

the above mentioned negotiations are accurate and true to the best of his knowledge and belief. Furthermore, that in event the aforementioned contract or supplemental agreement is awarded to any of the above firms, no part of the fixed-fee given as compensation hereof shall be paid to any person, firm or corporation for soliciting or assisting in any manner whatsoever in securing this contract.

HAWAIIAN CONSTRUCTORS,

Contractor.

By Paul Grafe,  
PAUL GRAFE.

Subscribed and sworn to this 22d day of March 1941.  
My commission expires the 14th day of March 1940.

CHARLES H. BIRNEY,  
Notary Public.

ARMY PEARL HARBOR BOARD EXHIBIT No. 46B

[RESTRICTED]

Contract No. W-414-eng-602

[1] 600.1 (Haw. Dept. Airfields)-75/3

SUPPLEMENTAL AGREEMENT No. 2

This supplemental agreement entered into this fifth day of May, 1941, by and between the UNITED STATES OF AMERICA, hereinafter called the Government, represented by the contracting officer executing this agreement, and The Hawaiian Constructors, a joint venture, composed of W. E. Callahan Construction Company, a Nebraska corporation, Guenther & Shirley Company, a Nebraska corporation, and Rohl-Connally, a Nevada corporation, joint contractors and co-adventurers, hereinafter called the contractor, WITNESSETH That:

WHEREAS, On the 20th day of December, 1940, the parties hereto entered into Contract No. W-414-eng-602 for the performance of work therein described at locations within the Territory of Hawaii, hereinafter referred to as the said contract, and

WHEREAS, On the 22nd day of March, 1941, the parties hereto executed a supplemental agreement modifying said contract, in order to provide for additional construction work and services, which supplemental agreement is hereinafter referred to as the first Supplemental Agreement; and

WHEREAS, It is found advantageous and in the best interests of the United States to modify the said contract as modified by said first Supplemental Agreement so that construction work and services, more particularly hereinafter described, in addition to that covered by the said contract as modified by said first Supplemental Agreement, may be performed for the benefit of the National Defense; and

WHEREAS, The work and services to be performed by this Supplemental Agreement hereinafter referred to as the Second Supplemental Agreement are authorized by, are for the purposes set forth in, and are chargeable to, Procurement Authorities which, with the available balances are listed below:—

(a) Procurement Authority No. SC 1450 P99A-0605-01, the available balance of which is \$130,000.00.

(b) Procurement Authority No. CAC 131 P99A-1210-N, the available balance of which is \$20,400.00.

(c) Procurement Authority No. CAC 126 P99A-1210-01, the available balance of which is \$7,758.00.

(d) Procurement Authority No. CAC 128 P99A-1204-01, the available balance of which is \$5,242.00.

(e) Procurement Authority No. Eng. 812 P99A-0540.068-N, the available balance of which is \$150,000.00.

(f) Procurement Authority No. Eng. 790 P99A-0540.067-N, the available balance of which is \$221,000.00.

(g) Procurement Authority No. Eng. 784 P99A-0540.067-N, the available balance of which is \$138,000.00.

(h) Procurement Authority No. Eng. 765 P99A-0540.068-N, the available balance of which is \$100,000.00.

(i) Procurement Authority No. Eng. 749 P99A-0540.068-N, the available balance of which is \$16,000.00.

(j) Procurement Authority No. Eng. 677 P99-0540.068-N, the available balance of which is \$2,943.00.

[2] (k) Procurement Authority No. Eng. 715 P99-0540.035-N, the available balance of which is \$300,000.00.

(l) Procurement Authority No. Eng. 602-P99A-0540.063-N, the available balance of which is \$176,000.00.

(m) Procurement Authority No. Eng. 711 P99A-0540.035-N, the available balance of which is \$80,500.00.

Now, THEREFORE, The said contract is hereby modified in the following particulars, but in no others:

1. The contractor agrees, for and in consideration of the fixed fee being increased as hereinafter provided, to perform the work and services (in addition to that covered by the said contract as modified by said first Supplemental Agreement) described in Schedules A to P (inclusive) herein and made a part hereof.

2. The estimated total cost of the work and services covered by this Supplemental Agreement is approximately \$1,123,875, exclusive of the Contractor's fee for said work and services. The estimated total cost set forth above is based upon field data now available and agreed to by both the Government and the Contractor.

3. The fixed fees stated in said contract and in said first Supplemental Agreement shall be increased in the amount of \$27,200 which shall cover all the work and services irrespective of the cost thereof. If the funds now available are not sufficient to perform all of the work and services herein described and if any additional sum or sums become available, the Contractor may be required to perform any work and services which may be necessary to complete any of the work and services herein described, for which there shall be no additional fee. Provided, however, that there shall be no adjustment in the amount of the fixed fee as provided in the said contract, or in the said contract as modified and amended, nor shall there be any claim for increased compensation, because of any errors and/or omissions made in computing the estimated cost of the construction of the work under the said contract, or under the said contract as modified and amended, or where the actual cost varies from the estimated cost of the work provided in the said contract, or in the said contract as modified and amended.

4. The work shall be done in conformity with the provisions of the War Department Construction policy dated June 15, 1940, File AG 600-12 (6-15-40) M-D-M, and its supplements.

5. Work to be done shall be undertaken immediately after receipt by the Contractor of notice to proceed. The work shall be prosecuted with faithfulness and energy and shall be completed as follows:

[3] (a) Construction of additional roads for aircraft warning service installations in the Territory of Hawaii as described in Schedule A within 60 calendar days from date of notice to proceed.

(b) Construction of additional fire control stations on the Island of Oahu as described in Schedule B within 60 calendar days from date of notice to proceed.

(c) Construction of portable seacoast searchlights shelter as described in Schedule C within 90 calendar days from date of notice to proceed.

(d) Armament, Fire Control, Supply and Repair Building (bombsight) as described in Schedule D within 120 calendar days from date of notice to proceed.

(e) Armament, Instrument Inspection and Adjustment Building as described in Schedule E within 120 calendar days from date of notice to proceed.

(f) Temporary warehouse as described in Schedule F within 120 calendar days from date of notice to proceed.

(g) Construction necessary for installation of utilities as described in Schedule G within 90 calendar days from date of notice to proceed.

(h) Installation of utilities consisting of additions to gasoline distribution system as described in Schedule H within 60 calendar days from date of notice to proceed.

(i) Grading, clearing and grubbing as described in Schedule I within 40 calendar days from date of notice to proceed.

(j) Construction of gasoline storage and distribution system in the Territory of Hawaii as described in Schedule J within 90 calendar days from date of notice to proceed.

(k) Warming up apron, Wheeler Field, as described in Schedule K within 40 calendar days from date of notice to proceed.

(l) Construction of third floor addition to Wing Operations Building as described in Schedule L, within 60 calendar days from date of notice to proceed.

(m) Construction of air base paint, oil and dope building as described in Schedule M within 60 calendar days from date of notice to proceed.

