South Dakota Department of Transportation

Minimum Sample and Test Requirements (MSTR)

Table of Contents

Page

1. Asphalt Construction: 1

1.1 Asphalt Concrete, Hot Mix 3
- A. Aggregate, Composite 3
- B. Rock, Sand, Filler, etc. 4
- C. Asphalt Binder 4
- D. Asphalt Binder Content 5
- E. RAP Content 6
- F. Lime Content 6
- G. Density, In-Place 6
- H. Density, Standard 7
- I. Bulk Specific Gravity, Mixture Densification, Voids in Mineral Aggregate and Dust to Binder Ratio 7
- J. Moisture Content of Mix 8

1.2 Cold In-Place Recycling 8
- A. Aggregate 8
- B. Density Standard 8
- C. Density In-Place 9
- D. Moisture Content (Prior to Compaction) 9
- E. Moisture Content (After Compaction) 9

1.3 Asphalt Surface Treatment 10
- A. Cover Aggregate, Types 1 & 2 and Mineral Aggregate for Microsurfacing 10
- B. Cover Aggregate, Type 3 10

1.4 Asphalt Liquid 10
- A. Material 10

1.5 Crack Sealing of Asphalt Concrete 11
- A. Sealant 11
- B. Backer Rod 11

1.6 Milling (Surface Texture) 12
- A. Cold Milling 12
- B. Micro-Milling 12

2. Subbase, Base Course, and Cushion Construction: 13

2.1 Untreated Subbase, Base Course, and Cushion 13
- A. Aggregate, Composite 13
- B. Rock, Clay, Sand Filler, etc. 14
- C. Density, In-Place (Excludes Gravel Cushion) 14
- D. Density, Standard (Excludes Gravel Cushion) 14

2.2 Asphalt Treated Subbase, Base Course, and Cushion (Cold Mix) 15
- A. Aggregate,Composite-Uncoated 15

B. Rock, Clay, Sand, Filler, etc. 15
C. Asphalt 15
D. Asphalt Content 16
E. Density, In-Place 16
F. Density, Standard 16

3. Miscellaneous Granular Materials: 17

3.1 Gravel and Sand for Maintenance Stockpiles 17
A. Aggregate 17

3.2 Gravel Surfacing 17
A. Aggregate 17
B. Rock, Stone, Sand, Clay, etc. 17

3.3 Blotting Sand for Prime Coat and Sand for Flush Seal 18
A. Aggregate 18

3.4 Bridge End Backfill 18
A. Aggregate 18
B. Density, In-Place 18

3.5 Gabion Fill (Rock or Stone) 18
A. Aggregate 18

3.6 Porous Backfill 19
A. Aggregate 19

3.7 Riprap 19
A. Aggregate 19

3.8 Pit Run 20
A. Aggregate 20
B. Density, In-Place 20
C. Density, Standard 20

3.9 Slope Protection Aggregate 21
A. Aggregate 21

3.10 Base Course Salvaged and Full Depth Reclamation Materials 21
A. Aggregate 21
B. Density, In-Place 21
C. Density, Standard 22

3.11 Granular Box Culvert Undercut Backfill 22
A. Aggregate 22
B. Density, In-Place 22
C. Density, Standard 23

3.12 Cold Milled Asphalt Concrete and Placing Cold Milled Material 23
A. Milled Material 23

3.13 MSE Backfill 23
A. Aggregate 23

3.14 Miscellaneous Granular Materials (Box Culvert Bedding/etc. when Specifications are noted) 23
A. Aggregate 24

4. Subgrade Construction (Embankments): 25

4.1 Specified Density (In-Place) 26
A. Embankment (Includes Subgrade Topping, Ordinary, and Heavy Roadway Shaping) 26
B. Berms 27
C. Bridge End Embankment 27
D. Cross Pipe Pre-Installation Density/Undercut (Does not include utility, storm sewer, gas, or water main) 27
E. Box Culvert Undercut Backfill 28
F. Pipe and Box Culvert Backfill 28
G. Density, Standard (Target) 29

4.2 Ordinary Compaction Method 30
A. Density 30
B. Density, Standard (Target) 30

4.3 Moisture Content 30
A. Embankment (Includes Select Subgrade Material, Berms, Box Culvert, and Pipe Backfill; Excludes Ordinary Compaction) 30
B. Moisture, Standard (Target) 31

5. Portland Cement Concrete Paving Construction: 32

5.1 Materials 33
A. Aggregate, Fine and Coarse 33
B. Aggregate, Fine and Coarse, Moisture Content 34
C. Cement 34
D. Water 34
E. Chemical Admixtures (Includes Air Entraining, Water Reducing, Accelerators, Retarders, etc.) 35
F Fly Ash 35

