State of Wisconsin

HMA PWL Production Spreadsheet Instruction Manual

2025 Edition

1. Disclaimer

This document is to be used as an instructive guide for the HMA PWL Production Spreadsheet and to answer frequently asked questions of Regional Technical Services Section (TSS) and those acting as Department Representatives. It is not a substitute for reading and understanding HMA Pavement Percent Within Limits (PWL) specifications.

If there is a question about dispute resolution or data entry that is not covered in this document, please contact the Regional PWL Representative. If consulting BTS is recommended by this document or the HMA PWL Production Spreadsheet, that contact should be made by TSS Staff.

The HMA PWL Production Spreadsheet is designed to simplify the recording and analysis of contractor Quality Control (QC) and department Quality Verification (QV) data related to pavement density and air voids used for HMA production pay adjustment.

The Plans, Standard Specifications, and Special Provisions ALWAYS supersede this document, even in cases where this document may contradict those provisions.

2. Table of Contents

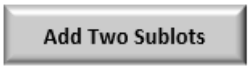
3. General

- A copy of this instruction manual is available within the PWL Production Spreadsheet on the *Project Info & Instructions* worksheet. Simply double click the button "PWL Production Spreadsheet Instructions" to access them from within the spreadsheet.

- The PWL Production Spreadsheet should be filled out and completed by the Department Representative.

- The *Project Info & Instructions* worksheet must be filled out first prior to entering test results. Some worksheets will not appear until the required project information has been entered.

- Worksheets tab colors indicate the following:
  - Green – Worksheets that require test results to be entered.
  - Red – Worksheets that only present results; no data entry is required in these sheets.

- Cells that are canary/yellow colored are data entry fields.
  - It is essential that no blank spaces are entered in or after any of the information entered into the fields.
  - All data should be entered in chronological order as mixture is produced.
  - In general, there should be no gaps in the data entry.
  - When copy/pasting, only use "Paste Values". If you use the hotkey combination, CTRL+V, values will be pasted automatically.
  - If at the end of the project there is a lot with only two (2) sublots with test results, the pay adjustment will not calculate for that lot. In this scenario, the final two sublots should be combined with the previous lot using the 

button to the right of the data entry of the respective lot.

4. Project Info & Instructions

This is the main entry point for the PWL Production Spreadsheet (Figure 1). It contains fields for information about the project as well as paving information such as the mix design, pavement layer and dimensions, and density technician information.

The *Project Info and Instructions* worksheet should be filled out completely by the Department Representative prior to beginning construction. Most of the fields in the *Project Info & Instructions* worksheet (i.e.: Contract Unit Price, Lane Width, Nominal Thickness, JMFs, etc.) are required for the worksheet to function correctly. A Density Method (nuclear, core, nuclear and core) must be selected to reveal the correct density worksheets for data entry. Additionally, the Longitudinal Joint Construction must also be specified to reveal the longitudinal joint density worksheets. Project information at the top of all other worksheets within the spreadsheet is referenced from the *Project Info & Instructions* worksheet and can only be changed from this worksheet.

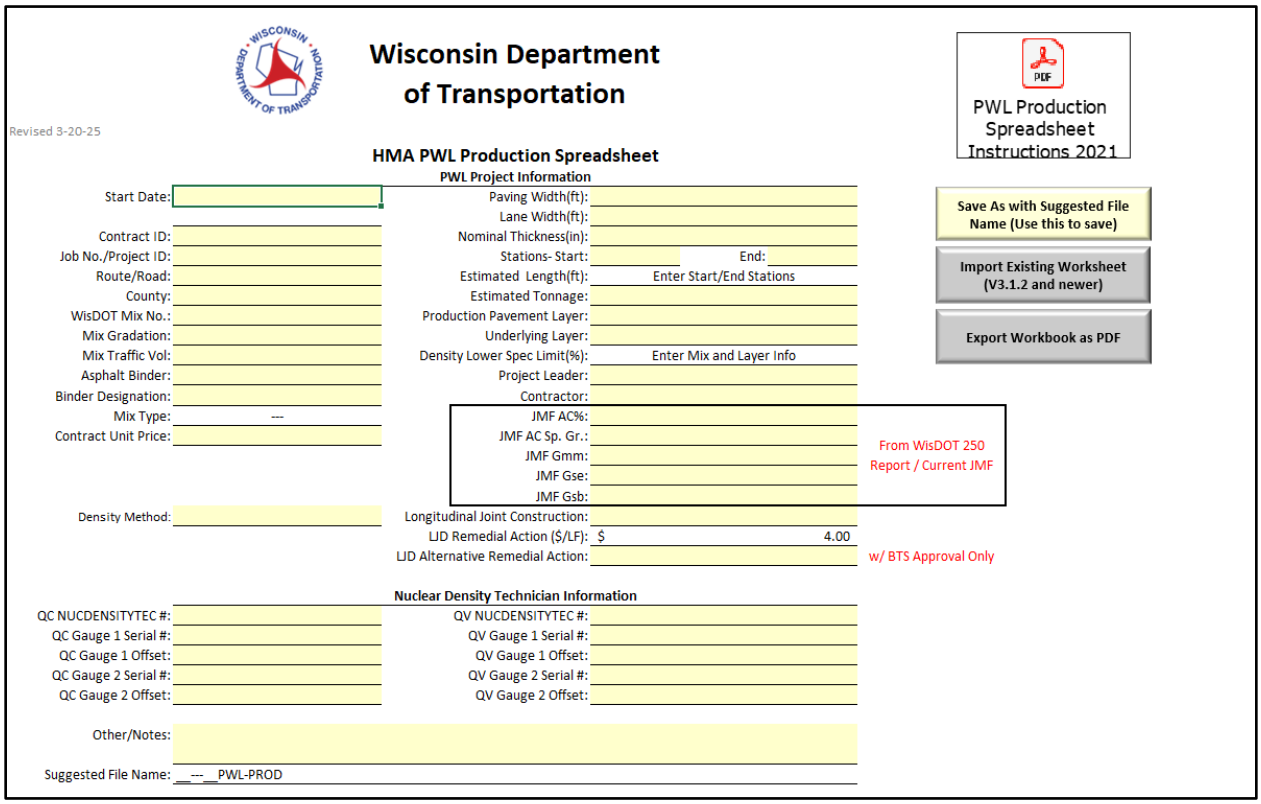
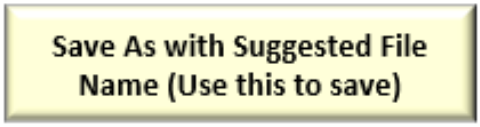


Figure 1: Project Info & Instructions User Interface.

There are several buttons for worksheet functions found on the righthand side of the interface. The buttons perform the following functions:

	• Saves the spreadsheet as a new Excel file (without overwriting old versions) with the suggested file name, including the date and time that the spreadsheet was saved. • This is the preferred method of saving the spreadsheet.
	• Import data from an existing PWL Production spreadsheet. • Only works on worksheet version V3.1.2 and newer. • WARNING: This process takes about 10 minutes to complete. Excel will be frozen during this process, but you may do other things on your computer during this time. A popup message will appear when the process is complete.
	• Exports the entire spreadsheet and its worksheets as a PDF.

5. Core Density Analysis

This worksheet only appears when either "Core" or "Nuclear and Core" is selected as the Density Method on the *Project Info & Instruction* worksheet. This worksheet is used to enter the mainline density test results obtained by cores.

The Department Representative will enter the following information from the core testing (Figure 2):

- Sublot length (ft.)
- Sublot width (ft.)
- Sublot thickness (in.)
- Date (date tested)
- Lot ID
- Sublot ID
- Core Density (%)

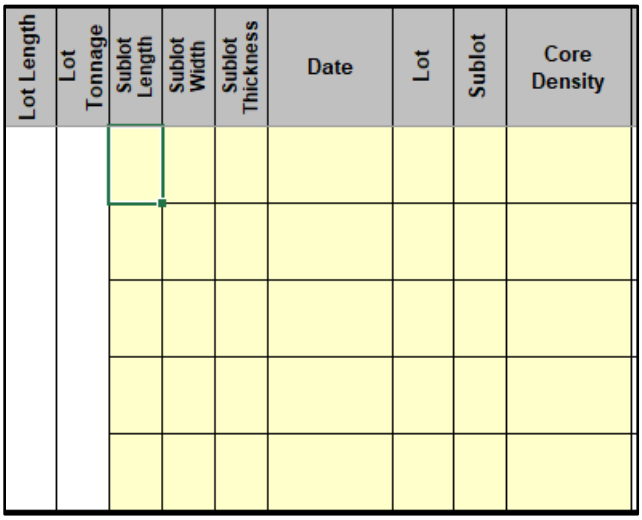


Figure 2: Core Density Analysis data entry fields.

Notes:

- F&t testing is not performed since there are only QV cores and there is no data to compare against.

In the event there are density test results that are more than 3.0% below the lower specification limit (LSL), the unacceptable test result's cell will turn red (Figure 3) and the corresponding sublot's Unacceptable Pavement Length Per Sublot and Cores 1 and 2 at the Extent of Unacceptable Material cells will turn canary colored (Figure 4). Results from determining the extents of unacceptable material should then be entered in those corresponding cells in columns AJ through AL (Figure 4). If the material is removed and replaced, the test results from the removed and replaced material should be entered into the corresponding cell in column AM (Figure 4).

Lot Length	Lot Tonnage	Sublot Length	Sublot Width	Sublot Thickness	Date	Lot	Sublot	Core Density	Data used for pay
		1500	12.0	2.25	3/21/2025	1	A	89.8	

Figure 3: Failing core density result.

Any comments for a particular test result can be entered in column AN (Figure 4).

AI	AJ	AK	AL	AM	AN
	For individual tests more than 3.0% below the LSL, proceed determining the length of unacceptable material according to CMM 815.11. Record the length of unacceptable material in columns AJ. Record the first acceptable forward and backward 50-foot incremental tests in columns AK and AL.			If unacceptable material is removed and replaced, enter the pavement density values after replacement below.	
Lot-Sublot	**Unacceptable Pavement Length Per Sublot**	**Core 1 at Extent of Unacceptable Material**	**Core 2 at Extent of Unacceptable Material**	**Replaced Pavement Cores**	**Comments**
1-A	Enter Unacceptable Length	Enter Core 1	Enter Core 2		

Figure 4: Location to enter results from determining the extents of unacceptable material, removed and replaced material test results, and comments.

Each lot will automatically calculate the standard deviation, mean, PWL value, Pay Factor (PF), and Pay Adjustment once there are at least three (3) test results in that lot (Figure 5).

Lot Length	Lot Tonnage	Sublot Length	Sublot Width	Sublot Thickness	Date	Lot	Sublot	Core Density	Data used for pay	Unacceptable Material Left In-Place (Ton)	Unacceptable Material Pay Adjustment	Standard Deviation	Mean	PWL_D	PF_D	Lot Length (ft)	Lot Size for PWL (Ton)	Density PWL Pay Adjustment	Total Pay Adjustment
7500	1260	1500	12.0	2.25	3/21/2025	1	A	94.5	94.5										
		1500	12.0	2.25	3/21/2025	1	B	94.7	94.7										
		1500	12.0	2.25	3/21/2025	1	C	93.8	93.8										
		1500	12.0	2.25	3/21/2025	1	D	94.4	94.4										
		1500	12.0	2.25	3/21/2025	1	E	95.1	95.1										
												0.474	94.5	100.00	104.00	7500	1260.0	$ 1,638.00	$ 1,638.00

Figure 5: Example Core Density Lot with Pay Adjustment.

6. LJ Core Density Analysis

This worksheet only appears when either "Core" or "Nuclear and Core" is selected as the Density Method AND a Longitudinal Joint Construction type is selected on the *Project Info & Instruction* worksheet. This worksheet is used to enter the mainline density test results obtained by cores.

The Department Representative will enter the following information from the applicable Median/Centerline and/or Outside longitudinal joint core testing (Figure 6):

- Joint Type (Confined – C, Unconfined – U)
- Joint Length (ft.)
- Core Density (%)

Notes:

- F&t testing is not performed since there are only QV cores and there is no data to compare against.
- Date Tested, Lot, and Sublot information correspond with the mainline test. This worksheet will automatically input this information from the Core Density Analysis worksheet.
- Unlike the *Core Density Analysis* worksheet, the joint pay adjustments are determined in another worksheet, *LJ Core Density Pay Adjustment*.

	HMA PWL Mainline Density	Select Jt Type: C = Confined, U = Unconfined	Job No./Project ID:						Layer: Upper					
			WisDOT Mix No.: 0-250-0126-2024						Traffic Vol: LT					
			Mix Type: 4-LT-58-28-S						Underlying Layer: New HMA					
			Median-CL Joint				Outside Joint							
Lot Length	Mainline Traffic Lane Lot Density in Disincentive?	Date	Lot	Sublot	Jt. Type	Joint Length	Core Density	Density LSL	Jt. Type	Joint Length	Core Density	Density LSL	Median-CL /Outside	Core Variance	Core Mean
	Traffic Lane NOT in Disincentive - LJD Eligible for Incentive	3/21/2025	1	A										
		3/21/2025	1	B										
		3/21/2025	1	C										
		3/21/2025	1	D										
		3/21/2025	1	E									M-CL	
													O	

Figure 6: LJ Core Density Analysis data entry fields.

