

ALDOT 344-83

DESIGN METHOD FOR SELECTING THE GRADE OF RECYCLING AGENT AND OPTIMUM ASPHALT CEMENT CONTENT OF HOT-MIX RECYCLE ASPHALT MIXTURES

1. Scope

- 1.1. This procedure covers the method of designing recycle asphalt mixtures using the Marshall Stability apparatus. This method is for use with mixtures containing aggregate up to 25 mm maximum particle size.

2. Applicable Documents

- 2.1. AASHTO T 49, Standard Method of Test for Penetration of Bituminous Materials
- 2.2. AASHTO T 84, Standard Method of Test for Specific Gravity and Absorption of Fine Aggregate
- 2.3. AASHTO T 85, Standard Method of Test for Specific Gravity and Absorption of Coarse Aggregate
- 2.4. AASHTO T 166, Standard Method of Test for Bulk Specific Gravity of Compacted Hot-Mix Asphalt Using Saturated Surface-Dry Specimens
- 2.5. AASHTO T 201, Standard Method of Test for Kinematic Viscosity of Asphalts (Bitumen)
- 2.6. AASHTO T 202, Standard Method of Test for Viscosity of Asphalts by Vacuum Capillary Viscometer
- 2.7. AASHTO T 209, Standard Method of Test for Theoretical Maximum Specific Gravity and Density of Hot-Mix Asphalt Paving Mixtures
- 2.8. AASHTO T 245, Standard Method of Test for Resistance to Plastic Flow of Bituminous Mixtures Using Marshall Apparatus
- 2.9. AASHTO T 308, Standard Method of Test for Determining the Asphalt Binder Content of Hot-Mix Asphalt (HMA) by the Ignition Method
- 2.10. ALDOT-258, Mechanical Analysis of Extracted Aggregate
- 2.11. ALDOT-307, Design Method For Selecting Optimum Asphalt Cement Content Of Hot Mix Asphalt By Means Of The Marshall Apparatus

3. Evaluate Reclaimed Asphalt Pavement

- 3.1. Determine the asphalt content of the reclaimed asphalt pavement using AASHTO T 308.
- 3.2. Determine the gradation of the extracted aggregate by ALDOT-258.

- 3.3. Determine the viscosity of the reclaimed asphalt at 140°F (60°C) by AASHTO T 202. Plot on left y-axis of Figure 2.
- 3.4. If the viscosity of the reclaimed asphalt is too high to easily measure, measure penetration at 77°F (25°C) and viscosity at 275°F (135°C) by AASHTO T 49 and AASHTO T 201. Using Figure 1, estimate the viscosity at 140°F (60°C).
- 3.5. Plot specification design target viscosity of the final binder. Draw horizontal line at target viscosity.
- 3.6. Select the grade of recycling agent to be used.
- 3.7. Determine percent of recycling agent to use.
 - 3.7.1. Use Figure 2 to determine how much recycling agent is needed to soften the reclaimed asphalt to the desired viscosity.
- 3.8. Check the blend for specification compliance.
 - 3.8.1. The blend must meet the specified asphalt specifications. If the blend does not substantially meet asphalt specifications, select another grade of recycling agent.

4. Test Procedures

4.1. Stability and Flow

4.1.1. AASHTO T 245 shall apply except where amended as follows:

Paragraph 2.4 shall be amended to include the following:

For the double or triple compaction hammers, a pedestal of suitable material and construction may be used, provided results are comparable to the results using the wooden pedestal.

Paragraph 2.5 shall be amended to read as follows:

Specimen mold holder shall be mounted on the compaction pedestal so as to be centered over the post. It shall hold the compaction mold, collar and base plate securely in position during compaction of the specimen.

Paragraph 3.2 shall be amended to read as follows:

Dry the new virgin aggregates to constant mass at 220 to 230°F (105 to 110°C). The reclaimed asphalt pavement should be air dried to prevent any further hardening of the asphalt cement. If moisture is suspected, reclaimed asphalt pavement may be oven dried at 140°F (60°C).

Paragraph 3.4 shall be amended to read as follows:

Proportion by weight the amount by percentages into separate pans of each material required to a batch that will result in a compacted specimen 65 ± 1 mm in height (about 1200 g). Place the pan or pans of the virgin aggregate in the oven and heat to a temperature not exceeding 600°F (316°C). Charge the mixing bowl with the heated aggregate and combine with the ambient reclaimed asphalt pavement. Dry mixes the blend for about 30 seconds to obtain heat transfer and to avoid smoking on addition of the recycle agent. Then add the heated recycling agent at the specified levels and mix until a uniform, complete, coating is obtained. If the mix is too cold to achieve complete coating or too stiff to compact, discard the mix, make new mix at an elevated virgin aggregate temperature.

