Engineer Construction in France: Work of the Division of Construction and Forestry, A. E. F.

Author(s): J. A. Woodruff

Source: *The Military Engineer*, January-february, 1920, Vol. 12, No. 61 (January-february, 1920), pp. 1-8, 49-60

Published by: Society of American Military Engineers

Stable URL: https://www.jstor.org/stable/44693718

JSTOR is a not-for-profit service that helps scholars, researchers, and students discover, use, and build upon a wide range of content in a trusted digital archive. We use information technology and tools to increase productivity and facilitate new forms of scholarship. For more information about JSTOR, please contact support@jstor.org.

Your use of the JSTOR archive indicates your acceptance of the Terms & Conditions of Use, available at https://about.jstor.org/terms

Society of American Military Engineers is collaborating with JSTOR to digitize, preserve and extend access to *The Military Engineer*

This content downloaded from
176.128.214.251 on Wed, 02 Jun 2021 19:56:14 UTC
All use subject to https://about.jstor.org/terms

Engineer Construction in France

Work of the Division of Construction and Forestry, A. E. F.

By

Lieut. Col. J. A. Woodruff

Corps of Engineers, U. S. Army

Discussion and Comment by Maj. Gen. W. C. Langfitt, Maj. Gen. M. M. Patrick Brig. Gen. Edgar Jadwin, Col. J. B. Cavanaugh, Col. Ernest Graves, and an Extract from the Final Report of General Pershing

[See Index Map, Page 67]

WITH the exception of a few barracks erected in the Gondrécourt area by troops of the 1st Division immediately after their arrival in their training area, the actual work of construction by the American forces in France was commenced by the 15th (Railway) Engineers, Col. Edgar Jadwin, C. E., commanding. This regiment was one of those raised in May, 1917, as a result of the Joffre Mission to the United States. It arrived at Vierzon July 28, 1917; its equipment, which consisted of about a trainload of tools and plant brought from America, also arrived promptly. The regiment at once began surveys, and construction detachments were distributed without delay to Issoudun, Bordeaux, Gondrécourt, and other important points between the Atlantic ports and the combat sectors.

The 17th Engineers (Railway), Col. J. S. Sewell, Engineers, commanding, arrived at St. Nazaire August 17, 1917; the 16th Engineers (Railway) Col. Harry Burgess, C. E., commanding, arrived at Is-sur-Tille August 26, 1917; the 18th Engineers (Railway), Col. J. B. Cavanaugh, C. E., commanding, arrived at Bordeaux August 20, 1917; the 10th Engineers, (Forestry), Col. J. A. Woodruff, C. E., commanding, arrived at Nevers October 9, 1917 (later consolidated with the 20th Engineers, Forestry). Other regiments, such as the 11th, 23d, 25th, 33d, 55th, 32d, 106th, 109th, 309th, 311th, 312th, 318th, 319th, and many other regiments and battalions performed valuable service during the time they were in the S. O. S., but the 15th, 16th, 17th, 18th, 10th and 20th, by virtue of their early arrival and long service may be considered as having formed the backbone of the field construction forces of the Services of Supply.

The organization as modified by General Jadwin in May, 1918, consisted of a central office at Tours, the headquarters of the Services of Supply, organized into four sections, viz: Administration, General Construction, Railroads and Docks, and Forestry, all in charge of a deputy director.

The construction work in the field was carried on through Section Engineer Officers whose territory corresponded with that of the sections of services of supply and consisted of an advance section, an intermediate section (divided into two construction sections on account of its extent) and seven base sections, each embracing the territory around a port of debarkation.

The forestry work in the field was carried on through district commanders, each of whom also com-

[The Division of Construction and Forestry in France in its final form was one of the four great departments of the engineer organization under the Chief Engineer of the American Expeditionary Forces. Its history began with the arrival of General Pershing in France when General Taylor, the Chief Engineer, assigned to one of his assistants the duty of directing the construction immediately necessary and planning for that ultimately to be required by the American forces.

In August of 1917 the Lines of Communication were formally organized to handle all phases of supply, housing and transportation in rear of combat sectors. Construction devolved upon the Chief Engineer of the Lines of Communication and was so continued until by a reorganization in February of 1918, the Lines of Communication were designated as the Services of Supply. This included as one of its great operating divisions, a Service of Utilities, with Maj. Gen. William C. Langfitt at its head as Chief of Utilities. This service included among other functions a Department of Construction and Forestry and a Department of Light Railways and Roads. In July of 1918, the Service of Utilities was discontinued as such and the two departments named were merged with the previously existing Engineer Department. The chief of utilities became the head of the consolidated department and succeeded to the title of the Chief Engineer, A. E. F. The previously existing activities connected with military engineering operations, engineer supply, construction and forestry, and light railways and roads, were continued as operating divisions of the new and enlarged engineer organization with a director at the head of each.

For brief periods in the summer months of 1917, Col. C. W. Kutz and Brig. Gen. C. H. McKinstry served successively as Chief Engineer, Lines of Communication. Brig. Gen. M. M. Patrick was appointed Chief Engineer, Lines of Communication, in September, 1917, and discharged the duties of the position until May 22, 1918, the title having been changed in the meantime to that of Director of Construction and Forestry, with no material change in duties. General Patrick having been appointed Chief of the Air Service, A. E. F., he was succeeded as Director of Construction and Forestry by Brig. Gen. Edgar Jadwin, who remained in charge of the construction work of the A. E. F. until demobilization of the forces had been practically completed in July, 1919.—Ed.]

This content downloaded from
176.128.214.251 on Wed, 02 Jun 2021 19:56:14 UTC
All use subject to https://about.jstor.org/terms

manded a battalion of the forestry troops which operated from two to eight saw-mills. The districts in the advance section and those in Base Section No. 2, where most of the forestry operations were located, were combined under a section forestry officer. These officers acted directly under the central office for production and shipments outside their own section, but filled local requisitions on orders of the section engineer officer in whose section they were located.

The changing and rapidly increasing force, together with the size which it had attained at the time of the armistice—150,823 men, of which 127,000 were available for work—and its wide distribution, called for an elastic and adaptable organization and methods.

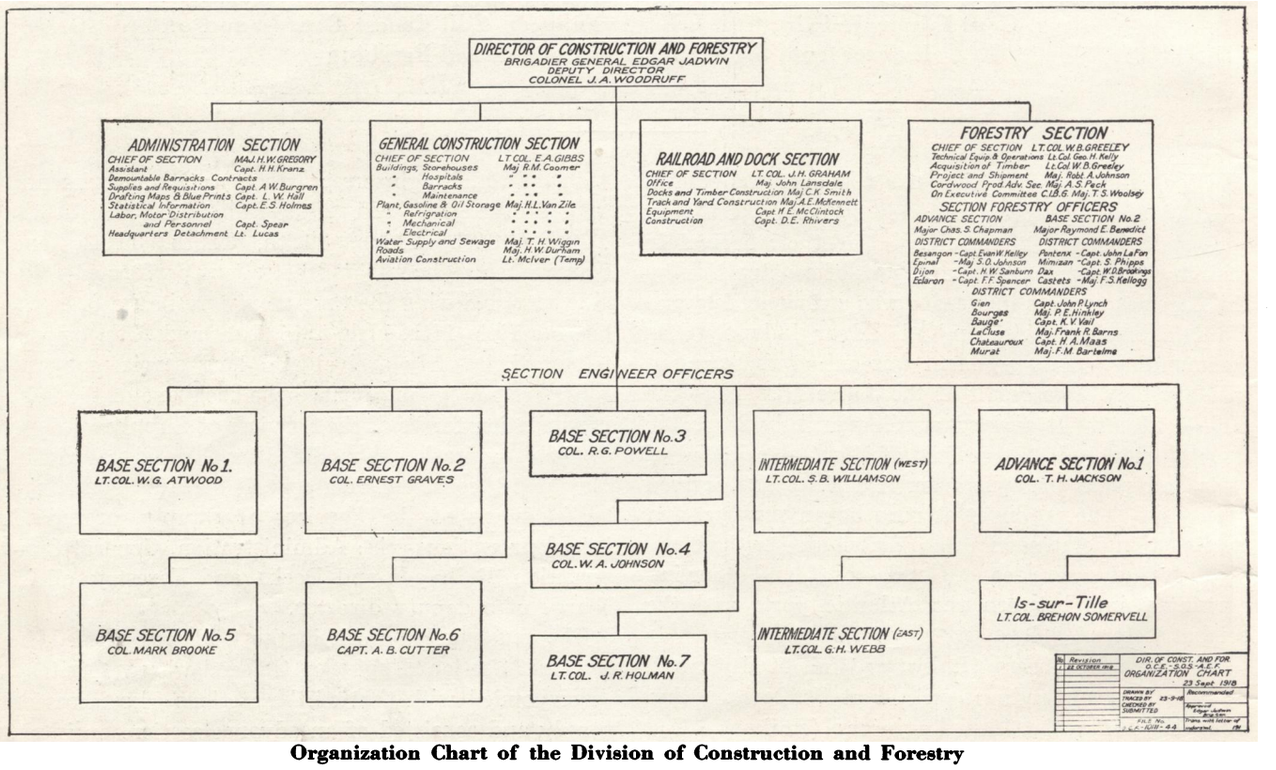
This was obtained by means of a decentralized organization and the use of type plans as far as practicable. The work was handled by the Director of Construction and Forestry with a central office at Tours, operating through a section engineer officer in each of the sections. General instructions were originally given to the S. E. officers, who were supported consistently so long as they observed the general policies of the director and of higher authority. Every possible help was given them by the central office in the securing of men and materials. The central office, under the immediate charge of the deputy director, carried on continuously along established policies and precedents. The director was thereby enabled to spend considerable time in inspections and consultations with the officers in the field, and the consideration of special suggestions, recommendations and requests made by the various section engineer officers and others concerned.

The results confirm this as a satisfactory type of organization for handling a large construction force under such varying and trying conditions.

Throughout the entire period of construction the labor forces available were inadequate. There was in particular a shortage of technical troops. It was necessary to use combatant troops and general labor organizations to perform special construction work. Such technical troops as were available were necessarily used for purpose of supervision. Requests were repeatedly made on the United States for the selection and organization of technical troops, but the need for them and combatant troops at the front and the inadequate transportation facilities made it impossible to obtain adequate technical troops and common labor. The use of civilian labor recruited from men not physically suited for service at the front was not a success. Because of this constant shortage, it was necessary to curtail the construction program at all times and to limit it to bare necessities.

The various classes of construction work carried on may be sub-divided into—

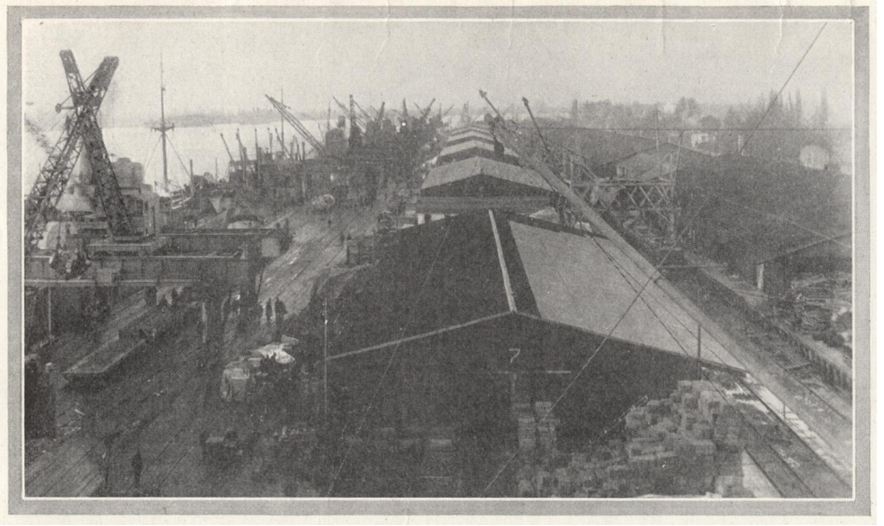
(1) *Shelter for troops,* including camps of various types such as rest and depot division areas, embarkation camps, camps for stevedores, women's camps, enclosures for American prisoners and prisoners of



Organization Chart of the Division of Construction and Forestry

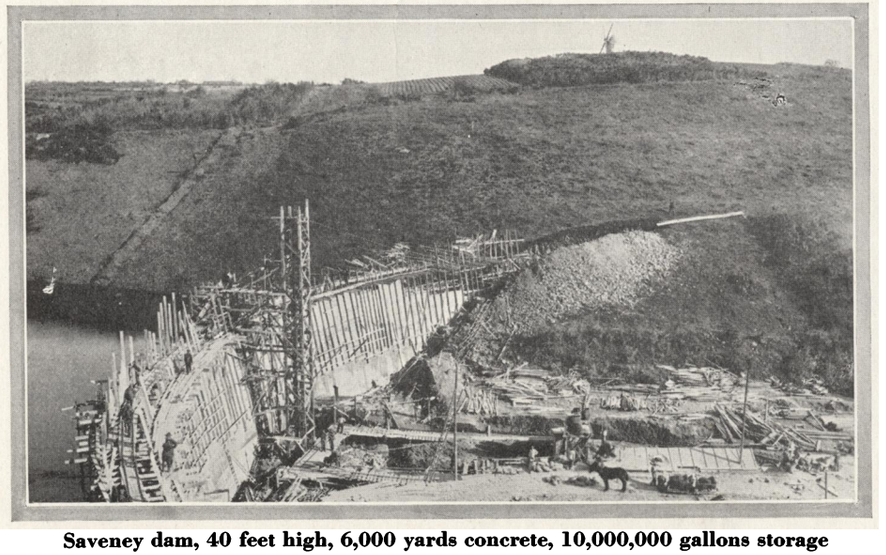
This content downloaded from
176.128.214.251 on Wed, 02 Jun 2021 19:56:14 UTC
All use subject to https://about.jstor.org/terms

Some of the Works of the American Engineers in France



The great docks at Bassens with up-to-date facilities—built and equipped by American engineers at a speed that caused the French to marvel

The great refrigerating plant at Gievres under construction. Capacity 7,500 tons of meat, and 500 tons of ice daily



Saveney dam, 40 feet high, 6,000 yards concrete, 10,000,000 gallons storage

The railroad bridge at Nevers. Built in "jig-time" to carry the heaviest loads

Great engineering projects of every kind are indispensable to victory in modern war. The Engineers with the A. E. F. undertook vast works of every conceivable class, including water and rail terminals, docks, light and standard railways, bridges, roads, buildings of all kinds and all materials, machine shops, dams, water supply, sewerage, electrical installations, refrigeration, etc. With unlimited zeal, enthusiasm and patriotism, joyously surmounting all the difficulties resulting from inadequate personnel, plant and materials, and the necessity of conducting difficult work in a foreign land across the seas, they rapidly and successfully accomplished every task assigned to them, and contributed to the great victory of civilization.

