

# Minimum Sample and Test Requirements (MSTR)

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## 1. **Asphalt Construction:**

### General Notes:

The Area Engineer must furnish representative samples of component mineral aggregate materials to the Bituminous Engineer to establish the design mix. The samples submitted will be tested for quality in the Central Laboratory. Mix production will not be permitted until the mix design has been obtained from the Bituminous Engineer. For mix designs, submit representative virgin mineral aggregate samples and recycled asphalt pavement (RAP) samples proportionate to the bin splits proposed for use during construction. The total aggregate submitted for mix designs will be from 400 to 500 pounds.

When quality tests are required by specifications, one sample per 50,000 ton will be submitted to the Central Laboratory. The first required quality test will be performed on material submitted for mix design and additional quality tests will be performed on composite samples submitted to the Central Laboratory. Aggregate production for asphalt concrete, base course, and similar materials from the same source used on one or more projects simultaneously requires only the single minimum test frequency for quality; however, results must be reported separately for each material for each project file. Sample size: 120 lbs., 4 bags; plus, an additional 60 lbs., 2 bags, when soundness is required. (DOT-1)

### Small Quantities:

Samples or tests on bituminous mixtures will not be specifically required for project quantities that do not exceed approximately 100 ton per day or approximately 500 ton per project, provided there are appropriate certificates and tests to ensure that the sources of supply have recently furnished satisfactory similar material and construction. Acceptance may be based on documented Visual Inspection for equipment, method of placement, compaction, temperature, etc., or mixture may be tested at the direction of the project engineer.

### Asphalt Concrete Composite:

Written certification from the producer stating that the asphalt concrete composite conforms to the specifications (DOT-97) and a Certificate of Compliance from the refinery for the asphalt binder used in the mixture will be furnished in duplicate to the Engineer. The Contractor will provide a job-mix formula (DOT-97) with supporting mix design to the Bituminous Engineer prior to production. The Engineer may accept the mixture based on the Certificate of Compliance, Visual Inspection for equipment, method of placement, compaction, temperature, etc.

### Calibration and Process Correction Tests:

Prior to production of asphalt concrete, certified technicians will conduct comparison tests at the plant with a split companion cold feed calibration sample of virgin aggregate to assure that all associated equipment and procedures provide comparable results. Comparison test results will meet the requirements of the mix design report and will

conform to the tolerances in this manual. The split companion calibration testing will continue until the results meet the requirements of the mix design report and are within the listed tolerances. The split companion calibration testing will be performed on each mix type produced prior to production of that mix type.

Calibration and process correction ("PC") samples taken and tested when production is stopped are to verify the proper calibration of the plant and to determine the effectiveness of changes in bin splits or other action taken to change the gradation and quality of the aggregate. Satisfactory test results are the basis for allowing production to resume; however, since production is shut down and these samples do not represent material actually produced for use, they will not be used as acceptance samples.

If production is not shut down after a failing test and the next sample is taken and tested to confirm the effectiveness of the process correction, this test is also an acceptance test, as it actually represents material produced and placed on the project. The sample will be numbered as the next consecutive acceptance sample.

IA testing is not required on Contractor furnished and Contractor furnished & placed material.

#### QC Test Frequency Reduction

The Contractor may request to reduce the QC testing frequency when the QC samples and the QA samples indicate acceptable results within the specifications located in Section 322 of the Standard Specifications for Roads and Bridges and the tolerances from R.S.T.C for sand equivalent, lightweight particles, crushed particles, and fine aggregate angularity and the Engineer and the Contractor are both confident that future production will meet specifications. The reduction in test frequency will be authorized in writing by the Area Engineer.

The Area Engineer will notify the Contractor in writing of the reduction in testing frequency and a copy of this letter will be forwarded to the Region Materials Engineer and Certification Program Administrator. A reduction in testing frequency may be revoked by the Area Engineer at any time.

The frequency of tests performed may be reduced using the following procedure. The QC technician will complete all tests on the first lot of material produced. A reduction in the frequency of testing will be allowed based upon the average test results obtained from five consecutive tests of material tested by the QC technician. This reduction in test frequency for any of the tests shown in the QC Test Frequency Reduction Guidelines will remain in effect as long as the test results remain within the range of the testing frequency currently being used.

The frequency of the QC testing for sand equivalent, lightweight particles, and crushed particles may be further reduced beyond what is shown in the QC Test Frequency Reduction Guidelines by the Area Engineer. The Area Engineer may reduce the frequency beyond what is shown in the QC Test Frequency Reduction Guidelines based on an evaluation of test results from the material source.

### QC TEST FREQUENCY REDUCTION GUIDELINES

#### **Sand Equivalent**

10 or more above minimum	Reduce test frequency to 1 test per lot
7 to 9 above minimum	Reduce test frequency to 2 tests per lot
4 to 6 above minimum	Reduce test frequency to 3 tests per lot
Within 3 of minimum	No reduction in test frequency

#### **+ #4 and - #4 Lightweight Particles (less than 1.95 Specific Gravity)**

Results of 0.0% lightweight particles	Reduce test frequency to 1 test per lot
1.5% or more below maximum	Reduce test frequency to 1 test per lot
1.1 to 1.4% below maximum	Reduce test frequency to 2 tests per lot
0.6 to 1.0% below maximum	Reduce test frequency to 3 tests per lot
Within 0.5% of maximum	No reduction in test frequency

#### **Crushed Particles**

Results of 100% crushed faces	Reduce test frequency to 1 test per lot
25% or more above minimum	Reduce test frequency to 1 test per lot
16 to 24% above minimum	Reduce test frequency to 2 tests per lot
6 to 15% above minimum	Reduce test frequency to 3 tests per lot
Within 5% of minimum	No reduction in test frequency

#### **Fine Aggregate Angularity**

2.5% or more above minimum	Reduce test frequency to 1 test per lot
2.0 to 2.4% above minimum	Reduce test frequency to 2 tests per lot
1.5 to 1.9% above minimum	Reduce test frequency to 3 tests per lot
Within 1.4% of minimum	No reduction in test frequency

### QC/QA Dispute Resolution System

If the differences between the QC and QA results are greater than the allowed tolerance in R.S.T.C. or SD 317, the Engineer will investigate the reason for the difference. The investigation may include review and observation of test procedures and equipment. The QA technician will test the next QC sample as soon as a difference between any QC and QA test result is found. The Engineer may require that a sample be tested jointly by the Contractor's QC technician, the Engineer's QA technician, and the Region Materials Engineer. The Region Materials Engineer test results or, if necessary, the Department's Materials & Surfacing Central Laboratory test results will be the referee used for acceptance and will determine which sample test results will be incorporated into the pay factor calculations only when a dispute between the QA and QC sample cannot be resolved.

#### **1.1 Asphalt Concrete, Hot Mix (Includes Base and Surfacing Courses).**

##### **A. Aggregate, Composite.**

- (1) Tier 3.
- (2) Certification.  
See "General Notes".
- (3) Acceptance.  
Class D, E, G, HR, S one sample per plant, per 1,000 ton of mix (1,000 ton of virgin aggregate for Class HR), tested for composite gradation, sand equivalent and fine aggregate angularity. Class S will

not be tested for sand equivalent and fine aggregate angularity. (DOT-69)

If required by specifications, a crushed and lightweight particle test will be made.

- (a) On each sample, the first three days of mix production and for each 5,000 ton of mix thereafter.
- (b) Following a failing test or change in the mix proportions

If equipment and or operations indicate taking and testing separate bin samples is required or desired, test will be mathematically combined to produce the composite gradation.

Material used for samples will be from the bins used for gradation determinations. (DOT-68)

Lightweight particles, crushed particles, sand equivalent and fine aggregate angularity testing will not be required when 100% of the material (excluding mineral filler and additives) used in the composite is quarry material (DOT-69).

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Class Q one sample per plant, per 1,000 ton for QC of mix 5,000 ton for QA, tested for composite gradation, crushed particles, light weight particles, sand equivalent and fine aggregate angularity. (DOT-69).

- (4) Independent Assurance.  
Class D, E, G, HR, S one sample per plant, per 10,000 ton of mix. None required for contract quantities less than 500 ton.

Lightweight particles, crushed particles, sand equivalent and fine aggregate angularity testing will not be required when 100% of the material (excluding mineral filler and additives) used in the composite is quarry material (DOT-69).

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Class Q one sample per plant, per 15,000 ton of mix. None required for contract quantities less than 500 ton.

B. Asphalt Binder.

- (1) Tier 2.

- (2) Certification.

A Certificate of Compliance is required for each conveyance or load of asphalt delivered to a project. The original and one copy should be received with each load delivered to the project.

NOTE: The Department is a member of a Combined State Binder Group. The group includes surrounding state Department of Transportation and a variety of suppliers of asphalt binder materials who have become certified through the process outlined by the group's publication. The certification and testing requirements will be

the same for materials received from these suppliers as with other suppliers.

(3) Acceptance.

One randomly selected sample per 200 ton, per type, grade, and source. Sample size: two 1 qt. samples. A certificate of compliance for each conveyance or load the sample represents must be submitted with each sample. (DOT-1)

The sample will be obtained from an in-line-sampling valve located between the storage unit and the mix plant. (SD 301)

Detailed analysis will be made on the 1<sup>st</sup> sample of each type or grade, from each source, then on a random basis for each 200 ton per type, grade, and source.

Identification tests may be made on all samples for which the detailed analysis is not made.

(4) Independent Assurance.

One per project by observation of acceptance sample. (DOT-1)

None required for contract quantities less than 100 ton.

C. Asphalt Binder Content.

(1) Tier not applicable.

(2) Certification.

None required.

(3) Acceptance.

Calculated daily using measured quantity of asphalt and tonnage of mix produced for each mix design. (DOT-89)

The asphalt binder content will be carried over and calculated with the next day of production if less than 500 ton of material is produced for the day. In case that there is no next day of production, an asphalt binder content will be measured and reported for the smaller than 500 ton day.

If asphalt concrete is being produced by a commercial source that is supplying two or more different types of mixes with different binder contents throughout the day, the binder content may be determined by using one of the following methods:

a) Stick the tank before each change of making different types of mixes as shown above for determining the quantity of binder used and the daily binder content.

b) Determine the binder content by using the ignition oven test method (AASHTO T 308) with at least one test per day for

determining the quantity of binder used and the daily binder content.

- c) The quantity of asphalt binder may be determined using a certified or calibrated pump/flow meter. The pump/flow meter will be certified or calibrated annually.
  - i Certification must be done by a state scale inspector, a licensed private testing company or a qualified representative of the pump/flow meter manufacturer and a letter of certification be retained in the plant control shack.
  - ii Calibration will be performed by the Contractor and will be witnessed by the DOT. The Contractor will provide all equipment for initial and subsequent calibration checks; furnish the DOT with a copy of all calibration checks; use a calibration vessel with a volume of at least 1,000 gallons; ensure the weigh scales have been tested and certified and provide copies to the DOT; and furnish the DOT a copy of the test report showing the asphalt cement specific gravity. Spot check failure will require the Contractor to perform a new calibration. The DOT may request additional calibrations throughout the construction season. Use the printout sheet from the plant which has the pump/flow meter readings showing the amount of binder added into the mix furnished to the project to determine the quantity of binder used and the daily binder content.

- (4) Independent Assurance.  
None required.

**D. RAP Content**

- (1) Tier not applicable.
- (2) Certification.  
None required.
- (3) Acceptance.  
One per day. (DOT-93).
- (4) Independent Assurance.  
None required.

**E. RAP in Asphalt Concrete**

- (1) Tier not applicable.
- (2) Certification.  
None required.

- (3) Acceptance.  
One sample per day, tested for sieve analysis and moisture.  
(DOT-35) (DOT-3) (SD 305)
- (4) Independent Assurance.  
None required.

F. Lime Content

- (1) Tier not applicable.
- (2) Certification.  
None required.
- (3) Acceptance.  
Calculated daily using weighed quantity of lime and tonnage of mix produced. (DOT-33Q)  
  
Lime supplied by non-certified lime plants will require 1 acceptance sample per 750 tons.
- (4) Independent Assurance.  
None required.

G. Density, In Place.

- (1) Tier not applicable.
- (2) Certification.  
None required.
- (3) Acceptance.  
Class D, E, G, HR one per lot of mix or one day's production, whichever is less. A lot will consist of 1,000 ton. A new lot will begin at the start of work each day and each time the mix design or source of material is changed. The last lot of the day may represent up to 1,500 ton. (DOT-42)  
  
Class Q: One per 1,000 ton subplot will be taken for determination of in place density. The average of the two core density results will be the 1,000 ton subplot value used for density in the pay factor calculations. (DOT-42Q)  
  
Class S: Three randomly located cores taken within the first 1,000 tons of hot mix placed. Send to the Central Lab for informational testing.
- (4) Independent Assurance.  
Class D, E, G, HR, one per 10,000 ton. None required for contract quantities less than 500 ton.  
  
Class Q: One taken during the first 5,000 tons of hot mix tested and then at a minimum frequency of one core per 15,000 tons thereafter.

H. Theoretical Maximum Specific Gravity (Rice)

(1) Tier not applicable.

(2) Certification.  
None required.

(3) Acceptance.  
Class D, E, G, HR one per 1,000 ton. (DOT-42)

Class Q one per 1,000 ton for QC, one per 5,000 ton for QA. Sample to be obtained from the windrow in front of the laydown machine. (DOT-86)

(4) Independent Assurance.  
Class D, E, G, HR one per 10,000 ton. None required for contract quantities less than 500 ton.

To verify that the end product is representative of what was actually designed, area personnel will provide the Region Materials Laboratory with a sample (50 to 60 lbs.) of un-compacted mix from the first regularly scheduled theoretical maximum specific gravity (Rice) test. The Region Materials Laboratory will perform theoretical maximum specific gravity (Rice) test for comparative purposes with the acceptance test and will perform tests to determine the bulk specific gravity (Gyratory) and the percent air voids. Report results to the Bituminous Engineer.

Class Q one per 15,000 ton. None required for contract quantities less than 500 ton.

I. Bulk Specific Gravity.

(1) Tier not applicable.

(2) Certification.  
None required.

(3) Acceptance.  
Class D, E, G, HR None required.

Class Q one per 1,000 ton for QC, 5,000 ton for QA. Sample to be obtained from the windrow in front of the laydown machine. (DOT-86)

(4) Independent Assurance.  
Class D, E, G, HR one per 10,000 ton. None required for contract quantities less than 500 ton. (DOT-42)

Class Q One per 15,000 ton.

J. Mixture Densification, Voids in Mineral Aggregate and Dust to Binder Ratio. (Class Q)

(1) Tier not applicable.



- (2) Certification.  
None required.
- (3) Acceptance.  
One per 1,000 ton for QC, 5,000 ton for QA. Sample to be obtained from the windrow in front of the laydown machine (DOT-86)
- (4) Independent Assurance.  
One per 15,000 ton.

K. Moisture Content of Mix (Class Q and HR)

- (1) Tier not applicable.
- (2) Certification.  
None required.
- (3) Acceptance.  
One per 10,000 ton. Sample to be obtained from the windrow in front of the laydown machine. (DOT-35)
- (4) Independent Assurance.  
None required.

L. Drain Down (Class S)

- (1) Tier not applicable
- (2) Certification  
None required.
- (3) Acceptance  
One per day (DOT-91)
- (4) Independent Assurance  
None required.