- 4.1.2. Age the specimens (samples for compaction, samples for maximum specific gravities) in a forced draft oven at compaction temperature for 45 minutes.
- 4.2. Bulk specific gravity of compacted bituminous mixtures.
 - 4.2.1. AASHTO T 166 shall apply.
 - 4.2.2. Prior to testing for stability and flow, the Bulk Specific Gravity shall be determined on the compacted specimen prepared in accordance with AASHTO T 245 as amended.
 - 4.2.3. Average the Bulk Specific Gravities for all compacted specimens of given asphalt content. Values obviously in error shall not be included in average.
- 4.3. Maximum Specific Gravity of bituminous mixtures.
 - 4.3.1. AASHTO T 209 shall apply.
 - 4.3.2. Determine the Maximum Specific Gravity of the asphalt mix for at least two asphalt contents, preferably on mixes at or near the optimum asphalt content and compute average. The Maximum Specific Gravity of the mixes with other contents can be computed as described in paragraph 4.4 of ALDOT-307.

5. Density and Voids Analysis

- 5.1. ALDOT-307 shall apply.

6. Selecting Optimum Asphalt Content

- 6.1. ALDOT-307 shall apply.

7. Determine the Viscosity of the Asphalt Cement at Optimum Asphalt Content.

- 7.1. Extract asphalt cement in accordance with AASHTO T 308
- 7.2. Determine viscosity of reclaimed asphalt in accordance with AASHTO T 202.

- 7.3. If the blend does not substantially meet the specified specifications, select another grade of recycling agent or reduce or increase the amount of reclaimed asphalt pavement.

