

[505.10.13.](#)

SECTION 505.40 LATEX MODIFIED HIGH EARLY STRENGTH CONCRETE.

505.40.1 Description. This work shall consist of a wearing surface of latex modified high early strength concrete constructed on a prepared surface in accordance with this specification and in accordance with lines, grades, thickness and typical cross sections shown on the plans or as directed by the engineer.

505.40.2 Material. All material shall be in accordance with [Sec 505.10](#), [Division 1000](#), Materials Details and specifically as follows:

Item	Section
Latex Emulsion Admixture	1054
Polyethylene Sheeting	1058
Water	1070

505.40.2.1 With approval of the engineer, a Type HE high-early-strength cement, in accordance with ASTM C 1157, may be used. Type III cement will not be permitted.

505.40.2.2 Coarse aggregate shall be an approved crushed limestone, crushed quartzite, flint chat from the Joplin area, or porphyry in accordance with [Sec 1005](#), Gradation E or Gradation F, except the percentage of deleterious substances shall not exceed the following values, and the sum of percentages of all deleterious substances shall not exceed one percent.

Item	Percent by Weight (Mass)
Deleterious Rock	1.0
Shale and Pyrite	0.2
Chert in Limestone	0.5
Other Foreign Material	0.1

505.40.2.3 Fine aggregate shall be in accordance with [Sec 1005](#) and shall be Class A sand in accordance with [Sec 501](#).

505.40.2.4 With approval of the engineer, other gradations of coarse or fine aggregate may be used, however all quality requirements, including a maximum of 2.0 percent passing the No. 200 for fine and coarse aggregate, shall apply and the maximum aggregate size shall not exceed that of [Sec 1005](#), Grade E aggregate.

505.40.2.5 Pozzoloanic material or Portland pozzolan cements shall not be used.

505.40.2.6 Latex admixture shall be kept in suitable enclosures which will protect it from freezing and from exposure to temperatures in excess of 85 F.

505.40.3 Concrete Mixture.

505.40.3.1 The concrete mixture shall meet the following requirements:

Property	Specific Value
Air Content percent	0 to 6.5
Slump, inches	3 to 6
Percent Fine Aggregate as percent of total aggregate by weight	50 to 55
Cement Content, lb/cu yd min.	658
Latex Emulsion Admixture, gal/cu yd	24.5
Net Water-Cement Ratio, max. Lbs. ^a of water/lbs. of cement	0.40

^aNet water shall be considered the quantity of mixing water added plus the non-solid portion of the latex

emulsion.

505.40.3.2 Chloride permeability shall not be greater than 1000 coulombs when tested in accordance with AASHTO T 277. Tests shall be performed on specimens at 28-days. This test shall be performed on each mixture submitted for approval. The tests are to be performed by a qualified commercial laboratory.

505.40.3.3 The mixture shall be designed to develop a minimum 28-day compressive strength of 4,500 psi.

505.40.3.4 Anti-foam additives as recommended by the latex emulsion manufacturer may be required if the concrete mixture entrained air is above the specified amount.

505.40.3.5 Air-entraining admixtures shall not be added.

505.40.3.6 A set control in accordance with the cement manufacturer's recommendation may be considered.

505.40.3.7 Admixtures containing calcium chloride shall not be used.

505.40.4 Mix Design. The contractor shall submit the mix design to Construction and Materials for approval. The mix design shall be within the limits specified in this provision. The mix design shall also include actual test results for the following information:

- (a) Air.
- (b) Slump.
- (c) Compressive strengths at 4-hours, 8-hours, 12-hours, 24-hours, 7-days and 28-days. Compressive strengths determined using 6 x 12 inch cylinders.
- (d) Results of chloride permeability testing.

505.40.4.1 If other aggregate gradations than standard specifications are utilized, the contractor shall designate the intended target gradation and allowable gradation range for each fraction. The target gradations and allowable gradation ranges will be used for inspection and quality control of the aggregates.

505.40.4.2 Any change in mix design or proportions shall be approved by the engineer.

505.40.5 Testing. Testing will be done in accordance with [Sec 505.10](#), except that the slump test will be conducted 4 to 5 minutes after discharge from the mixer. During the waiting period, concrete shall be deposited on the deck and shall not be disturbed.

505.40.6 Mixing.

505.40.6.1 The concrete shall be volumetrically mixed at the bridge site by a continuous mixer in accordance with [Sec 501](#). In addition to other requirements, the mixer shall provide positive control of the latex emulsion into the mixing chamber, and the latex emulsion shall calibrate to within ± 2 percent of that required. The mixer shall be capable of continuously circulating the latex emulsion and have a flow-through screen between the storage tank and the discharge.

