Compaction & Coring Guidance

March 9, 2021

Table of Contents

Introduction:

Compaction of the asphalt mixture is one of the most important things done during asphalt pavement construction which directly influences the longevity/durability of the pavement. The Contractor and agency track the density behind the rollers during the compaction phase for contract compliance. Depending on the compaction evaluation method, a monetary incentive or disincentive adjustment may be applied as the result of laboratory results. This document gives guidance and direction details relating to compaction methods, core layouts, and use of worksheets.

Definition of Terms:

Maximum Density: This compaction analysis method is defined by MnDOT as taking cores of the compacted pavement (a destructive test) to determine the relative density (Gmb/Gmm) of the in-place pavement. The number of core locations is determined by taking the total daily tons in maximum density ton areas and breaking it into lots according to Table 2360-21. Daily lots are usually between 1 and 6 lots. In each lot two locations (stations) of cores will be taken randomly to determine density compliance. At each station two cores are taken (one for the Contractor and one for the agency) one foot longitudinally of each other.

Longitudinal Joint: Additional cores taken on the outside of the mat under maximum density.

- Confined edge – edge of outside of pavement is abutting some sort of confinement (curb, previously placed lane, milled edge, etc.)
- Unconfined edge – edge of outside of pavement has not confinement (first pass, etc.)

Ordinary Compaction: No cores are taken with this compaction method. What is required is a control to strip be established to determine a standard rolling pattern. The standard rolling pattern for all the rollers will be maintained for the layer that is being constructed until the next layer and then a new control strip will be required.

Default Compaction Method:

Compaction will be evaluated by the maximum density method (cores) unless the ordinary compaction method is specified in the special provisions or the area where mixture is placed fits the list described in 2360.3.D.2.

Details on the Maximum Density Method:

Compaction must achieve at least the minimum required lot density values as indicated in Tables 2360-19 & 20 or a decreased monetary adjustment will be made. A monetary adjustment will be made if the results of the cores is above or below the density thresholds shown in Tables 2360-22 to 25.

- Determination of Design Air Voids: For a 4.0 design air voids mix the minimum density is 92%. For a 3.0 design air void mix the minimum is 93%. Refer to the mix designation in the plan to know the design air voids for the mix. For example, a SPWEB340B mix has 4.0 air voids. The 40 in the designation indicates the design air voids. It will either be a 30 or a 40 which refers to 3.0 or 4.0% design air voids.

- Longitudinal Joint Density requirement: Included with the maximum density method is taking longitudinal joint (outer edge of pavement) cores at one station within one lot per 5,000 tons/day/mix for mixture placed in maximum density areas.
- Elimination of Longitudinal Joint Cores: Many local agencies write out the longitudinal joint cores from their projects. This is done by including Special Provision SP2018-144 in their bid documents as found in the standard list of Boiler Plate special provisions at: http://www.dot.state.mn.us/pre-letting/prov/index.html.
- Failing density lots: **If all the cores in a day's production or greater than 50% of the lots on multiple days fail to meet the minimum density requirement**, then **stop production** and determine the source of the problem. The Contractor will discuss with the Engineer what corrective action will be taken to bring the work into compliance.

Details on the Ordinary Compaction Method:

Ordinary Compaction is defaulted in the following areas:

1) Layers identified in the typical sections with a minimum planned thickness of less the 1 ½ inches
2) Thin lift leveling
3) Wedging layer
4) Patching layers
5) Driveways
6) Areas the Contractor cannot compact with standard highway construction equipment and practices
7) Bike paths, walking paths, and other similar non-traffic areas

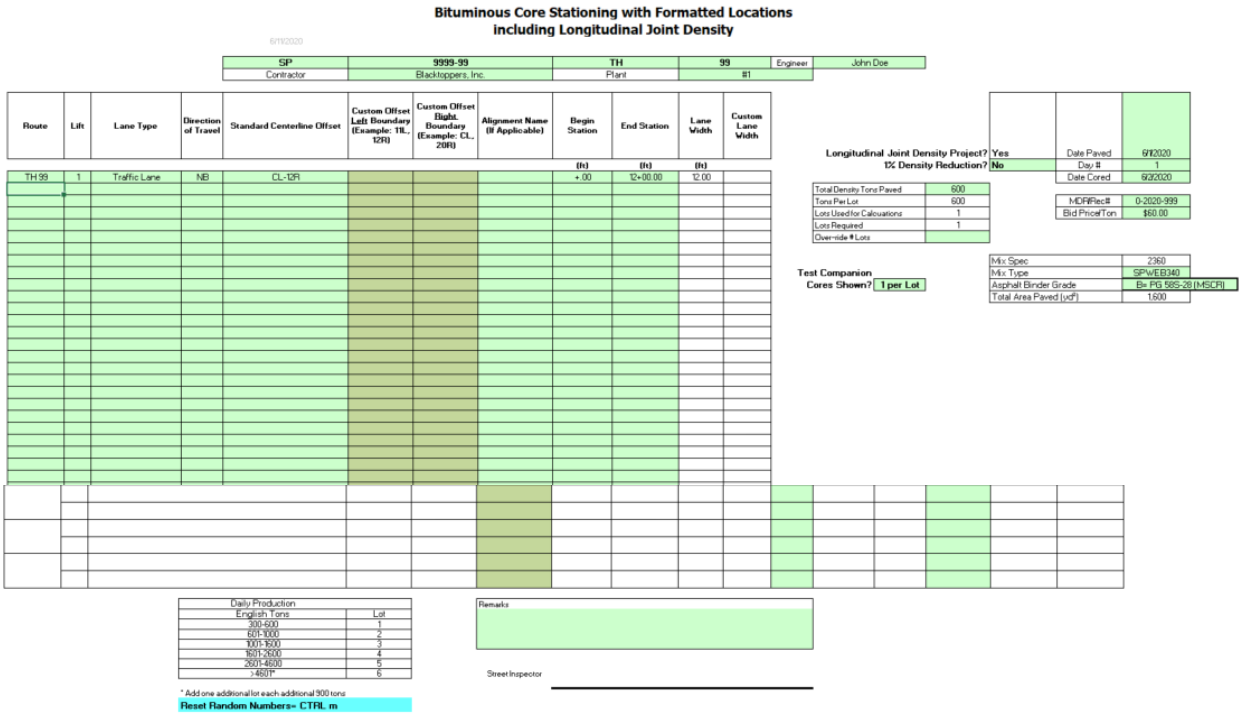
A control strip (of at least 395 sq. yd.) and same lift thickness shall be used to establish a rolling pattern. The Engineer may waive the control strip requirement in small localized areas or other areas not conducive to its establishment. (See spec 2360.3.D.2.a for details on control strip requirements.)