This content downloaded from
176.128.214.251 on Wed, 02 Jun 2021 19:56:14 UTC
All use subject to https://about.jstor.org/terms

war, instruction centers and schools for army, corps, artillery, aviation, tank, motor transport, ordnance, chemical warfare service, etc.

(2) *Hospitalization,* consisting of base, camp, evacuation and red cross hospitals and convalescent camps.

(3) *Ports,* comprising the construction of docks and warehouses thereon, railroad connections, and lighters.

(4) *Railroads,* including engine terminals, regulating stations, double-tracking at various congested points, cut-offs, receiving, classification and departure yards and tracks in storage depots, and their connections with the ports.

(5) *Storage depots,* including large storage depots required at the ports and in the intermediate and advance sections; also special ammunition and aviation depots, coal storage yards, gasoline and oil stations, motor transport centers, remount depots, veterinary hospitals, refrigerating plants and salvage plants.

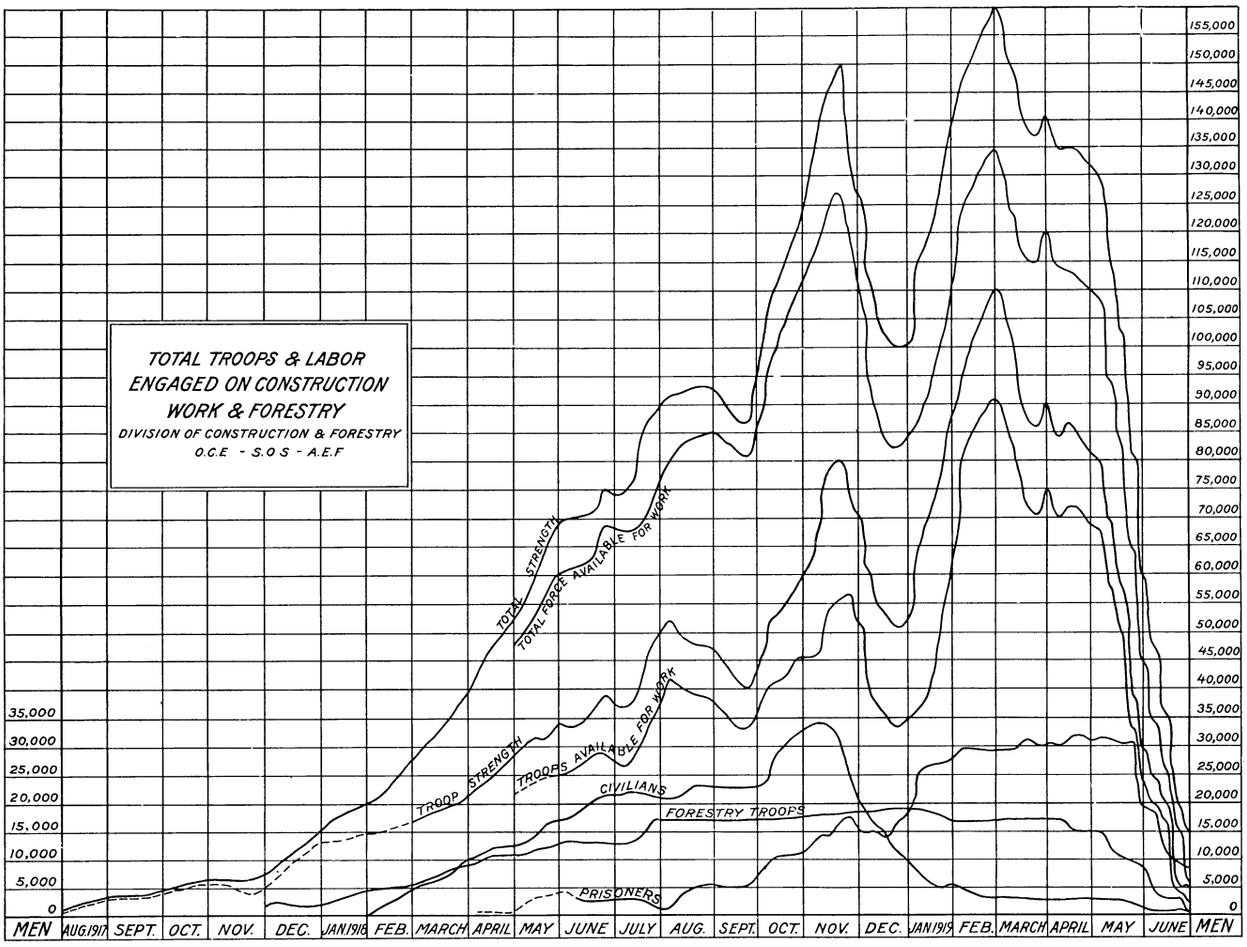
(6) *Roads.*

All of the above work was in sole charge of the D. C. & F. from its beginning, except the following:

(*a*) Railroad construction, which was in charge of the C. E., L. of C., up to September 14, 1917, when it was turned over to the transportation department. It was again placed under the D. C. & F. on March 12, 1918. Of the 1,035 miles of railroad constructed, 62 miles, or 6 per cent, were constructed while the work was in charge of the transportation department.

(*b*) Air service construction, taken over by the D. C. & F. on December 31, 1917, when approximately 7 per cent of the total work had been completed.

(*c*) Ordnance construction, assumed by the D. C. & F. on January 17, 1918. About 1 per cent of this work had been completed before that date.

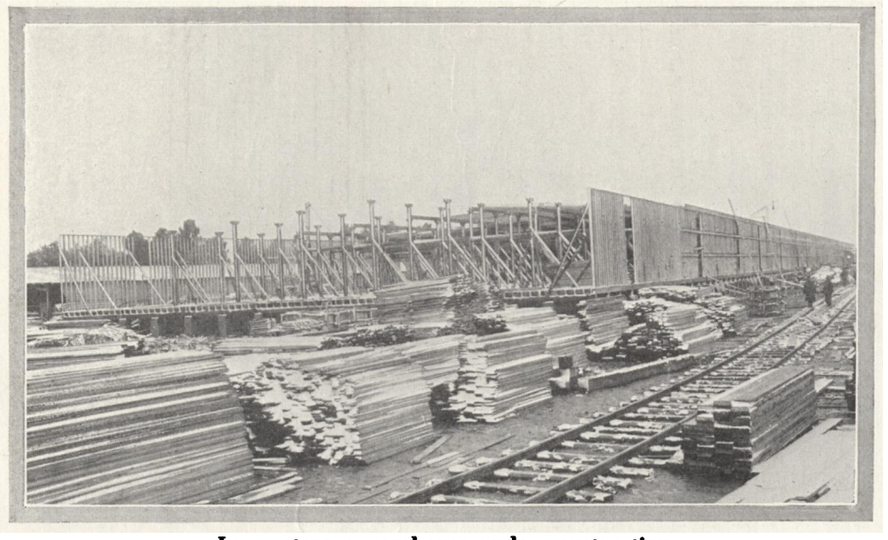


Shelter for Troops

Both in scope and general character of construction, the problem of providing shelter for troops had many features in common with the one of building hospitals. In fact, it was generally the erection of demountable barracks that served to initiate engineer troops newly arrived in France into actual construction work on foreign soil. Towns were flooded far beyond their billeting capacity as the stream of American soldiers came to flow inland from base ports, so that additional

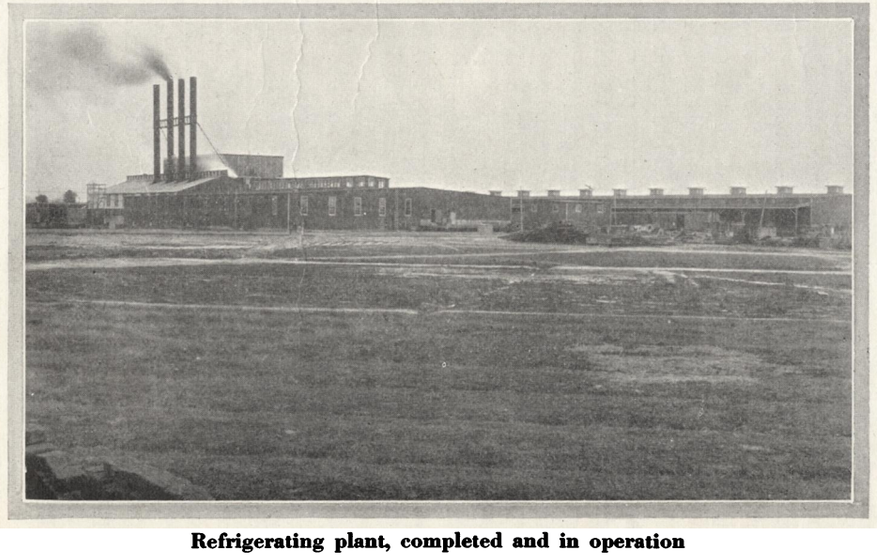
This content downloaded from
176.128.214.251 on Wed, 02 Jun 2021 19:56:14 UTC
All use subject to https://about.jstor.org/terms

Buildings for the Great Depot at Gièvres



Large storage warehouse under construction

Large warehouse, Type D, under construction



Refrigerating plant, completed and in operation

Veterinary hospital

This content downloaded from
176.128.214.251 on Wed, 02 Jun 2021 19:56:14 UTC
All use subject to https://about.jstor.org/terms

accommodations on a large scale in the form of camps of various types had to be furnished. The engineer department undertook the task of supplying barracks for one-third of the United States troops in France, assuming that the remainder would be billeted.

According to G. O. No. 46, G. H. Q., A. E. F., 1917, prescribing the allowance for troops as 20 square feet per man, in addition to kitchens and mess halls, 16 barracks 20 by 100 feet were required for 1,000 men. Contracts were made for demountable barracks with the French and British governments and with civilian contractors in France and Switzerland. A total of approximately 23,000 barracks were contracted for, of which 15,000, including 4,500 hospital barracks, were delivered. Most of these were of the demountable type. Deliveries were very slow except during August, September, and October, 1918, when over 1,000 barracks per month were received. On account of these slow deliveries, it was necessary to construct barracks in place from lumber furnished by forestry troops. Two types of barracks were developed, utilizing the minimum of lumber. Type "B" barracks required only 6,100 feet b. m. of lumber, and the type "C" barracks using corrugated iron roof and sides, with frame of wood, requiring only 1,600 feet b. m. of lumber. These barracks were furnished with 4-man bunks and would accommodate about 100 men.

A total of approximately 17,120 barracks were erected, which represents 324 miles of barracks.

The largest camp involving the construction of barracks and other facilities was the Pontanezen Camp at Brest, for 80,000 men—25,000 in tents and 55,000 in barracks—for which over 500 barracks for officers and men were constructed. There were also constructed for this camp 15 mess halls and kitchens, each with a rated capacity for 4,500 men per hour; a complete bathing, delousing and laundry plant and numerous administration, storage and welfare buildings. The tendency at the larger concentration and embarkation camps has been towards large kitchens operated by permanent personnel. There have been several types of these kitchens developed, the largest of which are those at Pontanezen camp, where, although these have a rated capacity of 4,500 men per hour, one of these kitchens has a record of 7,000 men served in 58 minutes.

Hospitalization

In August, 1917, instructions were issued to provide for hospitalization on the lines of communication for 300,000 men. In September, 1917, nine French hospitals were taken over, each of which was a nucleus for a hospital center, the original total capacity being about 6,000 beds, which were finally developed into about 34,800 beds.

During the fall of 1917 it was found impossible to obtain many existing hospitals from the French, so that preparations were made to construct a large number of barrack hospitals. Meanwhile, hospitalization had been tentatively authorized for 10 per cent of the strength of the A. E. F. A great deal of time was consumed in determining upon the sites, due to the necessity of meeting the conditions proposed by French and American services interested. Plans of the standard type barrack hospital were developed. A type "A" standard hospital provided for 1,000 normal beds and 1,000 beds by crisis-expansion in tentage, and a type "B" camp hospital provided 300 beds.

The experiences of both the French and English were freely consulted in original type plans and much attention given in the preparation of revised plans to economy of materials and personnel. For further economy in personnel, administration, and supply, hospitals were grouped, as far as local conditions would permit, into centers of hospitalization. Those centers were usually developed in multiples of the Type "A" 1,000-bed base-hospital to any size required.

Contracts were at once made for hospital barracks, but deliveries were slow and resort was had to construction in place, using materials most available. Most hospitals were constructed of lumber, but in some cases light masonry walls and concrete floors were used. At first a number of contracts for this work were let, as the contractors were then able to obtain materials, supplies and labor not available to the A. E. F. This advantage steadily decreased during 1918 as the A. E. F. obtained access to all markets for materials and as the quantity of troop-labor increased, while at the same time it became increasingly difficult for the contractors to get labor and materials and to obtain transportation.