M. Stabilizing Additive (Class S)

- (1) Tier not applicable
- (2) Certification  
None required.
- (3) Acceptance  
One per day (DOT-94)
- (4) Independent Assurance  
None required.

**1.2 Cold In Place Recycling.**

- A. Aggregate.
- (1) Tier 3.

- (2) Certification.  
None required.
- (3) Acceptance.  
One sample per day. (DOT-3)
- (4) Independent Assurance.  
None required.

**B. Density, Standard.**

- (1) Tier not applicable.
- (2) Certification.  
None required.
- (3) Acceptance.  
A minimum of one test strip will be completed to determine the target density. When there is significant change in mix proportions, weather conditions or other controlling factors, the Engineer may require completion of additional test strip(s) to check target density. (DOT-28)
- (4) Independent Assurance.  
None required.

**C. Density, In Place.**

- (1) Tier not applicable.
- (2) Certification.  
None required.
- (3) Acceptance.  
One per mile, per lane surfaced. (DOT-41)
- (4) Independent Assurance.  
None required.

**D. Moisture Content (Prior to Compaction).**

- (1) Tier not applicable.
- (2) Certification.  
None required.
- (3) Acceptance  
One per 1/2 mile, per lane processed. (DOT-35)

After the Contractor has informed the Engineer that the moisture specification has been met, the Engineer will perform the acceptance moisture tests. These moisture tests will be performed within the same areas as the density in place.

- (4) Independent Assurance.  
None required.

E. Moisture Content (After Compaction).

- (1) Tier not applicable.
- (2) Certification.  
None required.
- (3) Acceptance.  
One per mile, per lane surfaced. (DOT-35)

After the Contractor has informed the Engineer that the moisture specification has been met, the Engineer will perform the acceptance moisture tests. These moisture tests will be performed within the same areas as the density in place.

- (4) Independent Assurance.  
None required.

**1.3 Asphalt Surface Treatment.**

A. Cover Aggregate, Types 1 and 2.

- (1) Tier 3.
- (2) Certification.  
None required.
- (3) Acceptance.  
One sample per 500 ton, tested for gradation. One sample per 2,000 ton tested for P.I., and if required by specification flakiness index and crushed particles. (DOT-3 & DOT-61)
- (4) Independent Assurance.  
One sample per project. None required on quantities less than 1,500 tons.

B. Cover Aggregate, Type 3.

- (1) Tier 3.
- (2) Certification.  
None required.
- (3) Acceptance.  
One sample per 1,500 ton, tested for gradation, P.I., crushed particles and flakiness index. (DOT-3 & DOT-61)
- (4) Independent Assurance.  
One sample per project. None required on quantities less than 1,500 tons.

C. Mineral Aggregate for Microsurfacing

- (1) Tier 3.
- (2) Certification.  
None required.
- (3) Acceptance.  
One sample per 500 ton, tested for gradation. One sample per 2,000 ton tested for P.I., + #4 lightweights - #4 lightweights and if required by specification crushed particles. (DOT-3)
- (4) Independent Assurance.  
One sample per project. None required on quantities less than 1,500 tons.

**1.4 Asphalt Liquid.**

A. Material.

- (1) Tier 2.
- (2) Certification.  
A Certificate of Compliance is required for each conveyance or load of asphalt delivered to the project. The original and one copy should be received with each load delivered to the project.
- (3) Acceptance.  
One randomly selected sample per 100 ton, per type, grade, and source. Water added to dilute emulsified asphalt is not included in the 100 ton sampling frequency. Diluted emulsified asphalt will be sampled and tested. If water is added to dilute emulsified asphalt, note the dilution rate on the DOT-1. Sample sizes: Emulsions, two 1/2 gal. samples; all other asphalts, two 1 qt. samples. A Certificate of Compliance for each conveyance or load the sample represents must be submitted with each sample. (DOT-1)  
  
Asphalt delivered in a transport and pup ("Trailer") will be considered as one conveyance if it is from the same source and of the same grade.  
  
Detailed analysis will be made on the first sample of each type or grade, from each source. Then on a random basis for each 100 ton per type, grade, and source. Identification or detailed tests may be made on samples for which the detailed analysis is not required.
- (4) Independent Assurance.  
None required.

**1.5 Crack Sealing of Asphalt Concrete.**

A. Sealant.

- (1) Tier 2.

- (2) Certification.  
Item used must be on the Approved Products List.
- (3) Acceptance.  
One 5 lb. sample representing each lot or batch will be taken from the application wand during the sealing process. The sample will be placed in a Teflon or silicone lined box having a minimum capacity of 5 lbs. None required for contract quantities of 200 lbs. or less. (DOT-1)  
  
Visual Inspection will consist of measuring the width and depth of the routed vessel to ensure proper dimensions are obtained according to the plans.
- (4) Independent Assurance.  
None required.

B. Backer Rod.

- (1) Tier 2.
- (2) Certification.  
*APL*: None required.  
*Non-APL*: A Certificate of Compliance is required.
- (3) Acceptance.  
One 2 ft. length submitted with the sealant. (DOT-1)  
  
None required if less than 200 lbs. of sealant is used.
- (4) Independent Assurance.  
None required.

## 1.6 Milling (Surface Texture)

A. Cold Milling.

- (1) Tier not applicable.
- (2) Certification.  
None required.
- (3) Acceptance.  
One per day for mainline. A lot will consist of one day's production. (DOT-55A)  
  
None required for project quantities less than 2,000 square yards. Acceptance will be based on documented Visual Inspection.
- (4) Independent Assurance.  
None required

B. Micro-Milling.

(1) Tier not applicable.

(2) Certification.  
None required.

(3) Acceptance.  
One per day. A lot will consist of one day's production. (DOT-55A)  
  
None required for project quantities less than 2,000 square yards.  
Acceptance will be based on documented Visual Inspection.

(4) Independent Assurance.  
None required.

## 2. Subbase, Base Course, and Gravel Cushion Construction:

### General Notes:

When quality tests are required by specifications, one sample per 50,000 ton per source will be submitted to the Central Laboratory for testing. Aggregate production for asphalt concrete, base course, subbase, gravel cushion, etc., from the same source used on one or more projects simultaneously requires only the single minimum test frequency for quality; however, results must be reported separately for each material for each project file. Sample size: 120 lbs., 4 bags.

Samples and tests on aggregates will not be required for quantities less than 500 ton, provided there are prevailing test results to indicate the source has furnished satisfactory similar material. The quantity and source of the material will be provided to the Region Materials Engineer and the Chief Materials and Surfacing Engineer for review and approval. If approval is granted, acceptance will be based on documented Visual Inspection for equipment, method of placement, etc. Method of compaction must be approved by the Region Materials Engineer and Chief Material & Surfacing Engineer.

Prior to the first in place density test, the Area Engineer will submit a 60 lb., 2 bag sample to the Region Materials Laboratory where a 4-point determination will be made for each source, combination or type of material produced, including the specified additive or treatment where required. of materials used in the test will be determined and recorded. When changes in gradation, which may affect density results occur, additional 4-point determinations will be made as directed by the Region Materials Engineer.

When the material to be used on a project is from an established quarry on which a 4-point determination was previously made, it will be permissible to use that 4-point provided the 1-points fall within the range established by it. If the 1-points do not fall within the established range, another 4-point determination will be made.

### 2.1 Subbase and Base Course,

#### A. Aggregate, Composite.

(1) Tier 3.

(2) Certification.  
None required.

(3) Acceptance.  
One sample of composite mixture per 3,000 ton, tested for gradation, L.L., and P.I. Report the percentage and source of each component material used. (DOT-3)

If required by specifications, a crushed particles test will be performed each 6,000 ton. Crushed particle testing will not be required when material consists of 100% quarry material, 100% recycled Portland cement concrete pavement or 100% recycled asphalt pavement.

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- (4) Independent Assurance.  
One sample of composite mixture per 15,000 ton. None required for contract quantities less than 1,000 ton.

If required by specifications, a crushed particles test will be performed each 6,000 ton. Crushed particle testing will not be required when material consists of 100% quarry material, 100% recycled Portland cement concrete pavement or 100% recycled asphalt pavement.

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B. Density, In Place

- (1) Tier not applicable.
- (2) Certification.  
None required.
- (3) Acceptance.  
One per mile, per lift, per roadbed surface just prior to application of prime or subsequent course. Compacted lifts may be combined, not to exceed 6 in. total thickness, for testing purposes. (DOT-41)
- (4) Independent Assurance.  
One per 4 miles of roadbed surface. None required for contract quantities less than 1,000 ton.

C. Density, Standard

- (1) Tier not applicable.
- (2) Certification.  
None required.
- (3) Acceptance.  
One 1-point determination using material from or adjacent to the hole for each in place test. When the 1-point determination deviates more than 2 percentage points below or 1 percentage point above optimum moisture, another 1-point (nearer to optimum moisture) will be made. If the maximum density deviates outside the 4-point range, the Region Materials Engineer will be contacted. (DOT-41)
- (4) Independent Assurance.  
One per 4 miles of roadbed surface. None required for contract quantities less than 1,000 ton.

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**2.2 Gravel Cushion,**

A. Aggregate, Composite.

- (1) Tier 3.
- (2) Certification.  
None required.



- (3) Acceptance.  
One sample of composite mixture per 3,000 ton, tested for gradation, L.L., and P.I. Report the percentage and source of each component material used. (DOT-3)

If required by specifications, a crushed particles test will be performed each 6,000 ton. Crushed particles test is not required when material consists of 100% recycled portland cement concrete pavement or 100% recycled asphalt pavement.

- (4) Independent Assurance.  
One sample of composite aggregate per 15,000 ton.  
None required for contract quantities less than 1,000 ton.

### **3. Miscellaneous Granular Materials:**

#### General Notes:

When quality tests are required by specifications, one sample per 50,000 ton per source will be submitted to the Central Laboratory for testing. Aggregate production for asphalt concrete, base course, subbase, gravel cushion, etc. from the same source used on one or more projects simultaneously requires only the single minimum test frequency for quality; however, results must be reported separately for each material for each project file. Sample size: 120 lbs., 4 bags. (DOT-1)

#### **3.1 Gravel and Sand for Maintenance Stockpiles.**

- A. Aggregate.
  - (1) Tier 3.
  - (2) Certification.  
None required.
  - (3) Acceptance.  
One sample per 3,000 ton. (DOT-3)
  - (4) Independent Assurance.  
None required.

#### **3.2 Gravel Surfacing.**

- A. Aggregate.
  - (1) Tier 3.
  - (2) Certification.  
None required.
  - (3) Acceptance.  
One sample of composite mixture per 3,000 ton. (DOT-3)  
  
None required for contract quantities less than 100 ton.
  - (4) Independent Assurance.  
One sample of composite mixture per source. None required for contract quantities less than 1,000 ton.

#### **3.3 Blotting Sand for Prime Coat and Sand for Flush Seal.**

- A. Aggregate.
  - (1) Tier 3.
  - (2) Certification.  
None required.
  - (3) Acceptance.  
One sample per project. (DOT-3)

- (4) Independent Assurance.  
None required.

**3.4 Granular Bridge End Backfill.**

- A. Aggregate.
  - (1) Tier 3.
  - (2) Certification.  
None required.
  - (3) Acceptance.  
One sample per 1,000 ton. (DOT-3)
  - (4) Independent Assurance.  
None required.
- B. Density, In Place.
  - (1) Tier not applicable.
  - (2) Certification.  
None required.
  - (3) Acceptance.  
None required.
  - (4) Independent Assurance  
None required.

**3.5 Gabion Fill (Rock or Stone).**

- A. Aggregate.
  - (1) Tier 3.
  - (2) Certification.  
None required.
  - (3) Acceptance.  
Documented Visual Inspection for size and source.
  - (4) Independent Assurance.  
None required.

**3.6 Porous Backfill.**

- A. Aggregate.
  - (1) Tier 3.
  - (2) Certification.  
None required.

- (3) Acceptance.  
One sample per 250 ton. (DOT-3)

The Project Engineer may reduce the testing frequency to 1 per 2,000 ton after the first three passing tests provided the source remains the same and provided there is no apparent change in the properties of the material. If observations by the Project Engineer cause concern that specifications compliance is questionable, the testing frequency may return to the 1 per 250 ton.

- (4) Independent Assurance.  
None required.

### **3.7 Riprap.**

#### **A. Aggregate.**

- (1) Tier 3.

- (2) Certification.  
None required.

- (3) Acceptance.  
Documented Visual Inspection for size and source.

If requested by the Engineer, the Contractor will provide a sample of riprap weighing at least 5 ton meeting the gradation for the class specified.

The weight per cubic foot will be determined on this sample. The sample may be a part of the finished riprap covering. This sample will be used as a frequent reference for judging the gradation of the riprap supplied.

Any difference of opinion between the Engineer and the contractor will be resolved by dumping and checking the gradation of two random truckloads of riprap. The mechanical equipment, a sorting site, and labor to assist in checking gradation will be provided by the contractor at no additional cost to the State.

- (4) Independent Assurance.  
None required.

### **3.8 Pit Run.**

#### **A. Aggregate.**

- (1) Tier 3.

- (2) Certification.  
None required.

- (3) Acceptance.  
Documented Visual Inspection for size and source, and as determined by the Engineer a sieve analysis may be performed to verify the plans specified gradation. (DOT-3)
- (4) Independent Assurance.  
None required.

B. Density, In Place.

- (1) Tier not applicable.
- (2) Certification.  
None required.
- (3) Acceptance.  
One in place density per ½ mile, per site, per zone. The zones are defined in item 3 under the “Reduction of 1-point Determinations” in the “General Notes” for subgrade construction (Embankments). (DOT-41)
- (4) Independent Assurance.  
None required.

C. Density, Standard.

- (1) Tier not applicable.
- (2) Certification.  
None required.
- (3) Acceptance.  
One 1-point determination using material from or adjacent to the hole for each in place test. (DOT-41)
- (4) Independent Assurance.  
None required.

**3.9 Slope Protection Aggregate.**

A. Aggregate.

- (1) Tier 3.
- (2) Certification.  
None required.
- (3) Acceptance.  
One sample per source, per project. (DOT-3)
- (4) Independent Assurance.  
None required.

**3.10 Salvaged and Full Depth Reclamation Materials.**

A. Aggregate.

- (1) Tier 3.
- (2) Certification.  
None required.
- (3) Acceptance.  
One sample per day. (DOT-3)  
  
None required on surface preparation.
- (4) Independent Assurance.  
None required.

B. Density, In Place (when required by specification).

- (1) Tier not applicable.
- (2) Certification.  
None required.
- (3) Acceptance.  
One per mile, per lift, per roadbed surface. (DOT-41)  
  
None required if less than 500'.
- (4) Independent Assurance.  
None required.

C. Density, Standard (when required by specification).

- (1) Tier not applicable.
- (2) Certification.  
None required.
- (3) Acceptance.  
A minimum of one test strip per lift will be completed to determine the target density. When there is significant change in mix proportions, weather conditions or other controlling factors, the Engineer may require completion of additional test strip(s) to check target density. (DOT-28)  
  
None required if less than 500'.
- (4) Independent Assurance.  
None required.

### 3.11 Pipe and Box Culvert Undercut Backfill (Granular)

A. Aggregate.

- (1) Tier 3.
- (2) Certification.  
None required.
- (3) Acceptance.  
One sample per source, per project. (DOT-3)
- (4) Independent Assurance.  
None required.