(n) Installation of cleaning fluid storage as described in Schedule N within 40 calendar days from date of notice to proceed.

(o) Construction necessary for installation of electric and steam services to hangars as described in Schedule O within 40 calendar days from date of notice to proceed.

(p) Construction of pipe line facilities, etc., as described in Schedule P within 60 calendar days from date of notice to proceed.

[4] 6. Minor changes in structures and facilities as may be found necessary in the interest of economy or required due to climatic conditions may be directed by the contracting officer without additional compensation to the contractor.

7. The work as described in Schedules A to P (inclusive) shall be in accordance with the applicable paragraphs of Standard Specifications attached hereto and made a part hereof. The work and services to be performed under the contract, in addition to the procurement authorities enumerated therein, will be chargeable also to Procurement Authority No. CAC 131 P99-A 1210-N.

THIS SUPPLEMENTAL AGREEMENT shall be subject to the approval of the Under Secretary of War.

[5]

#### SCHEDULE "A"

Construction of additional roads for Aircraft Warning Service Installations to be located in the Territory of Hawaii as directed by the Contracting Officer

The work to be done shall include all excavating, backfilling and compacting necessary to the construction of the roadway and/or roadways and appurtenances thereto; the construction and/or installation of all drainage structures, complete, with approach and discharge ditches; the construction of paved surfaces on the prepared roadway subgrade, when and as directed. In general, the pavements to be constructed will consist of hot-mixed asphaltic concrete wearing surface on compacted rock base course.

#### SCHEDULE "B"

Construction of additional fire control stations including instrument structures and bunk houses, together with access roads and trails, as part of the fixed fortification to be located in the territory of Hawaii as directed by the Contracting Officer in accordance with applicable plans.

Instrument structures will be of reinforced concrete design approximately 16' x 16', and Bunk Houses of temporary wooden construction to be built in accordance with plans to be furnished. Access roads and trails will, in general, be unpaved.

#### SCHEDULE "C"

Construction of a Shelter for portable Seacoast Searchlight units, to be located in the Territory of Hawaii as directed by the Contracting Officer

The building will consist of light steel construction with corrugated iron walls and roof. The floor will be of concrete.

[6]

#### SCHEDULE "D"

Construction of an Armament, Fire Control, Supply and Repair Building (bomb-sight), in the Territory of Hawaii

This building shall be in general conformity with Quartermaster Corps drawings for the Armament, Fire Control, Supply and Repair Building at San Antonio Air Depot (Duncan Field), Texas, as modified.

Building will be of reinforced concrete design approximately 67' x 90' in dimensions.



## SCHEDULE "E"

Construction of an Armament, Instrument Inspection and Adjustment Building in the Territory of Hawaii

This building shall be in general conformity with Quartermaster Corps drawings for the Armament, Fire Control, Supply and Repair Building designed for the San Antonio Air Depot (Duncan Field), Texas, as modified.

Building will be of reinforced concrete design approximately 67' x 130' in dimensions.

## SCHEDULE "F"

Construction of a Temporary Warehouse in the Territory of Hawaii

This building consists of one (1) Air Corps Depot Supply Building. It shall be constructed in general conformity with Quartermaster plans for the present Mobile Depot Supply Building, as modified.

It shall be of reinforced concrete and steel design and approximately 100' x 200' in dimensions.

## SCHEDULE "G"

Construction necessary for installation of utilities

This work shall consist of furnishing a Sanitary Sewer System, Water System and Electrical System, necessary to service a population of approximately 2,000 men at Bellows Field. Work shall be in conformity with plans to be furnished.

[7]

## SCHEDULE "H"

Installation of Utilities, Hickam Field, T. H.

This installation shall consist of supplying compressed air, water and electrical service to existing outlet pits in the warm-up aprons at Hickam Field and for interconnecting the existing five (5) gasoline delivery lines at that place. Work shall conform to plans to be furnished.

## SCHEDULE "I"

Grading, clearing, and grubbing

This work shall consist of clearing, grubbing and minor grading of approximately 25 acres of land at Wheeler Field, T. H., as shown on plot plans to be furnished.

## SCHEDULE "J"

Construction of Gasoline Storage and Distribution System

This work shall consist of fabricating and installing underground, in accordance with plans to be furnished, twenty-four steel tanks of 50,000-gallon capacity each, together with necessary fittings, pumps and appurtenances. Installations shall be at those points in the Territory of Hawaii designated by the contracting officer.

## SCHEDULE "K"

Warming-up Apron, Wheeler Field, T. H.

| Item No. | Item                | Unit         | Quantity |
|----------|---------------------|--------------|----------|
| 1.....   | Concrete apron..... | Cu. yds..... | 8,500    |

Construction shall be in accordance with plans furnished and shall include necessary service pits, utility lines to the pits and tie down rings.

[8]

## SCHEDULE "L"

Construction of Third Floor Addition to Wing Operations Building, Hickam Field, T. H.

Work shall conform to plans to be furnished in general conformity to the reinforced concrete design of the existing Wing Operations Building.

SCHEDULE "M"

Construction of Air Base Paint, Oil and Dope Building

This building shall be of fireproof construction in accordance with plans to be furnished. Location of building is Hickam Field, T. H.

SCHEDULE "N"

*Installation of Cleaning Fluid Storage, Hickam Field, T. H.*

| Item No. | Item                                 | Unit      | Quantity |
|----------|--------------------------------------|-----------|----------|
| 1.....   | 5,000-gallon gasoline tank.....      | Each..... | 1        |
| 2.....   | 1,000-gallon kerosene tank.....      | Each..... | 1        |
| 3.....   | 1,000-gallon tank (used fluids)..... | Each..... | 1        |

SCHEDULE "O"

Construction necessary for installation of electric and steam services to hangars

Work shall consist of providing ducts in the floor of existing hangar and installing therein the necessary piping, electric cable, outlets, connections and fittings, all in accordance with plans to be furnished.

SCHEDULE "P"

Construction of Pipe Line Facilities, Hickam Field, T. H.

This work shall consist of the following items ;

1. Make rigid the existing aviation gasoline lines on deck at Hickam Field.
- [9] 2. Install pressure relief valve.
3. Replace existing control valves.
4. Install tank car unloading facilities.
5. Install two (2) pumps and measuring meter.
6. Install approximately 5,000 lineal feet of pipe line.

All work to be performed in accordance with plans to be furnished.

[10] IN WITNESS WHEREOF, The parties hereto have executed this agreement as of the day and year first above written.

THE UNITED STATES OF AMERICA,  
 By Theodore Wymann, Jr.,  
 THEODORE WYMAN, Jr.,  
*Contractor Officer,*  
*Lt. Col., Corps of Engineers,*  
*District Engineer.*  
 HAWAIIAN CONSTRUCTORS,  
*Contractor.*

By Paul Grafe  
 PAUL GRAFE,  
 714 W. Olympic Blvd., Los Angeles, Calif.

