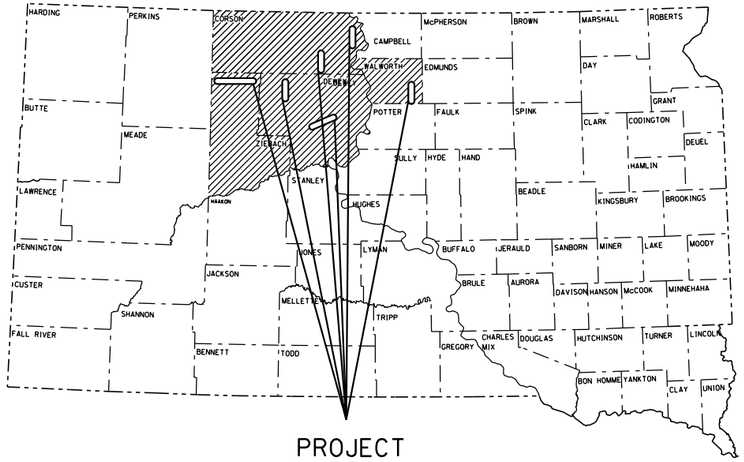
STATE OF	PROJECT	SHEET NO.	TOTAL SHEETS
S.D.	NH-P 0032(16)	1	20



PROJECT

STATE OF SOUTH DAKOTA
DEPARTMENT OF TRANSPORTATION
PLANS FOR PROPOSED

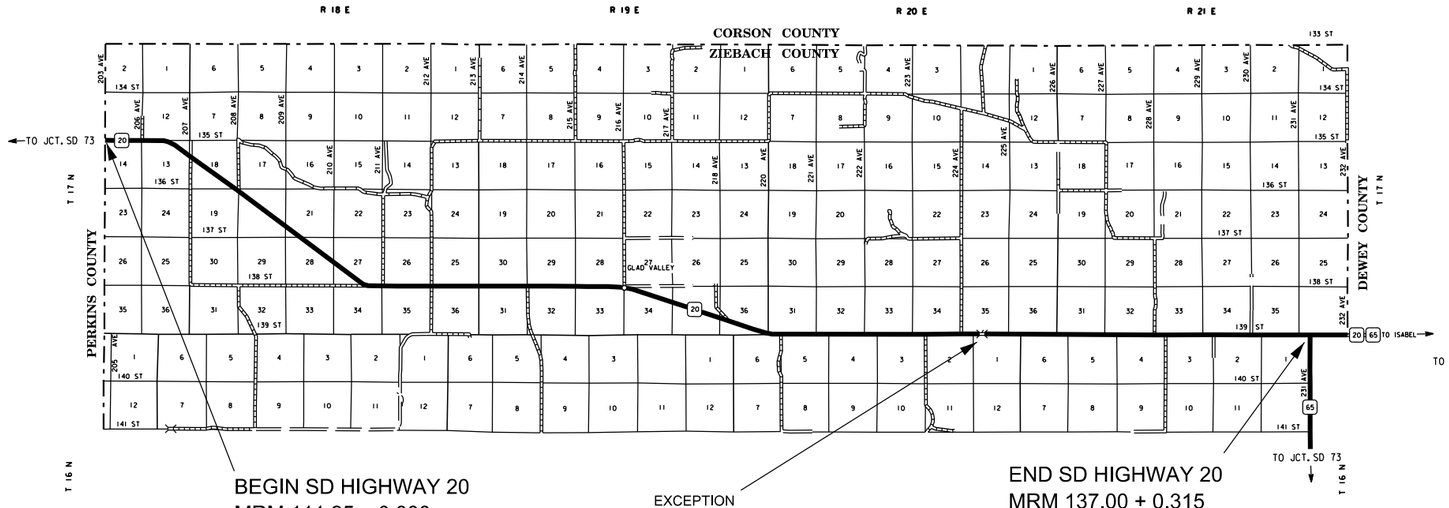
PROJECT NH-P 0032(16)
SD HIGHWAYS 20, 47, 1806 & 63
US HIGHWAY 212
CORSON, DEWEY, WALWORTH & ZIEBACH COUNTIES

ASPHALT SURFACE TREATMENT
PCN 0461

INDEX OF SHEETS

NH-P 0032(16)
SD HIGHWAY 20
ZIEBACH COUNTY
ASPHALT SURFACE TREATMENT
PCN 0461
LENGTH 25.905 MILES

NH-P 0032(16)
US HIGHWAY 212
DEWEY COUNTY
ASPHALT SURFACE TREATMENT
PCN 0461
LENGTH 8.856 MILES



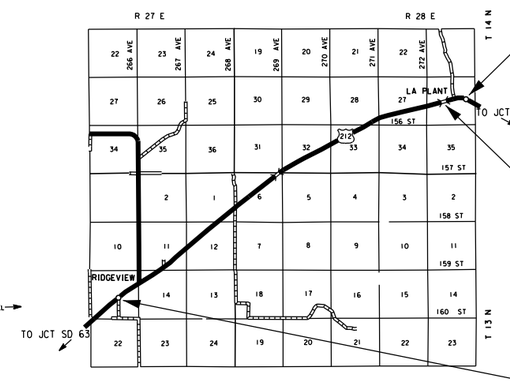
BEGIN SD HIGHWAY 20
MRM 111.25 + 0.000
STA. 0+00
MILEAGE 107.890

EXCEPTION
STR. NO. 69-195-060
LENGTH = 0.030 MILE
MRM 130.58

END SD HIGHWAY 20
MRM 137.00 + 0.315
STA. 1367+78.40
MILEAGE 133.795

DESIGN DESIGNATION

ADT (2012) 107



END US HIGHWAY 212
MRM 187.01 + 0.253
STA. 467+59.68
MILEAGE 185.652

EXCEPTION
STR. NO. 21-411-226
LENGTH = 0.023 MILE
MRM 186.54

BEGIN US HIGHWAY 212
MRM 178.00 + 0.417
STA. 0+00
MILEAGE 176.796

DESIGN DESIGNATION

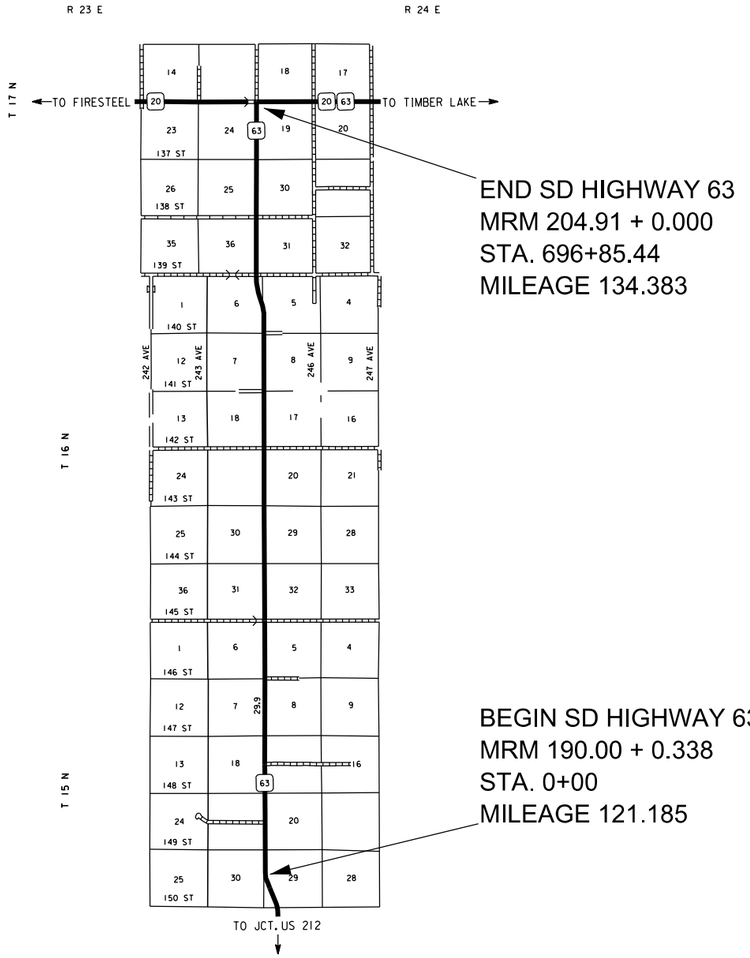
ADT (2012) 632

STORM WATER PERMIT

None Required

STATE OF	PROJECT	SHEET NO.	TOTAL SHEETS
S.D.	NH-P 0032(116)	2	20

NH-P 0032(16)
SD HIGHWAY 63
SEGMENT 1
DEWEY COUNTY
ASPHALT SURFACE TREATMENT
PCN 0461
LENGTH 13.198 MILES



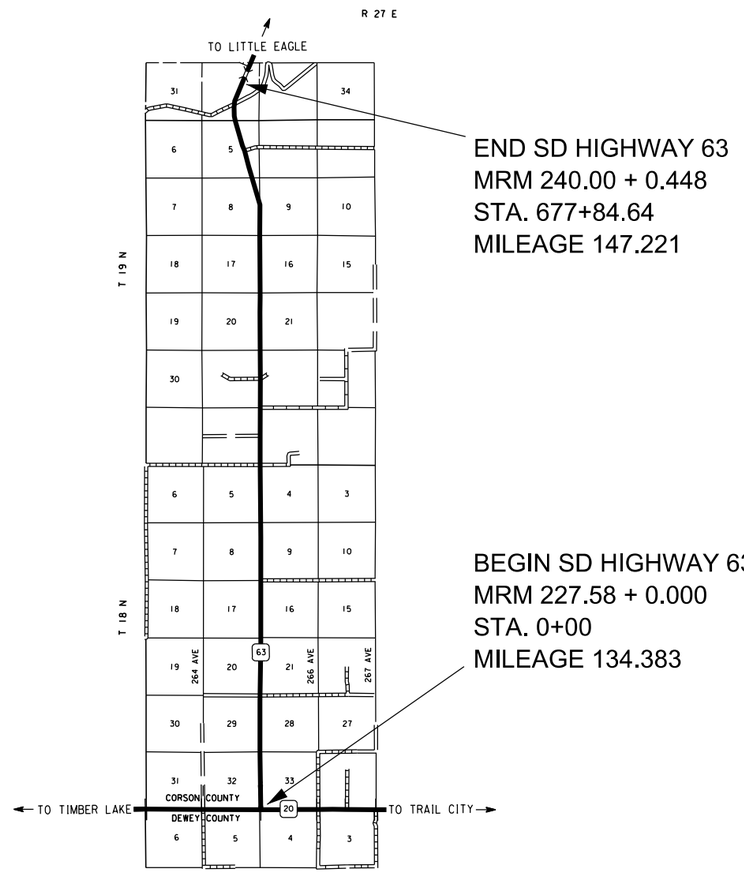
END SD HIGHWAY 63
MRM 204.91 + 0.000
STA. 696+85.44
MILEAGE 134.383