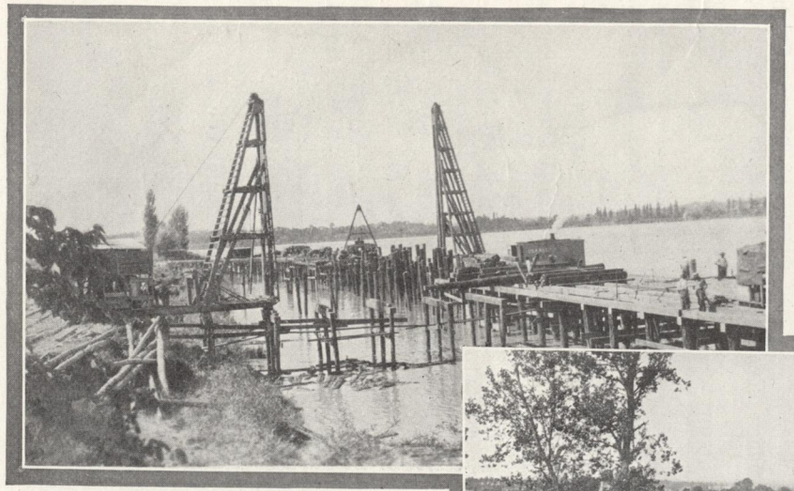
In May, 1918, the rate of troop arrivals was doubled and on June 1, 1918, the commander-in-chief directed that there be maintained an actual current bed status aggregating 15 per cent of the A. E. F. strength in Europe. The immediate effect was to triple the necessary rate of hospital construction. This increased rate was more than met.

On November 14, 1918, due to the cessation of hostilities, the authorized capacity of hospitalization was reduced to 7½ per cent. At that date bed space had been provided for 280,000, or 14.2 per cent of the strength of the A. E. F.

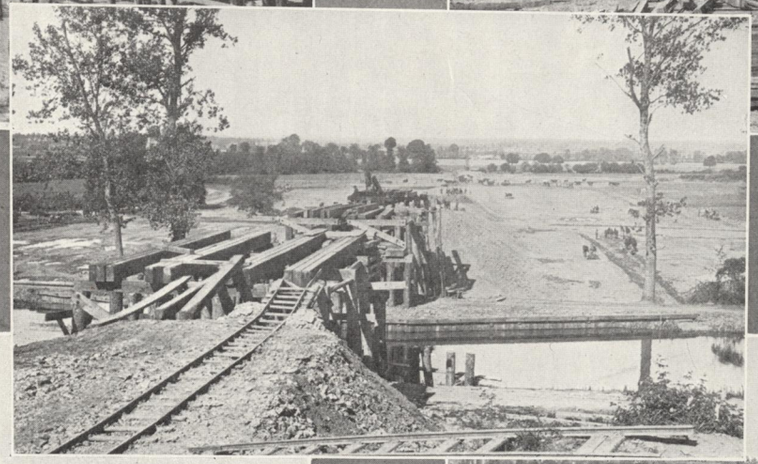
Of the hospital space of 280,000 beds provided on armistice day, 139,000 beds were in French buildings, and space for 141,000 beds had been provided by construction. In other words, slightly over one-half of the total hospitalization was provided by construction. This amounted to 7,700 hospital barracks, which represents 127 miles of wards.

In the 1,000-bed base hospitals spacing of beds provided for 3 feet 4 inches between beds. This gave

This content downloaded from
176.128.214.251 on Wed, 02 Jun 2021 19:56:14 UTC
All use subject to https://about.jstor.org/terms

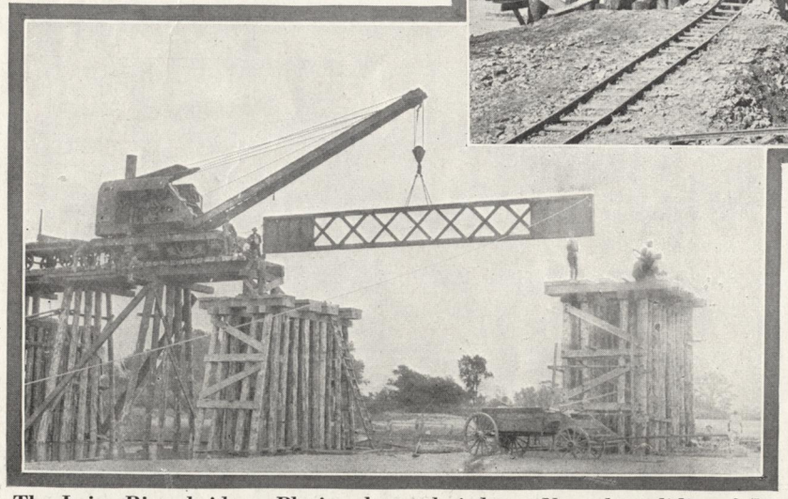


Driving piles for the American docks at Bassens



Inset—A hasty trestle bridge, designed for rapid erection and heavy duty. A typical piece of military engineering, adapted to the materials available, to meet the situation promptly without unnecessary elaboration or permanence.

The American docks at Bassens, in course of construction



The Loire River bridge. Placing the steel girders. Note the solidity of this structure, designed to carry heavy loads, while permitting rapid construction

The Loire bridge, showing pile piers and steel girders in place. Pile piers lack permanence but are ideal for military emergencies

This content downloaded from
176.128.214.251 on Wed, 02 Jun 2021 19:56:14 UTC
All use subject to https://about.jstor.org/terms

1,000 patients per unit; unit consisting of 20 ward buildings and other buildings necessary for administration, feeding, operating, etc., and 13 buildings for personnel.

As indicated above, the D. C. & F. was always able to keep ahead of the number of patients on the standard basis, taking into consideration the French hospitals secured and tents erected. The standard 1,000 bed hospital unit contemplated tentage to the same amount, so that 2,000 men would be handled in these units in emergencies with the same general facilities intended, in normal times, for 1,000. Due to the lack of sufficient medical personnel and equipment to operate all the hospitals, particularly those in French buildings, and to the shortage of tents, there were frequently more than 1,000 men placed per unit of the base hospitals, as those units enabled the largest number of men to be taken care of with the minimum medical personnel. At times the number thus handled per unit was as great as 1,500.

Wooden barrack buildings at Camp No. 4, near Bordeaux

Type of steel-frame warehouse; corrugated-iron roofing and siding, employed at Montoir yards

The maximum number of beds occupied by sick, wounded, and convalescent never exceeded 10 per cent, and the available bed space since the first week in July, 1918, was at all times at least 50,000 beds in excess of the number of beds occupied, although tentage for crisis expansion and operating personnel was not provided in sufficient amount to match the bed space provided by construction.

The large scale of hospital construction is typified by the 20,000 bed type "A" base hospital centers at Mars and Mesves

Continued on page 49

This content downloaded from
176.128.214.251 on Wed, 02 Jun 2021 19:56:14 UTC
All use subject to https://about.jstor.org/terms

Engineer Construction in France

Continued from Page 8

By Lt. Col. J. A. Woodruff, C. E.; Discussion and Comment by Maj. Gen. W. C. Langfitt, Maj. Gen. M. M. Patrick, Brig. Gen. Edgar Jadwin, Col. J. B. Cavanaugh, Col. Ernest Graves, and an Extract from the Final Report of General Pershing.

in the intermediate section, each with 4,000-bed convalescent camps, including road, water, sewerage and lighting facilities, and other features necessary that the projects might function as full grown municipalities. Each of the twenty 1,000-bed units was entirely self-contained and provided for the functioning of a completely equipped hospital, in addition to the buildings for administration and quarters for the operating personnel. In each unit were 20 ward buildings, in addition to kitchens, dining rooms, store rooms, operating buildings, laboratory, morgue, baths and personnel quarters; a total of 58 buildings per unit.

Work on the Mars hospital project was commenced February 23, 1918, and was 60 per cent complete when stopped by the armistice on November 11th. At that time 700 buildings, covering a floor space of 33 acres, had been completed and 14,000 wounded and sick American officers and soldiers were housed in comparative comfort, and provided all the facilities of a great modern hospital. In the specially designed operating rooms the most delicate operations of modern surgery could be undertaken with as much confidence as in the best appointed hospitals in the United States. The provision of these facilities necessitated the construction of a water-supply system, involving a 10-inch pipe-line 5 miles long and a 100,000-gallon reinforced-concrete reservoir; 6 miles of standard-gauge railroad; thousands of feet of concrete sewer pipe, and a 15,000-volt transmission line 11 miles long; maximum labor employed, 4,152 men.

In its scope and general layout, the hospital project at Mesves was practically a duplication of the 20,000-bed base center at Mars. Access to the site was provided by the construction of 3 miles of standard-gauge railroad, and on April 23, 1918, the first train-load of material was unloaded. At the time the armistice was signed, more than 4,000 car-loads of construction material had been delivered and quarters had been provided for over 20,000 patients. An idea of the magnitude of some of the work involved may be obtained by considering the fact that the water-supply system necessitated the laying of 28 miles of pipe, about the same amount also being required in the sewer system. In November, when operations were curtailed, a total of 45 acres of concrete floors for barracks had been laid and no less than 23,000 windows, containing 270,000 panes of glass, in place. The maximum amount of labor was 5,184 men.

The story of the Mesves project is one of continuous struggle against a shortage of material, labor and transportation. In July, many of the United States troops and many of the motor trucks were withdrawn from the work. At this time, materials were arriving in trains, requiring the unloading of 115 cars daily, and wounded were arriving in considerable numbers. The maximum number of patients at Mesves, on November 11, was approximately 18,700.

Ports

At first the main ports for debarkation for American supplies were St. Nazaire, Bordeaux, and La Pallice, using existing berths allotted to the A. E. F. by the French government. Brest was also used, but chiefly for the debarkation of troops. These ports at a later period were supplemented by Marseilles and certain small ports. Supplies coming through England were discharged at Le Havre. French ports of shallow draft, such as Tonnay-Charente and Les Sables d'Olonne, were used for coal. At all French ports it was necessary to alter the railway facilities to American standard, which is explained later under the heading of railroads.

Additional berths needed were constructed by the D. C. & F. Up to November 16, 1918, 67 ship berths had been obtained from the French government, 12 had been constructed, and work had been projected and material and equipment obtained for the construction of a total of 40. The port program as finally adopted contemplated the use of 160 berths by June, 1919, 40 of which were to have been built, the balance secured from the French. At all times there was a sufficient number of berths in advance of the necessity of unloading of materials and troops. For September and October, 1918, the total number of month-berths actually used was 63, and the total number available 77. As against this there was an average of 7 vessels waiting berths in the harbors.

During the early days of the A. E. F. the port program was the subject of much discussion. As a result of this discussion, the only construction authorized during 1917 was the 10-berth dock at American Bassens, with a preponderance of opinion in favor of undertaking the construction of a dock at Montoir. A consolidation of this opinion began to take form in December, 1917, by the appointment of a board of engineers known as the "Bassens Board," primarily to make recommendations on the structural difficulties of the Bassens dock, but resulting in a general discussion of the port program.

Further progress was made in January, 1918, when the Montoir board was appointed to report on the practicability of construction of a dock at Montoir. The action of this board was not only to recommend the construction of a dock at Montoir, but also to recommend further development at Brest and the possibility of using the port of Marseilles, provided the navy could furnish the necessary protection.

In March, 1918, the Chief of Utilities appointed a

This content downloaded from
176.128.214.251 on Wed, 02 Jun 2021 19:56:14 UTC
All use subject to https://about.jstor.org/terms

board to report on all possibilities of port development. This board again recommended the construction of a dock at Montoir, also docks at Talmont and at Brest, and lighterage docks at St. Loubes and Donges, with necessary lighters to serve them.

Construction having been started on Montoir, there remained many details yet undecided. In July, 1918, the C. G., S. O. S., appointed Brig. Gen. Edgar Jadwin and Col. W. J. Wilgus as a board to make a definite detailed report and program to be undertaken immediately and carried through to completion by June, 1919. The report of this board not only made recommendations, but also estimates of material and labor needed and transportation by rail required for each project, and was the final and consolidated program for all port development in the A. E. F.

Construction was started on a 10-berth dock at American Bassens in October, 1917, and it was ready for berthing ships by the following March. This dock was 4,100 feet long and 82 feet wide. As originally constructed, it was built of piles and timber mainly obtained from the United States. It had ample switching facilities, including classification and departure yards, and was connected by rail with the 10 berths used by the American Army at French Bassens, the 20 berths being connected by a third track constructed parallel with the P. O. railroad in order that a shuttle service could be operated to the St. Sulpice storage project. In August it was decided to reinforce the dock for installation of American gantry cranes, and 3,200 additional 80-foot piling were driven. This dock, as finally constructed, contained 11,000 piles and timber amounting to 4,500,000 feet b. m. It was equipped with 40 American gantry cranes.

Ward Barracks, Base Hospital—106, Beau Desert

The port program at Brest included the construction of two berths on the Jetée de l'Est and four berths on the Jetée du Sud. The two berths on the Jetée de l'Est were the only ones completed. This dock included warehouses and direct track connection with the Etat railroad. Actual construction was started in July, 1918, and the dock was in use the following September.

Because of the necessity of obtaining accurate soundings and other data, construction on the Montoir dock was not started until July, 1918. The original plan called for double-track trestle approach, 4,000 feet in length, and a dock 3,230 feet long. At the time of the armistice the double-track approach had been completed and 40 per cent of the dock proper. Because of the armistice, it was decided to construct only three berths, and those were completed and in use January, 1919. The outstanding feature of the construction of this dock was that all timbers and most of the piles were obtained in France. Piles 80 to 100 feet in length were found and cut in the Vosges, hauled to the nearest railroad point, and shipped by rail to Montoir.

