

## South Dakota Department of Transportation

### Minimum Sample and Test Requirements (MSTR)

#### Table of Contents

	<u>Page</u>
<b>1. Asphalt Construction:</b> .....	1
1.1 Asphalt Concrete, Hot Mix	
A. Aggregate, Composite.....	3
B. Asphalt Binder .....	4
C. Asphalt Binder Content.....	5
D. RAP Content.....	6
E. RAP in Asphalt Concrete.....	6
F. Lime Content .....	7
G. Density, In-Place .....	7
H. Theoretical Maximum Specific Gravity (Rice) .....	8
I. Bulk Specific Gravity.....	8
J. Mixture Densification, Voids in Mineral Aggregate and Dust to Binder Ratio (Class Q) .....	8
K. Moisture Content of Mix (Class Q and HR).....	9
L. Drain Down (Class S).....	9
M. Stabilizing Additive (Class S) .....	9
1.2 Cold In-Place Recycling	
A. Aggregate .....	9
B. Density Standard .....	10
C. Density In-Place .....	10
D. Moisture Content (Prior to Compaction).....	10
E. Moisture Content (After Compaction).....	11
1.3 Asphalt Surface Treatment	
A. Cover Aggregate, Types.....	11
B. Cover Aggregate, Type 3 .....	11
C. Mineral Aggregate for Microsurfacing .....	12
1.4 Asphalt Liquid	
A. Material.....	12
1.5 Crack Sealing of Asphalt Concrete	
A. Sealant.....	12
B. Backer Rod.....	13
1.6 Milling (Surface Texture)	
A. Cold Milling .....	13
B. Micro-Milling .....	14
<b>2. Subbase, Base Course, and Cushion Construction:</b> .....	15
2.1 Untreated Subbase, Base Course, and Cushion	
A. Aggregate, Composite.....	15
B. Density, In-Place .....	16
C. Density, Standard .....	16

2.2	Gravel Cushion	
A.	Aggregate, Composite.....	16
<b>3.</b>	<b>Miscellaneous Granular Materials:</b> .....	<b>18</b>
3.1	Gravel and Sand for Maintenance Stockpiles	
A.	Aggregate .....	18
3.2	Gravel Surfacing	
A.	Aggregate .....	18
3.3	Blotting Sand for Prime Coat and Sand for Flush Seal	
A.	Aggregate .....	18
3.4	Granular Bridge End Backfill	
A.	Aggregate .....	19
	B. Density, In-Place .....	19
3.5	Gabion Fill (Rock or Stone)	
A.	Aggregate .....	19
3.6	Porous Backfill	
A.	Aggregate .....	19
3.7	Riprap	
A.	Aggregate .....	20
3.8	Pit Run	
A.	Aggregate .....	20
	B. Density, In-Place .....	21
	C. Density, Standard .....	21
3.9	Slope Protection Aggregate	
A.	Aggregate .....	21
3.10	Salvaged and Full Depth Reclamation Materials	
A.	Aggregate .....	22
	B. Density, In-Place .....	22
	C. Density, Standard .....	22
3.11	Pipe and Box Culvert Undercut Backfill (Granular)	
A.	Aggregate .....	23
	B. Density, In-Place .....	23
	C. Density, Standard .....	23
3.12	Cold Milled Asphalt Concrete and Placing Cold Milled Material	
A.	Milled Material .....	23
3.13	MSE Backfill	
A.	Aggregate .....	24
3.14	Granular Material for Box Culvert and Pipe Bedding	
A.	Aggregate .....	24