BEGIN SD HIGHWAY 63
MRM 190.00 + 0.338
STA. 0+00
MILEAGE 121.185

DESIGN DESIGNATION

ADT (2012) 448

NH-P 0032(16)
SD HIGHWAY 63
SEGMENT 2
CORSON COUNTY
ASPHALT SURFACE TREATMENT
PCN 0461
LENGTH 12.838 MILES



END SD HIGHWAY 63
MRM 240.00 + 0.448
STA. 677+84.64
MILEAGE 147.221

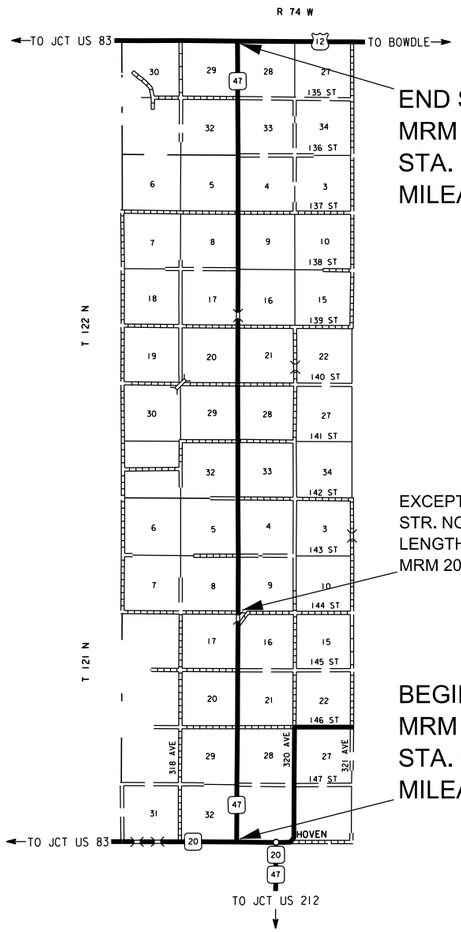
BEGIN SD HIGHWAY 63
MRM 227.58 + 0.000
STA. 0+00
MILEAGE 134.383

DESIGN DESIGNATION

ADT (2012) 301

STATE OF	PROJECT	SHEET NO.	TOTAL SHEETS
S.D.	NH-P 0032(16)	3	20

NH-P 0032(16)
SD HIGHWAY 47
WALWORTH COUNTY
ASPHALT SURFACE TREATMENT
PCN 0461
LENGTH 13.998 MILES



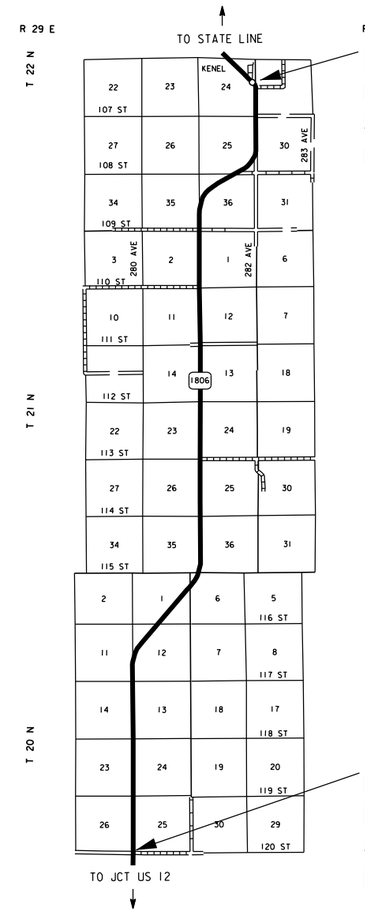
END SD HIGHWAY 47
MRM 217.63 + 0.000
STA. 739+09.44
MILEAGE 162.038

EXCEPTION
STR. NO. 65-330-201
LENGTH = 0.013 MILE
MRM 207.57

BEGIN SD HIGHWAY 47
MRM 203.62 + 0.000
STA. 0+00
MILEAGE 148.040

DESIGN DESIGNATION
ADT (2012) 497

NH-P 0032(16)
SD HIGHWAY 1806
CORSON COUNTY
ASPHALT SURFACE TREATMENT
PCN 0461
LENGTH 14.158 MILES



END SD HIGHWAY 1806
MRM 386.83 + 0.000
STA. 747+54.24
MILEAGE 147.221

BEGIN SD HIGHWAY 1806
MRM 372.00 + 0.346
STA. 0+00
MILEAGE 107.683

DESIGN DESIGNATION
ADT (2012) 375

ESTIMATE OF QUANTITIES
NH-P 0032(16)

Bid Item Number	Item	Quantity	Unit
009E0010	Mobilization	Lump Sum	LS
330E0300	SS-1h or CSS-1h Asphalt for Fog Seal	317.7	Ton
330E3000	Sand for Fog Seal	60.0	Ton
360E0020	AE150S Asphalt for Surface Treatment	1,401.6	Ton
360E1200	Modified Cover Aggregate	4,189.2	Ton
360E1200	Modified Cover Aggregate	2,067.0	Ton
360E1200	Modified Cover Aggregate	2,193.1	Ton
360E1200	Modified Cover Aggregate	2,078.5	Ton
360E1200	Modified Cover Aggregate	1,430.0	Ton
360E1200	Modified Cover Aggregate	2,136.8	Ton
633E1300	Pavement Marking Paint, White	3,010.0	Gal
633E1305	Pavement Marking Paint, Yellow	1,070.0	Gal
634E0010	Flagging	500	Hour
634E0020	Pilot Car	250	Hour
634E0100	Traffic Control	4,423	Unit
634E0120	Traffic Control, Miscellaneous	Lump Sum	LS
634E0630	Temporary Pavement Marking	177.9	Mile

The quantities of asphalt for surface treatment and cover aggregate are based on the rates shown in the Rates of Materials. This is only an estimate. The actual application rates of materials will be determined by mix design as stated in these plans. The mix design rates may vary from the estimated rates stated in the Rates of Materials depending on the aggregate source and the variation in gradation and flakiness index. The application rates may also be adjusted in the field due to results of gradations, flakiness index and differing surface conditions. Pay quantities will be those actually used, even though they may vary significantly from plans estimate.

QUANTITY SUBTOTALS
NH-P 0032(16)

Bid Item Number	Item	Quantity							Unit
		SD 20	SD 47	SD 63 Seg. 1	SD 63 Seg. 2	SD 1806	US 212	Total	
009E0010	Mobilization	Lump Sum	Lump Sum	Lump Sum	Lump Sum	Lump Sum	Lump Sum	Lump Sum	LS
330E0300	SS-1h or CSS-1h Asphalt for Fog Seal	103.5	44.8	42.2	44.9	49.6	32.7	317.7	Ton
330E3000	Sand for Fog Seal	10.0	10.0	10.0	10.0	10.0	10.0	60.0	Ton
360E0020	AE150S Asphalt for Surface Treatment	416.6	205.6	212.5	206.7	218.0	142.2	1401.6	Ton
360E1200	Modified Cover Aggregate	4189.2	2067.0	2136.8	2078.5	2193.1	1430.0	14094.6	Ton
633E1300	Pavement Marking Paint, White	876.0	474.0	447.0	434.0	479.0	300.0	3010.0	Gal
633E1305	Pavement Marking Paint, Yellow	311.0	168.0	159.0	155.0	170.0	107.0	1070.0	Gal
634E0010	Flagging	120	80	80	80	80	60	500.0	Hour
634E0020	Pilot Car	60	40	40	40	40	30	250.0	Hour
634E0100	Traffic Control	780	724	724	724	724	747	4423.0	Unit
634E0120	Traffic Control, Miscellaneous	Lump Sum	Lump Sum	Lump Sum	Lump Sum	Lump Sum	Lump Sum	Lump Sum	LS
634E0630	Temporary Pavement Marking	51.810	27.996	26.396	25.676	28.316	17.712	177.906	Mile

EVIRONMENTAL COMMITMENTS

An Environment Commitment is a measure that SDDOT commits to implement in order to avoid, minimize, and/or mitigate a real or potential environmental impact. Environmental commitments to various agencies and the public have been made to secure approval of this project. An agency mentioned below with permitting authority can influence a project if perceived environmental impacts have not been adequately addressed. Unless otherwise designated, the Contractor's primary contact regarding matters associated with these commitments will be the Project Engineer. These environmental commitments are not subject to change without prior written approval from the SDDOT Environmental Office. The environmental commitments associated with this project are as follows:

COMMITMENT H: WASTE DISPOSAL SITE

The Contractor shall furnish a site(s) for the disposal of construction/demolition debris generated by this project.

Action Taken/Required:

Construction and/or demolition debris may not be disposed of within the State ROW.

The waste disposal site(s) shall be managed and reclaimed in accordance with the following from the General Permit for Highway, Road, and Railway Construction/Demolition Debris Disposal under the South Dakota Waste Management Program issued by the Department of Environment and Natural Resources.

The waste disposal site(s) shall not be located in a wetland, within 200 feet of surface water, or in an area that adversely affects wildlife, recreation, aesthetic value of an area, or any threatened or endangered species, as approved by the Engineer.

If the waste disposal site(s) is located such that it is within view of any ROW, the following additional requirements shall apply:

1. Construction and/or demolition debris consisting of concrete, asphalt concrete, or other similar materials shall be buried in a trench completely separated from wood debris. The final cover over the construction and/or demolition debris shall consist of a minimum of 1 foot of soil capable of supporting vegetation. Waste disposal sites provided outside of the ROW shall be seeded in accordance with Natural Resources Conservation Service recommendations. The seeding recommendations may be obtained through the appropriate County NRCS Office. The Contractor shall control the access to waste disposal sites not within the State ROW through the use of fences, gates, and placement of a sign or signs at the entrance to the site stating "No Dumping Allowed".

2. Concrete and asphalt concrete debris may be stockpiled within view of the ROW for a period of time not to exceed the duration of the project. Prior to project completion, the waste shall be removed from view of the ROW or buried and the waste disposal site reclaimed as noted above.

The above requirements will not apply to waste disposal sites that are covered by an individual solid waste permit as specified in SDCL 34A-6-58, SDCL 34A-6-1.13, and ARSD 74:27:10:06.

Failure to comply with the requirements stated above may result in civil penalties in accordance with South Dakota Solid Waste Law, SDCL 34A-6-1.31.

All costs associated with furnishing waste disposal site(s), disposing of waste, maintaining control of access (fence, gates, and signs), and reclaiming of the waste disposal site(s) shall be incidental to the various contract items.

COMMITMENT I: HISTORICAL PRESERVATION OFFICE CLEARANCES

The SDDOT has obtained concurrences with the State Historical Preservation Office (SHPO or THPO) for all work included within the Project limits and all designated option borrow sites provided within the plans.

Action Taken/Required:

All earth disturbing activities not designated within the plans review of cultural resources impacts. This work includes, but is not limited to: staging areas, borrow sites, waste disposal sites, and all material processing sites.

The Contractor shall arrange and pay for the cultural resource survey and/or records search. The Contractor has the option to contact the state Archaeological Research Center (ARC) at 605-394-1936 or another qualified archaeologist, to obtain records search or a cultural resources survey. A record search might be sufficient for review; however, a cultural resources survey may need to be conducted by a qualified archaeologist.

The Contractor shall provide ARC with the following: a topographical map or aerial view on which the site is clearly outlined, site dimensions, project number, and PCN. If applicable, provide evidence that the site has been previously disturbed by farming, mining, or construction activities with a landowner statement that artifacts have not been found on the site.

The Contractor shall submit the records search or cultural resources report and if the location of the site is within the current geographical or historic boundaries of any South Dakota reservation to SDDOT Environmental Engineer, 700 East Broadway Avenue, Pierre, SD 57501-2586 (605-773-3180), SDDOT will submit the information to the appropriate SHPO/THPO. **Allow 30 Days** from the date this information is submitted to the Environmental Engineer for SHPO/THPO review.

If evidence for cultural resources is uncovered during project construction activities, then such activities shall cease and the Project Engineer shall be immediately notified. The Project Engineer will contact the SDDOT Environmental Engineer in order to determine an appropriate course of action.

SHPO/THPO review does not relieve the Contractor of the responsibility for obtaining any additional permits and clearances for staging areas, borrow sites, waste disposal sites, or material processing sites that affect wetlands, threatened and endangered species, or waterways. The Contractor shall provide the required permits and clearances to the Project Engineer at the preconstruction meeting.

