Validating Gyration Levels for Airport Asphalt Mix

Research Team: National Center for Asphalt Technology and University of Nevada, Reno
Sponsored by: AAPTP, in partnership with FAA and NAPA

Federal Aviation Administration (FAA) P-401 and P-403 specifications allow asphalt mixtures to be compacted for testing using either the Marshall hammer or the Superpave Gyratory Compactor (SGC). For decades, the Marshall method has served as the foundation of airfield asphalt design, but as SGC equipment becomes more common, agencies and contractors have questioned whether the two methods yield equivalent results.

This Airport Asphalt Pavement Technology Program (AAPTP) study evaluated the number of SGC gyrations needed to produce airfield asphalt mixtures with volumetric properties equivalent to those achieved using 50- and 75-blow Marshall compaction. Results strongly confirm that current FAA P-401 and P-403 requirements accurately align both compaction approaches, demonstrating that they can be used interchangeably with confidence.

Marshall Hammer

Superpave Gyratory Compactor (SGC)

Benefits

- Confirms that current FAA compaction levels produce consistent volumetric results for both Marshall and SGC methods.
- Builds confidence among agencies and contractors transitioning to SGC equipment.
- Improves laboratory consistency and repeatability between facilities.
- Supports modernization of FAA specifications by validating the SGC framework for airfield pavements.
- Reinforces the foundation for future integration of Balanced Mix Design principles.

Approach

The research team collected and tested 51 airfield asphalt mixtures from projects across the United States, representing a wide range of aggregate sources, binder grades, and climatic conditions. Each mixture was compacted using both the Marshall hammer and the SGC at 50- and 75-level efforts. The resulting bulk specific gravity was compared to determine the number of gyrations that produced equivalent volumetric properties.

Testing procedures followed ASTM D6925 for SGC compaction and ASTM D6926 for Marshall compaction. Additional checks verified that factors such as sample reheating did not influence test outcomes. The team evaluated both within- and between-laboratory variability to assess consistency, and statistical analyses were performed to identify the number of SGC gyrations that matched volumetric properties achieved through Marshall compaction.

Results

The findings showed a wide range of equivalent gyrations to match Marshall hammer compaction for individual P401 and P403 mixtures. On average, however, 50 gyrations in an SGC provided nearly the same specimen density as 50-blow compaction with a Marshall hammer, and 75 gyrations in an SGC closely aligned with 75-blows from a Marshall hammer. Across all tested mixtures, 50-blow Marshall compaction was equivalent to approximately 58 SGC gyrations, while 75-blow Marshall compaction was equivalent to 77 gyrations. These results confirm that current FAA P-401 and P-403 specifications, requiring 50 gyrations for lighter aircraft and 75 gyrations for heavier aircraft, are technically sound and produce equivalent volumetric properties. The study also demonstrated that SGC compaction yields lower variability between laboratories than the Marshall method, improving the consistency and reliability of mix design results. This reinforces SGC's suitability for both design and quality assurance testing and supports a smoother transition for agencies adopting newer compaction equipment and procedures.

Implementation

Agencies and contractors can confidently continue to use either the Marshall hammer or SGC, knowing that existing FAA compaction levels provide equivalent results. For organizations transitioning to SGC, no significant changes to volumetric targets or optimum asphalt content are expected, although minor adjustments may occasionally be needed to remain within specification tolerances.

Because the SGC method demonstrated improved repeatability and easier integration into modern laboratory workflows, its use supports FAA's broader efforts to align airport asphalt design practices with the performance-based approaches being developed under Balanced Mix Design. The results of this project validate FAA's current compaction framework and provide a foundation for consistent, reliable, and performance-driven mix design across airfield projects nationwide.

Download the ***Validation of Gyration Levels for Superpave Gyratory Compactor for Mix Design and Control of Airport Asphalt Mixtures*** report at: https://bit.ly/GyrationLevels.

Additional Resources

For more details, visit: airportasphalt.com

Watch the AAPTP BMD video: bit.ly/BMDAirfieldVideo

For more information, contact:

Richard Willis, PhD
Vice President for Engineering, Research, and Technology, NAPA
rwillis@asphaltpavement.org

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About AAPTP

The Airport Asphalt Pavement Technology Program (AAPTP) is a cooperative agreement effort between the National Asphalt Pavement Association (NAPA) and the Federal Aviation Administration (FAA) to advance asphalt pavements and pavement materials. The AAPTP advances solutions for asphalt pavement design, construction, and materials deemed important to airfield reliability, efficiency, and safety. The program leverages NAPA's unique technology implementation capabilities with assistance from the FAA and industry to advance deployment and adoption of innovative asphalt material technologies.

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