MISSOURI
HIGHWAYS and TRANSPORTATION COMMISSION

JEFFERSON CITY, MISSOURI

GENERAL PROVISIONS AND
SUPPLEMENTAL SPECIFICATIONS TO 2004
MISSOURI STANDARD SPECIFICATIONS FOR
HIGHWAY CONSTRUCTION

Effective December 1, 2008

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MISSOURI HIGHWAY AND TRANSPORTATION COMMISSION
105 W. Capitol Ave. Jefferson City, MO 65102
1-888-275-6636

Date:_____

Prepared Date:_____

GENERAL PROVISIONS
SECTION 404 NATIONWIDE PERMIT GENERAL CONDITIONS

General Conditions. The following general conditions shall be followed in order for authorization by a Nationwide Permit (NWP) to be valid. Permit authorization from U.S. Army Corps of Engineers (USACE) may have additional conditions that will be binding to the project. The contractor shall refer to the permit authorization letter included in the contract.

1.0 Navigation. No activity shall cause more than a minimal adverse effect on navigation.

2.0 Soil Erosion and Sediment Controls. Appropriate erosion and sediment controls shall be used and maintained in effective operating condition during construction, and all exposed soil and other fills, as well as any work below the ordinary high water mark or high tide line, shall be permanently stabilized at the earliest practical date. Work within waters of the USA shall be performed, when possible, during periods of low-flow or no-flow.

3.0 Aquatic Life Movements. No activity shall substantially disrupt the necessary life-cycle movements of those species of aquatic life indigenous to the waterbody, including those species that normally migrate through the area, unless the activity's primary purpose is to impound water. Culverts placed in streams shall be installed such that low flow conditions are maintained.

4.0 Equipment. Heavy equipment working in wetlands shall be placed on mats, or other measures shall be taken to minimize soil disturbance.

5.0 Regional and Case-by-Case Conditions. The contractor's activity shall comply with any regional conditions that may have been added to the contract by the USACE Division Engineer, (see 33 CFR 330.4(e)), and with any case-specific conditions added by the USACE or by the state in the Section 401 water quality certifications.

6.0 Wild and Scenic Rivers. No activity shall occur in a component of the National Wild and Scenic River System; or in a river officially designated by Congress as a "study river" for possible inclusion in the system while the river is in an official study status; unless the appropriate Federal agency, with direct management responsibility for such river, has determined in writing that the proposed activity will not adversely affect the Wild and Scenic River designation, or study status.

7.0 Tribal Rights. No activity shall impair reserved tribal rights, including, but not limited to, reserved water rights and treaty fishing and hunting rights.

8.0 Endangered Species.

8.1 No activity will be authorized under any NWP that is likely to jeopardize the continued existence of a threatened or endangered species or a species proposed for such designation, as identified under the Federal Endangered Species Act, or that is likely to destroy or adversely modify the critical habitat of such species. Non-federal permittees shall notify the USACE District Engineer if any listed species or designated critical habitat might be affected or is in the vicinity of the project, and shall not begin work on the activity until notified by the USACE District Engineer that the requirements of the Endangered Species Act have been satisfied and that the activity is authorized.

8.2 Authorization of an activity by a NWP shall not authorize the "take" of a threatened or endangered species as defined under the Federal Endangered Species Act. In the absence of separate authorization from the U.S. Fish and Wildlife Service, both lethal and non-lethal "takes" of protected species are in violation of the Endangered Species Act.

9.0 Historic Properties. No contractor activity, that may affect historic properties listed, or eligible for listing, in the National Register of Historic Places, will be authorized until the Commission has complied with the provisions of 33 CFR Part 325, Appendix C.

10.0 Section 404 Conditions. In addition to the General Conditions, the following conditions will apply only to activities that involve the discharge of dredged or fill material into waters of the USA, and shall be followed to maintain authorization by the NWPs.

10.1 Water Supply Intakes. No activity, including structures and work in navigable waters of the U.S. or discharges of dredged or fill material, shall occur in the proximity of a public water supply intake, except where the activity is for repair of the public water supply intake structures or adjacent bank stabilization.

10.2 Suitable Material. No activity, including structures and work in navigable waters of the U.S. or discharges of dredged or fill material, shall consist of unsuitable material such as trash, debris, car bodies, asphalt, etc. Material used for construction or discharged shall be free from toxic pollutants in toxic amounts in accordance with Section 307 of the Clean Water Act.

10.3 Mitigation. The project shall be constructed to avoid and minimize adverse affects to waters of the U.S. to the maximum extent practical at the project site.

10.4 Spawning Areas. Activities, including structures and work in navigable waters of the USA or discharges of dredged or fill material in spawning areas during spawning seasons shall be avoided to the maximum extent practical. Activities that result in the physical destruction of an important spawning area, such as excavation, fill or smother downstream by substantial turbidity, will not be permitted.

10.5 Management of Water Flows. Discharges shall not permanently restrict or impede the passage of normal or expected high flows or cause the relocation of the water, unless the primary purpose of the fill is to impound waters. The structure or discharge of dredged or fill material shall withstand expected high flows.

10.6 Adverse Effects from Impoundments. If the activity creates an impoundment of water, adverse effects on the aquatic system caused by the accelerated passage of water and/or the restriction of the water's flow shall be minimized.

10.7 Waterfowl Breeding Areas. Activities into breeding areas for migratory waterfowl shall be avoided.

10.8 Removal of Temporary Fills. Any temporary fills shall be completely removed entirety, and the affected areas shall be returned to the pre-existing elevation.

10.9 Section 404 Nationwide Permit No. 3.

10.9.1 The repair, rehabilitation, or replacement of any previously authorized, currently serviceable, structure or fill, or of any currently serviceable structure or fill authorized by 33 CFR 330.3, provided that the structure or fill is not to be put to uses differing from those uses specified or contemplated for the fill in the original permit or the most recently authorized modification. Minor deviations in the structure's configuration or filled area, including those due to changes in material, construction techniques, or current construction codes or safety standards necessary to make repair, rehabilitation, or replacement will be permitted, provided the environmental effects resulting from such repair, rehabilitation, or replacement are minimal. Currently serviceable shall mean useable as is or with some maintenance, but not so degraded as to essentially require reconstruction. The NWP authorizes the repair, rehabilitation, or replacement of those structures or fills destroyed or damaged by storms, floods, fire or other discrete events, provided the repair, rehabilitation, or replacement is commenced or under contract to commence within two years of the date of the destruction or damage. In cases of catastrophic events, such as hurricanes or tornadoes, this two-year limit may be waived by the COE District Engineer, provided the permittee can demonstrate funding, contract, or other similar delays.

10.9.2 Discharges of dredged or fill material, including excavation, into all waters of the US to remove accumulated sediment and debris in the vicinity of, and within, existing structures, such as bridges, culverted road crossings, water intake structures, etc., and the placement of new or additional rip rap to protect the structure, provided the permittee notifies the COE District Engineer in accordance with General Condition 13. The removal of sediment shall be limited to the minimum necessary to restore the waterway in the immediate vicinity of the structure to the approximate dimensions that existed when the structure was built, but cannot extend further than 200 feet (60 m) in any direction from the structure. The placement of riprap shall be the minimum necessary to protect the structure or to ensure the safety of the structure. All excavated material shall be deposited and retained in an upland area unless otherwise specifically approved by the COE District Engineer under separate authorization. Any bank stabilization measures not directly associated with the structure will require a separate authorization from the COE District Engineer.

10.9.3 Discharges of dredged or fill material, including excavation, into all waters of the U.S. for activities associated with the restoration of upland areas damaged by a storm, flood, or other discrete event, including the construction, placement, or installation of upland protection structures and minor dredging to remove minor obstructions in a water of the U.S. The NWP applies to activities in waters of the U.S. associated with the replacement of the uplands. The restoration of the damaged areas shall not exceed the contours, or ordinary high water mark, that existing before the damage. Minor dredging to remove obstructions from the adjacent waterbody shall be limited to 50 cubic yards (38 m^3) below the plane of the ordinary high water mark, and shall be limited to the amount necessary to restore the pre-existing bottom contours of the waterbody. The dredging shall not be done primarily to obtain fill for any restoration activities. This permit cannot be used in conjunction with NWP 18 or NWP 19 to restore damaged upland areas. This permit does not authorize new stream channelization or stream relocation projects. Any work authorized by this permit shall not cause more than minimal degradation of water quality, more than minimal changes to the flow characteristics of the stream, or increase flooding.

10.10 Section 404 Nationwide Permit No. 12. Activities required for the construction, maintenance and repair of utility lines and associated facilities in waters of the U.S. shall be as follows.

10.10.1 Utility lines. The construction, maintenance, or repair of utility lines, including outfall and intake structures and the associated excavation, backfill, or bedding for the utility lines, in all waters of the U.S., provided there is no change in preconstruction contours. A ‘‘utility line’’ will be defined as any pipe or pipeline for the transportation of any gaseous, liquid, liquescent, or slurry substance, for any purpose, and any cable, line, or wire for the transmission for any purpose of electrical energy, telephone, and telegraph messages, and radio and television communication. Material resulting from trench excavation may be temporarily sidecast (up to three months) into waters of the U.S., provided that the material is not placed in such a manner that the material is dispersed by currents or other forces. The COE District Engineer may extend the period of temporary side casting, not to exceed a total of 180 days, where appropriate. In wetlands, the top 6 to 12 inches (150 to 300 mm) of the trench shall be backfilled with topsoil from the trench. Furthermore, the trench shall not be constructed in such a manner as to drain waters of the U.S., such as backfilling with extensive gravel layers, creating a french drain effect. For example, utility line trenches may be backfilled with clay blocks to ensure that the trench does not drain the waters of the U.S. through which the utility line is installed. Any exposed slopes and stream banks shall be stabilized immediately upon completion of the utility line crossing of each waterbody.

10.10.2 Foundations for Overhead Utility Line Towers, Poles, and Anchors. The construction or maintenance of foundations for overhead utility line towers, poles, and anchors in all waters of the U.S., provided the foundations are the minimum size necessary and separate footings for each tower leg (rather than a larger single pad) shall be used where feasible.

10.10.3 Access Roads. The construction of access roads for the construction and maintenance of utility lines, including overhead power lines and utility line substations, in non-tidal waters of the US, provided the discharges do not cause the loss of greater than 1/2 acre (0.20 ha) of non-tidal waters of the U.S. Access roads shall be the minimum width necessary. Access roads shall be constructed so that the length of the road minimizes the adverse effects on waters of the US and as near as possible to preconstruction contours and elevations. Access roads constructed above preconstruction contours and elevations in waters of the U.S. shall be properly bridged or culverted to maintain surface flows. The term ‘‘utility line’’ does not include activities which drain a water of the U.S., such as drainage tile, or french drains; however, it does apply to pipes conveying drainage from another area. For the purposes of this NWP, the loss of waters of the U.S. includes the filled area plus waters of the U.S. that are adversely affected by flooding, excavation, or drainage as a result of the project. Activities authorized by paragraph 1.1 through 1.3 may not exceed a total of 1/2 acre (0.20 ha) loss of waters of the U.S. Waters of the U.S. temporarily affected by filling, flooding, excavation, or drainage, where the project area is restored to preconstruction contours and elevation, is not included in the calculation of permanent loss of waters of the U.S. This includes temporary construction mats (e.g., timber, steel, geotextile) used during construction and removed upon completion of the work. Mechanized land clearing necessary for the construction, maintenance, or repair of utility lines and the construction, maintenance and expansion of utility line substations, foundations for overhead utility lines, and access roads is authorized, provided the cleared area is kept to the minimum necessary and preconstruction contours are maintained as near as possible. The area of waters of the U.S. that is filled, excavated, or flooded must be limited to the minimum necessary to construct the utility line, substations, foundations, and access roads. Excess material shall be removed to upland areas immediately upon completion of construction. This NWP may authorize utility lines in or affecting navigable waters of the U.S. even if there is no associated discharge of dredged or fill material (See 33 CFR, Part 322).

10.11 Section 404 Nationwide Permit No. 13. The following bank stabilization activities will be necessary for erosion prevention provided the activity meets all of the following criteria.

10.11.1 No material is placed in excess of the minimum needed for erosion protection.

10.11.2 The bank stabilization activity is less than 500 feet (150 m) in length.

10.11.3 The activity will not exceed an average of one cubic yard per running foot (2.5 m^3 per running meter) placed along the bank below the plane of the ordinary high water mark.

10.11.4 No material is placed in any special aquatic site, including wetlands. Special aquatic sites include wildlife sanctuaries and refuges, wetland, mudflats, vegetated shallow and riffle and pool complexes.

10.11.5 No material is of the type, or is placed in any location, or in any manner, to impair surface water flow into or out of any wetland area.

10.11.6 No material is placed in a manner that will be eroded by normal or expected high flows (properly anchored trees and treetops may be used in low energy areas).

10.11.7 The activity is part of a single and complete project.

10.11.8 This NWP shall not be used for the channelization of a water of the U.S.

10.12 Section 404 Nationwide Permit No. 14. Activities required for the construction, expansion, modification, or improvement of linear transportation crossings (e.g., highways, railways, trails, airport runways, and taxiways) in waters of the U.S., including wetlands, if the activity meets the following criteria.

10.12.1 The discharge does not cause the loss of greater than 1/2-acre (0.20 ha) of waters of the US.

10.12.2 The width of the fill shall be limited to the minimum necessary for the crossing.

10.12.3 This permit does not authorize stream channelization, and authorized activities shall not cause more than minimal changes to the hydraulic flow characteristics of the stream, increase flooding, or cause more than minimal degradation of water quality of any stream.

10.13 Section 404 Nationwide Permit No. 15. Discharges of dredged or fill material incidental to the construction of bridges across navigable waters of the U.S., including cofferdams, abutments, foundation seals, piers, and temporary construction and access fills provided such discharges have been authorized by the U.S. Coast Guard as part of the bridge permit. Causeways and approach fills will not be included in this NWP and will require an individual or regional Section 404 permit.

10.14 Section 404 Nationwide Permit No. 23. Activities undertaken, assisted, authorized, regulated, funded, or financed, in whole or in part, by another Federal agency or department where that agency or department has determined, pursuant to the Council on Environmental Quality Regulation for Implementing the Procedural Provisions of the National Environmental Policy Act (40 CFR Part 1500 et seq.), that the activity, work, or discharge is categorically excluded from environmental documentation because it is included within a category of actions which neither individually nor cumulatively have a significant effect on the human environment, and the COEUSACE Office of the Chief of Engineers (ATTN: CECW-OR) has been furnished notice of the agency's or department's application for the categorical exclusion and concurs with that determination.

10.15 Section 404 Nationwide Permit No. 33. Temporary structures, work and discharges, including cofferdams, necessary for construction activities or access fills or dewatering of construction sites; provided that the associated primary activity is authorized by the USACE or the U.S. Coast Guard, or for other construction activities not subject to the USACE or U.S. Coast Guard regulations. Appropriate measures shall be taken to maintain near normal downstream flows and to minimize flooding. Fill shall be of materials, and placed in a manner that will not be eroded by expected high flows. The use of dredged material may be allowed if it is determined by the USACE District Engineer that it will not cause more than minimal adverse effects on aquatic resources. Temporary fill shall be entirely removed to upland areas, or dredged material returned to the original location, following completion of the construction activity, and the affected areas shall be restored to the pre-project conditions. Cofferdams shall not

be used to dewater wetlands or other aquatic areas changing the use of these areas. Structures left in place after cofferdams are removed will require a Section 10 permit if located in navigable waters of the U. S. (See 33 CFR, Part 322).

SECTION 401 WATER QUALITY CERTIFICATION CONDITIONS

1.0 Description. When a Clean Water Act Section 404 Nationwide Permit is in effect, the contractor is automatically permitted to perform this work under a Water Quality Certification (Section 401) by the Missouri Department of Natural Resources (MDNR). The contractor shall adhere to the following conditions:

1.1 During construction, clearing of vegetation shall be kept to the minimum necessary to accomplish the project.

1.2 Petroleum products, equipment and solid waste shall not be stored after construction working hours below the ordinary high water mark.

1.3 Equipment shall not be operated, except where permitted, nor petroleum products stored in wetlands.

1.4 Riparian areas and stream banks shall be restored to a stable condition as soon as possible after final contouring.

1.5 Work done in streams shall be conducted during low flows whenever possible.

1.6 Petroleum products spilled into any water of the state, or in areas where material could enter waters of the state, shall be cleaned up immediately and disposed of properly.

1.7 The following material shall not be used for streambank stabilization: earthen fill, gravel, fragmented asphalt, broken concrete with exposed rebar, tires, vehicle bodies and liquid concrete, including grouted riprap.

DISADVANTAGED BUSINESS ENTERPRISE (DBE) PROGRAM REQUIREMENTS

1.0 Disadvantaged Business Enterprise (DBE) Program Requirements. The subsequent Sections will apply only to contracts involving U.S. Department of Transportation (USDOT) federal-aid or federal financial participation. Federal-aid or federal financial participation includes, but is not limited to, any funds directly or indirectly received by MoDOT, or authorized for distribution to or through MoDOT, by the USDOT or any operating administration within the USDOT. These provisions will not apply to Commission contracts funded exclusively with state funds, or state and local funds. Any contractor, subcontractor, supplier, DBE firm, and contract surety involved in the performance of a federal-aid contract shall be aware of and fully understand the terms and conditions of the USDOT DBE Program, as the terms appear in Title 49 CFR Part 26 (as amended), the USDOT DBE Program regulations; Title 7 CSR Division 10, Chapter 8 (as amended), the Commission's DBE Program rules.

2.0 DBE Program Distinguished From Other Affirmative Action Programs. The USDOT DBE Program established by the U.S. Congress is not the same as, and does not involve or utilize, any of the elements or authority of other state or local affirmative action programs, nor does the program rely upon state legislation or gubernatorial executive orders for implementation or authorization, other than the general authority given the Commission in Section 226.150, RSMo. The USDOT DBE Program is implemented by the Commission and MoDOT, through and in conjunction with the FHWA, FTA and FAA, as a "recipient" defined in Title 49 CFR 26.5.

3.0 Policy Regarding DBE Firms. It is the policy of the U. S. Department of Transportation and MoDOT that businesses owned by socially and economically disadvantaged individuals have an opportunity to participate in the performance of contracts financed in whole or in part with federal funds. Consequently, the requirements of 49 CFR Part 26 (as amended) and the Commission's implementing state regulations in Title 7 CSR Division 10, Chapter 8, "Disadvantaged Business Enterprise Program", will apply to any contract with federal funds.

4.0 Opportunity for DBEs to Participate. Each contractor, subcontractor and supplier working on a contract financed in whole or in part with federal funds shall take all necessary and reasonable steps to ensure that DBEs have an opportunity to compete for, and participate in performance on project contracts and subcontracts.

5.0 Required Contract Provision. The federal-aid contract will include the following provision, as mandated by USDOT at Title 49 CFR 26.13(b):

(a) The contractor, subrecipient or subcontractor shall not discriminate on the basis of race, color, national origin, or sex in the performance of the contract. The contractor shall carry out applicable requirements of 49 CFR Part 26 in the award and administration of USDOT-assisted contracts. Failure by the contractor to carry out these requirements is a material breach of the contract, which may result in the termination of the contract or such other remedy, as the recipient deems appropriate.

In this provision, "contractor" will be defined as the contractor on the contract; "subrecipient" will be defined as any subcontractor performing the work. For the purposes of any federal-aid contract awarded by the Commission, "the recipient" will be defined as either the Commission, or MoDOT, or both. The contractor shall include this same contract provision in every supply contract or subcontract the contractor makes or executes with a subrecipient.

6.0 Bank Services. The contractor, and each subrecipient on a federal-aid contract, is encouraged to use the services of banks owned and controlled by socially and economically disadvantaged individuals. Such banking services, and the fees charged for services, typically will not be eligible for DBE Program contract goal credit. Any questions on this subject should be directed to the MoDOT External Civil Rights Administrator. See Sec 7.0.

7.0 DBE Program Information. DBE Program information may be obtained from the MoDOT External Civil Rights Administrator, 105 W. Capitol Avenue, P.O. Box 270, Jefferson City, Missouri 65102-0270. Phone (573) 751-6801, Fax (573) 526-0558, E-Mail: **dbe@modot.mo.gov.** It will be the duty of each contractor, for the contractor and for the contractor's subrecipients and surety, to take the steps necessary to determine the legal obligations and limitations under the DBE Program, as an element of responsibility. It will be the duty of each certified DBE firm to know, understand and comply with the DBE firm's legal obligations and limitations under the DBE Program, as a requirement of program participation. A surety providing a bid or contract bond will be bound by those bonds to the duties of the surety's principal.

8.0 DBE Certification, and the Missouri Unified Certification Program. At present, the only DBE firms eligible to perform work on a federal-aid contract for DBE contract goal credit are firms certified by MoDOT. When the Unified Certification Program (UCP) takes effect in Missouri pursuant to 49 CFR 26.81 and 7 CSR 10-8.061, certification of a firm as a DBE by the Missouri UCP will be equivalent to DBE certification by MoDOT.

9.0 DBE Program-Related Certifications Made By Bidders and Contractors. If the bidder makes a written, express disclaimer of one or more certifications or assurances in the bid, the bid will be considered non-responsive. By submitting a bid on any call involving USDOT federal financial participation, and by entering into any contract on the basis of that bid, the contractor makes each of the following DBE Program-related certifications and assurances to USDOT, to the Commission, and to MoDOT:

(a) The bidder certifies that management and bidding officers have reviewed and understand the bidding and project construction and administration obligations of the USDOT DBE Program regulations at Title 49 CFR Part 26 (as amended), the USDOT DBE Program regulations; Title 7 CSR Division 10, Chapter 8 (as amended), and the Commission's DBE Program rules. The bidder further certifies that the contractors management personnel on the project understand and are familiar with the requirements of these federal and state DBE Program regulations; and if the bidder was not familiar with or did not understand the requirements of these regulations, they have contacted the External Civil Rights Unit of MoDOT and have been informed as to their duties and obligations under the DBE Program regulations by MoDOT staff and/or by USDOT DBE Program staff.

(b) The bidder certifies that the bidder has complied with the federal and state DBE Program requirements in submitting the bid, and will comply fully with these requirements in performing any federal-aid contract awarded on the basis of that bid.

(c) The bidder agrees to ensure that certified DBE firms have a full and fair opportunity to participate in the performance of the contract financed in whole or in part with federal funds. The bidder certifies that all necessary and reasonable steps were taken to ensure that DBE firms have an opportunity to compete for, and perform work on the contract. The bidder further certifies that the bidder not discriminate on the basis of race, color, age, national origin or sex in the performance of the contract, or in the award of any subcontract.

(d) The bidder certifies, under penalty of perjury and other applicable penal laws that if awarded the federal-aid contract, the contractor will make a good faith effort to utilize certified DBE firms to perform DBE work at or above the amount or percentage of the dollar value specified in the bidding documents. The bidder further certifies the bidder's understanding that the bidder may not unilaterally terminate, substitute for, or replace any DBE firm that was designated in the executed contract, in whole or in any part, with another DBE, any non-DBE firm or with the contractor's own forces or those of an affiliate of the contractor, without the prior written consent of MoDOT as set out below.

(e) The bidder certifies, under penalty of perjury and other applicable penal laws that a good faith effort was made to obtain DBE participation in the contract, at or above the DBE participation contract goal. The bidder further certifies, under penalty of perjury and other applicable penal laws, that if the bidder is not able to meet the Commission's DBE contract goal, and if the bidder is not able to meet that DBE contract goal by the time the proposed DBE participation information must be submitted, within three business days after bid opening, the bidder has submitted with and as a part of the bid, a true, accurate, complete and detailed written explanation of good faith efforts to meet the DBE Contract Goal.

(f) The bidder understands and agrees that if awarded the contract the contractor is legally responsible to ensure that the contractor and each DBE subcontractor and supplier, comply fully with all regulatory and contractual requirements of the USDOT DBE Program, and that each DBE firm participating in the contract fully perform the designated tasks, with the DBE's own forces and equipment, under the DBE's own direct supervision and management. The bidder certifies, under penalty of perjury and other applicable penal laws, that if it awarded the contract and if MoDOT or the Commission determine that the contractor, a DBE or any other firm retained by the contractor has failed to comply with the DBE Program requirements or federal or state DBE Program regulations, the Commission, through MoDOT, shall have the sole authority and discretion to determine the extent of the monetary value to which the DBE contract goals have not been met, and to assess against and withhold monetary damages from the contractor in the full amount of that breach. The Commission, through MoDOT, may impose any other remedies available at law or provided in the contract in the event of a contract breach. The bidder further understands and agrees that this clause authorizes the Commission, through MoDOT, to determine and fix the extent of the damages caused by a breach of any contractual or regulatory DBE Program requirement and that the damage assessment will be enforced in addition to, and not in lieu of, any other general liquidated damages clause in the contract. By submitting a bid for a federal-aid contract, and by entering into a contract, the bidder irrevocably agrees to such an assessment of liquidated damages for DBE Program purposes, and authorizes the Commission and MoDOT to make such an assessment of liquidated damages against the contractor, and to collect that assessment from any sums due the contractor under the contract, or any other contract, or by other legal process. The bidder makes this certification, agreement and authorization on behalf of itself, its subcontractors and suppliers, and the bid bond and contract bond sureties, for each federal-aid contract.

(g) The surety upon any bid or contract bond acknowledges the surety is held and firmly bound to the Commission for each and every duty of the surety's principal provided in any bid or contract regarding the DBE program.

10.0 Designation of DBE firms to perform on contract. The bidder states and certifies, under penalty of perjury or other applicable penal laws, that the DBE participation information submitted in the bid or within the stated time thereafter is true, correct and complete and that the information provided includes the names of all DBE firms that will participate in the contract, the specific line item (s) that each DBE firm will perform, and the creditable dollar amounts of the participation of each DBE. The specific line item must reference the MoDOT line number and item number contained in the proposal. The bidder further states and certifies that the bidder has committed to use each DBE firm listed for the work shown to meet the DBE contract goal and that each DBE firm listed has clearly confirmed that the DBE firm will participate in and perform the work, with the DBE's own forces. Award of the contract will be conditioned upon meeting these and other listed requirements of 49 CFR 26.53.

(a) The bidder certifies the bidder's understanding that as the contractor on a contract funded in whole or in part by USDOT federal funds, the bidder may not unilaterally terminate, substitute for, or replace any DBE firm that was designated in the executed contract, in whole or in any part, with another DBE, any non-DBE firm or with the contractor's own forces or those of an affiliate, without the prior written consent of MoDOT. The bidder understands it must receive approval in writing from MoDOT for the termination of a DBE firm, or the substitution or replacement of a DBE before any substitute or replacement firm may begin work on the project in lieu of the DBE firm participation information listed in the executed contract.

(1) The bidder further certifies understanding, that if a DBE firm listed in the bid or approved in the executed contract documents ceases to be certified at any time during the performance of the contract work, and a contract or subcontract with that firm has not yet been executed by the prime and subcontractor, the contractor can not count any work performed by that firm after the date of the firm's loss of eligibility toward meeting the DBE contract goal. However, if the contractor has executed a subcontract with the firm before the DBE lost eligibility and ceased to be a certified DBE, the contractor may continue to receive credit toward the DBE contract goal for that firm's work.

(2) The bidder further certifies understanding, that if a DBE subcontractor is terminated, or fails, refuses or is unable to complete the work on the contract for any reason, the contractor must promptly request authority to substitute or replace that firm. The request shall include written documentation that the DBE firm is unwilling or unable to perform the specified contract work. The contractor shall make good faith efforts to find another DBE subcontractor to substitute or replace the dollar amount of the work that was to have been performed by the DBE firm. The good faith efforts shall be directed at finding another DBE to perform the same, or more, dollar amount of work that the DBE firm that was terminated was to have performed under the executed contract. The substitute or replacement DBE firm may be retained to perform the same or different contract work from that which the terminated firm was to have performed. The contractor shall obtain approval from MoDOT in writing before the replacement or termination of one firm with another before the work will count toward the project DBE goal.

(3) The bidder further certifies the bidder's understanding, that the dollar value of any work completed by a DBE firm prior to approval of the DBE's substitution or replacement, in writing, by MoDOT will not be credited toward meeting the DBE contract goal. The contractor will remain subject to appropriate administrative remedies, including but not limited to, liquidated damages for the full dollar amount that the DBE contract goal is not met. Liquidated damages will also be assessed against the contractor if the original, substitute or replacement DBE firms perform the required contract work, but are not paid in full for some or all of that work by the contractor, including back charges. No credit toward the DBE goal will be given for any amount withheld from payment to the DBE or "back charged" against monies owed to the DBE, regardless of the purpose or asserted debt.

11.0 Good Faith Effort to Secure DBE Services. The bidder shall make a good faith effort to seek DBEs in a reasonable geographic area to where the solicitation for subcontracts and material is made. If the bidder cannot meet the goals using DBEs from that geographic area, the bidder shall, as a part of the effort to meet the goal, expand the search to a wider geographic area.

11.1 Bidding Procedure. The following bidding procedure shall apply to the contract, for DBE program compliance purposes.

11.2 Contract Goal, Good Faith Efforts Specified. The bidder may submit the completed "DBE Identification Submittal" information in the bid documents at the same time as, and within the sealed bid, at the time the bid is submitted. However, if that information is not completed and submitted with the initial sealed bid, then as a matter of responsiveness and responsibility, the apparent low and second low bidder shall file the completed "DBE Identification Submittal" pages with MoDOT on or before 4:00 p.m. of the third business day after the bid opening date, directly to the External Civil Rights Administrator, Missouri Department of Transportation, 105 W. Capitol Avenue, P.O. Box 270, Jefferson City, Missouri 65102-0270. Telefax transmittal to MoDOT will be permitted at fax no. (573) 526-0558. The complete and signed original documents shall be mailed to MoDOT no later than the day of the telefax transmission. No extension of time will be allowed for any reason. The means of transmittal and the risk of timely receipt of the information shall be the bidder's.

11.3 Bid Rejection, Bid Security Disposition. The failure of either the apparent low bidder or the second low bidder to file the completed and executed "DBE Identification Submittal", listing actual, committed DBE participation equal to or greater than the DBE contract goal percentage specified in the bid by 4:00 p.m. on the third business day after the bid opening, will be cause for rejection of that bid, and the bid surety bond or bid guaranty of that bidder will be forfeited to and become the property of the Commission upon Commission demand.

(a) Any bidder rejected for failure to submit the completed and executed "DBE Identification Submittal" information in the bidding documents, with full documentation of sufficient DBE participation to satisfy the DBE contract goal cannot submit a bid on the same, or substantially similar, project, when and if the project is re-

advertised for bids. By submitting a bid on a federal-aid project, the bidder accepts and agrees to this provision, and the disposition of the bidders bid bond or guaranty, on behalf of the bidder and the bidders bid surety or guaranty.

(b) The surety separately acknowledges the surety to be held and firmly bound to the Commission to immediately upon demand pay to Commission the face amount of the bid bond.

11.4 Good Faith Efforts Described. Good faith efforts to meet the DBE contract goal may include, but are not limited to, the following:

(a) Attending a pre-bid meeting, if any, scheduled by the department to inform DBEs of contracting and subcontracting opportunities.

(b) Advertising in general circulation trade association and socially and economically disadvantaged business directed media concerning subcontracting opportunities.

(c) Providing written notice to a reasonable number of specific DBEs so that the DBE's interest in the contract are solicited in sufficient time to allow the firm to participate effectively.

(d) Following-up on initial written notice or solicitations of interest by contacting DBEs to determine with certainty whether the DBEs were interested.

(e) Maintaining documentation of responses received in the effort to solicit DBE participation.

(f) Selecting portions of work to be performed by DBEs to increase the likelihood of meeting the DBE goal, including, where appropriate, breaking down contracts into economically feasible units to facilitate DBE participation.

(g) Providing interested DBEs adequate information about plans, specifications and requirements of the contract.

(h) Negotiating in good faith with interested DBEs, not rejecting DBEs as unqualified without sound business reasons based on a thorough investigation of the DBE's capabilities.

(i) Making efforts to assist interested DBEs in obtaining bonding, lines of credit or insurance required by MoDOT or by the bidder.

(j) Making effective use of available disadvantaged business organizations, minority bidders' groups, local, state and federal disadvantaged business assistance offices, MoDOT and other organizations that provide assistance in the recruitment and placement of DBEs.

11.5 Documentation, and Administrative Reconsideration of the Bidder's Good Faith Efforts. In the bidding documents, the bidder has the opportunity and responsibility to provide certified written documentation as to whether the bidder made a good faith effort to meet the DBE contract goal as proposed by the Commission. Any bidder that has not met the Commission's proposed DBE contract goal at the time of bid opening must submit the completed "Certification of Good Faith Efforts to Obtain DBE Participation". The certification should be included in the bidding documents, fully and in detail, at the time its sealed bid is submitted; however, if that information is not completed and submitted with the initial sealed bid, the bidder must submit the documentation to MoDOT on or before 4:00 p.m. of the third business day after the bid opening date, directly to the External Civil Rights Administrator, Missouri Department of Transportation, 105 W. Capitol Avenue, P.O. Box 270, Jefferson City, Missouri 65102-0270. Telefax transmittal to MoDOT will be permitted at fax no. (573) 526-0558. The complete and signed original documents shall be mailed to MoDOT no later than the day of the telefax transmission. No extension of time will be allowed for any reason. The means of transmittal and the risk of timely receipt of the information shall be the bidder's. The bidder shall attach additional pages to the certification, if necessary, in order to fully detail specific good faith efforts made to obtain certified DBE firm participation in the proposed contract work. If the apparent low bidder appears to have failed to adequately document in the bid that the bidder made a good faith effort to achieve sufficient DBE participation in the contract work, that firm will be offered the opportunity for administrative reconsideration upon written request, before MoDOT and the Commission reject that bid as non-responsive. However, regardless of the DBE contract goal participation level proposed by the bidder, or the extent of good faith efforts shown, the apparent low and second low bidders shall each timely and separately file

their completed and executed "DBE Identification Submittal" or face potential sanctions and the bid bond or guaranty, as specified in Sec 10.0 of these provisions, may become the property of the Commission subject to Commission's demand.

12.0 DBE Participation for Contract Goal Credit. DBE participation on the contract will count toward meeting the DBE contract goal as follows:

(a) The applicable percentage of the total dollar value of the contract or subcontract awarded to the DBE will be counted toward meeting the DBE contract goal, only if that firm is certified by MoDOT as a DBE at the time the contract or subcontract is executed, and only for the value of the work, goods or services that are actually performed, or provided, by the DBE firm itself.

(b) When a DBE performs work as a participant in a joint venture, the contractor may count toward the DBE goal only that portion of the total dollar value of the contract equal to the distinct, clearly defined portion of the contract work that the DBE has performed with the DBE's own forces. The MoDOT External Civil Rights Administrator shall be contacted in advance regarding any joint venture involving both a DBE firm and a non-DBE firm to review and approve the contractor's organizational structure and proposed operation. When a DBE subcontracts part of the work of the contract to another firm, the value of that subcontracted work may be counted toward the DBE contract goal only if the DBE's subcontractor at a lower tier is a MoDOT certified DBE. Work that a DBE subcontracts to a non-DBE firm will not count toward the DBE contract goal. The cost of supplies and equipment a DBE subcontractor purchases or leases from the prime contractor or the prime's affiliated firms, or from another non-DBE subcontractor, will not count toward the DBE contract goal.

(c) The contractor may count expenditures to a DBE subrecipient toward the DBE contract goal only if the DBE performs a commercially useful function (CUF) on that contract.

(d) A contractor may not count the participation of a DBE subcontractor toward the contractor's final compliance with the contractor's DBE contract goal obligations until the amount being counted has actually been paid to the DBE. A contractor may count 60 percent of the contractor's expenditures actually paid for material and supplies obtained from a DBE certified by MoDOT as a regular dealer, and 100 percent of such expenditures actually paid for materials and supplies obtained from a certified DBE manufacturer.

(1) A regular dealer will be defined as a firm that owns, operates, or maintains a store, warehouse or other establishment in which the material, supplies, articles or equipment required and used under the contract are bought, kept in stock, and regularly sold or leased to the public in the usual course of business. To be a regular dealer, the DBE firm shall be an established, regular business that engages, as its principal business and under its own name, in the purchase and sale or lease of the products in question. Packagers, brokers, manufacturers' representatives, or other persons who arrange or expedite transactions will not be considered regular dealers.

(2) A DBE firm may be a regular dealer in such bulk items as petroleum products, steel, cement, gravel, stone or asphalt, without owning, operating or maintaining a place of business where it keeps such items in stock, if the DBE both owns and operates distribution equipment for the products it sells and provides for the contract work. Any supplementation of a regular dealer's own distribution equipment shall be by a long-term lease agreement, and not on an *ad hoc* or contract-by-contract basis.

(3) If a DBE regular dealer is used for DBE contract goal credit, no additional credit will be given for hauling or delivery to the project site goods or materials sold by that DBE regular dealer. Those delivery costs shall be deemed included in the price charged for the goods or materials by the regular dealer, who shall be responsible for their distribution.

(4) A manufacturer will be defined as a firm that operates or maintains a factory or establishment that produces on the premises, the material, supplies, articles or equipment required under the contract and of the general character described by the project specifications. A manufacturer will include firms that produce finished goods or products from raw or unfinished material, or that purchases and substantially alters goods and materials to make them suitable for construction use before reselling them.

(e) A contractor may count toward the DBE contract goal the following expenditures to certified DBE firms that are not "regular dealers" or "manufacturers" for DBE program purposes:

(1) The contractor may count toward the DBE contract goal the entire amount of fees or commissions charged by a certified DBE firm for providing a bona fide service, such as professional, technical, consultant or managerial services, or for providing bonds or insurance specifically required for the performance of the federal-aid contract, if the fee is reasonable and not excessive, compared with fees customarily charged for similar services.

(2) The contractor may count toward the DBE contract goal the entire amount of that portion of the construction contract that is performed by the DBE's own forces and equipment, under the DBE's supervision. This includes the cost of supplies and material ordered and paid for by the DBE for contract work, including supplies purchased or equipment leased by the DBE except supplies and equipment a DBE subcontractor purchases or leases from the prime contractor or its affiliates.

(f) A contractor may count toward the DBE contract goal 100 percent of the fees paid to a certified DBE trucker or hauler for delivery of material and supplies required on a job site, but not for the cost of those materials or supplies themselves, or for the removal or relocation of excess material from or at the job site, when the DBE certified trucking company is not also the manufacturer of or a regular dealer in those material and supplies, provided that the trucking or hauling fee is determined by MoDOT to be reasonable as compared with fees customarily charged by non-DBE firms for similar services. The certified DBE trucking firm shall also perform a CUF on the project and not operate merely as a pass through for the purposes of gaining credit toward the contract DBE goal. Prior to submitting a bid, the contractor shall determine, or contact the MoDOT External Civil Rights Administrator for assistance in determining, whether a DBE trucking firm will meet the criteria for performing a CUF on the project.

(g) The contractor will receive DBE contract goal credit for the fees or commissions charged by and paid to a DBE broker who arranges or expedites sales, leases or other project work or service arrangements, provided that those fees are determined by MoDOT to be reasonable and not excessive, as compared with fees customarily charged by non-DBE firms for similar services. A broker will be defined as a person or firm that does not own or operate the delivery equipment necessary to transport materials, supplies or equipment to or from a job site; a broker typically will not purchase or pay for the material, supplies or equipment, and if the broker does purchase or pay for those items, those costs will be reimbursed in full. In most instances, the broker is merely the entity making arrangements for delivery of material, supplies, equipment, or arranging project services. To receive DBE contract goal credit, MoDOT must determine that the DBE broker has performed a CUF in providing the contract work or service.

13.0 Performing a Commercially Useful Function (CUF). No credit toward the DBE contract goal will be allowed for contract payments or expenditures to a DBE firm, if that DBE firm does not perform a CUF on that contract. A DBE performs a CUF when the DBE is solely responsible for execution of a distinct element of the contract work, and the DBE actually performs, manages and supervises the work involved with the firm's own forces. To perform a CUF, the DBE alone shall be responsible, and alone must bear the risk, for the material and supplies used on the contract, selecting a supplier or dealer from those available, negotiating price, determining quality and quantity, ordering the material and supplies, installing those materials with the DBE's own forces and equipment and paying for those materials and supplies. The amount the DBE firm is to be paid under the contract shall be commensurate with the work the DBE actually performs and the DBE credit claimed for the DBE's performance.

13.1 Contractor's Obligation to Monitor CUF Performance. It shall be solely the contractor's responsibility to ensure that all DBE firms perform a CUF. Further, the contractor is responsible to, and shall ensure that each DBE firm fully performs the DBE's designated tasks, with the DBE's own forces and equipment, under the DBE's own direct supervision and management. MoDOT is under no obligation to warn the contractor that a DBE's participation may not count toward the goal, other than through official notification with an opportunity for administrative reconsideration at the conclusion of the contract work.

13.2 DBEs Must Perform a Useful and Necessary Role in Contract Completion. A DBE does not perform a commercially useful function if the DBE's role is limited to that of an extra participant in a transaction, contract, or project through which funds are passed in order to obtain the appearance of DBE participation.

13.3 DBEs Must Perform The Contract Work With Their Own Workforces. If a DBE does not perform and exercise responsibility for at least 30 percent of the total cost of the DBE's contract with the DBE's own work force, or the DBE subcontracts a greater portion of the work of a contract than would be expected on the basis of normal

industry practice for the type of work involved, MoDOT will presume that the DBE is not performing a commercially useful function.

13.4 Factors Used to Determine if a DBE Trucking Firm is Performing a CUF. The following factors will be used to determine whether a DBE trucking company is performing a commercially useful function (CUF):

(a) To perform a CUF, the DBE trucking firm shall be completely responsible for the management and supervision of the entire trucking operation that the DBE is being paid for on the contract work. There shall not be contrived arrangement, including but not limited to, any arrangement that would not customarily exist under regular construction project subcontracting practices for the purpose of meeting the DBE contract goal.

(b) The DBE must own and operate at least one fully licensed, insured and operational truck used in performance of the contract work. This does not include a supervisor's pickup truck or a similar vehicle that is not suitable for hauling the necessary materials or supplies.

(c) The DBE receives 100 percent contract goal credit for the total reasonable amount the DBE is paid for the transportation services provided on the contract using trucks the DBE owns, insures and operates, using drivers that the DBE employs.

(d) The DBE may lease trucks from another DBE firm, including an owner-operator who is certified as a DBE. The DBE firm that leases trucks from another DBE will receive credit for the total fair market value actually paid for of the transportation services the lessee DBE firm provides on the contract.

(e) The DBE may also lease trucks from a non-DBE firm, including an owner-operator. However, the DBE who leases trucks from a non-DBE is entitled to DBE contract goal credit only for the brokerage fee or commission the DBE receives as a result of the lease arrangement. The DBE will not receive credit for the total value of the transportation services provided by the non-DBE lessee. Furthermore, no DBE contract goal credit will be allowed, even for brokerage fees or commissions, where the DBE leases the trucks from the contractor on the project or a firm owned, controlled by, or affiliated by ownership or control to, the contractor.

(f) For purposes of this section, the lease shall indicate that the DBE firm leasing the truck has exclusive use of and control over the truck. This will not preclude the leased truck from working for others during the term of the lease with the consent of the DBE, provided the lease gives the DBE absolute priority for and control over the use of the leased truck. Leased trucks shall display the name and identification number of the DBE firm that has leased the truck at all times during the life of that lease.

13.5 MoDOT Makes Final Determination On Whether a CUF Is Performed. MoDOT and the Commission will have the final authority to determine whether a DBE firm has performed a CUF on a federal-aid contract. To determine whether a DBE is performing or has performed a CUF, MoDOT will evaluate the amount of work subcontracted by that DBE firm or performed by other firms, and the other firms forces and equipment. Any DBE work performed by the contractor, or by employees or equipment of the contractor will be subject to disallowance under the DBE Program, unless the independent validity and need is demonstrated.

14.0 Verification of DBE Participation, Liquidated Damages.

14.1 Prior to final payment by the Commission, the contractor shall file with the Commission a detailed list showing each DBE used on the contract work, and the work performed by each DBE. The list shall show the actual dollar amount paid to each DBE for the creditable work on the contract, less any rebates, kickbacks, deductions, withholdings or other repayments made. The list shall be certified under penalty of perjury, or other law, to be accurate and complete. MoDOT and the Commission will use this certification and other information available to determine if the contractor and the contractor's DBEs satisfied the DBE contract goal percentage specified in the contract and the extent to which the DBEs were fully paid for that work. The contractor shall acknowledge, by the act of filing the detailed list, that the information is supplied to obtain payment regarding a federal participation contract.

14.2 Failure on the part of the contractor to achieve the DBE participation to which the contractor committed in the contract may result in liquidated damages being imposed on the contractor by the Commission for breach of contract and for non-compliance. If the contract was awarded with less than the original DBE contract goal proposed by the Commission, the revised lower amount shall become the final DBE contract goal, and that goal will be used to

determine any liquidated damages to be assessed. Additionally, the Commission or MoDOT may impose any other administrative sanctions or remedies available at law or provided by the contract in the event of breach by the contractor by failing to satisfy the contractor's DBE contract goal commitment. However, no liquidated damages will be assessed, and no other administrative sanctions or remedies will be imposed when, for reasons beyond the control of the contractor and despite the good faith efforts made by the contractor, the final DBE contract goal participation percentage was not achieved. The contractor will be offered the opportunity for administrative reconsideration of any assessment of liquidated damages, upon written request. The administrative reconsideration officer may consider all facts presented, including the legitimacy or business reason for back charges assessed against a DBE firm, in determining the final amount of liquidated damages.

15.0 Prompt Payment Requirements. In accordance with Title 49 CFR 26.29, the contractor shall comply with the prompt payment requirements of that regulation, Section 34.057, RSMo., the provisions of the Commission's rule 7 CSR 10-8.111 and the contract. By bidding on a federal-aid contract, and by accepting and executing that contract, the contractor agrees to assume these contractual obligations, and to bind the contractor's subrecipients contractually to those prompt payment requirements at the contractor's expense.

16.0 Miscellaneous DBE Program Requirements. In accordance with Title 49 CFR Part 26 and the Commission's DBE Program rules in Title 7 CSR Division 10, Chapter 8, the contractor, for both the contractor and for the contractor's subcontractors and suppliers, whether DBE firms or not, shall commit to comply fully with the auditing, record keeping, confidentiality, cooperation and anti-intimidation or retaliation provisions contained in those federal and state DBE Program regulations. By bidding on a federal-aid contract, and by accepting and executing that contract, the contractor agrees to assume these contractual obligations, and to bind the contractor's subrecipients contractually, at the contractor's expense.

TRAINING PROVISION

1.0 Description. This provision supplements subparagraph 7(e) of the Contract Provision entitled "Standard Federal Equal Opportunity Construction Contract Specification" (Executive Order 11246)", and in the implementation of CFR Part 230, Subpart A, Appendix B.

2.0 Training Requirements. As part of the contractor's equal employment opportunity affirmative action program, training shall be provided as follows.

2.1 The contractor shall provide on-the-job training aimed at developing full journeymen in the type of trade or job classification involved.

2.2 The number of trainee hours to be provided under this provision will be specified in the bidding documents.

2.3 No apprentice/trainee can be assigned less than 500 hours on a contract. Providing less than 500 hours is not considered to be beneficial training nor helping to achieve journey-level status. Therefore, a trainee/apprentice, regardless of craft, must have been trained on the contact for at least 500 hours to be eligible for reimbursement. However, the contractor may transfer the trainee, with MoDOT's approval, to another MoDOT highway construction project in order to continue the training. Upon reaching the 500 hours, the contractor will be compensated as noted herein. If the enrollee is transferred to a non-federal project, MoDOT, upon availability of funding, may have the option of reimbursing the contractor for those hours completed that achieve the 500-hour minimum and for any hours that continue the successful training of the individual(s). The same documentation will be required to be submitted in order to determine if hours will be approved. However, if the trainee is moved to another federally funded enhancement, then a "change order" could be requested for the additional hours, and thus offer the Contractor the necessary credit so as to accomplish the 500 hour plateau. FHWA and MoDOT will only approve training programs meeting the requirements of the Training Special Provisions (TSP). A program will be approved if it is reasonably calculated to meet the equal employment opportunity obligations of the Contractor and to qualify the average trainee for journeyman status in the classification concerned by the end of the training period. Furthermore, apprenticeship programs registered with the U.S. Department of Labor, Bureau of Apprenticeship and Training, or with a State apprenticeship agency recognized by the Bureau and training programs approved but not necessarily sponsored by the Department of Labor, Manpower Administration, Bureau of Apprenticeship and Training will also be considered acceptable provided it is being administered in a manner consistent with the equal employment obligations of Federal-aid highway construction contracts.

2.4 When a contractor subcontracts a portion of the contract work, the contractor shall determine how many, if any, of the trainee hours are to be trained by the subcontractor, provided, however, that the contractor shall retain the primary responsibility for meeting the training requirements imposed by this provision.. The contractor shall also insure this training provision is made applicable to such subcontract. Where feasible, 25 percent of apprentices or trainees in each occupation shall be in their first year of apprenticeship or training.

2.5 The number of trainee hours shall be distributed among the work classifications on the basis of the contractor's needs and the availability of journeymen in the various classifications within a reasonable area of recruitment. Prior to commencing construction, the contractor shall submit to the engineer for approval a trainee notification for each individual they intend to train on the project. The contractor will be credited for the hours worked by each trainee employed on the contract work who is currently enrolled or becomes enrolled in an approved program and will be reimbursed for such trainees as provided hereinafter. If the trainee goal on the project is 1,000, no more than two trainees will be approved for the project. Each individual must complete at least 500 hours before reimbursement or hour will be counted towards meeting the goal. In the event a trainee leaves the training program prior to completing the minimum 500 hours the External Civil Rights Office will determine if that individual can be replaced on the project.

2.6 Training and upgrading of minorities and women toward journeyman status is a primary objective of this provision. Accordingly, the contractor shall make every effort to enroll minority trainees and women (e.g., by conducting systematic and direct recruitment through public and private sources likely to yield minority and women trainees) to the extent that such persons are available within a reasonable area of recruitment. The contractor shall be responsible for demonstrating the steps taken in pursuance thereof, prior to a determination as to whether the contractor is in compliance with this provision. This training commitment is not intended, and shall not be used, to discriminate against any applicant for training, whether a member of a minority group or not.

2.7 No employee shall be employed as a trainee in any classification in which the employee has successfully completed a training course leading to journeyman status or in which the employee has been employed as a journeyman. The contractor shall satisfy this requirement by including appropriate questions in the employee application or by other suitable means. Regardless of the method used the contractor's records shall document the findings in each case.

2.8 The minimum length and type of training for each classification will be as established in the training program selected by the contractor and approved by the engineer and FHWA. A program will be approved if it is reasonably calculated to meet the equal employment opportunity obligations of the contractor and to qualify the average trainee for journeyman status in the classification concerned by the end of the training period... Furthermore, apprenticeship programs registered with the U.S. Department of Labor, Bureau of Apprenticeship and Training, or with a state apprenticeship agency recognized by the Bureau of apprenticeship and training programs approved, but not necessarily sponsored by, the Department of Labor, Manpower Administration, Bureau of Apprenticeship and Training, will also be considered acceptable provided the training is being administered consistent with the equal employment obligations of Federal-aid highway construction contracts.

2.9 Approval or acceptance of a training program shall be obtained from the engineer prior to beginning work on the classification covered by the program. It is the intention of these provisions that training is to be provided in the construction crafts rather than clerk-typists or secretarial-type positions. Training will be permissible in lower level management positions, such as office engineers, estimators, timekeepers, etc., where the training is oriented toward construction applications. Training in the laborer classification may be permitted, provided significant and meaningful training is provided and approved by the engineer. Some offsite training will be permissible as long as the training is an integral part of an approved training program and does not comprise a significant part of the overall training.

2.10 Except as otherwise noted below, the contractor will be reimbursed $3.50 per hour of training given an employee in the contract in accordance with an approved training program. As approved by the engineer, reimbursement will be made for training persons in excess of the number of trainee hours specified in the contract. Reimbursement will be made even though the contractor receives additional training program funds from other sources, provided such other sources do not specifically prohibit the contractor from receiving other reimbursement. Reimbursement for offsite training indicated above may only be made to the contractor when the trainees are concurrently employed on a federal-aid project and the contractor does one or more of the following, and contributes to the cost of the training, provides instruction to the trainee, or pays the trainee's wages during the offsite training period. In order receive the reimbursement the trainee must complete at least 500 hours on the project

2.11 No payment will be made to the contractor if either failure to provide the required training or failure to hire the trainee as a journeyman is caused by the contractor and evidences a lack of good faith on the part of the contractor in meeting the requirements of this provision. It is normally expected that a trainee will begin training on the project as soon as feasible after start of work, utilizing the skill involved and remain on the project as long as training opportunities exist in the trainee's work classification or until the trainee has completed the training program. It is not required that all trainees be on board for the entire length of the contract. The contractor's responsibilities under this provision will be fulfilled if the contractor has provided acceptable training for the number of trainee hours specified.

2.12 Trainees shall be paid at least 60 percent of the appropriate minimum journeyman's rate specified in the contract for the first half of the training period, 75 percent for the third quarter of the training period, and 90 percent for the last quarter of the training period, unless apprentices or trainees in an approved existing program are enrolled as trainees on this project. In that case, the appropriate rates approved by the U.S. Department of Labor or Transportation in connection with the existing program will apply to all trainees being trained for the same classification who are covered by this provision.

2.13 Contractor may choose to transfer trainee hours worked on another project, whether MoDOT or not. The contractor must submit monthly trainee reports for that project to the RE Office where the hours will be credited. The contractor must submit with the monthly trainee reports, copies of the certified payrolls so the RE Office can verify the number of hours worked on the project, as well as the wage the trainee was being paid. Once the RE reviews the monthly reports, copies of the monthly reports should be sent to the External Civil Rights Office. The RE Office should include with the report a note indicating the hours that are being transferred from the other project. Both job numbers must be included in the note.

2.14 When the job is 50% complete the contractor must have at least 50% of the trainee hours assigned on that job completed. The percentage of job completion is based on the total value of the contract paid to the Contractor. The remaining amount of the hours must be completed before the completion of the project or the Contractor will be subject to liquidated damages unless a GFE is submitted to and approved by the External Civil Rights Office.

2.15 If the training hours have not been obtained and a GFE has not been displayed upon project completion, the Contractor will be assessed liquidated damages in the amount of $7.00 per hour for those hours not realized. For instance, if the project goal was 1,000 hours and only 450 hours were met, then liquidated damages would be assessed at 550 x $7.00 = $3,850.00.

2.16 If the External Civil Rights Office approves a GFE, then liquidated damages will not be assessed.

2.17 If the Contractor does not achieve the full OJT goal, they will not receive partial credit for hours completed. For instance, if the goal on the project was 1,000 hours and only 450 were convened, then no reimbursement will be given for any hours fulfilled. If the goal on the project is 2,000 hours and only 1,500 hours are completed and no GFE is demonstrated, the contractor will receive credit for the 1,500 hours and also be assessed liquidated damages in the amount of the 500 hours there were not met.

2.18 The contractor shall furnish to the trainee a copy of the training program the contractor will follow in providing the training. The contractor shall provide each trainee and the resident engineer with a certification showing the type and length of training satisfactorily completed.

2.19 The contractor shall provide for the maintenance of records and furnish monthly reports documenting the contractor's performance under this provision. Monthly reports shall include at least the following information:

Contractor's name and address
Period that the report covers
Job Number, Description, and Federal Aid number
Information for each employee being trained on the project, including:
- Name
- Social Security Number
- Trade/craft
- Pay percent, based on portion of training complete (if applicable)
- Journeyman's full prevailing wage applicable

- Trainee wage
- Hours this period
- Cumulative hours for the project

Total trainee hours for the project for this period
Cumulative trainee hours for the project

OPTIONAL ROLLER COMPACTED CONCRETE SHOULDERS

1.0 Description. Roller Compacted Concrete (RCC) is an optional method to be used in constructing A2 and A3 shoulders in lieu of conventional PCCP and HMA placement. RCC consists of aggregate, Portland cement and water. Other supplementary cementing materials, such as fly ash, ground granulated blast furnace slag, and silica fume may be used. RCC is proportioned, mixed, placed, compacted, and cured in accordance with these specifications. RCC shall conform to the lines, grades, thickness, and typical cross section shown in the plans or otherwise established by the Engineer.

2.0 Materials. All materials shall be in accordance with Division 1000, Materials Details, and specifically as follows:

Item	Section
Coarse Aggregate	1005.2
Fine Aggregate	1005.3
Ground Granulated Blast Furnace Slag	1017
Fly Ash	1018
Cement	1019
Concrete Admixture	1054
Curing Compound	1055
Water	1070

2.1 Aggregate. The plasticity index of the aggregates used shall not exceed 5. The aggregate gradation shall be well-graded without gradation gaps and conform to the following combined gradation:

Sieve Size	Percent Passing by Weight
1 inch	100
½ inch	70 - 90
3/8 inch	60 - 85
No. 4	40 - 60
No. 200	0 - 8

3.0 Mix Design. At least 30 days prior to the beginning of placing RCC on the project, the Contractor shall submit a proposed mix design to the Engineer. The target and allowable gradation range of each fraction shall be included. The contractor may be required to submit representative samples of each ingredient to Construction and Materials for laboratory testing.

3.1 Required Information. The mix design shall contain the following information:

(a) Source, type and specific gravity of Portland cement

(b) Source, type (class, grade, etc.) and specific gravity of supplementary materials, if used

(c) Source, name, type and amount of admixture, if used

(d) Source, type (formation, etc.), ledge number if applicable, of the aggregate

(e) Specific gravity and absorption of each fraction in accordance with AASHTO T 85 for coarse aggregate and

AASHTO T 84 for fine aggregate, including raw data

(f) Unit weight of each fraction in accordance with AASHTO T 19

(g) Batch weights of Portland cement and supplemental cementitious materials

(h) Batch weights of coarse, intermediate and fine aggregates

(i) Batch weight of water in pounds per cubic yard (optimum moisture content)

(j) Maximum laboratory density

(k) The laboratory proctor curves illustrating moisture contents vs. density for each cementitious material content.

The RCC mix design shall be done in a similar fashion as is done to determine the relationship between the moisture content and the unit weight as soils and soil aggregate mixtures. The apparatus and compacted effort used to fabricate the moisture density specimens correspond to that described in AASHTO T 180, Method D. Strength specimens shall be made in accordance with ASTM C 1176 at the optimum moisture content for each cementitious material content to verify minimum compressive strength requirements.

3.2 Trial Batch. The Contractor shall prepare and test a trial batch mixture at the mixing facility to verify that the RCC mix complies with the design criteria. The trial batch shall be prepared and tested in the presence of the Engineer.

3.3 Production. Production shall not begin until an approved mix design has been obtained and verified by the trial batch.

3.4 Design Strength. The mix design shall have a minimum compressive strength of 3500 psi within 28 days when specimens prepared according to ASTM C 1176.

3.5 Minimum Water Content. The water cement ratio shall not be lower than 0.25.

3.6 Minimum Cementitious Content. The total amount of cementitious materials shall not be below 400 pounds per cubic yard.