Coring Details:

The agency inspector will mark the core locations that the Contractor will core will normally use the Core Stationing worksheet found on the MnDOT Bituminous office website https://www.dot.state.mn.us/materials/bituminousqualitymanagementpage.html. At each coring location two cores are taken. One for the contractor labeled Lot#.Core# (example 1.1). An additional core is taken 12 inches longitudinally from the Contractor's core and labeled Lot #.Core #C (example 1.1C). "C" stands for "companion" core. The Contractor will cut the core on the lift line ~~into the proper lift~~ and immediately give the agency companion core (XX.XC) ~~core~~ to the agency representative. The Agency will test at least one core in each lot (some Agencies do both).

Coring Stationing worksheet:

The Core Stationing worksheet is used to determine the random location of cores that will be taken using the maximum density method. It is found on the MnDOT Bituminous Engineering website at: https://www.dot.state.mn.us/materials/bituminousqualitymanagementpage.html A new worksheet file will need to be created each day, for each type mix that is placed under maximum density. Start out each worksheet with using the key stroke of Ctrl-m to reset the random numbers.



Bituminous Core Stationing with Formatted Locations including Longitudinal Joint Density

SP	9999-99	TH	99	Engineer	John Doe
Contractor	Blacktoppers, Inc.	Plant	#1		

Route	Lift	Lane Type	Direction of Travel	Standard Centerline Offset	Custom Offset Left Boundary (Example: TIL, 12R)	Custom Offset Right Boundary (Example: CL, 20R)	Alignment Name (If Applicable)	Begin Station (ft)	End Station (ft)	Lane Width (ft)	Custom Lane Width
TH 99	1	Traffic Lane	NB	CL-12R				+.00	12+00.00	12.00	

Longitudinal Joint Density Project? Yes
15% Density Reduction? No

Total Density Tons Paved	600
Tons Per Lot	600
Lots Used for Calcuations	1
Lots Required	1
Over-ride # Lots	

Test Companion Cores Shown? 1 per Lot

Date Paved	6/7/2020
Day #	1
Date Cored	6/2/2020
MDR Rec#	0-2020-999
Bid Price/Ton	$60.00

Mix Spec	2360
Mix Type	SPWEB340
Asphalt Binder Grade	Bk PG 58S-28 (MSCR)
Total Area Paved (sqf)	1,600

Daily Production	
English Tons	Lot
300-600	1
601-1000	2
1001-1600	3
1601-2600	4
2601-4600	5
>4601*	6

