2022
Sport Court DESIGN GUIDE

WAPA
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Sport Court Design Guide
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Foreword

Purpose of this Guide

Outdoor public sport courts have become an increasingly popular attraction. These courts, which often use asphalt materials in their design and construction, can help a community demonstrate its investment and commitment to its residents by increasing an area's aesthetic appeal, adding safe areas for socialization and promoting exercise and fitness.

As consumer demand for sport court installations continues to rise, the Wisconsin Asphalt Pavement Association (WAPA) has developed the 2022 Sport Court Design Guide to provide general guidance and an overview of the construction process. While the playing surface materials on athletic sport courts/running tracks may vary, the steps involved in constructing the asphalt layers below the surface are generally the same.

This guide is intended to assist owners, contractors, design professionals, and hot mix asphalt suppliers in the design and installation of hot mix asphalt for athletic purposes; however, it is not intended to serve as a replacement for any project-required specification. As a result of the wide variation in construction methods, site conditions and materials availability, WAPA recommends consulting the services of a qualified and experienced design professional prior to using this guide for any specific project.

This document will reference the WAPA Asphalt Pavement Design Guide (**wispave.org/designguide**) regarding material requirements and selections for use. Additional information and guide specifications for the construction of asphalt athletic facilities are available from the American Sports Builders Association (ASBA) and other resources listed at the end of this document.

WAPA's Objectives

WAPA and its members are dedicated to fulfilling the following objectives:

- Maintaining strong working relationships through partnerships with industry leaders, governmental agencies, and transportation construction organizations.
- Educating professional engineers, government employees, and the public at large about the latest advancements in asphalt technology as well as the advantages and benefits of asphalt pavements.
- Promoting public interest in the durability, sustainability, economic responsibility, safety features, and other benefits gained through the use of asphalt materials.
- Providing guidance and solutions through proper planning, analysis, design, construction techniques, and maintenance to help keep asphalt the pavement of choice in Wisconsin.

The ultimate quality of an asphalt paving project is directly related to the experience, skill, professionalism, and equipment of the contractor doing the project. This is why WAPA urges consumers to be sure that bidders for their asphalt paving projects are properly qualified asphalt pavers.

WAPA takes pride in presenting the 2022 Sport Court Design Guide and will be happy to provide readers with additional information.

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1 Introduction

1.1 Using Asphalt for Sport Courts

Across the United States, asphalt is the preferred foundational material for outdoor sport court construction projects. It's an even more logical solution for use here in Wisconsin, where extreme temperature changes and humidity levels can wreak havoc on other types of materials. It offers additional advantages as well, such as:

- **Comfort.** The softness of asphalt materials put less stress on a player's joints.
- **Cost-Effectiveness.** Asphalt is an economical and easy-to-maintain material.
- **Durability.** Asphalt pavements are relatively weather resistant and can be constructed to need only periodic maintenance.
- **Adaptability.** Asphalt offers excellent adhesion for many surface types to meet a variety of sporting needs.
- **Reliability.** Asphalt holds paint well, ensuring lines and boundaries remain vibrant over time.
- **Safety.** Asphalt offers high skid resistance, giving players the confidence they need to perform their best.

1.2 Common Types of Sport Court Applications

Asphalt pavement can be used as a surface for any outdoor activity requiring a hard surface. The most common sporting applications for asphalt pavements are tennis courts, basketball courts, pickleball courts, and running tracks.

As discussed in Chapter 5, asphalt can also be used beyond the court to improve players' experience. A paved apron around the court of play extends the usable area, while edging around the perimeter of the court adds an attractive finishing touch. Finally, an asphalt parking lot and pathway to the court allows players and spectators to easily access the space.

1.3 Organization of this Guide

This guide is organized into the following chapters:

- **Chapter 2. Supply and Workforce** identifies the issues to address before choosing a contractor/material supplier for the design and construction of a sport court.
- **Chapter 3. Court Design** provides an overview of common asphalt sport courts and the locational issues that should be considered.
- **Chapter 4. Materials and Hot Mix Asphalt Mixture Designs** gives technical details regarding asphalt pavement designs.
- **Chapter 5. Site Grading/Subgrade Preparation** provides information for selecting and preparing a site.
- **Chapter 6. Construction** offers recommendations for successfully installing a sport court.
- **Chapter 7. Repair, Reconstruction and Renovation** supplies solutions for fixing aging or deteriorating courts.
- **Chapter 8. Cleaning and Care Instructions** suggests recommendations for maintaining a completed sport court.
- **Chapter 9. Steps to Ensure a Successful Project** summarizes guidance from the American Sports Builders Association (ASBA).
- **Chapter 10. References and Links** provides a list of the resources used in this publication.

2 Supply and Workforce

2.1 Qualified Suppliers

Construction of an athletic sport court consists of one or more layers of hot mix asphalt (HMA) placed on a properly prepared foundation. The low-volume asphalt mixtures used for athletic purposes consist of a blend of dense/well-graded aggregates and specified type(s) and grade(s) of asphalt binder.

The manufacturing facility should be capable of producing HMA in accordance with requirements detailed in this guide and all applicable Wisconsin Department of Transportation (WisDOT) specifications on an ongoing and consistent basis. Please contact a WAPA member or the WAPA office if you would like additional information regarding mixtures produced within the state of Wisconsin. A list of WAPA members can be found on WAPA's website at **wispave.org/member-listing**.

Additional information regarding quality asphalt pavements can be found in Chapter 2 of the **WAPA Asphalt Pavement Design Guide.**

WAPA recommends that the contractor/material supplier demonstrate the ability to provide the following:

- Program oversight and quality control of testing measures performed both at the asphalt plant and on the job site.
- A list or organizational chart showing key personnel and their responsibilities at the asphalt plant or laboratory.
- The necessary equipment, materials and labor to install the HMA in accordance with applicable contract documents.

In addition, WAPA recommends the contractor appoint a single person to be responsible for overseeing the previously listed activities and to serve as the point of contact for the owner. This individual should be knowledgeable in all aspects of asphalt mix design, production and installation, and have the ability to authorize any necessary corrective actions or adjustments.

2.2 Workforce Considerations

HMA full-depth pavements, overlays, repairs and coatings should be completed in such a manner as not to unduly delay the progress of the project. Every attempt should be made to complete the upper layer placement without cold joints. The timing and process should be discussed with the owner before proceeding with the work.

3 Court Design

3.1 Overview

Traditional sport courts are comprised of four different layers: subgrade, aggregate base course, hot mix asphalt, and playing surface.

The bottom layer, or the *subgrade layer*, is intended to serve as a barrier between the ground, preventing roots and organic matter from damaging the court. This layer also provides a soil base with a consistent line and grade to support the court's construction.

The second layer, or *aggregate base course*, accommodates proper subsurface drainage and protects the court from frost damage.

The third layer, or *HMA layer(s),* vary greatly depending on the application but is designed to create a stable surface atop which the playing surface will be placed.

The fourth and final layer is called the *playing surface layer*. This is the layer that's visible when looking at a sport court. There are many different playing surface types and coatings, all of which perform best when placed over smooth, sustainable asphalt properly constructed by a qualified contractor.

Additional material details and specifics are provided in Chapter 5 of this Guide.

3.2 Orientation Relative to the Sun

When evaluating the location of an athletic sport court design, it should be laid out to minimize players looking into the sun when serving or when following the flight of a ball. The court should also be laid out to avoid distracting shadow lines and patterns on the court surface in accordance with the ASBA.

It is not unusual to orient a sport court to match a specific season. Courts in the northern United States, for example, are generally used from late April to October. Therefore, northern courts usually are oriented according to the summer solstice occurring approximately mid-season and, therefore, an average of the varying solar angles during this period.

Orientation can be more specific. If a court is to be used most often in the afternoon hours during the spring, as is the case with many collegiate facilities, the court should be oriented west of north for the months of April and May to minimize conflict with the afternoon sun. If the court is to be used for a specific tournament held at the same time each year, the court can be oriented properly for the actual hours of play of the final match. Additional information is provided by the ASBA and can be found at **https://sportsbuilders.org/**.

3.3 Location Relative to Other Factors

Orientation also should take into consideration other structures and features on the site, neighboring property, vehicle and pedestrian traffic and prevailing winds. Property lines, zoning requirements, topography of the site and efficient site utilization should be considered as well.

Another consideration when choosing a sport court site is trees and existing vegetation. Trees in close proximity to the sport court's site should be removed to prevent damage to the court surface from roots, debris, shadowing and staining.

3.4 Court Layouts

Tennis

The basic layout for a tennis court is illustrated below in **Figure 1**.

A single court is typically a minimum of 60 feet by 120 feet, while a double court is 120 feet by 114 feet and 120 feet by 168 feet for a triple court.

Additional references and full details can be found on the **ASBA's Court's Division website**.

Back Space

Tournament tennis requires a minimum of 21 feet from base line to fixed obstruction (i.e., backstop, wall, etc.). In non-tournament play, this distance may be reduced to 18 feet.