3.7 Supplementary Cementitious Material. RCC may use fly ash, GGBFS or silica fume. Ternary mixes will be allowed for RCC. Ternary mixes are mixes that contain a combination of Portland cement and two supplementary cementitious materials. The amount of supplementary cementitious material content shall be limited to the following requirements:

Supplementary Cementitious Material (SCM)	
SCM	**Maximum Percent of Total Cementitious Material**
Fly Ash (Class C or Class F)	25 %
Ground Granulated Blast Furnace Slag (GGBFS)	30 %
Silica Fume	8 %
Ternary Combinations	40 %

4.0 Equipment. RCC shall be constructed with any combination of equipment that will produce a pavement meeting the requirements for mixing, transporting, placing, compacting, finishing, and curing as provided in this specification.

4.1 Mixing Plant: The mixing plant shall be capable of producing RCC to the proportions defined by the final approved mix design and within the specified tolerances. The capacity of the plant shall be sufficient to produce a uniform mixture at a rate compatible with the placement equipment.

4.2 Paver: RCC shall be placed with a high-density or conventional asphalt type paver subject to approval by the Engineer. The paver shall be of suitable weight and stability to spread and finish the RCC material, without segregation, to the required thickness, smoothness, surface texture, cross-section, and grade.

4.3 Compactors: Self-propelled steel drum vibratory rollers shall be used for primary compaction. For final compaction, a steel drum roller, operated in a static mode, or a rubber-tired roller shall be utilized.

4.4 Haul Equipment: The hauling equipment shall be smooth, mortar-tight, metal containers capable of discharging the concrete at a controlled rate without segregation. Hauling equipment shall have a retractable cover to protect mix from weather and excessive evaporation.

4.5 Access for Inspection and Calibration: The Engineer shall have access at all times for any plant, equipment, or machinery to be used in order to check calibration, scales, controls, or operating adjustments.

5.0 Construction Requirements.

5.1 Preparation of Subgrade. Before the RCC processing begins, the subgrade and base course must be prepared in accordance with Sec 304.

5.2 Subbase Condition. The surface of the subbase shall be clean and free of foreign material and standing water prior to placement of the RCC. The aggregate base shall be uniformly moist at the time of RCC placement. RCC shall not be placed upon frozen subbase.

5.4 Mixing Time. Mixing time shall be adequate to ensure a thorough and complete mixing of all materials. Concrete shall be homogeneous with no aggregate segregation. In no case shall the mixing time, after all materials including water are in the mixer, be less than 90 seconds.

5.5 Operating Tolerances. The mixing plant shall receive the quantities of individual ingredients to within the following tolerances:

Material	Variation by Weight
Cementitious Materials	± 2.0%
Water	± 3.0%
Aggregates	± 4.0%

5.6 Plant Calibration. Prior to RCC production, the Contractor shall calibration the plant in accordance with the manufacturer's recommended practice. A copy of the calibration shall be provided to the Engineer when requested.

5.7 Curing. Immediately after final rolling, the surface of the RCC pavement shall be kept continuously moist until an approved curing compound is applied. The application of the curing compound shall progress such that no more than 10 linear feet of the final RCC surface is exposed without curing at any time.

5.7.1. Water Cure. Water cure shall be applied such that a uniform moist condition on the surface of the RCC is attained. Application of this moisture shall be done in a manner that will not erode or damage the surface of the finished RCC pavement.

5.7.2 Curing Compound. White pigmented curing compound shall be applied at the rate of one gallon for each 100 square feet.

5.8 Weather Conditions.

5.8.1 Hot Weather Precautions. During periods of hot weather or windy conditions, special precautions shall be taken to minimize moisture loss due to evaporation.

5.8.2 Cold Weather. The contractor shall provide a method, meeting the approval of the engineer, of monitoring the concrete that demonstrates that the concrete has been protected from freezing.

5.8.3 Protection Against Rain. To protect against rain, the contractor shall have on location at all times material for the protection of the unhardened concrete. The contractor shall protect the concrete from damage due to rain.

5.9 Finished Surface. The finished surface of the RCC pavement shall be smooth, uniform, and continuous without tears, ridges, or aggregate segregation once it leaves the paver.

5.9.1 Inaccessible Areas. All areas inaccessible to either roller or paver shall be paved with cast-in-place concrete in accordance with Sec 502.

5.9.2 Handwork. Broadcasting or fanning the RCC material across areas being compacted is not permissible. Such additions of materials may only be done immediately behind the paver and before any compaction has taken place.

5.9.3 Segregation. If segregation occurs in the RCC during paving operations, placement shall cease until corrective measures are taken.

5.10 Cold Joints. Prior to placing fresh RCC mixture against a cold vertical joint, the joint shall be thoroughly cleaned of loose or foreign material. The vertical joint face shall be wetted and in a moist condition immediately prior to placement of the adjacent lane.

5.11 Control Joints. Concrete control joints shall be constructed at 15-foot intervals in the RCC shoulder. The control joints shall match the adjacent 15-foot mainline joints. All joints shall be tooled or cut to 1/3 the depth of the RCC shoulder thickness. Sealing the control joints is not required.

5.12 Opening to Traffic. The Contractor shall protect the RCC from traffic during the curing period. The RCC shoulder pavement may be opened to light traffic after three days. The shoulder pavement may be opened to unrestricted traffic after 14 days.

6.0 Material Acceptance.

6.1 Quality Control Testing. The contractor shall perform all quality control tests necessary to control the production and construction processes applicable to this specification. Quality control testing shall be performed by technicians qualified through MoDOT's technician certification program. Testing shall include, but not necessarily be limited to, deleterious content, aggregate gradation, coarse aggregate absorption, thin or elongated pieces, shoulder thickness and density. The contractor shall record all test results and furnish a copy to the engineer no later than the beginning of the day following the test.

6.2 Quality Control Plan. The Quality Control Plan (QCP) for the mainline concrete pavement will be used for the RCC. Any differences shall be noted in the QCP.

6.3 Coring. Cores of the RCC shall be taken in accordance with AASHTO T 24. The core diameter shall be no less than 3 inches and no more than 4 inches. Sampling locations will be determined by the engineer using random sampling procedures in accordance with ASTM D 3665. Cores shall not be taken within 6 inches of an unconfined joint. Cores shall not be taken until 14 days after placement. Cores shall be neatly cut with a core drill. The contractor shall furnish all tools, labor and materials for cutting samples and filling the cored hole. The contractor shall fill the core holes with an approved non-shrink grout within one day after sampling.

6.4 Testing Cores. QC shall determine the density of the RCC shoulder at a frequency of no less than one per 7500 square yards. The density shall be determined in accordance with ASTM C 642. Cores shall be tested for density 28 days after placement. The core thickness shall be determined by the average caliper measurement in accordance with AASHTO T 148.

6.5 Aggregate Gradation. A sieve analysis shall be performed once a week. Testing shall be performed in accordance with AASHTO T 27 from randomly sampled material taken from the discharge gate of storage bins or from the conveyor belt.

6.6 Deleterious Materials. Deleterious content shall be determined each day at a frequency of one test per 7500 square yards of material placed or fraction thereof. Test shall be performed in accordance with MoDOT TM 71 from randomly sampled material taken from the discharge gate of storage bins or from the conveyor belt. Test shall be performed on coarse aggregate fractions.

6.7 Absorption. Samples for coarse aggregate absorption shall be taken from the discharge gate of storage bins or from the conveyor belt at least once every 2000 cubic yards with a minimum of once per project. Coarse aggregate absorption shall be performed in accordance with AASHTO T 85.

6.8 Thin or Elongated. Thin or elongated pieces shall be determined on samples of coarse aggregate taken from the discharge gate of the storage bins or from the conveyor belt. Test shall be performed in accordance with ASTM D 4791 using a ratio of 5:1. Test shall be performed on aggregate particles retained on the ¾ in. sieve. Test shall be performed at least once every 10,000 cubic yards with a minimum of once per project.

6.9 Retained Samples. All aggregate samples taken by the contractor, including but not limited to gradation, deleterious, absorption, and thin or elongated pieces shall be retained for the engineer for a minimum of seven days unless otherwise instructed. The retained sample shall be the remaining half of the final reduction in sample size obtained for QC testing. These samples shall be maintained in clean covered containers, without contamination, readily accessible to the engineer. The retained sample's identification shall consist of, but is not limited to:

(a) Time and date sampled

(b) Product specification number

(c) Type of sample, i.e. belt, bin, stockpile

(d) Lot and sublot designation

(e) Sampler/Tester

(f) Project Job Number

6.10 Acceptance.

6.10.1 Density. The core density shall not be less than 95 percent of the maximum laboratory density.

6.10.2 Thickness. The core thickness shall not be deficient by more than 10 percent of the plan thickness.

6.10.3 Aggregate Gradation. When one test is outside the allowable gradation range, immediate steps shall be taken to correct the gradation.

6.10.4 Deleterious Materials. When one test is out side the specification limits, immediate steps shall be taken to correct the deleterious content.

6.10.5 Absorption.

6.5.1 Adjustments. The contractor shall halt production and make appropriate adjustments whenever either of the following occurs:

(a) One point falls outside the action limit line for individual measurement

(b) Two points in a row fall outside the specification limit but within the action limit line for individual measurement

6.10.5.2 Action Limits. The following action limit shall be used to control the aggregate absorption.

Individual Measurements	
Control Parameter	**Action Limit**
Absorption	Mix Design plus 0.3% to Mix Design plus 0.6%

6.10.6 Thin or Elongated Pieces. The coarse aggregate shall not have more than 5 percent thin or elongated pieces.

7.0 Quality Assurance. Corrective action shall be required when any QA tests are outside the required ranges or action limits. The engineer will at a minimum, independently test at the following frequency:

Test	Frequency
Density	1 test per 30,000 square yards
Thickness	1 test per 30,000 square yards
Aggregate Gradation	1 per project
Coarse Aggregate Deleterious	1 per week
Absorption	1 per 10,000 cubic yards
Thin or Elongated	1 per project

7.1 Retained Samples. The QA inspector will test at least ten percent of the retained portion of the QC samples for aggregate gradations and deleterious content. The QA inspector will test at least twenty percent of the QC retained samples for absorption and thin or elongated pieces. Retained samples will be chosen at random. A comparison will be considered favorable when the QA results of a QC retained sample are within the applicable limits specified in Sec 403.

8.0 Method of Measurement. Final measurement of the completed pavement will not be made except for authorized changes during construction, or where appreciable errors are found in the contract quantity. Where required, measurement of the RCC shoulder, complete in place, will be made to the nearest 1/10 square yard. The revision or correction will be computed and added to or deducted from the contract quantity.

9.0 Basis of Payment. The accepted quantities of RCC will be paid for at the contract unit price, for specified A2 or A3 shoulder, with proper allowance made for any deductions resulting from non-compliant tests. The contract unit price for A2 or A3 shoulder will be considered as full compensation for all materials, equipment, tools, labor, and incidentals necessary to satisfactorily complete the work. No additional compensation will be allowed for any excess thickness.

"DRIVE SMART" SIGNS

1.0 Description. This work shall consist of installing "Drive Smart" signs. The 48 x 48-inch (1200 x 1200 mm) signs will be furnished by the Commission. The contractor shall furnish labor, equipment, posts and hardware for installation of the signs in accordance with this provision and the plans, or as directed by the engineer.

2.0 Material. All material shall be in accordance with Division 1000, Material Details.

3.0 Construction Requirements. The signs shall be post-mounted and placed approximately 500 feet (150 m) before the beginning of the project limits or the "ROAD WORK AHEAD" sign or the "ROAD WORK NEXT XX MILES" sign, if used, when these signs are located outside the project limits for each direction of travel affected by the project. A project on only one pavement of a dual divided facility will require only one sign. The contractor shall maintain all signs until completion of the project. Upon completion of the project, the contractor shall disassemble the signs and retain the posts and hardware. The signs shall remain the property of the Commission and shall be delivered without damage to locations as directed by the engineer.

4.0 Basis of Payment. The accepted quantity of signs will be paid for at the contract unit price per each.

"POINT OF PRESENCE" SIGNS

1.0 Description. This work shall consist of installing a 96 X 48 inch (2400 X 1200 mm) “Point of Presence" sign. The Commission will furnish the sign. The contractor shall furnish labor, equipment, posts and hardware for installation of the sign in accordance with this provision or as directed by the engineer.

2.0 Construction Requirements. The "Point of Presence" sign shall be post mounted on three 3-pound/foot (4.5 kg/m) U-channel posts with 32-inch (815 mm) spacing between posts. The sign shall be placed as shown on the plans. A project impacting only one direction of a divided highway will require only one sign. The contractor shall maintain all signs until completion of the project. Upon completion of the project, the “Point of Presence” signs shall remain in place. The sign, posts and hardware will remain the property of the Commission.

3.0 Basis of Payment. The accepted quantity of "Point of Presence" signs will be paid for at the contract unit price per each.

ALTERNATE TEMPORARY EROSION CONTROL MEASURES

1.0 Description. This provision provides for alternate temporary erosion control measures to those specified in Sec 806 or as shown on the plans. All work shall be in accordance with Sec 806, except as herein specified.

2.0 Material and Design. The major items of the installation shall be the best standard products of the manufacturer and shall be of the manufacturer's latest approved design. The contractor shall furnish a manufacturer's certification that the units furnished are identical in material and design to those approved.

Alternative temporary erosion control measures shall be pre-approved prior to use. The following products have been pre-approved:

Ditch Check Type	*Product*	*Manufacturer*	*Slope*	*Drainage Area*
I	Dura Check Sediment Control Panel	Panel Products, Inc. 3216 S. Saratoga Springfield, MO 65804 Telephone (417) 886-9838	0-10%	3 acres (1.2 ha)
II	Triangular Silt Dike	Triangular Silt Dike Co., Inc. 608 Greenwood Midwest City, OK 73110 Telephone (800) 290-8473	0-10%	50 acres (20 ha)
II	Enviro Berm Porous Sediment Control System	Cascade Distribution, Inc. 15620-121A Avenue Edmonton, Alberta Canada T5V 1B5 Telephone (800) 565-6130	0-10%	50 acres (20 ha)

3.0 Installation. Alternate temporary erosion control methods shall be installed in accordance with the manufacturer's recommendations at the locations shown on the plans.

4.0 Maintenance. Alternate temporary erosion control methods shall be maintained as required by the manufacturer and as directed by the engineer.

ERRATA CORRECTIONS TO 2004 MISSOURI STANDARD SPECIFICATIONS FOR HIGHWAY CONSTRUCTION

The following changes are issued to address typographical corrections.

Page	Section	
	105.18.1	The last sentence should read "…..effective on the date arbitration is demanded…."
	105.18.4.3 F-3.	Should read "Shall be replaced with the following:"
149	216.50.2.2	The section reference should read Sec 1081.
150	216.60.2.4	The section reference should read Sec 1081.
191	403.13	In the last sentence the metric equivalencies should be (50 mm) for SP190 and (75 mm) for SP250.
229	413.30.4.1.2	Should read 600 Mg.
229	413.30.4.1.3	Should read 600 Mg.
280	505.20.3.1	Fifth row in table should read "Latex Emulsion Admixture, gallons/sack (L/kg) min."
396	625.20.2.1	The density requirement should read, 3 pcf (48 kg/m^3).
536	901.3	Ninth row in table should read "Galvanized Coating of Steel…... 1080."
546	902.4	Thirteenth row in table should read "Fiber Optic Cable….. 1092".
546	902.4	Thirteenth row in table should read "Fiber Optic Interconnect…."

REVISIONS TO 2004 MISSOURI STANDARD SPECIFICATIONS FOR HIGHWAY CONSTRUCTION

SECTION 101 – DEFINITION OF TERMS

Amend Sec 101.2 to indicate the following: ***08/07***

Appreciable Error. Any of the following will be considered an appreciable error: an error resulting in a change in quantity of 10 percent from the original contract quantity of an item; an error resulting in a monetary change of at least $5,000 from an original contract item amount; or an error in the calculation of a contract item quantity based on the finite dimensions shown on the plans.

SECTION 102 – BIDDING REQUIEMENTS AND CONDITIONS

Delete Sec 102.3 through 102.3.4 and substitute the following: ***02/07***

102.3 Bidding . Bidders will be allowed to submit paper bids or submit bids electronically using the BidExpress® website.

102.3.1 The Commission will make the bidding documents available to the prospective bidder. The documents will state the location, description and requirements of the contemplated construction and will show the estimate of the various quantities and types of work to be performed or material to be furnished, and will have a schedule of items for which unit bid prices are invited. The bidding documents will state the time in which the work shall be completed, the amount of the bid guaranty and the date, time and place of the opening of bids.

102.3.2 Bidders that choose to submit bids via the internet shall have on file with the Commission an "Internet Bidding Agreement", a copy of which can be found on MoDOT's website. This agreement shall be initiated by the prospective bidder and submitted to the Commission. A bid will not be opened and read unless a fully executed agreement is on file with the Commission at least seven days prior to the time set for the opening of the bids.

102.3.3 The prospective bidder will be required to pay the Commission the sum stated in the notice of bid opening for each copy of a project's bidding documents. The *Missouri Standard Specifications for Highway Construction, Missouri Standard Plans for Highway Construction*, including all revisions of these documents, and other items referenced in the bidding documents, whether attached or not, will be considered a part of the bid. A prospective bidder will be expected to separately purchase the current edition of the *Missouri Standard Specifications for Highway Construction* and the *Missouri Standard Plans for Highway Construction*, including all revisions of these documents.

102.3.4 Bidders choosing to submit bids via the internet will be responsible for any additional fees associated with submitting bids using Trns•port Expedite® Electronic Bidding System software and the BidExpress® website.

102.3.5 It will be conclusively presumed that all of the bidding documents are in the bidder's possession and that these documents have been reviewed and used by the bidder in the preparation of any bid submitted. The effective dates of the *General Provisions & Supplemental Specifications* and the *Supplemental Plans for Highway Construction* will be specified in the contract documents. A copy of the latest version of these documents is available on MoDOT's web site.

Delete Sec 102.5.1 and substitute the following: ***12/08***

102.5.1 Other documentary information, consisting of boring logs and other factual subsurface information that does not constitute part of the contract or contract documents, will be provided with project plans that contain cross sections, or they will be available from the engineer upon the bidder's written request. This information, used for project design and quantity estimation purposes, was not obtained to determine actual subsurface conditions, actual quantities of subsurface material or appropriate construction methods, nor shall this information be considered a representation of actual conditions to be encountered during construction. Furnishing this information does not relieve a bidder from the responsibility of making an investigation of conditions to be encountered, including but not limited to site visits, and basing the bid on information obtained from these investigations and the professional interpretation and judgment of the bidder. The bidder shall assume the risk of error if the information is used for any purposes for which the information was not intended. The Commission makes no representation as to the accuracy of the logs or other subsurface information, since the accuracy of this information is limited by the equipment used, the personal judgment of the persons making the investigation, and by the limited number of samples taken. Records indicate conditions encountered only at the times and the specific locations shown. Ground water observations are not routinely recorded in all boring logs. The absence of such data does not mean ground water will not be encountered. An indication of ground water constitutes no representation or warranty as to where ground water will be found, nor its volume or artesian character, during the project work. Any assumptions a bidder may make from this data is at the bidder's risk; none are intended by the Commission.

Delete Sec 102.6 and substitute the following: ***12/07***

102.6 Sales and Use Taxes. The Commission will issue a sales tax exemption certificate as described in Section 144.062 RSMo to contractors for the Commission. The tax exemption will apply to the prime contractor, any subcontractors, or suppliers for materials and supplies incorporated or consumed during the construction of the Commission project.

Delete Sec 102.7 through 102.7.5 and substitute the following: ***02/07; 06/08***

102.7 Preparation of Bidding Documents. Bids may be prepared on paper or electronically.

102.7.1 Bids submitted on paper shall be properly signed, sealed and submitted in accordance with Sec 102.10. Each bidder shall specify in the bid, in figures, a unit price for each of the separate items listed in the bidding documents, except a unit price entry will not be necessary for those items having a quantity of one and only the amount for that item need be entered. Zero will be considered a valid bid. The bidder shall not enter zero in any "Unit Price" field unless zero is the intended bid for that item. A unit price left blank, with or without an extension, other than items having a quantity of one, will be considered as zero by the Commission. In case of alternate items, unit prices shall be entered for only one alternate, unless otherwise specified in the bidding documents. A unit price may be carried out to the third decimal. Unit prices carried out further than the third decimal will be rounded to the nearest third decimal by the commission. Bids shall not contain interlineations, alterations or erasures except as noted in Sec 102.7.1. The bidder shall show the products of the respective unit prices and quantities in the amount column provided for that purpose. These extensions shall be totaled and in case of errors or discrepancies in extensions, the unit prices shall govern. All entries in the bid shall be in ink. If, in the sole discretion of the engineer, an obvious and apparent clerical error exists in the unit price listed for an item due to a misplaced decimal, but the extension appears to be correct and as intended in all respects, the engineer may correct the unit price bid in accordance with the extension listed. All errors in extensions or totals will be corrected by the engineer and such corrected extensions and totals will be used in comparing bids.

102.7.2 Bids submitted electronically shall be prepared using the latest version of Trns Port Expedite® Bid and be submitted using the BidExpress® website. Each bidder shall specify in the bid, in figures, a unit price for each of

the separate items listed. The bidder shall not enter zero in any "Unit Price" field unless zero is the intended bid for that item. A unit price left blank will be considered a zero by the Commission. In case of alternate items, unit prices shall be entered for only one alternate, unless otherwise specified in the bidding documents.

102.7.3 A bidder may alter or correct a unit price, lump sum bid or extension entered on the paper bid form or the computer-generated itemized paper bid form by crossing out the figure with ink and entering a new unit price, lump sum bid or extension above or below in ink, with the bidder's initials.

102.7.4 A bidder may submit a separate bid on any or all projects, except that bids shall be submitted for all projects in a required combination. Bidders not having the ability to simultaneously execute all contracts for bids submitted during a bid opening may state, in one of the bids, the maximum total value of contract awards the bidder is willing to accept for that bid opening. Only one statement of "Maximum Monetary Value of Awards Accepted this Bid Opening" shall be completed per bid opening. In the event a bidder submits multiple statements of maximum award, the lowest value stated will be used. The Commission reserves the right to select and award the combination of bids, not exceeding this maximum, that will be to the best interest of the State, provided these bids are in conformance with the requests for bids. Any corrected bid that exceeds the lowest specified maximum award may be declared non-responsive.

102.7.5 The bid of an individual, including those doing business under a fictitious name, shall include the signature and address of the individual. The signature shall be exactly the same as that appearing on the contractor questionnaire.

Delete Sec 102.7.6 and substitute the following: ***06/07***

102.7.6 Bids submitted electronically shall have the digital ID of an individual authorized to sign bids for their respective company. The individual must be identified as an officer for the company on the contractor questionnaire.

Delete Sec 102.7.7 through 102.7.12 and substitute the following: ***02/07***

102.7.7 The bid by a partnership or joint venture, including individuals doing business under fictitious names or corporations, shall be executed by at least one of the partners followed by the title "Partner" or one of the joint venturers followed by the title "Joint Venturer" and the business address of the partnership or joint venturer shown. The true legal name and address of each partner and joint venturer shall also be shown and shall appear exactly the same as that shown on the contractor questionnaire.

102.7.8 The bid by a corporation, whether acting alone or as a joint venturer, shall show the address and name of the corporation exactly as shown on the contractor questionnaire, and shall include the signature or digital ID and title of a person authorized by its board of directors to bind the corporation.

102.7.9 Each bidder shall submit with each bid a sworn statement, executed by or on behalf of the bidder to whom a contract may be awarded, certifying that the bidder has not, either directly or indirectly, entered into any agreement, participated in any collusion or otherwise taken any action in restraint of free competitive bidding in connection with the bid or any contract that may result from its acceptance.

102.7.10 A bid will not be accepted or considered if the bid is the product of collusion among bidders, if the bidder is disqualified or determined not responsible or if the bid is irregular in accordance with Sec 102.8.

102.7.11 For bids submitted on paper, the bidder may use the Trns•port Expedite® Electronic Bidding System software to generate the itemized bid sheets. Changes in accordance with Sec 102.7.1 will be permitted. When the bidder submits computer-generated itemized bid sheets, the itemized bid sheets included in the bidding documents shall not be completed and may be removed. If both are completed and submitted, only the computer-generated itemized bid sheets will be recognized and used as the official bid. The product of the bidder's unit price and the Commission's quantity for that same line number will be used in comparing bids and in the successful bidder's contract. Computer-generated itemized bid sheets not meeting the above requirements may cause the bid to be considered irregular and subject to rejection.

102.7.12 Subcontractor disclosure. For contracts of more than $2,000,000 each bidder shall submit with each bid a disclosure of the subcontracts that have a subcontract value that is equal to or greater than twenty percent of the

total project bid or subcontracts that are greater than or equal to $2,000,000. The disclosure of subcontracts must include the name of each subcontractor, the category of work that each subcontractor will perform (e.g. asphalt, concrete, earthwork, bridges…) and the dollar value of each subcontract. The information shall be disclosed on the form provided in the bidding documents. If that information is not available at the time of bid the bidder shall submit the "Subcontractor Disclosure Form" pages with MoDOT on or before 4:00 p.m. of the third business day after the bid opening date, directly to the Design Division, Missouri Department of Transportation, 105 W. Capitol Avenue, P.O. Box 270, Jefferson City, Missouri 65102-0270. Telefax transmittal to MoDOT will be permitted at fax no. 573-522-2281. Failure to disclose this information may result in a bid being declared non-responsive. The complete signed original documents do not need to be mailed to MoDOT, but the bidder shall have it available if requested by the Design Division or the engineer.

Delete Sec 102.9 through 102.12.2.2 and substitute the following: ***02/07***

102.9 Bid Guaranty. No bid will be considered unless accompanied by a certified check or cashier's check on any bank or trust company insured by the Federal Deposit Insurance Corporation, payable to the Director of Revenue, Credit State Road Fund, for no less than five percent of the amount of the bid, or by a bid bond secured by an approved surety or sureties in accordance with Secs 103.4.2 and 103.4.3, for no less than five percent of the amount of the bid. Bid bonds shall be submitted on forms furnished by the Commission, which are available on MoDOT's website. Bid bond forms will be furnished to the prospective bidder upon request. Electronically produced copies of the bid bond form may be utilized, however, the exact wording used on the Commission furnished form shall be included in full and without deviation. Bid bond forms shall be complete and correct at the time of submittal or the bid may be considered non-responsive. Only the version of the bid bond form provided with the request for bid shall be submitted, unless the Request for Bid or Notice of Bid Opening authorizes the use of alternate bid bond forms. The bid bond power of attorney shall be an original document, not a facsimile. Bids accompanied by bid guaranties that are not in accordance with this section or accompanied by bid bonds that are not issued by an approved surety will be rejected.

102.9.1 Bidders submitting the bid electronically may choose to submit a paper bid guaranty in accordance with 102.9, or an electronic bid bond with the bid prior to the time designated for receiving bids.

102.9.1.2 The electronic bid bond shall be part of the digitally signed bid and be verified via digital encryption by the bonding agent.

Delete Sec 102.10 and substitute the following: ***06/08***

102.10 Delivery of Bids. Paper bids shall be submitted in a sealed envelope that clearly indicate the vendor name, vendor address, vendor number , county , route, call number, and job number on the outside of the envelope. If sent by mail, the sealed bid shall be addressed to the Commission Attention Bid/Bid Bond at the address specified in the bidding documents. All bids shall be filed prior to the time and at the place specified in the notice to contractors. Bids received after the time for opening of bids will be returned to the bidder unopened.

102.10.1 Bids submitted via the internet shall use the latest version of Trns Port Expedite Bid, and be submitted using the BidExpress website. All bids shall be filed prior to the time specified in the notice to contractors. BidExpress will not accept any bids submitted after that time.

102.10.2 If a bidder submits a bid via the Internet and also submits a paper bid the paper bid will be considered the official bid from the bidder.

102.11 Withdrawal or Revision of Bids. A bidder may withdraw or revise a paper bid after the bid has been deposited with the Commission provided the revision or the request for such withdrawal is received in writing by the Commission, at the address specified in the bidding documents, before the time set for opening bids.

102.11.1 Any request for withdrawal of a bid submitted electronically shall be completed through Bid Express® prior to the time set for opening bids. The bidder may submit multiple electronic bids on the same project, however, the last bid received supersedes all previous submittals.

102.12 Combination Bids. Combination bids for two or more projects may be required or permitted and will be designated as such in the bidding documents.

102.12.1 On required combinations, the bidder shall complete the bid for each project included in the combination.

102.12.2 On permitted combinations, the bidder will be allowed to combine all projects in the combination or bid each project separately. The Commission reserves the right to determine the combination and make awards of the bids, that will be to the best interest of the State, provided they are in conformance with the request for bids and the bids submitted.

102.12.2.1 When the bidder submits computer-generated itemized bid sheets for projects listed in permitted combination, the bidder shall include all itemized bid sheets for all projects. For conventional paper bids, the bidder shall indicate "No Bid" for all projects not bid. For electronic bids, the bidder shall leave the project's bid items blank for all projects not bid.

102.12.2.2 To combine all projects in a permitted combination, the bidder shall enter a complete bid for each project and mark the "All or None" box in the Bid. By marking "All or None" and combining all the projects, the bidder will be awarded all the projects in the combination or none of the projects.

102.12.2.3 If the bidder does not combine all of the projects, bids for the individual projects will be considered separately. The bidder shall complete the bid for each project the bidder desires to bid.

Delete Sec 102.13 and substitute the following: ***06/08***

102.13 Public Opening of Bids. Bids will be opened and the bid totals made public.

SECTION 105 – CONTROL OF WORK

Delete section 105.15.1 and substitute the following: ***08/06***

105.15.1 Partial Acceptance. The contractor may request that the engineer inspect the following completed sections of work for acceptance at any time during the prosecution of the project:

(a) Any section 0.5 mile or more in length.
(b) Any section 0.5 mile or more in length in one direction of a divided highway.
(c) A complete bridge.
(d) An intersection traffic signal system. Partial acceptance may be made for signal equipment prior to the 30 day testing period though any required performance tests and/or guarantees shall remain applicable.
(e) Devices intended to be used for traffic safety and control. Acceptance of traffic safety devices is limited to guardrail, impact attenuation barriers, traffic signal items, signs, delineators, lighting, concrete barrier walls, concrete bridge parapet, bridge railing, guard cable, crash cushions and fence, which are permanently installed in their final position in accordance with the contract documents.

Upon inspection, if the engineer finds that the section has been completed in accordance with the contract, the engineer will accept that section as being complete and the contractor will be relieved of further responsibility for that section.

Delete Sec 105.153.2.1 and substitute the following: ***08/08***

105.15.2.1 When required by the contract, project documentation shall consist of the following: Contractor's Affidavit Regarding Settlement of Claims (Form C-242), Final Change Order, DBE Participation List and Final Verification, Affidavit – Compliance with the Prevailing Wage Law.

Amend Sec 105 to include the following: ***07/04***

105.18 Arbitration.

105.18.1. Purpose. By adoption of 226.096 RSMo (L. 2003, HB 668), certain controversies or claims to which the Missouri Department of Transportation is a party that arises out of or relates to a contract awarded pursuant to subdivision (9) of subsection 1 of 226.130 (RSMo) subject to certain limits and preconditions are subject to, "be settled (sic) by arbitration administered by the American Arbitration Association under its Construction Industry

Arbitration Rules, except as provided," in 226.096. Under the provisions of Chap. 435 RSMo arbitration is the subject of agreement between the parties to a contract. This section provides for incorporation of the, American Arbitration Association's, *Construction Industry Arbitration Rules and Mediation Procedures (AAA Rules)*, amended and effective on the date arbitration is demanded and for their modification and revisions as permitted by the AAA Rules and Chap. 435 RSMo.

105.18.2. Incorporation. The AAA Rules are incorporated as part of the contract except as amended or excluded. The AAA Rules are further expressly amended or excluded as provided herein and as provided directly or indirectly by 226.096 RSMo (L. 2003, HB 668) and Chap. 435 RSMo.

105.18.3 Regular Track Procedures. The AAA Construction Industry Arbitration Rules, Regular Track Procedures, July 1, 2003 are amended as follows:

105.18.3.1 R-1. Agreement of Parties. Not revised.

105.18.3.2 R-2. AAA and Delegation of Duties. Not revised.

105.18.3.3 R-3. National Roster of Neutrals – Shall be replaced with the following:

In cooperation with the National Construction Dispute Resolution Committee the AAA shall establish and maintain a National Roster of Construction Arbitrators ("National Roster") and shall appoint arbitrators as provided first by the provisions of Missouri law, including 7 CSR 10-26, and then as provided in these rules. The term "arbitrator" in these rules refers to the arbitration panel, constituted for a particular case, whether composed of one or more arbitrators, or to an individual arbitrator, as the context requires.

105.18.3.4 R-4. Initiation under an Arbitration Provision in a Contract. Not revised.

105.18.3.5 R-5. Initiation under a Submission. Not revised.

105.18.3.6 R-6. Changes to Statement of Controversy or Claim - Shall be replaced with the following:

The contract between the parties provides for a Notice of Controversy or a Claim for adjustment to the contract prior to any demand for arbitration. Arbitration demands, issues, nature or amount of relief sought, shall not differ or be additional to that in the Notice of Controversy or Claim for contract adjustment provided for in the contract. There may not be a revision of the issues, nature of relief sought or increase in relief during or by way of any presentation of evidence during the arbitration. No award may be upon different issues or basis of relief or provide relief different in nature or greater in amount than contained in the Notice of Controversy or Claim given under the contract and stated in the demand for arbitration. No new or different controversy, claim or counterclaim may be submitted to the arbitrator except with the consent of both parties and the arbitrator and any consent must be clearly expressed, written and signed by the parties. There will be no amendments by implication.

105.18.3.7 R-7. Consolidation or Joinder - Shall be replaced with the following:
If Commission expressly agrees in writing with regard to multiple disputes arising under a particular contract, multiple demands may be consolidated so long as the relief sought in total does not exceed $328,011 in the principal relief sought, as adjusted on an annual basis effective January first of each year in accordance with the Implicit Price Deflator for Personal Consumption Expenditures as calculated pursuant to subsection 5 of section 537.610, RSMo. Demands to which Commission is not a party in direct privity of contract will never be joined. The issue of consolidation of claims and joinder of parties will not be arbitrable. Nothing in this section shall prohibit more than one demand for arbitration pursuant to the same contract, provided that each demand for arbitration arises from a separate claim based upon facts supporting a separate right of relief, filed with the Department and accepted by the department under the Missouri Department of Transportation's "Contractor Claims and Controversies Procedures". Neither shall a prime contractor be prohibited from filing a demand for arbitration arising from work, which was subcontracted provided that; (a) the claim was initially accepted by the department under "Contractor Claims and Controversies Procedures." and (b) would provide a right to contract adjustment separate from any claimed or which could be claimed by the prime contractor for it's sole benefit. However, subcontractors shall have no right to file a demand for arbitration with the Commission.

105.18.3.8 R-8. Jurisdiction. Not revised.

105.18.3.9 R-9. Mediation. Not revised.

105.18.3.10 R-10. Administrative Conference. Not revised.

105.18.3.11 R-11. Fixing of Locale. Not revised.

105.18.3.12 R-12. Appointment of Arbitrators – Delete paragraphs (a), (b), and (c) and replace with the following:

Arbitrators will be selected and appointed in accordance with 7 CSR 10-26.

105.18.3.13 R-13. Direct Appointment by a Party. Not revised.

105.18.3.14 R-14. Appointment by a Chairperson by Party-Appointed Arbitrators or Parties. Not revised.

105.18.3.15 R-15. Nationality of Arbitrator in International Arbitration. Not revised.

105.18.3.16 R-16. Number of Arbitrators. Not revised.

105.18.3.17 R-17. Disclosure. Not revised.

105.18.3.18 R-18. Disqualification of Arbitrator. Not revised.

105.18.3.19 R-19. Communication with Arbitrator. Not revised.

105.18.3.20 R-20. Vacancies. Not revised.

105.18.3.21 R-21. Preliminary Hearing. Not revised.

105.18.3.22 R-22. Exchange of Information. Not revised.

105.18.3.23 R-23. Date, Time, and Place of Hearing. Not revised.

105.18.3.24 R-24. Attendance at Hearings. Not revised.

105.18.3.25 R-25. Representation. Not revised.

105.18.3.26 R-26. Oaths. Not revised.

105.18.3.27 R-27. Stenographic Record. Not revised.

105.18.3.28 R-28. Interpreters. Not revised.

105.18.3.29 R-29. Postponements. Not revised.

105.18.3.30 R-30. Arbitration in the Absence of a Party or Representative. Not revised.

105.18.3.31 R-31. Conduct of Proceedings. Not revised.

105.18.3.32 R-32. Evidence. Not revised.

105.18.3.33 R-33. Evidence by Affidavit and Posthearing Filing of Documents or Other Evidence. Not revised.

105.18.3.34 R-34. Inspection or Investigation. Not revised.

105.18.3.35 R-35. Interim Measures. Not revised.

105.18.3.36 R-36. Closing of Hearing. Not revised.

105.18.3.37 R-37. Reopening of Hearing. Not revised.

105.18.3.38 R-38. Waiver of Rules. Not revised.

105.18.3.39 R-39. Extensions of Time. Not revised.

105.18.3.40 R-40. Serving of Notice – Paragraphs (a) and (b) shall be replaced with the following:

(a) Any papers, notices, or process necessary or proper for the initiation or continuation of an arbitration under these rules; for any court action in connection therewith, or for the entry of judgment on any award made under these rules, may be served on a party by mail addressed to the party or its representative at the last known address with return receipt or by personal service, in or outside the state where the arbitration is to be held, provided that reasonable opportunity to be heard with regard thereto has been granted to the party.

(b) The AAA, the arbitrator and the parties may also use overnight delivery with return receipt or electronic facsimile transmission (fax) to give the notices required by these rules. Facsimile transmission must require an acknowledgment that an entire legible transmission was received. Where all parties and the arbitrator agree, notices may be transmitted by electronic mail (email), or other methods of communication.

(c) Not revised

105.18.3.41 R-41. Majority Decision. Not revised.

105.18.3.42 R-42. Time of Award. Not revised.

105.18.3.43 R-43. Form of Award – Paragraph (b) shall be replaced with the following:
(a) Not revised.

(b) The arbitrator shall provide a concise, written breakdown of the basis of the award and a written explanation and justification for the awarded amount.

105.18.3.44 R-44. Scope of Award. Not revised.

105.18.3.45 R-45. Award upon Settlement. Not revised.

R105.18.3.46 R-46. Delivery of Award to Parties. Not revised.

105.18.3.47 R-47. Modification of Award. Not revised.

105.18.3.48 R-48. Release of Documents for Judicial Proceedings. Not revised.

105.18.3.49 R-49. Applications to Court and Exclusion of Liability – Paragraph (c) shall be replaced with the following:

(a) Not revised.

(b) Not revised.

(c) Parties to these rules shall be deemed to have consented that judgment upon the arbitration award shall be entered as provided by 226.096, RSMo (L. 2003, HB 668).

(d) Not revised.

105.18.3.50 R-50. Administrative Fees. Not revised.

105.18.3.51 R-51. Expenses. Not revised.

105.18.3.52 R-52. Neutral Arbitrator's Compensation. Not revised.

105.18.3.53 R-53. Deposits. Not revised.

105.18.3.54 R-54. Interpretation and Application of Rules. Not revised.

105.18.3.55 R-55. Suspension for Nonpayment. Not revised.

105.18.4 Fast Track Procedures. The AAA Construction Industry Arbitration Rules, Fast Track Procedures, July 1, 2003 are amended as follows:

105.18.4.1 F-1. Limitation on Extensions. Not revised.

105.18.4.2 F-2. Changes of Claim or Counterclaim - Shall be replaced with the following:

The contract between the parties provides for a Notice of Controversy or a Claim for adjustment to the contract prior to any demand for arbitration. Arbitration demands, issues, nature or amount of relief sought, shall not differ or be additional to that in the Notice of Controversy or Claim for contract adjustment provided for in the contract. There may not be a revision of the issues, nature of relief sought or increase in relief during or by way of any presentation of evidence during the arbitration. No award may be upon different issues or basis of relief or provide relief different in nature or greater in amount than contained in the Notice of Controversy or Claim given under the contract and stated in the demand for arbitration. No new or different controversy, claim or counterclaim may be submitted to the arbitrator except with the consent of both parties and the arbitrator and any consent must be clearly expressed, written and signed by the parties. There will be no amendments by implication.

105.18.4.3 F-3. Serving of Notice – Shall be replaced with the following:

(a) Any papers, notices, or process necessary or proper for the initiation or continuation of an arbitration under these rules; for any court action in connection therewith, or for the entry of judgment on any award made under these rules, may be served on a party by mail addressed to the party or its representative at the last known address with return receipt or by personal service, in or outside the state where the arbitration is to be held, provided that reasonable opportunity to be heard with regard thereto has been granted to the party.

(b) The AAA, the arbitrator and the parties may also use overnight delivery with return receipt or electronic facsimile transmission (fax) to give the notices required by these rules. Facsimile transmission must require an acknowledgment that an entire legible transmission was received. Where all parties and the arbitrator agree, notices may be transmitted by electronic mail (email), or other methods of communication.

105.18.4.4 F-4. Appointment and Qualification of Arbitrator - Shall be replaced with the following:

The provisions of 7 CSR 10-26 and the procedures for regular track arbitrator selection, apply to fast track procedure arbitrations.

105.18.4.5 F-5. Preliminary Telephone Conference. Not revised.

105.18.4.6 F-6. Exchange of Exhibits. Not revised.

105.18.4.7 F-7. Discovery. Not revised.

105.18.4.8 F-8. Proceedings on Documents. Not revised.

105.18.4.9 F-9. Date, Time, and Place of Hearing. Not revised.

105.18.4.10 F-10. The Hearing. Not revised.

105.18.4.11 F-11. Time of Award. Not revised.

105.18.4.12 F-12. Time Standards. Not revised.

105.18.4.13 F-13. Arbitrator's Compensation. Not revised.

105.18.5 Form of Award – Shall be added as follows:

The arbitrator shall provide a concise, written breakdown of the basis of the award and a written explanation and justification for the awarded amount.

SECTION 106 – CONTROL OF MATERIAL

Amend Sec 106 to include the following: ***04/05***

106.14 Proprietary Items. In the event a proprietary item included in a contract becomes unavailable during the term of the contract, the contractor shall promptly provide documentation to the engineer substantiating that the proprietary item is unavailable. Price or credit terms demanded of the contractor by the supplier will not constitute sufficient reason to substitute for the specified proprietary item. As part of the documentation, the contractor shall propose an alternative source or item that meets the performance requirements of the original proprietary item included in the contract. Any adjustment in the contract unit price shall be made in accordance with Sec 109.4. If an acceptable alternative item cannot be located, the proprietary item and any associated work may be underrun from the contract.

SECTION 108 PROSECUTION AND PROGRESS

Insert Sec. 108.1.4 as follows: ***05/06***

108.1.4 A contractor, at the discretion of the engineer, may make a substitution for a subcontract that was disclosed with the bid in accordance with 102.7 or may add a subcontract that would have required disclosure in accordance with 102.7. The contractor shall submit the name of the new subcontractor, the category of work, the dollar value of each subcontract and the reason for the substitution or addition in writing to the engineer for consideration.

SECTION 109 – MEASUREMENT AND PAYMENT

Delete Sec 109.7.2 and substitute the following: ***11/05***

109.7.2 Material Allowance. The engineer may, in any payment estimate, include the value of any non-perishable material that will be finally incorporated in the completed work. The material shall be in conformity with the plans and specifications in the contract, and shall not have been used at the time of such estimate. The value of such material in a single submission from one supplier shall be no less than $10,000.00. The material shall be delivered to the project or other location that is approved by the engineer. Any storage area not within the right of way shall be leased at the contractor's expense with provisions for right of entry by the engineer during the period of storage. Invoices for material payment shall be submitted to the engineer at least four days prior to the estimate date. Receipted invoices for all material payments previously allowed on the estimate shall be submitted to the engineer within 42 days of the date of the estimate on which material allowance was made or such material allowance will be deducted from future payments. The amounts paid for such material shall reduce the amount of other partial or final payments due the contractor for the work performed as the materials are fabricated or incorporated in the completed work.

Delete Sec 109.14 and substitute the following: ***08/06; 10/08***

109.14 Price Adjustment for Fuel. The method of price adjustment for the fuel used on various items of work that may be involved in the construction of this project will be based on "Fuel Usage Factors" for the various items as noted below: The On-Road Factor is based upon a 30-mile round trip haul:

Item of Work	Unit	Fuel Usage Factor	Fuel Usage Factor On-Road Hauling (30 mile avg.)
Class A Excavation	gal/yd^3 (L/m^3)	0.20 (0.99)	n/a
Unclassified Excavation	gal/yd^3 (L/m^3)	0.30 (1.49)	n/a
Class C Excavation			

(Includes Sandstone and Igneous Rock Excavation)	gal/yd^3 (L/m^3)	0.40 (1.98)	n/a
Embankment in Place	gal/yd^3 (L/m^3)	0.35 (1.73)	n/a
Bituminous Construction[a] (Includes all Gal/Ton (L/Mg) of Plant Mix Asphalt Mixes) If paid by SY convert to equivalent tons.	Total Mix	2.65 (11.06)	0.67 (2.79)
Concrete Pavement Round to nearest 1" increment. (e.g. if 7.5" pavement use 8" factor). If less than 6" use 6" factor. If paid by CY convert to equivalent thickness.	gal/yd^2 (L/m^2) 6" (150) 7" (175) 8" (200) 9" (225) 10" (250) 11" (275) 12" (300) 13" (325) 14" (350)	 0.27 (1.22) 0.29 (1.31) 0.31 (1.41) 0..3 (1.36) 0.35 (1.58) 0.36 (1.63) 0.39 (1.76 0.41 (1.85) 0.42 (1.90)	 0.22 (0.99) 0.26 (1.18) 0.29 (1.31) 0.33 (1.49) 0.37 (1.67) 0.41 (1.86) 0.44 (1.99) 0.48 (2.17) 0.52 (2.35)
Aggregate Base	gal/yd^2 (L/m^2) 4" (100)	 n/a	 0.15 (0.68)

[a] Includes ultrathin bonded asphalt wearing surface

Delete Sec 109.15 and substitute the following: ***06/08***

109.15 Fixed Cost Items. The following fixed prices shall be used when referenced in the specifications:

Sec	Item No.	Item of Work	Unit	Fixed Price
201.4.3	201-30.00	Clearing and Grubbing	Acre	$3,500.00
	201-30.10	Clearing and Grubbing	Ha	$8,500.00
203.9.4	**≤500 cy (380 m^3)**			
	203-20.00	Class C Excavation	cy	$25.00
	203-20.05	Class C Excavation	m^3	$32.70
	>500 cy (380 m^3) but < 2000 cy (1530 m^3)			
	203-20.00	Class C Excavation	cy	$20.00
	203-20.05	Class C Excavation	m^3	$26.20
	≥ 2000 cy (1530 m^3)			
	203-20.00	Class C Excavation	cy	$ 8.00
	203-20.05	Class C Excavation	m^3	$10.50
206.6.2	206-36.00	Supplemental Foundation Test Holes	ft	$ 6.00
	206-36.05	Supplemental Foundation Test Holes	m	$ 19.70
206.6.3.1	206-10.03	Class 1 Excavation in Rock	cy	$120.00
	206-10.07	Class 1 Excavation in Rock	m^3	$157.00
206.6.3.2	206-20.03	Class 2 Excavation in Rock	cy	$170.00
	206-20.07	Class 2 Excavation in Rock	m^3	$222.40.00
206.6.3.3	206-31.00	Class 3 Excavation in Rock	cy	$ 85.00
	206-32.00	Class 3 Excavation in Rock	m^3	$ 111.20.
206.6.3.4	206-34.00	Class 4 Excavation in Rock	cy	$85.00
	206-34.05	Class 4 Excavation in Rock	m^3	$111.20
214.5.1.2	214-20.00	Furnishing Rock Fill	cy	$ 15.00
	214-20.05	Furnishing Rock Fill	m^3	$ 19.60
303.5.1.2	303-06.00	Furnishing Rock Base Material	sy	$ 10.00
	303-06.05	Furnishing Rock Base Material	m^2	$ 12.00
401.14	401-05.00	Sample of Compacted Plant Mix Bituminous Pavement	Each	$ 75.00
403.23.2	403-05.00	Sample of Compacted Asphaltic Concrete Pavement	Each	$ 75.00
611.30.5.1	611-30.10	Furnishing Type 1 Rock Blanket	cy	$24.00
	611-30.15	Furnishing Type 1 Rock Blanket	m^3	$31.40
	611-30.20	Furnishing Type 2 Rock Blanket	cy	$25.00
	611-30.25	Furnishing Type 2 Rock Blanket	m^3	$32.70
703.5.1	**Concrete Fill > 2 cy (> 2 m^3)**			
	703-20.02	Class B Concrete (Misc)	cy	$500.00
	703-20.13	Class B Concrete (Misc)	m^3	$654.00
703.5.1	**Concrete Fill < 2 cy (< 2 m^3)**			
	703-20.02	Class B Concrete (Misc)	cy	$750.00
	703-20.13	Class B Concrete (Misc)	m^3	$981.00

SECTION 202 – REMOVAL OF ROADWAYS AND BUILDINGS

Amend Section 202 to include the following: ***11/05***

202.40.1.1 Notification of Demolition. The contractor shall provide proper notification to all appropriate federal, state and local agencies prior to demolition. Notification is necessary for the demolition of a building regardless of whether asbestos is present. The notification procedures and forms are available from MDNR. The contractor shall provide copies of all completed and approved forms to the engineer prior to any demolition work.

SECTION 205 – MODIFIED SUBGRADE

Delete Section 205 in its entirety and substitute the following ***05/06***

SECTION 205

SUBGRADE STABILIZATION

205.1 Description. This work shall consist of modifying a subgrade to improve stability. This work shall be performed as specified in the contract, at the contractor's option with concurrence from the engineer or at the direction of the engineer.

205.2 Material. All material shall be in accordance with Division 1000, Material Details, and specifically as follows.

205.2.1 The modifying material shall be hydrated lime or other chemical material, a geogrid, a geotextile, or other material approved by the engineer.

205.2.1.1 If hydrated lime is used, the contractor shall furnish or require the supplier to furnish with each load certification that the product is in accordance with AASHTO M 216.

205.2.1.2 If chemical modifying material other than hydrated lime is used, the material and application plan shall be approved by the engineer prior to use.

205.2.2 If a geogrid or geotextile is used the product type and layout plan shall be approved by the engineer prior to use.

205.3 Construction Requirements.

205.3.1 Application.

205.3.1.1 If not directed by the engineer or specified in the contract, the contractor may determine the locations, amount or area of modifying material and depth of application, within the limits of this specification and subject to concurrence from the engineer.

205.3.1.2 Where performed, chemical subgrade modification shall be done to all areas uniformly and laterally between outside shoulder points plus 18 inches (450 mm) on each side. When the chemically modified areas are stopped and started, there shall be a longitudinal transition zone at the rate of 30 feet per 6 inches (9 m/150 mm) of modified depth. The transition may be made by reducing modifying material or by mixing depth.

205.3.1.3 Chemical modifying material shall be spread in uniform and regular patterns. No material shall be applied if the material is being blown from the work area.

205.3.1.4 The application rate of the chemical modifying material shall be approved by the engineer.

205.3.2 Compaction. When chemically modified the subgrade shall be uniformly mixed with the modifying material. Mixing and compaction shall continue until the subgrade is shown to have suitable compaction as demonstrated by the roller equipment. Density and moisture testing will ordinarily be waived for subgrade

chemically modified under this specification, except that should compaction not be demonstrated to the engineer's satisfaction, the engineer reserves the right to run such tests as necessary to ensure density. When stabilized with a geogrid or geotextile, the subgrade will require recompaction to the specified density and moisture content only if it is disturbed by the geogrid or geotextile placement.

205.4 Method of Measurement. Measurement of modified subgrade will be made to the nearest square yard (m^2), including transition areas. Subgrade meeting all other requirements, suitable for the placing of base material and having modifying material incorporated as specified herein, will be paid for at the contract unit price per square yard (m^2) except as noted herein.

205.5 Basis of Payment.

205.5.1 If included in the contract, payment for modified subgrade will be made per square yard (m^2) of modified subgrade at the contract unit price. No direct payment will be made for the required modifying material.

205.5.2 If performed at the option of the contractor, payment for modified subgrade will be made at the invoiced material cost from the supplier, and no reimbursement will be made for incorporation or for processing.

205.5.3 If modified subgrade is not included in the contract and is directed by the engineer, payment will be made in accordance with Sec 104.3.

205.5.4 Reimbursement for transition areas will be made at the contract unit price per square yard (m^2) for 1/2 the area of the transition.

205.5.5 Reimbursement will be limited to modified areas, the width of the pavement and shoulders, plus 18 inches (450 mm) on each side.

205.5.6 Only one payment for modified subgrade will be made for any area, regardless of the depth of stabilized material, number of applications or other circumstances.

SECTION 206 – EXCAVATION FOR STRUCTURES

Delete Section 206.5.2 – 206.5.2.1 and substitute the following: ***11/05***

206.5.2 Final measurement of Class 3 Excavation for sewers, utilities, pipe culverts, drop inlets or manholes will not be made unless there is an authorized change from plan location resulting in a different quantity or there is an authorized change averaging more than 6 inches (150 mm) in the foundation elevation. If a revision is made or an appreciable error is found in the contract quantity, the revision or correction will be computed and added to or deducted from the contract quantity. Measurement of Class 3 Excavation will be made to the nearest cubic yard (m^3) for each structure of that volume of material actually removed from within the area bounded by vertical planes 18 inches (450 mm) outside of the outer walls of the structure. The upper limits of the volume measured, will be the existing ground line, or the lower limits of the roadway excavation, whichever is lower. The lower limits of the volume measured will include excavation necessary for pipe bedding.

Delete Section 206.5.3 and substitute the following: ***11/05***

206.5.3 Measurement of Class 4 Excavation for box culverts classified as bridges will be made to the nearest cubic yard (m^3) for each structure of that volume of material actually removed from within the area bounded by vertical planes 18 inches (450 mm) outside of the outer walls of box culverts with bottom slabs. The upper limits of the volume measured will be the existing ground line, or the lower limits of the roadway excavation, whichever is lower. Class 4 Excavation under embankments and in channel changes will be measured from the original ground surface unless otherwise designated on the plans. For box culverts without bottom slabs, measurement will be made as above except no material below plan flow line will be included that is outside of the area bounded by vertical planes 18 inches (450 mm) each side of and parallel with the neat lines of the walls or footings. Final measurement of Class 4 Excavation for box culverts not classified as bridges, small retaining walls and miscellaneous structures will not be made unless there is an authorized change from plan location resulting in a different quantity or there is an authorized change averaging more than 6 inches (150 mm) in the foundation elevation. If a revision is made or an appreciable error is found in the contract quantity, the revision or correction will be computed and added to or

deducted from the contract quantity. Excavation classification will not change if a substitution of a drainage structure type is approved.

Delete Section 206.5.4 and substitute the following: ***11/05***

206.5.4 Where concrete in footings or walls is cast against the vertical faces of the excavation, the neat lines of the concrete footings will be considered the limits of excavation for that depth in which the concrete is in contact with the excavation, and no measurement will be made of any excavation or overbreak beyond the neat footing lines.

Amend Section 206.5 to include the following: ***11/05***

206.5.5 Final measurement of the porous backfill will not be made except for authorized changes during construction, or where appreciable errors are found in the contract quantity. Where required, the volume of porous backfill will be computed to the nearest cubic yard (m^3) at each structure from dimensions on the plans. Any porous backfill material placed outside the neat lines shown on the plans shall be placed at the contractor's expense. The revision or correction will be computed and added to or deducted from the contract quantity.

SECTION 216 – REMOVALS FOR BRIDGE STRUCTURES

Delete Sec 216.10.2 and substitute the following: ***11/05***

216.10.2 Removal Requirements. The entire structure, including all substructure units, shall be removed to an elevation 2 feet (600 mm) below the finished ground line or streambed. Any portion of an existing structure below the ground line that interferes with the construction of the new structure shall be removed. Existing structures used for handling temporary traffic shall not be removed until the replacement structure is open to traffic. Notification of demolition shall be made in accordance with Sec 202.40.1.1.

Delete Sec 216.20.2 and substitute the following: ***06/08***

216.20.2 Removal Requirements. The bridge deck shall be uniformly scarified to the depth as shown on the plans. Excessive tearing of the deck surface shall require immediate correction. Over areas of half-sole repair and full depth repair, the scarified removal depth may be coincidental with the repair removal operation. The scarification shall produce a very rough texture that is acceptable to the engineer as a bondable surface for the new concrete wearing surface or as a starting profile for total surface hydro demolition. The scarifying process shall not produce a polished or slick surface. Any epoxy patches encountered shall be completely removed to sound, natural concrete.

Delete Sec 216.30.2 and substitute the following: ***06/08***

216.30.2 Removal Requirements.

216.30.2.1 All material and residue shall be removed. Staining will be permitted. The equipment and procedures used for removal shall be such that no damage will be done to the existing concrete deck. Any epoxy patches encountered shall be completely removed to sound, natural concrete. Excessive tearing of the deck surface shall require immediate correction.

216.30.2.2 When a concrete wearing surface is to be installed, the removal of the wearing surface plus the amount of deck as shown on the plans shall produce a very rough texture that is acceptable to the engineer as a bondable surface for the new concrete wearing surface or as a starting profile for total surface hydro demolition. The removal process shall not produce a polished or slick surface.

Delete Sec 216.70.3.3 and substitute the following: ***06/08***

216.70.3.3 Existing reinforcing steel utilized in the new concrete shall be prepared in accordance with Sec 216.60.2.2. Existing reinforcing steel not utilized in the new concrete shall be cut off one inch (25 mm) into the concrete. Any holes outside the limits of new concrete shall be filled with a qualified special mortar.

Delete Sec 216.80.3.2 and substitute the following: ***06/08***

216.80.3.2 Existing reinforcing steel utilized in the new concrete shall be prepared in accordance with Sec 216.60.2.2. Existing reinforcing steel not utilized in the new concrete and existing rail post bolts shall be cut off one inch (25 mm) into the concrete. Any holes outside the limits of new concrete shall be filled with a qualified special mortar.

Delete Sec 216.90.3.3 and substitute the following: ***06/08***

216.90.3.3 Existing reinforcing steel utilized in the new concrete shall be prepared in accordance with Sec 216.60.2.2. Existing reinforcing steel not utilized in the new concrete shall be cut off one inch (25 mm) into the concrete. Any holes outside the limits of new concrete shall be filled with a qualified special mortar. Any reinforcement that interferes with the installation of the new expansion joint system shall be called to the attention of the engineer and may be shifted, cut or removed as directed by the engineer. Any reinforcing steel removed that was to remain in place shall be replaced with bars of like size and shape, Grade 60 (Grade 420), in accordance with Sec 706 or Sec 710 and spliced 24 bar diameters as directed by the engineer.

Delete Sec 216.100.3.2 and substitute the following: ***06/08***

216.100.3.2 Existing reinforcing steel utilized in the new concrete shall be in accordance with Sec 216.60.2.2. Existing reinforcing steel not utilized in the new concrete shall be cut off one inch (25 mm) into the concrete. Any holes outside the limits of new concrete shall be filled with a qualified special mortar. Any reinforcement that interferes with the installation of the new expansion joint seal or sealant shall be called to the attention of the engineer and may be shifted, cut or removed as directed by the engineer. Any reinforcing steel removed that is to remain in place shall be replaced with bars of like size and shape being Grade 60 (Grade 420).

