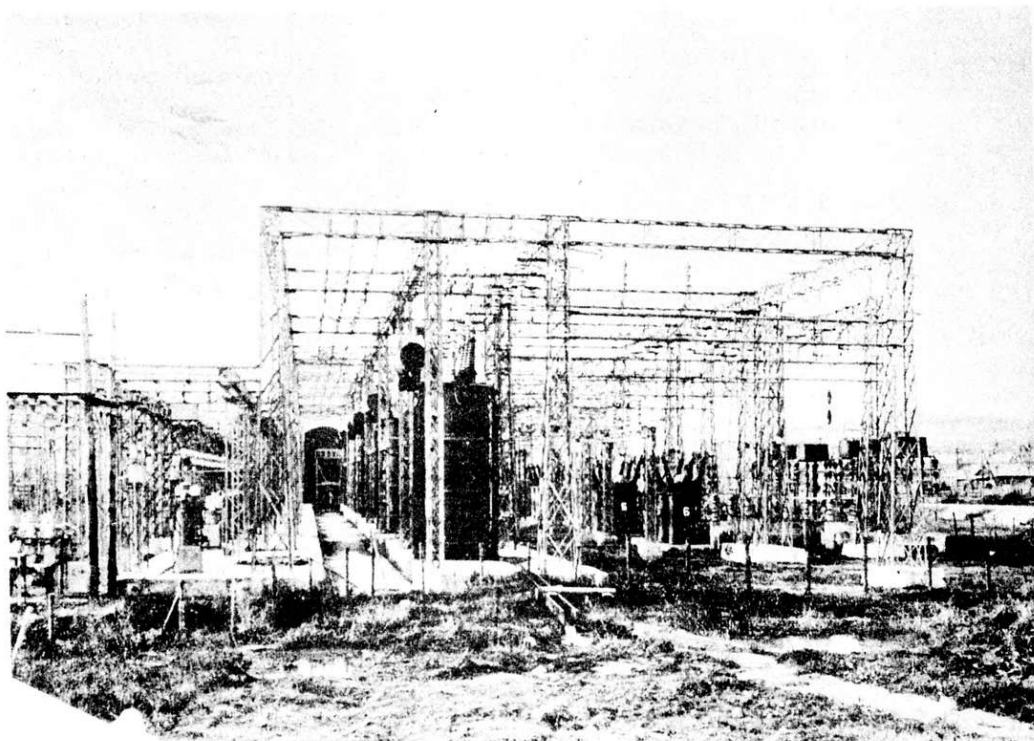


Figure 8. View of the Konan transformer station, Reference (b), looking northeast.

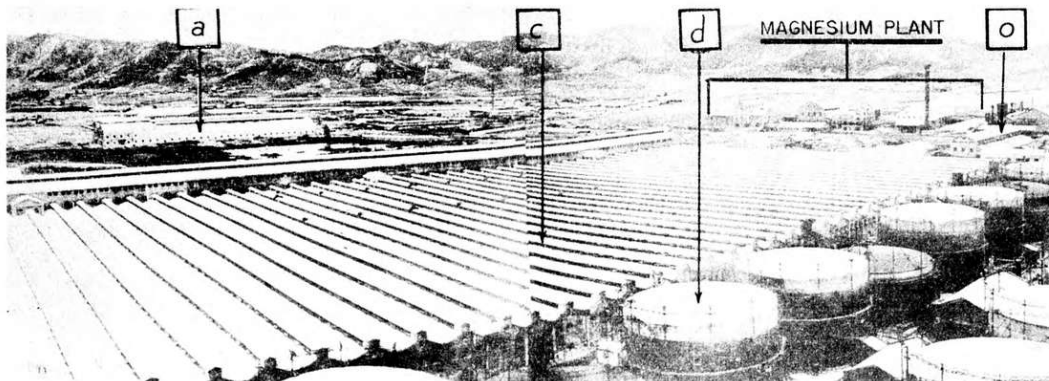


Figure 9. Hydrogen-and-Oxygen Electrolysis Plant, Reference (c), showing gas tanks, Reference (d), in the foreground; and machine shops, Reference (o), Magnesium Plant and Carbon-electrode Plant, Reference (a), in the back-ground. View is looking east.

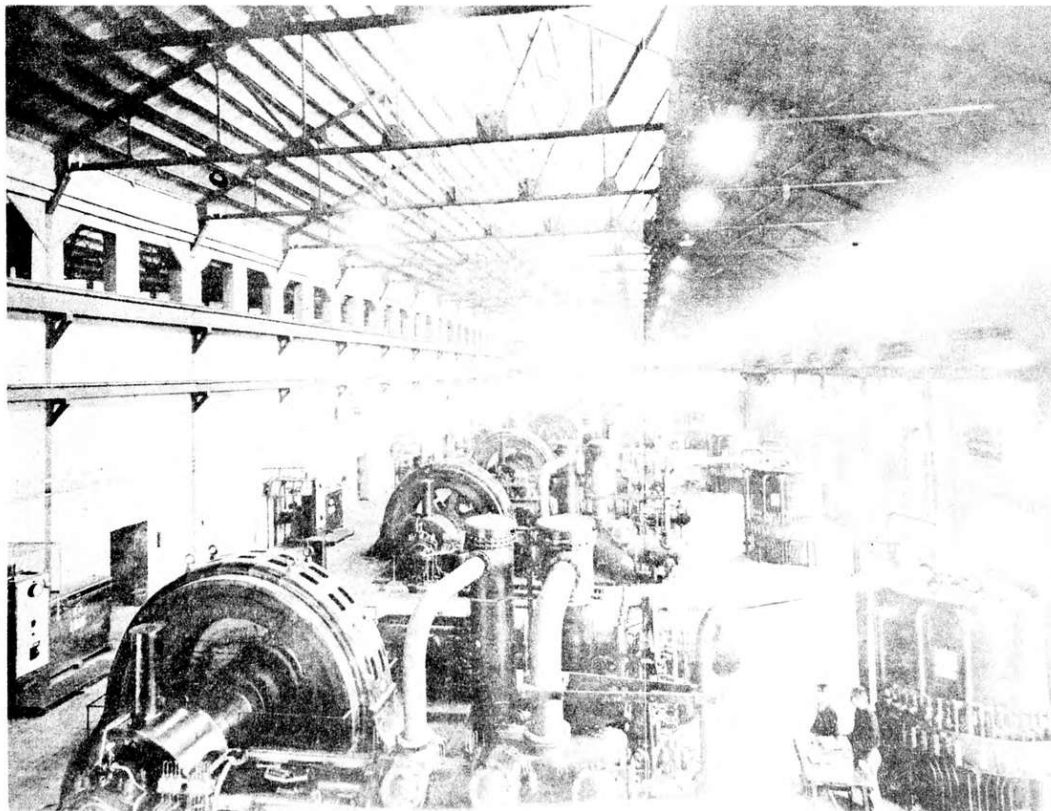


Figure 10. View of the compressor group, Ammonia Synthesis Plant, Reference (c).

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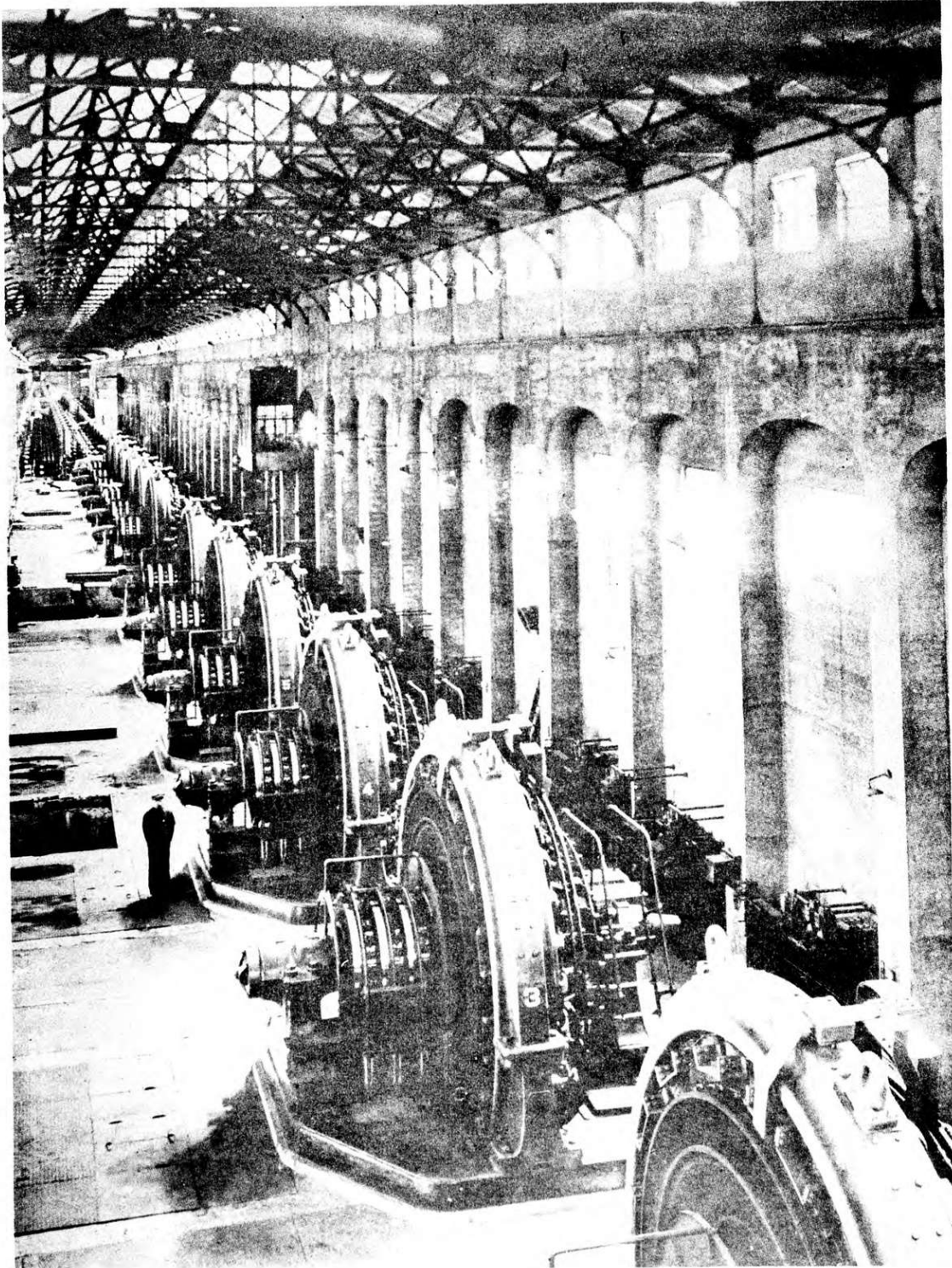