B. Density, In Place.

- (1) Tier not applicable.
- (2) Certification.  
None required.
- (3) Acceptance.  
One per each 1 foot zone per installation. (DOT-41)

The density in the top 1 foot zone will be taken in the top lift of the undercut backfill immediately prior to installation of the pipe or box culvert.

Where insulating board is used, the density will be taken in the lift below it.

- (4) Independent Assurance.  
None required.

C. Density, Standard.

- (1) Tier not applicable.
- (2) Certification.  
None required.
- (3) Acceptance.  
One 1-point determination using material from or adjacent to the hole for the in place test. 1-point may be referred when undercut depth exceeds 1 foot and multiple in place densities are required for the installation.
- (4) Independent Assurance.  
None required.

### 3.12 Cold Milled Asphalt Concrete and Placing Cold Milled Material.

A. Milled Material.

- (1) Tier 3.

- (2) Certification.  
None required.
- (3) Acceptance.  
One sample per mile. (DOT-3)
- (4) Independent Assurance.  
None required.

**3.13 MSE Backfill.**

- A. Aggregate.
  - (1) Tier 3.
  - (2) Certification.  
None required.
  - (3) Acceptance.  
One sample per 5,000 yd<sup>3</sup> / 7,000 ton. (DOT-3)
  - (4) Independent Assurance.  
One sample per project.

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**3.14 Granular Material for Box Culvert and Pipe Bedding.**

- A. Aggregate.
  - (1) Tier 3.
  - (2) Certification.  
None required.
  - (3) Acceptance.  
One sample per 10,000 ton. (DOT-3)
  - (4) Independent Assurance.  
One sample per 50,000 ton.  
None required on quantities of 3,000 ton or less.

**3.15 Miscellaneous Granular Materials**

- A. Aggregate.
  - (1) Tier 3.
  - (2) Certification.  
None required.
  - (3) Acceptance.  
One sample per project. (DOT-3)
  - (4) Independent Assurance.  
None required.

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B. Rock, Clay, Sand Filler and Miscellaneous Granular Materials.

- (1) Tier 3.
- (2) Certification.  
None required.
- (3) Acceptance.  
One sample prior to blending with aggregate per 750 ton.
- (4) Independent Assurance.  
None required

C. Density, In Place.

- (1) Tier not applicable.
- (2) Certification.  
None required.
- (3) Acceptance.  
One per project, or other specified frequency, if density requirements are required by plans.
- (4) Independent Assurance.  
None required

D. Density, Standard.

- (1) Tier not applicable.
- (2) Certification.  
None required.
- (3) Acceptance.  
One 1-point determination using material adjacent to the hole for each project. (DOT-41) 1-point may be referenced to similar material on the project.
- (4) Independent Assurance.  
None required

#### **4. Subgrade Construction (Embankments):**

##### General Notes:

Embankment, berms and pipe backfill will each require a separate set of numbers for density and moisture tests.

The Central Laboratory will make preliminary tests for soils representing the major excavation areas and soil types. The results will be recorded for reference on the soils profile.

During construction, at least one acceptance test for gradation, L.L., and P.I. will be made to verify A-3 or A-2-4(0) soil classifications per source, per project, per day. (DOT-3) An independent assurance test will be made per 200,000 yd<sup>3</sup> on this material. This requirement is waived for the ordinary compaction method.

When material meeting specifications for fine aggregate as per Section 800.2.E. is hauled to the project from a commercial source to be used as pipe backfill, one acceptance sieve analysis will be required per source, per project, per 500 yd<sup>3</sup>. (DOT-3)

Visual observations will be made to detect possible changes in soil characteristics. When there is doubt about soil classification, contact the Region Materials Engineer.

##### Moisture and Density Testing:

Prior to or during early stages of construction, soil samples will be submitted by the Area Engineer to the Region Materials Laboratory. The samples will represent each of the major soil types and be sufficient in size to complete soil classification per SD 103 and a 4-point determination per SD 104 (Method 1 – 30 lb, Method 3 – 60 lb). The 4-point determination will be used to verify the “Family of Curves” that may be used. When the soil encountered contains + 3/4” materials, the sieve analysis will be made on an unscreened sample and the 4-point determination will be made on the - 3/4” material as per SD 104 Method 3. A 4-point will be performed on the - 3/4” material even if the material contains over 40% by weight of durable material. A 4-point determination will not be required if the excavation quantities on a project are 5,000 yd<sup>3</sup> or less.

Soils not compatible with the normal “Family of Curves” will require a 4-point to determine target moistures and densities. A 1-point determination will not be used for non-compatible soils, unless a special “Family of Curves” is established.

A 1-point may be used to determine target moistures and densities on soils compatible with the Ohio “Family of Curves” or special curves that have been established.

A target moisture and density will be determined prior to or at the same time the initial testing begins within each 1/2 mile segment.

When a density test is performed at the time the embankment is being placed and compacted, the moisture determination is acceptable as a moisture control test. (DOT-35).

Reduction of 1-Point Determinations:

The requirements for 1-point determinations outlined in paragraph 4.1 G. (3) and 4.3 B. (3) may be reduced, if the following conditions are met:

1. One-point determinations will be made on the first three tests (moisture tests or density tests) performed within each 1/2 mile segment.
2. Maximum dry densities of these three 1-point determinations must be within a spread of 6 lbs/ft<sup>3</sup>.
3. When the above is satisfied, the minimum number of 1-point determinations (moisture tests or density tests) required per 1/2 mile segment, for each roadbed, will be as follows:

Zone:	Depth:	Minimum required:
1	0 to 1 ft.	2*
2	1 ft. to 3 ft.	1
3	3 ft. to 5 ft.	1
4	5 ft. to bottom	1 per 5 ft.

\*In accordance with Section 120, this density will be performed within the upper 6 inches after the grade is prepared for surfacing.

Additional 1-point determinations will be made as required by changes in soil types within the 1/2 mile segment.

A density or moisture test may refer to a 1-point determination within 2,000 ft. of the test location, including backfill for pipe or box culverts.

When a 1-point determination is not made for a test and the test results in a failing moisture, failing density, or unusually high moisture or density, a 1-point determination will be made using material from the test location to ensure that the proper curve data is being used to determine the target moisture or density. This 1-point determination may be used for subsequent re-testing at the same location.

**4.1 Specified Density (In Place).**

A. Embankment (Includes Subgrade Topping, Ordinary and Heavy Roadway Shaping).

- (1) Tier not applicable.
- (2) Certification.  
None required.
- (3) Acceptance.  
One per 1/2 mile, per roadbed, per zone. The zones are defined in item 3 under "Reduction of 1-Point Determinations" in the "General Notes" for this section. (DOT-41)

- (4) Independent Assurance.  
One per 200,000 yd<sup>3</sup> of excavation.  
None required for contract quantities less than 10,000 yd<sup>3</sup>.

**B. Berms.**

- (1) Tier not applicable.
- (2) Certification.  
None required.
- (3) Acceptance.  
One per berm, per structure, per zone. (DOT-41)

Zone:	Depth:	Minimum required:
1	0 to 1 ft.	2*
2	1 ft. to 3 ft.	1
3	3 ft. to 5 ft.	1
4	5 ft. to bottom	1 per 3 ft.

\*In accordance with Section 120, the second density will be performed within the upper 6 inches after the grade is prepared for surfacing.

- (4) Independent Assurance.  
A minimum of one per project.

**C. Bridge End Embankment**

- (1) Tier not applicable.
- (2) Certification.  
None required.
- (3) Acceptance.  
Prior to placing the bridge end embankment, one density test will be required for the scarified and recompacted approach berm. In addition, three density tests will be required for each abutment backwall less than 7 ft. tall. Four density tests will be required for backwalls 7 ft. tall or over. Zones for density test will be equally spaced. (DOT-41)
- (4) Independent Assurance.  
A minimum of one per project.

**D. Cross Pipe Pre-Installation Density (Does not include utility, storm sewer, gas, or water main).**

- (1) Tier not applicable.
- (2) Certification.  
None required.

- (3) Acceptance.  
One below rural mainline cross pipe per installation prior to installing pipe. None required if pipe is undercut. (DOT-41)
- (4) Independent Assurance.  
None required.

E. Pipe Undercut Backfill (Soil).

- (1) Tier not applicable.
- (2) Certification.  
None required.
- (3) Acceptance.  
One per each 1 foot zone per installation (DOT-41)

The density in the top 1 foot zone will be taken in the top lift of the undercut backfill immediately prior to installation of the pipe or box culvert. 1-point may be referred when undercut depth exceeds 1 foot and multiple in place densities are required for the installation.

- (4) Independent Assurance.  
None required.

F. Pipe and Box Culvert Backfill

- (1) Tier not applicable.
- (2) Certification.  
None required.
- (3) Acceptance.
  - (a) Cross pipe, storm sewer pipe, sanitary sewer pipe, water main pipe, and box culvert. (DOT-41)
    - 1. Minimum Requirements per Installation.
      - a. On round pipe 24 in. or less in diameter or arch pipe 30 in., or less, one test approximately halfway up and one test in the 2 ft. of backfill above the pipe.
      - b. On round pipe that is 30 in. up to 72 in. in diameter, arch pipe that is 36 in. up to 84 in., or box culverts up to 6 ft. in height, one test in the lower one-half, one test in the upper one-half and one test in the 2 ft. of backfill above the pipe or box culvert.
      - c. On round pipe greater than 72 in. in diameter, arch pipe 96 in. or greater, or box culverts greater than 6 ft. in height, one test in the bottom one-third, one test in the middle one-third, one test in the top one-third and one test

in the 2 ft. of backfill above the pipe or box culvert. Testing locations within the zones will alternate from side to side of the pipe or box culvert. If a different source of backfill material or compaction procedure is used on either side, each zone will be tested on both sides.

2. After the minimum requirements have been met, one test per installation, per 3 ft. of backfill beginning 2 ft. above the top of the pipe or box culvert will be taken up to the elevation where normal grading operations commence over the pipe or box culvert.
- (b) Approach Pipe.  
The same as "(a) cross pipe, storm sewer pipe, sanitary sewer pipe, water main pipe, and box culvert", except none required for farm and field approaches.
- (4) Independent Assurance.
  - (a) Longitudinal Pipe (Storm Sewer, Sanitary Sewer or Water Main).  
One per 2,000 lineal feet. None required if total installation is less than 200 lineal feet.
  - (b) Cross pipe and box culvert.  
One per 10 installations. None required if project has a single installation that totals less than 200 lineal feet.
  - (c) Approach pipe.  
None required.

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The definition of "Per installation" as shown for density tests will be:

Each pipe or box culvert placed its entire length at one time.

Two or more pipes at one site when backfill is placed uniformly around all pipes and compactive effort is uniform around each pipe.

Each segment laid at different times such as in one-half length installations.

Each 300 lineal foot segment of cross, storm sewer, sanitary sewer, and water main pipe or portion thereof.

- G. Density, Standard (Target).
- (1) Tier not applicable.
  - (2) Certification.  
None required.

- (3) Acceptance.  
One 1-point determination using material from or adjacent to the hole for each in place test. (DOT-41)
- (4) Independent Assurance.  
One 1-point determination per in place density.

#### 4.2 Ordinary Compaction Method.

A. Density.

- (1) Tier not applicable.
- (2) Certification.  
None required.
- (3) Acceptance.  
Obtained as per ordinary compaction methods (DOT-41)
- (4) Independent Assurance.  
None required.

B. Density, Standard (Target).

- (1) Tier not applicable.
- (2) Certification.  
None required.
- (3) Acceptance.  
One 1-point determination using material from or adjacent to the hole for each in place test. (DOT-41)
- (4) Independent Assurance.  
None required.

#### 4.3 Moisture Content.

A. Embankment (Includes Select Subgrade Material, and Berms, Excludes Ordinary Compaction).

- (1) Tier not applicable.
- (2) Certification.  
None required.
- (3) Acceptance.  
As required to fix control, then one every 2 hours at each construction area. (DOT-35)

A representative sample is to be taken from soil being processed and compacted.

If the moisture content for an in place density test is not within the specified moisture limits for the project, the density will be considered as failing and will be corrected.

- (4) Independent Assurance.  
None required.

**B. Box Culvert, and Pipe Backfill.**

- (1) Tier not applicable.

- (2) Certification.  
None required.

- (3) Acceptance.  
None required.

If moisture test taken independent of density test, moisture will be documented on DOT-35.

- (4) Independent Assurance.  
None required.

**C. Moisture, Standard (Target).**

- (1) Tier not applicable.

- (2) Certification.  
None required.

- (3) Acceptance.  
One 1-point determination using material from or adjacent to the hole for each in place test. (DOT-35)

- (4) Independent Assurance.  
None required.



## 5. Portland Cement Concrete Paving (PCCP) Construction:

### General Notes:

For Special Provision for Contractor Furnished Mix Designs for PCCP:

All job mix designs for Portland cement concrete paving will be formulated by an approved testing firm. The concrete paving mix design will be verified by the Central Laboratory.

The samples of all materials to be used by both the testing firm and the Central Laboratory will be taken at the same time and split proportionately.

The Project Engineer will be notified prior to sampling and submitting mix design aggregate to the Central Lab.

For all other PCCP:

All job mix designs for Portland cement concrete paving will be either approved or formulated by the Concrete Engineer and may be tested in the Central Laboratory.

Samples of the aggregates will be submitted to the Central Testing Laboratory at least 40 days prior to anticipated use on the project for Quality and/or Design Mix testing/verification.

Material from proposed aggregate sources must be submitted when a new or modified mix is required or desired. The following quantities are required to be submitted for each mix design in bags no larger than 80 lbs. or buckets no larger than 5 gallons:

Fine aggregate.....	750 lbs.
Coarse aggregate .....	1100 lbs.*
Cement** .....	210 lbs.
Fly Ash*** .....	65 lbs.
Air Entraining Agent.....	8 oz.
Water Reducing Agent(s) .....	32 oz.

\*A minimum of 350 lbs. for each size.

\*\* A complete Certified Chemical Analysis and Physical Test Report are required for cement other than GCC Dacotah Rapid City.

\*\*\* A complete Certified Chemical Analysis and Physical Test Report are required for fly ash.

Quality and other special tests on aggregates that require equipment not available at the Region Materials Laboratory and field labs will be made in the Central Laboratories for each size and source on samples representing

- (a) The first 31,500 yd<sup>3</sup> taken at the start of production.
- (b) Each 31,500 yd<sup>3</sup> thereafter.

For aggregate material that has a satisfactory soundness record and has been used in concrete for five years or more, the sodium sulfate soundness test requirement may be reduced to once per year.

The sample sizes for all fine and coarse quality tests require 60 lbs. of each material. (DOT-1)

For contract quantities less than 20 yd<sup>3</sup> of concrete, certification and acceptance will be as per Section 7.1.A., except one air content determination, one slump test, and one set of cylinders per source. (DOT-23).

## **5.1 Materials.**

### **A. Aggregate, Fine and Coarse.**

(1) Tier 3.

(2) Certification.  
None required.

(3) Acceptance.  
One sample per 1,000 yd<sup>3</sup> of concrete for each size and source. Fine and coarse aggregate be sampled and tested simultaneously. (DOT-3 / DOT-68)

When flat and elongated is specified, one sample tested per the first 15,000 yd<sup>3</sup> then one per 30,000 yd<sup>3</sup> thereafter.

Resampling because of a deviation from specifications of one of the aggregates requires resampling and retesting of only that material which failed.

When 100% of the material used in the coarse aggregate is quarry material, lightweight particle testing for the coarse aggregate is not required.