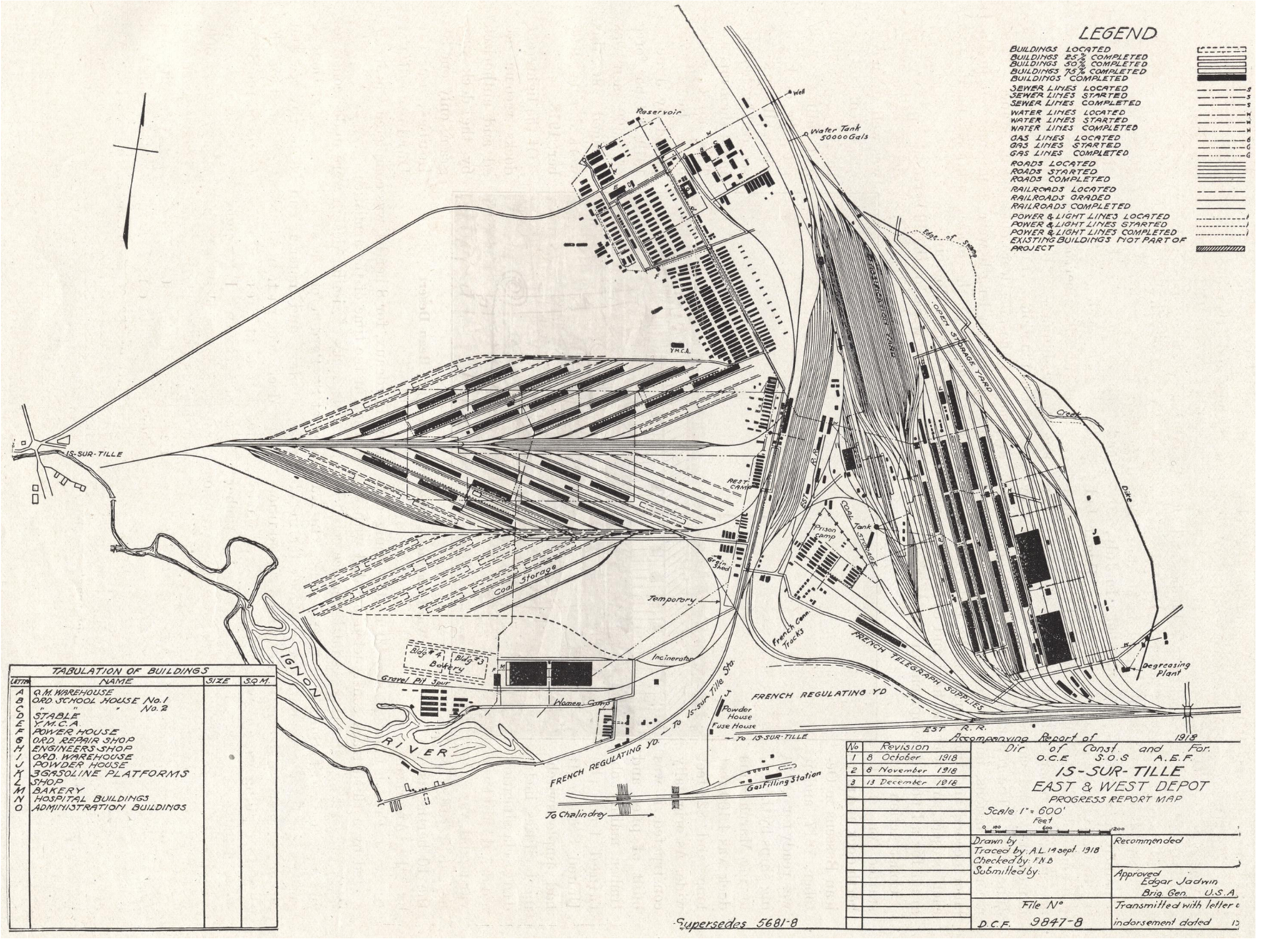
Preliminary work for the 10-berth dock and storage depot at Talmont was well advanced, equipment and material assembled, and railroad built into the dock site when all work was stopped by the signing of the armistice. This dock would have been completed by June 1, 1919. A labor force of 2,500 men was engaged on this work during October, 1918.

Of the lighterage docks recommended and authorized by the dock program, only one, St. Loubes, on the Dordogne River near Bordeaux, for 8 berths, was completed and in operation at the time of the armistice.

Other docks of similar design were under construction at St. Pardon, on the same river, and at Donges, near Montoir, and material had been delivered and other dock construction was ready to start on the Jetée du Sud at Brest and at two points on the Seine River near Rouen. Fifty-eight 300-ton lighters were constructed from French timber and twenty-six 500-ton lighters from American timber, besides seven derrick barges of from 30 to 100 ton lifting capacity and others in course of construction. A part of this work and a part of the construction of Bassens dock was done under contract by the Phœnix Construction Company and James Stewart & Co.

In addition to the above construction, detailed plans had been provided, equipment assembled and construction started for adapting many French

This content downloaded from
176.128.214.251 on Wed, 02 Jun 2021 19:56:14 UTC
All use subject to https://about.jstor.org/terms



This content downloaded from
176.128.214.251 on Wed, 02 Jun 2021 19:56:14 UTC
All use subject to https://about.jstor.org/terms

berths to American standards, notably at Marseilles, Toulon, Cette, Brest, and Le Havre, in accordance with the program mapped out in the Jadwin-Wilgus report dated August 19, 1918. The 17th Engineers handled most of the work near St. Nazaire, and the 18th Engineers that near Bordeaux.

Railroads

The main lines of communication for the A. E. F. utilized existing French double-track railroads, extending from the ports of Brest, St. Nazaire, La Pallice and Bordeaux eastward and converging in the center of France within the quadrangle formed by the cities of Tours, Chateauroux, Bourges, and Orleans, thence radiating easterly to Is-sur-Tille, Chaumont, Neufchateau and St. Dizier, which points were in close proximity to the rear of the American armies. These railroads were the Paris-Orleans Railway, the Paris, Lyons and Marseilles Railway, the Etat and the Est railways. These railways comprised both the first and second lines of communication, and were the lines of railway along which the main American facilities were constructed and upon which American trains with American train crews were operated. The P. L. M. Ry., from Marseilles and Toulon was also used, but with the exception of a few track changes at the ports included no American facilities and was operated by the French.

Starting at the ports and extending the entire length of the lines of communication, all construction work was done in a very densely populated foreign country, with all the consequent difficulties to be met and overcome.

The track layouts at the dock and port facilities were entirely the French standard, where tracks were parallel and all connection was by means of turntables operated by hand, making a very slow and cumbersome operation. In order to get the maximum capacity and use of American railway equipment it was necessary to change from the French standard to the American standard of switching. This change entailed a complete rearrangement of tracks with all the coincident troubles of street crossing, removal of buildings, overhead crossing, and the construction work carried on under traffic. At St. Nazaire, the first port used by the A. E. F., these changes entailed a rearranging and construction to the American standard of switching of a total of 23 miles of track, and at other French ports and docks in like proportion.

There was urgent necessity for getting the supplies away from the ship's side as fast as possible, and in order to do this it was necessary to build direct track connection under American control between the docks and the storage and classification yards. At St. Nazaire, a double-track connection was built, approximately 4 miles in length, involving considerable grading and one double-track bridge across the Etang de Mean. At Bordeaux a third track was built parallel to the P. O. road, a distance of 8 miles, to the storage yard at St. Sulpice.

In order to properly classify and store supplies pending shipment it was necessary to build extensive yards and storehouses as near to the ports as there was available ground. These were built at Montoir for St. Nazaire, at St. Luce for Nantes, at St. Sulpice for Bordeaux, and similar construction was started at Aigrefeuille for La Pallice, and Miramas for Marseilles.

The storage depot at Montoir was originally designed for a total trackage of 240 miles. The construction work proceeded as the facilities were needed, and at the time of the armistice 128 miles of track had been built and were in operation. These facilities included complete operating facilities, comprising 25 miles of track in receiving and departure yards, 5 miles in classification yards, 5 miles in engine terminal, 6 miles in ordnance storage yard, and the balance of track to serve general storage warehouses and the many connections necessary to serve minor facilities. Construction of the project at Montoir started on September 30, 1917, and was completed December 31, 1918. The maximum number of men engaged in the construction work was 3,083. The project at St. Sulpice was practically identical with that at Montoir.

The two large intermediate storage projects were located at Gièvres, and Montierchaume, near the city of Chateauroux. These projects were intended to accommodate the reserve supplies for the operation of the American Army.

At the storage project at Gièvres, supplies were received from all ports and held in storage until needed in the advance depots or elsewhere. This project as originally designed contemplated a total trackage of 280 miles, and at the time of the armistice there was laid and in operation 143 miles of track, which comprised the 36 miles in the receiving and departure yard, 9 miles in the classification yards, 7 miles in engine terminal, 13 miles in engineer depot for open storage, and the balance, 69 miles, to serve the 165 warehouses, refrigerating plant and other lesser facilities; Gièvres was the largest of the storage facilities. It covered an area 6 miles in length and 2 in depth. There were 30,000 men stationed in camps within the project, 20,000 for construction and 10,000 for operation purposes. Construction work was started at Gièvres by the 15th Engineers (Railway) in September, 1917, and the depot started functioning in November of the same year. The maximum number of men employed on construction was 5,877.

The intermediate storage yards at Montierchaume were designed on approximately the same plan and size as Gièvres. Construction work was started on

This content downloaded from
176.128.214.251 on Wed, 02 Jun 2021 19:56:14 UTC
All use subject to https://about.jstor.org/terms

a small scale in April, 1918, and was accelerated in June, and at the time of the armistice a total amount of 50 miles of track had been laid, including receiving, classification and departure yards, engine terminal and storage tracks.

Ammunition storage depots were constructed at Jonchery, Mehun, Issoudun and St. Loubes.

Advance storage and regulating stations were built at Is-sur-Tille and Liffol-le-Grand, and the French regulating station at St. Dizier was used. At Is-sur-Tille, 10 miles north of Dijon, the largest advance storage and regulating station was built, comprising a total of 95 miles of track. This was divided into receiving, classification and departure yards, storage and miscellaneous tracks, and included engine terminal facilities. Construction on this project commenced October, 1917, by the 16th Engineers, and the station began functioning in December of the same year, and was practically completed in June, 1918. The construction of this yard involved heavy grading, a large part of which was in solid rock. The maximum number of men engaged on this work during the course of construction was 3,984.

Liffol-le-Grand, near Neufchateau, was in reality a regulating station, with comparatively small amount of storage. It consisted of 26 miles of track in receiving, departure and classification yards, 7 miles of track in engine terminal facilities, 12 miles for storage purposes. Construction was started in April, 1918, but for military reasons the work was not rushed until the following July. The maximum number of men engaged on work was 2,576. The work was practically complete, and the yard functioning in October, 1918.

It was found that the engine terminal facilities along the French railways would not be of sufficient capacity to handle the heavy traffic necessary to adequately supply the A. E. F., and as these engine terminals were in congested centers, it was decided to build new ones solely for American operations. Under this program engine terminals were built at Montoir, Saumur, Gièvres, Cercy-la-Tour, Is-sur-Tille, Liffol-le-Grand, and along the line out of Bordeaux, at Nexon, Perigueux, and Montierchaume. All these engine terminals were constructed and in operation. Studies were made and in some cases construction was started on other engine terminals in order to further increase the American traffic, but these were suspended by the armistice.

The engine terminals were practically of the same design, including receiving and departure yards, engine house and repair shop and other necessary facilities. The trackage involved varied from 8 to 14 miles. The water supply along the French railroads used by the A. E. F. was improved and augmented in numerous places.

In addition to the railroad work as set forth above, it was necessary to construct sidings and spur lines at the various hospitals, aviation centers, camps, ordnance storage projects, oil and gasoline stations, and to the many forestry operations. A total of 1,055 miles of railroad was constructed. If this were laid in a continuous line it would reach from the Atlantic Ocean at St. Nazaire across France and Germany and to the Russian frontier.

Comprehensive plans were prepared by the transportation service for all track facilities, but the shortage of materials and labor and the rapid increase of the program of troop arrivals called for wise discrimination as to what was needed and what was not, in order to meet the actual situation. It was necessary to make decisions almost from day to day as to what tracks should be put down on the various projects extending from the ports to the front, in order to provide facilities urgently and immediately needed, as there were neither labor nor materials to construct all facilities shown on plans. The comprehensive plans contemplated four tracks along each line of storehouses and open storage space, two on each side of the storehouse. It was found in practice that at the intermediate depots all the traffic could be handled on one track on one side of each line of storehouses without unreasonable delay in loading and unloading of cars. Later, the same type of arrangement was also being used at the large base depots.

Experience and observation of the tracks which were used most and those that were not largely used led to the conclusion that on this class of work, under war conditions, to avoid loss of man-power and material without adequate return, considering the rapidly changing conditions, it was advisable to put in little more than the number of tracks that were needed to start operations, leaving space to add others as their necessity develops.

Storage Depots

The covered storage as estimated by the various services was originally 21 square feet per man in the A. E. F., but it was found by experience that for a 90-day reserve, 10 square feet per man was sufficient for supplies actually requiring cover, inclusive of ammunition. This was later reduced to 5 square feet when a reserve of 45 days was decided upon. These requirements were met as follows:

	Square feet	*Square feet*
Gièvres	3,850,000	
St. Sulpice	2,652,000	
Montoir	3,456,000	
Montierchaume	1,222,000	
Is-sur-Tille	1,380,000	
Other depots	3,608,000	
Total depot storage		16,168,000
Dock storage		3,213,000
Miscellaneous storage		3,858,000
Grand total		23,239,000

This content downloaded from
176.128.214.251 on Wed, 02 Jun 2021 19:56:14 UTC
All use subject to https://about.jstor.org/terms

Original warehouses were constructed of lumber with ruberoid roofing. Owing to the difficulty in obtaining lumber, a type was developed with wood frame and corrugated-iron roofing and sides, using round poles for posts. The warehouse was 50 by 490 feet, and 12 feet high at the eaves and required only 20,800 feet board-measure of lumber and 44,000 square feet of corrugated iron, and could be easily and quickly erected. At Gièvres, on one occasion, a warehouse of 50 by 294 feet was erected by 60 men in 8½ hours, only the roof and ends being covered—with corrugated iron.

It was found necessary to omit floors except in buildings where supplies subject to injury by moisture, such as sugar, salt, and flour, were stored. In these cases a floor was built, or the supplies were placed on loose dunnage.

Considerable attention was also given to the question of placing in open storage supplies that would not be damaged in the length of time that they would have to remain in the open. Experience has demonstrated that the following main classes of supplies can be placed in the open with paulin covers without material damage: hay, canned goods, small arms ammunition and projectiles.