Figure 11. View of the autotransforming current transformer group.  
Ammonia Synthesis Plant, Reference (e).

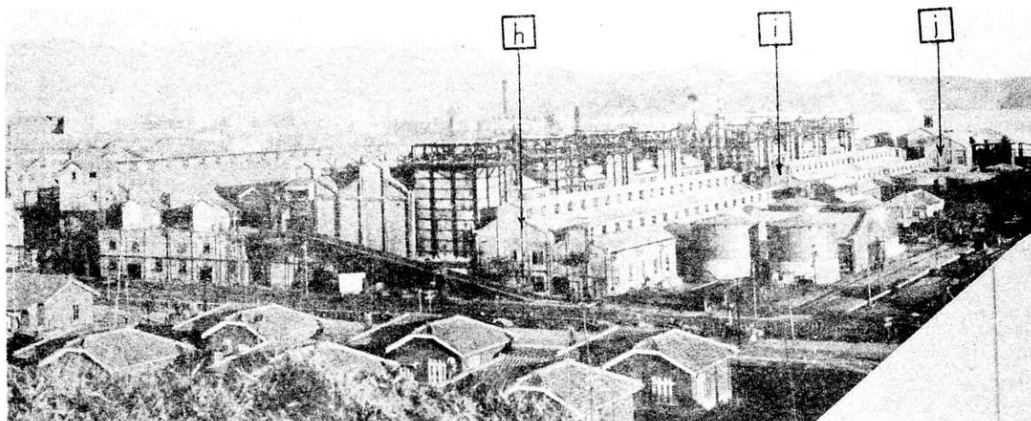


Figure 12. View of the Sulphuric-acid Plant, Reference (h), the Nitric-acid Plant, Reference (i), and the Phosphoric-acid Plant, Reference (j). View is looking east.

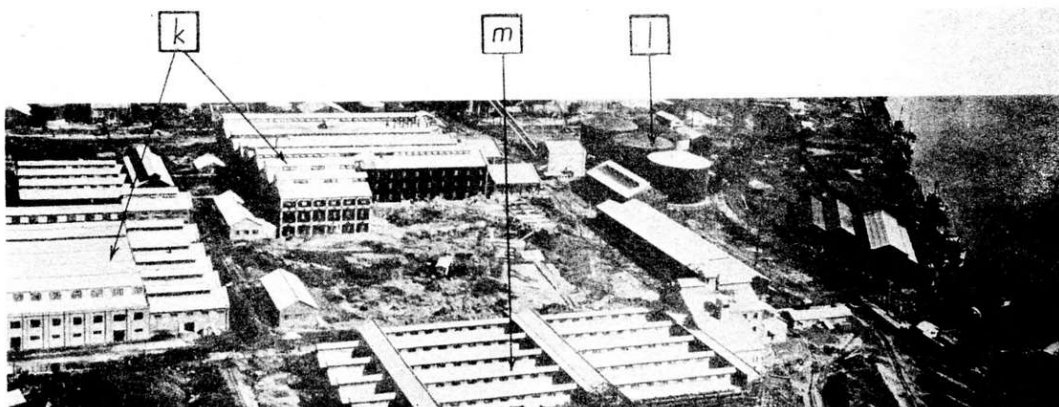


Figure 13. View of Fish oil-and-Glycerine Plant, Reference (k), Super-phosphates Plant, Reference (m), under construction, and fish oil storage tanks, Reference (l). View is looking northeast.

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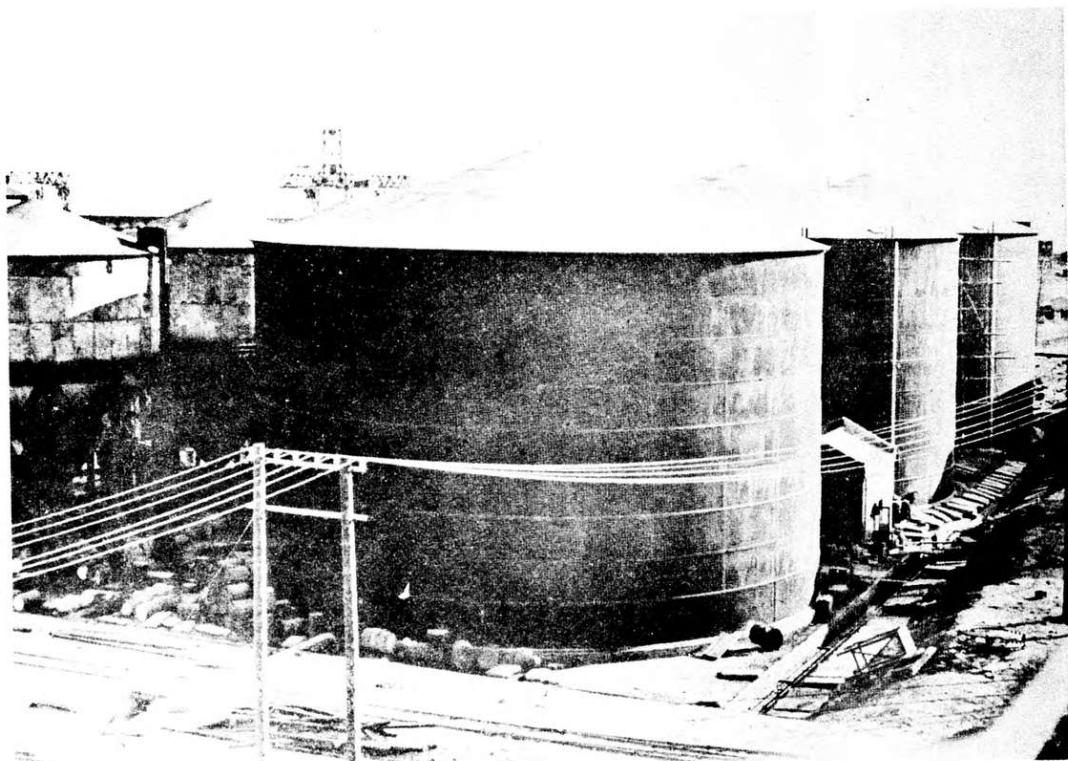


Figure 14. View of the fish oil storage tanks, Reference (1), looking south.

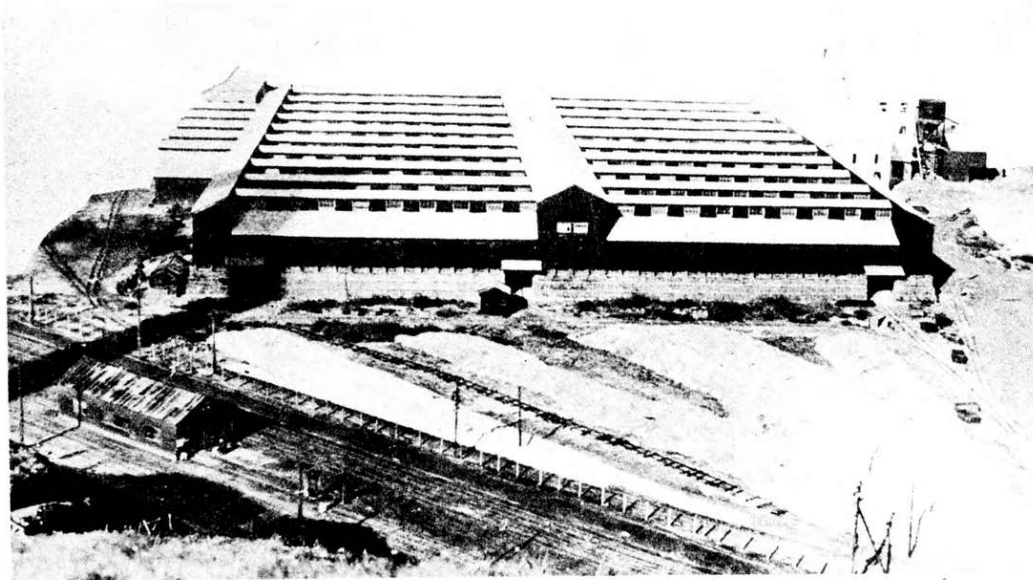


Figure 15. View of the Super-phosphates Plant, Reference (m), after completion. View is looking north.

