

2211 AGGREGATE BASE

2211.1 DESCRIPTION

This work consists of placing aggregate base.

2211.2 MATERIALS

A Aggregate..... 3138

Provide the class of aggregate as required by the contract.

2211.3 CONSTRUCTION REQUIREMENTS

A General

Remove aggregate base, placed under the contract, that saturates subgrade soils. Dry and recompact the subgrade at no additional cost to the Department.

Ensure each lift of aggregate provides a solid platform for placement and compaction of the succeeding lift.

Protect the aggregate material placed on the roadway embankment before suspending operations.

B Contractor Quality Control (QC) Testing

Test according to the rates listed in the Schedule of Materials Control.

Certify materials on Form 24346-02 (*Certification of Aggregate and Granular Materials*), available on the Department's website at the Grading and Base homepage.

Retest corrected base, which fails either QC or VT tests.

B.1 Aggregate Production

Perform the following QC tests during production:

- (1) Gradation,
- (2) Crushing,
- (3) Aggregate quality, and
- (4) Bitumen content

B.2 Aggregate Placement

Perform the following QC tests during placement:

- (1) Gradation,

- (2) Determine the moisture content during compaction using test methods listed in the Grading and Base Manual, and
- (3) Provide the Engineer a copy of the moisture test results on a daily basis.

C Placing and Compacting

Ensure the underlying layer meets QC and Verification (VT) requirements before the next layer is placed and correct non-complying materials.

Maintain the moisture content per Table 2211-1.

Classification (Virgin Aggregate)	Moisture Content (% by dry weight)
Class 3 and 4	≥ 7%
Class 5 and 6	≥ 5%

Ensure the aggregate material has a uniform consistency before compaction.

Construct base lifts per Table 2211-2.

Maximum Base Lift Thickness	Compaction Method
≤ 3 in [75 mm]	No Vibratory Compactors Used
≤ 6 in [150 mm]	Both Vibratory and 25 ton Pneumatic Compactors Used

Construct the compacted base to support construction traffic and such that it allows no greater than ½ inch [13 mm] of surface displacement. Maintain the quality, integrity, and properties of the aggregate material in each lift until placing the next lift.

Blend and re-compact aggregate material represented by failing tests. Perform QC tests on the corrected material, and provide copies to the Engineer before VT testing.

D Agency Verification Testing (VT)

Test according to the rates listed in the Schedule of Materials Control.

D.1 Gradation

Sample aggregates from the roadway after spreading and before compaction using the random sampling method in the Grading and Base Manual. However, when layer thickness is 3 inches [75 mm] or less, sample prior to placement.

Correct failing material, before placing the next lift. The Engineer will perform VT testing after the QC tests meet specifications. The Engineer will test the entire lot or area with new random locations for corrected base.

The Engineer will test materials for the contract item *Stockpile Aggregates* before delivery and stockpiling.

D.2 Compaction

The Engineer will test for compaction in the areas with the greatest rutting or deflection.

Correct any area represented by a failing test. The Engineer will perform a new test in corrected areas with the greatest rutting or deflection.

The Engineer will test the compacted aggregate material using the Penetration Index Method in accordance with 2211.3.D.2.c, "Penetration Index Method." Allowable optional compaction testing methods include the following:

D.2.a Specified Density Method

The Department will only allow the specified density method on virgin aggregates.

Compact each lift to at least 100 percent of maximum density.

Refer to the Grading and Base Manual for the field density and maximum density test methods.

D.2.b Quality Compaction Method

Compact each lift until there is no further evidence of consolidation using rollers in accordance with 2123, "Permeable Asphalt Stabilized Stress Relief Course (PASSRC) and Permeable Asphalt Stabilized Base (PASB)."

D.2.c Penetration Index Method

Compact each lift to achieve a penetration index value and a seating value as per Table 2211-3.

Table 2211-3 Penetration Index Method — Maximum Seat and DPI				
Grading Number*	Moisture Content 	Maximum Allowable SEAT, [mm]†	Maximum Allowable DPI, [mm/blow]‡	Test Layer, in [mm]
3.1–3.5	<5.0	40	10	4.0–6.0 [100–150]
	5.0–8.0	40	12	
	>8.0	40	16	
3.6–4.0	<5.0	40	10	4.0–6.0 [100–150]
	5.0–8.0	45	15	
	> 8.0	55	19	
4.1–4.5	<5.0	50	13	5.0–6.0 [125–150]
	5.0–8.0	60	17	
	>8.0	70	21	
4.6–5.0	<5.0	65	15	6.0–12.0 [150–300]
	5.0–8.0	75	19	
	>8.0	85	23	
5.1–5.5	<5.0	85	17	7.0–12.0 [175–300]
	5.0–8.0	95	21	
	>8.0	105	25	
5.6–6.0	<5.0	100	19	8.0–12.0 [200–300]
	5.0–8.0	115	24	
	>8.0	125	28	
<p>* Grading Number (GN) is the sum of the percent passing these sieves divided by 100. GN = (1 in + ¾ in + 3/8 in. + No. 4 + No. 10 + No. 40 + No. 200)/100 [GN = (25.0 mm + 19.0 mm + 10.0 mm + 4.75 mm + 2.00 mm + 425 µm + 75 µm)/100]</p> <p> Percent of dry weight, see Grading and Base Manual for calculation</p> <p>† Total penetration of first two blows</p> <p>‡ Average of each set of three subsequent blows, following seating blows. For example, average of blows 3 – 5, 6 – 8, 9 – 11, etc.</p>				

E Workmanship and Quality

Construct each aggregate course to the profile and cross-section as required by the contract in accordance with 2112, “Subgrade Preparation.”

