

ASPHALT NEWS

ASBA Executive Summary on Asphalt

May 2015

Asphalt for Athletic Facilities

The purpose of the asphalt guidelines document is to assist ASBA membership with general and specific strategies that should be followed to help make the use of asphalt for athletic purposes (tennis and pickle courts, running tracks, basketball courts, and multiuse courts) successful. It is important to remember the following bullet points as well as the detailed (technical) asphalt guidelines included within as well as previously published by the ASBA in both the Tennis Courts and Running Tracks Construction & Maintenance Manuals, current edition.

Tips for Producing Asphalt for Athletic Facilities

- Specify and Install asphalt for low volume use; base, leveling, and surface.
- Provide Asphalt Surface Course Mix Design with:
 1. Maximum particle size of ½" or less,
 2. Crushed coarse and fine particles,
 3. No aggregates that rust (iron pyrite or steel)
 4. Minimum of 45% sand portion in surface course mixture,
 5. Target laboratory air voids = 3.5%.
- Install asphalt surface course to:
 1. Eliminate cold joints,
 2. Specified minimum in-place density of 94.0%,
 3. Planarity, level, and trueness per ASBA.

“Utilizing the correct asphalt mix design, requiring proper production practices, performing process control, and ensuring acceptable installation follows will lead to compliant asphalt that will not cause athletic coatings or surfaces to fail prematurely.”

*- Timothy R. Murphy, P.E.
Murphy Pavement Technology, Inc.*



Running track with asphalt underlayment.

In The Guideline

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AMERICAN SPORTS BUILDERS ASSOCIATION ASPHALT GUIDELINES

This Guideline is intended to assist owners, contractors, design professionals, and hot mix asphalt suppliers in the design and installation of hot mix asphalt concrete to meet exacting sports construction standards. Because of the wide variation in climate, construction methods, site conditions and materials availability, the services of a qualified and experienced design professional should be obtained before use to ensure suitability for a specific project. The American Sports Builders Association does not represent that this Guideline is suitable for any specific project, disclaims any and all warranties with respect to this Guideline, and assumes no responsibility for the use of this Guideline with respect to any project.

Asphalt for Athletic Uses

Qualified Suppliers

Hot Mix Asphalt (HMA) shall be manufactured from a state approved / certified HMA manufacturing facility. Work consists of one or more courses of HMA constructed on a properly prepared foundation. The low-volume (aka athletic use) asphalt concrete consists of a mixture of dense (aka well) graded aggregate and specified type and grade of asphalt binder. The manufacturing facility shall be capable of producing HMA in accordance with the following requirements and all applicable local agency specifications on an ongoing and consistent basis.

Ensuring uniform material is produced and selecting the vendor for these asphalt projects will require timely submittal of documents and qualifications to the satisfaction of the Owner. Contractor / material supplier shall demonstrate the existence of the following documents:

- Approved vendor certificate for the locality (state / county / city, et. al.) where work is being done,
- Quality Control manual for material production oversight and testing measures being performed both at the asphalt plant as well as on the job site, and
- List / Organizational Chart showing personnel responsible for use of equipment and actions of the crew on the grade while paving and compacting asphalt.

Calibrated equipment and qualified personnel must be accessible at all times during the construction of the HMA. The Contractor installing the HMA shall provide the necessary equipment, materials, and labor to complete the job acceptable to the Owner and in accordance with applicable contract documents. Variations in the size and amount of equipment will depend on the size of the area being paved.

It is imperative that all documents list a “Person-in-Charge” who is responsible for the oversight of the previously listed activities. This individual will be the point of contact for the Owner and shall work with the Owner to ensure timely project completion and specification compliance. This individual shall be knowledgeable in all aspects of asphalt design, production, and



installation and shall be an employee of the Contractor installing the asphalt, even if the HMA is being produced and supplied by a separate vendor.

This individual shall be knowledgeable in all aspects of asphalt mix design, production, and installation and shall be an employee of the company holding the contract with the Owner, even if the HMA is being produced and supplied by a separate vendor. This person shall have authority to take corrective actions needed to make the athletic asphalt fit for use.