* Add one additional lot each additional 900 tons

Reset Random Numbers= CTRL m

Remarks

Street Inspector

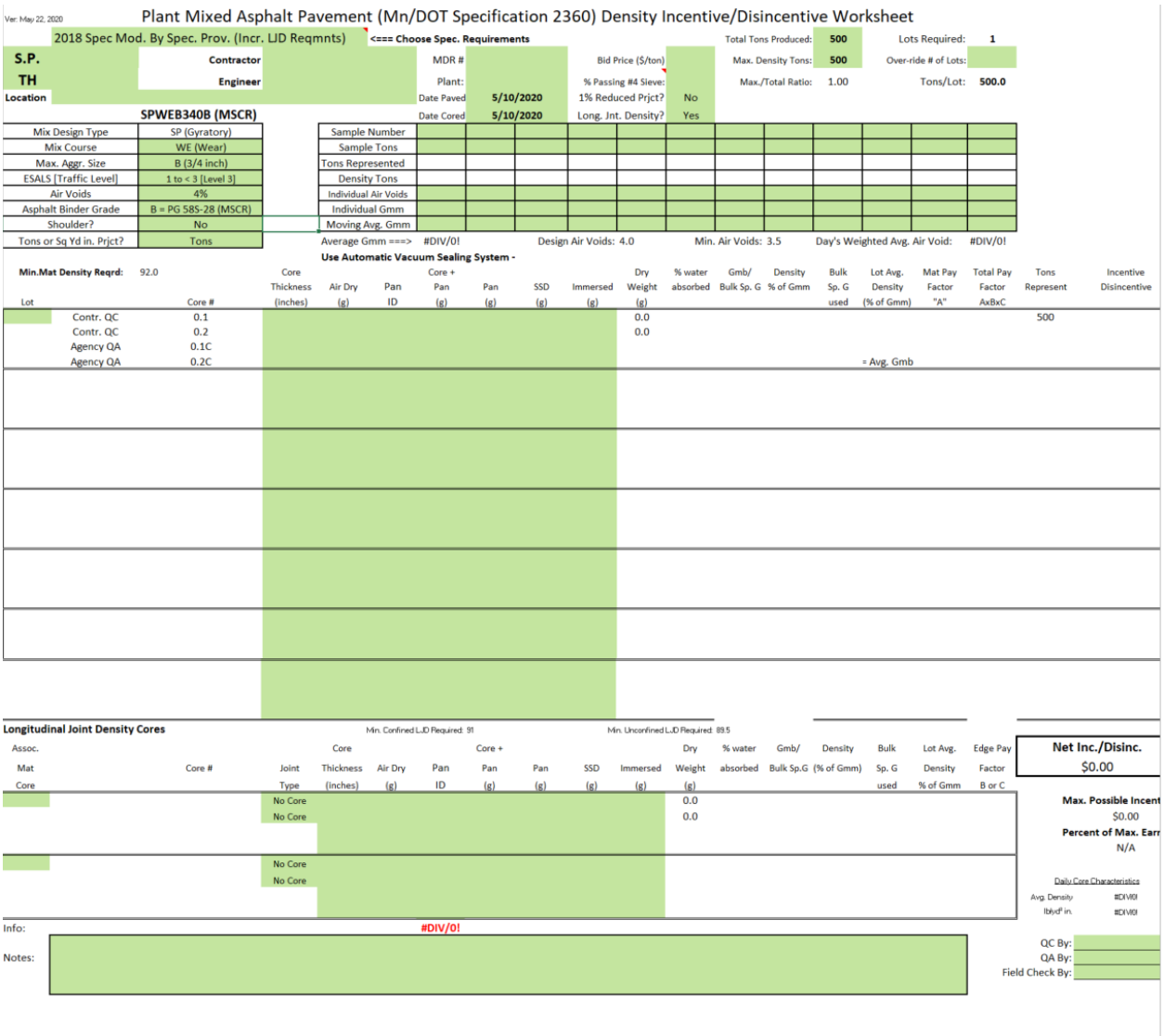
The paving characteristics need to be entered in the worksheet. Fill in the green shaded boxes. Most are standardized drop-down boxes. The "Core Layout Example" section of the document below will give details on how to fill out the "offset" columns. Note: The stationing format number required by the columns **"Begin Station" and "End Station" are to be keyed in as follows: Actual field station = 100+50, Spreadsheet key in is 10050 (do not key in the + sign)**.

Maximum Density Method Documentation Worksheets:

The Core Incentive/Disincentive worksheet is used as a means of calculating density values of each cores, overall lot specification compliance, and calculation of any monetary incentive or disincentive payment. Again, the worksheet is found on the MnDOT Bituminous Engineering website at: https://www.dot.state.mn.us/materials/bituminousqualitymanagementpage.html

- Remember use the correct worksheet that applies to your project. (Correct year)
- Multiple days can be put on multiple tabs within the same worksheet.

Overall view of the Core Incentive/Disincentive worksheet (for maximum density projects)



Ver. May 22, 2020

Plant Mixed Asphalt Pavement (Mn/DOT Specification 2360) Density Incentive/Disincentive Worksheet

2018 Spec Mod. By Spec. Prov. (Incr. LJD Reqmnts) <=== Choose Spec. Requirements

Total Tons Produced: 500 Lots Required: 1

S.P. Contractor MDR # Bid Price ($/ton) Max. Density Tons: 500 Over-ride # of Lots:

TH Engineer Plant: % Passing #4 Sieve: Max./Total Ratio: 1.00 Tons/Lot: 500.0

Location Date Paved 5/10/2020 1% Reduced Prjct? No

SPWEB340B (MSCR) Date Cored 5/10/2020 Long. Jnt. Density? Yes

Mix Design Type	SP (Gyratory)
Mix Course	WE (Wear)
Max. Aggr. Size	B (3/4 inch)
ESALS [Traffic Level]	1 to < 3 [Level 3]
Air Voids	4%
Asphalt Binder Grade	B = PG 58S-28 (MSCR)
Shoulder?	No
Tons or Sq Yd in. Prjct?	Tons

Sample Number													
Sample Tons													
Tons Represented													
Density Tons													
Individual Air Voids													
Individual Gmm													
Moving Avg. Gmm													

Average Gmm ===> #DIV/0! Design Air Voids: 4.0 Min. Air Voids: 3.5 Day's Weighted Avg. Air Void: #DIV/0!