5.2 Strength Tests 35
A. Compressive Strength 35

5.3 Fresh (Plastic) Concrete Tests 36
A. Air Content, Unit Weight, Slump, and Temperature 36

5.4 Measurements 36
A. Longitudinal Surface 36
B. Texture 37
C. Thickness 37
D. Width 38

5.5 Curing Materials 38
A. Liquid Membrane Curing Compound 38
B. Burlap and Cotton Mat 38
C. Polyethylene Sheeting 38

5.6 Joint Materials 39
A. Preformed Expansion Type (Includes Non-Extruding and Resilient Bituminous and Non-Bituminous Types) 39
B. Hot Poured Elastic Type 39
C. Backer Rod (Hot Pour) 39
D. Silicone 40
E. Backer Rod (Silicone) 40

5.7 Keyways 41
A. Material 41

6. Portland Cement Concrete Structure Construction: 42

6.1 Materials 42
A. Aggregate, Fine and Coarse 42
B. Aggregate, Fine and Coarse, Moisture Content 43
C. Cement 44
D. Water 44
E. Chemical Admixtures (Includes Air Entraining, Water Reducer, Accelerators, Retarders, etc.) 44
F. Fly Ash 45

6.2 Strength Tests 45
A. Compressive Strength 45

6.3 Fresh (Plastic) Concrete Tests 46
A. Air Content, Unit Weight, Slump, and Temperature 46

6.4 Curing Materials 46
A. Liquid Membrane Curing Compound 46
B. Burlap 47
C. Film (Sheet Materials Including Water Proof Paper, Polyethylene Sheeting, White Burlap-Polyethylene Sheeting, Etc.) 47

6.5 Joint Materials 47
A. Strip Seal and Preformed Elastomeric Open Cell Compression Type With Lubricant/Adhesive 47
B. Preformed Expansion Type (Includes Non-Extruding and Resilient Bituminous and Non-Bituminous Types) 48
C. Hot Poured Elastic Type 48
D. Silicone 48
E. Backer Rod 49

6.6 Commercial Textured and Special Surface Finish 49
A. Materials 49

6.7 Abutment Backwall Coating 49
A. Materials 49

6.8 Measurement of Texture 50
A. Tined Surface 50

6.9 Measurement of Deck Roughness 50
A. Surface 50

7. Portland Cement Concrete Miscellaneous Construction – Class M (Class I): 51

7.1 Materials and Plant 51
A. Requirements 51

8. Roadway Lighting and Traffic Control: 52

8.1 Materials....52
A. Standard Items of Electrical Equipment 52
B. Miscellaneous Hardware Items 52
C. Items that are on the Approved Products List (APL)....53
D. Items Requiring Approval of Catalogue Cuts or Shop Drawings 53
E. Items Requiring an Umbrella Certificate for the Material 54
F. Lighting and Signal Anchor Bolts, Nuts & Washers 54
G. High-Strength Bolts 55

9. Roadside Development: 56

9.1 Materials....56
A. Burlap, Excelsior Blanket, and Erosion Control Blanket (Includes Fasteners)....56
B. Fertilizer....56
C. Fiber Mulch....56
D. Seeds....57
E. Mulch 57

10. Buildings and Rest Area Construction: 58

10.1 Materials....58
A. Brick....58
B. Insulation 58
C. Building Block (Hollow or Solid)....59
D. Basin and Manhole Block....59
E. Miscellaneous Hardware Items 59

11. Miscellaneous Incidental and Manufactured or Fabricated Items: 60

11.1 Aluminum 60
A. Cast, Framing, Handrail, Hardware, and Sheet (Includes Extruded Types) 60

11.2 Bearing Pads....60
A. Bronze or Copper 60
B. Canvas and Red Lead....60
C. Elastomeric....60
D. Neoprene....61
E. Fabric (Preformed) 61

11.3 Bridge Deck Drains 61
A. Material....61

11.4 Castings and Cast Iron 62
A. Bridge Hardware....62
B. Drop Inlet Frames, Grates, Box Curb Assemblies, etc. 62
C. Grid Floor....62

11.5 Cattle Guards 62
A. Material 62

11.6 Chloride 63
A. Calcium, Sodium, and Magnesium 63

11.7 Epoxy-Resin Adhesive 63
A. Material 63

11.8 Fencing 63
A. Barb Wire 63
B. Chain-Link System (Includes Fabric, Posts, Rails, Fittings, And Hardware) 64
C. Woven Wire 64
D. Brace Wire 64
E. Miscellaneous Fasteners, Staples, Ties, etc. 65
F. Gates (Tubular Frame) 65
G. Steel Posts 65
H. Wood Posts 65