When test results for lightweight particles in fine aggregate for five consecutive tests indicate passing results with an average of 0.4% or less and no individual test over 0.6%, the test frequency may be reduced to 1 test for lightweight particles in fine aggregate per 5,000 yd<sup>3</sup>. Normal testing frequency will resume for the remainder of the project if there are any failing tests. In addition, the lightweight particles in fine aggregate test will also be completed for all samples selected for independent assurance (IA) testing.

(4) Independent Assurance.  
One sample per 15,000 yd<sup>3</sup> of concrete paving for each size. None required for contract quantities less than 500 yd<sup>3</sup>. Lightweight particle test will not be required for coarse aggregate. One flat & elongated sample per project if required.

### **B. Aggregate, Fine and Coarse, Moisture Content.**

(1) Tier not applicable.

(2) Certification.  
None required.

- (3) Acceptance.  
One sample per 2 hours of paving operations for each size. (DOT-35)

Moisture testing may be reduced by the Engineer when automated concrete batching equipment with fine aggregate, or fine and coarse aggregate, moisture sensing capability is used. When only fine aggregate moisture sensors are used, the concrete plant will use a coarse aggregate moisture (DOT-98A) acceptable to the Engineer. Any moisture sensor will be accurate to 1.0% of the aggregate total moisture.

When the moisture testing is reduced, a moisture test for each size of aggregate will be made at the start of production and every 10,000 yd<sup>3</sup> or one per month, whichever happens first.

- (4) Independent Assurance.  
None required.

C. Cement.

- (1) Tier 2.

- (2) Certification.  
*From a certified supplier:* None required.

*From a non-certified supplier:* A Certificate of Compliance is required for each acceptance sample obtained.

- (3) Acceptance.  
One sample per 10,000 yd<sup>3</sup> of paving. Two 4 lb. samples. (DOT-1)  
None required for contract quantities less than 500 yd<sup>3</sup>.

- (4) Independent Assurance.  
None required.

D. Water.

- (1) Tier 3.

- (2) Certification.  
None required.

- (3) Acceptance.  
One 8 oz. sample in a plastic container per source prior to use. Frequency of testing thereafter to be determined by any changes (Runoff, growth of algae, etc.) affecting the source. (DOT-1)

Testing is not required for water from municipal supplies except in the north part of the Rapid City Region (Contact the Region Materials Engineer regarding this area).

- (4) Independent Assurance.  
None required.

E. Chemical Admixtures (Includes Air Entraining, Water Reducing, Accelerators, Retarders, etc.).

(1) Tier 2.

(2) Certification.

*APL:* None required.

*Non-APL:* A Certificate of Compliance is required.

(3) Acceptance.

One 8 oz. sample in a plastic container per type, lot, and source.  
(DOT-1)

Material must be thoroughly stirred, air agitated, or otherwise properly mixed to disperse all settlement just prior to sampling.

(4) Independent Assurance.

None required.

F. Fly Ash.

(1) Tier 2.

(2) Certification.

A Certificate of Compliance is required and must be submitted with each acceptance sample obtained.

(3) Acceptance.

One sample per 10,000 yd<sup>3</sup> of paving. The sample will be a 4 lb. sample taken from a randomly selected conveyance. (DOT-1).

(4) Independent Assurance.

None required.

**5.2 Strength Tests.**

A. Compressive Strength.

(1) Tier not applicable.

(2) Certification.

None required.

(3) Acceptance.

One set of cylinders for the first 250 yd<sup>3</sup> (for 1st days production); thereafter, one set of cylinders per 1500 yd<sup>3</sup> of concrete produced from each plant per day. (DOT-23)

No more than 2 sets per day will be required.

A set of cylinders will consist of a minimum of 4 cylinders. Two cylinders will be used for compressive strength at 28 days (One cylinder is tested at 28 days and the other is saved for the backup). The other two cylinders will be used for early breaks (normally at 7

and 14 days). If additional early breaks are desired or required, additional cylinders must be made.

If early break cylinders are not available (already tested, etc.), it is preferred that 4 in. diameter cores be used to determine the strength of hardened concrete for purposes of opening to traffic. If cores cannot be obtained the impact test hammer may be used to determine the approximate strength of hardened concrete.

- (4) Independent Assurance.  
None required.

### **5.3 Fresh (Plastic) Concrete Tests.**

#### **A. Air Content, Unit Weight, Slump, and Temperature.**

- (1) Tier not applicable.
- (2) Certification.  
None required.
- (3) Acceptance.  
Air content, unit weight, slump, and temperature determinations will be made each time a cylinder for compressive strength determination is made. Additional determinations will be made to ensure proper control, and not less than one determination will be made for each 2 hours of mixing-pouring operations. (DOT-23)
- (4) Independent Assurance.  
One air content, unit weight, slump, and temperature determination per 15,000 yd<sup>3</sup> of paving. None required for contract quantities less than 500 yd<sup>3</sup> of concrete. The slump tests may be by observation of acceptance tests.

### **5.4 Measurements.**

#### **A. Longitudinal Surface.**

- (1) Tier not applicable.
- (2) Certification.  
None required.
- (3) Acceptance.  
When profilograph testing is not required, test in accordance with SD 417. (DOT-29)

On projects where profilograph tests are required, coordinate with the contractor. Operation of the profilograph is the responsibility of the contractor. Calibration of the profilograph must be made after 1/2 mile of paving is available and periodically, (At DOT discretion), from then on.

A spot check will be made on each project, with a 10' straight edge to verify the effectiveness of corrective action taken to satisfy the acceptance requirements.

- (4) Independent Assurance.  
None required.

**B. Texture.**

- (1) Tier not applicable.
- (2) Certification.  
None required.
- (3) Acceptance.  
One per 10,000 yd<sup>2</sup> lot. (SD 418) (DOT-55)
- (4) Independent Assurance.  
None required.

**C. Thickness.**

- (1) Tier not applicable.
- (2) Certification.  
None required.
- (3) Acceptance.  
Coordinate with the Concrete Engineer (Coring to check thickness is a responsibility of the Concrete Engineer unless quantity is less than 4,000 yd<sup>2</sup>).

For projects with contract quantities less than 4,000 yd<sup>2</sup>, cores will not be taken, unless requested by the Area Engineer. A minimum of four depth checks will be made on the plastic concrete. (Miscellaneous Test Document)

- (4) Independent Assurance.  
None required.

**D. Width.**

- (1) Tier not applicable.
- (2) Certification.  
None required.
- (3) Acceptance.  
Coordinate with the Concrete Engineer (Checking width for each coring unit is a responsibility of the Concrete Engineer unless quantity is less than 4,000 yd<sup>2</sup>).

For projects with contract quantities less than 4,000 yd<sup>2</sup>, a width check will be made for each different paved width. (Miscellaneous Test Document)

- (4) Independent Assurance.  
None required.

## 5.5 Curing Materials.

### A. Liquid Membrane Curing Compound.

- (1) Tier 2.
- (2) Certification.  
*APL:* None required.  
*Non-APL:* A Certificate of Compliance is required.
- (3) Acceptance.  
One 8 oz. sample in a plastic or glass container per type, lot, and source. Sampling will occur from the end of the spray nozzle. (DOT-1)
- (4) Independent Assurance.  
None required.

### B. Burlap and Cotton Mat.

- (1) Tier 3.
- (2) Certification.  
None required.
- (3) Acceptance.  
Documented Visual Inspection.
- (4) Independent Assurance.  
None required

### C. Polyethylene Sheeting.

- (1) Tier 3.
- (2) Certification.  
None required.
- (3) Acceptance.  
Documented Visual Inspection.
- (4) Independent Assurance.  
None required.

## 5.6 Joint Materials.

### A. Preformed Expansion Type (Includes Non-Extruding and Resilient Bituminous and Non-Bituminous Types).

- (1) Tier 3.

- (2) Certification.  
None required.
- (3) Acceptance.  
One sample at least 6 in. x 36 in. x full thickness. The sample must be packaged to prevent distortion or breakage in handling and shipment.  
  
None required for contract quantities less than 25 ft<sup>2</sup>; acceptance will be based on Visual Inspection, for size and type.

- (4) Independent Assurance.  
None required.

B. Hot Poured Elastic Type.

- (1) Tier 2.
- (2) Certification.  
*APL*: None required.  
*Non-APL*: A Certificate of Compliance is required.
- (3) Acceptance.  
One 5 lb. sample representing each lot or batch will be taken from the application wand during the sealing process. The sample will be placed in a Teflon or silicone lined box having a minimum capacity of 5 lbs. (DOT-1)  
  
None required for contract quantities of 200 lbs. or less.
- (4) Independent Assurance.  
None required.

C. Backer Rod (Hot Pour).

- (1) Tier 2.
- (2) Certification.  
*APL*: None required.  
*Non-APL*: A Certificate of Compliance is required.
- (3) Acceptance.  
One 2 ft. length submitted with the joint material. (DOT-1)  
  
None required if less than 200 lbs. of sealant is used, acceptance will be based on Visual Inspection, for size and type.
- (4) Independent Assurance.  
None required.

D. Silicone.

- (1) Tier 2.



- (2) Certification.  
Item used must be on the Approved Products List.
- (3) Acceptance.  
One component silicone: One 1 pt. sample (In paint sample can) per lot, per source. (DOT-1)

In Place: 1 random sample approximately 3 in. in length will be cut per 1/10 mile of roadbed from the in place material to check bonding, width, thickness, shape and non-adherence to backer rod. The results of these measurements will be documented. (DOT-10)

Test cannot fail bond check that is performed in less than 7 days.

Acceptance samples of silicone or in place tests are not required for projects that have 500 ft. or less of joints to be sealed, provided basis of acceptance is documented.

- (4) Independent Assurance.  
None required.

E. Backer Rod (Silicone).

- (1) Tier 2.
- (2) Certification.  
*APL:* None required.  
*Non-APL:* A Certificate of Compliance is required.
- (3) Acceptance.  
None required.
- (4) Independent Assurance.  
None required.

**5.7 Keyways.**

A. Material.

- (1) Tier 3.
- (2) Certification.  
None required.
- (3) Acceptance.  
Documented Visual Inspection of dimension measurements.
- (4) Independent Assurance.  
None required.

## 6. Portland Cement Concrete Structure Construction:

### General Notes:

When specified, the Contractor will design and be responsible for the performance of all concrete mixes used for structural concrete. The mix design data and support information for each mix will be reported to the Concrete Engineer on a DOT-24.

Quality, acceptance and independent assurance (IA), sampling, testing, and certification of the aggregates, admixtures, etc. used in Contractor mix design concrete will be performed by DOT personnel in accordance with the provisions of this section as they are incorporated into the work.

The Department will continue to perform job mix designs for special Portland cement concrete structural construction. The designs will be formulated and tested in the Central Laboratory. The following material quantities for this testing will be submitted to the Central Laboratory in bags no larger than 80 lbs. or buckets no larger than 5 gallons

Fine aggregate.....	750 lbs.
Coarse aggregate .....	1,100 lbs.*
Cement** .....	210 lbs.
Fly Ash*** .....	65 lbs.
Air Entraining Agent.....	8 oz.
Water Reducing Agent(s) .....	32 oz.

\*A minimum of 300 lbs. for each size.

\*\* A complete Certified Chemical Analysis and Physical Test Report are required for cement other than GCC Dacotah Rapid City.

\*\*\* A complete Certified Chemical Analysis and Physical Test Report are required for fly ash.

Quality tests and other special tests on aggregates that require equipment not available at the Region Materials Laboratory and field labs will be made in the Central Laboratories on samples representing each 31,500 yd<sup>3</sup>.

For aggregate material that has a satisfactory soundness record and has been used in concrete for five years or more, the sodium sulfate soundness test requirement may be reduced to once per year.

The sample sizes for Quality tests are as follows: Sand, 30 lbs.; limestone, quartzite, or granite, 60 lbs. (DOT-1)

Samples of materials not previously tested will be submitted to the Central Laboratory at least 40 days prior to use.

### 6.1 Materials.

- A. Aggregate, Fine and Coarse.  
(1) Tier 3.

- (2) Certification.  
None required.
- (3) Acceptance.  
One sample per 200 yd<sup>3</sup> of concrete for each size and source. Fine and coarse aggregate will be sampled and tested simultaneously. (DOT-3)  
  
Resampling because of a deviation from specifications of one of the aggregates requires resampling and retesting of only that material which failed.  
  
When 100% of the material used in the coarse aggregate is quarry material, lightweight particle testing is not required.
- (4) Independent Assurance.  
One sample for each size. None required for contract quantities less than 100 yd<sup>3</sup> of concrete. Lightweight particle test will not be required for coarse aggregate.

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B. Aggregate, Fine and Coarse, Moisture Content.

- (1) Tier not applicable.
- (2) Certification.  
None required.
- (3) Acceptance.  
One sample per day for each size, prior to beginning of production, and additional samples not to exceed 200 yd<sup>3</sup>. (DOT-35)  
  
Not required on low slump deck overlays.  
  
Moisture testing may be reduced by the Engineer when automated concrete batching equipment with fine aggregate, or fine and coarse aggregate, moisture sensing capability is used. When only fine aggregate moisture sensors are used, the concrete plant will use a coarse aggregate moisture (DOT-98A) acceptable to the Engineer. Any moisture sensor will be accurate to 1.0% of the aggregate total moisture.  
  
When the moisture testing is reduced, a moisture test for each size of aggregate will be made at the start of production and every 10,000 yd<sup>3</sup> or one per month, whichever happens first.
- (4) Independent Assurance.  
None required.

C. Cement.

- (1) Tier 2.
- (2) Certification.  
*From a certified supplier:* None required.

*From a non-certified supplier:* A Certificate of Compliance is required for each acceptance sample obtained.

- (3) Acceptance.  
One sample per type for each contract. Two 4 lb. samples. (DOT-1)

None required for contract quantities less than 50 yd<sup>3</sup>.

- (4) Independent Assurance.  
None required.

D. Water.

- (1) Tier 3.

- (2) Certification.  
None required.

- (3) Acceptance.  
One 8 oz. sample in a plastic container per source prior to use. Frequency of testing thereafter to be determined by any changes (Runoff, growth of algae, etc.) affecting the source. (DOT-1)

Testing is not required for water from municipal supplies except in the north part of the Rapid City Region (Contact the Region Materials Engineer regarding this area).

- (4) Independent Assurance.  
None required.

E. Chemical Admixtures (Includes Air Entraining, Water Reducer, Accelerators, Retarders, etc.).

- (1) Tier 2.

- (2) Certification.  
*APL:* None required.  
*Non-APL:* A Certificate of Compliance is required.

- (3) Acceptance.  
One 8 oz. sample in a plastic or glass container per type, lot, and source. (DOT-1)

Material must be thoroughly stirred, air agitated, or otherwise properly mixed to disperse all settlement just prior to sampling.

- (4) Independent Assurance.  
None required.

F. Fly Ash.

- (1) Tier 2

- (2) Certification.  
A Certificate of Compliance is required for each acceptance sample obtained.
- (3) Acceptance.  
One randomly selected 4 lb. sample per contract. (DOT-1)  
  
None required for contract quantities less than 50 yd<sup>3</sup> of concrete. A certificate of compliance for each conveyance the sample represents must be submitted with each sample.
- (4) Independent Assurance.  
None required.