Witnesses to Signature of Contractor :

B. L. Robinson  
 B. L. ROBINSON,  
*U. S. Engineer Office,*  
*Honolulu, T. H.*

P. C. Chew  
 P. C. CHEW,  
*U. S. Engineer Office,*  
*Honolulu, T. H.*

Approved Jun 25, 1941.

ROBERT P. PATTERSON,  
*Under Secretary of War.*

Approval recommended Jun 23, 1941.

John J. Kingman,  
 JOHN J. KINGMAN,  
*Brigadier General,*  
*Acting Chief of Engineers.*

[1]

## SECTION IV—CONCRETE

4-01. *Proportioning.* Concrete shall be composed of cement, natural or crushed aggregates, and water of the qualities herein specified and in the required proportions; these ingredients to be well mixed and brought to a proper consistency. The exact proportions in which such materials are to be used for different parts of the work shall be as determined by the contracting officer from time to time during the progress of the work, and as analyses and tests are made of samples of the aggregates and the resulting concrete. In general, the proportions shall be designed to produce a concrete of maximum practical economy to the Government and having ultimate compressive strength at the age of 28 days of not less than the following amounts for the various classes.

| Class  | Pounds per sq. inch | Nominal limits in size of aggregate in inches |
|--------|---------------------|---|
| A----- | 3,300               | $\frac{1}{4}$ " to $1\frac{1}{2}$ "           |
| B----- | 3,000               | $\frac{1}{2}$ " to $1\frac{1}{2}$ "           |
| C----- | 2,500               | $\frac{3}{4}$ " to $1\frac{1}{2}$ "           |

[3]

*No. 4 Rock and Rock Dust*

| Size of Screen<br>(Square opening) | Per cent of<br>weight |
|------------------------------------|-----------------------|
| No. 4 sieve-----                   | 90-100                |
| No. 8 sieve-----                   | 50-85                 |
| No. 16 sieve-----                  | 27-65                 |
| No. 100 sieve-----                 | 2-10                  |

(f) *Composite grading limits.* The grading of coarse aggregate in the mixed concrete shall fall within the following limits:

|   | Per cent of<br>weight passing |
|---|-------------------------------|
| Maximum size mesh screen (square mesh)-----               | 95-100                        |
| $\frac{1}{2}$ maximum size mesh screen (square mesh)----- | 40-70                         |
| No. 4 sieve-----  | 0-10                          |

(g) *Storing.* In the event coarse aggregate is stored in stock piles in advance of concreting operations, such stock piles shall be built up by approved methods so that coning or segregation of the material cannot occur.

4-05. *Water for Concrete.* The water used in the mixing of concrete must be clean and free from objectionable quantities of organic matter, alkali, salts, and other impurities which, in the opinion of the contracting officer, might reduce the strength, durability, or other qualities of the concrete.

4-06. *Measurement of cement and aggregate.* (a) *Measurement.* The amount of cement and the amount of each separate size of aggregate entering each batch of concrete shall be determined by direct weighing equipment; provided, that where batches are proportioned so as to contain an integral number of sacks of cement, and the cement is delivered at the mixer in the original unbroken sacks, the weight of the cement contained in each such sack may be taken without weighing as 94 pounds. Said direct weighing equipment shall comply with the following requirements:

(1) The accuracy of the weighing equipment shall conform to the requirements of the United States Bureau of Standards. Spring scales will not be permitted.

(2) The equipment shall weigh each aggregate separately and each unit shall include an under and overweight indicator. The underweight indicator shall indicate the filling of the last 200 pounds of the batch. The overweight indicator shall indicate overweight to a maximum of 50 pounds. Both shall be graduated in a manner at least as legible as 5 pound units indicated by alternate black and white divisions  $\frac{3}{8}$  inch wide with other markings to emphasize 25, 50 and 100 pounds. At the contractor's option approved cumulative weighing equipment may be used instead of the individual weighing equipment herein specified. [4] Said cumulative weighing equipment shall be equipped with a visible dial or equally



suitable device which will accurately indicate scale load at any state of the weighing operation from zero to full load.

(3) The equipment shall be so arranged that the operator may conveniently observe and inspect the operation of the bin gates and also the materials in the weighing hopper. The under and overweight indicators or weighing dials shall be in full view of the operator when he is at the controls.

(4) The equipment shall be capable of ready adjustment for compensating for the varying weight of moisture contained in the aggregates, or for changing the proportionate batch weights.

(5) The equipment shall be so operated as to control the weight of the cement to within one per cent of that specified and the weight of the fine and coarse aggregates to within two per cent of the specified weight for each separate size of aggregate. Automatic weighing and batching equipment shall be used unless the use of manually-operated equipment is authorized by the contracting officer.

(6) The equipment shall be so arranged as to permit the convenient removal of overweight material in excess of the prescribed tolerances.

4-07. *Measurement of water.* The quantity of water entering the mixed shall be measured by a suitable water meter or other measuring device of a type approved by the contracting officer and capable of measuring the water in variable amounts within a tolerance of one per cent. The meter mechanism shall be capable of being locked in position so as to deliver constantly any specified amount of water to each batch of concrete. A positive quick-acting valve shall be used for a cut-off in the water line to the mixer. The operating mechanism must be such that leakage will not occur when the valves are closed. The use of horizontal tanks for the measurement of water will not be permitted.

4-08. *Construction of forms.* (a) Forms shall be of wood, steel or other approved material except that, unless specifically authorized, the sheathing for all exposed surfaces shall be tongue and groove lumber, plywood or fibreboard of uniform width and thickness. All forms shall be true in every respect to the required shape and size, shall conform to the established alignment and grades, and maintain their position and shape under the loads and operations incident to placing and vibrating the concrete. Metal forms shall be accurately made so that similar removable parts will be interchangeable.

The contracting officer may select and/or approve a maximum size of aggregate within the above limits which he considers the most adaptable for the type of constructions being performed or the conditions under which it is to be placed.

4-02. *Water content.* (a) In calculating the total water content in any mix, the amount of moisture carried on the surface of the aggregate particles shall be included. Unless otherwise directed by the contracting officer, the total water content per bag of cement for each batch of concrete shall not exceed the following:

|           |             |    |             |
|-----------|-------------|----|-------------|
| Class "A" | 5.5 gallons | or | 45.8 pounds |
| Class "B" | 6.5 gallons | or | 54.1 pounds |
| Class "C" | 7.0 gallons | or | 58.3 pounds |

(b) *Variation.* In all cases, however, the amount of water to be used shall be the minimum amount necessary to produce a plastic mixture of the strength specified and of the desired density, uniformity and workability. In general, the consistency of any mix shall be that required for the specific placing conditions and methods of placement, and ordinarily the slump shall be between 1½" and 4" when tested in accordance with the current specifications for "Method of Test for Consistency of Portland Cement Concrete," of the American Society for Testing Materials.

(c) *Increase.* An increase in the maximum water content will not be permitted unless comparative tests under job conditions show conclusively that such increase in water content will not result in a decrease in concrete strength and provided further that such increase does not exceed one gallon per cubic yard.