F Aggregate for the Contract Item *Stockpile Aggregate*

Produce and certify the class of material required by the contract.

Deliver and stockpile certified material to the designated sites listed in the contract.

2211.4 METHOD OF MEASUREMENT

The Engineer will measure the aggregate base in accordance with 1901, "Measurement of Quantities". The Engineer will not deduct the mass or volume of water and admixtures.

Conversion tables in the Grading and Base Manual are based on a mass per compacted volume of 135 lb per cu ft [2,160 kg per cu m].

2211.5 BASIS OF PAYMENT

The contract unit price for the accepted quantities of *Aggregate Base* includes the costs of production, testing, and placement.

The contract unit price for the accepted quantities of *Stockpile Aggregate* includes the costs of production, testing, delivery, and stockpiling at the project site.

Base placed before the Engineer accepts the Contractor's certification is unauthorized work in accordance with 1512, "Unacceptable and Unauthorized Work."

The Contractor may accept a price reduction instead of correcting failing material in accordance with Table 2211-4, Table 2211-5, and Table 2211-6, if the failing materials do not require "Corrective Action." The Engineer may issue a price reduction instead of "Corrective Action" after consulting with the Grading and Base Engineer.

The Department will add price reductions for each failing sieve and bitumen content result.

The Department will apply the price reduction against the entire quantity represented by the failing test or lot.

Table 2211-4			
Aggregate Gradation Payment Reduction Schedule*			
Based on the Average of 4 Samples per Lot			
Sieves			Acceptance Schedule (Price Reduction), %
2 in [50 mm], 1½ in [37.5 mm], 1 in [25 mm], ¾ in [19.0 mm], ⅜ in [9.5 mm]	No. 4 [4.75 mm], No. 10 [2.00 mm], No. 40 [425 µm]	No. 200 [75 µm]	
Percent Passing Outside Specified Limits			
5	1	0.1	5
—	—	0.2	6
6	—	—	7
7	—	0.3	9
8	—	0.4	11
9	—	—	13
—	—	0.5	14
10	2	0.6	15
>10	>2	>0.6	Corrective action required

* Use when the class of material is more than 4,000 ton [3,600 metric ton] or 2,200 cu. yd [1,700 cu. m].

**Table 2211-5
Aggregate Gradation Payment Reduction Schedule*
Based on an Individual Sample**

Sieves			Acceptance Schedule (Price Reduction), %
2 in [50 mm], 1½ in [37.5 mm], 1 in [25 mm], ¾ in [19.0 mm], ⅜ in [9.5 mm]	No. 4 [4.75 mm], No. 10 [2.00 mm], No. 40 [425 µm]	No. 200 [75 µm]	
Percent Passing Outside Specified Limits			
1	1	0.1–0.6	1
—	—	0.7	2
—	—	0.8	3
—	—	0.9–1.0	4
2–5	—	1.1	5
—	—	1.2	6
6	—	1.3	7
—	—	1.4	8
7	—	1.5	9
—	2	1.6–1.7	10
8	—	1.8	11
—	—	1.9	12
9	—	2.0	13
—	—	2.1	14
10	3	2.2–2.5	15
>10	>3	>2.5	Corrective action required

* Use when the class of material is less than 4,000 ton [3,600 metric ton] or 2,200 cu. yd [1,700 cu. m].

Table 2211-6 Bitumen Content Acceptance Schedule	
Bitumen Content (Composite Mixture), %	Acceptance Schedule (Price Reduction), %
3.1	1
3.2	2
3.3	4
3.4	6
3.5	8
3.6	11
3.7	14
3.8	17
3.9	21
4.0	25
4.1	30
4.2	36
4.3	43
4.4-4.5	50
> 4.5	Corrective action required

The Department will pay for aggregate base on the basis of the following schedule:

Item No.:	Item:	Unit:
2211.501	Aggregate Base, Class ____	ton [metric ton]
2211.502	Aggregate Base (LV), Class ____	cubic yard [cubic meter]
2211.503	Aggregate Base (CV), Class ____	cubic yard [cubic meter]
2211.505	Stockpile Aggregate, Class ____	ton [metric ton]
2211.506	Stockpile Aggregate (LV), Class ____	cubic yard [cubic meter]
2211.507	Stockpile Aggregate (SV), Class ____	cubic yard [cubic meter]

2212 DRAINABLE AGGREGATE BASE

2212.1 DESCRIPTION

This work consists of constructing a drainable Aggregate Base on a finished base or filter layer.

2212.2 MATERIALS

A Drainable Bases..... 3136

2212.3 CONSTRUCTION REQUIREMENTS

A General

Before placing the drainable base, maintain the underlying surface in accordance with 2112.3.E, "Tolerances."

Maintain a uniform gradation during placement.

B Contractor Quality Control (QC) Testing

Test according to the rates listed in the Schedule of Materials Control.