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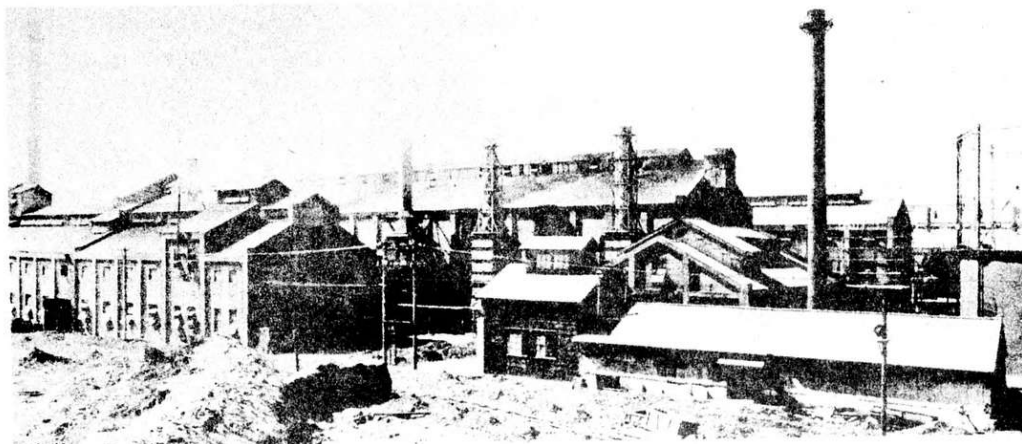


Figure 16. View of the Steam Plant, looking northwest.

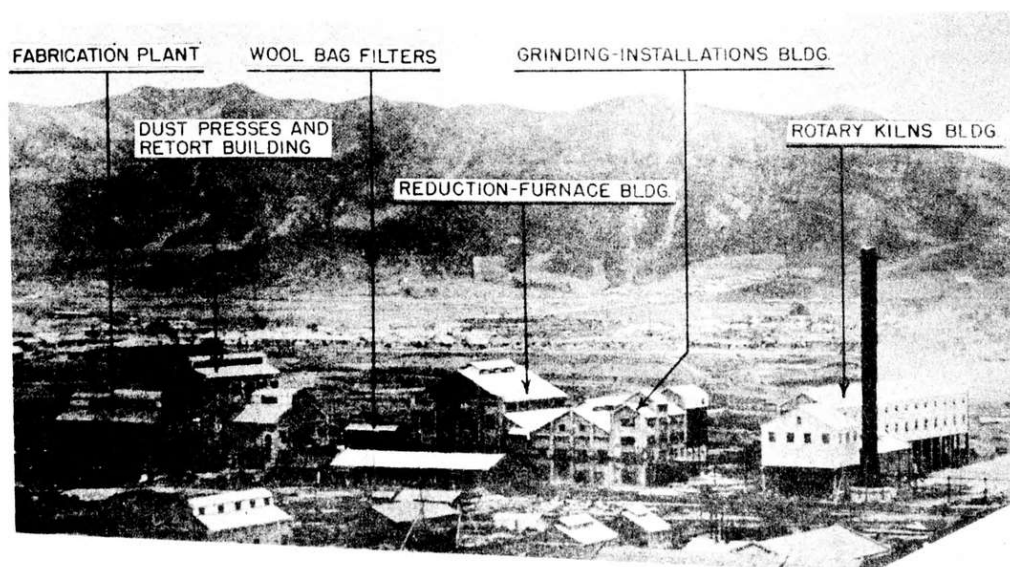


Figure 17. Annotated view of the magnesium plant, looking east.

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4. Wool Bag Filters (Figure 17). The wool bag filters are enclosed in 18 steel tanks, which are not in a building, but are under a corrugated iron roof.

5. Dust Presses-and-Retort Furnaces Building (Figure 17). The Dust Presses-and-Retort Furnace Building has one section about 50 by 70 feet, and 90 feet high. Eighteen retort furnaces are in operation, each with a capacity for the recovery of 1 ton of metal in three days. This retort building is a land mark indicating the location of the magnesium plant, and is by far the highest building in the Konan industrial area.

6. Fabrication Plant (Figure 17). The Fabrication Plant is connected to the retort section, and is about 100 by 70 feet, and 45 feet high. It includes a rolling mill and extrusion press. When a trial of these fabricating facilities was only begun the War Ministry ordered that it not be used for magnesium fabrication, but that all magnesium be shipped out. This plant was then used by the company to fabricate lead into pipe, sheet, etc. for use at the adjacent chemical plants.

Plant II

The Chosen Nitrogen Explosives Factory, is approximately 2 miles west of Plant I and runs along the north bank of Josen River (Figures 18 through 21). Storage revetments are northwest of the factory which was, before the war, the Empire's second largest producer of glycerine and one of the largest manufacturers of industrial explosives. It also produces high explosives, detonators, fuses, percussion caps, etc.

Plant III

Motomiya Chemical Plant. The Motomiya Chemical Plant (Figures 6 and 22 through 24) is approximately 1 3/4 miles northwest of Plant I on the railroad to Kanko, is sometimes known as the Hongu Plant, and includes the largest chlorine-and-electrolytic caustic soda plant in the Far East. Also located here is a new nitrogen plant, carbide factory, soybean cake-and-oil factory, installed with 2 giant soybean mills which treat 200,000 tons a year, calcium cyanamide plant and lime kilns used in the production of superphosphate of lime.

New Plants. According to information and measurements taken from aerial photographs<sup>7</sup>, the following new plants are in operation at Motomiya, in an area beginning 3,500 feet northwest of the heart-shaped reservoir which is situated along the Josen river (Port-plan). These new plants extend approximately 5,000 feet beyond the former limits of the Motomiya Chemical Plant in an area ranging from 1,500 to 2,400 feet in width.

A coal liquefaction plant occupies a rectangular area, 1,900 feet by 1,700 feet, includes 12 major buildings, and at least 30 tanks, 4 of which are over 60 feet in diameter. The plant is bounded by railway spurs on the east end by the river and railway spurs on the west. Open coal piles lie off the northeast and southeast corners of the plant.

In this area are two major buildings which cover approximately 12,500 square yards and 9,167 square yards respectively, and appear to be rolling mills. It is possible that they are used for the 4 open-hearth steel furnaces which stand 600 yards southeast of them, and 1,200 yards north of the Motomiya Plant's transformer station.

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<sup>7</sup>Sortie 4 MR44 - 468 BG, 21 December 1944.

Scale: 1:52,000; fair quality.

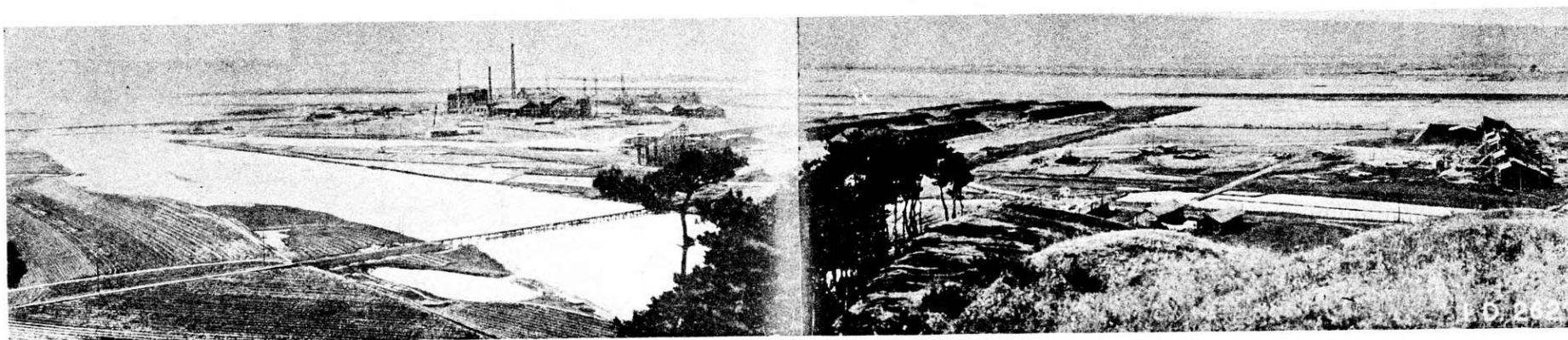


Figure 18. Panoprame of the Chosen Nitrogen Explosives Factory under construction, showing storage revetments in the center of picture. View is looking south-southwest.