Definitions

1. Surface Course – The low volume surface / wearing course shall be installed uniformly, to all finished lines and grades, smooth, durable, impervious thus protecting lower layers, and stable. Workmanship of the finished surface course shall be of the highest industry standards (NAPA, AI, ASBA, and NHI references) and applicable to sports surfaces prior to acceptance by the Owner. The surface course shall be built with a fine-graded, 1/2” maximum aggregate particle size (Nominal Maximum Aggregate Size of 3/8”) or smaller. Surface course shall be installed to a minimum average 1-1/2” compacted thickness; ensure that no thickness of less than 1- 1/4” compacted thickness is placed.
2. Leveling Course – The course and location of the recreational area that requires placement of a variable thickness of HMA to ‘true up’ the area prior to placement of the surface course. This course has a Maximum Aggregate Size (MAS) no greater than that of the surface course.
3. Base Course – The lower courses of the pavement structure below the surface and leveling course with a MAS of between 3/4” and 1”. Base courses shall not be allowed to remain without the surface course placed over an extended period of time and as approved by the engineer. The base shall be kept clean and must be completely dry before proceeding. If the minimum thicknesses shown above cannot be met then install surface mixture as base course.
4. Tacking / Priming – The process of applying one coat of emulsified asphalt to all horizontal and vertical surfaces of either an existing pavement for an overlay or between lifts while building an improved or new structure (tacking), or upon the aggregate base (priming).

Designer Note: For other low-volume, fine-graded asphalt mixtures, if permitted by the Engineer, follow the National Center for Asphalt Technology recommended guidelines shown below for minimum lift thicknesses. [Commentary: Absolute minimum is achieved by specifying 1/4” greater than listed below.]

HMA Mixture NMAAS	NCAT Fine Graded HMA Compacted Thickness, min.
1/2” (12.5 mm)	(3) x 1/2” = 1- 1/2” (2” preferred)
3/4” (19.0 mm)	(3) x 3/4” = 2- 1/4” (3” preferred)



Materials

- Tack Coat and Prime Coat: AASHTO M140 or M208 (Reference the Asphalt Institute MS-19 for Handling, Storage and Application criteria: typically 0.05 gal / sy to 0.15 gal / sy (0.02 gal / sy to 0.05 gal / sy residual AC) depending on the existing surface condition; see Surface Preparation section and current AI and NAPA publications).
 - Tack Coat: SS-1, SS-1h, CSS-1 or CSS-1h diluted with an equal amount of water, or agency acceptable product.
 - Prime Coat: Prime Coat materials of MS-2, CMS-2, or HFMS-2s.

- Hot Mix Asphalt (Low Volume):
 - Aggregates, mineral filler, and asphalt binder shall meet or exceed the requirements of local specifications for asphalt pavements placed under this contract for qualities and types. The coarse aggregate shall be sound, angular crushed stone, crushed gravel, or crushed air-cooled blast furnace slag (not steel). The fine aggregate shall be well graded, moderately sharp to sharp (angular) sands. No aggregates known to cause rust spots or pop-outs (steel slag, iron pyrite, and / or dust balls) are allowed in the asphalt. No recycled concrete is allowed in any of the asphalt mixtures.
 - All HMA mix designs shall be performed in accordance with the Asphalt Institute Manual Series #2 (MS-2), current edition. The HMA mix designs developed shall meet the requirements of one of the following for compactive effort in the laboratory:
 1. Marshall, 50-Blow,
 2. Superpave, 50-Gyrations, or
 3. Hveem, Low Volume Mix.
 4. Alternate **Low Volume** Asphalt Mix Designs may be allowed with the Engineers approval prior to time of bidding.

- HMA Mix Designs shall be performed by qualified personnel with proven past experience and successes in the mix design and quality control of asphalt production. Resumes of the signing “individual-in-charge” may be required by the Owner and shall be supplied if requested. The design shall meet the following requirements and be less than 24-months old. However the mix design method used shall be the Contractors option, as stated previously, based on various methods which currently exist around the nation. A completed design shall be signed by a professional engineer and require submittal of documentation as detailed within this specification. This is required by the Owner in order for the producer to demonstrate knowledge of asphalt mix design and production criterion needed to supply athletic asphalt.