RATES OF MATERIALS

The Estimate of Quantities is based on the following quantities of materials per mile.

ASPHALT SURFACE TREATMENT: NH-P 0032(16)

SD Highway 20
MRM 111.25 to 137.00+0.315 (Sta. 0+00 to 1367+78.40)

AE 150 S Asphalt for Surface Treatment at the rate of 16.1 tons applied 23 feet wide.
(Rate = 0.28 Gal./S.Y.).

Modified Cover Aggregate at the rate of 161.9 tons applied 23 feet wide.
(Rate= 24 Lbs./S.Y.).

Asphalt for Fog Seal CSS-1h or SS-1h at the rate of 4.0 tons applied 32 feet wide.
(Rate= 0.05 Gal./S.Y.).

SD Highway 47
MRM 203.62 to 217.63 (Sta. 0+00 to 739+09.44)

AE 150 S Asphalt for Surface Treatment at the rate of 14.7 tons applied 21 feet wide.
(Rate = 0.28 Gal./S.Y.).

Modified Cover Aggregate at the rate of 147.8 tons applied 21 feet wide.
(Rate= 24 Lbs./S.Y.).

Asphalt for Fog Seal CSS-1h or SS-1h at the rate of 3.2 tons applied 26 feet wide.
(Rate= 0.05 Gal./S.Y.).

SD Highway 63 Segment 1
MRM 190.00+0.338 to 204.91 (Sta. 0+00 to 696+85.44)

AE 150 S Asphalt for Surface Treatment at the rate of 16.1 tons applied 23 feet wide.
(Rate = 0.28 Gal./S.Y.).

Modified Cover Aggregate at the rate of 161.9 tons applied 23 feet wide.
(Rate= 24 Lbs./S.Y.).

Asphalt for Fog Seal CSS-1h or SS-1h at the rate of 3.2 tons applied 26 feet wide.
(Rate= 0.05 Gal./S.Y.).

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SD Highway 63 Segment 2
MRM 227.58 to 240.00+0.448 (Sta. 0+00 to 677+84.64)

AE 150 S Asphalt for Surface Treatment at the rate of 16.1 tons applied 23 feet wide.
(Rate = 0.28 Gal./S.Y.).

Modified Cover Aggregate at the rate of 161.9 tons applied 23 feet wide.
(Rate= 24 Lbs./S.Y.).

Asphalt for Fog Seal CSS-1h or SS-1h at the rate of 3.5 tons applied 28 feet wide.
(Rate= 0.05 Gal./S.Y.).

SD Highway 1806
MRM 372.00+0.346 to 386.83 (Sta. 0+00 to 747+54.24)

AE 150 S Asphalt for Surface Treatment at the rate of 15.4 tons applied 22 feet wide.
(Rate = 0.28 Gal./S.Y.).

Modified Cover Aggregate at the rate of 154.9 tons applied 22 feet wide.
(Rate= 24 Lbs./S.Y.).

Asphalt for Fog Seal CSS-1h or SS-1h at the rate of 3.5 tons applied 28 feet wide.
(Rate= 0.05 Gal./S.Y.).

US Highway 212
MRM 178.00+0.417 to 178.00+0.500 (Sta. 0+00 to 4+40)
MRM 178.00+0.549 to 187.01+0.253 (Sta. 7+00 to 467+59.67)

AE 150 S Asphalt for Surface Treatment at the rate of 16.1 tons applied 23 feet wide.
(Rate = 0.28 Gal./S.Y.).

Modified Cover Aggregate at the rate of 161.9 tons applied 23 feet wide.
(Rate= 24 Lbs./S.Y.).

Asphalt for Fog Seal CSS-1h or SS-1h at the rate of 3.7 tons applied 30 feet wide.
(Rate= 0.05 Gal./S.Y.).

MRM 178.00+0.500 to 178.00+0.549 (Sta. 4+40 to 7+00)

AE 150 S Asphalt for Surface Treatment at the rate of 16.1 tons applied 23 feet wide.
(Rate = 0.28 Gal./S.Y.).

Modified Cover Aggregate at the rate of 161.9 tons applied 23 feet wide.
(Rate= 24 Lbs./S.Y.).

Asphalt for Fog Seal CSS-1h or SS-1h at the rate of 4.6 tons applied 37 feet wide.
(Rate= 0.05 Gal./S.Y.).

SPECIFICATIONS

Standard Specifications for Roads and Bridges, 2004 Edition and Required Provisions, Supplemental Specifications and/or Special Provisions as included in the Proposal.

SEQUENCE OF OPERATIONS

The Contractor shall submit his/her proposed sequence of operations for the Engineer's approval at least one week prior to the preconstruction meeting.

MODIFIED COVER AGGREGATE

Aggregate for Cover Aggregate shall conform to the following gradation requirements:

Passing a 3/8 Inch Sieve	100%
Passing a No. 4 Sieve	0-75%
Passing a No. 8 Sieve	0-30%
Passing a No. 40 Sieve	0-6%
Passing a No. 200 Sieve	0-3.0%

Aggregate may be crushed or uncrushed.

After the aggregate stockpile has been produced, a sample shall be submitted to the Asphalt Supplier a minimum of 14 days prior to starting the project to allow time to evaluate the compatibility and design of the surface treatment. A copy of the test results from the Asphalt Supplier shall be submitted to the Engineer and Bituminous Engineer prior to starting the surface treatment.

Quality tests on the Cover Aggregate for abrasion and soundness are required by specification. The Contractor shall notify the Area Office prior to sampling and a representative from the Area Office shall witness all sampling of aggregates to be submitted to the Central Testing Laboratory for quality testing. Satisfactory test results for the Cover Aggregate shall be obtained prior to its use on the Project.

All other requirements of the Standard Specifications for Type 1B shall apply.

Cover Aggregate Modified shall be furnished by the Contractor.

BRIDGES, APPROACH SLABS, SLEEPER SLABS, STRIP SEALS, RAILROAD CROSSINGS, MANHOLES, WATER VALVES AND CONCRETE

Asphalt Surface Treatment and Fog Seal Treatment shall not be placed on any of the bridges, approach slabs, sleeper slabs, strip seals, railroad crossings, manholes, water valves or any type of concrete on these projects. Any emulsion or cover aggregate found to be on any of the above listed items after final brooming shall be removed by the contractor as directed by the Engineer at no cost to the state.

Cover aggregate materials shall not be broomed under any guardrail, 3 cable guardrail, or into any drop inlets along the project.

All strip seal glands or plug joints on any bridge along the project shall be masked the entire length prior to Asphalt Surface Treatment operations. This masking shall remain in place until completion of the Fog Seal and any final brooming operations. The masking shall then be removed and any loose material cleaned out of each of the strip seal glands or plug joints. Any damage to the glands or plugs caused by the Asphalt Surface Treatment operations shall be repaired at no cost to the state contract. All costs related to this work shall be incidental to the various contract bid items.

FOG SEAL

The fog seal shall be placed immediately following the completion of the Asphalt Surface Treatment. Prior to the application of the fog seal the Contractor will be required to broom the Asphalt Surface Treatment. In addition, the rumble strips shall be thoroughly broomed clean prior to the application of the fog seal. A CSS-1h or SS-1h emulsion shall be used for the fog seal application. A water-to-emulsion rate of 1:1 should be used for the binder application. The oil applied shall be dependent on the type of aggregate used.

Blotting Sand for Fog Seal shall conform to the Standard Specifications Section 879.1.B.

Prior to hauling, Blotting Sand shall be screened to minimize segregation, eliminate oversize and effectively breakup or discard material bonded into chunks.

HAUL ROAD

The Contractor shall be responsible for any haul roads used to transport material to the project site. The State will not participate in the cost of restoration of any haul roads used by the Contractor.

GENERAL MAINTENANCE OF TRAFFIC

Removing, relocating, covering, salvaging and resetting of existing traffic control devices, including delineation, shall be the responsibility of the Contractor. Cost for this work shall be incidental to the contract unit prices for the various items unless otherwise specified in the plans. Any delineators and signs damaged or lost shall be replaced by the Contractor at no cost to the State.

Storage of vehicles and equipment shall be as near as possible to the right-of-way line. Contractor's employees should mobilize at a location off the right-of-way and arrive at the work sites in a minimum number of vehicles necessary to perform the work.

Indiscriminate driving and parking of vehicles within the right-of-way will not be permitted. Any damage to the vegetation, surfacing, embankment, delineators and existing signs resulting from such indiscriminate use shall be repaired and/or restored by the Contractor, at no expense to the State, and to the satisfaction of the Engineer.

All breakaway sign supports shall comply with FHWA NCHRP 350 or MASH crash-worthy requirements. The Contractor shall provide post installation details at the preconstruction meeting for all steel post breakaway sign support assemblies.

Work activities during non-daylight hours are subject to prior approval.

GENERAL MAINTENANCE OF TRAFFIC (Continued)

Traffic approaching the project from intersecting roadways, streets, and approaches must be adequately accommodated. Major intersections or large commercial entrances may require additional signing, flaggers, and channelizing devices on a temporary basis until work activities pass these areas.

"ROAD WORK NEXT ___ MILES", Special "REDUCED SPEED LOOSE GRAVEL", and "END ROAD WORK" signs are the only signs that need to be mounted on Fixed Location Breakaway Sign Supports. "ROAD WORK AHEAD", "FLAGGER", "ONE LANE ROAD AHEAD" and any other signs may be mounted on portable supports. The bottom of signs on portable or temporary supports shall not be less than seven feet above the pavement in urban areas, and one foot above the pavement in rural areas. The signs mounted on portable supports shall be moved as necessary to keep current with the work activities.

Traffic Control units, as shown in the Estimate of Quantities, are estimates. Contractor's operation may require adjustments in quantities, either more or less. Payment will be for those signs actually ordered by the Engineer and used. Traffic Control units will be paid for separately for each project.

MAINTENANCE OF TRAFFIC CONTROL

Until initial brooming, additional flagger(s) and FLAGGER symbol sign(s) shall be provided to alert the traveling public entering completed portions of the project to the potential of airborne chips.

The flagger(s) shall provide each motorist with a printed notice on the Contractor's letterhead similar to the one shown. Cost of the notice shall be incidental to other contract bid items.

"CONTRACTORS LETTERHEAD"

THIS HIGHWAY IS BEING RESURFACED WITH A CHIP SEAL COAT.

THIS TYPE OF CONSTRUCTION HAS THE POTENTIAL OF CAUSING VEHICLE DAMAGE SUCH AS CHIPPED WINDSHIELDS AND BROKEN HEADLIGHTS DUE TO ROCKS BEING THROWN BY HIGH SPEED ONCOMING OR PASSING TRAFFIC.

YOU MAY WISH TO CONSIDER TAKING AN ALTERNATE ROUTE. IF YOU PROCEED, KEEP TO THE RIGHT AND DRIVE 40 MPH OR LESS. ANOTHER FLAGGER AND A PILOT CAR WILL BE ESCORTING YOU AROUND THE SEAL COAT APPLICATION AREA.

THANK YOU.

TEMPORARY PAVEMENT MARKINGS

The temporary road markers shall have secure covers, which must be manually removed. Any markers that are non-reflective shall be cleaned.

All costs associated with furnishing, installing, removing covers and cleaning of the Temporary Road Markers used on this project will be incidental to the contract unit price per mile for Temporary Pavement Marking.

The total length of no passing zone on this project is estimated to be 35.3 miles. SD Hwy 20 = 5.4 miles, SD Hwy 47 = 5.3 miles, SD Hwy 63 Seg.1 = 9.6 miles, SD Hwy 63 Seg.2 = 9.3 miles, SD Hwy 1806 = 5.4 miles and US Hwy 212 = 1.2 miles.

