

CHAPTER 10: PAVING

AGGREGATE

Aggregate has become more specific on how it is paid for. Therefore, make sure the plan specifies they type of aggregate to use.

Spec 2118 Aggregate Surfacing - Aggregate placed as shoulder or adjacent to bituminous/concrete shoulder or mainline bituminous. This includes aggregate placed as surfacing on entrances and road connections.

Spec 2211 Aggregate Base - to be used under mainline bituminous and can be used under bituminous shoulders if placed at same time as mainline aggregate.

Spec 2221 Shoulder Base Aggregate -Aggregate placed under shoulder bituminous/concrete, either as a different class or separate operation than mainline aggregate base.

AGGREGATE BEDDING

The current Spec Book has redefined aggregate bedding. Therefore, plans will no longer be using 2451 AGGREGATE BEDDING. This item is being replaced with one of three possible items... Aggregate bedding has become more specific on how it is paid for. Therefore, make sure the plan specifies they type of aggregate bedding.

- 2451.507 FINE AGGREGATE BEDDING (_V) by CU YD
- 2451.507 COARSE AGGREGATE BEDDING (_V) by CU YD
- 2451.507 CONDUIT AGGREGATE BEDDING (_V) by CU YD

Refer to page 548 of the 2016 Spec book or page 573 of the 2018 Spec book for material specifications under 3149.2.G.

BITUMINOUS ITEMS IN PLANS

The following is the recommended way to show Bituminous Items on the typical sections, tabulations, and everywhere else they appear.

TYPICAL SHEET

2" Type SP 9.5 Wearing Course Mixture (SPWEA440E)
2" Type SP 12.5 Wearing Course Mixture (SPWEB440E)
2" Type SP 12.5 Non Wearing Course Mixture (SPNWB440B)
2" Type SP 19.0 Non Wearing Course Mixture (SPNWC440B)
Type SP 12.5 Wearing Course Mixture (SPWEB440A) 2" Thick

TABULATION SHEET

Type SP 9.5 Wearing Course	Type SP 9.5 Wearing Course 2" Thick
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(SPWEA440E)	(SPWEA440E)
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NOTES

The patching mixture shall be Type SP 12.5 Wearing Course Mixture (SPWEB340B).

NOTE: All of the above are shown as examples only. The following are what the various letters and numbers represent.

Mix Designations

Mix designations for bituminous items are required in the plan whenever you reference the bituminous surface.

In terms of our normal spec. 2360 (plant mixed asphalt) mixture designation, here is a quick summary. Example: (SPWEB340B)

The first two letters (SPWEB340B) represent the mix type...
 SP = Superpave (really this just means that the asphalt mixture was designed using mixture volumetrics with compaction being done in a gyratory mixer to determine the starting point for mixture production. It is a result of research done nationally.)
 SMA = Stone Matrix Asphalt, this is rarely used and follows spec 2365.

The third and fourth letters (SPWEB340B) represent the course...
 WE = Wearing Course
 NW = Non Wearing Course
 The top 4 inches of mixture is normally WE and any mixture placed below that would be NW. The local agencies have the cutoff at 3 inches.

The fifth letter (SPWEB340B) represents the aggregate size...
 A = 1/2 inch, SP 9.5, our "A" aggregate size is 100% of the material passing the 1/2 inch sieve.
 B = 3/4 inch, SP 12.5, Maximum aggregate size. Our normal aggregate size is 100% of the material passing the 3/4 inch sieve, which is classified as "B".
 C = 1 inch, SP 19.0, this is rarely used.
 D = 3/8 inch, SP 4.75, this is rarely used.

The sixth digit (SPWEB340B) represents the traffic level... This number indicates the amount of traffic the mixture is designed to carry in a 20 year period in millions of ESALs.
 Traffic levels are as follows:

2	< 1 million ESALs
3	1 to < 3 million ESALs
4	3 to < 10 million ESALs
5	10 to < 30 million ESALs
6	is used with a different specification, 2365, Stone Matrix Asphalt (SMA).

