

912 SHOTCRETE

Shotcrete is a pneumatically placed concrete mix that is also commonly called "gunite".

Shotcrete is a very useful and versatile method of paving flat slabs, vertical walls, and the entire gamut of slopes and shapes between. It is especially suited for constructing warped surfaces around structures. It has been used to construct inlets and outlets to culverts for the purpose of improving the efficiency of the structures. It may also be used successfully to preserve and protect or to enhance the appearance of a concrete wall or other structure providing the concrete is firm and reasonably sound. Construction costs, particularly on curved surfaces, are reduced because complex forms are not normally required. The equipment used is mobile and therefore usable in areas where it might be difficult to operate other types of equipment.

912-3 Construction Requirements

Slopes that are to be gunited are best constructed by overbuilding. That is, fill and compact past the limits of the slope grading, then trim back to the desired grade. The exposed surface must be kept moist to reduce sloughing during construction operations.

The subgrade must be finished accurately to aid in maintaining uniformity in thickness. The subgrade must be damp but not wet in order to avoid having water drawn out of the shotcrete. The areas upon which shotcrete is to be placed are to be checked to see that they have been properly graded and compacted and that joints, wire mesh, side forms, and weep holes have been provided where required.

Welded wire fabric is usually specified for reinforcement. It will be designated in the following manner; 6 x 6 - W1.4 x W1.4 (152 x 152 - MW 9.1 x MW 9.1) which means a 6-inch (152 mm) longitudinal by 6-inch (152 mm) transverse wire spacing using wires having a nominal diameter of 0.134-inch (3.4 mm) and a cross-sectional area of 0.014 in.² (9.08 mm²).

Specifications for wire fabric are to be found in AASHTO M55.

Wire mesh reinforcement must be held in its planned location and adequately supported to prevent appreciable, permanent deflection under the impact of the mortar. Dependence on proper positioning of the wire mesh by pulling it up through the fresh mortar should not be permitted because too often the mesh remains on the subgrade, in which case the reinforcement is ineffective and is subject to rusting.

The success of shotcrete construction depends on having proper equipment, a satisfactory mix, and an experienced operator on the nozzle. An experienced nozzleman can get the best results with the least amount of rebound and filling in of low areas. Uniform pressures are necessary at the mixing tank, on the waterline and at the nozzle. Leaky lines or too long a nozzle line can have adverse effects on the pressure system. Where feasible, the equipment should be moved along the work rather than to use long hoses.

Rebound material may not be reused. The thickness shall be checked frequently. The placing of gauging wires aids in obtaining a uniform thickness and true surface.

Precaution is necessary to see that shotcrete is never subjected to hydrostatic pressure on the underside or backside. Paved slopes should have a cut-off wall at the top so that surface water can be diverted away from the paved slope where feasible. Weep holes, properly placed and spaced, with the proper filter material, are helpful in avoiding failure from hydrostatic pressure.

912-3.06 Quality Control Testing

All materials used to manufacture shotcrete shall be sampled and tested as prescribed for use in concrete.

The specification gives detailed requirements for making shotcrete test specimens. It is important to note that the test method calls for coring a test panel. The test panel is made by shooting the shotcrete onto a flat surface, then trimming the edges back to make the correct sized panel. Cylinders are not used with shotcrete.

912-3.09 Curing

Curing has been neglected in some cases because it was thought that curing was not necessary since the shotcrete does not carry a load and does not need strength. Curing is necessary for the prevention of cracks and to assure a hard, weatherproof surface.

Curing should be performed by one or more of the methods prescribed in the specifications. If the liquid membrane method is used, the Inspector should assure himself that the required amount of material is being used. Due to the normally rough surface texture of shotcrete, it will be necessary to use a heavier application of curing material than that prescribed by the specifications in order to obtain complete coverage of the rough textured surface.

Due to the tendency of the compound to leave extra material on the side of the irregularities opposite the nozzle of the applicator, the second application should be applied from the opposite direction from the first application where feasible.

912-6 Records

The Inspector should record the square yards of area covered with shotcrete in his/her diary each day with the following information; mix design code, type of equipment, length and size of hose, pressures, being utilized. Additional information such as operational problems affecting the quality of the work, any shutdowns, reasons for shutdowns, such as breakdown of equipment, lack of material, insufficient grade, or other reasons should also be noted.

The record must also show that the shotcrete being used meets the applicable specifications. A mix design is to be furnished by the Contractor and verification is needed that the designed mix is being produced.

Temperature records are to be kept, especially when temperatures are close to the specification limits. Whenever air temperatures reach 50 degrees F (10 degrees C), it is necessary to be alert to the possible need for a shut down of the work and/or protective action.

A record of the application rate of curing compound should be kept.