- Bidding documents shall include the Contractors proposed Asphalt Mixture Design sheets. (Ref. Mix Design Submittal Checklist sheet at the end of this document.) Designs will be for HMA to be placed for each of the uses anticipated on each project; patching, base, leveling,



and / or surface course. Different asphalt suppliers shall require different design submittals. In addition to mix designs, submit Asphalt Placement Work Plan, indicating: paving pass widths, paving directions, site access, and timing / coordination of athletic equipment installation (tennis net posts, vault boxes, fencing, etc.) Bid document except the asphalt mix design shall be submitted within 10 days of project award; asphalt mix design cover sheet which summarizes all materials and optimum asphalt content is required with project bidding.

- All submitted HMA mix designs shall have a completed Mix Design Submittal Checklist [Reference last page of these guidelines] and contain at a minimum the following information:
 - All Aggregate Gradations and Quality Measurements
 - Plot (0.45 power graph) of Final Aggregate Blend
 - Bulk (dry) Specific Gravity of All Aggregates and Final Blend (G_{sb}) including worksheets for natural (virgin) as well as reclaimed asphalt pavement (RAP).
 - Statement of Asphalt Binder (PG) being used in Asphalt Mixture
 - Optimum % Asphalt Binder (P_b)
 - Mix Air Voids at Optimum (V_a)
 - Bulk Specific Gravity of Mix at Optimum (G_{mb})
 - Theoretical Maximum Specific Gravity at Optimum (G_{mm})
 - Voids in the Mineral Aggregate (VMA) and Voids Filled with Asphalt (VFA)
 - Dust to total AC Ratio
 - All Design Data and associated Design Curves

Mix Design Method Requirements

Measures	Superpave	Marshall	Hveem
Stability, lbs.	n/a	1,200 min.	30 min.
Flow, 0.01 in.	n/a	8 to 16	n/a
Swell, in.	n/a	n/a	0.030 max.
Air Voids @ optimum AC with 2-hr. aging (cure-time).	3.5%	3.5%	3.5%
VMA based on NMAS			
#4 (4.75 mm)	16.0 min.	16.0 min.	16.0 min.
$\frac{3}{8}$ " (9.5 mm)	15.0 min.	15.0 min.	15.0 min.
$\frac{1}{2}$ " (12.5 mm)	14.0 min.	14.0 min.	14.0 min.
$\frac{3}{4}$ " (19.0 mm)	13.0 min.	13.0 min.	13.0 min.
VFA	73 to 80	73 to 80	73 to 80
Dust to effective AC (design & production)	0.7 to 1.3	0.7 to 1.3	0.7 to 1.3
Tensile Strength Ratio	80% min.	80% min.	80% min.



In addition, all design methods and measures listed above shall meet the following criterion for design and throughout production.

- Base mixes shall have a minimum of 45% passing the #4 sieve,
- Surface and leveling mixes shall have a minimum of 45% passing the #8 sieve,
- Coarse Aggregate fraction shall have a minimum of 85% / 75% crushed faces,
- Fine Aggregate Angularity (AASHTO T-304, Method A), shall be $\geq 40\%$ with no more than 20% natural sand allowed,
- Mix Designs shall include a breakdown factor, increase to minus #200, introduced during the design stage to mimic production values,
- VMA is based on the aggregate bulk (dry) specific gravity, G_{sb} , as determined by AASHTO T-84 and T-85,
- Performance Graded (PG) binder shall meet typical agency specification for new construction low volume roadways, [Reference LTPPBind, current edition; 98% reliability.]
- Reclaimed Asphalt Pavement (RAP):
 - a. May be used up to 20% in the HMA Binder / Base and Leveling Courses.
 - b. May be used up to 15% in the HMA Surface Course.
 - c. Requires a signed and notarized letter stating that no pyrite or steel slag aggregates are within the RAP being utilized is required.
 - d. Requires the G_{sb} of the RAP to be determined and used in VMA calculations, not the G_{se} . The RAP G_{sb} shall be determined after running the RAP G_{mm} and then from calculating the RAP G_{se} minus 0.1 for high absorptive aggregates and RAP G_{se} minus 0.05 for low absorptive aggregates.
 - e. Requires that all RAP shall be crushed and screened over a $\frac{5}{8}$ " screen deck or smaller for Binder / Base and Leveling Courses and $\frac{1}{2}$ " screen deck for surface mixtures; no exceptions.
- Reclaimed Asphalt Shingles (RAS) are not allowed in athletic facilities asphalt,
- Current Quality Control testing of the mixture, aggregates, and RAP proposed to be used on the project shall be submitted to the Owner prior to acceptance of the proposed mix design.