3.15	Miscellaneous Granular Material	24
A.	Aggregate .....	24
B.	Rock, Clay, Sand Filler and Miscellaneous Granular Material .....	25
C.	Density, In Place.....	25
D.	Density, Standard .....	25
<b>4.</b>	<b>Subgrade Construction (Embankments):</b> .....	<b>26</b>
4.1	Specified Density (In-Place)	
A.	Embankment (Includes Subgrade Topping, Ordinary, and Heavy Roadway Shaping) .....	27
B.	Berms .....	28
C.	Bridge End Embankment.....	28
D.	Cross Pipe Pre-Installation Density/Undercut (Does not include utility, storm sewer, gas, or water main).....	28
E.	Pipe Undercut Backfill (Soil).....	29
F.	Pipe and Box Culvert Backfill .....	29
G.	Density, Standard (Target) .....	30
4.2	Ordinary Compaction Method	
A.	Density.....	31
B.	Density, Standard (Target) .....	31
4.3	Moisture Content	
A.	Embankment (Includes Select Subgrade Material, Berms, Box Culvert, and Pipe Backfill; Excludes Ordinary Compaction) .....	31
B.	Box Culvert, Pipe Backfill. ....	32
C.	Moisture, Standard (Target) .....	32
<b>5.</b>	<b>Portland Cement Concrete Paving Construction:</b> .....	<b>33</b>
5.1	Materials	
A.	Aggregate, Fine and Coarse .....	34
B.	Aggregate, Fine and Coarse, Moisture Content.....	34
C.	Cement .....	35
D.	Water .....	35
E.	Chemical Admixtures (Includes Air Entraining, Water Reducing, Accelerators, Retarders, etc.).....	36
F	Fly Ash.....	36
5.2	Strength Tests	
A.	Compressive Strength .....	36
5.3	Fresh (Plastic) Concrete Test	
A.	Air Content, Unit Weight, Slump, and Temperature.....	37
5.4	Measurements	
A.	Longitudinal Surface.....	37
B.	Texture.....	38
C.	Thickness.....	38
D.	Width.....	38
5.5	Curing Materials	
A.	Liquid Membrane Curing Compound .....	39
B.	Burlap and Cotton Mat.....	39
C.	Polyethylene Sheeting.....	39

5.6	Joint Materials	
A.	Preformed Expansion Type (Includes Non-Extruding and Resilient Bituminous and Non-Bituminous Types).....	39
B.	Hot Poured Elastic Type.....	40
C.	Backer Rod (Hot Pour) .....	40
D.	Silicone .....	40
E.	Backer Rod (Silicone).....	41
5.7	Keyways	
A.	Material.....	41
<b>6.</b>	<b>Portland Cement Concrete Structure Construction:</b>	<b>42</b>
6.1	Materials	
A.	Aggregate, Fine and Coarse .....	42
B.	Aggregate, Fine and Coarse, Moisture Content.....	43
C.	Cement.....	43
D.	Water .....	44
E.	Chemical Admixtures (Includes Air Entraining, Water Reducer, Accelerators, Retarders, etc.).....	44
F.	Fly Ash.....	44
6.2	Strength Tests	
A.	Compressive Strength.....	45
6.3	Fresh (Plastic) Concrete Tests	
A.	Air Content, Unit Weight, Slump, and Temperature.....	45
6.4	Curing Materials	
A.	Liquid Membrane Curing Compound .....	47
B.	Burlap .....	47
C.	Film (Sheet Materials Including Waterproof Paper, Polyethylene Sheeting, White Burlap-Polyethylene Sheeting, Etc.) .....	47
6.5	Joint Materials	
A.	Strip Seal and Preformed Elastomeric Open Cell Compression Type with Lubricant/Adhesive .....	48
B.	Preformed Expansion Type (Includes Non-Extruding and Resilient Bituminous and Non-Bituminous Types).....	48
C.	Hot Poured Elastic Type.....	48
D.	Silicone .....	49
E.	Backer Rod .....	49
6.6	Commercial Textured and Special Surface Finish	
A.	Materials .....	49
6.7	Abutment Backwall Coating	
A.	Materials .....	49
6.8	Measurement of Texture	
A.	Tined Surface .....	50
6.9	Measurement of Deck Roughness	
A.	Surface .....	50