The principal motor transport project was the main base plant and repair shop at Verneuil, near Nevers. It was designed to serve as the base repair center for the motor transport corps. The total number of vehicles repaired in this plant up to March 1, 1919, amounted to: light and heavy trucks, 4,592; automobiles, 1,700; ambulances, 324; motorcycles, 3,230, and bicycles, 1,724. Repair parts, amounting to 485,724, have been manufactured from raw material, and 6,635 broken and salvaged motor vehicle parts have been returned to service. In addition, repair and salvage work was done on horse-drawn vehicles and other miscellaneous equipment and material.

The project consisted of the main base plant, which included 14,400 square feet of office space, 120,000 square feet of stock storage, and 361,000 square feet of shops; the camp for personnel, amounting to a total floor space of 302,430 square feet; and the prisoner-of-war enclosures.

The principal air service project was the air service production center, No. 2, at Romorantin, near Gièvres. This project was designed to be the main assembly and salvage depot for the air service in France and was to receive and assemble all airplanes from the United States, to salvage a large part of the planes from the front, to repair and rebuild planes, to repair and maintain all motor transportation for the air service, and to serve as a depot for air service supplies. Later, a complete balloon depot and repair station and 1,000-bed base hospital were added. The location was chosen principally because it was accessible to the converging main lines of communication from the ports, and at the same time within easy flying distance of the distributing points near the front, while still near the extreme bombing radius for enemy planes.

The supply depot and airplane spare parts depot handled all air service supplies and all airplane and engine parts. An average of 30 cars per day were used in handling these supplies.

The original project was authorized December 27, 1917. A small detachment of Engineers started work on the railroad on January 21, 1918. The first air service personnel arrived January 19, and began erecting barracks January 21. The maximum number of men employed at one time was 2,684. When construction was stopped on November 15, 1918, 85 per cent of the entire authorized work had been completed. The construction consisted of 1,297,200 square feet of shops, 765,200 square feet of storehouses and hangars, 616,000 square feet of barracks, and 126,000 square feet of hospital space.

The plant as completed was capable of assembling about 30 planes per day and would have soon been able to handle double that number. The number of planes assembled was 1,177; liberty and foreign engines repaired, 1,670; salvaged, 212; planes repaired (all types), 776; planes of all types salvaged, 308.

Remount Depots and Veterinary Hospitals

In addition to the work of providing shelter for troops there was the problem of providing necessary shelters for animals required for the A. E. F.

This construction was initiated in August, 1917, when a request was made for the immediate erection of temporary shelters for the mounts of a cavalry regiment expected to arrive at an early date. As a result of this request arrangements were made with the French government to supply 500 demountable wooden stables, each with a capacity of 50 horses, and to use many small existing remount stations to which additional capacity was added when possible.

During May, 1918, a program of remount and veterinary hospital construction was instituted. A board selected sites in the base, intermediate and advance sections and visited the British area to study construction of buildings and accompanying facilities which had been developed during the four years of the war.

Remount depots with veterinary hospitals in close proximity were established at the principal base ports to care for animals arriving from the states or other overseas sources, until they could be forwarded to the intermediate or advance depots. Large depots with veterinary hospitals adjoining were established at Gièvres, Selles-sur-Cher, and Sougy, in the intermediate section. In the advance section a large depot and veterinary hospital was built at Lux, near Is-sur-Tille, and many smaller remount depots

This content downloaded from
176.128.214.251 on Wed, 02 Jun 2021 19:56:14 UTC
All use subject to https://about.jstor.org/terms

and hospitals between that point and the front lines.

The total facilities authorized by the staff comprise remount depots for 61,200 animals and veterinary hospitals for 39,100 animals. Of these, there was actually available on February 1, 1919, the following space for animals:

In remount depots constructed by the engineers.	27,700	
In remount depots obtained from the French...	12,000	
		39,700
In veterinary hospitals constructed by engineers.	16,500	
In veterinary hospitals obtained from the French	11,100	
		27,600
Total space in remount depots and veterinary hospitals		67,300

These facilities involved the construction of 2,210,000 square feet of stabling, provision for quarters for 650 officers and 17,000 enlisted men, and the various facilities required for the functioning of these projects.

At each separate remount depot and veterinary hospital there were required dressing rooms, operating rooms, dipping vats, sulphurizing chambers, forges, and blacksmiths' shops, and storehouses for equipment and forage.

Each large project required a standard-gauge railroad siding and spur with facilities for rapidly unloading animals, an ample water supply and good roads and drainage.

The type of horse shelter adopted for remount depots and veterinary hospitals after a study of the best French and British practice was a stable, 216 by 23 feet, with a space for 100 animals. Supports were of 6-inch round poles with a framework of 2 by 4's and covered with corrugated iron if available, otherwise with 1-inch sheeting and tar paper.

For shelter alone each animal required from 80 to 140 feet board-measure of lumber, depending whether or not corrugated iron was used for covering. The stables actually constructed consumed over five million feet board-measure of lumber.

In general, remount depots were built for 2,000 to 5,000 animals with a veterinary hospital near at hand for from 1,000 to 2,000 animals. The project at Sougy has a capacity for 5,000 animals in the remount depot and 2,000 in the veterinary hospital. It has quarters for 100 officers, 2,500 enlisted men, with necessary mess halls, bath houses, and includes a recreation building.

Water Supply and Sewerage.

In connection with the classes of work described above, much water supply and sewerage work was required. A large amount of labor was required in the listing of supplies to be purchased in American and European markets and in the preparation of priority schedules to permit this material to be ordered and shipped so as to be available in time for use.

A system of water analysis laboratories was established and the water supply in the S. O. S. placed under the same kind of care from bacteriological and sanitary point of view as is customary in the cities and states of the United States. Arrangements were made for the chlorination of various water supplies in the S. O. S. and the storage and forwarding of chlorinating apparatus for the armies. Arrangements were entered into with the cities of Tours, Vendome, St. Nazaire, Le Mans and Dijon for the chlorination of the whole city supply.

The water supply for the city of St. Nazaire and vicinity constituted the biggest single problem of the D. C. & F. The ordinary French uses amounted to about 1,000,000 gallons per day and was obtained from reservoirs of a capacity of 160,000,000 gallons which were filled during the rainy season. During unusually dry seasons it was necessary to resort to tank boats in order to furnish the city. The combined French and American uses were estimated at about 3,000,000 gallons per day and, as the country does not yield deep well water, it being underlaid with solid granite rock, and as the nearest surface free from salinity was at a distance of about 15 miles, it was decided to be more feasible to provide additional storage reservoirs of a capacity of 400 million gallons. It was necessary to construct one rapid sand filter of 3,000,000 gallons daily capacity and another of 1,000,000 gallons daily capacity in order to provide satisfactory water. To fill the reservoirs in the rainy season and to elevate the water to the various levels of the project, 15 pumps with a total capacity of 30 million gallons per day had to be installed; 48,000 feet of 24-inch to 12-inch pipe, 60,000 feet of 8-inch to 4-inch pipe, and elevated tanks of 200,000 gallons capacity were used in the supply and main distribution systems alone, not to mention miles of smaller pipe used for distribution as well as for interior plumbing and piping.

The water supply of the docks and camps at Brest and vicinity offered another large problem. The original French systems which supplied Port de Commerce, Foutras Barracks, Bougen Fortress and Pontanezen Barracks, were insufficient and it was necessary to immediately make provision for an additional 900,000 gallons per day. A pumping station on the Penfield River was installed with a daily capacity of 1,300,000 gallons and 28,000 feet of pipeline laid. In order to supply all portions of the projects and to provide adequate pressure, pumps of a total capacity of 2,000,000 gallons per day and elevated tanks of a total capacity of 100,000 gallons, were installed. Due to the increase in the size of the Pontanezen camp and constantly increasing needs at other ports of the project, this original augmentation of the French supply, almost before completed, became inadequate and further provision had to be made. It was estimated that 3,000,000 gallons per

This content downloaded from
176.128.214.251 on Wed, 02 Jun 2021 19:56:14 UTC
All use subject to https://about.jstor.org/terms

day would be necessary and with this to do away to a large extent with the use of the French system, particularly at Port de Commerce. The Penfield River was selected as the source. Two reservoirs, one of 23,000,000 gallons capacity and another of 2,000,000 gallons capacity, were built. Two pumping stations containing 6 pumps and with a total capacity of 4,700,000 gallons daily were constructed. Forty-one thousand feet of 14-inch to 10-inch pipe and 10,000 feet of 6-inch and 4-inch pipe were used on the main supply and distribution system.

While Brest and St. Nazaire presented the largest problems of water supply, practically all the other large projects constructed required water supply installations of considerable magnitude, a few of which may be mentioned as of interest. For the Saveney Hospital water supply, a concrete arch dam 40 feet high and containing over 6,000 cubic yards of concrete to provide a reservoir storage capacity of 10 million gallons was constructed, in addition to 2 filter plants, each of 330,000 gallons daily capacity. Some 25,000 feet of sewer lines and 50,000 feet of water mains were laid and a concrete standpipe of 50,000 gallons capacity was installed. For the Mars Hospital supply a 10-inch force main, 5 miles long, was laid. A reinforced concrete reservoir of 100,000 gallons, on towers 30 feet high, was constructed. Two pumping stations, each of 500,000 gallons daily capacity, were installed, and a filter plant of 500,000 gallons per day was erected. For the Mesves Hospital an installation practically duplicating that of Mars was made. At both Allerey and Beaune hospitals, some 57,000 feet of sewer pipe and 40,000 feet of water mains were laid. At Romorantin air service plant two filters, each of about 200,000 gallons daily capacity, were placed. A slow sand-filter was installed at both Langres and Chateauroux hospitals. The installations at the Montierchaume storage depot involved the laying of some 30,000 feet of 4-inch, 6-inch, and 8-inch pipe, the installation of pumping stations of a capacity of 100 horsepower, the drilling of wells of a total depth of 1,700 feet, and the construction of elevated tanks of a total capacity of 150,000 gallons. The general intermediate storage depot at Gièvres called for even a larger installation than that at Montierchaume. At Bassens, 1,500,000 gallons of water per day was obtained by drilling two artesian wells to a depth of 700 feet. A well of 1,520-foot depth was drilled at Beau Desert Hospital, and one of 1,020-foot depth at St. Sulpice.

Refrigeration

In addition to such cold storage space as could be obtained from the French, plants were constructed by the D. C. & F., upon plans prepared by experts engaged by the Q. M. C., for the storage of frozen meats from the United States, with a total refrigerated space for the storage of 14,900 tons, and ice-making facilities for 500 tons per day.

The plants at Gièvres and Bassens are the largest of those constructed, having an ultimate capacity for 7,500 and 6,000 tons frozen beef, respectively. These figures are based upon full utilization of refrigerated space with consequent elimination of alleyways. The original rated capacities of these plants, making liberal allowance for alleyways, were 5,200 and 4,000 tons, respectively. Plans were prepared and equipment obtained from the United States for a duplicate of the Bassens plant to be located in the advance section, as well as for a duplication of the cold storage building at the Gièvres plant; also plans for a 400-ton plant at Marseilles, these three projects being canceled after the armistice. A beef storage plant of 700 tons capacity was authorized at Bendorf, near Coblenz, February 6, 1919. This plant is included in the above capacity figures.

The beef storage building at the Bassens plant is cork insulated throughout, using 100,000 cubic feet cork obtained from a point near Bordeaux. The floor is of reinforced concrete over corkboard on a 4-foot sand fill. The cold storage rooms contain 134,800 linear feet of 2-inch standard pipe. The engine room is modern in every respect; the refrigerating machines are driven by cross-compound condensing Corliss engines. The boiler capacity is 900 horsepower. The reinforced concrete reservoir has capacity for 130,000 gallons water. Due to the use of cork for insulation, and improved design, the amount of lumber used was reduced to 931,000 feet board-measure. This plant was constructed and in operation in 4½ months after commencement of work.

