INDIANA DEPARTMENT OF TRANSPORTATION
Division of Materials and Tests

Directive 112

Failed Materials

In accordance with 105.11 and 106.07, all work or materials which is not in accordance with the contract will be considered unacceptable work, subject to conditions set out in 105.03. Unacceptable work will be designated herein as a Failed Material. Failed Material, in which the materials used or the work performed are not in accordance with 105.03, will be reviewed to determine whether the Failed Material is or is not acceptable. Failed Material that has been determined acceptable will remain in place in accordance with 105.03, and a quality adjustment will be determined in accordance with 109.05.1(d). Failed Material that has been determined not acceptable shall be removed and replaced or otherwise remedied as directed with no additional payment.

Failed Materials Committee

The Failed Materials Committee (FMC) will consist of the following:

1. Director, Division of Materials and Tests, Chair
2. State Materials Engineer – voting member
3. State Construction Engineer – voting member
4. A representative from Pavement or Bridge Asset Management – voting member
5. A representative from Design – voting member
6. Chief Engineer of Construction (Only in the event of a disagreement)
7. FMC Coordinator

The FMC will hold meetings when a determination on a Failed Material cannot be reached by the procedures described below, or when reviewing and discussing a contractor's disagreement of an FMC determination. The Chair will cast a vote only if there is a tie vote among the FMC voting members. The FMC will typically meet on the 4th Wednesday of each month at 1:00 pm. This schedule is subject to change as instructed by the Chair.

The FMC Coordinator will compile and maintain a record of FMC activities, prepare FMC meeting agendas, and oversee correspondence.

Failed Material Procedures

A Failed Material Report (FMR) will be initiated by the District Testing Engineer for each Failed Material. The FMR will be assigned an FMC case number and will report all applicable information listed in Appendix A. The FMR will be sent to the Project Engineer/Project Supervisor, the Contractor, and the FMC Coordinator.

The District Testing Engineer or Chair may determine the matter where designated by this Directive. Otherwise, the FMR will be submitted to the FMC for determination. The submitted FMR will be accompanied by any quality control test results, original acceptance test results, retest results as a result from any disputed original acceptance test results (if applicable), and any additional test results or pertinent information. The appropriate subject matter expert within the Department will conduct an investigation and prepare a recommendation memorandum and a determination letter. The FMC will utilize the recommendation memorandum to make a determination on the Failed Material. The memorandum will be reviewed and approved by the State Materials Engineer prior to review by the FMC.

The FMC will review and consider all information available for each Failed Material to determine whether the failure is or is not acceptable to leave in place, and any necessary quality adjustment. The FMC may set guidelines as necessary to provide for efficiency and uniformity of evaluation of the Failed Material. In the event the FMC requires a prolonged amount of time to make a determination, a memorandum will be sent to the Project Engineer/Project Supervisor and the District Testing Engineer to make them aware.

A determination letter, under the signature of the FMC Chair, will be sent to the Prime Contractor, through the FMC Coordinator, regarding the FMC decision on the Failed Material. Copies of the determination letter will be sent to the District Construction Director, Project Engineer/Project Supervisor, District Testing Engineer, Producer (if applicable), and Committee members.

Disagreements

The Prime Contractor may disagree with the determination of the District Testing Engineer, Chair, or the FMC by sending written notification of disagreement to the Chair, through the FMC Coordinator, within 15 days of the date of written or electronic notification of the Failed Material determination. The Prime Contractor may also request a meeting with the FMC to discuss the details of the Failed Material disagreement. Any request for a meeting and a detailed basis of the disagreement shall be included in the written notification.

Meetings will be scheduled for 30 minutes. The Contractor may invite anyone they deem necessary to the discussion, including suppliers and subcontractors. Meetings are intended to allow the Contractor to provide additional information, explanation, or rationale of which the FMC was previously unaware. The FMC may, but are not required to, share information related to the determination. A resolution to the disagreement will not be made during the meeting. The FMC will invite District representatives and take their concerns into consideration to form a resolution to the disagreement.

