



---

## Design Scene Part 2 – Plan Conventions

Chapter 10 Paving

10/18/2021

---

## Contents

Design Scene Part 2 – Plan Conventions .....	1
Chapter 10 Paving.....	3
Aggregate.....	3
Aggregate Bedding.....	3
Bituminous Mix Designation in Plan .....	3
Compaction of Bituminous Mixtures .....	3
Concrete Joint Pay Items.....	4
Concrete Overlays.....	4
Concrete Pavement Rehabilitation (CPR).....	4
Concrete Paving Plan Joint Layout Sheets.....	5
Concrete Pay Items (Not Alternate Bid).....	5
Concrete Truck Aprons (Roundabouts).....	6
Dowel Bars .....	7
Diamond Grinding.....	7
Headers.....	8
Inclusion of 1717 When Using 2399 For Concrete Paving.....	9
Joint Sealing Requirements.....	9
Non Wearing Course .....	9
Overlay Transition Tapers .....	9
Quality Management .....	10
Rumbles in Concrete .....	10
Roadway Profile for Concrete Overlays .....	10
Safety Shape for Pavement Edge .....	10

## Chapter 10 Paving

### Aggregate

Plans should specify the type of aggregate.

Spec 2118 Aggregate Surfacing - 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 - placed under mainline bituminous and can be used under bituminous shoulders if placed at same time as mainline aggregate.

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

### Aggregate Bedding

Plans should specify the 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

### Bituminous Mix Designation in Plan

It is recommended to show the full Bituminous Mix Designations in the tabulations, typical sections, and any other details and plan views.

For example:

- Pay item:
  - 2360.504 TYPE SP 12.5 WEARING COURSE MIX (4,F)
- Designation on tabulation and typical section:
  - TYPE SP 12.5 WEARING COURSE MIX (SPWEB440F)

The bituminous mixture letter and digit identifiers are defined in Section 2360 in the MnDOT Standard Specifications for Construction.

### Compaction of Bituminous Mixtures

Bituminous density requirements **should not** be placed in the construction notes or anywhere else in 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 2360.3D.2. Section 2360.3D.2 is titled "Ordinary Compaction".

## Concrete Joint Pay Items

The following provide as explanation of what joints to pay for on new concrete pavement. The spec 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 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), 2108 (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 2302 Concrete Rehabilitation Standards are included in the 2020 Standard Specifications for Construction. Standard details and a web-based interactive guide is available on the Concrete Office website at [MnDOT Concrete Pavement Rehabilitation](#)

CPR Pay Items:

- 2302.502 DOWEL BARS by EACH
- 2302.502 DRILL AND GROUT REINFORCEMENT BAR (EPOXY COATED) by EACH
- 2302.502 DOWEL BAR RETROFIT by EACH
- 2302.502 JOINT REPAIR (TYPE A1) by EACH
- 2302.502 JOINT REPAIR (TYPE A2) by EACH
- 2302.503 JOINT AND CRACK REPAIR (TYPE B3) by LIN FT
- 2302.503 FULL DEPTH REPAIR (TYPE CA-LV) by LIN FT
- 2302.503 FULL DEPTH REPAIR (TYPE CD-LV) by LIN FT
- 2302.503 FULL DEPTH REPAIR (TYPE CD-HV) by LIN FT

2302.504 PAVEMENT REPLACEMENT (TYPE CX) by SQ YD  
2302.504 UTILITY TRENCH FULL DEPTH REPAIR (TYPE C2-LV) by SQ YD  
2302.508 SUPPLEMENTAL REINFORCEMENT BARS (EPOXY COATED) by POUND  
2302.518 PARTIAL DEPTH REPAIR (TYPE BA) by SQ FT  
2302.518 PARTIAL DEPTH REPAIR SPECIAL (TYPE BE) by SQ FT  
2302.518 SPOT FULL DEPTH REPAIR (TYPE C1-LV) by SQ FT

### **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. Do not schedule a CPR project with an early start or will extend late into the construction season, after October 15<sup>th</sup>.

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. Contact the Concrete Engineering unit for recommendations on projects with anticipated opening times with less than 12 hours cure time.

Contact the Concrete Engineering Unit with questions regarding preparation and review of CPR plans.

### **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 questions 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.

<b>Pay Item Selection for Concrete Paving Projects (Not Alternate Bid)</b>				
<b>Item No.</b>	<b>Description</b>	<b>Unit</b>	<b>Method A</b>	<b>Method B</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

**Concrete Truck Aprons (Roundabouts)**

**Concrete Truck Apron Design Details**

Concrete truck aprons are included in Specification 2521, "Walks."

- Truck aprons should be designed using standard thickness of 7 inches.
- Use Pay Item 2521.518 7" CONCRETE WALK.
- Spec 2521 also addresses colored concrete which would include truck aprons.