[2] 4-03. *Cement.* All cement used shall be Portland, of American manufacture, conforming to Federal Specification SS-C-191A. All cement delivered to the site of construction shall be in sacks bearing the brand and name of the manufacturer. All cement delivered for any one project shall be all of the same brand. All cement will be furnished to the contractor by the Government.

4-04. *Aggregates.* (a) All aggregates will be furnished the contractor by the Government which shall conform to the following requirements. Fine aggregate

for concrete shall consist of a mixture of equal parts of natural sand and rock dust. Sand shall be composed of clean, hard, strong, durable, uncoated grains, free from shale, salt, lumps, soft or flaky particles and from injurious amounts of dust, alkali, organic matter, loam or other deleterious substances. The sand shall be taken from a part of the beach which has not been recently in contact with salt water.

(b) Beach sand shall be graded in accordance with the following requirements:

| Size of Screen     | Per cent by weight passing |
|--------------------|----------------------------|
| No. 4 sieve.....   | 100%                       |
| No. 100 sieve..... | 0.5%                       |

(c) Coarse aggregate shall consist of gravel or broken stone composed of strong, hard, clean, durable, uncoated pebbles or rock fragments, free from alkali, organic or other deleterious matter. All broken stone or gravel shall be washed and uniformly moistened before batching. The relative amounts of each size of broken stone or gravel to be used in each mix of concrete in all parts of the work will be determined by the contracting officer, and will be based on securing a well-graded aggregate producing concrete having the required workability, density, strength and economy without the use of excess sand, water, or cement.

(d) *Maximum sizes.* For class "A", "B" and "C" concrete, the maximum size mesh screen for the aggregate shall be not less than one-half inch and not more than one and one-half ( $1\frac{1}{2}$ ) inches.

(e) *Grading.* The aggregate shall be separated and graded in accordance with the following requirements and the specified sizes delivered separately to individual proportioning hoppers.

| Size of Screen<br>(Square opening) | Per cent by weight passing |
|------------------------------------|----------------------------|
| $1\frac{1}{2}$ ".....              | 95-100                     |
| $\frac{3}{4}$ ".....               | 0-10                       |

No. 2 Rock ( $1\frac{1}{2}$  inch to  $\frac{3}{4}$  inch size)

| Size of Screen<br>(Square opening) | Per cent by weight passing |
|------------------------------------|----------------------------|
| $\frac{3}{4}$ ".....               | 95-100                     |
| $\frac{3}{8}$ ".....               | 20-45                      |
| No. 4 sieve.....                   | 0-10                       |

No. 3 Rock (3.4 inch to No. 4 mesh size)

(b) *Securing.* Suitable and effective means shall be provided for holding adjacent edges and ends of panels and sections tightly together and in accurate alignment so as to prevent the formation of ridges, fins, [5] offsets, or similar surface defects in the finished concrete. The forms shall be tight, so as to prevent the loss of water, cement, and fines during placing and vibrating of the concrete.

(c) *Number of forms.* Adequate and suitable means for removing forms, without injury to the surface of the finished concrete, shall be provided. Forms shall be of such construction as to permit them to be moved forward rapidly, and a sufficient number of forms of each kind shall be provided to permit the required rate of progress to be maintained.

(d) *Form ties.* When ties extending through the concrete are used to support or to strengthen forms, they shall be so constructed and so removed that no tie other than metal will be left in the concrete, and that no metal tie which extends to within one and one-half inches of any concrete surface shall be left in the concrete.

4-09. *Maintenance of forms.* Forms shall be maintained at all times in good condition, particularly as to size, shape, strength, rigidity, tightness, and smoothness of surface. Before concrete is placed the forms shall be thoroughly cleaned and coated with a non-staining mineral oil or other lubricant approved by the contracting officer. Any excess lubricant shall be satisfactorily removed before placing concrete. Fibre-board and plywood, when used as form facing material, shall be given a coat of shellac before being oiled.

4-10. *Removal of forms.* Directions of the contracting officer as to the removal of forms shall be strictly followed and all such work shall be done with care so as to avoid injury to the concrete. No heavy loading on green concrete shall be



permitted. Immediately upon removal of the forms the concrete surfaces shall be thoroughly wet down and kept wet until the sealing compound is applied or other curing procedure made effective as hereinafter specified. As soon as the forms are removed, the inspector shall carefully examine the surface of the concrete after which any irregularities in the surface shall be repaired as required.

4-11. *Preparing of surfaces for concreting.* (a) Rock surfaces, upon or against which concrete is to be placed, must be free from mud and debris, and shall be thoroughly wetted prior to the placing of any concrete. Earth surfaces after being trimmed and compacted as hereinbefore provided shall be thoroughly wetted by sprinkling prior to the placing of any concrete and these surfaces shall be kept moist by frequent sprinkling up to the time of placing concrete thereon. A moisture penetration of at least 12 inches in sandy soil shall be obtained by the above sprinkling, and not less than 6 inches elsewhere, except where application of water to such a degree causes the soil to become muddy or soggy. The surface shall be free from pools of water at the time of placing concrete.

(b) Unformed concrete surfaces upon or against which concrete is subsequently to be placed and to which new concrete is to adhere shall be cleaned with an air-water jet under pressure sufficient to remove laitance, at such time, as determined by the contracting officer, when the cement film can be washed clean from the mortar and aggregate without dislodging the aggregate. Immediately prior to placing new concrete on old, to which it is to adhere, the surface of the old concrete shall be thoroughly cleaned [6] of all sealing compound and other substances that might prevent a bond with new concrete. It shall then be wetted, and surplus water removed. When, upon inspection, it is the judgment of the contracting officer that any such surface is not in proper condition for bond with the concrete about to be placed, the contractor shall roughen the surface or remove objectionable matter therefrom by wet sandblasting and again clean it before depositing concrete. Wherever concrete is to be placed on hardened concrete, or when starting to fill a deep form, the contact surfaces, after cleaning and wetting as herein provided, shall be coated with a one-inch layer of a mortar of the same ratio of fine aggregate to cement as the concrete used on the job. This mortar shall be scrubbed with wire brooms into the surfaces, upon which new concrete is to be placed, where accessible, before new concrete is placed against them. When the placing of concrete is to be interrupted long enough for the concrete to take its final set, the working face shall be given a shape by the use of forms or other means, that will secure proper union with subsequent work.

4-12. *Exclusion of water.* No concrete shall be deposited under water, nor shall the contractor, without explicit permission, allow still water to rise on any concrete until the concrete shall have attained its initial set. Water in motion shall not be permitted to flow over the surface of any concrete in such manner or at such velocity as will injure the surface finish of the concrete.