The Contractor is allowed to use DO NOT PASS and PASS WITH CARE signs for a period of 2 weeks to mark no passing zones on roads with an average daily traffic of 2500 vehicles or less. It is estimated that 169 DO NOT PASS and 164 PASS WITH CARE signs will be required to mark the no passing zones, should the Contractor elect to use these signs. Portable sign supports may be used as long as the duration is less than 3 days. If the duration is more than three days, the signs shall be on fixed supports.

Cost for furnishing, installing and removing the DO NOT PASS and PASS WITH CARE signs shall be incidental to the contract unit price per mile for Temporary Pavement Marking.

Flagger symbol signs (W20-7a) and flaggers, or a shadow vehicle with rotating yellow lights or strobe lights, shall be positioned on the roadway shoulder in advance of workers for both directions of traffic during the installation of temporary road markers. The traffic control device used shall be moved to provide proper warning of the work operation. A ROAD WORK AHEAD (W20-1) sign, a Workers symbol sign (W21-1a), or a BE PREPARED TO STOP (W3-4) warning sign shall be mounted on the rear of the shadow vehicle. The method of traffic control used by the Contractor for this work shall be approved by the Engineer.

PERMANENT PAVEMENT MARKINGS

Traffic Control for permanent pavement marking operations shall be incidental to the cost of application. The striper and advance or trailing warning vehicle shall be equipped with flashing amber lights or advance warning arrow panel.

The Contractor shall advise the Engineer a minimum of 2 weeks prior to the application of the permanent pavement marking to allow the State to check and mark the location of no passing zones. All materials shall be applied as per manufacturer's recommendations.

The Contractor will be required to repaint all existing pavement marking including centerline, edge line, lane lines, turn arrows, crosswalk, stop bars, etc. This list is approximate. The Contractor will be required to inventory and mark, with appropriately colored tabs, the extent and location of the existing word messages, turn arrows, stop bars, railroad crossings, pedestrian crossings, etc. before the markings are obliterated. The Engineer will be provided a copy of the pavement marking inventory. Additional quantities are included in the estimate of quantities to paint the additional pavement marking. The cost of the tabs shall be incidental to the contract unit prices for the various items.

The application of permanent pavement marking paint may begin 7 calendar days following completion of final surfacing and shall be completed within 14 calendar days following completion of final surfacing.

For each working day the application of permanent pavement marking paint remains uncompleted after the previously stated time requirements, the Contractor will be assessed liquidated damages at the rate of $250.00 per day.

The liquidated damages shall apply up to the Contract Completion Date, as extended. After the completion date, liquidated damages will be assessed in accordance with section 8.7 of the Standard Specifications, until the Permanent Pavement Marking is completed, even though the project may be open to traffic.

EXISTING PAVEMENT CONDITIONS AND TRAFFIC VOLUMES

The existing pavement conditions for each project are listed in the table below. The descriptions are from the McLeod procedure for seal coat design.

PROJECT	EXISTING PAVEMENT CONDITION
SD HWY 20	Slightly porous and oxidized
SD HWY 47	Slightly pocked, porous and oxidized
SD HWY 63 Segment 1	Slightly porous and oxidized
SD HWY 63 Segment 2	Slightly porous and oxidized
SD HWY 1806	Slightly porous and oxidized
US HWY 212	Slightly pocked, porous and oxidized

The traffic volumes are shown on the title sheet for each project.

ASPHALT FOR SURFACE TREATMENT MIX DESIGN

After the aggregate stockpiles have been produced, the Contractor shall submit samples of the aggregates to the asphalt supplier, prior to construction, to determine a mix design and verify compatibility of the aggregate and asphalt.

The asphalt surface treatment will be designed in accordance with the Modified McLeod Design Procedure found in Volume II of Appendix C of the Preventive Maintenance Surface Treatments Report. The asphalt surface treatment design will be prepared by qualified personnel experienced in asphalt surface treatment design.

The surface design will be based on the traffic volume(s) and pavement conditions contained in the plans. The final application rate for the asphalt binder and cover aggregate will be determined after the source of the material is known and field adjustments are made. The design will include the following information:

1) Aggregate gradation.
2) Bulk specific gravity of the aggregate.
3) Loose unit weight of the aggregate.
4) Asphalt type and rate of application.
5) Aggregate rate of application.

In addition to the above data, the Contractor will submit with the design of the asphalt surface treatment a sample of each aggregate and emulsion for use by the Engineer for verifying the test results. The design may be verified by the Department.

The mix design shall be submitted to the Engineer at least one week prior to the start of construction.
Appendix C Volume II. Guidelines for Design of Chip Seals are reproduced below:

Volume II. Guidelines for Design of Chip Seals

Introduction

This volume presents the guidelines for the design of chip seals. The guidelines first cover some general information regarding the aggregate chips and the asphalt emulsion. The guidelines then address the specific material properties that are used in the recommended design procedure. Finally, the design equations for the aggregate and emulsion application rates are presented. An example design problem, illustrating the design procedure in a step-by-step manner, is also presented.

Aggregate Chips

Aggregate Type

Three aggregate types–quartzite, limestone and natural aggregates– are commonly used throughout the state. Quartzite is more common in the eastern part of the state, whereas limestone is more common in the western part of the state. Natural aggregates are found in the central as well as the northeast portion of the state. Other aggregate types, such as river gravel and granite, have been used for chip seals but are not common.

The selection of the aggregate type should be based on the availability and cost of aggregates in the area. The performance of chip seals with specific aggregate types should also be considered in the selection. On specialized applications, such as for high-volume roadways, additional considerations may need to be taken into account. For example, crushed aggregate can provide improved retention and durability characteristics.

Aggregate Shape

The ideal shape for aggregate chips is cubical and angular, as opposed to flat and rounded. Flat particles tend to orient on their flattest side under traffic loadings and can become completely covered with emulsion and create a bleeding problem. In addition, these completely embedded chips prevent proper embedment of chips that lie on top of the embedded chips, resulting in continued chip loss. With cubical aggregates, the chip height is essentially the same regardless of its orientation, resulting in more uniform chip embedment.

Angular or crushed aggregate particles are preferred over rounded particles. Rounded aggregates are more susceptible to rolling and displacement under traffic, especially in locations of stopping or turning traffic. Angular particles tend to lock together and provide better long-term retention and stability.

Aggregate Gradation

The aggregate gradation plays a key role in the design, construction and performance of chip seals. The gradation requirements shown in this Design Procedure are for information only and Modified Cover Aggregate is specified in the plans. The ideal gradation comprises the following characteristics:

- The aggregate chips should be similarly sized. A one-size aggregate provides a more uniform thickness and a more consistent and proper embedment of the chips, which improves the retention and performance of the chip seal. Similarly sized chips also help improve the surface friction and drainage capabilities of the chip seal.

- The aggregate bands should not be too wide. Allowing a wide range of aggregate retained on a particular sieve will result in widely varying gradations and differing performance. A tight gradation band ensures consistency and uniformity of the chip seal.

- The gradation should limit the amount of fines (material passing the 0.075 mm [No. 200] sieve). Fine materials create dust and can be a safety hazard for passing vehicles. Furthermore, fine materials absorb emulsion and can affect the bonding characteristics and performance of the chip seal.

To better account for these ideal properties, the aggregate gradations in Table II-1 are recommended for all roadways. The maximum aggregate size is 9.52 mm (⅜ in). The gradation also forces the majority of the aggregate to a small range to create a more uniform chip seal. The gradation also addresses the amount of fines by limiting the material passing the 0.075 mm (No. 200) sieve to one percent. The recommended gradation for sections using a second choke stone layer is also provided in the table.

Table II-1. Recommended aggregate gradations for chip seal designs.

Sieve Size	Percent Passing	
	Aggregate Chips	Choke Stone
12.7 mm (½ in)	100	100
9.52 mm (⅜ in)	90 – 100	100
6.35 mm (¼ in)	40 – 70	100
4.75 mm (No. 4)	0 – 15	85 – 100
2.36 mm (No. 8)	0 – 5	10 – 40
1.18 mm (No. 16)	–	0 – 10
0.300 mm (No. 50)	–	0 – 5
0.075 mm (No. 200)	0 – 1	0 – 1

Flat and Elongated Particles (Flakiness Index)

Like small particles, flat and elongated particles can become completely embedded in the emulsion and thus prevent larger aggregate particles from achieving proper embedment. The flakiness index – determined in accordance with the Central Federal Lands Highway Division (CFLHD) DFT-508, *Standard Method of Determining the Flakiness Index and Average Least Dimension of Aggregates* – should be performed to limit the amount of flat and elongated particles. The Flakiness Index is a measure of the percentage, by weight, of flat particles. For most applications, the Flakiness Index should be limited to 30 percent (i.e., the weight of flat and elongated particles should not exceed 30 percent of the total aggregate weight). For special applications such as high-volume roadways, the limit should be tightened to 20 or 25 percent.

ASPHALT FOR SURFACE TREATMENT MIX DESIGN(Continued)

Asphalt Emulsion

Emulsification is a process in which two otherwise incompatible materials are blended together. In the case of asphalt emulsion, the two incompatible materials are asphalt and water. An asphalt emulsion consists of asphalt particles dispersed in water, which is stabilized using a chemical solution (also know as an emulsifier). Upon application, the water and asphalt separate, a process referred to as "breaking" of the emulsion. The water then evaporates leaving the asphalt as the bonding agent.

Emulsion Classification

Asphalt emulsions are classified into three categories – anionic, cationic and nonionic – referring to the electrical charge of the emulsifier surrounding the asphalt particles. Anionic emulsions have a negative electrical charge surrounding the asphalt particles, and cationic emulsions have a positive charge.

Because opposite electrical charges attract, anionic emulsions should be used with aggregates that have a positive charge (such as limestone and natural aggregates). Likewise, cationic emulsions should be used with aggregates that have a negative charge (such as quartzite).

Emulsions are further identified based on how quickly they revert back to asphalt cement. The following terms are used to classify the emulsion grades:

- Rapid-setting (RS)
- Medium-setting (MS)
- Slow-setting (SS)
- Quick-setting (QS)

The grades indicate the speed at which the emulsion will become unstable and "break" coming into contact with the aggregate. An RS emulsion breaks very quickly and has little or no ability to mix with an aggregate. An MS emulsion will mix with coarse aggregate but not fine aggregate. SS and QS emulsions are designed to mix with fine aggregates.
High-float emulsions (designated as HF) allow a thicker film of asphalt material on the aggregate, which enhances the bonding and retention. They are designated as such because they pass the Float Test (ASTM D139 or AASHTO T50). High-float emulsions are recommended for use with dusty aggregates (greater than 2 percent fines).

Numbers are used in the classification to indicate the relative viscosity of the emulsion. Lower numbers indicate a lower viscosity or more fluid material (i.e., an MS-2 is more viscous than an MS-1). Letters are also sometimes used following the designation: "h" indicates a harder base asphalt, "s" indicates a softer base asphalt and "p" indicates a polymer-modified asphalt.

Table II-2 shows the classifications for asphalt emulsion. Standard specifications are available for anionic asphalt emulsions (ASTM D977 or AASHTO M140) and for cationic asphalt emulsions (ASTM D2397 or AASHTO M208).

Table II-2. Classifications of asphalt emulsions.

Anionic Asphalt Emulsions	Cationic Asphalt Emulsions
RS-1	CRS-1
RS-2	CRS-2
HFRS-2	–
MS-1	–
MS-2	CMS-2
MS-2h	CMS-2h
HFMS-1	–
HFMS-2	–
HFMS-2h	–
HFMS-2s	–
SS-1	CSS-1
SS-1h	CSS-1h

Chip Seal Design

Chip seals should be designed so that the proposed materials are of sufficient quality and have the desired properties to provide the expected performance. Proper design also ensures that the proper application rates are being used. The design procedure presented herein is a modified version of the McLeod design procedure (McLeod 1969) and is currently being used by the Minnesota Department of Transportation (Janisch and Gaillard 1998).