SECTION 303 – ROCK BASE

Delete Sec 303.2 through 303.2.2 and substitute the following: ***07/06***

303.2 Material. The material source for rock base shall be in accordance with approval from the engineer. Geologic conditions may vary from available subsurface information. Approval from the engineer of a source for the inherent stone will not constitute approval of the final rock base product.

303.2.1 Material for rock base shall be durable stone or broken concrete containing a combined total of no more than 10 percent, by weight, of earth, sand, shale and non-durable rock. Material from geologic-filled sink deposits or stone indicating evidence of solution activity shall not be used.

303.2.2 The material shall be as large as can be conveniently handled within the limits of this specification. No particle dimension shall exceed approximately12 inches (300 mm). There shall be some material with particle dimensions exceeding approximately 9 inches (225 mm).

Delete Sec 303.3.3 and substitute the following: ***07/06***

303.3.3 Rock base shall be 18 inches (450 mm) thick and may be placed in one lift. Rock base material may be placed thicker, with approval from the engineer, in maximum 24-inch (600 mm) lifts, provided a uniform drainage plane under the rock base is provided. No particle dimension shall exceed approximately 6 inches (150 mm) less than the placed lift thickness. There shall be some material with particle dimensions exceeding approximately 50 percent of the lift thickness. No additional payment will be made for the thicker rock base material. Class C Excavation in rock cuts shall be performed to allow placement of the specified lift thickness.

SECTION 304 – AGGREGATE BASE COURSE

Delete Sec 304.3.4.2 and substitute the following: ***06/07***

304.3.4.2 Type 1 aggregate base used for shoulders shall be compacted to a minimum 95 percent of standard maximum density. Type 1 aggregate base used on other than shoulders shall be compacted to no less than standard maximum density. Type 5 aggregate base under both roadway and shoulders shall be compacted to a minimum 95 percent of standard maximum density. The Standard Compaction Test will be conducted in accordance with

AASHTO T 99, Method C, replacing any material retained on the 3/4-inch (19.0 mm) sieve, as provided therein. Field density will be determined in accordance with AASHTO T 191 or AASHTO T 310, Direct Transmission, for wet density. The volume of the test hole may be reduced as necessary to accommodate available testing equipment. If nuclear density test methods are used, moisture content will be determined in accordance with AASHTO T 310, except a moisture correction factor will be determined for each aggregate in accordance with MoDOT Test Method TM 35. In lieu of the density requirements for Type 1 aggregate base used for shoulders with thicknesses less than 4 inches (100 mm), the aggregate shall be compacted by a minimum of three complete coverages with a 5 ton (4.5 Mg) roller. Rolling shall be continued until there is no visible evidence of further consolidation.

Amend Sec 403.4 to include the following: ***06/06***

304.4.3 Small Quantities. When less than 7,500 square yards (square meters) of aggregate base is specified in the contract the testing will done by the engineer.

SECTION 401 – PLANT MIX BITUMINOUS BASE AND PAVEMENT

Delete Sec 401.2.1 and substitute the following: ***11/05; 12/05***

401.2.1 The grade of asphalt binder will be specified in the contract. When the plasticity index on individual aggregate fractions with 10 percent or more passing the No. 30 (600 µm) sieve exceeds 3, a moisture susceptibility test shall be required in accordance with Sec 401.4.5 during the mix design process. If the plasticity index exceeds that of the material approved for the mix design, additional testing may be required. All material shall be in accordance with Division 1000, Material Details, and specifically as follows:

Item	Section
Coarse Aggregate	1004.2
Fine Aggregate	1002.3
Mineral Filler	1002.4
Hydrated Lime	1002.5
Asphalt Binder, Performance Graded (PG)	1015

Delete Sec 401.2.2 and substitute the following: ***11/05; 08/08***

401.2.2 Recycled Asphalt Material. Recycled asphalt materials shall be in accordance with Sec 403.2 except, all RAP material shall be in accordance with Sec 1004 for deleterious and other foreign material.

Delete Sec 401.3 – 401.3.2 and substitute the following: ***11/05; 02/08***

401.3 Composition of Mixtures. Aggregate sources shall be from the specific ledge or combination of ledges within a quarry, or processed aggregate from a particular product, as submitted in the mix design. The total aggregate prior to mixing with asphalt binder shall be in accordance with the following gradation requirements:

Sieve Size	Percent Passing by Weight (Mass)			
	Base	BP-1	BP-2	BP-3
1 inch (25.0 mm)	100	100	100	100
3/4 inch (19.0 mm)	85-100	100	100	100
1/2 inch (12.5 mm)	60-90	85-100	95-100	100
3/8 inch (9.5 mm)	---	---	---	100
No. 4 (4.75 mm)	35-65	50-70	60-90	90-100
No. 8 (2.36 mm)	25-50	30-55	40-70	---
No. 16 (1.18 mm)	---	---	---	30-60
No. 30 (600 µm)	10-35	10-30	15-35	---
No. 200 (75 µm)	6-12	5-12	5-12	7-12

Sieve Size	Percent Passing by Weight (Mass)		
	Base	**BP-1**	**BP-2**
1 inch (25.0 mm)	100	100	100
3/4 inch (19.0 mm)	85-100	100	100
1/2 inch (12.5 mm)	60-90	85-100	95-100
No. 4 (4.75 mm)	35-65	50-70	60-90
No. 8 (2.36 mm)	25-50	30-55	40-70
No. 30 (600 µm)	10-35	10-30	15-35
No. 200 (75 µm)	5-12	4-12	4-12

Amend Sec 401.4.2 to include the following and re-letter subsequent sections: ***04/06;05/06***

(b) Source, type (formation, etc.), ledge number(s) if applicable, gradation, and deleterious content of the aggregate.

(c) Plasticity index of each aggregate fraction.

(d) Bulk and apparent specific gravities and absorption of each aggregate fraction in accordance with AASHTO T 85 for coarse aggregate and AASHTO T 84 for fine aggregate, including all raw data.

Delete Sec 401.4.1 and substitute the following: ***02/08***

401.4.1 Mixture Design. Laboratories that participate and achieve a score of 3 or greater in the AASHTO proficiency sample program for T 11, T 27, T 84, T 85, T 166, T 209, T 308 and T 245 or T 312 will have the mixture verification process waived. The mix design shall be submitted to Construction and Materials for approval at least seven days prior to mixture production.

Delete Sec 401.4.4 through Sec 401.4.5 and Substitute the following: ***02/08***

401.4.4 Mixture Characteristics.

401.4.4.1 Base, BP-1 and BP-2 mixtures shall have the following properties, when tested in accordance with AASHTO T 245. The number of blows with the compaction hammer shall be 35 or the number of gyrations shall be 50 with the gyratory compactor. BP-1 and BP-2 mixtures shall have between 60 and 80 percent of the VMA filled with asphalt binder.

Percent Air Voids	AASHTO T 245 Stability lb (N)	Voids in Mineral Aggregate[a] (VMA)
3.5-4.5	750 (3350)	13.0

[a]Bituminous base mixtures that would require 12.0 percent VMA following Asphalt Institute MS-2 will have a minimum 12.0 percent requirement.

401.4.4.2 BP-3 mixtures shall have the following properties, when tested in accordance with AASHTO T 312. The number of gyrations shall be 50 with the gyratory compactor. BP-3 mixtures shall have a minimum 75 percent of the VMA filled with asphalt binder and dust to effective binder ratio of 0.9 to 2.0.

Percent Air Voids	Voids in Mineral Aggregate (VMA)
3.5-4.5	16.0

401.4.4.3 When specified in the contract as BP-3NC, BP-3 mixtures containing limestone aggregate shall contain a minimum amount of non-carbonate aggregate as shown in the table below, or the aggregate blend shall have an acid-insoluble residue (A.I.R.), MoDOT Test Method TM 76, meeting the criteria of crushed non-carbonate material.

The A.I.R. shall be determined on the minus No. 4 (4.75 mm) sieve. Non-carbonate aggregate shall have an A.I.R. of at least 85 percent insoluble residue.

Aggregate	Minimum Non-Carbonate by Volume
Limestone	20% Minus No. 4
Dolomite	No Requirement

401.4.5 Moisture Susceptibility. Moisture susceptibility may be tested in accordance with AASHTO T 283. A minimum retained strength of 70 percent shall be obtained when tested for moisture susceptibility. An approved anti-strip additive may be added to increase retained strength to a passing level. When testing is required by Sec 401.2.1, the mixture shall be testing during production in accordance with Sec 403.19.

Delete Sec 401.5 in its entirety and insert the following: ***04/06; 02/08***

401.5 Gradation and Deleterious Content Control. In producing mixtures for the project, the plant shall be operated such that no intentional deviations from the job-mix formula are made. The contractor shall determine on a daily basis at minimum, the gradation on the aggregate reclaimed from the RAP by either extraction or binder ignition. The gradation results shall be used to determine the daily specification compliance for the combined gradation. Mixtures as produced shall be subject to the following tolerances and controls:

(a) The maximum variations from the approved job-mix formula shall be within the following tolerances:

Passing No. 8 (2.36 mm) sieve [a]	± 5.0 percentage points
Passing No. 200 (75 µm) sieve	± 2.0 percentage points

[a] Use No. 16 (1.18 mm) sieve for BP-3

(b) The deleterious content of the material retained on the No. 4 (4.75 mm) sieve shall not exceed the limits specified in Sec 1004.2.

(c) If the plasticity index of any fraction exceeds that of the material approved for the mix design, additional testing may be required.

(d) The quantity of asphalt binder introduced into the mixer shall be the quantity specified in the job-mix formula. No changes shall be made to the quantity of asphalt binder without written approval from the engineer. The quantity of asphalt binder determined by tests on the final mixture shall not vary by more than ± 0.5 percent from the job-mix formula.

Delete Sec 401.5.1 in its entirety and insert the following: ***04/06***

401.5.1 Sample Location. The gradations of the total aggregate will be determined from samples taken from the hot bins on batch-type plants or continuous mixing plants or from the composite cold feed belt on drum mix plants. The deleterious content of the total aggregate shall be determined from samples taken from the composite cold feed belt. When required, samples for plasticity index shall be taken from the stockpile. The RAP shall be sampled from the RAP feeding system on the asphalt plant. Samples for asphalt content determination may be taken at the plant.

Delete Sec 401.5.2 and substitute the following: ***02/08***

401.5.2 Substitutions. At the option of the contractor and at no cost to the Commission, the contractor may use a mixture with smaller size aggregate or an approved Sec 403 mixture, design level C or, E, with the same or smaller size aggregate in lieu of any Sec 401 mixture. When this substitution is made, the layer thickness and density requirements in Sec 401 will apply.

Delete Sec 401.8.1 in its entirety and insert the following: ***04/06***

401.8.1 Mixture Testing. The contractor shall test the mixture at least once every 1000 tons (1000 Mg) of production or a minimum of once per day for the gradation, deleterious content, and the asphalt content. If RAP is used and AASHTO T 308 is used to determine the asphalt content, the binder ignition oven shall be calibrated in

accordance with MoDOT Test Method TM 77. At the engineer's discretion, testing may be waived when production does not exceed 200 tons (200 Mg) per day. The contractor shall certify the proper proportions of a previously proven mixture were used.

Delete Sec 401.8.2 in its entirety and insert the following: ***04/06; 02/08***

401.8.2 Failing Test. If a gradation, deleterious content, or asphalt content test result falls outside of the specification tolerances, a review or adjustment of the plant settings and production shall be made and another sample shall be immediately taken. If the second test falls outside of the specification tolerances, production shall be immediately ceased until the mixture can be brought back into specification.

Delete Sec 401.8.3 in its entirety and insert the following: ***04/06; 02/08***

401.8.3 Retained Samples. One half of the contractor's sample for gradation, deleterious content, plasticity index, and asphalt content and all cores shall be retained for the engineer. The contractor shall retain the samples for 7 days after testing has been completed and the results accepted by the engineer.

Delete Sec 401.9 in its entirety and insert the following: ***04/06***

401.9 Quality Assurance. Acceptance tests will be performed by the engineer at a rate of one independent sample per day when production exceeds 500 tons (500 Mg) per day. A favorable comparison will be considered when a QA test is within the specification tolerances. At least once for every five days of production, a split of the contractor's sample will be tested. If the results of the split sample are not within five percent on all sieves above the No. 200 (75µm), two percent on the No. 200 (75µm), within the specification ranges on the deleterious content, within two percentage points on the plasticity index, and within 0.5 percent on the asphalt content from the contractor's results, another split sample will be taken jointly with the contractor and tested. If the second test results do not compare within the specification tolerances, production shall cease until the discrepancy is resolved. If the second test results compare within the above tolerances, production may continue. Results of QA testing will be furnished to the contractor within 24 hours of obtaining the sample.

SECTION 402 – PLANT MIX BITUMINOUS SURFACE LEVELING

Delete Sec 402.2 and substitute the following: ***11/05***

402.2 Material. All material shall be in accordance with Division 1000, Material Details, and specifically as follows:

Item	Section
Coarse Aggregate	1004.2
Fine Aggregate	1002.3
Mineral Filler	1002.4
Asphalt Binder, Performance Graded (PG)	1015.3

Delete Sec 402.2.2 and substitute the following: ***04/06***

402.2.2 Wet Bottom Boiler Slag. The contractor may furnish wet bottom boiler slag of approved quality in lieu of coarse aggregate specified in Sec 402.2. If wet bottom boiler slag is used, the slag shall meet the requirements for coarse aggregate, except that the percentage of wear specified in Sec 1004.2.1 will not apply.

Delete Sec 402.2.3 and substitute the following: ***11/05; 02/08***

402.2.3 Recycled Asphalt Material. Recycled asphalt material shall be in accordance with Sec 403.2 except, all RAP material shall be in accordance with Sec 1004 for deleterious and other foreign material.

Delete Sec 402.3.3 ***11/05***

Delete Sec 402.5 and substitute the following: ***04/06***

402.5 Gradation and Deleterious Content Control. In producing mixture for the project, the plant shall be operated such that no deviations from the job mix formula are made. The contractor shall determine on a daily basis, at a minimum, the gradation on the aggregate reclaimed from the RAP by either extraction or binder ignition. The gradation results shall be used to determine the daily specification compliance for the combined gradation. Mixture as produced will be subject to the following tolerances and control:

(a) The total aggregate gradations shall be within the master range specified in Sec 402.3.

(b) Material passing the No. 200 (75 µm) sieve shall not vary from the job mix formula by more than ± 2.0 percentage points.

(c) The deleterious content of the material retained on the No. 4 (4.75 mm) sieve shall not exceed the limits specified in Sec 1004.2.

(d) If the plasticity index of any fraction exceeds that of the material approved for the mix design, additional testing may be required.

(e) The quantity of asphalt binder introduced into the mixer shall be that quantity specified in the job mix formula. No changes may be made to the quantity of asphalt binder specified in the job mix formula without written approval from the engineer. The quantity of asphalt binder determined by calculation or tests on the final mixture shall not vary more than ± 0.5 percent from the job-mix formula.

Delete Sec 402.6 and substitute the following: ***04/06***

402.6 Sample Location. The gradations of the total aggregate will be determined from samples taken from the hot bins on the batch-type plants, or from hot bins or combined hot aggregate flow on continuous mixing plants, or from the combined cold feed on dryer-drum plants. The deleterious content of the total aggregate will be determined from the samples taken from the combined cold feed belt. Samples for plasticity index will be taken from the stockpile. The RAP shall be sampled from the RAP feeding system on the asphalt plant.

Delete Sec 402.10.9 and substitute the following: ***02/08***

402.10.9 Hauling Over Completed Surface. Hauling of plant mix bituminous mixture over any completed portion of the project will not be permitted unless allowed by special provision.

SECTION 403 – ASPHALTIC CONCRETE PAVEMENT

Delete Sec 403.1.1 and substitute the following: ***12/05; 02/08***

403.1.1 Naming Convention. The nomenclature of Superpave bituminous mixture names, such as SP125CLP, will be as follows. When only the aggregate size is shown, such as SP125, the specifications shall apply to all variations of that size, such as SP125B, SP125C, SP125CLP, etc. When "x" is indicated, such as SP125xLP, specifications shall apply to all variations of mixture designs. Stone Matrix Asphalt will be generally referred to as SMA and designated by SM or SMR.

Superpave Nomenclature	
SP	**Superpave**
095	9.5 mm (3/8 inch) nominal aggregate size
125	12.5 mm (1/2 inch) nominal aggregate size
190	19.0 mm (3/4 inch) nominal aggregate size
250	25.0 mm (1 inch) nominal aggregate size
x	Mixture design: B, C, E or F (as described below)
LP	Limestone porphyry (when designated)
SM	Stone Matrix Asphalt (when designated)
SMR	Stone Matrix Asphalt limestone/non-carbonate (when designated)

Delete Sec 403.2.1 and substitute the following: ***02/08***

403.2.1 Fine Aggregate Angularity. Fine aggregate angularity (FAA) shall be measured on the fine portion of the blended aggregate. When tested in accordance with AASHTO T 304 Method A, aggregate particles passing the No. 8 (2.36 mm) sieve shall meet the following criteria for the minimum percent air voids in loosely compacted fine aggregate:

Design	FAA
E	40
C	45
B	45

Delete Sec 403.2.3 through 403.2.4 and substitute the following: ***02/08***

403.2.3 Clay Content. When tested in accordance with AASHTO T 176, blended aggregate particles passing the No. 4 (4.75 mm) sieve shall meet the following minimum sand equivalent criteria:

Design	Sand Equivalent
E	40
C	45
B	50

403.2.4 Thin, Elongated Particles. For all mixtures except SMA, the blended aggregate particles retained on the No. 4 (4.75 mm) sieve shall not exceed 10 percent, based on a ratio of 5:1 when tested for flat and elongated particles in accordance with ASTM D 4791.

Delete Sec 403.2.5 and substitute the following: ***12/05, 02/08***

403.2.5 Stone Matrix Asphalt. In addition to other requirements, material for SMA mixtures shall meet the following. Coarse aggregate shall consist of crushed limestone and either porphyry or steel slag in accordance with the quality requirements of Sec 1002, except as follows. The Los Angeles (LA) abrasion, when tested in accordance with AASHTO T 96, shall not exceed 40 percent based on initial ledge approval and source approval. The percent absorption, when tested in accordance with AASHTO T 85, shall not exceed 3.5 percent based on the individual fractions. The amount of flat and elongated particles, measured on material retained on a No. 4 sieve (4.75 mm), of the blended aggregate shall not exceed 20 percent based on a 3:1 ratio or 5 percent based on a 5:1 ratio.

Delete Sec 403.2.5.1 and substitute the following: ***04/05***

403.2.5.1 Filler Restriction. Rigden void content determined in accordance with MoDOT Test Method TM-73 shall be no greater than 50 percent.

Delete Sec 403.2.6 and substitute the following:; ***02/08***

403.2.6 Recycled Asphalt. The asphalt binder content of recycled asphalt materials shall be determined in accordance with AASHTO T 164, ASTM D 2172 or other approved method of solvent extraction. A correction factor for use during production may be determined for binder ignition by burning a sample in accordance with AASHTO T 308 and subtracting from the binder content determined by extraction. The aggregate specific gravity shall be determined by performing AASHTO T 209 in accordance with Sec 403.19.3.1.2 and calculating the G_{se} to use in lieu of G_{sb} as follows:

$$G_{se} = \frac{100 - P_b}{\frac{100}{G_{mm}} - \frac{P_b}{G_b}}$$

403.2.6.1 Recycled Asphalt Pavement. Recycled Asphalt Pavement (RAP) may be used in any mixture, except SMA mixtures. A maximum of 20 percent may be used in mixtures without changing the grade of binder. Mixtures may be used with more than 20 percent RAP provided testing according to AASHTO M 323 is included with the job mix formula that ensures the combined binder meets the grade specified in the contract. All RAP material, except as noted below, shall be tested in accordance with AASHTO TP 58, *Method of Resistance of Coarse Aggregate*

Degradation by Abrsion in the Micro-Deval Apparatus. Aggregate shall have the asphalt coating removed either by extraction or binder ignition. The material shall be tested in the Micro-Deval apparatus at a frequency of once per 1500 tons (Mg). The percent loss shall not exceed the Micro-Deval loss of the combined virgin material by more than five percent. Micro-Deval testing will be waived for RAP material obtained from MoDOT roadways. All RAP material shall be in accordance with Sec 1002 for deleterious and other foreign material.

403.2.6.2 Recycled Asphalt Shingles. Recycled Asphalt Shingles (RAS) may be used in any mixture specified to use PG 64-22 in accordance with AASHTO PP 53 except as follows: A maximum of 7 percent RAS may be used. When the ratio of virgin binder to total binder in the mixture is less than 70 percent, the grade of the virgin binder shall be PG 52-28 or PG 58-28. Shingles shall be ground to ½-inch minus. Waste, manufacturer or new, shingles shall be essential free of deleterious materials. Post-consumer RAS shall not contain more than 1.5 percent wood by weight or more than 3.0 percent total deleterious by weight. Post-consumer RAS shall be certified to contain less than the maximum allowable amount of asbestos as defined by national or local standards. The gradation of the aggregate may be determined by solvent extraction of the binder or using the following as a standard gradation:

Shingle Aggregate Gradation	
Sieve Size	**Percent Passing by Weight**
3/8 in. (9.5 mm)	100
No. 4 (4.75 mm)	95
No. 8 (2.36 mm)	85
No. 16 (1.18 mm)	70
No. 30 (600 µm)	50
No. 50 (300 µm)	45
No. 100 (150 µm)	35
No. 200 (75 µm)	25

Delete Sec 403.3.1 and substitute the following: ***12/05; 02/08***

403.3.1 Gradation. Prior to mixing with asphalt binder, the combined aggregate gradation, including filler if needed, shall meet the following gradation for the type of mixture specified in the contract. A job mix formula may be approved which permits the combined aggregate gradation during mixture production to be outside the limits of the master range when the full tolerances specified in Sec 403.5 are applied.

Percent Passing by Weight						
Sieve Size	**SP250**	**SP190**	**SP125**	**SP095**	**SP125xSM(R)**	**SP095xSM(R)**
1 1/2 in. (37.55 mm)	100	---	---	---	---	---
1 in. (25.0 mm)	90 - 100	100	---	---	---	---
3/4 in. (19.00 mm)	90 max.	90 - 100	100	---	100	---
1/2 in. (12.5 mm)	---	90 max.	90 - 100	100	90-100	100
3/8 in. (9.5 mm)	---	---	90 max.	90-100	50-80	70-95
No. 4 (4.75 mm)	---	---	---	90 max.	20 - 35	30-50
No. 8 (2.36 mm)	19 - 45	23 - 49	28 - 58	32-67	16 - 24	20-30
No. 16 (1.18 mm)	---	---	---	---	---	21 max.
No. 30 (600 □m)	---	---	---	---	---	18 max.
No. 50 (300 □m)	---	---	---	---	---	15 max.
No. 100 (150 □m)	---	---	---	---	---	---
No. 200 (75 □m)	1 - 7	2 - 8	2 - 10	2-10	8.0-11.0	8.0-12.0

Delete Sec 403.3.3 and substitute the following: ***12/05; 02/08***

403.3.3 Porphyry Mixtures. For SP125xLP and SMA mixtures, at least 50 percent by volume of the plus No. 8 (2.36 mm) material shall be from crushed porphyry in accordance with Sec 1002. Depending on the actual gradation of porphyry aggregate furnished, the amount of crushed porphyry required may vary, however at least 40 percent by weight (mass) of crushed porphyry will be required. Steel slag may be substituted for porphyry in SP125xLP and SM mixtures, except at least 45 percent by weight (mass) of crushed porphyry and/or slag will be required. The engineer may approve the use of other hard, durable aggregate in addition to porphyry and steel slag. . When an SMR mixture is designated, the mixture shall contain aggregate blends in accordance with Sec 403.3.5 using the plus No. 4 requirements for SP125 and the minus No. 4 requirements for SP095.

Delete Sec 403.3.4 and substitute the following: ***12/05***

403.3.4 Minimum Stone Matrix Asphalt Binder. The percent asphalt binder for SMA mixtures shall not be less than 6.0 percent unless otherwise allowed by the engineer.

Delete Sec 403.3.5 and substitute the following: ***02/08***

403.3.5 Surface Mixtures. Design level B surface mixtures, except as described in Sec 403.15.3, containing limestone coarse aggregate shall contain a minimum amount of non-carbonate aggregate. The LA abrasion values, AASHTO T 96, of the limestone will determine the type and amount of non-carbonate aggregate required as shown in the table below. The LA abrasion value will be determined from the most recent source approval sample. In lieu of the above requirements, the aggregate blend shall have an acid insoluble residue (AIR), MoDOT Test Method TM 76, meeting the plus No. 4 (4.75 mm) criteria of crushed non-carbonate material. Non-carbonate aggregate shall have an AIR of at least 85 percent insoluble residue.

Coarse Aggregate (+ No. 4)	Minimum Non-Carbonate by Volume
Limestone, LA ≤ 30	30% Plus No. 4
Limestone, LA > 30	20% Minus No. 4[a]
Dolomite	No Requirement

[a] Use for all SP095 containing limestone.

Delete Sec 403.4 and substitute the following: ***02/08***

403.4 Job Mix Formula. At least 30 days prior to placing any mixture on the project, the contractor shall submit a mix design for approval to Construction and Materials. The mixture shall be designed in accordance with AASHTO R 35 or PP 41 and shall be tested in accordance with AASHTO T 312 except as noted herein. A detailed description of the mix design process shall be included with the job mix formula (JMF). Representative samples of each ingredient for the mixture shall be submitted with the mix design. Aggregate fractions shall be provided in the same proportions as the proposed job mix formula. A minimum of 150 pounds (68 kg) will be required for any individual fraction. The amount of each ingredient submitted shall be as follows for each mix design to be verified:

Ingredient	Minimum Amount
Aggregate	750 Pounds (340 kg)
Hydrated Lime, Mineral Filler and/or Baghouse Fines	20 Pounds (9 kg)
Asphalt Binder	10 Gallons (38 L)

Delete Sec 403.4.2 (b) and substitute the following: ***04/06***

(b) Source, type (formation, etc.), ledge number if applicable, gradation, and deleterious content of each aggregate fraction

Delete Sec 403.4.2 (k) and substitute the following: ***02/08***

(k) Theoretical maximum specific gravity (G_{mm}) as determined by AASHTO T 209, in accordance with Sec 403.19.3, after the sample has been short term aged in accordance with AASHTO R 30.

Delete Sec 403.4.2 (u) and substitute the following: ***12/05***

(u) Voids in coarse aggregate (VCA) for both the mixture and dry-rodded condition for SMA mixtures.

Delete Sec 403.4.2 (v) and substitute the following: ***12/05***

(v) Draindown for SMA mixtures.

Delete Sec 403.4.5 and substitute the following ***12/05, 02/08***

403.4.5 Design Gyrations. The number (N) of gyrations required for gyratory compaction shall be as follows:

Design	$N_{initial}$	$^{a}N_{design}$	$^{a}N_{maximum}$
E	7	75	115
C	8	100	160
B	9	125	205

[a]SMA mixtures shall have N_{design} equal to 75 and no $N_{maximum}$ requirement.

In addition, the compaction level, as a percent of theoretical maximum specific gravity, shall be less than or equal to 91.5 percent for Design F, 90.5 percent for Design E and 89.0 percent for Designs C and B at $N_{initial}$, equal to 96.0 percent at N_{design} and less than or equal to 98.0 percent at $N_{maximum}$.

Delete Sec 403.4.6.2 and substitute the following: ***12/05; 02/08***

403.4.6.2 Voids in the Mineral Aggregate (VMA).

Mixture	VMA Minimum (percent)
SP250	12.0
SP190	13.0
SP125 (except for SMA)	14.0
SP095 (except for SMA)	15.0
SMA	17.0

Delete Sec 403.4.6.3 and substitute the following: ***12/05***

403.4.6.3 Voids Filled With Asphalt (VFA).

Design	VFA (percent)[a]
E	65 – 78
C	65 – 75
B	65 – 75

[a]SMA mixtures shall have a minimum VFA of 75 percent.

Delete Sec 403.4.7 – 403.4.10 and substitute the following: ***12/05***

403.4.7 Dust to Binder Ratio. For all mixtures except SMA, the ratio of minus No. 200 (75 µm) material to effective asphalt binder (P_{be}) shall be between 0.8 and 1.6.

403.4.8 Moisture Susceptibility. For all mixtures except SMA, the mixture shall have a tensile strength ratio (TSR) greater than 80 percent when compacted to 95 mm (3.7 inches) with 7 ± 0.5 percent air voids and tested in accordance with AASHTO T 283. SMA mixtures shall have a TSR greater than 80 percent when compacted to 95 mm (3.7 inches) with 6 ± 0.5 percent air voids and tested in accordance with AASHTO T 283.

403.4.9 Draindown. AASHTO T 305, Draindown Test, shall be performed on all SMA mixtures prior to job mix approval. The mixture shall be stabilized in such a way that the draindown of the asphalt binder shall not exceed 0.3 percent by weight (mass) of mixture.

403.4.10 Voids in Coarse Aggregate. The percent VCA_{MIX} of SP125xSM mixtures shall be less than or equal to the VCA_{DRC} as determined using AASHTO T 19. This may be calculated using the following equations:

$$VCA_{DRC} = 100 \times (G_{CA}\gamma_w - \gamma_s) / G_{CA}\gamma_w$$

$$VCA_{MIX} = 100 - (P_{bp} \times G_{mb} / G_{CA})$$

$$P_{bp} = P_s \times PA_{bp}$$

Where:

G_{CA}	=	bulk specific gravity of the combined coarse aggregate (AASHTO T 85),
γ_s	=	unit weight (mass) of coarse aggregate in the dry-rodded condition (DRC) (lb/ft^3) (kg/m^3) (AASHTO T 19),
γ_w	=	unit weight (mass) of water (62.34 lb/ft^3) (1000 kg/m^3),
P_{bp}	=	percent aggregate by total mixture weight (mass) retained on No. 4 (4.75 mm) sieve and
PA_{bp}	=	percent aggregate by total aggregate weight (mass) retained on No. 4 (4.75 mm) sieve*.

*Use No. 8 (2.36 mm) sieve for SP095xSM

Delete Sec 403.5.1 and substitute the following: ***11/05; 04/06; 02/08***

403.5.1 Gradation and Deleterious Content Control. The gradation of the aggregate shall be determined from samples taken from the hot bins on batch-type or continuous mixing plants or from the composite cold feed belt on drum mix plants.. The gradation may also be obtained by sampling the mixture and testing the residual aggregate. The deleterious content of the aggregate shall be determined from samples taken from the composite cold feed belt. The RAP shall be sampled from the RAP feeding system on the asphalt plant. The contractor shall determine on a daily basis at minimum, the gradation on the aggregate reclaimed form the RAP by either extraction or binder ignition. The results shall be used to determine the daily specification compliance for the combined gradation.

Delete Section 403.5.1.1 and substitute the following: ***12/05***

403.5.1.1 Stone Matrix Asphalt Tolerances. In producing mixtures for the project, the plant shall be operated such that no intentional deviations from the job mix formula are made. The maximum deviation from the approved job mix formula shall be as follows for SMA mixtures:

Sieve	**Max. Tolerance (Percent Passing by Mass)**	
	SP095	SP125
3/4 in. (19.0 mm)	---	---
1/2 in. (12.5 mm)	---	±4
3/8 in. (9.5 mm)	±4	±4
No. 4 (4.75 mm)	±3	±3
No. 8 (2.36 mm)	±3	±3
No. 200 (75 μm)	±2	±2

Delete Sec 403.5.1.2 and substitute the following: ***04/06***

403.5.1.2 Mixture Tolerance. For all other SP mixtures, the percent passing the first sieve size smaller than the nominal maximum size shall not exceed 92.0 percent, a tolerance not toexceed 2.0 percent on the No. 8 sieve (2.36 mm) from the table in Sec 403.3.1, and within therange listed in Sec 403.3.1 for the No. 200 sieve (75 µm). The deleterious content of the material retained on the No. 4 (4.75 mm) sieve shall not exceed the limits specified in Sec 1002.2.

Delete Sec 403.5.2 and substitute the following: ***12/05***

403.5.2 Density. The final, in-place density of the mixture shall be 94.0 ± 2.0 percent of the theoretical maximum specific gravity for all mixtures except SMA. SMA mixtures shall have a minimum density of 94.0 percent of the theoretical maximum specific gravity. The theoretical maximum specific gravity shall be determined from a sample representing the material being tested. Tests shall be taken not later than the day following placement of the mixture. The engineer will randomly determine test locations.

Delete Sec 403.5.8 and substitute the following: ***12/05***

403.5.8 Fibers. The fiber proportioning and delivery system for SMA mixtures shall have an accuracy of 10 percent by weight (mass) of the material actually being measured in any given period of time.

Delete Sec 403.5.9 and substitute the following: ***02/08***

403.5.9 Moisture Content. The asphaltic concrete mixture, when sampled and tested in accordance with AASHTO T 329, shall not contain more than 0.5 percent moisture by weight (mass) of the mixture

Delete Sec 403.10.2 and substitute the following: ***12/05; 02/08***

403.10.2 Substitutions. With approval from the engineer, the contractor may substitute a smaller nominal maximum size mixture for a larger sized mixture. Specifications governing the substitute mixture shall apply. Except for a single surface layer, the total pavement thickness shall be maintained when the substitute mixture layer is reduced as allowed in Sec 403.13 by increasing the thickness of other layers or courses. The contract unit price for the original mixture shall be used.

Delete Sec 403.11 through 403.11.1 and substitute the following: ***02/08***

403.11 Field Adjustments of Job Mix Formulas. When test results indicate the mixture produced does not meet the specification requirements, the contractor may field adjust the job mix formula as noted herein. Field adjustments may consist of changing the percent binder as listed on the original approved job mix by no more than 0.3 percent. Additional fractions of material or new material will not be permitted as field adjustments. The engineer shall be notified immediately when any change is made in the cold feed settings, the hot bin settings or the binder content. A new G_{sb} shall be calculated using the new aggregate percentages. The gradation of the adjusted mixture shall meet the requirements of the mixture type specified in the contract. When the binder content is adjusted more than 0.3 percent, the mixture will be considered out of specification, and a new mix design shall be established.

403.11.1 Field Mix Redesign. When a new mix design will be required, the contractor will be permitted to establish the new mix design in the field. The mixture shall be designed in accordance with AASHTO R35 or AASHTO PP 41 and shall meet the mix design requirements, including TSR. A representative sample of the mixture shall be submitted with the new mix design to the Central Laboratory for mixture verification. The amount of mixture submitted for verification shall weigh (have a mass of) at least 50 pounds (24 kg).

Delete Sec 403.13 and substitute the following: ***12/05***

403.13 Spreading and Finishing. The base course, primed or tacked surface, or preceding course or layer shall be cleaned of all dirt, packed soil or any other foreign material prior to spreading the asphaltic mixture. If lumps are present or a crust of mixture has formed, the entire load will be rejected. The thickness and width of each course shall conform to the typical section in the contract. The contractor may elect to construct each course in multiple

layers. The minimum compacted thickness shall be 1.25 inches (30 mm) for SP095, 1.75 inches (45 mm) for SP125, 2 inches (50 mm) for SP190, and 3 inches (75 mm) for SP250.

Delete Sec 403.15 and substitute the following: ***12/05***

403.15 Compaction. After the asphaltic mixture has been spread, struck off and surface irregularities adjusted, the asphaltic mixture shall be compacted thoroughly and uniformly by rolling to obtain the required compaction while the mixture is in a workable condition. Excessive rolling, to the extent of aggregate degradation, will not be permitted. A pneumatic tire roller shall be used as the initial or intermediate roller on any course placed as a wedge or leveling course. Rollers shall not be used in the vibratory mode when the mixture temperature is below 225 F (107 C). Pneumatic tire rollers shall not be used for SMA mixtures.

Delete Sec 403.17.2.3 and substitute the following: ***02/08***

403.17.2.3 Retained Samples. All samples taken by the contractor, including but not limited to tested aggregate, volumetric and density samples, shall be retained for the engineer for a minimum of seven days after the contractor's tests are complete and accepted unless otherwise instructed. These samples shall be maintained in clean covered containers, without contamination, readily accessible to the engineer. The retained sample's identification shall consist of, but is not limited to:

(a) Time and date sampled.

(b) Product specification number.

(c) Type of sample, i.e. belt, bin, stockpile.

(d) Lot and sublot designation.

(e) Sampler/Tester.

(f) Project Job Number.

Delete Sec 403.17.2.3.1 and insert the following: ***04/06***

403.17.2.3.1 Gradation and Deleterious Content Samples. For each gradation and deleterious sample taken, the contractor shall retain for the engineer, the portion of the sample not tested after reducing the original sample to testing size.

Delete the table in Sec 403.17.3.1 and insert the following: ***04/06; 02/08***

Equipment - Test Method (AASHTO)	Requirement	Interval (Month)
Gyratory Compactor - T 312	Calibrate – 1.16 ± .02° internal angle	12[a]
Gyratory Compactor - T 312	Verify	Daily
Gyratory Molds - T 312	Check Critical Dimensions	12
Thermometers – T 209, T 166, T 312	Calibrate	6
Vacuum System - T 209	Check Pressure	12
Pycnometer (Flask) - T 209	Calibrate	Daily
Binder Ignition Oven - T 308	Verify	12[b]
Nuclear Content Gauge – T 287 or MoDOT TM 54	Drift & Stability – Manuf. Recommendation	1
Mechanical Shakers - T 27	Check Sieving Thoroughness	12
Sieves	Check Physical Condition	6
Weighted Foot Assembly - T 176	Check Weight	12
Mechanical Shaker - T 176	Check Rate & Length of Throw	12
Liquid Limit Device - T 89	Check Wear & Critical Dimensions	12
Grooving Tool - T 89	Check Critical Dimensions	12
Ovens	Verify Temp. Settings	4

Balances	Verify	12[b]
Timers	Check Accuracy	6

[a]Calibrate and/or verify after each move.
[b]Verify after each move.

Delete Sec 403.18.1 and substitute the following: ***04/06***

403.18.1 Assurance Testing. The engineer will independently sample and test the mixture from the roadway at the frequency listed in Sec 403.19.3. The independent sample will be of sufficient size to retain half for possible disputes. Further testing of this sample will be under the direction of the engineer. The retained portion of the QC samples for mixture properties , gradation, and deleterious content will be tested at a frequency no less than once per week. The engineer's test results, including all raw data, will be made available to the contractor when completed and no later than the next working day.

Delete Sec 403.18.2 and substitute the following multiple sections: ***04/06***

403.18.2 Aggregate Comparison. Comparison for aggregate will be considered favorable when the contractor's QC results and the engineer's QA test results of a retained sample compare within the following limits.

403.18.2.1 Gradation.

Sieve Size	Percentage Points
3/4 inch (19 mm) and larger	5.0
1/2 inch (12.5 mm)	5.0
3/8 inch (9.5 mm)	4.0
No. 4 (4.75 mm)	4.0
No. 8 (2.36 mm)	3.0
No. 10 (2.00 mm)	3.0
No. 16 (1.18 mm)	3.0
No. 20 (850 μ m)	3.0
No. 30 (600 μ m)	3.0
No. 40 (425 μ m)	2.0
No. 50 (300 μ m)	2.0
No. 100 (150 μ m)	2.0
No. 200 (75 μ m)	1.0

403.18.2.2 Coarse Aggregate Angularity. Angular particles shall be within 5 percentage points.

403.18.2.3 Fine Aggregate Angularity. Void content shall be within 2 percentage points.

403.18.2.4 Sand Equivalent. Sand equivalency shall be within 5 percentage points.

403.18.2.5 Thin, Elongated Particles. Flat, elongated particle content shall be within one percentage point.

403.18.2.6 Deleterious. The total and individual deleterious content shall not exceed the specification limits.

Delete the table in Sec 403.19.3 and replace with the following table: ***11/05; 02/08***

Tested Property	Pay Factor	Test Method	Contractor Frequency	Engineer Frequency
Mixture temperature	No	----	1/Sublot	1/day
Temperature of base and air	No	----	As needed	As needed
Mat Density (% of theoretical maximum density) by contractor	Yes	MoDOT Test Method TM-41 or AASHTO T 166	1 Sample[b]/Sublot As needed for joints & shoulders.	1 Sample/Lot
Unconfined Joint Density	No	MoDOT Test Method TM-41 or AASHTO T 166	1 Sample[b]/Sublot	1 Sample/Lot
Cold feed or hot bin gradation and deleterious content	No	AASHTO T 27 and AASHTO T 11	2/Lot	1/Lot
FAA, CAA, Clay Content and Thin, Elongated Particles from material sampled from the cold feed or hot bin	No	AASHTO T 304, ASTM D 5821, AASHTO T 176 and ASTM D 4791	1/10,000 tons with a minimum of 1/project/mix type	1/project
Asphalt content	Yes	AASHTO T 164, or MoDOT Test Method TM-54, or AASHTO T 287, or AASHTO T 308	1/Sublot	1/Lot
Asphalt content of RAP	No	AASHTO T 164[d]	1/Lot	1/project
VMA @ N_{des} gyrations	Yes[a]	AASHTO T 312 and PP 28	1/Sublot	1/Lot
V_a @ N_{des} gyrations	Yes[a]	AASHTO T 312 and PP 28	1/Sublot	1/Lot
VFA @ N_{des} gyrations	No[a]	AASHTO T 312 and PP 28	1/Sublot	1/Lot
Theo. max SG of the mixture	No	AASHTO T 209	1/Sublot	1/Lot
TSR of the in place mixture	No[c]	AASHTO T 283	1/10,000 Tons or fraction thereof	1/50,000 Tons or 1/project combination

[a]Based on the average of a minimum of two compacted specimens.
[b]Core samples shall consist of one core. Up to two additional cores, as stated in the QC Plan, may be obtained at the same offset within one foot (0.3 m) of the randomly selected location. If more than one core is obtained, all cores shall be combined into one sample.
[c]Payment will be based on the table in Sec 403.23.5.

Delete Sec 403.19.3.1.1 and substitute the following: ***11/05***

403.19.3.1.1 Binder Ignition Modification. Asphalt content determination in accordance with AASHTO T 308, Section 6.9.1 shall be modified by adding the following: If the calibration factor exceeds 1.0 percent, lower the test temperature to 427 ± 5 C (800 ± 8 F) and repeat test. Use the calibration factor obtained at 427 C (800 F) even if it exceeds 1.0 percent. If RAP is used, the binder ignition oven shall be calibrated in accordance with MoDOT Test Method TM 77. At the engineer's discretion, testing may be waived when production does not exceed 200 tons (200 Mg) per day. The contractor shall certify the proper proportions of a previously proven mixture were used.

Delete Sec 403.19.3.2.1 and substitute the following: ***02/08***

403.19.3.2.1 Small Quantities. For each separate mixture of less than 3000 tons (3000 Mg) on individual projects, including individual projects in combination contracts, the contractor has the option to use all testing frequencies in accordance with Sec 403.19.3 or the following shall apply:

(a) A field laboratory will not be required for monitoring mixtures. All required QC and QA testing shall be performed in an approved laboratory.

(b) QC tests required in Sec 403.19.3 shall be performed at a frequency of no less than one per day if production does not exceed 750 tons (750 Mg) and at a frequency of no less than two per day if production exceeds 750 tons (750 Mg). Independent or retained sample QA tests shall be performed at least once per 1500 tons (1500 Mg), as indicated.

Delete Sec 403.19.3.2.2 (a) and substitute the following: ***02/08***

(a) All base widening shall be constructed in accordance with Sec 401.7 and subsections.

Delete the table in Sec403.23.5 and substitute the following: ***02/08***

TSR	Percent of Contract Price
90% and above	103
75-89%	100
70-74%	98
65-69%	97
<65%	Remove
90% and above	103
75-89%	100
70-74%	98

Delete Sec 403.23.7.3 and substitute the following: ***12/05***

403.23.7.3 Removal of Material. All lots of material with a PF_T less than 50.0 shall be removed and replaced with acceptable material by the contractor. Any sublot of material with a percent of theoretical maximum density of less than 90.0 percent or greater than 98.0 percent shall be removed and replaced with acceptable material by the contractor. For SMA mixtures, any sublot of material with a percent of theoretical maximum density of less than 92.0 percent shall be removed and replaced with acceptable material by the contractor. Any sublot of material with air voids in the compacted specimens less than 2.5 percent shall be removed and replaced with acceptable material by the contractor. No additional payment will be made for such removal and replacement. The replaced material will be tested at the frequencies listed in Sec 403.19. Pay for the material will be determined in accordance with the applicable portions of Sec 403.23 based on the replacement material.

Delete Sec 403.23.7.4.1 and substitute with the following: ***12/05; 02/08***

403.23.7.4.1 Small Quantities. For each separate mixture of less than 3000 tons (3000 Mg) on individual projects, including individual projects in combination contracts, the following shall apply unless the contractor states in the Bituminous QC Plan that normal evaluation of the material will be followed:

(a) QLA and PWL will not be required.

(b) Mixtures shall be within the specified limits for VMA, V_a, AC and density. In addition to any adjustments in pay due to profile, the contract unit price for the mixture represented by each set of cores will be adjusted based on actual field density above or below the specified density using the following schedule:

Field Density (Percent of Laboratory Max. Theoretical Density)			**Pay Factor (Percent of Contract Unit Price)**
For all SP mixtures other than SMA:			
		92.0 to 96.0 inclusive	100
96.1 to 96.5	or	91.5 to 91.9 inclusive	90
96.6 to 97.0	or	91.0 to 91.4 inclusive	85
97.1 to 97.5	or	90.5 to 90.9 inclusive	80
97.6 to 98.0	or	90.0 to 90.4 inclusive	75
Above 98.0	or	Below 90.0	Remove and Replace
For SMA mixtures:			
		>94.0	100
		93.5 to 93.9 inclusive	90
		93.0 to 93.4 inclusive	85
		92.5 to 92.9 inclusive	80
		92.0 to 92.4 inclusive	75
		Below 92.0	Remove and Replace

SECTION 409 – CHIP SEAL

Delete Sec 409 in its entirety and substitute the following: ***02/08***

SECTION 409

SEAL COAT

409.1 Description. This work shall consist of placing bituminous material followed by placing cover aggregate material.

409.2 Material. All material shall be in accordance with Division 1000, Material Details, and specifically as follows:

Item	**Section**
Aggregate for Seal Coats[a]	1003

[a]The grade of aggregate will be specified in the contract.

409.2.1 Asphalt binder shall meet the following criteria:

Asphalt Binder Requirements			
Tests on Asphalt Binder[a]	**Test Method**	**Minimum**	**Maximum**
Penetration @ 77°F	ASTM D 5	60	150
Elastic Recovery @ 50°F, %	AASHTO T 301	65	---

[a] These tests shall be done on the asphalt residue for emulsions and cutbacks.

409.2.2 Pre-coating binder shall be in accordance with Sec 1015 for PG binder or emulsions.

409.3 Job Mix Formula. Prior to placing the seal coat, the contractor shall submit the mix design to the engineer for approval.

409.3.1 The mix design shall contain the following information:

(a) Source, grade and certified test results for the asphalt binder.

(b) Source, type (formation, etc.), ledge number if applicable, and gradation of the aggregate.

(c) The grade and certified test results for the aggregate.

(d) The application rate used to pre-coat the aggregate as allowed in Sec 1003.

(e) The percent binder application rate, gallons per square yard (L/m^2).

(f) The aggregate application rate, pounds per square yard (kg/m^2).

409.3.2 The application rates shall not vary from the mix design by more than the following amounts:

Material	Tolerance
Asphalt Binder	– 0.05 to + 0.15
Aggregate	± 5

409.4 Equipment. Equipment shall be capable to perform the following:

(a) Heating and applying bituminous material, measuring temperature of tank contents and continuously verify application rates. The calibration of the system shall be approved by the engineer prior to use, and the contractor shall furnish all equipment, material and assistance necessary if calibration is required.

(b) Removal of loose aggregate from applied surface.

(c) Seating of aggregate without causing aggregate fracture.

(d) Accurately measuring and uniformly spreading the aggregate over the full width of the bituminous material.

409.5 Construction Requirements.

409.5.1 Weather Limitations. Bituminous material shall not be placed on any wet surface or when the ambient temperature or the temperature of the pavement on which it is to be placed is below 60 F (15.5 C). Temperatures shall be obtained in accordance with MoDOT Test Method TM 20.

409.5.2 Surface Preparation. The surface shall be thoroughly cleaned.

409.5.3 Application of Bituminous Material.

409.5.3.1 Bituminous material shall be uniformly applied within the temperature range recommended by the manufacturer. Any bituminous material on adjacent Portland cement or asphaltic concrete pavements, curbs, bridges or any areas not specified to be sealed shall be removed by the contractor, at the contractor's expense.

409.5.3.2 When pre-coating is required, the cover aggregate shall be pre-coated at a minimum rate of 0.5 percent residual asphalt by weight of aggregate.

409.6 Traffic Control.

409.6.1 The contractor shall perform work in such a way as to avoid damage to vehicles resulting from asphalt or loose aggregate. Conformance with the specifications, standards and traffic control plan is considered a minimum effort and is not intended to absolve any liability for damage to vehicles as a result of construction operations. The contractor shall designate a responsible person for receiving and resolving damage claims from the public. This person shall be available, by telephone, during normal business hours Monday through Friday. The company name and contact information shall be posted as designated on the plans. The contractor shall submit a list of all damage claims and disposition to the engineer on a bi-weekly basis.

409.6.2 The contractor shall provide contact information signs with their company name and phone number on a variable width by 24 inch tall sign with black lettering on an orange background. The first line shall state "CONTRACTOR" in uppercase 4 inch C highway font, the second line shall contain the contractor name in upper/lower case 4 inch B highway font and the third line shall contain the contractor's phone number in 4 inch C highway font. Signs shall be posted near the beginning and end of the project limits as approved by the engineer.

409.7 Basis of Acceptance. Seal coat will be evaluated by the engineer based on the following criteria. Any of the following may be grounds for rejection:

(a) During normal traffic operations, the presence of any loose stone that may be picked off the surface by vehicles.

(b) During normal traffic operations, the presence of any dust that is a nuisance to adjoining properties or impairs visibility.

(c) During normal traffic operations, the presence of any bleeding or moderate tracking.

(d) Transverse or longitudinal construction joints from the chip seal application that are not straight and uniform and create a bump or poor riding joint.

(e) An asymmetric appearance seen in a chip seal surface characterized by longitudinal grooves or ridges in the surface.

(f) A surface not having complete aggregate coverage with holes or failures in the surface.

409.8 Method of Measurement. Final measurement of the completed seal coat will not be made except for authorized changes during construction, or where appreciable errors are found in the contract quantity. Where required, measurement of seal coat, complete in place, will be made to the nearest square yard (m^2). The revision or correction will be computed and added to or deducted from the contract quantity.

409.9 Basis of Payment. The accepted quantities of seal coat, in place, will be paid for at the contract unit price. . No separate payment will be made for pre-coating aggregate or for providing and installing contact information signs.

SECTION 413 – SURFACE TREATMENTS

Delete Sections 413.10.2.5, 413.10.2.5.1, 413.10.2.5.2 and 413.2.5.3 and substitute the following: 11/05

413.10.2.5. Material Acceptance. All aggregate shall be sampled, tested and approved by the engineer prior to use. Portland cement and hydrated lime may be accepted for use based on visual examination.

Delete Section 413.10.5.2 and substitute the following: 11/05

413.10.5.2 Surface Preparation. The surface shall be thoroughly cleaned of all vegetation, loose material, dirt, mud, and other objectionable material and shall be pre-wetted as required immediately prior to application of the micro-surfacing. All pavement marking shall be removed, maintained, and compensated for in accordance to Sec 620.

Delete Sec 413.30 in its entirety and substitute the following: 02/08

SECTION 413.30 ULTRATHIN BONDED ASPHALT WEARING SURFACE

413.30.1 Description. This work shall consist of producing and placing an ultrathin bonded asphalt wearing surface.

413.30.2 Material. All material shall be in accordance with Division 1000, Material Details, and specifically as follows, except as modified herein:

Item	Section

Coarse Aggregate	1002.2
Fine Aggregate	1002.3
Mineral Filler	1002.4

413.30.2.1 Coarse Aggregate. Coarse aggregate may consist of crushed gravel, limestone, dolomite, porphyry, steel slag, flint chat, or blends of two or more of these aggregates will be acceptable. When coarse aggregate for these mixes are from more than one source or of more than one type of material, the coarse aggregate shall be proportioned and blended to provide a uniform mixture. Coarse aggregate shall be material predominantly retained above the No. 4 (4.75 mm) sieve and shall be in accordance with the following requirements:

Coarse Aggregate Modified Requirements			
Test	**Method**	**Min**	**Max**
Los Angeles Abrasion Value, % Loss[a]	AASHTO T 96		35
Soundness, % Loss, Sodium Sulfate[a]	AASHTO T 104		12
Flat & Elongated Ratio, % @ 3:1[b]	ASTM D 4791		25
% Crushed, single face[b]	ASTM D 5821	95	
% Crushed, two faces[b]	ASTM D 5821	85	
Micro-Deval, % loss[a]	AASHTO TP 58		18

[a]Tests shall be determined on each individual ledge basis.
Tested on the coarse portion of the blended aggregate

413.30.2.2 Fine Aggregate. Fine aggregate shall be material predominantly passing the No. 4 (4.75 mm) sieve and shall be in accordance with the following requirements:

Fine Aggregate Modified Requirements			
Tests	**Method**	**Min**	**Max**
Sand Equivalent	AASHTO T 176	45	
Methylene Blue	AASHTO TP 57		10
Uncompacted Void Content	AASHTO T 304	40	

[b]Tested on the fine portion of the blended aggregate

413.30.2.3 Asphalt Binder. The asphalt binder shall be in accordance with Sec 1015, including all subsections pertaining to PG70-22.

413.30.2.4 Polymer Modified Emulsion Membrane. The emulsion shall be polymer modified and shall be in accordance with Sec. 1015.

413.30.3 Job Mix Formula. At least 30 days prior to placing any mixture on the project, the contractor shall submit a mix design to Construction and Materials for approval. Representative samples from each ingredient for the mix shall be submitted with the mix design.

413.30.3.1 Proficiency Sample Program. Laboratories that participate in and achieve a score of three or greater in the AASHTO proficiency sample program for T 11, T 27, T 84, T 85, T 166, T 176, T 209, T 304 (ASTM C 1252), T 308 and T 312 will have the mixture verification process waived. The mix design shall be submitted to Construction and Materials for approval at least seven days prior to mixture production.

413.30.3.2 Required Information. The mix design shall include raw data from the design process and contain the following information:

(a) Source, grade and specific gravity of asphalt binder.

(b) Source, type (formation, etc.), ledge number if applicable, and gradation of the aggregate.

(c) Bulk and apparent specific gravities and absorption of each aggregate fraction in accordance with AASHTO T 85 for coarse aggregate and AASHTO T 84 for fine aggregate including all raw data.

(d) Specific gravity of hydrated lime, mineral filler or baghouse fines, if used, in accordance with AASHTO T 100.

(e) Percentage of each aggregate component.

(f) Combined gradation of the job mix.

(g) Percent asphalt binder, by weight (mass), based on the total mixture.

(h) Theoretical maximum specific gravity (G_{mm}) as determined by AASHTO T 209, in accordance with Sec 403.19.3.1, after the sample has been short term aged in accordance with AASHTO R 30.

(i) The tensile strength ratio as determined by AASHTO T 283 including all raw data.

(j) Mixing temperature and gyratory molding temperature.

(k) Bulk specific gravity (G_{sb}) of the combined aggregate.

(l) Percent chert contained in each aggregate fraction.

(m) Percent deleterious contained in each aggregate fraction.

(n) Blended aggregate properties for clay content, angularity, and thin and elongated particles.

(o) Draindown for mixture.

(p) Film thickness for mixture

413.30.4 Composition of Mixture.

413.30.4.1 Asphalt Amount. The amount of asphalt binder in the mixture shall meet the following limits for the type of mixture specified in the contract.

Mix Design Criteria			
	Type A	**Type B**	**Type C**
Asphalt Content, %	5.0 – 5.8	4.8 – 5.6	4.6 – 5.6

413.30.4.2 Gradation. Prior to mixing with asphalt binder, the combined aggregate gradation, including filler if needed, shall meet the following gradation for the type of mixture specified in the contract.

Mix Design Criteria			
Composition by Weight (Mass) Percentages			
	Type A	**Type B**	**Type C**
Sieves	**% Passing**	**% Passing**	**% Passing**
3/4 in. (19.0 mm)			100
1/2 in. (12.5 mm)		100	75 – 100
3/8 in. (9.5 mm)	100	75 – 100	50 – 80
No. 4 (4.75 mm)	40 – 55	25 – 38	25 – 38
No. 8 (2.36 mm)	22 – 32	19 – 27	19 – 27
No. 16 (1.18 mm)	15 – 25	15 – 23	15 – 23
No. 30 (600 µm)	18 max.	10 – 18	10 – 18
No. 50 (300 µm)	13 max.	8 – 13	8 – 13
No. 100 (150 µm)	10 max.	6 – 10	6 – 10
No. 200 (75 µm)	4.0 – 6.0	4.0 – 6.0	4.0 – 6.0

413.30.4.3 Film Thickness. The film thickness shall be a minimum 9.0 microns when calculated using the effective asphalt content in conjunction with the surface area for the aggregate in the Job Mix Formula. The surface area factors can be found in Table 6.1 of the Asphalt Institute MS-2, *Mix Design Methods for Asphalt Concrete and Other Hot Mix Types*, Sixth Edition.

413.30.4.4 Non-Carbonate Aggregate Requirement. Mixtures containing limestone coarse aggregate shall contain a minimum amount of non-carbonate aggregate as shown in the table below, or the aggregate blend shall have an acid-insoluble residue (A.I.R.), MoDOT Test Method TM 76, meeting the plus No. 4 (4.75 mm) sieve criteria of crushed non-carbonate material. Non-carbonate aggregate shall have an A.I.R. of at least 85 percent insoluble residue.

Coarse Aggregate (+ No. 4)	Minimum Non-Carbonate by Volume
Limestone	30% Plus No. 4
Dolomite	No Requirement

413.30..4.5 Drain Down. Drain down from the loose mixture shall not exceed 0.10 percent when tested in accordance with AASHTO T 305.

413.30.4.6 Moisture Susceptibility. The mixture shall have a tensile strength ratio (TSR) of 80 percent or greater when compacted to 95mm (3.7 inches) with 7 +/- 0.5 percent air voids and tested in accordance with AASHTO T 283.**413.30.4.7 Reclaimed Material.** The mixture shall not contain reclaimed material.

413.30.5 Construction Requirements.

413.30.5.1 Weather Limitations. A damp pavement surface may be acceptable for placement if free of standing water and favorable weather conditions are expected to follow. Mix shall not be placed if the air temperature or the temperature of the surface on which the mixture is to be placed is below 50 F (10 C), the surface is wet or frozen, or weather conditions prevent the proper handling or finishing of the mixture. Temperatures shall be obtained in accordance with MoDOT Test Method TM 20.

413.30.5.2 Paver. The paver shall be capable of spraying the polymer modified asphalt emulsion membrane, applying the hot mix asphalt overlay and leveling the surface of the mat in one pass. Wheels or other parts of the paving machine shall not come in contact with the polymer modified emulsion membrane before the hot mix asphalt concrete wearing course is applied. The screed shall have the ability to crown the pavement at the center and shall have vertically adjusted extensions to accommodate the desired pavement profile.

