Section 301 Base, Subbase, and Subgrade Aggregate

301.1 Description

Revise 301.1 to clarify that 301 does not apply to all of part 3 but only to 305-313 and 350.

(1) This section describes requirements common to sections 305 through 313 and 350. Exceptions and additional requirements are specified in those sections.

301.2 Materials

301.2.1 General

(1) Provide coarse aggregates from a department-approved source as specified under 106.3.4.2.

301.2.2 Definitions

Revise 301.2.2(1) to add crushed gravel, add natural material, and clarify crushed stone definitions.

(1) Interpret these terms, used throughout part 3, as follows:

Aggregate A composite mixture of hard, durable mineral materials that have been mechanically processed.

Breaker run Aggregate resulting from the mechanical crushing of quarried stone or concrete not screened or processed after primary crushing.

Crushed gravel Crushed angular particles of gravel retained on a No. 10 sieve.

Crushed stone Crushed angular particles of quarried rock retained on a No. 10 sieve.

Fractured face An angular, rough, or broken particle surface with sharp edges.

Gravel Naturally occurring rounded particles of rock that will be retained on a No. 10 sieve.

Pit run Unprocessed aggregate, with predominately 1 1/2-inch or larger sized particles, obtained from a gravel pit.

Natural material Material that is excavated, mined, quarried, or originates from a pit or quarry; reclaimed asphalt or crushed concrete are not natural materials within part 3.

Reclaimed asphalt Crushed or processed asphaltic pavement or surfacing

Reprocessed material Waste material for which a commercially demonstrated process uses the material as a raw material.

Sand Granular material having at least 90 percent passing the No. 4 sieve and predominantly retained on the No. 200 sieve.

Select crushed material Crushed and screened aggregate with particles predominately larger than 1 1/2 inches.

Virgin materials Mineral materials in a native or raw form, not previously-used.

301.2.3 Sampling and Testing

(1) Department and contractor testing shall conform to the following:

Sampling[1]	AASHTO T2
Percent passing the 200 sieve	AASHTO T11
Gradation[1]	AASHTO T27
Gradation of extracted aggregate	AASHTO T30
Moisture content[1]	AASHTO T255
Liquid limit	AASHTO T89
Plasticity index	AASHTO T90
Wear	AASHTO T96
Sodium sulfate soundness (R-4, 5 cycles)	AASHTO T104
Freeze/thaw soundness	AASHTO T103
Deleterious materials	AASHTO T113
Fracture[1]	ASTM D5821
Moisture/density[1]	AASHTO T99 and AASHTO T180
In-place density[1]	AASHTO T191
Asphaltic material extraction	CMM 8-36 WisDOT Test Method 1560

[1]As modified in CMM chapter 8.

(2) Contact the engineer to collect sample aggregates proposed for the project. The engineer and contractor will jointly obtain the sample. The sampler must be HTCP certified to sample aggregates. Do not place base until the engineer tests and approves the material, except as allowed in 106.1.

301.2.4 Aggregate Requirements

301.2.4.1 General

Revise 301.2.4.1(1) to clarify that sources need department approval and to list potentially deleterious materials.

(1) Obtain material from department-approved sources as specified under 106.3.4.2 and furnish material substantially free of deleterious materials that include: shale, chert, phyllite or other altered rock formed from clay materials, soft or porous rock fragments, clay lumps, coal, and other non-durable or organic particles.

301.2.4.2 Aggregate Classifications

(1) Provide aggregate conforming to one of the following classifications based on weight percentages.

Crushed stone or crushed gravel >= 85 percent virgin aggregates

Crushed concrete >= 90 percent crushed concrete that is substantially free of steel reinforcement and includes < 10 percent asphaltic pavement or surfacing, base, or a combination of asphaltic pavement, surfacing, and base, incorporated during the removal operation.

Reclaimed asphalt >= 75 percent asphaltic pavement or surfacing.

Reprocessed material Consists of crushed concrete, reclaimed asphalt, crushed stone, crushed gravel, or other construction materials that are thoroughly mixed and meet the following:

1. >= 80 percent is a combination of crushed concrete and reclaimed asphalt; where:
   - < 90 percent is crushed concrete, or else the material is classified as crushed concrete.
   - < 75 percent is reclaimed asphalt, or else the material is classified as reclaimed asphalt.
2. < 20 percent is crushed stone, crushed gravel, concrete block, brick, cinder, or slag particles; where:
   - < 10 percent of the final mixture is concrete block particles.
   - < 5 percent of the final mixture is brick, cinder, or slag particles.

