

Job-Mix Formula Process

Upon receiving an approved mix design, the Resident Engineer shall forward it to the contractor and request the contractor propose a job-mix formula (JMF). The contractor will submit his proposed JMF to the Resident Engineer for review and approval. After reviewing the proposed JMF and making any necessary corrections, the Resident Engineer will establish the approved JMF and send it to the contractor. The Resident Engineer will also send copies of the approved JMF to the Chief Construction Engineer, Assistant District Engineer, Chief Materials Engineer and District QA Staff. When distributing the approved JMF, it is helpful to attach a copy of the approved mix design.

The first JMF should be JMF No. 1. Subsequent JMFs must be issued if there is a change in any item shown. Additional JMFs will be numbered with the next subsequent number (i.e. 2, 3, 4, 5...). When a JMF has been distributed with typos and/or errors, the corrected JMF will be a revised JMF. The JMF number will not change. However, a letter "R" will be added to the number (i.e. 1R, 2R, 3R...). After JMF No. 1, any required changes and/or revisions should be in **bold** for easy identification.

Example A: The Resident Engineer completed and distributed JMF No. 1 based on the approved mix design. However, recent test results indicate he needs to adjust the combined percent passing target and job-mix range for two sieves. The Resident Engineer will change the combined percent passing targets on the two sieves and adjust the job-mix range accordingly. This job-mix will be JMF No. 2.

Example B: The Resident Engineer completed and distributed JMF No. 1 based on the approved mix design and later notices that it has the incorrect bitumen ratio. The Resident Engineer will revise the JMF to reflect the correct bitumen ratio and redistribute the JMF as JMF No. 1R.

If the Materials Division approves using a previously approved mix design from another contract, JMF No. 1 should match the latest JMF being used on the other contract. The Resident Engineer can contact the Construction Division, Quality Assurance Section for the latest JMF being used for a previously approved mix design.

NOTE: Every contract will have its own set of JMF No's. for each approved mix design.

The approved JMF should include the following: (See Attached Examples)

1. **Lab No. (Mix Design No.).**
2. **Material source(s), asphalt type and producer.**
3. **Bin Percentages.** JMF No. 1 shall reflect the bin percentages shown on the approved mix design. The contractor shall request bin percent changes through the Resident Engineer. The Resident Engineer has the authority to allow up to a 6% total change from the original mix design. The 6% total bin change will also apply if the contractor cannot produce a passing hotdrop. For instance, a 3% decrease on the 3/4" rock bin and a 3% increase on the 3/8" rock bin would be a 6% total change. For bin percent changes in excess of 6% total from the original mix design, Resident Engineers shall contact the Materials Division for their recommendation. Bin percent changes in excess of 10% total from the original mix design, may require a new mix design based on the Materials Division's recommendation.

4. **Combined percent passing targets and allowable operational tolerances.** The combined percent passing targets for JMF No. 1 should match the mix design. If informational test results, prior to or during the hotdrop process, indicate the combined percent passing is different than the mix design, the combined percent passing targets may be adjusted by the Resident Engineer up to +/- 3% per sieve. The combined percent passing may also be adjusted up to +/- 3% by the Resident Engineer to allow the maximum job-mix range. Any adjustments greater than the $\pm 3\%$ should be discussed with the Materials Division. The job-mix operational range is based on the combined percent passing targets and allowable tolerances as stated in Subsection 401.02.02 of the specifications. If test results continually indicate a combined percent passing target is out of the job-mix operational range but within the broadband specifications, the combined percent passing target and job-mix operational range should be adjusted to reflect these test results.
5. **Broadband Specifications.** All JMFs will match the broadband specification range as shown in Subsection 705.03.01 of the specifications for Plantmix Bituminous Surface Aggregates and Subsection 705.03.02 of the specifications for Plantmix Bituminous Open-Graded Surface Aggregates. These specification ranges are the minimum and maximum numbers allowed when establishing the job-mix operational range for the combined percent passing targets. The job-mix operational range must be within the broadband specifications.
6. **Bitumen Ratio.** Per Subsection 401.02.02 of the specifications, JMF No. 1 shall reflect the bitumen ratio shown on the approved mix design. However, the Materials Division may adjust the bitumen ratio based on field trial mixture/s test results. Any further adjustments to the bitumen ratio must be discussed with the Materials Division. A new JMF will be required for any adjustments to the bitumen ratio.
7. **Actual lime percentages and method used, (Marination Method).** Per Subsection 401.03.08 of the specifications, wet cure the coarse aggregates with mineral filler at a minimum rate of 1% of the mass of dry aggregate. Wet cure the fine aggregates at a minimum rate of 2% of the mass of dry aggregate. Fine aggregate stockpiles are defined as having a minimum of 50% passing the No. 4 sieve. All other stockpiles will be treated as coarse aggregate. For this job-mix formula, the coarse stockpiles total 52% (0.52). The fine stockpiles total 48% (0.48). Therefore, $0.52 \times 1 = 0.52$ and $0.48 \times 2 = 0.96$. Thus, the actual total combined lime percentage equals 1.48%. Calculate and show a new lime percentage for any changes to the bin percentages and issue a new JMF.
8. **The use or non-use of baghouse fines.** The use of baghouse fines is not a requirement. However, the use or non-use must be monitored and consistent throughout the duration of the project. Use or non-use of baghouse fines must be noted on the JMF. Per Subsection 401.03.01 of the specifications, the amount of baghouse fines introduced into the mix cannot exceed 2% by dry mass of the aggregate.
9. **Target temperatures for leaving the plant and at the hopper of the paver.** According to Subsection 401.02.02 of the specifications, the target temperature at the plant is a single value selected by the contractor and approved by the Resident Engineer. The actual temperatures may fluctuate +/- 20°F from the target temperature. Subsection 401.02.02 of the specifications state that the maximum temperature of the mixture at the plant shall be 350°F and the minimum temperature of the mixture at the hopper of the paver shall be 300°F. In no case, shall the temperature drop between the mixture leaving the plant and arriving at the hopper of the paver be more than 20°F for dense-grade and 15°F for open-grade.