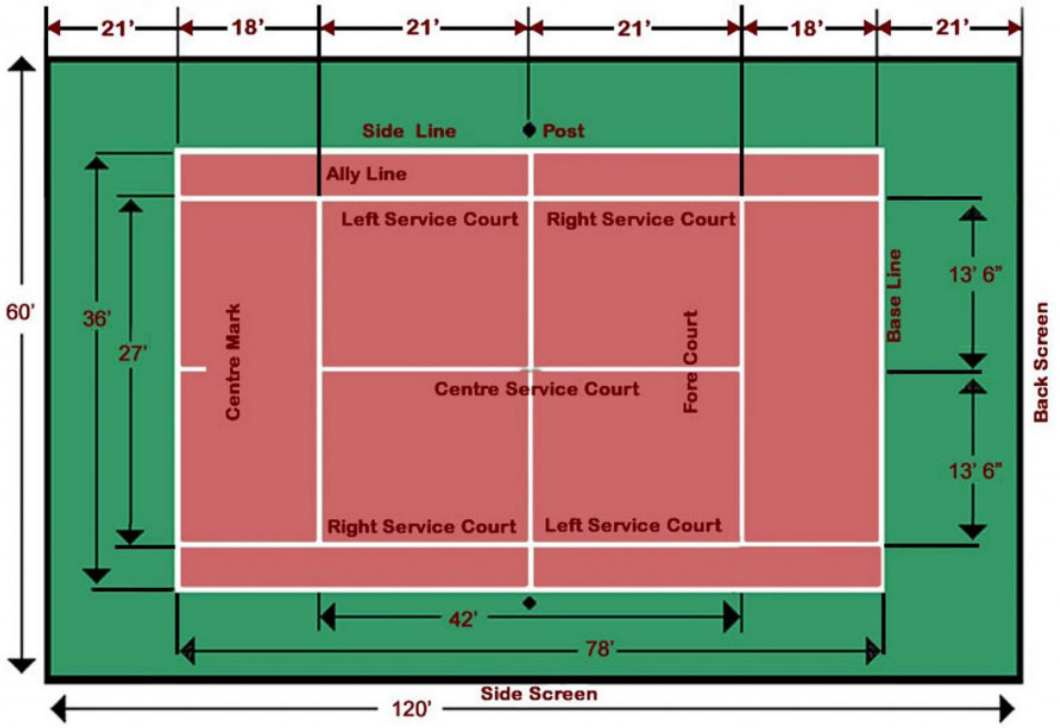

Figure 1. Layout of a Tennis Court.[1]

Side Space

No less than 12 feet is required from the sideline of a tennis court to a fixed obstruction (i.e., side stop, light pole, wall, etc.). Where courts are in battery and where netting is used between courts, the netting is considered to be a movable obstruction, in which case 9 feet is considered a minimum between sideline and netting. This dimension does not restrict obstructions at the net line, such as the net post of the adjacent court or light standards.

Clearance Between Courts

Where courts are constructed within the confines of a common enclosure, the distance between side lines should be not less than 12 feet. Where space permits, additional space between side lines is recommended to enhance play.

Overhead Clearance

The space directly above the area within the playing lines should be free from any overhead obstructions for outside play. Obstructions should be at least 21 feet above the baseline, but 38 feet is recommended over the net line.

Stadium-Tournament Court

For tournament play where judges are required, a clear area a minimum of 70 feet by 130 feet should be provided. This allows a minimum clear playing area of 60 feet by 120 feet with an additional perimeter area for judges as well as a safe overrun area for the players.

Basketball

Common basketball court dimensions are as follows:

- NBA/NCAA regulation basketball court dimensions are 94 feet long by 50 feet wide.
- High school basketball courts measure 84 feet long by 50 feet wide.
- Jr. high school basketball courts measure 74 feet long by 42 feet wide.

An illustration of an NCAA-regulation basketball court is depicted in **Figure 2**.

A half-court, which is precisely half the size of a full-size basketball court, can offer a great solution for smaller outdoor areas.

Pickleball

The official USA Pickleball Rulebook states that "2.A.3. The minimum playing surface measures 30 feet wide and 60 feet long." **Figure 3** shows an illustration of a pickleball court.

1. Image courtesy of Virginia Asphalt Pavement Association. This drawing is intended only for purposes of example and should not be used for design.

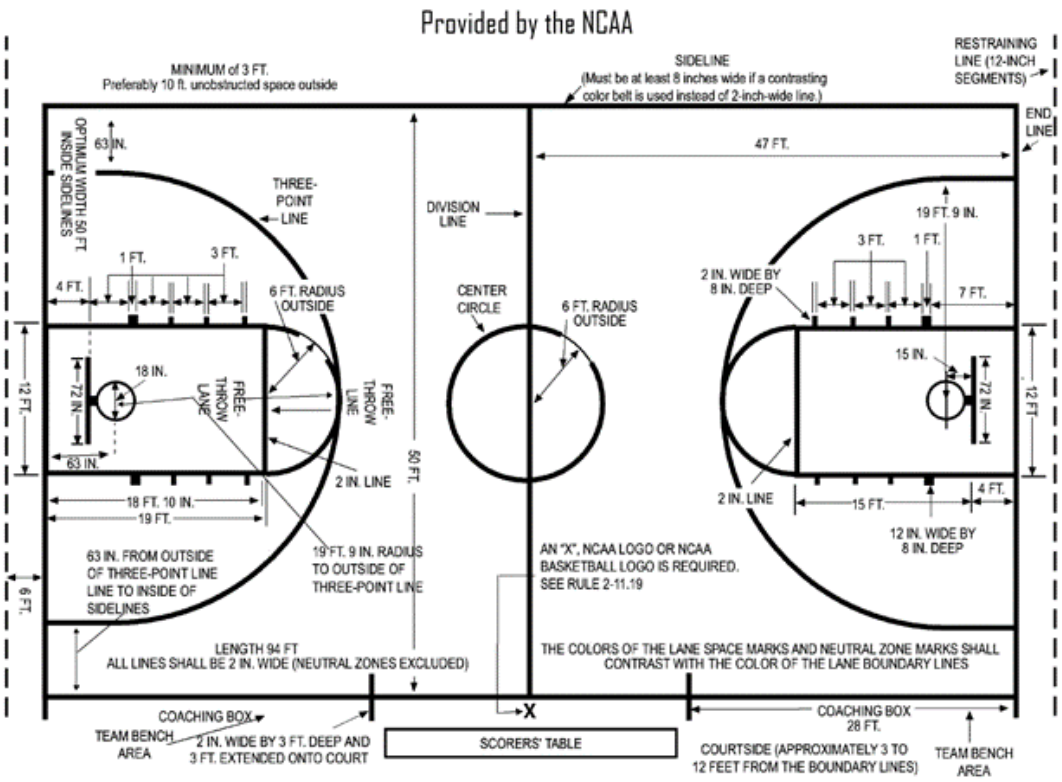

Figure 2. Layout of a Basketball Court.[2]

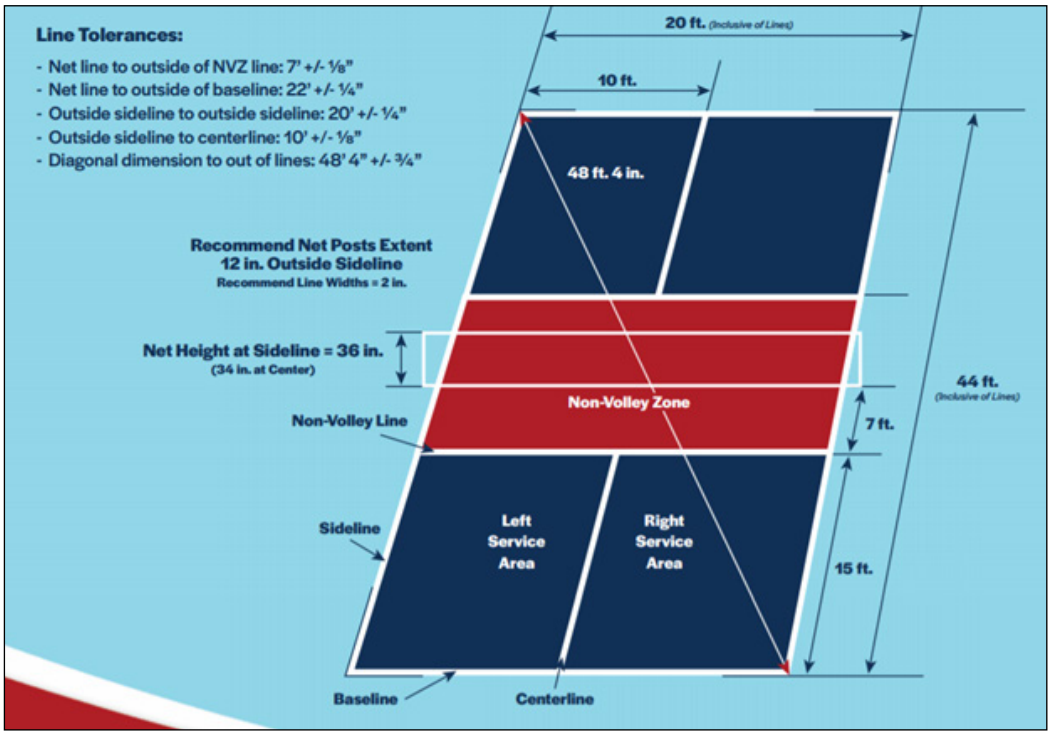

Figure 3. Diagram of a Pickleball Court.[3]

2. Image courtesy of NCAA. This drawing is intended only for purposes of example and should not be used for design.
3. Image courtesy of USA Pickleball. This diagram is intended only for informational purposes and should not be used for design.

4 Materials and Hot Mix Asphalt Mixture Designs

4.1 Hot Mix Asphalt Mix Design Recommendations

Mix designs should be created in accordance with the WisDOT Mix Design Method, or alternatively the Asphalt Institute Manual Series #2 (MS-2), current edition or equivalent. The HMA mix designs developed should meet the Superpave Method for compactive effort in the laboratory meeting the requirement of a WisDOT LT HMA Mixture.

Alternate low volume asphalt mix designs may be allowed with the Engineer's approval prior to time of bidding (Asphalt Institute MS-2 50-gyration mix).

The mix designs should be approved prior to use, and any WisDOT design being used should be approved for the current construction year. Additional information can be found in Chapter 4 of the **WAPA Asphalt Pavement Design Guide**.

Aggregate Recommendations

Master gradation ranges for aggregates used in asphalt mixtures are specified by WisDOT as shown in Table 1. The aggregate blend should consist of hard durable particles containing no more than a combined total of one percent, by weight, of lumps of clay, loam, shale, soft particles, organic matter, adherent coatings, and other deleterious material when tested according to AASHTO T112. If the blend contains materials from different deposits or sources, the material from each deposit or source should be verified to meet the minimum requirements listed in Table 2 on page 7.