Testing

- Testing required to validate or control the mix supplied is the Paving Contractor's responsibility and will be included in the bid cost for providing these HMA items. Daily maximum theoretical specific gravity (G_{mm}) values must be made available to the Contractor's density technician for verifying in-place density within four hours of start of production. Asphalt content, gradation, and bulk specific gravity (G_{mb}) testing shall be performed on the first day of installation for each product used, then done a minimum of once every 400 tons of HMA supplied or every third day for low tonnages that when added together successively do not equal 400 tons. Acceptable average measures are made by use of a correlated nuclear density gauge, a correlated Pavement Quality Indicator or



PaveTracker (non-nuclear) or by cutting (4) cores per lift, per day and testing per AASHTO T-166, Method C. Additional testing shall be performed on any given day once 400 tons of asphalt is placed on that day.

- The average sub-lot (daily or 400 tons; whichever is less) in-place density measure for surface course mixtures shall be 94.0% of G_{mm} with no value less than 92.5% of G_{mm} . Base and leveling installation of asphalt shall meet local DOT specifications for in-place density measures or average of 92.0% of G_{mm} , whichever is greater. Surface course longitudinal joints shall be measured directly upon the joint, centered upon by core or density gauge, and shall meet the mat density requirements. Base and leveling course longitudinal joint density measures shall achieve between 95% - 102% of maximum achievable individually, with an average of 98% on any given day.
- Process Control testing shall be in accordance with state standards for frequency and methods where the work being performed is done with a minimum of testing meeting the above QC requirements.
- Process Control Voids and minus #200 gradation shall target mix design with no test outside plus / minus 1.0% and VMA shall target the asphalt mix design value or greater, with no test value less than minimum allowed minus 0.3%.
- Print outs of ingredients used shall be supplied for each run of asphalt; data logger or computer screen shot. Print outs shall be supplied daily with the final load of asphalt ticket.

Recommended Means & Methods

Equipment

- Tack / Prime Coat Distributor Truck must have an insulated tank, heating system, and a calibrated distributor capable of maintaining a uniform application of emulsified asphalt under pressure throughout the area to be paved. This requires a pump in good working order, full circulating spray bars, and free flowing nozzles. Small, isolated areas may be tacked with a wand.
- Trucks shall have smooth, clean and tight metal beds that do not have mixture sticking to the truck bed and from which the entire quantity of HMA can be discharged smoothly into the spreading equipment. Trucks shall have a tarp and insulation as needed to protect the asphalt mixture from wind, rain and cold temperatures. Trucks for hauling asphalt mixture shall be in good, safe working condition.
- Paving Equipment must be capable of placing, spreading and finishing courses of HMA to the specified thicknesses. HMA shall be free of marks, segregation and be placed to the required uniform elevation with a smooth texture not showing tearing, shoving, or gouging. Auger extensions are required while pavers are extended beyond the basic screed width. Paving Equipment shall be self-propelled and capable of maintaining the line and grade shown on the plans with suitable electronic equipment. The screed shall be straight and true with no bow and utilizing a vibratory screed. Hand work shall be minimized to ensure the best possible finished surface. It is recommended that paving equipment be equipped with



sonar pods or no contact skis for sports asphalt construction. Additionally, it should be equipped with automatic slope control to maintain required tolerances. Finally, paving equipment should have fully functional screed heaters and joint preheaters.

