

**S T A T E**

**O F**

**T E N N E S S E E**

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(Rev. 11-16-15)  
(Rev. 5-15-17)  
(Rev. 11-6-17)  
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(Rev. 12-30-19)

January 1, 2015

**Supplemental Specifications - Section 500**

**of the**

**Standard Specifications for Road and Bridge Construction**

**January 1, 2015**

**Subsection 501.03 A.1** (pg. 393), 5-13-19; **Proportioning, General**; Revise 1<sup>st</sup> paragraph:

Submit the proposed concrete design to the Engineer for approval. Determine the design using saturated surface dry aggregate weights. Verify the design by preparing trial batches meeting the requirements of these specifications. Ensure that the concrete design is prepared by a TDOT Certified Concrete Mix Design Technician, or by an approved independent testing laboratory under the direction of a registered professional Civil Engineer, licensed by the State of Tennessee. The TDOT Certified Concrete Mix Design Technician or the Civil Engineer shall certify that the information contained on the design is correct and is the result of information obtained from the trial batches. Prepare trial batches for design, including admixtures in the proper proportion, no more than 90 days before the design submittal. The approved mix design will expire at the end of each calendar year or if it does not meet the minimum 28-day requirements. All cost of concrete design, preparation, and submittal are the Contractor's responsibility.

**Subsection 501.03 A.2** (pg. 394), 5-13-19; **Design and Production Parameters**; Revise 4<sup>th</sup> Paragraph:

Admixtures to be incorporated into the concrete shall be compatible and incorporated into the concrete in accordance with the manufacturer's recommendations. Concrete mixtures utilizing multiple admixture manufacturers shall prove compatibility in accordance with the Department's Standard Operating Procedure 4-4.

**Subsection 501.03** (pg. 395), 5-18-15; 3. Mix Design Submittal; Replace the first paragraph with the following:

“Instead of the above mix design submittal, a request to use an existing design may be submitted for approval provided the design has been used on a state funded project within the last six (6) months. The approval of this concrete design submittal will not relieve the Contractor of the responsibility of providing concrete meeting the requirements of these Specifications. A temporary mix design may be issued if the 7-day or 14-day compressive strengths exceed the required 28-day strengths.”

**Subsection 501.03 A. Proportioning** (pg. 395) 5-15-17; Add water as 22. on the list of Design Submittal requirements, update the paragraph below the list to add water requirements:

**“A. Proportioning**

**3. Design Submittal.** Include the following information as a minimum in the proposed concrete design submittal:

1. Source of all aggregate
2. Brand and type of cement
3. Source and class of fly ash (if used)
4. Source and grade of ground granulated blast furnace slag (if used)
5. Specific gravity of cement
6. Specific gravity of fly ash (if used)
7. Specific gravity of ground granulated blast furnace slag (if used)
8. Admixtures (if used)
9. Gradation of aggregates
10. Specific gravities of aggregates (saturated surface dry)
11. Air content (if air entrainment is used)
12. Percentage of fine aggregate of the total aggregate (by volume)
13. Slump
14. Weight per cubic yard
15. Yield
16. Temperature of plastic concrete
17. Water/cement ratio (pound/pound)
18. 7-day compressive strength [minimum of two 4-inch x 8-inch cylinders]
19. 14-day compressive strength [minimum of two 4-inch x 8-inch cylinders]
20. 28-day compressive strength [minimum of two 4-inch x 8-inch cylinders]
21. Weight of each material required to produce a cubic yard of concrete
22. Water – submit testing results per Tables 921.01-1 & 921.01-2

Instead of the above mix design submittal, a request to use an existing design may be submitted for approval provided the design has been used on a state funded project within the last six (6) months. When submitting for the use of an existing mix design, the most current water testing results per 921.01 shall accompany the submittal. The approval of this concrete design submittal will not relieve the Contractor of the responsibility of providing concrete meeting the requirements of these Specifications. A temporary mix design may be issued if the 7-day or 14-day compressive strengths exceed the required 28-day strengths.”