In the event there are density test results that are more than 3.0% below the lower specification limit (LSL), the unacceptable test result's cell will turn red (Figure 7) and the corresponding sublot's Unacceptable Joint Length Within (Median-CL and/or Outside) Joint Sublot and First Acceptable (Median-CL and/or Outside) Forward/Backward 50-foot Incremental Test cells will turn canary colored (Figure 8). Results from determining the extents of unacceptable material should then be entered in those corresponding cells in columns AG through AM (Figure 8). If the

material is removed and replaced, the test results from the removed and replaced material should be entered into the corresponding cells in columns AN through AO (Figure 8).

3/21/2025	1	E	U	1500	86.9	90.0				

Figure 7: Failing LJ Core Density Result.

AE	AF	AG	AH	AI	AJ	AK	AL	AM	AN	AO
For individual tests more than 3.0% below the LSL, proceed determining the length of unacceptable material according to CMM 815.11. Record the length of unacceptable material in columns AG and/or AK. Record the first acceptable forward and backward 50-foot incremental tests in columns AH and AI and/or AL and AM.									If unacceptable material is removed and replaced, enter the pavement density values after replacement below.	
Lot-Sublot	**Jt. Type**	**Unacceptable Joint Length Within Median-CL Joint Sublot**	**First Acceptable Median-CL Forward 50-foot Incremental Test**	**First Acceptable Median-CL Backward 50-foot Incremental Test**	**Jt. Type**	**Unacceptable Joint Length Within Outside Joint Sublot**	**First Acceptable Outside Forward 50-foot Incremental Test**	**First Acceptable Outside Backward 50-foot Incremental Test**	**Replaced Median-CL Joint Core Tests**	**Replaced Outside Joint Core Tests**
1-A	C									
1-B	C									
1-C	U									
1-D	U									
1-E	U	Enter Joint Length	Enter Density Result	Enter Density Result						

Figure 8: Location to enter results from determining the extents of unacceptable material for longitudinal joints and removed and replaced material test results.

Comments for individual test results can be entered in column AP.

7. LJ Core Density Pay Adjustment

This worksheet only appears when either "Core" or "Nuclear and Core" is selected as the Density Method AND a Longitudinal Joint Construction type is selected on the *Project Info & Instructions* worksheet. This worksheet is used to review the sublots' density results and the associated pay adjustments (Figure 9).

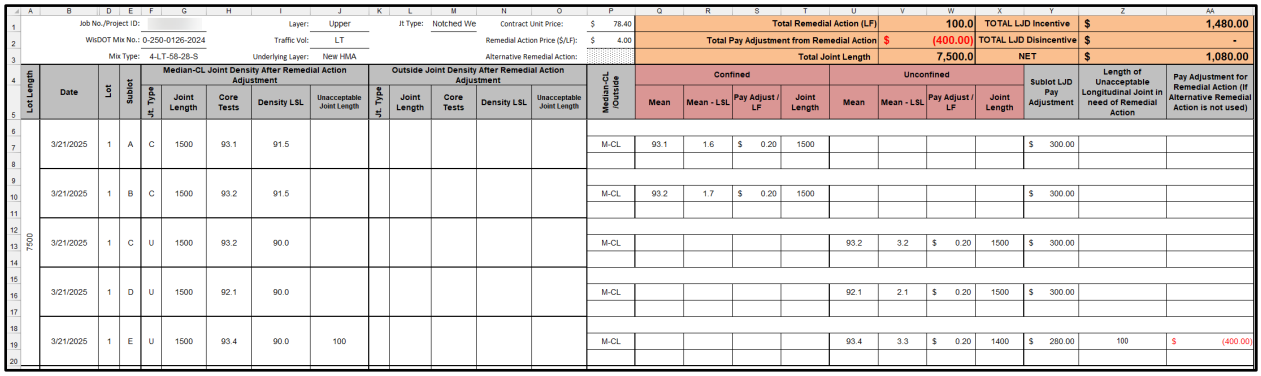
No information is to be entered into this worksheet.

Median-Centerline (CL) and Outside Joint tests are separated for each sublot and shown in columns F through J and K through O, respectively.

The sublot's mean, mean – LSL, Pay Adjustment per Lineal Foot, and applicable Joint Length are shown in columns Q through T for confined joints, and columns U through X for unconfined joints.

The sublot's Pay Adjustment, Length of Unacceptable Longitudinal Joint in Need of Remedial Action, and the Pay Adjustment for Remedial Action are shown in columns Y through AA.

Net Pay Adjustments are accumulated in the upper right-hand corner of the worksheet.



Job No./Project ID: | Layer: Upper | Jt Type: Notched We | Contract Unit Price: $ 78.40
WisDOT Mix No.: 0-250-0126-2024 | Traffic Vol: LT | Remedial Action Price ($/LF): $ 4.00
Mix Type: 4-LT-58-28-S | Underlying Layer: New HMA | Alternative Remedial Action:

Total Remedial Action (LF)	100.0	TOTAL LJD Incentive	$ 1,480.00
Total Pay Adjustment from Remedial Action	$ (400.00)	TOTAL LJD Disincentive	$ -
Total Joint Length	7,500.0	NET	$ 1,080.00

Lot Length	Date	Lot	Sublot	Median-CL Joint Density After Remedial Action Adjustment					Outside Joint Density After Remedial Action Adjustment					Median-CL /Outside	Confined				Unconfined				Sublot LJD Pay Adjustment	Length of Unacceptable Longitudinal Joint in need of Remedial Action	Pay Adjustment for Remedial Action (If Alternative Remedial Action is not used)
				Jt. Type	Joint Length	Core Tests	Density LSL	Unacceptable Joint Length	Jt. Type	Joint Length	Core Tests	Density LSL	Unacceptable Joint Length		Mean	Mean - LSL	Pay Adjust / LF	Joint Length	Mean	Mean - LSL	Pay Adjust / LF	Joint Length			
7500	3/21/2025	1	A	C	1500	93.1	91.5							M-CL	93.1	1.6	$ 0.20	1500					$ 300.00		
	3/21/2025	1	B	C	1500	93.2	91.5							M-CL	93.2	1.7	$ 0.20	1500					$ 300.00		
	3/21/2025	1	C	U	1500	93.2	90.0							M-CL					93.2	3.2	$ 0.20	1500	$ 300.00		
	3/21/2025	1	D	U	1500	92.1	90.0							M-CL					92.1	2.1	$ 0.20	1500	$ 300.00		
	3/21/2025	1	E	U	1500	93.4	90.0	100						M-CL					93.4	3.3	$ 0.20	1400	$ 280.00	100	$ (400.00)

Figure 9: Longitudinal Joint Core Density Pay Adjustment Example.

8. Nuc Density F&t

This worksheet only appears when either "Nuclear" or "Nuclear and Core" is selected as the Density Method on the *Project Info & Instruction* worksheet. This worksheet is used to enter the mainline density test results obtained by nuclear density gauge.

The Department Representative will enter the following information from the nuclear density testing (Figure 10):

- Sublot Length (ft.)
- Sublot Width (ft.)
- Date Tested
- Lot ID
- Sublot ID
- QC Test Results (%)
- QV Test Results (%)
- Dispute Resolution Cores (if needed)

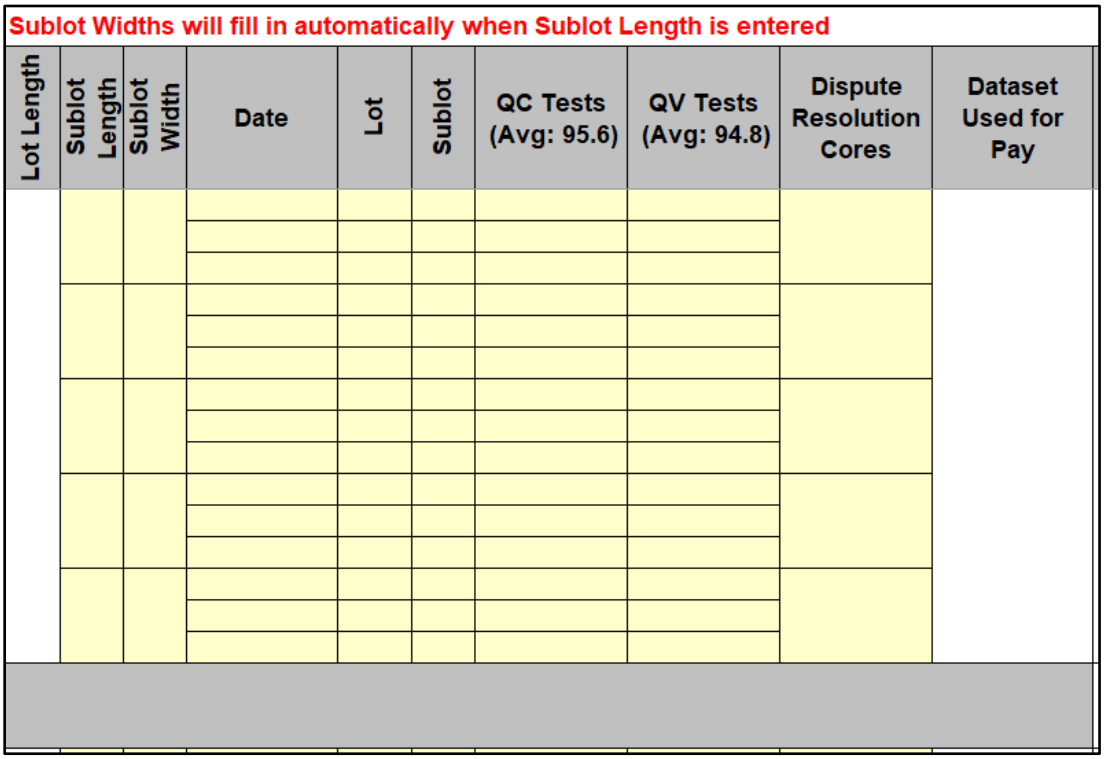


Figure 10: Nuc Density F&t data entry fields.

Notes:

- HMA Field Density Worksheets (V2.2+) contain an automated worksheet, *Formatted for PWL*, that converts daily nuclear density test results into a format that can be easily copied and pasted into the HMA PWL Production spreadsheet.

Additionally, the Department Representative will enter the results of the daily footprint testing in columns Z and AA (Figure 11).

Notes:

- If the difference between the QC and QV gauges exceeds 1.0 pcf (0.7 percent) for an average of 10 locations, investigate the cause, check gauge moisture and density standards, and perform additional footprint testing. If the cause of the difference between gauge readings cannot be identified, the Department Representative will consult the State's Radiation Safety Officer (RSO) and BTS HMA Unit to determine necessary actions.

Z	AA	AB
Foot Print Tests (For QC/QV gauge comparison only)		
QC	QV	Difference (%)
97.3	96.6	0.7
96.7	95.6	1.1
95.3	96.6	-1.3
95.8	94.8	1.0
96.8	94.6	2.2
95.0	95.3	-0.3
95.0	94.5	0.5
94.3	95.7	-1.4
95.2	95.7	-0.5
94.7	95.7	-1.0
94.5	94.3	0.2
94.3	95.0	-0.7
95.0	94.6	0.4
94.9	94.7	0.2
93.4	94.6	-1.2

Figure 11: Example Nuclear Gauge Footprint Testing Fields.

After the initial two (2) lots of data entries have been completed, the worksheet will begin to display preliminary F&t results to give an early indication as to how well the datasets are comparing (Figure 12). This information can be useful to determine if re-correlation may be needed, or if a particular nuclear gauge should be removed from the job.

QC Variance	QC Mean	QV Variance	QV Mean	Do the Variances Compare?	Do the Means Compare?
Informational Purposes Only, NOT yet used for pay.					
0.892	95.5	0.283	95.1	Yes	Yes

Figure 12: Preliminary F&t Results shown after two (2) lots of data have been entered.

After the first three (3) lots of data entries have been completed, the worksheet will determine if the means and variances compare for those first three (3) lots via F&t testing, shown in columns S and V (Figure 13). This will determine which testing party's data, QC or QV, will be used for acceptance and pay adjustment. If the means AND variances compare, QC data will be used, otherwise QV data will be used. Additional information regarding the data, if applicable, will be shown after the first three (3) lots, and each subsequent lot thereafter in the lot's notification area (row 57 in Figure 13).

	A	C	D	E	F	G	H	I	J	K	L	M	N	O	S	V
1		Job No./Project ID:						Layer:	Upper	Lane Width(ft):	12.0					α
2		WisDOT Mix No.:		0-250-0126-2024				Traffic Vol:	LT	Nominal Thickness(in):	1.75					
3		Mix Type:		4-LT-58-28-S				Density LSL(%):	93.0							0.025
4	Sublot Widths will fill in automatically when Sublot Length is entered															
5	Lot Length	Sublot Length	Sublot Width	Date	Lot	Sublot	QC Tests (Avg: 95.6)	QV Tests (Avg: 94.8)	Dispute Resolution Cores	Dataset Used for Pay	QC Variance	QC Mean	QV Variance	QV Mean	Do the Variances Compare?	Do the Means Compare?
36	7500	1500	12.0	6/12/2024	8	4C	97.0	94.1		QC						
37				6/12/2024	8	4B	96.2									
38				6/12/2024	8	4A	96.3									
39		1500	12.0	6/12/2024	8	3C	95.7	94.1								
40				6/12/2024	8	3B	95.7									
41				6/12/2024	8	3A	95.2									
42		1500	12.0	6/12/2024	8	2C	93.9	95.2								
43				6/12/2024	8	2B	94.0									
44				6/12/2024	8	2A	96.1									
45		1500	12.0	6/12/2024	8	1C	94.7	95.2								
46				6/12/2024	8	1B	95.1									
47				6/13/2024	8	1A	94.7									
48		1500	12.0	6/13/2024	7	5C	95.9	95.1								
49				6/13/2024	7	5B	95.6									
50				6/13/2024	7	5A	94.9									
57	The lot average for QC is different from the lot average for QV by more than 0.5%. Lot 3 qualifies for dispute resolution.										0.830	95.5	0.309	95.0	Yes	Yes

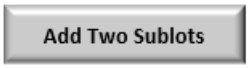
Figure 13: Means and Variances Comparison (F&t) Testing Results.