Performance Graded (PG) Binder Recommendations

Binder(s) should meet typical agency specification for new construction on low volume roadways (WisDOT PG58-28/ southern region and PG58-34/northern region). The typical binder designation used is an “S,” or standard grade; however, for increased durability and protection from weathering an "H" grade binder is recommended. Additional details regarding binder designations can be found in Chapter 3 of the **WAPA Asphalt Pavement Design Guide**.

Recycled/Reclaimed Asphalt Materials (RAM) Recommendations

Reclaimed Asphalt Pavement (RAP), with percentages given by total weight:

- May be used up to 20 percent in the Lower Layer and Leveling Layers

The current ASBA Tennis Courts Construction & Maintenance Manual does not recommend the use of RAP in the upper layer. However, per the ASBA Asphalt Guidelines if documentation can prove/show that all the aggregates within the RAP are hard, uniform, free of contaminants, and won't rust, then RAP is allowed at the architect's/engineer's discretion. WAPA advises no more than 15 percent RAP in the upper layer.

All RAP should be crushed and screened over the appropriate screen deck to minimize any "oversized" material, based on the hot mix asphalt NMAS size of the mixture being used.

- No Reclaimed Asphalt Shingles (RAS) are allowed in athletic sport court facilities HMA regardless of layer.

Table 1. Aggregate Gradation Master Range and VMA Requirements

Sieve	Percent Passing by Designated Sieves (Nominal Size)			
	No. 3 (19.0mm)	No. 4 (12.5mm)	No. 5 (9.5mm)	No. 6 (4.75mm)
25.0mm	100	–	–	–
19.0mm	90 - 100	100	–	–
12.5mm	90 max	90 - 100	100	–
9.5mm	90 max	90 - 100	100	–

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	No. 3 (19.0mm)	No. 4 (12.5mm)	No. 5 (9.5mm)	No. 6 (4.75mm)
4.75mm	—	—	90 max	100
2.36mm	23 -49	28 - 58	32 - 67	90 max
1.18mm	—	—	—	30 - 55
0.60mm	—	—	—	
.075mm	2.0 - 8.0*	2.0 - 10.0*	2.0 -10.0*	6.0 - 13.0*
% VMA	13.0 min	14.5 min	15.5 min	16.0 - 17.5
* These values should include additional amount of anticipated breakdown during production.				

WAPA recommends that submitted HMA mix designs should contain the following information:

- Individual aggregate gradations and consensus property data.
- Plot (0.45 power graph) of final aggregate blend.
- Bulk (dry) specific gravity of all aggregates and final blend (Gsb) including natural/virgin materials as well as reclaimed asphalt pavement (RAP).
- Asphalt PG binder(s) used in asphalt mixture(s) (certification or bill of lading).
- Optimum percent asphalt binder (Pb) at design and production (regressed air voids for WisDOT designs).
- Bulk specific gravity (Gmb) of mix at design and calculated for production (regressed for WisDOT designs).
- Theoretical maximum specific gravity (Gmm) at design and calculated for production (regressed for WisDOT designs).
- Voids in the mineral aggregate (VMA) and voids filled with binder (VFB).
- Dust-to-binder ratio using Pbe.
- All design data and associated design curves.
- Any current quality control testing of the mixture, aggregates, and RAP proposed to be used on the project should be available upon request.

Table 2. Mix Design Method Recommendations	
Aggregate Properties	**Superpave**
LA Wear (AASHTO T96) 100 revolutions (max % loss)	13
500 revolutions (max % loss)	50
Soundness (AASHTO T104)	12
Freeze/Thaw (AASHTO T103 as modified in CMM 860.2.7) (specified counties, max % loss)	18
Fractured Faces (ASTM D5821 as modified in CMM 860.7.2) (1 face, % by count)	65
Flat & Elongated (ASTM D4791) (max % by weight)	5 (5:1 ratio)
Fine Aggregate Angularity (AASHTO T304, method A, min)	40[1]
Sand Equivalency (AASHTO T176, min)	40
Clay Lumps and Friable Particle in Aggregate (AASHTO T112)	≤1%
Mixture Properties	**Superpave**
Air Voids @ Optimum AC with 2-hr aging (cure time)	4.0%[2]
Compactive Effort	Gyrations
Nini	6
Ndes	40*
Nmax	60
Voids Filled with Binder (VFB or VFA)	68 - 80[3]
Dust to Binder Ratio (% passing 0.075mm/Pbe)	0.6 to 1.2[4]
Tensile Strength Ratio	75% min[5][6]
* 50 gyrations if done per Asphalt Institute MS-2. [1] 4.75mm mixture (#6 WisDOT mix) requirement is 43. [2] Determine the target JMF asphalt binder content for production from the mix design data corresponding to 3.0 percent air voids (97 percent Gmm) target at the design number of gyrations (Ndes). Add liquid asphalt to achieve the required air voids at Ndes. [3] 4.75mm (#6 WisDOT mix) requirement is 67-79. [4] 4.75mm (#6 WisDOT mix) requirement is 1.0 to 2.0. [5] Eliminates freeze-thaw conditioning cycles from the TSR test procedure testing. [6] Run TSR at asphalt content corresponding to 3.0 percent air void regressed design using distilled water for testing.	

4.2 Mixture Testing Recommendation

Testing required to validate or control the mix supplied is the Paving Contractor's responsibility and should be included in the bid cost for providing these HMA items. Daily Gmm values should be made available to the contractor's density technician for verifying in-place density within a timely manner from the start of production. Asphalt content, gradation, Gmm, and Gmb testing should be performed on the first day of installation for each mixture used. Testing will continue for every 500 tons, with a minimum of one test required daily once production exceeds 100 tons.

Quality control sampling/testing should be completed in accordance with WisDOT standards/guidance/procedures at the above mentioned frequency.

Table 2 lists the requirements for a mixture design with an understanding that these properties will vary during mixture production. Quality control testing will target percent air voids (Va) and percent 0.075mm gradation within +/-1.0 percent. The voids in mineral aggregate (VMA) design target is a minimum, but should not exceed more than -0.3 percent from target. The asphalt binder content (Pb) should not exceed more than -0.4 percent from the design target.

Density Testing Recommendation

Traditional HMA construction allows for additional consolidation of the pavements placed for a certain period of time due to its flexible nature. However, for this type of construction there is no additional loading or compactive effort, so the in-place density will remain throughout the pavement life. This makes the densification of the HMA layers a very critical component to the success of the project.

The average sub-lot (daily or 500 tons, whichever is less) in-place density requirement for upper layer mixtures shall target 94.0 percent of Gmm with no value less than 92.5 percent of Gmm. Lower layer and leveling installation of asphalt shall target 92.0 percent of Gmm.

Record Keeping

Printed records of mixture components, test results, certifications, etc. should be available upon request for each day of HMA production.

These material recommendations are a collection of WisDOT standard specifications and guidance documents, ASBA Executive Summary on Asphalt, ASBA Guidelines for Tennis Court Construction and ASBA Asphalt Guidelines.

5 Site Grading/Subgrade Preparation

ASBA has stated that the greatest single factor in the deterioration of recreational surfaces is the presence of standing water on or free water beneath the surface. Proper site preparation is critical to the long-term performance of sport court facilities. Since these facilities typically require large site areas, cutting and filling is common. In addition, topsoil, rocks, tree stumps, large roots or other deleterious material must be removed from the site, and any holes filled and compacted. Any low areas must be raised by the addition of suitable structural fill. Both existing soil and fill material must be compacted before construction can continue. Suitable fill material must be stable, compactible, and free of organic matter that will decompose and settle over time.

Appropriate fill material should be placed in lifts no greater than 6 inches and thoroughly compacted (95 percent of Standard Proctor) before the next layer is placed over suitable structural soils. Fill should not be placed over wet soils. This process should be repeated until the desired grade shown on the plans or established by the owner has been achieved.

Proof-rolling is also recommended as a good indication of the stability of the pavement subgrade. Proper grading of the site and proper slope of the playing surface provides a means of removing water from the court surface. Excavation, filling, grading and compaction of the site and construction of the subgrade should be performed in such a way that the finished court surface is 6 to 12 inches above the surrounding ground (depending on the type of court being constructed), and slopes between 0.83 percent (1:120) and 1.00 percent (1:100). The subgrade should be shaped to true and even lines to ensure a uniform thickness of aggregate base course. The subgrade surface should have a maximum variance of +/- half an inch. The base course depth should be suitable to support both asphalt paving equipment and material delivery vehicles.

5.1 Drainage and Slope Provisions

Each court should be sloped in a true plane. The court should slope side to side, end to end or corner to corner. The natural slope of the terrain where the court is being constructed should be considered and the shortest direction for good drainage and water removal should be chosen.

Tennis courts should not slope from the net line toward the baselines or from the baselines toward the net, since this has the effect of raising or lowering the net. Neither should they be sloped from the center line to the sides since this creates a ridge in the court. The entire court should be sloped in one plane. When multiple courts are constructed adjacent to one another, a drainage swale in the asphalt between the courts is desired.

Consideration should be given to blending the plane of the tennis court back into the surrounding surface. The maximum slope for the lawn surface should be 10 percent (1:10) within 5 feet of the edge of the asphalt.

Stormwater runoff can cause erosion, surface abrasion or undermining of the areas around the edges of the court where the storm water is discharged, leading to pavement failure. Channel drains are an effective way to intercept the water on the courts but must be kept out of the area of play.

Some sites may require retaining walls to stabilize cut and fill, and drainage should be included with all walls. This includes footing drains as well as weep holes (openings in the wall to permit passage of water collected behind the wall and placed so they do not drain directly onto the court, causing staining and degradation of the court surface). If a retaining wall abuts the court surface, a channel drain should be constructed between the wall and the court.