The procedure is based on two basic principles:

- The aggregate application rate is designed to provide a chip seal that is one stone thick (i.e., there should be a single layer of uniformly sized chips) with minimal excess.

- The voids in the aggregate are designed to be 70 percent filled with asphalt cement for good performance (i.e., the chips should be 70 percent embedded).

Emulsion Properties

Residual Asphalt Content

A portion of an asphalt emulsion consists of water, which evaporates as the binder breaks. The amount of asphalt cement that remains after breaking is referred to as the residual asphalt content. It is important to consider the residual asphalt content because it represents the amount of material that is available for bonding to the aggregate. In general, the residual asphalt content is about 65 to 70 percent (i.e., 65 to 70 percent of an asphalt emulsion consists of asphalt cement).

As mentioned, the objective of this design procedure is to achieve 70 percent embedment of the average-sized aggregate. To accomplish this, the emulsion must be at the top of the average-sized aggregate before curing. If only 70 percent of the aggregate is covered initially, the asphalt height will be about 30 percent too low after curing.

Aggregate Properties

Median Particle Size

The median particle size is the theoretical size through which 50 percent of the material passes. It is determined from the gradation chart using the following sieve sizes: 25.0 mm (1 in), 19.0 mm (¾ in), 12.5 mm (½ in), 9.5 mm (⅜ in), 6.3 mm (¼ in), 4.75 mm (No. 4), 2.36 mm (No. 8), 1.18 mm (No. 16), 0.300 mm (No. 50) and 0.075 mm (No. 200).

Flakiness Index

The Flakiness Index is a measure of the percentage, by weight, of flat particles. It is determined by testing a sample of aggregate particles for their ability to fit through a slotted plate. The test is conducted in accordance with the Central Federal Lands Highway Division (CFLHD) DFT-508, *Standard Method of Determining the Flakiness Index and Average Least Dimension of Aggregates.* The weight of the material passing the slots is divided by the total weight of the aggregate sample to determine the percent of flat particles or Flakiness Index.

Average Least Dimension

The average least dimension represents a reduction of the median particle size after accounting for the amount of flat particles. It represents the chip seal thickness in the wheel path after traffic has reoriented the chips on their flattest side. It is determined from the median particle size and flakiness index using the following equation:

$$H = \frac{M}{1.139285 + 0.011506FI} \qquad \text{(Eq. II-1)}$$

where:

H = Average Least dimension, in.
M = Median particle size, in.
FI = Flakiness index, percent.

Loose Unit Weight

The loose unit weight is required in order to determine the voids in the aggregate in a loose condition. The voids represent the available space for the asphalt binder after placement and rolling. The loose unit weight is a function of the gradation, shape and specific gravity of the aggregate. It should be determined in accordance with ASTM C29.

Bulk Specific Gravity

Bulk specific gravity represents the weight of aggregate as compared to the weight of water. Different aggregate types have different unit weights or specific gravities. This factor affects the application rate of the aggregate chips because a heavier aggregate will require more weight of chips (or a higher application rate) than a lighter aggregate to cover the same area. Bulk specific gravities for aggregates typically range from 2.40 to 3.00. Natural aggregates are generally about 2.40 and quartzite and limestone aggregates are generally around 2.60.

ASPHALT FOR SURFACE TREATMENT MIX DESIGN(Continued)

Voids in Loose Aggregate

The voids in the loose aggregate represent the voids after the aggregate chips are placed on the pavement. It is based on the loose unit weight and can be determined using the following equation:

$$V = 1 - \frac{W}{62.4G} \qquad \text{(Eq. II-2)}$$

where:

V = Voids in the loose aggregate.
W = Loose unit weight of the aggregate chips, lb/ft^3.
G = Bulk specific gravity of the aggregate.

For one-sized chips, this factor will typically be around 50 percent. Rolling will reduce the amount of voids, typically to around 30 percent. Traffic will further reduce the amount of voids to around 20 percent.

Aggregate Absorption

Aggregates, especially porous aggregates, will absorb a portion of the asphalt emulsion. This will affect the amount of asphalt binder that is available for bonding with the aggregate chips. To ensure that enough binder remains, this factor must be taken into account when designing the emulsion application rate. An absorption correction factor of 0.09 l/m^2 (0.02 gal/yd^2) is recommended for aggregates with absorption greater than 1.5 percent. Quartzite is generally not too absorptive and will not require an adjustment. Some limestone and natural aggregates, however, may require an adjustment to the emulsion application rate.

Other Design Properties

Traffic Volume

The traffic volume will influence the amount of asphalt binder that is required to provide sufficient embedment of the aggregate chips. All other factors equal, roadways with higher traffic volumes will require less asphalt binder. This may appear to be the opposite of what is typically expected. However, consider that traffic causes a reorientation of the chips until they eventually lie on their flattest side.

More traffic thus results in a greater probability that the chips will be laying on their flattest side and will result in a thinner chip seal. Less traffic will result in a thicker chip seal and will thus require more asphalt binder to achieve sufficient embedment. Table II-3 provides the recommended traffic correction factor to be used in determining the emulsion application rate. Failure to account for this factor will result in bleeding in the wheel paths.

Table II-3. Recommended traffic correction factor.

Traffic (ADT)	Traffic Factor
< 100	0.85
100 – 500	0.75
500 – 1000	0.70
1000 – 2000	0.65
> 2000	0.60

Traffic Whip-Off

A portion of the aggregate chips will get thrown off the roadway before final curing and embedment under traffic has occurred. This is accounted for in the procedure using a traffic whip-off factor. The factor is based on the traffic volume and traffic speed of the roadway. Low-volume, residential streets will have about a 5 percent loss, whereas the loss on high-volume, high-speed roadways will be around 10 percent. The factor can be computed using the following equation:

$$E = 1 + \frac{P}{100} \qquad \text{(Eq. II-3)}$$

where:

E = Traffic whip-off factor.
P = Expected loss of aggregate chips, percent.

Thus, an expected loss of 10 percent results in a traffic whip-off factor of 1.10.

Existing Pavement Condition

The surface condition of the existing pavement will greatly influence the amount of asphalt emulsion that is required. A dry, porous pavement will absorb a tremendous amount of asphalt binder and thus affect the emulsion application rate. Conversely, a new pavement (or a pavement with bleeding on the surface) will absorb much less binder. The varying condition is accounted for in the design procedure by the surface correction factor. The recommended value, based on the pavement surface texture, is provided in Table II-4.

The same application rate cannot be used for all roadways with varying conditions. Similarly, the surface condition should be monitored during placement, and the application rate adjusted as needed to address areas of differing condition

Table II-4. Recommended surface correction factors.

Existing Pavement Surface Texture	Surface Correction Factor, gal/yd^2
Black, flushed asphalt	-0.01 to -0.06
Smooth, non-porous	0.00
Slightly porous and oxidized	+0.03
Slightly pocked, porous and oxidized	+0.06
Badly pocked, porous and oxidized	+0.09

Design Equations

Once the inputs are determined, the application rates can be calculated using the McLeod design equations. The equations for aggregate and emulsion application rates are presented below.

Aggregate Application Rate

The following equation is used to determine the aggregate application rate:

$$C = 46.8(1 - 0.4V) \times H \times G \times E \qquad \text{(Eq. II-4)}$$

where:

C = Chip application rate, lbs/yd^2.
V = Voids in loose aggregate.
H = Average Least dimension, in.
G = Bulk specific gravity.
E = Traffic whip-off factor.

Emulsion Application Rate

The emulsion application rate is determined using the following equation:

$$B = \frac{2.244 \times H \times T \times V + S + A}{R} \qquad \text{(Eq. II-5)}$$

where:

B = Binder application rate, gal/yd^2.
H = Average Least dimension, in.
T = Traffic correction factor.
V = Voids in loose aggregate.
S = Surface correction factor.
A = Aggregate absorption factor, gal/yd^2.
R = Residual asphalt content of binder.

Minnesota performs an additional calculation of the emulsion application rate to account for snowplow damage (Janisch and Gaillard 1998). The emulsion application rate is recalculated using the median particle size instead of the average least dimension. This new emulsion rate provides the required rate if the chips are not reoriented, and thus is more representative of the rate required outside the wheel path. The average of the two rates is then used as the starting point in the field. Minnesota has found that if this additional calculation is not performed, insufficient binder is applied in non-traffic areas, and snow plows shave off the chips (Janisch and Gaillard 1998).

Example Design Problem

A 68 kg (150 lb) sample of quartzite aggregate has been submitted for design. The roadway has traffic levels of 2,125 vehicles per day. The pavement surface is slightly pocked, porous and oxidized. A CRS-2 emulsion with a residual asphalt content of 66.5 percent will be used as the binder. Determine the emulsion and aggregate application rates for this project.

ASPHALT FOR SURFACE TREATMENT MIX DESIGN(Continued)

Step 1. Determine the aggregate gradation, bulk specific gravity and percent absorption.

Laboratory testing of the aggregate revealed the gradation as shown in Table II-5. Testing in accordance with AASHTO T 84-94 indicates a bulk specific gravity of the aggregate of 2.61. The aggregate absorption based on AASHTO T 84-94 is 0.55 percent, so no correction is needed.

Table II-5. Gradation results for design project.

Sieve Size	Percent Passing
12.7 mm (½ in)	100
9.52 mm (⅜ in)	95
6.35 mm (¼ in)	62
4.75 mm (No. 4)	12
2.36 mm (No. 8)	3.2
0.075 mm (No. 200)	1.3

Step 2. Determine the mean particle size.

The median particle size (M) is determined by plotting the gradation results and reading off the size at which 50 percent of the particles pass. The median particle size represents the theoretical size at which half the stones are larger and half are smaller. For the given gradation, the median particle size is determined to be 5.8 mm (0.23 in).

Step 3. Determine the flakiness index.

To determine the flakiness index, the aggregate particles are fitted through slots. The results of this testing is shown in Table II-6.

Table II-6. Results of flakiness index test.

Size Fraction	Weight Retained on Slot, grams	Weight Passing Slot, grams
12.5 to 9.5 mm (½ to ⅜ in)	54.2	12.3
9.5 to 6.3 mm (⅜ to ¼ in)	123.3	43.5
6.3 to 4.75 mm (¼ in to No. 4)	184.4	89.5
Total	**361.9**	**145.3**

Using these results, the flakiness index (FI) is determined as follows:

$$FI = \frac{Weight\ of\ Flat\ Chips}{Weight\ of\ Sample} = \frac{145.3}{361.9 + 145.3} = 0.286 = 28.6\ percent$$

Step 4. Determine the average least dimension.

The average least dimension (H) is the expected thickness of the chip seal after the chips have been reoriented on their flattest side from traffic. It is determined using Equation II-2 as follows:

$$H = \frac{M}{1.139285 + 0.011506FI} = \frac{0.23\ in}{1.139285 + (0.011506 \times 28.6)} = 0.157\ in$$

Step 5. Determine the loose weight of the aggregate.

A metal cylinder with a volume of 0.014 m^3 (0.50 ft^3) was loosely filled with aggregate and weighed. This process was repeated three times, the results of which are shown in Table II-7.

Table II-7. Results of loose unit weight testing.

Test Number	Weight of Aggregate, kg (lbs)
1	20.57 (45.25)
2	20.60 (45.32)
3	20.59 (45.29)
Average	**20.59 (45.29)**

The loose unit weight (W) is then determined as follows:

$$W = \frac{Weight\ of\ Aggregate}{Weight\ of\ Cylinder} = \frac{45.29\ lbs}{0.50\ ft^3} = 90.58\ lbs/ft^3$$

Step 6. Determine the voids in the loose aggregate.