Notes:

- F&t testing uses a rolling window of 3 lots. See section 19.1 F&t Testing for more details.

Density results may be disputed by the contractor on a lot-by-lot basis if one of the following criteria is met:

1. The lot average for either QC or QV is below the lower specification limit.
2. The lot average for QC is different from the lot average for QV by more than 0.5%.
3. The lot is in disincentive.

The worksheet will determine if a lot is eligible for contractor dispute resolution and present a notification in the notification area below the lot that is eligible for dispute. Dispute core density results can then be entered for the lot in column J, Dispute Resolution Cores, next to the corresponding QV nuclear density tests. If a lot has more than five (5) QV tests in it, the lot can be expanded using the 

button to accommodate up to 7 QV core locations.

Notes:

- Do not continue nuclear density test result entry in the overflow sublots that were added to accommodate dispute cores using the "Add two sublots" button. The exception to this rule is entering the final sublots of the project that would have otherwise had been combined with the previous lot for analysis reasons as described in the General section.
- Dispute Resolution Cores are always used for acceptance and pay adjustment of the lot, when available, regardless of the status of the F&t testing.

In the event there are density test results that are more than 3.0% below the lower specification limit (LSL), the unacceptable test result's cell will turn red (Figure 14) and the corresponding test's Unacceptable Pavement Length Per Sublot cell will turn canary colored (Figure 15). Results from determining the extents of unacceptable material should then be entered in the corresponding cell in column AE (Figure 15). If the material is removed and replaced, the test results from the removed and replaced material should be entered into the corresponding cells in columns AF through AH (Figure 15).

Any comments for a particular test result can be entered in column AI (Figure 15)

5	Lot Length	Sublot Length	Sublot Width	Date	Lot	Sublot	QC Tests (Avg: 95.5)	QV Tests (Avg: 94.8)	Dispute Resolution Cores
58	7500	1500	12.0	6/13/2024	7	4C	89.0	96.3	
59				6/13/2024	7	4B	95.6		
60				6/13/2024	7	4A	96.1		
61		1500	12.0	6/13/2024	7	3C	97.0	94.8	
62				6/13/2024	7	3B	96.2		
63				6/13/2024	7	3A	96.6		
64		1500	12.0	6/13/2024	7	2C	96.3	96.4	
65				6/13/2024	7	2B	94.7		
66				6/13/2024	7	2A	94.3		
67		1500	12.0	6/13/2024	7	1C	96.9	94.4	
68				6/13/2024	7	1B	94.9		
69				6/13/2024	7	1A	96.7		
70		1500	12.0	6/13/2024	6	5C	94.1	95.0	
71				6/13/2024	6	5B	95.5		
72				6/13/2024	6	5A	95.9		
79									

Figure 14: Failing nuclear density result.

AD	AE	AF	AG	AH	AI	AJ
For Individual Test more than 3.0% below the LSL, proceed according to CMM 815.11 in determining the length of unacceptable material. Record the length of unacceptable material in column AE.		If unacceptable material is removed and replaced, enter the pavement density values after replacement below.			Unacceptable material that has not been removed and replaced will be paid at 50%	
Lot-Sublot	**Unacceptable Pavement Length Per Sublot**	**Replaced Pavement QC Tests**	**Replaced Pavement QV Tests**	**Replaced Pavement Dispute Cores**	**Comments**	**Unacceptable Material Left In-Place (Ton)**
7-4C	Enter Unacceptable Length					Unacceptable Length Needed
7-4B						
7-4A						
7-3C						
7-3B						
7-3A						
7-2C						
7-2B						
7-2A						
7-1C						
7-1B						
7-1A						
6-5C						
6-5B						
6-5A						

Figure 15: Location to enter results from determining the extents of unacceptable material, removed and replaced material test results, and comments.

9. Nuc Density Pay Factors

This worksheet only appears when either "Nuclear" or "Nuclear and Core" is selected as the Density Method on the *Project Info & Instructions* worksheet. This worksheet is used to review the lots' density results and the associated pay adjustments (Figure 16).

No information is to be entered into this worksheet.

Depending on the results of the F&t testing performed on the *Nuc Density F&t* worksheet (also shown in columns AH and AI of this sheet), the QC or QV test result will be displayed in column J, Contractor or DOT Test Result.

If taken, Dispute Resolution Cores will be shown in column K. In the event dispute cores result in a Pay Factor that is less than or equal to the nuclear gauge pay factor, a fee will be assessed for the lot and shown in column AD.

Net Lot Pay Adjustments are shown in column AK and accumulated in the upper right-hand corner of the worksheet.

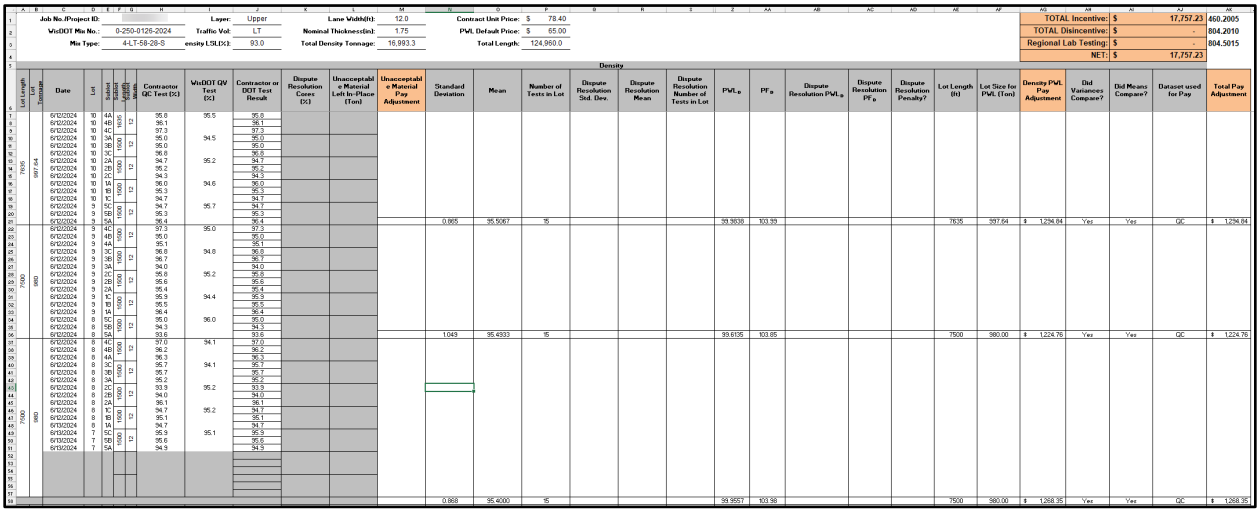


Figure 16: Nuc Density Pay Adjustment Example.

In the event there is a lot with unacceptable material where the extents of unacceptable material were not entered in column AE in the *Nuc Density F&t* worksheet, this worksheet will display, "Enter length of Unacceptable Material on Density F&t Tab" at the top of the sheet (Figure 17).

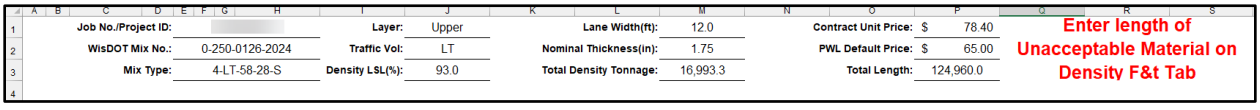


Figure 17: Missing Extents of Unacceptable Material Example.

10. LJ Nuc Density F&t

This worksheet only appears when either "Nuclear" or "Nuclear and Core" is selected as the Density Method AND a Longitudinal Joint Construction type is selected on the *Project Info & Instruction* worksheet. This worksheet is used to enter the longitudinal joint density test results obtained by nuclear density gauge.

The Department Representative will enter the following information from the applicable Median/Centerline and/or Outside longitudinal joint nuclear density testing (Figure 18):

- Joint Type (Confined – C, Unconfined – U)
- Joint Length (ft.)
- QC Test Results (%)
- QV Test Results (%)

	HMA PWL Mainline Density	Select Jt Type: C = Confined, U = Unconfined			Job No./Project ID:												
					WisDOT Mix No.:	0-250-0126-2024					Layer:	Upper					
					Mix Type:	4-LT-58-28-S					Traffic Vol:	LT					
					Median-CL Joint						Underlying Layer:	New HMA					
											Outside Joint						
Lot Length	Mainline Traffic Lane Lot Density in Disincentive?	Date	Lot	Sublot	Jt. Type	Joint Length	QC Tests	QV Tests	Density LSL	QC/QV Data Used	Jt. Type	Joint Length	QC Tests	QV Tests	Density LSL	QC/QV Data Used

Figure 18: LJ Nuc Density F&t Data Entry Fields.

Notes:

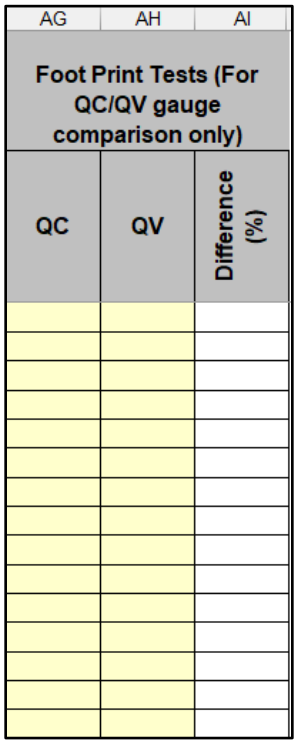
- HMA Field Density Worksheets (V2.2+) contain an automated worksheet, *Formatted for PWL*, that converts daily nuclear density longitudinal joint test results into a format that can be easily copied and pasted into the HMA PWL Production spreadsheet.

Additionally, the Department Representative will enter the results of the daily footprint testing in columns AG and AH (Figure 19).

Notes:

- If the difference between the QC and QV gauges exceeds 1.0 pcf (0.7 percent) for an average of 10 locations, investigate the cause, check gauge moisture and density standards, and perform additional footprint testing. If the cause of the difference between

gauge readings cannot be identified, the Department Representative will consult the State's Radiation Safety Officer (RSO) and BTS HMA Unit to determine necessary actions.



AG	AH	AI
Foot Print Tests (For QC/QV gauge comparison only)		
QC	QV	Difference (%)

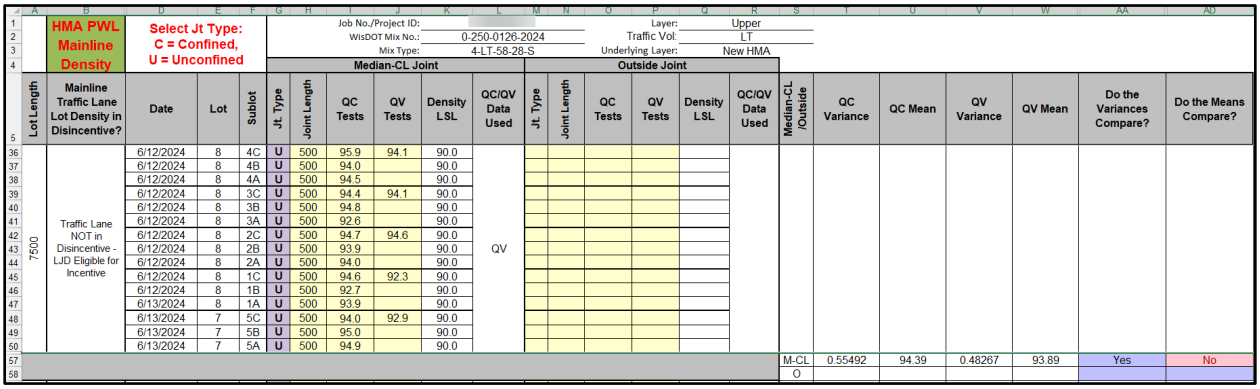
Figure 19: Example Longitudinal Joint Nuclear Gauge Footprint Testing Fields.

After the initial two (2) lots of data entries have been completed, the worksheet will begin to display preliminary F&t results for both Median-Centerline (M-CL) and Outside (O) joints to give an early indication as to how well the datasets are comparing (Figure 20).

Median-CL /Outside	QC Variance	QC Mean	QV Variance	QV Mean	Do the Variances Compare?	Do the Means Compare?
	Informational Purposes Only, NOT yet used for pay.					
M-CL	0.48461	94.46	0.27344	94.03	Yes	Yes
O						

Figure 20: Preliminary F&t Results shown after two (2) lots of data have been entered.

After the first three (3) lots of data entries have been completed, the worksheet will determine if the means and variances compare for those first three (3) lots via F&t testing, shown in columns AA and AD (Figure 21). This will determine which testing party's data, QC or QV, will be used for acceptance and pay adjustment. If the means AND variances compare, QC data will be used, otherwise QV data will be used.