5.2 Soil Conditions

Proper grading and adequate compaction play a huge role with regard to a successful project.

Most sites will require a soils investigation to determine soil type and subsoil conditions, depth to ground water and surface drainage patterns of the site. Although soil survey reports are available, it is recommended in most situations that soil borings or test pits be taken and evaluated by a geo-

technical engineer.

If no soil problems are suspected, hand-dug test pits or backhoe excavation may provide sufficient information to determine if a particular site is suitable. This will also provide information with regard to topsoil removal, requirements for excavation and/or fill and water-management needs.

Sand and gravel, sandy loam and sandy clay, drain and dry quickly and compact well and are desirable soils for this type of construction. Peat, humus and loam are composed largely of decaying organic material, are difficult to compact and often settle as decomposition continues. These soils also absorb water, which makes them more susceptible to freeze-thaw concerns. Organic soils should be removed and replaced with a suitable structural fill to support construction equipment and prevent premature failure of the asphalt pavement.

Any soft areas showing signs of rutting or pumping from construction equipment loading should be mitigated prior to stone placement and again prior to asphalt paving.

5.3 Surface Drainage Types

Surface drainage controls the removal of above-ground storm water. Surrounding areas should not drain onto the court. There are three types of surface drainage systems: open, closed and combination.

Figure 4. An image of an open drain.[4]

Open drainage systems use swales (a natural drainage channel covered with vegetation, usually grass) and gutters (a paved swale) to divert water away from tennis courts by gravity.

Closed drainage systems are made up of pipes linking drainage structures such as channel drains and catch basins. With a closed system, water is not guided along the surface; it is collected by the structures and diverted through pipes. A grated drain, or channel drain, is a type of gutter with a grate on top that prevents debris from entering. Channel drains can also be set at a uniform grade, eliminating the need for a sloped swale or gutter.

An effective way to capture stormwater from a court and the surrounding area is to install catch basins and underground piping. Catch basins are installed below grade with a grate on top. Water is directed by swales, gutters or subsurface piping to the catch basin, which directs it into pipes to carry it away from the site.

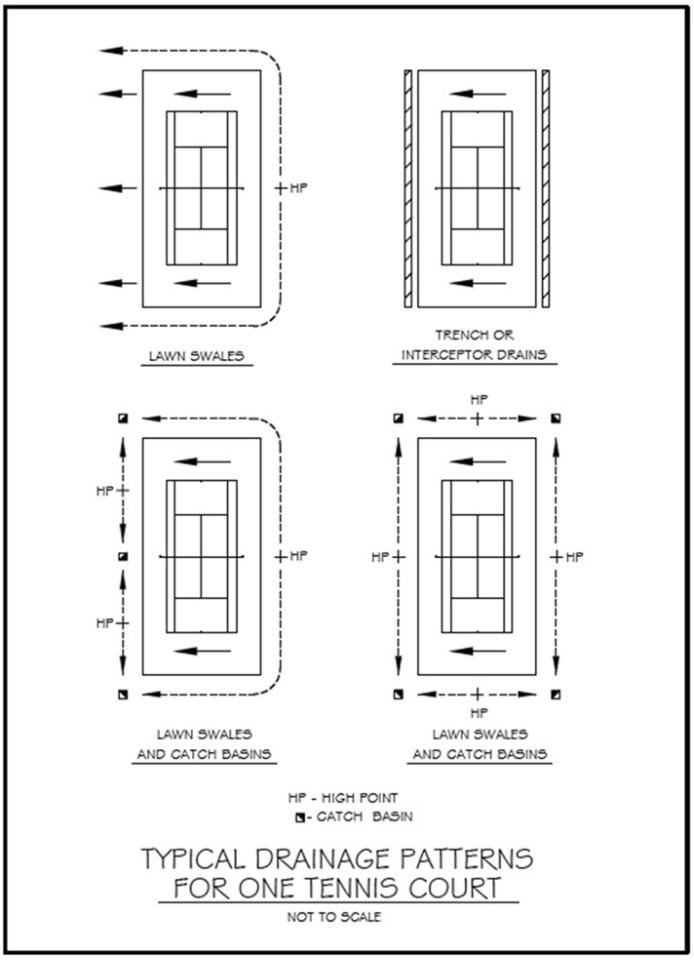

Figure 5. A diagram of tennis court drainage designs.

Combination systems describe most surface drainage systems, which are made up of a combination of swales, gutters, catch basins and/or pipes.

5.4 Surface Drainage Considerations

Surface drainage must be engineered based on the tributary area, the types of soils, the ground cover and similar site factors. Stormwater management has become increas-

4. The images on this page are provided courtesy of ASBA.

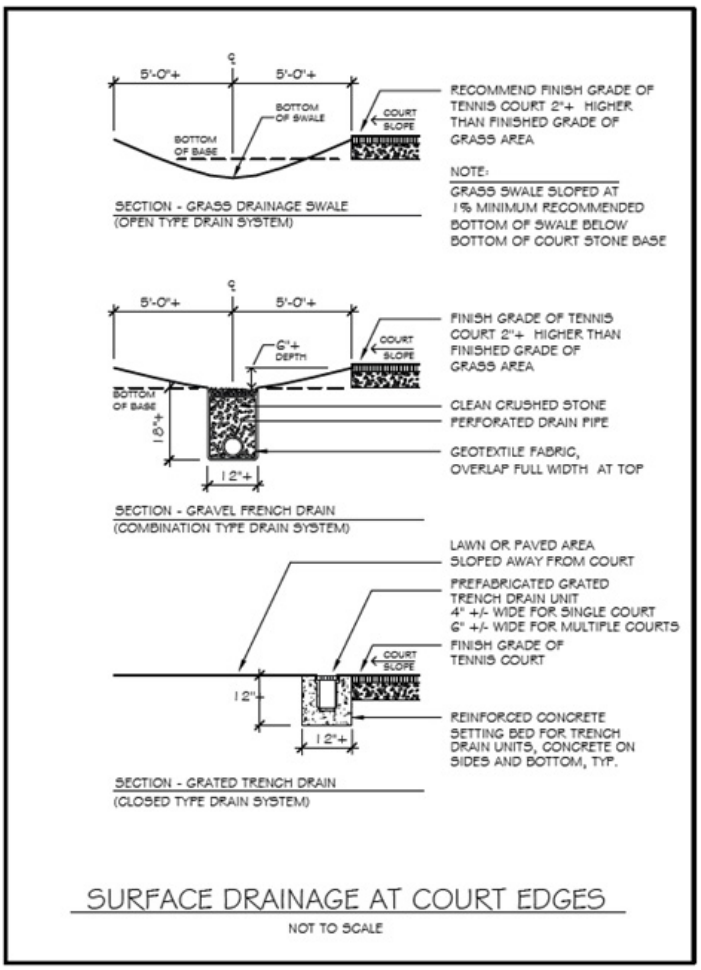

Figure 6. Surface drainage at court edges.[5]

ingly important and must be carefully considered when selecting a site.

All surface drainage systems should be sized to convey frequent stormwater flows from the tennis court as well as areas around the court. Drainage is critical to the success of the tennis court surface, therefore water should be collected and conveyed away from the court pavement, keeping the pavement subbase and subgrade dry.

Figure 7. An image of a French drain.[6]

5.5 Subsurface Drainage

Subsurface drainage addresses the management of water below ground that is present in soil or rock. One way of controlling subsurface water is by construction of a gravel trench drain, also called a French drain, which places an underground barrier between the court and subsurface water. The most common type of French drain consists of a trench around the perimeter of the facility and at least 5 feet outside of the edge of pavement to prevent water from percolating

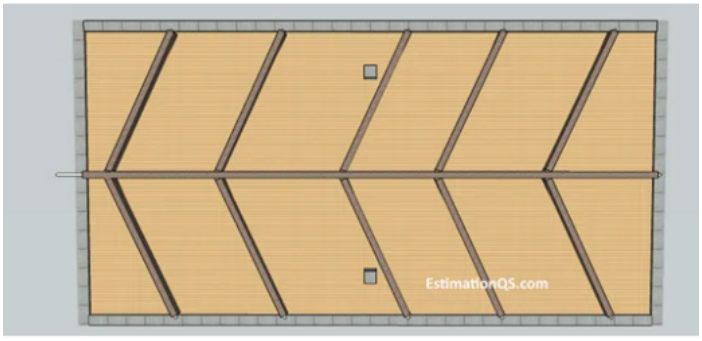

Figure 8. An illustration of drain tiles placed in a herringbone pattern.[7]

out of the drain and under the court. The trench should be 12 to 24 inches wide and usually 24 to 48 inches deep. If the drain is placed on aggregate base and not at the bottom of the trench, it should be at least 18 inches deep, but not less than the depth of the subgrade of the court(s), depending on local conditions.

Figure 9. An image of a finished trench.[8]

Drain tile is another form of a French drain used to collect and redirect the subsurface water. The pipes will be placed in a herringbone pattern as shown in Figure 8. A 1.5- by 2-inch-deep trench will be dug below subgrade for each of the drain pipes. The center pipe (4-inch diameter) is approximately 120 feet long. The connecting pipes (3-inch diameter) are placed in a herringbone pattern at a 25-degree angle from the center pipe and are roughly 30 feet long.

5. **Image provided courtesy of ASBA.**
6. **Image provided courtesy of ASBA.**
7. Illustration courtesy of Estimationqs.com.
8. **Image provided courtesy of ASBA.**

Traditionally, a geotextile fabric is used to line the bottom of the trench and up the sides. Open-graded drainage material is placed in the bottom of the drainage trench as pipe bedding to move the water away from the court; a slope of at least 1 percent (1:100) is desired. Next, a perforated pipe is installed on top of the aggregate, perforations down. A porous cover (geotextile filter fabric) is placed over the pipe to prevent silt or other materials from clogging the pipe. The remainder of the trench is backfilled with open-graded drainage material and finished with smaller washed stone for an open drain or, when a closed drain is required, with sod or a drainage swale. Usually, French drains are covered with grass and do not handle large volumes of surface drainage. The drains are used as a capillary barrier to prevent any vertical movement of the water and to move it away from the site.