11.9 Glass Beads 66
A. Material 66

11.10 Paint 66
A. Traffic Marking Paint (Regular & Epoxy) 66
B. Bridge Paint and Primer 67
C. Bridge Field Painting – Surface Preparation 67
D. Bridge Field Painting – Paint Application 67

11.11 Permanent Plastic Pavement Markings 68
A. Material 68

11.12 Piling 68
A. Pre-Cast and Pre-Stressed Concrete 68
B. Steel Beam or Sheet (Includes Corrugated) 68
C. Timber (Treated) 68
D. Piling Shoes 69

11.13 Pipe 69
A. Concrete 69
B. Corrugated Metal 69
C. PVC 70
D. Polyethylene Underdrain 70
E. High-Density Polyethylene 70

11.14 Pre-Cast and Pre-Stressed Concrete 71
A. Aggregate, Fine and Coarse 71
B. Cement 71
C. Chemical Admixtures (Includes Air Entraining, Water Reducer, Accelerators, Retarders, etc.) 72
D. Fly Ash 72
E. Water 72
F. Concrete, Strength Tests 72
G. Fresh (Plastic) Concrete Tests. (Air Content, Unit Weight, Slump, and Temperature) 73
H. Metal Components 73

11.15 Miscellaneous Precast Concrete Products 74
A. Material 74

11.16 Signing Materials 75
A. Aluminum (Sheet and Extruded) 75
B. Signing Anchor Bolts, Nuts & Washers 75
C. High-Strength Bolts 75
D. Posts 75
E. Reflective Sheeting 76

11.17 Steel 76
A. Bolt Assemblies (Bolts, Nuts, Washers, and Direct Tension Indicators, (If required)). 76
B. Guardrail Cable 78
C. Smooth Dowel Bars (Includes Bars in Dowel Bar Assemblies) 78
D. Support Baskets for Dowel Bars & Tie Bars 78
E. Reinforcing Bars, Deformed Dowel Bars, and Deformed Tie Bars 78
F. Wire Ties and Spacers 79
G. Reinforcing Wire Mesh (Miscellaneous) 80
H. Structural (Includes Steel Bridge Girders, Trusses, Arches, Main Supporting Members, Steel Bridge Rail, Steel Diaphragms, Sign Bridges, Splice Plates, and Bearings) 80
I. Miscellaneous Steel (Includes all Steel not addressed in 11.17 H) 80
J. Guardrail and Steel Guardrail Posts 80
K. W Beam Guardrail Flared End Terminal, and W Beam Guardrail Tangent End Terminal 81
L. High Tension Cable Guardrail 81
M. Insert Assemblies for Guardrail 81
N. Wedge Anchor 81
O. Rebar Splice 82
P. Concrete Insert 82

11.18 Timber 82
A. Structural 82
B. Guardrail Posts 83
C. Plank, etc. 83

11.19 Gabions 84
A. Material 84

11.20 Drainage Fabric 84
A. Material 84

11.21 MSE/Geotextile Fabric 85
A. Material 85

11.22 Erosion Control Items 85
A. Material 85

11.23 Controlled Density Fill/Flowable Fill 85
A. Material 85

11.24 Polyethylene Sheeting 86
A. Material 86

11.25 Polymer Modified Asphalt Growth Joint and Asphalt Bridge Joint.....86
A. Joint System 86
B. Aggregate 86
C. Binder 86

11.26 Mailbox Assemblies 87
A. Material 87

12. Pavement Restoration: 88

12.1 PCC Pavement Repair.....88
A. Silicone 88
B. Backer Rod.....88
C. Hot Poured Elastic Type.....89
D. Backer Rod (Hot Pour) 89

12.2 Joint and Spall Repair.....89
A. Concrete from Ready-Mix Plants 89
B. Commercial Pre-Packaged Mix.....90
C. Fly Ash.....90
D. Silicone 90
E. Backer Rod.....90
F. Hot Poured Elastic Type.....91
G. Backer Rod (Hot Pour) 91

12.3 Pavement Jacking and Undersealing 91
A. Portland Cement.....91
B. Fly Ash.....91
C. Water 92
D. Strength Tests 92
E. Flow Test 92
F. Jacking Foam 92

13. Bridge Deck Restoration: 93

13.1 Density Tests, Low Slump Concrete.....93
A. Density, In-Place 93
B. Density, Standard 93

13.2 Bridge Deck Polymer Chip Seal.....93
A. Polymer.....93
B. Aggregate 94

13.3 Measurement of Texture.....94
A. Tined Surface.....94

13.4 Measurement of Deck Roughness.....94
A. Surface 94