Use Automatic Vacuum Sealing System -

Min.Mat Density Reqrd: 92.0

Lot		Core #	Core Thickness (inches)	Air Dry (g)	Pan ID	Core + Pan (g)	Pan (g)	SSD (g)	Immersed (g)	Dry Weight (g)	% water absorbed	Gmb/ Bulk Sp. G	Density % of Gmm	Bulk Sp. G used	Lot Avg. Density (% of Gmm)	Mat Pay Factor "A"	Total Pay Factor AxBxC	Tons Represent	Incentive Disincentive
	Contr. QC	0.1								0.0								500	
	Contr. QC	0.2								0.0									
	Agency QA	0.1C																	
	Agency QA	0.2C													= Avg. Gmb				

Longitudinal Joint Density Cores

Min. Confined L.J.D Required: 91 Min. Unconfined L.J.D Required: 89.5

Assoc. Mat Core	Core #	Joint Type	Core Thickness (inches)	Air Dry (g)	Pan ID	Core + Pan (g)	Pan (g)	SSD (g)	Immersed (g)	Dry Weight (g)	% water absorbed	Gmb/ Bulk Sp.G	Density (% of Gmm)	Bulk Sp. G used	Lot Avg. Density % of Gmm	Edge Pay Factor B or C
		No Core								0.0						
		No Core								0.0						
		No Core														
		No Core														

Net Inc./Disinc. $0.00

Max. Possible Incent $0.00

Percent of Max. Earr N/A

Daily Core Characteristics

Avg. Density #DIV/0!

lb/yd³ in. #DIV/0!

Info: #DIV/0!

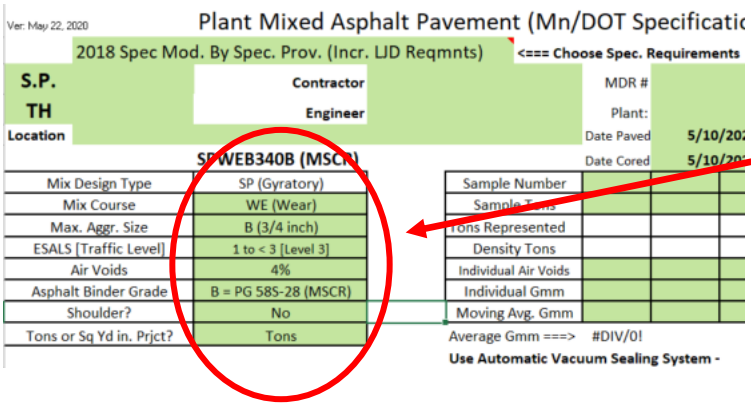
Notes:

QC By:

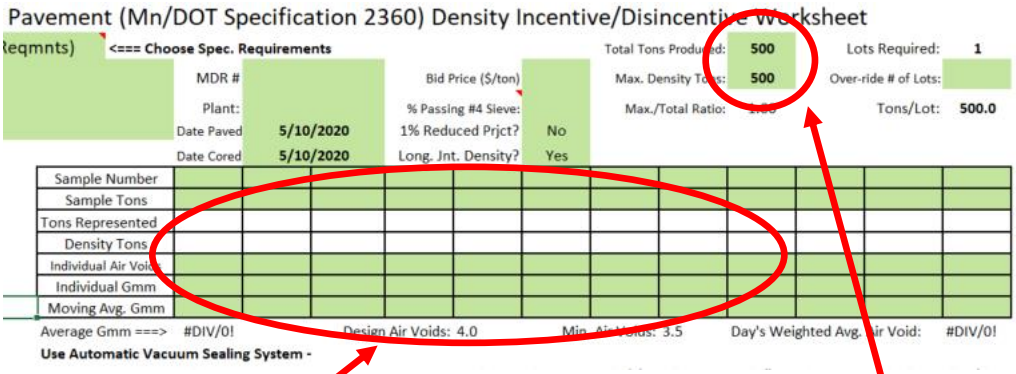
QA By:

Field Check By:

Next are highlighted portions of the worksheets with explanations.



Use drop downs indicate the mix type of the cores.



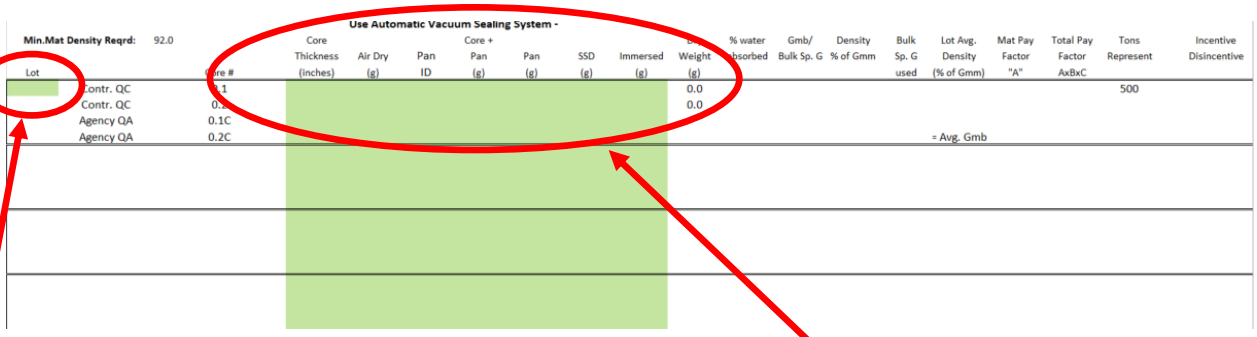
Insert values from the particular day's mixture testing results.

The **Total Tons Produced** = total tons of that particular mix produced that day at the plant.

Max. Density Tons = Totals tons placed in an area evaluated by the maximum density method.

