

by the engineer is not sufficient, the splicing, including labor, equipment and material, shall be paid for on the basis of extra work unless a contract item is provided to cover the payment.

Brackets, plates or other reinforcement on steel piles required by the engineer in addition to those shown on the plans will be paid for as extra work.

If not covered by a contract item, metal shoes for piling, ordered by the engineer, will be paid for at cost delivered to the site, plus 15 per cent.

No additional allowance, or adjustment, will be made in the contract prices for furnishing or driving piling because of these additional requirements.

2. 3. 19.—PAYMENT FOR TEST PILES.

Test piles ordered by the engineer shall be paid for as follows:

If piles are used in the structure as a result of the test, the test piles shall be paid for as in the case of other piles.

If, however, piling is not used in the structure, the test piles will be paid for as provided for extra work, due consideration being given to the cost of bringing the pile driver to the site and removing it from the work.

2. 3. 20.—PAYMENT FOR LOADING TESTS.

Payment for loading tests shall include the cost of all material, equipment and labor incidental to making the loading test or tests as directed by the engineer, or as specified in the special provisions. Payment shall be made on the basis of the contract price for pile loading tests, or, in the absence of such a price, shall be made on the basis of extra work.

Section 4.—Concrete Masonry

2. 4. 1.—GENERAL.

Concrete masonry shall consist of portland cement, aggregates and water which shall conform to the requirements of division IV and which shall be proportioned as hereinafter specified.

2. 4. 2.—CARE AND STORAGE OF CONCRETE AGGREGATES.

The handling and storage of concrete aggregates shall be such as to prevent segregation or the admixture of foreign materials; the engineer may require that aggregates be stored on separate platforms at satisfactory locations.

When specified in the special provisions, the coarse aggregate shall be separated into two or more sizes in order to secure greater uniformity of the concrete mixture. Different sizes of aggregate shall be stored in separate stock piles sufficiently removed from each other to prevent the material at the edges of the piles from becoming intermixed.

2. 4. 3.—STORAGE OF CEMENT.

All cement shall be stored in suitable weatherproof buildings which will protect the cement from dampness. These buildings shall be placed in locations approved by the engineer. Provision for storage shall be ample, and the shipments of cement as received shall be separately stored in such a manner as to provide easy access for the identification and inspection of

each shipment. Storage buildings shall have a capacity for the storage of a sufficient quantity of cement to allow sampling at least 12 days before the cement is to be used. Stored cement shall meet the test requirements at any time after storage when a retest is ordered by the engineer.

On small jobs, storage in the open may be permitted by written authorization from the engineer, in which case a raised platform and ample waterproof covering shall be provided.

When required by the terms of the contract, the contractor shall keep accurate records of the deliveries of cement and of its use in the work. Copies of these records shall be supplied to the engineer in such form as may be required.

2. 4. 4.—CLASSES OF CONCRETE.

Ten classes of concrete are provided for in these specifications, five classes of non-air-entrained concrete and five corresponding classes of air-entrained concrete. Each class of concrete shall be used in that part of the structure where called for on the plans or where designated by the engineer. The classes are as follows:

Non-air-entrained concrete	Air-entrained concrete
Class A	Class A (AE)
Class B	Class B (AE)
Class C	Class C (AE)
Class X	Class X (AE)
Class Y	Class Y (AE)

The following requirements shall govern unless otherwise shown on the plans:

Class A or Class A (AE) concrete shall be used for all superstructures, except as noted below, and for reinforced substructures except where the sections are massive and lightly reinforced. The more important items of work included are slabs, beams, girders, columns, arch ribs, box culverts, reinforced abutments, retaining walls, reinforced footings, precast piles and cribbing. Concrete deposited in water shall be Class A with 10 per cent additional cement. Class A (AE) shall be used in all locations where the concrete will be exposed to severe or moderate natural weathering (alternate freezing and thawing) as well as in concrete exposed to salt water action.

Class B or Class B (AE) concrete shall be used in mass footings, pedestals, massive pier shafts, gravity walls, with none or only a small amount of reinforcement.

Class C or Class C (AE) concrete shall be used in massive unreinforced sections.

Class X or Class X (AE) concrete shall be used in massive sections, lightly reinforced where a higher grade than Class B or Class B (AE) is required.

Class Y or Class Y (AE) concrete shall be used in thin reinforced sections, for handrails except as specified for precast railing under "Railings" and for filler in steel grid floors. Class Y (AE) shall be used in all

locations where the concrete will be exposed to severe or moderate weathering (alternate freezing and thawing).

ARTICLE 2. 4. 5.—COMPOSITION OF CONCRETE.