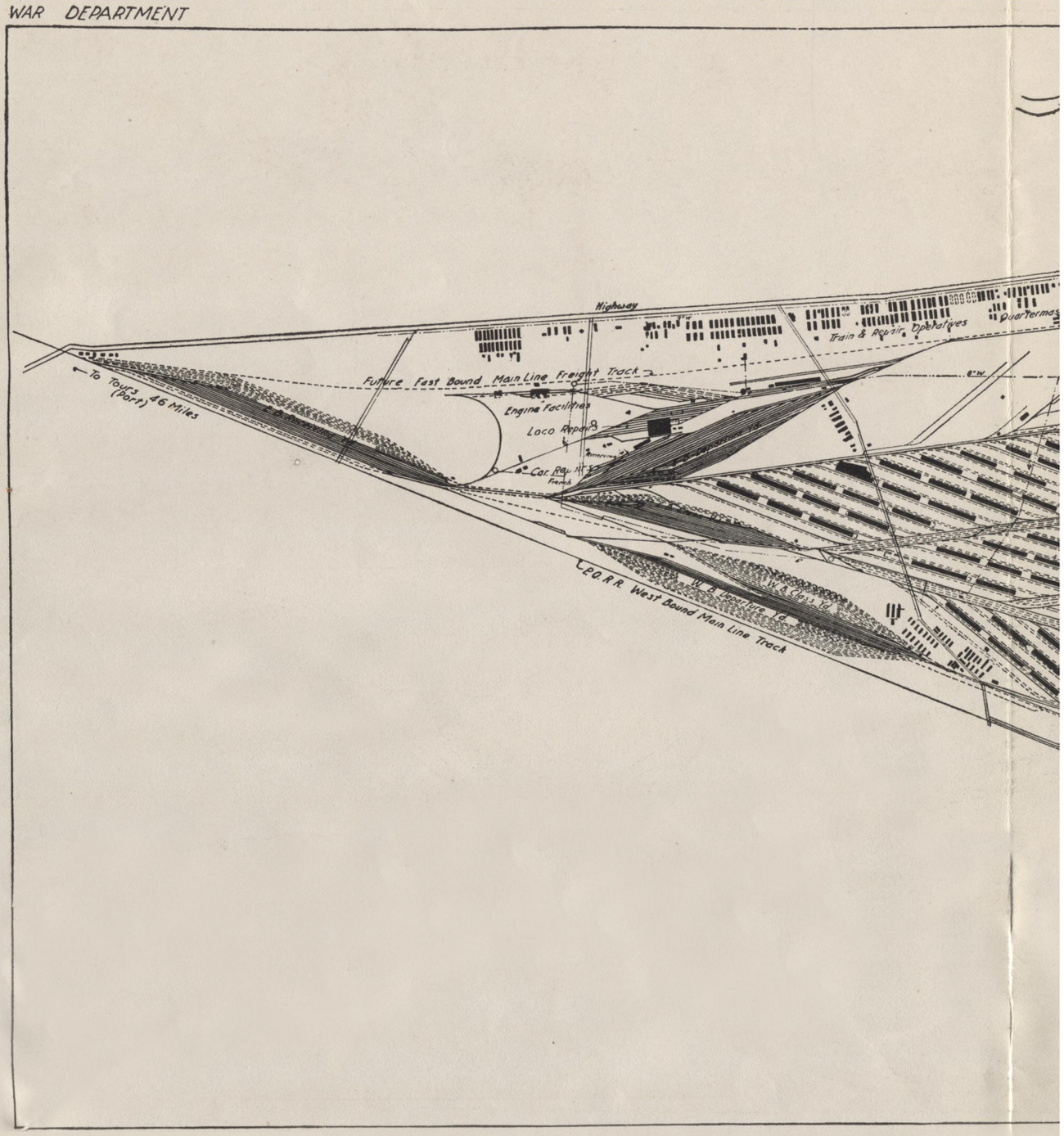
Bakeries

A mechanical bakery at Is-sur-Tille was constructed from plans furnished by the Q. M. C. with a capacity of 800,000 pounds daily. This plant is capable of emergency production of 1,000,000 pounds daily. Mechanical bakeries were constructed from plans furnished by the D. C. & F. at Brest and Bordeaux, with a capacity of 150,000 pounds daily and at St. Nazaire of 120,000 daily. Plans were completed for a mechanical bakery at Liffol-le-Grand with a capacity of 400,000 pounds daily. Plans were furnished for the construction of field bakeries totaling in capacity approximately 600,000 pounds daily. Of this amount, construction capable of producing 500,000 pounds daily was completed.

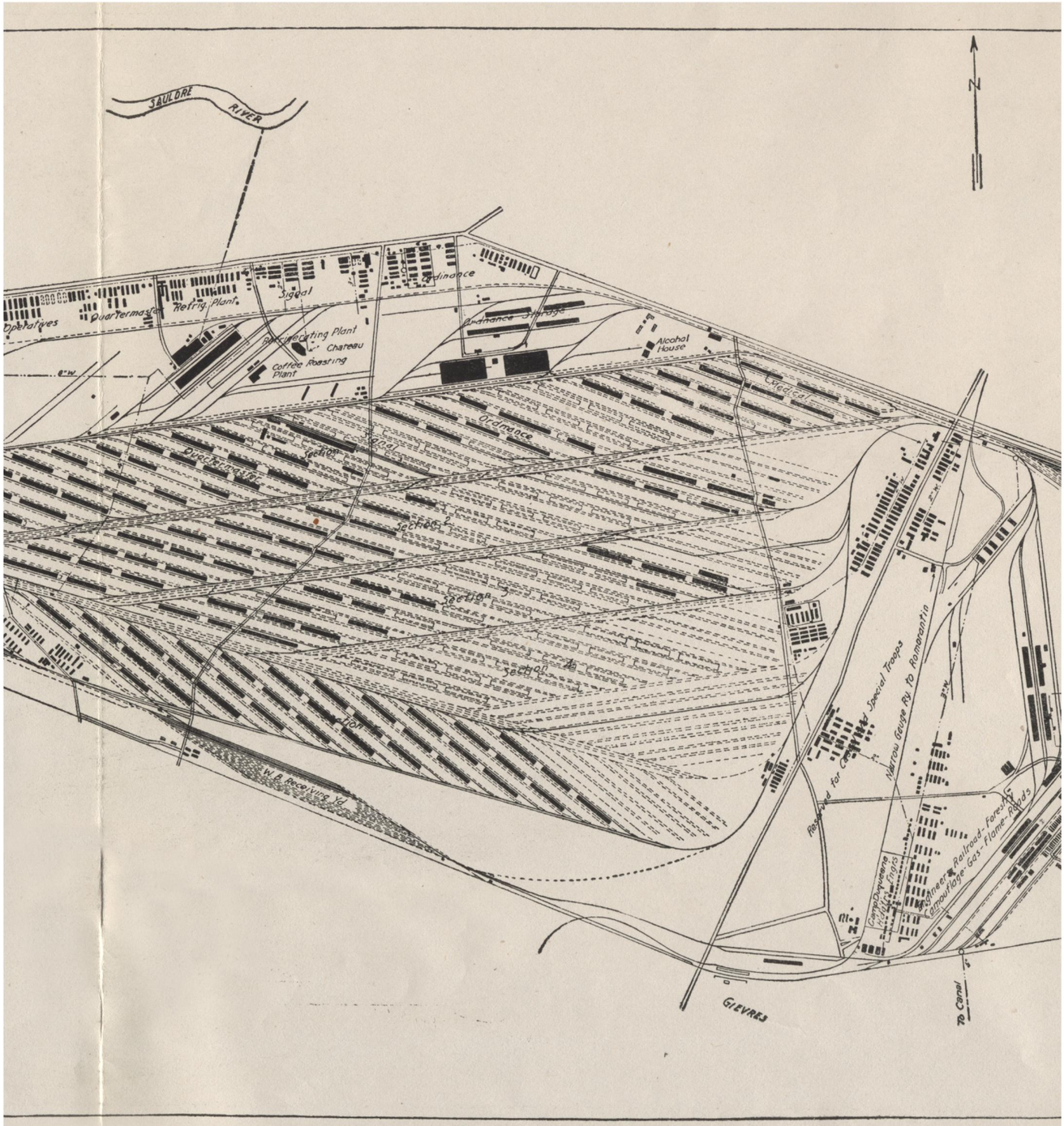
Two steel truss buildings, 240 by 380 feet, with a corrugated iron roof and sides, were erected for the mechanical bakery at Is-sur-Tille. The floors were concrete throughout. All machinery in the plant was electric-driven, power being furnished from a modern steam turbo-generating plant of 900 K.W.

This content downloaded from
176.128.214.251 on Wed, 02 Jun 2021 19:56:14 UTC
All use subject to https://about.jstor.org/terms

WAR DEPARTMENT

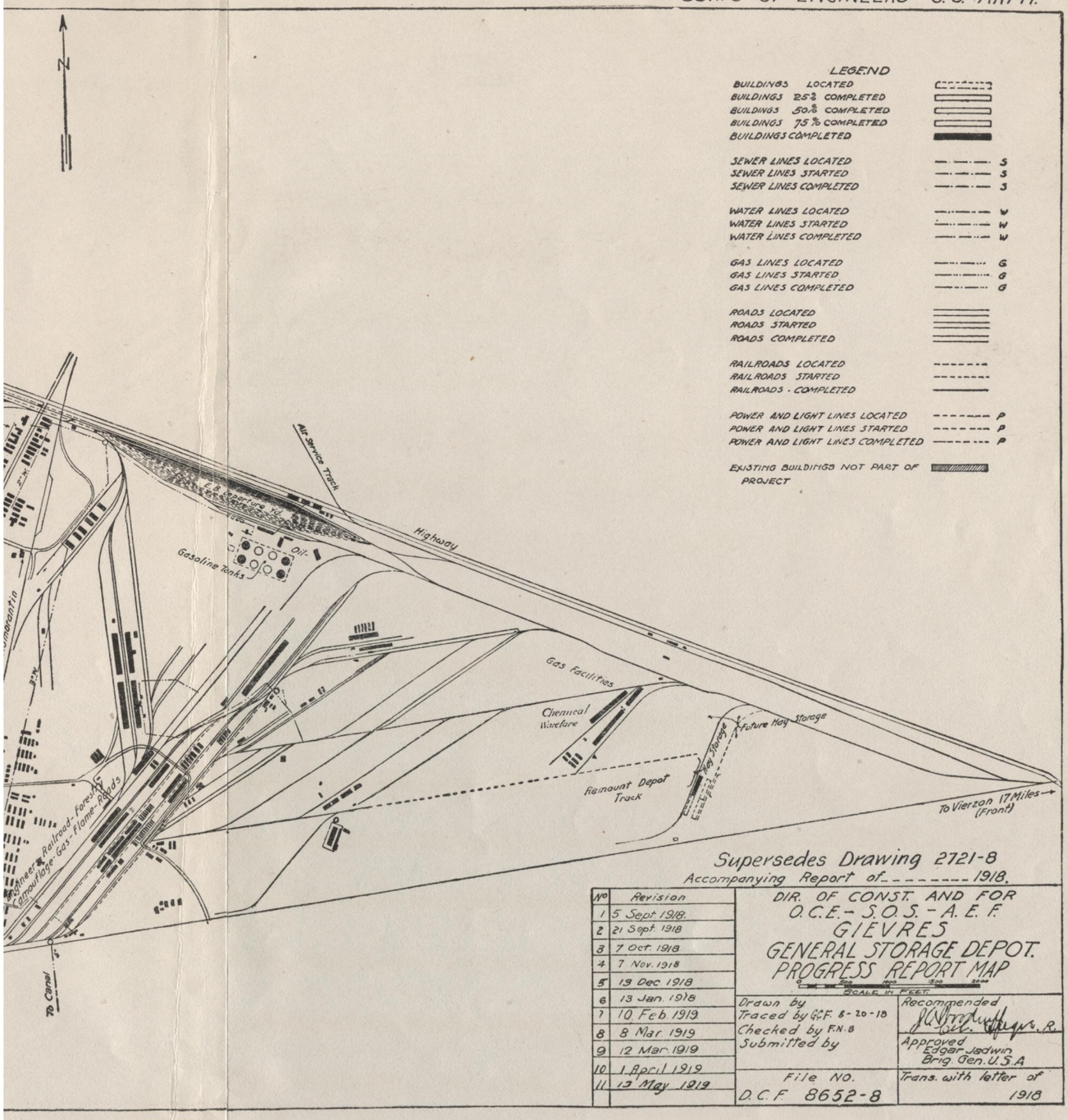


This content downloaded from
176.128.214.251 on Wed, 02 Jun 2021 19:56:14 UTC
All use subject to https://about.jstor.org/terms



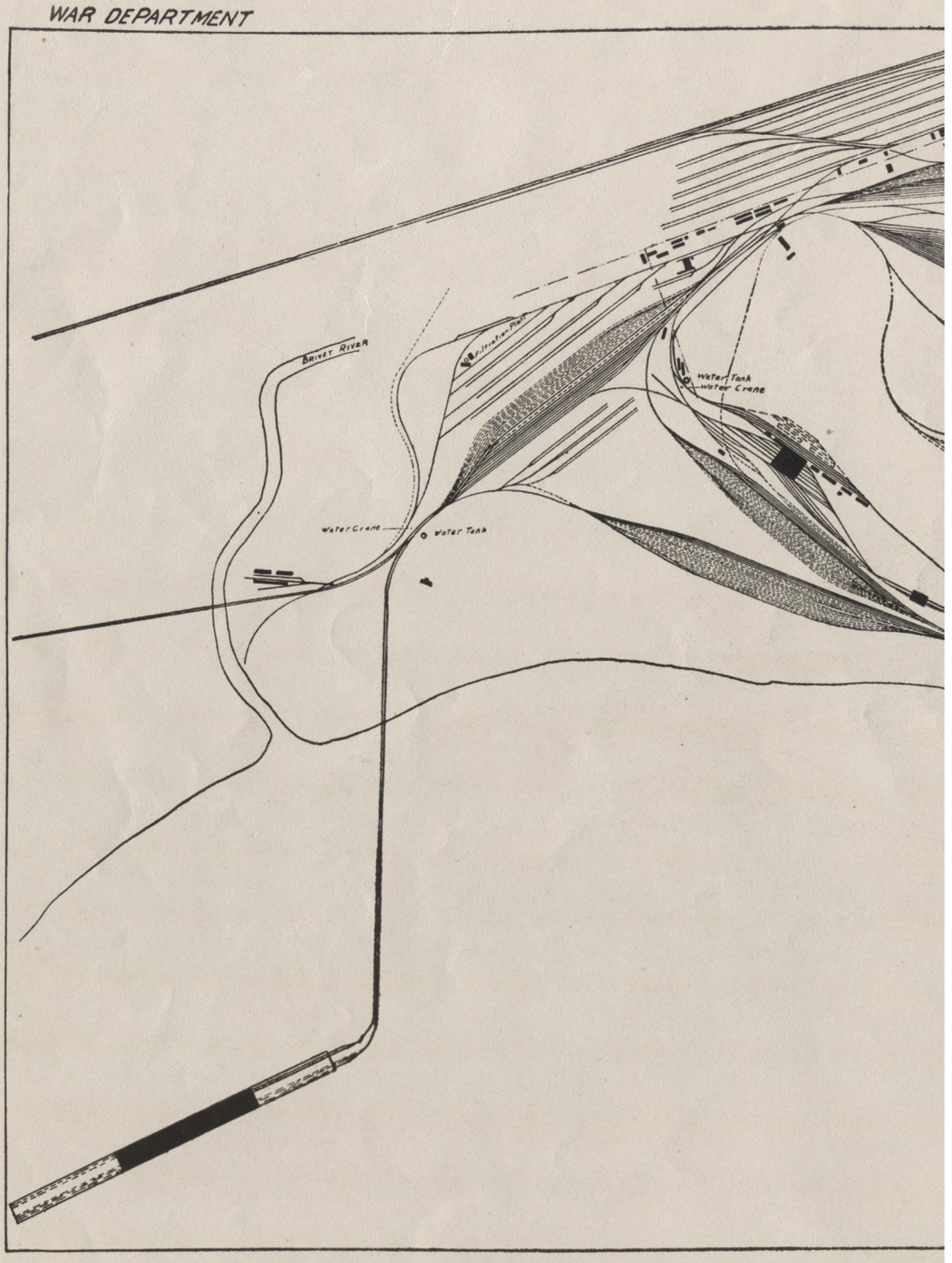
Gievres; General Storage Depot

This content downloaded from
176.128.214.251 on Wed, 02 Jun 2021 19:56:14 UTC
All use subject to https://about.jstor.org/terms