The last two digits (SPWEB340B) indicate the air void requirement:
 40 = 4.0% for SP and Wear mixtures
 30 = 3.0% for SP Non Wear and Shoulder and Local Agency (low volume) Wear

The letter at the end of the mixture designation identifies the asphalt binder grade. Designers/soils engineers will start using a new binder grade system beginning January 1, 2016. The new grades will be:

Old Grades	New Grades
A = PG 52 34	A = PG 52S-34
B = PG 58 28	B = PG 58S-28
C = PG 58 34	C = PG 58H-34
E = PG 64 28	E = PG 58H-28
F = PG 64 34	F = PG 58V-34
L = PG 64 22	L = PG 64S-22
H = PG 70 28	H = PG 58V-28

There is a table in spec. 2360 (see Table 2360-2), basically a B letter means a PG 58-28 grade asphalt binder will be used. In a very general sense, 58 = the maximum temperature (in °C) that the binder will resist rutting, and – 28, is the temperature (in °C) that the binder will resist thermal cracking. Different letter grades will change the top or bottom number.

COMPACTION OF BITUMINOUS MIXTURES

Bituminous density requirements **should not** be placed in the construction notes or anywhere else within the plan.

The specification states that all pavements will be compacted in accordance with the Maximum Density Method unless otherwise specified in the Contract special provisions or as noted in Section 2360.6C. Section 2360.6C is titled “Ordinary Compaction Method”.

CONCRETE JOINT PAY ITEMS

There seems to be a number of people with questions on what joints to pay for on new concrete pavement. The following is a brief explanation. The specification book gives the guidelines. We encourage a tabulation on the plan which defines square yard quantities and cubic yard quantities (as required).

We do not provide a separate pay item for the Longitudinal Expansion Joints, therefore, longitudinal E1H joints do NOT need to be tabulated. However, show all of the E1H joints in the concrete paving plan.

Payment for joints should be limited to the dowelled transverse expansion joints only, such as: E2H-D, and E4H-D. The lineal foot measurement of 2301.503 Dowelled Expansion Joints, Design ____, includes dowel bars, dowel bar assembly, expansion joint filler, and saw and sealing.

CONCRETE OVERLAYS

Concrete Overlay over existing concrete is called “Unbonded” Concrete Overlays. Because

reflective cracking is likely to occur if bonding from the old to the new concrete pavement, a bond breaker (e.g. 2363 (PASSRC), 2360 (Plant Mixed Asphalt), 2105 (Geotextile Fabric), 2302 (Mill Bituminous Surface)) is placed between the in-place and newly placed concrete pavement. If the in-place concrete pavement had been previously overlaid with bituminous it is typically milled leaving 1 inch of bituminous remaining over the in-place concrete pavement.

Concrete Overlay over an existing bituminous pavement is called “Whitetopping” or “Bonded Concrete Overlay (BCOA)”. Usually the bituminous is milled prior to the concrete pavement in order to remove deteriorated bituminous and more importantly to aid in the bonding of the concrete to the underlying bituminous.

Contact the Concrete Engineering Unit when designing any of these types of projects for assistance in determining the special provisions and the language needed for surveying, paying for the bond breaker, the concrete, etc.

See the “Roadway Profile for Concrete Overlays” for more information.

CONCRETE PAVEMENT REHABILITATION (CPR)

The Concrete Rehabilitation Standards are available for downloading as boilerplates on the Concrete Office website at [MnDOT Concrete Pavement Rehabilitation](#)

Special Provision Notes

The special provisions have also been revised to reflect the changes to the CPR details.

CPR Pay Items

The pay items for these have changed as well. The new pay items are....