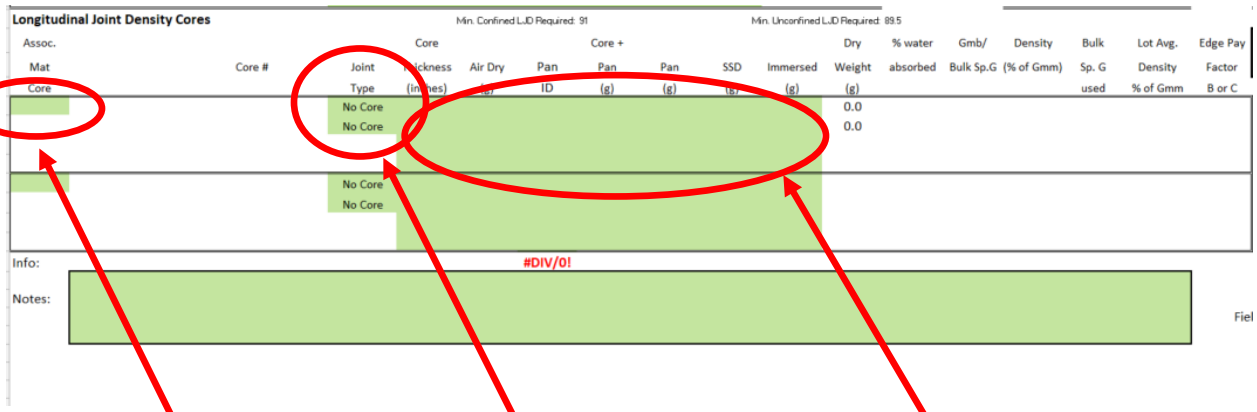
If all the day's paving was in an area of maximum density, these two values will match.

If some of the day' paving was for narrow shoulders, trails, approaches, etc. that are evaluated by ordinary compaction, then numbers will not match. Calculated the total maximum density tons by determining the area covered according to the following formula: (Tons = area ((yd^2 x inches thick x 113 lb. /yd^2 inch)/2000) and insert that value in the Max. Density tons cell.



Insert the beginning lot number for the day's paving.

The Contractor's QC lab results will be inserted in the first two lines of each lot. The 3rd and 4th rows are the Agencies QA results from the lab. Remember the Agency only is required to test one core in each lot (many do both).



Insert the Core ID (ex. 1.1) of the mat core at the same station the longitudinal joint cores were taken.

The Contractor's QC lab results will be inserted in the first two lines of each lot. The 3rd and 4th rows are the Agencies QA results from the lab.

Choose/Indicate the joint type as either:
No Core, Confined, or Unconfined

The Core incentive/disincentive worksheet is used to document core lab weights and the calculated density values.

- The Contractor will fill out the worksheet with their core results and header information. They will then send a copy of the Agency.
- The Agency will give their core results to the Contractor for them to fill in on the worksheet.
- Finally, the agency will check the worksheet for any typos and correct data.

Core Layout Examples:

In the following sections a grey table will be shown to indicates the physical characteristics of the operation related to how the paver is placing the mat across the roadway. The green table below then indicates how the offset portion of the core stationing worksheet is filled out for that situation.

Mill & Inlay

Operation	Left Boundary of paver	Right Boundary of paver
Mill & Inlay	Centerline	12 foot right of centerline

Standard Centerline Offset	Custom Offset Left Boundary (Example: 11L, 12R)	Custom Offset Right Boundary (Example: CL, 20R)
CL-12R		

Explanation: Mat cores locations will be randomly determined between 1 foot right and 11 feet right of centerline. Longitudinal Joint cores would be cut 6 inches from the edge of the mat (0.5 and 11.5 feet) at one location/5000 tons of maximum density tonnage/mix type/day. Since the pavement is being inlayed in the existing pavement, both longitudinal joints would be confined.

Driving lane only

Operation	Left Boundary of paver	Right Boundary of paver
Driving lane (12 feet)	Centerline	12 foot right of centerline

Standard Centerline Offset	Custom Offset Left Boundary (Example:	Custom Offset Right Boundary (Example:

	11L, 12R)	CL, 20R)
CL-12R		

Explanation: Mat cores locations will be randomly determined between 1 foot right and 11 feet right of centerline. Longitudinal Joint cores would be cut 6 inches from the edge of the mat (0.5 and 11.5 feet) at one location/5000 tons of maximum density tonnage/mix type/day. The outside edges of the pavement are either confined or unconfined depending which pass and type of confinement.

Driving lane and narrow (<= 6 feet) outside shoulder in one pass

Operation	Left Boundary of paver	Right Boundary of paver
Driving lane (12 feet) and narrow outside shoulder (3 feet) paved in one pass	Centerline	14 foot right of centerline

Standard Centerline Offset	Custom Offset Left Boundary (Example: 11L, 12R)	Custom Offset Right Boundary (Example: CL, 20R)
CL-12R		

Explanation: Mat cores locations will be randomly determined between 1 foot right and 11 feet right of centerline. Longitudinal Joint cores would be only be cut 6 inches from the centerline edge of the mat (0.5 feet) at one location/5000 tons of maximum density tonnage/mix type/day. The longitudinal joint core on the far outside (narrow shoulder) of the pavement would be eliminated (no core) because the outside 2 feet would be classified as a narrow shoulder and would have the criteria of ordinary compaction.