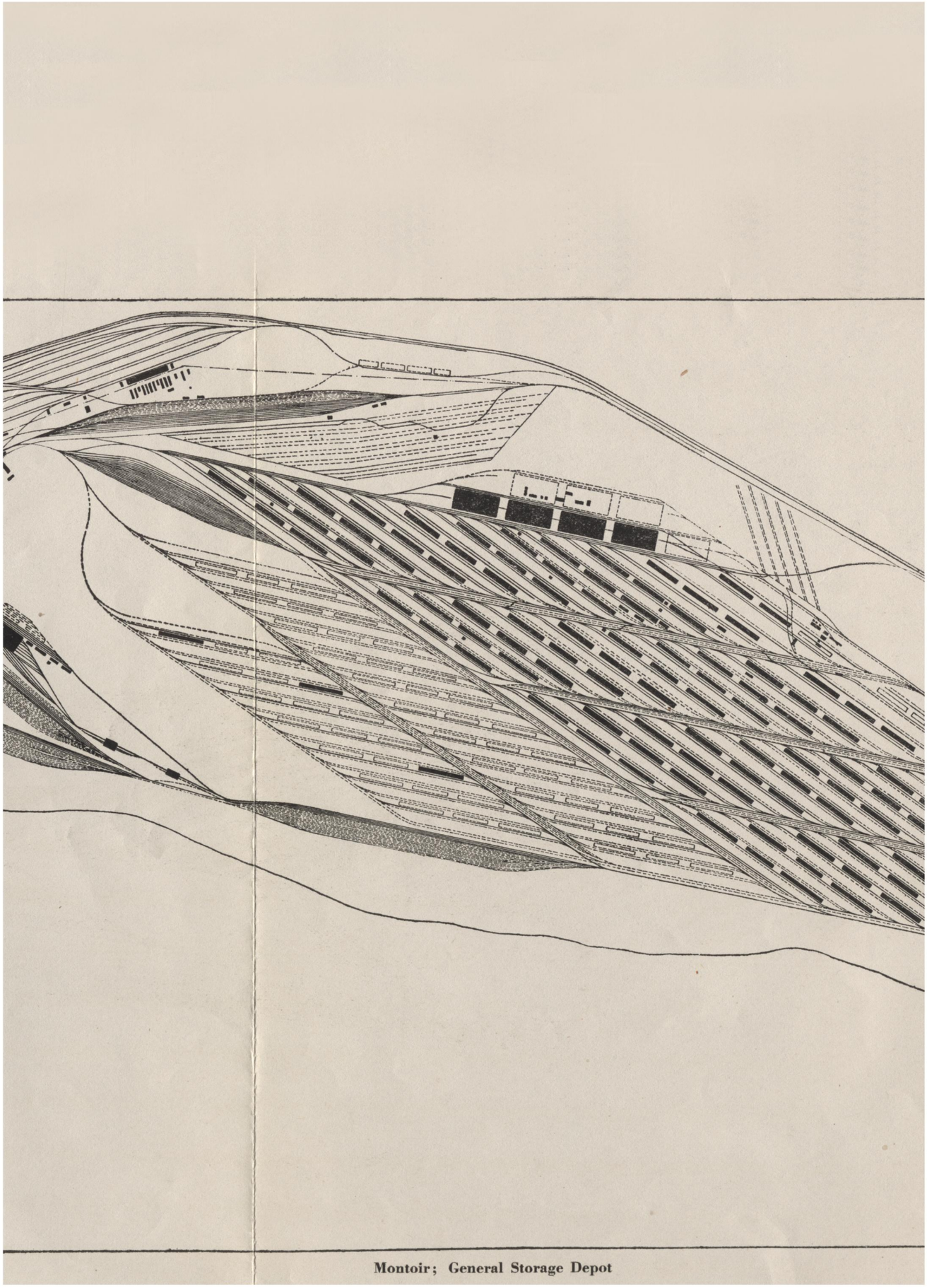


This content downloaded from
176.128.214.251 on Wed, 02 Jun 2021 19:56:14 UTC
All use subject to https://about.jstor.org/terms

WAR DEPARTMENT



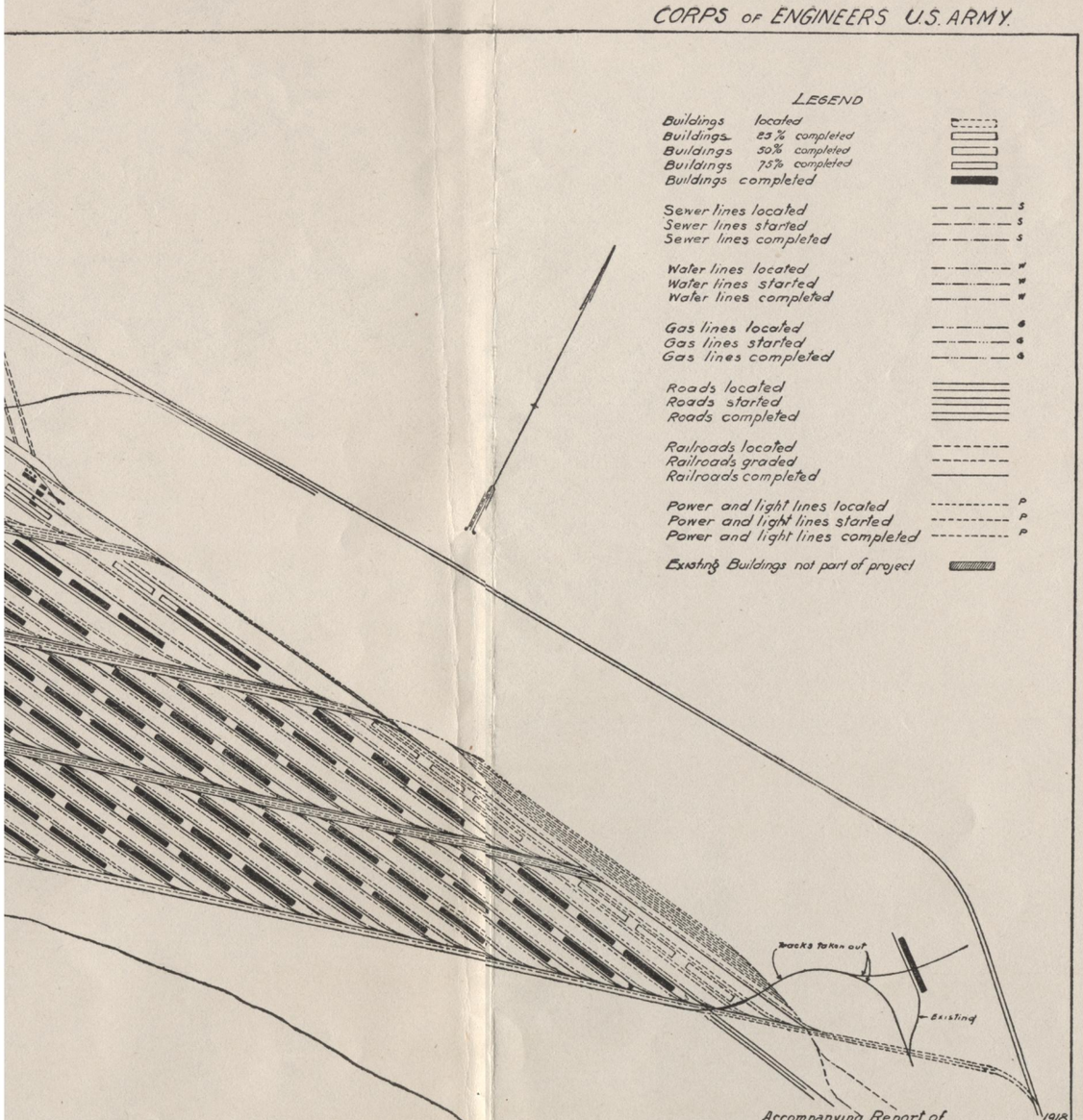
This content downloaded from
176.128.214.251 on Wed, 02 Jun 2021 19:56:14 UTC
All use subject to https://about.jstor.org/terms



Montoir; General Storage Depot

This content downloaded from
176.128.214.251 on Wed, 02 Jun 2021 19:56:14 UTC
All use subject to https://about.jstor.org/terms

CORPS OF ENGINEERS U.S. ARMY.



Accompanying Report of 1918

No	Revisions
1	24 July 1918.
2	31 July 1918
3	5 August 1918.
4	5 Sept 1918
5	23 Sept 1918
6	7 Oct. 1918
7	9 Nov. 1918
8	12 Dec. 1918.
9	11 Jan. 1919
10	10 March 1919
11	12 March 1919
12	15 May 1919

DIR. OF CONST. AND FOR.
C.E. - S.O.S. - A.E.F.
MONTOIR:
GENERAL STORAGE DEPOT
PROGRESS REPORT MAP.

0 500 1000 1500 2000
SCALE IN FEET

Drawn by
Traced by O.D.M. 18-7-18
Checked by F.K.B. 18/7/18
Submitted

Recommended

Approved
Edgar Jadwin
Brig Gen. U.S.A.

File No
D.C.F. 7824-8

Transmitted with letter of
Indorsement 191

This content downloaded from
176.128.214.251 on Wed, 02 Jun 2021 19:56:14 UTC
All use subject to https://about.jstor.org/terms

capacity, the power-house being a separate building, 55 by 125 feet. Ovens were built on standard British practice in groups of seven, so arranged as to lessen chance of plant being totally disabled.

Electrical Installation

Steam generating stations involving approximately 3,000 K.W. of power were designated and in process of construction when the armistice was signed. The larger of these were a 200-K.W. plant for the bakery and storage project at Is-sur-Tille; a 1,000-K.W. standby plant for the Bassens project; a 750-K. W. plant for the air service production center at Romorantin.

Three thousand K.W., in rotary convertor substations, were designed and under construction. These were at Neuvy Pailloux to serve the tank factory; at Marseilles, La Pallice and St. Nazaire, to serve the gantry cranes. A 2,500-K.W. substation was constructed at Mehun from plans furnished by the Ordnance Department to serve the ordnance shops. A 2,500-K.W. substation design by the Transportation Department was constructed at Bassens to serve the projects at that point. Of this station 1,500 K.W. was in rotary convertors and the remainder in transformers for miscellaneous light and power.

One hundred and twenty-five miles of transmission line had been constructed or was under way, the plans and specifications for which were furnished by the D. C. & F. Low-tension distribution systems and interior wiring of all hospitals, storage yards, warehouses, docks, shops, schools, and camps in the S.O.S. were installed on the basis of plans and specifications furnished by the D. C. & F.

Oil and Gasoline Storage

The D. C. & F. was charged with the construction of the oil and gasoline seacoast storage stations, intermediate storage station fabrication shops for small tanks at Gièvres, and the construction of the small gasoline distributing stations throughout France. The following seacoast gasoline storage stations have been constructed and placed in operation:

La Pallice, four 25,000-barrel tanks; St. Loubes, one 25,000-barrel tank. Two 25,000-barrel storage tanks were erected at Blaye, but this plant was never placed in operation.

Intermediate storage station, four 10,000-barrel-tanks were constructed and placed in operation at Gièvres.

At the Gièvres shop for the fabrication of small tanks there were constructed and tested 69 300-barrel tanks and 150 150-barrel tanks. Of this number 29 300-barrel tanks and 119 150-barrel tanks were shipped out to small gasoline distributing stations at various field locations. To facilitate the installation of the small gasoline distributing stations, the necessary pipe, valves, fittings, and pumps were assembled and marked for field erection and shipped out at the same time as the small tanks. The construction work on the seacoast and intermediate gasoline storage stations and the 150 and 300 barrel tanks was largely done by contract with the James Stewart Company under the supervision of engineer officers. Thirty-seven complete installations of small gasoline distributing stations were shipped out, 17 of which were placed in operation and other 20 were either canceled or construction suspended. These stations were constructed by engineer troops.

With the storage and distributing stations already erected, sufficient gasoline can be stored to provide for any emergency, and the small distributing stations not yet erected could be relocated without much expenditure of labor, and without any further demand for material.

Roads

The D. C. & F. in the year 1918 had charge of all road work in the S. O. S. except that in the advance section, which was performed under the section engineer officer for the division of light railways and roads. During this period 90 miles of new road were constructed within projects such as the larger hospital units, general storage projects, ordnance and aviation projects. The major part of the road equipment available was needed at the front, and for this reason and for the lack of labor due to priority of other work, the maintenance and repair work was limited to approximately 300 miles. The repair work was performed mainly in congested centers, such as the immediate vicinity of Bordeaux, the docks at Bassens, and the streets of St. Nazaire adjacent to the docks and leading to the camps.

The national highways and other French roads along our line of communications and serving the many camps, training centers, and other activities of the A. E. F. were under extremely heavy traffic during the summer and fall of 1918, and comparatively little repair work was undertaken because no labor was available either from French or American sources. The wet weather in the western and southern part of France and the freezing weather in the eastern and northern parts during the month of December put the roads in bad condition and the C. in C. directed that month that extensive repairs be undertaken along the entire lines of communication, not only in justice to the French in repairing their roads damaged by the American traffic but also to permit continued use of the roads by the American Army. This resulted in the issuing on January 2, 1919, of an order placing all road work in the S. O. S. and Luxemburg under the direction of the D. C. & F. and that in the occupied areas of Germany under the C. G., 3rd Army, giving the D. C. & F. a co-ordinating supervision.