## 6.2 Strength Tests.

### A. Compressive Strength.

- (1) Tier not applicable.
- (2) Certification.  
None required.
- (3) Acceptance.  
One set of cylinders (Made from the same batch of concrete) per 200 yd<sup>3</sup> of concrete, per day for each class of concrete from each plant.  
  
Strength tests for bridge deck concrete will be 1 per 100 yd<sup>3</sup> of concrete per day. (DOT-23)  
  
A set of cylinders will consist of a minimum of 4 cylinders. Two cylinders will be used for compressive strength at 28 days (One cylinder is tested at 28 days and the other is saved for the backup). The other two cylinders will be used for early breaks (Normally at seven and 14 days). If additional early breaks are desired or required, additional cylinders must be made.  
  
It is recommended that cylinders be used to determine the attained strength of the hardened concrete. The impact test hammer may be used to determine the attained strength of hardened concrete for permitting traffic use and for comparative or confirmation tests. (DOT-9) When possible, the impact hammer should be tested on a concrete cylinder prior to breaking and adjust the correction factor for the comparative or confirmation tests.
- (4) Independent Assurance.  
None required.

## 6.3 Fresh (Plastic) Concrete Tests.

### A. Air Content, Unit Weight, Slump, and Temperature.

- (1) Tier not applicable.

- (2) Certification.  
Drilled Shaft Construction Report (DOT-297).

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- (3) Acceptance.  
Air content, unit weight, slump, and temperature determinations will be made each time a cylinder for compressive strength determination is made. Additional determinations will be made to ensure proper control, and not less than one determination for each 2 hours of mixing-placing operations. (DOT-23)

Additional determinations for air content, unit weight, slump, and temperature will be made for each one hour of mixing-placing operations on bridge decks.

**Drilled Shaft:**

Fresh Concrete tests will be made on every load of concrete before it is placed. When a pour of 18 cu. yds. or less is made, all concrete will be on site and the concrete in each conveyance will be tested before any concrete is placed.

**Self-Consolidating Concrete (SCC):**

First Truckload: The following fresh (plastic) concrete tests will be performed on the concrete from the first truckload of any individual concrete placement.

Slump Flow and VSI, J-Ring, Temperature, Air Content, and Unit Weight.

Subsequent Truckloads: After the first truckload, fresh (plastic) concrete tests will be performed on the concrete from all subsequent truckloads at the following frequency:

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Slump Flow and VSI: Slump flow spread will be tested at a rate of every other conveyance.

J-Ring: J-Ring will be tested at a rate of one out of every four conveyances.

The Slump Flow and the J-Ring tests will be performed on the same conveyance. The tests will be performed concurrently or subsequently with no more than six minutes elapsed time between the slump flow and J-ring tests.

Temperature: Temperature will be tested at a rate of one out of every four conveyances.

Air Content and Unit Weight: Air content and unit weight will be tested at a rate of one out of every four conveyances. Additional determinations will be made if more than 2 hours has passed from the previous test.

- (4) Independent Assurance.  
One air content, unit weight, slump, and temperature determination per contract. None required for contract quantities less than 100 yd<sup>3</sup> of concrete. (DOT-23) The slump tests may be by observation of acceptance tests.

Self-Consolidating Concrete (SCC) - Slump flow, visual stability index, and J-ring testing may be by observation of acceptance tests.

#### 6.4 Curing Materials.

A. Liquid Membrane Curing Compound.

- (1) Tier 2.

- (2) Certification.  
*APL:* None required.

*Non-APL:* A Certificate of Compliance is required.

- (3) Acceptance.  
One 8 oz. sample in a plastic or glass container per type, lot, and source. Sampling will occur from the end of the spray nozzle. (DOT-1)

- (4) Independent Assurance.  
None required.

B. Burlap.

- (1) Tier 3.

- (2) Certification.  
None required.

- (3) Acceptance.  
Documented Visual Inspection.

- (4) Independent Assurance.  
None required.

C. Film (Sheet Materials Including Waterproof Paper, Polyethylene Sheeting, White Burlap-Polyethylene Sheeting, etc.).

- (1) Tier 3.

- (2) Certification.  
None required.

- (3) Acceptance.  
Documented Visual Inspection.

- (4) Independent Assurance.  
None required.

**6.5 Joint Materials.**

- A. Strip Seal and Preformed Elastomeric Open Cell Compression Type with Lubricant/Adhesive.
- (1) Tier 2.
  - (2) Certification.  
*APL:* None required.  
*Non-APL:* A Certificate of Compliance is required for both the joint seal and lubricant/adhesive.
  - (3) Acceptance.  
Documented Visual Inspection for correct size, shape, etc.
  - (4) Independent Assurance.  
None required.
- B. Preformed Expansion Type (Includes Non-Extruding and Resilient Bituminous and Non-Bituminous Types).
- (1) Tier 3.
  - (2) Certification.  
None required.
  - (3) Acceptance.  
One sample at least 6 in. x 36 in. x full thickness. The sample must be packaged to prevent distortion or breakage in handling and shipment.  
  
None required for contract quantities less than 25 ft<sup>2</sup>; acceptance will be based on Visual Inspection, for size and type.
  - (4) Independent Assurance.  
None required.
- C. Hot Poured Elastic Type.
- (1) Tier 2.
  - (2) Certification.  
*APL:* None required.  
*Non-APL:* A Certificate of Compliance is required.
  - (3) Acceptance.  
One 5 lb. sample representing each lot or batch will be taken from the application wand during the sealing process. The sample will be placed in a Teflon or silicone lined box having a minimum capacity of 5 lbs. (DOT-1)  
  
None required for contract quantities of 200 lbs. or less.



- (4) Independent Assurance.  
None required.

D. Silicone.

- (1) Tier 2.
- (2) Certification.  
Item used must be on the Approved Products List.
- (3) Acceptance.  
Documented Visual Inspection to verify that the item used is on the Approved Products List and that installation is in accordance with plan details.
- (4) Independent Assurance.  
None required.

E. Backer Rod.

- (1) Tier 2.
- (2) Certification.  
*APL*: None required.  
*Non-APL*: A Certificate of Compliance is required.
- (3) Acceptance.  
Documented Visual Inspection to verify that the item used is on the Approved Products List and that installation is in accordance with plan details.
- (4) Independent Assurance.  
None required.

**6.6 Commercial Textured and Special Surface Finish.**

A. Materials.

- (1) Tier 2.
- (2) Certification.  
Item used must be on the Approved Products List.
- (3) Acceptance.  
Documented Visual Inspection to verify that the item used is on the Approved Products List and that installation is in accordance with plan details.
- (4) Independent Assurance.  
None required.

**6.7 Abutment Backwall Coating.**

A. Materials.

- (1) Tier 2.

- (2) Certification.  
Item used must be on the Approved Products List.
- (3) Acceptance.  
Documented Visual Inspection to verify that the item used is on the Approved Products List.
- (4) Independent Assurance.  
None required.

**6.8 Measurement of Texture.**

- A. Tined Surface.
  - (1) Tier not applicable.
  - (2) Certification.  
None required.
  - (3) Acceptance.  
One per structure, per pour. (SD 418) (DOT-55)
  - (4) Independent Assurance.  
None required.

**6.9 Measurement of Deck Roughness.**

- A. Surface.
  - (1) Tier not applicable.
  - (2) Certification.  
None required.
  - (3) Acceptance.  
On projects where profilograph tests are required, coordinate with the contractor. Operation of the profilograph is the responsibility of the contractor. Calibration of the profilograph is required.  
  
When profilograph testing is not required, test in accordance with SD 417. (DOT-29)
  - (4) Independent Assurance.  
None required.

7. **Portland Cement Concrete Miscellaneous Construction - Class M:**

7.1 **Materials and Plants.**

A. Requirements.

(1) Tier 2.

(2) Certification.

Prior to placement, each supplier of Portland cement concrete, "Class M", will furnish the Area Engineer with a signed statement certifying that the "Class M" concrete meets specification requirements (DOT-57).

None required if material is listed on "Concrete Pipe Release Dates" report.

(3) Acceptance.

One air content determination, one slump test, and one set of cylinders per source. (DOT-23)

**Self-Consolidating Concrete:** One air content, slump flow, visual stability index, J-ring, temperature of fresh concrete, and one set of cylinders per placement. Additional determinations may be made to ensure proper control of mixing-placing operations (DOT-23).

None required for contract quantities less than 50 yd<sup>3</sup> of concrete.

Documented Visual Inspection that the materials, methods, and equipment used to produce the concrete are satisfactory.

None required if material is listed on "Concrete Pipe Release Dates" report

(4) Independent Assurance.

None required.

B. Preformed Expansion Type Joint Material (Includes Non-Extruding and Resilient Bituminous and Non-Bituminous Types).

(1) Tier 3.

(2) Certification.

None required.

(3) Acceptance.

One sample at least 6 in. x 36 in. x full thickness. The sample must be packaged to prevent distortion or breakage in handling and shipment. (DOT-1)

None required for contract quantities less than 25 ft<sup>2</sup>; acceptance will be based on Visual Inspection, for size and type.

(4) Independent Assurance.

None required.

## **8. Roadway Lighting and Traffic Control:**

### General Notes:

If the acceptability of any item is questionable, the Region Traffic Engineer will be notified. He may request a sample be submitted for approval, may make an inspection, or may approve the item by other means.

Where the specifications contain the "Or equal" clause, it is understood that other makes of equal size, quantity, quality, and performance may be accepted if approved by the Region Traffic Engineer prior to installation.

### **8.1 Materials.**

#### **A. Standard Items of Electrical Equipment.**

Circuit breakers  
Conduit, sleeves, couplings, and fittings  
Dry type transformers, etc.  
Electric cables (Conductor)  
Fused Y connector kits  
In-line fuse holder connectors  
Weatherproof cases with multiple contactors and fuses

- (1) Tier 3.
- (2) Certification.  
None required.
- (3) Acceptance.  
Documented Visual Inspection for stamps or markings indicating size, type, and approval by UL, IPCEA, NEMA, or other recognized agency. It will also be ascertained and documented that the items are the correct size and type for the intended use.
- (4) Independent Assurance.  
None required.

#### **B. Miscellaneous Hardware Items.**

Electrical junction boxes (not on APL).  
Ground rods and clamps

- (1) Tier 3.
- (2) Certification.  
None required.
- (3) Acceptance.  
Documented Visual Inspection to verify that the items are of adequate size and compatible type for the intended use.
- (4) Independent Assurance.  
None required.

C. Items that are on the Approved Products List.

Detector Loop Sealer.  
Detector Unit  
Electrical Junction Box  
MASH Compliant Pedestal Signal Pole  
MASH Compliant Pedestrian Push Button Pole  
Pedestrian Push Buttons  
Photoelectric Cells.  
Traffic Signal Controller - TS2  
Video Detection Systems

(1) Tier 2.

(2) Certification.  
Item used must be on the Approved Products List.

(3) Acceptance.  
Documented Visual Inspection to verify that the item used is on the Approved Products List. If the identification is doubtful or the item is not on the list, the Region Traffic Engineer will be notified, and his approval of the item requested.

(4) Independent Assurance.  
None required.

D. Items Requiring Approval of Catalogue Cuts or Shop Drawings.

Anchor Bolts  
Battery Backup System for Traffic Signal  
Detector units (Not on APL)  
Emergency Preemption Unit  
Fiber Optic Cable  
Lowering Devices  
Luminaires  
Optical Detector  
Pedestal Signal Poles (Not on APL)  
Pedestrian Push Buttons (Not on APL)  
Pedestrian Push Button Pole (Not on APL)  
Pre-formed Detector Loops (When factory made and not fabricated by the Contractor in accordance with plan details)  
Radar Detection Systems  
Rectangular Rapid Flashing Beacon  
\*Signal and Luminaire poles  
Signal heads and accessories  
Solar Powered Flashing Beacon  
Traffic Signal Controllers and accessories (Not on APL).  
Transmitter and Receiver units and accessories.  
Video Detection Systems (Not on APL)  
Wireless In-pavement Detection Systems

\*Signal and lighting poles (Listed here as a "Tier 1" material only to satisfy the requirement that Shop Drawings and Registered PE Certificate must be approved prior to fabrication. See following page for Umbrella Certification requirements for these materials).

- (1) Tier 1.
- (2) Certification.  
Prior to installation, the Contractor will submit catalogue cuts or shop drawings (5 copies) to the Traffic Design Engineer for review. Approved catalogue cuts and shop drawings will be forwarded to the Area Engineer.
- (3) Acceptance.  
Documented Visual Inspection to ensure that the items delivered for use on the project are the same as indicated by the catalogue cuts or shop drawings and that the items have not been damaged by shipping and handling.
- (4) Independent Assurance.  
None required.

E. Items Requiring an Umbrella Certificate for the Material.

Fixed and breakaway bases.  
Mast arms and luminaires extensions.  
Signal and lighting poles.  
Span wire and pole clamps.  
Transformer bases.

- (1) Tier 2
- (2) Certification.  
Umbrella Certificate. (DOT-99)  
  
If records are audited, the Contractor must produce a Certified Copy of the Mill Test Report for castings, and structural and tubular sections showing both physical and chemical properties.
- (3) Acceptance.  
Documented Visual Inspection for correct size, obvious defects in fabrication, shipping, and handling damage, etc.
- (4) Independent Assurance.  
None required.

9. Erosion and Sediment Control

9.1 Materials.

A. Erosion Control Devices

- (1) Tier 3.
- (2) Certification.  
*APL*: None required.  
*Non-APL*: A Certificate of Compliance is required.
- (3) Acceptance.  
Documented Visual Inspection.
- (4) Independent Assurance.  
None required.

B. Fertilizer.

- (1) Tier 2.
- (2) Certification.  
A Bill of Lading, bag label, tag, or other document is required to confirm name and address of manufacturer, brand, grade, and a guaranteed analysis showing minimum percentages of total nitrogen, available phosphoric acid, and water soluble potash.  
  
None required for contract quantities less than 500 lbs.
- (3) Acceptance.  
None required.
- (4) Independent Assurance.  
None required.

C. Fiber Mulch.

- (1) Tier 2.
- (2) Certification.  
A Certificate of Compliance is required.
- (3) Acceptance.  
Documented Visual Inspection to verify that the packages are marked by the manufacturer with air dry content.
- (4) Independent Assurance.  
None required.

D. Seeds.

- (1) Tier 2.

- (2) Certification.  
A Certificate of Seed Analysis or Certified Test Report for each lot of seed to be used on the project. Certification is not required on projects requiring 100 lbs. of seed or less.

- (3) Acceptance.  
Field obtained seed samples for determination of South Dakota noxious weeds will be taken at the following frequency: (SD 512) (DOT-1)

0 to 500 lbs.	None required
500 to 1,000 lbs.	One sample
every 1,000 lbs. thereafter	One sample

Samples taken to satisfy the requirements shown above will be tested for South Dakota noxious weed content only. SDSU seed laboratory will randomly select a number of these samples per year and do a detailed analysis. The random selection will be influenced by possible irregularities noted while conducting the noxious weed checks.

Documented Visual Inspection to ensure that the seed bag tags are from the same lot covered by the Certification.

- (4) Independent Assurance.  
None required.

E. Mulch.

- (1) Tier 3.
- (2) Certification.  
None required.
- (3) Acceptance.  
Visual Inspection.
- (4) Independent Assurance.  
None required.

F. Mycorrhizal Inoculum.

- (1) Tier 3.
- (2) Certification.  
A Certificate of Compliance is required.
- (3) Acceptance.  
None Required.
- (4) Independent Assurance.  
None required.