505.40.6.2 The concrete discharged from the mixer shall be uniform in composition and consistency. Mixing capability shall be such that initial and final finishing operations can proceed at a steady pace. Final finishing shall be completed before the formation of a plastic surface film on the surface.

505.40.6.3 The moisture content of aggregates at the time of proportioning shall be such that water will not drain or drip from a sample. Coarse and fine aggregate shall be furnished and handled to avoid variations in the moisture content affecting the uniform consistency of the concrete.

505.40.6.4 Each drum of latex admixture shall be mechanically agitated or hand rolled until thoroughly mixed prior to being introduced into the mixer storage compartment. Latex admixture that is stored in the

mixer storage compartment overnight or during delays in mixing of four hours or more shall be agitated by at least two complete cycles in a continuous circulating pump or by mechanical means in the storage compartment. The flow through screen shall be cleaned immediately prior to beginning proportioning and as often as necessary thereafter. Latex admixtures of different brands shall not be combined together in any manner.

505.40.6.5 The water/cement ratio shall be within 0.02 of that specified in the approved mix design. If adjustments for water content beyond that are necessary, a previously tested and approved mixture shall be used.

505.40.6.6 Prior to placement of concrete in the work, the contractor shall be required to prepare trial batches of concrete for testing. Trial batches shall comply with the limits specified in this provision.

505.40.7 Surface Preparation. Surface preparation shall be in accordance with [Sec 505.10](#) except as specified herein.

505.40.7.1 Prior to scarifying or chipping on concrete adjacent to latex modified high early strength concrete, 24 hours of curing shall elapse. If practical, or unless otherwise shown on the plans, all scarifying by mechanical units shall be completed prior to placing any latex modified high early strength concrete. Areas from which unsound concrete and patches have been removed shall be kept free of slurry produced by wet sawing or wet scarifying by planning the work such that this slurry will drain away from the completed areas of preparation.

505.40.7.2 On both old and new decks within 24 hours before latex modified high early strength concrete placement begins, the entire surface shall be thoroughly cleaned by hydro blasting followed by an air blast in accordance with [Sec 505.10](#).

505.40.8.0 Finishing Equipment.

505.40.8.1 The finishing machine shall be self-propelled with one or more rollers, augers and vibratory pans capable of 1,500 to 2,500 vpm. It shall also be capable of forward and reverse movement under positive control, with a provision for raising all screeds to clear the screeded surface for traveling in reverse. A drag float may be necessary. Any modifications shall be subject to approval from the engineer.

505.40.8.2 Support rails shall be in accordance with [Sec 505.10](#).

505.40.9 Placing and Finishing Concrete. Placing and finishing shall be in accordance with [Sec 505.10](#) except as specified herein.

505.40.9.1 Prior to placement of latex modified high early strength concrete, the cleaned surface shall be thoroughly wetted for a minimum of one hour, then covered with polyethylene sheeting until time of concrete placement. The surface shall be damp at the time the overlay is placed. Any standing water in depressions, holes or areas of concrete removal shall be blown out with compressed air. No free water or puddles of standing water shall exist at the time of placement.

505.40.9.2 Expansion joints and dams shall be formed in the concrete overlay. Formation of the joint by sawing through the overlay will not be allowed.

505.40.9.3 Water shall not be added to the surface of the concrete during finishing. A commercially available evaporation retardant may be used judiciously with a misting device during the finishing process until the wet burlap is applied only to prevent the surface of the concrete from drying out. The evaporation retardant shall not be used to increase surface workability.

505.40.9.4 Texturing shall occur immediately after finishing and before the plastic film forms on the surface. Texturing shall be performed in a manner to prevent pulling the concrete away from an existing vertical face. Care shall be taken not to texture too deep and not to tear the surface.

505.40.9.5 Screed rails and headers shall be separated from the newly placed material by passing a pointing trowel along their inside face. Metal expansion dams shall not be separated from the new overlay. The

trowel cut shall be made for the entire depth and length of rails or headers after the mixture has stiffened sufficiently and shall prevent the concrete from flowing back into the cut.

505.40.9.6 During placement of the overlay, all joints with adjacent concrete shall be sealed with a mortar paste of equal parts cement and fine aggregate, using latex emulsion in lieu of mixing water.

505.40.9.7 The overlay concrete shall be moist cured from the time placed until opened to traffic.

505.40.9.8 The wet cure shall be applied promptly after the concrete has been placed on the deck without deforming the finished surface.

505.40.9.9 Within one hour of covering with wet burlap, a layer of white polyethylene sheeting shall be placed on the wet burlap. The surface shall receive a wet cure until the latex modified high early strength concrete has attained a compressive strength of at least 3,200 psi.