The voids in the loose aggregate (V) is determined using Equation II-2 as follows:

$$V = 1 - \frac{W}{62.4\,G} = 1 - \frac{90.58\ lbs/ft^3}{62.4\ lbs/ft^3 \times 2.61} = 0.44$$

Step 7. Determine the aggregate application rate.

With the inputs determined above, Equation II-4 is used to determine the aggregate application rate (C):

$$C = 46.8(1 - (0.4V)) \times H \times G \times E$$
$$= 46.8(1 - (0.4 \times 0.44)) \times 0.157 \times 2.61 \times 1.10 = 17.3\ lbs/yd^2$$

Step 8. Determine the emulsion application rate.

The emulsion application rate is determined using Equation II-5. The calculation is performed twice – once for the wheel path areas (using the average least dimension) and again for the non-wheel path areas (using the median particle size). These calculations are shown below:

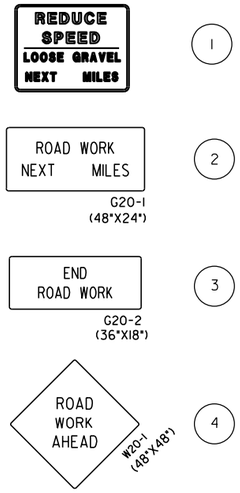
$$B = \frac{2.244 \times H \times T \times V + S + A}{R}$$
$$= \frac{2.244 \times 0.157 \times 0.60 \times 0.44 + 0.06 + 0.00}{0.665} = 0.23\ gal.yd^2$$

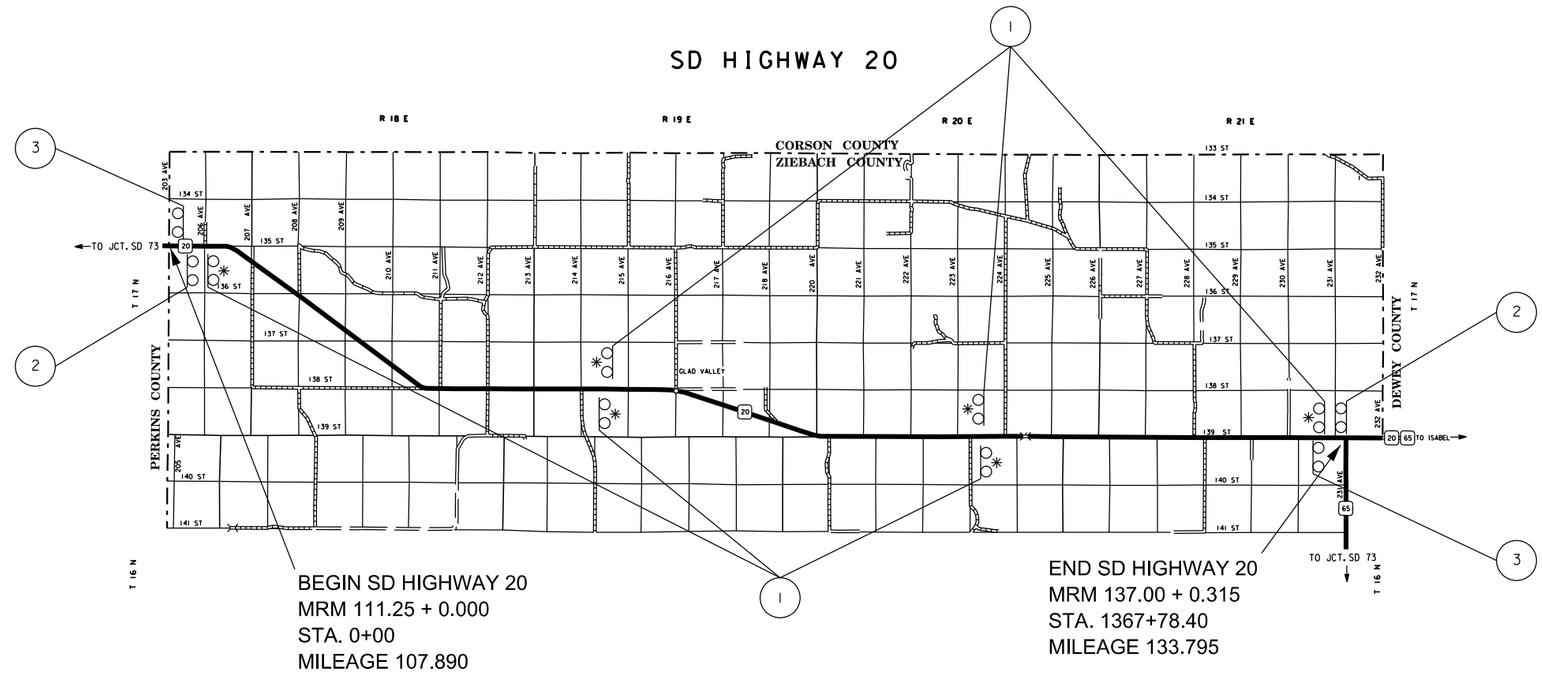
$$B = \frac{2.244 \times M \times T \times V + S + A}{R}$$
$$= \frac{2.244 \times 0.23 \times 0.60 \times 0.44 + 0.06 + 0.00}{0.665} = 0.30\ gal.yd^2$$

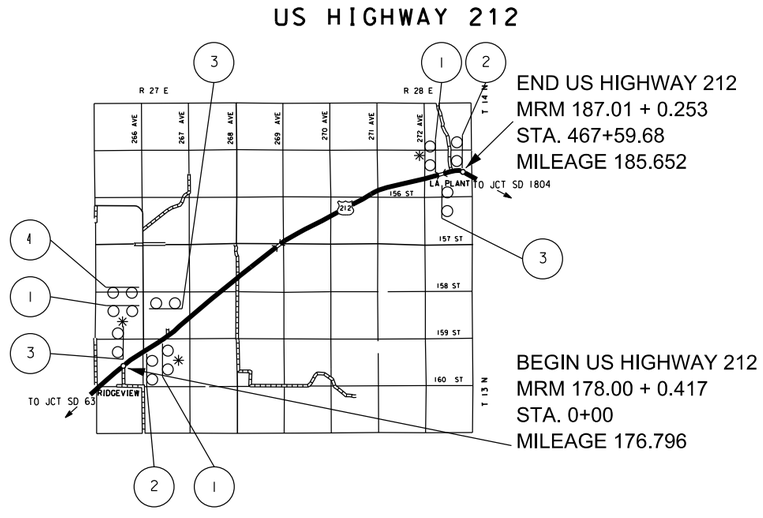
The average of the two results (0.27 gal/yd^2) is used as the starting point in the field.

STATE OF	PROJECT	SHEET NO.	TOTAL SHEETS
S.D.	NH-P 0032(116)	14	20

FIXED LOCATION SIGNS







Notes:

Sign locations will be verified in the field by the Engineer prior to installation.

Fixed location signs to remain in place until the completion of permanent pavement markings.

Special Sign (See details for Special Sign)

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S.D.	NH-P 0032(116)	15	20

FIXED LOCATION SIGNS

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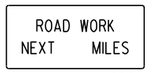

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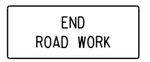

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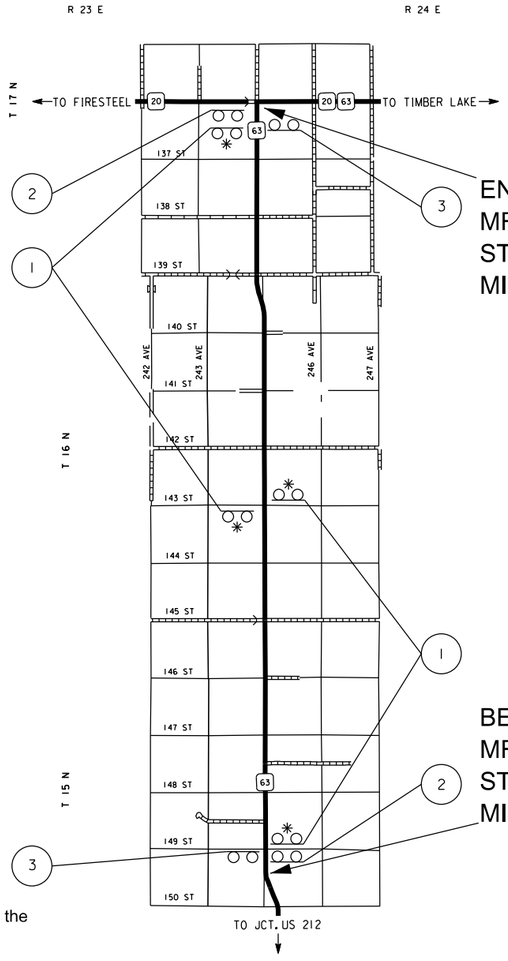
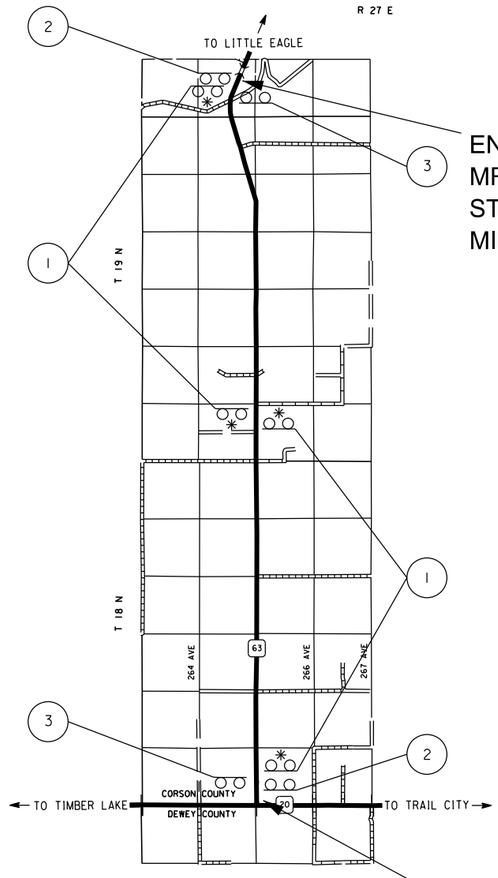
SD HIGHWAY 63
SEGMENT 1



END SD HIGHWAY 63
MRM 204.91 + 0.000
STA. 696+85.44
MILEAGE 134.383

BEGIN SD HIGHWAY 63
MRM 190.00 + 0.338
STA. 0+00
MILEAGE 121.185

SD HIGHWAY 63
SEGMENT 2



END SD HIGHWAY 63
MRM 240.00 + 0.448
STA. 677+84.64
MILEAGE 147.221

BEGIN SD HIGHWAY 63
MRM 227.58 + 0.000
STA. 0+00
MILEAGE 134.383

Notes:

Sign locations will be verified in the field by the Engineer prior to installation.

Fixed location signs to remain in place until the completion of permanent pavement markings.