413.30.5.3 Surface Preparation. Immediately prior to placing the ultrathin bonded asphalt wearing surface, the roadway surface shall be thoroughly cleaned of all vegetation, loose material, dirt, mud and other objectionable material. All non-working surface cracks with an opening size exceeding 1/4 inch (6 mm) and any size working crack shall be sealed prior to placement of the ultrathin bonded asphalt wearing surface. Immediately prior to spraying the polymer modified emulsion membrane, the surface shall be free of fresh bituminous mix. The ultrathin bonded asphalt wearing surface shall not be placed until the sealant has cured. Curing time of sealant shall be in accordance with the manufacturer's recommendations.

413.30.5.4 Application of Membrane. The polymer modified emulsion membrane application shall be applied in accordance with the manufacturer's recommendations. The sprayer shall accurately and continuously monitor the rate of spray and shall provide a uniform application across the entire width to be overlaid.

413.30.5.4.1 Adjusting Membrane Rate. The engineer may make adjustments to the spray rate based on the existing pavement surface conditions and the recommendations of the polymer modified emulsion membrane manufacturer.

413.30.5.4.2 Application Rate of Membrane. Limits of the target application rate of the asphalt emulsion shall be 0.20 ± 0.07 gallon per square yard (0.9 ± 0.3 L/m^2).

413.30. 5.5 Application of Mixture. The hot mix asphalt concrete shall be applied at a temperature of 290 to 330 F (143 - 166 C) and shall be spread over the polymer modified emulsion membrane immediately after application of

the polymer modified emulsion. The hot asphalt concrete wearing course shall be placed over the full width of the polymer modified emulsion membrane with a heated vibratory-tamping bar screed.

413.30.5.5.1 Handwork. For handwork, the hot mix asphalt shall be applied within five minutes after the application of the polymer modified emulsion.

413.30.5.5.2 Application Rate of Mixture. The target application rate of the ultrathin bonded asphalt wearing course shall be as shown on the plans. The application rate shall be adjusted to minimize fracturing of the top size aggregate by the screed. The engineer will determine the acceptable extent of fracturing at the edges for tapering purposes.

413.30.5.6 Rolling. Rolling of the wearing course shall consist of no more than three passes immediately following placement of the ultrathin bonded asphalt wearing course with a steel, double-drum, asphalt roller with a minimum weight of 10 tons (9 Mg). All rolling shall be completed before the material temperature has fallen below 195 F (91 C). Rollers shall be equipped with a functioning water system and scrapers to prevent adhesion of the fresh mix onto the roller drums. An acceptable release agent approved by the engineer may be added to the water system to prevent adhesion of the fresh mix to the roller drum and wheels. Rolling shall be done in the static mode. Excessive rolling to the extent of aggregate degradation will not be permitted. The engineer will determine the acceptable extent of fracturing at the edge of the pavement from the rolling operation. New pavement shall not be opened to traffic nor shall any roller sit idle on the pavement until the rolling operation is complete and the material has been cooled below 140 F (70 C).

413.30.5.7 Bituminous Mixing Plants. Bituminous mixing plants and preparation of materials and mixtures shall be in accordance with Sec 404.

413.30.5.8 Hauling Equipment. Trucks used for hauling bituminous mixtures shall be in accordance with Sec 404.

413.30.5.9 Wearing Course. The finished wearing course shall have a minimum thickness of 1/2 inch (13 mm) for Type A, 5/8 inch (16 mm) for Type B, and 3/4 inch (19 mm) for Type C.

413.30.5.10 Pavement Marking. Pavement marking shall be replaced in accordance with Sec 620.

413.30.5.11 Acceptance. Acceptance will be based on test results indicating that the ultrathin bonded asphalt wearing surface meets the specification requirements, the contractor following the approved QC Plan, and favorable comparison of the contractor's QC test and the engineer's QA test.

413.30.6 Quality Control.

413.30.6.1 Quality Control Operations. Quality control shall be conducted in accordance with Sec 403.17, except as follows.

413.30.6.1.1 Aggregate Gradation. Sieve analysis shall be performed for every 600 tons (600 Mg) of mixture produced Test shall be performed in accordance with AASHTO T 27 from randomly sampled material taken from the composite cold feed belt or the hot bins.

413.30.6.1.2 Asphalt Content. The asphalt binder content shall be determined for each 600 tons (600 Mg) of mixture produced. Test shall be performed in accordance with AASHTO T 287 or AASHTO T 308. Samples for determination of the asphalt binder content shall be retrieved from the hot elevator at the asphalt plant or from the transport truck at the plant by random sampling.

413.30.6.1.3 Deleterious Content. Deleterious content shall be determined for every 600 tons (600 Mg) of mixture produced. Test shall be performed in accordance with MoDOT Test Method TM 71 from randomly sampled material taken from the composite cold feed belt.

413.30.6.2 Gradation and Asphalt Binder Tolerances. The total aggregate gradation and asphalt content shall be within the range specified in Sec 413.30.4.2 and the maximum variations from the approved job mix formula shall be within the following tolerances:

Gradation and Asphalt Binder Tolerances			
	Percent Passing		
Sieves	Type A	Type B	Type C
3/4 in. (19.0 mm)	-	-	-
1/2 in. (12.5 mm)	-	-	± 5.0
3/8 in. (9.5 mm)	-	± 5.0	-
No. 4 (4.75 mm)	± 5.0	± 4.0	± 4.0
No. 8 (2.36 mm)	± 4.0	± 4.0	± 4.0
No. 16 (1.18 mm)	± 4.0	-	-
No. 200 (75 µm)	± 1.0	± 1.0	± 1.0
Asphalt Content, %	± 0.3	± 0.3	± 0.3

413.30.6.3 Deleterious Content Tolerance. The deleterious content of the material retained on the No. 4 sieve shall not exceed the limits specified in Sec 1002.2.

413.30.6.4. Verifying Membrane Rate. The application rate of the polymer emulsion membrane shall be verified by dividing the volume of polymer modified emulsion membrane used by the area of paving for that day.

413.30.6.5 Mix Adjustments. The contractor may make field adjustments to the job mix formula as noted herein. The adjusted job mix formula shall be in accordance with the mix design requirements of Sec 413.30.4. The engineer shall be notified prior to making any change in the cold feed settings, the hot bin settings or the binder content. No additional fractions of material or new material will be permitted for field adjustments.

413.30.6.6 Defective Areas. The contractor shall remove and replace defective areas at the contractor's expense with material meeting specification requirements as directed by the engineer.

413.30.7 Quality Assurance. Quality assurance will be conducted in accordance with Sec 403 except as follows.

413.30.7.1 Sampling Frequency. Corrective action shall be taken by the contractor if any QA tests are outside the QC tolerances shown in Sec 413.30.6.2. The engineer will, at a minimum, independently sample and test at the following frequency:

Sample	Frequency
Aggregate Gradation	1 per day
Asphalt Binder Content	1 per day
Deleterious Content	1 per day

413.30.7.2 Testing Retain Samples. The engineer will test, at a minimum, one retained QC gradation sample and one retained QC asphalt binder content sample per calendar week. The engineer's test results, including all raw data, will be made available to the contractor by the next working day.

413.30.7.2.1 Aggregate Comparison. A favorable aggregate comparison will be achieved when test results are within the specified tolerances shown in Sec 403.18.2.

413.30.7.2.2 Asphalt Content Comparison. A favorable asphalt content will be achieved when test results are within 0.3 percent.

413.30.8 Method of Measurement. Final measurement of the completed surface will not be made except for authorized changes during construction, or where appreciable errors are found in the contract quantity. Where required, measurement of ultrathin bonded asphalt wearing surface, complete in place, will be made to the nearest square yard (m^2). The revision or correction will be computed and added to or deducted from the contract quantity.

413.30.9 Basis of Payment. The accepted quantity of ultrathin bonded asphalt wearing surface will be paid for at the contract unit price.

SECTION 501 – CONCRETE

Delete Sec 501 in its entirety and substitute the following: ***08/07***

SECTION 501

CONCRETE

501.1 Description. Concrete shall consist of a mixture of cement, fine aggregate, coarse aggregate and water, combined in the proportions specified for the various classes. Admixtures may be added as specifically required or permitted.

501.2 Material. All material shall be in accordance with Division 1000, Material Details, and specifically as follows:

Item	Section
Coarse Aggregate[a]	1005.2
Fine Aggregate[a]	1005.3
Ground Granulated Blast Furnace Slag	1017
Fly Ash	1018
Cement	1019
Concrete Admixture	1054
Concrete Tinting Material	1056
Water	1070

[a]Regardless of the gradation of the coarse and fine aggregate used in concrete for pavement or base, the aggregate shall meet the quality requirements of coarse and fine aggregate for concrete pavement.

501.2.1 Aggregate Acceptance. Aggregate for Portland cement concrete masonry will be sampled and tested by the engineer in accordance with the following table at the last possible point of incorporation into the project.

Item	Property	Minimum Number of Tests
Portland Cement Concrete Masonry	Gradation of Coarse Aggregate - AASHTO T 27 and T 11	One per 500 cubic yards per fraction per project. None if less than 100 cubic yards.
	Gradation of Fine Aggregate - AASHTO T 27 and T 11	
	Deleterious Content - MoDOT Test Method TM 71	
	Absorption of Coarse Aggregate - AASHTO T 85	
	Thin or Elongated Pieces - ASTM D 4791 (+3/4 in., 5:1)	One per project.

501.2.2 Retained Samples. The engineer shall retain the portion of the sample not tested after reducing the original sample to testing size. Approximately twenty percent of the retained samples will be sent to the Central Laboratory for comparison purposes.

501.3 Mix Design. The proportions of cement, fine aggregate and coarse aggregate for concrete shall be approved by the engineer within the applicable limits of the specifications for the class of concrete specified in the contract. The contractor shall submit a mixture designed by absolute volume methods or an optimized mix design method such as Shilstone method or other recognized optimization method. Optimized will refer to aggregate gradations that produce lower water demands, as well as improved workability and finishing characteristics. The target and allowable gradation range of each fraction shall be included. The contractor may be required to submit representative samples of each ingredient to Construction and Materials for laboratory testing.

501.3.1 Required Information. The concrete mix design shall contain the following information:

(a) Source, type and specific gravity of Portland cement

(b) Source, type (class, grade, etc.) and specific gravity of supplementary materials, if used

(c) Source, name, type and amount of admixtures

(d) Source, type (formation, etc.), ledge number if applicable, and gradation of the aggregate

(e) Specific gravity and absorption of each fraction in accordance with AASHTO T 85 for coarse aggregate and AASHTO T 84 for fine aggregate, including raw data

(f) Unit Weight of each fraction in accordance with AASHTO T 19

(g) The percent of each aggregate component used for optimized concrete mixes

(h) The design air content and slump

(i) Batch weights of Portland Cement and supplemental cementious materials

(j) Batch weights of coarse, intermediate and fine aggregates

(k) Batch weight of water

Delete Sec 501.3.2 and Substitute the following: ***08/08***

501.3.2 Paving Concrete. For PCCP mixes, the gradation requirements of Sec 1005.2 and Sec 1005.3 will not apply. For all fractions, 100 percent of each fraction shall pass the 2-inch (50 mm) sieve. When Grade F is required, 100 of each fraction shall pass the 3/4-inch (19.0 mm) sieve.

501.3.3 Optimized Masonry Concrete. For optimized PCCM mixes, the gradation requirements of Sec 1005.2 and Sec 1005.3 will not apply. For coarse aggregate, 100 percent of each fraction shall pass the one-inch (25 mm) sieve and no more that 2.5 percent shall pass the No. 200 (75 µm) sieve. For fine aggregate, no more than 2.0 percent shall pass the No. 200 (75 µm) sieve for natural sand, and no more than 4.0 percent shall pass the No. 200 (75 µm) sieve for manufactured sand.

501.3.4 Non-Optimized Masonry Concrete. When optimized aggregate gradations are not selected by the contractor, all provisions, including gradations requirements of Sec 105 shall apply

501.3.5 Fine Aggregate Classes. Fine aggregates are grouped into four classes and a minimum cement factor has been established for each class.

501.3.6. Cement Factors. The minimum cement requirements in pounds per cubic yard (kg/m^3) of concrete for the various classes of sand shall be as follows:

Cement Requirements[a,b]							
Class of Sand	**Class A-1 Concrete**	**Class B Concrete**	**Class B-1 Concrete**	**Class B-2 Concrete**	**Class MB-2 Concrete[g,h]**	**Pavement Concrete**	**Seal Concrete**
A[c]	600(360)	525(310)	610(360)	705(420)	600(360)	560(330)	660(390)
B[d]	640(380)	565(330)	640(380)	735(430)	620(370)	560(330)	695(410)
C[e]	--	585(350)	660(390)	750(450)	640(380)	560(330)	715(420)
D[f]	--	620(370)	695(410)	790(470)	660(390)	560(330)	735(430)

[a]When used, Type IP, I(PM), IS or I(SM) cement shall be substituted on a pound for pound (kg for kg) basis for Type I or Type II cement and adjustments in design mix proportions will be required to correct the volume yield of the mixture.
[b]The contractor may submit an optimized mix design which has a maximum 50 pounds per cubic yard (30 kg/m^3) reduction in cement from that shown in the tables. If the contractor chooses this option, the mixture

will be subject to review, laboratory testing and approval by the engineer. All other requirements for the cement factor will apply.

[c]Class A sand will include all sand, except manufactured sand, weighing 109 pounds per cubic foot (having a mass of 1740 kg/m^3) or more.

[d]Class B sand will include all chert, river and Crowley Ridge sand weighing from 106 to 108 pounds, inclusive, per cubic foot (having a mass of 1610 - 1730 kg/m^3 inclusive) or glacial sand weighing 108 pounds or less per cubic foot (having a mass of 1730 kg/m^3 or less).

[e]Class C sand will include all chert, river and Crowley Ridge sand weighing from 101 to 105 pounds, inclusive, per cubic foot (having a mass of 1610 - 1680 kg/m^3, inclusive).

[f]Class D sand will include all sand weighing 100 pounds or less per cubic foot (having a mass of 1600 kg/m^3 or less) and any manufactured sand that is produced by the process of grinding and pulverizing large particles of aggregate or which contains more than 50 percent of material produced by the reduction of coarser particles. Manufactured sand produced from limestone or dolomite shall not be used in Portland cement concrete for driving surfaces such as bridge decks, pavements and shoulders.

[g]Modified B-2 (MB-2) concrete may be used in-place of Class B-2 Concrete.

[h]Modified B-2 (MB-2) concrete shall use at least one supplementary cementitious material in accordance with this specification. In no case shall MB-2 concrete use less than 15 percent fly ash or GGBFS.

501.3.7 Unit Weight. The weight per cubic foot (mass/m^3) shall be the dry rodded weight per cubic foot (mass/m^3) of the aggregate, determined in accordance with AASHTO T 19.

501.3.8 Compressive Strength Requirements. Concrete classes shall meet the following compressive strength requirements in pounds per square inch (MPa):

Minimum Design Compressive Strength[1]						
Class A-1 Concrete	**Class B Concrete**	**Class B-1 Concrete**	**Class B-2 Concrete**	**Class MB-2 Concrete**	**Pavement Concrete**	**Seal Concrete**
6,000 (42)	3,000 (21)	4,000 (28)	4,000 (28)	4,000 (28)	4,000 (28)	3,000 (21)

[1]Minimum compressive strength required unless otherwise specified in the contract documents or approved by the engineer.

501.4 Sampling. Sampling of fresh concrete shall be in accordance with AASHTO T 141, except that for central or truck mixed concrete, the entire sample for slump and air tests and for molding compressive strength specimens may be taken at one time after approximately one cubic yard (m^3) of concrete has been discharged, instead of at three or more regular intervals during the discharge of the entire batch. Acceptability of the concrete for slump and air content and, if applicable, for strength requirements, will be determined by tests on these samples.

501.5 Consistency The slump of the concrete shall be within the limits for the respective classes of concrete. The concrete shall be uniform in consistency and shall contain the minimum quantity of water required to produce the designated slump. The slump of concrete mixes will be determined in accordance with AASHTO T 119. The quantity of mixing water in the concrete shall be considered the net quantity after proper allowance has been made for absorption by the aggregate. The slump and mixing water content of the concrete, when placed in the work, shall not exceed the following limits:

Slump and Maximum Water/Cementitious Materials Ratio			
Class of Concrete	**Max. Slump, In. (mm)**	**Max. Pounds of Mixing Water Per Pound of Cementitious Materials (Max. Kilograms of Mixing Water Per Kilogram of Cement)**	
		Air-Entrained	**Non-Air-Entrained**
A-1	3 1/2 (90)	0.46	0.51
B	4 (100)	0.51	0.55
B-1	4 (100)	0.44	0.53
B-2	3 (75)	0.40	----
MB-2	6 (150)	0.42	----
Pavement	----	0.50	0.53
Seal	8 (200)	----	0.53

501.6 Measurement of Material. The cement and aggregate for concrete shall be measured by weight (mass). The weights (masses) of coarse and fine aggregates to be used will be calculated from the proportions approved by

the engineer. Batches that do not contain the proper quantities of material shall be wasted at the contractor's expense.

501.6.1 Weighing Tolerances. The weighing (mass determination) and batching equipment shall be designed and maintained in such a condition that the material for each batch can be quickly and accurately weighed (determined) and shall be operated within a tolerance of plus or minus 0.5 percent for cement and plus or minus 1.0 percent for aggregate. The equipment used for delivery of material to the weigh hoppers shall not permit intermingling of material. Weighing hoppers shall discharge completely and there shall be no accumulation of tare material. Scales shall be accurate to within 0.4 percent of the net load applied. The change in load required to change the position of rest of the indicating element or elements of indicating scales an observable amount shall not be greater than 0.1 percent of the nominal scale capacity. If beam-type scales are used, a separate beam shall be provided for each type of material to be used and means shall be provided for adjustment of tare on a scale separate from those used for other material.

501.6.2 Water Meter Tolerances. Mixing water shall be measured by volume or by weight (mass). If measured by weight (mass), scales shall be in accordance with Sec 501.6.1. The device for the measurement shall be readily adjustable and under all operating conditions shall measure the required quantity within a tolerance of one quart (one liter) or one percent, whichever is greater.

501.6.3 Calibration Frequency. Plant scales and water metering devices shall be calibrated and certified by an approved commercial scale service. A copy of the certification and calibration shall be provided to the engineer upon request. Plants shall be calibrated and certified annually, and whenever plants are moved or found to be out of tolerance during verification. Scales and water metering devices shall be verified by the contractor in the presence of the engineer every 30 working days.

501.7 Mixing. The mixer shall produce concrete uniform in color, appearance and distribution of the material throughout the mixture. The cement, aggregate and no less than 60 percent of the water shall be mixed a minimum of one minute. The remaining water shall be added within 15 seconds after all other material for the batch is in the mixer. If mixers having multiple compartment drums are used, the time required to transfer material between compartments will be considered mixing time. The speed at which the drum rotates shall be as designated by the manufacturer. If such mixing does not result in uniform and smooth texture concrete, a sufficient number of additional revolutions at the same speed shall be performed until a thorough mixing of each batch of concrete is secured. The mixing time shall be measured from the time all cement, aggregate and 60 percent of the water are in the drum. The volume of concrete mixed in each batch shall not exceed the manufacturer's rated capacity. The mixer shall be equipped to automatically time the mixing of each batch of concrete. If the automatic timing device becomes inoperable, a manual timing device shall be provided to complete the day's operation.

501.8 Central and Truck Mixed Concrete. The following additional requirements will apply to central and truck mixed concrete.

501.8.1 Mixer Inspection. All central mixers, truck mixers and agitators shall be in accordance with of these specifications prior to use, and inspection of the equipment shall be made periodically during the work. Only equipment found acceptable in every respect and capable of producing uniform results will be permitted.

501.8.2 Uniformity Testing. Central mixed concrete shall be mixed in a stationary mixer. Except as otherwise permitted in accordance with Sec 501.8.9, the concrete shall be transported to the point of delivery in a truck mixer operating at agitating speed or in an agitator truck. The mixing time shall be in accordance with Sec 501.7, and as necessary to produce concrete that meets the uniformity criteria when tested in accordance with Section 10.3 of ASTM C 94, with the following additions and exceptions:

(a) the two samples shall be obtained within an elapsed time of no more than 15 minutes.

(b) The air content, slump and mix proportions of the concrete tested shall be in accordance with these specifications for that class of concrete or the uniformity tests shall be invalid.

(c) The use of a one-quarter cubic foot (0.007 m^3) measure will be permitted in determination of weight per cubic foot (mass/m^3).

(d) Cylinders may be cured in damp sand after the first 48 hours.

(e) The contractor may designate the mixing time for which uniformity tests are to be performed. The mixing time shall be a minimum of 60 seconds. The maximum mixing time shall not exceed the mixing time established by uniformity tests by more than 60 seconds for air-entrained concrete. The mixed concrete shall meet the uniformity requirements specified above before any concrete may be used for pavement or structures. The engineer may allow the use of the test concrete for appropriate incidental construction. Tests shall be performed by the contractor, in the presence of the engineer. No direct payment will be made for labor, equipment, material or testing. After operational procedures of batching and mixing are thus established, no changes in procedure will be permitted without re-establishing procedures by uniformity tests.

501.8.2.1 Measuring Mixing Time. Measurement of mixing time shall start at the time all the solid material is in the drum and shall end at the beginning of the next sequential operation.

501.8.2.2 Verification of Mixer. Mixer performance tests shall be repeated whenever the appearance of the concrete or the coarse aggregate content of samples selected in accordance with ASTM C 94, as modified above, indicates that adequate mixing is not being accomplished.

501.8.3 Truck Mixed Concrete. Truck mixed concrete shall be mixed at the proportioning plant and the mixer shall operate at agitating speed while in transit. Truck mixed concrete may be mixed at the point of delivery, provided the cement or cement and mixing water, are added at that point. Mixing of truck mixed concrete shall begin immediately after the introduction of the mixing water and cement to the aggregate or the introduction of the cement to the aggregate.

501.8.4 Truck Mixer Requirements. A truck mixer shall consist of a watertight revolving drum suitably mounted, fitted with adequate blades, and equipped with a device for determining the number of mixing revolutions. Truck mixers shall produce a thoroughly mixed and uniform mass of concrete and shall discharge the concrete without segregation. A truck agitator shall consist of a watertight revolving drum or a watertight container suitably mounted and fitted with adequate revolving blades. Truck agitators shall transport and discharge the concrete without segregation. Mixers and agitators shall be cleaned of accumulation of hardened concrete or mortar.

501.8.5 Rating Plate. Except as hereinafter permitted, each truck mixer shall have permanently attached to the truck a metal rating plate issued by and in accordance with the capacity requirements of the Truck Mixer Manufacturers Bureau (TMMB), as approved by NRMCA, on which is stated the maximum capacity in terms of volume of mixed concrete for the various uses to which the equipment is applicable. The truck shall also have attached a manufacturer's data plate that shall state the actual capacity as an agitator, and the maximum and minimum mixing and agitating speeds. If truck mixers are used for mixing or agitating, the volume of concrete in each batch shall not exceed the maximum capacity shown on the metal rating plate issued by the TMMB, as approved by NRMCA, except that if a lower capacity for agitating is shown on the manufacturer's data plate, that lower capacity shall govern. The minimum batch size for truck mixers shall be one cubic yard (m^3). The engineer may reduce the batch size or reject use of any truck mixer that does not produce concrete uniform in color, appearance and distribution of material throughout the mass. A quantity of concrete that results in axle and gross loads in excess of statutory limits will not be permitted.

501.8.6 Truck Mixing Requirements. Truck mixers and agitators shall be operated at the speed of rotation designated by the manufacturer of the equipment. Truck mixed concrete shall initially be mixed no less than 70 or more than 100 revolutions of the drum at mixing speed after all ingredients, including water, are in the mixer, except that when the batch volume does not exceed 57.5 percent of the gross volume of the drum or 91 percent of the rated maximum capacity, the number of revolutions required for mixing shall be no less than 50 or more than 100. When a truck mixer or truck agitator is used for transporting concrete that has been completely mixed, agitation of the concrete shall continue during transportation at the speed designated by the manufacturer of the equipment as agitating speed. Water may be added to the mixture no more than two times after initial mixing is completed. Each time water is added, the drum shall be turned an additional 30 revolutions, or more if necessary, at mixing speed, until uniform mixing is accomplished. All water added will be included in determining the effective water in the mixture.

501.8.7 Water Adjustments at Job Site. Each increment of water added at the job site shall be measured within a tolerance of one percent of the total effective water required for the batch. Water used to wash the drum of the mixer shall not be used as mixing water.

501.8.8 Handling and Discharge Requirements. Central or truck mixed concrete shall be delivered to the site of the work and shall meet the following conditions:

(a) The handling and discharge of concrete shall not cause segregation or damage to the concrete and will allow placement with a minimum of handling. All handling and discharge shall occur prior to initial set of the concrete.

(b) Truck mixed concrete shall not exceed 300 revolutions after the beginning of mixing.

501.8.9 Non-Agitating Equipment. The discharge of concrete transported in non-agitating equipment shall not cause segregation or damage to the concrete and will allow placement with a minimum of handling. All handling and discharge shall occur prior to initial set of the concrete. Bodies of non-agitating hauling equipment shall be smooth, mortar-tight metal containers capable of discharging the concrete at a satisfactory, controlled rate without segregation.

501.8.10 Testing Facilities. Proper facilities shall be provided for the engineer to inspect ingredients and processes used in the manufacture and delivery of the concrete. A Type 1 field laboratory in accordance with Sec 601 shall be provided at the proportioning plant. Facilities for obtaining representative samples of each fraction of aggregate, cement and each admixture just prior to incorporation into the mix shall be provided by the producer. Aggregate samples may be taken either by sampling the flowing aggregate stream or by belt sampling. The producer shall furnish the necessary equipment and personnel to assist the engineer in obtaining a representative sample.

501.8.11 Delivery Tickets. The manufacturer of truck mixed concrete and of central mixed concrete for use in structures shall furnish to the engineer with each truck load of concrete before unloading at the site, a delivery ticket on which is shown information concerning the concrete as follows:

(a) Name of concrete plant.

(b) Serial number of the ticket.

(c) Date and truck number.

(d) Name of contractor.

(e) Specific project, route and county designation.

(f) Specific class of concrete.

(g) Quantity of concrete in cubic yards (m^3).

(h) Time when batch was loaded or of first mixing of cement and aggregate.

501.9 Volumetric Batched and Continuous Mixed Concrete. Upon written request by the contractor, the engineer may approve the use of concrete proportioned by volume. If concrete is proportioned by volume, the other requirements of these specifications with the following modifications will apply.

501.9.1 Proportional Devices. Volume proportioning devices, such as counters, calibrated gate openings or flow meters, shall be available for controlling and determining the quantities of the ingredients discharged. In operation, the entire measuring and dispensing mechanism shall produce the specified proportions of each ingredient.

501.9.2 Controls. All indicating devices that affect the accuracy of proportioning and mixing of concrete shall be in full view of and near enough to be read by the operator while concrete is being produced. The operator shall have convenient access to all controls.

501.9.3 Calibration. The proportioning devices shall be calibrated by the contractor in the presence of and subject to approval from the engineer. Calibration of the cement and aggregate proportioning devices shall be accomplished by weighing (determining the mass of) each component. Calibration of the admixture and water proportioning devices shall be accomplished by weight (mass) or volume. Tolerances in proportioning the individual components will be as follows:

Item	Tolerance
Cement, Weight (Mass) percent	0 to +4
Fine Aggregate, Weight (Mass) percent	± 2
Coarse Aggregate, Weight (Mass) percent	± 2
Admixtures, Weight (Mass) or Volume percent	± 3
Water, Weight (Mass) or Volume Percent	± 1

501.9.4 Verification of Yield. Verification of the proportioning devices may be required at any time by the engineer. Verification shall be accomplished as follows. With the cement meter set on zero and all other controls set for the designated mix, the activated mixer shall discharge mixed material into a 1/4 cubic yard (0.25 m^3) container measuring 36 x 36 x 9 inches (1000 x 1000 x 250 mm). When the container is level-struck full, making provisions for settling the material into all corners, the cement meter shall show a discharge equal to the design proportion of cement for 1/4 cubic yard (0.25 m^3). A tolerance of ± 1/8 inch (± 3 mm) from the top of the container will be permitted. If the correct yield is not obtained, the proportioning devices shall be adjusted to obtain the design mix or the proportioning devices shall be recalibrated as directed by the engineer.

501.9.5 Water Control. The rate of water supplied shall be measured by a calibrated flow meter coordinated with the cement and aggregate feeding mechanism and with the mixer. The rate shall be adjustable in order to control slump at the desired level.

501.9.6 Liquid Admixture. Liquid admixtures shall be dispensed through a controlled flow meter. A positive means to observe the continuous flow of material shall be provided. If an admixture requires diluting, the admixture shall be diluted and thoroughly mixed prior to introducing the admixture into the dispenser. When admixtures are diluted, the ratio of dilution and the mixing shall be approved by and performed in the presence of the engineer.

501.9.7 Concrete Mixer. The concrete mixer shall be approved by the engineer and shall be an auger-type continuous mixer used in conjunction with volumetric proportioning. The mixer shall produce concrete, uniform in color and appearance, with homogeneous distribution of the material throughout the mixture. Mixing time necessary to produce uniform concrete shall be established by the contractor and shall comply with other requirements of these specifications. Only equipment found acceptable in every respect and capable of producing uniform results will be permitted.

501.9.7.1 Material Storage Capacity. The continuous mixer shall be capable of carrying sufficient unmixed dry bulk cement, fine aggregate, coarse aggregate, admixtures and water, in separate compartments to produce no less than 6 cubic yards (4.5 m^3) of concrete at the job site. Each batching or mixing unit or both, shall carry in a prominent place a metal plate or plates on which are plainly marked the gross volume of the unit in terms of mixed concrete, discharge speed and the weight-calibrated constant of the machine in terms of a revolution counter or other output indicator.

501.9.7.2 Measurement of Cement. The continuous mixer shall be capable of positive measurement of cement being introduced into the mix. A recording meter visible to the operator and equipped with a ticket printout shall indicate the quantity.

501.9.7.3 Measurement of Water. The continuous mixer shall provide positive control of the flow of water and admixtures into the mixing chamber. Water flow shall be indicated by a flow meter and be readily adjustable to provide for minor variations in aggregate moisture. The mixer shall be capable of continuously circulating or mechanically agitating the admixtures.

501.9.7.4 Scalping Screen. The continuous mixer shall have a one-inch (25 mm) maximum size scalping screen over the fine aggregate bin to screen out mud balls, conglomerate lumps or any other contaminant material that could interrupt the flow of fine aggregate during proportioning.

501.9.7.5 Batching Operations. The continuous mixer shall be capable of being calibrated to automatically proportion and blend all components on a continuous or intermittent basis as required, and shall discharge mixed material through a conventional chute.

501.9.8 Handling Materials. Storage facilities for all material shall be designed to permit the engineer to make necessary inspections prior to the batching operations. The facilities shall also permit identification of approved material at all times, and shall be designed to avoid mixing with or contaminating by, unapproved material. Coarse and fine aggregate shall be furnished and handled so variations in the moisture content affecting the uniform consistency of the concrete will be avoided.

501.10 Air-Entrained Concrete Air content for all classifications of concrete shall be determined in accordance with AASHTO T 152. Air-entrained concrete shall be used for the construction of the following items:

(a) All retaining walls and bridge units, except culvert-type structures and seal courses.

(b) Concrete median barriers.

(c) All piles (not required for cast-in-place concrete piles).

(d) Concrete pavements.

(e) Approach slabs and paved approaches.

(f) Concrete medians and median strips.

(g) Sidewalks, curb ramps and steps.

(h) Curbs, gutters, curb and gutter and surface drain basins and drains.

(i) Concrete pedestals for signs, signals and lighting.

501.10.1 Other Concrete. All other concrete, except seal concrete, may be air-entrained but only in accordance with the requirements of these specifications.

501.10.2 Required Air Content. If air-entrained concrete is used, the designated quantity of air by volume shall be a minimum of 5.0 percent. For concrete pavement, the specified air content will apply to the measurements taken behind the paver or to measurements taken in front of the paver minus the established air loss through the paver.

501.10.3 Incorporation Procedures. Air-entraining admixtures shall be added to the concrete during the mixing process. The admixture shall be of such volume and strength that the admixture can be accurately measured and dispensed in accordance with the manufacturer's recommendations. The dispenser shall consistently deliver the required quantity of admixture within a tolerance of ± 3 percent.

501.10.4 Redosing. When the measured air content is below the minimum specified value, the contractor will be allowed to re-dose the concrete in the field one time. The contractor shall submit a Re-dosing Plan to the engineer for approval. The Re-dosing Plan shall address the following:

(a) Field measurement of the air entrainment admixture
(b) Brand of air entrainment admixture being used
(c) Incorporation and mixing of the air entrainment admixture
(d) The use of additional water

501.10.4.1 Allowed. The Re-dosing Plan shall be approved prior to use.

501.10.4.2 Other Requirements. All other requirements of this specification shall still apply.

501.10.4.3 Unacceptable Results. Concrete with a measured air content below 4.0 percent is unacceptable.

501.11 Concrete Admixtures for Retarding Set. If specified in the contract, an approved retarding admixture shall be provided and incorporated into the concrete. If not specified in the contract, the use of an approved retarding admixture will be permitted upon written notification from the contractor. Any retarding admixture shall be added in accordance with Sec 501.10.3 by means of a dispenser conforming to the requirements of that section.

No direct payment will be made for furnishing the retarding admixture or for incorporating the admixture into the mixture.

Delete Sec 501.12 and substitute the following: ***08/08***

501.12 Water-Reducing Admixtures. Type A water-reducing admixtures may be used in any concrete. When Type A water-reducing admixture is added to pavement concrete for paving purposes, a reduction of cement up to 25 lbs. per cubic yard (15 kg/m^3) will be permitted. The dosage rate of Type A water-reducing admixture shall be within the ranges recommended by the manufacturer and approved by the engineer. Any cementitious material substitution permitted by specification shall be based on the reduced cement content. Water-reducing admixtures shall be added in accordance with Sec 501.10.3 by means of a dispenser conforming to the requirements of that section. High range water-reducing admixtures may be used when specified or as approved by the engineer.

501.12.1 Modified B-2 Utilized. Modified B-2 concrete shall use a Type A or Type D water-reducer admixture.

501.12.2 Silica Fume Utilized. Concrete utilizing silica fume shall use a water-reducer admixture that may be added by hand methods. The amount of water contained by the water-reducer admixture shall be included in the overall water content of the concrete.

501.12.3 Consistency Requirement. When a water-reducer admixture is used the maximum allowed slump may be increased to 6 inches for all concrete classes. The concrete shall be homogeneous with no aggregate segregation.

501.13 Calcium Chloride. The use of calcium chloride or other approved accelerating admixtures in concrete mixtures will not be permitted, except in concrete used for pavement repair in accordance with Sec 613.

501.14 Supplementary Cementitious Materials in Concrete. The contractor may use fly ash, GGBFS or silica fume in the production of concrete in accordance with these specifications. Ternary mixes will be allowed for all concrete classes. Ternary mixes are mixes that contain a combination of Portland cement and two supplementary cementitious materials. Supplementary cementitious materials may be used to replace a maximum of 40 percent of the Portland cement. The amount of each supplementary cementitious materials used in a ternary mix shall not exceed the limits specified herein.

501.14.1 Fly Ash. Approved Class C or Class F fly ash may be used to replace a maximum of 25 percent of the Portland cement on a pound for pound (kg for kg) basis in all concrete.

501.14.2 Ground Granulated Blast Furnace Slag. Approved GGBFS may be used to replace a maximum of 30 percent of the Portland cement on a pound for pound (kg for kg) basis in all concrete.

501.14.3 Silica Fume. Approved silica fume may be used to replace a percent of the Portland cement on a pound for pound (kg for kg) basis. The following limits shall apply when silica fume is used:

Silica Fume Replacement Limits, %		
Class of Concrete	**Minimum**	**Maximum**
MB-2	6	8
A-1, B, B-1, B-2, PCCP, Seal	----	8

501.14.3.1 Silica Fume Requirements. Silica fume shall be approved prior to use and be in accordance with ASTM C 1240, except as noted herein. If dry compacted form, the admixture shall be 100 percent silica fume with no admixtures. Silica fume slurries may contain other approved admixtures, such as water reducers or retarders, if the admixtures are included by the manufacturer of the silica fume admixture.

501.14.3.2 Manufacturer Certification. The contractor shall furnish to the engineer a manufacturer's certification along with the brand name, batch identification, quantity represented, percent solids and the type, name and quantity of any admixtures, that are provided in the silica fume admixture.

501.14.3.3 Silica Fume Test Results. The manufacturer's certification shall contain results of recent tests conducted on samples of the silica fume material taken during production or transfer and indicating conformance with Tables 1 and 3 of ASTM C 1240 and this specification. The supplier shall further certify that the material being furnished is in accordance with this specification.

501.14.3.4 Silica Fume Approval. For approval prior to use, the supplier shall furnish the same information to: Construction and Materials, P.O. Box 270, Jefferson City, MO 65102, along with any requested samples for testing.

501.14.3.5 Silica Fume Slurry. Liquid silica fume admixture shall be protected from freezing at all times.

501.14.3.6 Admixture Compatibility. All admixtures used shall be compatible with the silica fume admixture and shall be recommended or approved in writing by the manufacturer of the silica fume admixture.

501.14.4 Source Changes. Changes in class or source of fly ash, grade and source of GGBFS, or brand and source of silica fume used in concrete structures will be permitted only with written approval from the engineer. Only fly ash, GGBFS or silica fume resulting in concrete of the same color shall be used in any individual unit of the structure.

501.14.5 Mix Proportions. When fly ash or GGBFS is used, an adjustment in design mix proportions will be required to correct the volume yield of mixture. Approval shall be obtained from the engineer prior to any change in mix design or proportions.

501.14.6 Mixing Water. Maximum mixing water shall be based on total cementitious material. The quantity of mixing water in the concrete shall be considered the net quantity after proper allowance has been made for absorption by the aggregate.

501.14.7 Measuring Fly Ash and Ground Granulated Blast Furnace Slag. Fly ash or GGBFS shall be measured in the same manner and with the same accuracy as cement. (The mass determination of) Fly ash or GGBFS may be weighed (determined) separately on the same scale as cement, provided the scale increments are such that the specified weighing (mass determination) accuracy can be maintained. If the (mass of) fly ash or GGBFS is weighed (determined) together with the cement, the (mass of) cement shall be weighed (determined) first and the accuracy shall apply to the combined weight (mass).

501.14.8 Measuring Silica Fume. Silica fume shall be measured by weight (mass) or volume within a tolerance of plus or minus 2 percent.

501.14.9 Silica Fume Batching Sequence. Silica fume shall be added at the plant at the same point in the batch sequence as recommended by the manufacturer of the silica fume. The silica fume may be added by hand methods.

501.14.10 Calculating Silica Fume Solids. For silica fume solutions, the quantity of liquid silica fume admixture needed to furnish the required silica fume solids shall be calculated based on the weight per gallon (mass per liter) and percent solids of the silica fume admixture being used.

501.14.11 Measuring Cementitious Materials. Fly ash, GGBFS or silica fume will be considered as cement when measuring mixing time.

501.15 Commercial Mixture. If specified in the contract that an approved commercial mixture of concrete may be used, the contractor shall notify the engineer in writing, setting out for approval the source and proportions of the mixture proposed to be furnished. The statement shall include the following:

(a) The types and sources of aggregate.

(b) Type and source of cement and other cementitious material.

(c) Scale weights (masses) of each aggregate proposed as pounds per cubic yard (kg/m^3) of concrete.

(d) Quantity of water proposed, as pounds or gallons per cubic yard (kg or L per m^3) of concrete.

(e) Quantity of cement proposed as pounds per cubic yard (m^3) of concrete. n.

501.15.1 Minimum Cement Content. The concrete shall contain no less than 517 pounds (305 kg) of cement per cubic yard (m^3). The use of fly ash, GGBFS or silica fume shall be in accordance with Sec 501.14. The plant shall comply with other requirements of these specifications or be as approved by the engineer. The concrete will be subject to acceptance or rejection by visual inspection at the job site.

501.15.2 Certification. The supplier shall furnish certification with the first truck load of each day's production of concrete that the material and mix proportions used are in accordance with the approved mixture. Upon completion of the work, plant certification shall be furnished by the supplier for the total quantity delivered.

SECTION 502 – PORTLAND CEMENT CONCRETE BASE AND PAVMENT

Delete Sec 502.4.7 and substitute the following: ***08/07***

502.4.7 Tie Bar Placement. Tie bars shall be supported in the proper position by chairs driven into the subgrade, or may be placed by approved mechanical methods prior to the consolidation of the concrete after the concrete has been struck off. Tie bars shall be free from dirt, oil, paint and grease. Tie bars required at longitudinal construction joints shall be positioned before concrete base or pavement consolidation.

Delete Sec 502.4.8.3.1 through 502.4.8.3.4.2 and substitute the following: ***08/07***

502.4.8.3.1 Sample Container. Plastic sample containers for ASTM E 965 testing shall be of a rigid material that will crack or break if the container is deformed. Damaged or deformed containers shall not be used.

502.4.8.3.2 Required Texture Depth. The results of ASTM E 965 shall show a texture depth of any sublot, as defined in Sec 502.10.1, to have a minimum value of 0.70 mm. Any sublot showing a texture depth of less than 0.70 mm shall require diamond grinding of the pavement represented by this sublot to attain the necessary texture. All testing of the surface texture shall be completed no later than the day following pavement placement.

502.4.8.3.3 Minimum Diamond Grinding Length. Diamond grinding, except for bump correction, shall be across the entire width of the traveled way and shall be continuous for a minimum of 0.1 mile (0.2 km).

502.4.8.3.4 Wave Texture Testing. ASTM E 965 will be waived if the contractor elects to diamond grind or tine the concrete with a wire comb. The concrete may be tined either longitudinally or transversely.

502.4.8.3.4.1 Wire Comb. A wire comb shall be no less than 10 feet (3 m) long with a single line of wires exposed to a length of approximately 4 inches (100 mm). The wire shall be blue-tempered and polished spring steel with nominal dimensions of 0.028 inch (0.71 mm) thick and 0.100 to 0.125 inch (2.54 to 3.175 mm) wide. The wires shall be spaced to provide 1/2-inch (13 mm) clear space between wires and securely mounted in a rigid head. Except for concrete finished by hand methods, the wire comb shall be mechanically operated and capable of covering the full width of slab in a single pass, at a uniform speed and at a uniform depth. Final approval of the wire comb will be based on satisfactory performance during actual use

502.4.8.3.4.2 Texturing with Wire Comb. Successive passes of the comb shall be overlapped the minimum necessary to attain a continuously textured surface. The surface texture produced shall have an average texture depth of approximately 0.125 inch (3 mm). Small or irregular areas, or areas not suitable for machine texturing when adjacent surrounding concrete is ready for texturing, may be textured with a hand operated device producing a textured surface equivalent to that required for machine combing.

Delete Sec 502.5.2 and substitute the following: ***11/05***

502.5.2 Construction Joints. Construction joints shall be made at the close of each day's work or when the work is stopped or interrupted for more than 30 minutes. Transverse construction joint shall be located 15 feet from the last contraction joint. Construction joints shall be constructed perpendicular to the top surface and the centerline of the concrete base or pavement. Construction joints may be formed with a timber header or may be sawed full depth. The final joint shall conform to the cross-section of the pavement. Before paving operations are resumed, all surplus concrete and other refuse shall be removed from the subgrade.

Delete Sec 502.5.3 and substitute the following: ***11/05; 12/05***

502.5.3 Sawing Joints. Unless otherwise provided, all transverse contraction joints and all Type L longitudinal joints shall be sawed in a single cutting operation with the joint groove cut to the dimensions shown on the plans except as herein specified. If the groove for poured type transverse joints is cut prior to removal of the forms, the groove shall be cut as close as is practical to the concrete base or pavement edge, and the resulting crescent shaped plug in the groove, immediately adjacent to the form, will be acceptable. For intersections and irregular pavement,

joints shall be sawed at locations as approved by the engineer. Sawing of the joints shall begin as soon as the concrete has hardened sufficiently to permit sawing without excessive raveling. All joint grooves shall be established before uncontrolled shrinkage cracking takes place. The sawing of any joint shall be omitted if a crack occurs at or near the joint location prior to the time of sawing. Sawing shall be discontinued when a crack develops ahead of the saw. The engineer reserves the right to have the contractor install preformed type joints on multiple width construction when the use of sawed joints fails to prevent random cracking. Any joint that opens more than ¼ inch (6 mm) shall be sealed. Any pavement with random cracking not controlled by dowels or tie bars shall be either removed and replaced using dowels or tie bars as appropriate to the nearest controlled joint or repaired with some other method approved by the engineer at the contractor's expense.

Amend Sec 502 to include the following: ***08/08***

502.5.3.1 Forming Longitudinal Joint. A joint forming device may be used to establish the longitudinal joint between the two driving lanes or between the driving lane and shoulder 6 foot wide or greater. The pavement shall have a plan thickness of 8 inches or greater.

502.5.3.1.1 Notification. The contractor shall indicate in the Quality Control Plan if the longitudinal joint forming devices is going to be utilized on the project.

502.5.3.1.2 Joint Forming Device. The joint forming device shall consist of a pair of straight blades mounted under the paver. The first blade shall be placed under the front of the primary pan extending forward between the vibrators, if mechanically possible. The second blade shall be placed on the finishing pan in identical alignment to the first blade. Blade depth shall be equal to one-third of the slab thickness.

502.5.3.1.3 Depth Verification. The engineer shall have access behind the paver to randomly check joint formation by inserting a thin metal strip equal to one-third of the slab thickness into the formed joint.

502.5.3.1.4 Weak Plane Verification. The contractor shall take four 4-inch diameter cores in the longitudinal joint. Cores shall be taken and tested the following day after the first day of paving. Samples shall be taken from random locations determined by the engineer. The cores shall be centered within ± ½ inch around the joint forming trail. The first one-third of the slab thickness and the second one-third of the slab thickness of each core shall be sawed off from the top and tested in the vertical position for split tensile strength. The average strength ratio of the first and second cores shall be 1/3 or less.

502.5.3.1.5 Testing Frequency. For each successive day after the first day of paving, two 4-inch diameter cores shall be taken in the longitudinal joint. Samples shall be taken from random locations determined by the engineer. Cores shall taken and tested the following day after placement. Cores shall be tested to determine the indirect tensile strength ratios. If satisfactory results are consistently achieved, the engineer may reduce the number of cores taken.

502.5.3.1.6 Joint Continuity. The contractor shall ensure longitudinal joint continuity between consecutive day's paving.

502.5.3.1.7 Unacceptable Results. If the test results or the quality of the joint forming process are not satisfactory to the engineer, the contractor shall saw the longitudinal joint for the length affected.

Delete Sec 502.5.4 and substitute the following: ***11/05***

502.5.4 Sealing Joints All sawed contraction joints shall be unsealed, unless otherwise specified. Sawed or formed expansion joints shall be sealed with joint sealing material before the pavement is opened to any traffic, including construction traffic. Immediately prior to sealing, the joints shall be thoroughly cleaned and dried. The sealing material shall be heated to the pouring temperature recommended by the manufacturer. Any material which has been heated above the maximum safe heating temperature will be rejected. Any excess material shall be removed from the pavement surface.

Delete Sec 502.9 and substitute the following: ***08/08***

502.9 Opening to Traffic. The concrete base and pavement shall not be opened for low volume, light construction traffic until the concrete has attained a minimum compressive strength of 3000 psi (21 MPa). The concrete base and pavement shall not be opened to all types of traffic until the concrete has attained a minimum compressive strength of 3500 psi (24 MPa) and all sawed

joints that have opened more than ¼-inch are sealed. Compressive strength will be determined by tests conducted in accordance with MoDOT test methods. Pavement shall be cleaned prior to opening to traffic.

Delete 502.10.1 and substitute the following: ***11/05***

502.10.1 Lot Definition. A lot shall be the surface area placed in a single day. Each lot shall be divided into no less than four or more than six sublots of equal surface area. For high daily production rates exceeding 7500 square yards (6275 m^2) per day, the contractor may choose to divide the day's production into two equal lots consisting of no less than four or more than six sublots each. The contractor shall notify the engineer of the size of the sublot or of the decision to divide a day's production into two equal lots prior to taking any core samples. When a day's production involves less than 600 square yards (500 m^2), combine the following day's or days' production to reach 600 square yards (500 m^2) and treat as a single lot, except while completing a particular mix design or project, in which case combine with the previous day's production and treat as a single lot. If a project has less than 7500 square yards (6275 m^2) of a particular mix type, the lot will be defined as the plan quantity shown in the contract documents.

Delete Sec 502.10.3 through 502.10.4.5 and substitute the following: ***08/07***

502.10.3 Coring. Cores shall be taken in accordance with AASHTO T 24. Cores shall not be taken until a minimum compressive strength of 3000 psi (21 Mpa) has been attained. Cores shall be neatly cut with a core drill. The contractor shall furnish all tools, labor and material for cutting samples and filling the cored hole. The contractor shall fill the core holes with an approved non-shrink grout within one day after sampling.

502.10.3.1 Testing Cores. The core thickness shall be determined by the average caliper measurement in accordance with AASHTO T 148. After the thickness is determined, the cores shall be sawed to an L/D ratio of 2.0 and tested in accordance with AASHTO T 22. Cores shall not be taken until a minimum compressive strength of 3000 psi (21 MPa) has been attained. The contractor shall determine the compressive strength by approved methods. Cores shall be tested for compressive strength 28 days after placement.

502.10.3.2 Pavement Thickness after Diamond Grinding. If the contractor elects to diamond grind to improve smoothness or surface texture, in accordance with Sec 502.4.8.3, re-coring of the concrete for thickness acceptance will be required for all lots that were previously determined to be at plan thickness or less. The engineer may require re-coring, regardless of the initial slab thickness, if two or more diamond grinding passes are conducted within a given lot. Cores shall be 4 inch (100 mm) in diameter. Location of coring will be determined by the engineer using random sampling procedures in accordance with ASTM D 3665.

502.10.4 Quality Level Analysis. Compressive strength and thickness shall be evaluated for acceptance on a lot-by-lot basis using a Quality Level Analysis (QLA). The QLA will consider the variability (standard deviation) of the material and the testing procedures, as well as the average (mean) value of the test results to calculate the percentage of material that is above the lower specification tolerance limit (LSL) for compressive strength and thickness.

502.10.4.1 Determine Quality Index. The Percent Within Limits (PWL) will be based on the mean, standard deviation and quality index of each lot's test results as follows:

Mean

$$x_a = \sum \frac{x_i}{n}$$

where:

x_a = Mean of the individual values being considered
$\sum x_i$ = The summation of all the individual values being considered
n = The number of individual values under consideration

Standard Deviation

$$s = \sqrt{\frac{\sum (x_i - x_a)^2}{n-1}}$$

Where:

s = Standard Deviation

Upper Quality Index

$$Q_U = \frac{USL - x_a}{s}$$

Lower Quality Index

$$Q_L = \frac{x_a - LSL}{s}$$

Where:

Q_U = Upper Quality Index
Q_L = Lower Quality Index
USL = Pay Factor Item Upper Spec Limit
LSL = Pay Factor Item Lower Spec Limit

502.10.4.2 Determine Percent Within limits. The upper (PWL_U) and lower (PWL_L) will be determined from Table I. Total percent within limits is: $PWL_t = (PWL_U + PWL_L) - 100$. For thickness and compressive strength in this specification, PWL_U shall be 100.

502.10.4.3 Utilizing Quality Control Test Results. The engineer will make the Quality Level Analysis (QLA) within 24 hours after receipt of the contractor's test results, by determining the PWL_t for each designated pay factor item. The contractor's test results will be used when applicable to determine the PWL, provided the contractor's QC tests and the engineer's QA tests compare favorably, and provided the engineer's inspection and monitoring activities indicate the contractor is following the approved QC Plan.

502.10.4.4 Material Rendered Unfit. The engineer may at any time reject and require the contractor to dispose of any batch of concrete mixture which is rendered unfit for use due to contamination, segregation, improper slump or improper entrained air content. Such rejection may be based on only visual inspection. In the event of such rejection, the contractor may take a representative sample of the rejected material in the presence of the engineer, and if demonstrated in the laboratory in the presence of the engineer that such material was erroneously rejected, payment will be made for the material at the contract unit price.

502.10.4.5 Lower Specification Limits. .The lower specification limit (LSL) for compressive strength and thickness shall be:

(a) Compressive Strength – 4000 psi (28 MPa).

(b) Thickness – Plan thickness minus 1/2 inch (13 mm).

Delete Sec 502.11.1 and substitute the following: ***12/05***

502.11.1 Quality Control Plan. Prior to approval of concrete mix designs by the engineer, the contractor shall submit a QCP to Construction and Materials. The QCP shall be approved prior to placing any concrete. The QCP shall include:

(a) Name and contact information should be provided for the contractor's representative in charge of QC and the project level representative if different from the contractor's representative.

(b) Identify the number of sublots each lot will utilize and describe how lots and sublots will be designated.

(c) State the method for determining when concrete cores can be extracted.

(d) State the method for demonstrating the concrete has been protected from freezing.

(e) State the location where control charts will be posted.

(f) For optimized concrete mix, state the target gradation and allowable gradation ranges for each fraction being used.

(g) A proposed independent third party company name, contact person, address, and phone number for dispute resolution.

Delete Sec 502.11.2 through 502.11.2.1.2 and substitute the following: ***04/06; 08/07***

502.11.2 Quality Control Testing. The contractor shall perform all quality control tests necessary to control the production and construction processes applicable to this specification and as set forth in the QCP. Quality control testing shall be performed by technicians qualified through MoDOT's technician certification program. Testing shall include, but not necessarily be limited to, deleterious content, coarse aggregate absorption, thin or elongated pieces, entrained air content, slump, pavement thickness and compressive strength. The contractor shall record all test results and furnish a copy to the engineer no later than the beginning of the day following the test.

502.11.2.1 Fine and Coarse Aggregate.

502.11.2.1.1 Aggregate Gradation. A sieve analysis shall be preformed once a week. Testing shall be performed in accordance with AASHTO T 27 from randomly sampled material taken from the discharge gate of storage bins or from the conveyor belt. Sieve analysis shall be performed on the following sieves:

Mix Design Method	Sieves Tested
Absolute Volume	Maximum sieve size[a]
Optimized	Sieves sizes specified by the mix design

[a]Coarse aggregate only

502.11.2.1.2 Deleterious Materials. Deleterious content shall be determined each day at a frequency of one test per 7500 square yards (6275 m2) of material placed or fraction thereof. Test shall be performed in accordance with MoDOT Test Method TM 71 from randomly sampled material taken from the discharge gate of the storage bin or from the conveyor belt. Test shall be performed on coarse aggregate fractions.

Insert Sec 502.11.2.1.3 as follows: ***04/06***

502.11.2.1.3 Absorption. Samples for coarse aggregate absorption shall be taken from the discharge gate of the storage bins or from the conveyor belt at least once every 2000 cubic yards (1500 m^3) with a minimum of once per project. Coarse aggregate absorption shall be in accordance with AASHTO T 85.

Delete Sec 502.11.2.1.4 through 502.11.2.1.5 and substitute the following: ***04/06; 08/07***

502.11.2.1.4 Thin or Elongated Pieces. Thin or elongated pieces shall be determined on samples of coarse aggregate taken from the discharge gate of the storage bins or from the conveyor belt. The aggregate particles retained on the 3/4 in. (19.00 mm) sieve shall not exceed 5 percent when tested in accordance with ASTM D 4791, based on a 5:1 ratio. Test shall be preformed at least once every 10,000 cubic yards with a minimum of once per project.

502.11.2.1.5 Retained Samples. All aggregate samples taken by the contractor for determining the gradation, deleterious content, absorption, and thin or elongated pieces shall be retained for the engineer for a minimum of

seven days unless otherwise instructed. The retained sample shall be the remaining half of the final reduction in sample size obtained for QC testing. These samples shall be maintained in clean covered containers, without contamination, readily accessible to the engineer. The retained sample's identification shall consist of, but is not limited to:

(a) Time and date sampled.

(b) Product specification number.

(c) Type of sample, i.e. belt, bin, stockpile.

(d) Lot and sublot designation.

(e) Sampler/Tester.

(f) Project Job Number.

Delete Sec 502.11.3.1 and substitute the following: ***11/05, 04/06***

502.11.3.1 Fine and Coarse Aggregate Gradation . The contractor shall record the gradation tests for each control sieve on linear control charts. Specification limits from Sec 1005, Sec 501.3, or the limits established in the QC plan for optimized mixtures, shall be superimposed on the control chart for job control.

Delete Sec 502.11.3.2 through 502.11.4.2 and substitute the following: ***11/05; 04/06; 08/07***

502.11.3.2 Slump, Air Content and Absorption. The contractor shall maintain linear control charts for both individual measurements of slump, air content, and absorption in accordance with the following action limits. The individual measurement control charts shall use the mix design target values as indicators of central tendency.

Individual Measurements	
Control Parameter	**Action Limit**
Slump	+1 in. (25 mm)
Air Content	4.5 to 5.0%
Absorption	Mix Design plus 0.3% to Mix Design plus 0.6%

502.11.4 Corrective Action. As a minimum, a process shall be deemed out of control and corrective action taken if any one of the conditions below exists. In addition, each truckload of material en route prior to the process of being deemed out of control shall be tested for specification compliance.

502.11.4.1 Aggregate Gradation. When one test is outside the allowable range, immediate steps shall be taken to correct the gradation.

502.11.4.2 Deleterious Content. When one test is outside the specification limits, immediate steps shall be taken to correct the deleterious content.

Delete Sec 502.11.4.3 and substitute the following: ***04/06***

502.11.4.3 Slump, Air Content, and Absorption. The contractor shall halt production and make appropriate adjustments whenever either of the following occurs:

(a) One point falls outside the action limit line for individual measurements or range.

(b) Two points in a row fall outside the specification limit but within the action limit line for individual measurements.

Delete Sec 502.11.5 through 502.12.1 substitute the following: ***12/05; 08/07***

502.11.5 Pavement. For pavements with a plan thickness below 8 inches, the following shall apply:

(a) QC shall determine compressive strength at a frequency of no less than one per 7500 square yards. Compressive strength shall be determined from at least two 6- by 12-inch (150- by 300-mm) cylinders or from at least three 4- by 8-inch (100- by 200-mm) cylinders made in accordance with AASHTO T-23 or by the Maturity Method in accordance with the contract documents. QA will determine the compressive strength at least once per 30000 square yards. Cylinders shall be tested in accordance with AASHTO T-22. A compressive strength of 3500 (24 MPa) shall be attained by 28-days.Sampling locations will be determined by the engineer using random sampling procedures in accordance with ASTM D 3665

(b) QC shall determine pavement thickness of the fresh concrete at a frequency of no less than one per 7500 square yards. QA will determine the pavement thickness of the fresh concrete at least once per 30000 square yards. Sampling locations will be determined by the engineer using random sampling procedures in accordance with ASTM D 3665

(c) QC shall determine the slump, air content, gradation, deleterious, thin and elongated and absorption in accordance with Sec 502.11. QA will determine the slump, air content, gradation, deleterious, thin and elongated and absorption in accordance with Sec 502.12.

502.11.6 Shoulders. Shoulders with a plan thickness 8 inches or greater shall be inspected in accordance with requirements applied to concrete placed in the travel way. Shoulders with a plan thickness below 8 inches shall be handled in accordance with Sec 501.11.5.