## 10. Buildings and Rest Area Construction:

### General Notes:

Minimum Sample and Test Requirements (MSTR), listed in other sections of this manual, will apply when the same material items are used for the construction in this section. This refers to material items such as Portland cement concrete, reinforcing steel, seeding, fencing, and any other items appearing elsewhere in this manual.

Where the specifications contain the "Or equal" clause, it is understood that other makes of equal size, quantity, quality, and performance may be accepted, if approved by the Area Engineer prior to use.

Shop drawings, brochures, and schedules, used as a basis for approval, must be submitted in accordance with specifications to the Central Office for review and approval. Items accepted based on certification, brochures, or shop drawings will be visually inspected in the field to verify compliance with requirements. Documentation of this inspection will be made in the diary. Documented inspection will also be made on items accepted based on labels, identification tags, or other means.

### 10.1 Materials.

#### A. Brick.

- (1) Tier 3.
- (2) Certification.  
None required.
- (3) Acceptance.  
Documented Visual Inspection to verify that units are sound and free from cracks and other defects.
- (4) Independent Assurance.  
None required.

#### B. Insulation.

- (1) Tier 3.
- (2) Certification.  
None required.
- (3) Acceptance.  
Documented Visual Inspection.
- (4) Independent Assurance.  
None required.

#### C. Building Block (Hollow or Solid).

- (1) Tier 3.
- (2) Certification.  
None required.

- (3) Acceptance.  
Documented Visual Inspection to verify that units are sound and free from cracks and other defects.
- (4) Independent Assurance.  
None required.

D. Basin and Manhole Block.

- (1) Tier 3.
- (2) Certification.  
None required.
- (3) Acceptance.  
Documented Visual Inspection to verify that units are sound and free from cracks and other defects.
- (4) Independent Assurance.  
None required.

E. Miscellaneous Hardware Items.

Faucets, copper pipe, and fittings.  
Light fixtures and other electrical items.  
Lock sets, hinges, and door closures.  
Other plumbing items and fixtures, etc.

- (1) Tier 3.
- (2) Certification.  
None required.
- (3) Acceptance.  
Documented Visual Inspection for stamps or markings indicating size, type, and approval by UL, NEMA, or another industry recognized agency. It will also be ascertained and documented that the items are the correct size and type for the intended use.
- (4) Independent Assurance.  
None required.

**11. Miscellaneous Incidental and Manufactured or Fabricated Items:**

**11.1 Aluminum.**

- A. Cast, Framing, Handrail, Hardware, and Sheet (Includes Extruded Types).
- (1) Tier 2.
  - (2) Certification.  
A Certified Copy of the Mill Test Report showing the chemical and physical tests for each heat or lot number.
  - (3) Acceptance.  
Documented Visual Inspection for measurements.
  - (4) Independent Assurance.  
None required.

**11.2 Bearing Pads.**

- A. Bronze or Copper.
- (1) Tier 2.
  - (2) Certification.  
A Certificate of Compliance is required for each type and source.
  - (3) Acceptance.  
Documented Visual Inspection.
  - (4) Independent Assurance.  
None required.
- B. Elastomeric.
- (1) Tier 2.
  - (2) Certification.  
A Certificate of Compliance is required for each source.  
  
When furnished by pre-stressed fabricator - Umbrella Certification.  
(DOT-99)
  - (3) Acceptance.  
Documented Visual Inspection.
  - (4) Independent Assurance.  
None required.
- C. Preformed Fabric.
- (1) Tier 3.
  - (2) Certification.  
None required.

- (3) Acceptance.  
One sample per source. Sample size: 6 in. x 6 in. x full thickness.  
(DOT-1)
- (4) Independent Assurance.  
None required.

### **11.3 Bolt Assemblies (Bolts, Nuts, Washers, and Direct Tension Indicators)**

#### **A. High-Strength Bolts**

- (1) Tier.
  - (a) ASTM F3125 grades A325 and A490 high-strength bolt assemblies used on steel girder or truss bridges. Tier 1.
  - (b) All other bolt assemblies not covered by the provisions in (a) above. Tier 2.
- (2) Certification.
  - (a) Bolt assemblies.  
A Certified Copy of the Mill Test Report.
  - (b) Bolt assemblies used in guardrail, signing and lighting  
Umbrella Certificate. (DOT-99)

If records are audited, the Contractor must produce a Certified Copy of the Mill Test Report.

A307 bolts including guardrail bolts, eye bolts, ribbed, and unfinished used in non-critical applications may be accepted in the Certification Office by Certificate of Compliance.

- (3) Acceptance.
  - (a) Grade A325 high-strength bolt assemblies used on steel girder or truss bridges.

#### **I. Rotational capacity.**

One sample of three bolt assemblies (Excluding direct tension indicators - DTI) for each bolt diameter, length, and lot number, tested for rotational capacity in accordance with SD 507. (DOT-96)

A bolt assembly is defined as a bolt, nut and washer(s) that are from the same rotational capacity lot # as is to be used in the work and as tested by the Supplier.

#### **II. Direct tension indicator (DTI).**

One sample of three direct tension indicator bolt assemblies for each diameter, length and lot number of bolt and for each lot number of direct tension indicator, tested in accordance

with SD 503. (DOT-96). For bolts defined as short bolts in SD 503, an additional three direct tension indicator bolt assemblies with bolts meeting the minimum length requirements specified in the Short Bolts for DTI Testing table, will be furnished.

A direct tension indicator bolt assembly is defined as a bolt, nut, washer(s) and direct tension indicator that are from the same lot as is to be used in the work.

- (b) All other bolt assemblies Documented measurements and Visual Inspection for size markings and coating.
- (4) Independent Assurance.  
None required.
- B. Anchor Bolts, Nuts and Washers.
  - (1) Tier 1.
  - (2) Certification  
A Certified Copy of the Mill Test Report.
  - (3) Acceptance.  
None required.
  - (4) Independent Assurance.  
None required.
- C. Tie Bolts (Precast Box Culvert and Reinforced Concrete Pipe)
  - (1) Tier 2.
  - (2) Certification.  
Umbrella Certificate. (DOT-99)  
  
If records are audited, the Contractor must produce a Certified Copy of the Mill Test Report.
  - (3) Acceptance.  
Documented measurements and Visual Inspection.
  - (4) Independent Assurance.  
None required.

#### **11.4 Bridge Deck Drains / Abutment Joint Drains.**

- A. Material.
  - (1) Tier 2.
  - (2) Certification.  
Umbrella Certificate. (DOT-99)

If records are audited, the Contractor must produce for each component either a Certified Copy of the Mill Test Report or a Certificate of Compliance.

- (3) Acceptance.  
Documented Visual Inspection.
- (4) Independent Assurance.  
None required.

**11.5 Bridge Paint.**

A. Bridge Paint and Primer.

- (1) Tier 2
- (2) Certification.  
Item used must be on the Approved Products List unless otherwise specified.
- (3) Acceptance.  
None.
- (4) Independent Assurance.  
None required.

B. Bridge Field Painting – Surface Preparation.

- (1) Tier 3
- (2) Certification.  
None required.
- (3) Acceptance.  
Documented Visual Inspection when steel is abrasive blast cleaned.
- (4) Independent Assurance.  
None required.

C. Bridge Field Painting – Paint Application.

- (1) Tier 3
- (2) Certification.  
None required.
- (3) Acceptance.  
Documented Visual Inspection of dry film thickness (DFT).
- (4) Independent Assurance.  
None required.

## 11.6 Castings and Cast Iron.

### A. Bridge Hardware.

- (1) Tier 2.
- (2) Certification.  
A Certificate of Compliance is required for each source.
- (3) Acceptance.  
None required.
- (4) Independent Assurance.  
None required.

### B. Drop Inlet Frames, Grates, Box Curb Assemblies, etc.

- (1) Tier 2.
- (2) Certification.  
Item used must be from an Approved Products List manufacturer.
- (3) Acceptance.  
Documented Visual Inspection for manufacturer, size, and type.
- (4) Independent Assurance.  
None required.

### C. Grid Floor.

- (1) Tier 2.
- (2) Certification.  
A Certificate of Compliance is required for each source.
- (3) Acceptance.  
None required.
- (4) Independent Assurance.  
None required.

## 11.7 Cattle Guards.

### A. Material.

- (1) Tier 2.
- (2) Certification.  
A Certified Copy of the Mill Test Report
- (3) Acceptance.  
Documented Visual Inspection and measurements.
- (4) Independent Assurance.  
None required.

**11.8 Chloride.**

A. Calcium, Sodium, and Magnesium.

- (1) Tier 2.
- (2) Certification.  
A Bill of Lading is required for each source per shipment.
- (3) Acceptance.  
Granular formulation: One 3 lb. sample per shipment in a metal, plastic, or glass container. (DOT-1)  
  
Liquid formulation: One 8 oz. sample per shipment in a plastic or glass, air-tight container. (DOT-1)  
  
Randomly select three approximately equal portions to make the composite sample.
- (4) Independent Assurance.  
None required.

**11.9 Controlled Density Fill/Flowable Fill.**

A. Material.

- (1) Tier 2.
- (2) Certification.  
Prior to furnishing, the supplier of controlled density fill will provide the Area Engineer with a signed statement certifying that the controlled density fill meets the specification requirements. (DOT-77)
- (3) Acceptance.  
Documented Visual Inspection.
- (4) Independent Assurance.  
None required.

**11.10 Drainage Fabric.**

A. Material.

- (1) Tier 2.
- (2) Certification.  
*APL:* None required.  
*Non-APL:* A Certificate of Compliance is required.  
  
When supplied by pre-cast fabricator - Umbrella Certification. (DOT-99)
- (3) Acceptance.  
Documented Visual Inspection.



- (4) Independent Assurance.  
None required.

#### 11.11 Epoxy-Resin Adhesive.

- A. Material.
  - (1) Tier 2.
  - (2) Certification.  
A Certificate of Compliance is required for each type and source.
  - (3) Acceptance.  
None required.
  - (4) Independent Assurance.  
None required.

#### 11.12 Fencing.

- A. Barb and Smooth Wire.
  - (1) Tier 2.
  - (2) Certification.  
A Certificate of Compliance including the statement "Melted and Manufactured in the United States".
  - (3) Acceptance.  
One sample per 50 spools. Sample length to contain 6 barbs. (DOT-1)  
  
None required if less than 500 lineal feet of a fence type is used on a contract. Acceptance will be based on documented Visual Inspection for wire gauge, barbs, and coating.
  - (4) Independent Assurance.  
None required.
- B. Chain-Link System (Includes Fabric, Posts, Rails, Fittings, and Hardware).
  - (1) Tier 2.
  - (2) Certification.  
Umbrella Certificate. (DOT-99)  
  
If records are audited, the Contractor must produce a Certificate of Compliance for each source.
  - (3) Acceptance.  
For fabric, one sample per 50 rolls. Sample length will be full vertical section containing 6 vertical wires. (DOT-1)

None required if less than 500 lineal feet of a fence type is used on a contract. Acceptance will be based on documented Visual Inspection for gauge and coating.

For chain-link posts, rails, fittings, and hardware, acceptance will be based on documented Visual Inspection for size and coating.

- (4) Independent Assurance.  
None required.

C. Woven Wire.

- (1) Tier 2.

- (2) Certification.  
A Certificate of Compliance including the statement "Melted and Manufactured in the United States".

- (3) Acceptance.  
One sample per 50 rolls. Sample length will be 3 ft. containing 3 stay [vertical] wires. (DOT-1)

None required if less than 500 lineal feet of a fence type is used on a contract. Acceptance will be based on documented Visual Inspection for gage, spacing, and coating.

- (4) Independent Assurance.  
None required.

D. Brace Wire.

- (1) Tier 2.

- (2) Certification.  
A Certified Copy of the Certificate of Compliance including the statement "Melted and Manufactured in the United States".

- (3) Acceptance.  
Documented Visual Inspection for gage and coating.

- (4) Independent Assurance.  
None required.

E. Miscellaneous Fasteners, Staples, Ties, etc.

- (1) Tier 3.

- (2) Certification.  
None required.

- (3) Acceptance.  
Documented Visual Inspection for measurement, size, and coating.

- (4) Independent Assurance.  
None required.

F. Gates (Tubular Frame).

- (1) Tier 3.
- (2) Certification.  
None required.
- (3) Acceptance.  
Documented Visual Inspection for size, gauge, and coating.
- (4) Independent Assurance.  
None required.

G. Steel Posts.

- (1) Tier 2.
- (2) Certification.  
A Certified Copy of the Certificate of Compliance stating, "Melted and Manufactured in the United States".
- (3) Acceptance.  
One lot of 5 posts per 1,000 of each size, per source will be inspected in the field for length and weight and the results documented. (Miscellaneous Test Document)
- (4) Independent Assurance.  
None required.

H. Wood Posts.

- (1) Tier 2.
- (2) Certification.  
*Job site accepted posts:* A Certificate of Compliance covering posts, preservatives, and treatment is required.  
  
*Plant site accepted posts:* None required.
- (3) Acceptance.  
*Job site accepted posts:* One sample per charge or shipment. Sample size: A minimum of 20 cores taken approximately midpoint of the posts. No more than one core per post is permitted. The minimum core length will be a minimum of half the diameter of the posts. (DOT-1)  
  
If contract quantities are less than 100 post acceptance will be based on documented Visual Inspection for size, soundness, and straightness  
  
*Plant site accepted posts:* For bundled posts, the State Inspector must retrieve the tag and send it to the Certification Engineer with documentation of the date, tag number(s), number of posts, size of posts, and the name of the supplier. Each bundle that has a DOT numbered tag may be accepted without further testing. (DOT-1)

If contract quantities are less than 100 posts, bundle tags are not required; however, Visual Inspection for size and type will be documented to verify that the posts came from a certified supplier.

Bundles received that are not tagged must be sampled at the job site. Posts should not be used until satisfactory test results are received.

- (4) Independent Assurance.  
None required.

#### **11.13 Gabion Baskets.**

A. Material.

- (1) Tier 2.

- (2) Certification.  
*APL:* None required.  
*Non-APL:* A Certificate of Compliance is required.

- (3) Acceptance.  
One sample per shipment and source when baskets are fabricated in the field. Sample size: One 2 ft. section of the wire basket material. (DOT-1)

Documented Visual Inspection of gabions for dimensions, gauge of wire mesh and tie wires, tie spacing, etc.

None required for prefabricated gabions.

- (4) Independent Assurance.  
None required.

#### **11.14 Mailbox Assemblies.**

A. Material.

- (1) Tier 2.

- (2) Certification.  
None required.

- (3) Acceptance.  
Documented Visual Inspection.

Visual Inspection will document that the post support assembly used is 1) an approved product, 2) 4" x 4" square or 4" round wood post (As per standard plate), or 3) an alternate approved by the Engineer prior to installation. If an alternate support assembly is to be utilized, the Contractor will provide written certification that the alternate mailbox support assembly meets the test level 3 crash testing requirements of NCHRP 350 or MASH. Visual Inspection will also document that the post support assembly utilized was installed in

accordance with the standard plate and/or the manufacturer's installation instructions.

- (4) Independent Assurance.  
None required.

#### 11.15 MSE/Geotextile Fabric.

A. Material.

- (1) Tier 2.

- (2) Certification.  
*APL*: None required.  
*Non-APL*: A Certificate of Compliance is required.

Material Certification obtained from supplier should be submitted with sample.

- (3) Acceptance.  
Documented Visual Inspection.
- (4) Independent Assurance.  
None required.