In the case of both surface and subsurface drainage, proper slope and consistency of grade is important. It is also important that an appropriate means of disposing of the collected water be identified and conform to local, state and federal regulations for stormwater management.

6 Construction

6.1 Placement of Layers

Climate plays a critical role in the development/construction of the sport court facilities. The more frequent the freeze-thaw cycles and the greater the depth the ground freezes, the more carefully soil conditions, drainage and subgrade construction must be considered.

The material recommendations in this section are a collection of WisDOT standard specifications and guidance documents, ASBA Executive Summary on Asphalt, ASBA Guidelines for Tennis Court Construction and ASBA Asphalt Guidelines. See Chapter 9 of this document for links.

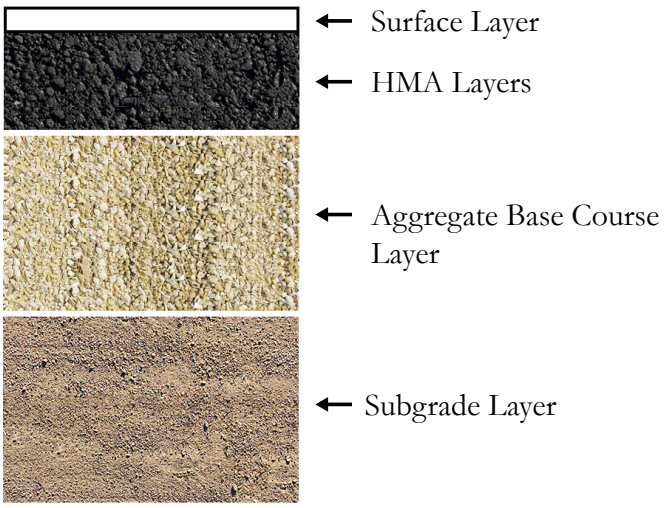

Figure 10. Asphalt Sport Court Layers

Subgrade Layer Preparation

A soil examination should be conducted to determine its suitability as a foundation material. Trees and other vegetation, including root systems, must be removed from the site and the soil treated with a sterilizing agent that will effectively inhibit future flora growth.

The site should be excavated and filled to provide the finished grades shown on the plans or established by the owner. Because the earth subgrade must serve both as a working platform to support construction equipment and as the foundation for the pavement structure, it is imperative that the subgrade is properly compacted and graded. All topsoil should be removed and low-quality soils should be improved by adding cement or other suitable admixtures such as lime or granular materials. Any soft, yielding material should be replaced with a suitable material that is not greater than 6-inch lifts and compacted to a density of 95 percent standard density at optimum moisture. Good compaction is particularly important in sport court construction, as subsequent settlement of the subgrade may cause cracking in the court surface.

All excavating, filling, grading requirements and compacting work of the subbase should be performed so that the finished subgrade is 6 to 12 inches above the surrounding ground and slopes not less than 0.83 percent (1:120) and not more than 1 percent (1:100). The subgrade should be shaped to true and even lines to ensure a base course that is uniformly thick. The subgrade surface should have a maximum variance of plus or minus 1/2 inch.

Aggregate Base Course Layer

The crushed aggregate should be placed and compacted to a uniform thickness and required density with a maximum grade variance of 1/2 inch in 10 feet measured in any direction. All aggregate material should conform to Wisconsin Department of Transportation Standard Specifications for Highway and Structure Construction Section 305. Additional details can be found in Chapter 3 of the **WAPA Asphalt Pavement Design Guide**. The compaction of this material is critical to the performance of the completed asphalt pavement, regardless of the thickness of the course being placed. Compacted thickness will depend on local soil and climatic conditions but compacted aggregate thickness should not be less than 4 inches. For poor or questionable soil types, use a minumum thickness of 8 inches.

The base aggregate material should be placed in a manner that produces uniform thickness, and compacted to 95 percent Standard Proctor test at a minimum with equipment capable of providing uniform density.

HMA Placement Recommendations

Hot mix asphalt should not be placed when the base aggregate is wet or contains excessive moisture, when the temperatures are below 50F, or during rainy weather.

Prior to placement of successive pavement layers, the previous course should be cleaned and, if needed, a tack coat of emulsified asphalt applied. The tack coat may be eliminated if the previous course is freshly placed and thoroughly cleaned. The tack coat material should meet the Wisconsin Department of Transportation Standard Specifications for Highway and Structure Construction Section 455 using the appropriate material types and application rate(s). See Appendix A for additional details.

HMA Lower Layer

The specified thickness of the lower layer should be placed in one lift on the prepared aggregate base course layer. The HMA mixture should have a maximum aggregate size of 3/4 inch to 1/2 inch (WisDOT Gradations No. 3 or 4) per WisDOT Standard Specification Table 460-1 to a compacted thickness of not less than 2 1/4 inches or 1 3/4 inches respectively. The material should be compacted using the appropriate equipment to achieve the required uniform density previously identified in Chapter 4. The finished base should conform to the true lines and grade as established on the plans or by the owner with a variance of not more than 1/2 inch when measured with a 10-foot straight edge.

It is recommended that the lower layer(s) should not remain without the upper layer being placed over an extended period of time. The lower layer should be kept clean and must be completely dry before proceeding. If the minimum thicknesses referenced above cannot be met, the upper layer mixture should be installed as an additional lower layer.

HMA Leveling Layer

If the minimum required thickness of the HMA lower layer is unable to be constructed, an HMA leveling layer should be placed over the aggregate base course. The mixture should have a maximum aggregate size of 1/2 inch to 3/8 inch (WisDOT Gradations No. 4 or 5) per WisDOT Standard Specification Table 460-1, and a compacted thickness of not less than 1 1/2 inch.

This mix should be spread and compacted by methods and in a manner that produces a uniform density and thickness but does not require density testing. The finished leveling layer should not vary more than 1/4 inch in 10 feet when measured in any direction.

HMA Upper Layer

There can be only one upper layer, all other layers are considered to be lower layers.

The upper layer should be installed uniformly, to all finished lines and grades. It should be smooth, durable, stable and impervious to protect the lower layer(s). It is recommended that the upper layer shall be built with a fine-graded mixture having a maximum aggregate size of 1/2 inch or 3/8 inch (WisDOT Gradations No. 4 or 5) per WisDOT Standard Specification Table 460-1. It is recommended that the upper layer be installed to a minimum compacted thickness of 1 3/4 inch or 1 1/4 inch.

Recycled Asphaltic Materials (RAM)

RAM is comprised of asphalt millings, HMA pavement demolition or reclaimed asphalt shingles (RAS). RAS is not to be used in any of the HMA layers.

In years past RAP had not been accepted for use in these types of pavements, but is now recognized as providing many benefits and good sustainable practice. Usage is restricted. See Chapter 4 for additional guidance.

Curing

The recommended cure time should be a minimum of 45 days before the wearing/playing surface is applied. Follow the manufacturer's recommendations for application of the playing surface material.

6.2 Additional Considerations During Construction Phase

In-Ground Posts

Tennis

Net posts are most commonly made out of steel, however aluminum posts are now being manufactured to resist rusting, and wooden or brass options are also available. Net posts should be set in sleeves for easy maintenance and resurfacing.

For tennis, net posts should be set 3 feet outside the sideline, which is 42 feet apart, center-to-center for doubles play, and 33 feet apart, center-to-center for singles play.

Post foundations should be 24 inches in diameter at the top, 30 inches in diameter at the bottom, and not less than 36 inches in depth. All underground footings should be installed prior to asphalt paving. Post footings should be 6 inches deeper than the frost depth, not to exceed 42 inches. The

dimension between posts is 33 feet on single courts and 42 feet on double courts. The standard net is 42 feet in length by 3 feet 3 inches high. The standard net for doubles is 42 feet in length by 3 feet 6 inches high.

Basketball

For NCAA-regulation courts, the hoop post should be placed four feet from the court edge and the top of the hoop should be 10 feet above the playing surface.

Pickleball

Like tennis, a pickleball net will span the width of the court. Posts to support the net should have a diameter of no more than 3 inches and be placed 22 feet apart on the court sidelines.

Perimeter Edging

If desired, an edging of brick, concrete, steel, or treated wood can be installed around the entire perimeter of the court area. Sections may be left open to allow trucks and other equipment to enter and leave the court area until other work specified herein has been completed. Top elevation of the edging should be 1/2 inch below the finished grade level and the court's surface course should start tapering 6 inches away to meet it.

Figure 11 depicts an illustrated cross-section of an optional court edging.

Apron

For tennis, the overall dimensions of an individual court should be 61 feet by 121 feet to provide a 6-inch apron around the court, or 62 feet by 122 feet to provide a 1-foot apron around the court. This additional footage helps keep vegetation away from the perimeter, facilitates landscape maintenance and adds to the overall cosmetics. Fencing should remain at 60 feet by 120 feet and should be installed after HMA paving and prior to placement of the wearing/playing surface.

Figure 12 shows a cross section of an optional court extended apron.