Driving lane and narrow (<= 6 foot) inside shoulder in one pass

Operation	Left Boundary of paver	Right Boundary of paver
Driving lane (12 feet) and narrow inside shoulder (2 feet) paved in one pass	14 feet left of centerline	CL

Standard Centerline Offset	Custom Offset Left Boundary (Example: 11L, 12R)	Custom Offset Right Boundary (Example: CL, 20R)
12L-CL		

Explanation: Mat cores locations will be randomly determined between 1 foot left and 11 feet left of centerline. Longitudinal Joint cores would be only be cut 6 inches from the

centerline edge of the mat (0.5 feet left) at one location/5000 tons of maximum density tonnage/mix type/day. The longitudinal joint core on the left side of the pavement(narrow inside shoulder) would be eliminated (no core) because the outside edge has the criteria of ordinary compaction.

Outside shoulder (> 6 feet wide) as separate operation

Operation	Left Boundary of paver	Right Boundary of paver
Outside Shoulder (10 feet) paved as separate operation	12 feet right of centerline	22 feet right of centerline

Standard Centerline Offset	Custom Offset Left Boundary (Example: 11L, 12R)	Custom Offset Right Boundary (Example: CL, 20R)
12R-22R (10' R SHLD)		

Explanation: Mat cores locations will be randomly determined between 13 feet right and 21 feet right of centerline. Since the shoulder is 10 feet wide, it would be evaluated under maximum density (greater than 6 feet wide and considered a separate paving pass, see 2360.3.D.1.a). Longitudinal Joint cores would be cut 6 inches from each the edge of the mat (12.5 and 21.5 feet right of centerline) at one location/5000 tons of maximum density tonnage/mix type/day.

Middle Lane (multilane)

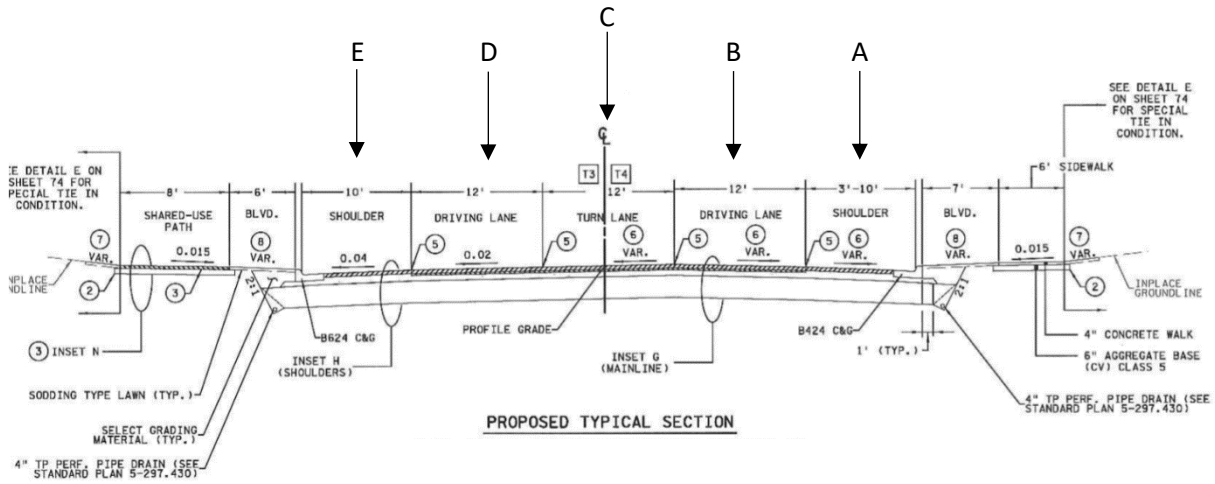
Operation	Left Boundary of paver	Right Boundary of paver
Middle lane (12 feet)	12 feet right of centerline	24 feet right of centerline

Standard Centerline Offset	Custom Offset Left Boundary (Example: 11L, 12R)	Custom Offset Right Boundary (Example: CL, 20R)
12R-24R		

Explanation: Mat cores locations will be randomly determined between 13 feet right and 23 feet right of centerline. Longitudinal Joint cores would be cut 6 inches from each the edge of the mat (13.5 and 22.5 feet right of centerline) at one location/5000 tons of maximum density tonnage/mix type/day.

Custom Lane Widths:

Certain designs require custom lane widths for various reasons. Below is an example from a plan of paving through an urban section. This can be accomplished by instead of using the list of options in the "Standard Centerline Offset" column, that a custom location will be put in "Left Boundary of paver" and "Right Boundary of paver" columns of the worksheet.



A: EB Shoulder:

Operation	Left Boundary of paver	Right Boundary of paver
10-foot EB Shoulder	18 feet right of centerline	28 feet right of centerline

Standard Centerline Offset	Custom Offset Left Boundary (Example: 11L, 12R)	Custom Offset Right Boundary (Example: CL, 20R)
	18L	28L

B: EB Driving Lane:

Operation	Left Boundary of paver	Right Boundary of paver
12-foot traffic lane	6 feet right of centerline	18 feet right of centerline

Standard Centerline Offset	Custom Offset Left Boundary (Example: 11L, 12R)	Custom Offset Right Boundary (Example: CL, 20R)
	6R	18R

C: Center Turn Lane:

Operation	Left Boundary of paver	Right Boundary of paver
12-foot Center Turn lane	6 feet left of centerline	6 feet right of centerline

Standard Centerline Offset	Custom Offset Left Boundary (Example: 11L, 12R)	Custom Offset Right Boundary (Example: CL, 20R)
6L-6R		

D: WB Traffic Lane:

Operation	Left Boundary of paver	Right Boundary of paver
12-foot WB Traffic Lane	18 feet left of centerline	6 feet left of centerline

Standard Centerline Offset	Custom Offset Left Boundary (Example: 11L, 12R)	Custom Offset Right Boundary (Example: CL, 20R)
18L-6L		

E: WB Shoulder:

Operation	Left Boundary of paver	Right Boundary of paver
8-foot WB Shoulder	26 feet left of centerline	18 feet left of centerline

Standard Centerline Offset	Custom Offset Left Boundary (Example: 11L, 12R)	Custom Offset Right Boundary (Example: CL, 20R)
	26L	18L

Turn Lane:

The turn lane is compacted under maximum density. If the entire turn lane and marked taper is paved full width, then the full section would be included. If a taper is paved into the turn lane then only include that portion that is greater than 6 feet wide.