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#### 11.16 Pavement Markings

A. Traffic Marking Paint

- (1) Tier 2.

- (2) Certification.  
A Certificate of Compliance is required per type, source and lot. (It may be in the form of a manufacturer's certified analysis from the label on the container.)

- (3) Acceptance.  
One 1 pt. sample per type, source, and lot. (DOT-1)

None required for contract quantities less than 20 gal.

No sample required on epoxy paint.

- (4) Independent Assurance.  
None required.

B. Permanent Plastic Pavement Markings.

- (1) Tier 2.

- (2) Certification.  
*APL*: None required.  
*Non-APL*: A Certificate of Compliance is required.

- (3) Acceptance.  
Field inspection documenting that the materials and installation procedures are in accordance with manufacturer's recommendations.
- (4) Independent Assurance.  
None required.

C. Reflective Elements.

- (1) Tier 3.
- (2) Certification.  
None required.
- (3) Acceptance.  
One sample per type, source and lot. Three cement cans as per SD 508. (DOT-1)  
  
None required if less than 40 gallons of paint is used on a project.
- (4) Independent Assurance.  
None required.

**11.17 Piling.**

A. Pre-Cast and Pre-Stressed Concrete.

The Minimum Sample and Test Requirements (MSTR) outlined in paragraph 11.21 will apply.

B. Steel Beam or Sheet (Includes Corrugated Pipe).

- (1) Tier 2.
- (2) Certification.  
A Certified Copy of the Mill Test Report for each heat or lot number. Pile Reports (DOT-203 & DOT-204).
- (3) Acceptance.  
None required.
- (4) Independent Assurance.  
None required.

C. Timber (Treated).

- (1) Tier 2.
- (2) Certification.  
A Treatment Certificate from the treating plant showing analysis of treating agent, the retention, and depth of the penetration.  
  
Prior to driving operations, the inspector will verify that the Treatment Certificate represents the actual piling shipped.

Each piling will be tagged or stamped with a number, such as a charge number. This number will also appear on the Treatment Certificate.

The Treatment Certificate will state where the stamps and tags are located on the piling.

- (3) Acceptance.  
None required.
- (4) Independent Assurance.  
None required.

**D. Piling Shoes.**

- (1) Tier 3.
- (2) Certification.  
None required.
- (3) Acceptance.  
Documented measurements and Visual Inspection.
- (4) Independent Assurance.  
None required.

**11.18 Pipe.**

**A. Concrete.**

- (1) Tier 2.
- (2) Certification.  
None required.
- (3) Acceptance.  
The Central Testing Laboratory will periodically load test each size and type at the plant or perform compressive strength tests on cylinders made by the manufacturer. The type and quantity of testing is at the discretion of the Central Testing Laboratory. Results will be documented in the form of a Concrete Pipe Release Date report.

Prior to installation, a documented field inspection for valid release dates, defects, or damage will be made.

If the pipe is 84" or larger, it will be inspected and tested in accordance with 11.21 F

One sample for each size and source of fine and coarse aggregate will be sampled and tested for quality and sieve analysis annually. (DOT-1, DOT-3)

- (4) Independent Assurance.  
None required.

B. Corrugated Metal.

(1) Tier 2.

(2) Certification.  
*APL:* None required.

*Non-APL:* Shipping list showing fabricator, size, gauge, heat numbers, quantity (Including end sections); and Certified Mill Test Reports for all metal used in fabrication of the culvert.

(3) Acceptance.  
*APL:* Documented Visual Inspection for size, gauge, and heat number.

*Non-APL:* One sample for each heat number and gauge. Sample size: three pieces, each at least 2 1/4 in. x 2 1/4 in. (DOT-1)

Documented Visual Inspection for size, gauge, and heat number.

(4) Independent Assurance.  
None required.

C. PVC.

(1) Tier 3.

(2) Certification.  
None required.

(3) Acceptance.  
Documented Visual Inspection for manufacturer, size, and type.

(4) Independent Assurance.  
None required.

D. Polyethylene

(1) Tier 2.

(2) Certification.  
*APL:* None required.

*Non-APL:* A Certificate of Compliance is required.

(3) Acceptance.  
Documented Visual Inspection for manufacturer, size, and type.

(4) Independent Assurance.  
None required.



E. High-Density Polyethylene.

- (1) Tier 2
- (2) Certification.  
*APL*: None required.  
*Non-APL*: A Certificate of Compliance is required.
- (3) Acceptance.  
Documented Visual Inspection for manufacturer, size, and type.
- (4) Independent Assurance.  
None required.

F. Steel Pipe

- (1) Tier 2
- (2) Certification.  
A Certified Copy of the Mill Test report for each heat or lot number will be furnished.  
  
A Certificate of Compliance for the coating.
- (3) Acceptance.  
Documented Visual Inspection for size, and type.
- (4) Independence Assurance.  
None required.

G. HDPE Slip Line Pipe

- (1) Tier 2.
- (2) Certification.  
Certificate of Compliance is required.
- (3) Acceptance.  
Documented Visual Inspection for size, and type.
- (4) Independent Assurance.  
None required.

**11.19 Polyethylene Sheeting.**

A. Material.

- (1) Tier 3.
- (2) Certification.  
None required.
- (3) Acceptance.  
Documented Visual Inspection.

- (4) Independent Assurance.  
None required.

**11.20 Polymer Modified Asphalt Growth Joint and Asphalt Bridge Joint.**

- A. Joint System.
  - (1) Tier 2.
  - (2) Certification.  
Item used must be on Approved Products List.
  - (3) Acceptance.  
None required.
  - (4) Independent Assurance.  
None required.
- B. Binder.
  - (1) Tier 2.
  - (2) Certification.  
Certificate of Compliance.
  - (3) Acceptance.  
None required
  - (4) Independent Assurance.  
None required.

**11.21 Pre-cast and Pre-stressed Concrete.**

If the Contractor proposes to utilize an out of state supplier to fabricate pre-cast or pre-stressed concrete components, the Contractor will notify the Department and the components will be fabricated in accordance with the contract specifications. The Department may allow testing and certification quality control procedures to be performed in accordance with the other state Department's quality control procedures under a separate agreement between the two states.

- A. Aggregate, Fine and Coarse.
  - (1) Tier 3
  - (2) Certification.  
None required.
  - (3) Acceptance.  
One sample per project for each size. Fine and coarse aggregate will be sampled and tested simultaneously. (DOT-3)  
  
The moisture testing requirements on fine and coarse aggregate are waived in this application.

Resampling because of a deviation from specifications of one of the aggregates requires resampling and retesting of only that material which failed.

When 100% of the material used in the coarse aggregate is quarry material, lightweight particle testing is not required. If independent assurance (IA) fails, acceptance testing will resume.

- (4) Independent Assurance.  
One sample per project for each size and source. None required if acceptance testing performed by Region Materials personnel. None required for contract quantities less than 100 yd<sup>3</sup>.

A quality sample will be submitted for each size annually. This test may be shared throughout the year.

B. Cement.

- (1) Tier 2.

- (2) Certification.  
Umbrella Certification. (DOT-99)

- (3) Acceptance.  
One sample per type, per year, per plant. Annual sample from each plant may be shared throughout the year.

- (4) Independent Assurance.  
None required.

C. Chemical Admixtures (Includes Air Entraining, Water Reducer, Accelerators, Retarders, etc.).

- (1) Tier 2.

- (2) Certification.  
Umbrella Certification. (DOT-99)

- (3) Acceptance.  
One sample per type, per year, per plant. Annual sample from each plant may be shared throughout the year.

- (4) Independent Assurance.  
None required.

D. Fly Ash.

- (1) Tier 2.

- (2) Certification.  
A Certificate of Compliance is required for load sampled.

- (3) Acceptance.  
One sample per type, per year, per plant. Annual sample from each plant may be shared throughout the year.

- (4) Independent Assurance.  
None required.

E. Water.

- (1) Tier 3.
- (2) Certification.  
None Required.
- (3) Acceptance.  
None required.
- (4) Independent Assurance.  
None required.

F. Concrete, Strength Tests.

- (1) Tier not applicable.
- (2) Certification.  
None required.

- (3) Acceptance.  
Cylinders, to determine the release time for pre-stressing steel and that the minimum design compressive strength requirements are met, will be made by the fabricator, and witnessed by the Engineer or his representative (DOT-23, DOT-54).

The producer will ensure that the cylinders are cured under identical conditions for the same length of time as the precast units.

A group of test cylinders will be made for each line of precast units, for each pour, or for each curing chamber, whichever is less. In addition, one group of test cylinders will be made for each class of concrete for each day's production, not to exceed 150 cubic yards.

For beams a set of cylinders is to be made for each day's production, each set of cylinders is to represent a specific number of beams, but not to exceed 160 ft. of casting bed.

A group of test cylinders will consist of a minimum of four (4) cylinders to determine strength of concrete for prestress transfer and compressive strength of pre-cast items. Two will be used to determine design strength if contractor desires to deliver or obtain Acceptance prior to 28-day age and two for the 28-day tests (one back-up cylinder).

When tests of the cylinders above indicate at least minimum design compressive strength, the pre-cast or pre-stressed concrete items may be delivered, and the 28-day cylinder tests waived.

- (4) Independent Assurance.  
None required.

G. Fresh (Plastic) Concrete Tests. (Air Content, Unit Weight, Slump, and Temperature).

- (1) Tier not applicable.
- (2) Certification.  
None required.
- (3) Acceptance.  
Air content, unit weight, slump and temperature of fresh concrete will be determined as required to maintain control and when strength test specimens are made (DOT-23, DOT-54).

**Self-Consolidating Concrete (SCC):**

Air Content, unit weight, slump flow, visual stability index, J-ring, and temperature of fresh concrete will be made each time a cylinder for compressive strength determination is made. Additional determinations will be made to ensure proper control, and not less than one determination for each 2 hours of mixing-placing operations (DOT-23).

- (4) Independent Assurance.  
One per project.

H. Metal Components.

- (1) Tier 2.
- (2) Certification.
  - (a) Bars, plates, structural shapes, and anchorage assembly. A Certified Copy of the Mill Test Report for each heat number.
  - (b) Pre-stressing strands.  
A Certified Copy of the Mill Test for each shipment.
  - (c) Reinforcing wire mesh.  
A Certified Copy of the Mill Test for each shipment.
  - (d) Reinforcing bars.  
Certification will be in accordance with paragraph 11.24 D.(2).  
  
Umbrella Certification - (DOT-99) When pre-cast/pre-stressed components are fabricated within the State of South Dakota.
- (3) Acceptance.
  - (a) Bars, plates, structural shapes, and anchorage assembly.  
None required.
  - (b) Pre-stressing strands.  
One sample per shipment. Sample size: One 2 ft. section.
  - (c) Reinforcing wire mesh.  
None required.

- (d) Reinforcing bars.  
Acceptance will be in accordance with paragraph 11.24 D.(3).

- (4) Independent Assurance.  
None required.

#### **11.22 Precast Concrete Products Miscellaneous.**

This includes all Items listed on the DOT-54 form that are not class pipe or pipe ends. This also includes right-of-way monuments, drop inlets, manholes and other precast concrete products not covered under MSTR 11.17, 11.18, or 11.21.

A. Material.

- (1) Tier 3.

- (2) Certification.  
None required.

- (3) Acceptance.  
Concrete  
The Central Testing Laboratory will perform compressive strength tests on cylinders made by the manufacturer and document the results in the form of a Concrete Pipe Release Date report.

Prior to installation, a documented Visual Inspection for valid release dates, defects, or damage will be made. (DOT-214)

One sample for each size and source of fine and coarse aggregate will be sampled and tested for quality and sieve analysis annually. (DOT-1, DOT-3)

- (4) Independent Assurance.  
None required.

#### **11.23 Signing Materials.**

A. Aluminum (Sheet and Extruded).

- (1) Tier 2.

- (2) Certification.  
Umbrella Certificate. (DOT-99)

If records are audited, the Contractor must produce a Certified Copy of the Mill Test Report.

- (3) Acceptance.  
Documented measurements and Visual Inspection.

- (4) Independent Assurance.  
None required.

B. Posts.

(1) Tier 2.

(2) Certification.

(a) Steel.

Umbrella Certificate. (DOT-99)

If records are audited, the Contractor must produce a Certified Copy of the Mill Test Report.

(b) Wood.

Umbrella Certificate. (DOT-99)

If records are audited, the Contractor must produce a Certificate of Compliance covering posts, preservative, and treatment for each type and source.

(3) Acceptance.

(a) Steel.

Documented measurements and Visual Inspection, as applicable, for coating, weight per foot, hole spacing, etc.

(b) Wood.

Prior to use, documented inspection and Visual Inspection for size, soundness, and straightness.

(4) Independent Assurance.

None required.

C. Reflective Sheeting.

(1) Tier 2.

(2) Certification.

Umbrella Certificate. (DOT-99)

If records are audited, the Contractor must produce a Certificate of Compliance.

(3) Acceptance.

Documented Visual Inspection for type of sheeting.

(4) Independent Assurance.

None required.

**11.24 Steel.**

A. Guardrail Cable.

(1) Tier 2.

(2) Certification.

Umbrella Certificate. (DOT-99)

If records are audited, the Contractor must produce a Certified Copy of the Mill Test Report.

- (3) Acceptance.  
Documented Visual Inspection for size and coating.
- (4) Independent Assurance.  
None required.

**B. Smooth Dowel Bars (Includes Bars in Dowel Bar Assemblies).**

- (1) Tier 2.
- (2) Certification.  
A Certified Copy of the Mill Test Report for the steel, and when the bars are epoxy coated, a Certificate of Compliance stating that the coating material and coating process conforms to specifications.
- (3) Acceptance.  
None required.
- (4) Independent Assurance.  
None required.

**C. Support Baskets for Dowel Bars and Tie Bars.**

- (1) Tier 3.
- (2) Certification.  
None required.
- (3) Acceptance.  
Documented Visual Inspection.
- (4) Independent Assurance.  
None required.

**D. Reinforcing Bars, Deformed Dowel Bars, and Deformed Tie Bars.**

- (1) Tier 2.
- (2) Certification.  
*From a certified supplier:* None required.

*From a non-certified supplier, all epoxy coated bars and stainless steel:* A Certified Copy of the Mill Test Report showing the chemical analysis and physical properties for each heat or lot number will be furnished. Deliveries to the project will be identified by heat numbers, using metal or weather and wear resistant tags wired to the bundles.

A Certificate of Compliance stating that the epoxy coating, the coating process, and the quality/production report(s) conform to specifications.



- (3) Acceptance.  
One sample, two 24 in. lengths, per source, per project from a randomly selected size, (do not submit bars larger than #8 for testing) representing not more than 3 sizes or 3 heat numbers to be tested for physical properties in the Central Laboratory for all bars (Excludes black steel listed on the Approved Products List). (DOT-1)

*From a certified supplier and for uncoated bars:* Documented Visual Inspection for rust scales, proper grade markings, and signs of mishandling.

*From a non-certified supplier, all epoxy coated bars and stainless steel:* Documented Visual Inspection on delivery to the project including heat number, size, length, shape, and condition of shipment.

On epoxy coated bars, check for voids, holes, cracks, and handling and shipping damage to epoxy coatings. Each bundle of steel will be marked with a metal or weather and wear resistant tag showing the heat number(s) represented. The tags will be secured to the appropriate bundles, so the heat numbers can be checked against the shipping papers and the Certified Mill Test Reports.