HMA PWL Mainline Density

Select Jt Type: C = Confined, U = Unconfined

Job No./Project ID:
WisDOT Mix No.: 0-250-0126-2024
Mix Type: 4-LT-58-28-S
Layer: Upper
Traffic Vol: LT
Underlying Layer: New HMA

					Median-CL Joint						Outside Joint												
Lot Length	Mainline Traffic Lane Lot Density in Disincentive?	Date	Lot	Sublot	Jt. Type	Joint Length	QC Tests	QV Tests	Density LSL	QC/QV Data Used	Jt. Type	Joint Length	QC Tests	QV Tests	Density LSL	QC/QV Data Used	Median-CL /Outside	QC Variance	QC Mean	QV Variance	QV Mean	Do the Variances Compare?	Do the Means Compare?
7500	Traffic Lane NOT in Disincentive - LJD Eligible for Incentive	6/12/2024	8	4C	U	500	95.9	94.1	90.0	QV							M-CL	0.55492	94.39	0.48267	93.89	Yes	No
		6/12/2024	8	4B	U	500	94.0		90.0								O						
		6/12/2024	8	4A	U	500	94.5		90.0														
		6/12/2024	8	3C	U	500	94.4	94.1	90.0														
		6/12/2024	8	3B	U	500	94.8		90.0														
		6/12/2024	8	3A	U	500	92.6		90.0														
		6/12/2024	8	2C	U	500	94.7	94.6	90.0														
		6/12/2024	8	2B	U	500	93.9		90.0														
		6/12/2024	8	2A	U	500	94.0		90.0														
		6/12/2024	8	1C	U	500	94.6	92.3	90.0														
		6/12/2024	8	1B	U	500	92.7		90.0														
		6/13/2024	8	1A	U	500	93.9		90.0														
		6/13/2024	7	5C	U	500	94.0	92.9	90.0														
		6/13/2024	7	5B	U	500	95.0		90.0														
		6/13/2024	7	5A	U	500	94.9		90.0														

Figure 21: Means and Variances Comparison (F&t) Testing Results.

In the event there are density test results that are more than 3.0% below the lower specification limit (LSL), the unacceptable test result's cell will turn red (Figure 22) and the corresponding sublot's Unacceptable Joint Length Within (Median-CL and/or Outside) Joint Sublot and First Acceptable (Median-CL and/or Outside) Forward/Backward 50-foot Incremental Test cells will turn canary colored (Figure 23). Results from determining the extents of unacceptable material should then be entered in those corresponding cells in columns AV through BB (Figure 23). If the material is removed and replaced, the test results from the removed and replaced material should be entered into the corresponding cells in columns BC through BF (Figure 23).

Any comments for a particular test result can be entered in column BG.

	Density	U = Unconfined			Median-CL Joint					
Lot Length	Mainline Traffic Lane Lot Density in Disincentive?	Date	Lot	Sublot	Jt. Type	Joint Length	QC Tests	QV Tests	Density LSL	QC/QV Data Used
7635	Traffic Lane NOT in Disincentive - LJD Eligible for Incentive	6/12/2024	10	4A	U	500	86.9	93.7	90.0	QV
		6/12/2024	10	4B	U	500	94.4		90.0	
		6/12/2024	10	4C	U	635	95.2		90.0	
		6/12/2024	10	3A	U	500	95.0	94.1	90.0	
		6/12/2024	10	3B	U	500	94.1		90.0	
		6/12/2024	10	3C	U	500	93.4		90.0	
		6/12/2024	10	2A	U	500	94.1	93.9	90.0	
		6/12/2024	10	2B	U	500	94.4		90.0	
		6/12/2024	10	2C	U	500	94.3		90.0	
		6/12/2024	10	1A	U	500	95.2	93.7	90.0	
		6/12/2024	10	1B	U	500	94.0		90.0	
		6/12/2024	10	1C	U	500	95.2		90.0	
		6/12/2024	9	5C	U	500	94.1	94.8	90.0	
		6/12/2024	9	5B	U	500	94.5		90.0	
		6/12/2024	9	5A	U	500	94.8		90.0	

Figure 22: Failing longitudinal joint nuclear density result.

AT	AU	AV	AW	AX	AY	AZ	BA	BB	BC	BD	BE	BF
For an individual test more than 3.0% below the LSL, proceed according to STSP 460-075 460.3.3.2(7) in determining the length of unacceptable material. Record the length of unacceptable material in columns AZ and BD. Record the first acceptable forward and backward 50-foot incremental tests in columns BA and BB or BE and BF.									If unacceptable material is removed and replaced, enter the pavement density values after replacement below.			
Lot-Sublot	Jt. Type	Unacceptable Joint Length Within Median-CL Joint Sublot	First Acceptable Median-CL Forward 50-foot Incremental Test	First Acceptable Median-CL Backward 50-foot Incremental Test	Jt. Type	Unacceptable Joint Length Within Outside Joint Sublot	First Acceptable Outside Forward 50-foot Incremental Test	First Acceptable Outside Backward 50-foot Incremental Test	Replaced Median-CL Joint QC Tests	Replaced Median-CL Joint QV Tests	Replaced Outside Joint QC Tests	Replaced Outside Joint QV Tests
10-4A	U	Enter Joint Length	Enter Density Result	Enter Density Result								
10-4B	U											
10-4C	U											
10-3A	U											
10-3B	U											
10-3C	U											
10-2A	U											
10-2B	U											
10-2C	U											
10-1A	U											
10-1B	U											
10-1C	U											
9-5C	U											
9-5B	U											
9-5A	U											

Figure 23: Location to enter results from determining the extents of unacceptable material and removed and replaced material test results.

11. LJ Nuc Density Pay Adjustment

This worksheet only appears when either "Nuclear" or "Nuclear and Core" is selected as the Density Method AND a Longitudinal Joint Construction type is selected on the *Project Info & Instructions* worksheet. This worksheet is used to review the lots' longitudinal joint density results and the associated pay adjustments (Figure 24).

No information is to be entered into this worksheet.

Median-Centerline (CL) and Outside Joint tests are separated for each lot and shown in columns F through K and L through Q, respectively.

The sublot's mean, mean – LSL, Pay Adjustment per Lineal Foot, and applicable Joint Length are shown in columns T through W for confined joints, and columns X through AA for unconfined joints.

The sublot's Pay Adjustment, Length of Unacceptable Longitudinal Joint in Need of Remedial Action, and the Pay Adjustment for Remedial Action are shown in columns AB through AD.

Net Pay Adjustments are accumulated in the upper right-hand corner of the worksheet.

Job No./Project ID:
WisDOT Mix No.: 0-250-0126-2024
Mix Type: 4-LT-58-28-S
Layer: Upper
Traffic Vol: LT
Underlying Layer: New HMA
Jt Type: Notched Wedge (left in place)
Contract Unit Price: $ 78.40
Remedial Action Price ($/LF): $ 4.00
Alternative Remedial Action:

Total Remedial Action (LF)	100.0	TOTAL LJD Incentive	$ 24,672.00
Total Pay Adjustment from Remedial Action	$ (400.00)	TOTAL LJD Disincentive	$ -
Total Joint Length	124,960.0	NET	$ 24,272.00

Lot Length	Date	Lot	Sublot	Median-CL Joint Density After Remedial Action Adjustment						Outside Joint Density After Remedial Action Adjustment					
				Jt. Type	Joint Length	QC Tests	QV Tests	Density LSL	Unacceptable Joint Length	Jt. Type	Joint Length	QC Tests	QV Tests	Density LSL	Unacceptable Joint Length
7635	6/12/2024	10	4A	U	500	93.7	93.7	90.0	100						
	6/12/2024	10	4B	U	500	94.4		90.0							
	6/12/2024	10	4C	U	635	95.2		90.0							
	6/12/2024	10	3A	U	500	95.0	94.1	90.0							
	6/12/2024	10	3B	U	500	94.1		90.0							
	6/12/2024	10	3C	U	500	93.4		90.0							
	6/12/2024	10	2A	U	500	94.1	93.9	90.0							
	6/12/2024	10	2B	U	500	94.4		90.0							
	6/12/2024	10	2C	U	500	94.3		90.0							
	6/12/2024	10	1A	U	500	95.2	93.7	90.0							
	6/12/2024	10	1B	U	500	94.0		90.0							
	6/12/2024	10	1C	U	500	95.2		90.0							
	6/12/2024	9	5C	U	500	94.1	94.8	90.0							
	6/12/2024	9	5B	U	500	94.5		90.0							
	6/12/2024	9	5A	U	500	94.8		90.0							

Sublot	Median-CL /Outside	Dataset used for Pay	Confined				Unconfined				Sublot LJD Pay Adjustment	Length of Unacceptable Longitudinal Joint in need of Remedial Action	Pay Adjustment for Remedial Action (If Alternative Remedial Action is not used)
			Mean	Mean - LSL	Pay Adjust / LF	Joint Length	Mean	Mean - LSL	Pay Adjust / LF	Joint Length			
4A													
4B	M-CL	QV					93.7	3.7	$ 0.20	1535	$ 307.00	100	$ (400.00)
4C													
3A													
3B	M-CL	QV					94.1	4.1	$ 0.20	1500	$ 300.00		
3C													
2A													
2B	M-CL	QV					93.9	3.9	$ 0.20	1500	$ 300.00		
2C													
1A													
1B	M-CL	QV					93.7	3.7	$ 0.20	1500	$ 300.00		
1C													
5C													
5B	M-CL	QV					94.8	4.8	$ 0.20	1500	$ 300.00		
5A													

Figure 24: LJ Nuc Density Pay Adjustment Example.

12. Gmm F&t

This worksheet is used to enter the Gmm (Specific Gravity – Mixture Theoretical Maximum) test results used in part along with the Gmb (Specific Gravity – Mixture Bulk) test results to calculate the mixture's air voids.

The Department Representative will enter the following information from the Gmm testing (Figure 25):

- Sublot Size (Tons)[1]
- Date Sampled
- QC Test Results
- QV Test Results

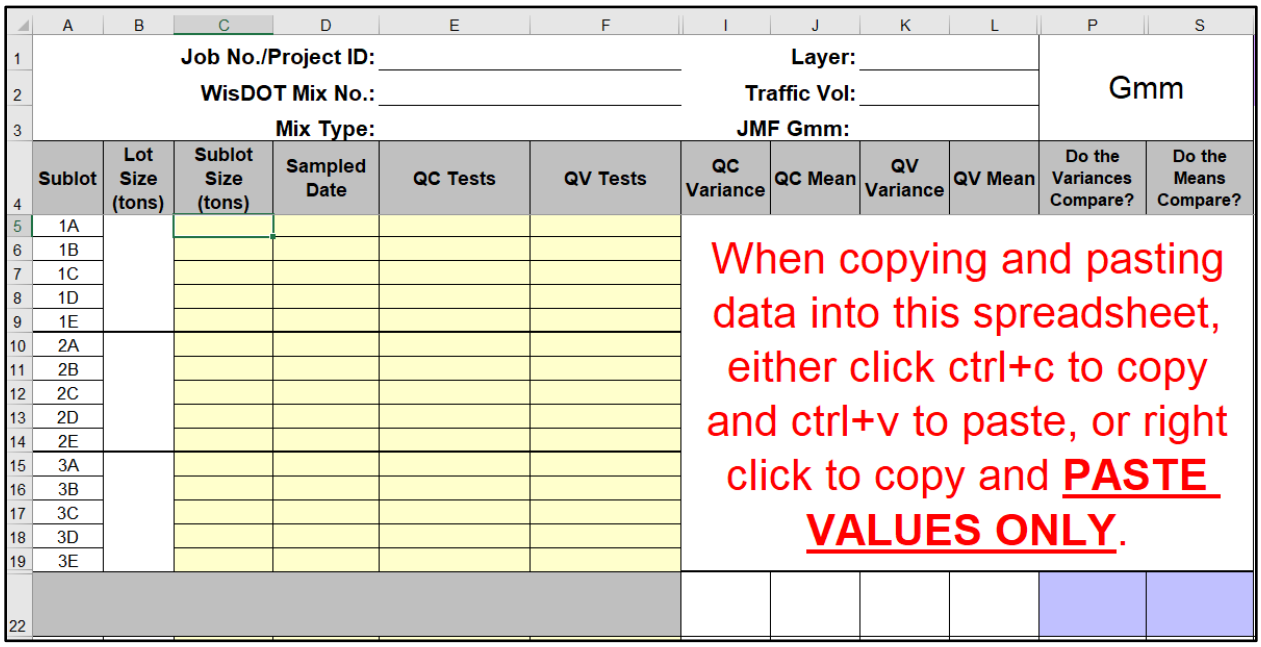


Figure 25:Gmm F&t Data Entry Fields.

Notes:

- Lot Size (tons, column B) will not accumulate sublot tonnage until a corresponding QC test is entered in *Gmm F&t*, *Gmb F&t,* AND *AC %* worksheets. This is to allow for tracking missed tests while not giving the tonnage credit in the pay adjustment for the rest of the lot.

After the first three (3) lots of data entries have been completed, the worksheet will determine if the means and variances compare for those first three (3) lots via F&t testing, shown in columns P and S (Figure 26). This will determine whether the lots' results are disputed. If the means AND

[1] The Sublot Size will always be less than or equal to 750 tons. Add a random sample for any fraction of 750 tons at the end of production for a specific mixture design. Entering a value larger than 750 tons will result in an error message.

variances compare, QC data is verified and will be used for acceptance and pay adjustment, otherwise dispute resolution will begin. Additional information regarding the data, if applicable, will be shown after the first three (3) lots, and each subsequent lot thereafter in the lot's notification area (row 22 in Figure 26).