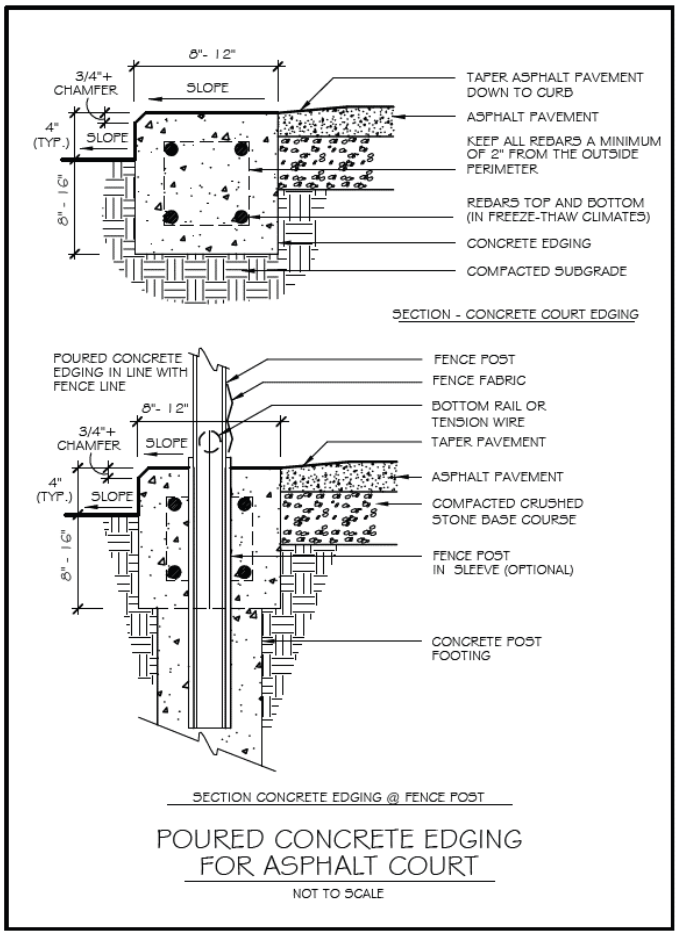

Figure 11. Typical Asphalt Court Edging with Brick or Concrete Block.[9]

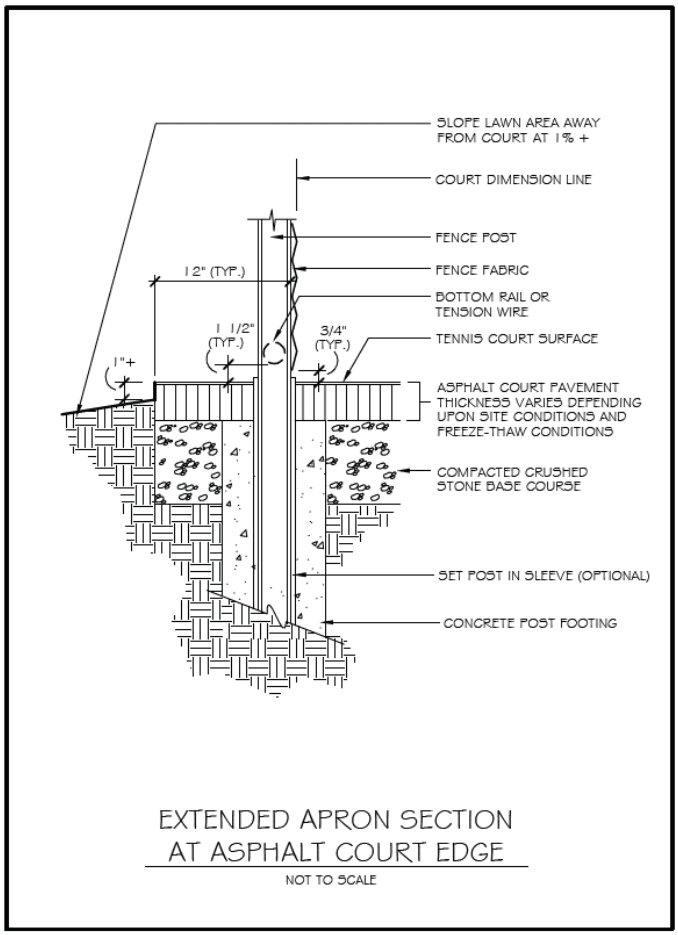

Figure 12. Extended Apron Section at Asphalt Court Edge.

9. The images on this page are provided courtesy of ASBA.

Lighting Recommendations

Lighting is key for safety and illuminating the fast-moving play on the courts. Players need to be able to react quickly and visibility is essential to gameplay. Other considerations include:

Quality of light

- Light should be uniformly spread throughout the area of play.
- Light should adequately render color.
- Glare should be minimized as much as possible by avoiding reflective surfaces and controlling the amount of light on the court.

Sources of light

- High Intensity Discharge (HID) lamps last on average 12,000 hours and require a warm-up time of 3-12 minutes but achieve maximum light output.
- LED lighting lasts up to 100,000 hours, costs less than other options and requires less maintenance. This type of lighting can be used with dimmers.

Wiring recommendations

- Installed underground if possible, outside of the court area.
- Consider wiring multiple courts separately so each can be operated individually to save costs.

Light poles

- Installed a minimum distance of 5 feet away from the sideline to light poles, and consider adding padding if poles are inside the fence.
- Centered on or immediately outside the fence or court if possible.
- Should not be used as fence posts.
- Generally, the bigger the area, the higher the light poles need to be.

Fencing

The primary purpose for adding a fence around a sport court is to keep the ball within the court during play. Chain-link fencing is most commonly used and should be rust-proof and free of protrusions that could injure players. Wooden fencing, walls, hedges and netting can also serve a similar purpose.

For pickleball, fencing or an acceptable alternative can improve play when installed across the back of the court (backstop) and along each sideline from the corner 20 feet to 40 feet up the sidelines (side stop). The area up to 40 feet on either side of the net can be left open or shorter fencing may be used. Additional guidance from USA Pickleball includes:

- Backstops should be a minimum height of 10 feet, but taller if there are problems associated with the ball leaving the confines.
- Side stops should not be less than 3 feet in height. Minimum height should be the same as the backstop for at least 20 feet from the backstop, with 30 feet being more recommended.
- Gates should be present on both ends of the court to allow access, and wide enough to allow for wheelchairs/maintenance equipment.
- Windbreaks are recommended to deflect the wind from interfering with play, while also providing a background against which the ball can be seen.

Where local conditions dictate additional security or ball retention, a higher backstop may be required. For residential courts, 8 feet in height is adequate when the adjacent area is such that a ball going over the backstop or side stop can be retrieved without personal hazard or hardship and without undue intrusion on adjoining property.

Landscaping

When landscaping, carefully consider the type of vegetation being planted, its potential growth and future effects. Avoid planting trees too close to the court's edge, as branches could eventually hang over the court and contribute to shade, leaves and other debris that can contaminate the surface, and roots below ground that may one day affect the court's structure and stability.

7 Repair, Reconstruction and Renovation

Many court surface failures are likely due to poor design, poor construction, poor maintenance, inadequate materials and/or poor drainage.

7.1 Asphalt Pavement Problems

Cracking

The most common problem with asphalt courts is pavement cracking. Cracking of asphalt is caused, at least in part, by the natural tendency of asphalt to shrink as it weathers, oxidizes and ages. One method of delaying or deterring cracking is the installation of control joints. This method makes use of the natural tendency of asphalt to crack where it is weakest. During construction, the asphalt pavement is saw-cut under the net and between courts in a multicourt project. These saw cuts provide a place for movement and shrinkage of the pavement when contraction occurs, preventing or minimizing the number and severity of cracks in other portions of the pavement. In addition, cracks from one court in a multi-court battery will stop at the control joint and will not travel to the adjacent court. The asphalt pavement is routed (saw-cut) two-thirds to three-quarters its thickness, and the cut is filled with an elastomeric crack sealant. The sealant will require supplemental work every one to two years as it degenerates through expansion and contraction of the cracks.

There are different types of asphalt cracks that occur for different reasons. An experienced contractor or design professional can help determine the specific types and causes of cracking and can recommend a method of repair.

Hairline Cracks

Hairline cracks are small irregular cracks that occur over large areas of the court. They are typically superficial and do not affect the play of the game. Such cracks may be caused by natural weathering or aging, by foreign matter in the asphalt or coating material, by improper application of coating, by improper asphalt mix design, or by stripping. If untreated, hairline cracks will develop into more serious types of cracks and will require more extensive repair.

Alligator Cracking

Alligator cracking is a pattern of interlocking cracks over the surface, resembling an alligator hide. Such cracking may vary in depth from a very faint surface pattern to full-depth cracking. Alligator cracking may be a sign of an inadequately prepared subgrade, or compacting HMA that was placed too thin or using a roller that was too heavy.

Shrinkage Cracks

Shrinkage cracks, or stress cracks, are a random pattern of interconnected cracks with irregular angles and sharp corners. They are small cracks, usually 1/16 of an inch or less. Shrinkage cracks may be caused by the weathering of the asphalt, by improper mix design, or by issues with the surface coating or its application.

Structural Cracks

Structural cracks penetrate through the asphalt pavement. They may result from the natural aging and shrinking of asphalt pavement, lack of proper subgrade preparation, improper or lack of drainage, or non-uniform base or asphalt thickness/compaction. Often structural cracks appear as straight parallel lines running lengthwise on the court (in the vicinity of the paving joints).

Reflection Cracks

Reflection cracks occur in asphalt surface overlays and mirror a crack pattern in the old pavement underneath. They are caused by movement in the pavement beneath the overlay or in the subgrade or, if present in an asphalt overlay of a concrete court, they may follow the joints or cracks in the original concrete slab.

Radial Cracks

Cracks sometimes appear at the point where concrete net post, light pole or fence post footings meet the asphalt court pavement. They occur because the concrete footing material and the asphalt court material expand and contract at different rates in response to temperature changes. Footing cracks can be avoided or minimized by using round post footings and by recessing the footing below asphalt courses, leaving a continuous asphalt surface course.

Stripping

Stripping can be a problem in new asphalt pavements. It shows up as many fine hairline cracks in the pavement. Stripping occurs when water gets into the asphalt mix with the aggregate and prevents the asphalt from adhering to the aggregate. Where stripping occurs, depending on the severity, repairs may include everything from recoating to reconstruction.