Blended material Consists of a blend of crushed stone, crushed gravel, crushed concrete, reclaimed asphalt, or reprocessed material that are thoroughly mixed and meet the following:

1. Each individual component material, incorporated into the blend must meet the requirements of table 301-2 except for gradation. The final blend must conform to the specified gradation.
2. < 75 percent is reclaimed asphalt, or else the material is classified as reclaimed asphalt.
3. < 90 percent is crushed concrete, or else the material is classified as crushed concrete.
4. < 80 percent is a combination of crushed concrete and reclaimed asphalt, or else the material is classified as reprocessed material.
5. < 85 percent is virgin aggregate, or else the material is classified as crushed stone or crushed gravel.

301.2.4.3 Uses For Aggregate Classifications

Revise 301.2.4.3(1) table 301-1 to prohibit crushed concrete in open graded, prohibit reclaimed asphalt in 3-inch, and limit reclaimed asphalt in reprocessed or blended 3-inch base.

(1) The contractor may furnish the aggregate classifications, at the contractor's option, for the specified base types as allowed in table 301-1.

TABLE 301-1 USES FOR VARIOUS AGGREGATE BASE CLASSIFICATIONS

BASE TYPE	CRUSHED STONE	CRUSHED GRAVEL	CRUSHED CONCRETE	RECLAIMED ASPHALT	REPROCESSED MATERIAL	BLENDED MATERIAL
Dense 3/4-inch	Yes	Yes	Yes	No	Yes[1]	Yes[1]
Dense 1 1/4-inch	Yes	Yes	Yes	Yes	Yes	Yes
Dense 3-inch	Yes	Yes	Yes	No	Yes[2]	Yes[2]
Open-graded	Yes	Yes	No	No	No	No

[1] The contractor may provide reprocessed material or blended material as 3/4-inch base only if the material contains 50 percent or less reclaimed asphalt, by weight.

[2] Ensure that material is substantially free of reclaimed asphalt.

301.2.4.4 By-Product Materials

(1) The contractor may provide an aggregate with one of the following by-product materials mixed with crushed gravel, crushed concrete, or crushed stone up to the listed maximum percentage, by weight.

Glass 12%
Foundry slag 7%
Steel mill slag 75%
Bottom ash 8%
Pottery cull 7%

(2) Furnish by-product materials substantially free of deleterious material.

(3) Crush, screen, and combine materials to create a uniform mixture conforming to the predominant material specifications.

(4) If the aggregate contains a by-product material, the department will test the final product for gradation, wear, soundness, liquid limit, plasticity, and fracture as required for the predominant material.

(5) Do not use aggregate containing a by-product material in the top 3 inches of a temporary or permanent aggregate wearing surface.

301.2.4.5 Aggregate Base Physical Properties

(1) Furnish aggregates conforming to the following:

TABLE 301-2 AGGREGATE BASE PHYSICAL PROPERTIES

PROPERTY	CRUSHED STONE	CRUSHED GRAVEL	CRUSHED CONCRETE	RECLAIMED ASPHALT	REPROCESSED MATERIAL	BLENDED MATERIAL
Gradation AASHTO T27 dense open-graded	305.2.2.1 310.2	305.2.2.1 310.2	305.2.2.1 not allowed	305.2.2.2 not allowed	305.2.2.1 not allowed	305.2.2.1[1] not allowed
Wear AASHTO T96 loss by weight	≤50%	≤50%	note[2]	___	note[2]	note[3]
Sodium sulfate soundness AASHTO T104 loss by weight dense open-graded	≤18% ≤12%	≤18% ≤12%	___ not allowed	___ not allowed	___ not allowed	note[3] not allowed
Freeze/thaw soundness AASHTO T103 loss by weight dense open-graded	≤18% ≤18%	≤18% ≤18%	___ not allowed	___ not allowed	___ not allowed	note[3] not allowed
Liquid limit AASHTO T89	≤25	≤25	≤25	___	___	note[3]
Plasticity AASHTO T90	≤6[4]	≤6[4]	≤6[4]	___	___	note[3]
Fracture ASTM D5821[6] min one face by count dense open-graded	58% 90%	58% 90%	58% not allowed	___ not allowed	note[5] not allowed	note[3] not allowed

[1] The final aggregate blend must conform to the specified gradation.