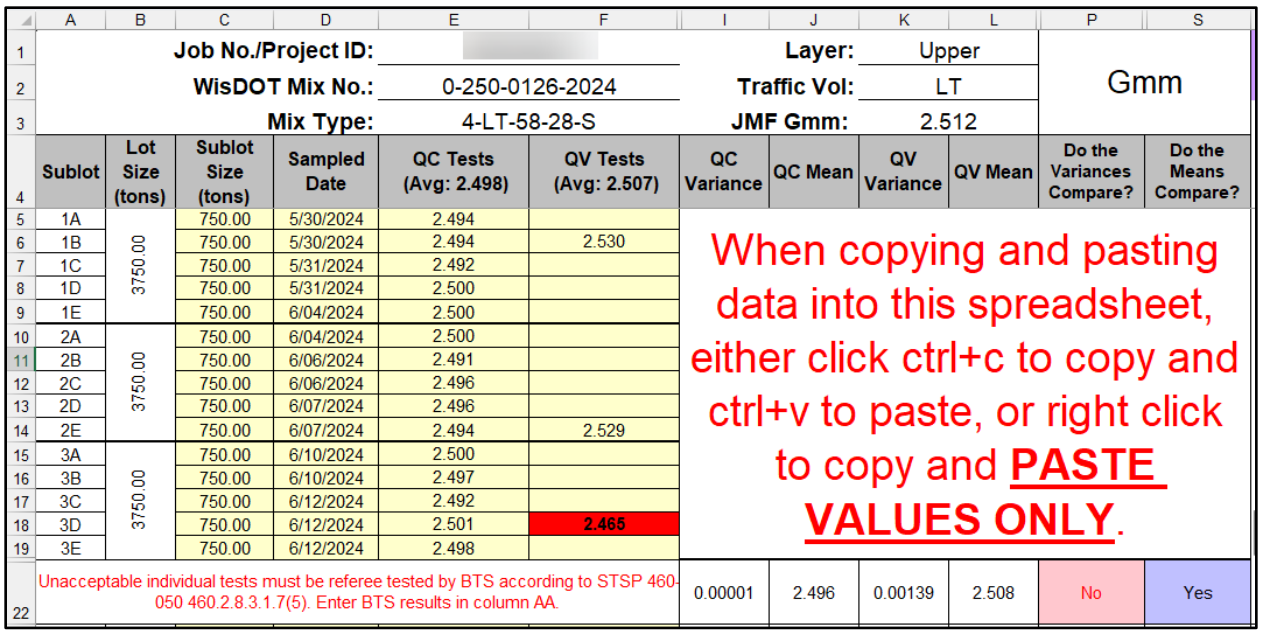
	A	B	C	D	E	F	I	J	K	L	P	S
1				Job No./Project ID:				Layer:	Upper		Gmm	
2				WisDOT Mix No.:	0-250-0126-2024			Traffic Vol:	LT			
3				Mix Type:	4-LT-58-28-S			JMF Gmm:	2.512			
4	Sublot	Lot Size (tons)	Sublot Size (tons)	Sampled Date	QC Tests (Avg: 2.498)	QV Tests (Avg: 2.514)	QC Variance	QC Mean	QV Variance	QV Mean	Do the Variances Compare?	Do the Means Compare?
5	1A	3750.00	750.00	5/30/2024	2.494		When copying and pasting data into this spreadsheet, either click ctrl+c to copy and ctrl+v to paste, or right click to copy and **PASTE VALUES ONLY**.					
6	1B		750.00	5/30/2024	2.494	2.530						
7	1C		750.00	5/31/2024	2.492							
8	1D		750.00	5/31/2024	2.500							
9	1E		750.00	6/04/2024	2.500							
10	2A	3750.00	750.00	6/04/2024	2.500							
11	2B		750.00	6/06/2024	2.491							
12	2C		750.00	6/06/2024	2.496							
13	2D		750.00	6/07/2024	2.496							
14	2E		750.00	6/07/2024	2.494	2.529						
15	3A	3750.00	750.00	6/10/2024	2.500							
16	3B		750.00	6/10/2024	2.497							
17	3C		750.00	6/12/2024	2.492							
18	3D		750.00	6/12/2024	2.501	2.522						
19	3E		750.00	6/12/2024	2.498							
22	Means do not compare, but the Pay Factor is greater than 102%. No dispute resolution testing required.						0.00001	2.496	0.00002	2.527	Yes	No

Figure 26: Means and Variances Comparison (F&t) Testing Results.

Notes:

- If the lot does not compare via the F&t testing but the Pay Factor for the lot is greater than 102% (as determined in the hidden *Va Pay Factor_Comparison* worksheet), then dispute resolution testing is not required. The lot's notification area will notify you if this situation occurs.
- A non-comparison for either Gmm or Gmb will result in the lot requiring dispute resolution for both tests as well as asphalt content. The lot's notification area will notify you if this situation occurs.

In the event there is unacceptable material (individual air voids results not meeting the acceptance limits) dispute resolution is automatically initiated for that lot. Failing results will be flagged with a red cell background as well produce a notification (Figure 27).



			Job No./Project ID:			Layer:	Upper			Gmm		
			WisDOT Mix No.:	0-250-0126-2024		Traffic Vol:	LT					
			Mix Type:	4-LT-58-28-S		JMF Gmm:	2.512					
Sublot	Lot Size (tons)	Sublot Size (tons)	Sampled Date	QC Tests (Avg: 2.498)	QV Tests (Avg: 2.507)	QC Variance	QC Mean	QV Variance	QV Mean	Do the Variances Compare?	Do the Means Compare?	
1A	3750.00	750.00	5/30/2024	2.494		When copying and pasting data into this spreadsheet, either click ctrl+c to copy and ctrl+v to paste, or right click to copy and **PASTE VALUES ONLY**.						
1B		750.00	5/30/2024	2.494	2.530							
1C		750.00	5/31/2024	2.492								
1D		750.00	5/31/2024	2.500								
1E		750.00	6/04/2024	2.500								
2A	3750.00	750.00	6/04/2024	2.500								
2B		750.00	6/06/2024	2.491								
2C		750.00	6/06/2024	2.496								
2D		750.00	6/07/2024	2.496								
2E		750.00	6/07/2024	2.494	2.529							
3A	3750.00	750.00	6/10/2024	2.500								
3B		750.00	6/10/2024	2.497								
3C		750.00	6/12/2024	2.492								
3D		750.00	6/12/2024	2.501	2.465							
3E		750.00	6/12/2024	2.498								
Unacceptable individual tests must be referee tested by BTS according to STSP 460-050 460.2.8.3.1.7(5). Enter BTS results in column AA.						0.00001	2.496	0.00139	2.508	No	Yes	

Figure 27: Failing air voids result flagged in the Gmm F&t worksheet as well as its corresponding failure notification.

Dispute resolution is initiated if any of the following scenarios occur:

- Either the means or variances do not compare AND the air voids pay factors for both the QC and QV datasets are not greater than 102% as determined in the hidden *Va Pay Factor_Comparison* worksheet.
- There is an individual unacceptable QC or QV air voids test result.

When dispute resolution occurs, the reason for the dispute will appear in the lot's notification area in red text. The Department Representative will select the retained sample/s to be referee tested either from the lot that caused the dispute, or from within the rolling five (5) lot analytical window of the dispute lot. The results of the referee testing will be entered into column AA, BTS Tests, for the applicable tested sublot in the *Gmm F&t*, and *Gmb F&t* worksheets (Figure 28), and column I in the *AC %* worksheet (Figure 35).

Regardless of the reason dispute resolution is initiated from the list above, once the referee test results are entered, F&t analysis will be reperformed between the QC dataset and the QV dataset with the referee results replacing the original QV results in the comparison. The results of the second round of F&t testing are shown in columns AI and AL in Figure 28. If the datasets compare, dispute resolution ends and QC test results will be used for acceptance and pay adjustment. If the datasets do not compare, then the Department's Regional Lab will test the retained samples for the remaining four (4) sublots in the disputed lot and enter those test results in column AQ (Figure 29). The Department's Regional Lab results will be used for acceptance and pay adjustment, unless disputed by the contractor.

Notes:

- A Dispute Resolution Flowchart is available in the appendix in section 19.2 Volumetric Dispute Resolution Flowchart.
- BTS's test results from the second round of F&t testing, column AA, will auto-populate in column AQ.

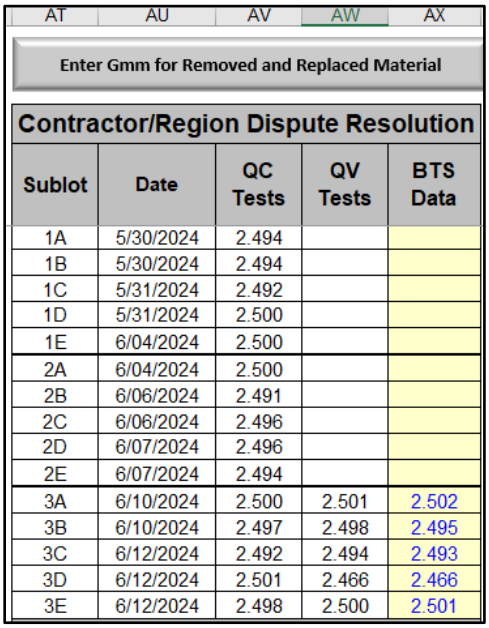
W	X	Y	Z	AA	AI	AL
BTS Dispute Resolution						
Sublot	**Date**	**QC Tests**	**QV Tests**	**BTS Tests**	**Do the Variances Compare?**	**Do the Means Compare?**
1A	5/30/2024	2.494				
1B	5/30/2024		2.530			
1C	5/31/2024	2.492				
1D	5/31/2024	2.500				
1E	6/04/2024	2.500				
2A	6/04/2024	2.500				
2B	6/06/2024	2.491				
2C	6/06/2024	2.496				
2D	6/07/2024	2.496				
2E	6/07/2024		2.529			
3A	6/10/2024	2.500				
3B	6/10/2024	2.497				
3C	6/12/2024	2.492				
3D	6/12/2024		2.466	2.466		
3E	6/12/2024	2.498				
Variances do not compare. The region will test the remaining 4 sublots according to STSP 460-050 460.2.8.3.1.7(2) Step [2]ii. Enter results of region testing in column AQ.					No	Yes

Figure 28: Dispute Resolution Data Entry Location for Gmm and Gmb.

AN	AO	AP	AQ	AR
Region Lab Dispute Resolution				
Sublot	**Date**	**QC Tests**	**QV Tests**	**BTS Data**
1A	5/30/2024	2.494		
1B	5/30/2024	2.494		
1C	5/31/2024	2.492		
1D	5/31/2024	2.500		
1E	6/04/2024	2.500		
2A	6/04/2024	2.500		
2B	6/06/2024	2.491		
2C	6/06/2024	2.496		
2D	6/07/2024	2.496		
2E	6/07/2024	2.494		
3A	6/10/2024	2.500	2.501	
3B	6/10/2024	2.497	2.498	
3C	6/12/2024	2.492	2.494	
3D	6/12/2024	2.501	2.466	2.466
3E	6/12/2024	2.498	2.500	

Figure 29: Remaining Four (4) Sublots Department Regional Lab Testing Data Entry Location for Gmm and Gmb.

If the contractor disputes the results of the Regional Lab Testing (and BTS referee testing), then the remaining retained samples for the disputed lot will all be referee tested by BTS and those results entered in column AX (Figure 30).



AT	AU	AV	AW	AX

Enter Gmm for Removed and Replaced Material

Contractor/Region Dispute Resolution

Sublot	Date	QC Tests	QV Tests	BTS Data
1A	5/30/2024	2.494		
1B	5/30/2024	2.494		
1C	5/31/2024	2.492		
1D	5/31/2024	2.500		
1E	6/04/2024	2.500		
2A	6/04/2024	2.500		
2B	6/06/2024	2.491		
2C	6/06/2024	2.496		
2D	6/07/2024	2.496		
2E	6/07/2024	2.494		
3A	6/10/2024	2.500	2.501	2.502
3B	6/10/2024	2.497	2.498	2.495
3C	6/12/2024	2.492	2.494	2.493
3D	6/12/2024	2.501	2.466	2.466
3E	6/12/2024	2.498	2.500	2.501

Figure 30: Contractor-Initiated Full Lot Dispute Resolution Data Entry Location.

If material is removed and replaced, the test results from the newly placed material should be entered in columns AZ and BA (Figure 31). To reveal these locations, click the

button located at the top of the worksheet between columns AT And AX. Additionally, if this area was mistakenly revealed, it can again be hidden by clicking the newly revealed

button between columns AZ and BA (Figure 31).

Any comments for a particular test result can be entered in column CS.

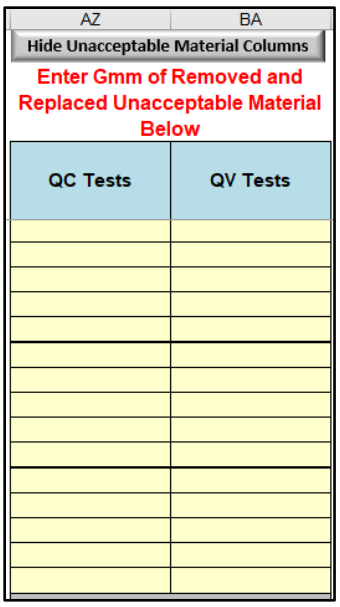


Figure 31: Location for Removed and Replaced Material Test Results.