- Rollers shall conform to the manufacturer's specifications for all ballasting. At least one vibratory roller shall be required for each project with two rollers required as a minimum. (Three rollers shall be required when tonnage is greater than 300 tons / day.) Rollers shall be of good condition and capable of compacting the HMA to the minimum in-place density required by this specification.

Surface Preparation

1. Repair pavement failures and perform crack repair according to specification requirements prior to HMA installation.
2. Cold-milling and/or grinding may be necessary to ensure that the asphalt edges at concrete abutments such as approaches, sidewalks, curbing, and drainage basins have smooth transitions.
3. After site review, detail whether wedge milling is necessary to assure positive drainage and transition. Install leveling course, if required, on the project per the site details and quantities shown on the plan sheets.
4. Existing surfaces to receive HMA must be clean prior to the installation of any portion of the work. Clean the surface on which the asphalt concrete is to be placed, and keep it free of accumulations of materials that would contaminate the mixture, prevent bonding, or interfere with spreading operations. Methods used may include but not be limited to the use of a sweeper that can wet and vacuum the area free of dirt and debris, clay, and dust, or any other foreign material.
5. Any oil or grease spots shall be scraped and treated to prevent bleeding through the tack coat. Bad oil spills may require removal with a wire brush or other suitable tool. Maintain clean pavements prior to applying emulsified tack coat. When approved sub-grade or pavement courses previously constructed under the Contract become loosened, rutted, or otherwise defective, the Contractor must correct the deficiency according to the contract item or items involved before the spreading of a subsequent pavement course.
6. If subsequent lifts are laid beyond 24 or 48 hours, apply tack coat at the diluted rate of 0.05 gal / sy (0.02 gal / sy residual AC) over newly constructed asphalt leveling or base mixes, 0.10 gal / sy (0.04 gal / sy residual AC) over existing asphalt pavements and 0.15 gal / sy (0.05 gal / sy residual AC) over milled surfaces. The higher rate shall be used on dry and brittle surfaces. All vertical edges abutting proposed asphalt surfaces shall receive a tack coat. Excessive asphalt applications, drooling, or pooling shall be swept with a broom to ensure proper bonding of the HMA. Install the HMA after the asphalt



emulsion has 'broken'; i.e. turned from a brown to a black color, indicating water has evaporated. If pick up occurs, wait until emulsion cures.

7. If shown on the plans, apply prime coat at the diluted rate of 0.30 gal / sy over newly placed aggregate base course prior to the installation of the base asphalt.
8. Install tack / prime coat during appropriate weather conditions and protect the tack / prime coat from traffic so as not to wear and track. Allow the tack / prime coat to 'break', i.e. turn from brown to black prior to installation of the HMA.
9. Perform work in appropriate weather conditions that are dry with no rain, snow, or other forms of precipitation falling or imminent (anticipated during installation of the HMA).

Pavement Placement

10. Install HMA which shall generally arrive on the project between 270 – 300° Fahrenheit (see producer recommendation) asphalt in accordance with above weather conditions and with a temperature of 50° F. and rising for all asphalt lifts.
11. Establish an acceptable rolling pattern with the assistance of a density technician on the first day of construction. Record temperatures, equipment, rolling pattern, and in-place density results throughout the project.
12. Surface course longitudinal joints shall be smooth and true; no deviation from level and true as required of the mat will be allowed. Detail and submit to the Owner a paving plan on the site plan sheet prior to placement of asphalt.
13. The entire athletic surface course shall be paved on the same day. The timing and process should be discussed with and approved by the Owner before proceeding with the work. If a cold seam will occur it must be agreed to with the Owner in advance such as: occur near or at a planned saw and seal joint or under the fence line.
14. Rolling shall start as soon as the HMA can be compacted without displacement. Rolling shall continue until the HMA is thoroughly compacted and all roller marks have disappeared. Compact the HMA to a minimum in-place density of 94.0% of the Theoretical Maximum Specific Gravity, G_{mm} . [Reference density pay factor table.]
15. Smoothness shall meet the requirements of no greater than 1/4" in 10 ft. for base and leveling courses and 1/8" in 10 ft. for surface course. [Reference ASBA manual.]
16. Thickness of the overall mat shall be within 1/4" (surface course, no minus) of the specified plan thickness at all locations. However, the yield for the day and for the entire site shall meet calculated theoretical based on 94% of G_{mm} supplied from the Contractors mix design and daily test values.