<b>7.</b>	<b>Portland Cement Concrete Miscellaneous Construction – Class M .....</b>	<b>51</b>
7.1	Materials and Plant	
A.	Requirements .....	51
B.	Preformed Expansion Type Joint Material (Includes Non-Extruding and Resilient Bituminous and Non-Bituminous Types) .....	51
<b>8.</b>	<b>Roadway Lighting and Traffic Control: .....</b>	<b>52</b>
8.1	Materials	
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
<b>9.</b>	<b>Erosion and Sediment Control .....</b>	<b>55</b>
9.1	Materials	
A.	Erosion Control Devices .....	55
B.	Fertilizer .....	55
C.	Fiber Mulch .....	55
D.	Seeds .....	55
E.	Mulch .....	56
F.	Mycorrhizal Inoculum .....	56
<b>10.</b>	<b>Buildings and Rest Area Construction: .....</b>	<b>57</b>
10.1	Materials	
A.	Brick .....	57
B.	Insulation .....	57
C.	Building Block (Hollow or Solid) .....	57
D.	Basin and Manhole Block .....	58
E.	Miscellaneous Hardware Items .....	58
<b>11.</b>	<b>Miscellaneous Incidental and Manufactured or Fabricated Items: .....</b>	<b>59</b>
11.1	Aluminum	
A.	Cast, Framing, Handrail, Hardware, and Sheet (Includes Extruded Types) .....	59
11.2	Bearing Pads	
A.	Bronze or Copper .....	59
B.	Elastomeric .....	59
C.	Preformed Fabric .....	59
11.3	Bolt Assemblies (Bolts, Nuts, Washers, and Direct Tension Indicators)	
A.	High Strength Bolts .....	60
B.	Anchor Bolts, Nuts and Washers .....	61
C.	Tie Bolts (Precast Box Culvert and Reinforced Concrete Pipe) .....	61
11.4	Bridge Deck Drains / Abutment Joint Drains	
A.	Material .....	61

11.5	Bridge Paint	
	A. Bridge Paint and Primer .....	62
	B. Bridge Field Painting – Surface Preparation .....	62
	C. Bridge Field Painting – Paint Application .....	62
11.6	Castings and Cast Iron	
	A. Bridge Hardware.....	63
	B. Drop Inlet Frames, Grates, Box Curb Assemblies, etc. ....	63
	C. Grid Floor.....	63
11.7	Cattle Guards	
	A. Material.....	63
11.8	Chloride	
	A. Calcium, Sodium, and Magnesium.....	64
11.9	Controlled Density Fill/Flowable Fill	
	A. Material.....	64
11.10	Drainage Fabric	
	A. Material .....	64
11.11	Epoxy-Resin Adhesive	
	A. Material.....	65
11.12	Fencing	
	A. Barb and Smooth Wire .....	65
	B. Chain-Link System (Includes Fabric, Posts, Rails, Fittings, And Hardware).....	65
	C. Woven Wire .....	66
	D. Brace Wire .....	66
	E. Miscellaneous Fasteners, Staples, Ties, etc. ....	66
	F. Gates (Tubular Frame).....	67
	G. Steel Posts .....	67
	H. Wood Posts .....	67
11.13	Gabions	
	A. Material .....	68
11.14	Mailbox Assemblies	
	A. Material.....	68
11.15	MSE/Geotextile Fabric	
	A. Material.....	69
11.16	Pavement Markings	
	A. Traffic Marking Paint (Regular & Epoxy).....	69
	B. Permanent Plastic Pavement Markings .....	69
	C. Reflective Elements.....	70
11.17	Piling	
	A. Pre-Cast and Pre-Stressed Concrete.....	70
	B. Steel Beam or Sheet (Includes Corrugated) .....	70
	C. Timber (Treated).....	70
	D. Piling Shoes.....	71