502.11.7 Dispute Resolution. When there are significant discrepancies between the engineer's and the contractor's test results, dispute resolution procedures will be used.

502.11.7.1 Cease Work. The contractor's operations may be required to cease until the dispute is resolved, if the test results indicate the mixture is unacceptable.

502.11.7.2 Third Party Resolution. The first step in dispute resolution will be to identify differences in procedures and to correct inappropriate procedures before moving to third party resolution. If that does not resolve the dispute, either the contractor or the engineer may request the approved QCP third party involvement. The recommendations of the approved third party will be binding on both the engineer and contractor.

502.11.7.3 Third Party Payment. The contractor shall be responsible for the costs associated with third party testing and resolution if the final result indicates the engineer's test results were correct. Likewise the Commission will be responsible for the cost associated with the third party testing and resolution if the final result indicates the contractor's results were correct.

502.11.7.4 Other Adjustments. The contractor will not be entitled to any additional payment for costs incurred due to use of the dispute resolution procedures such as, but not limited to, those for delay, cessation of operations, costs to subcontractors, etc. The engineer may give consideration to adjustment of working days, if warranted.

502.12 Quality Assurance. Corrective action shall be required in accordance with Sec 502.11.4 for any QA tests outside the action limit. The engineer will at a minimum, independently test at the following frequency:

Test	Frequency
Compressive Strength	1 per lot
Thickness	1 per lot
Surface Texture	1 per lot
Slump	1 per day
Entrained Air Content	1 per day
Aggregate Gradation	1 per project
Coarse Aggregate Deleterious	1 per week

Aggregate Absorption	1 per 10,000 cubic yards
Thin or Elongated Pieces	1 per project

502.12.1 Retained Samples. The QA inspector will test at least ten percent of the retained portion of the QC samples for aggregate gradation and deleterious content. The QA inspector will test at least twenty percent of the QC retained samples for absorption and thin or elongated pieces. Retained samples will be chosen at random. A comparison will be considered favorable when the QA results of a QC retained sample are within the applicable limits specified in Sec 403.18.2

Amend Sec 502 to include the following: ***08/08***

502.11.8 Concrete Mix Design Adjustment

502.11.8.1 Field Adjustment. When test results indicate the concrete produced does not meet the specification requirements or is not performing satisfactory, the contractor may adjust the mix design in the field as noted herein. Field adjustments may consist of changing the constituents listed on the approved mix design by no more than 5.0 percent or changing the water cement ratio by no more than 0.02 from the approved mix design. The engineer shall be notified immediately when any change is made to the mix design. Additional fractions of material or new material will not be permitted as a field adjustment. The field adjusted mix shall meet the requirements specified in Sec 501.

502.11.8.2 Field Redesign. When the constituents listed on the approved mix design are adjusted by more than 5.0 percent or the water cement ratio is changed by more than 0.02, the contractor shall submit a new mix design meeting the requirements specified in Sec 501. The mix design shall be submitted immediately to the District for approval. The contractor will be allowed to continue production while the mix design is reviewed.

Delete Sec 502.12.2 and substitute the following: ***12/05***

502.12.2 Quality Control Equipment. All QC mixture testing shall be performed using equipment maintained in accordance with Sec 403.17.3, except as follows:

Equipment – Test Method (AASHTO)	Requirement	Interval (Month)
Sieves	Check Physical Condition	6
Mechanical Shakers - T27	Check Sieving Thoroughness	12
Ovens	Verify Temp. Settings	4
Balances	Verify	12[a]
Air Meters - T152	Calibrate	12
Compression Testing Machine - T22	Verify Load Indications	12
Capping Material	Check Strength	3
Slump Cones - T119	Check Critical Dimensions	12

[a]Verify after each move.

Delete Sec 502.13 and substitute the following: ***08/07***

502.13 Unacceptable Material. Any material meeting the following criteria shall be considered unacceptable:

(a) If any core measurement of thickness is greater than 10 percent deficient from the plan thickness

(b) If any core measurement of compressive strength is less than 3500 psi (24Mpa)

(c) All material with an entrained air content less than 4.0 percent.

Delete Sec 502.15.3.1 and substitute the following: ***12/05***

502.15.3.1 Incentives. Smoothness incentive will be paid per section based on the profile index before any corrections. If diamond grinding is the final texture of the pavement surface, smoothness incentive will be paid per section based on the profile index after diamond grinding. If after applying the surface texture, the contractor elects to diamond grind the entire project, the smoothness incentive will be paid per section based on the profile index after diamond grinding. Within a section qualifying for incentive pay, any segment having a profile index requiring correction will not be included in incentive payment for that section.

Delete Sec 502.15.3.2 and substitute the following: ***12/05***

502.15.3.2 Deductions. Corrected areas will be considered marred surfaces. A deduction of 20 percent of the contract price will be made for the affected area. Continuous corrective action performed on the entire pavement width for a length of 0.1 mile (0.2 km) or more, but not the entire section, will not be considered a marred surface but will not be eligible for the smoothness incentive. Continuous corrective action performed on the entire pavement width of an entire section will not be considered a marred surface and will be eligible for the smoothness incentive. Constant-width acceleration and deceleration lanes shall be considered as mainline pavements.

Table I	
Profile Index, Inches Per Mile (mm/km)	**Percent of Contract Price**
10.0 (158) or less	105
10.1 - 15.0 (159 - 237)	103
15.1 - 25.0 (238 - 395)	100
25.1 (396) or greater	100[a]

Table II	
Profile Index, Inches Per Mile (mm/km)	**Percent of Contract Price**
20 (316) or less	103
20.1 - 45.0 (317 - 711)	100
45.1 (712) or greater	100[b]

[a]After correction to 25.0 inches per mile (395 mm/km) or less.
[b]After correction to 45.0 inches per mile (711 mm/km) or less.

Delete Sec 502.15.3.5 and substitute the following: ***12/05***

502.15.3.5 Incentive Exception. The contractor will not be allowed to make corrective grinding to increase the percent of pay when the final profile index is 25.0 (395) or less (Table I), or 45.0 (711) or less (Table II). If the contractor elects to diamond grind the entire project, the smoothness incentive will be paid per section based on the profile index after diamond grinding.

Delete Sec 502.15.4 and substitute the following: ***11/05***

502.15.4 Compensation. The contract unit price for Portland cement concrete base and pavement will be considered as full compensation for all material, including reinforcement, dowels, dowel supports, tie bars and any other items entering into the construction of the traveled way pavement or Portland cement concrete shoulders, and for the cost of QC testing and smoothness testing. No additional compensation will be allowed for any excess thickness.

Delete Sec 502.15.8 substitute the following: ***11/05;08/07***

502.15.8 Small Quantities. For each mix type less than 7500 square yards (6275 m^2), the following shall apply:

QLA and PWL will not be required.

Concrete mix shall be within the specified limits for compressive strength, pavement thickness, slump, air content, gradation, deleterious, and thin and elongated.

Payment for each mix type will be made at 100 percent of the contract unit price if compressive strength is equal to or greater than 3500 psi (24 Mpa) and the pavement thickness is not deficient by more that 10 percent of the plan thickness.

Delete Sec 502.15.9 through 502.15.11 and substitute the following: ***12/05; 08/07***

502.15.9 Pavements. For pavements with a plan thickness below 8 inches, the following shall apply:

(a) QLA and PWL will not be required

(b) Concrete mix shall be within the specified limits for compressive strength, pavement thickness, slump, air content, gradation, deleterious, and thin and elongated.

(c) Payment will be made at 100 percent of the contract unit price if compressive strength is equal to or greater than 3500psi (24MPa) and pavement thickness is not deficient by more than 10 percent of the plan thickness

502.15.10 Shoulders. Shoulders with a plan thickness below 8 inches shall be handle in accordance with Sec 502.15.9.

502.15.11 PWL Determination Table. Values in Table III are estimates of the PWL corresponding to specific values of the Quality Index (Q). For Q values less than zero, the table shall be subtracted from 100.

SECTION 504 – CONCRETE APPROACH PAVEMENT

Delete Sec 504.1 through 504.4 and substitute the following: ***08/07***

504.1 Description. This work shall consist of placement and preparation of base material and the construction of concrete approach pavement in accordance with these specifications, as shown on the plans or as directed by the engineer.

504.2 Material. All material, proportioning, air-entraining, mixing, slump and transporting of Portland cement concrete shall be in accordance with Sec 501. Approach pavement shall be constructed of pavement concrete or an approved Class B-1 concrete mixture. All material shall be in accordance with Division 1000, Material Details, and specifically as follows:

Item	Section
Aggregate for Base	1007.3
Concrete Curing Material	1055
Material for Joints	1057

504.3 Construction Requirements. Base placement shall be in accordance with Sec 304. Concrete approach pavement and shoulders shall be constructed in accordance with Sec 503. Concrete approach pavement will not require sealing with a concrete sealer. Type A Curb, where required, shall be constructed in accordance with Sec 609.

504.4 Method of Measurement. Final measurement of the completed concrete approach pavement will not be made except for authorized changes during construction or where appreciable errors are found in the contract quantity. Where required, concrete approach pavement areas, including shoulders, will be measured to the nearest 1/10 square yard (0.1 m^2). The revision or correction will be computed and added to or deducted from the contract quantity.

SECTION 505 – BRIDGE DECK CONCRETE WEARING SURFACE

Delete Sec 505.10.3.1 and substitute the following: ***08/08***

505.10.3.1 The contractor shall submit a mix design to Construction and Materials meeting the following properties:

Property	Requirement

Air Content, percent (minimum)	5.0
Slump, inches (mm)	1/2 ± 1/2 (13 ± 13)
Percent Fine Aggregate as Percent of Total Aggregate by Absolute Volume	50
Cement Content, lbs./cubic yard (kg/m^3)	818 to 827 (485 to 490)

Amend Sec 505.10 to include the following: ***04/05***

505.10.2.1.1 Gradation D may be used when the plan thickness of the bridge deck overlay is 3 inches or greater.

Delete Sec 505.10.4.4 and substitute the following: ***08/08***

505.10.4.4 Compressive strength will be determined from at least two 6- by 12-inch (150- by 300-mm) cylinders or from at least three 4- by 8-inch (100- by 200-mm) cylinders prepared in accordance with AASHTO T 23 and tested in accordance with AASHTO T 22. One set of cylinders will be made for 28-day compressive strength from each day's production. Cylinders made for determining when to permit traffic will be made at a frequency determined by the engineer, and will be cured in the near vicinity and in the same manner as the bridge deck. The maturity method may be used for determining when to open concrete to traffic.

Delete Sec 505.10.6.2 and substitute the following: ***06/08***

505.10.6.2 On old existing concrete decks with existing wearing surfaces, the wearing surface shall be removed in accordance with Sec 216. On existing concrete decks without existing wearing surfaces, the surface shall be scarified in accordance with Sec 216.

Delete Sec 505.10.8.6 and substitute the following: ***06/08***

505.10.8.6 The areas of half-sole and full-depth repair shall have individual concrete placement up to bottom of the low slump concrete wearing surface. These individual placements shall remain rough and shall be completed before the overlay course is started. Areas of half-sole, full-depth repair and all other patched areas shall be surface dried, sandblasted and cleaned prior to the placement of low slump concrete wearing surface.

Delete Sec. 505.10.8.13 and substitute the following: ***04/05***

505.10.8.13 After texturing the concrete surface, but before applying the wet cure, all vertical joints with the adjacent concrete shall be sealed by painting with thinned grout consisting of equal parts cement, sand and sufficient water for the mixture to be the consistence of paint.

Delete Sec. 505.10.8.15 and substitute the following: ***04/05***

505.10.8.15 The wet cure shall be applied within 30 minutes after the concrete has been placed on the deck, except when the surface will be excessively marred by so doing, as determined by the engineer. If the concrete requires refinishing because of failure to meet density requirements, the time will be extended 15 minutes. Failure to apply wet cure within the required time shall be cause for rejecting the work affected. Surface concrete in the rejected area shall be removed and replaced by the contractor at the contractor's expense.

Delete Sec. 505.10.8.16 and substitute the following: ***04/05***

505.10.8.16 The surface shall receive a wet cure of at least 72 hours.

Delete Sec. 505.20.8.3 and substitute the following: ***04/05***

505.20.8.3 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.

Delete Sec. 505.20.8.6 and substitute the following: ***04/05***

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

Delete Sec. 505.20.8.7 and substitute the following: ***04/05***

505.20.8.7 The surface shall receive a wet cure for at least 48 hours.

Delete Sec. 505.20.9.2 and substitute the following: ***04/05***

505.20.9.2 No latex modified concrete shall be placed at ambient or deck surface temperatures below 45° F (7° C). Latex modified concrete shall be protected to maintain a minimum specified curing temperature of 45° F (7° C). Any concrete damaged by freezing or which is exposed to a temperature of less than 45° F (7° C) during the first 8 hours after placement shall be removed and replaced at the contractor's expense.

Delete Sec. 505.30.3.1 and substitute the following: ***04/05;08/08***

505.20.3.1 The contractor shall submit a mix design to Construction and Materials meeting the following requirements:

Property	Requirement
Air Content, percent	0 to 6.5
Slump, inches (mm)	4 to 6 (100 to 150)
Percent Fine Aggregate as percent of Total Aggregate by Absolute Volume	50 to 55
Cement Content, lbs./cubic yard (kg/m^3) min.	658 (390)
Latex Emulsion Admixture, gallons/cubic yard (L/m^3) min.	24.5 (121.29)
Net Water/Cement Ratio, max., lbs.[a] (kg) water/lbs. (kg) cement	0.40

[a] Net water shall be considered the quantity of mixing water added, plus the non-solid portion of the latex emulsion.

Delete Sec 505.30.1.1 through 505.30.1.2 in their entirety ***08/07***

Delete Sec 505.30.2.1 through 505.30.2.4 and substitute the following: ***08/07***

505.30.2.1 Silica fume shall be in accordance with Sec 501

505.30.2.2 Aggregate shall be in accordance with Sec 505.10.2.

505.30.2.3 Pozzolanic material, other than silica fume or Portland pozzolan cements shall not be used.

505.30.2.4 A retarding admixture may be permitted, if recommended by the manufacturer of the silica fume admixture.

Delete Sec 505.30.2.4.1 through 505.30.2.4.3 in their entirety. ***08/07***

Delete Sec 505.30.2.6 and 505.30.2.7 in their entirety ***08/07***

Delete 505.30.3.1 through 505.30.3.2 and substitute the following: ***08/07***

505.30.3.1 The contractor shall submit a mix design to Construction and Materials with the following properties:

Property	Requirement
Air Content, percent, minimum	5.0
Slump, inches (mm), maximum	6 (150)

Cement Content, pounds/cubic yard (kg/m^3), min	640 (380)
Water/Cement Ratio lbs. (kg) water/lbs. (kg) cementitous materials, max.	0.37
Silica Fume, % replacement of cement	6-8
Percent Fine Aggregate (as percent of total fine and coarse aggregate by absolute volume)	50 – 55
High Range Water Reducer	As required

505.30.3.2 The water content shall include all free moisture in the fine and coarse aggregate, water content of the silica fume admixture and water content of the high range water reducer.

505.30.3.3 The contractor shall designate in the mix design letter what the slump will be when tested on the job. The slump during the placement of the silica fume concrete shall not vary from that slump by more than ± 1.5 inches (± 38 mm).

Delete Sec 505.30.5 through 505.30.5.7 and substitute the following: ***08/07***

505.30.5.1 Silica fume concrete shall be batched and mixed in accordance with Sec 501, except as herein specified.

505.30.5.2 High range water-reducing admixtures shall be incorporated and mixed into the silica fume concrete in accordance with the silica fume admixture manufacturer's recommendations and as approved by the engineer. Water-reducing admixtures may be added by hand methods. The water-reducing admixture shall not be mixed with the air-entraining admixture nor shall the water reducer be added to the same portion of the mixing water as the air-entraining admixture. Either the air-entraining admixture or the water-reducing admixture shall be mixed into the concrete before the other is added.

505.30.5.3 Truck mixed silica fume concrete shall be initially mixed for at least 70 revolutions at a rate of no less than 12 revolutions per minute or more than 18 revolutions per minute. Truck mixed silica fume concrete shall be transported to the work site at agitating speeds of 2 to 6 revolutions per minute. After arriving at the work site and before use, the silica fume concrete shall be mixed for at least 30 revolutions at 12 to 18 revolutions per minute.

505.30.5.4 If on-site rotating paddle-type mixers or on-site rotating drum mixers are used, the length of mixing time and the revolution rate shall be as recommended by the silica fume admixture manufacturer.

505.30.5.5 The silica fume admixture manufacturer's technical representative shall advise the engineer in writing of the proper batching sequence, mixing time, mixing speed and other handling procedures necessary to produce a uniform, homogeneous mixture in accordance with this specification prior to preparation of silica fume concrete trial batches or placement of any silica fume concrete.

505.30.5.6 Prior to placement of concrete in the work, the contractor may be required to prepare trial batches of concrete for tests. Trial batches shall comply with and be paid for in accordance with Sec 501.

Delete Sec. 505.30.8.3 and substitute the following: ***04/05***

505.30.8.3 The surface shall receive a wet cure for at least 7 days. Time when the ambient temperature is below 45° F (7° C) will not be counted as cure time. Cure shall be continued if 3000 psi (21 MPa) compressive strength has not been attained.

Amend Sec 505 to include the following: ***02/07***

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 (75µm) 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 (30°C).

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 (mm)	3 to 6 (75 to 150)
Percent Fine Aggregate as percent of total aggregate by weight	50 to 55
Cement Content, lb/cu yd (kg/m^3) min.	658 (390)
Latex Emulsion Admixture, gal/cu yd (L/m^3)	24.5 (121.3)
Net Water-Cement Ratio, max. Lbs.[a] (kg) of water/lbs. (kg) of cement	0.40

[a]Net 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 4500 psi (31 MPa).

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 (150 x 300 mm) 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 1500 to 2500 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 3200 psi (22 MPa).

505.40.9.10 The thickness of the overlay shall not exceed 3 inches (75 mm), 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 (30°C). 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 (0.05 $kg/m^2/hr$) 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 (40.7 $L/hr/m^2$). 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 (80 µm) 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 (7°C). Latex modified high early strength concrete shall be protected to maintain a minimum specified curing temperature of 45°F (7°C). 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 (7°C) 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 (7°C) and 90°F (32°C). If either the aggregate or water is heated, the maximum temperature for each shall be 100°F (38°C) 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 3200 psi (22 MPa). 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 (3 m) 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.

SECTION 506 – CONCRETE OVERLAYS FOR PAVEMENTS

Delete Sec 506.20.1 and substitute the following: ***08/07***

506.20.1 Description. This work shall consist of applying a debonding material and constructing a Portland cement concrete unbonded overlay in accordance with the details and locations shown on the plans. Work shall also include minor surface pavement repair, joint filling and other associated operations. The contractor shall establish the roadway profile after the bituminous interlayer is placed or the existing roadway is milled prior to the overlay. The profile shall be submitted to the Resident Engineer and include edge of pavement and centerline elevations at 50 foot intervals. The engineer will determine the final profile within 7 calendar days of receipt. The cubic yards (m^3) of concrete required will be determined by the engineer from this profile. This quantity will be the field established plan quantity. The contractor shall construct the overlay to the line and grade established from the engineers profile.

Delete Sec 506.20.2.1through 506.20.2.1.3.3 and substitute the following: ***08/07***

506.20.2.1 Debonding Material.

506.20.2.1.1 The debonding material between the existing pavement or shoulder surface and the new concrete pavement overlay shall demonstrate the following:

(a) Lack of bond between asphaltic concrete and Portland cement concrete overlay.

(b) Control heat buildup so that the base pavement surface temperature does not exceed 85 degrees F.

(c) No detrimental effect to the asphalt or concrete overlay as a result of the use.

(d) Reasonable durability under traffic, resisting removal prior to overlay.

506.20.2.1.2 Upon request, the contractor shall provide any testing necessary to demonstrate the specified properties.

Delete Sec 506.20.3.3.1 and substitute the following: ***11/05***

506.20.3.3.1 Tie bar, dowel bar and joint saw depths shall be as shown on plans. Tie bars will be required for the centerline.

Delete Sec 506.20.3.3.3 and substitute the following: ***04/05***

506.20.3.3.3 New transverse joints will not be required to match existing transverse joints, except new transverse expansion joints shall be cut or placed to match the underlying joint configuration.

Delete Sec 506.20.4 through 506.20.5.5 and substitute the following: ***08/07***

506.20.4 Method of Measurement.

506.20.4.1 When required, measurement for furnishing unbonded overlay concrete will be to the nearest 0.1 cubic yard (m^3). The cubic yard quantity will be calculated based on the total concrete yield as determined by the count of batches incorporated into the unbonded overlay.

506.20.4.2 Measurement for placing unbonded overlay concrete will be computed to the nearest 0.1 square yard (m^2). Final measurement of the completed pavement will not be made except for authorized changes during construction, or where appreciable errors are found in the contract quantity. The revision or correction will be computed and added to or deducted from the contract quantity.

506.20.4.3 Measurement for surface preparation of the existing pavement surface will be computed to the nearest square yard (m^2), including traffic lanes and shoulders. Final measurement will not be made except for authorized changes during construction, or where appreciable errors are found in the contract quantity. The revision or correction will be computed and added to or deducted from the contract quantity.

506.20.5 Basis of Payment.

506.20.5.1 When there is direct pay for volume of unbonded concrete listed in the contract, the accepted volume of portland cement concrete for the unbonded overlay will be paid for at the contract unit price for furnishing unbonded concrete overlay, per cubic yard (m^3). Further payment for the placement of the portland cement concrete unbonded overlay will be paid for at the contract unit price for placing unbonded overlay per square yard (m^2). No direct payment will be made for furnishing labor, equipment, dowels, reinforcement and other materials to place, finish, texture and cure the overlay including sawing and sealing the joints, in accordance with the plans and specifications. Payment for surface preparation including application of the debonding material, patching, joint filling of the existing surface and any other incidental work and material necessary to complete this item will be paid for at the contract unit price for surface preparation per square yard (m^2).

506.20.5.2 Any adjustments in payment as a result of the profilograph index or pavement thickness deficiency of the unbonded overlay will be made to the contract unit price for furnishing unbonded overlay concrete, placing unbonded overlay, and surface preparation, each, for the segments involved. Adjustment in payment for QC/QA concrete strength pay factors will be made to the contract unit price for placing unbonded overlay concrete and furnishing unbonded overlay, each, for the segments involved. For all adjustments, the furnishing unbonded overlay concrete per cubic yard (m^3) price will be adjusted to a square yard (m^2) price based on the plan overlay thickness.

506.20.5.4 Payment for full depth and partial depth repairs shall be in accordance with Sec 613.

506.20.5.5 Payment for bituminous interlayer will be paid for at the contract unit price and shall be in accordance with Sec 401.

506.20.5.6 Payment for contractor staking will be in accordance with Sec 105.

SECTION 507 – STRENGTH OF CONCRETE USING THE MATURITY METHOD

Insert Sec 507 in its entirety: ***08/07***

SECTION 507

STRENGTH OF CONCRETE USING THE MATURITY METHOD

507.1 Description. This specification covers the maturity method as a non-destructive means of determining in-place concrete strength for pavement or structural applications. The concept of the maturity method is based on the combined effects of concrete age and temperature, during hydration, on the rate of strength gain for a specific concrete mix. This method requires the establishment of a relationship between compressive strength and calculated maturity indices for a specific concrete mixture prior to placement of the mixture in the field. The contractor may use the maturity method in accordance with this specification to estimate the compressive strength of the in-place concrete.

507.2 Procedure. In-place concrete strength determined by the maturity method shall be in accordance with ASTM C 1074, except as noted herein.

507.2.1 Maturity Meter. The maturity meter shall have a secure means of collecting data that is unalterable.

507.2.2 Maturity Function Values. In lieu of determining values for datum temperature, T_o, or activation energy divided by the gas constant, Q, values of 14° F (-10° C) or 5000 Kelvin may be used, respectively.

507.2.3 Standardization. The calibration of systems used for monitoring the maturity of concrete shall be verified every seven working days in accordance with AASHTO T 325, Sec 9.1 and ASTM C 1074, Sec 7.1.

507.2.4 Development of the Strength-Maturity Relationship. The contractor shall develop the strength-maturity relationship prior to placing any concrete on the project, and shall notify the engineer prior to development of the maturity curve. The development of the strength-maturity relationship shall be done in the field using project equipment and materials.

507.2.4.1 Preparing Test Specimens. When the strength-maturity relationship is developed, compressive strength specimens shall be fabricated, cured and tested at the plant site and fabricated from a minimum 3 cubic yard (2.3 m^3) batch of concrete. Temperature of the fresh concrete shall be measured and recorded. All field specimens shall be fabricated and cured in accordance with AASHTO T 23, with the following exceptions. Specimens shall be cured for the first 24 hours under similar or like temperature conditions anticipated during construction, and specimens, including the cylinder used to monitor temperature, shall be de-molded at approximately 24 hours and cured in accordance with AASHTO T 23. The concrete mixture shall meet the specification requirements in order to determine the strength-maturity relationship. The concrete mixture shall be at or above the target air content established by the contractor.

507.2.4.2 Required Documentation. The contractor shall provide the engineer with the following information prior to placing any concrete on the project:

(a) The project number, route, county, concrete job mix number and date of testing.
(b) The air, slump and water content from the batch of concrete tested.
(c) The amount and type of admixture(s) used in the concrete mix.
(d) The strength of each test specimen, and the average strength of test specimens at each test age.
(e) Maturity index for each instrumented test specimen, and the average maturity index for the instrumented specimens at each test age.
(f) A graph of the average compressive strength versus the average value of the maturity index, as described in the strength-maturity relationship section of ASTM C 1074.

507.2.5 Compressive Strength Testing. At a minimum, compressive strength tests shall be performed on three specimens, and the average strength computed at 1, 3, 7, 14 and 28 days. Production may start after the seven-day compressive strengths have been determined with approval from the engineer.

507.2.6 Placement of Temperature Sensors. For pavement and pavement repairs, temperature sensors shall be embedded at approximately mid-depth and 18 inches (450 mm) from the edge of pavement. For other applications, temperature sensors shall be embedded in locations considered critical in terms of exposure conditions and structural requirements. Temperature sensors shall be placed at the following frequency:

Structure Component Frequency	
Pavement	1 sensor per 3750 sq. yd. (3000 m^2), with a minimum of one in the last 50 feet (15 m) of pavement
Pavement Repairs	1 sensor per 10 patches, with a minimum of one sensor in the last patch
Structural	A minimum of one sensor at the end of the pour, with three others sensors available to be placed as directed by the engineer

507.3 Proportioning, Mixing, Placing and Curing Field Placed Concrete. The maturity method does not account for variations in strength due to proportioning, mixing, placing and curing of concrete. Proper methods shall be followed at all times during proportioning, mixing, placing and curing the field placed concrete.

507.3.1 Field Placed Concrete Mix Requirements. Mix constituents of the field placed concrete shall not change, and mix proportions of the field placed concrete shall not vary more than 5.0 percent from the concrete mix used to develop the strength-maturity relationship. The water cement ratio shall not vary by more than 0.02.

507.3.2 Requiring Immediate Validation of Strength-Maturity Relationship. If the mix constituents change more than 5.0 percent, the water cement ratio changes more than 0.02, the material sources change or the mixing operation changes, an immediate validation of the strength-maturity curve shall be done in accordance with Sec 507.4.

507.4 Validation of Strength-Maturity Relationship. At a minimum, every seventh day of concrete placement a validation test shall be conducted to verify that in-place concrete strength is accurately represented by the strength maturity relationship. The engineer shall be notified at least one business day in advance of when and where the validation test will be done.

507.4.1 Documentation for Validation. The contractor shall document the air, slump, and water content from the batch of concrete tested and any deviations from the original job mix.

507.4.2 Specimens for Validation. During placement of the field placed concrete, a minimum of four compressive strength cylinders shall be fabricated and cured as specified in Sec 507.2.4.1.

507.4.3 Sensor Location for Validation. A temperature sensor shall be embedded to within 1/2 inch (13 mm) of the center of one cylinder for computing the maturity index from the measured temperature history as specified in Sec 507.2.

507.4.4 Test Specimens for Validation. Once the maturity index, according to the temperature monitored cylinder, is achieved which corresponds to the maturity index desired for the first critical action such as opening pavement to traffic or removing formwork, three cylinders shall be tested for compressive strength.

507.4.5 Strength-Maturity Relationship Validated. The average compressive strength of the three cylinders shall be compared to the compressive strength as determined by the strength-maturity relationship. If the predicted strength is within 10 percent or 200 psi, whichever is less, of the actual compressive strength, then the strength-maturity relationship will be considered validated.

507.4.6 Strength-Maturity Relationship Acceptable. If the actual compressive strength is more than 10 percent or 200 psi (1380 kPa) above the compressive strength as determined by the strength-maturity relationship, then a new strength-maturity relationship may be developed.

507.4.7 Strength-Maturity Relationship Not Validated. If the actual compressive strength is more than 10 percent or 200 psi (1380 kPa), whichever is less, below the compressive strength as determined by the strength-maturity relationship, the contractor shall make cylinders to determine compressive strengths until a new strength-maturity relationship has been developed.

507.5 Field Documentation. The contractor shall provide the engineer with the following information prior to taking any field action based on the strength-maturity strengths:

(a) Project number, route, county, and date tested.
(b) A list of each concrete lot evaluated.
(c) Station numbers.
(d) Quantity of concrete.
(e) Maturity index determined for each sensor location.
(f) Estimated strength determined for each sensor location.

507.5.1 Calibration and Verification Records. The contractor shall record all test results for equipment calibration and verification, and shall maintain all results in an organized format.

507.5.2 Availability of Test Results. Test results shall be available to the engineer at all times.

507.6 Basis of Payment. No additional payment will be made for compliance with this specification.

SECTION 606 – GUARDRAIL, CRASHWORTHY END TERMINALS, ONE-STRAND ACCESS RESTRAINT CABLE AND THREE-STRAND GUARD CABLE

Delete Sec 606.10.2.3.1 and substitute the following: ***11/05***

606.10.2.3.1 Material. All material shall be in accordance with Division 1000, Material Details, and specifically as follows:

Item	Specification
Delineators	1065

Delete Sec 606.10.2.3.2 – 606.10.2.3.4 and substitute the following: ***11/05***

606.10.2.3.2 Construction Requirements.

606.10.2.3.2.1 Delineator reflector colors shall correspond with pavement marking. Delineators shall be sheeted on one side, facing oncoming traffic, unless otherwise specified. Where guardrail divides opposing lanes of travel, the delineators shall have retroreflective sheeting on both sides corresponding to adjacent pavement markings. Guardrail located on ramps shall have red reflective sheeting placed on the reverse side of the reflector.

606.10.2.3.2.2 Delineators will be installed according to manufacturer's recommendations.

606.10.2.3.2.3 Any damaged or missing delineators shall be replaced by the contractor at the contractor's expense.

Delete Sec 606.10.4 and substitute the following: ***11/05***

606.10.4 Basis of Payment. The accepted quantities of guardrail, bridge anchors, end anchors, transition sections and bullnose guardrail systems, complete in place, will be paid for at the contract unit price for each of the pay items included in the contract. No direct payment will be made for end sections or terminal connectors. No direct payment will be made for setting posts in rock. No direct payment will be made for guardrail delineators provided on new guardrail. Delineators specified for installation on existing guardrail will be measured and paid for per each.

Delete Sec 606.50.2.4 and substitute the following: ***06/06***

606.50.2.4 Aggregate Bedding. Material for aggregate bedding shall consist of a durable crushed stone, shot rock or broken concrete with approximately 20 percent of the pieces being between 1 inch and 3 inches in diameter but none greater than 3 inches. The remainder of the material shall be such that provides a uniform, angular appearance. Acceptance by the engineer will be made by visual inspection.

Delete Sec 606.50.2.5 and substitute the following: ***11/05***

606.50.2.5 Delineators. Delineator spacing and reflector colors shall be in accordance with Sec 617.30.

Delete Sec 606.50.4 and substitute the following:

606.50.4 Basis of Payment. The accepted quantities of three-strand guard cable, end anchors, posts, hardware and aggregate bedding will be paid for at the contract unit price for each of the pay items included in the contract. No direct payment will be made for setting posts in rock. No direct payment will be made for guard cable delineators provided on new guard cable. Delineators specified for installation on existing guard cable will be measured and paid for per each.

SECTION 607 – FENCING

Amend Sec 607.10 to include the following: ***11/05***

607.10.3.5 Post braces shall be installed for each gate, corner, pull and end post. The brace shall extend from the mid point of the gate, corner, pull and end post to the midpoint of the adjacent line post. A truss rod shall be connected to the midpoint of the line post and run back to the bottom of the gate, corner, pull and end post. The truss rod shall be equipped with a turnbuckle or other equivalent device for adjustment.

SECTION 612 – IMPACT ATTENUATORS

Delete Sec 612.4.1 and substitute the following: ***04/05;08/08***

612.4.1 Truck or Trailer Mounted Attenuator. A truck mounted attenuator or trailer mounted attenuator (TMA) shall be used for all moving operations conducted under traffic and as specified in the contract. Each TMA shall consist of an impact attenuator unit, a support vehicle, and truck-mounted or trailer mounted flashing arrow panel. Any damaged TMA shall be removed from service and either repaired or replaced to the satisfaction of the engineer.

Delete Sec. 612.4.2.2 and insert the following: ***05/06***

612.4.2.2 A decal designed as a Type I object marker with MoDOT fluorescent orange retroreflective sheeting or a Type 3 object marker with MoDOT Type 3 yellow sheeting shall be applied to the lead module facing traffic for arrays located 12 feet (3.6 m) or less from the edge of the traveled way.

SECTION 613 – PAVEMENT REPAIR

Delete Sec 613.2 and substitute the following: ***11/05***

613.2 Material. All material, unless specified otherwise in this specification, shall be in accordance with Division 1000, Material Details, and specifically as follows:

Item	Section
Epoxy or Polyester Bonding Agents for Dowels	1039
Concrete Curing Material	1055
Material for Joints	1057

Delete Sec 613.10.1 and substitute the following: ***11/05***

613.10.1 Description. Full depth pavement repairs shall consist of removing specified areas of existing variable thickness Portland cement concrete pavement and subsequent bituminous overlays and replacing the removed material with non-reinforced Portland cement concrete as shown on the plans.

Delete Sec 613.10.2.2 and substitute the following: ***11/05; 07/06***

613.10.2.2 All full depth pavement repairs exceeding 30 feet (9 m) in length shall be constructed with tie bars along the longitudinal centerline joint in accordance with Sec 502. Dowel bars, tie bars and holes shall be as shown on the plans. Dowel bars shall be epoxy coated. Bar holes shall be drilled to the specified diameter and to the depth shown on the plans. Equipment designed to drill multiple holes simultaneously will only be allowed provided such

equipment causes no damage to existing pavement. The holes shall be blown clean and allowed to dry. The holes shall be injected with an approved epoxy or polyester bonding agent in accordance with Sec 1039.30 and shall fill the voids around the bar. The bonding agent shall be thoroughly mixed in accordance with the manufacturer's recommendations prior to injection into the holes. The bonding agent shall be injected into the hole by inserting the injection device to the back of the hole and slowly withdrawing the device while dispensing sufficient material to completely fill the void around the bar when inserted. Other methods may be used as approved by the engineer. The contractor shall use a method to prevent the bonding agent from flowing from the hole during placement of the bar and to create an effective face at the entrance of the hole. The bar shall be inserted into the hole with a twisting motion so the material in the back of the hole is forced up and around the bar. The bars shall be placed parallel to the surface and the centerline of the traveled way and shall not vary more than 1/4 inch (6 mm) in alignment. Bars shall be firmly seated prior to placing concrete.

Delete Sec 613.10.2.3.1 through 613.10.2.3.2 and substitute the following: ***04/08***

613.10.2.3.1 When the repair is to be made and opened to traffic after 24 hours, the concrete shall be in accordance with the following requirements:

Property	Existing Slab Design Thickness	Requirement
Compressive Strength in 24 hours	8 in. (200 mm) or less 9 in. (225 mm) 10 in. (250 mm) or more	3000 psi (21 MPa), min. 2700 psi (18.6 MPa), min. 2000 psi (14 MPa), min.
Compressive Strength in 28 days	--	4000 psi (28 MPa), min.

[a]The cure time shall be the time determined to reach this compressive strength. The roadway may be opened to traffic when this compressive strength has been attained.

613.10.2.3.2 When the repair is to be made and opened to traffic in less than 24 hours, the concrete shall be in accordance with the following requirements:

Property	Existing Slab Design Thickness	Requirement
Compressive Strength in 4 hours[a]	8 in. (200 mm) or less 9 in. (225 mm) 10 in. (250 mm) or more	3000 psi (21 MPa), min. 2700 psi (18.6 MPa), min. 2000 psi (14 MPa), min.
Compressive Strength in 28 days	--	4000 psi (28 MPa), min.

[a]The cure time shall be the time determined to reach this compressive strength. The roadway may be opened to traffic when this compressive strength has been attained.

Delete Sec 613.10.2.9 in its entirety ***11/06***

Delete Sec 613.20.2.1.1 and substitute the following: ***04/05; 08/08***

613.20.2.1.1 Concrete shall be in accordance with the following requirements. Compressive strength specimens shall be prepared in accordance with current MoDOT methods and cured to simulate actual field conditions. Testing of compressive specimens shall be performed by methods and at facilities acceptable to the engineer. A new trial mix may be required if the engineer determines the field conditions vary substantially from trial mix conditions. The coarse aggregate for the concrete shall be Gradation E or Grade F in accordance with Sec 1005 or an optimized aggregate gradation approved by the engineer. The optimized aggregate gradation shall have 100 percent passing the 3/4 inch (12.5 mm) sieve.

Property	Requirement
Compressive Strength in 4 hours [a]	1600 psi (11 MPa), min.
Compressive Strength in 24 hours	4000 psi (28 MPa), min.
Air Content	4 percent, min.
Slump	1 inch (25mm), max.

[a] The cure time shall be the time determined to reach this compressive strength. The roadway may be opened to traffic when this compressive strength has been attained.

Delete Sec 613.20.2.2 and substitute the following: ***08/08***

613.20.2.2 When the repair can be protected from traffic for 24 hours or more, concrete shall be in accordance with the following. Coarse aggregate for the concrete shall be in accordance with Sec 613.20.2.1.1.

Property	Requirement
Compressive Strength in 4 hours [a]	1600 psi (11 MPa), min.
Compressive Strength in 24 hours	4000 psi (28 MPa), min.
Air Content	4 percent, min.
Slump	1 inch (25mm), max.

[a] The cure time shall be the time determined to reach this compressive strength. The roadway may be opened to traffic when this compressive strength has been attained.

Delete Sec 613.20.2.3 and substitute the following: ***06/08***

613.20.2.3 Compressible inserts shall be rectangular and shall have a minimum thickness of 1/4 inch (6 mm). The material shall be preformed fiber expansion joint filler in accordance with Sec 1057 or, if approved by the engineer, other material may be used.

Delete Sec 613.20.3.1 through 613.20.3.1.3 and substitute the following: ***04/05; 08/07***

613.20.3.1 Removal of Concrete. Repair limits shall extend beyond the delaminated or spalled area by 3 to 4 inches (75 to 100 mm). Boundaries of any removal shall be kept square or rectangular. If repair areas are less than 2 feet (0.6 m) apart, the areas shall be combined as one repair. The maximum amount of spalling allowed on the edges of the channel will be 3/8 inch (9 mm). The channel depth shall not exceed half the slab depth. Concrete shall be removed by a milling process. Residue slurry from milling operations shall be removed in accordance with Sec 622.30.3.8. If the top of dowel bars are exposed but not structurally damaged, the exposed section of the dowel bar shall be coated with an approved bond breaker.

613.20.3.1.1 Milling. Milling equipment shall be in accordance with Sec 622.10, and shall be equipped with a device for stopping at a preset depth. Milling may be performed either across lanes or parallel to the pavement centerline. After milling, the bottom of the repair area shall be checked by sounding to ensure all unsound material has been removed. Any unsound material remaining shall be chipped free. All transverse sides of the removal shall be uniform and tapered 30° to 60° from vertical by milling or chipping. If excessive concrete is removed, or if dowel bars or reinforcement are damaged to the extent to require full depth pavement repair, the cost for the repair shall be at the contractor's expense.

613.20.3.1.2 Full Depth Pavement Repair Required. If during the removal of material for partial depth pavement repair the pavement constituted full depth pavement repair in accordance with Sec 613.20.1.2, removal operations shall cease at that location. The contractor may conduct full depth pavement repair at that time, or temporarily patch the area and perform full depth pavement repair at a later date. If the location is opened to traffic prior to the full depth pavement repair, all loose material shall be removed and either a bituminous material approved by the engineer or a concrete mixture in accordance with Sec 613.20.2 shall be used to patch the location. Reestablishing joints or cracks in temporary repairs by sawing will not be required. Material provided for temporary patches shall be provided at the contractor's expense.

Delete Sec 613.20.3.4.1 and substitute the following: ***08/07***

613.20.3.4.1 Bonding Material. Bonding material shall be applied in a thin even coat, shall cover the entire area, including the repair walls, shall overlap the pavement surface and shall be in accordance with the following.

Delete Sec 613.20.3.5 and substitute the following: ***08/07***

613.20.3.5 Resealing Joints and Cracks. After the concrete has initial set, all longitudinal and transverse joint and crack inserts shall be removed by sawing. All joints and cracks shall be sawed at least as wide as the rest of the joint or crack in the adjoining concrete, and the underlying concrete pavement. All transverse joints and cracks shall be sawed to a minimum depth of 3/8 inch (9 mm) below the pavement surface. All longitudinal joints abutting to an adjoining concrete pavement lane shall be sawed to a depth equal to 1/2 inch (12.5 mm) less than one-half of the pavement thickness. Where concrete extends into the shoulder, the saw cut shall be to the depth of the patch. The reservoir for any crack or joint wider that ¼ inch shall then be filled with a hot-poured, elastic-type concrete joint sealer in accordance with Sec 1057.

Delete Sec 613.20.3.7 and substitute the following: ***04/05***

613.20.3.7 Acceptance. All pavement repairs will be sounded by the engineer prior to acceptance. Sounding will not be performed until the repair material has reached design compressive strength and the repair has been open to traffic for a minimum of 30 days. If sounding indicates unsound material, the entire pavement repair shall be removed to the limits designated by the engineer and replaced by the contractor at the contractor's expense.

Delete Sec 613.20.4.1 and substitute the following: ***04/05***

613.20.4.1 Measurement for repairing spalled areas, cracks or joints will be made to the nearest 1/10 square yard (0.1 m^2). Any material removed beyond the repair area designated by the engineer due to the removal methods used by the contractor will not be included in the measurement for pavement repair. Measurement of all concrete material furnished and placed in the repair of spalled areas, cracks or joints will be made to the nearest 1/10 cubic yard (0.1 m^3). Measurement for the saw cut to re-establish the joint or crack will be made to the nearest linear foot (0.5 m).

SECTION 614 – DRAINAGE FITTINGS

Delete Sec 614.10.4 – 614.10.5 and substitute the following: ***04/05***

614.10.4 Basis of Payment. The accepted quantity of parallel bar grates and bearing plates, and curved vane grates and frames will be paid for at the contract unit price for each of the items included in the contract.

SECTION 616 – TEMPORARY TRAFFIC CONTROL

Delete Sec 616.2 and replace with the following: ***04/05***

616.2 Material. All material shall be in accordance with Division 1000, Material Details, and specifically as follows:

Item	Section
Temporary Traffic Control Devices	1063

Insert Sec 616.3.1 and renumber subsequent sections accordingly: ***10/07***

616.3.1 All workers within highway right of way who are exposed to traffic or construction equipment shall wear high-visibility safety apparel meeting Class 2 or Class 3 requirements of ANSI/ISEA 107-2004 publication entitled, "American National Standard for High-Visibility Safety Apparel and Headwear".

Amend Sec 616.3 to include the following: ***10/07***

616.3.4 The contractor shall:

(a) Designate a trained person at the project level who has the primary responsibility, with sufficient authority, for implementing the traffic management plan and other safety and mobility aspects of the project. The name of that person, proof they successfully completed MoDOT's Advanced Work Zone course, ATSSA's Traffic Control Supervisor course or an approved equivalent training course, and a 24-hour contact number for that person shall be provided to the engineer at the pre-construction meeting. Re-certification will be required as dictated by the organization providing the training.

(b) Ensure all contractor personnel are trained in traffic control to a level commensurate with their responsibilities.

(c) Advise the engineer, as required, at least two working days before any work requiring a lane closure begins and 14 calendar days prior to the imposition of height, width and weight restrictions.

(d) Perform quality control of work zones to promote consistency and ensure compliance with contract documents, policies and guidelines.

Delete Sec 616.4.1.2 and renumber subsequent sections accordingly ***08/07***

Delete Sec 616.4.2.5 and substitute the following: ***10/07; 08/08***

616.4.2.5 As soon as possible after observing a traffic control deficiency, the engineer will report the deficiency to the contractor, either verbally or in writing. After receiving notification, if the contractor does not make corrections within an agreed upon timeline, order records or suspension of the work may occur. Regardless of the severity of the deficiency, corrections shall be made as soon as possible to maintain a quality work zone.

616.4.2.5.1 The severity of a deficiency will be categorized as follows:

(a) Category 1 – Presents an immediate danger to the traveling public or workers and needs to be addressed immediately.

(b) Category 2 – The situation doesn't pose an immediate threat to either the public or the workers, but can impact the proper functioning of the work zone.

(c) Category 3 – The situation doesn't impact the functioning of the work zone but is more of a maintenance or aesthetic issue.

616.4.2.5.2 When the engineer determines that the contractor has not made a good faith effort in correcting a deficiency as agreed upon in Sec 616.4.2.5, an order record will be issued and the contractor will be notified if the following timelines to correct the deficiency.

(a) A Category 1 deficiency shall be corrected within one hour.

(b) A Category 2 deficiency shall be corrected within 24 hours.

(c) A Category 3 deficiency shall be corrected within 96 hours.

616.4.2.5.3 When the engineer determines the contractor has not made a good faith effort in complying with an order record issued in accordance with Sec 616.4.2.5.2, the following action may be taken:

(a) A second order record will be issued.

(b) The engineer may find the contractor in violation of the contract in accordance with Sec 105.

616.4.2.5.4 For reoccurring deficiencies of similar nature within the contractor's control, the engineer may issue order records in accordance with Sec 616.4.2.5.3, bypassing Sec 616.4.2.5.2 requirements.

Delete Sec 616.4.3 and substitute the following: ***08/07; 12/08***

616.4.3 Each flagger, automated flagger assistance devices (AFAD) operator, portable flagger device (PDF) operator and pilot vehicle operator shall maintain a valid flagger certification card that certifies the individual has been trained in the principles of flagging in accordance with the MUTCD. Certifications will not be required in emergency situations that arise due to actions beyond the contractor's control when flagging is necessary to maintain safe traffic control on a temporary basis. All flagging, AFAD, PFD and pilot vehicle operations shall be in accordance with the MUTCD. Flaggers and pilot vehicles shall be provided as shown on the plans or as approved or directed by the engineer. When not specified in the plans, the contractor may use a Type B (Red/Yellow Lens) AFAD PFD or pilot vehicle to supplement the flagging operation upon approval from the engineer. When two-way traffic is maintained over a single lane, each flagger, AFAD operator, if used in tandom, and pilot vehicle operator involved in the traffic flagging operation shall be equipped with a portable, two-way, communication system approved by the engineer. When the AFED or PFD are not in use they shall be removed from the roadside.

Delete Sec 616.8.3 and substitute the following: ***12/08***

616.8.3 Portable Traffic Signals. Portable traffic signals shall be in accordance with Sec 1063. The contractor shall place the portable traffic signal (PTS) units a minimum of 6 feet (2 m) beyond the edge of shoulder at the location shown on the plans or as directed by the engineer. Each unit shall be level to the satisfaction of the engineer. Each PTS shall be delineated with a minimum of five non-metallic drum-like channelizers. The PTS shall not be located in the median.

Amend Sec 616.9 as follows; renumber subsequent sections accordingly: ***12/08***

616.9 Portable Flagger Device. Portable flagger devices (PFD) shall be installed on each side of roadway per direction and in accordance with Sec 1063.9.

Delete Sec 616.10 and 616.10.1 and substitute the following: ***08/07; 08/08***

616.10 Basis of Payment. Temporary traffic control devices specified in the traffic control plan or authorized by the engineer will be paid for at the contract unit price for each of the pay items included in the contract. No direct payment will be made for the following:

(a) Incidental items necessary to complete the work, unless specifically provided as a pay item in the contract.

(b) Installing, operating, maintaining, cleaning, repairing, removing or replacing traffic control devices.

(c) Covering and uncovering existing signs and other traffic control devices.

(d) Relocating temporary traffic control devices, including permanent traffic control devices temporarily relocated, unless specifically included as a pay item in the contract.

(e) Worker apparel.

(f) Flaggers, AFADs, pilot vehicles, and appurtenances at flagging stations.

(g) Furnishing, installing, operating, maintaining and removing construction-related vehicle and equipment lighting.

(h) Construction and removal of temporary equipment crossovers, including restoring pre-existing crossovers.

SECTION 617 – CONCRETE TRAFFIC BARRIER

Delete Sec 617.20.4.1 through 617.20.4.2 and substitute the following: ***11/06***

617.20.4.1 New temporary concrete traffic barrier will not be required; however, barrier shall be in a serviceable condition during installation and relocation as determined by the engineer. The contractor may use either the two-loop or three-loop style of temporary concrete traffic barrier. When the two-loop and three-loop styles of temporary concrete traffic barrier are used in combination, the keeper pin assembly will be required. Visual cracks in the loop steel will be cause for rejection of the barrier unit by the engineer. As directed by the engineer, damaged units shall be immediately replaced and removed from the right of way at the contractors expense.

617.20.4.2 Existing two-loop concrete barrier owned by contractors or previously accepted two-loop concrete barrier in a manufacturer's stockpile (inventory) will be allowed for use on MoDOT projects as long as:

(a) The barrier was fabricated prior to January 1, 2004.

(b) Either the MoDOT acceptance stamp is legible on the barrier or certification is provided by the contractor stating that the barrier was fabricated prior to January 1, 2004, and in accordance with MoDOT specifications.

(c) The barrier is in acceptable condition.

Delete Sec 617.30.2 and substitute the following: ***11/05***

617.30.2 Material. All material shall be in accordance with Division 1000, Material Details, and specifically as follows:

Item	Specification
Delineators	1065

Delete Sec 617.30.3.1 – 617.30.3.2.1 and substitute the following: ***11/05***

617.30.3.1 Delineators shall be placed on all concrete traffic barrier spaced at 50-foot (15 m) intervals.

617.30.3.2 Delineator reflector colors shall correspond with pavement marking. Delineators shall be sheeted on one side, facing oncoming traffic, unless otherwise specified. Where permanent concrete traffic barrier divides opposing lanes of travel, the delineators shall have retroreflective sheeting on both sides corresponding to adjacent pavement marking.

617.30.3.2.1 Delineators mounted on permanent concrete traffic barrier shall be anchored with galvanized mechanical fasteners that prevent movement in accordance with the manufacturer's recommendations.

SECTION 620 – PAVEMENT MARKING

Delete Sec 620 in its entirety and substitute the following: ***10/07***

SECTION 620

PAVEMENT MARKING

620.1 Description. This work shall consist of furnishing, installing, maintaining and removing temporary and permanent pavement marking as shown on the plans, as specified herein or as directed by the engineer.

620.2 Construction Requirements.

620.2.1 General.

620.2.1.1 All pavement marking shall be in accordance with the latest edition of the MUTCD and the FHWA *Standard Highway Signs* at the time of the bid opening.

620.2.1.2 All pavement marking shall be uniform in appearance with crisp, well-defined edges and shall be uniform in width and thickness. Surface distribution of the beads shall be uniform.

620.2.1.3 Longitudinal pavement marking shall not be placed on longitudinal joints.

620.2.1.4 The contractor will be responsible for the protection of all liquid pavement marking until the pavement marking has reached a no-track state as determined by the engineer.

620.2.1.5 Damage to pavement marking as a result of the contractor's operations, including resurfacing of shoulders, shall be repaired or replaced at the contractor's expense.

620.2.1.6 All pavement marking shall be installed in accordance with this specification and all manufacturer's recommendations. Manufacturer's written application or installation instructions shall be provided by the contractor to the engineer.

620.2.1.7 The engineer will check application rates occasionally during the course of the work.

620.2.1.8 When surface preparation is required, the area prepared shall be 1 inch wider than the final pavement marking and shall meet the requirements of Sec 620.2.4.2. The method of surface preparation shall not cause structural damage to the pavement and shall meet the approval of the engineer.

620.2.2 Permanent Pavement Marking.

620.2.2.1 On roadways open to traffic, permanent pavement marking shall be in place no later than five days after final paving operations, except when the permanent striping will be placed within the rumble strip, then the permanent striping shall be placed no later than five days after the completion of the rumble strip. Permanent pavement marking applications for surface treatments requiring more than five days of cure shall be placed in accordance with manufacturer's recommendations and as directed by the engineer.

620.2.2.2 When installing permanent pavement marking, the contractor shall begin intermittent pavement marking, starting with the gap, immediately after the last existing intermittent pavement marking to maintain the specified cycle length along the entire length of the intermittent pavement marking line.

620.2.2.3 If the permanent pavement marking cannot be placed according to these specifications and the road is to be opened to traffic with no permanent pavement marking in place, the contractor shall, at the direction of the engineer, place and maintain temporary pavement marking at the contractor's expense. The contractor shall remove temporary pavement marking and place the permanent pavement marking according to these specifications and as directed by the engineer.

620.2.3 Inspection.

620.2.3.1 Permanent pavement marking will be inspected following installation. The engineer will measure the initial retroreflectivity with a retroreflectometer. Measurements will be taken no sooner than seven days after application. . Contractor may clean any pavement markings at the contractor's expense prior to measurements being taken. Uncleaned pavement markings shall not be grounds for dispute of retroreflectivity readings.

620.2.3.2 If the performance inspection discloses any permanent pavement marking that does not meet the acceptance requirements, the contractor shall repair or replace such work to the satisfaction of the engineer within 30 days of notification, at the contractor's expense.

620.2.3.3 Upon completion of the initial performance inspection and after satisfactory completion of any necessary corrections, the engineer will notify the contractor, in writing, of the date of acceptance and release the contractor from further performance responsibility.

620.2.4 Acceptance.

620.2.4.1 Retroreflectivity inspection will be performed by the engineer using a 30-meter geometry retroreflectometer at 0.1 mile (0.16 km) intervals for a mobile retroreflectometer. If a hand held retroreflectometer is used, the intervals and acceptance shall be in accordance with MoDOT Test Method TM 80. Retroreflectivity acceptance requirements will be as follows:

Retroreflectivity Acceptance Requirements		
Type of Material	**Color**	**Millicandelas/m^2/lux (Minimum Initial)**
Epoxy	White	300
	Yellow	225
Preformed Marking Tape	White	Per Manufacturer's Specifications
	Yellow	Per Manufacturer's Specifications
Paint	White	300
	Yellow	225
Polyurea	White	300
	Yellow	225

620.2.4.2 Visual inspection requirements shall be as follows:

(a) Lateral deviation shall not exceed one inch in 100 feet (25 mm in 30 m).

(b) Width of markings shall not deviate more than shown in the following table:

Marking Width Tolerance	
Marking Width	**Requirement**
4 inch (100 mm)	+ 1/4 inch (6 mm)
6 and 8 inches (150 mm to 200 mm)	± 1/4 inch (6 mm)
10 inches (250 mm) and above	± 1/2 inch (12 mm)

(c) Length of markings shall not deviate more than 3 inches (75 mm) in 10 feet (3 m).

620.2.4.3 Deductions for pavement marking, based upon average readings obtained using hand-held retroreflectometers or 0.1 mile (0.16 km) interval readings using a 30-meter geometry retroreflectometer, shall be as shown below. These deductions will not be applied if 98 percent of the readings meet the retroreflectivity acceptance requirements of Sec 620.2.4 and no readings are at or below the removal criteria as shown below.

White [a]	Yellow [a]	Percent of Contract Price
>=300	>=225	100
290-299	215-224	80 [b]
280-289	205-214	60 [b]
270-279	195-204	50 [b]
<270	<195	Remove
[a] Millicandelas/m^2/lux		
[b] Contractor has the option to accept this reduction in pay for this work or to remove and replace at the contractor's expense.		

620.2.5 Temporary Pavement Marking for Milling, Grinding and Resurfacing Operations. The contractor shall place and maintain preformed short term marking tape or temporary raised pavement markers on pavement undergoing milling, grinding or resurfacing operations. At the completion of each day's operation, the contractor shall install and maintain temporary pavement marking until permanent pavement marking material has been placed as specified in the contract, at the contractor's expense. At no time shall more than one mile (1.6 km) of roadway behind the operation be unmarked. The contractor shall ensure all pavement marking, temporary or permanent, has been placed prior to leaving the work zone unattended. Pavement marking shall be replaced in the same configuration as the previously existing pavement marking unless otherwise shown on the plans or directed by the engineer.

620.2.5.1 On two-lane, two-way roadways with "no passing zone" marking, all yellow centerline marking shall be replaced with temporary raised pavement markers with yellow on both sides. White lane line marking on climbing or turn lanes shall be replaced with white/red raised pavement markers with white facing traffic. Temporary raised pavement markers shall be in accordance with Sec 620.60.

620.2.5.2 On resurfacing projects, when the adjacent layer of resurfacing has not been placed and the existing centerline or lane line marking has been obliterated, the temporary marking shall be placed on the higher layer at the centerline of the roadway or lane. Any temporary pavement marking damaged, displaced or missing before the final pavement marking is installed shall be replaced at the contractor's expense within two hours' upon notification from the engineer.

620.2.5.3 If temporary pavement marking is to be in place more than fifteen days, the engineer may require that temporary paint be placed and maintained at the contractor's expense. Temporary paint shall have a minimum initial retroreflectivity of 150 mcd/m2/lux. Temporary paint shall be maintained at a minimum retroreflectivity of 100 mcd/m2/lux with a least 95 percent of the stripe present. When temporary paint is used on the final pavement surface and permanent pavement marking will be done by others, any paint outside of the final pavement marking footprint shall be removed by and at the contractor's expense.

620.2.6 Temporary Pavement Marking for Traffic Pattern Changes. The contractor shall place pavement marking paint, preformed removable pavement marking tape or preformed short-term pavement marking tape for bypasses, lane shifts, narrow lanes and other traffic pattern changes as shown on the plans and all other conditions not described in Sec 620.2.5. The contractor shall install and maintain temporary pavement marking until the permanent marking material has been placed as specified in the contract.

620.2.6.1 For temporary marking durations of less than two weeks, and when removal of the temporary marking is not required, preformed short term pavement marking tape may be used as specified in Sec 620.30.

620.2.6.2 For temporary marking requiring removal of the marking, preformed removable pavement marking tape shall be used as specified in Sec 620.30, unless otherwise shown on the plans. Other pavement marking may be used in lieu of preformed removable pavement marking tape with approval from the engineer.

SECTION 620.10 PREFORMED PAVEMENT MARKING TAPE

620.10.1 Description. This work shall consist of furnishing and placing preformed pavement marking tape, as specified, at locations shown on the plans or as directed by the engineer.