The cement content, coarse aggregate size, consistency, air content (in the case of AE mixes) and the approximate weights of fine and coarse aggregate (saturated surface-dry basis) for each class of concrete shall be as follows:

Class of Concrete	Cement Content	Coarse Aggregate Size	Consistency (range in slump)		Air Content (range)	Approximate Weights (saturated surface-dry) of Fine and Coarse Aggregate per sack (94 lbs.) of cement					
			Vi-brated	Non-vi-brated		Rounded Coarse Aggregate		Angular Coarse Aggregate			
						Fine Lbs.	Coarse Lbs.	Fine Lbs.	Coarse Lbs.		
A	6.0	1 in.-No. 4	2-4	3-5	---	220	310	235	275		
A (AE)	6.0	1 in.-No. 4	2-4	3-5	4-7	200	310	215	275		
B	4.5	2 in.-No. 4	1-2	2-3	---	265	485	290	440		
B (AE)	4.5	2 in.-No. 4	1-2	2-3	3-6	245	485	270	440		
C	3.5	2½ in.-No. 4	1-2	2-3	---	345	640	380	590		
C (AE)	3.5	2½ in.-No. 4	1-2	2-3	3-6	315	640	350	590		
X	5.5	2 in.-No. 4	1-2	2-3	---	205	400	230	360		
X (AE)	5.5	2 in.-No. 4	1-2	2-3	3-6	185	400	205	360		
Y	7.0	½ in.-No. 4	2-4	3-5	---	215	200	220	185		
Y (AE)	7.0	½ in.-No. 4	2-4	3-5	6-9	200	200	205	185		

The weights of fine and coarse aggregate given in the above table are based on the use of aggregates having bulk specific gravities, in a saturated surface-dry condition, of $2.65 \pm .05$. In the case of blast furnace slag, the bulk specific gravity, unless determined on the particular material being used, may be assumed to be 2.25. For reasonably well-graded materials of normal physical characteristics, the use of the above indicated proportions, together with sufficient water to obtain the required consistency, will result in concrete of the specified cement content, plus or minus two per cent. For aggregates having specific gravities outside the ranges indicated above, the weights shall be corrected by multiplying the weights shown in the table by the ratio of the specific gravity of the aggregate to be used and 2.65.

The relative weights of fine and coarse aggregate per sack of cement given in the above table are based on the use of a natural sand having a fineness modulus within the range of 2.70 to 2.90 and methods of placing which do not involve high frequency vibration. When sharp, angular manufactured sands or extremely coarsely graded sands are used, the relative amount of fine aggregate should be increased. For finer sands the relative amount of fine aggregate should be decreased. In general, the least amount of sand which will insure concrete of the required workability for the placing conditions involved should be used. Any change in weight of fine

aggregate made by the engineer for the purpose of adjusting workability should always be compensated for by changing the weight of coarse aggregate in the opposite direction by a corresponding amount.

When air-entrained concrete is specified, and an air-entraining admixture is to be used, the engineer shall determine by means of trial batches on the project the amount of admixture required to produce an air content within the range specified. In case an air-entraining cement is to be used the engineer shall determine whether the cement when used in concrete in the required proportions will entrain air in the concrete within the limits specified. In case the air content, thus determined, falls outside the specified range and it is found impossible to obtain the required air content by slight adjustments in the fine-coarse aggregate ratio and/or by changes in mixing procedures, the contractor may, if the air content is too low, use an air-entraining admixture of the same type as that used in the manufacture of the air-entraining cement, in an amount sufficient to bring the air content within the required range. If the air content is too high, the contractor, subject to approval by the engineer, may use a non-air-entraining cement as a replacement for a portion of the air-entraining cement in an amount sufficient to bring the air content within the required range.

2. 4. 6.—SAMPLING AND TESTING.

Compliance with the requirements shown in Section 2. 4. 5 shall be determined in accordance with the following standard methods of the A.A.S.H.O.:

- (a) Sampling Fresh Concrete T 141-49
- (b) Cement Content T 121-45
- (c) Size of Coarse Aggregate T 27-46
- (d) Consistency T 119-42
- (e) Air Content T 152-51
- (f) Bulk Specific Gravity and Absorption (T 84-45) (T 85-45)

Tests for strength (when required) shall be made in accordance with the following:

- (a) Molding Concrete Specimens in the Field T 23-49
- (b) Compressive Strength of Molded Cylinders T 22-49

2. 4. 7.—MEASUREMENT OF MATERIALS.

Materials shall be measured by weighing, except as otherwise specified or where other methods are specifically authorized by the engineer. The apparatus provided for weighing the aggregates and cement shall be suitably designed and constructed for this purpose. Each size of aggregate and the cement shall be weighed separately. The accuracy of all weighing devices shall be such that successive quantities can be measured to within 1 per cent of the desired amount. Cement in standard packages (sack) need not be weighed, but bulk cement shall be weighed. The mixing water shall be measured by volume or by weight. The water measuring device shall be susceptible of control accurate to plus or minus ½ per cent of the capacity of the tank. All measuring devices shall be subject to approval.