**Subsection 501.03 A.3** (pg. 395), 5-13-19; **Mix Design Submittal**; Revise 2<sup>nd</sup> paragraph:

Instead of the above mix design submittal, a request to use an existing design may be submitted for approval within the current calendar year. When submitting for the use of an existing mix design, the most current water testing results per 921.01 shall accompany the submittal. The approval of this concrete design submittal will not relieve the Contractor of the responsibility of providing concrete meeting the requirements of these Specifications. A temporary mix design may be issued if the 7-day or 14-day compressive strengths exceed the required 28-day strengths.

**Subsection 501.03 A.3** (pg. 395-396), 12-30-19; **Mix Design Submittal**; Revise 3<sup>rd</sup> paragraph:

If proposing to use materials or admixtures from sources other than those shown on the approved concrete mix design, submit a ~~written request to the Regional Materials and Tests Engineer explaining the necessity for the change and include a~~ new mix design developed in accordance with this Subsection **501.03**. Do not place any concrete until the new design is approved. The Engineer will not accept concrete produced using materials that are not shown on an approved concrete design.

**Subsection 501.03 A.6** (pg. 398-399), 12-30-19; **Adjustments to Mix Proportions**; Remove entire subsection:

~~**6. Adjustments to Mix Proportions.** Meet the mix proportions approved by the Department during the progress of the work, except make the following adjustments as necessary with the Engineer's approval:~~

- ~~1. Maintain the cement content within 2% of the designated value by adjusting the proportions of materials as necessary.~~
- ~~2. If concrete of the desired plasticity and workability cannot be obtained with the proportions originally designed, adjust the aggregate weights as required, provided that the originally designated cement content is not changed except as specified in paragraphs (3), (4) and (5) below.~~
- ~~3. If it is found impossible to produce concrete having the required consistency without exceeding the maximum allowable water-cement ratio specified, increase the cement content so that the maximum allowable water-cement ratio will not be exceeded.~~
- ~~4. If for any reason the concrete must be placed by hand methods and the water-cement ratio established for the vibrated concrete cannot be maintained, adjust the mix proportions for placement by hand methods and increase the cement proportion by 38 pounds per cubic yard, or more if necessary, in order to maintain the water-cement ratio established for the vibrated concrete. The Department will not make additional payment to the Contractor for the cost of the additional cement.~~
- ~~5. Change the mix proportions if the character or source of materials changes.~~
- ~~6. Change the mix proportions or mixing procedure to maintain the air content within the specified limits.~~
- ~~7. Change the mix proportions to allow for the use of retarders or other chemical additives that may be required or approved.~~

**Subsection 501.03 B** (pg. 399), 5-13-19; **Quality Control and Acceptance of Concrete**; Revise 2<sup>nd</sup> paragraph:

Provide qualified technicians to perform sampling, testing, and inspection for process control. A TDOT Certified Concrete Plant Quality Control Technician shall provide process control of the concrete at the concrete plant. This technician shall be present at the concrete plant during all batching operations for the Project and shall have the primary responsibility during production of performing process control. A TDOT Certified Concrete Field Testing Technician or equivalent shall provide process control of the concrete at the placement site and shall be present during all concrete placement. A TDOT Certified Concrete Field Testing Technician or equivalent is not required to be at the placement site during small quantity placing operations but shall perform one complete set of tests during the life of the Project.

**Subsection 501.03.B** (pg. 399), 12-30-19; **Quality Control and Acceptance of Concrete**; Revise 2<sup>nd</sup> paragraph:

Provide qualified technicians to perform sampling, testing, and inspection for process control. A TDOT Certified Concrete Plant Quality Control technician shall provide process control of the concrete at the concrete plant. This technician shall be present at the concrete plant during all batching operations for the Project and shall have the primary responsibility during production of performing process control. A TDOT Certified concrete Field Testing or equivalent shall provide process control of the concrete at the placement site and shall be present during all concrete placement. A TDOT Certified Concrete Field Testing technician or equivalent is not required to be at the placement site during minor structures, as listed in 604.11 B, small-quantity-placem~~ent~~ing operations. ~~but shall perform one complete set of tests during the life of the Project.~~