Special Sign (See details for Special Sign)

STATE OF	PROJECT	SHEET NO.	TOTAL SHEETS
S.D.	NH-P 0032(16)	16	20

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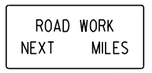

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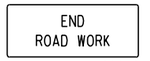

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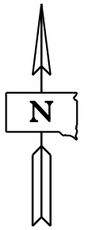
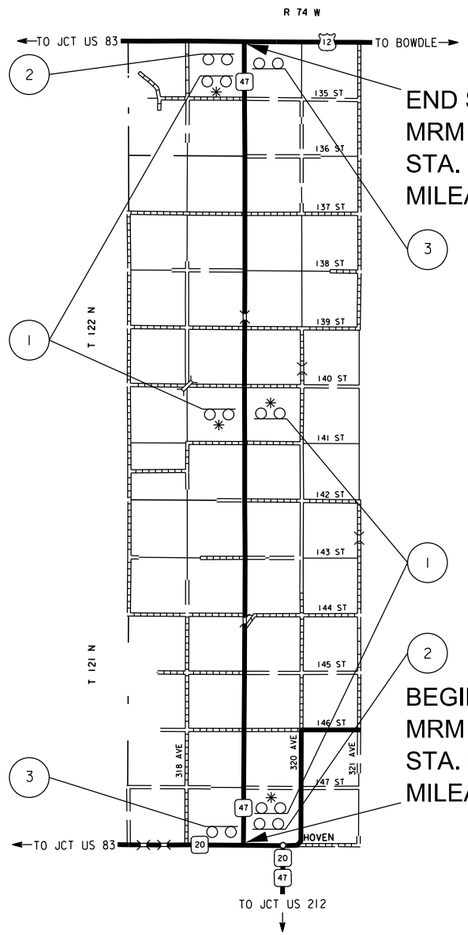


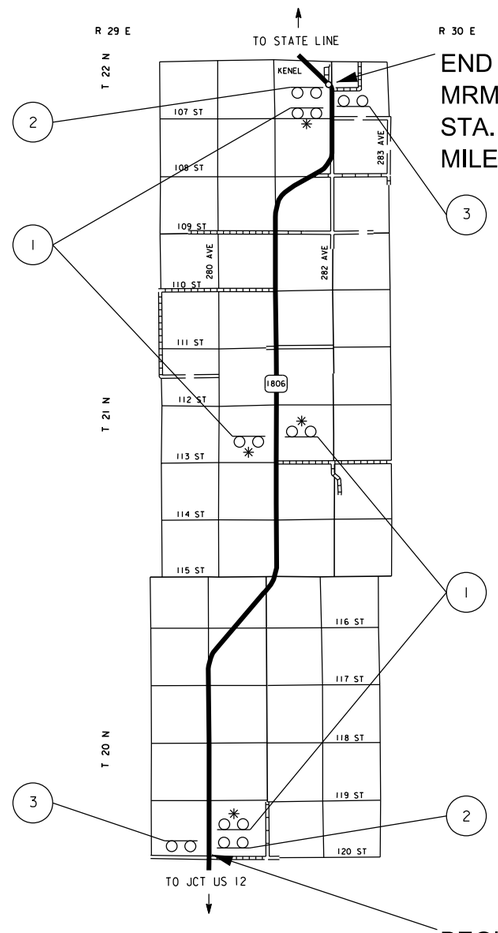
SD HIGHWAY 47



END SD HIGHWAY 47
MRM 217.63 + 0.000
STA. 739+09.44
MILEAGE 162.038

BEGIN SD HIGHWAY 47
MRM 203.62 + 0.000
STA. 0+00
MILEAGE 148.040

SD HIGHWAY 1806



END SD HIGHWAY 1806
MRM 386.83 + 0.000
STA. 747+54.24
MILEAGE 147.221

BEGIN SD HIGHWAY 1806
MRM 372.00 + 0.346
STA. 0+00
MILEAGE 107.683

Notes:

Sign locations will be verified in the field by the Engineer prior to installation.

Fixed location signs to remain in place until the completion of permanent pavement markings.

Special Sign (See details for Special Sign)

STATE OF SOUTH DAKOTA	PROJECT	SHEET NO.	TOTAL SHEETS
	NH-P 0032(16)	17	20

SIGN TABULATION

PROJECT NH-P 0032(16)

SD HIGHWAY 20

SIGN CODE	SIGN SIZE	DESCRIPTION	NUMBER REQUIRED	UNITS PER SIGN	UNITS
G20-1	48" x 24"	ROAD WORK NEXT ## MILES	2	24	48
G20-2	36" x 18"	END ROAD WORK	2	17	34
W8-6	48" x 48"	TRUCK CROSSING	2	34	68
W20-1	48" x 48"	ROAD WORK #### FT. OR AHEAD	4	34	136
W20-4	48" x 48"	ONE LANE ROAD #### FT. OR AHEAD	4	34	136
W20-7a	48" x 48"	FLAGGER	4	34	136
W21-2	36" x 36"	FRESH OIL	2	27	54
SPECIAL	48" x 36"	REDUCED SPEED GRAVEL NEXT X MILE	6	28	168
				TOTAL UNITS	780

SD HIGHWAY 47

SIGN CODE	SIGN SIZE	DESCRIPTION	NUMBER REQUIRED	UNITS PER SIGN	UNITS
G20-1	48" x 24"	ROAD WORK NEXT ## MILES	2	24	48
G20-2	36" x 18"	END ROAD WORK	2	17	34
W8-6	48" x 48"	TRUCK CROSSING	2	34	68
W20-1	48" x 48"	ROAD WORK #### FT. OR AHEAD	4	34	136
W20-4	48" x 48"	ONE LANE ROAD #### FT. OR AHEAD	4	34	136
W20-7a	48" x 48"	FLAGGER	4	34	136
W21-2	36" x 36"	FRESH OIL	2	27	54
SPECIAL	48" x 36"	REDUCED SPEED GRAVEL NEXT X MILE	4	28	112
				TOTAL UNITS	724

SD HIGHWAY 63 Segment 1

SIGN CODE	SIGN SIZE	DESCRIPTION	NUMBER REQUIRED	UNITS PER SIGN	UNITS
G20-1	48" x 24"	ROAD WORK NEXT ## MILES	2	24	48
G20-2	36" x 18"	END ROAD WORK	2	17	34
W8-6	48" x 48"	TRUCK CROSSING	2	34	68
W20-1	48" x 48"	ROAD WORK #### FT. OR AHEAD	4	34	136
W20-4	48" x 48"	ONE LANE ROAD #### FT. OR AHEAD	4	34	136
W20-7a	48" x 48"	FLAGGER	4	34	136
W21-2	36" x 36"	FRESH OIL	2	27	54
SPECIAL	48" x 36"	REDUCED SPEED GRAVEL NEXT X MILE	4	28	112
				TOTAL UNITS	724

SD HIGHWAY 63 Segment 2

SIGN CODE	SIGN SIZE	DESCRIPTION	NUMBER REQUIRED	UNITS PER SIGN	UNITS
G20-1	48" x 24"	ROAD WORK NEXT ## MILES	2	24	48
G20-2	36" x 18"	END ROAD WORK	2	17	34
W8-6	48" x 48"	TRUCK CROSSING	2	34	68
W20-1	48" x 48"	ROAD WORK #### FT. OR AHEAD	4	34	136
W20-4	48" x 48"	ONE LANE ROAD #### FT. OR AHEAD	4	34	136
W20-7a	48" x 48"	FLAGGER	4	34	136
W21-2	36" x 36"	FRESH OIL	2	27	54
SPECIAL	48" x 36"	REDUCED SPEED GRAVEL NEXT X MILE	4	28	112
				TOTAL UNITS	724

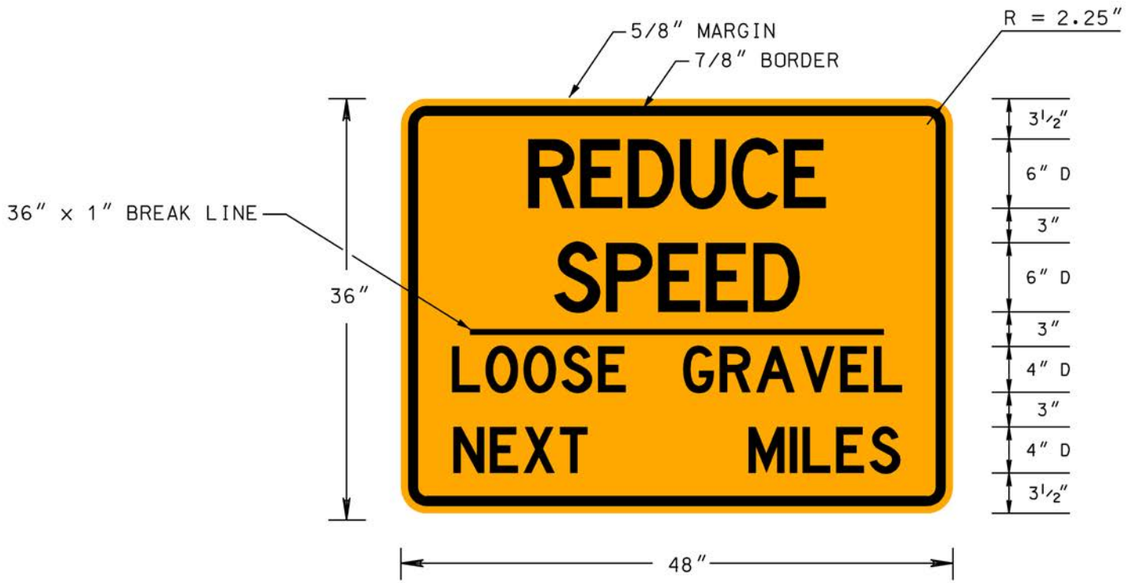
SD HIGHWAY 1806

SIGN CODE	SIGN SIZE	DESCRIPTION	NUMBER REQUIRED	UNITS PER SIGN	UNITS
G20-1	48" x 24"	ROAD WORK NEXT ## MILES	2	24	48
G20-2	36" x 18"	END ROAD WORK	2	17	34
W8-6	48" x 48"	TRUCK CROSSING	2	34	68
W20-1	48" x 48"	ROAD WORK #### FT. OR AHEAD	4	34	136
W20-4	48" x 48"	ONE LANE ROAD #### FT. OR AHEAD	4	34	136
W20-7a	48" x 48"	FLAGGER	4	34	136
W21-2	36" x 36"	FRESH OIL	2	27	54
SPECIAL	48" x 36"	REDUCED SPEED GRAVEL NEXT X MILE	4	28	112
				TOTAL UNITS	724

US HIGHWAY 212

SIGN CODE	SIGN SIZE	DESCRIPTION	NUMBER REQUIRED	UNITS PER SIGN	UNITS
G20-1	48" x 24"	ROAD WORK NEXT ## MILES	2	24	48
G20-2	36" x 18"	END ROAD WORK	3	17	51
W8-6	48" x 48"	TRUCK CROSSING	2	34	68
W20-1	48" x 48"	ROAD WORK #### FT. OR AHEAD	5	34	170
W20-4	48" x 48"	ONE LANE ROAD #### FT. OR AHEAD	4	34	136
W20-7a	48" x 48"	FLAGGER	4	34	136
W21-2	36" x 36"	FRESH OIL	2	27	54
SPECIAL	48" x 36"	REDUCED SPEED GRAVEL NEXT X MILE	3	28	84
				TOTAL UNITS	747

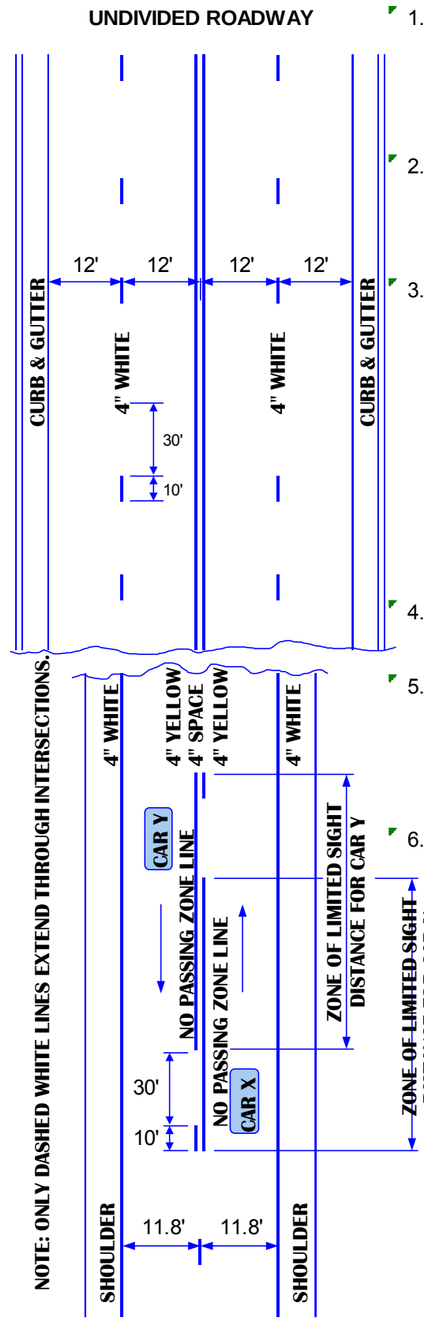
DETAILS FOR SPECIAL SIGN



LEGEND - BLACK (NON-REFLECTORIZED)
BACKGROUND - ORANGE (RETROREFLECTIVE)

NOTE: QUANTITY INCLUDED AS SPECIAL SIGN IN THE SIGN TABULATION.