Certify materials on Form 24346-02, "Certification of Aggregate and Granular Materials," available on the Mn/DOT website at the Grading and Base home page.

B.1 Aggregate Production

Perform the following QC tests during production:

- (1) Gradation,
- (2) Crushing, and
- (3) Aggregate quality.

B.2 Aggregate Placement

Perform QC gradation testing during placement.

Correct failing material before placing the next layer. Sample and test material after correction.

C Placing and Compacting

Provide placement equipment meeting the following requirements:

- (1) Will not rut the in place surface,
- (2) Will not displace or damage the geotextile,
- (3) Capable of placing the required thickness without creating segregation, and
- (4) Do not use vibratory equipment.

Do not allow traffic on the drainable base after final placement and compaction. Use the quality compaction method in accordance with 2211.3.D.2.b, "Quality Compaction Method." Maintain drainage.

D Agency Verification Testing (VT)

Test according to the rates in the Schedule of Materials Control.

Sample and test by the random sampling method in the Grading and Base Manual. However, when layer thickness is 3 inches [75 mm] or less, sample prior to placement.

Test the entire lot or area of corrected material with new random samples.

Perform VT testing after QC tests meet specifications.

2212.4 METHOD OF MEASUREMENT

Measure the material in accordance with 1901, "Measurement of Quantities".

2212.5 BASIS OF PAYMENT

The Department will pay for drainable base on the basis of the following schedule:

Item No.:	Item:	Unit:
2212.501	Open Graded Aggregate Base (CV)	cubic yard [cubic meter]
2212.501	Drainable Stable Base (CV)	cubic yard [cubic meter]

2213 PERMEABLE ASPHALT STABILIZED STRESS RELIEF COURSE (PASSRC) AND PERMEABLE ASPHALT STABILIZED BASE (PASB)

2213.1 DESCRIPTION

This work consists of constructing a permeable base of hot mix asphalt-aggregate mixture on the approved prepared foundation, base course, or existing surface.

A Permeable Asphalt Stabilized Stress Relief Course (PASSRC) is paved on an in-place concrete or bituminous surface to act as a separation layer and to move water from beneath the unbounded pavement overlay.

This work also consists of constructing Permeable Asphalt Stabilized Base (PASB) on a prepared base under a new concrete or bituminous surface to drain surface infiltrated water under the pavement, or on a prepared subgrade with a geotextile filter layer when below a widened pavement.

2213.2 MATERIALS

- A Aggregate..... 3139.3**
- B Asphalt Binder 3151.2.A (PG 64-34)**

2213.3 CONSTRUCTION REQUIREMENTS

A Mixture Design

A.1 Submittal Location

The Department will perform the PASSRC or PASB mix design in the District Materials Laboratory.

A.2 Aggregate

Submit 80 lb [35 kg] of aggregate retained on the No. 4 [4.75 mm] sieve and 35 lb [15 kg] of aggregate passing the No. 4 [4.75 mm] sieve to the District Materials Laboratory. Obtain and store an equal size sample until the Department issues the Mixture Design Report (MDR).

Notify the Department at least 24 h before intent to sample.

Test the quality of each source, class, type, and size of virgin and non-asphaltic salvage aggregate source for the mix design.

A.3 Documentation

Provide the following information with each proposed JMF submitted:

- (1) The name(s) of the individual(s) responsible for the Quality Control of the mixture during production.
- (2) The low project number of the Contract on which the mixture will be used.
- (3) The temperature ranges the mixture is intended to be discharged from the plant and compacted at the roadway as supplied by the asphalt binder supplier. Temperatures to be included are, laboratory mixing and compaction temperature ranges and maximum field mixing and compaction temperatures.
- (4) The percentage in units of 1 percent (except the No. 200 sieve [0.075 mm] in units of 0.1 percent) of aggregate passing each of the specified sieves for each aggregate to be incorporated into the mixture.
- (5) The source and description of materials to be used. The aggregate pit or quarry source number. The proportion of each material (in percent of total aggregate).
- (6) The composite gradation based on the information in items (4) and (5) above.

A.4 Asphalt Binder

Submit four 1 qt [1 L] samples of the asphalt binder from the same supplier as will be used for production.

A.5 Restriction

Do not perform paving without an MDR.

B Mixture Quality Management

B.1 Sampling and Testing Rate

Provide a 35 lb [15 kg] belt sample for the following tests:

B.2 Gradation

Perform one gradation test per 1,000 ton [1,000 tonne].

B.3 Coarse Aggregate Angularity

Perform one coarse aggregate angularity test per 1,000 ton [1,000 tonne].

B.4 Asphalt Binder

Perform at least one asphalt binder spot check per day.

B.5 Quality

Sample and test for quality as directed by the Engineer.

B.6 Startup

At the start of production, for the first 2,000 ton [1,800 tonne] of material, perform one test per 500 ton [450 tonne].

B.7 Documentation

Include the following production test results and mixture information on the Department-approved test summary sheet:

- (1) Gradation for sieves listed in 3139.3.B.1, "PASB," or 3139.3.B.2, "PASSRC,"
- (2) Coarse aggregate angularity,
- (3) Spot check for percent asphalt binder content,
- (4) Aggregate proportions in use at the time of sampling,
- (5) Weight in tons [metric ton] where sampled,
- (6) Cumulative weight in tons [metric ton],
- (7) Weight in tons [metric ton] represented by test,
- (8) Signature line for Department and Contractor representative, and

(9) Mn/DOT verification sample test results.