Disagreements with FMC determinations are moderated by the Chief Engineer of Construction. A resolution letter under the signature of the Chief Engineer of Construction will be sent to the Prime Contractor, though the FMC Coordinator, regarding the final FMC determination on the Failed Material. Copies of the resolution letter will be sent to the District Construction Director, Project Engineer/Project Supervisor, District Testing Engineer, Producer (if applicable), and Committee members.

Determination by the Chair

The Chair of the FMC is authorized to make a determination on a Failed Material in lieu of a committee when the nature of the Failed Material meets one of the following:

1. For Failed Materials with a credit schedule as defined in Appendix B where the value indicates "FMC."
2. When the Failed Material is deemed a low risk to the safety of the public and lifespan of the asset. *
3. When too much time has elapsed where an opportunity to rectify or improve the Failed Material no longer exists. *

* When a Failed Material is forwarded to the FMC Coordinator, the District Testing Engineer is authorized to request determination by the Chair.

Determination by District Testing Engineer

The District Testing Engineer is authorized to make a determination on Failed Material and assess a quality adjustment for all Failed Materials in accordance with the credit schedule defined in Appendix B. The District Testing Engineer may consult with the Division of Materials and Tests to decide whether additional testing is needed or to verify the contents of the FMR.

APPENDIX A

1. Date of report [dd/mm/yyyy]
2. FMC Case Number
3. Initiator/Author
4. Project Engineer/Supervisor Contact Information, including email address
5. Prime Contractor Contact Information
6. Producer Contact Information (if applicable)
7. District
8. Contract Number with letter prefix
9. Road
10. Location Description
11. Beginning coordinate [GPS]
12. Ending coordinate (if applicable) [GPS]
13. National Bridge Index (NBI) reference number (if applicable)
14. Pavement Key (PK) reference number (if applicable)
15. Contract Item Number
16. Failed Material Category
17. Material Code [xxxMxxxxx]
18. Material Name
19. Original Sample ID number [Ryydssssxxxxx]
20. Retest Sample ID number (if applicable) [Ryydssssxxxxx]
21. Field inspection reports (if applicable)
22. Beginning date material placed [dd/mm/yyyy]
23. Ending date material placed [dd/mm/yyyy]
24. Quantity
25. Unit of Measurement
26. Unit Price
27. Mix ID (if applicable)
28. PE/S Comments
29. DTE Comments
30. Property pay factors and resulting Composite pay factor (if QC/QA HMA) [x.xx]
31. Credit issued (if/when adjudicated by the District Testing Engineer, Chair, or FMC) [$]

APPENDIX B

1. The credits will be cumulative to establish the total credit to be assessed.

2. The quality adjustment will be the actual calculated value of the credit for the material.

3. The pay factors for air voids, Vbe and density of QC/QA HMA will be reduced to 1.00 if the pay factors for these properties are above 1.00.

4. The cost of the investigation to establish the acceptability of the material will be included in the quality adjustment when the material is left in place. A cost of $500 or the actual cost, whichever is greater, will be assessed.

5. The District Testing Engineer will account for all quality adjustments listed in the following tables. Where FMC is indicated, determination by the Failed Materials Committee is required.

6. As described in 401.20, the $500 credit adjustment for appealed sublots that did not result in an improvement to the SCPF or Lot PF, is still in effect. If original results are considered failing, the original SCPF or Lot PF shall be determined using this policy for comparison to appeal results.

QC/QA HOT MIX ASPHALT -- Open Graded Mixtures

Binder Content -- Sublots with a binder content deviation from the DMF greater than 1.0% will be assessed a binder content pay factor of 0.00.

Air Voids -- Sublots with an air void deviation from the DMF greater than 5.0% will be assessed an air void pay factor of 0.50.