Resultant datasets used for acceptance, pay adjustment, and dispute resolution are shown in columns BC and BF (Figure 32).

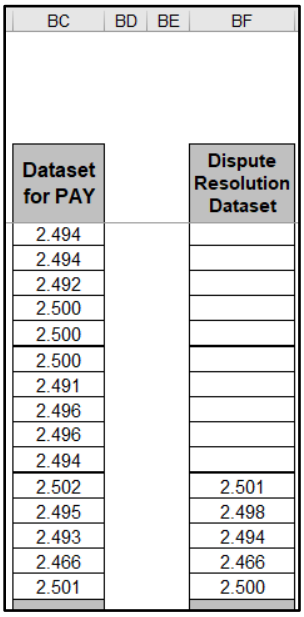


Figure 32: Resultant Datasets for Acceptance and Pay Adjustment.

13. Gmb F&t

This worksheet is used to enter the Gmb (Specific Gravity – Mixture Bulk) test results used in part along with the Gmm (Specific Gravity – Mixture Theoretical Maximum) test results to calculate the mixture's air voids.

The Department Representative will enter the following information from the Gmb testing (Figure 33):

- QC Test Results
- QV Test Results

	A	B	C	D	E	F	I	J	K	L	P	S
1				Job No./Project ID:				Layer:			Gmb	
2				WisDOT Mix No.:				Traffic Vol:				
3				Mix Type:								
4	Sublot	Lot Size (tons)	Sublot Size (tons)	Sampled Date	QC Tests	QV Tests	QC Variance	QC Mean	QV Variance	QV Mean	Do the Variances Compare?	Do the Means Compare?
5	1A						When copying and pasting data into this spreadsheet, either click ctrl+c to copy and ctrl+v to paste, or right click to copy and **PASTE VALUES ONLY**.					
6	1B											
7	1C											
8	1D											
9	1E											
10	2A											
11	2B											
12	2C											
13	2D											
14	2E											
15	3A											
16	3B											
17	3C											
18	3D											
19	3E											
22												

Figure 33: Gmb F&t Data Entry Fields.

Notes:

- Sublot Size (tons) and Sampled Date auto-populate from the *Gmm F&t* worksheet, and cannot be entered/changed in this worksheet.
- Lot Size (tons, column B) will not accumulate sublot tonnage until a corresponding QC test is entered in *Gmm F&t*, *Gmb F&t,* AND *AC %* worksheets. This is to allow for tracking missed tests while not giving the tonnage credit in the pay adjustment for the rest of the lot.

➢ Features of this worksheet, including notifications, F&t analysis, and dispute resolution, are the same as they are for Gmm. Refer to section Gmm F&t for details about these processes and procedures, they will not be repeated here.

Any comments for a particular test result can be entered in column CS.

14. AC %

This worksheet is used to enter the results of QC and QV mixture asphalt content testing, as well as QC Gsb (Specific Gravity – Stone Bulk) tracking. The Gsb, Gmb, and mixture asphalt binder content (AC % / Pb) are used to calculate and track the VMA (Voids in Mineral Aggregate, %).

The Department Representative will enter the following information from the mixture asphalt content testing (Figure 34):

- Gsb (Reported)
- QC Test Results (%)
- QV Test Results (%)
- BTS Referee Test Results (if needed, %)

	A	B	C	D	E	F	G	H	I
1				Job No./Project ID:				Layer:	
2				WisDOT Mix No.:				JMF AC%:	
3				Mix Type:				JMF Gsb:	
4	Sublot	Sublot Size (tons)	Lot Size (tons)	Sampled Date	Gsb (Reported)	Target AC%	QC Asphalt Content (%)	QV Asphalt Content (%)	BTS Asphalt Content (%)
5	1A								
6	1B								
7	1C								
8	1D								
9	1E								
10	2A								
11	2B								
12	2C								
13	2D								
14	2E								
15	3A								
16	3B								
17	3C								
18	3D								
19	3E								
22									

Figure 34: Mixture Asphalt Content and Gsb Data Entry Fields.

Notes:

- F&t testing is not currently performed with this dataset.
- QC results are used for acceptance unless dispute resolution occurs.

Asphalt contents that exceed the action or acceptance limits will be flagged with red text or a red cell background, respectively (Figure 35 and Figure 36), and produce a corresponding notification in the notification areas below the lots. In both situations, dispute resolution is initiated and retained samples should be sent to BTS for referee testing. The Department Representative will enter the results of the BTS testing in column I[2].

[2] BTS will test the retained sample for Gmm, Gmb, and AC as part of this dispute resolution testing in case the results for Gmm and Gmb are also needed so that additional reheats of the retained material are not required. If asphalt content is the only cause for dispute resolution testing, only enter the referee asphalt content test results.

	A	B	C	D	E	F	G	H	I
1				Job No./Project ID:				Layer:	Upper
2				WisDOT Mix No.:	0-250-0126-2024			JMF AC%:	5.7
3				Mix Type:	4-LT-58-28-S			JMF Gsb:	2.702
4	Sublot	Sublot Size (tons)	Lot Size (tons)	Sampled Date	Gsb (Reported)	Target AC%	QC Asphalt Content (Avg: 5.8%)	QV Asphalt Content (Avg: 5.6%)	BTS Asphalt Content (Avg: 5.5%)
5	1A	750.00	3750.00	5/30/2024	2.703	5.7	6.0		
6	1B	750.00		5/30/2024	2.703	5.7	5.9	5.7	
7	1C	750.00		5/31/2024	2.703	5.7	5.9		
8	1D	750.00		5/31/2024	2.703	5.7	5.7		
9	1E	750.00		6/04/2024	2.703	5.7	5.9		
10	2A	750.00	3750.00	6/04/2024	2.703	5.7	5.9		
11	2B	750.00		6/06/2024	2.704	5.7	6.0		
12	2C	750.00		6/06/2024	2.704	5.7	5.6		
13	2D	750.00		6/07/2024	2.704	5.7	5.9		
14	2E	750.00		6/07/2024	2.704	5.7	5.3	5.6	5.5
15	3A	750.00	3750.00	6/10/2024	2.704	5.7	5.8		
16	3B	750.00		6/10/2024	2.704	5.7	6.1		
17	3C	750.00		6/12/2024	2.704	5.7	6.0		
18	3D	750.00		6/12/2024	2.704	5.7	5.9	5.6	
19	3E	750.00		6/12/2024	2.704	5.7	6.0		
22	Notify Engineer: QC Non-Conforming, take a non-random QV sample and follow STSP 460-050 460.2.8.2.1.7(4).								

Figure 35: Asphalt Content Exceeding Action Limits.

	A	B	C	D	E	F	G	H	I
1				Job No./Project ID:				Layer:	Upper
2				WisDOT Mix No.:	0-250-0126-2024			JMF AC%:	5.7
3				Mix Type:	4-LT-58-28-S			JMF Gsb:	2.702
4	Sublot	Sublot Size (tons)	Lot Size (tons)	Sampled Date	Gsb (Reported)	Target AC%	QC Asphalt Content (Avg: 5.8%)	QV Asphalt Content (Avg: 5.6%)	BTS Asphalt Content (Avg: 5.5%)
5	1A	750.00	3750.00	5/30/2024	2.703	5.7	6.0		
6	1B	750.00		5/30/2024	2.703	5.7	5.9	5.7	
7	1C	750.00		5/31/2024	2.703	5.7	5.9		
8	1D	750.00		5/31/2024	2.703	5.7	5.7		
9	1E	750.00		6/04/2024	2.703	5.7	5.9		
10	2A	750.00	3750.00	6/04/2024	2.703	5.7	5.9		
11	2B	750.00		6/06/2024	2.704	5.7	6.0		
12	2C	750.00		6/06/2024	2.704	5.7	5.6		
13	2D	750.00		6/07/2024	2.704	5.7	5.9		
14	2E	750.00		6/07/2024	2.704	5.7	5.1	5.6	5.5
15	3A	750.00	3750.00	6/10/2024	2.704	5.7	5.8		
16	3B	750.00		6/10/2024	2.704	5.7	6.1		
17	3C	750.00		6/12/2024	2.704	5.7	6.0		
18	3D	750.00		6/12/2024	2.704	5.7	5.9	5.6	
19	3E	750.00		6/12/2024	2.704	5.7	6.0		
22	Notify Engineer: QC Unacceptable, take a non-random QV sample and follow STSP 460-050 460.2.8.2.1.7(4).								

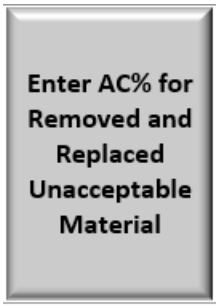
Figure 36: Asphalt Content Exceeding Acceptance Limits.

If two or more consecutive test results fall outside of the action limits, the notification area will turn red and produce a notification to STOP PRODUCTION (Figure 37). Refer to the specifications to determine how to resume production.

	A	B	C	D	E	F	G	H	I
1				Job No./Project ID:				Layer:	Upper
2				WisDOT Mix No.:	0-250-0126-2024			JMF AC%:	5.7
3				Mix Type:	4-LT-58-28-S			JMF Gsb:	2.702
4	Sublot	Sublot Size (tons)	Lot Size (tons)	Sampled Date	Gsb (Reported)	Target AC%	QC Asphalt Content (Avg: 5.8%)	QV Asphalt Content (Avg: 5.6%)	BTS Asphalt Content (Avg: 5.5%)
8	1D	750.00	3	5/31/2024	2.703	5.7	5.7		
9	1E	750.00		6/04/2024	2.703	5.7	5.9		
10	2A	750.00		6/04/2024	2.703	5.7	5.9		
11	2B	750.00		6/06/2024	2.704	5.7	6.0		
12	2C	750.00	3750.00	6/06/2024	2.704	5.7	5.6		
13	2D	750.00		6/07/2024	2.704	5.7	5.9		
14	2E	750.00		6/07/2024	2.704	5.7	5.3	5.6	5.5
15	3A	750.00		6/10/2024	2.704	5.7	5.3		
16	3B	750.00		6/10/2024	2.704	5.7	6.1		
17	3C	750.00	3750.00	6/12/2024	2.704	5.7	6.0		
18	3D	750.00		6/12/2024	2.704	5.7	5.9	5.6	
19	3E	750.00		6/12/2024	2.704	5.7	6.0		
22	Notify Engineer: QC Non-Conforming, take a non-random QV sample and follow STSP 460-050 460.2.8.2.1.7(4). STOP PRODUCTION: 460.2.8.2.1.7(3). Two consecutive %AC test results outside of action limits.								

Figure 37: Two Consecutive Asphalt Content Test Results Outside of the Action Limits.

If material is removed and replaced, the test results from the newly placed material should be entered in columns M through O (Figure 38). To reveal these locations, click the



button located at the top of the worksheet between columns K and L. Additionally, if this area was mistakenly revealed, it can again be hidden by clicking the newly revealed 

button between columns M and O.

M	N	O
Hide Unacceptable Material Columns		
Enter AC% of Removed and Replaced Unacceptable Material Below		
QC Calibrated Asphalt Content, %	QV Calibrated Asphalt Content, %	BTS Asphalt Content %

Figure 38: Location for Removed and Replaced Material Test Results.

Additional calculated information is shown in columns CM through CV including calculated asphalt content, VMA, and Gse (Specific Gravity – Stone Effective) for each testing party based off of that party's test results (Figure 39).

CM	CN	CO	CP	CQ	CR	CS	CT	CU	CV
	AC Sp. Gr.:	1.030		Min VMA:	14.5				
	JMF Gse:	2.753							
Additional Volumetric Parameters									
Graph x-axis	QC Calculated AC%	QV Calculated AC%	BTS Calculated AC%	QC VMA	QV VMA	BTS VMA	QC Calculated Gse	QV Calculated Gse	BTS Calculated Gse
1	6.2			15.8			2.743		
2	6.2	5.3		15.8	15.3		2.739	2.774	
3	6.3			15.6			2.735		
4	6.0			15.5			2.735		
5	6.0			15.4			2.746		
6	6.0			15.9			2.744		
7	6.3			15.7			2.739		
8	6.2			15.4			2.726		
9	6.2			15.6			2.741		
10	6.2	5.3		15.3	15.3		2.710	2.768	
11	6.0	6.0	6.0	14.8			2.717		
12	6.1	6.1	6.2	16.1			2.752		
13	6.3	6.2	6.2	15.9			2.740		
14	6.0	5.5	7.0	15.8	15.2		2.748	2.759	
15	6.1	6.0	6.0	15.8			2.748		

Figure 39: Additional Calculated Parameters.

Any comments for a particular test result can be entered in column CX.

15. Volumetric Pay Factors

This worksheet is used to review the lots' volumetric test results and their associated pay adjustments.

No information is to be entered into this worksheet.

Depending on the results of the F&t testing and any dispute resolution performed on the *Gmm F&t*¸*Gmb F&t*, and *AC %* worksheets, the QC or QV test results for air voids will be displayed in column G, and any unacceptable air void results will be shown in column H. The Gmm and Gmb values used to calculate the air voids are shown in columns E and F, respectively. Only QV Asphalt contents are shown in column AA, since pay adjustment for asphalt contents is only based on the QV or BTS results.

