

MUNICIPAL DEPARTMENT

CULVERT SPECIFICATIONS.*

(Continued from last issue.)

11. All cement furnished must be of a well and favorably known brand of Portland cement, and shall be approved by the engineer or superintendent in charge of the work. It shall be delivered in barrels or equally tight receptacles, and after delivery must be protected from the weather by storing in a tight building or by suitable covering. The packages shall not be laid directly on the ground, but shall be placed on boards raised a few inches from it.

12. The water employed for mortar shall be fresh and clean, free from mud or other objectionable matter.

13. Mortar shall be composed of two parts of sand and one part of cement, mixed thoroughly dry, and tempered to the required consistency. It shall be used as soon as made, and any mortar that may have "set" while unused shall be wasted. No variations from the above proportions shall be permitted, unless to make the mortar richer when required in special cases. The thorough mixing and incorporation of the materials will be insisted upon. The dry cement and sand shall be turned over and mixed with shovels by skilled workmen not less than ten (10) times before the water is added; after the water is added, the paste shall be again turned over and mixed by skilled workmen not less than six (6) times before it is used. Mortar shall be mixed on a flooring to be provided by the contractor.

14. The centring must be well formed, an exact semi-circle, of ample strength, securely placed in position, and in every respect conform to the requirements of the superintendent. The ribs must not be placed farther apart than three (3) feet. The lagging shall be three (3) inches thick; the supports of centres shall be substantial and well constructed. Centres shall not be struck without permission from the superintendent.

A CEMENT-CONCRETE ARCH CULVERT.

1. The culvert shall be built in accordance with the dimensions indicated upon the plans and drawings hereunto attached, and forming part of these specifications.

2. Concrete referred to in this specification shall be known as "fine concrete" and "rubble concrete." Unless rubble concrete is definitely specified, fine concrete shall be used.

3. The abutments are to be erected within a framework of dressed lumber, closely boarded up against the work as it

proceeds. The centring for the arch must be well formed, an exact semi-circle. The ribs must not be placed farther apart than three (3) feet, and the lagging shall be three (3) inches thick, dressed to the intrados of the arch. The framework, centring and their supports shall be substantial and well constructed, and shall not be removed less than fourteen days from the completion of the work.

4. Fine concrete shall be composed of one part by measure of Portland cement, two parts by measure of sand, and four parts, by measure of broken stone. The concrete shall be mixed in a water-tight box placed close to the work, by first spreading evenly a layer of sand; upon this shall be evenly spread the proportionate quantity of cement, and the two thoroughly mixed in a dry state. To this water shall be added and the whole thoroughly mixed and brought to the consistency of a stiff mortar. The proportionate amount of stone shall then be spread evenly over the mortar, and thoroughly intermixed therewith. The concrete, when mixed as described, shall be immediately put in place and thoroughly pounded and rammed until it is perfectly and uniformly solid, moisture appearing on the surface.

5. Within the body of the abutments of culverts, of not less than four foot span, but not nearer than six inches to the surface in any direction, large stones may be placed by hand in layers. These stones shall be in "rack and pinion" order, and not less than two inches apart. Concrete shall be carefully inserted between the stones thus placed and thoroughly packed and rammed so as to fill all voids. Concrete shall cover each layer of stones to a thickness of half the depth of the stones, when another layer of stones may be placed. A facing of concrete is at all times to be kept at least six inches higher than the rubble concrete; and shall be united with the rubble concrete so as to form a continuous and solid mass. This outer rim of concrete shall precede the placing of the rubble work within, and shall be placed around the interior of the casing to a height of nine inches and a thickness of six inches. It is to be thoroughly pounded so that no cavities shall remain when the outside casing is removed. In no instance is the rubble con-

crete to extend higher than one foot below the top of the abutment, which top of the abutment shall be finished with fine concrete. The rubble stone is not under any circumstance to extend into the arch.

(6) All cement employed in the work must be of a favorably known brand of Portland cement, and approved by the superintendent in charge of the work. It shall be delivered in barrels or equally tight receptacles, and after delivery must be protected from the weather by storing in a tight building or by suitable covering. The packages shall not be laid directly on the ground, but shall be placed on boards raised a few inches from it.

(7) The stone used shall be granite, quartzite, fine grained limestone, or other equally strong and durable stone, care being taken to exclude soft limestone, friable sand stone, and stone affected by the atmosphere. It shall be broken into varying sizes, the largest to pass any way through a two inch ring. The sand used shall be clean, sharp, silicious and of varying sized grain. The water used shall be clean and care shall be taken not to use an excessive amount, the concrete when mixed and ready for the work to have the consistency of freshly dug earth.

(8) When gravel is used instead of broken stone, it shall be screened to remove all sand and earthy material. If excessively dirty it shall be well flushed to remove loamy matter, the dirty water being allowed to run off; nor shall it contain stones any diameter of which exceeds two inches.

(9) Care should be taken to make the extrados of the arch a smooth, regular surface such as moisture will not find lodgement. All framework and centring shall be of dressed, well fitted lumber, and the concrete shall be perfectly rammed into place so that all surfaces shall be smooth, without cavities, when the casing is removed.

(10) While the work is in progress, it shall be so arranged that a steady supply of mixed concrete shall pass from the mixing box to the point where it is to be placed. At any time when the work is interrupted before its completion, or at the end of the day, a wet covering shall be placed over the last layer of concrete; before the work of depositing the concrete is resumed, this surface shall be thoroughly flushed with water to remove any foreign material which may have gathered thereon. No concrete shall be laid in wet or freezing weather.

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