620.10.2 Material. All material shall be in accordance with Division 1000, Material Details, and specifically as follows:

Item	Section
Preformed Pavement Marking Tape	1048.10

620.10.3 Construction Requirements.

620.10.3.1 Preformed pavement marking tape shall be installed according to the manufacturer's recommendations. A copy of the manufacturer's installation specifications shall be provided to the engineer.

620.10.3.1.1 Type 1 preformed pavement marking tape shall be installed in accordance with the manufacturer's recommendations.

620.10.3.1.2 Type 2 preformed pavement marking tape shall be installed in a groove in accordance with the manufacturer's recommendations.

620.10.3.1.3 Arrows, words and symbols shall be white and may be formed from one piece or multiple pieces of Type 2 preformed pavement marking tape material specifically designed for intersection marking.

620.10.4 Acceptance. Acceptance for pavement markings, except for intersection markings, shall be in accordance with Sec 620.2.4. Acceptance for intersection markings will be based on visual inspection.

620.10.5 Method of Measurement.

620.10.5.1 Final measurement will not be made except for authorized changes during construction or where appreciable errors are found in the contract quantity. The revision or correction will be computed and added to or deducted from the contract quantity.

Delete Sec 620.10.5.2 and substitute the following: ***10/08***

620.10.5.2 Where required, measurement of 4-inch (100 mm), 6-inch (150 mm), 8-inch (200 mm), 12-inch (300 mm) and 24-inch (600 mm) pavement marking will be made to the nearest linear foot (0.5 m). Where intermittent lines are specified, deductions will be made for the gaps in pavement marking.

620.10.5.3 Where required, measurement of arrows, words and symbols will be made per each.

620.10.6 Basis of Payment. The accepted quantity of preformed pavement marking tape will be paid for at the contract unit price for each of the pay items included in the contract.

SECTION 620.20 PREFORMED REMOVABLE PAVEMENT MARKING TAPE

620.20.1 Description. This work shall consist of furnishing and placing preformed removable marking tape at locations shown on the plans or as directed by the engineer.

620.20.2 Material. All material shall be in accordance with Division 1000, Material Details, and specifically as follows:

Item	Section
Preformed Removable Pavement Marking Tape	1048.20

620.20.3 Construction Requirements. All preformed removable pavement marking tape within the project limits shall be maintained by the contractor at the contractor's expense in a manner approved by the engineer. All preformed removable marking tape shall be installed according to the manufacturer's recommendations.

Delete Sec 620.20.4 and substitute the following: ***10/08***

620.20.4 Method of Measurement. Measurement of 4-inch (100 mm), 6-inch (150 mm), 8-inch (200 mm), 12-inch (300 mm) and 24-inch (600 mm) preformed removable pavement marking tape will be made in accordance with Sec 620.10.5.
with Sec 620.10.3.2.

620.20.5 Basis of Payment.

620.20.5.1 The accepted quantity of preformed removable pavement marking tape will be paid for at the contract unit price for each of the pay items included in the contract, except when used for temporary pavement marking, payment will be made in accordance with Sec 620.20.5.2.

620.20.5.2 The accepted quantity of temporary pavement marking will be paid for at the contract unit price for each of the pay items included in the contract. Payment will be made for the initial installation only. Repair or replacement of the temporary pavement markings will be at the contractor's expense.

SECTION 620.30 PREFORMED SHORT TERM PAVEMENT MARKING TAPE

620.30.1 Description. This work shall consist of furnishing and placing preformed short-term pavement marking tape at locations shown on the plans or as directed by the engineer. With approval from the engineer, pavement marking paint may be used in lieu of preformed short term pavement marking tape at the contractor's expense.

620.30.2 Material. All material shall be in accordance with Division 1000, Material Details, and specifically as follows:

Item	Section
Preformed Short Term Pavement Marking Tape	1048.30

620.30.3 Construction Requirements. Preformed short term marking tape shall be installed according to the manufacturer's recommendations.

Delete Sec 620.30.4 and substitute the following: ***10/08***

620.30.4 Method of Measurement. Measurement of preformed short term pavement marking tape will be made in accordance with Sec 620.10.5.

620.30.5 Basis of Payment. The accepted quantity of preformed short-term pavement marking tape will be paid for at the contract unit price for each of the pay items included in the contract, except as follows. When preformed short term marking tape is used in accordance with Sec 620.2.5, then no direct payment will be made. When preformed short term marking tape is used in accordance with Sec 620.2.6, payment will be made in accordance with Sec 620.20.5.2.

SECTION 620.40 PAINT FOR PAVEMENT MARKING

620.40.1 Description. This work shall consist of furnishing and placing pavement marking paint and drop-on glass beads at locations shown on the plans or as directed by the engineer. When paint is specified, the contractor may use either waterborne or acrylic copolymer pavement marking paint at the contract unit price in accordance with this specification and with approval from the engineer.

Delete Sec 620.40.2 and substitute the following: ***10/08***

620.40.2 Material. Traffic paint shall be used as specified on the plans or as approved by the engineer. Material for application of traffic marking paint shall be in accordance with Division 1000, Material Details, and specifically as follows:

Item	Section
Drop-On Glass Beads	1048.40.5
Acrylic Copolymer Fast Dry Pavement Marking Paint	1048.80
High Build Acrylic Waterborne Pavement Marking Paint	1048.90
Acrylic Waterborne Pavement Marking Paint	1048.100

620.40.3 Construction Requirements.

620.40.3.1 Equipment. All equipment for application of pavement marking paint shall be of such design and maintained in such a condition to properly and evenly apply marking paint and drop-on glass beads.

Delete Sec 620.40.3.2 and substitute the following: ***10/08***

620.40.3.2 Surface Preparation. The surface on which paint is to be placed shall be clean and dry. Paint shall not be applied in damp conditions or if there is any evidence of surface moisture on the pavement. On new Portland cement concrete surfaces, the curing compound shall be removed in accordance with Sec 620.70.3.3.

620.40.3.3 Weather Limitations. The pavement surface temperature and air temperature shall be determined before the start of each day of marking operation and at any other time deemed necessary by the engineer. Temperatures shall be obtained in accordance with MoDOT Test Method TM 20.

620.40.3.3.1 For waterborne applications, the pavement surface temperature and ambient air temperatures shall be above 50 F (10 C). Waterborne paint shall not be applied if the forecast conditions for the eight hours immediately following final application include precipitation or temperatures below 50 F (10 C).

620.40.3.3.2 For acrylic copolymer applications, the pavement surface temperature and ambient air temperature shall be above 35 F (2 C).

620.40.3.4 Paint Application.

620.40.3.4.1 Paint shall be machine applied using spray guns designed and adjusted to apply paint at the required thickness and width. If there is any evidence of gun clogging, splattering or uneven paint distribution, painting operations shall cease until equipment is restored to proper operation.

620.40.3.4.2 Painting of stop lines, arrows, words and symbols may be applied by hand using paint spray equipment. Equipment shall be capable of applying paint evenly to the required thickness. Dimensions shown on the plans shall be used for arrows, words and symbols.

Delete Sec 620.40.3.4.3 and substitute the following: ***10/08***

620.40.3.4.3 High-Build paint shall be applied to a minimum wet thickness of 20 mils (0.500 mm). The wet film thickness of the applied paint shall be tested with a paint thickness gauge as directed by the engineer.

Delete Sec 620.40.3.4.4 and 620.40.3.4.5 and substitute the following: ***10/08***

620.40.3.4.4 Acrylic waterborne paint and acrylic copolymer paint shall be applied to a minimum wet thickness of 15 mils (0.380 mm). The wet film thickness of the applied paint shall be tested with a paint thickness gauge as directed by the engineer.

620.40.3.4.5 Paint may be heated to a maximum temperature of 150 F (66 C) for waterborne and 125 F (52 C) for acrylic copolymer before application.

620.40.3.4.6 Finished markings shall have well-defined edges, and lateral deviation shall not exceed one inch in 100 feet (25 mm in 30 m).

620.40.3.5 Drop-On Glass Bead Application. Drop-on glass beads shall be mechanically applied to the wet paint directly behind the paint spray guns. Glass beads shall be applied at a rate required to meet the provisions of Sec. 620.2.4.1. For stop lines, arrows, words and symbols, glass beads may be applied by hand. Glass beads shall be applied evenly and shall completely cover the painted area. If beads do not embed properly in the paint, all marking operations shall cease until corrections are made.

620.40.3.6 Quality of Work. The applied marking paint shall be inspected continually for overall quality. The glass beads shall appear uniform on the entire marking surface. The cured paint shall properly adhere to the pavement surface. If the marking paint does not provide initial nighttime retroreflectivity or if the marking does not have the required minimum thickness or required color, the contractor shall re-apply the marking paint to the required thickness, at the contractor's expense, and shall meet all requirements as described above.

620.40.4 Method of Measurement. Measurement of 4-inch (100 mm), 6-inch (150 mm), 8-inch (200 mm), 12-inch (300 mm) and 24-inch (600 mm) pavement marking paint will be made in accordance with Sec 620.10.5.

620.40.5 Basis of Payment. The accepted quantity of pavement marking paint will be paid for at the contract unit price for each of the pay items included in the contract, except when used for temporary pavement marking, payment will be made in accordance with Sec 620.20.5.2.

SECTION 620.50 PAVEMENT MARKING REMOVAL

620.50.1 Description. This work shall consist of all necessary operations for removal of existing pavement marking when no longer required.

Delete Sec 620.50.2 and substitute the following: ***10/08***

620.50.2 Construction Requirements. Removal of all pavement marking within the project limits shall be as shown on the plans or as directed by the engineer. Pavement marking shall be completely removed to the satisfaction of the engineer with minimal damage to the pavement. No more than five percent of the existing marking shall remain. The pavement surface shall not be left scarred with an image that might mislead traffic. Any excess damage or scarring of the pavement shall be repaired at the contractor's expense. It is the contractor's responsibility to determine what type of material needs to be removed.

620.50.3 Method of Measurement.

620.50.3.1 Final measurement will not be made, except for authorized changes, during construction or where significant errors are found in the contract quantity. The revision or correction will be computed and added to or deducted from the contract quantity.

620.50.3.2 Where required, measurement for the removal of pavement markings will be made to the nearest linear foot (0.5 m). Where intermittent lines are specified or existing, deductions will be made for gaps in the removal. Measurement will not be made for removal of pavement marking within the limits of a bypass roadway or other roadway to be obliterated at the completion of the project.

620.50.4 Basis of Payment. The accepted quantity of pavement marking removal will be paid for at the contract unit price for each of the pay items included in the contract.

SECTION 620.60 TEMPORARY RAISED PAVEMENT MARKERS

620.60.1 Description. This work shall consist of installing, maintaining and removing reflectorized temporary raised pavement markers (RPM's) on roadway lane lines, centerlines or edge lines as shown on the plans or as directed by the engineer.

620.60.2 Material. All material shall be in accordance with Division 1000, Material Details, and specifically as follows:

Item	Section
Temporary Raised Pavement Markers	1048.50

620.60.3 Construction Requirements.

620.60.3.1 Temporary RPM's shall be of the colors shown on the plans unless otherwise directed by the engineer. Reflective faces shall be oriented to face traffic. Temporary RPM's shall be installed according to the manufacturer's recommendations and placed at approximately 40-foot (12 m) intervals.

620.60.3.1.1 Type 1 Temporary RPM's, with covers, shall be used for surface treatment projects as defined in Sec 413 when temporary RPM's are specified. When used for other than surface treatment projects no covers are required.

620.60.3.1.2 Type 2 Temporary RPM's shall be used as shown on the plans.

620.60.3.2 On resurfacing projects, temporary RPM's shall be removed on intermediate lifts of asphalt before additional lifts are laid above them. Temporary RPM's on final wearing surfaces shall be removed if specified on the plans or as directed by the engineer.

620.60.4 Method of Measurement. Final measurement will not be made, except for authorized changes, during construction or where appreciable errors are found in the contract quantity. Where required, measurement of temporary raised pavement markers will be made per each. The revision or correction will be computed and added to or deducted from the contract quantity.

620.60.5 Basis of Payment. The accepted quantity of temporary RPM's will be paid for at the contract unit price for each of the pay items included in the contract, except when temporary RPM's are used in accordance with Sec 620.2.5, then no direct payment will be made. No direct payment will be made for the removal of temporary RPM's.

SECTION 620.70 EPOXY PAVEMENT MARKING MATERIAL.

620.70.1 Description. This work shall consist of furnishing and placing epoxy pavement marking material and drop-on glass beads at locations shown on the plans or as directed by the engineer.

620.70.2 Material. All material shall be in accordance with Division 1000, Material Details, and specifically as follows:

Item	Section
Epoxy Pavement Marking Material	1048.60
Drop-On Glass Beads	1048.40.5

620.70.3 Construction Requirements.

620.70.3.1 Equipment. The application equipment shall have a system capable of spraying epoxy pavement marking material in the proportions recommended by the manufacturer. The application equipment shall include the following features.

620.70.3.1.1 Individual material reservoirs or space for storage of Part A and Part B of the epoxy material, equipped with the necessary stirring or blending equipment to ensure delivery of uniformly mixed components to the mixing unit.

620.70.3.1.2 Heating equipment of sufficient capacity to maintain the individual components at the manufacturer's recommended temperature and the capability to producing the required amount of heat at the mixing head and gun tip to maintain those temperatures within the tolerances recommended by the manufacturer for spray application.

620.70.3.1.3 Drop-on glass beads shall be mechanically applied to the wet epoxy paint directly behind the spray guns at a rate required to meet the provisions of Sec. 620.2.4.1. For stop lines, arrows, words and symbols, glass beads may be applied by hand. Glass beads shall be applied evenly and shall completely cover the painted area. If beads do not embed properly in the paint, all marking operations shall cease until corrections are made.

620.70.3.1.4 Each proportioning unit shall have individual metering devices or pressure gauges and stroke counters to monitor gallon (L) usage. All such devices shall be visible to the engineer.

620.70.3.1.5 The equipment shall be capable of thoroughly mixing the components to the manufacturer's recommendations prior to application.

620.70.3.2 Transfer of Material. The contractor shall provide all necessary equipment to adequately mix each shipping container. At any time that partial shipping containers are transferred to the reservoirs on the striping equipment, complete mixing of that container shall be performed prior to beginning transfer operations.

620.70.3.3 Surface Preparation. The pavement surface on which the pavement marking is to be placed shall be free of all debris, paint, laitance and any other contaminants that may hinder the adhesion of the system to the surface. Whenever grinding, scarifying, sandblasting, shot blasting or other operations are performed, the debris generated shall be contained through vacuum type equipment or equivalent. The pavement surface shall not be left scarred with an image that might mislead traffic. Any excess damage or scarring of the pavement shall be repaired by the contractor, at the contractor's expense.

620.70.3.3.1 Removal and cleaning work shall be conducted in such a manner as to control and minimize airborne dust and similar debris that may become a hazard to motor vehicle operation or a nuisance to property owners.

620.70.3.3.2 Care shall be taken on bituminous and Portland cement concrete surfaces when performing removal and cleaning work to prevent damage to transverse and longitudinal joints.

620.70.3.3.3 After all cleaning operations are completed, the pavement surface shall be power broomed and then blown with compressed air to remove residue and debris resulting from the cleaning work. All such debris shall be properly contained and disposed of as approved by the engineer.

620.70.3.3.4 Cleaning and surface preparation work shall be confined to the area specified for the application of the pavement marking material, to the surface area of existing pavement markings that are specified for removal on the plans, or to the area specified by the engineer.

620.70.3.3.5 Surface preparation work shall include cleaning for lines, letters and symbols.

620.70.3.3.6 The area of preparation shall be the width of the new pavement marking or existing line, plus one inch (25 mm) on each side of the line. For letters and symbols, the area of preparation shall be sufficiently large to accommodate the new marking or to remove existing markings.

620.70.3.3.7 On new Portland cement concrete pavement, cleaning operations shall not begin until the concrete has attained the minimum design compressive strength, as determined by MoDOT Test Methods. The extent of the curing compound removal work shall be to clean and prepare the concrete surface such that there is no visible evidence of curing compound and the extent of the removal shall ensure that any laitance is removed from both old and new concrete.

620.70.3.3.8 On new asphaltic concrete pavement, cleaning operations shall not begin until after the new mat has reached ambient temperature. The extent of cleaning on new asphaltic concrete shall be such that 75 percent of the stone substrate is exposed.

620.70.3.3.9 All existing pavement marking shall be removed to the extent that 95 to 100 percent of the existing marking is removed. Existing epoxy pavement markings that are in good condition and that will not interfere with or otherwise conflict with newly applied markings, as determined by the engineer, may remain. Removal operations shall be conducted in such a manner that no more than moderate color or surface texture change results on the surrounding pavement surface. The engineer will make the determination of acceptable removal.

620.70.3.4 Application. The pavement marking material shall be applied to the road surface at 25 mils (0.64 mm) on concrete or asphalt pavement through the use of equipment designed to precisely meter the two components in the ratio recommended by the material manufacturer.

620.70.3.4.1 The pavement marking shall only be applied during dry weather and on dry pavement surfaces. At the time of installation, the pavement surface temperature and ambient temperature shall be above 45 F (7 C).

620.70.3.4.2 Both components shall be brought to the temperature recommended by the manufacturer, prior to mixing and application and shall remain at that temperature throughout the operation.

620.70.3.5 Method of Measurement. Measurement of epoxy pavement marking will be made in accordance with Sec 620.5.

620.70.3.6 Basis of Payment. The accepted quantity of epoxy pavement marking will be paid for at the contract unit price for each of the pay items included in the contract.

SECTION 620.80 POLYUREA PAVEMENT MARKING MATERIAL.

620.80.1 Description. This work shall consist of furnishing and placing polyurea pavement marking material and drop-on glass beads on Portland cement concrete pavement at locations shown on the plans or as directed by the engineer.

620.80.2 Material. All material shall be in accordance with Division 1000, Material Details, and specifically as follows:

Item	Section
Polyurea Pavement Marking Material	1048.70
Drop-On Glass Beads	1048.40.5

620.80.3 Construction Requirements.

620.80.3.1 Equipment. Equipment shall be in accordance with section 620.90.3.1.

620.80.3.2 Transfer of Material. Transfer of material shall be in accordance with Sec 620.90.70.3.2.

620.80.3.3 Surface Preparation. Surface preparation shall be in accordance with Sec 620.90.70.3.3 except as follows. All existing pavement marking shall be removed to the extent that 95 to 100 percent of the existing marking is removed. Existing polyurea pavement markings that are in good condition and that will not interfere with or otherwise conflict with newly applied markings, as determined by the engineer, may remain. Removal operations shall be conducted in such a manner that no more than moderate color or surface texture change results on the surrounding pavement surface. The engineer will make the determination of acceptable removal.

620.80.3.4 Application. The pavement marking material shall be applied to the road surface at 20 mils (0.508 mm) on concrete pavement through the use of equipment designed to precisely meter the two components in the ratio recommended by the material manufacturer.

620.80.3.4.1 The pavement marking shall only be applied during dry weather and on dry pavement surfaces. At the time of installation, the pavement surface temperature and ambient temperature shall be above 40 F (4 C).

620.80.3.4.2 Both components shall be brought to the temperature recommended by the manufacturer, prior to mixing and application and shall remain at that temperature throughout the operation.

620.80.3.5 Method of Measurement. Measurement of polyurea pavement marking will be made in accordance with Sec 620.5.

620.80.3.6 Basis of Payment. The accepted quantity of polyurea pavement marking will be paid for at the contract unit price for each of the pay items included in the contract.

SECTION 622 – PAVEMENT AND BRIDGE SUFACING REMOVAL AND TEXTURING

Amend Sec 622.2 to include the following: ***08/07***

622.2.4 The contractor shall provide signing informing motorists of coldmilled areas open to traffic, at the contractors expense. The contractor may use static signs, changeable message signs, or a combination thereof to provide this warning. Signing shall be deployed in advance of an exit from the mainline prior to the milled area to allow motorists an opportunity to take an alternate route. Signing shall also be placed on any ramps leading into the milled area. If an alternate route cannot be provided, deployment of the signs shall be located in advance of the milled area to allow motorists to safely negotiate the section of milled pavement. Sign locations shall be approved by the engineer prior to installation. Signing shall be in accordance with Sec 616. Sign layout for static signs shall be as shown in the standard plans. Changeable message signs shall be programmed as directed by the engineer.

SECTION 626 – RUMBLE STRIPS

Delete Sec 626 and substitute the following: ***11/05***

SECTION 626
RUMBLE STRIPS

626.1 Description. This work shall consist of constructing rumble strips as shown on the plans or as directed by the engineer.

Delete Sec 626.2 and substitute the following; ***12/05; 10/07***

626.2 Construction Requirements. Rumble strips shall be milled into bituminous and concrete pavements to produce a neat and uniform finish. Milled material shall be handled in accordance with Sec 622. Any damage to the pavement or pavement marking resulting from the contractor's operations shall be repaired or replaced to the satisfaction of the engineer by the contractor, at the contractor's expense. On roadways open to traffic, rumble strips shall be in place no later than five days after the final paving operations.

626.3 Method of Measurement. Final measurement will not be made except for authorized changes during construction or where appreciable errors are found in the contract quantity. Where required, rumble strips will be measured separately for each shoulder and the centerline, which will be measured along the centerline of the travel way, and made to the nearest 1/10 station (5 m). The revision or correction will be added to or deducted from the contract quantity.

Delete Sec 626.4 and substitute the following: ***12/05***

626.4 Basis of Payment. The accepted quantity of rumble strips will be paid at the contract unit price per 1/10 station (5 m). Payment will be considered full compensation for all labor, equipment, and material necessary to complete the described work, including loading, hauling, stockpiling and disposal of milled material; and any other incidental items.

SECTION 627 – CONTRACTOR FURNISHED SURVEYING AND STAKING

Delete Sec 627.2 and substitute the following: ***12/07***

627.2 Staking Requirements. Staking work shall be in accordance with general accepted surveying practices and provisions of the contract. The MoDOT's current Engineering Policy Guide, Section 238.4, may be used as guidance and is available on MoDOT's web site.

Delete Sec 627.2.3 and substitute the following: ***12/07***

627.2.3 The engineer will furnish and set control points with known coordinates. The engineer will furnish all coordinate data to lay out the job and locate benchmarks as shown on the plans. The contractor shall provide all other staking necessary for the successful prosecution of the work. All alignment control established by the contractor shall be referenced, and a copy of the references shall be furnished to the engineer.

Delete Sec 627.2.7 and substitute the following: ***12/07***

627.2.7 Adjustments necessary to provide accurate staking or match improvements to existing features shall be immediately brought to the attention of the engineer The engineer will determine the nature of the discrepancy and will make revisions as necessary. The contractor shall perform any restaking required by such revisions. Any reimbursement due to the contractor for additional staking due to design errors will be in accordance with Sec 109.4.3.

Delete Sec 627.4.2 and substitute the following: ***12/07***

627.4.2 Complete payment will not be made until the contractor has provided all of the original surveying field notes, layouts, computations and notebooks to the engineer.

SECTION 701 – DRILLED SHAFTS

Delete Section 701.4.7.1 and substitute the following: ***11/05***

701.4.7.1 Time Restrictions. The integrity of the drilled shaft excavation shall be maintained by the placing of reinforcement and concrete in a timely manner following completion of the excavation. No two adjacent shafts shall be excavated at the same time, and shafts shall not be constructed within 24 hours of the completion of an adjacent shaft if the center-to-center spacing is less than 3 shaft diameters.

Delete Sec 701.4.13.1.1 and substitute the following: ***12/07***

701.4.13.1.1 Placement of Concrete in the Shaft. Concrete shall be placed for each shaft with the flow of concrete directed down the center of the shaft. Concrete shall be placed by free fall or through a tremie or concrete pump. The free fall placement method will only be permitted in dry holes when approved by the engineer. The maximum height of free fall placement shall be 80 feet (24.4 m). Concrete placed by free fall shall fall directly to the base without contacting either the reinforcing cage or hole sidewall. Drop chutes may be used to direct concrete to the base during free fall placement.

Delete Sec 701.4.13.2 and substitute the following: ***12/07***

701.4.13.2 Concrete Placement by Tremie. Tremies used to place concrete shall consist of a tube of sufficient length to discharge concrete at the shaft base elevation. The tremie shall have sufficient weight to rest on the shaft bottom before the start of concrete placement and to prevent curling of the tremie line during placement of the concrete. The tremie shall not contain aluminum parts that may come in contact with the concrete. A tremie shall consist of a watertight tube having an inside diameter of no less than 10 inches (250 mm) and fitted with a hopper at the top. The inside and outside surfaces of the tremie shall be clean and smooth to permit both flow of concrete and unimpeded withdrawal during concrete placement. The tremie wall thickness shall be adequate to prevent crimping or sharp bends that restrict concrete placement. Tremies used for depositing concrete in a dry drilled shaft excavation shall be supported such that the free fall of the concrete is less than 80 feet (24.4 m) at all times.

Delete Sec 701.4.13.4 and substitute the following: ***12/07***

701.4.13.4 Drop Chutes. Drop chutes may be used to direct placement of free fall concrete down the center of the shaft excavations where the maximum depth of water does not exceed one inch (25 mm). The free fall method of placement shall not be used in wet excavations. Drop chutes shall be a smooth tube constructed either as a continuous one-piece unit or as removable sections. Aluminum drop chutes will not be permitted. Concrete may be placed through either a hopper at the top of the tube or side openings as the drop chute is retrieved during concrete placement. The drop chute shall be supported such that the free fall of the concrete measured from the bottom of the chute is less than 80 feet (24.4 m) at all times.

SECTION 702 – LOAD-BEARING PILES

Delete Sec 702.3.5 and substitute the following: ***10/07; 04/08; 10/08***

702.3.5 Hammer Energy. The minimum energy developed by hammer per blow shall be no less than the following:

Hammer Energy	
ENGLISH	
Type of Pile	Minimum Hammer Energy Required per Blow, foot-pound (ft-lb)
Steel Shells for Cast-In-Place	The largest of the following: (a) 3.0 ft-lb/lb times the total pile weight in pounds, including mandrel if used (b) 8000 ft-lb.
Structural Steel	The largest of the following: (a) 3.0 ft-lb/lb times the total pile weight in pounds, including mandrel if used. (b) 32 ft-lb/kip times the nominal axial pile compressive resistance value in kips or 112.5 ft-lbs/kip times design bearing value in kips, divided by the pile batter factor, B, if applicable. (c) 8000 ft-lb.
METRIC	
Type of Pile	Minimum Hammer Energy Required per Blow, Newton-meter (N-m)
Steel Shells for Cast-In-Place	The largest of the following: (a) 9.0 N-m/kg (mass) times the total pile mass in kilograms, including mandrel if used (b) 11,000 N-m.
Structural Steel	The largest of the following: (a) 9.0 N-m/kg (mass) times the total pile mass in kg. including mandrel if used (b) 10.0 N-m/kN times the nominal axial pile compressive resistance value in kN or 35 N-m/kN times design bearing value in kN divided by the pile batter factor, B, if applicable. (c) 10850 N-m.

Delete Sec 702.4.10 and substitute the following: ***10/07; 04/08; 10/08***

702.4.10 Dynamic Bearing Formulas. The following formulas shall be used to determine the nominal (ultimate) bearing value of piles when other methods of determination are not specified in the contract documents:

ENGLISH
$P = 1.75(E)^{0.5}\log_{10}(10N) - 100$
METRIC
$P = 7(E)^{0.5}\log_{10}(10N) - 550$

P = Nominal Axial Pile Compressive Resistance value or 3.5(Design Bearing value) measured during pile driving in kips (kN)

E = Developed hammer energy in foot-pounds (Joules). This is the kinetic energy in the ram at impact for a given blow and may be assumed equal to the ram weight times the stroke.

N = Number of hammer blows for 1.0 inch (25 mm) of pile permanent set in blows/inch (blows/25 mm).

Delete Sec 702.4.10.2 and substitute the following: ***10/07***

702.4.10.2 For piles driven to a batter, the normal (ultimate) allowable bearing value, P, in the equations provided in Sec 702.4.10 shall be divided by the pile batter factor, B, in order to calculate the value of N, the number of hammer blows for 1.0 inch of pile permanent set.

$$B = \frac{0.1\,(10 - m)}{(1 + m^2)}\text{, pile batter factor}$$

m = the tangent of the angle of batter to a vertical line

Delete Sec 702.4.11 and substitute the following: ***11/05; 10/07; 04/08***

702.4.11 Minimum and Maximum Limits of Pile Driving. Piles shall be driven to at least the minimum tip elevation indicated on the plans. If no minimum tip elevation is shown on the plans, piles shall have a tip elevation at least 10 feet (3 m) below the bottom of the supported footing or 10 feet (3 m) below the natural ground line, whichever is lower, unless specifically authorized otherwise by the engineer. Piles shall be driven to attain a bearing value no less than that shown on the plans, determined in accordance with Sec 702.4.10. Prior to driving structural steel piles, the contractor shall review the boring logs to determine the depth at which rock may be anticipated. The contractor shall be attentive to the physical conditions associated with pile refusal on hard rock. When indication of pile refusal on hard rock occurs, driving shall cease immediately to avoid damage to the pile and to reduce the risk of injury.

Delete Sec 702.6.6 and substitute the following: ***06/08***

702.6.6 Splices. Splices may be required extend a structural steel or steel shell pile to reach adequate bearing. No Direct payment will be made for splices that are within the plan length plus 10 percent. Any additional splices authorized to achieve bearing will be paid for as an additional 8 feet (2.5 m) of pile in place at the contract unit price.

SECTION 704 – CONCRETE MASONARY REPAIR

Delete Sec 704.3.7 and substitute the following: ***06/08***

704.3.7 Substructure Repair (Formed). This work shall consist of formed substructure repair. The required areas shall be patched with Class B-1 concrete. Coarse aggregate shall be Gradation E in accordance with Sec 1005.

Delete Sec 704.4.1.3 and substitute the following: ***06/08***

704.4.1.3 Conventional Hand/Mechanical Equipment. Conventional hand/mechanical equipment consisting of jackhammers no heavier than the 35-pound (15.9 kg) class shall be used for concrete removal. For bridge decks rated 5 or below, the jackhammers shall not be heavier than the 65-pound (29.5 kg) class. Chipping hammers from the 15-pound (6.8 kg) class shall be used to remove concrete from beneath any reinforcing bars, where required. The bits shall be sharp in order to reduce pounding. Jackhammers shall be operated to minimize damage to the sound concrete around the patch area. Other methods that would be less damaging to the concrete and reinforcement may be used with approval from the engineer.

Delete Sec 704.4.1.6 and substitute the following: ***06/08***

704.4.1.6 Reinforcing Bar Exposed. All exposed reinforcing bars shall be thoroughly cleaned by sand or hydro blasting to the satisfaction of the engineer.

704.4.1.6.1 Superstructure and Substructure Repair. The concrete within the boundary area for superstructure repair (unformed), substructure repair (formed) and substructure repair (unformed) shall be removed a minimum of one inch (25 mm) beyond the inside edge of any exposed reinforcing bars, including the main reinforcement.

704.4.1.6.2 Deck Repairs. The minimum depth of repair for repairing concrete deck (half-soling) or modified deck repair shall expose the upper layer of the top mat of reinforcing steel. When the bond between existing concrete and a reinforcing bar has been destroyed, or more than half the diameter of a reinforcing bar is exposed, the concrete adjacent to the reinforcing bar shall be removed to a depth that will permit the concrete to bond to the entire periphery of the bar. A minimum of one-inch (25 mm) clearance shall be maintained.

704.4.1.6.3 If a reinforcing bar is exposed during slab edge repair, the concrete adjacent to the bar shall be removed to a depth that will permit a qualified special mortar to bond to the entire periphery of the bar. A minimum of one-inch (25 mm) clearance shall be maintained.

SECTION 705 – PRESTRESSED CONCRETE MEMBERS FOR BRIDGES

Delete Sec 705.5 and Sec 705.6 and substitute the following: ***04/08***

705.5 Method of Measurement. Measurement of prestressed concrete members, complete in place, in the finished structure will be based on contract plan quantities. Final measurement will not be made, prestressed concrete members will be computed to the nearest linear foot (0.5 m) for each structure and each type of prestressed concrete member.

705.6 Basis of Payment. Accepted prestressed concrete members will be paid for at the contract unit price for each of the pay items included in the contract.

SECTION 706 – REINFORCING STEEL FOR CONCRETE STRUCTURES

Delete Sec 706.3.1 and substitute the following: ***11/05***

706.3.1 Reinforcing steel shall be protected from damage at all times. When placed in the work and before concrete is placed, reinforcing steel shall be free from dirt, oil, paint, grease, loose mill scale, thick rust, any dried mortar and other foreign substances. A thin layer of powdery rust may remain. All reinforcing steel required for superstructure concrete, such as slabs, girders and beams and top slabs of culverts with more than a 4-foot (1.2 m) span, shall be held securely in correct position with approved metal or plastic apparatus. Securing apparatus shall consist of supports, ties, clips, and other devices capable of holding reinforcing bars against displacement. For bridge decks and top slabs of culverts, bars in the top mat shall be firmly secured at each cross or lap. At other locations, the bars shall be firmly secured at alternate crossings or closer. The steel shall be secured in the correct position with proper clearance maintained between the forms and the reinforcement. The contractor shall construct the unit in accordance with the plans. Measurements to reinforcing steel will be made to the centerline of bar, except where the clear distance from face of concrete is shown on the plans.

SECTION 712 – STRUCTURAL STEEL CONSTRUCTION

Delete Sec 712.10.6 through 712.10.9 and substitute the following: ***06/08***

712.10.6 Coatings. For recoating or overcoating, the contract documents will indicate the estimated number of tons (Mg) to be coated for informational purposes.

712.10.6.1 Weight (Mass) Measurement. If the contract specifies a unit of measurement of coating steel structures in tons (Mg), the weight (mass) of the steel to be cleaned and coated will be based on plan quantities to the nearest 1/10-ton (0.1 Mg). The weight (mass) will not vary with the number of coats applied.

712.10.6.2 Surface Area Measurement. If the contract specifies a unit of measurement of coating steel structures in square feet (m^2), the area of the girders or stringers to have surface preparation performed or to be coated will be computed to the nearest 100 square feet (10 m^2). The bearings, diaphragms, stiffeners and all other miscellaneous steel within the limits of surface preparation or of the field coatings will not have the area computed and will be considered completely covered by the area computations of the girders or stringers. The area will not vary with the number of coats applied. Final measurement will not be made.

712.10.6.3 Lump Sum Measurement. Measurement will not be made when the contract specifies units of measurement per lump sum.

712.10.7 Bar Dams. A steel bar dam shall consist of the complete assembly on both sides of the expansion joint and will be considered a unit.

712.10.8 Shear Connectors. The weight (mass) of shear connectors will be based on the theoretical weight (mass) and will be included for payment in the weight (mass) of material to which the connectors are attached.

Delete Sec 712.11.3 through 712.11.6 and substitute the following: ***06/08***

712.11.3 Coatings. Payment for surface preparation and applying field coatings to the structural steel, if specified as a contract item, will be based on the contract plan quantities. Any change in the contract plan quantities, based on approved change orders, will be paid for at the contract unit price. If no contract item is specified for surface preparation or applying field coatings, no direct payment will be made. Payment for the shop applied coatings, including inaccessible areas, will be considered completely covered by the cost of the fabricated structural steel. No direct payment will be made for the surface preparation or applying field coatings to the bearings, diaphragms, stiffeners and all other miscellaneous steel within the limits of surface preparation or of the field coatings. No direct payment will be made for stencils, paint and painting specified in Sec 1081. No direct payment will be made for field touch-ups specified in Sec 1081.

712.11.4 Bar Dams. The accepted number of steel bar dams will be paid for at the contract unit price.

SECTION 725 – METAL PIPE AND PIPE ARCH CULVERTS

Delete Sec. 725.4 and substitute the following: ***01/05***

725.4 Inspection. The internal diameter of the barrel shall not be reduced by more than ten percent of the pipe's nominal inside diameter when measured no less than 30 days following completion of installation. After the roadway has been completed and before final inspection of the project, the engineer will inspect all pipe locations for proper installation. Any section of pipe found to be improperly installed shall be replaced or repaired by the contractor, at the contractor's expense and to the satisfaction of the engineer. Repaired or replaced pipe will be re-inspected by the engineer. The contractor shall provide equipment and assistance deemed necessary by the engineer to perform any testing. Pipe deflections will be determined by the engineer by having the contractor either pushing or pulling a mandrel through the pipe or verifying deflections by other methods approved by the engineer. Mandrels used for deflection testing may have either fixed or adjustable arms, but shall be approved by the engineer prior to use. The following will constitute improper installation:

(a) If any horizontal or vertical alignment is in excess of 15 percent from plan alignment, will restrict flow or will cause excessive ponding within the pipe.

(b) Any section of pipe with a diameter deflection greater than ten percent, based upon the units of measurement used in fabricating the pipe.

(c) If settlement is greater than one inch (25 mm) at five percent or more joints.

(d) If the pipe shows evidence of being crushed at any location.

(e) If the pipe shows evidence of joint separation.

SECTION 726 – RIGID PIPE CULVERTS

Delete Sec. 726.4 and substitute the following: ***01/05***

726.4 Inspection. After the roadway has been completed and before final inspection of the project, the engineer will inspect all pipe locations for proper installation. Any section of pipe found to be improperly installed shall be replaced or repaired by the contractor, at the contractor's expense and to the satisfaction of the engineer. Any separation at joints deemed not detrimental to the pipe performance by the engineer shall be resealed with either plastic joint compound, cement mortar or other approved material in accordance with Sec 726.3.1. Repaired or

replaced pipe will be re-inspected as deemed necessary by the engineer. The contractor shall provide equipment deemed necessary by the engineer to perform any testing. The following will constitute improper installation:

(a) If any horizontal or vertical alignment is in excess of 15 percent from plan alignment, will restrict flow or will cause excessive ponding within the pipe.

(b) If settlement is greater than one inch (25 mm) at five percent or more joints.

(c) If the pipe shows evidence of separation at any location.

SECTION 727 – STRUCTURAL PLATE PIPE AND STRUCTURAL PLATE PIPE-ARCH CULVERTS

Delete Sec. 727.4 and substitute the following: ***01/05***

727.4 Inspection and Replacement. Inspection and replacement of structural plate pipe and pipe-arch culverts shall be in accordance with Sec 725.4, except deflection testing and maximum deflection allowed will not apply.

SECTION 728 – CORRUGATED POLYVINYL CHLORIDE CULVERT PIPE

Delete Sec. 728.3.5 and substitute the following: ***01/05***

728.3.5 Inspection. The internal diameter of the barrel shall not be reduced by more than 7.5 percent of the pipe's nominal inside diameter when measured no less than 30 days following completion of installation. After the roadway has been completed and before final inspection of the project, the engineer will inspect all pipe locations for proper installation. Any section of pipe found to be improperly installed shall be replaced or repaired by the contractor at the contractor's expense to the satisfaction of the engineer. Repaired or replaced pipe will be re-inspected by the engineer. The contractor shall provide equipment and assistance as deemed necessary by the engineer to perform any testing. Pipe deflections will be determined by the engineer by having the contractor pushing or pulling a mandrel through the pipe, or verifying deflections by other methods approved by the engineer. Mandrels used for deflection testing may have either fixed or adjustable arms, but shall be approved by the engineer prior to use. The following will constitute improper installation:

(a) If any horizontal or vertical alignment is in excess of 15 percent from plan alignment, will restrict flow or will cause excessive ponding within the pipe.

(b) Any section of pipe with deflections greater than 7.5 percent, based upon the units of measurement used in fabricating the pipe.

(c) If settlement is greater than one inch (25 mm) at five percent or more joints.

(d) The pipe shows evidence of being crushed or buckled at any location.

(e) The pipe shows evidence of joint separation.

SECTION 730 – CORRUGATED POLYETHYLENE PIPE CULVERTS

Delete Sec. 730.3.5 and substitute the following: ***01/05***

730.3.5 Inspection. The internal diameter of the barrel shall not be reduced by more than five percent of the pipe's nominal inside diameter when measured no less than 30 days following completion of installation. After the roadway has been completed and before final inspection of the project, the engineer will inspect all pipe locations for proper installation. Any section of pipe found to be improperly installed shall be replaced or repaired by the contractor at the contractor's expense and to the satisfaction of the engineer. Repaired or replaced pipe will be re-inspected by the engineer. The contractor shall provide equipment and assistance as deemed necessary by the engineer to perform any testing. Pipe deflections will be determined by the engineer by having the contractor either pushing or pulling a mandrel through the pipe, or verifying deflections by other methods approved by the engineer. Mandrels used for deflection testing may have either fixed or adjustable arms, but shall be approved by the engineer prior to use. The following will constitute improper installation:

(a) If any horizontal or vertical alignment is in excess of 15 percent from plan alignment, will restrict flow or will cause excessive ponding within the pipe.

(b) Any section of pipe with deflections greater than five percent, based upon the units of measurement used in fabricating the pipe.

(c) If settlement is greater than one inch (25 mm) at five percent or more joints.

(d) The pipe shows evidence of being crushed or buckled at any location.

(e) The pipe shows evidence of joint separation.

SECTION 802 – MULCHING

Delete Sec 802.1 and substitute the following: ***09/06***

802.1 Description. This work shall consist of applying vegetative mulch and a specified stabilization covering as indicated in the contract.

Delete Sec 802.3.1 and substitute the following: ***09/06***

802.3.1 Application. Vegetative mulch shall be applied at a minimum rate of 2 1/2 tons per acre (5.5 Mg/ha). All mulch shall be distributed evenly within 24 hours following the seeding operation. Following the mulching operation, precautions shall be taken to prohibit foot or vehicular traffic over the mulched area. Any mulch that is displaced shall be replaced at once, but only after the work preceding the mulching which was damaged as a result of the displacement has been repaired to the satisfaction of the engineer. The contractor may use erosion control blankets in lieu of mulch.

Delete Sec 802.3.2 through 802.3.2.1 and substitute the following: ***09/06***

802.3.2 Stabilization. Vegetative mulch shall be secured from movement by either mulch overspray or embedment as indicated in the contract documents, or other methods as approved by the engineer.

802.3.2.1 Mulch Overspray. Mulch overspray shall be applied over the vegetative mulch as a separate operation. Mulch overspray shall be applied in accordance with the manufacturer's recommendations at a minimum rate of 750 pounds per acre.

SECTION 805 – SEEDING

Amend Sec 805 to include the following: ***04/05***

805.3.3 All seeded areas shall be mulched in accordance with Sec 802.

SECTION 806 – POLLUTION, EROSION AND SEDIMENT CONTROL

Delete Sec 806.4.1 and Substitute the folloting: ***08/08***

806.4.1 If erosion control measures, as shown on the plans, are not suitable due to site conditions, a suitable system of Best Management Practices (BMP) as defined by MoDOT's current General Permit, from the Department of Natural Resources, for construction or land disturbance activities shall be applied as approved by the engineer.

Delete Sec 806.4.5 and substitute the following: ***04/08***

806.4.5 The engineer will limit the additional amount of erodible surface areas exposed by clearing and grubbing, excavation, borrow and fill operations with the amount of fill area in which the finished grading, mulching, seeding and other such permanent erosion control measures have not been completed and properly maintained. If seasonal limitations make such operations impractical, temporary erosion control measures shall be taken immediately.

Delete Sec 806.50.2 and substitute the following: ***04/08***

806.50.2 Construction Requirements. Seeding and mulching shall be a continuous operation on all cut and fillslopes, excess material sites and borrow pits during the construction process. All disturbed areas shall be seeded and mulched as necessary to eliminate erosion. When a project is shown in the contract to be constructed in stages and operations in those staged areas are suspended for a significant amount of time, the contractor shall receive payment for temporary seed and mulch. When the engineer allows the contractor to disturb additional ground beyond the restrictions in Sec 806.4.4 solely to enhance the contractor's operation, the contractor shall not receive compensation for temporary seed or mulch, as required by the engineer, for ground cover for areas exceeding the restrictions in Sec 806.4.4.

Delete Sec 806.30.2.2 and 806.30.2.3 and substitute the following: ***08/08***

806.30.2.1 Posts. Wood, steel or synthetic posts may be used. Posts shall be of sufficient length, but no less than 4 feet (1.2 m), to ensure adequate embedment while fully supporting the ditch check and shall have sufficient strength to resist damage during installation and to support applied loads while in service.

806.30.2.2 Support Fence. All geotextile fabric for ditch checks shall be supported either externally by wire or other approved mesh to a height of at least 24 inches (600 mm) or by a suitably designed support system capable of keeping the material erect. Either method shall be strong enough to withstand applied loads.

Delete Sec 806.30.3.1 through 806.30.3.2.1 and substitute the following: ***08/08***

806.30.3.1 Type I Ditch Checks. Type I ditch checks shall be constructed of straw bales, geotextile fabric fence or an alternative erosion control measure as approved by the engineer. Type I ditch checks shall not be used where drainage areas exceed 3 acres (1.2 ha) or where ditch slopes exceed 10 percent. Type II ditch checks may be substituted for Type I ditch checks at the contractor's expense. Straw bale and silt fence ditch checks shall be constructed as shown on the plans in accordance with the contract documents. Approved alternate Type I ditch checks shall be installed and maintained according to the manufacturer's recommendations.

806.30.3.2 Type II Ditch Checks. Alternate Type II ditch checks may be used as approved by the engineer. Type II ditch checks shall not be used where drainage areas exceed 50 acres (20.2 ha) or where ditch slopes exceed 10 percent.

806.30.3.2.1 Rock Ditch Checks. Rock ditch checks shall be constructed of rock with a predominant size between 4 and 12 inches.

Delete Sec 806.50.3 and Sec 806.50.4 and substitute the following: ***04/08***

806.50.3 Method of Measurement. Measurement of temporary seed mixtures and accompanying mulch as set forth in the contract will be made to the nearest 1/10 acre (0.05 ha).

806.50.4 Basis of Payment. The accepted quantities of temporary seed mixtures and the accompanying mulch will be paid for at the contract unit price per acre (ha).

Delete Sec 806.70.2.2 through 806.70.2.3 and substitute the following: ***08/08***

806.70.2.2 Prefabricated Fence. Prefabricated fence systems may be used if the systems meet all of the above material requirements.

SECTION 902 – TRAFFIC SIGNALS

Delete Sec 902.14.3 and substitute the following: ***02/08***

902.14.3 The top surface of all pull boxes shall be flush with surfaced areas and approximately one inch (25 mm) above earth or sodded areas.

Delete Sec 902.15.1 and substitute the following: ***02/08***

902.15.1 Post Bases. Concrete bases for posts shall be in accordance with the dimensions shown on the plans. Metal forms no less than 26 inches (660 mm) high shall be used for all Type A bases. The top 12 inches (300 mm) of Type F bases shall be formed. Reinforcing steel for concrete bases shall be in accordance with Sec 706. Anchor bolts for steel posts and mast arms shall be as shown on the fabricator's approved shop drawings. Conduit shall extend above all post bases a nominal 4 inches (100 mm).

Delete Sec 902.19.2 and 902.19.3 and substitute the following: ***02/08***

switch located on the power supply to controller cabinet terminals. Power cable shall be encased in conduit of the size shown on the plans. Energized power cables shall run to circuit breakers. The neutral cable shall be terminated on the neutral bus bar and the equipment ground conductor shall be terminated on the ground bus in the controller cabinet.

902.19.3 Where luminaires are required, pole and bracket cable shall be installed between the luminaire and the power source at the base of the post. Each luminaire shall be connected to the power source by No. 12 AWG (4 mm^2) conductors with suitably sized equipment grounding conductor. A premolded fused connector assembly shall be installed on each conductor carrying current between the source cable and the pole and bracket cable. The assembly and cable shall be insulated with a protective rubber boot designed for the premolded connector.

SECTION 903 – HIGHWAY SIGNING

Delete Sec 903.2 and substitute the following: ***12/05***

903.2 Material. All material shall be in accordance with Division 1000, Material Details, and specifically as follows:

Reinforcing Steel for Concrete	1036
Highway Sign Material	1042
Delineators, Mile and Marker Posts	1044
Paints for Structural Steel	1045
Electrical Conduit	1060
Expansive Mortars	1066
Low-Carbon Steel Bolts, Nuts and Washers	1080
Structural Carbon Steel	1080
Structural Low Alloy Steel	1080
Low-Carbon Steel Anchor Bolts	1080
High-Strength Bolts, Nuts and Washers	1080
Galvanized Coating of Structural Steel, Tubular Steel Sign Supports, Sign Trusses and Appurtenances	1081

Delete Section 903.2.1 and substitute the following: ***04/06***

903.2.1 Sign Posts and Tubular Steel Sign Supports

Item	Section/Specification
Wood Posts	**1050**
Steel Pipe Posts	ASTM A 53, Grade B, or ASTM A 500, Grade B
Galvanizing of Steel Pipes Posts	ASTM A 53
Structural Steel Welding Electrodes	AWS A5.1 or AWS A5.5
Structural Steel Posts	ASTM A 36, Grade 50
U-Channel Posts	ASTM A 499, Grade 60

Amend Sec 903.3.1 to include the following: ***12/08***

903.3.1.3 Optional Footings. Substructures for butterfly and cantilever overhead sign trusses and posts may be either drilled shafts or spread footings.

903.3.1.3.1 The quantities shown on the plans reflect the total cubic yards of substructure, based upon drilled shaft quantities.

903.3.1.3.2 No adjustment in payment will be made for providing the equivalent spread footing design that differs in area from the specified drilled shaft design.

903.3.1.3.3 If rock is encountered and the depth of drilled shafts are adjusted accordingly, cubic yard quantities will be recalculated for those locations and payment will be adjusted accordingly. Cubic yard quantities will not be recalculated for spread footings if rock is encountered, unless it is considered differing site conditions in accordance with Sec 104.2 of the standard specifications.

Delete Sec 903.3.6 and substitute the following: ***12/05***

903.3.6 Delineators. Delineators shall be installed vertically and any delineator considered unfit for use by the engineer shall be removed and replaced at the contractor's expense.

Delete Sec 903.5.5 and substitute the following: ***12/05***

903.5.5 Measurement of delineators will be made per each.

Delete Sec 903.6.3 and substitute the following: ***12/05***

903.6.3 Delineator posts will be paid for at the contract unit price. No direct payment will be made for reflective sheeting or post anchors.

SECTION 1001 – GENERAL REQUIREMENTS FOR MATERIAL

Delete Sec 1001.11 and substitute the following: ***04/06***

1001.11 Approval of Aggregate Sources. All sources of aggregate shall be evaluated by the engineer for initial approval and source approval as herein prescribed, prior to acceptance of aggregate from that source.

Delete Sec 1001.11.1 and substitute the following: ***04/06***

1001.11.1 Sources of crushed stone shall be evaluated for initial approval on a ledge by ledge basis. Each exposed ledge will be identified, and the engineer will describe the ledge boundaries. Only identified ledges shall be used in the manufacture of the final product. A sample for initial approval will be required from each ledge. Resampling will be required if source approvals indicate a significant change has occurred.

Delete Sec 1001.11.2 and substitute the following: ***04/06***

1001.11.2 Source approvals will be required a minimum of every year. Source approval samples will be required for each unique combination of ledges. Resampling will be required at closer intervals if, in the judgment of the engineer, any significant change has occurred to the source. Samples of aggregate for source approval shall be taken while the engineer is present.

Delete Sec 1001.11.3 and substitute the following: ***04/06***

1001.11.3 Sources approval of natural sand, gravel and manufactured lightweight aggregate shall be evaluated as the final product

Delete Sec 1001.11.5 in its entirety. ***04/06***

Delete Sec 1001.11.6 in its entirety. ***04/06***

Delete Sec 1001.14 in its entirety. ***04/06***

SECTION 1002 – AGGREGATE FOR ASPHALTIC CONCRETE

Delete Sec 1002.2.1.1 and substitute the following: ***04/06***

1002.2.1.1 The total coarse aggregate for asphaltic concrete shall be in accordance with Sec 1002.2.1.

Delete Sec 1002.2.1.1 through 1002.2.1.3 and substitute the following Sec 1002.2.1.3 as follows: ***02/08***

1002.2.1.1 The above requirements apply to combined aggregates during production when used in accordance with Sec 403

1002.2.1.2 Crushed stone shall be obtained from rock of uniform quality. Rock tested from any combination of ledges for source approval, and trial mix samples, shall meet the following criteria.

Property	Value
Los Angeles Abrasion, AASHTO T 96, percent loss, max	50
Absorption, AASHTO T 85, percent, max	4.0

Delete Sec 1002.4 and substitute the following: ***04/05***

1002.4 Mineral Filler. Mineral filler shall be in accordance with AASHTO M 17. Prior to approval and use of mineral filler for SMA mixtures, the manufacturer shall submit to Construction and Materials a certified test report from an approved independent testing laboratory showing specific test results when tested in accordance with applicable sections of AASHTO M17 and MoDOT Test Method TM-73. The certified test report shall contain the manufacturer's name, product, date tested and date of manufacture. In addition, the manufacturer shall submit to Construction and Materials a sample representing the mineral filler tested by the independent testing laboratory and accompanied by a material data sheet and an MSDS showing the product and composition or description of the product. The manufacturer shall guarantee that as long as the material is furnished under that brand and designation, the material will be of the same composition as originally approved and will in no way be altered or changed. Upon approval of the mineral filler, the manufacturer and product will be placed on a list of qualified SMA mineral fillers.

SECTION 1004 – GRADED AGGREGATE FOR BITUMINOUS SURFACES

Delete Sec 1004.2 – 1004.2.2 and substitute the following: ***11/05, 04/06; 02/08***

1004.2 Course Aggregate.

1004.2.1 All Coarse aggregate shall consist of sound, durable rock, free from cemented lumps or objectionable coatings. The percentage of deleterious substances shall not exceed the following values and the sum of percentages of all deleterious substances shall not exceed 8.0 percent.

Deleterious Material	Percent by Weight (Mass)
Deleterious Rock	8.0
Mud Balls and Shale Combined	2.0
Clay, uniformly dispersed	3.0
Other Foreign Material	0.5

1004.2.1.1 The above requirements apply to combined aggregates during production when used in accordance with Secs 401 and 402.

1004.2.1.2 If a density requirement is specified for asphaltic concrete, the total quantity of chert in each size or fraction of produced crushed stone aggregate, including that permitted as deleterious, shall not vary by more than 10 percentage points from the quantity present in the aggregate used in the approved laboratory job mixtures.

1004.2.1.3 Crushed stone shall be produced from rock of uniform quality. Rock tested from any combination of ledges for source approval and trial mix samples shall meet the following criteria.

Property	Value
Los Angeles Abrasion, AASHTO T 96, percent loss, max.	55
Absorption, AASHTO T 85, percent, max.	4.5

1004.2.2 Gravel aggregate shall be washed sufficiently to remove any objectionable coating and shall meet the following criteria for source approval and trial mix samples.

Property	Value
Los Angeles Abrasion, AASHTO T 96, percent loss, max.	55
Absorption, AASHTO T 85, percent, max.	5.5

1004.2.3 Steel slag consisting principally of a fused mixture of oxides and silicates shall be a synthetic aggregate produced as a by-product of basic oxygen, electric or open hearth steel making furnaces. The steel slag shall be aged at least three months after crushing and screening. Steel slag, which has been previously crushed, screened, and aged three months will not be required to receive additional aging. Steel slag from one source shall not be blended with steel slag from a different source.

SECTION 1005 – AGGREGATE FOR CONCRETE

Delete Sec 1005.2.1 and substitute the following: ***04/06; 08/07; 08/08***

1005.2.1 All coarse aggregate for concrete shall consist of sound, durable rock, free from objectionable coatings and frozen and cemented lumps. The percentage of deleterious substances shall not exceed the following values, and the sum of percentages of all deleterious substances, exclusive of Items 5 and 6, shall not exceed 6.0 percent. For crushed stone, the percentage of wear shall not exceed 50 when tested in accordance with AASHTO T 96.

Deleterious Material	**Percent by Weight (Mass)**
Deleterious Rock	6.0
Shale	1.0
Chert in Limestone	4.0
Other Foreign Material	0.5
Material Passing No. 200 (75 µm) Sieve, Gradation D & E	2.5
Thin or Elongated	5.0

Delete Sec 1005.2.1.2 and substitute the following: ***08/07***

1005.2.1.2 Crushed stone shall be obtained from rock of uniform quality. Rock tested for initial approval shall be in accordance with the criteria below. Source approval and production samples shall also meet the following criteria:

Property	**Value**
Los Angeles Abrasion, AASHTO T 96, percent loss, max	50
Absorption, AASHTO T 85, percent, max.: (a) Portland Cement Concrete Pavement (b) Portland Cement Concrete Masonry	 -- 3.5
Soundness, MoDOT Test Method TM 14, percent loss, max.: (a) Portland Cement Concrete Pavement (b) Portland Cement Concrete Masonry	 -- 18.0
Durability Factor, AASHTO T 161 Procedure B, percent, min: (a) Portland Cement Concrete Pavement (b) Portland Cement Concrete Masonry	 75[a] --

[a] Approval will be based on maximum aggregate size produced that meets durability requirements.

Delete Sec 1005.2.1.3 and substitute the following; renumber subsequent sections accordingly: ***11/05***

1005.2.1.3 Gravel shall be washed and shall be in accordance with the criteria below for initial approval. Source approval and production samples shall also meet the following criteria:

Property	Value
Los Angeles Abrasion, AASHTO T 96, percent loss, max.	45
Absorption, AASHTO T 85, percent, max.	4.5
Soundness, MoDOT Test Method TM 14, percent loss, max.	18.0

Delete Sec 1005.2.1.4 and substitute the following: ***08/07***

1005.2.1.4 The engineer reserves the right to use additional test methods, such as ASTM C 586, AASHTO T 161 or other appropriate tests, to measure the soundness and durability of aggregate for use in concrete when deemed necessary.

Delete Sec 1005.2.2 through 1005.2.4 and substitute the following: ***08/07***

1005.2.2 Coarse aggregate for concrete pavement or base course shall be crushed stone or porphyry.

1005.2.3 Grade F Aggregate. Coarse aggregate for Portland cement concrete pavement, base and approach slabs for bridges that is not produced from the Burlington, Keokuk, Cedar Valley (formerly Callaway) or Warsaw limestone formations, which is obtained from sources in the following areas shall have a maximum top size of ¾ inch:

(a) State of Kansas, Iowa and Nebraska.

(b) Counties of Missouri – Adair, Andrew, Atchison, Bates, Benton, Buchanan, Caldwell, Carroll, Cass, Cedar, Chariton, Clay, Clinton, Daviess, DeKalb, Gentry, Grundy, Harrison, Henry, Holt, Jackson, Johnson, Lafayette, Linn, Livingston, Mercer, Macon, Nodaway, Pettis, Platte, Putnam, Randolph, Ray, St. Clair, Saline, Schuyler, Sullivan, Vernon and Worth.

Delete Sec 1005.2.4 and substitute the following: ***08/08***

1005.2.4 Coarse aggregate for concrete for structures, except as specified in Sec 1005.2.5, may be gravel or crushed stone. Coarse aggregate for Class B, B-1, B-2, MB-2 or Seal concrete shall be in accordance with either Gradation D or E. Coarse aggregate for Class A-1 concrete shall be in accordance with Gradation E.