Operation	Left Boundary of paver	Right Boundary of paver
12-foot right turn lane (Urban)	12 feet right of centerline	24 feet right of centerline

Standard Centerline Offset	Custom Offset Left	Custom Offset Right

	Boundary (Example: 11L, 12R)	Boundary (Example: CL, 20R)
12R-24R		

Explanation: Maximum density mat cores locations will be between 13R and 23R feet. Longitudinal Joint cores would be cut 6 inches from each the edge of the mat (12.5 and 23.5 feet right) at one location/5000 tons of maximum density tonnage/mix type/day.

Ramps/Loops:

Ramps/Loops are more difficult because they are variable width. If they are a different mix type than mainline, then a separate core stationing sheet would be required. The best approach would be to either break it into segments (deceleration segment, ramp, turn lanes) or make the entire ramp (all segment as a custom average width). This is one area that a commonsense approach to make it work would apply. Therefore, all combinations cannot be covered here. They likely will have all their own alignments.

Operation	Left Boundary of paver	Right Boundary of paver
Deceleration ramp	Centerline	10 feet right of centerline

Standard Centerline Offset	Custom Offset Left Boundary (Example: 11L, 12R)	Custom Offset Right Boundary (Example: CL, 20R)
	CL	10R

Explanation: Ramps and loops are constant width in part of the segment and variable in others. Since ramps are have their own alignments, you will reference this. Depending on how the Contractor paves the ramp will influence how the offsets are entered into core stationing worksheet. Normally the Contractor will pave with the center longitudinal joint running along the centerline alignment (center of ramp) and thus allowing the paver to vary the width of the screed to pave the ramp and shoulder at the same time. Evaluate the layout to determine the appropriate offset for the left and right boundary to use for the driving lane portion of the ramp under maximum density and if there is any shoulder area mentioned in the plan. If maximum density, then mat cores locations will be between 1R and 9R feet. Longitudinal Joint cores would be cut 6 inches from each the edge of the mat (0.5 and 9.5 feet right) at one location/5000 tons of maximum density tonnage/mix type/day.

Roundabout:

A roundabout may have a different mix type than mainline to resist the slow turning movement traffic and would then require a separate core stationing sheet. Use the roundabout stationing for laying out the cores.

Operation	Left Boundary of paver	Right Boundary of paver
Roundabout	Centerline	20 feet right of centerline

Standard Centerline Offset	Custom Offset Left Boundary (Example: 11L, 12R)	Custom Offset Right Boundary (Example: CL, 20R)
	CL	20R

Explanation: Roundabouts have their own separate alignment. They will be compacted using the maximum density method including longitudinal joint cores like any other lane. Typically, they are designed with an inside and outside curb.

What to Do in Other Paving Areas?

Gore Areas:

These irregular wedge-shaped pieces of pavement at the bottom of ramps would be compacted under ordinary compaction.

Echelon Paving (two pavers placing mix simultaneously in adjoining lanes):

Echelon paving produces the highest quality longitudinal joint (hot on hot). Each paver is going to be thought of as a separate paving operation and therefore the same guidance given in scenario #2 (driving lane only) would be used.

Crossovers:

Each crossover is unique in design and how it is constructed. Therefore, exact guidance cannot be given here. Density will either be maximum density or ordinary compaction. Contact the Bituminous office to assist your decision for your project. If using maximum density, the custom offsets can be used to approximate the paving geometry.

Parking Lanes:

Since these by specification would be shoulders greater than 6 feet wide, the area would be cored for maximum density cores.

Trails:

Bike paths, walking paths, and other similar nob-traffic areas would be compacted under ordinary compaction (per 2360.3.D.2).

Driveways:

Driveways would be compacted under ordinary compaction (per 2360.3.D.2).

City Streets:

Unless written out by special provision, the street would be compacted under maximum density (taking cores). See previous sections to find a case that fits your situation.

Other Mixes

Ultra-Thin Bonded Wearing Course:

This is specification 2353 and no cores are taken. A minimum of two roller passes is required before the material temperature has fallen below 185°F. Static double drum asphalt rollers with a minimum weight of 11 tons are required.

Permeable Asphalt Stabilized Stress Relief Course (PASSRC) and Permeable Asphalt Stabilized Base (PASB):

This is specification 2363 and no cores are taken (see reference for ordinary compaction, 2360.3.D.2). See 2363.3.G for details. Self-propelled steel wheeled rollers (min. 8 tons) are required to with compaction in static mode only. If mixture placement exceeds 100 tons/hour a minimum of two rollers is required. Compact before the mixture cools to 110°F. Water may be used to accelerate the cooling process.

Stone Matrix Asphalt:

This is specification 2365 and coring is the same as maximum density under spec 2360 except no longitudinal joint cores are required. See previous sections for applicable guidance.