Item No	Description	Unit
2301.602	Drill and Grout Reinforcement Bar (Epoxy Coated)	Each
2302.602	Dowel Bar (1)	Each
2302.602	Dowel Bar Retrofit	Each
2302.603	Joint Repair (Type A1)	Lin Ft
2302.603	Joint Repair (Type A2)	Lin Ft
2302.603	Joint and Crack Repair (Type B3)	Lin Ft
2302.603	Full Depth Repair (Type CA-LV)	Lin Ft
2302.603	Full Depth Repair (Type CD-LV)	Lin Ft
2302.603	Full Depth Repair (Type CD-HV)	Lin Ft
2302.604	Pavement Replacement (Type CX)	SQ YD
2302.604	Utility Trench Full Depth Repair (Type C2-LV) ONLY	SQ YD
2302.604	Concrete Grinding	SQ YD
2302.604	Concrete Grinding Special	SQ YD
2302.608	Supplemental Reinforcement Bars (Epoxy Coated)	Pound
2302.618	Partial Depth Repair (Type BA)	SQ FT
2302.618	Partial Depth Repair (Type BE)	SQ FT
2302.618	Spot Full Depth Repair (Type C1-LV)	SQ FT

(1) **11 dowel bar baskets, used in Type CX repairs**

CPR “LV” DETAILS FOR STATE AID PROJECTS ONLY

All the CPR Details that have the LV (Low Volume) designation are for State Aid Projects only. For Interstate highways or Trunk highways, use only the details that do not contain the LV designation.

Use of the Type A1 Repair

Most projects will not have the Joint Repair (Type A1) as a pay item. This is because all of the type B & C repairs now have the saw and sealing as a (incidental) part of performing the individual Type B or C repair. Even though the Joint Repair (Type A1) will not be used as a pay item on a project the detail will need to be included in the plan. This is because all of the Type B and C repairs details refer to the Joint Repair (Type A1) for the proper procedure for sawing and sealing joints and cracks that are contained within the Type B and C repairs.

When clean and seal Joint Repair (Type A2) is used, the measurement stops at the Type B or C Repair. The Joint Repair (Type A1) incidental when use with the Type B and C repairs. Contact the Concrete Engineering Unit for further recommendations.

Note: The Concrete Engineering Unit does not recommend re-sawing and sealing in place joints on roadways with a speed limit of greater than 45 mph. Contact the Concrete Engineering Unit for further recommendations.

Pavement Replacement (Type CX) Repair

Another change is to the Pavement Replacement (Type CX) repair detail as to when drill and grout reinforcement bars (tie bars) are required. The repair detail states drill and grout reinforcement bars are not required unless the longitudinal repair length exceeds 75 feet. Unless a project is anticipating Pavement Replacement (Type CX) repairs greater than 75 feet long, do not include Item 2301.602 Drill and Grout Reinforcement Bar (Epoxy Coated).

Details for Catch Basin, Curb and Gutter and Sidewalk Removals and Repairs

The “How To” repair details use MnDOT standard pay items and show a routine procedures and pay items for catch basin removal and repairs, curb and gutter removals and repairs, and sidewalk removals and repairs.

“HOW TO” REPAIRS		
Previous	Current	Changes to Repairs
None	Catch Basin Repairs	Uses MnDOT Standard Pay Items
None	Curb and Gutter	
None	Sidewalk Repair	

Time and Traffic Considerations

Because of the ambient temperature requirements, consideration should be given to the time

of year the CPR project is to take place. If Table 2302-1 is to be used, do not schedule a CPR project with an early start or will extend late into the construction season, after 10/15/XX.

These provisions do not cover anticipated minimum times to opening of less than 12 hours, also known as ultra-high early concrete (UHE.) Ultra-high early concrete (UHE) is defined as repair concrete that will have construction or general traffic place on the concrete repairs with under 12 hours of cure time. Ultra-high early concrete projects require additional concrete testing, a test pour, and other requirements that are not in the published 2302 special provisions.

When designing a project and the Engineer determines that the pavement repairs will need to be opened to traffic in less than 12 hours – DO NOT use the standard CPR special provisions. Contact the Concrete Engineering unit for the correct special provisions and further recommendations on projects with anticipated opening times with less than 12 hours cure time.