Heaving

Heaving, or upheaval, is the result of localized movement of some portion of the pavement. In heaving, a portion of the pavement is pushed up, often by frost expansion or by the swelling of moisture-laden expansive soil beneath the court, cracking the asphalt pavement. Reconstruction is usually required to remedy major upheaval. However, prior to reconstruction, the cause of the upheaval should be identified and corrected or the condition will recur. Heaving may be caused by tree roots, water freezing and expanding under the asphalt, geologic conditions and other forms of vegetation. This heaving sometimes appears as localized bumps in the surface. Proper repair of these surface imperfections would require grinding or removal of the impurity and patching.

Raveling

Raveling is the spalling or crumbling of the surface of a pavement, resulting in a pockmarked appearance after construction. It is caused by oxidation of the surface as a result of prolonged wear and exposure to UV radiation.

Depressions

There are several types of depressions in sport court facilities:

Loads that are not evenly distributed can result in point loading damage. For tennis courts that host advanced competitions, net support posts may be used to keep the net higher. Those posts are under a lot of pressure from the net wire and can penetrate into the asphalt layer if they do not have a cap on them to distribute the load. Other point loading damage can be caused by chairs, benches, receptacles or other items. placed on the playing surface that don't adequately disperse the loading.

Dents (divots) are small depressions, usually caused by racquets hitting the court, by stones or hard-soled street shoes. Such dents generally do not affect play. They can, however, be repaired individually, using patching material, or be corrected by resurfacing or by an overlay as part of a larger repair project.

Birdbaths are defined as any areas where standing water more than 1/16 of an inch deep remains after drainage of the area has ceased, or after one hour at 70 degrees Fareinheit in sunlight. Such minor depressions delay play after a rain event and may cause staining on the court as they dry.

Major depressions, accompanied by cracking of the pavement, are most often caused by insufficient compaction of the subgrade, decay of organic material beneath the court, or water under the court causing undermining in the subgrade. Reconstruction is usually required to remedy major depressions. However, prior to reconstruction, the cause of the collapse of the pavement should be identified and corrected, or the condition will recur.

Bubbling in Surface Coatings

Bubbles in the color coating on asphalt courts most often are caused by moisture between the pavement and the coating material. The moisture can come from a variety of sources. Moisture trapped below the asphalt can be drawn up through the pavement, or the water may come from the pavement itself if the asphalt isn't completely cured prior to the application of coating materials.

Whenever water is present on, in, or beneath a sport court pavement, heat from a warm day may draw the moisture upward to the surface where it vaporizes and expands. The trapped vapor then breaks the bond between the coating and the pavement, forming a bubble. At times, these bubbles may open or crack the coating.

Bubbles also may form between layers of coating. Coating products that aren't fully dry before successive coats are added is another potential source of bubbling and/or coating failure.

If larger amounts of moisture are present, if too many layers of surface coatings have been applied, if the coats are too thick or if an impermeable coating material is used, the water cannot permeate the coating and bubbles are inevitable.

Small bubbles may be punctured with a sharp object and pressed down, which may allow the coating to re-adhere. Stepping down on bubbles will only be effective if there is still liquid under the bubble. If not, adhesive must be injected with a syringe to facilitate rebonding.

Large bubbles most likely will need to be cut out and patched with new materials. If the entire surface of the court shows bubbling or if bubbling recurs, one approach is to remove

the coating by shot-blasting, hydroblasting or grinding, then recoating the court.

Installation of a vapor barrier or barriers in construction, construction of proper drainage, proper curing of the asphalt prior to coating, along with proper installation of coatings should prevent bubbling. When recoating an existing court, it is often better to remove old coats before applying new coating, since each additional layer of coating reduces the permeability of the surface, increasing the likelihood of bubbling.

7.2 Hard-Court Repair and Recoating

An asphalt sport court that is structurally sound with a proper slope, evenness and good drainage can be preserved with repair and recoating. This process may include the following:

- The court surface should be cleaned to promote the adhesion of the new surface coatings. Surface cleaning should include scraping, sanding, brooming and/or power washing to clean the surface and remove stains.
- Coatings that are delaminating or bubbling need to be removed down to the asphalt pavement layer.
- Any cracks within the court surface should be sealed and sanded to prevent the introduction of water into the pavement subbase and subgrade. Cracks can be repaired with a variety of products; those 1/8 inch wide or less can be filled with a flexible sealant preapproved by the coating manufacturer. Larger cracks can treated with one of several membrane systems that "bridges" the crack and slows down the reopening of the cracks.
- Any low areas should be filled and leveled with patching compounds to re-establish the evenness of the court surface.
- High areas, if any, should be leveled by scraping, milling or grinding of the asphalt to reestablish the evenness of the court surface.
- Depending on the seriousness of deterioration or cracking and the number of repairs, one or more layers of the surfacing material may be applied in repaired areas, or over the entire pavement area.
- The court should then be recoated with multiple coats of an appropriate surface coating by a qualified contractor, according to the manufacturer's instructions.

Crack Repairs

The appropriate method of crack repair depends on the type and size of the crack to be repaired and the underlying problems that caused the crack. Most commonly, small cracks are treated with a crack filler. The crack is first cleaned and dried, then the crack filler is worked into the crack. The crack must be filled; it cannot merely be covered or bridged. Pressure on the filler should be applied in all directions so that the crack repair material fills all spaces. Once the crack is completely filled, excess material on the surface is removed. When the crack filler has dried, the surface of the filled crack is smoothed to remove any ridges.

Birdbath Repairs

Birdbaths, or low spots, can be repaired by patching. First, the court should be flooded to identify the low lying areas, and marked with soapstone or chalk. Next, the area should be cleaned and allowed to dry. A tack coat should be applied to the area within the marked line. The birdbath should then be filled with a thin coat or several thin coats of patching material. The patch should be leveled with a straightedge and the area around the patch should be feathered and smoothed to meet the existing pavement. Finally, the patch should be allowed to cure, sanded or smoothed of all rough textures, and recoated according to the manufacturer's instructions.

Recoating

Repaired areas and crack filling may leave a court with an unattractive freckled appearance; of which recoating will fix. Recoating also will correct other cosmetic defects, shallow depressions or shallow cracks.

Upon completion of the surface repairs, one or more resurfacing coats are applied. This material, specially designed for sport court resurfacing, helps fill minor imperfections in the surface and provides a smooth and uniform base for recoating. After the drying and curing of the resurfacing coats, multiple layers of color coatings are applied to produce the final playing surface.

Pavement Overlays

Existing sport court pavements that are badly cracked, yet maintain reasonable slope and evenness, may be overlaid using a variety of industry-recognized overlay processes while leaving the existing pavement structure in place. Any overlay process should ensure existing pavement cracks will not reflect up through the newly installed overlay. For example, the installation of a new asphalt pavement overlay directly on top of a badly cracked existing pavement will most likely crack at the same locations as the existing

pavement cracks. This is referred to as "reflective cracking."

A layer of stone screenings is effective in retarding the transfer of cracks from the old pavement to a new overlay. A minimum 2-inch layer of processed stone is installed over the existing pavement (consult a local sport court contractor to determine the appropriate thickness). The processed stone layer can also be used to correct any court slope issues that may prevent water from properly draining off the court surface.

After the installation of the layer of stone screenings, it is necessary to select the type, thickness and number of layers of asphalt to be overlaid.

In some instances the existing pavement structure is deteriorated to the point that a new structure needs to be established prior to being overlaid. If the structure is concrete, the slab may need to be "fractured" or "cracked" and re-seated prior to the asphalt overlay.

Before any overlay is to be considered, the owner must first adequately address drainage on and around the sport court which is key to the overall success of overlay, and the long-term playability of the court playing surface. Before undertaking any hard-court repair or resurfacing, attention should be paid to the existing drainage systems on and around the court(s). Improper drainage makes surface damage more likely and more severe, especially in our climate with the amount of freeze-thaw activity. Wet soil under the court will expand and contract in response to temperature, causing the surface to heave or to settle. Poor surface drainage also may cause dirt or silt to accumulate on the court surface or cause damage to color coating systems. Also, poor surface drainage can cause soil erosion around the perimeter of the court.

An inspection of the site on and around a sport court should be conducted to establish the necessary drainage repairs or construction to protect the tennis court from the effects of surface and subsurface water. To alleviate potential drainage issues, the following remedial measures should be considered (for more on drainage, see Chapter 5):

- **Swales:** Swales around the tennis court area can capture surface water and convey stormwater away from sport court pavements before impacting the court.
- **French drains:** French drains can intercept groundwater before it has a chance to collect under the tennis court pavement.
- **Channel drains:** Channel drains can collect water from pavement areas and efficiently convey it away from the court.
- **Ground elevation adjacent to courts:** Areas around the court should not slope toward the sport court pavement. Sufficient regrading of areas outside the tennis court fence should direct water away from the court pavement.
- **Sod and/or landscaping higher than the court surface:** Lawn or planting areas adjacent to the court pavement should be regraded to ensure water will effectively drain off the pavement after rain or snow.

8 Cleaning and Care Instructions

Sport court surfaces normally require only minimal maintenance, but the amount of maintenance needed will depend largely on the court's location, environment and how much it's used.

Courts should be swept with a traditional broom, leaf blower, or water broom approximately once per week depending on the severity of surface contamination.

Heavy airborne pollution, such as dust, leaves and vehicle fumes, can quickly settle onto the court surface. In a heavy maintenance environment, it is recommended that foreign debris be hosed off at least once per week to minimize build-up. If the surface becomes dirty or stained, it can be cleaned with a light-duty wet scrubber/vacuum machine with a soft brush attachment. A non-residual organic cleaning solution may be used but should be applied in accordance with the manufacturer's specifications for the particular surface type and stain.