**Subsection 501.03** (pg. 399-402) 11-16-15; B. Quality Control and Acceptance of Concrete, adjust the following:

- “1. Test to determine aggregate gradations (AASHTO T 27 with AASHTO T 11 when required). Conduct a combined belt gradation before work starts and at least daily to verify consistency if using a dynamic, multi-aggregate feed system.
3. Calibrate the weighing systems, aggregate feed flow rate and weigh bridges, water meters, and admixture dispensing systems before starting production.
4. Ensure accurate weighing or flow rate of the aggregates and cement, the proper metering of water and admixtures, and the quality of water.
6. Adjust mix proportions due to actual moisture content of both coarse and fine aggregates, with moisture content determined according to AASHTO T 255. If using a dynamic aggregate weighing system, multi-aggregate proportioning adjustments are to be made by using an in-bin moisture sensor.”
7. Conduct slump (AASHTO T119) or slump flow (ASTM C1611) and air tests (AASHTO T152).

Page 401- “Make, cure, and transport all early break cylinders (7-14 day, etc.) according to AASHTO T 23, and deliver to the Regional laboratory or other established satellite laboratories

for testing. Make all early break cylinders (7-14 day, etc.) for self-consolidating concrete according to ASTM C1758, and deliver to the Regional laboratory or other established satellite laboratories for testing.”

Page 402 - “Correct batch weights or aggregate feed flow rates to compensate for surface moisture on the aggregate at the time of use. The Contractor...”

**Subsection 501.03 B.12** (pg. 401), 5-13-19; **Quality Control and Acceptance of Concrete**; Add “r” to list:

12. A concrete delivery ticket shall accompany each load to the placement site. The ticket shall include as a minimum the following:
  - a. Date
  - b. Contract number
  - c. County
  - d. Class of concrete
  - e. Concrete design number
  - f. Number of cubic yards
  - g. Load number
  - h. Truck number
  - i. Maximum water allowed by design
  - j. Total water added at the plant
  - k. Maximum water allowed to be added on the project
  - l. Actual water added on project
  - m. Number of revolutions at mixing speed at plant
  - n. Number of revolutions at mixing speed at project
  - o. Time loaded
  - p. Time discharged
  - q. Actual and target batch weights of each component including each aggregate, chemical admixture and mineral admixture used
  - r. Signature of producer’s TDOT Certified Concrete Plant Quality Control Technician

**Subsection 501.03** (pg. 401) 5-14-18; B. Quality Control and Acceptance of Concrete, remove AASHTO T23 and replace with specification 604.15 C.”

“Make, cure, and transport all early break cylinders (7-14 day, etc.) in accordance with 604.15.C, and deliver to the Regional Laboratory or other established satellite laboratories for testing.”

**Subsection 501.04** (pg. 402) 11-16-15; replace the following:

**“A. Batching Plant, Multi-Aggregate Feed System, and Equipment,**

1. General. The batching plant shall include bins, weighing hoppers or belt feeds with weigh bridges and load cells, and scales. If using cement in bulk,...

2. Bins and Hoppers- Add the following new paragraph under the existing paragraph

For multi-aggregate feed systems, provide bins as noted with variable size openings and variable speed belts. Each bin must have a calibrated moisture sensor to adjust aggregate feed flow rates. Assure consistent, uninterrupted aggregate flow and consistent belt speeds once aggregate feed system is calibrated.

3. Scales- Add the following new paragraph under the last paragraph in the section.

For multi-aggregate feed systems, provide a dual idler weight bridge with load cells to accurately weigh the actual aggregate flow rate.”

**Subsection 501.04 A. 1.** (pg. 402), 11-6-17; General, Add the following after the first paragraph:

“All producers of concrete shall be on the Department’s approved producer list and be actively certified by the National Ready Mixed Concrete Association (NRMCA) Plant Certification Program.”