For further clarifications or for CPR recommendations contact the Concrete Engineering Unit.

CONCRETE PAVING PLAN JOINT LAYOUT SHEETS

The Concrete Engineering Unit recommends creating paving plan joint layout sheets. Remove topography and other information not necessary for the actual concrete pavement construction. The Concrete Engineering Unit also recommends including the longitudinal joint designations on the Typical Sections if practical. If the Designer decides not to create separate paving plan joint layout sheets, but does have specific joint layout desires, include a single joint layout sheet that is typical of the project. Include the pavement lane widths, excluding curb and gutter that is placed in a separate operation.

Contact the Concrete Engineering Unit with question regarding preparation and review of joint layouts.

CONCRETE PAY ITEMS (Not Alternate Bid)

The following table should aid in selection of which pay items are needed whenever there is any concrete pavement pay items except bridge approach panels and concrete pavement rehabilitation on the job.

Method A: Pavement Constructed on Aggregate Base

Utilize Method A when, the longitudinal roadway profile has been established in the plan and the concrete pavement is placed on a shaped & compacted aggregate base. Such as new construction/grading projects in which the in place pavement is removed.

Method B: Pavement Placed on Bond Breakers

Utilize Method B when prior to the construction of the concrete pavement, a **bond**

breaker layer is placed or a **milled bituminous surface** remains. For either case (bond breaker or milled surface), the concrete pavement will likely have cross slope corrections (variable cross-sectional concrete thickness) and a post letting revised longitudinal profile. Because the final quantity will be revised, do not make pay item **2301.511 Structural Concrete** a plan (P) quantity.

Pavement Reinforcement

Supplemental Pavement Reinforcement is placed at mid-depth of the concrete pavement. Supplemental pavement reinforcement item is used when the concrete pavement is constructed over excavated underground utilities (culverts, storm sewers, water mains, etc.). Previously placed underground utilities usually do not require Supplemental Pavement Reinforcement unless; settlement is an ongoing issue (a dip in the roadway over an underground utility).

Reinforcement Bars shown on the Standard Plan Sheets are incidental: The Engineer will not separately measure keyway bars (L2KT), tie bars (L1T), taper steel (gores < 6' wide), and stopper bars (used at the discontinuation of a longitudinal joint).

Dowel Bars remain a pay item and are paid by the each.

Pay Item Selection for Concrete Paving Projects (Not Alternate Bid)				
Item No.	Description	Unit	Method A	Method B
2301.502	Dowel Bar	Each	Maybe	Maybe
2301.503	Dowelled Expansion Joints, Design ____	linear foot	Not likely	Not likely
2301.503	Integrant Curb, Design ____	linear foot	Maybe	Maybe
2301.504	Concrete Pavement ____ in	square yard	Yes	No
2301.504	Concrete Pavement ____ in High-Early	square yard	Maybe	No
2301.504	Place Concrete Pavement ____ in	square yard	No	Yes
2301.507	Structural Concrete	cubic yard	No	Yes
2301.507	Structural Concrete High-Early	cubic yard	No	Maybe
2301.508	Supplemental Pavement Reinforcement	pound	Maybe	Maybe

DOWEL BARS

If the dowel bars are standard size according to the Dowel Bar Diameter table as shown on standard plan sheet 5-297.221 sheet 1 of 2 then use the pay item 2301.502 DOWEL BAR by EACH.

If however, the bar size is modified to a different diameter than the table on the standard plan sheet 5-297.221 sheet 1 of 2 then use the pay item 2301.602 X" DOWEL BAR by EACH where "X" is the size of the dowel bar needed.