B.8 JMF Limits

The mixture production targets and JMF limits are listed on the MDR. The Contractor's field results may deviate from the JMF target values, if the JMF limits meet the following requirements:

Table 2213-1 JMF Limits	
Item	JMF Limits, %
Gradation	95
Asphalt binder	-0.3

B.9 Failing Materials (Gradation, Coarse Aggregate Angularity, and Percent Asphalt Binder)

The Engineer will determine price adjustments for failing materials in accordance with Table 2213-2, "Pay Factors." Do not continue to produce if all lots produced in a day fail or if more than 50 percent of the lots on at least two consecutive days fail to meet minimum requirements for gradation (Table 3139-4 or Table 3139-5), crushing (Table 3139-6), or binder content from the JMF.

Table 2213-2 Reduced Payment Schedule for Individual Test Results	
Item	Pay Factor*, %
Gradation	95
Coarse aggregate angularity	90
Asphalt binder content	90
* The Department will apply the Lowest Pay Factor for single tests with multiple reductions The Department will not reduce prices for asphalt content greater than the allowable tolerance, if the Department does not visually observe asphalt drain down.	

B.9.a Gradation

The Engineer will consider a gradation as failing if the test result falls outside the JMF broadband limit (Table 3139-4 or Table 3139-5). The Engineer will consider a gradation as unsatisfactory or unacceptable if the individual gradation test result exceeds the JMF limit specified in Table 2213-1, "JMF Limits." The Department will reduce payment for all material tonnage represented by failing, unsatisfactory, or unacceptable gradation tests in accordance with Table 2213-2.

B.9.b Coarse Aggregate Angularity

The Engineer will consider material as unsatisfactory or unacceptable if the individual test result for coarse aggregate angularity fails to meet the specification minimum (Table 3139-6). The Department will reduce payment for all material tonnage represented by failing coarse aggregate angularity tests in accordance with Table 2213-2. The Department will consider the percentage of fractured faces as 100 percent if the Contractor provides 100 percent Class A or Class B aggregate or any combination aggregate blend of both. The Department will not require coarse aggregate testing if the Contractor uses a combination of 100 percent Class A or Class B material.

B.9.c Asphalt Binder Content

The Engineer will consider the material as unsatisfactory or unacceptable if the individual test result for asphalt binder content falls below the minimum JMF limit listed on the MDR. The Department will reduce payment for all material tonnage represented by failing asphalt binder content tests in accordance with Table 2213-2, "Pay Factors." The Department will not reduce price for asphalt binder content greater than the JMF target value if the Engineer determines no asphalt drain down from a visual observation. The Engineer will determine a price reduction for an observed asphalt drain down.

B.9.d Verification Testing

The Engineer will perform verification testing for gradation and coarse aggregate angularity in accordance with 2360.2.G.3, "Verification Sample." The Department will not perform verification testing if the Contractor provides 100 percent Class A or Class B aggregate or any combination aggregate blend of both. The Department will perform one spot check per day. The Department will allow differences between the Contractor's test results and the Department's verification test results in accordance with the following requirements:

Table 2213-3 Allowable Differences (Tolerances) between Contractor and Department Tests	
Item or Sieve Size (% Passing)	Allowable Difference, %
Coarse aggregate angularity	± 15
≥ No. 4 [4.75 mm]	± 5
No. 8 [2.36 mm]	± 3
No. 30 [600 μm]	± 3
No. 200 [75 μm]	± 2

C Handling and Placement

C.1 Mixing and Compaction Temperature

Mix and compact mixtures at the temperatures recommended by the binder supplier so that there is a 100 percent coating of the aggregate particles with no excess run-off or puddling of the asphalt binder.

C.2 Rutting Existing Surface

Use equipment to deliver or place the mixture capable of not rutting the in-place aggregate base (filter) layer or subgrade, or tear or displace the in-place geotextile. Repair ruts before placing the mixture to allow water to drain through the mixture, to prevent ponding, and to prevent the creation of soft spots on the base or subgraded as approved by the Engineer and at no additional cost to the Department.

C.3 Tack Application

Apply a bituminous tack coat in accordance with 2357, "Bituminous Tack Coat," to a clean surface between the surface of the in-place pavement structure and the PASSRC or PASB.

C.4 PASSRC – Surface Preparation

Remove loose or deteriorated surfacing and clean the surface by power sweeping and air blasting. Use air blasting, a small milling machine, or handwork as directed by the Engineer to remove deteriorated areas from joints, cracks, and bituminous-patched areas. Perform air blasting equipment capable of providing air at least 100 psi [690 kPa].

D Maintenance

Maintain the integrity of the PASSRC or PASB until placing the concrete or bituminous pavement. Correct deficiencies in thickness, smoothness, or density as approved by the Engineer.

D.1 Contamination

Remove contaminated material and soils from PASSRC, PASB, and associated drains as approved by the Engineer and at no additional cost to the Department.

D.2 Drainage

Maintain drainage and prevent water from ponding within the PASSRC or PASB.