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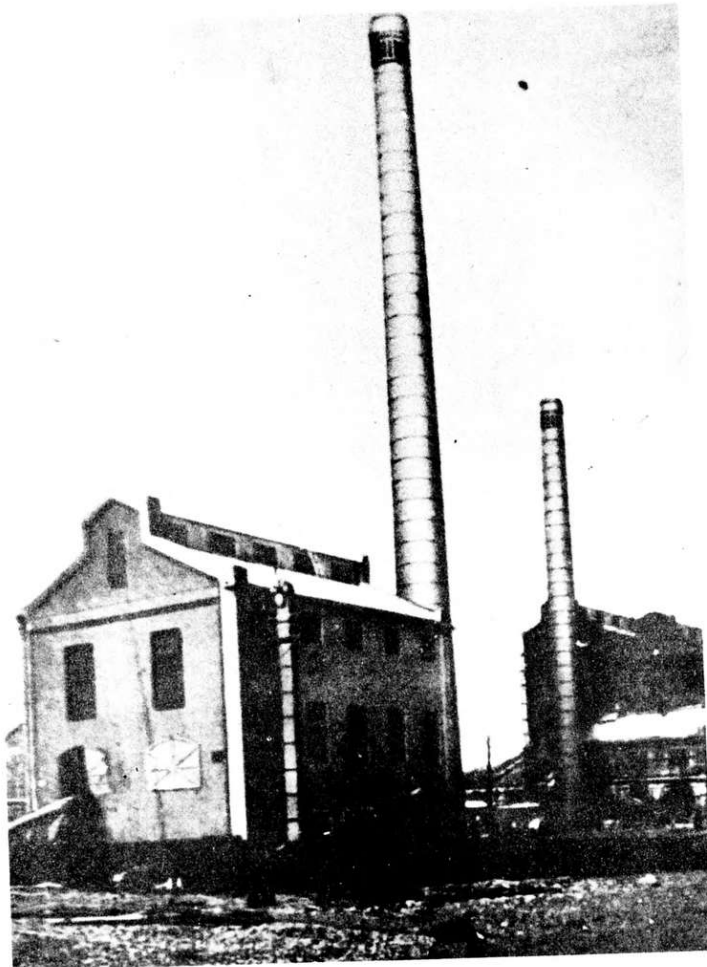


Figure 19. View of a part of the Chosen Nitrogen Explosives Factory after completion. View is looking east.

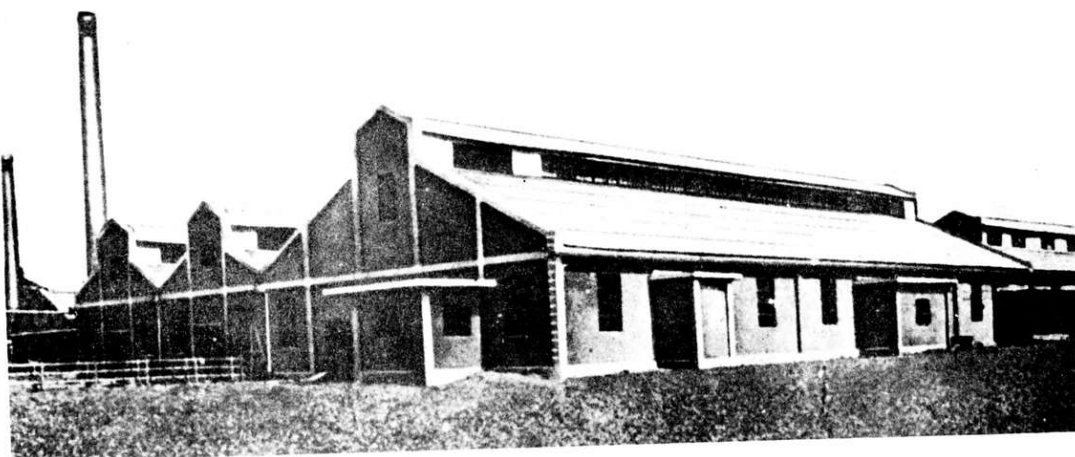


Figure 20. View of the boiler plant, Chosen Nitrogen Explosives Factory. View is looking northeast.

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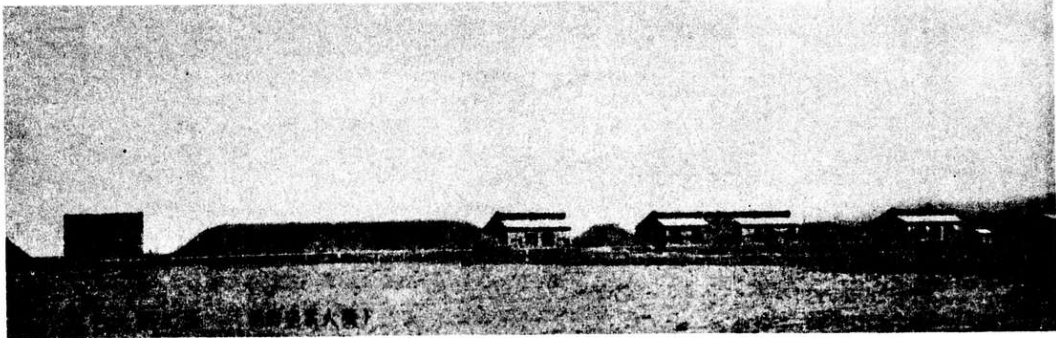


Figure 21. View of powder cellars, Chosen Nitrogen Explosives Factory. View is probably looking north-northwest.

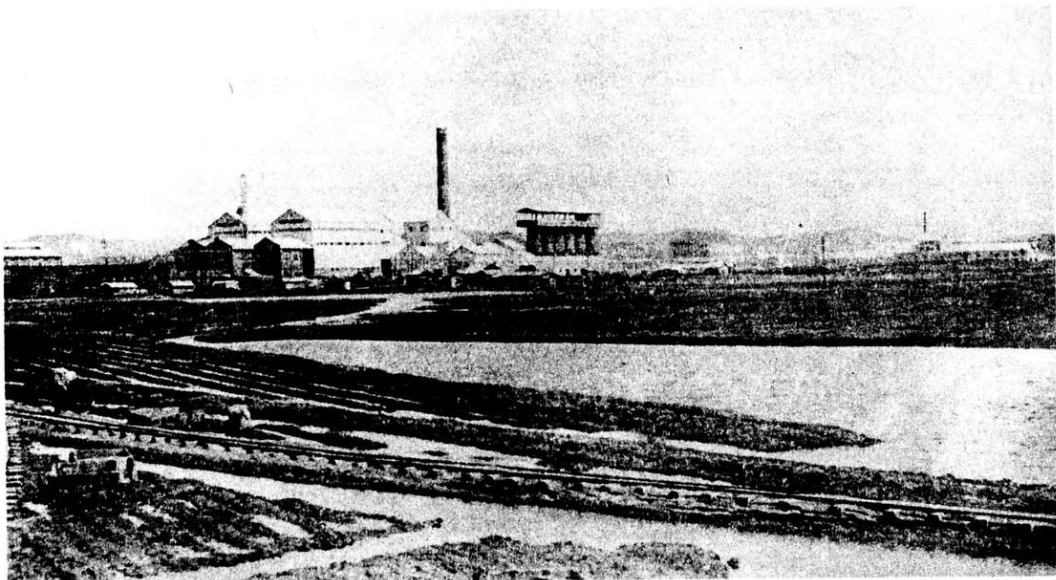


Figure 22. View of the Motomiya Chemical Plant, probably looking southeast.

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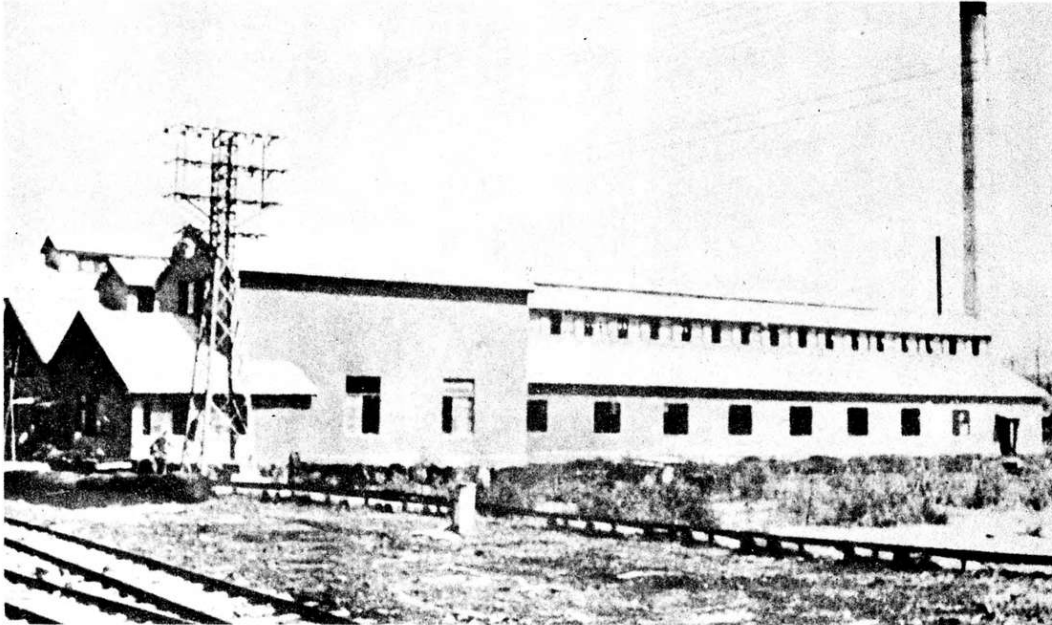


Figure 23. View of the Caustic Soda Works, 1937. Direction unknown.