DIAMOND GRINDING

A Boiler plate Special Provision (1717 Air, Land, and Water Pollution for Concrete Grinding) is completed for this operation and must be included in the special provisions for BOTH 92302) CPR and (2301) Concrete Paving projects. State law allows concrete grinding slurry to be placed within MnDOT Right of Way, in accordance with Special Provision (1717 Air, Land, and Water Pollution for Concrete Grinding) Special Provision 1717 outlines both areas where slurry can be placed and areas where slurry cannot be placed within MnDOT Right-of-Way. Special Provision 1717 requires Areas of Environmental Sensitivity **(areas that require slurry collection and disposal off the Right-of-Way)** be identified on the plan set.

The plans must show federally recognized tribal reservation boundaries. Identification of federally recognized tribal reservation boundaries may be found on the following website: [Minnesota Indian Tribes](#).

All Areas of Environmental Sensitivity (AES) must be shown in the plans. Areas of Environmental Sensitivity are as follows:

- MnDNR Public Waters Inventory (PWI).
- National Wetland Inventory (NWI).
- Calcareous fens.
- Permanent vegetation designated for preservation, such as areas adjacent to the right of way identified as a 'Site of Biodiversity Significance' or 'Native Plant Community' by the DNR Minnesota Biological Survey (MBS).
- Prairie remnants, including but not limited to areas adjacent to Railroad Rights-of-way Prairies.
- Wooded areas with specimen trees.
- Locations with Federal or State listed Threatened or Endangered plant species.
- Locations with Federal or State listed Threatened or Endangered aquatic species.
- Historic properties.

For identification of items 1- 5, the following web link will provide the needed information:

[MN DNR Ecological and Water Resources](#)

For identification of items 6-9 information and direction will be provided by the Office of Environmental Stewardship (OES) staff through the project's Early Notification Memo (ENM) process.

In addition to the AES locations the following must also be identified on the plans:

- Curb and gutter sections that convey storm water to catch basin inlets into a closed drainage system (storm sewers).
- Inlet structures that utilize a piping system to convey storm water directly into stormwater treatment ponds or AES.
- Bridge deck grinding.

- Stormwater treatment ponds.
- Infiltration/filtration basins.

For projects that offer little or no opportunities to deposit the slurry within the project limits, as identified in the CPR plan set, the grinding contractor will likely haul all the grinding slurry to a pit/facility meeting the criteria specified in the Special Provision 1717, which will increase to unit price.

HEADERS

The number of construction header joints is usually controlled by the contractor and, as such, we should say that they are incidental. Also, when these headers are incidental, it is recommended that a note be included stating the steel is needed (e.g. # 7 bars for construction headers). Permanent Headers are also an incidental item. Reference steel needed similar to construction headers. Concrete pavement lugs should be paid for by the lin. foot.

INCLUSION OF 1717 WHEN USING 2399 FOR CONCRETE PAVING

Concrete Paving Projects that contain (2399) Ride specifications should also include the (1717) Air, Land, and Water Pollution (Concrete Grinding) Special Provision. This is because the ride spec 2399 requires concrete grinding to correct ride deficiencies.

JOINT SEALING REQUIREMENTS

MnDOT’s standard practice is not to seal any contraction or longitudinal joints on concrete pavements, except for the following:

- All roadways where speed limit is 45 mph or less, excluding ramps and loops, and L2 and L3 joints.
- Concrete Overlays “Whitetopping” < 6” thick
- Resealing CPR projects when roadway speed limits are ≤ 45 mph.

All expansion (E) joints require sealing in accordance with Standard Plan 5-297.221 (Sheet 1 of 2). If it is determined that sealing contraction (C) and longitudinal (L) joints is desired, the requirement is a single 1/8” wide saw cut sealed with MnDOT Spec. 3725 hot pour designated as a C2H or C2H-D joint.

The MnDOT Pavement Design Manual, Chapter 5, Table 530.2 has been updated to reflect the current guidance.