[2] No requirement for material taken from within the project limits. Maximum of 50 percent loss, by weight, for material supplied from a source outside the project limits.

[3] Required as specified for the individual component materials defined in columns 2 - 6 of the table before blending.

[4] For base placed between old and new pavements, use crushed stone, crushed gravel, or crushed concrete with a plasticity index of 3 or less.

[5] ≥75 percent by count of non-asphalt coated particles.

[6]as modified in CMM 8-60.

301.3 Construction

301.3.1 Equipment

(1) Use specialized pneumatic or vibratory compaction equipment or a combination of both types of machines. Do not use tamping rollers. Use pneumatic compaction equipment conforming to 207.3.6.2. The engineer may allow the contractor to compact the shoulder foreslopes with other equipment.

301.3.2 Preparing the Foundation

(1) Prepare the subgrade, or resurface the previously placed base layer, as specified in 211.3.3 before placing base. Do not place base on foundations that are soft, spongy, or covered by ice or snow. Do not place base on frozen foundations unless the engineer approves otherwise. Water and rework or re-compact dry foundations as necessary to ensure proper compaction, or as the engineer directs.

Add 301.3.2(2) to require the contractor to report and correct yielding subgrade before placing overlying materials.

(2) Before placing material, identify areas of yielding subgrade and perform corrective work as specified in 205.3.13.

301.3.3 Stockpiling

(1) If continuous compliance with material specifications is questionable, the engineer may require the contractor to supply material from a stockpile of previously tested material. Maintain a sufficiently large stockpile to preclude the use of material not previously approved.

(2) Build and maintain stockpiles using methods that minimize segregation and prevent contamination. If the contract specifies location, place stockpiles where specified. Clear and prepare stockpile areas to facilitate the recovery of the maximum quantity of stockpiled material.

301.3.4 Constructing Base

301.3.4.1 General

(1) Place aggregate in a way that minimizes hauling on the subgrade. Do not use vehicles or operations that damage the subgrade or in-place base. Deposit material in a way that minimizes segregation.

(2) Construct the base to the width and section the plans show. Shape, and compact the base surface to within 0.04 feet of the plan elevation.

(3) Ensure there is adequate moisture in the aggregate during placing, shaping, and compacting to prevent segregation and achieve adequate compaction.

(4) Maintain the base until paving over it, or until the engineer accepts the work, if paving is not part of the contract. The contractor is not responsible for maintaining material placed on detours, unless the special provisions specify otherwise.

301.3.4.2 Standard Compaction

(1) Compact the base until there is no appreciable displacement, either laterally or longitudinally, under the compaction equipment. Route hauling equipment uniformly over previously placed base. Compact each layer before placing a subsequent layer. If the material is too dry to readily attain the required compaction, add water as necessary to achieve compaction.

301.3.4.3 Special Compaction

(1) If the contract requires special compaction, compact each layer to 95 percent of maximum density, or more, before placing the subsequent layer. The engineer will determine the maximum density according to AASHTO T99 method C or D and in-place density according to AASHTO T191.

301.3.5 Excavation Below Subgrade

(1) The engineer may request EBS in areas of placed base or subbase. Restore the surface in EBS areas to the plan grade and cross-section or as the engineer directs.

301.3.6 Controlling Dust

(1) Apply water or other engineer-approved dust control materials to control dust during construction and maintenance of the base and shoulders.

301.4 Measurement

(1) For measurement by the ton, the department will determine weight based on contractor-provided tickets submitted daily. Submit a ticket for each load showing the material, net weight, date, and project ID. For material with more than 7 percent moisture, the department will reduce the ticket weight by the weight of water exceeding 7 percent. The department will determine moisture content as a percent of dry weight.

(2) For measurement by the cubic yard, the department will determine the volume in the vehicle.

(3) The department may convert the measurement between weight and volume as specified in 109.1.

301.5 Payment

(1) Contractor testing for department-approved aggregate sources is incidental to the work.

Revise 301.5(2) to clarify that the department only pays for EBS in areas the engineer has approved for subsequent operations in cuts and shallow fills. The contractor is responsible for fills over 2 feet deep.