This content downloaded from
176.128.214.251 on Wed, 02 Jun 2021 19:56:14 UTC
All use subject to https://about.jstor.org/terms

The D. C. & F. used his existing organization for this work and through the section engineer officers of the various sections, immediately started the leasing and acquiring of quarries, a system of distribution of stone by rail haul and motor transportation, distributed labor upon roads most requiring repair, put into service all available road equipment and tools, both from French and American sources. The section engineer officers were instructed to adopt the cantonier system, which was a system of constant patrol and of carefully placing well-tamped patches and resurfacing wherever the surface of the road developed weak spots. Special attention was also given to opening up all drains and ditches and the removal of accumulated mud, both from the surface of the road and ditches. The French government cooperated by issuing instructions to their departmental engineers to furnish all stone and equipment available and in a few places stone was furnished by the French, transported in American cars and trucks and placed upon the roads by combined forces of Americans and French. The results obtained from the use of this system were very satisfactory and some roads that were almost impassable in January were put in reasonably good condition. This system reduces the cost of new roads and keeps all roads in better condition by constant patrols and repair.

The maximum force engaged in road work has approximated 110,000 men who were scattered in small working parties over nearly 16,000 kilometers of road and placed about 90,000 tons of stone per week. This stone was obtained from quarries operated by the French government and French contractors; also from quarries opened up and operated by the D. C. & F., any many small local quarries where the rock was taken out and broken up by hand. The quarries operated by American labor were 90 in number; the total number operated by the French, 50. The stone was hauled by rail from the quarries to the nearest station and then distributed by motor truck. From the small quarries the distribution was made by means of motor trucks and horse-drawn wagons direct.

The following table shows the work done from January 1 to June 1, 1919, at which time the road program was practically completed in all sections.

Section	Roads worked—km.	Rock distributed—metric tons	Man-days—8-hour day	Truck-ton days—8-hour day	Road rollers
B. S. No. 1...	500	91,000	261,500	38,900	22
B. S. No. 2...	1,700	154,000	295,450	51,830	27
B. S. No. 5...	75	197,500	156,220	16,330	9
B. S. No. 7...	575	25,200	80,530	12,580	8
Int. Sec. W...	4,200	291,000	658,850	78,510	39
Int. Sec. E...	550	95,000	115,230	24,310	17
Advance	5,400	512,500	2,671,600	171,250	135
Total in France	13,000	1,367,500	4,239,380	393,710	257
Luxembourg ..	350	19,700	17,000	4,000	...
Occupied ter...	2,500	307,500	487,250	80,320	40
Total.....	15,850	1,694,700	4,743,630	478,030	297

In the advance section 650 kilometers of road were reconstructed within the battle areas devastated previous to the arrival of the American Army. There was also constructed 34,000 square yards of stone-paved street and 21,000 square yards of concrete road. In addition to restoring and maintaining the road surfaces more than 500,000 tons of crushed rock were distributed and left along the roads for future repair work by the French authorities.

Forestry

The lack of ocean transport made it necessary to obtain practically all of the lumber and other forest products required by the A. E. F. from the French and other European sources. Shipments of such bulky material from the United States was restricted to a small quantity of piling and dock timbers used chiefly in the Bassens dock. Furthermore, the shortage of forest products in France and the heavy requirements of the French and British armies made it necessary for the A. E. F. to be self-sustaining in the supply of these essential materials, which were called for in enormous and steadily increasing quantities. The current monthly requirements of the army at the time of the armistice totaled 50,000,000 feet board-measure of lumber and timbers, 250,000 railroad ties, 6,500 pieces of piling and cribbing, 1,500,000 poles and entanglement stakes, and something over 100,000 cords of fuel wood.

Limited quantities of lumber were obtained from France, Switzerland and Norway. Approximately 590,000 railroad ties used in the first installations were advanced by the French government and some additional ties were obtained under contracts placed in Spain and Portugal. Fully 75 per cent of the lumber and ties, over 90 per cent of the poles and piling, and a large part of the fuel wood required by the army were produced in France by the forestry section.

Lumber production was begun in December, 1917, by the 10th Engineers (Forestry), which operated two American and four French mills that month and cut 321,000 feet of lumber, 205 piles, 12,000 ties, 20,000 poles, and 1,200 cords of fuel wood. During the winter and spring of 1918, the Forestry troops were augmented by the ten battalions of the 20th Engineers (Forestry), and by three battalions comprising the 41st, 42d, and 43d Engineers. Nine battalions of engineer service troops were also assigned to forestry work. Thirty-four mills were operated in March, 1918, and 59 mills in June. At the time of the armistice, 90 operations, including 81 sawmills, were in progress, employing nearly 12,000 technical engineer troops and 8,500 service troops.

The earliest operations of the forestry section were undertaken (1) in the Landes pineries of base section No. 2, where there was an early demand for piling, warehouse lumber, and railroad ties; (2) in the Loire River valley near the line of communica-

This content downloaded from
176.128.214.251 on Wed, 02 Jun 2021 19:56:14 UTC
All use subject to https://about.jstor.org/terms

tion and the large depots and construction projects in central France, and (3) in the soft wood forests of the Vosges and Jura mountains and the hardwood areas immediately behind the American Sector of the Front. The forest resources of these regions were fully explored and new operations placed as far as possible with reference to the main points of consumption and the varied demands of the army for different classes of forest products. Construction lumber had to be obtained mainly from the soft-wood forests of the south and of the eastern mountains. These regions also furnished the bulk of the piling. The hardwood forests of central and western France were drawn upon heavily for railroad ties, road planks, dock, barge, and bridge timbers, and fuel wood. In the summer of 1918, it was necessary to push out into the southern Jura region and the central plateau of France, in order to obtain the quantities of timber needed.

The forestry operations at the time of the armistice were grouped in the 14 operating districts, each under a battalion commander and organized as far as practicable to function as a self-contained unit. In addition, 8 operating units with portable sawmills were attached to the first and second armies, working near engineer camps and supplying them with the forest products most urgently needed from time to time.

At the completion of its work June 25, 1919, the forestry section had produced approximately 206 million feet of lumber, 3 million standard-gauge ties, 1 million small ties, 39,000 piles and 1,800,000 poles and entanglement stakes, for the A. E. F. In addition to these amounts, approximately 10,000,000 feet of lumber and 440,000 standard ties were cut by two forestry battalions which were loaned to the French and British armies. All told, the forestry section up to the same date supplied 400,000 cords of fuel-wood to the army. In addition, 30 of its officers were loaned to the quartermaster corps to direct the production of large quantities of fuel-wood by quartermaster troops.

To maintain this enormous production, it was necessary to scout practically all of France south of the northern provinces for suitable timber and to negotiate its purchase through French channels. This work was extended into the Pyrenees, the French Alps, and the central plateau, in order not only to keep the forestry troops in France continuously supplied with timber, but also to obtain the large quantities needed for the operations of 24,000 additional troops approved by the War Department for forestry work in September. By the date of the armistice, 630 million feet of timber and 700,000 cords of fuel-wood had been acquired; and half as much had been located and cruised and was in process of acquisition.

On account of the delay in the arrival of American equipment, 8 stationary French saw-mills were leased or requisitioned in the fall and winter of 1917 and 12 portable French mills were acquired. This equipment aided greatly in meeting the acute shortage of lumber. The French plants were largely remodeled by the forestry troops and their production doubled or trebled. Their capacity was still so limited, however, that they were discarded as rapidly as American mills could be obtained.

Three types of American saw-mills were employed:

(1) A heavy-powered, permanent steam plant, rated to cut 20,000 feet board-measure in ten hours.

(2) A moderately powered, portable type of steam saw-mill, rated to cut 10,000 feet board-measure in ten hours.

(3) A very light, portable "bolter mill" run either by steam or by gas tractor, rated to cut 5,000 board-feet in ten hours and especially suited to light products, like railroad ties.

Twenty of the large mills were installed at points where the supply of timber permitted their operation for eight months or longer. The other mills were well adapted to the many small wood-lots in France which it was necessary to utilize. In the face of a critical shortage of lumber, every possible effort was made to speed up production. Practically all saw-mills were operated day and night shifts and some of them three 8-hour shifts. More than double the rated capacity of the plants was obtained currently in most of the forestry operations. Upwards of 150,000 feet of lumber were cut in twenty hours at several of the large mills whose rated capacity for the same period was 40,000 feet. Cuts as high as 66,000 feet of railroad ties were made in 20 hours on the little bolter mills. All of the large and many of the small mills were steamed successfully by means of "dutch" ovens for burning sawdust, designated and installed on the ground by forestry millwrights. An enormous quantity of fuel-wood was saved by this means.

Standard or motor gauge railroad installations, up to 3 miles in length, were necessary at two-thirds of the mills to give them direct rail connections and provide adequate facilities for loading cars. Light railroads of 3-foot, meter, or 60-centimeter gauge, with steam or gas locomotives or horse-drawn trams, were used for logging at many operations. A difficult area in the Vosges Mountains was logged by means of a 4,000-foot meter-gauge incline, with an average grade of 35 per cent, down which carloads of logs were lowered by donkey engine and cable. Much of the logging was done by horses with log wagons, spool carts, or high wheels. The excellent French roads were used extensively for bringing in logs by motor trucks and by tractors drawing a low-speed trailer of log-wagons. One hundred-foot piles were hauled by this means for distances up to 15 kilometers.

One of the noteworthy accomplishments of the forestry section was the cutting and logging of 15,000 piles from 65 to 100 feet in length, under great difficulties, which assured the completion of the major dock

This content downloaded from
176.128.214.251 on Wed, 02 Jun 2021 19:56:14 UTC
All use subject to https://about.jstor.org/terms

projects at the A. E. F. base ports. Approximately 15,000,000 feet of long heavy timbers, requiring special selection and manufacture, were also furnished for dock, barge, and bridge construction. By an active field organization, it was possible to keep the current rail and cargo deliveries of lumber, ties and piling up to 70 per cent of current production in spite of the shortage of transportation facilities in France.

While the changing program and the difficulties incident to the submarine warfare, an insufficient amount of ocean tonnage, cars, man-power and material, were all great, still the division of construction and forestry met all of its essential responsibilities and was equal to the situation in each of the various activities of the A. E. F. dependent on it for their success. This was due on the one hand to the organization, to the character of the men in the service, their splendid loyalty, enormous amount of work which they performed, and their rapid adaptability to the changing conditions, and on the other hand to the backing received from the Chief Engineer, the C. G. S. O. S., and the C. in C.

As an illustration of the work done, if all the railroads constructed were laid in a continuous straight-line track it would reach from the Atlantic Ocean at St. Nazaire, across France and Germany to the Russian frontier. Similarly, if all the building construction were consolidated into one building having the width of our standard barrack and hospitals it would reach from St. Nazaire, across France and to the Elbe River. The Forestry troops produced 75 per cent of the lumber and ties used on this construction, and in addition 375 miles of corded fuelwood, and 144 miles of piling.

An appreciation of the work of the division of construction and forestry is contained in the following letter from the Commander-in-Chief:

28 March, 1919.

Brigadier General EDGAR JADWIN,
Director, Construction and Forestry,
Through Chief Engineer, A. E. F.

My Dear General:

Now that hostilities have ceased it gives me great pleasure to thank you, and through you the officers and soldiers of your organization, for the splendid work you have accomplished.

The Division of Construction and Forestry required the services and unselfish efforts of experts in many lines of skilled endeavor. It is a source of deep pride and satisfaction that numbers of this type of men responded readily, and through their invaluable assistance you attained the highest goal of achievement.

The supply and shelter of troops was one of the most responsible tasks that befell any organization. Although operating in a foreign country, under conditions and circumstances vastly dissimilar to those accustomed to, you met successfully each and every demand.

You, and the officers and men of your organization, labored in almost every department in France, often in isolated detachments, working under arduous conditions of service and making countless sacrifices. Yet they withstood all hardships and difficulties, surmounted all obstacles and kept tenaciously at their important tasks. Such tireless energy, actuated as it was by a high sense of duty, deserves the commendation of all.

The vast projects wisely planned and boldly executed by you and your efficient personnel, the thoroughness and celerity with which you labored, the splendid co-operation maintained throughout, especially among the highly trained men of affairs who gave their best to the common cause, the keen foresight displayed in preparing for emergencies and the many sacrifices made are worthy of the highest American traditions.

In the name of the American Expeditionary Forces, I thank them one and all and send them the appreciation of their comrades and their Commander-in-Chief.

Sincerely yours,

JOHN J. PERSHING.

Discussion and Comment

Maj. Gen. W. C. Langfitt
Chief Engineer, American Expeditionary Forces

Colonel Woodruff's article describes in detail the operations of the Division of Construction and Forestry, one of the main divisions of the Office of the Chief Engineer, A. E. F. There seems but little room for comment by the Chief Engineer, except to express here publicly his very great appreciation of the loyal work of the Division of Construction and Forestry and of the great results achieved.

The organization in its final form was necessarily a growth. General McKinstry, I think, first suggested the idea of districts somewhat along the lines of our river and harbor districts, but did not remain long enough in charge to develop the scheme. General Patrick worked along the same lines and the organization was finally developed and perfected by General Jadwin. It, of course, met with my hearty approval and I know of no other suggestion which could have brought about such satisfactory results.

The types of construction and, in fact, all plans were evolved always keeping in mind two main essential governing features. First, the views of the department for whom the construction or work was being undertaken. Second, to keep ahead, so far as possible, of the demands of the various departments.

The first demanded much diplomatic interchange of ideas with the various supply departments, the Transportation Department and, in design of hospitals, with the Medical Department. The second required simplicity and standardization. Standardized buildings were therefore designed, so as: (1) to be built with a minimum of material: (2), to require minimum preparation for erection work: (3), to consume minimum time in erection, with minimum economical force.

As a result of this foresight and care, the Division of Construction and Forestry met all requirements most satisfactorily. Full recognition was had, at all times that we were building only for the duration of the war, resulting in suitability with the ut-

This content downloaded from
176.128.214.251 on Wed, 02 Jun 2021 19:56:14 UTC
All use subject to https://about.jstor.org/terms