4-13. *Mixing.* (a) The cement, sand, and broken stone or gravel shall be so mixed and the quantity of water added shall be such as to produce a homogeneous mass of uniform consistency. Dirt and other undesirable substances shall be carefully excluded. All concrete shall be thoroughly mixed in a batch mixer of an approved type and size, so designed as positively to insure a uniform distribution of all the component materials throughout the mass during the mixing operation. Only sufficient water shall be used in mixing to give a workable mix, conforming to the consistency requirements of Section 4-02. The mixing of each batch shall continue not less than 1½ minutes after all materials, including water, are in the mixer, during which time the mixer shall rotate at the speed for which it has been designed or at such speed as will produce a mass of uniform consistency at the end of the mixing period. Wherever necessary to secure proper results, the concrete shall be mixed for a longer period than herein specified. Overmixing of concrete or overloading of mixers will not be permitted.

(b) *Timing.* A batch timer and counter, including lock, release, and audible indicator, shall be installed and used on each concrete mixer.

(c) *Cleaning.* Hardened concrete or mortar shall not be permitted to accumulate on the inner surfaces of the mixer.

(d) *Addition of water.* Retempering, i. e., remixing, with the addition of water, concrete that has partially hardened, will not be permitted.

4-14. *Placing concrete.* (a) Concrete shall be placed in the work with the least possible delay after mixing, and in no event after it has contained [7] its water content for more than 45 minutes. Only methods of transporting and placing that will deliver into the work concrete of the proper consistency and specified maximum size without separation will be permitted. All ends of

chutes, hopper gates and all other points of concrete discharge throughout any conveying, hoisting, and placing system adopted, shall be so designed and arranged that concrete passing from them shall not be separated in falling into the form receiving it. Adequate headroom provision must be made at such points for a vertical drop and for proper baffling. No chutes or conveyor belts shall be used except as approved by the contracting officer. Chutes longer than 50 feet and conveyor belts longer than 100 feet will not be permitted. Minimum slopes of chutes shall be such that concrete of the specified consistency will readily flow in them. If a conveyor belt is used, it shall be wiped clean by a device operated in such a manner that none of the mortar adhering to the belt will be wasted. All conveyor belts and chutes shall be covered.

(b) *Manner.* Concrete shall not be dropped through reinforcement steel or into any deep form whether reinforcement is present or not, so as to cause separation of the coarse aggregate from the mortar on account of repeatedly hitting rods or the sides of the form as it falls, nor shall concrete be placed in any form in such a manner as to leave accumulations of mortar on the form surfaces above the placed concrete. In such cases hoppers and, if necessary, vertical ducts shall be used in the forms, or other means employed so that the concrete may reach the place of final deposit without separation. Concrete shall be uniformly distributed during the process of depositing, and in no case after depositing shall any portion be displaced in the forms more than 3 feet in a horizontal direction. Concrete in forms shall be deposited in uniform horizontal layers, not deeper than 2 feet, care being taken to avoid inclined layers or inclined construction joints. Each layer shall be placed while the previous layer is still soft. No concrete shall be placed except in the presence of a duly authorized representative of the contracting officer.

4-15. *Power vibrators.* As concrete is placed in the forms it shall be thoroughly settled and compacted throughout the entire depth of the layer which is being consolidated into a dense, homogeneous mass, filling all corners and angles of the forms, thoroughly embedding the reinforcement, eliminating rock pockets and bringing only a slight excess of mortar to the exposed surfaces of concrete during placement. Such settling and compacting shall be accomplished by the use of internally-vibrated, high-speed power vibrators of an approved type in sufficient numbers, with standby units as required, and of sufficient power to compact concrete in the quantities and of the medium consistency herein specified within 15 minutes after being placed. Compaction and consolidation of the concrete shall be obtained by inserting the vibrator for short periods of time at close intervals. Excessive vibration at one point shall be avoided.

4-16. *Finish of formed surfaces.* All finished, formed surfaces shall conform accurately to the shape, alignment, grades and sections as shown on the drawings or as prescribed by the contracting officer. Surfaces shall be free from fins, bulges, ridges, offsets, honeycombing, or roughness of any kind, and shall present a finished, smooth, continuous, hard surface. All sharp angles, where required, shall be rounded or leveled by the use of moulding strips, or suitable moulding or finishing tools.

[8] 4-17. *Treatment of defects on formed surfaces.* (a) As soon as forms are removed, all exposed surfaces shall be carefully examined and any irregularities found in the surface shall be immediately rubbed or ground down in a satisfactory manner so as to secure a smooth uniform and continuous surface. Plastering or coating of surfaces to be smoothed will not be permitted. Shallow defects shall be repaired with gunite or an approved compressed air mortar gun.

(b) *Patching.* Holes left by tie rod cones, and other imperfections shall not be united but shall be repaired in an approved manner with dry packed mortar, prepared from sand and cement identical with that used for the mortar in the concrete at that section, and mixed in the same proportions. Surfaces shall be made smooth and hard by steel troweling and shall receive the same kind and amount of curing treatment as required for concrete in the repaired section.

4-18. *Construction, expansion and contraction joints.* All joints shall be constructed at such points and of such dimensions as may be directed or as shown on the drawings. Vertical joints shall be formed with tongue and groove bonds or keys at such locations and of such shapes and dimensions as approved or directed. Horizontal joints shall be formed with keys, or where horizontal pressure is always in one direction, with steps. Where required, dowel rods shall be used. All concrete in vertical members shall have been in place not less than twelve (12) hours, and longer if so directed, before concrete in horizontal members resting thereon is placed. Before placing is resumed, all laitance and excessive



water shall be removed and the concrete shall be cut away, where necessary to insure a strong, dense concrete at the joint. Except as otherwise specified herein, the surface of existing concrete shall be cleaned and roughened and shall then be spread with a one-half ( $\frac{1}{2}$ ) inch layer of mortar of the same cement-sand ratio as is used in the concrete, immediately before the new concrete is deposited. Steel water stops shall be placed at all construction joints, and in such manner, as to form a water-tight diaphragm. Copper water stops shall be placed at all expansion joints.

4-19. *Embedded items.* Before concrete is placed, all embedded items shall be firmly and securely fastened in place as indicated on drawings. They shall be thoroughly clean and free from coating, rust, scale, oil or other foreign matter.

4-20. *Test specimens.* (a) Test specimens to determine whether the compressive of the concrete is in accordance with that specified in paragraph 4-01 will be taken by the inspector. At least one set of three (3) specimens will be made for every major pour, and in general for every Two Hundred Fifty (250) cubic yards of concrete placed, but in any event a sufficient number of specimens will be taken to give a comprehensive knowledge of the concrete in each section of the work.

(b) *Taking of specimens.* All specimens will be taken from the concrete as it is placed in the forms and in accordance with the current specifications of the American Society for Testing Materials.

4-21. *Trowelled concrete surfaces.* All floor or other surfaces requiring a smooth finish, as specified in the drawings, shall be trowelled [9] to a smooth hard finished surface. Before the concrete has received its initial set, a topping mixture consisting of one part cement to two parts medium coarse sand shall be applied to all surfaces to a depth of one-half inch and smoothly finished. Such topping mix shall be struck off to the true established grade specified, after which it shall be thoroughly compacted and floated by means of wood floats. After such preliminary floating, and the concrete has set sufficiently to prevent separation of materials, the surface shall be steel trowelled until a smooth surface is obtained, free from defects and blemishes.