D.3 Construction Equipment

The Department will only allow the paver, rollers, and bituminous haul trucks on the PASB necessary to construct the first lift of plant-mixed asphalt over the PASB.

Only allow bituminous haul trucks to drive onto and off the PASB immediately in front of the paver to unload. Repair damage to the PASSRC, PASB, or underlying layers at no additional cost to the Department.

D.4 Density

Provide densities for PASSRC and PASB that prevent rutting and is stable during the placement of the overlying pavement.

D.5 Damage

Repair damage to the PASB or PASSRC as approved by the Engineer and at no additional cost to the Department.

E Drain Installation (See 2502)

E.1 Concrete Pavement

Install drain after constructing the pavement.

E.2 Bituminous Pavement

Install drain after constructing the non-wear courses are, but before placing the wearing course.

E.3 Shoulder Base Aggregate

Install drains before placing shoulder base aggregate.

F PASB Widening

F.1 Subsurface Drain

Construct the subsurface drain before cutting the pavement widening trench. Place the fine filter aggregate 4 in [100 mm] above the proposed bottom of the pavement widening as shown on the plans. Use a special widening design approved by the Engineer to place the subsurface drain after cutting and widening the widening trench.

F.2 Trench

Before placing the PASB, shape and compact the bottom of the widening trench. Only allow compaction equipment in the trench. After shaping and compacting the widening bottom, clean the exposed edge of the in-place pavement to allow water to freely drain into the adjacent PASB. Do not crush the in-place drain pipe. Place clean filter aggregate after compaction. Clean or replace contaminated filter aggregate or PASB at no additional cost to the Department and as approved by the Engineer.

F.3 Geotextile

Place the geotextile in the bottom of the widening trench after compaction as shown on the plans, if required. Extend the geotextile from the edge of the in-place pavement to the inside edge of the drain trench. Do not lap up onto the in-place pavement or extend across the drain trench.

G Pavement Density

Compact the permeable asphalt layer in accordance with 2360.3.D.2, "Ordinary Compaction." Allow the permeable asphalt layer to cool before compaction rolling to prevent rutting and shoving. Do not compact the permeable asphalt layer at temperatures less than 110 °F [43 °C].

Do not use water to accelerate the cooling process.

Compact using steel-wheeled rollers, front and back, as approved by the Engineer and in accordance with 2360.3.D.2, "Ordinary Compaction," except do not perform vibratory compaction. Use at least two steel-wheeled rollers if the rate of placement is greater than 100 ton [100 metric ton] per hour. Do not over roll causing aggregate particles to degrade.

H Thickness and Smoothness Requirements

H.1 Elevation

Construct the finished surface of permeable asphalt layer to an elevation not varying by greater than $\pm\frac{5}{8}$ in [16 mm] from the prescribed elevation for that point as determined from the grades staked by the Engineer and the cross section as shown on the plans.

H.2 Thickness

Compact to a depth within $\pm\frac{1}{4}$ in [6 mm] as shown on the plans.

H.3 Deficient Thickness

Correct areas with a deficient thickness greater than $\frac{1}{2}$ in [13 mm] by scarifying, adding mixture, compacting, shaping, and finishing in accordance with this section (2213) as approved by the Engineer.

2213.4 METHOD OF MEASUREMENT

The Engineer will separately measure bituminous mixture and bituminous material for mixture.

The Engineer will measure bituminous mixture for the permeable asphalt layer by weight.

The Engineer will measure bituminous material incorporated into the permeable asphalt layer by weight.

2213.5 BASIS OF PAYMENT

The contract ton [metric ton] price for bituminous mixture includes the cost of constructing the permeable asphalt layer, mixture production, aggregate incorporation, placement, and compaction.

The contract ton [metric ton] price for bituminous material includes the cost of the bituminous material, additives, and incorporating the bituminous material into the mixture.

The Department will include the cost of geotextile, if required for widening designs, with the other relevant contract pay items.

The Department will pay for PASSRC and PASB on the basis of the following schedule:

Item No.:	Item:	Unit:
2213.501	Bituminous Mixture for Permeable Asphalt Stabilized Stress Relief Course	ton [metric ton]
2213.501	Bituminous Mixture for Permeable Asphalt Stabilized Base	ton [metric ton]
2213.501	Bituminous Material for Mixture	ton [metric ton]

2215 FULL DEPTH RECLAMATION (FDR)

2215.1 DESCRIPTION

This work consists of pulverizing and blending the in-place pavement with a portion of the underlying material to produce a uniform product.

Bituminous FDR may only be used within or above the road core as defined in 2105, "Excavation and Embankment"

2215.2 MATERIALS

A Modified Aggregate Bases..... 3135

2215.3 CONSTRUCTION REQUIREMENTS

A General

Do not place oversize pavement pieces within the right-of-way. The Department will deduct \$500.00 from payment for each instance when the Contractor's personnel are observed placing oversized pavement in the right-of-way. Remove oversize pavement pieces in the right-of-way.

If the pulverization operation causes damage to structures, repair the damage at no additional cost to the Department.

B Equipment Requirements

B.1 Reclaiming Machine

Use a road reclaiming machine capable of uniformly pulverizing the pavement and the underlying layer to the specified depth.