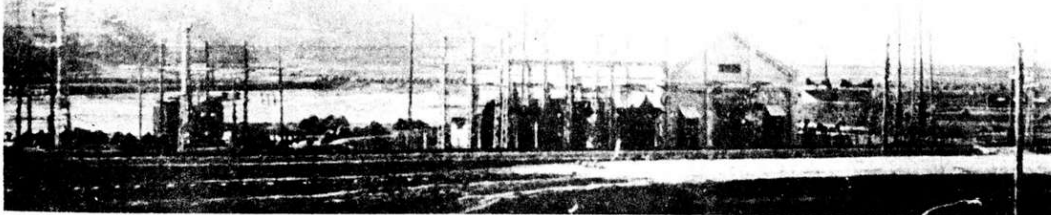


Figure 24. View of the pumping station east of the Motomiya Chemical Plant. View is looking southwest.

The building in which these furnaces are housed is approximately 1,000 feet by 250 feet and is a part of the main construction of the steel plant which runs northeast-southwest in three sections totaling 1,350 feet in length, and varying from 250 to 300 feet in width.

Two wings, probably rolling mills, project off the northeast corner of the Open-Hearth-Furnaces Building. The one measures 600 feet by 130 feet, the other 800 feet by 180 feet. Another wing, 500 feet by 80 feet, extends between two chimneys projecting southward from the same building.

Coke ovens and blast furnaces are believed to be situated immediately south of the Open-Hearth-Furnaces Building.

#### New Factory Area

Between the employees barracks at Kyuryuri and the explosives plant on the banks of the Josen river, is a new factory site. The site covers an area approximately 1,500 by 2,000 feet and lies a short distance in from the shoreline.

In this area are 5 major buildings, the individual functions of which are unknown. The largest building measures 185 by 400 feet, and has a saw-tooth roof; the reason for this design is not clear. The 2 buildings southeast of this are 125 by 340 feet, and 300 by 110 feet respectively. Near these are a power house, a 60-foot oil tank, and three adjacent smaller buildings. The two major buildings west of the large building measure 250 by 300 feet, and 160 by 270 feet. Several smaller buildings stand close-by.

Detailed information on this area is not available; it is possible, however, that this is the new aluminum plant referred to in recent unconfirmed reports.

#### Estimate of Production of the Konan Plants, Japan Nitrogen Fertilizer Company (1937)

##### 1. Metals Products:

Gold	2 1/2	Metric Tons	Nitric acid	10,000	Metric Tons <sup>9</sup>
Silver	25	Metric Tons	Glycerine	2,500	Metric Tons
Copper	300	Metric Tons	Fatty acid	20,000	Metric Tons
Magnesium(1942)	3,500	Metric Tons	Ammophoska	30,000	Metric Tons
Alumina(1943)	12,000	Metric Tons	Cyanamide	50,000	Metric Tons
Aluminum(1943)	6,000	Metric Tons	Liquid chlorine	1,000	Metric Tons
Sponge iron			Sodium fluosilicate		
(1939)	23,000	Metric Tons		100	Metric Tons
Electric Steel			Butyl alcohol		
(1939)	21,000	Metric Tons	(annual capacity)	117,000	gallons

##### 2. Industrial Chemical Products:

Ammonium sulphate	450,000	Metric Tons
Ammonium chloride	20,000	Metric Tons
Ammonium nitrate	1,000	Metric Tons
Superphosphates	50,000	Metric Tons
Caustic soda (annual capacity)	36,000	Metric Tons
Chlorine (annual capacity)	17,700	Metric Tons
Sulphuric acid <sup>8</sup>	450,000	Metric Tons
Hydrochloric acid	15,000	Metric Tons

##### 3. Commercial Products:

Carbide	60,000	Metric Tons
Hardened fish oil	40,000	Metric Tons
Carbon electrodes	(No Data)	
Bleaching powder	15,000	Metric Tons
Soap	20,000	Metric Tons
Oleomargarine	400	Metric Tons
Black gum powder	1,000	Metric Tons
Dynamite	3,000	Metric Tons

<sup>8</sup>Large capacity low grade; some high grade.

<sup>9</sup>Capacity reported to be 73,000.

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Employee's Housing Facilities,  
Japan Nitrogen Fertilizer Co.

The Japan Nitrogen Fertilizer Company has erected relatively fireproof barracks and houses for its employees (Figure 25). These are constructed of brick and concrete and cover extensive areas near the plants.

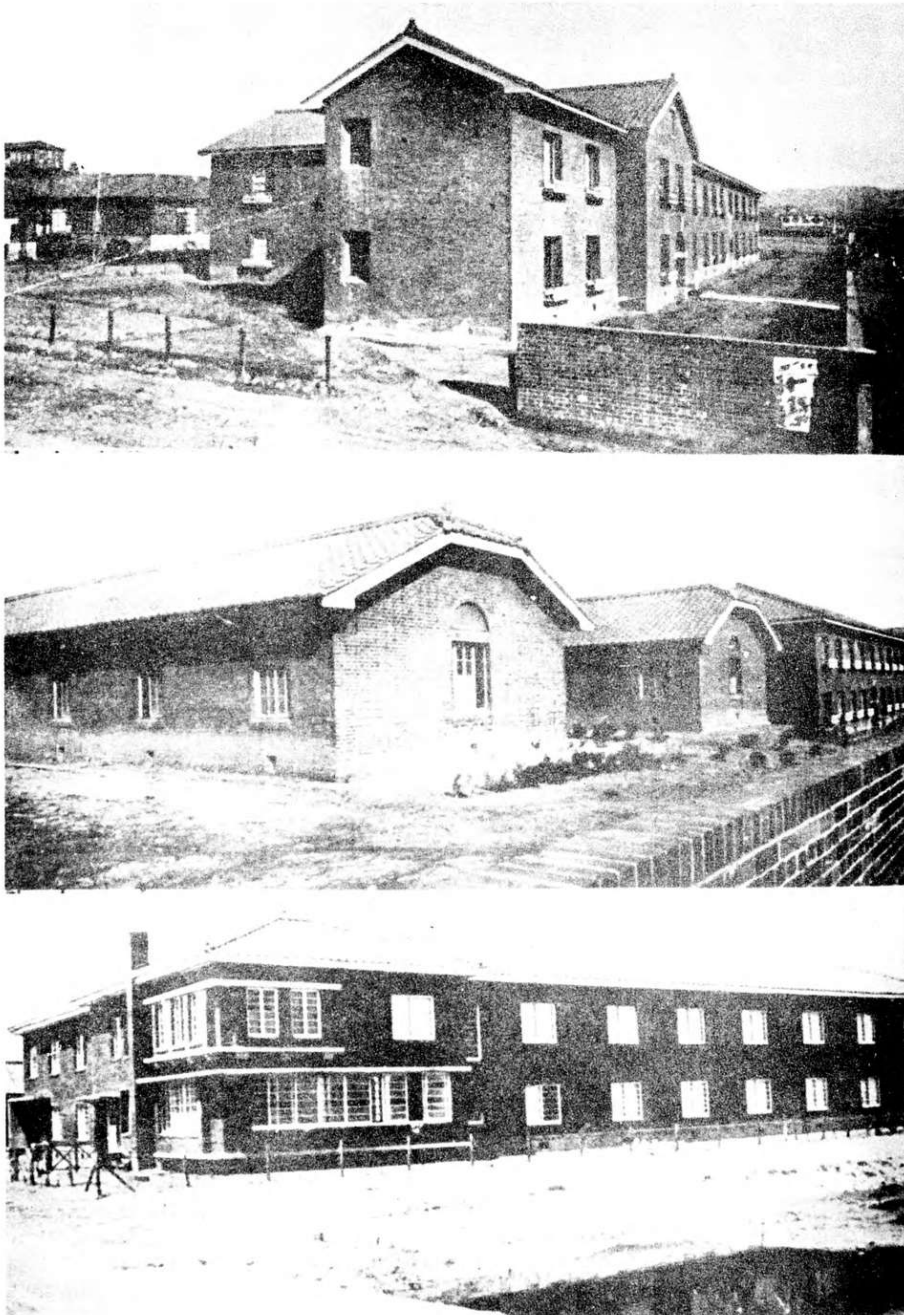


Figure 25. Types of houses provided to workers by the Japan Nitrogen Fertilizer Company.

Detailed information concerning their capacity and floor space is contained in the table on next page.