4-22. *Mastic for joints.* Mastic joint filler shall be constructed as shown on the plans. All mastic shall be of asphalt composition of approved quality and shall be such as to not deform by ordinary handling. Thin strips of stiffener will be allowed.

4-23. *Curing.* (a) The contractor shall protect all concrete from injury until its final acceptance by the Government. All construction joints shall be kept continuously moist, regardless of time, until they are covered with concrete. All other concrete surfaces shall be kept moist in contact with wet burlap for at least two weeks after the forms are removed. Wooden forms shall be wetted immediately before concreting and kept moist until removed. Whenever sealing compound has been applied on surfaces against which concrete is subsequently to be placed, and to which it is to adhere, the said compound shall be entirely removed by wet sandblasting or other approved means just prior to placing of the new concrete.

(b) Interior concrete surfaces to be cured by the water spray method shall be tightly closed off by bulkheads or other means or entirely surrounded by tight inclosures. The surface of the concrete within such bulkheads or inclosures shall be kept moist by an adequate sprinkling or spray system or other suitable means. The sprinkling system or wetting system used shall be provided with jets or nozzles at regular intervals and controlled by readily adjustable, automatic regulating device or devices to regulate the duration of each sprinkling and the period between successive sprinklings as required to keep the surface of the concrete continuously wet but with the smallest possible excess of water. The curing of any interior surfaces by the water spray method as herein specified shall be continued for 14 days following removal of forms.

(c) *Sealing compound method.* Wherever directed, surfaces shall be cured by the sealing-compound method. All surfaces to be cured shall be sprayed thoroughly, completely and uniformly with two coats of a commercial sealing compound, at the rate of not less than one gallon to each 200 square feet of concrete surface for each coat. Application shall be made under pressure of at least 80 pounds per square inch so as to completely seal all surfaces and not to flow off when applied to vertical surfaces. All concrete surfaces to be cured by the sealing-compound method shall be kept wet under wet burlap from the time of stripping of forms or finishing of unformed surfaces, as the case may be, until the application of the first coat of sealing compound as specified above.



5-01. *Reinforcement.* (a) *Bar placing.* Steel reinforcement bars for concrete will be furnished by the Government. Reinforcement steel will be furnished in the form of deformed bars conforming to Type B, Grade 2 of Federal Specifications for "Bars, Reinforcement, Concrete," File QQ-B-71a. All reinforcement shall, when surrounding concrete is placed, be free from rust, scale, grease or other coating which might destroy its bond with concrete. Bending and placing of steel shall be in accordance with drawings furnished or approved by the contracting officer. All reinforcement shall be secured in place, true to lines and grades indicated, by use of approved metal or concrete supports, spacers or ties, or spot welds. Supports shall be of sufficient strength to maintain the reinforcement in place throughout the concreting operation and shall be used in such manner as not to be left exposed to the face of or, in any way, mark or discolor the finished concrete surface.

(b) *Splicing.* Where splices in reinforcement, in addition to those indicated, are necessary, there shall be sufficient lap to transfer the stress by bond, as may be directed. Bars shall be lapped not less than 40 diameters and splices shall be staggered. The lapped ends of bars shall be wired together and connected properly to develop the full strength of the bar.

(c) *Coverage.* All main reinforcement shall be placed three (3) inches from any concrete surface, except as otherwise specifically indicated on the drawings.

## SECTION VI—MISCELLANEOUS METAL WORK

6-01. *Miscellaneous metal work.* (a) *Installation.* All metal parts shall be installed in position and securely fastened prior to the placing of concrete. All metal parts shall be clean, free from all dirt, rust, oil, or other material deleterious to the bonding of the imbedding concrete.

(b) *Doors.* All metal doors shall be installed on the imbedded frame complete with all necessary fastenings, connections and appurtenance for efficient operation and maintenance.

(c) *Painting.* After installation, all exposed metal parts shall be thoroughly cleaned by means of wire brushes, sandpaper or other approved methods, after which they shall be painted in a good and workmanlike manner, with two coats of approved paint furnished by the Government.

## SECTION VII—FENCING

7-01. *Materials.* (a) The fabric for the man-proof fence shall be 2" diamond mesh, chain link, and of width as shown on the drawing, and shall be [11] made of copper bearing steel wire of No. 9 gauge, with edges twisted and barbed finish. The fencing shall be galvanized after weaving.

The steel wire shall develop unit tensile strength of not less than 85,000 pounds per square inch.

The fencing shall conform in every respect to A. S. T. M. Specification Serial A 117-33 for "Zinc-coated Iron or Steel Chain Link Fence Fabric Galvanized After Weaving", and shall be in continuous lengths of one hundred (100) feet. It shall be similar and equal to Cyclone Invincible Fence, U. S. Steel Cyclone Fence Co. Catalog 107.

(b) *Barbed wire top strands.* Barbed wire used in the construction shall be in accordance with Federal Specification No. RR-F-221, as amended for "Fencing; Wire (barbed, netting and woven) Black and Galvanized." Type A Barbs shall be 4 pounds and spaced 6 inches apart.

(c) *Fence posts.* All line posts shall be two inches (2") outside diameter copper bearing steel tubing weighing not less than 2.72 pounds per linear foot galvanized inside and out by the hot dipped method in conformity with A. S. T. M. Specification No. A-123-33.

In lieu of the tubing specified, two and one-fourth inch (2¼") H-shaped sections of copper-bearing steel, weighing not less than 4.10 pounds per linear foot, galvanized as specified, may be used. All other posts except swing gate posts, shall be as specified for line posts except that three inch (3") diameter tubing weighing not less than 5.79 pounds per linear foot shall be used.

Single swing gate posts used for single swing gates wider than six feet (6') up to and including a thirteen-foot (13') opening shall be four-inch (4") tubing weighing not less than 9.1 pounds per linear foot.

Single swing gate openings used for single swing gates wider than thirteen feet (13') shall be 6 $\frac{5}{8}$ " diameter tubing weighing not less than 18.97 pounds per linear foot.

(d) *Angle brackets.* All intermediate fence posts shall be fitted with pressed steel angle brackets to support three (3) strands of barbed wire. All end and corner posts shall be fitted with heavy malleable iron angle brackets. All brackets shall incline outward at an angle of 45 degrees from the vertical and shall be of sufficient length that the top wire of the angle brackets, when mounted to the fence post, shall position the top barbed wire twelve inches (12") above the fabric and twelve inches (12") out from the fence line.

(e) *Bracing.* Gates and corner posts shall be braced with galvanized tubing 1 $\frac{5}{8}$ " in diameter, weighing not less than 2.27 pounds per foot. Gate posts shall be reinforced with auxiliary braces as shown on the drawings.