B.2 Rollers

B.2.a Pneumatic-Tired Roller

Use a pneumatic-tired roller weighing at least 25 ton [22.7 tonne] or 616 lb per in [111 kg per cm] of rolling width. Ensure the tire arrangement allows compaction over the full width of the roller with each pass.

B.2.b Pad Foot Vibratory Roller

Use a pad foot roller weighing at least 25,000 lb [11,300 kg].

C Contractor Quality Control (QC) Testing

Perform tests following the methods listed in the Grading and Base Manual.

Correct and test all failing areas

Submit results to the Engineer within 24 h of the completion of the tests.

C.1 Pulverization

Measure the blending depth every 1,000 ft [300 m] during each pass.

C.2 Gradation

Provide gradation test results to the Engineer within the first 500 ft [150 m] of production and within 500 ft [150 m] after a failing gradation.

Sample and test material after the completion of corrective action.

D Pulverizing Operation

Before beginning pulverization, remove vegetation and topsoil adjacent to the surface.

Blend, add water, spread, compact, and shape pulverized material by the end of the workday.

Uniformly spread additional aggregate material across the roadway surface before incorporating it into the reclaim mixture.

Protect and avoid damaging existing drainage or utility structures during pulverization.

Correct reclaim sections represented by a failed gradation.

E Spreading and Compacting

Uniformly mix reclamation material before spreading.

Spread and compact the reclamation material to the profile and cross section shown on the plans before placing the next layer.

Maintain the moisture content from 3 to 7 percent by dry weight during compaction.

Place and compact reclamation materials in maximum 3-inch [75-millimeter] lifts. Compact the reclamation material with rollers in accordance with 2215.3.B.2, "Rollers."

The Engineer may allow lift thickness up to 6 in [150 mm] when compacted with both of the following rollers:

- (1) Pneumatic-tired roller in accordance with 2215.3.B.2.a, "Pneumatic-Tired Roller," and
- (2) Pad foot vibratory roller in accordance with 2215.3.B.2.b, "Pad Foot Vibratory Roller."

The Contractor may use excess reclamation material from other locations on the project to attain the profile or cross-section as shown on the plans.

Compact each layer to achieve a penetration index value of 0.4 in [10 mm] and a seating value of 1.5 in [40 mm] as measured by the Mn/DOT Standard Dynamic Cone Penetrometer (DCP) device.

F Agency Verification Testing (VT)

Test according to the rates listed in the Schedule of Materials Control.

Test compaction using the Penetration Index Method.

Contact the Grading and Base Engineer for adjusted testing requirements.

Randomly sample for gradation, according to the grading and Base Manual, after spreading and before compaction.

The Engineer will sample and test the reclaim material after receiving acceptable test results from the Contractor.

G Workmanship, Quality, Repair, and Maintenance

Shape the reclamation material to the profile and cross-section as shown on the plans.

The Engineer will provide staking to re-establish the centerline, when Contractor-staking is not required by the contract.

Shape the final profile of the reclamation surface to ± 0.05 ft [15 mm] of the plan dimensions.

2215.4 METHOD OF MEASUREMENT

The Engineer will measure the reclamation area by the length and width.

2215.5 BASIS OF PAYMENT

The contract unit prices for the reclamation material contract items include the cost of production, testing, placement, occasional variations in the bituminous pavement thickness, removing vegetation and topsoil adjacent to the surface, and necessary maintenance.

The Engineer may issue a price reduction for failing material after consulting with the MnDOT Grading and Base Engineer

The Department will pay for reclamation on the basis of the following schedule:

Item No.:	Item:	Unit:
2215.501	Full Depth Reclamation	square yard [square meter]
2215.502	Haul Full Depth Reclamation (LV)	cubic yard [cubic meter]

2221 SHOULDER BASE AGGREGATE

2221.1 DESCRIPTION

This work consists of placing Contractor-certified aggregate on shoulders adjacent to pavements.

2221.2 MATERIALS

A Aggregate..... 3138

Use the class of aggregate required by the contract.

2221.3 CONSTRUCTION REQUIREMENTS

A General

Comply with the requirements of 2211.3.A, "Construction Requirements, General."

B Contractor Quality Control (QC) Testing

Comply with the requirements of 2211.3.B, "Contractor Quality Control (QC) Testing."

C Shoulder Preparation

Remove vegetation and replace contaminated material as directed by the Engineer.

Shape the bottom of the proposed shoulder aggregate to the grade and cross section as shown on the plans.

Compact the existing material using the Quality Compaction Method as specified in 2211.3.D.2.b, "Quality Compaction Method."

Disturbed materials not used on the project become the Contractor's property. Remove disturbed materials not used on the project in accordance with 2104.3.D, "Disposal of Materials and Debris."

D Placing and Mixing

Comply with the requirements of 2211.3.C, "Placing and Compacting."

Do not place shoulder aggregate on the existing pavement surface.

Immediately sweep spilled material from the pavement surface.

E Construction Under Traffic

Protect traffic as specified by the Temporary Traffic Control Zone Layouts Field Manual.

F Agency Verification Testing (VY)

Comply with the requirements of 2211.3.D, "Agency Verification Testing"

G Tolerances

Construct aggregate shouldering in accordance with 2112.3.E, "Tolerances."