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TABLE OF EMPLOYEES' BARRACKS AREA  
KONAN (1944)

<u>Barracks Area</u>	<u>Sq. Feet of Floor Space</u>	<u>Number of Units</u>		<u>Total Capacity</u>	
		<u>Barracks</u>	<u>Houses</u>	<u>Men</u>	<u>Families</u>
1. North of Explosives Plant. Between Explosives Plant and Motomiya.	125,000 77,000	20	41	2,500	82
2. West side of railroad. Directly north of possible aluminum plant in new factory area.	28,000 124,000 137,000	7	46 76	525	92 152
3. Directly west of residential area of Konan. Kyuryuri.	380,000 142,000 46,500 74,500	87 63 6	69	7,830 3,780 900	69
4. Adjoining main plant of the north-west.	150,000 55,000 148,000 32,500	33 4	132 44	3,630 460	132 88
5. In valley northwest of Konan.	580,000 120,000 67,000 188,000 75,000	133 16	46 84	11,270 2,400	46 168
6. Motomiya Plant barracks. North of liquefaction plant. (Complete extent limited by photo coverage.)	615,000 375,000 34,000 65,000	220 85 5	60	12,800 7,200 650	60
7. Scattered barracks areas not drawn on overlay, located about 2 miles north of harbor area.	100,000 95,000	36 15		1,980 1,875	
<u>TOTALS</u>	3,833,500	760	598	59,300	889

OTHER INDUSTRY

There is a coal mine 6 miles west of Konan, producing about 30,000 tons of third grade coal per year. The percentage of ash is great, and its heating value is weak. It is transported to Genzan and Konan. Also located in Konan is a brick plant, quarry, ceramics company, and the Tayo Rayon Co., which has an output of 20 tons of rayon daily. The Japan Nitrogen Fertilizer Co., is reported to have moved its production center of rayon from Japan Proper to Konan - site unknown.

West of the Rempo airfield and 3/4 mile southeast of the city of Rempo (the city is approximately 2 1/2 miles southwest of Konan, on south side of the Josen River), is an hangar area with factory buildings adjacent to it. This is probably an airplane factory; however, there are no details concerning its size and production.

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#### HYDRO-ELECTRIC POWER

Power for the industries at Konan, which have been estimated to require about 400,000 kilowatts, is supplied principally by the Fusen and Choshin River developments (Figures 26 through 32). They, however, are only 2 of the principal units in the North Korea Power Network. High-tension lines from the Kosuiri and Kokai projects (Figure 26) connect with the Fusen-Choshin circuits at the Kiroku switching station and at the Choshin Hydro-electric Plant No. 1, supplying additional power to the Konan area.

Detailed information regarding these developments is given in Table I.

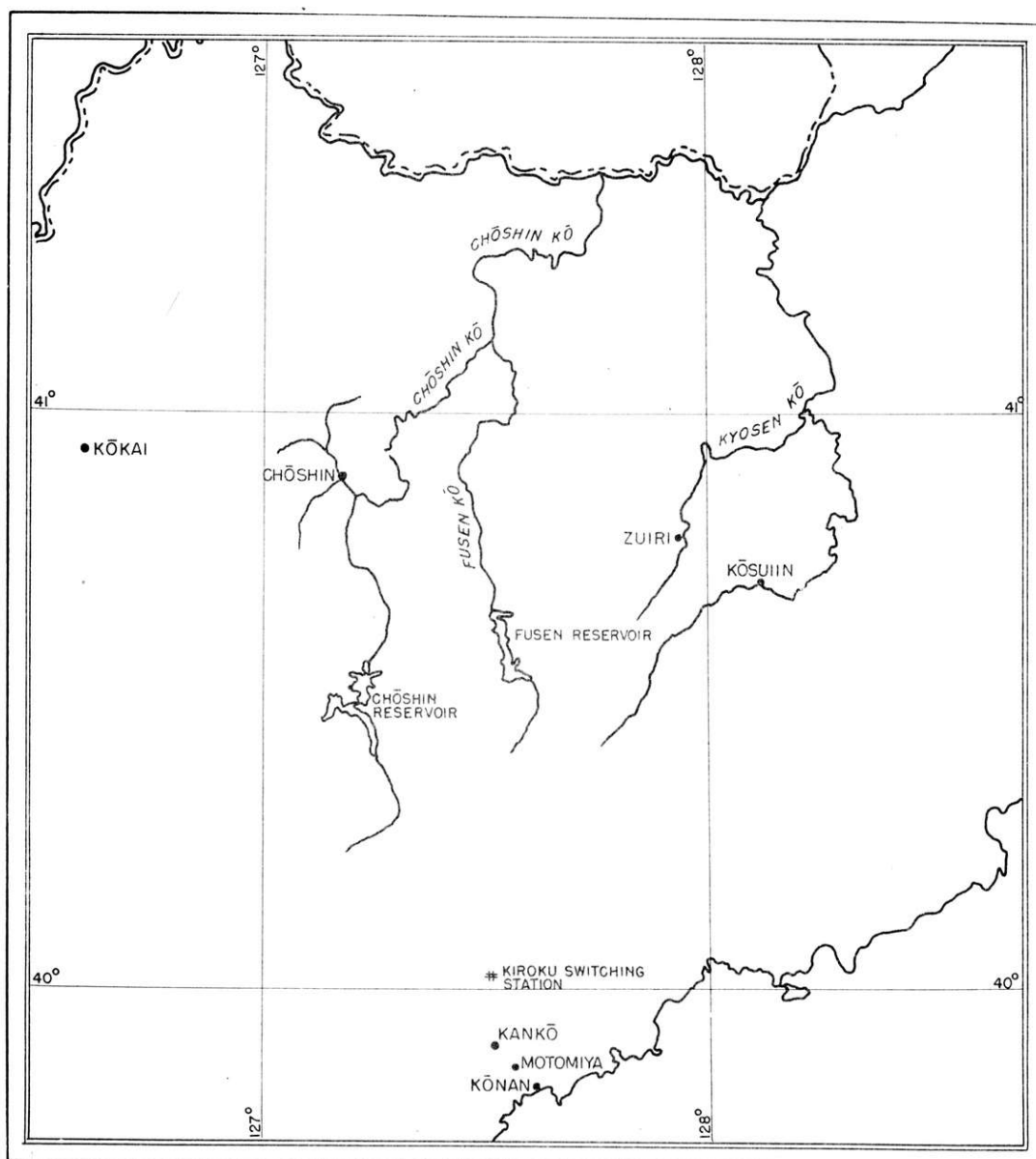


Figure 26. Plan of hydro-electric developments supplying power to Konan.

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TABLE I  
HYDRO-ELECTRIC POWER, KONAN

Name of Project	Reservoir	Conduit	No. of Plants	Capacity (Kilowatts)
(1) Fusen River Project	Approximately 45 miles North of Kanko.	Concrete-lined pressure tunnel.	4	Plant 1 129,600 Plant 2 41,400 Plant 3 18,000 Plant 4 12,000 Total 201,000 Reported to have been increased - amount unknown.
	Dam: 262 by 1,312 feet.			
	Area: 9.26 square miles; 612 million cu. yds. water reserve available.			
	Greatest depth of water - 239 ft.			
(2) Choshin River Project	Approximately 47 miles Northwest of Konan.	Concrete-lined pressure tunnel.	4	Plant 1 140,000 Plant 2 112,000 Plant 3 40,000 Plant 4 28,000 Total 320,000 Reported to have been increased - amount unknown.
	Dam: 142 feet high.			
	Perimeter of reservoir: 80 miles.			
(3) Kosuiin Project (Kyosen River)	Two reservoirs - one near Zuiru, other near Kosuiin.	Flume	4 planned; 3 in operation in 1941	Plant 1 144,000 Plant 2- Plant 3- 96,000 Plant 4- Total 240,000
	Size unknown.			
(4) Kokai Project (Choshin River)	Near Choshin	Flume over total distance of 20 to 30 miles	4 (at least 2 in operation)	Total 270,000
Name of Project	Installations	Trans. Lines from Plant to	Trans. Line Voltage	Remarks
(1) Fusen River Project	Plant 1 Concrete power house (approximately 53 ft. wide, 242 ft. long, 64 ft. high)	Genzan and Konan (Via Kiroku switching station)	220,000	Each generator capable of operating with its transformer over a transmission

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Name of Project	Installations	Trans. Lines from Plant to	Trans. Line Voltage	Remarks
(1) Fusen River Project	Plant 1 (cont'd) 4 exposed penstocks, welded steel pipes reinforced at lower length with shrink rings. 4 horizontal turbo-generators 5 bench-type main switchboards 20 auxiliary vertical panels Outdoor transformer station (approximately 200 by 140 ft.)			system as separate and complete unit. All vital equipment of No. 1 plant above floor level. In case of heavy damage to turbines or penstocks, all downstream plants would be out of operation.
(2) Choshin River Project	Plant 1 Concrete power house (approximately 300 by 85 feet) Transformer yard (directly southwest of power house) 4 penstocks 4 horizontal turbo-generators	Konan and Genzan. Heijo and Keijo. Seishin via Kanko.	220,000 154,000 110,000	Same as above
(3) Kosuiin Project (Kyosen River)	Plant 1 4 penstocks 4 turbo-generators	Joshin and Seishin. Kanko (Via Kiroku switching station)	220,000 220,000	None
(4) Kokai Project (Choshin River)	No Information	Kanko and Konan Oryokko System	220,000	Also connected with Yalu-Heijo-Keijo transmission system.

#### SHIPBUILDING AND REPAIR FACILITIES

Konan has no extensive repair facilities. However, repair of derricks, etc., can be undertaken by the Fertilizer Company adjacent to the pier. At nearby Seikoshin on the northeast side of the bay, there is a ship-building yard and an iron foundry which are equipped for small-vessel construction and repair.

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Figure 27. View of the reservoir and Dam No. 1 of the Fusen River Development. View is looking southeast.