QC/QA HOT MIX ASPHALT -- Dense Graded Mixture ≥ One Lot

Lot PWL values for the air voids, Vbe, or in-place density (%Gmm) less than 50 will have pay factors assigned from the following formula and as indicated in the table.

$$PF = \frac{100 - \left(0.000020072x(100 - PWL)^{3.5877}\right)}{100}$$

Pay Factors										
PWL	9	8	7	6	5	4	3	2	1	0
40	0.73	0.71	0.69	0.67	0.65	0.62	0.60	0.57	0.55	0.52
30	0.49	0.46	0.43	0.39	0.36	0.32	0.29	0.25	0.21	0.16
20	0.12	0.07	0.03	FMC	FMC	FMC	FMC	FMC	FMC	FMC
10	FMC	FMC	FMC	FMC	FMC	FMC	FMC	FMC	FMC	FMC
0	FMC	FMC	FMC	FMC	FMC	FMC	FMC	FMC	FMC	FMC

Vbe – Lots with a Vbe PWL < 27 will be assessed a Vbe pay factor of 0.00.

QC/QA HOT MIX ASPHALT -- Dense Graded Mixture < One Lot

Air Voids -- Sublots with an air void deviation from the DMF greater than 2.0% will be assessed an Air Void pay factor as follows:

Deviation	Air Void PF
2.1	0.69
2.2	0.62
2.3	0.55
2.4	0.48
2.5	0.42
2.6	0.35
2.7	0.28
2.8	0.22
2.9	0.15
3.0	0.09
FMC	

Volume of Effective Binder -- Sublots with a Vbe that deviates more than 2.0% below specification minimum will be assessed a Vbe pay factor of 0.00. Sublots with a Vbe that deviates more than 3.5% above specification minimum; FMC.

Vbe	Vbe PF
+3.1	0.70
+3.2	0.65
+3.3	0.60
+3.4	0.55
+3.5	0.50
> +3.5	FMC
> -2.0	0.00

Density -- Sublots with an in-place density (%Gmm) outside of the ranges in 401.19(b) will be assigned a Sublot Composite Pay Factor (SCPF) as follows:

Density, % Gmm		SCPF
Superpave 5		
89.9	98.0	0.53
89.8	98.1	0.50
89.7	98.2	0.45
89.6	98.3	0.42
89.5	98.4	0.38
89.4	98.5	0.35
89.3	98.6	0.32
89.2	98.7	0.27
89.1	98.8	0.23
89.0	98.9	0.20
< 89.0	> 98.9	FMC

HOT MIX ASPHALT (402 HMA)

For assessing a credit to the contract, the following material values will be used:

HMA Curbing ---------- Binder Index @ 7.0% + $15.00/ton aggregate @ 93.0%

HMA for Temporary Pavement
- Base ---------- Binder Index @ 4.5% + $15.00/ton aggregate @ 95.5%
- Intermediate -------- Binder Index @ 5.0% + $15.00/ton aggregate @ 95.0%
- Surface ---------- Binder Index @ 6.0% + $15.00/ton aggregate @ 94.0%

HMA Patching
- Base ---------- Binder Index @ 4.5% +$15.00/ton aggregate @ 95.5%
- Intermediate -------- Binder Index @ 5.0% +$15.00/ton aggregate @ 95.0%

The following credit schedules will be applied to the contract bid price of the mixture:

Mixture

AIR VOIDS	
Deviation from DMF (%)	**% Credit**
>2.0 and ≤ 2.2	5
> 2.2 and ≤ 2.4	10
> 2.4 and ≤ 2.6	20
> 2.6 and ≤ 2.8	30
> 2.8 and ≤ 3.0	50
> 3.0	FMC
BINDER CONTENT	
Deviation from DMF (%)	**% Credit**
> 0.7 ≤ 1.5	5.0 for each 0.1 % above 0.7
> 1.5	FMC

Low Temperature Density

Density, % MSG	% Credit
≥ 98.0	FMC
92.0 - 92.9	0.4 for each 0.1 % below 93.0
91.0 - 91.9	4.0 + 0.8 for each 0.1 % below 92.0
89.0 - 90.9	12.0 + 2.0 for each 0.1 % below 91.0
≤ 88.9	FMC

PERFORMANCE GRADED ASPHALT BINDERS

More than one credit per binder sample may be assessed. The following credit schedule will be applied to the binder index for the month of the failure. Per 902.01(a)2, the failure represents one week of HMA production.