505.40.9.10 The thickness of the overlay shall not exceed 3 inches, unless otherwise approved by the engineer.

505.40.9.11 The finished deck will be examined for cracking. If cracking is found, the engineer will determine whether cracking is detrimental, whether remedial surface repairs are needed or whether the overlay in the cracked area should be removed and replaced. All remedial surface repairs, removal or replacement shall be done by the contractor at the contractor's expense.

505.40.9.12 After placement and curing of the latex modified high early strength concrete, the finished deck will be tested to detect unbonded areas.

505.40.9.13 No surface sealing shall be applied to the latex modified high early strength concrete wearing surface.

505.40.10 Limitations of Operations.

505.40.10.1 No latex modified high early strength concrete shall be placed when the ambient or deck surface temperature is above 85 F. Deck temperature shall be determined in accordance with MoDOT Test Method T20.

505.40.10.2 Since latex modified high early strength concrete may not exhibit bleed water, the probability of plastic shrinkage cracking is increased. At surface evaporation rates above 0.1 pounds per square foot per hour plastic shrinkage cracking is probable and the contractor should take precautions such as erecting windbreaks, lowering the mix temperature or delaying operations until ambient temperatures are lower. Fogging the concrete surface will only be allowed, as provided for in this specification. Surface evaporation rates can be predicted from mix temperature, air temperature, relative humidity and wind velocity using Figure 1 of ACI 308-81 (revised 1986) "Standard Practice for Curing Concrete".

505.40.10.3 A fogging system shall be in-place prior to concrete placement. The fogging system shall consist of pressurized equipment that distributes water at minimum rate of 0.10 gallon per hour per square foot. The fogging system shall apply the fog uniformly over the entire surface of the bridge deck. The fogging system shall produce atomized water that has a droplet with a maximum diameter of 0.003 inches and which keeps the finished deck surface saturated without producing standing water. The contractor shall submit a letter certifying that their fogging system is in accordance with this provision.

505.40.10.4 The fogging system shall be started progressively along the length of the deck, during or immediately after floating.

505.40.10.5 No latex modified high early strength concrete shall be placed at ambient or deck surface temperatures below 45 F. Latex modified high early strength concrete shall be protected to maintain a minimum specified curing temperature of 45 F. The contractor shall provide a method, meeting the approval of the engineer, of monitoring the concrete that demonstrates that the concrete has been maintained above the minimum curing temperature and has been protected from freezing. Any concrete damaged by freezing or which is exposed to a temperature of less than 45 F during the first 8 hours after

placement shall be removed and replaced at the contractor's expense.

505.40.10.6 The temperature of the latex modified high early strength concrete at time of placement shall be between 45 F and 90 F. If either the aggregate or water is heated, the maximum temperature for each shall be 100 F at the time of addition to the mix. Any method of heating during the mixing of concrete may be used provided the heating apparatus will heat the mass uniformly and avoid hot spots which will burn the material. Cement or aggregate containing lumps or crusts of hardened material or frost shall not be used.

505.40.10.7 No vehicle traffic shall be permitted on the latex modified high early strength concrete surface until the latex modified high early strength concrete has attained a minimum compressive strength of 3,200 psi. Compressive strength will be determined by tests conducted in accordance with MoDOT test methods.

505.40.10.8 Concrete shall not be placed adjacent to a parallel surface course which is less than 24 hours old; however, this restriction will not apply to a continuation of placement in a lane or strip beyond a joint in the same lane or strip.

505.40.10.9 Preparation of the area, except scarifying, may be started in a lane or strip adjacent to newly placed surface the day following the surface placement. If this work is started before the end of the curing period, the work will be restricted such that any interference with the curing process is held to the minimum practical time only.

505.40.10.10 Longitudinal construction joints shall be placed between designated traffic lanes. The location of the longitudinal joints shall be subject to the approval from the engineer.

505.40.10.11 Transverse joints in the overlay may be permitted if approval by the engineer. Transverse joints shall be located a minimum of 10 feet from the centerline of bent.

505.40.10.12 A header shall be installed in case of delay in the placement operations exceeding one-half hour in duration. During minor delays of one-half hour or less, the end of the placement shall be protected from drying with several layers of wet burlap.

505.40.10.13 Adequate precautions shall be taken to protect freshly placed concrete from rain. All placing operations shall stop when rain begins. The engineer may order removal of any material damaged by rainfall and such material shall be replaced in accordance with this specification at the contractor's expense.

505.40.11 Removal. Material removal and disposal shall be in accordance with [Sec 505.10](#).

505.40.12 Repair. Repair shall be in accordance with [Sec 505.10](#).

505.40.13 Method of Measurement. Measurement will be in accordance with [Sec 505.10](#).

505.40.14 Basis of Payment. The basis for payment will be in accordance with [Sec 505.10](#).