(f) *Tops.* All fence posts except those capped for and/or with angle brackets shall be capped with galvanized malleable iron fittings to exclude moisture.

[12] (g) *Top rail.* Top rail shall be 1 $\frac{5}{8}$ " outside diameter seamless copper-bearing tubing weighing not less than 2.27 pounds per foot, galvanized as specified in subparagraph (c) hereof.

(h) *Tension bars.* Tension bars shall be copper-bearing steel, three-quarters inch ( $\frac{3}{4}$ " wide, one-fourth inch ( $\frac{1}{4}$ " thick, galvanized as specified in subparagraph (c) hereof.

(i) *Brace and tension bars.* Brace and tension bars shall be of an approved type, galvanized as specified in subparagraph (c) hereof.

(j) *Gates.* Gates shall be fabricated as shown on the drawings for framed tubings and shall be of two-inch (2") diameter copper-bearing seamless tubing weighing not less than 2.72 pounds per foot and galvanized as specified in subparagraph (c) hereof. All intermediate bracing shall be 1 $\frac{5}{8}$ " outside diameter seamless steel tubing, weighing not less than 2.27 pounds per foot, galvanized as specified in subparagraph (c) hereof. Gate fillers shall be of the same fabric as the fence.

(k) *Hinges and latches.* Hinges and latches shall be of an approved design, made of malleable iron forged steel, galvanized as specified in subparagraph (c).

#### SECTION VIII—RAILROAD CONSTRUCTION

8-01. *Materials.* (a) All materials shall be new and unused unless otherwise specified and shall be of the best grade suitable for its intended use. Certified copies of mill inspection certificates shall be furnished for all material mill produced but such certificates will not preclude subsequent rejections of unsatisfactory materials.

(b) *Rails.* All rails shall conform to all the requirements of A. S. T. M. specification, Serial Designation A1-39 for "Open Hearth Carbon, Steel Rails." All rails shall be furnished free from kinks, crooks, or excessive rust and shall be sawed at the ends and furnished in standard mill lengths. Rails which are badly rounded or which have crystallized or which have line or surface bends will be rejected.

(c) *Track bolts.* All track bolts and nuts shall conform to the requirements of A. S. T. M. specifications, Serial Designation A-766-33.

(d) *Spring washers.* All spring washers shall conform to the requirements of appropriate A. R. E. A. specifications.

(e) *Tie plates.* All tie plates shall be standard A. R. E. A. construction conforming to the requirements of A. S. T. M. specifications, Serial Designation A-67-33.

(f) *Spikes.* All track spikes shall conform to the requirements of A. S. T. M. specification, Serial Designation A-65-33.

(g) *Joint bars.* All joint bars shall conform to the requirements of A. R. E. A. specification for "Quenched carbon, Steel Joint Bars" or [13] A. S. T. M. specification, Serial Designation A-4-14.

8-02. *Track laying.* (a) Lining and spacing of cross ties. (1) *Number required.* Ties shall be laid at the spacing as specified on the drawings.

(2) *Lining ties.* The ends of all ties shall be lined parallel and equal distance from the center line of track except in the case of switch ties which shall be lined as directed by the contracting officer.

(3) *Joint and intermediate ties.* The ties of better quality shall be used at all rail joints and on curves and shall be evenly spaced from center to center



with the exception of the switch ties which shall be spaced as directed by the contracting officer.

(b) *Placing ties.* Ties shall be placed with the widest heartwood side face down, square to the line of rail.

(c) *Adjoining ties.* Only sufficient adjoining shall be done to obtain a true bearing for the entire section of the laid rail.

(d) *Tie plugs.* Spikes shall, insofar as possible, not be withdrawn after once driven. If necessary to withdraw spikes, the holes made by such withdrawn spikes shall be immediately plugged so as to completely and tightly fill the hole made by the withdrawn spike. In re-driving spikes for any tie where spikes have been withdrawn and holes plugged, the tie shall first be turned before any new spikes are driven.

(e) *Rail braces.* On all curves, rail braces shall be installed on the outside of rail along the outside rail of the curve, for each tie, and shall be so placed to provide full bearing against the outside surface of the rail. Rail braces shall be double spiked.

(f) *Laying rail.* (1) *Unloading.* Rails shall be unloaded, stored and distributed along the track roadbed in such a manner to prevent any injury to any rail. Dropping of rails in unloading will not be permitted. Rails with sharp crooks or with kinks, or with any other defects which might impair their strength, shall not be laid but shall be removed from the site of the construction as ordered by the contracting officer. All rails shall be laid one at a time and all rail ends shall be brought square together and shall be toled before being spiked. They shall be so laid that the joints in one rail shall be opposite the middle of the rail in the opposite line.

(2) *Bolting.* All bolting shall be uniformly alternated from inside to outside of each joint. All connections shall be made with four bolts, each equipped with one spring washer and nut. Track bolts shall be installed when the track is laid and the nuts shall be turned snug after which bolting shall be tightened three times; the first after the track has been laid to true alignment; secondly, after it has been raised on ballast, and, finally, just prior to final completion. The fishing spaces for rails shall be swabbed with heavy oil before bolting.

(3) *Gauging.* One line of track shall be laid and spiked before the opposite line is gauged to true spaced intervals, as herein specified. Standard gauge for track tangents shall be 3'-0" and all track must be gauged before spiking. On curves, track shall be gauged as provided in the hereinafter schedule:

|      |  |
|------|--|
| [14] | Curves of 5-6°—widen gauge $\frac{1}{8}$ "   |
|      | Curves of 7-8°—widen gauge $\frac{1}{4}$ "   |
|      | Curves of 9-10°—widen gauge $\frac{3}{8}$ "  |
|      | Curves of 11-12°—widen gauge $\frac{1}{2}$ " |
|      | Curves of 13-14°—widen gauge $\frac{5}{8}$ " |
|      | Curves of 15-16°—widen gauge $\frac{3}{4}$ " |

When gauging track on curves, proper alignment should be maintained on the outside rail and the extra width of gauge applied to the inside rail. Where gauge is widened on curved track, metal frogs should be attached to the track gauge or iron shims used to insure uniformity. Where frogs are located on the inside of main track curves, the gauge of the track at the frog shall be maintained at standard gauge. Where frogs are located on the outside of curves, which require extra gauging width, the width of the flange way between the guard rail and the adjoining main track rail must be increased as much as the extra gauge.

(g) *Tie plates.* The contractor shall install standard 60 pound tie plates on all ties for all rail. Each tie plate shall be punched with four  $\frac{11}{16}$ " square holes. All tie plates shall be so installed as to have a true even bearing for their entire surface on all ties. All rails shall be gauged prior to the installation of any tie plates and no tie plate shall be used as a rail brace or shim. When spiking is completed, the outer shoulder of each tie plate shall have a full bearing against the base of the rail.