Bending Beam Rheometer		
PAV Material		
Required: ≤ 300 Mpa		
		%Credit
> 300	315	2.5
> 315	330	5
> 330	345	10
> 345	360	15
> 360	375	20
> 375	390	30
> 390	405	40
> 405	420	50
> 420	N/A	*

Bending Beam Rheometer		
PAV Material -- M value		
Required: ≥ 0.300		
		%Credit
0.285	< 0.300	2.5
0.27	< 0.285	5
0.255	< 0.270	10
0.24	< 0.255	15
0.225	< 0.240	20
0.21	< 0.225	30
0.195	< 0.210	40
0.18	< 0.195	50
N/A	< 0.180	*

Dynamic Shear Rheometer (M320)		
RTFO Material		
Required: ≥ 2.20 kPa		
		%Credit
2.10	< 2.20	2.5
2.00	< 2.10	5.0
1.90	< 2.00	10.0
1.80	< 1.90	15.0
1.70	< 1.80	20.0
1.60	< 1.70	30.0
1.50	< 1.60	40.0
1.40	< 1.50	50.0
N/A	< 1.40	*

Dynamic Shear Rheometer, MSCR					
RTFO Material					
Deviation from maximum $J_{nr3.2}$ per M332, kPa^{-1}					
58S-28	%Credit	**58H-28**	%Credit	**58E-28**	%Credit
≤ 0.3	2.5	≤ 0.3	5	≤ 0.3	15
≤ 0.4	5	≤ 0.4	10	≤ 0.4	20
≤ 0.5	10	≤ 0.5	15	≤ 0.5	30
≤ 0.6	15	≤ 0.6	20	≤ 0.6	40
≤ 0.7	20	≤ 0.7	30	≤ 0.7	50
≤ 0.8	30	≤ 0.8	40	> 0.7	*
≤ 0.9	40	≤ 0.9	50		
≤ 1.0	50	> 0.9	*		
> 1.0	*				

* Credits in excess of 50.0 % for an individual test or the accumulation of an excess of 50.0 % for all tests will be determined by the Failed Materials Committee.

For 58H-28 and 58E-28:
If percent recovery (R-3.2) fails per R92, determined by the Failed Materials Committee.

PCC THIN CONCRETE OVERLAY

The following credit schedules will be applied to the contract bid price of the item:

Percent Deduction for Thickness

	CD - DD						
		-0.1	-0.2	-0.3	-0.4	-0.5	< -0.5
ACD - DD	≥0.0	0%	5%	10%	25%	30%	Remove & Replace
	-0.1	4%	10%	15%	25%	30%	
	-0.2		15%	20%	30%	35%	
	-0.3			25%	35%	40%	
	-0.4				40%	45%	
	-0.5					50%	

FMC Sublot Pay Factors for Thickness

	CD - DD						
		-0.1	-0.2	-0.3	-0.4	-0.5	< -0.5
ACD - DD	≥0.0	1.00	0.95	0.90	0.75	0.70	Remove & Replace
	-0.1	0.96	0.90	0.85	0.75	0.70	
	-0.2		0.85	0.80	0.70	0.65	
	-0.3			0.75	0.65	0.60	
	-0.4				0.60	0.55	
	-0.5					0.50	

CD – Core Depth of shortest individual core (inches)
DD – Design Depth of thin PCC overlay (inches)
ACD – Average Core Depth of two cores (inches)
- Defined in Standard Specifications (not a failed material)