**Subsection 501.04** (pg. 404) 11-16-15; B. Mixers, remove the complete 4th paragraph.

**Subsection 501.04 B. 3.** (pg. 403), 11-6-17; Truck Mixers and Truck Agitators, Add the following to the beginning of the first paragraph:

“Truck mixers shall be certified by the National Ready Mix Concrete Association (NRMCA) Delivery Vehicle Certification Program Option A or Option B.”

**Subsection 501.09** (pg. 410) 10-8-18; Revise course to coarse in the 3<sup>rd</sup> paragraph of the subsection:

“Separately weigh the fine aggregate and each size of coarse aggregate into the hopper or hoppers in the respective amounts set by the Engineer. The coarse aggregates shall meet the gradation requirements for Size No. 467, as specified in **903.22**, or a blend of Size No. 4 and Size No. 67 that meets the required gradation for Size No. 467, specified in **903.22**.”

**Subsection 501.12 – Placing Concrete** (pg. 413-415) 5-15-17; replace the subsection:

**“501.12 Placing Concrete**

Either unload the concrete into an approved spreading device, or deposit it directly on the base, and mechanically spread the concrete in a manner that prevents segregation of the materials. When using central or transit mixed concrete, deposit it in an approved spreader. Place the mixture so as to minimize rehandling and relocation from point of placement. The mechanical spreader will not be required on areas too small to accommodate the paving equipment, projects that contain 10,000 square yards or less of concrete paving, and on variable width sections and ramps. Placing shall be continuous between transverse joints without the use of intermediate bulkheads. Do not place concrete on frozen grade.

Perform any necessary hand spreading with shovels or other approved tools. Do not allow workmen to walk in the freshly mixed concrete with boots or shoes coated with earth or other foreign substances.

If placing concrete adjacent to a previously constructed lane of pavement and mechanical equipment is to be operated on this existing lane of pavement, that lane shall meet the requirements for opening to traffic specified in **501.22**. If the existing lane is to only carry finishing equipment, the Contractor may begin paving the adjoining lanes after 7 days.

Deposit concrete as near to expansion and contraction joints as possible without disturbing them; do not dump concrete from the discharge bucket or hopper onto a joint assembly unless the hopper is well centered on the joint assembly.

Immediately remove all concrete materials that may fall on or be worked into the surface of a completed slab using approved methods.

When using the slip-form method of concrete paving, place the concrete with an approved slip-form paver meeting the requirements of **501.04.D.11**.

Ensure that the sliding forms are rigidly held together laterally to prevent spreading of the forms. The forms shall trail behind the paver for such a distance that no appreciable slumping of the concrete will occur and so that necessary finishing can be accomplished while the concrete is still within the forms. Before the concrete has hardened, correct any edge slump of the pavement, exclusive of edge rounding, in excess of 1/4 inch.

Operate the slip-form paver with as nearly a continuous forward movement as possible, and coordinate all operations of mixing, delivering, and spreading of concrete so as to provide uniform progress while minimizing the stopping and starting of the paver. If, for any reason, it is necessary to stop the forward movement of the paver, also immediately stop the vibratory and tamping elements. Apply no tractive force to the machine, other than that which is controlled from the machine. Replace slabs with random cracks before completion of paving operations.

Contractor may choose to utilize a single lift or two lift paving process according to the following requirements.

**A. Single Lift Pavement**

Use vibrators to thoroughly consolidate the concrete against and along the faces of all forms and along the full length and on both sides of all joint assemblies. Do not allow vibrators to come in contact with a joint assembly, the grade, or a side form. Do not operate the vibrator for longer than 5 seconds in any one location.

The Contractor may only use hand-operated vibrators on projects containing 10,000 square yards or less of concrete paving and on variable width sections. Only operate vibrators mounted on a machine while the machine is in motion.

Equip the slip-form paver with vibrators meeting the applicable requirements of **501.04.D.1** to vibrate the concrete for the full width and depth of the strip of pavement being placed.

## B. Two Lift Composite Pavement

When placing two lift composite pavements, the upper lift shall be of a lesser thickness as designated by contract design. It shall be placed such that the result is a wet-on-wet application. The lower lift will be one foot less in width than the upper lift.