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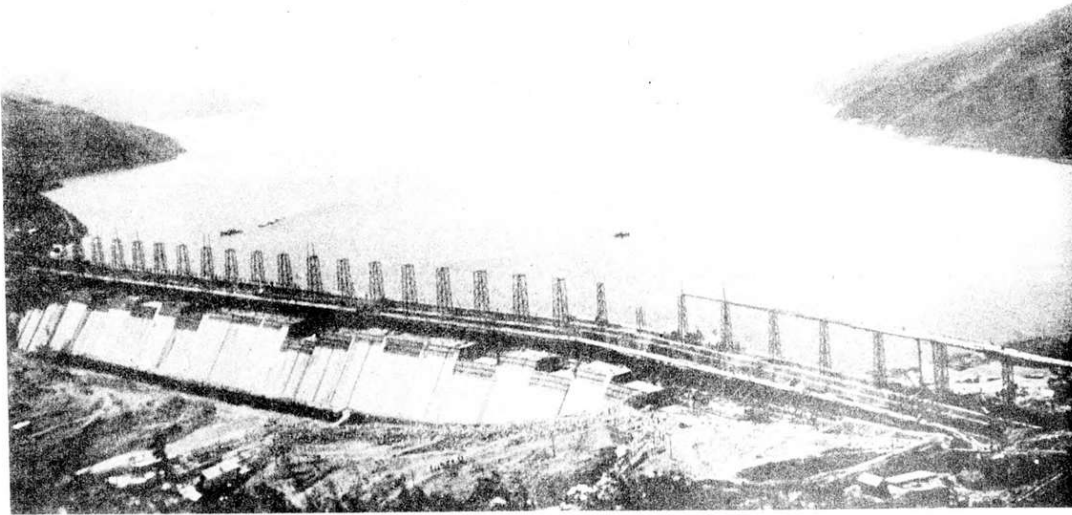


Figure 28. View of the reservoir and dam of the Choshin River Development, looking south.



Figure 29. View of the Fusen hydro-electric plant No. 1. View is looking north.

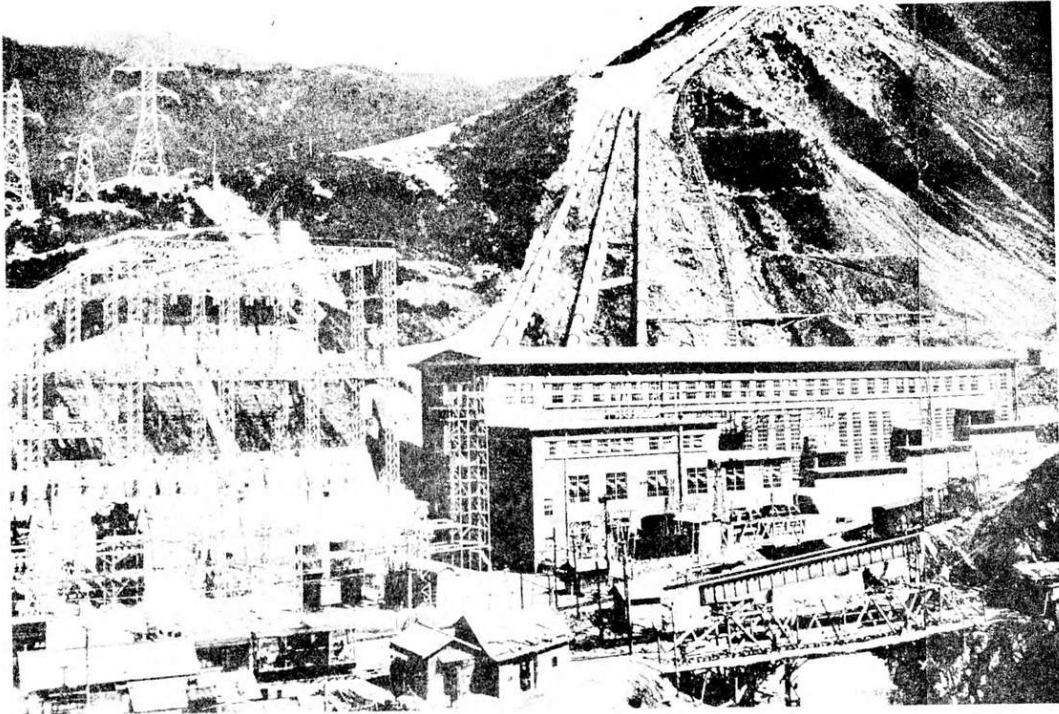


Figure 30. View of the Choshin hydro-electric plant No. 1. View is looking northwest.

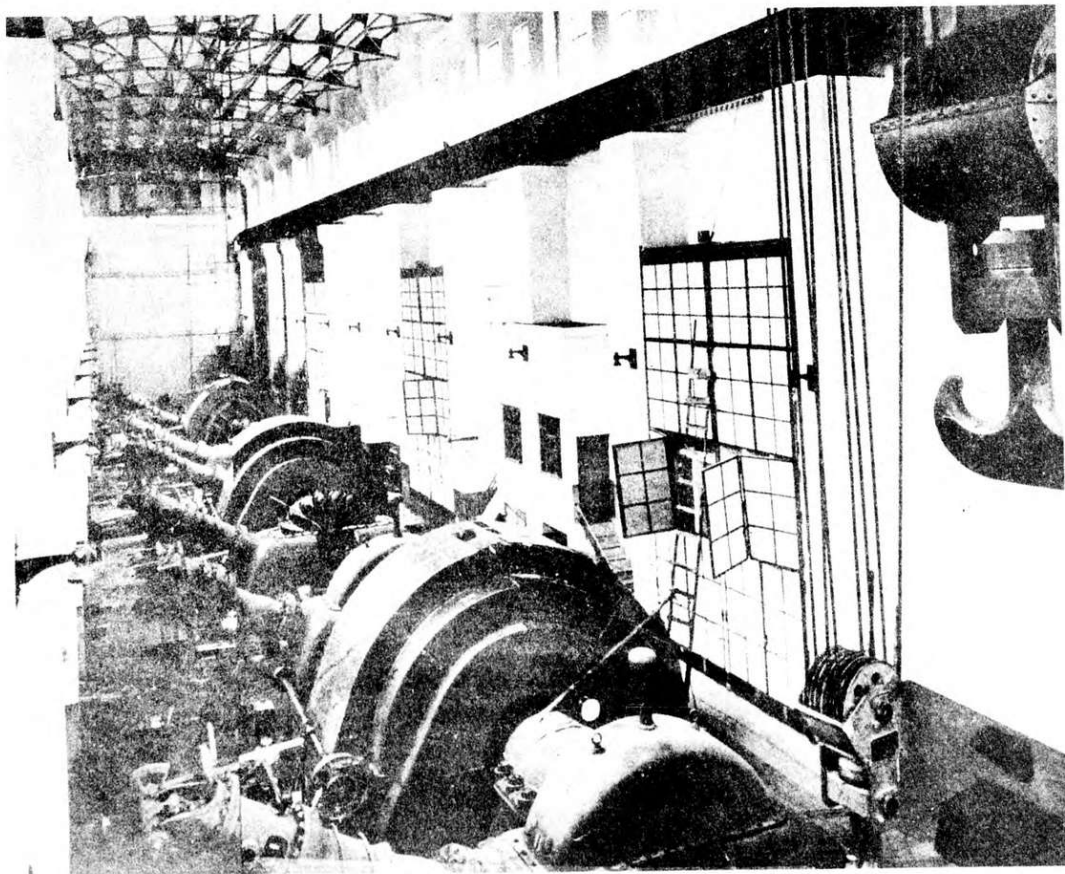


Figure 31. View of turbo-generators used in the Choshin and Fusen River Developments.

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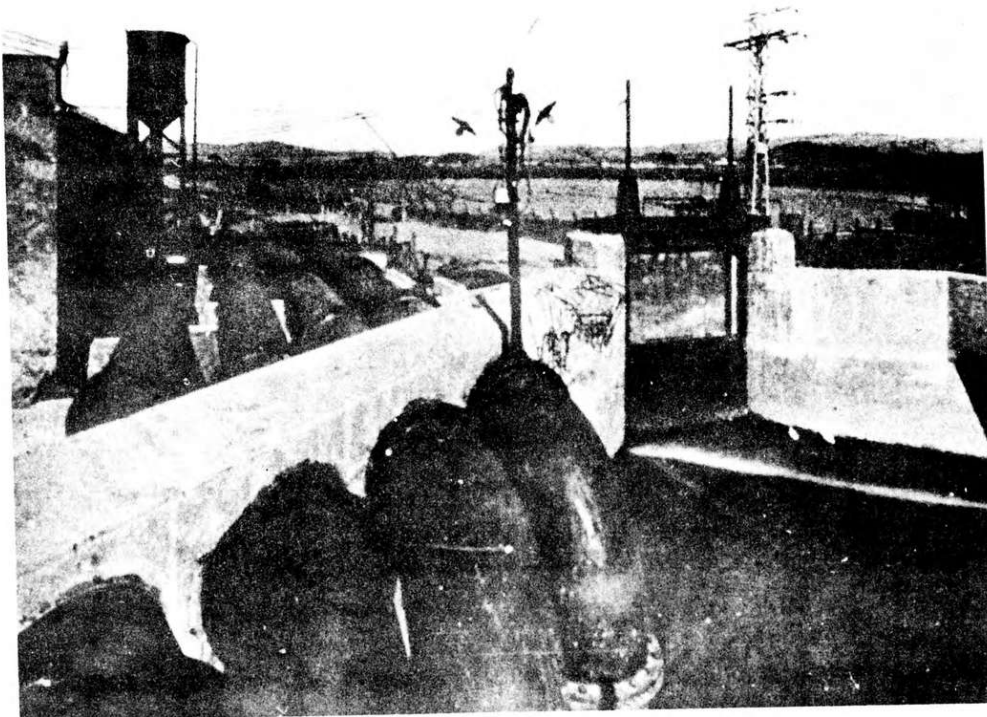


Figure 32. View of exposed penstocks installed in the Choshin and Fusen River Developments.