Note: Powdered calcium hypochlorite solution should not be used on the playing surface because it can leave a white residue on the surface after drying. Solvent based/scouring type products, i.e., solvent thinners and similar products should similarly not be used on some surfaces. Always test cleaners and methods on a small portion of the surface before applying to the entire area. Contact your local authority prior to commencement of cleaning to conform to the environment requirements in your area.

8.1 Mold Growth and Tree or Plant Contamination

It is recommended to prune overhanging trees or plants to prevent excess surface contamination and staining.

Mold may build up on areas of the surface where plant/leaf contamination occurs or where water pools after rain. These areas should be cleaned on a regular basis using the following methods:

a) Hose off foreign debris with the aid of a stiff bristle broom.

b) Saturate the surface with clean water.

c) Use a diluted solution of sodium hypochlorite (liquid pool chlorine); dilution rate is dependent on the severity of mold growth.

d) Sweep solution over the moldy area and soak for 10-15 minutes. Do not allow to dry.

e) Hose off surface thoroughly with clean water to remove all residual solution.

f) Heavily contaminated surfaces may require additional treatment, or in severe cases, high-pressure water blasting and sodium hypochlorite treatment.

8.2 Food and Drink Contamination

Wash any food or drink contamination immediately for best results. If staining has occurred, the same cleaning methods suggested for dirt or other contaminations are recommended.

8.3 Other Contaminations

Animal droppings and worms will cause degradation of some types of playing surfaces. These contaminations should be removed immediately by mechanically scraping them off or by high-pressure washing.

In severe cases where surface blistering or peeling of the surface is visible, the asphalt below may have received damage as well. If this happens, the surface can be patched with recommended surface materials.

Bird/wildlife contamination can usually be removed by a non-residual organic cleaner with a stiff-bristle brush/broom and hosed off with plenty of clean water.

Only white-soled or non-staining/marking shoe types should be used when playing on the court surface. If dark-colored rub marks appear, they can usually be removed with a non-residual organic cleaner and stiff-bristle brush. Some rubber types are difficult to remove when they are fresh; weathering will usually make it easier for these marks to be removed.

Shoe sole marking will be more noticeable and prevalent with new surfaces. Wipe shoes before entering court to prevent stones, twigs, or other sharp objects from becoming embedded into the surface.

Chewing gum is very difficult to remove from court surfaces. Mechanical scraping is recommended.

Grease and oil stains can be removed with a non-residual organic cleaner. It may require several applications to remove the grease/oil contamination. Thoroughly hose off the surface with clean water after the application of the detergent solution.

8.4 Avoiding Surface Damage

The playing surfaces are highly resistant to damage from normal use. However, metal racquets that forcefully impact the court surface can cause slight cuts in the surface. Such damage is usually confined to the top layers and can be readily repaired. Chairs, benches, waste receptacles, umpire stands, etc. should have padded bases on the legs to minimize damage to the surface. Distribute all loading to avoid point source loads which can cause damage to the surface.

8.5 Drying the Court Surface

After rain, game play can resume quickly by simply removing excess water with a wide sponge roller or squeegee. Most court surfaces are slip-resistant when damp.

8.6 Additional Information

More tips can be found in ASBA & USTA'S Tennis Court Construction & Maintenance Manual, and a cleaning checklist can be found on SportMaster's **website**.

9 Steps to Ensure a Successful Project

Summarized from ASBA Asphalt Guidelines (**https://cdn.ymaws.com/sportsbuilders.org/resource/resmgr/track_division_page_documents/asphalt_guidelines.pdf**)

Equipment Needs

The asphalt plant should be capable of producing the quantities of asphaltic mixtures required.

Tack 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.

Haul trucks shall have smooth, clean and tight metal beds that do not have mixture sticking to the truck box and from which the entire quantity of HMA can be discharged smoothly into the paving equipment. Asphalt release agents are allowed to be used in the haul trucks to keep the mixture from adhering to the truck box as long as they are on the WisDOT approved products list. 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 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 sport court asphalt construction. Additionally, it should be equipped with automatic slope control to maintain required tolerances. Rollers shall conform to the manufacturer's specifications for all ballasting. It is recommended that one vibratory roller be used with two rollers as a minimum.

(Three rollers are encouraged 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 contract.

Ensure the subgrade is stable, the aggregate base course layer is compacted, level and stable, and drainage has been properly considered before the installation of the HMA layers. 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).

Apply tack during appropriate weather conditions and protect the tack coat from equipment traffic so as not to wear and track the material. Allow the tack coat to 'break', i.e., turn from a brown to a black color (indicating the water has evaporated) prior to installation of the HMA. If subsequent HMA layers lifts are laid beyond 24 hours, apply tack coat at the rate per current WisDOT standard specifications. All vertical edges abutting proposed asphalt surfaces shall receive a tack coat. Excessive tack coat applications, drooling, or pooling shall be swept with a broom to ensure proper bonding of the HMA occurs, wait until emulsion cures or breaks.

Pavement Placement

HMA mixture will generally arrive on the project between 270 and 300 degrees Fahrenheit (see producer recommendation) in accordance with good weather conditions and an air temperature of 50 degrees Fahrenheit and rising for placement of all asphalt layers.

Establish an acceptable rolling pattern with the assistance of a density technician on the first day of construction. It's recommended to track and record temperatures, equipment, rolling pattern, and in-place density results throughout the project.

The upper layer HMA longitudinal joints shall be smooth and true. It is recommended that there be no mat deviation from level and true.

It is recommended that where practical, the entire upper

layer shall be paved on the same day. If a cold seam will occur it should be agreed to with the Owner in advance (i.e., occur near, or at a planned saw and seal joint, under the fence line, etc.).

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.

Smoothness shall meet the requirements of no greater than 1/4 inch in 10 ft. for the lower and leveling layers, and 1/8 inch in 10 ft. for the upper layer per the ASBA manual.

Thickness of the overall mat shall be within 1/4 inch of the specified plan thickness at all locations, with no negative deviation for the upper layer mixture.

Paving Joint Best Practices [Install/build control joints per the contract details]:

- Minimize construction, longitudinal, and transverse joints left open for an extended period of time.
- Construct longitudinal joints by paving them "hot" as much as practical.
- Compact all joints and provide a neat, uniform and tightly bonded joint that will meet both surface tolerances and density requirements. Adjacent passes should be overlapped by 2 inches and placed at the appropriate height needed to produce a smooth joint.
- If needed, cut straight and true (vertical) construction or transverse joints prior to the placement of the next pass to ensure the best performing joint possible.
- It is recommended to off-set joints a minimum of 6 inches between lifts of asphalt, with transverse joints a minimum of a 24-inch offset.

Allow positive drainage off of the athletic sport court facility and towards drainage outlets. Any ponding of water is not advisable. Please reference the ASBA Tennis Construction & Maintenance Manual or ASBA Running Tracks Construction & Maintenance Manual for ponding tolerances.

Protect the HMA layers until such time that the playing/wearing surface coating can be placed, particularly during other construction activities between asphalt installation and playing/wearing surface installation. It is recommended that the timeframe for the pavement to "cure" is a minimum of 45 days prior to the surface coating application.

10 References and Links

Asphalt Resources

Asphalt Institute:
www.asphaltinstitute.org/

MS-2 Asphalt Mix Design Methods:
bookstore.asphaltinstitute.org/catalog/book/ms-2-asphalt-mix-design-methods

MS-22 Construction of Quality Asphalt Pavements:
bookstore.asphaltinstitute.org/catalog/book/ms-22-construction-quality-asphalt-pavements

Minnesota Asphalt Paving Design Guide:
cdn.ymaws.com/www.asphaltisbest.com/resource/resmgr/MAPA-Asphalt-Paving-Design-G.pdf

National Asphalt Pavement Association (NAPA):
www.asphaltpavement.org/

National Center for Asphalt Technology (NCAT):
www.ncat.us/

Hot Mix Asphalt Materials, Mixture Design, and Construction:
www.eng.auburn.edu/research/centers/ncat/research/ncat-textbook.html

Virginia Asphalt Association Pavement Design by Use:
vaasphalt.org/pavement-guide/pavement-design-by-use/

WAPA Asphalt Pavement Design Guide:
www.wispave.org/wp-content/uploads/dlm_uploads/WAPA-Design-Guide-2021-1.pdf

WisDOT Roadway Standards:
wisconsindot.gov/Pages/doing-bus/eng-consultants/cnslt-rsrces/rdwy/default.aspx

WisDOT Standard Specifications:
wisconsindot.gov/Pages/doing-bus/eng-consultants/cnslt-rsrces/rdwy/stndspec.aspx

Court Construction

American Sports Builders Association (ASBA):
sportsbuilders.org/

Asphalt Guidelines:
cdn.ymaws.com/sportsbuilders.org/resource/resmgr/guidelines/asphalt/ASBA_Guidelines_on_Asphalt_f.pdf

Asphalt Guidelines - Executive Summary:
cdn.ymaws.com/sportsbuilders.org/resource/resmgr/guidelines/asphalt/ASBA_Executive_Summary_for_A.pdf

Pickleball Courts: A Construction & Maintenance Manual:
sportsbuilders.org/store/viewproduct.aspx?id=14327595

Tennis Courts: A Construction and Maintenance Manual:
sportsbuilders.org/store/ViewProduct.aspx?id=14327322

Additional Industry Resources

Ace Surfaces:
ace-surfaces.com/tennis-court-repair-maintenance-tips/

Asphalt Applications for Sports Courts and Facilities:
www.forconstructionpros.com/pavement-maintenance/article/21319240/asphalt-applications-for-sports-courts-and-facilities

Laykold:
www.laykold.com/

My Tennis HQ:
mytennishq.com/

Perfect Tennis:
www.perfect-tennis.com/

SportMaster:
www.sportmaster.net/maintenance/

Sport Surfaces:
sportsurfaces.com/

USA Pickleball:
usapickleball.org/