Production Questions

Small tonnage (< 300 tons for the total project):

Density may be accepted by the Engineer without testing. Form 2403 is required to be filled out to document the tonnage.

Daily Small tonnage (< 300 tons for the day, but total project tonnage > 300 tons):

If the daily tons placed is the less than 300, the mat does not need to be cored that day. Sum the daily tons over multiple days until the 300-ton threshold is met then put all the areas in at once and determine the core locations.

Multiple Lifts Paved on the Same Day:

Multiple lifts can be paved on the same day assuming the mixture has cooled enough to be stable (no rutting) of equipment when placing the lift on top. Assuming this can be done, it would be acceptable to total the tons for the day and determine the locations needed to take cores. If the locations are in both the bottom and top lift, then just use the top lift locations and then core all the way through both lifts and saw them apart into the distinct lifts to use as two cores for analysis. Describe in detail on the Core Stationing worksheet and Core Incentive/Disincentive worksheet exactly what was done.

24-hour paving/weekend paving:

If mixture placement will take place continuously over a 24 hour plus period, the following are recommendations for mixture placement and coring:

- Break the mixture placement into 12-hour periods so lots sizes do not grow too large.
- If mixture is being produced by multiple plants, one plant may only deliver mix to one paver. (Explain this to all truck drivers.)

Waiving Maximum Density (1% Reduced Density):

The Contractor may elect to reduce the density requirement by 1% if they are paving the first lift on top of one of the following conditions:

- aggregate base (mainline & shoulder)
- Reclaimed or cold in-place recycled courses
- A roadway with a spring load restriction (including shoulders) no greater than 7 ton

The Contractor must notify the Engineer in writing by the end of the third day of paving of their intent to waive maximum density (density requirement reduced 1%) and thereby use Tables 2360-19 & 23. Once maximum density is waived the reduced density will remain in effect for the duration of mixture placed on that lift for that entire year.

First Lift Paved on Concrete:

The first lift paved on concrete will have the density requirement reduced according to Tables 2360-19 & 23. This reduces the required compactive effort that the Contractor would normally use with the rollers so no more damage to the deteriorated concrete panels will happen during the paving of the first lift. Likely the concrete pavement has limited or no joint transfer, broken dowel bars, and/or cracked panels. Any subsequent lifts placed above the first lift on concrete would have density evaluated according to normal required densities.

Recoring:

The Engineer may allow the Contractor to re-core a sample if the sample was damaged in the coring process or damaged in transit to the laboratory through no fault of the Contractor. Just because a core sample results in a number that is unexpected is not a reason to recore.

Additional Questions:

If you have additional questions or need help with your particular situation contact the MnDOT Bituminous Engineering section at: https://www.dot.state.mn.us/materials/bituminouscontacts-new.html

Summary of Reference Specifications (2018 version):

2360.3.D: Mix will be compacted according to maximum density unless ordinary compaction is specified in the special provisions or as described in the ordinary compaction section (2360.3.D.2).

2360.3.D.1: Compact the pavement to at least the minimum density required in Table 2360-19. (4% Design Voids >= 92% or 3 Design Voids >= 93%)

2360.3.D.1.a: Unless shown otherwise, compact shoulders greater than 6 feet wide using maximum density method. If compacted as a separate paving pass, delineate as lot tonnage in separate lots.

2360.3.D.1.b: Unless shown otherwise, compact shoulders less than or equal to 6 feet wide using ordinary compaction method. The Department will exclude mixture compacted under ordinary compaction from lot density requirements and from incentive or disincentive payment.

2360.3.D.1.c: Two pavers running next to each (Echelon paving) other will be considered separate operations.

2360.3.D.1.g: Number of lots will be determined by Table 2360-11

2360.3.D.1.h: Four cores will be obtained in each lot. Two core locations will be randomly determined by the Engineer. A companion core will be taken one foot longitudinally of each core. The companion core will be given to the Engineer immediately after coring and sawing. Do not take cores for compacted mat density within 1 foot of any longitudinal joint. The Engineer may require additional density lots to isolate areas affected by equipment malfunction, heavy rain, or other factors affecting normal compaction operations.

2360.3.D.1.i: Cores must be at least 4 inches in diameter determined and marked by the Engineer. Mark cores with lot number and core number. Core holes must be filled within 24 hours after cutting, or the Contractor will fine the Contractor $100/working day/lot until restored.

2360.3.D.1.j The Department will select at least one of the two companion cores per lot for verification. For lots designated as longitudinal joint density lots, the Department will test at least one of the mat companion cores and one of the longitudinal joint cores.

2360.3.D.1.m The Contractor may elect to waive the maximum density requirement and reevaluate the density in accordance with one percent reduced density requirement, Table 2360-19, “Required Minimum Lot Density (Mat)”. The Department will exclude incentive payments for reduced minimum density in accordance with Table 2360-19, “Required Minimum Lot Density (Mat).” The Contractor may elect to waive the reduced density requirement and reevaluate the density in accordance with Table 2360-23, “1 Percent Reduced Table”. The Contractor must notify the Engineer, in writing, by the end of the third day of paving of their intent to waive maximum density. Once maximum density has been waived the reduced density will remain in effect for the duration of mixture placement on that lift. For multi-year projects, the waiving of maximum density will be for that year only and will be reevaluated for subsequent years on an annual basis. The Contractor is required to comply with any construction requirements on subsequent lifts. One percent reduced density is required for the first lift constructed over PCC pavements.