Gradation D	Percent by Weight (Mass)
Passing 1-inch (25.0 mm) sieve	100
Passing 3/4-inch (19.0 mm) sieve	85-100
Passing 3/8-inch (9.5 mm) sieve	15-55
Passing No. 4 (4.75 mm) sieve	0-10

Gradation E	Percent by Weight (Mass)
Passing 3/4-inch (19.0 mm) sieve	100
Passing 1/2-inch (12.5 mm) sieve	70-100
Passing 3/8-inch (9.5 mm) sieve	40-70
Passing No. 4 (4.75 mm) sieve	0-10
Passing No. 8 (2.36 mm) sieve	0-6

Delete Sec 1005.3.1 and substitute the following: ***08/07***

1005.3.1 Fine aggregate for concrete shall be a fine granular material naturally produced by the disintegration of rock of a siliceous nature, or shall be manufactured from an approved limestone or dolomite source as defined in Sec 1005.2. By specific approval from the engineer, chat sand produced from flint chat in the Joplin area or fines

manufactured from igneous rock or chert gravel may be used. Fine aggregate shall be free from cemented or conglomerated lumps and shall not have any coating of injurious material. The percentage of deleterious substances shall not exceed the following values:

Deleterious Material	Percent by Weight (Mass)
Clay Lumps and Shale	0.25
Coal and Lignite	0.50
Total Lightweight (low mass density) Particles, Including Coal and Lignite	0.50
Material Passing No. 200 (75 µm) Sieve (a) Natural Sand (b) Manufactured Sand	 2.0 4.0
Other Deleterious Substances	0.10

Delete Sec 1005.3.5 and substitute the following: ***08/07***

1005.3.5 All fine aggregate for PCCM shall meet the following gradation requirements:

Sieve	Percent by Weight (Mass)
Passing 3/8-inch (9.5 mm) sieve	100
Passing No. 4 (4.75 mm) sieve	95-100
Passing No. 8 (2.36 mm) sieve	70-100
Passing No. 16 (1.18 mm) sieve	45-90
Passing No. 30 (600 µm) sieve	15-65
Passing No. 50 (300 µm) sieve	5-30
Passing No. 100 (150 µm) sieve	0-10

SECTION 1010 – SELECT GRANULAR BACKFILL FOR STRUCTURAL SYSTEMS

Delete Sec 1010.3.3 and renumber subsequent sections: ***09/06***

SECTION 1011 – GEOTEXTILE

Delete Sec 1011.3.5 and substitute the following: ***10/08***

1011.3.5 Erosion Control Blankets. Erosion control blankets shall be prequalified and categorized based on performance testing performed by the Texas Department of Transportation and the Texas Transportation Institute using the minimum standards cited in the Texas DOT Erosion Control Report "TXDOT / TTI Hydraulics and Erosion Control Laboratory Field Performance Testing of Selected Erosion Control Products Final Performance Analysis Through the Most Recent Evaluation Cycle".

SECTION 1015 – BITUMINOUS MATERIAL

Delete Sec 1015 and substitute the following: ***04/05,***

SECTION 1015

BITUMINOUS MATERIAL

1015.1 Scope. This specification covers bituminous material to be used in highway construction.

1015.2 Approval of Source. The contractor shall obtain approval of the source of bituminous material from the engineer before any shipments to the work site are made.

1015.3 Sampling, Testing and Acceptance Procedures. The supplier shall certify that the bituminous material complies with the specification requirements.

1015.3.1 Certification. The supplier shall furnish the truck driver a copy of the bill of lading, manifest or truck ticket to be available to MoDOT at the destination prior to unloading. The engineer at the source shall be furnished a copy. The bill of lading, manifest or truck ticket shall provide the following information regarding the shipment: type and grade of material, specific gravity at 60° F (15.6° C), net gallons (L), consignee, truck number, identification number, weight (mass) of truck before and after loading, destination, date loaded, name and location of the source, and a certification statement. The certification statement shall be signed by an authorized representative of the supplier and shall be substantially as follows:

> "This certifies that the bituminous material in this shipment is in accordance with MoDOT specifications for the grade specified and the weights (masses) shown hereon were obtained on MoDOT approved scales and are correct within the specified scale requirements."

1015.3.2 Sampling. The engineer will at random observe the sampling and testing of truck shipments and tanks, and will select representative samples of the material being supplied for testing in the field or in the Central Laboratory. When test results certified by the supplier are not representative of the material being shipped, the source approval will be withdrawn. A source may be reinstated when proof is furnished that the deficiency has been corrected and adequate controls are in effect to guarantee delivery of material meeting specifications. Sampling and test methods for asphalt shall be as follows:

Property	Method	RC	MC	PG
Sampling	AASHTO T 40	X	X	X
Water	AASHTO T 55	X	X	X
Flash Point (Tag Open Cup)	AASHTO T 79	X	X	
Flash Point (Cleveland Open Cup)	AASHTO T 48			X
Viscosity, Centistokes	AASHTO T 201	X	X	
Distillation	AASHTO T 78	X	X	
Penetration	AASHTO T 49	X	X	
Ductility	AASHTO T 51	X	X	
Solubility in Trichlorethylene	AASHTO T 44	X	X	X
Ash in Bituminous Material	AASHTO T 111			
Viscosity (Rotational)	ASTM D 4402			X
Dynamic Shear	AASHTO 315			X
Rolling Thin Film Oven Test	AASHTO T 240			X
Pressure Aging Test	AASHTO R28			X
Creep Stiffness	AASHTO T 313			X
Direct Tension	AASHTO T 314			X

1015.3.3 Sampling Equipment. The supplier shall furnish the required sampling equipment and shall sample the contents of the truck under the direction of the engineer. The supplier shall keep all sampling equipment clean and in good condition. Sampling devices on truck transports will be approved provided an adequately insulated valve is used with a pipe or nipple inserted a suitable distance into the tank.

1015.3.4 Truck Log. Each truck transport shall carry a log showing types of material and the dates hauled with respect to previous shipments, or the supplier shall furnish to the engineer such information with respect to the previous load.

1015.3.5 Intermediate Storage. Intermediate storage tanks for storage and transfer of material between the refinery or terminal and the point of acceptance shall be equipped for sealing and shall be reserved exclusively for MoDOT work. Use of any material from unsealed tanks will be subject to delay until material can be sampled, tested and approved.

1015.3.6 Other Transportation. At sources from which liquid bituminous material is being accepted by certification, the applicable requirements of the foregoing sections shall be followed for shipments of material in transportation units other than trucks. The certification and all information regarding each shipment shall be furnished to the engineer at the source.

1015.3.7 Railroad Shipments. For railroad shipments from refineries where inspection is not maintained by MoDOT, the supplier shall sample each car load at the source and submit the sample promptly to the Central Laboratory. A bill of lading or identification sheet shall accompany each sample and contain the following information: car number, type and grade of material, quantity represented, including gross gallons (L), temperature and net gallons (L) at 60° F (15.6° C), destination of shipment, project number and consignee. A certification statement as specified in Sec 1015.3.1 shall accompany each sample. Approval of the source may be withdrawn if samples submitted are not representative of the material shipped in the car.

1015.4 Proportioning and Blending Bituminous Material Constituents. All material shall be properly proportioned and thoroughly blended in suitable tanks prior to delivery to transportation equipment, or material may be proportioned and blended by use of automatic proportioning equipment. All automatic-proportioning blenders shall meet the approval of the engineer and shall be equipped with precision instruments, including electrically interlocked motors and automatic meters. Blending quantities of less than 8000 gallons (30,000 L) in tanks or in tank trucks will not be permitted.

1015.5 Application Temperatures for Bituminous Material.

Bituminous Material	Temperature, Degrees Fahrenheit (Celsius)			
	Spraying		Mixing	
	Min	Max	Min	Max
Asphalt Binder				
PG 46-28	260 (125)	325 (165)	----	----
All Other Grades	285 (140)	350 (175)	275 (135)	350 (175)
Liquid Asphalt RC-MC				
Grade				
30	70 (20)	150 (65)	50 (10)	110 (45)
70	100 (40)	180 (80)	90 (30)	140 (60)
250	150 (65)	220 (105)	130 (55)	170 (75)
800	180 (80)	260 (125)	170 (75)	210 (100)
3000	210 (100)	290 (145)	200 (95)	240 (115)
Asphalt Emulsions				
RS-1	70 (20)	140 (60)	----	----
RS-2	125 (50)	185 (85)	----	----
SS-1	70 (20)	160 (70)	70 (20)	160 (70)
SS-1h	70 (20)	160 (70)	70 (20)	160 (70)
CRS-1	125 (50)	185 (85)	----	----
CRS-2	125 (50)	185 (85)	----	----
CSS-1	70 (20)	160 (70)	70 (20)	160 (70)
CSS-1h	70 (20)	160 (70)	70 (20)	160 (70)
EA-90P	130 (55)	180 (80)	----	----
CRS-2P	130 (55)	180 (80)	----	----

1015.5.1 Application temperatures of other grades of emulsions shall be as specified in the contract.

1015.5.2 The spraying temperature for non-modified PG 46-28 asphalt binder shall be 260 - 325° F (125 - 165° C), and for all other higher temperature non-modified performance grades, the spraying temperature shall be 285 - 350° F (140 - 175° C). The mixing and compaction temperatures for performance graded asphalt binder shall be determined by rotational viscosity testing as defined in ASTM D 4402.

1015.5.3 When material to be applied by pressure distributor is, due to refining or blending procedures, delivered at a temperature above the specified limits, the material may be applied at the higher temperature provided satisfactory application can be obtained at the specified rate and provided sufficient precaution is exercised with respect to the fire hazard.

1015.6 Measurement of Bituminous Material. Field weight (mass) or field volumetric determinations of the material actually incorporated into the work will be used for measurement of the quantity of bituminous material for payment. The volume of material supplied from intermediate storage tanks will be determined from the net weight (mass) of the material. The net weight (mass) will be determined from the gross weight (mass) of the loaded

transport vehicle used to deliver the material to the project less the empty transport vehicle weight (mass). The volume correction methods specified below will be used for determining the volume of bituminous material. Scales for determining the weight (mass) of bituminous material shall be in accordance with Sec 310.

1015.6.1 Liquid Bituminous Material and Asphalt Binder - Volumetric Determination. Measurement of the material will be based on the volume at 60° F (15.6° C). The volume correction factors of ASTM D 1250, Table 24b, will be used for converting the material from the volume at the observed temperature to the volume at 60° F (15.6° C). The volume of uncalibrated distributors and tank trucks will be determined from the net weight (mass) of the material. The net weight (mass) will be determined from the gross weight (mass) of the loaded delivery vehicle less the empty delivery vehicle weight (mass). For computing the volume in gallons (l) from weight (mass), the following formula will be used:

ENGLISH

$$G = \frac{W}{SG \times 8.328}$$

where:

G = Volume in gallons at 60° F.
W = Weight of material in pounds.
SG = Specific Gravity of material at 60° F.

METRIC

$$L = \frac{M}{SG \times 997.914}$$

where:

L = Volume in liters at 15.6° C.
M = Mass of material in kilograms
SG = Specific Gravity of material at 15.6° C.

1015.6.2 Emulsified Asphalt. Measurement of the material will be based on the volume at 60° F (15.6° C) using a coefficient of expansion of 0.0003 per degree F (0.00054 per degree C) for converting the material from the volume at the observed temperature to the volume at 60° F (15.6° C).

SECTION 1015.10 PEFORMANCE GRADED ASPHALT BINDER

1015.10.1 General. Performance graded asphalt binder shall be an asphalt-based binder produced from petroleum residue either with or without the addition of non-particulate organic modifiers. The grade shall be as specified in the contract.

1015.10.2 Basis of Acceptance. Suppliers furnishing performance graded asphalt binders to MoDOT projects by certification shall be in accordance with AASHTO R 26, except as noted herein. To become pre-qualified to furnish material, a written request shall be sent to Construction and Materials, along with a copy of the supplier's QC plan. Split samples may be required. Changes in formulation, base stock or methods of manufacture of qualified performance graded binders shall be noted and may require requalification.

1015.10.2.1 Quality Control Plan Requirements. The QC plan shall be in accordance with AASHTO R 26 with the following exceptions and modifications:

(a) The plan shall be written to cover multiple terminals or shipping facilities, in addition to the primary manufacturing facility, provided specific requirements for each location are clearly stated.

(b) The plan shall state the lot size used to designate the frequency of QC and specification compliance testing for each performance grade to be supplied. The lot size will depend upon the method of manufacture and may be designated on a tank basis, or on a time basis in the case of binders that are blended into trucks or tanks or that are continually blended into "live" tanks.

(c) For terminals or manufacturing facilities, the minimum reduced frequency of testing for QC or specification compliance shall be one series of tests every two weeks for "live" tanks or blenders and one series of tests every four weeks for "static" tanks that have had no material added between testing, per lot per grade of binder shipped.

(d) Quality Control testing may be used to determine that binders being shipped from terminals or manufacturing facilities have not been contaminated, provided that such testing is shown to be of sufficient accuracy to detect contamination and to assure that material meets required specifications. Surrogate tests may be used for QC testing of non-modified performance graded binders.

(e) Terminals or shipping facilities that blend performance graded binders from different sources, that blend to produce a different performance grade, or that blend to modify the properties of an existing performance grade shall perform complete AASHTO M 320 specification compliance testing.

(f) The shipping facility shall document that each transport vessel was inspected prior to loading and was found to be acceptable for the material being shipped. The inspection shall be documented by a statement on the bill of lading or truck ticket, or by maintaining a record of transport vessel inspections at the shipping facility, which shall be available for review by MoDOT.

1015.10.2.2 Quality Control Plan Test Data. The facility shall retain test data of specification compliance and QC testing for five years. At a minimum, the name of the facility, the dates of testing activity, results of individual specification compliance and QC tests identified by blender or tank number, and the mean, minimum and maximum test result for each specification compliance and QC test performed shall be readily available to MoDOT upon request.

1015.10.2.3 Approval of Laboratories. The supplier's primary testing laboratory shall be approved by MoDOT. The approval process will include split sample testing, and may include an on-site visit by department personnel. The primary testing laboratory shall be regularly inspected by the AASHTO Materials Reference Laboratory (AMRL). Any satellite testing laboratory operated by a supplier shall be inspected at the same frequency by the supplier's primary AMRL inspected laboratory staff, and a copy of the inspection report shall be forwarded to MoDOT.

1015.10.2.4 Failure to Comply. Failure to fulfill any of these requirements may result in disqualification of the performance graded binder supplier. If a primary manufacturing facility is disqualified, all terminals shipping performance graded binder manufactured at the primary facility and who are not performing AASHTO M 320 specification compliance testing will automatically be disqualified. In cases of dispute, test results obtained by MoDOT will be considered final.

1015.10.3 Characteristics. Performance graded asphalt binder shall be in accordance with AASHTO M 320 for the grade specified, except as follows. AASHTO T 111, *Inorganic Matter or Ash in Bituminous Materials*, may be substituted for AASHTO T 44, *Solubility of Bituminous Materials*, at the specification value indicated. The direct tension test will be waived. The following additional requirements will apply:

Binder Characteristics		
Absolute Temperature Spread Between Upper and Lower Temperature for PG Binder Grade[a]	**Elastic Recovery[b], Percent, Minimum, AASHTO T 301**	**Separation Test[c], Percent Difference, Maximum, ASTM D 5976**
86 C	-	-
92 C	55	10
98 C	65	10
104 C	75	10

[a]Temperature Spread = Upper PG Temperature minus Lower PG Temperature.
[b]Elastic recovery test to be performed on the residue from the Rolling Thin Film Oven Test at 25 C and 10 cm elongation.
[c]Separation test to be performed in accordance with ASTM D 5976, except test upper and lower portions as original binder for G* value according to AASHTO T 315.

1015.10.4 Storage. Performance graded asphalt binder shall be furnished as a uniform mixture shipped directly to the project site from the asphalt binder supplier's permanent plant address or intermediate storage facility, suitable for direct use. Asphalt binder shall be capable of being stored at the project site without separation or settling. Automatic blending will be allowed, except no intermediate blending of asphalt binder and any other modifiers will be allowed at the project site.

SECTION 1015.20 LIQUID BITUMINOUS MATERIAL

1015.20.1 Basis of Acceptance. Suppliers electing to furnish liquid bituminous material to MoDOT projects by QC/QA certification shall furnish material in accordance with Sec 1015.20.2. To become pre-qualified to furnish material, a written request shall be submitted to Construction and Materials, along with a copy of the supplier's QC plan. For source approval for any supplier of liquid bituminous material, split samples and an on-site laboratory inspection may be required. A manufacturer may forgo a formal QC plan and elect to perform full compliance testing, and certify each batch of material. If a manufacturer elects to forgo a formal QC Plan, all truck shipments shall be loaded from approved storage tanks that have been sampled, tested and certified by the supplier. If a manufacturer so elects, and automatic blending equipment is used, blender material will be approved for use provided the finished product is in accordance with this specification. At least one complete specification compliance test shall be conducted every two weeks on each grade of material furnished for MoDOT work from the blender. A certified copy of the test results shall be furnished to the engineer. For all liquid bituminous material, AASHTO T 111, *Inorganic Matter or Ash in Bituminous Materials*, may be substituted for AASHTO T 44, *Solubility of Bituminous Materials*, at the specification value indicated.

1015.20.2 Quality Control Plan Requirements. The QC plan shall be in accordance with the following:

(a) The plan may be written to cover multiple terminals, shipping facilities, blending or manufacturing facilities.

(b) The plan shall state the location, organization and responsible personnel for each facility, including the physical address and telephone contact information. In general, following the guidelines in AASHTO R 26 will be acceptable.

(c) The plan shall state the minimum testing frequency for all material supplied. At a minimum, each grade of material supplied to MoDOT shall have complete specification compliance testing conducted monthly. Polymer modified material shall have complete specification compliance testing conducted every two weeks. The manufacturer's internal QC testing frequency shall be approved by MoDOT prior to implementation. The manufacturer shall perform sufficient tests and at a frequency to ensure specification compliant material is being supplied to MoDOT at all times. For emulsified asphalt, QC testing on each batch, at a minimum, shall consist of viscosity, sieve test, determination of residue by either distillation or evaporation and an identifier test, if applicable, for that particular grade, either cement mixing, particle charge or demusibility. The manufacturer may elect to perform additional QC tests. For cutback material, QC testing shall be a minimum of the viscosity on a daily basis when material is being shipped to MoDOT work.

(d) In the event of a failing sample, the manufacturer shall follow the steps outlined in AASHTO R 26, Sec. 9.2. If a sample fails to comply with any specification requirement at the Central Laboratory, the manufacturer may only ship new material of that grade after full specification compliance testing. After the manufacturer has certified through specification compliance testing that three consecutive batches are in accordance with the material specification, the manufacturer may return to the testing frequency outlined in the QC/QA plan. If a second sample of the same grade from the same facility fails to comply with any specification requirement within the same calendar year, approval of that facility to supply that grade under QC/QA may be withdrawn. If approval for a grade is withdrawn, that material may only be supplied to MoDOT work after full certification compliance testing has been performed at the Central Laboratory. Re-approval to supply under the supplier's QC/QA Plan will occur only after three consecutive batches meet specifications after testing at the Central Laboratory. Failure of multiple grades from a single facility tested at the Central Laboratory may result in that facility being removed from approval to supply material to MoDOT. Reinstatement will occur only after all materials in question have been tested at the Central Laboratory and have met all specifications, and documentation from the supplier outlining the reason for the failures and what corrective measures have been taken are to the satisfaction of MoDOT.

(e) The shipping facility shall document that each transport vessel was inspected prior to loading and was found to be acceptable for the material shipped. The inspection shall be documented by a statement on the bill of

lading or truck ticket, or by maintaining a record of transport vessel inspections at the shipping facility, which shall be available for review by MoDOT.

The results of QC/QA testing shall be retained by the supplier for a period of three years. A report containing all test results for any material shall be available to MoDOT upon request.

1015.20.3 Type RC Liquid Asphalt. Type RC liquid asphalt shall be produced by fluxing an asphaltic base with suitable petroleum distillates. The material shall show no separation or curdling prior to use and shall not foam when heated to the application temperature. The material shall be in accordance with AASHTO M 81, invoking Note 3 using penetration in lieu of viscosity for the grade specified in the contract.

1015.20.4 Type MC Liquid Asphalt. Type MC liquid asphalt shall be produced by fluxing an asphaltic base with suitable petroleum distillates. The material shall show no separation or curdling prior to use and shall not foam when heated to the application temperature. The material shall be in accordance with AASHTO M 82, invoking Note 4 using penetration in lieu of viscosity for the grade specified in the contract.

1015.20.5 Emulsified Asphalt. Emulsified asphalt shall be in accordance with AASHTO M 140 or AASHTO M 208, for the type and grade specified in the contract.

1015.20.5.1 Polymer Modified Asphalt Emulsion. Bituminous material for polymer modified asphalt shall be in accordance with the following:

Polymer Modified Asphalt Emulsion				
Test [a]	**CRS-2P**		**EA-90P**	
	Min	**Max**	**Min**	**Max**
Viscosity, SSF @ 50 C	100	400	100	400
Storage Stability Test[b], 24 hour, percent	----	1	----	1
Classification Test	Pass	----	----	----
Particle Charge Test	Positive	----	----	----
Sieve Test, 850 µm mesh, percent	----	0.3	----	0.3
Demulsibility, 0.02 N $CaC1_2$, percent	----	----	30	----
Distillation:				
Oil distillate by volume of emulsion, percent	----	3	----	3
Residue from distillation[c], percent	65	----	65	----
Tests on Residue from Distillation:				
Penetration, 25 C, 100 g, 5 sec	100	200	100	200
Ductility, 4 C, 5 cm/minute, cm	30	----	25	----
Ash[d], percent	----	1	----	1
Float Test at 60 C, sec	----	----	1200	----
Elastic Recovery[e], percent	58	----	58	----

[a]All tests shall be performed in accordance with AASHTO T 59 except as noted.
[b]In addition to AASHTO T 59, upon examination of the test cylinder, and after standing undisturbed for 24 hours, the surface shall show no appreciable white, milky colored substance and shall be a homogeneous brown color throughout.
[c]AASHTO T 59 shall be modified to maintain a 204° C ± 5° C maximum temperature for 15 minutes.
[d]Percent ash shall be determined in accordance with AASHTO T 111, *Ash in Bituminous Material*.
[e]Elastic recovery shall be determined as follows. Condition the ductilometer and samples to be treated at 10 C. Prepare the brass plate, mold and briquet specimen in accordance with AASHTO T 51. Keep the specimen at the specified test temperature of 10° C for 85 to 95 minutes. Immediately after conditioning, place the specimen in the ductilometer and proceed to elongate the sample to 20 cm at a rate of pull of 5 cm/min. After the 20 cm elongation has been reached, stop the ductilometer and hold the sample in the elongated position for 5 minutes. After 5 minutes, clip the sample approximately in half by means of scissors or other suitable cutting devices. Let the sample remain in the ductilometer in an undisturbed condition for one hour. At the end of this time period, retract the half sample specimen until the two broken ends touch. At this point note the elongation (x) in cm. Calculate the percent recovery by the following formula:

$$\% \text{ Recovery} = \frac{20 - X}{20} \times 100$$

1015.20.5.2 Asphalt Emulsion for Micro-Surfacing. Bituminous material for micro-surfacing shall be a polymer modified asphalt emulsion, grade CSS-lh, in accordance with the following table. The bituminous material shall show no separation after mixing. A minimum of 3.0 percent polymer content, by mass, of an approved polymer shall be milled into the asphalt emulsion at the time of manufacture of the emulsion. The emulsion shall be sampled in accordance with AASHTO T 40.

Micro-Surfacing Emulsion (MSE-1)			
	Min.	**Max.**	**Test Method**
Viscosity, Saybolt Furol at 25 C, s	20	100	AASHTO T 59
Storage stability test, 24 hr, percent	- -	1[a]	AASHTO T 59
Particle charge test positive[b]			AASHTO T 59
Sieve test, percent	- -	0.50	AASHTO T 59
Residue, percent	62	- -	AASHTO T 59
Tests on Residue from Distillation	**Min.**	**Max.**	**Test Method**
Penetration, 25 C, 100 g, 5 s,	40	90	AASHTO T49
Ductility, 25 C, 5cm/min, cm,	40	- -	AASHTO T 51
Solubility in Trichloroethylene, %	97.50	- -	AASHTO T 44

[a]The storage stability test may be waived provided the asphalt emulsion storage tank at the project site has adequate provisions for circulating the entire contents of the tank, and provided satisfactory field results are obtained.

[b]If the particle charge test is inconclusive, material having a maximum pH value of 6.7 will be acceptable.

1015.20.5.3 Scrub Seal Emulsion. Scrub seal emulsion shall be smooth and homogeneous, polymer modified, shall contain an asphalt rejuvenator and shall be in accordance with the following:

Scrub Seal Emulsion (SSE-1)			
	Min.	**Max.**	**Test Method**
Saybolt Furol Viscosity, SFS @ 25 C	30	100	AASHTO T 59
Storage Stability Test [a] , 24 hr., %	--	1[a]	AASHTO T 59
Demulsibility, 35 ml of 0.02N, $CACl_2$, %	--	60	AASHTO T 59
Sieve Test [b], percent	--	0.3	AASHTO T 59
Residue by Distillation [(c)] @ 205 ± 5 C, %	60	--	AASHTO T 59
Oil Distillate by Volume, percent	--	3	AASHTO T 59
Tests on Residue from Distillation	**Min.**	**Max.**	**Test Method**
Penetration @ 25 C, 5 s, 100 g, dmm	100	300	AASHTO T 49
Float Test @ 60 C, s	1200	--	AASHTO T 50
Ash, percent	--	1	AASHTO T 111
Elastic Recovery, 10 C, 200 mm elongation, 60 min. recovery, percent	30	--	ASTM D 5976
Saturates [d], percent	- -	20	ASTM D 4124

[a]Upon examination of the test cylinder after standing undisturbed for 24 hours, the surface shall show no white, milky colored substance and shall be a homogeneous brown color throughout.

[b]A percentage of 0.30 will be acceptable for samples taken at the point of use or shipped to the Central Laboratory for testing.

[c]ASTM D 244 shall be modified to include a 205 ± 5° C maximum temperature to be held for 15 minutes.

[d]ASTM D 4124 shall be modified to use Alumina, CG - 20 Grade, available from Aluminum Company of America, Pittsburgh, PA.

1015.20.6 Ultrathin Bonded Wearing Surface. Bituminous material for ultrathin bonded wearing surface shall be in accordance with the following.

1015.20.6.1 Asphalt Binder. The asphalt binder shall be in accordance with Sec 1015.10, and specifically as follows:

Tests	Method	Min.	Max.
Separation Test, %	AASHTO PP-5		10
Elastic Recovery Test, %	ASTM D 6084	65	

1015.20.6.2 Polymer Modified Emulsion Membrane. The anionic or cationic emulsion shall be polymer modified and shall be in accordance with one of the following:

Anionic Polymer Modified Emulsion Membrane (PEM-1)				
Tests on Emulsion		**Method**	**Min.**	**Max.**
Viscosity, Saybolt Furol @122° F (50° C), s		AASHTO T 59	25	125
Storage Stability Test[a], 24 h, percent		AASHTO T 59		1
Sieve Test[b], percent		AASHTO T 59		0.3
Residue by Distillation[c], percent		AASHTO T 59	63	
Oil Distillate by Distillation, percent		AASHTO T 59		2
Demulsibilty, %	35 ml, 0.02 N $CaCl_2$	AASHTO T 59	60	
Tests on Residue From Distillation				
Penetration		AASHTO T 49	90	150
Elastic Recovery, percent		AASHTO T 301	60	

Cationic Polymer Modified Emulsion Membrane (CPEM-1)				
Tests on Emulsion		**Method**	**Min.**	**Max.**
Viscosity, Saybolt Furol @122°F (50° C), s		AASHTO T 59	25	125
Storage Stability Test[a], 24 h, percent		AASHTO T 59		1
Sieve Test[b], percent		AASHTO T 59		0.3
Residue by Distillation[c], percent		AASHTO T 59	63	
Oil Distillate by Distillation, percent		AASHTO T 59		2
Demulsibility, %	35 ml, 0.8% dioctyl sodium sulfosuccinate	AASHTO T 59	60	
Tests on Residue From Distillation				
Penetration		AASHTO T 49	90	150
Elastic Recovery, %		AASHTO T 301	60	

[a]After standing undisturbed for 24 hours, the surface shall show no white, milky colored substance, but shall be a smooth homogeneous color throughout.
[b]The sieve test will be waived if successful application of the material has been achieved in the field.
[c]AASHTO T 59 shall be modified to include a 400° F ± 10° F (205° C ± 5° C) maximum temperature to be held for a period of 15 minutes.

SECTION 1018 – FLY ASH FOR CONCRETE

Delete Sec 1018 in its entirety and substitute the following: ***08/07***

SECTION 1018

FLY ASH FOR CONCRETE

1018.1 Scope. This specification covers fly ash for use in Portland cement concrete.

1018.2 General. Only fly ash from sources qualified in accordance with these specifications will be permitted. The mixing of different classes and sources of fly ash will not be permitted. All fly ash shall be in accordance with AASHTO M 295, Class C or F, except as herein specified.

1018.2.1 Class C fly ash shall meet one or both of the following requirements:

(a) The 7-day Strength Activity Index with Portland cement shall be at a minimum be 85 percent of the control.

(b) The Calcium oxide content shall be 23 percent , minimum.

1018.2.2 The percent each of silicon dioxide (SiO_2), aluminum oxide (Al_2O_3) and iron oxide (Fe_2O_3) shall be reported in addition to the total of the three.

Class	Range
Class C	50-66%
Class F	74% Minimum

1018.2.3 Loss on Ignition shall not exceed 1.5 percent.

1018.2.4 The term "manufacturer", as used in this specification, will be the actual manufacturer of the fly ash. The term, "marketing entity", as used in this specification, will be the supplier or broker of the fly ash. The marketing entity shall be responsible to be in accordance with these specifications.

1018.2.5 Cement used for testing fly ash shall be in accordance with AASHTO M85..

1018.2.6 All marketing entities, terminals, and independent testing laboratories shall be qualified prior to acceptance of any material.

1018.3 Laboratory Qualification.

1018.3.1 Laboratories approved prior to 10/01/06 shall maintain qualification based on continued compliance with all of the of all requirements specified herein.

1018.3.2 In order to become qualified, a written request shall be sent by the marketing entity to Construction and Materials, along with a copy of the independent laboratory's most recent Cement and Concrete Reference Laboratory (CCRL) certification and the latest CCRL Pozzolan proficiency sample report. The CCRL inspection shall cover all tests required by the specification. Documentation showing satisfactory resolution of all inspection deficiencies shall be included.

1018.3.3 **Failure to Comply.** Failure to comply with any of these requirements and/or specified herein may result in the issuance of a strike. If a laboratory accumulates three strikes, the laboratory shall be disqualified. For every year a laboratory does not receive a strike, a strike will be removed from the laboratory's accumulated total. In cases of dispute, test results obtained by MoDOT will control.

1018.3.4 Disqualified Facilities. If a laboratory has been disqualified, the marketing entity must utilize an existing MoDOT approved laboratory or qualify a laboratory fulfilling MoDOT requirements. A disqualified laboratory will be unable to maintain qualification based on requirements governed in this specification. Labratories found to not be operating independent of qualified mareketing entities shall be disqualified.

1018.4 Marketing Entity Qualification. In order to become qualified, a written request shall be sent by the marketing entity to Construction and Materials, along with a copy of the marketing entity's QC plan and the following information. The power plant and terminals may be inspected to verify the information and to establish personal contact with the QC personnel.

1018.4.1. The following information shall be included in the request for qualification:

(a) An outline of the QC program from the coal yard to the point where the product is relinquished to the purchaser. The QC program shall cover all tests required by the specification, and shall include the testing frequency for each test. The name of the testing laboratory shall also be included.

(b) A copy of the testing laboratory's most recent Cement and Concrete Reference Laboratory (CCRL) inspection report and the latest CCRL proficiency sample report. The CCRL inspection shall cover all tests required by the specification. Documentation showing satisfactory resolution of all inspection deficiencies shall be included.

(c) Complete name and address of the fly ash source and owner. If located in an area without precise address identification, a complete map description shall be furnished.

(d) Complete name and address or map location of the coal mine. If more than one source of coal is used, all sources shall be listed.

(e) Type of coal used.

(f) Class of fly ash produced.

(g) A description of production procedures including, but not limited to, any additives mixed with the coal during production, any additive or dust suppressant used to collect the fly ash, ash collection methods, production capacity in tons (Mg) per day, and the proportions and proportioning procedures of any blended coals.

(h) Description of storage facilities, including capacities and set-aside capabilities.

(i) A copy of a typical bill of lading in accordance with the certification statement.

(j) A split sample of the class of fly ash proposed for use, obtained from the autosampler over a minimum of one production day. The marketing entity's test results for the split sample shall also be submitted.

1018.4.2 In order to maintain qualification, the following will be required:

(a) Quality control test results covering the production of all fly ash proposed for use in MoDOT projects, including the high, low and average results for each class shall be kept on file by the marketing entity. Sampling and testing frequency shall be in accordance with ASTM C 311. Results shall include the percent each of silicon dioxide (SiO2), aluminum oxide (Al2O3) and iron oxide (Fe2 O3) in addition to a total of all three.

(b) A copy of the most recent CCRL inspection and proficiency sample reports and any deficiency resolutions shall be forwarded promptly to MoDOT.

(c) Semi-annual split samples for the class of approved fly ash shall be obtained by MoDOT for joint testing by the marketing entity. Marketing entity test results on the split samples shall be furnished to Construction and Materials when completed.

(d) All QC test results shall be available for a minimum of three years, for MoDOT review upon request.

(e) All monthly or each 3200-ton samples shall be available for a minimum of one year, for MoDOT testing upon request.

(f) Only fly ash in compliance with these specifications shall be allowed into a silo destined for MoDOT projects.

1018.4.3 Failure to Comply. Failure to comply with any of these requirements and/or specified herein may result in the issuance of a strike. If a marketing entity accumulates three strikes, the marketing entity shall be disqualified. For every year a marketing entity does not receive a strike, a strike will be removed from the marketing entitiy's accumulated total. In cases of dispute, test results obtained by MoDOT will control.

1018.5 Terminal Qualification. In order to become a qualified terminal, a written request shall be sent from terminal personnel to Construction and Materials. A letter shall accompany the request from each affected and qualified marketing entity, advising of the intent to ship through the respective terminal. Any changes in fly ash source shall be updated in the same manner. Terminals shall be inspected to ensure adequacy to accept, retain and ship fly ash from qualified marketing entities.

1018.6 Sampling, Testing and Acceptance Procedures. All fly ash will be subject to inspection and sampling by MoDOT at the power plant, an intermediate shipping terminal or destination. MoDOT shall be allowed unlimited access to all facilities and records in order to conduct inspection and sampling.

1018.6.1 Failure to Comply. Failure to fulfill any of these requirements may result in disqualification of the fly ash manufacturer, marketing entity or a terminal. In cases of dispute, test results obtained by MoDOT will control.

1018.6.2 Disqualified Facilities. If a facility has been disqualified, the marketing entity may elect to designate the silo, bin or storage facility from which the marketing entity proposes to furnish fly ash for MoDOT projects. If this option is used, each silo, bin or storage facility designated must be sampled, tested, sealed and approved by MoDOT prior to shipment. The marketing entity shall also sample, test and report the test results for each designated silo, bin or storage facility.

1018.6.3 Shipping. Fly ash shall be continually sampled and tested via autosamplers at a location, frequency and duration acceptable to MoDOT, and may be continuously shipped direct from a marketing entity or generating station silo.

1018. 6.4 Storage. All fly ash intended for use shall be sampled, tested, and placed in designated silos or bins.

1018.6.5 Coal Sources and Process. Fly ash from each coal source at each plant shall be qualified separately. Coals from different sources may be blended prior to burning, but the qualification shall be based on the blend. When the production procedure or fuel source is changed, or when any change is made by the manufacturer that alters the properties or characteristics of the qualified fly ash, requalification may be required.

1018.6.6 Acceptance. The marketing entity shall certify that the material complies with the specification requirements. When a qualified marketing entity or terminal is shipping fly ash for, or purchasing fly ash from, another qualified marketing entity, the

bill of lading or delivery receipt shall be from the shipping company. The certification statement showing the actual manufacturer shall be prominently placed on the bill of lading or delivery receipt. A copy of the bill of lading or delivery receipt shall accompany each shipment and shall be furnished to MoDOT at the shipping and destination points.

1018.6.7 The bill of lading or delivery receipt for each shipment to MoDOT projects shall carry the following certification statement:

"This is to certify this Class ___ fly ash originated from a MoDOT qualified manufacturer, has been maintained to meet MoDOT specifications and was loaded from silo number _____."

_____
Name and Location of Manufacturer

_____
Name and Location of Shipping Facility

By_____
Signature and Name of Marketing Entity

SECTION 1019 – CEMENT

Delete Sec 1019.2.1 and substitute the following: ***11/05;04/08***

1019.2.1 Portland Cement. All Portland cement shall be in accordance with AASHTO M 85. with the following modifications:

(a) Specific surface, fineness, for all Type I Portland cements shall not exceed 420 m^2/kg using Air permeability test. When sample fails to meet the requirements of the air permeability test, the turbidimeter test shall be used and requirement of 230 m^2/kg maximum for the turbidimeter method shall govern.

(b) For limestone cements, include the CO_2 content of Portland cement on all mill test reports. Determine the CO_2 content in accordance with ASTM C114. When the CO_2 content exceeds 1.0% or when any quantity of limestone is added, report the C3S as calculated in ASTM C150, Annex A1, using the actual CO_2 value.

Delete Sec 1019.2.3 and substitute the following: ***11/05***

1019.2.3 Blended Hydraulic Cement. All blended hydraulic cement shall be in accordance with Type IP, I(PM), IS or I(SM) of AASHTO M 240 with the modification that chemical composition shall be provided and tolerances checked in accordance with Section 7.2 of AASHTO M240.

Delete Sec 109.3.1.2 and substitute the following: ***04/08***

1019.3.1.2 In order to maintain qualification, the following will be required:

(a) Monthly QC test results covering the production of cement types proposed for use in MoDOT projects, including the high, low and average results for each type shall be forwarded to MoDOT upon manufacturer completion.

(b) A copy of the most recent CCRL inspection and proficiency sample reports and any deficiency resolutions shall be forwarded promptly to MoDOT.

(c) Semi-annual split samples for each type of approved cement will be obtained by MoDOT for joint testing by the manufacturer. Manufacturer test results on the split samples shall be furnished to MoDOT when completed.

(d) All QC test results shall be available for a minimum of three years, for MoDOT review upon request.

(e) Only cement in compliance with these specifications shall be allowed into a silo destined for MoDOT projects.

SECTION 1020 – CORRUGATED METALLIC-COATED STEEL CULVERT PIPE, PIPE-ARCHES AND END SECTIONS

Delete Sec. 1020.2 and substitute the following: ***01/05***

1020.2 Basis of Acceptance. Unless otherwise specified, the basis of acceptance will be in accordance with AASHTO M 36. Pipe shall be from an approved qualified plant and will be accepted based on certification, manufacturer quality control documentation and tests on samples as required by the engineer. Pipe may be fabricated using English units of measurement. Pipe fabricated using English measurements shall be in accordance with the dimensions and tolerances shown on the plans.

Delete Sec. 1020.5.1 and substitute the following: ***01/05***

1020.5.1 Application for Placement on the Qualified List. For a plant to become qualified, a written request shall be sent by the manufacturer to Construction and Materials with the following information:

(a) A QC Plan, in accordance with Sec 1020.5.2, for each plant from which pipe is to be fabricated for use on MoDOT projects.

(b) A certification statement from the manufacturer that the quality control procedures at the plant, at a minimum, meet the requirements set forth in the manufacturer's QC Plan.

(c) Sources for each material to be used in the fabrication of pipe shall be provided.

(d) A guarantee that all material to be used in the fabrication of pipe will be in accordance with MoDOT specifications and that pre-approval for any source of material will be received prior to use.

(e) Units of measurement, English or metric, used to fabricate the pipe.

SECTION 1026 – REINFORCED CONCRETE CULVERT PIPE

Delete Sec 1026.4.1 and substitute the following: ***01/05***

1026.4.1 Application for Placement on Qualified List. To become qualified, a written request shall be sent by the manufacturer to Construction and Materials with the following information:

(a) A statement certifying that the quality control procedures at the plant meet the requirements set forth by the American Concrete Pipe Association (ACPA) Compliance Audit and Certification Program.

(b) Sources for each material to be used in the fabrication of pipe. For aggregate sources, the ledge the material is being taken from shall also be included.

(c) A guarantee that all material to be used in the fabrication of pipe will be in accordance with MoDOT specifications, and pre-approval for any source of material will be received prior to use.

(d) Units of measurement, English or metric, used to fabricate the pipe.

SECTION 1028 – CORRUGATED POLYVINYL CHLORIDE CULVERT PIPE

Delete Sec. 1028.4.1 and substitute the following: ***01/05***

1028.4.1 Application for Placement on Qualified List. To become qualified, a written request shall be sent by the manufacturer to Construction and Materials with the following:

(a) A QC plan for each plant from which pipe is to be fabricated for use on MoDOT projects. The QC plan shall be in accordance with Sec 1028.4.2, and shall provide that pipes be randomly selected for test by an independent testing laboratory, and that randomly selected pipes are representative of that manufacturer's pipe.

(b) A statement certifying that the quality control procedures at the plant, at a minimum, meet the requirements set forth in the manufacturer's QC plan.

(c) Sources for each material to be used in the fabrication of pipe.

(d) Certification that all pipe material to be used in the fabrication of pipe will be in accordance with MoDOT specifications.

(e) Units of measurement, English or metric, used to fabricate the pipe.

SECTION 1029 – FABRICATING PRESTRESSED CONCRETE MEMBERS FOR BRIDGES

Delete Sec 1029.6.1 and substitute the following: ***06/08***

1029.6.1 Shop Drawings. Shop drawings showing in detail the type, size, number of units, location of tendons, enclosures, method and sequence of releasing the strands, anchorage details and details of proposed lifting loops and lifting procedure shall be submitted to the engineer for approval. The contractor may select the method of prestressing, provided an approved specific method is used and the total prestressing force and the center of gravity of the prestressing tendons as shown on the plans are maintained. The shop drawings shall show a tabulation of the design computations and the total prestress force, size and spacing of all reinforcing steel and concrete compressive strengths for strand release and design. No inspection will be conducted until the plant inspector has received a copy of the approved shop drawings. Prior to making shop drawings, the contractor shall submit in writing for approval of the engineer any proposed tack welding in lieu of tying of the reinforcing bars of prestressed members. If approved by the engineer, the location of tack welding of reinforcing bars shall be shown on the shop drawings submitted for approval. No heat or welding will be permitted in the proximity of prestressing tendons in the members. Shop drawings for the prestressed concrete solid, voided slab and box girder beams shall be required to include the alignment of the holes for the tie rods. The holes shall be aligned in such a way as to prevent damage to the precast units during the placement of the precast units on the beam caps and the installation and tensioning of the tie rods through the precast units.

Delete Table I from Sec 1029.8 and substitute the following: ***06/08***

Table I Dimensional Tolerances – I–Girders, Solid Slab Beams, Voided Slab Beams, Box Girder Beams and Miscellaneous Prestress Units	
ENGLISH	
Length of Beam	±1/8 inch per 10 feet of beam length, but no greater than 3/4 inch
Width (Flanges, Web and Fillets)	+3/8 inch, -1/4 inch
Depth (Flanges, Web and Fillets)	±1/4 inch
Depth (Overall)	+1/2 inch, -1/4 inch
Horizontal Alignment - I-Girders and Miscellaneous Prestressed Units (Deviation from a straight line parallel to centerline of member)	1/2 inch max., to 40-foot lengths 3/4 inch max., 40 to 60-foot lengths 1 inch max., 60-foot or greater lengths
Horizontal Alignment - Solid Slab, Voided Slab and Box Girder Beams (Deviation from a straight line parallel to centerline of member)	1/4 inch max., to 40-foot lengths 3/8 inch max., 40 to 60-foot lengths 1/2 inch max., 60-foot or greater lengths
Camber (Deviation from design camber within 7 days of strand release)	±1/2 inch, to 80-foot lengths ±1 inch, greater than 80-foot lengths
Stirrup Bars (Projection above top of beam)	± 3/4 inch
Stirrup Bars (Longitudinal spacing)	± 2 inches
Tendon Position- I-Girders and Miscellaneous Prestressed Units	± 1/4 inch center of gravity of strand group and individual tendons

Tendon Position - Solid Slab, Voided Slab and Box Girder Beams	± 1/8 inch center of gravity of strand group and individual tendons
Position of Deflection Points for Deflected Strands	± 6 inches, longitudinal
Position of Lifting Devices	± 6 inches, longitudinal
Side Inserts (Centerline to centerline and centerline to end)	± 1/2 inch
Coil Inserts (Centerline to centerline and centerline to end)	± 2 inches horizontal, except must be 3 inches or more from end of beam and within reinforcement cage of bent, ±1 inch vertical
Slab Drain Inserts	± 1/2 inch from designated location, engineer may approve location ± 6 inches from design, multiple inserts for single drain must be within ± 1/2 inch of vertical line
Exposed Beam Ends (Deviation from square or designated skew)	± 1/4 inch horizontal, ± 1/8 inch vertical per foot of beam height
Bearing Area (Deviation from plane)	±1/8 inch
Bearing Plates (Centerline to centerline)	±1/8 inch per 10 feet of beam length, but no greater than 3/4 inch
Bearing Plates (Centerline to end of beam)	±1/2 inch
Diaphragm Hole Location	±1 1/2 inches for centerline of group ±1/2 inch within group
Scupper holes, blockouts and voids	Placed as close as possible to design location after reinforcement steel and strands are properly located

Table I **Dimensional Tolerances – I–Girders, Solid Slab Beams, Voided Slab Beams, Box Girder Beams and Miscellaneous Prestress Units**	
METRIC	
Length of Beam	±1 mm per meter of beam length, but not greater than 18 mm
Width (Flanges, Web and Fillets)	+9 mm, -6 mm
Depth (Flanges, Web and Fillets)	±6 mm
Depth (Overall)	+12 mm, -6 mm
Horizontal Alignment - I-Girders and Miscellaneous Prestressed Units (Deviation from a straight line parallel to centerline of member)	12 mm max., to 12 m lengths 18 mm max., 12 to 18 m lengths 25 mm max., 18 m or greater lengths
Horizontal Alignment - Solid Slab, Voided Slab and Box Girder Beams (Deviation from a straight line parallel to centerline of member)	6 mm max., to 12 m lengths 9 mm max., 12 to 18 m lengths 12 mm max., 18 m or greater lengths
Camber (Deviation from design camber within 7 days of strand release)	± 12 mm, to 24 m lengths ± 25 mm, greater than 24 m lengths
Stirrup Bars (Projection above top of beam)	± 18 mm
Stirrup Bars (Longitudinal spacing)	± 50 mm
Tendon Position - I-Girders and Miscellaneous Prestressed Units	± 6 mm center of gravity of strand group and individual tendons
Tendon Position - Solid Slab, Voided Slab and Box Girder Beams	± 3 mm center of gravity of strand group and individual tendons
Position of Deflection Points for Deflected Strands	± 150 mm, longitudinal
Position of Lifting Devices	± 150 mm, longitudinal
Side Inserts (Centerline to centerline and centerline to end)	± 12 mm
Coil Inserts (Centerline to centerline and centerline to end)	± 50 mm horizontal, except must be 75 mm or more from end of beam and within reinforcement cage of bent, ± 25 mm vertical
Slab Drain Inserts	± 12 mm from designated location, engineer may approve location ± 150 mm from design, multiple inserts for single drain must be within ± 12 mm of vertical line
Exposed Beam Ends (Deviation from square or designated skew)	± 6 mm horizontal, ± 10 mm vertical per foot of beam height
Bearing Area (Deviation from plane)	± 3 mm
Bearing Plates (Centerline to centerline)	± 1 mm per meter of beam length, but not greater than 18 mm
Bearing Plates (Centerline to end of beam)	± 12 mm
Diaphragm Hole Location	± 38 mm for centerline of group ± 12 mm within group
Scupper holes, blockouts and voids	Placed as close as possible to design location after reinforcement steel and strands are properly located

SECTION 1036 – REINFORCING STEEL FOR CONCRETE

Delete Sec 1036.3.3 through 1036.4 and renumber subsequent sections accordingly ***08/07***

Amend Sec 1063.3 and insert the following: ***10/08***

1036.3.3 Welded steel wire fabric shall be in accordance with AASHTO M 55 or AASHTO M 221.

SECTION 1039 – EPOXY RESIN MATERIAL

Delete Sec 1039.60.5 and substitute the following: ***12/07***

1039.60.5 Test Methods. Tests will be performed in accordance with the following methods:

Test Methods	
Rotational Viscosity	ASTM D 2393 Model LVT Brookfield viscometer
Epoxy equivalent	MoDOT Test Method TM 73
Volatile content[a]	ASTM D 1259, Method B, for mixed system
Filler content	MoDOT Test Method TM 73
Ash content	ASTM D 482
Pot life	AASHTO T 237
Tensile strength	ASTM D 638
Compressive strength	ASTM C 881
Water absorption	ASTM D 570
Thermal Shear	MoDOT Test Method TM 72

[a]Sample cured 4 days at room temperature and weighed on a previously weighed metal foil.

SECTION 1040 – GUARDRAIL, END TERMINALS, ONE-STRAND ACCESS RESTRAINT CABLE AND THREE-STRAND GUARD CABLE MATERIAL

Delete Sec 1040.4 and substitute the following: ***10/07***

1040.4 Crashworthy End Terminals.

1040.4.1 Material. Only new material shall be used in the fabrication of end terminals. The major items of the installations shall be the best standard products of a manufacturer regularly engaged in the production of that type of end terminal and shall be of the manufacturer's latest approved design. After installation, the end terminal shall redirect traffic face side vehicle impacts within the prescribed performance crash test criteria ranges.

1040.4.2 Manufacture's Approval. Prior to approval and use of a end terminal, the manufacturer shall submit to MoDOT the manufacturer's name, the product brand name or model number, a copy of the NCHRP 350 test results, a copy of the FHWA acceptance letter, and shop drawings.

1040.4.3 Acceptance. Acceptance of the material will be based on the manufacturer's certification and upon satisfactory field performance.

1040.4.4 Contractor's Certification. Prior to installation, the contractor shall furnish to the engineer a manufacturer's certification that the units furnished are identical in material and design to approved units.

Delete Sec 1040.6.2.3 and substitute the following: ***12/07***

1040.6.2.3 Hook Bolts, Hex Bolts, Nuts and Washers. Hook bolts, hex bolts and washers shall be in accordance with ASTM A 307. Cable hook nuts shall be 5/16-18 threads and in accordance with ASTM A 563. Hook bolts, as installed, shall develop an ultimate pull open strength of 450 to 1000 pounds (2.0 to 4.5 kN) applied in a direction normal to the axis of the post. Hooked anchor studs shall be in accordance with AASHTO M 314, except the threads and nominal diameter shall be 3/4-10 and in accordance with ASTM F 568, Class 4.6. All items shall be

galvanized in accordance with AASHTO M 232 or may be mechanically galvanized in accordance with AASHTO M 232, Class C.

SECTION 1042 – HIGHWAY SIGN MATERIAL

Delete Sec 1042.2.7 through 1042.2.7.3.2 and substitute the following ***06/07***
Renumber subsequent sections accordingly:

1042.2.7 Retroreflective Sheeting. Retroreflective sheeting shall be in accordance with ASTM D 4956, except as noted herein. Retroreflective sheeting shall have sufficient strength and flexibility such that the sheeting can be handled, processed and applied according to the manufacturer's recommendations without appreciable stretching, tearing, cracking or other damage. The sheeting surface shall be readily screen processed and compatible with recommended transparent and opaque screen process colors. The retroreflective sheeting manufacturer shall furnish information as to the type of solvent or solvents that may be used to clean the surface of the sheeting without detrimental loss of brightness and durability. The sheeting shall be properly orientated on the sign face to meet retroreflection requirements as specified herein.

1042.2.7.1 Type 1. Type 1 retroreflective sheeting shall be in accordance with ASTM D 4956, Type I, Class 1 or 2, except as noted herein. Type 1 retroreflective sheeting shall be enclosed lens glass-bead sheeting.

1042.2.7.2 Type 3. Type 3 retroreflective sheeting shall be in accordance with ASTM D 4956, Type IV, Class 1 or 2, except as noted herein. Type 3 retroreflective sheeting shall be high intensity prismatic classification.

SECTION 1044 – POSTS FOR MARKERS AND DELINEATORS

Delete Sec 1044.3 – 1044.3.4.4 and substitute the following: ***11/05***

1044.3 Channel Post Delineator. Channel post for delineators shall be manufactured from ductile ASTM A 36 or ASTM A 1011 Gr 60 and as shown on the plans. Posts shall be hot dipped galvanized after manufacture in accordance with Sec 1080. Damaged coating shall be repaired in accordance with Sec 1081. The contractor shall furnish to the engineer three copies of the fabricator's certification that the material supplied is in accordance with the requirements specified.

SECTION 1046 – PIPE LINER

Delete Sec 1046.2 and substitute the following: ***11/06***

1046.2 Material. Pipe liner shall be in accordance with one of the following.

(a) HDPE pipe in accordance with ASTM F 714, maximum DR 32.5.

(b) HDPE pipe in accordance with ASTM D 3350 cell classification 345464C. This pipe liner shall have approved dimensions on file with Construction and Materials.

(c) HDPE pipe in accordance with ASTM F 894 open profile, Class RSC 100 or RSC 160.

(d) PVC pipe in accordance with ASTM F 949, except that the PVC pipe and fittings shall be made of a PVC compound having a minimum call classification of 12454B, in accordance with ASTM D 1784. The joining method for PVC pipe shall be by elastomeric material in accordance with ASTM F 949.

SECTION 1047 – CORRUGATED POLYETHYLENE CULVERT PIPE

Delete Sec 1047.3.4 and substitute the following: ***10/08***

1047.3.4 Each individual section of pipe shall be marked in accordance with AASHTO M 294

Amend Sec. 1047.3 to include the following: ***01/05***

1047.3.5 Pipe may be fabricated using English units of measurement. Pipe fabricated using English measurements shall meet the diameter dimensions shown on the plans. Pipe tolerances will be in accordance with AASHTO M 294.

Delete Sec. 1047.4.1 and substitute the following: ***01/05; 10/08***

1047.4.1 Application for Placement on Qualified List. To become qualified, a written request shall be sent by the manufacturer to Construction and Materials, and shall include the following information:

(a) A copy of the manufacturer's current National Product Evaluation Program (NTPEP) certification.

(b) The pipe manufacturer's certified analysis certificate setting forth the name or brand of pipe to be furnished, the specified type, category, grade and class of polyethylene compounds. The certificate shall be sworn for the manufacturer by a person having legal authority to bind the company. The certificate shall have attached a certified test report from an approved independent testing laboratory showing specific results of tests performed on each diameter pipe to be furnished, conforming to all requirements of these specifications. Pipes shall be randomly selected for test by the independent testing laboratory and shall be representative of that manufacturer's pipe.

(c) A guarantee that all pipe furnished shall be in accordance with the specification requirements, shall bear a suitable identification brand or mark and shall be replaced without cost to the Commission when not in accordance with the specified requirements. The guarantee shall be worded such that the guarantee will remain in effect as long as the manufacturer continues to furnish material. The manufacturer shall conduct tests and measurements as necessary to ensure the material produced complies with all specification requirements. These tests and measurements shall be identified by the identification symbols or code used on the pipe in a manner that will permit the manufacturer to produce specific reports showing test results representative of specific lots of polyethylene pipe. Copies of reports of these tests shall be kept on file and shall be submitted to the engineer upon request. The brand shall be removed or obliterated by the manufacturer on all material where control tests, as outlined herein, are not in accordance with this specification.

(d) Units of measurement, English or metric, used to fabricate the pipe.

Delete Sec 1047.4.2 through 1047.4.3.1 and substitute the following: ***10/08***

1047.4.2 Maintaining Qualification. To maintain qualification, the manufacturer shall perform and maintain a quality control program in accordance with the NTPEP Certification Program. The manufacturer's NTPEP certification shall be maintained. The manufacturer shall maintain for three years a record of all test results, inspections and the bill of lading for each shipment of material used in the production of pipe and for each shipment of pipe. The manufacturer shall notify Construction and Materials at least 24 hours prior to each shipment of pipe to a MoDOT project. Additional pipe may be considered part of the original shipment when the ordered quantity was underestimated or material was lost or damaged. A bill of lading in accordance with Sec 1047.6 shall be provided for each shipment of pipe.

1047.4.3 Disqualification of a Manufacturer. A manufacturer may be disqualified to provide pipe for use on MoDOT projects based on the discretion of Construction and Materials, for reasons including, but not limited to, not maintaining NTPEP certification, failure of material to consistently meet specifications, falsification of documentation, misbranding of pipe, unsatisfactory performance in the field or for other reasons indicating lack of consistent material quality.

1047.4.3.1 In the case where a manufacturer loses NTPEP certification and was not disqualified for any other reason, reinstatement will be considered when the manufacturer is recertified by NTPEP.

SECTION 1048 – PAVEMENT MARKING MATERIAL

Delete Sec 1048 in its entirety and substitute the following: ***10/07***

SECTION 1048

PAVEMENT MARKING MATERIAL

1048.1 Scope. This specification covers Type 1 and Type 2 preformed pavement marking tape, preformed removable pavement marking tape, preformed short-term pavement marking tape, drop-on glass beads, temporary raised pavement markers, snowplowable raised pavement markers, epoxy pavement marking paint, acrylic copolymer fast dry pavement marking paint and acrylic waterborne pavement marking paint.

1048.1.1 Certification and Acceptance. All material contained in Sec 1048 shall be in accordance with the following requirements.

1048.1.1.1 To obtain approval of the material, the manufacturer shall submit material and application specifications, samples of the material, and a history of satisfactory use to Construction and Materials for testing and evaluation. The sample quantity submitted shall be at the discretion of Construction and Materials. The approval process shall not be initiated prior to obtaining the concurrence of Construction and Materials. Following testing and evaluation, satisfactory material will be placed on a qualified list.

1048.1.1.2 For acceptance on a project, the contractor shall furnish to the engineer a manufacturer's certification stating the manufacturer and trade name, lot or batch number and that all material furnished is similar to the material originally qualified. For extruded or hot-spray thermoplastic, the certification shall state the specific gravity of the lot or batch. Acceptance of the material will be based on the manufacturer's certification, the results of such tests that may be performed by the engineer and satisfactory performance in the field.

1048.1.1.3 The material may be inspected and sampled at the point of manufacture, at an intermediate shipping terminal or at destination. The engineer shall be allowed access to all facilities and records as required to conduct inspection and sampling. The contractor shall adequately mix the contents of all shipping containers prior to obtaining samples or transferring partial containers of material to tanks on the striping equipment.

SECTION 1048.10 PREFORMED PAVEMENT MARKING TAPE

1048.10.1 Type 1 Preformed Pavement Marking Tape.

1048.10.1.1 Application. On bituminous surfaces, Type 1 preformed pavement marking tape shall be capable of being installed onto wearing surfaces during the final roller operation. Application on concrete surfaces shall be in accordance with the manufacturer's application recommendations. After application, the tape shall be immediately ready to receive traffic.

1048.10.1.2 Composition. The tape shall consist of a mixture of polymeric material, pigments and glass beads distributed throughout the cross-sectional area, with a reflective layer of glass beads embedded in the top surface. The tape shall be sufficiently flexible to conform to the roadway without cracking or breaking.