Asphalt Consistency – Temperature Chart

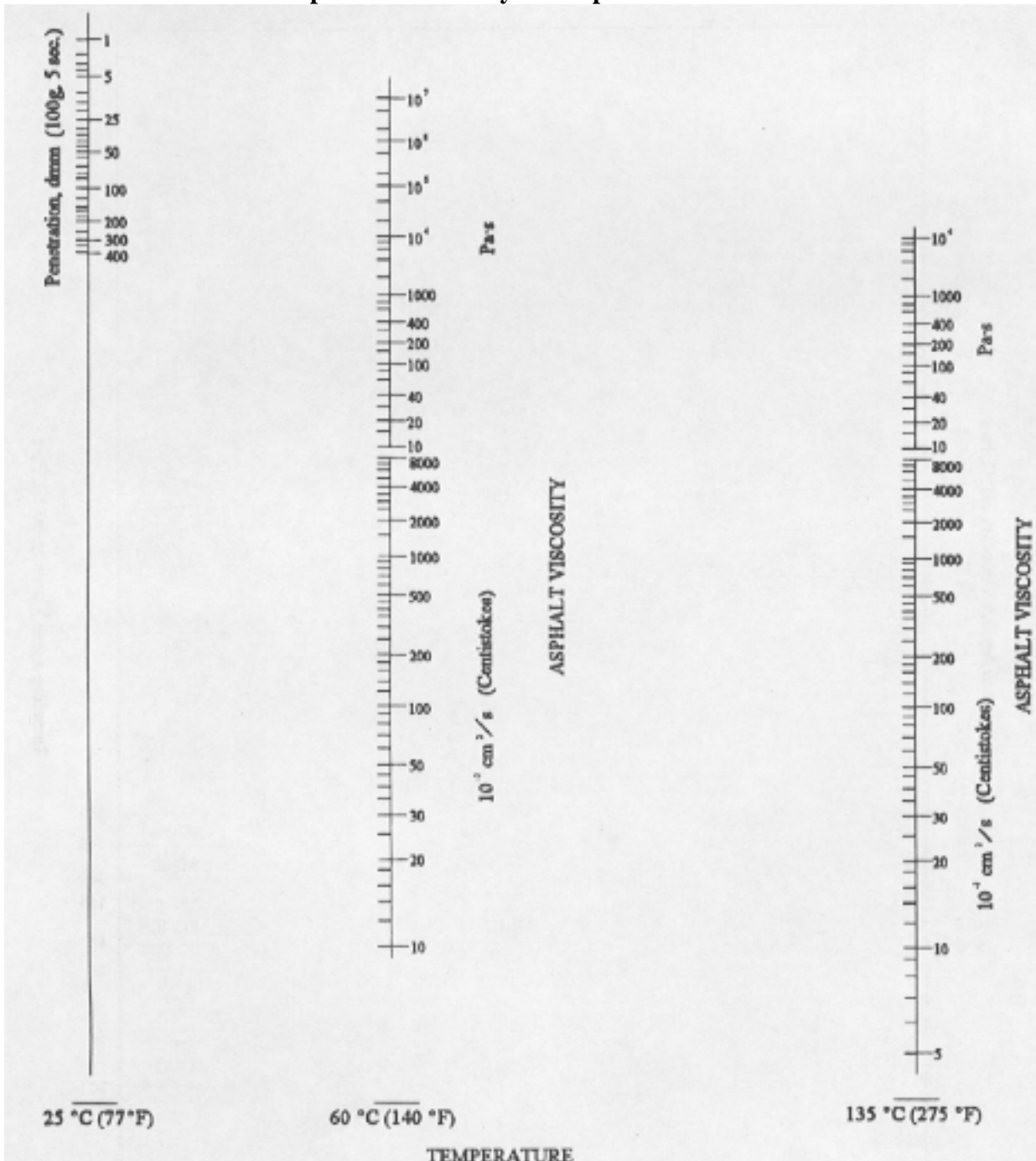


Figure 1

Viscosity Blending Chart

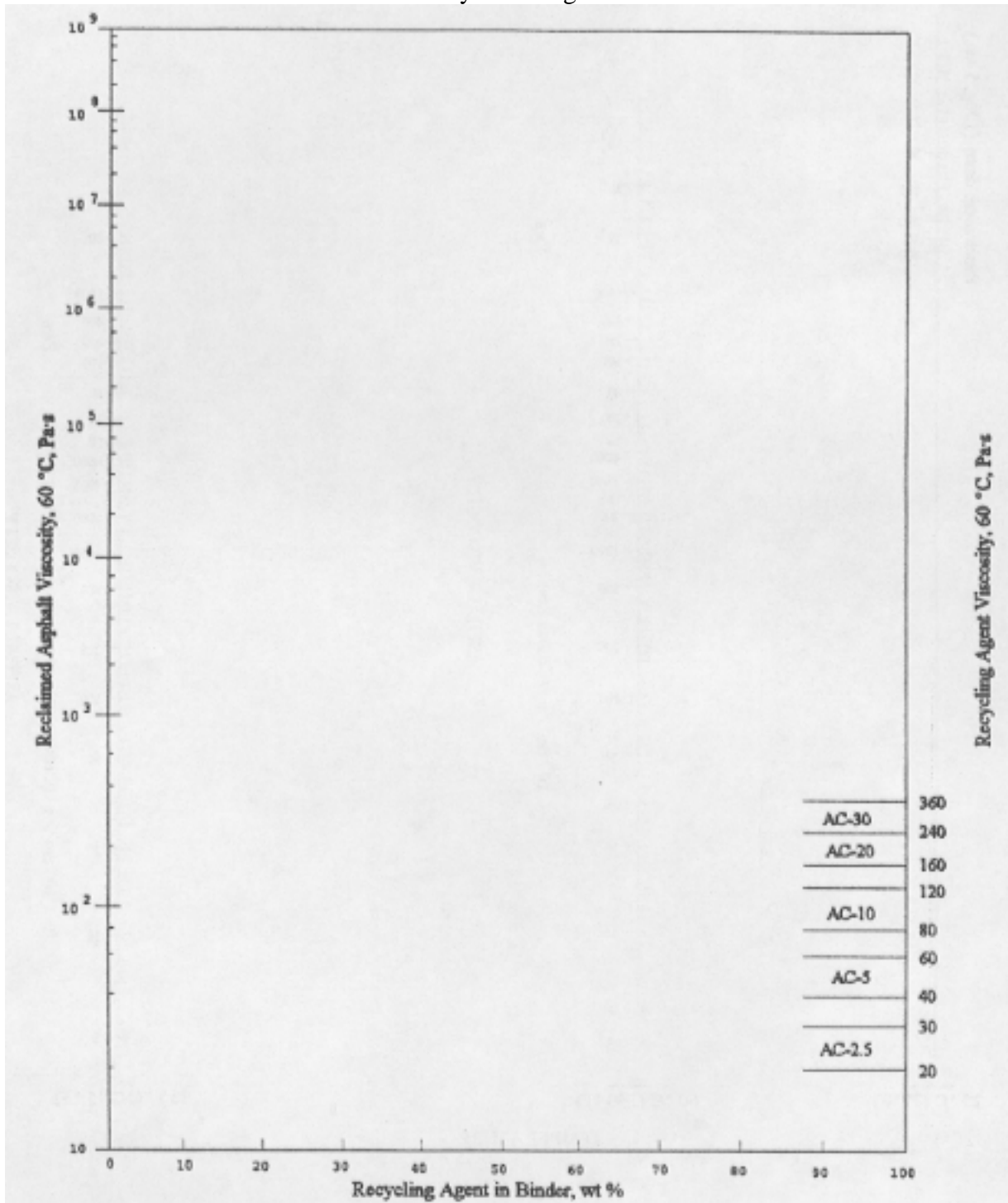


Figure 2