Table 530.2 – Concrete Joint Sealing Guidelines			
Type of Construction *	Speed Limit	Base Material	Joint Reference
All Roadways, excluding ramps and loops	≤ 45 mph	All	C2H C2H-D

PCC Overlay on Existing HMA (Whitetopping) < 6" thick	> 45 mph	Existing HMA	
New Construction	> 45 mph	All	C1U C1U-D
Unbonded PCC Overlay of Existing PCC (UBOL)			
PCC Overlay on Existing HMA (Whitetopping) ≥ 6" thick			
Ramps and Loops	All		
* For future concrete pavement rehabilitation (CPR) projects, follow the same recommended practices as original construction. Contact the MnDOT Concrete Unit with questions.			

Contact the Concrete Engineering Unit with any questions or concerns regarding the updated guidance, or to discuss suitability of sealing joints on a specific project.

NON WEARING COURSE

Whenever non wearing course is referenced it should have a space between NON and WEARING not a dash and not connected.

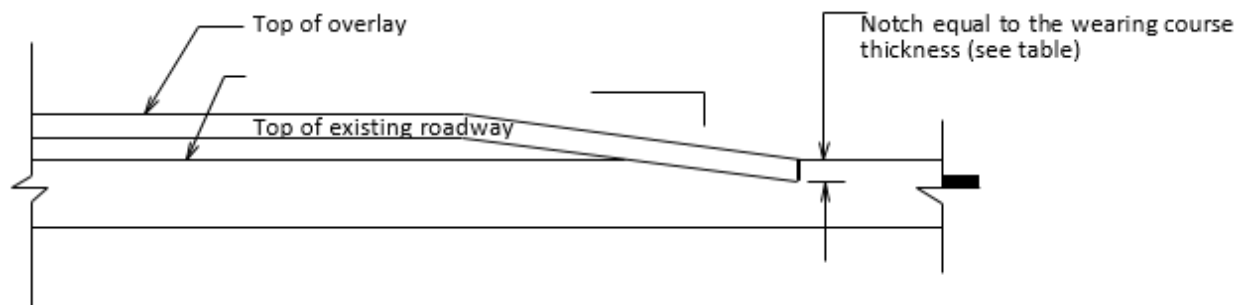
OVERLAY TRANSITION TAPERS

Currently, MnDOT does not have a policy or standard regarding the rate of transition tapers at the beginning and end of pavement overlays. As a result of this there is quite a variation in taper rates used throughout the state, ranging from about 1:240 to 1:600. Experience in Minnesota indicates that a transition taper of 1:400 results in an acceptable ride for high-speed roads. A recent survey of other state DOT's indicated that 1:400 is typical of taper rates used country-wide.

In order to provide pavement overlay transitions that provide a smooth ride, yet are economical, the rate of transition taper on pavement overlays should be determined from the following table.

DESIGN SPEED	RATE OF TAPER
50 mph or greater	1:400
35 to 45 mph	1:300
30 mph or less	1:200

Prior to placement of an overlay, the in-place surface in each taper should be notched as shown in the sketch below.



QUALITY MANAGEMENT

Please see chapter 7 for information regarding Quality Management and Quality Management Special.

RUMBLES IN CONCRETE

Sinusoidal rumbles should be used when placing rumble strips on concrete shoulders. These are typically on the inside shoulders of a concrete roadway.

ROADWAY PROFILE FOR CONCRETE OVERLAYS

The Concrete Engineering Unit recommends establishing the roadway profile after placement and compaction of the bond breaker layer/after completion of the bituminous milling. Contact the Concrete Engineering Unit to discuss the options.

The Designer will need to select either MnDOT or Contractor Surveying language (2011) specific to concrete overlays.

SUBGRADE PREPARATION

In the 2005 Spec Book it stated that...”Payment for subgrade preparation, as a separate item, will be made only when the roadbed or other course being prepared was constructed under a previous contract.”

The 2014 Materials Lab Supplemental Specifications for Construction book does not contain this language. Therefore, If subgrade preparation is required on your project you either need to note it as “Incidental” or use the pay item ...2112 SUBGRADE PREPARTION.

The 2016 and 2018 Spec Book states, under 2105.5.E and 2106.5.E that subgrade preparation is incidental unless there is a pay item for 2112 SUBGRADE PREPARATION.