11.18	Pipe	
A.	Concrete .....	71
B.	Corrugated Metal.....	72
C.	PVC .....	72
D.	Polyethylene Underdrain .....	72
E.	High-Density Polyethylene .....	73
F.	Steel Pipe .....	73
G.	HDPE Slip Line Pipe.....	73
11.19	Polyethylene Sheeting	
A.	Material.....	73
11.20	Polymer Modified Asphalt Growth Joint and Asphalt Bridge Joint	
A.	Joint System .....	74
B.	Binder .....	74
11.21	Pre-Cast and Pre-Stressed Concrete	
A.	Aggregate, Fine and Coarse .....	74
B.	Cement .....	75
C.	Chemical Admixtures (Includes Air Entraining, Water Reducer, Accelerators, Retarders, etc.).....	75
D.	Fly Ash.....	75
E.	Water .....	76
F.	Concrete, Strength Tests.....	76
G.	Fresh (Plastic) Concrete Tests. (Air Content, Unit Weight, Slump, and Temperature).....	77
H.	Metal Components .....	77
11.22	Precast Concrete Products Miscellaneous	
A.	Material.....	78
11.23	Signing Materials	
A.	Aluminum (Sheet and Extruded) .....	78
B.	Posts .....	79
C.	Reflective Sheeting.....	79
11.24	Steel	
A.	Guardrail Cable .....	79
B.	Smooth Dowel Bars (Includes Bars in Dowel Bar Assemblies) .....	80
C.	Support Baskets for Dowel Bars & Tie Bars.....	80
D.	Reinforcing Bars, Deformed Dowel Bars, and Deformed Tie Bars .....	80
E.	Wire Ties and Spacers .....	81
F.	Reinforcing Wire Mesh (Miscellaneous).....	81
G.	Structural (Includes Steel Bridge Girders, Trusses, Arches, Main Supporting Members, Steel Bridge Rail, Steel Diaphragms, Sign Bridges, Splice Plates, and Bearings) .....	82
H.	Miscellaneous Steel (Includes all Steel not addressed in 11.24.G) .....	82
I.	Guardrail and Steel Guardrail Posts.....	82
J.	W Beam Guardrail Flared End Terminal, and W Beam Guardrail Tangent End Terminal.....	82
K.	High Tension Cable Guardrail.....	83
L.	Insert Assemblies for Guardrail .....	83
M.	Rebar Splice .....	83
N.	Concrete Insert .....	83

11.25	Timber	
A.	Structural .....	84
B.	Guardrail Posts .....	84
C.	Plank, etc. ....	85
11.26	Concrete Patching Materials	
A.	Material.....	85
<b>12.</b>	<b>Pavement Restoration:</b>	<b>86</b>
12.1	PCC Pavement Repair	
A.	Silicone .....	86
B.	Backer Rod.....	86
C.	Hot Poured Elastic Type.....	87
D.	Backer Rod (Hot Pour) .....	87
12.2	Joint and Spall Repair	
A.	Concrete from Ready-Mix Plants .....	87
B.	Commercial Pre-Packaged Mix.....	88
C.	Fly Ash.....	88
D.	Silicone .....	88
E.	Backer Rod .....	88
F.	Hot Poured Elastic Type.....	89
G.	Backer Rod (Hot Pour) .....	89
H.	Epoxy Resin .....	89
12.3	Pavement Jacking and Undersealing	
A.	Portland Cement.....	90
B.	Fly Ash.....	90
C.	Water .....	90
D.	Strength Tests .....	90
E.	Flow Test .....	90
F.	Jacking Foam .....	90
<b>13.</b>	<b>Bridge Deck Restoration:</b>	<b>91</b>
13.1	Density Tests, Low Slump Bridge Deck Concrete	
A.	Density, In-Place .....	91
B.	Density, Standard .....	91
13.2	Bridge Deck Polymer Chip Seal	
A.	Polymer.....	91
B.	Concrete Patching Material .....	92
C.	Aggregate .....	92
13.3	Measurement of Bridge Deck Texture	
A.	Tined Surface .....	92
13.4	Measurement of Bridge Deck Roughness	
A.	Surface .....	92