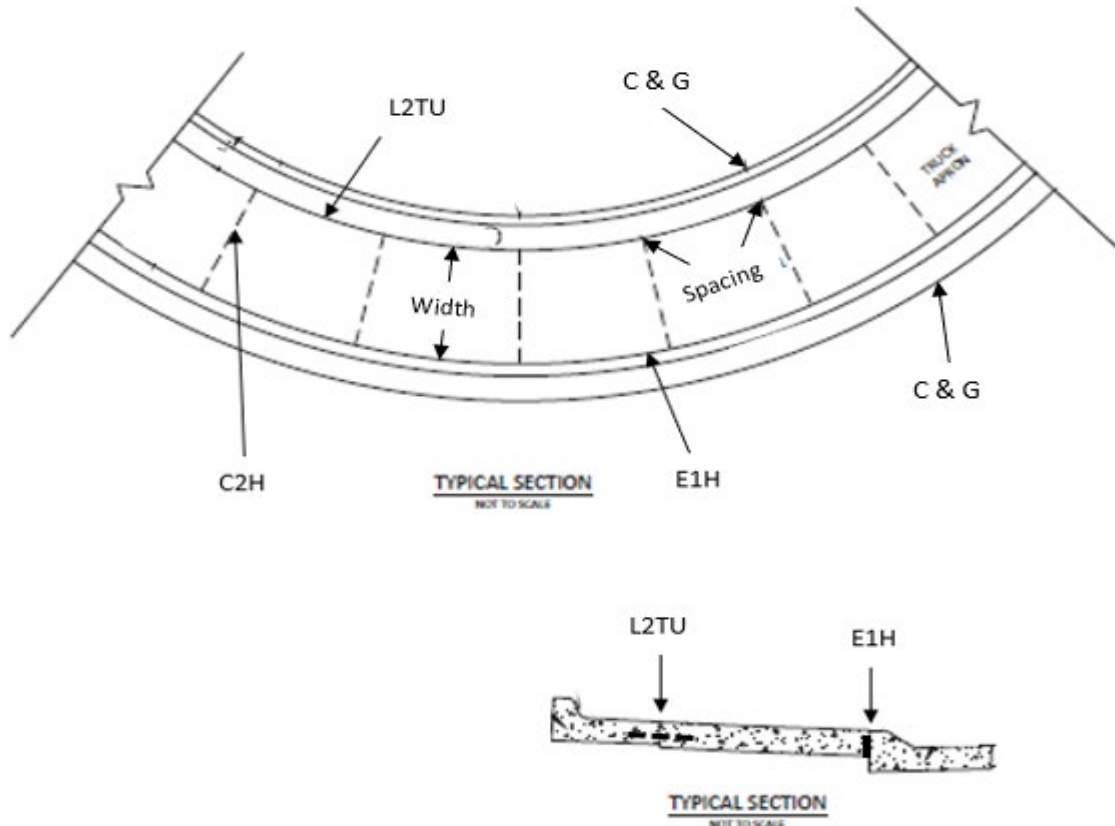
**Concrete Truck Apron Jointing**

Transverse contraction joints within the truck apron should be designated as C2H. Dowel bars are not required in the design of the truck aprons. The longitudinal joint between the outside radius of the truck apron and the back of curb should be designated as E1H. The longitudinal joint between the inside radius of the truck apron and the toe of the inner most curb and gutter should be designated as L2TU.

The joint spacing of the inner most curb and gutter should match the joint spacing of the truck apron. If the roundabout mainline is concrete, match the joint spacing of the curb and gutter located between the truck apron and mainline with the joint spacing of the mainline concrete pavement.

Create a truck apron jointing plan showing the joint layout as shown in the example sketch below. Include the truck apron width, curb and gutter types and transverse contraction joint spacing.

Send to the Concrete Office for review of the plans and specifications.



## 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 (2302) 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  $\leq$  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. [MnDOT Pavement Design Manual Ch 5](#)

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 guidance:

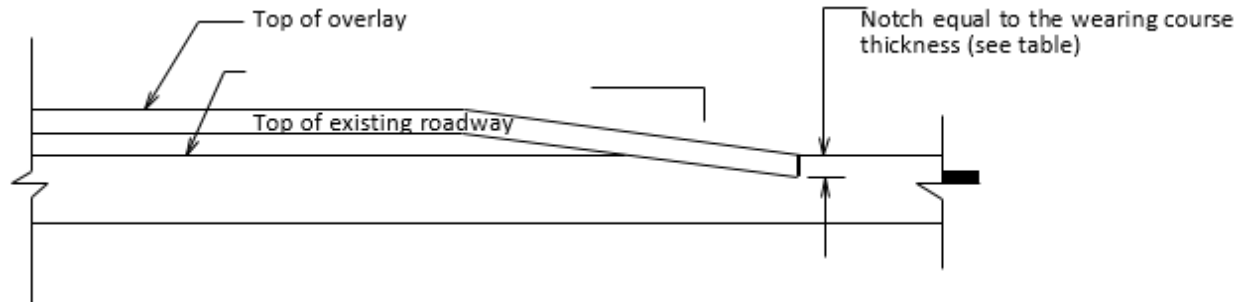
RATE OF TAPER for DESIGN SPEED

1:400 for  $\geq$  50 mph

1:300 for 35-45 mph

1:200 for  $\leq 30$  mph

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



## Quality Management

For information regarding when the Quality Management - Intelligent Construction Technology pay items are required on a given project see **Design Scene Part 1 Pay Item Guidance**.

## 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.

## Safety Shape for Pavement Edge

Technical Memorandum No. 16-01-T-01 dated February 15, 2016 states that ALL Mn/DOT projects will have to include a safety edge if it meets the requirements as outlined in the Technical Memorandum (under guidelines).

Construction of a safety edge at the edge of the paved surface significantly reduces the potential of “tire scrubbing” and minimizing the consequences of drifting off the pavement surface.

The safety edge construction is done by shaping the edge of the pavement material with a 30-degree slope during the paving process (measured from the pavement/shoulder cross slope plane).

Payment for the safety edge will be included in the roadway bituminous or concrete quantities. Add a note to the tabulation indicating that the quantity includes the safety edge shape.

See Design Details on the Standard Plans website for the detail: [Safety Edge Detail](#)