(2) The department will only pay for engineer-approved EBS to correct problems beyond the contractor's control. Work performed under 105.3 to correct unacceptable work is the contractor's responsibility. For EBS performed after placing subbase or base in the EBS area, and where the engineer approved that area for subsequent operations under 205.3.13, the department will pay for EBS as follows:

1. For excavation, the department will pay 3 times the contract unit price for the Excavation Common bid item under the EBS Post Placing Subbase or EBS Post Placing Base administrative item.

2. For backfill and restoration with the materials the engineer directs, the department will pay 3 times the contract unit price for the bid items of each material used to fill the excavation and restore the subbase or base under the Restoration Post Completion (item) administrative item.
3. For excavation, backfill, or restoration work without contract bid items, as extra work.

(3) Payment also includes water for compaction and dust control except, if the contract contains the Water bid item, the department will pay separately for compaction and dust control water under 624.5.

Section 305 Dense Graded Base

305.1 Description

(2) This section describes constructing a dense graded base using one of the following aggregates at the contractor's option:

Crushed stone	Reclaimed asphalt
Crushed gravel	Reprocessed material
Crushed concrete	Blended material

305.2 Materials

305.2.1 General

2 Provide aggregate conforming to 301.2 for crushed stone, crushed gravel, crushed concrete, reclaimed asphalt, reprocessed material, or blended material.

Add 305.2.1(2) to limit the placement of recycled/reclaimed materials under virgin aggregate base course layers.

(2) Where the contract specifies or allows 1 1/4-inch base, do not place crushed concrete, reclaimed asphalt, reprocessed material or blended materials below virgin aggregate materials unless the contract specifies or the engineer allows in writing.

305.2.2 Gradations

305.2.2.1 General

(2) Except for reclaimed asphalt, conform to the following gradation requirements:

	PERCENT PASSING BY WEIGHT		
SIEVE	3-INCH	1 1/4-INCH	3/4-INCH
3-inch	90 - 100	___	___
1 1/2-inch	60 - 85	___	___
1 1/4-inch	___	95 - 100	___
1-inch	___	___	100
3/4-inch	40 - 65	70 - 93	95 - 100
3/8-inch	___	42 - 80	50 - 90
No. 4	15 - 40	25 - 63	35 - 70
No. 10	10 - 30	16 - 48	15 - 55
No. 40	5 - 20	8 - 28	10 - 35
No. 200	2.0 - 12.0	2.0 - 12.0[1][3]	5.0 - 15.0[2]

[2] Limited to a maximum of 8.0 percent for base placed between old and new pavement.

[3] 8.0 - 15.0 percent if base is >= 50 percent crushed gravel.

[4] 4.0 - 10.0 percent if base is >= 50 percent crushed gravel.

(3) Unless the plans or special provisions specify otherwise, do the following:

Use 1 1/4-inch in base course layers. Always use 1 1/4-inch in the top 4 inches of base. The contractor may substitute 3-inch for 1 1/4-inch in lower base zones including material underlying the shoulder.

Use 3/4-inch in shoulders. Always use 3/4-inch to match the thickness of the paved shoulder in the unpaved portion of the shoulder and on exposed shoulder foreslopes. The contractor may substitute 1 1/4-inch for 3/4-inch elsewhere in shoulders and shoulder foreslopes. If using 1 1/4-inch, limit the allowable reclaimed asphalt content to 50 percent or less.

305.2.2.2 Reclaimed Asphalt

Revise 305.2.2.2 to require engineer approval to place reclaimed asphalt below virgin aggregate base layers.

(2) The contractor may use reclaimed asphalt with 100 percent passing a 1 1/4-inch sieve as 1 1/4-inch base. The engineer will assess gradation primarily by visual inspection but may test questionable material.

305.3 Construction

General

(2) Construct dense graded base conforming to 301.3.

Compaction

305.3.2.1 General

[3] Compact each base layer, including shoulder foreslopes, with equipment specified in 301.3.1. Use standard compaction conforming to 301.3.4.2. Final shaping of shoulder foreslopes does not require compaction.

Compacting 1 1/4-Inch Base and 3/4-Inch Base

(6) If using a pneumatic roller, do not exceed a compacted thickness of 6 inches per layer. For the first layer placed over a loose sandy subgrade, the contractor may, with the engineer's approval, increase the compacted layer thickness to 8 inches.

(7) If using a vibratory roller, do not exceed a compacted thickness of 8 inches per layer.

Compacting 3-Inch Base

(2) Compact with a vibratory or pneumatic roller. Do not exceed a compacted thickness of 9 inches per layer.