2221.4 METHOD OF MEASUREMENT

The Engineer will measure the shoulder aggregate in accordance with 1901, "Measurement of Quantities." The Engineer will not deduct the mass or volume of water and admixtures.

A Shoulder Aggregate

Conversion tables in the Grading and Base Manual are based on a mass to compacted volume (CV) of 135 lb per cu.ft [2,160 kg per cu. m].

2221.5 BASIS OF PAYMENT

The contract unit price for placing aggregate shoulder will include the costs of the removing vegetation, disposing of excess material, and shaping the existing shoulder.

Materials placed before the Engineer accepts the Contractor's Certification, and/or

Materials with no or failing Contractor QC tests are unacceptable work per 1512 "Unacceptable or Unauthorized Work".

The contract unit price for the accepted quantities of shoulder aggregate includes the costs of production, testing, and placement as required by the contract.

If approved by the Engineer, the Contractor may accept a price reduction instead of correcting failing material in accordance with Table 2211-4, Table 2211-5, and Table 2211-6. If the failing materials fall within the "Corrective Action Required" section of the tables, the Engineer may issue a price reduction after consulting with the Grading and Base Engineer.

The Department will pay for shoulder aggregate on the basis of the following schedule:

Item No.:	Item:	Unit:
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2221.501	Shoulder Aggregate, Class ____	ton [metric ton]
2221.502	Shoulder Aggregate (LV), Class ____	cubic yard [cubic meter]
2221.503	Shoulder Aggregate (CV), Class ____	cubic yard [cubic meter]

2231 BITUMINOUS SURFACE RECONDITIONING

2231.1 DESCRIPTION

This work consists of reconditioning the existing pavement surface before constructing a bituminous overlay or surfacing courses.

2231.2 MATERIALS

A Bituminous Patching Mixture

Provide bituminous patching material matching the type of material used in the first layer of bituminous surfacing placed on the reconditioned surface.

B Mixture for Joints and Cracks

Provide a mixture for joints and cracks consisting of a prepared mix of fine aggregate and bituminous material in accordance with the following requirements:

Table 2231-1	
Joint and Cracks Mixture Requirements	
Material	Requirement, %
Aggregate gradation*:	
½ in [12.5 mm] sieve	100
No. 8 [2.00 mm] sieve	45 – 80
No. 200 [75 µm] sieve	2.0 – 7.0
Aggregate spall	< 5
Bituminous material	6.5 – 7.0†
* Percent passing requirement.	
Match PG grade to grade used on first lift of plant mixed asphalt.	
† Percent by weight.	

C Joint and Crack Filler

Provide joint and crack filler in accordance with the special provisions.

2231.3 CONSTRUCTION

A Surface Repair

Remove loose, unstable, or deteriorated portions of the existing pavement to provide a stable surface after completion of the patching operation. Remove waste or surplus material from the project. Repair and fill the holes and depressions with mix in accordance with the special provisions. Compact the mix using conventional roller equipment or mechanical tampers in areas inaccessible to conventional roller equipment.

B Joint Repair

B.1 Concrete Pavement

Clean and refill joints and cracks at least $\frac{1}{4}$ in [6 mm] wide.

B.2 Bituminous Pavement

Rout and seal cracks $\frac{1}{4}$ in to $\frac{3}{4}$ in [6 mm to 20 mm] wide. For cracks greater than $\frac{3}{4}$ in [20 mm] wide, fill with the mixture for joints and cracks and tamp in place.

2231.4 METHOD OF MEASUREMENT

The Engineer will separately measure the accepted quantities of bituminous patching mixture, mixture for joints and cracks, and joint and crack filler, as provided and placed, by the weight or by the loose volume of material as shown on the plans.

2231.5 BASIS OF PAYMENT

The contract unit prices for *Bituminous Patching Mixture*, for *Mixture for Joints and Cracks*, and for *Joints and Crack Filler* include the cost of removing and disposing of the existing deteriorated materials.

If the contract does not specify a specific contract pay item for removing concrete base or pavement in accordance with 2104, "Removing Pavement and Miscellaneous Structures," the Department will pay for the removal of a concrete base or pavement to full depth and width between existing joints, or by sawing, as extra work in accordance with 1402, "Contract Revisions."

The Department will pay for bituminous surface reconditioning on the basis of the following schedule:

Item No.:	Item:	Unit:
2231.501	Bituminous Patching Mixture	ton [metric ton]
2231.502	Bituminous Patching Mixture	cubic yard [cubic meter]
2231.505	Mixture for Joints and Cracks	pound [kilogram]

2231.507 Joint and Crack Filler

pound [kilogram]

2232 MILL PAVEMENT SURFACE

2232.1 DESCRIPTION

This work consists of removing the existing pavement by cold milling.

2232.2 MATERIALS — (BLANK)

2232.3 CONSTRUCTION REQUIREMENTS

A Equipment

Mill the existing pavement with a power operated, self-propelled cold milling machine capable of removing concrete and bituminous materials to the profile, cross-slope, grade, and elevation uniformly across the pavement surface as shown on the plans. Use automatic controls to control grade, elevation, cross-slope, and profile. Use a machine with ski, matching shoe, or an independent grade control to reference the existing pavement and automatically establish profile grades along each edge of the machine within $\pm\frac{1}{4}$ in [6 mm].