1048.10.1.3 Dimensions. The tape, without adhesive, shall have a minimum thickness of 60 mils (1.5 mm). A patterned surface will be allowable but the tape shall have a minimum thickness of 60 mils (1.5 mm) over at least 50 percent of the tape's surface. The edges of the tape shall not be tapered.

1048.10.1.4 Adhesive. The tape shall be supplied with a precoated factory-applied adhesive for immediate application to bituminous pavement without the use of heat, solvent or other adhesive operations. The tape and adhesive shall be of a type that water used on the compaction roller will not be detrimental to successful application. On concrete surfaces, application shall be in accordance with the manufacturer's recommendations.

1048.10.1.5 Reflectance. The tape shall have a minimum specific luminance as shown in the table below, expressed as millicandelas per footcandle per square foot (millicandelas/lux/m^2). The tape shall be applied to an 8 x 36-inch (200 x 900 mm) panel in a longitudinal orientation and measured in accordance with MoDOT Test Method TM 8 at an 86-degree entrance angle.

Type I Preformed Pavement Marking Tape Reflectance Requirements		
Observation Angle	**White**	**Yellow**
0.2 degree	550	410
0.5 degree	380	250

1048.10.2 Type 2 Preformed Pavement Marking Tape

1048.10.2.1 Application. After application, the tape shall be immediately ready to receive traffic.

1048.10.2.2 Composition. Type 2 preformed pavement marking tape shall consist of a mixture of polymeric material and pigments with beads distributed throughout the cross-sectional area and with a reflective layer of ceramic beads embedded in the embossed, patterned surface. The patterned surface shall have 50 percent ± 15 percent of the surface area raised and presenting a near vertical face (angle of 0 degrees to 60 degrees from vertical) to traffic from any direction. The channels between the raised areas shall be substantially free of exposed beads or particles. The marking shall be capable of adhering to bituminous or concrete surfaces by a flexible conforming backing. A primer may be required to precondition the pavement surface.

1048.10.2.3 Dimensions. The tape, without adhesive, shall have a patterned surface with a minimum thickness of 65 mils (1.65 mm) in the raised (thickest) area of the cross section and a minimum thickness of 20 mils (0.5mm) in the depressed (thinnest) areas of the cross section.

1048.10.2.4 Adhesive. The tape shall be supplied with a precoated factory-applied pressure sensitive adhesive.

1048.10.2.5 Reflectance. The tape shall have a minimum specific luminance as shown in the table below, expressed as millicandelas per footcandle per square foot (millicandelas/lux/m^2). The tape shall be applied to an 8 x 36-inch (200 x 900 mm) panel in a longitudinal orientation and measured in accordance with MoDOT Test Method TM 8.

Type II Preformed Pavement Marking Tape Reflectance Requirements			
Entrance Angle	**Observation Angle**	**White**	**Yellow**
86.0	0.2 degree	1100	800
86.5	1.0 degree	700	475

1048.10.2.6 Index of Refraction. The ceramic beads on the raised, patterned surface of the material shall have a minimum index of refraction of 1.70 when tested using the liquid oil immersion method. Ceramic beads with an index of refraction greater than 1.80 shall not be used. The beads mixed into the pliant polymer shall have a minimum index of refraction of 1.50 when tested by the oil immersion method.

SECTION 1048.20 PREFORMED REMOVABLE PAVEMENT MARKING TAPE

1048. 20.1 General. Preformed removable pavement marking tape shall be capable of being removed and shall leave no objectionable or misleading image or damage to the pavement after removal.

1048. 20.2 Reflectance. Tape shall have a minimum specific luminance as shown in the table below, expressed as millicandelas per footcandle per square foot (millicandelas/lux/m^2). The tape shall be applied to an 8 x 36-inch (200 x 900 mm) panel in a longitudinal orientation and measured in accordance with MoDOT Test Method TM 8 at an 86-degree entrance angle.

Preformed Removable Pavement Marking Tape Reflectance Requirements		
Observation Angle	**White**	**Yellow**
0.2 degree	1750	1300
0.5 degree	1250	800

1048. 20.3 Adhesive. Tape shall have a pre-coated pressure sensitive adhesive requiring no activation procedures. The adhesive shall be resistant to normal roadway chemicals or materials.

1048. 20.4 Durability. The tape shall be weather-resistant and show no appreciable fading, lifting or shrinkage during the tape's useful life. Samples of the tape applied to standard specimen plates and tested in accordance with Federal Test Method No. 141, Method 6192, for 1000 cycles, using a CS-17 wheel and 1000-gram load shall not expose the backing material over more than five percent of the abraded area.

SECTION 1048.30 PREFORMED SHORT TERM PAVEMENT MARKING TAPE

1048.30.1 Reflectance. The tape shall have a minimum specific luminance as shown in the table below, expressed as millicandelas per footcandle per square foot (millicandelas/lux/m^2). The tape shall be applied to an 8 x 36-inch (200 x 900 mm) panel in a longitudinal orientation and measured in accordance with MoDOT Test Method TM 8 at an 86-degree entrance angle.

Preformed Short Term Pavement Marking Tape Reflectance Requirements		
Observation Angle	**White**	**Yellow**
0.2 degree	1350	800
0.5 degree	750	500

1048.30.2 Adhesive. Tape shall have a pre-coated pressure sensitive adhesive requiring no activation procedures. Adhesive shall be resistant to normal roadway chemicals or materials.

1048.30.3 Durability. The tape shall be weather-resistant and show no appreciable fading, lifting or shrinkage during the tape's useful life. Samples of the tape applied to standard specimen plates and tested in accordance with Federal Test Method No. 141, Method 6192, for 1000 cycles, using a CS-17 wheel and 1000-gram load shall not expose the backing material over more than five percent of the abraded area.

SECTION 1048.40 DROP-ON GLASS BEADS

1048.40.1 General. When tested in accordance with MoDOT Test Method TM 70 for water resistance, the beads shall show no readily discernible dulling and the amount of 0.1 normal hydrochloric acid needed to titrate the filtrate shall not exceed 4.5 mL. When tested in accordance with MoDOT Test Method TM 70 for calcium chloride and sodium sulfide resistance, the beads shall show no readily discernible darkening or dulling.

1048.40.2 Type 1 Drop-On Glass Beads. Type 1 beads shall be moisture-resistant and manufactured from glass of a composition that is highly resistant to traffic wear and to the effects of weathering. Glass beads shall be in accordance with AASHTO M 247, Type 1.

1048.40.3 Type L Drop-On Glass Beads. Type L beads shall be embedment coated and manufactured from glass of a composition that is highly resistant to traffic wear and to the effects of weathering. The beads shall be in accordance with AASHTO M 247, Type 1, except as follows.

1048.40.3.1 Coating. The beads shall be coated to ensure satisfactory embedment and adhesion when applied to uncured traffic marking material. The coating shall be tested in accordance with MoDOT Test Method TM 70.

1048.40.3.2 Roundness. Type L beads shall have a minimum of 80 percent rounds per screen for the two highest sieve quantities, and no more than 3 percent angular particles per screen, as determined by visual inspection. The remaining sieve fractions shall be determined visually per aspect ratio using microfiche reader to be no less than 75 percent rounds. The tests shall be in accordance with Federal Lands Highway - Test Method T520-93.

1048.40.3.3 Gradation. Type L beads shall meet the following gradation requirements when tested in accordance with ASTM D 1214:

Type L Bead Gradation Requirements	
Sieve Size	**Percent Passing**
No. 12 (1.7 mm)	100
No. 14 (1.4 mm)	95 - 100

No. 16 (1.18 mm)	80 - 98
No. 18 (1.00 mm)	10 - 42
No. 20 (850 µm)	0 - 7
No. 25 (710 µm)	0 - 2

1048.40.4 Intermix Beads. Intermix beads shall be uncoated, and in accordance with AASHTO M 247, Type 1. Intermix beads shall be uniformly mixed throughout the thermoplastic material at the rate of no less than 30 percent, by weight (mass) of the thermoplastic material.

1048.40.5 Type P Drop-On Glass Beads. Type P beads shall be manufactured from glass of a composition that is highly resistant to traffic wear and to the effects of weathering. If coating is required to meet the performance requirements for the specific marking material used, the beads shall be coated to ensure satisfactory embedment and adhesion. Glass beads shall have a minimum of 95 mass percent passing a No. 18 (1 mm) sieve and a maximum of 5 mass percent passing a No. 100 (150 µm) sieve.

SECTION 1048.50 TEMPORARY RAISED PAVEMENT MARKERS

1048.50.1 General. The brand name and manufacturer shall be stamped or indelibly printed on each container.

1048.50.2 Type 1 Temporary Raised Pavement Markers. Markers shall consist of an L-shaped or T-shaped flexible polymer body with prismatic reflective tape on both faces of the vertical section. The prismatic reflective faces shall be a minimum of 0.38 square inches (0.0002 m^2) for each face. The marker base shall have affixed a pressure-sensitive adhesive, protected by a release paper, for application to the pavement surface. A protective sleeve that prevents contamination of the reflective faces during pavement surface treatment operations shall be affixed to each marker. The protective sleeve shall be easily removable after the work is complete.

1048.50.3 Type 2 Temporary Raised Pavement Markers. Markers shall consist of a plastic shell with prismatic reflective faces with a minimum of 0.38 square inches (0.0002 m^2) of reflective surface for each face. If reflective faces are specified on both sides, the faces shall be 180 degrees opposed. The marker shall be fitted with a pressure-sensitive adhesive for application to a primed surface or may be applied to the pavement surface with a bituminous adhesive material.

SECTION 1048.60 EPOXY PAVEMENT MARKING MATERIAL

1048.60.1 General. Epoxy pavement marking material shall not contain toxic heavy metals. The material shall be two-component, 100 percent solids and formulated and tested to perform as a pavement marking material with glass beads applied to the surface. The two components shall be epoxy resin and an amine curing agent.

1048.60.2 Toxicity. Upon heating to application temperature, the material shall not release fumes that are toxic to persons or property. Upon curing, the material shall be completely inert, with all components fully reacted and environmentally benign.

104860.3 No Track Time. The material shall have a no-track time of 10 minutes or less, when mixed in the proper proportions and applied at a 25-mil (0.635 mm) wet film thickness at 75 ± 2 F (24 ± 1 C) with the proper application of glass beads and when tested in accordance with ASTM D 711. The material shall fully cure under a constant surface temperature of 32 F (0 C) or above.

1048.60.4 Adhesion to Concrete. The pavement marking material shall have a high degree of adhesion to the concrete surface such that there is a 100 percent concrete failure when tested in accordance with ACI 503, Appendix A.1. The prepared specimens shall have a film thickness of 15 ± 1 mil (0.381 ± 0.025 mm) and shall be applied to concrete with a minimum compressive strength of 4000 psi (28 MPa). The concrete surface shall be 90 ± 2 F (32 ± 1 C) when the material is applied. The applied material shall be cured for 72 hours at 75 ± 2 F (24 ± 1 C) before performing the test.

1048.60.5 Hardness. The material shall have a minimum Shore D Hardness of 75 when tested in accordance with ASTM D 2240.

1048.60.6 Tensile Strength. The material shall have a minimum tensile strength of 5000 psi (34 MPa) after 72 hours of cure at 75 ± 2 F (24 ± 1 C) when tested in accordance with ASTM D 638.

1048.60.7 Compressive Strength. The material shall have a minimum compressive strength of 10,000 psi (69 MPa) after 72 hours of cure at 75 ± 2 F (24 ±1 C) when tested in accordance with ASTM D 695.

1048.60.8 Abrasion Resistance. The material shall have a maximum abrasion resistance of 150 mg at 15 ± 1 mil (0.375 ± 0.025 mm) thickness after 72 hours of cure and with a CS-17 wheel under a load of 1000 grams for 1000 cycles, when tested in accordance with ?ASTM C 501.

1048.60.9 Yellowness Index. The material shall have a maximum yellowness index of 6 before the QUV test and a maximum of yellowness index of 23 after the 72-hour QUV test, when tested in accordance with ASTM D 1925.

104860.10 Color. The finished white color shall be free from tint, furnishing good opacity and visibility under both daylight and artificial light. The finished yellow color shall closely match Federal Test Standard 595 - Color Chip Number 13538.

1048.60.11 Drop-on Glass Beads. Type P glass beads shall be in accordance with Sec 1048.40.5.
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1048.60.12 Qualification. In addition to the requirements of Sec 1048.1.1, the material shall have been field tested at NTPEP test decks in a northern, wet climate region for a minimum of six months. The maintained retroflectivity and durability shall be in accordance with the following requirements after being installed on at least one NTPEP test deck for a minimum of six months, including December, January and February.

1048.60.12.1 Maintained Retroreflectivity. Photometric quantity to be measured will be the coefficient of retroreflective luminance (R_L) in accordance with ASTM E 1743 for 15-meter geometry or ASTM E 1710 for 30-meter geometry. The average R_L for concrete and asphalt surfaces shall be expressed in millicandelas per footcandle per square foot (millicandelas/lux/m^2) and shall be at least 125 for 15-meter geometry or 100 for 30-meter geometry, when measured in the wheel path area.

1048.60.12.2.2 Durability. Paint shall have a durability rating of at least 5 for both concrete and asphalt surfaces when tested in the wheel path area of the NTPEP test deck.

1048.60.13 Packaging. The manufacturer's name and address, product name, color, manufacturing date, date of expiration and if the material is Part A or B shall be visible on the containers. In addition to the requirements of Sec 1048.1.1, the certification supplied by the manufacturer shall include reference to the specific NTPEP test deck to which the paint formulation was applied, including NTPEP identification numbers and report numbers.

Section 1048.70 Polyurea Pavement Marking Material

1048.70.1 Polyurea Pavement Marking Material. Polyurea pavement marking material shall not contain toxic heavy metals. It shall be two component, 100 percent solids, and formulated and tested to perform as a pavement marking material with glass beads applied to the surface.

1048.70.2 Toxicity. Upon heating to application temperature, the material shall not release fumes that are toxic to persons or property. Upon curing, the material should be completely inert, with all components fully reacted and environmentally benign.

1048.70.3 No Track Time. The material shall have a no-track time of 10 minutes or less when mixed in the proper proportions and applied at 20 mils (0.508 mm) wet film thickness at 75 ± 2 F (24 ± 1 C) with the proper application of glass beads and when tested in accordance with ASTM D 711. The material shall fully cure under a constant surface temperature of 32 F (0 C) or above.

1048.70.4 Adhesion to Concrete. The pavement marking material shall have a high degree of adhesion to the concrete surface such that there is a 100 percent concrete failure when tested in accordance with ACI 503, Appendix A.1. The prepared specimens shall have a film thickness of 15 ± 1 mils (0.375 ±0.025 mm) and be applied to concrete with a minimum compressive strength of 4000 psi (28 MPa). The concrete surface shall be 90 ± 2 F (32 ± 1 C) when the material is applied. The applied material shall be cured for 72 hours at 75 ± 2 F (24 ± 1 C) before performing the test.

1048.70.5 Hardness. The material shall have a minimum Shore D Hardness of between 70 and 100 when tested in accordance with ASTM D 2240.

1048.70.6 Abrasion Resistance. The material shall have a maximum abrasion resistance of 150 mg at 15 ± 1 mils (0.375 ± 0.025 mm) thickness after 72 hour curing time and with a CS-17 wheel under a load of 1000 grams for 1000 cycles, when tested in accordance with ASTM C 501.

1048.70.7 Yellowness Index. The material shall have a maximum yellowness index of 6 before the QUV test and a maximum of 23 after the 72 hour QUV test, when tested in accordance with ASTM D 1925.

1048.70.8 Color. The finished white color shall be free from tint, furnishing good opacity and visibility under both daylight and artificial light. The finished yellow color shall be defined by Federal Test Standard 595 - Color Chip Number 13538, using Federal Tests Standard 141 (Method 4252).

1048.70.9 Accelerated Weathering. The material shall have been field tested at NTPEP test decks for a minimum of six months. The material shall have satisfactory results from the NTPEP test deck.

1048.70.10 Drop-on Glass Beads. Type P moisture-resistant glass beads shall be in accordance with Sec 1048.40.5 Type P Drop-On Glass Beads.

1048.70.11 Qualification. In addition to the requirements of Sec 1048.1.1, the material shall have been field tested at NTPEP test decks in a northern, wet climate region for a minimum of six months. The maintained retroflectivity and durability shall be in accordance with the following requirements after being installed on at least one NTPEP test deck for a minimum of six months, including December, January and February.

1048.70.11.1 Maintained Retroreflectivity. Photometric quantity to be measured will be the coefficient of retroreflective luminance (R_L) in accordance with ASTM E 1743 for 15-meter geometry or ASTM E 1710 for 30-meter geometry. The average R_L for concrete and asphalt surfaces shall be expressed in millicandelas per footcandle per square foot (millicandelas/lux/m^2) and shall be at least 125 for 15-meter geometry or 100 for 30-meter geometry, when measured in the wheel path area.

1048.70.11.2 Durability. Paint shall have a durability rating of at least 5 for both concrete and asphalt surfaces when tested in the wheel path area of the NTPEP test deck.

1048.70.12 Packing. The pavement marking material shall be shipped to the job site in strong, substantial containers. The manufacturer shall include the MSDS with each shipment. The manufacturer's name and address, name of the product, lot number and/or batch number, color, tare weight, manufacturing date, date of expiration, mixing proportions and if it is Part A or B shall be contained on a label and/or painted on the containers.

SECTION 1048.80 ACRYLIC COPOLYMER FAST DRY PAVEMENT MARKING PAINT

1048.80.1 Description. Acrylic copolymer fast dry pavement marking paint shall be capable of receiving and holding glass beads for producing retroreflective pavement marking.

1048.80.2 Material. The paint shall contain no more than 3200 ppm lead or more than 800 ppm chromium based on dry weight, and shall have limited VOC content as noted herein.

1048.80.2.1 General. The finished paint shall be formulated and manufactured from first-grade material and shall be a fast drying, solvent-based, acrylic copolymer resin type paint capable of withstanding air and roadway temperatures without bleeding, staining, discoloring or deforming. The dried paint film shall be capable of maintaining original dimensions and placement without chipping, spalling or cracking. The dry paint film shall not deteriorate because of contact with normal roadway chemicals or materials.

1048.80.2.2 Durability Testing. Determination of conformance to this specification will include, but will not be limited to, the evaluation of test data from NTPEP or other MoDOT approved facilities. The maintained retroreflectivity and durability shall be in accordance with the following requirements after being installed on at least one NTPEP test deck in a northern, wet climate region for at minimum of six months, including December, January and February.

1048.80.2.2.1 Maintained Retroreflectivity. Photometric quantity to be measured will be the coefficient of retroreflective luminance (R_L) in accordance with the requirements of ASTM E 1743 for 15-meter geometry or ASTM E 1710 for 30-meter geometry. The average R_L for concrete and bituminous surfaces shall be expressed in millicandelas per footcandle per square foot (millicandelas/lux/m^2) and shall be at least 100 for 15-meter geometry or 75 for 30-meter geometry, when measured in the wheel path area.

1048.80.2.2.2 Durability. Paint shall have a durability rating of at least 4 for both concrete and bituminous surfaces when tested in the wheel path area of the NTPEP test deck.

1048.80.2.3 Mixed Paint.

1048.80.2.3.1 The mixed paint shall be strained before filling, using a screen or a sieving device no coarser than 40 mesh.

1048.80.2.3.2 The VOC content of the finished paint shall be less than 1.25 pounds of volatile organic matter per gallon (150 g/L) of total non-volatile paint material when tested in accordance with ASTM D 3960.

1048.80.2.3.3 The paint shall have the following physical properties.

Property	Requirement
Viscosity, KU	80 - 95
Laboratory Dry Time, ASTM D 711, minutes, max.	10

1048.80.2.3.3.1 Color. For white, the color shall closely match Color Chip 37925 of Federal Standard 595b. For yellow, the color shall closely match Color Chip 33538 of Federal Standard 595b. Color determination will be made for markings and the diffuse daytime color of the markings shall be in accordance with the below CIE Chromaticity coordinate limits. Color determination for liquid marking materials will be made over the black portion of a 2A or 5C Leneta Chart or equal, at least 24 hours after application of a 15-mil (380 µm) wet film. Color readings will be determined in accordance with the requirements of ASTM E 1349 using CIE 1931 2-degree standard observer and CIE standard illuminant D65.

CIE Chromaticity Coordinate Limits (Initial)								
Color	1		2		3		4	
	x	y	x	y	x	y	x	y
White	0.334	0.357	0.334	0.317	0.297	0.357	0.297	0.317
Yellow	0.531	0.483	0.531	0.429	0.471	0.483	0.471	0.429

1048.80.2.3.3.2 Contrast Ratio. The contrast ratio shall be a minimum of 0.98 when drawn down as a 15-mil (380 µm) wet film on a 2A or 5C Leneta Chart or equal, and air-dried for 24 hours. The contrast ratio shall be calculated as follows: Contrast ratio = Black/White.

1048.80.2.3.3.4 Reflectance. The daylight directional reflectance of a 15-mil (380 µm) wet film applied to a 2A or 5C Leneta Chart or equal and dried for a minimum of 24 hours shall be 84% minimum for the white paint and 50% minimum for the yellow paint.

1048.80.3. Acceptance.

1048.80.3.1 Except as noted, each batch or lot of paint shall be sampled and approved by the engineer prior to use.

1048.80.3.2 No paint shall be used that is more than 15 months old.

1048.80.3.3 In addition to the requirements of Sec 1048.1.1, the certification supplied by the manufacturer shall include reference to the specific NTPEP test deck to which the paint formulation was applied, including NTPEP identification numbers and report numbers.

SECTION 1048.90 HIGH BUILD ACRYLIC WATERBORNE PAVEMENT MARKING PAINT

1048.90.1 Description. Acrylic waterborne pavement marking paint shall be capable of receiving and holding glass beads for producing retroreflective pavement marking.

104890.2 Material. The paint shall contain no more than 3200 ppm lead or more than 800 ppm chromium, based on dry weight.

1048.90.2.1 General. The finished paint shall be formulated and manufactured from quality material and shall be a fast-drying, water-based, acrylic resin-type paint capable of withstanding air and roadway temperatures without bleeding, staining, discoloring or deforming. The dried paint film shall be capable of maintaining original dimensions and placement without chipping, spalling or cracking. The dry paint film shall not deteriorate from contact with normal roadway chemicals or materials.

1048.90.2.2 Acrylic Emulsion Polymer. The acrylic emulsion polymer used in the manufacture of the paint shall be Rohm & Haas HD-21, Dow DT400 or equal.

Delete Sec 1048.90.2.3 and substitute the following: ***10/08***

1048.90.2.3 Durability Testing. Determination of conformance to this specification will include, but will not be limited to, the evaluation of test data from NTPEP or other MoDOT approved facilities. The maintained retroreflectivity and durability shall be in accordance with the following requirements after being installed on at least one NTPEP test deck in a northern climate region for at minimum of six months, including December, January and February.

1048.90.2.3.1 Maintained Retroreflectivity. Photometric quantity to be measured will be the coefficient of retroreflective luminance (R_L) in accordance with the requirements of ASTM E 1743 for 15-meter geometry or ASTM E 1710 for 30-meter geometry. The average R_L for concrete and bituminous surfaces shall be expressed in millicandelas per footcandle per square foot (millicandelas/lux/m^2) and shall be at least 100 for 15-meter geometry or 75 for 30-meter geometry, when measured in the wheel path area.

1048.90.2.3.2 Durability. Paint shall have a durability rating of at least 4 for both concrete and bituminous surfaces when tested in the wheel path area of the NTPEP test deck.

1048.90.3 Mixed Paint.

1048.90.3.1 The paint shall be strained before filling using a screen or a sieving device no coarser than 40 mesh or equivalent.

1048.90.3.2 The volatile content of the finished paint shall contain less than 150 grams of volatile organic matter per liter in accordance with ASTM D 3960.

1048.90.3.3 The paint shall have the following physical properties:

Acrylic Waterborne Pavement Marking Paint Physical Properties	
Property	**Requirement**
Viscosity, 77 F (25 C), KU	83-98
Grind (Hegman Gage), minimum	3
Laboratory Dry Time, ASTM D 711, @ 15 mil, minutes, max.	10
Laboratory Dry Time, ASTM D 711, @ 25 mil, minutes, max.	25
Dry Through Time, minutes, max.	150

1048.90.3.3.1 Color. For white, the color shall closely match Color Chip 37925 of Federal Standard 595b. For yellow, the color shall closely match Color Chip 33538 of Federal Standard 595b. Color determination will be made for markings and the diffuse daytime color of the markings shall be in accordance with the below CIE Chromaticity coordinate limits. Color determination for liquid marking material will be made over the black portion of a 2A or 5C Leneta Chart or equal, at least 24 hours after application of a 15-mil wet film. Color readings will be determined

in accordance with the requirements of ASTM E 1349 using CIE 1931 2-degree standard observer and CIE standard illuminant D65.

CIE Chromaticity Coordinate Limits (Initial)								
Color	**1**		**2**		**3**		**4**	
	x	**y**	**x**	**y**	**x**	**y**	**x**	**y**
White	0.334	0.357	0.334	0.317	0.297	0.357	0.297	0.317
Yellow	0.531	0.483	0.531	0.429	0.471	0.483	0.471	0.429

1048.90.3.3.2 Flexibility. The paint shall show no cracking or flaking when tested in accordance with Federal Specification TT-P-1952B.

1048.90.3.3.3 Water Resistance. The paint shall conform to Federal Specification TT-P-1952B. There shall be no blistering or appreciable loss of adhesion, softening or other deterioration after examination.

1048.90.3.3.4 Freeze-Thaw Stability. The paint shall show no coagulation or change in consistency greater than 10 Kreb Units when tested in accordance with Federal Specification TT-P-1952B.

1048.90.3.3.5 Heat Stability. The paint shall show no coagulation, discoloration or change in consistency greater than 10 Kreb Units when tested in accordance with Federal Specification TT-P-1952B.

1048.90.3.3.6 Dilution Test. The paint shall be capable of dilution with water at all levels without curdling or precipitation such that the wet paint can be readily cleaned up with water only.

1048.90.3.3.7 Storage Stability. After 30 days of storage in a 3/4 filled, closed container, the paint shall show no caking that cannot be readily remixed to a smooth, homogeneous state, and shall show no skinning, livering, curdling or hard settling. The viscosity shall change no more than 5 Kreb Units from the viscosity of the original sample.

1048.90.3.3.8 Contrast Ratio. The minimum contrast ratio (hiding power) shall be 0.96 when drawn down with a 0.005 bird film applicator on a 2A or 5C Leneta Chart or equal and air-dried for 24 hours. The contrast ratio shall be calculated as follows: Contrast Ratio = Black/White.

1048.90.3.3.9 Reflectance. The daylight directional reflectance of a 15-mil (380 µm) wet film, applied to a 2A or 5C Leneta Chart or equal and dried for a minimum of 24 hours, shall be no less than 84 percent for the white paint and no less than 50 percent for the yellow paint.

1048.90.3.3.10 Bleeding. The paint shall have a minimum bleeding ratio of 0.97 when tested in accordance with Federal Specification TT-P-1952B. The asphalt saturated felt shall be in accordance with ASTM D 226 for Type I.

1048.90.3.3.11 Dry Through Time. The paint shall be applied to a non-absorbent substrate at a wet film thickness of 15 ± 1 mil and placed in a humidity chamber controlled at 90 ± 5 percent relative humidity and 72.5 ± 2.5 F (22.5 ± 1.4 C). The dry through time shall be determined in accordance with ASTM D 1640, except that the pressure exerted shall be the minimum needed to maintain contact with the thumb and film.

1048.90.4 Acceptance.

1048.90.4.1 Except as noted, each batch or lot of paint shall be sampled and approved by the engineer prior to use.

1048.90.4.2 No paint shall be used that is more than 15 months old.

1048.90.4.3 In addition to the requirements of Sec 1048.1.1, the certification supplied by the manufacturer shall include reference to the specific NTPEP test deck to which the paint formulation was applied, including NTPEP identification numbers and report numbers.

Amend Sec 1048 to include the following: ***10/08***

1048.100 STANDARD ACRYLIC WATERBORNE PAVEMENT MARKING PAINT.

1048.100.1 Description. Standard acrylic waterborne pavement marking paint shall be capable of receiving and holding glass beads for producing retroreflective pavement marking.

1048.100.2 Material. The paint shall contain on more than 3200 ppm lead or more than 800 ppm chromium, based on dry weight.

1048.100.2.1 General. The finished paint shall be formulated and manufactured from quality material and shall be a fast-drying, water-based, acrylic resin-type paint capable of withstanding air and roadway temperatures without bleeding, staining, discoloring or deforming. The dried paint film shall be capable of maintaining original dimensions and placement without chipping, spalling or cracking. The dry paint film shall not deteriorate from contact with normal roadway chemicals or materials.

1048.100.2.2 Acrylic Emulsion Polymer. The acrylic emulsion polymer used in the manufacture of the paint shall be Rohm & Haas E-2706, Dow DT211 or equal. Later generation acrylic emulsions may be substituted as approved by the engineer.

1048.100.2.3. Durability Testing. The provisions of section 1048..90.2.3 will apply.

1048.100.2.3.1 Maintained Retroreflectivity. Photometric quantity to be measured will be the coefficient of retroreflective luminance (R_L) in accordance with the requirements of ASTM E 1743 for 15-meter geometry or ASTM E 1710 for 30-meter geometry. The average R_L for concrete and bituminous surfaces shall be expressed in millicandelas per footcandle per square foot (millicandelas/lux/m^2) and shall be at least 100 for 15-meter geometry or 75 for 30-meter geometry, when measured in the wheel path area.

1048.100..2.3.2 Durability. Paint shall have a durability rating of at least 4 on both concrete and bituminous surfaces when tested in the wheel path area of the NTPEP test deck..

1048.100.3 Mixed Paint The provisions of Sec 1048.90.3 shall apply.

1048.100.4 Acceptance.

1048.100.4.1 Except as noted, each batch or lot of paint shall be sampled and approved by the engineer prior to use.

1048.100.4.2 No paint shall be used that is more than 15 months old.

1048.100.4.3 In the addition to the requirements of Sec 1048.1.1, the certification supplied by the manufacture shall include reference to specific NTPEP test deck to which the paint formulation was applied, including NTPEP identification numbers and report numbers.

<u>SECTION 1056 – CONCRETE TINTING MATERIAL</u>

Delete Sec 1056 and substitute the following: ***03/07***

SECTION 1056

CONCRETE TINTING MATERIAL

1056.1 Scope. This specification covers material for tinting concrete as shown on the plans.

1056.2 Acceptance. The contractor shall supply the engineer with a manufacturers certification indicating that the material supplied is in accordance with this specification.

1056.3 Concrete Tinting Material. This material shall consist of a homogeneous mixture mineral oxide pigment of an approved tint with such other additives as deemed necessary by the manufacturer. The tinting material shall conform to specification outlined on ASTM C979. The material shall be free from oil, grease, dirt and nonferrous

particles. The tinting material shall not contain any material that might promote oxidation of the iron particles if exposed to air and moisture, or that might have any detrimental effect on concrete.

SECTION 1057 – MATERIAL FOR JOINTS

Delete Sec 1057.8 and substitute the following: ***04/08***

1057.8 Plastic Joint Compound for Vitrified Clay and Concrete Pipe. Plastic joint compound shall be a homogeneous blend of bituminous or butyl rubber material, inert filler and suitable solvents or plasticizing compounds thoroughly mixed at the factory to a uniform consistency suitable for sealing joints of vitrified clay and concrete pipe. The physical requirements of the compound shall be in accordance with ASTM C 990. Trowel grade material shall conform to the following requirement:.

Bitumen, soluble in CS2 or Butyl Rubber (Hydrocarbon Blend), ASTM D482 with 1200F (649 C) max test temperature, percent by weight (mass), min	45
Ash, percent by weight (mass)	15-50
Penetration, standard cone, 150 g, 5 sec, 25 C – use 12 ounce (340 g) can	110-250

Primer, as recommended by the manufacturer, shall be used with extruded rope or flat tape types, if required to maintain the material in position while pipe sections are being joined.

Delete Sec 1057.12 and substitute the following: ***09/06***

1057.12 Backer Rod. The backer rod shall be closed-cell as recommend by the sealant manufacture or shall be in accordance with ASTM D 5249, Type 3.

SECTION 1061 – ELECTRICAL CONDUCTORS

Delete Sec 1061.1 and 1061.2 and substitute the following: ***02/08***

1061.1 General. This specification covers electrical conductors and associated material for use on highway construction projects. Contractor furnished equipment that will become the property of the Commission shall be of new stock unless stated otherwise in the contract documents. Electrical conductors and associated equipment shall be in accordance with applicable requirements of ICEA, IMSA, NEMA, EIA, NEC, NFPA and regulations of the National Board of Fire Underwriters and shall meet the approval of the engineer.

1061.2 Conductors. Except as noted, all conductors shall be soft drawn, Class B or C stranded copper wire in accordance with NEMA WC70/ICEA A-95-658. Solid conductors may be used only for grounding where connected to a ground rod.

Delete Sec 1061.4 and substitute the following: ***02/08***

1061.4 Low Voltage Power Cable. Low voltage power cable shall be 600-volt, single conductor cable and thermoplastic or thermosetting cross-linked polyethylene insulated. All cable shall be plainly marked on the outside with the manufacturer's name and identification in accordance with industry practice. Insulation type shall be THHN/THWN-2 orXHHW-2. Average thickness of insulation shall be no less than specified in the following table, with a minimum thickness of 90 percent thereof.

Size (AWG or kcmil)	**Thickness, Mils THHN/THWN-2)**
14-12	15
10	20
8-6	30
4-2	40
1-4/0	50

250-500	60
501-1000	70
Size (AWG or kcmil)	**Thickness, Mils THHN/THWN-2)**
14-10	30
8-2	45
1-4/0	55
213-500	65
501-1000	80

Delete Sec 1061.6 and substitute the following: ***02/08***

1061.6 Pole and Bracket Cable. Pole and bracket cable located in the lighting or signal pole that supplies electrical power to highway lighting shall consist of two single conductors. Wire size shall be No. 10 AWG (6 mm^2) in accordance with the requirements of low voltage power cable. Insulation type shall be THHN/THWN-2 or XHHW-2. Average insulation shall be in accordance with Sec 1061.4.

Delete Sec 1061.7 and substitute the following: ***02/08***

1061.7 Multi-Conductor Cable Multi-conductor cable for traffic signals shall be No. 16 AWG (4 mm^2), rated at 600 volts. The cable shall be in accordance with IMSA Specification No. 20-1.

SECTION 1063 – TEMPORARY TRAFFIC CONTROL DEVICES

Delete Sec 1063.3 through 1063.4 and substitute the following: ***08/07***
Renumber subsequent sections accordingly

1063.3 Channelizers and Tubular Markers. All channelizers and tubular markers shall be manufactured from a non-metallic material, pigmented and molded of a Highway Orange color throughout and stabilized against fading by ultraviolet or other light rays by the incorporation of adequate inhibitors. Drum-like channelizers shall be closed-top. Retroreflective marking, as shown on the plans, shall be in accordance with Sec 1042 and ASTM D 4956, Supplemental Requirements, Section S2. Retroreflective marking on cones will not be required.

1063.4 Signs.

Delete Sec 1063.8.2 through 1063.8.3 and substitute the following: ***06/07;08/07***

1063.7.2 Computer Interface. The CMS shall have a digital cellular transceiver capable of receiving a message in the location deployed from a remote location and forwarding the message to the CMS controller to change the displayed message.

1063.7.2.1 The CMS shall have the necessary hardware to allow the message to be changed from the CMS location without connection. A minimum 5-foot (1.5 m) connecting cable shall be provided to connect the CMS sign controller to a notebook computer. For on-sight operation, the CMS shall have a removable waterproof keyboard with display panel.

1063.7.2.2 The supplier shall provide the Commission the required software and licenses necessary to change the message from a remote location. This software shall be compatible with Windows 98, NT, XP, or 2000 operating systems and shall be able to issue -compatible modem commands. The supplier shall provide technical assistance with the installation and operation of software.

1063.7.3 Solar Power Supply. The power supply shall use a battery bank with sufficient capacity to operate a full display of characters for 30 consecutive days with no sun. All terminals and connections shall be clearly labeled.

Amend Sec 1063 to include the following; renumber subsequent sections accordingly: ***12/08***

1063.9 Portable Flagger Device. Each portable flagger device (PFD) system shall consist of four portable cart-mounted units. Each PFD unit shall provide a vertical upright with one signal head, vehicle detection, radio

controller, and self-contained power supply capable of operating the unit for 16 continuous hours. All components shall be capable of operating in a temperature range of –20 to 120 F (-30 to 50 C).

1063.9.1 Signal Heads and Indications. The signal head shall consist of three (red ball, amber ball, green ball) 12-inch LED signal indications. All signal heads shall be mounted on the vertical uprights with a minimum clearance of 7 feet when the upright is fully extended.

1063.9.2 Vehicle Detection. Detection shall be provided by one of the non-intrusive vehicular detection methods specified in Sec 902 with the capability of providing coverage for a 6-foot x 30-foot (1.8 m x 9 m) area.

1063.9.3 System Operation. The system shall be able to operate in a fixed-time, traffic-actuated, and manual-control mode. The system shall be MUTCD compliant with a controller and conflict monitor and include a wireless radio communication package and wireless remote.

SECTION 1065 – DELINEATORS

Delete Sec 1065 and substitute the following: ***11/05***

SECTION 1065
DELINEATORS

1065.1 Scope. This specification covers delineators for use in highway construction.

1065.2 Guardrail, Median Barrier Delineator Body. The delineator body shall be manufactured from high-impact, weather-resistant plastic and final body thickness shall be a minimum of 0.08 inch (2.03 mm). Dimensions shall be as shown on the plans.

1065.3 Channel Post Delineator Body. The delineator body shall be flat sheet in accordance with Sec 1042 and dimensions as shown on the plans.

1065.4 Retroreflective Sheeting. The retroreflective sheeting shall be an approved MoDOT Type 7 sheeting in accordance with Sec 1042. Retroreflective sheeting shall be permanently affixed to the body of the delineator. Manufacturer's certification shall be provided for delineator sheeting.

SECTION 1073 – JOINT MATERIAL FOR STRUCTURES

Amend Sec 1073 to include the following; renumber subsequent sections accordingly: ***12/08***

1073.2 Acceptance. All material under this specification shall be obtained from a source identified on the PAL designated for this specification. All material will be inspected and accepted in accordance with Sec 106.

Delete Sec 1073.5 and Sec 1073.6 and substitute the following: ***12/08***

1073.6 Documentation. Prior to approval and use of this material, the manufacturer shall submit to Construction and Materials a certified test report showing specific test results in accordance with all requirements of these specifications. The certified test report shall contain the manufacturer's name, brand name of material, lot tested and date of manufacture. In addition, the manufacturer shall submit a sample of the seal or polystyrene material and a one-pint (0.5 L) sample of the adhesive for laboratory testing, accompanied by a technical data sheet and an MSDS. With approval by the engineer of the certified test report and satisfactory results of tests performed on the sample submitted, the brand name and manufacturer will be placed on the appropriate pre-acceptance list. Pre-acceptance lists are available through Construction and Materials or MoDOT's web site. New certified test results and samples shall be submitted any time the manufacturing process or the material formulation is changed, and may be required when random sampling and testing of material offered for use indicates nonconformity with any of the requirements herein specified.

SECTION 1080 –STRUCTURAL STEEL FABRICATION

Delete Sec 1080.2 and substitute the following: ***06/08***

1080.2 Material. Except as amended by Sec 1080.2.4, all material shall be in accordance with Division 1000, Material Details, and specifically as follows:

Item	Section / Specification
Shear Connectors	1037
Paint for Structural Steel	1045
Coating of Structural Steel	1081
Structural Carbon Steel	AASHTO M 270, Grade 36 (250) ASTM A 709, Grade 36 (250)
Structural Low Alloy Steel	AASHTO M 270, Grade 50 (345) ASTM A 709, Grade 50 (345) AASHTO M 270, Grade 50W (345W) ASTM A 709, Grade 50W (345 W)
Quenched and Tempered Alloy Steel	AASHTO M 270, Grade HPS 50W (HPS 345W) ASTM A 709, Grade HPS 50W (HPS 345W) AASHTO M 270, Grade HPS 70W (HPS 485W) ASTM A 709, Grade HPS 70W (HPS 485W) ASTM A 709, Grade 100/100W (690/690W)
Low Carbon Steel Bolts and Nuts	ASTM A 307
High Strength Bolts, Nuts and Washers	AASHTO M 164 (ASTM A 325) AASHTO M 253 (ASTM A 490)
Cold Finished Carbon Steel Shafting	AASHTO M 169 (ASTM A 108)
Carbon Steel Forgings	AASHTO M 102 (ASTM A 668) Class F
Alloy Steel Forgings	AASHTO M 102 (ASTM A 668) Class G
Gray Iron Castings	AASHTO M 105 (ASTM A 48) Class 50
Malleable Iron Castings	ASTM A 47
Carbon Steel Castings	AASHTO M 103 (ASTM A 27) Grade 485-275
Galvanized Coatings	AASHTO M 111 (ASTM A 123)
Lead for Bearing Pads	ASTM B 29

Delete Sec 1080.2.5 through 1080.2.5.1 and substitute the following: ***06/08***

1080.2.5 High Strength Fastener Assemblies. In addition to the requirements of Sec 712.2, high strength bolts, nuts and washers shall meet the following requirements. The contractor shall furnish a manufacturer's certification showing results of tests performed. Identification in accordance with the appropriate AASHTO/ASTM specifications shall be maintained by container markings which shall match identifying numbers on the certifications and be traceable to the certified mill test reports. High strength fastener assemblies shall be galvanized unless used with unpainted weathering steel or specifically indicated otherwise by the contract documents. When high strength bolts are used with weathering steel, the fasteners shall be Type 3. AASHTO M 253 (ASTM A 490) bolts shall be installed black, tensioned and then cleaned and coated with the coating system as specified on the plans. The cleaning and the zinc coating shall not be applied by any process, which can cause hydrogen embrittlement. All certification testing requirements and mill test reports referenced in the following sections shall be in accordance with Sec 106.

1080.2.5.1 Bolts. All bolts shall be in accordance with AASHTO M 164 (ASTM A 325) except when ASSHTO M 253 (ASTM A 490) bolts are specified on the plans. If the contractor elects to use load indicator bolts, only a hex head will be permitted. The type of head used shall be consistent throughout the entire structure, unless otherwise approved by the engineer.

Delete Sec 1080.2.5.4.5 and substitute the following: ***06/08***

1080.2.5.4.5 Required Tension. The tension reached at the above rotation shall be equal to or greater than 1.15 times the required installation tension. The installation tension and the tension for the turn test for AASHTO M 164 (ASTM A 325) and ASSHTO M 253 (ASTM A 490) bolts shall be as follows:

Required Bolt Tensions									
Diameter, in.	**1/2**	**5/8**	**3/4**	**7/8**	**1.00**	**1-1/8**	**1-1/4**	**1-3/8**	**1-1/2**
(mm)	**(12.7)**	**(15.9)**	**(19.0)**	**(22.2)**	**(25.4)**	**(28.6)**	**(31.8)**	**(34.9)**	**(38.1)**
AASHTO M 164 (ASTM A 325)									
Req. Installation Tension, kips (kN)	12 (53)	19 (85)	28 (125)	39 (173)	51 (227)	56 (249)	71 (316)	85 (378)	103 (458)
Turn Test Tension, kips (kN)	14 (62)	22 (98)	32 (142)	45 (200)	59 (262)	64 (285)	82 (365)	98 (436)	118 (525)
AASHTO M 253 (ASTM A 490)									
Req. Installation Tension, kips (kN)	15 (627)	24 (107)	35 (156)	49 (218)	64 (285)	80 (356)	102 (454)	121 (538)	148 (658)
Turn Test Tension, kips (kN)	17 (76)	28 (125)	40 (178)	56 (249)	74 (329)	92 (409)	117 (520)	139 (618)	170 (756)

SECTION 1081 – COATING OF STRUCTURAL STEEL

Delete Sec 1081.2 and substitute the following: ***04/05***

1081.2 Systems of Coatings. The required system and color or choice of systems and color will be specified on the plans. Each coat of the specified system shall be applied to all structural steel, unless the contract specifically delineates otherwise. The system and color of coating to be shop-applied shall be shown on the shop drawings. All coatings shall comply with local VOC (Volatile Organic Compound) regulations where the paint is applied. The system and color shall not vary for any portion of the entire structure, including material for field repairs, and shall be compatible products of a single manufacturer. The contractor shall coordinate the various items of work to ensure compliance with the requirements of this section. Approved material specification and dry film thickness for the coating systems shall be as indicated in the following table:

Paint Systems for Structural Steel		
System G (High Solids, Inorganic Zinc Silicate-Epoxy-Polyurethane)		
Coating	**Specification**	**Dry Film Thickness mils (µm)**
Prime Coat	Sec 1045.3	3.0 (75) min.-6 (150) max.
Epoxy Intermediate Coat	Sec 1045.4	3.0 (75) min.-5 (125) max.
Polyurethane Finish Coat, Gray or Brown	Sec 1045.5	2.0 (50) min.-4 (100) max.
System H (High Solids, Inorganic Zinc Silicate-Waterborne Acrylic Intermediate-Waterborne Acrylic Finish)		
Coating	**Specification**	**Dry Film Thickness mils (µm)**
Prime Coat	Sec 1045.3	3.0 (75) min.-6 (150) max.
Waterborne Acrylic, Intermediate Coat	Sec 1045.6	2.0 (50) min.-4 (100) max.

Waterborne Acrylic, Finish Coat, Gray or Brown	Sec 1045.6	2.0 (50) min.-4 (100) max.
Calcium Sulfonate System		
Coating	**Specification**	**Dry Film Thickness mils (µm)**
Calcium Sulfonate Rust Penetrating Sealer	Sec 1045.9.2	1.0 (25) min.
Calcium Sulfonate Primer	Sec 1045.9.3	4.0 (100) min.
Calcium Sulfonate Topcoat	Sec 1045.9.4	5.0 (125) min.

Aluminum & Gray Epoxy-Mastic Primer		
Coating	**Specification**	**Dry Film Thickness mils (µm)**
Aluminum Epoxy-Mastic Primer	Sec 1045.7	5.0 (125) min.
Gray Epoxy-Mastic Primer	Sec 1045.8	5.0 (125) min.

Delete Sec 1081.4.3 through 1081.4.3.3 and substitute the following: ***06/08***

1081.4.3 Surface Preparation. Cleaning and coating of structural steel shall proceed in areas or sections as approved by the engineer, usually consisting of one or more complete spans. The cleaning and application of the coatings for each specified section shall be entirely completed and accepted by the engineer prior to proceeding with additional cleaning or coating. Surface preparation shall be in accordance with Sec 1081.3.2. All existing coatings and paint shall be removed by blast cleaning unless specifically indicated otherwise in the contract.

1081.4.3.1 Approved Blast Media. Approved blast media materials, such as silica sand and steel abrasive, shall be used to remove lead and non-lead paint. This approved blast media can be sent to a lead smelter for recycling and is not considered a solid or hazardous waste in accordance with 40 CFR 261.2(e)(1)(ii). The use of other blast media shall be approved in writing by the receiving lead smelter prior to use to determine if the smelter can recycle the blast media. A copy of the smelter approval letter shall be submitted to the engineer and to the Environmental Section in Design Division. Only blast media approved by the receiving lead smelter will be permitted. Surface preparation areas cleaned with unapproved blast media shall be at the contractor's expense. The collected residue shall consist of media no larger than one inch (25 mm) and removed paint chips.

1081.4.3.2 Environmental Regulations. The paint removal operation shall comply with all local, state and federal regulations, including but not limited to, the EPA, OSHA Standards 29 CFR 1910 and 1926.62, and the Missouri Code of State Regulations, including 10 CSR 10 Air Conservation Commission, 10 CSR 20 Clean Water Commission, 10 CSR 25 Hazardous Waste Commission, and 10 CSR 80 Solid Waste Management. The contractor shall have all necessary licenses and certifications as required by the Missouri Department of Health including necessary licenses and certification for lead abatement/removal workers prior to commencement of the cleaning operation. If hazardous waste will be generated at the site, the contractor shall notify the engineer and Environmental Section in Design Division and comply with all applicable hazardous waste generator requirements.

1081.4.3.3 Collection of Blast Residue. The contractor shall collect the lead contaminated or non-lead blast residue from the cleaning operations for recycling or disposal. Blast residue shall be managed as a recyclable material or hazardous waste. Container management shall be in accordance with Sec 1081.4.3.3.2. Analytical testing required for the disposal of blast residues shall be the responsibility of the contractor.

1081.4.3.3.1 Hazardous Waste Notification. The contractor shall request the Environmental Section in Design Division to obtain an EPA identification number and inform the engineer that the request has been made. The Environmental Section in Design Division will submit a "Notification of Regulated Waste Activity" form to MDNR Hazardous Waste Program to obtain the EPA identification number. Requests shall be submitted as soon as hazardous waste is determined or at least 30 days prior to shipping hazardous waste. The cost of obtaining the EPA identification number will be considered as part of the surface preparation cost and the engineer will subtract the cost from the contract. Hazardous waste will not be permitted to be shipped offsite until the EPA identification number has been received. The Environmental Section in Design Division will file the quarterly and annual hazardous waste reports in accordance with 10 CSR 25-5.262(2)(D)1 and will deactivate the EPA identification number when the project is finished.

1081.4.3.3.2 Container Management.

1081.4.3.3.2.1 The blast residue from cleaning operations shall be stored in contractor furnished, watertight 55-gallon steel drum containers stacked on wooden pallets with labels facing outward. The containers shall be free of structural defects and all other materials including but not limited to construction debris, solvents, flammables, aluminum, magnesium, aerosol cans, rags and any ferrous or non-ferrous metals larger than one cubic inch (16.4 cm^3). The containers shall have removable lids complete with a bolt ring, bolt and nut. Containers shall remain closed at all times, except when necessary to add blast residue. Material other than the blast residue from the cleaning operations shall not be placed in the containers. At the end of each day's work, the containers shall be stored outside the 100-year floodplain in a secure area as approved by the engineer. Containers of approved blast residue destined for recycling, shall be marked with a "Blast Residue" label provided by the engineer or Environmental Section in Design Division and marked with the following information:

(a) Blast Residue.

(b) Marked with one of the following:

(1) Contains Heavy Metals/Lead Compounds.

(2) Contains Non-Lead Compounds.

(c) Generator: MoDOT.

(d) Bridge Site Number.

(e) Date Container was Filled.

1081.4.3.3.2.2 Containers of hazardous waste, such as unapproved blast media, shall be packaged, marked and labeled according to hazardous waste regulations 10 CSR 25-5.262(2)(C)1. Containers of hazardous waste shall be stored separate from containers of non-hazardous waste and approved blast media destined for recycling. The contractor shall maintain an inventory of the quantity of the containers stored at the site and the quantity delivered to an approved facility. All containers shall be delivered to the approved facility within 30 days upon completion of the surface preparation. Copies of container inventories, all test results, shipping papers, hazardous waste manifest signed by the receiving facility, solid waste disposal request, recycling certificates and any other disposal documentation shall be submitted to the engineer with a copy to the Environmental Section in Design Division within 30 days upon delivery to the approved facility.

1081.4.3.3.3 Shipment of Residue. Approved blast media residue containing heavy metals/lead or non-lead residue shall be shipped with a bill of lading to a lead smelter for recycling. Heavy metal/lead contaminated residue determined to be a hazardous waste shall be transported by a Missouri licensed hazardous waste transporter with a hazardous waste manifest and land ban forms, if required, to an approved lead smelter or approved hazardous waste treatment, storage and disposal facility. The contractor shall obtain appropriate shipping papers (bill of lading), hazardous waste manifest forms and land ban forms, if required, from the engineer or Environmental Section in Design Division. These shipping forms shall be completed prior to shipment. The lead smelter or approved hazardous waste treatment, storage and disposal facility will reject any shipment received without the proper shipping paper or hazardous waste manifest. The contractor shall notify the receiving facility at least 2 days prior to shipment to ensure the receiving facility will be able to accept the load.

1081.4.3.3.4 Personal Protective Equipment. Clothing, tarps, hoses and other cleaning material containing lead and lead blast residue shall be managed as a hazardous waste unless determined non-hazardous. Personal protective equipment being disposed, such as tyvek suits, respirator cartridges, boots, etc. but not tarps, shall be placed into 55-gallon steel drums. Spent tarps shall be placed into DOT approved cardboard boxes and stacked on wooden pallets. Container management shall be in accordance with Sec 1081.4.3.3.2.

1081.4.3.3.5 Invoices and Payment. The lead smelter or hazardous waste treatment, storage and disposal facility shall submit a billing and paid invoice to the Environmental Section in Design Division for the disposal costs of the lead and non-lead based residue and personal protective equipment based on the gross weight or number of containers of material received at the lead smelter or hazardous waste treatment, storage and disposal facility. Payment to the facility will be made by MoDOT for the amount shown on the billing invoice. The Environmental Section will send the billing and paid invoices to the engineer who will forward the invoices to the contractor. The

engineer will subtract the amount on the paid invoice from the contract. Transporting cost shall be the contractor's responsibility. For more information concerning management of blast residue, approved lead smelters or approved hazardous waste treatment, storage and disposal facilities, contact the Environmental Section in Design Division.

Delete Sec 1081.5.3.1 through 1081.5.3.2.2 and substitute the following: ***06/08***

1081.5.3.1 Removal of Existing Paint. The existing steel shall be cleaned by approved methods in accordance with Sec 1081.5.3.2.

1081.5.3.1.1 Environmental Regulations. The paint removal operation shall be in accordance with all local, state and federal regulations, including those defined in Sec 1081.4.3.2.

1081.5.3.1.2 Water for Power Washing. The water used for power washing shall be clean, potable water, free from contaminants. Non-hazardous wastewater shall be collected and disposed of in accordance with all applicable state, local and federal clean water regulations. Wastewater determined to be hazardous waste in accordance with Sec 1081.5.3.1.3 shall be collected and disposed of in accordance with Sec 1081.5.3.1.3. The wastewater shall not be discharged onto the ground or into waters of the state without a permit. Water collected from the power washing operation shall not be reused in the power washing operation.

1081.5.3.1.3 Collection of Residue. Collection of lead or non-lead based residue shall be in accordance with Sec 1081.4.3.3 with the addition of the following requirements. The containers shall remain closed at all times, except when necessary to add additional residue or wastewater. Material other than the residue or wastewater from the cleaning operations shall not be placed in the containers. Wastewater collected during cleaning operations shall be tested in accordance with 40 CFR 261.24. Wastewater that test results indicate is a hazardous waste as determined by 40 CFR 261.24 shall be handled as hazardous waste in accordance with the 10 CSR 25. The contractor shall keep an inventory of the quantity of heavy metal contaminated wastewater generated and delivered to the storage site and the quantity of heavy metal contaminated wastewater that has been disposed. Wastewater that has been tested and determined to be non-hazardous shall be handled in accordance with Sec 1081.5.3.1.2. Any remaining hazardous or non-hazardous residues shall be disposed of in accordance with Sec 1081.4.3.3. Any testing required for the disposal of the wastewater or residues shall be the responsibility of the contractor. Copies of the inventory, all testing data, required certifications and shipping manifests shall be provided to the engineer and to the Environmental Section in Design Division in accordance with Sec 1081.4.3.3.2.2.

1081.5.3.1.4 Testing of Water Samples. At the conclusion of the power washing operation, the contractor shall obtain samples of the wastewater in the presence of the engineer. The samples shall be analyzed by an independent testing laboratory for total metals, oil and grease, biochemical oxygen demand, total suspended solids, pH and Toxicity Characteristic Leaching Procedure (TCLP) heavy metals. Samples shall be collected and analyzed in accordance with EPA approved methods. Copies of all test reports shall be supplied to the engineer and the Environmental Section in Design Division. Additional testing required to comply with any federal, state or local regulations shall be provided by the contractor.

1081.5.3.2 Cleaning of Structural Steel. All exposed steel surfaces shall be mechanically cleaned in accordance with Sec 108.5.3.2.1 and in accordance with the pain manufacturer's recommendations prior to application of the coating. Power washing will not be required. However, the contractor may use power wash cleaning if desired during surface preparation. All surfaces cleaned shall be approved by the engineer prior to application of the coating.

1081.5.3.2.1 Mechanical Cleaning. Exposed structural steel where mechanical cleaning is required shall be cleaned in accordance with SSPC-SP2 or SSPC-SP3. Blast cleaning as a substitute cleaning method will be acceptable. Mechanical cleaning will be required for areas of rusted steel, loose, cracked or brittle paint or areas indicated by the engineer. The cleaning shall be performed 2 inches (50 mm) beyond the areas of rust or defective paint in all direction or until tightly adhered paint is obtained with no rust or blisters. Edges between the bare steel and the paint shall be feathered. Collection of the residue removed shall be in accordance with Sec 1081.5.3.1.3.

1081.5.3.2.2 Power Wash Cleaning. The contractor may clean the steel by a low-pressure power wash to remove loose paint, dirt and other loose deleterious material. The maximum pressure for the power washing shall be 1500 psi (10 MPa). If necessary, solvent cleaning in accordance with SSPC-SP1 shall be employed to augment the power washing. Collection of the wastewater, solvents and other residues from the power washing operation shall be in accordance with Sec 1081.5.3.1.1. After the power washing operation, areas that have remaining rust or loose paint

shall be recleaned in accordance with Sec 1081.5.3.2.1, except that vacuum power tools will be required for power tool cleaning. All surfaces washed shall be completely free of all foreign matter, surface dry and approved by the engineer prior to application of the coating.

Amend Sec 1081 to include the following: ***06/08***

1081.7.2.1 Environmental Regulations. The surface preparation operation shall be in accordance with all local, state and federal regulations, including those defined in Sec 1081.4.3.2.

1081.7.2.2 Collection of Residue. The collection of residue shall be in accordance with Sec 1081.4.3.3 and 1081.5.3.1.3.

Amend Sec 1081 to include the following: ***04/05***

1081.7 Aluminum & Gray Epoxy-Mastic Primer.

1081.7.1 Scope. This specification covers the application of other approved primer coatings for touch-up and other repair applications.

1081.7.2 Surface Preparation. The epoxy-mastic shall be applied over an SSPC-SP2, SSPC-SP3 or SSPC-SP6 surface preparation, including removal of all rust scale, loose rust, loose mill scale and loose or non-adherent paint. Oil and grease shall be removed in accordance with SSPC-SP1 Solvent Cleaning. Areas adjacent to required areas will not be required to be masked to prevent overspray.

1081.7.3 Application. Material application methods, air and surface temperatures and relative humidity shall be in accordance with the manufacturer's written instructions and Sec 1081.3. The most restrictive application and environmental requirements for the epoxy-mastic shall be used when applying the primer to the steel.

SECTION 1092 – SIGNAL EQUIPMENT

Delete Sec 1092.4.5.4.1.2.1 and substitute the following: ***12/07***

1092.4.5.4.1.2.1 Omnidirectional Antenna. All omnidirectional antennas shall be in accordance with the following:

Item	Requirement
General Frequency Range	896-960 Megahertz
Bandwidth at Rated VSWR	70 Megahertz, min.
VSWR	1.5:1, min.
Polarization	Vertical
Maximum Power Input	250 watts, min.
Connector	N Female
Antenna Housing	Fiberglass Radome
Radiating Elements	Brass or Copper
Support Pipe	6061-T6 Aluminum
Lightning Protection	Direct Ground
Rated Wind Velocity	100 mph (160 km/h), min.