(h) *Spiking.* All tracks shall be spiked to the tie with one spike inside of rail and one spike outside. Spikes shall be started vertically in driving, spaced one-half their width from the base of the rail and shall then be driven straight with the face of the spike in contact with the rail to permit full bearing of the spike head on the base of the rail. All rails must be fully spiked, four spikes to each tie, which shall be driven carefully to provide the bearing above specified and



shall not be bent over the rail. Spikes should be staggered, the outside spikes of both rails being placed on one side of the tie and the inside of the spikes on the other side.

8-03. *Ballasting and surfacing.* All ballasting shall be evenly spread to cross section specified and shall have sufficient running surface to prevent bending or distortion of rails. All track being ballasted shall be maintained in true alignment. Both rails shall be raised uniformly at the same time by means of picks or other approved methods. In using jacks, care shall be taken that jacking shall be done close enough together to prevent bending of rail or springing of joint. Ballast shall be tamped uniformly for the entire length of tie. Tamping shall be performed from outside end of ties to one foot inside of rail. Joint ties shall be tamped last. When track has been laid and sufficiently tamped and properly compacted, the final tamping shall be made by jacking the track to final grade as specified and ballast thoroughly driven under and around each tie for their entire length by means of tamping machines, tamping picks or tamping bars. The ballasting shall be to true surface grade as shown on the drawings. After final ballasting, the entire track section shall be dressed to true section [15] as shown on the drawings, by means of templates. The edge of ballast shall be shaped to true line against form boards by means of shovels or forks and all ballast shoulders shall be uniformly shaped and compacted. The ballast shall be applied flush with top of ties in the center of track and slope each way towards the sides leaving the ends of ties exposed as shown on the drawings.

8-04. *Turnouts.* Turnouts shall be installed at the locations as shown on the drawings and/or as staked in the field. All frogs, switches, switch plates, switch rods, switch stands and all other necessary appurtenances shall be constructed and/or installed to provide efficient operation at all times of all turnout assemblies. Turnout curves shall be properly lined in true position by means of offset measurements from the main track rail. Stock rails shall be given a bend or set at the vertex of the switch  $6\frac{3}{8}$ " ahead of the actual switch point and the switch shall be so installed to allow for  $4\frac{5}{8}$ " throw. Frogs shall be installed of rigid, self guarded type of bolt design, of the length and size necessary for proper installation. Switches shall be of the size, dimension and section to adequately serve their purpose and shall be installed in accordance with general A. R. E. practice. All switches shall have installed in conjunction, suitable for efficient use, a low switch stand of heavy construction, equipped with an adjustable throw, positive in action and automatic.

8-05. *Connections with main line trackage.* All necessary connections of any construction specified herein with main line trackage shall be cut in and constructed under the direction and to the satisfaction of the contracting officer.

8-06. *Construction of track at firing position.* Firing position locations shall have a subgrade prepared and ballast laid as herein provided. After the subgrade has been ballasted and the ties laid as shown on the drawings, the entire roadbed shall have provided over and around the ballast and extending in slopes a selected fill embankment. Such embankment shall be of the section and grade as shown on the drawings and shall be made with clean, select material suitable for compacting properly as directed by the contracting officer.

8-07. *Installation of track bumpers.* At the end of each track run there shall be placed a track bumper as shown on the drawing or as directed by the contracting officer.

8-08. *Highway crossings.* Where the main lead track crosses the highway, such crossing shall be constructed as indicated on the drawings and as staked in the field. The approaches shall be graded to the elevations shown on the drawing and the subgrade shall be rolled with a suitable power roller prior to placement of crushed stone. Excessive material excavated from the approaches shall be disposed of as directed by the contracting officer. After preparation of subgrade, a base course of broken stone shall be placed to the satisfaction of the contracting officer.

After the broken stone base course has been thoroughly consolidated and the installation of the track has been completed, all pavement removed from the track crossing shall be restored in such a manner as to provide a true [16] section joining the undisturbed highway pavement. The reconstructed pavement shall be of a gradient to permit proper alignment with the track rail and the

entire highway surface shall be replaced to provide a surface across the tracks equal to that existing prior to any work being performed under this contract. After the base course has been reconstructed it shall be surfaced with asphaltic concrete wearing surface satisfactory to the contracting officer.

8-09. *Crossing tracks of other ownership.* The contractor shall reconstruct the trackage of other ownership at the location where the main load track specified crosses such track. The track shall be removed and reconstructed to the alignment, dimension, section and grade as shown on the drawing. All materials removed from the existing trackage shall be incorporated in the reconstruction of the crossed track. Materials unsuitable for use in reconstruction shall be removed and disposed of as directed by the contracting officer, and new materials necessary for proper installation as herein specified shall be provided and installed.

ARMY PEARL HARBOR BOARD NUMBER NO. 467

Contract No. W-44-eng-002  
Supplemental Agreement No. 2

[Stamp: ] Office Chief of Engineers, Jun 30 1941,  
600.1 (Hawaii Dept. Airfield) 59/2

SUPPLEMENTAL AGREEMENT

This supplemental agreement entered into this 23rd day of May, 1941, by and between the UNITED STATES OF AMERICA, hereinafter called the Government, represented by the contracting officer executing this agreement, and Hawaiian Constructors, a joint venture consisting of W. K. Callahan Construction Company, a Nebraska corporation, Gunther & Shirley Company, a Nebraska corporation, and Hehl-Connelly Company, a Nevada corporation, joint contractors and co-venturers, and Ralph E. Woolley, an individual operating as Ralph E. Woolley, of the City of Honolulu, in the Territory of Hawaii, hereinafter called the contractor, WITNESSETH THAT:

WHEREAS, On the 20th day of December, 1940, the Government and Hawaiian Constructors entered into Contract No. W-44-eng-002, for the construction of works of National Defense at locations within the Hawaiian Islands, which contract was subsequently modified by Supplemental Agreements entered into March 22, 1941, and May 5, 1941, hereinafter referred to as the first Supplemental Agreement and Supplemental Agreement No. 2, respectively, and

WHEREAS, It is found advantageous and in the best interests of the United States to modify the said contract, as modified by the said first Supplemental Agreement and Supplemental Agreement No. 2, for the following reasons: The skill, experience and resources of an additional general and building contractor can be advantageously used in expediting the construction of works of National Defense in the Hawaiian Islands;

Now, THEREFORE, The said contract, as modified by the said first Supplemental Agreement and Supplemental Agreement No. 2, is hereby further modified in the following particulars, but in no others:

(2) Ralph E. Woolley, General and Building Contractor, operating as an individual of the City of Honolulu, Territory of Hawaii, is joined as co-venturer with W. K. Callahan Construction Company, a Nebraska Corporation, Gunther & Shirley Company, a Nebraska Corporation, and Hehl-Connelly Company, a Nevada Corporation, to constitute a joint venture and to act both jointly and severally, under the name of Hawaiian Constructors, as contractor in the performance of the said Contract.

THIS SUPPLEMENTAL AGREEMENT shall be subject to the favorable recommendation of the Chief of Engineers and approval of the Under Secretary of War.