305.3.3 Constructing Aggregate Shoulders

General

2 Construct aggregate shoulders to the elevations and typical sections the plans show, except for minor modifications needed to conform to other work.

3 Use equipment that does not damage or mar the pavement surface, curbs, or appurtenances.

4 Place aggregate directly on the shoulder area between the pavement edge and the outer shoulder limits. Recover uncontaminated material deposited outside the limits and place within the limits.

5 Do not deposit aggregate on the pavement during placement, unless the engineer specifically allows. Do not leave aggregate on the pavement overnight. After placing the shoulder aggregate, keep the pavement surface free of lose aggregate.

6 Spread and compact the aggregate in compacted layers of 6 inches or less. Use standard compaction conforming to 301.3.4.2.

7 After final compaction, shape the shoulders to remove longitudinal ridges to ensure proper drainage.

301.3.1 Shoulders Adjacent to Concrete Pavement or Base

(2) Construct shoulders along concrete pavement or concrete base so the completed shoulder is at the approximate grade and cross-section before opening the pavement to public traffic.

305.3.3.3 Shoulders Adjacent to Asphaltic Pavement or Surfacing

(2) If the roadway is closed to through traffic during construction, construct the aggregate shoulders before opening the road.

Revise 305.3.3.3(2) to require elimination of drop offs within 2 days with shoulder material at a 3:1 or flatter slope.

(3) If the roadway remains open to through traffic during construction and a 2-inch or more drop-off occurs within 3 feet or less from the edge of the traveled way, eliminate the drop-off within 48 hours after completing that days paving. Unless the special provisions specify otherwise, provide aggregate shoulder material compacted to a temporary 3:1 or flatter cross slope from the surface of the pavement edge.

(4) Provide and maintain signing and other traffic protection and control devices, as specified in 643, until completing shoulder construction to the required cross-section and flush with the asphaltic pavement or surfacing.

301.3.4 Shaping Shoulders

(3) Under the Shaping Shoulders bid item, blade, shape, and compact the existing shoulder aggregate, before the end of the day's work, to ensure proper drainage while salvaging existing pavement and constructing new pavement. Do not contaminate the shoulder aggregate with deleterious material. Incorporate material obtained from shaping shoulders in the new shoulder, in widening the roadbed, or as the plans show.

301.3.4 Constructing Detours

2 Under the Aggregate Detours bid item, provide aggregate on the designated detour at the locations the plans show or the engineer directs. Use 3/4-inch base unless the plans or special provisions specify otherwise.

301.3.4.3 Measurement

(2) The department will measure the Base Aggregate Dense and Aggregate Detours bid items under this section by the ton or cubic yard acceptably completed. The department will determine weight or volume, adjust for moisture, and convert between weight and volume as specified in 301.4. The department may deduct for contaminated aggregate or unrecovered aggregate deposited outside the outer shoulder limits.

(3) The department will measure Shaping Shoulders by the station acceptably completed, measured along the centerline for each shoulder separately.

Payment

(1) The department will pay for measured quantities at the contract unit price under the following bid items:

ITEM NUMBER	DESCRIPTION	UNIT
305.0110	Base Aggregate Dense 3/4-Inch	TON
305.0115	Base Aggregate Dense 3/4-Inch	CY
305.0120	Base Aggregate Dense 1 1/4-Inch	TON
305.0125	Base Aggregate Dense 1 1/4-Inch	CY
305.0130	Base Aggregate Dense 3-Inch	TON
305.0135	Base Aggregate Dense 3-Inch	CY
305.0410	Aggregate Detours	TON
305.0415	Aggregate Detours	CY
305.0500	Shaping Shoulders	STA

(2) Payment for the Base Aggregate Dense and the Aggregate Detours bid items is full compensation for preparing the foundation; and for placing, shaping, compacting, and maintaining the base.

(3) Payment for Shaping Shoulders is full compensation for blading, shaping, compacting, and maintaining the existing aggregate shoulders.

Revise 305.5(4) to specify payment for substitutions allowed for base course and shoulder aggregate.

(2) If the contractor substitutes 3-inch in base course or 1 1/4-inch in shoulders as allowed under 305.2.2.1, the department will pay for the substitute material as follows:

At the Base Aggregate Dense 1 1/4-Inch unit price if substituting 3-inch in base course.

At the Base Aggregate Dense 3/4-Inch unit price if substituting 1 1/4-inch in shoulders.