

Finding the ideal hot mix asphalt pavement mixture

A clear, thorough guide for selecting hot mix asphalt (HMA) pavement mixtures based on current gyratory compaction technology (SuperPave) saves time and energy for engineers and technicians who are involved in specifying HMA paving material for local projects. The Statewide Urban Designs and Specifications (SUDAS) program has provided such a guide in their design manual.

Section 5D-1 (HMA Pavement Mixture Selection) of the SUDAS Design Manual was adapted from Iowa DOT design guidance for local agencies. The Iowa DOT guide did not provide sufficient direction for the unique characteristics of urban areas, such as slower speed, stopping and turning traffic, urban truck volumes, and high traffic volumes. SUDAS tweaked the guide so it is useable for both rural and urban areas.

Michael J. Kvach, executive vice president of the Asphalt Paving Association of Iowa, says that before SUDAS's guide, local agencies and consulting firms around the state all had various processes for making mixture selection. "This obviously made for real problems in the consistency of pavement performance around the state," he says.

"With [the guide's] proliferation across the state," Kvach says, "improperly designed HMA pavements should become a thing of the past."

The guide makes it clear what needs to be calculated in order to decide on the best HMA pavement mixture for any situation. Factors to be calculated include the daily average number of trucks on a street, daily equivalent single axle loads (ESALs), layer designation, and a few other criteria.

Design checklist

By following the easy, step-by-step procedure below, pavement designers can make proper HMA mixture selections based on the pavement loading conditions and the constraints of the owner agency.

1. Determine the level of traffic forecasted in the next 20 years.

2. Understand the pavement section design or rehabilitation strategy.

In order to make the proper mixture selection, the designer must have knowledge of the proposed pavement construction or rehabilitation and intended pavement performance.

3. Determine the regional climate conditions.

Iowa's one-day low pavement temperature ranges approximately 5°C from north to south. Adjusted for 98% reliability, the values range from -29°C to -24°C. The seven-day high pavement temperature across the state varies by 3°C. Adjusted for 98 percent reliability, the pavement temperature values range from 56°C to 59°C. Climate details for a specific location can be obtained from the FHWA website, www.tfhrc.gov/pavement/ltp/bind/download.htm.

4. Compute the anticipated 20-year pavement loading (ESAL20).

The design pavement loading is measured in ESALs. To determine the design ESALs on the project, use the traffic conditions from step 1 and compute the ESAL20 using the methods outlined in Section 5D-1,G, of SUDAS's design manual.

5. Identify any special conditions that impact the pavement.

The standard selection process is based on high-speed traffic with a broad distribution of vehicle types. There are numerous special conditions, such as heavy trucks and seasonal traffic, that may require changes in the standard pavement materials/mixture selection.

6. Select the HMA mixture criteria for each pavement layer.

Using the information developed in steps 1 through 5, select the PG binder grade, mixture size, mix design level (ESAL20), and aggregate properties.

7. Check for availability of materials to meet the mix design criteria.

Review the mix design criteria selected in step 6 and determine if the binder and aggregates required to meet the mix design criteria are readily available or accessible at a reasonable cost.

8. Place mix criteria in the project plans and proposal.

Sample project plans

This section contains an example of what may be included in project plans, which are mentioned in step 8 of the design checklist.

Title page

The traffic and ESAL20 projections should be listed on the title sheet of the plans.

The ESAL20 value should coincide with the selected mix design level.

Typical section

Lift thickness should be shown on the typical section. The lift thickness should match or exceed the recommended lift thickness for the mixture size selected. The lift should be designated as surface, intermediate, or base.

Bid items

Unless otherwise specified, each bid item covers the mixture and binder grade selected. HMA mixture bid items follow the same general format used by the Iowa DOT, as shown in the following example:

HMA (1M ESAL) Surface, 3/8 in., PG 58 -28

The diagram shows the text "HMA (1M ESAL) Surface, 3/8 in., PG 58 -28" with vertical lines connecting it to labels below. "Mix design level" points to "(1M ESAL)", "Lift designation" points to "Surface", "Mix size" points to "3/8 in.", and "Binder grade" points to "PG 58 -28".

For more information

To learn more about HMA pavement mixture selection and view more detailed instructions and charts, go to www.iowasudas.org/documents/5D-1-07.pdf for the PDF version of Section 5D-1, "HMA Pavement Mixture Selection," of the SUDAS Design Manual.

To view the online version of the entire SUDAS Design Manual, go to www.iowasudas.org/design.cfm.

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