Metrics for each lots' air voids are shown in columns K through X. Gross pay adjustments are shown for Unacceptable Air Voids in column J, PWL Air Voids in column Y, and Asphalt Content in column AC. Additionally, if a fee is assessed in a lot for Regional Lab Testing or BTS Referee Testing, it will be shown in columns AD and AE, respectively, with a "Yes" or "No" indicating the whether or not the fee applied. The total pay adjustment for each lot is shown in column AF, and accumulated in the upper part of the worksheet in columns W through AC.

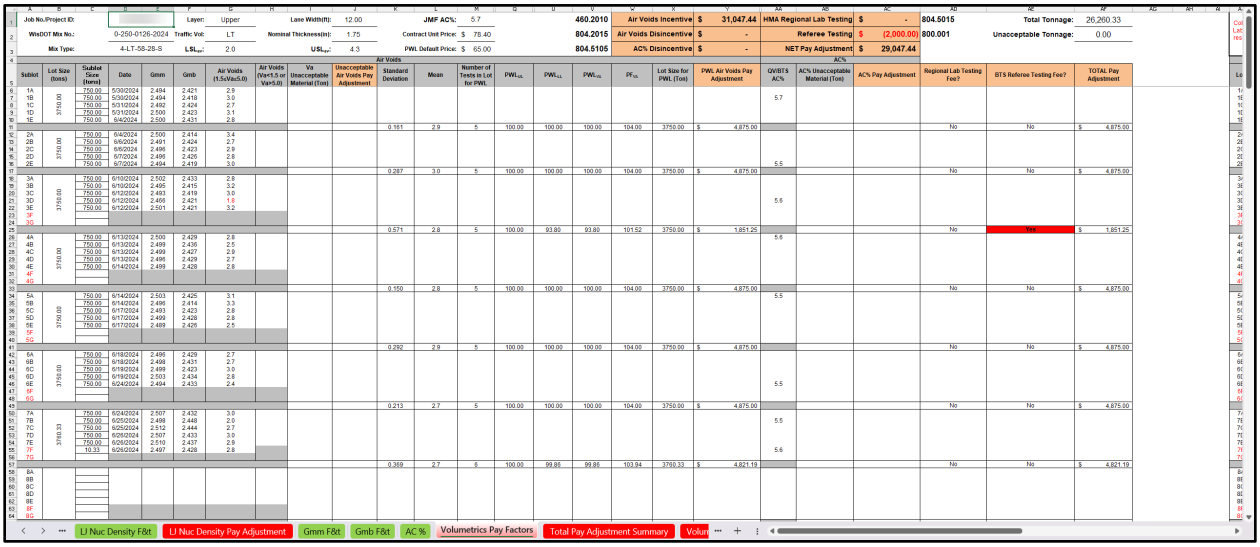


Figure 40: Volumetric Pay Adjustment Example.

Columns AJ through BK show a similar pay adjustment table that only includes the results of any regional lab dispute resolution testing performed. This is so that if the contractor disputes the results of the regional lab dispute testing, the dispute results can be compared between the BTS and the regional lab to determine whether or not a fee is assessed for the lot. The pay adjustments in this range (AJ through BK) are otherwise NOT used in the determination of the net pay adjustment for the lot.

16. Total Pay Adjustment Summary

This worksheet is used to summarize the incentives, disincentives, and net pay adjustments for density and volumetric testing (Figure 41).

No information is to be entered into this worksheet.

Density testing is further broken down into nuclear density, core density, and longitudinal joint density pay adjustments, while air voids and asphalt content pay adjustments are shown under the Volumetrics header. Near the bottom of the worksheet, Regional Lab Testing fees and Referee Testing Fees are shown. At the bottom of the worksheet, the Total Incentive, Total Disincentive, and Combined NET Pay Adjustment are shown for the project.

Contract:	[redacted]	Project Limits:	695+60 to 700+29	Paving Width(ft):	24.0
Job No./Project ID:	[redacted]	Route/Road:	STH 76	Lane Width(ft):	12.0
WisDOT Mix No.:	0-250-0126-2024	Layer:	Upper	Nominal Thickness(in):	1.75
Mix Type:	4-LT-58-28-S	Traffic Vol:	LT	Contract Unit Price:	$78.40
File Name:	[redacted]_STH 76_4-LT-58-28-S_Upper_PWL-PROD				

Export All Worksheets as pdf with Date & Time

Export Summary as pdf with Date & Time

Save with Suggested File Name, Date & Time

Nuclear Gauge Density			
Total Nuc Density Tonnage		**16,993.3**	
Total Unacceptable Tonnage		**0.0**	
Total Nuc Density Length		**124,960.0**	
Average Pay Factor (PF_D)		**103.30**	
Nuc Density Incentive	**$**	**18,286.43**	**460.2005 Incentive Density PWL HMA Pavement**
Nuc Density Disincentive	**$**	**-**	**804.2010 Disincentive Density PWL HMA Pavement**
Density NET Pay Adjustment	**$**	**18,286.43**	
Core Density			
Total Core Density Tonnage		**1,260.0**	
Total Unacceptable Tonnage		**0.0**	
Total Core Density Length		**7,500.0**	**Check first and last sublot length - unlikely to be increment of 1500**
Average Pay Factor (PF_D)		**104.00**	
Core Density Incentive	**$**	**1,638.00**	**460.2005 Incentive Density PWL HMA Pavement**
Core Density Disincentive	**$**	**-**	**804.2010 Disincentive Density PWL HMA Pavement**
Density NET Pay Adjustment	**$**	**1,638.00**	
Longitudinal Joint Density			
Total Joint Length		**132,460.0**	
Total Remedial Action (LF)		**200.0**	
TOTAL Incentive	**$**	**26,152.00**	**460.2007 Incentive Density HMA Pavement Longitudinal Joints**
TOTAL Disincentive	**$**	**-**	**804.2012 Disincentive Density HMA Pavement Longitudinal Joints**
Remedial Action Pay Adjust	**$**	**(800.00)**	
LJ Density NET Pay Adjustment	**$**	**25,352.00**	
Volumetrics			
Total Volumetrics Tonnage		**26,260.3**	
Total Unacceptable Tonnage		**0.0**	
Average Pay Factor (PF_{VA})		**103.08**	
Air Voids Incentive	**$**	**29,196.19**	**460.2010 Incentive Air Voids HMA Pavement**
Air Voids Disincentive	**$**	**(2,875.03)**	**804.2015 Disincentive Air Voids HMA Pavement**
AC% Disincentive	**$**	**-**	**804.5105 Disincentive HMA Binder Content**
Volumetric NET Pay Adjustment	**$**	**26,321.16**	
Administrative Items for Additional Testing			
Regional Lab testing	**$**	**-**	**804.5015 HMA Regional Lab Testing**
Referee Testing	**$**	**(2,000.00)**	**800.0010 Referee Testing**
Combined PWL Pay Adjustment			
TOTAL Combined Incentive	**$**	**75,272.62**	
TOTAL Combined Disincentive	**$**	**(5,675.03)**	
Combined NET Pay Adjustment	**$**	**69,597.59**	

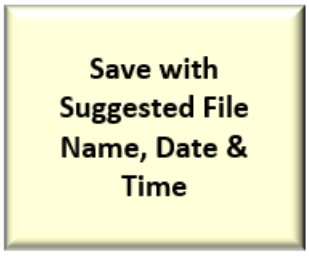
Revised 3-20-25

Figure 41: Total Pay Adjustment Summary Example.

Notes:

- If the Total Nuc Density Length or Total Core Density Length are divisible by 1,500, the length of a typical full-length sublot, with no remainder, then there is a chance that one or more sublots may be the incorrect length due to only using a typical sublot size for the sublot size. Double check the sublot lengths such that they are actual length. The worksheet will identify when this may have happened in red text next to the suspect length. However, it is possible that the project ended with a whole increment of 1,500 feet.
- If the Total Joint Length is divisible by 500, or one-third (1/3) the length of a typical sublot, with no remainder, then there is a chance that one or more sublots may be the incorrect length due to only using a typical sublot size for the sublot size. Double check the sublot lengths such that they are actual length. The worksheet will identify when this may have happened in red text next to the suspect length. However, it is possible that the project ended with a whole increment of 500 feet.
- If the Total Volumetric Tonnage is divisible by 750, the typical size of a sublot, with no remainder, then the final sublot likely used a full sublot size rather than the actual produced tonnage. The worksheet will identify when this may have happened in red text next to the Total Volumetric Tonnage fields. However, it is possible that the project ended with a whole increment of 750 tons.

There are several buttons for worksheet functions found on the righthand side of the interface. The buttons perform the following functions:

	• Exports all worksheets in the workbook as PDF with the current date and time.
	• Exports only the Total Pay Adjustment Summary worksheet as a PDF with the current date and time.
	• Saves the spreadsheet as a new Excel file (without overwriting old versions) with the suggested file name, including the date and time that the spreadsheet was saved. • This is the preferred method of saving the spreadsheet.

17. Volumetric Charts

This worksheet displays volumetric test results for Air Voids, Gmm, Gmb, Asphalt Content, VMA, and calculated Gse on charts (Figure 42). Charts are labeled with QC, QV, BTS, Regional Test results, and BTS Referee Tests for Contractor Disputes as applicable, along with applicable action, specification, and acceptance limits. This worksheet is useful for visualizing the data's variability and results in relation to their limits as well as between testing parties.

No information is to be entered into this worksheet.

Results shown on the charts obey the following style guidelines:

- QC results are shown with solid yellow lines and markers.
- QV results are shown with solid dark blue lines and markers.
- BTS Referee results are shown with solid maroon markers.
- Regional Lab results (remaining four (4) sublots) are shown with hollow green markers and dashed green lines.
- BTS Referee for Contractor Dispute results are shown with solid light blue markers and lines.
- JMFs are shown with dashed black lines.
- Specification Limits are shown with dashed orange lines.
- Action Limits are shown with solid green lines.
- Acceptance Limits are shown with solid red lines.
- Calculated QC, QV, and BTS calculated values use their respective colors described above, except they use hollow markers and dashed lines.

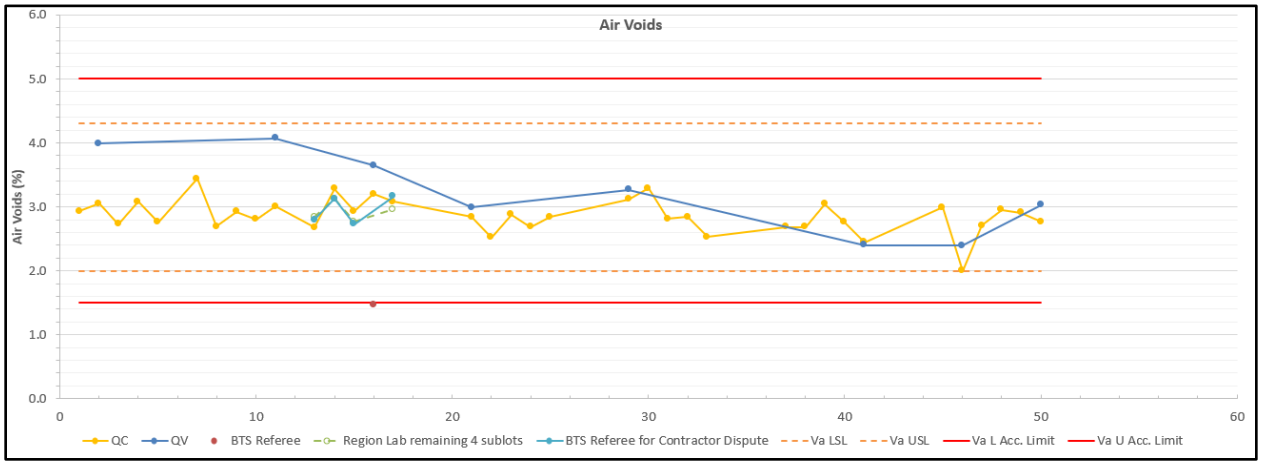


Figure 42: Example of an Air Voids Volumetric Chart.

18. Daily Average Gmm for Density

This worksheet is used to determine the Daily Average Gmm for Density according to WisDOT's Manual of Test Procedures WTM T355 section 10.1.1 (). These average Gmm values are used to determine the Gmm that is to be used for final adjustment of field density results prior to entering the density results in either the *Nuc Density F&t* or *LJ Nuc Density F&t* worksheets.

Notes:

- This feature is only available on PWL Production spreadsheets V3.2 and newer.
- The Gmm values in this table are used to adjust field density results in V2.2 or newer of the HMA Field Density worksheet.
- The values in this table are automatically calculated and account for any dispute resolution testing.
- This table will only show a Gmm for dates where the Gmms were tested. If there is a day of small tonnage paving and no Gmm values were taken that day, you will need to use the previous day's Daily Average Gmm for Density. Refer to WisDOT's Manual of Test Procedures for additional guidance on selection of the Daily Average Gmm.

INSTRUCTIONS

This table provides the Daily Average Gmm to be entered in the HMA Field Density Worksheet (V2.2+) to adjust the density results for final acceptance and pay adjustment. The adjusted density results should then be entered into the Nuc Density F&t and LJ Nuc Density F&t worksheets.

Date	Daily Average Gmm
5/30/2024	2.494
5/31/2024	2.496
6/4/2024	2.500
6/6/2024	2.494
6/7/2024	2.495
6/10/2024	2.499
6/12/2024	2.487
6/13/2024	2.499
6/14/2024	2.499
6/17/2024	2.494
6/18/2024	2.497
6/19/2024	2.501
6/24/2024	2.501
6/25/2024	2.505
6/26/2024	2.505

Figure 43: Daily Average Gmm for Density Example.