#### UTILITIES AND SUPPLIES

##### WATER

Water is supplied to Dock No. 1 by a 6-inch primary water-main and a 3-inch secondary water-main. Each of six 2-inch hydrants at the dock can supply 30 tons of water per hour. There is a water pumping station and reservoir on the Josen Ko west of Konan at 39-50-30 N., 127-34-30 E.

##### GASOLINE AND OIL

The Chosen Nitrogen Fertilizer Company of Eian produces synthetic gasoline and oil and supplies them to the fertilizer plant at Konan. A coal liquefaction plant was planned for Konan and it probably is in operation now. There are four oil storage tanks each 45 feet in diameter on the breakwater east of Dock No. 1.

##### COAL

Coal is available at the fertilizer plant and at the Marufuta Coal Yard (500 tons storage capacity) on the Seikoshin Coastal Highway east of Konan. There is reported to be a coal mine approximately six miles west of the town.

##### ELECTRICITY

Electric power is supplied to industry at Konan from the hydro-electric development projects 40 miles north on the Fusen Ko and Choshin Ko. There is a large steam plant at the Chosen Nitrogen Fertilizer Company, on the water front, and a small steam plant at the base of Dock No. 1.

##### LUMBER

There is reported to be a lumber yard on the Seikoshin Highway east of Konan.

PROVISIONS

A large supply of fresh vegetables, fish and some beef are believed to be available at towns along the bay.

TRANSPORTATION AND COMMUNICATIONSRAILROADS

Konan lies on the northeastern branch of the Y-shaped railroad system of Korea on the government-owned Genzan-Yujo principal trunk line (336 miles). This line connects with Heijo on the west coast at Kogen, with rail routes to Fusan and Keijo at Genzan, and with Manchurian Railroads at Kamisambo and Nanyo, which lie on the Seishin-Rashin principal trunk line. All of these routes are standard gauge and single-tracked except for partly double-tracked sections between Seishin and Kamisambo.

At least 4 standard-gauge tracks lead from the Konan Railroad Station to No. 1 dock where there is a network of tracks and spurs. A light railway, standard-gauge and double-tracked, runs along the coast from Dock No. 1 to Shinkyuryu Station, 1 mile southwest, where a line branches off to the Chosen Nitrogen Explosives Factory (Port-plan). From here both railroads extend northwest to converge with the trunk line 2 miles beyond the Motomiya Factory.

In addition, two narrow gauge tracks run from Manko, 7 miles northwest on the principal trunk line, to Kyushinri and Fusenkohan. The Choshin Hydro-electric Plants 1 and 2 lie on the Kyushinri Line and the Fusen Hydro-electric Plant No. 1 is located on the Fusenkohan Route. Also of strategic importance is the magnesium mine located on the Genzan-Seishin Line near Joshin, which supplies magnesium to the plant in Konan.

ROADS

Konan is connected with Kanko by a first-class highway that runs along the rail route. A primary highway runs northeast from Konan to the northern ports of Korea and to the Manchurian Border at Kamisambo, and south to Genzan where it diverges to Heijo and Keijo, thence to Fusan.

A second-class highway runs east from Konan along Seikoshin-wan thence north along the Japan Sea to Kogen where it converges with the main highway to northeastern Korea. Another road leads from Dock No. 1 southwest to the town of Rempo where it converges with a second-class highway to Kanko.

BRIDGES

A steel bridge on the Genzan-Seishin Railroad Line crosses the Josen River at 39-54-30 N., 127-32 E. (Kanko).

TUNNELS

Eleven tunnels lie on the railroad line between Konan and Taicho-wan, the biggest one being about a half mile long and passing under Chanki-san.

AIR FACILITIES

There is a newly constructed airfield southwest of Konan near Rempo (30-48 N., 127-33 E). It has a north-south runway approximately 5,000 feet long. East and north of the field there are over 25 heart-shaped plane revettments 80 to 110 feet wide and at least 25 smaller plane revettments 30 to 80 feet wide. Some of these revettments have middle partitions permitting shelter for two fighter-type aircraft. In addition there are a number of hangers in the southwest corner of the field.

CONFIDENTIAL

There is another airfield about 4 miles northwest of near-by Kankō. It has 2 diagonal runways running northwest to southeast and northeast to southwest.

TELEPHONE AND TELEGRAPH

There is telegraphic connection with the main Korean system and probably telephone service at Konan.

RADIO FACILITIES

There is a long wave radio broadcasting station in nearby Kankō, with the call letters, JBDK, and located approximately 39-55 N., 127-31-28 E. It has an 0.25 kilowatt power with a 285.7 m. wave length, and an 0.05 kilowatt power with a 384.6 m. wave length.

There is also a fixed wireless and aeronautical station near Kankō which is reported to be at 39-45 N., 127-34 E. It has an 0.25 kilowatt power and operates on wave lengths of 73.17 m., 63.16 m., and a 50.59 m.

DEFENSES

Aerial photographs show the following defense installations at Konan, indicated on the Port-Plan by reference numbers.

- Reference D-1: 2 heavy anti-aircraft gun emplacements<sup>10</sup>
- Reference D-2: 4 heavy anti-aircraft gun emplacements.  
1 heavy machine gun.  
Ammunition storage to SW and NE of gun emplacements.
- Reference D-3: 4 heavy anti-aircraft gun emplacements.
- Reference D-4: 2 heavy anti-aircraft gun emplacements. Guns have 20-foot barrels. Lack of activity around emplacements suggests that these may be dummies. Ground information reports at least 2 dummy gun batteries northwest of harbor area.
- Reference D-5: Possible battery of 2 automatic anti-aircraft guns.
- Reference D-6: 2 heavy anti-aircraft gun emplacements.
- Reference D-7: Possible gun observation point.

At Kankō, 6 1/2 miles northwest of Konan there is an infantry regiment headquarters which is reported to have barracks, drill field, hospital and powder magazine.

Air defenses are adequately covered under AIR FACILITIES.

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<sup>10</sup>The anti-aircraft gun emplacements are clover designs with an inside diameter of 20 feet and 10-foot rectangular pockets.

## APPENDIX A

Climatic Table for Genzan

		<u>Jan.</u>	<u>Feb.</u>	<u>Mar.</u>	<u>Apr.</u>	<u>May</u>	<u>Jun.</u>	<u>Jul.</u>
1. Avg. daily Temp. °F.	Max.	34	36	45	59	69	75	80
	Min.	18	18	29	40	50	59	67
2. Highest Temp. on record in °F.		54	58	76	88	99	101	103
3. Lowest Temp. on record in °F.		-7	-3	4	24	34	45	53
4. Percentage of avg. rel. humidity		55	57	58	63	68	76	83
5. Percentage of avg. monthly cloud		35	37	46	56	62	70	77
6. Avg. total monthly precipitation in inches		1.4	1.5	1.9	2.8	3.5	4.8	11.2
7. Velocity of surface wind in m.p.h.		5.8	5.6	5.8	5.8	5.4	4.9	4.9
8. Max. No. of days per month with winds 34 m.p.h. or over		0	0	0	0	1	0	2
9. Prevailing direction of wind		W	W	W	W	W	NE	E
10. Avg. No. of days with fog		0.2	0.3	0.6	1.2	2.3	1.5	1.7
11. Avg. No. of days with a trace or more of snow		8	9	7	2	0.5 or less	0	0

		<u>Aug.</u>	<u>Sep.</u>	<u>Oct.</u>	<u>Nov.</u>	<u>Dec.</u>	<u>Yr.</u>	<u>No. of Yrs.</u>
1. Avg. daily Temp. °F.	Max.	81	74	65	51	38	59	29
	Min.	68	58	47	34	23	43	29
2. Highest Temp. on record in °F.		100	94	87	76	64	103	29
3. Lowest Temp. on record in °F.		52	39	29	8	-4	-7	29
4. Percentage of avg. rel. humidity		87	75	67	58	52	66	29
5. Percentage of avg. monthly cloud		72	60	42	38	33	52	29
6. Avg. total monthly precipitation in inches		12.4	7.1	3.1	2.7	1.4	53.8	29
7. Velocity of surface wind in m.p.h.		4.9	4.9	5.1	5.8	6.0	5.4	25
8. Max. No. of days per month with winds 34 m.p.h. or over		2	1	0	0	0		
9. Prevailing direction of wind		E	SW	W	W	W	W	29
10. Avg. No. of days with fog		0.6	0.1	0.1	0.2	0.2	9.0	29
11. Avg. No. of days with a trace or more of snow		0	0	0	3	6	35	15