17. Paving Joints [Install / build control joints per the Architectural Drawings.]
 - Minimize construction, longitudinal, and transverse joints left open for an extended period of time.
 - Construct longitudinal joints by paving in a hot fashion with a temperature of not less than 220°F to ensure maximum performance.
 - Compact all joints to provide for a neat, uniform and tightly bonded joint that will meet both surface tolerances and density requirements.
 - Cut straight and true (vertical) construction or transverse joints if the material has cooled to less than 220°F prior to the placement of the next pass to ensure the best performing joint possible.
 - Off-set joints a minimum of 6” between lifts of asphalt.
18. Allow positive drainage off of the athletic facility and towards drainage outlets. Any ponding of water is not acceptable and shall require correction or replacement at the Contractor’s expense and as directed by the Engineer. Please reference the ASBA Tennis Construction & Maintenance Manual or ASBA Running Tracks Construction & Maintenance Manual for ponding tolerances. Flood pavement areas as directed by the Owner and in the presence of the Architect / Engineer and surfacing contractor to determine positive drainage acceptability.
19. Protect the HMA until such time that coating can be placed upon the properly compacted asphalt, particularly during other construction activities between asphalt installation and athletic surface installation.
20. If excessive segregation is occurring during placement operations, the Contractor will investigate the cause(s) and make appropriate changes to the satisfaction of the Owner. [Reference AI MS-22.]
21. Excessive leveling and smoothness correction required to be performed by the surfacing contractor shall be the responsibility of the paving contractor.

Work Timeliness

HMA Full-depth pavements / Overlays (a/k/a Resurfacing): The repairs, HMA overlay, and coating shall be accomplished in such a manner as not to unduly delay the progress of the project. Every attempt should be made to complete the surface course placement process in one continuous placement with no cold joints. The timing and process should be discussed with the Owner before proceeding with the work.

Site Specific Identification, Contractor shall:

- Remove all waste materials from the site and dispose of according to local ordinances.
- Complete all work in compliance with the American Sports Builders Association (ASBA) requirements or as modified here, whichever is more restrictive.
- Notify Owner when work is complete.



- Supply Owner with Notarized Certificate of Compliance for all products used on the project.
- Supply Owner with yield calculations for all products used on the project. (for example, placement of 1,300 sq. yds. of Hot Mix Asphalt, 1-3/4" compacted thickness will require 128 tons when the unit weight = 150 pcf.)

References:

Asphalt Institute, Lexington, KY [MS-2, Asphalt Mix Design and MS-22, Asphalt Construction.]
National Asphalt Pavement Association, Lanham, MD. [Athletic Asphalt.]
National Center for Asphalt Technology [HMA Materials, Mixture Design, and Construction.]
American Sports Builders Association [Construction and Maintenance Manual.]



Mix Design Submittal Checklist

Project: _____ **Date:** _____

Supplier: _____ **Mix Design:** _____ Surface / Leveling / Base

Included	Missing	N/A	Required Information
			Contractor to select mix design method: (design shall be less than 24 months old)
			50-Blow Marshall
			50-Gyrations Superpave
			Hveem, Low Volume
			Other, Engineers Approval Req'd Before Bidding
			Proper Authorizing Signature for Mix Design
			All Aggregate Types, Gradations & % Crush
			FAA >= 40%, Maximum of 20% Natural Sand
			Plot (0.45 Power Graph) of Final Aggregate Blend
			Bulk (Dry) Specific Gravity of All Aggregates and Final Blend (Gsb), Include All Worksheets
			Optimum Binder Content (Pb)
			Mix Voids at Optimum (Va)
			VMA at Optimum
			Bulk Specific Gravity of Mix at Optimum (Gmb)
			Theoretical Maximum Specific Gravity at Optimum (Gmm)
			Dust to Total AC Ratio
			All Design Data and Associated Design Curves
			Recent Quality Control Production Charts
			Other Information per Specifications
Comments: _____			