19. Appendix

19.1 F&t Testing

The spreadsheet adheres to the specifications for determining whether QC and QV data compare by conducting paired F- and t-tests on rolling windows of lots.

Notes:

- Density testing uses a three (3) lot rolling window (Figure 44).
- Volumetrics testing begins with a three (3) lot window that grows with each lot after the 3rd lot into a rolling five (5) lot window (Figure 45).

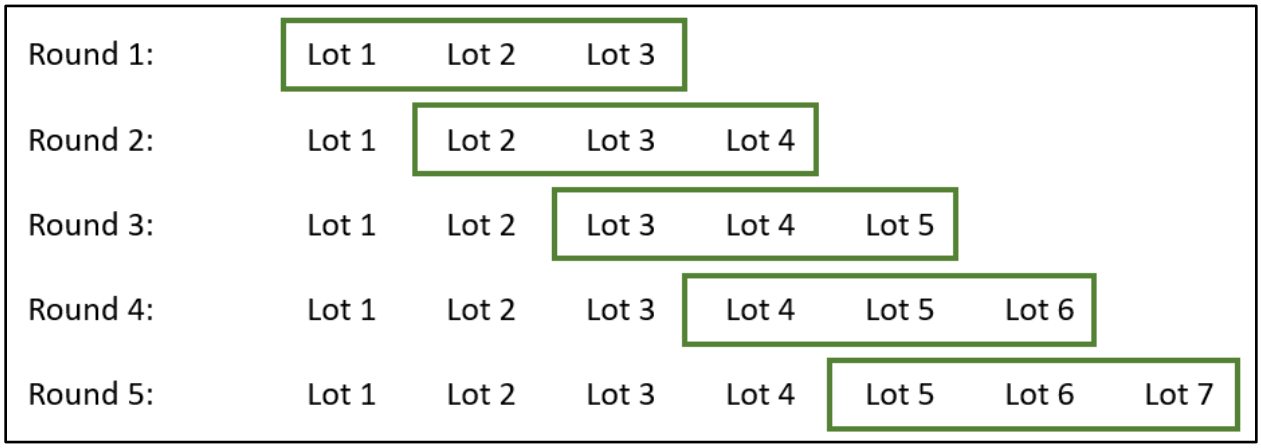


Figure 44: F&t Rolling Window - Density

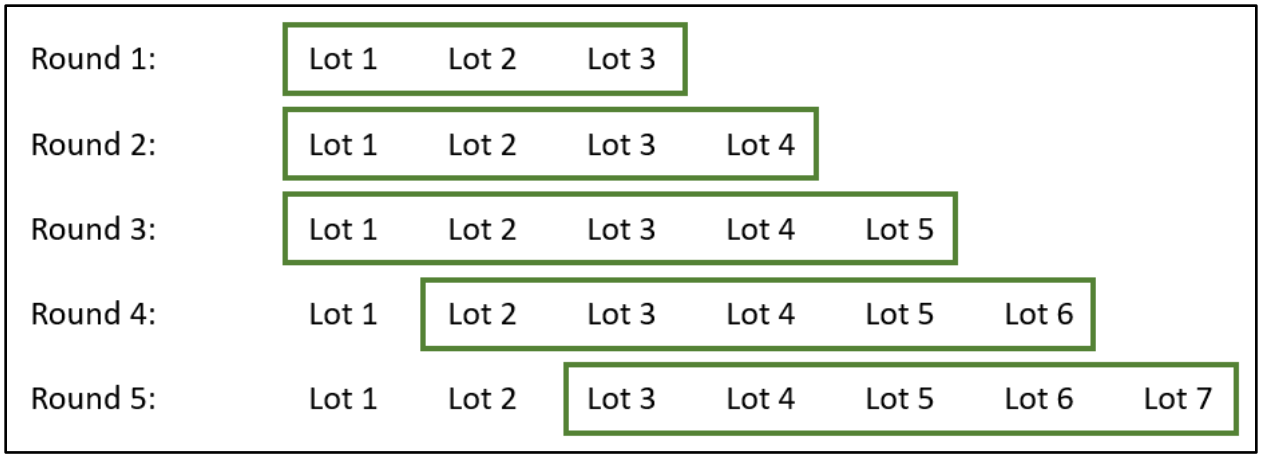


Figure 45: F&t Rolling Window – Volumetrics

These rolling windows for both density and volumetrics were selected such that the power of the tests is reasonable as shown in Figure 46 and Figure 47.

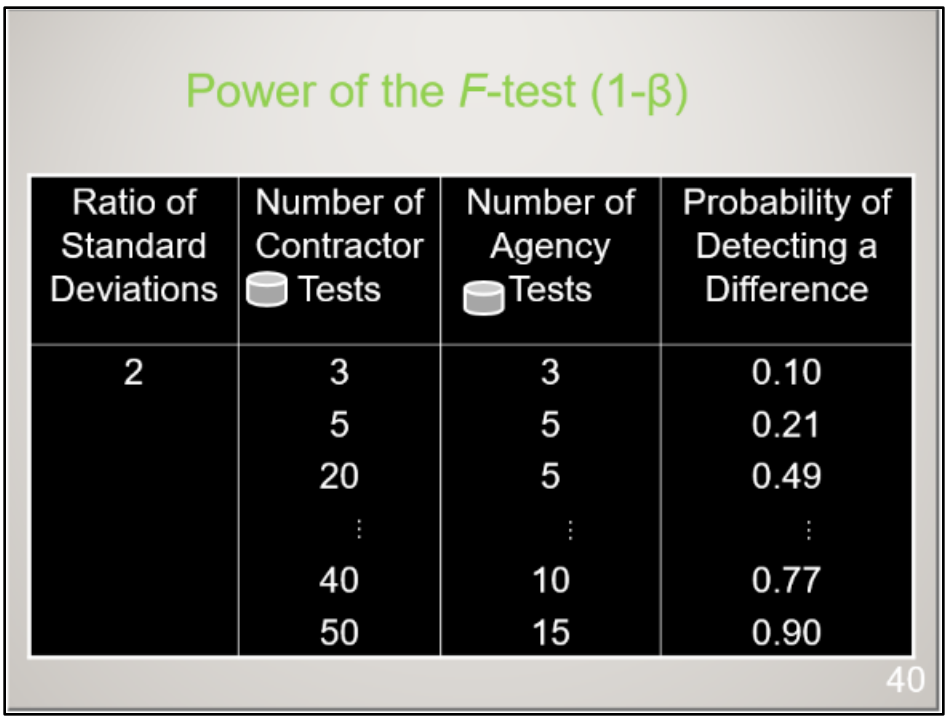


Figure 46: Power of the F-Test.

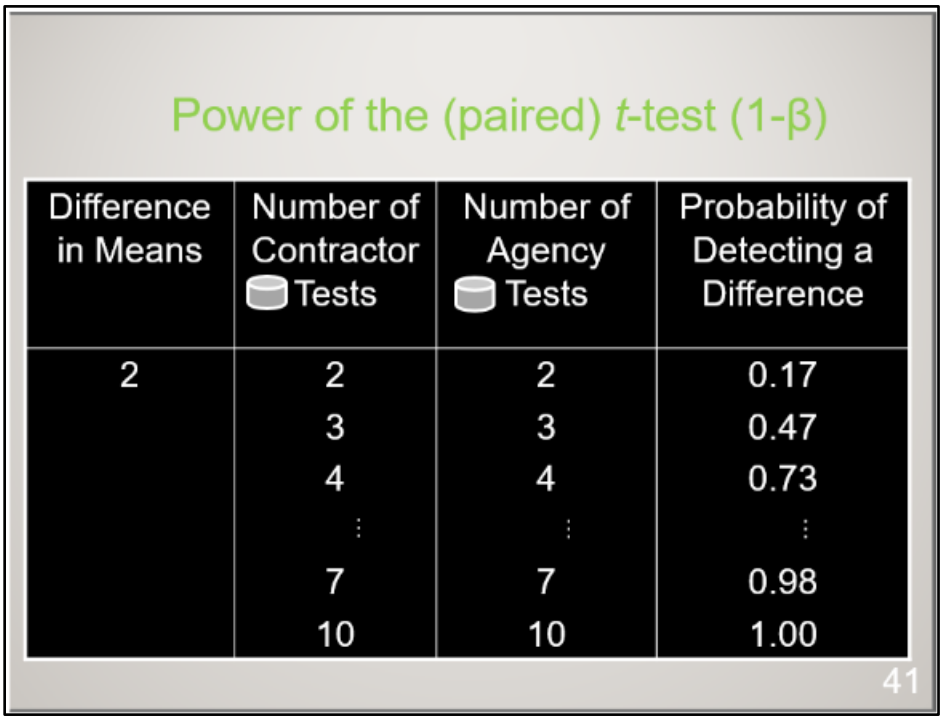


Figure 47: Power of the t-Test.

F- and t-tests use an alpha value of 0.025. The alpha value determines the likelihood of a "false flag" or a failed comparison due to factors other than an actual difference in the population (or material source). Using an alpha value of 0.025, the F-test or t-test will fail 1 in 40 times (or

about 2.5% of the time) when the two datasets are actually from the same population. F- and t-tests “pass” or compare when the p-value from either test is greater than alpha. The alpha value of 0.025 was determined to be the optimal value for alpha by FHWA.

19.2 Volumetric Dispute Resolution Flowchart

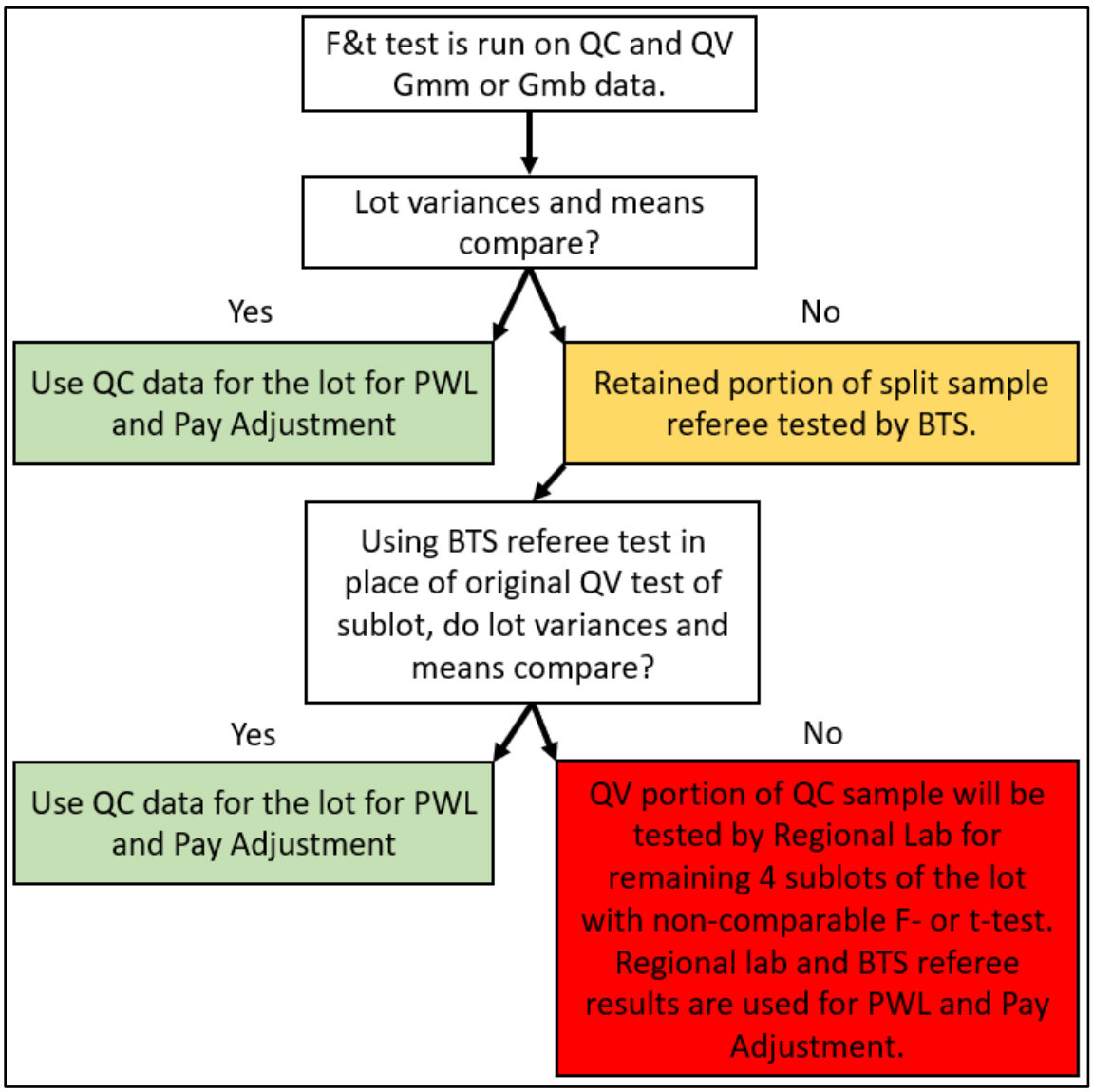


Figure 48: Volumetric Dispute Resolution Flowchart

Notes:

- If the contractor chooses to dispute the Regional Lab and BTS test results, the retained portion of each sublot will be referee tested by BTS and the results used for PWL and pay adjustment.
    - If the pay factor increases, there is no fee for the additional testing.
    - If the pay factor decreases, there is a fee for the additional testing.
    - The spreadsheet will automatically determine if a fee will be assessed.