B Operations

Mill the pavement surface to the depth, width, grade, and cross-slope as shown on the plans. Perform milling without tearing or gouging the underlying material. Surface irregularities exceeding $\frac{1}{2}$ in [6 mm] under a 10-foot [3-meter] straightedge laid transversely and longitudinally after milling is complete are unacceptable. Reference the milling operation from an independent grade control in areas directed by the Engineer. Establish and maintain grade control as approved by the Engineer.

Mill the entire pavement width to a flush surface at the end of each work period, when the pavement is open to traffic. If uncompleted operations result in a vertical or near vertical longitudinal face, re-slope the longitudinal face to provide a taper, construct a temporary bituminous taper or provide protective measures, as approved by the Engineer. Taper transverse cutting faces at the end of each working period where pavement is open to traffic. Construct temporary bituminous tapers at intersecting streets, around utility appurtenances, and appropriated entrances during the milling operations, as directed by the Engineer.

Mill areas inaccessible to the milling machine using other equipment or methods as approved by the Engineer.

The Contractor may recycle the surfacing removed by the milling operations and use on the project in accordance with 3138, "Aggregate for Base and Surface Courses," or 3139, "Graded Aggregate for Bituminous Mixtures," or dispose of the millings outside the right-of-way in accordance with 2104.3, "Removing Pavement and Miscellaneous Structures, Construction Requirements."

After milling to the depth shown on the plans, sweep or vacuum clean the milled area with equipment approved by the Engineer. Clean the milled area as approved by the Engineer. Dispose of debris from milling and cleaning operations outside of the right-of-way in accordance with 2104.3, "Removing Pavement and Miscellaneous Structures, Construction Requirements," except as otherwise approved by the Engineer.

Mill previously patched areas to the specified depth below the pavement surface that existed before placement of the previous patch, and not from the surface of the patch.

Avoid disturbing or damaging existing drainage or utility structures on the project. Repair damage resulting from the milling operations at no additional cost to the Department.

Keep the milled pavement surface free of all loose materials and dust.

2232.4 METHOD OF MEASUREMENT

The Engineer will measure pavement milling by the area of each type of surface removed. The Engineer will measure areas milled, based on actual finished dimensions of the work.

2232.5 BASIS OF PAYMENT

The contract unit price for pavement milling includes the cost of traffic safety, cleanup, and disposal operations.

The cost of constructing a temporary milled taper and providing, placing, and removing temporary bituminous tapers is included in the contract unit price for other relevant contract items.

The Department will pay for mill pavement surface on the basis of the following schedule:

Item No.:	Item:	Unit:
2232.501	Mill Bituminous Surface ___ in [___mm]	square yard [square meter]
2232.502	Mill Concrete Surface ___ in [___mm]	square yard [square meter]

2233 MILL PAVEMENT RUMBLE STRIPS

2233.1 DESCRIPTION

This work consists of:

- (1) Constructing continuous milled rumble strips,
- (2) Constructing intermittent milled rumble strips, and
- (3) Constructing stop line milled rumble strips.

2233.2 MATERIALS — (BLANK)

2233.3 CONSTRUCTION REQUIREMENTS

Construct the following in accordance with this section and as shown on the plans:

- (1) Continuous rumble strips,
- (2) Intermittent rumble strips, and
- (3) Stop line rumble strips.

Mill all rumble strips.

Coat rumble strips milled into a bituminous pavement with an asphalt emulsion fog seal in accordance with 2355, "Bituminous Fog Seal," before final striping as directed by the Engineer.

A Equipment

Mill the existing pavement with a power operated, self-propelled cold milling machine capable of removing concrete and bituminous materials to the profile, shape, and elevation as shown on the plans.

B Operations

Mill the pavement surface to the profile, width, and elevation as shown on the plans.

After milling to the depth shown on the plans, sweep excess waste material resulting from the operation onto the unpaved shoulder and spread. If an adjacent grassed shoulder is not available or if directed by the Engineer, vacuum the milled area with equipment approved by the Engineer.

2233.4 METHOD OF MEASUREMENT

The Engineer will measure *Milled Rumble Strips – Continuous* and *Milled Rumble Strips – Stop Line* by length, in linear feet [meter], for each shoulder.

The Engineer will measure *Milled Rumble Strips – Intermittent* by length, in linear feet [meter], for each shoulder, including gaps, but excluding entrances, ramps, and turn lanes.

2233.5 BASIS OF PAYMENT

The contract unit prices for pavement milling include the cost of traffic safety, cleanup, and disposal operations.

The Department will include the cost of coating stop line rumble strips in the contract linear foot [meter] price for *Milled Rumble Strips – Stop Line*.

The Department will include the cost of coating continuous rumble strips in the contract linear foot [meter] price for *Mill Rumble Strips – Continuous*.

The Department will include the cost of coating intermittent rumble strips in the contract linear foot [meter] price for *Mill Rumble Strips – Intermittent*.

The Department will pay for mill pavement surface and milled rumble strips on the basis of the following schedule:

Item No.:	Item:	Unit:
2233.502	Milled Rumble Strips – Stop Line	linear foot [meter]
2233.503	Milled Rumble Strips – Continuous	linear foot [meter]
2233.504	Milled Rumble Strips – Intermittent	linear foot [meter]