Paving operations shall be adjusted and approved by the Engineer as necessary to assure a wet-on-wet monolithic pavement section. If the bonding between lifts or the consolidation of concrete is determined to be unsuitable by the Engineer, the lower lift shall be removed and replaced prior to the upper lift placement.

**1. Lower Lift.** Uniformly spread concrete with a spreader or slipform machine. Internal vibration will be required for the lower lift. Tie bars and dowel bars (with the use of dowel baskets) shall be placed in the lower lift at mid-depth of the finished concrete pavement thickness. The lower lift shall not require curing, texturing, or sawing before the upper lift is placed. The lower lift shall be struck off to provide a nominal lower lift thickness that complies with the pavement design. The upper lift shall be struck off to allow for the finished total pavement to conform to the cross section shown in the contract plans.

**2. Upper Lift.** Place the upper lift within 45 minutes following the placement of the lower lift. Placement of the upper lift shall be such that intermingling of the two concrete mixtures is minimal. External vibration for the upper lift will be allowed if proper consolidation and finishing can be demonstrated in accordance with **501.16**. Dowel bars can be inserted during the placement of the upper lift. Cure the upper lift only in accordance with **501.18**. At no time shall the total thickness be less than shown on the pavement design and the cross section shown in the contract plans.

Frequency of the vibrators shall be established based on the workability of the concrete mixture and past experiences. Electronic, internal, T-shaped, poker vibrators shall be used. Other types of vibrating equipment may be approved by the Engineer. Vibrator impulses shall be delivered directly to the concrete and the intensity of vibration shall be sufficient to consolidate the concrete thoroughly and uniformly throughout the depth and width of the lift. Increase in the speed of the vibrators will be allowed with the permission of the Engineer.

A paving plan shall be supplied to the Engineer for review and approval prior to pouring. The plan shall document procedures to ensure consistency of material properties during concrete placement and finishing, identify and eliminate potential for load misidentification, and maintain speed of production and paving. Concrete for each lift shall be produced from the same ready-mix facility.”

**Subsection 501.17** (pg. 424) 11-16-15; A. Surface Testing, modify the following:

- “3. Ramps where the design speed is greater than 40 miles per hour
  - (a) Test sections shall terminate 100 feet from a stop or slow speed yield condition
  - (b) Superelevated sections greater than 40 miles per hour design speed must be ground in accordance with **Table 501.17-1**
- 4. Ramps where the design speed is 40 miles per hour or less
  - (a) Test sections shall terminate 100 feet from a stop or slow speed yield condition
  - (b) Superelevated sections with a design speed of 40 miles per hour or less must be ground in accordance with **Table 501.17-2**



**Subsection 501.17** (pg. 425) 11-16-15; B. Pay Factors and Required Corrective Action, modify the following:

“Payment factors and required corrective actions relative to profile indexes for ramps with design speeds of 40 MPH or less shall conform to Table 501.17-2.

Table 501.17-2: Pay Factors & Corrective Action for Ramps with Design Speeds of 40 mph or less

<b>Profile Indexes</b>	<b>Pay Factor</b>	<b>Corrective Action</b>
<10 inches per mile	105%	None
10 to < 20 inches per mile	100%	None
20 to < 23 inches per mile	98%	Grind to 20 inches per mile
23 plus inches per mile	95%	Grind to 20 inches per mile

**Subsection 501.26 – Basis of Payment** (pg. 434) 5-15-17; add the following sentence to the 7<sup>th</sup> paragraph of the subsection:

The Department will pay for additional concrete, measured in accordance with **501.25**, at the purchase price, F.O.B. the unloading point, as verified by invoices, with no compensation allowed for further handling. The State will be reimbursed from monies due the Contractor for a decrease in concrete measured in accordance with **501.25** in an amount equal to the purchase price of the cement, F.O.B. the unloading point. No payment will be allowed for any changes in the proportions of the aggregates. No additional payment will be made if two-lift composite pavement alternate is selected.”