FURNISHING AND APPLYING PAVEMENT MARKING PAINT



1. Pavement marking paint and glass beads will be furnished and applied by the Contractor. Material shall meet the requirements of Section 980 and 981 of the Standard Specifications. The bead application rate shall be 8 pounds/gallon of paint.

2. Construction requirements, methods of measurement and basis of payment shall conform to the requirements of Section 633 of the Standard Specifications and the Supplemental Specifications.

3. Approximate paint application rates shall be as follows:

Four Lane Roadway (Rates for one line)	**Two Lane Roadway**
Solid Yellow Centerline Rate = 16.90 Gals./Pass-Mile	Yellow Centerline (Includes No Passing Zones) Rate = 12± Gals./Pass-Mile
Dashed White Laneline Rate = 4.60 Gals./Pass-Mile	Solid White Edgeline (Rate for one line) Rate = 16.90 Gals./Pass-Mile
Solid White Edgeline (Not applicable in curb & gutter section) Rate = 16.90 Gals./Pass-Mile	

4. Typical pavement marking as shown on this sheet shall be applied throughout the entire length of undivided roadway.

5. Exact location of NO PASSING ZONE lines will be determined in the field by the Engineer. A dash of white paint will mark the beginning and end of all no passing zones. NO PASSING ZONE signs and the ending post in fence lines, if present, shall not be used as the beginning and ending of NO PASSING ZONE lines.

6. Traffic Control shall be incidental to the cost of application. The striper and advance or trailing warning vehicle shall be equipped with flashing amber lights or advance warning arrow panel.

ESTIMATED QUANTITIES	
PAVEMENT MARKING PAINT	QUANTITY
WHITE	3010 GALLONS
YELLOW	1070 GALLONS
TOTAL	4080 GALLONS

Posted Speed Prior to Work (M.P.H.)	Spacing of Advance Warning Signs (Feet) (A)	Spacing of Channelizing Devices (Feet) (G)
0 - 30	200	25
35 - 40	350	25
45 - 50	500	50
55	750	50
60 - 65	1000	50

Flagger

Channelizing Device

For low-volume traffic situations with short work zones on straight roadways where the flagger is visible to road users approaching from both directions, a single flagger may be used.

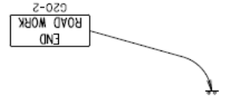
The ROAD WORK AHEAD and the END ROAD WORK signs may be omitted for short duration operations (1 hour or less).

For tack and/or flush seal operations, when flaggers are not being used, the FRESH OIL sign (W21-2) shall be displayed in advance of the liquid asphalt areas.

Flashing warning lights and/or flags may be used to call attention to the advance warning signs.

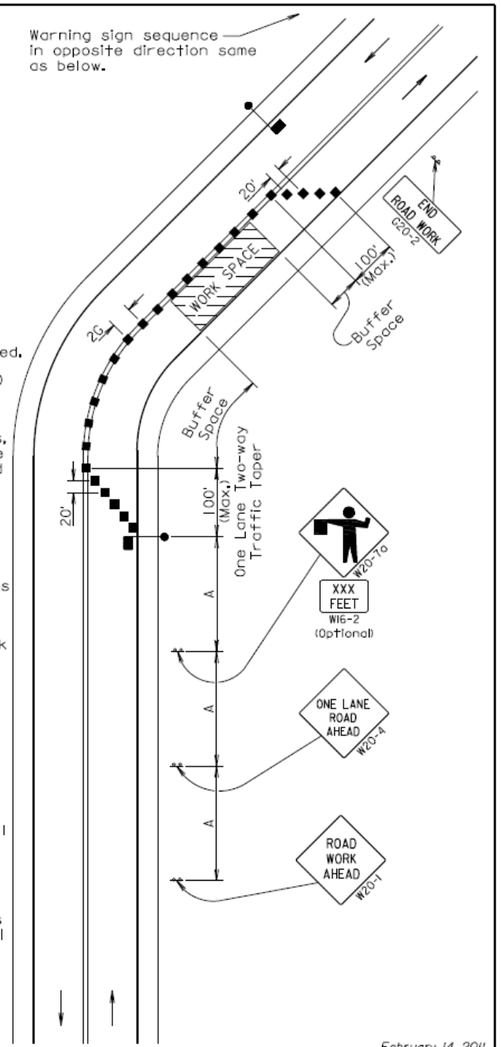
The channelizing devices shall be drums or 42" cones.

Channelizing devices are not required along the centerline adjacent to work area when pilot cars are utilized for escorting traffic through the work area.



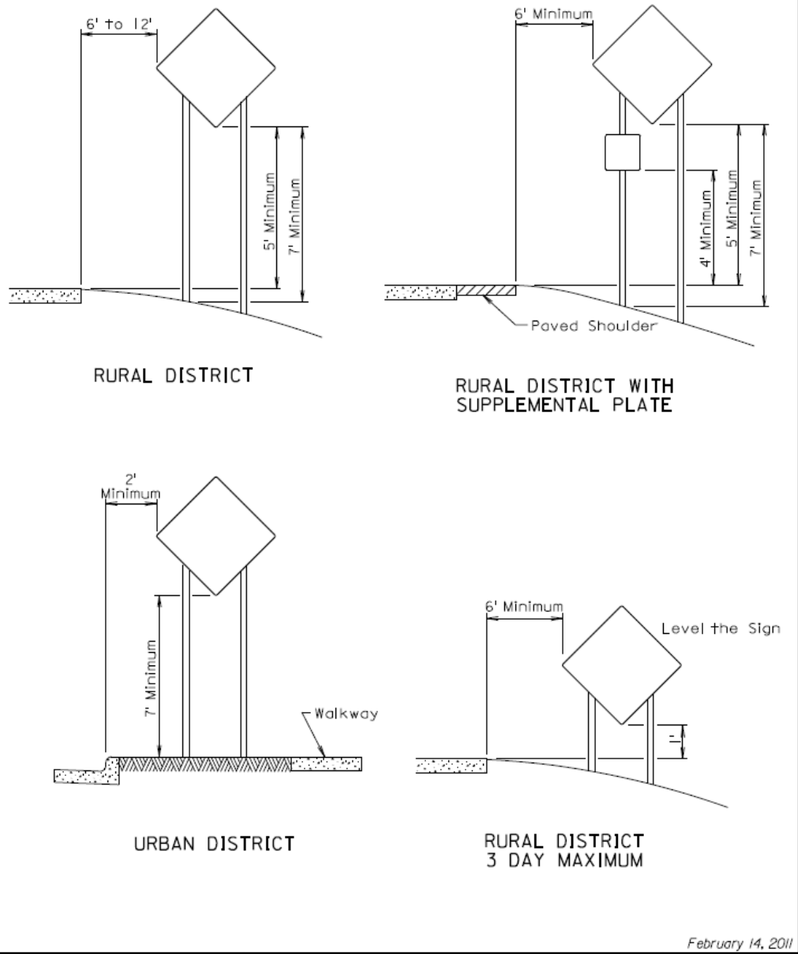
Channelizing devices and flaggers shall be used at intersecting roads to control intersecting road traffic as required.

The buffer space should be extended so that the two-way traffic taper is placed before a horizontal or vertical curve to provide adequate sight distance for the flagger and queue of stopped vehicles.



February 14, 2011

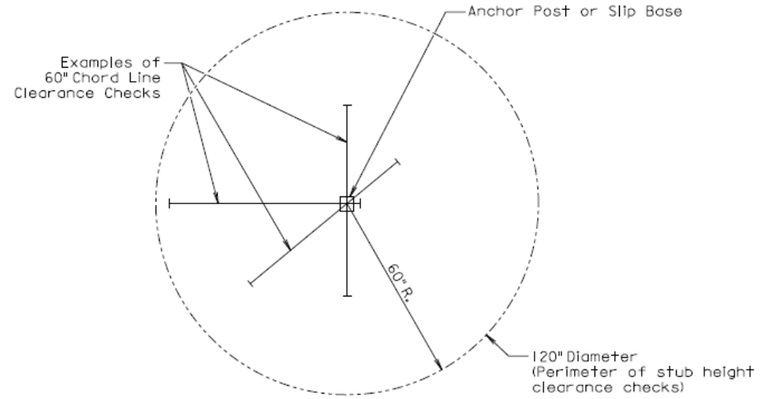
Published Date: 1st Qtr. 2014	SDDOT	GUIDES FOR TRAFFIC CONTROL DEVICES LANE CLOSURE WITH FLAGGER PROVIDED	PLATE NUMBER 634.23 Sheet 1 of 1



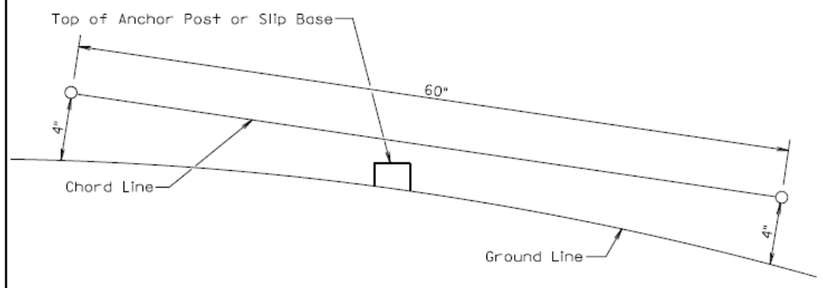
February 14, 2011

Published Date: 1st Qtr. 2014	SDDOT	CRASHWORTHY SIGN SUPPORTS (Typical Construction Signing)	PLATE NUMBER 634.85 Sheet 1 of 1

STATE OF SOUTH DAKOTA	PROJECT	SHEET NO.	TOTAL SHEETS
	NH-P 0032(16)	20	20



PLAN VIEW
(Examples of stub height clearance checks)



ELEVATION VIEW

GENERAL NOTES:

The top of anchor posts and slip bases SHALL NOT extend above a 60" chord line within a 120" diameter circle around the post with ends 4" above the ground.

At locations where there is curb and gutter adjacent to the breakaway sign support, the stub height shall be a maximum of 4" above the ground line at the localized area adjacent to the breakaway support stub.

The 4" stub height clearance is not necessary for U-channel lap splices where the support is designed to yield (bend) at the base.

July 1, 2005

Published Date: 1st Qtr. 2014	SDDOT	BREAKAWAY SUPPORT STUB CLEARANCE	PLATE NUMBER 634.99
			Sheet 1 of 1