- (4) Independent Assurance.  
None required.

E. Wire Ties and Spacers.

- (1) Tier 3.
- (2) Certification.  
None required.
- (3) Acceptance.  
Documented Visual Inspection.
- (4) Independent Assurance.  
None required.

F. Reinforcing Wire Mesh.

- (1) Tier 3.
- (2) Certification.  
A Certified Copy of the Mill Test Report showing the chemical analysis and physical properties for each heat or lot number will be furnished. Deliveries to the project will be identified by heat numbers, using metal or weather and wear resistant tags wired to the bundles.
- (3) Acceptance.  
Documented Visual Inspection for gage, spacing and coating.
- (4) Independent Assurance.  
None required.

- G. Structural (Includes Steel Bridge Girders, Trusses, Arches, Main Supporting Members, Steel Bridge Rail, Steel Diaphragms, Sign Bridges, Splice Plates and Bearings).
- (1) Tier 1.
  - (2) Certification.  
A Certified Copy of the Mill Test Report for each heat or lot number. Also, shop fabrication inspector's report certifying that material used is represented by the mill test.
  - (3) Acceptance.  
Documented measurements and Visual Inspection for size and coating.
  - (4) Independent Assurance.  
None required.
- H. Miscellaneous Steel (Includes all steel not addressed in 11.24 G).
- (1) Tier 2.
  - (2) Certification.  
A Certified Copy of the Mill Test Report for each heat or lot number. Also, shop fabrication inspector's report (If applicable) certifying that material used is represented by the mill test.
  - (3) Acceptance.  
Documented measurements and Visual Inspection for size and coating.
  - (4) Independent Assurance.  
None required.
- I. Guardrail and Steel Guardrail Posts.
- (1) Tier 2.
  - (2) Certification.  
Umbrella certificate. (DOT-99) Refer to 11.3.A for guardrail bolts.  
  
If records are audited, the Contractor must produce a Certified Copy of the Mill Test Report.
  - (3) Acceptance.  
Documented measurements and visual inspection for size, type, and coating.
  - (4) Independent Assurance.  
None required.
- J. W Beam Guardrail Flared End Terminal, and W Beam Guardrail Tangent End Terminal
- (1) Tier 2

- (2) Certification.  
None required. Must be from APL.
- (3) Acceptance  
Documented Visual Inspection for size, type, and coating.
- (4) Independent Assurance.  
None required.

K. High Tension Cable Guardrail

- (1) Tier 2
- (2) Certification.  
Certificate of Compliance.
- (3) Acceptance  
Documented Visual Inspection for size, type, and coating.
- (4) Independent Assurance.  
None required.

L. Insert Assemblies for Guardrail.

- (1) Tier 2.
- (2) Certification.  
*APL*: None required.  
*Non-APL*: A Certified Copy of the Mill Test Report.
- (3) Acceptance.  
Documented measurements and Visual Inspection for size, type, and coating.
- (4) Independent Assurance.  
None required.

M. Rebar Splice.

- (1) Tier 2.
- (2) Certification.  
Certificate of Compliance.
- (3) Acceptance.  
Visual Inspection of epoxy coating when applicable.
- (4) Independent Assurance.  
None required.

N. Concrete Inserts.

- (1) Tier 2.
- (2) Certification.  
Certificate of Compliance.

- (3) Acceptance.  
None required.
- (4) Independent Assurance.  
None required.

**11.25 Timber.**

A. Structural.

- (1) Tier 2.
- (2) Certification.  
A Grade Certificate by a Certified Lumber Association inspector for each shipment.  
  
A treatment certificate, if applicable, by the company applying the treating agent, for each shipment. The certificate will show analysis of treating agent, penetration, and retention. This certificate may be submitted as an "open file" so that subsequent shipments from the same treatment may be referred to the certificate on file by tagging or other means of identification.  
  
A Certificate of Origin by the fabricator, jobber, or other supplier stating that the shipment of material furnished is that represented by the grade, or grade and treatment, certificate above.
- (3) Acceptance.  
None required.
- (4) Independent Assurance.  
None required.

B. Guardrail Posts.

- (1) Tier 2.
- (2) Certification.  
*Job site accepted posts:* A Certificate of Compliance covering posts, preservatives, and treatment is required.  
  
*Plant site accepted posts:* None required.
- (3) Acceptance.  
*Job site accepted posts:* One sample per charge or shipment.  
  
Sample size: A minimum of 20 cores taken approximately midpoint of the posts. No more than one core per post is permitted. The minimum core length will be 3 in. (DOT-1)  
  
None required for contract quantities less than 20 posts.  
  
Documented Visual Inspection for size, soundness, and straightness.

*Plant site accepted posts:* Bundled guardrail posts will have a round tag stamped "South Dakota Department of Transportation Inspected" and a number. In addition, each post will have "DOT" in 1/2 in. letters stamped on one end.

For bundled posts, the State inspector must retrieve the tag and send it to the Certification Engineer with documentation of the date, tag number(s), number of posts, size of posts, soundness, straightness and the name of the supplier. Each bundle that has a DOT numbered tag may be accepted without further preservative testing.

For loose posts that are stamped "DOT" on one end, documentation must show the number of posts, size of posts, date, supplier, and a statement that each post was stamped.

If contract quantities are less than 20 posts, bundle tags are not required, however, Visual Inspection will be documented to verify that posts came from a certified supplier.

Bundles received that are not tagged must be sampled at the job site. Posts should not be used until satisfactory test results are received.

- (4) Independent Assurance.  
None required.

C. Plank, etc.

- (1) Tier 2.
- (2) Certification.  
A Certificate of Compliance covering the item and, if applicable, treating agent and treatment is required.
- (3) Acceptance.  
Documented Visual Inspection or size, straightness, etc..
- (4) Independent Assurance.  
None required.

## 11.26 Concrete Patching Materials.

A. Material

- (1) Tier 2.
- (2) Certification  
A Certificate of Compliance is required.
- (3) Acceptance  
Visual Inspection.
- (4) Independent Assurance.  
None required.

## 12. Pavement Restoration:

### General Notes:

The Minimum Sample and Test Requirements (MSTR) outlined in paragraph 5.1 A. will apply to the aggregate, except that a minimum of one independent assurance (IA) test will be required per project. None required for contract quantities less than 100 yd<sup>3</sup>.

The Minimum Sample and Test Requirements (MSTR) outlined in paragraphs 6.1 B. through 6.5 E. will apply to the balance of the materials unless changed below.

**Self-Consolidating Concrete:** Air Content, unit weight, slump flow, visual stability index, J-ring, and temperature of fresh concrete will be made each time a cylinder for compressive strength determination is made. Additional determinations will be made to ensure proper control, and not less than one determination for each 2 hours of mixing-placing operations (DOT-23).

Samples or tests will not be specifically required for contract quantities of 25 yd<sup>3</sup> or less. Documentation of visual inspection that materials, methods, and equipment are satisfactory, will be provided.

### 12.1 PCC Pavement Repair.

#### A. Silicone.

(1) Tier 2.

(2) Certification.

Item used must be on the Approved Products List.

(3) Acceptance.

One component silicone: One 1 pt. sample (In paint sample can) per lot, per source.

In Place: After the silicone has cured 7 days, 5 random samples approximately 3 in. in length will be cut per 1/2 mile of roadbed from the in place material to check bonding, width, thickness, shape and non-adherence to backer rod. The results of these measurements will be documented. (SD 421)

When only the joints within or adjacent to the repair areas are sealed, the lot of 5 samples will be selected per 7,500 yd<sup>2</sup> of area repaired.

Acceptance samples of silicone or in place tests are not required for projects that have 500 ft. or less of joints to be sealed provided, the basis of acceptance is documented.

(4) Independent Assurance.

None required.

#### B. Backer Rod.

(1) Tier 2.

- (2) Certification.  
*APL:* None required.  
*Non-APL:* A Certificate of Compliance is required.
- (3) Acceptance.  
None required.  
Perform test according to A (3) under silicone.
- (4) Independent Assurance.  
None required.

**C. Hot Poured Elastic Type.**

- (1) Tier 2.
- (2) Certification.  
*APL:* None required.  
  
*Non-APL:* A Certificate of Compliance is required.
- (3) Acceptance.  
One 5 lb. sample representing each lot or batch will be taken from the application wand during the sealing process. The sample will be placed in a Teflon or silicone lined box having a minimum capacity of 5 lbs.  
  
None required for contract quantities of 200 lbs. or less.
- (4) Independent Assurance.  
None required.

**D. Backer Rod (Hot Pour).**

- (1) Tier 2.
- (2) Certification.  
*APL:* None required.  
*Non-APL:* A Certificate of Compliance is required.
- (3) Acceptance.  
One 2 ft. length submitted with the joint material. (DOT-1)  
  
None required if less than 200 lbs. of sealant is used, provided basis of acceptance is documented.
- (4) Independent Assurance.  
None required.

**12.2 Joint and Spall Repair.**

**A. Concrete from Ready-Mix Plants.**

The minimum sample and test requirements outlined in paragraph 5.1 A. and paragraphs 6.1 B., 6.1 C., 6.1 D., and 6.1 E. will apply, except as follows.

Acceptance samples of cement from a non-certified supplier and each size aggregate will be taken when:

- (1) There has been a delay of three or more days' production of material used on the project.
- (2) The production of the ready-mix plant indicates that the material represented by the prior samples has been exhausted on other construction.

**B. Commercial Pre-Packaged Mix.**

Item is classified as a Tier 2 material.

**C. Fly Ash.**

The minimum sample and test requirements outlined in paragraph 6.1 F. will apply, except the acceptance samples will consist of one sample per source. Sample size: 4 lb. sample per 25 ton.

**D. Silicone.**

(1) Tier 2.

(2) Certification.

Item used must be on the Approved Products List.

(3) Acceptance.

One component silicone: One 1 pint. sample (in paint sample can) per lot, per source. (DOT-1)

In Place: After the silicone has cured 7 days, 5 random samples approximately 3 in. in length will be cut per 1/2 mile of roadbed from the in place material to check bonding, width, thickness, shape and non-adherence to backer rod. The results of these measurements will be documented. (SD 421)

When only the joints within or adjacent to the repair areas are sealed, the lot of 5 samples will be selected per 7,500 yd<sup>2</sup> of area repaired.

Acceptance samples of silicone, or in place tests are not required for projects that have 500 ft. or less of joints to be sealed, provided, the basis of acceptance is documented.

(4) Independent Assurance.

None required.

**E. Backer Rod.**

(1) Tier 2.

(2) Certification.

*APL:* None required.

*Non-APL:* A Certificate of Compliance is required.



- (3) Acceptance.  
None required.
- (4) Independent Assurance.  
None required.

F. Hot Poured Elastic Type.

- (1) Tier 2.
- (2) Certification.  
*APL:* None required.  
*Non-APL:* A Certificate of Compliance is required.
- (3) Acceptance.  
One 5 lb. sample representing each lot or batch will be taken from the application wand during the sealing process. The sample will be placed in a Teflon or silicone lined box having a minimum capacity of 5 lbs. (DOT-1)  
  
None required for contract quantities of 200 lbs. or less.
- (4) Independent Assurance.  
None required.

G. Backer Rod (Hot Pour).

- (1) Tier 2.
- (2) Certification.  
*APL:* None required.  
*Non-APL:* A Certificate of Compliance is required.
- (3) Acceptance.  
One 2 ft. length submitted with the joint material. (DOT-1)  
  
None required if less than 200 lbs. of sealant is used, provided basis of acceptance is documented.
- (4) Independent Assurance.  
None required.

H. Epoxy Resin

- (1) Tier 2.
- (2) Certification  
A Certificate of Compliance is required.
- (3) Acceptance  
None.
- (4) Independent Assurance.  
None required.

**12.3 Pavement Jacking and Undersealing.**

- A. Portland Cement.  
The minimum sample and test requirements outlined in paragraph 6.1 C. will apply, except the acceptance samples from a non-certified supplier will be one per 50 ton, per source.
- B. Fly Ash.  
The Minimum Sample and Test Requirements (MSTR) outlined in paragraph 6.1 F. will apply, except the acceptance samples will consist of one sample per 5 conveyances. The sample will be a 4 lb. sample taken from a randomly selected conveyance.
- C. Water.  
The Minimum Sample and Test Requirements (MSTR) outlined in paragraph 6.1 D. will apply.
- D. Strength Tests.  
The Minimum Sample and Test Requirements (MSTR) outlined in paragraph 6.2 A. will apply, except strength tests for acceptance will be at the rate of one set of cylinders per day.  
  
Watertight, one piece, plastic cylinder molds will be used for making cylinders.
- E. Flow Test.
  - (1) Tier not applicable.
  - (2) Certification.  
None required.
  - (3) Acceptance.  
One per day for the first three days, thereafter each time the mix is changed. (ASTM C 939)
  - (4) Independent Assurance.  
None required.
- F. Jacking Foam.
  - (1) Tier 2.
  - (2) Certification.  
Certificate of Compliance.
  - (3) Acceptance.  
Visual Inspection.
  - (4) Independent Assurance.  
None required.

### 13. Bridge Deck Restoration:

#### General Notes:

The Minimum Sample and Test Requirements (MSTR) outlined in paragraphs 6.1 through 6.5 and 6.9 will apply unless changed below.

Testing for moisture content in the fine & coarse aggregate will not be required for this material.

#### 13.1 Density Tests, Low Slump Bridge Deck Concrete.

- A. Density, In Place.
  - (1) Tier not applicable.
  - (2) Certification.  
None required.
  - (3) Acceptance.  
One test per day, per structure, per 1,000 yd<sup>2</sup>. (DOT-56)
  - (4) Independent Assurance.  
One per project.
- B. Density, Standard.
  - (1) Tier not applicable.
  - (2) Certification.  
None required.
  - (3) Acceptance.  
Two unit weight determinations made on the first pour, then one unit weight determination per pour thereafter. (DOT-56)
  - (4) Independent Assurance.  
None required.

#### 13.2 Bridge Deck Polymer Chip Seals

- A. Polymer
  - (1) Tier 2.
  - (2) Certification  
Item must be on the Approved Products List
  - (3) Acceptance  
Pull off test performed by Contractor as specified in Section 491 of the Standard Specifications.
  - (4) Independent Assurance.  
None required.

B. Concrete Patching Materials

- (1) Tier 2.
- (2) Certification  
A Certificate of Compliance is required.
- (3) Acceptance  
Visual Inspection.
- (4) Independent Assurance.  
None required.

C. Aggregate

- (1) Tier 2.
- (2) Certification  
Certified Analysis.
- (3) Acceptance  
Moisture Content.  
One per structure. (DOT-35)
- (4) Independent Assurance.  
None required.

**13.3 Measurement of Bridge Deck Texture.**

A. Tined Surface.

- (1) Tier not applicable.
- (2) Certification.  
None required.
- (3) Acceptance.  
One per structure, per pour, per 1,000 yd<sup>2</sup>. (SD 418) (DOT-55)
- (4) Independent Assurance.  
None required.

**13.4 Measurement of Bridge Deck Roughness.**

A. Surface.

- (1) Tier not applicable.
- (2) Certification.  
None required.
- (3) Acceptance.  
When profilograph testing is not required, test in accordance with SD 417. (DOT-28)

On projects where profilograph tests are required, coordinate with the contractor. Operation of the profilograph is the responsibility of the Contractor. Calibration of the profilograph is required.

- (4) Independent Assurance.  
None required.