Track Asphalt & Paving

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Presentation Outline

• Asphalt Mixes for Sports Facility Paving Including Specifications
• Asphalt Product and Mix Design Problems for Sports Paving
• Drainage
Presentation Outline

• Sub-Base & Base Construction
• Asphalt Paving Techniques
• Asphalt Paving Problems
• Questions & Answers
Sport Facility Paving consists of more than Parking Lots and Roads.
Paving Tracks requires more than meeting the curb
There is a very tight tolerance for Paving Tennis Courts
Basketball Courts
The same tolerance is necessary for all Sport Surfaces
Sport Courts
Walking Tracks

- Paving around Fields
- Sidewalks around Bleachers
- Walking & Biking Trails
“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.
Asphalt Mixes for Sport Facility Paving
Including Specifications
Asphalt Mixes for Sports Facilities

- Type of Asphalt & Stone Aggregate is Determined by Soil or Climatic Conditions and by the Availability of Materials in a Specific Area.
- The Most Frequently Used Asphalt Mix is a Non-permeable Highway Mix Specified to a Particular State’s DOT.
- ASBA Has Designed New National Guidelines Which We Will Review.
Asphalt Mixes for Sports Facilities

- Asphalt is a Flexible Pavement Making it More Desirable for Northern and Eastern U.S. Because of Freeze Thaw Ground Movement.
- Asphalt is Also Cost Effective Contributing to its Desirability for Sports Facilities.
- While Flexible, Asphalt Becomes Brittle as it Weathers & Ages the Pavement Oxidizes, Shrinks, and Hardens Making it Less Flexible and Subject to Cracking.
Recommended Specifications

Hot Mix Asphalt:

- 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 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.
Tips for Producing Asphalt for Athletic Facilities

- Specify and Install asphalt for low volume use; base, leveling, and surface.
- Perform Asphalt Mix Design with:
  1. Maximum particle size of 1/2”,
  2. Crushed particles,
  3. No aggregates that rust (iron pyrite or steel)
  4. Minimum of 45% sand portion in surface course mixture,
  5. Target 3.5% laboratory air voids.
- 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
Standard Sports Surfaces Tolerances

- **Base Course** – The base course shall be installed uniformly to +/- $\frac{1}{4}”$ within 10’ planarity.
- **Surface Course**– The surface / wearing course shall be installed uniformly to +/- $\frac{1}{8}”$ within 10’ planarity.
- **Workmanship** of the finished surface course shall be of the highest industry standards.
Recommended Specifications

- Possible prior to acceptance by the Owner. The surface course shall be built with a maximum aggregate particle size of fine-graded 3/8” or ¼”.
- Surface course shall be installed at 1-½” compacted thickness; no thickness less than 1” compacted thickness. For other mixtures, if permitted by the Engineer, follow the National Center for Asphalt Technology recommended guidelines shown on Next Slide.
Recommended Specifications

- HMA Mixture NCAT Fine Graded HMA
- Minimum Compacted Thickness
  - $\frac{1}{4}$" (6.35mm) (3)x $\frac{1}{4}$" = 1” (Because 1” is a minimum)
  - $\frac{3}{8}$" (9.53) (3)x $\frac{3}{8}$" = 1-1/4”
  - $\frac{1}{2}$" (12.5 mm) (3) x $\frac{1}{2}$” = 1- 1/2”
  - $\frac{3}{4}$” (19.0 mm) (3) x $\frac{3}{4}$” = 2- 1/4”
  - 1” (25.0 mm) (3) x 1” = 3”
Recommended Specifications

- Leveling Course – The course and location of the recreational area that requires placement of variable thickness of HMA to ‘true up’ the area prior to placement of the surface course. This course has a MAS no greater than that of the surface course.

- Base Course – The lower courses of the pavement structure below the surface and leveling course with a MAS of between ¾” and 1”. Base courses shall not be allowed to remain without the surface course placed over an extended period of time (48 hours) and as approved by the engineer. If the minimum thicknesses shown above cannot be met then install surface mixture as base course.

- 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), if time between pavement lifts is greater than 48 hours,

- Prime coating of the aggregate is done upon request when specified.
Definition of HMA

In simple terms…

A mixture of asphalt binder and graded mineral aggregate, mixed at an elevated temperature and compacted to form a relatively dense pavement layer

(≈ 5% binder and ≈ 95% aggregate)
Components

- Asphalt Binder
- Mineral Aggregate
- Air
- Optional Modifiers/Additives:
  - Binder Modifiers/Additives (e.g., polymers, elastomers, fibers, rubber)
  - Aggregate Modifiers/Additives (e.g., lime, granulated rubber, anti-strip agents)
Components (cont.)

- Air void
- Asphalt binder
- Mineral aggregate
- Air void
Types of HMA Mixtures

- **Dense-Graded (DGA)**
  - Size evenly distributed from smallest to largest size (well-graded)

- **Open-Graded (or Uniformly-Graded) Friction Course (OGFC)**
  - Primarily coarse aggregate with few fines

- **Stone Mastic (Matrix) Asphalt (SMA)**
  - Mid-size aggregate missing or reduced
The Introduction to:
“Superpave”

What it did it do to the Tennis & Track Industry?
Table: Volumetric Test Results at $N_{\text{design}}$

<table>
<thead>
<tr>
<th>Asphalt Content</th>
<th>$V_a$</th>
<th>VMA</th>
<th>VFA</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.9 %</td>
<td>5.2%</td>
<td>14.2%</td>
<td>62.7%</td>
</tr>
<tr>
<td>5.4 %</td>
<td>4.0%</td>
<td>13.5%</td>
<td>70.4%</td>
</tr>
<tr>
<td>5.9 %</td>
<td>2.7%</td>
<td>12.8%</td>
<td>78.1%</td>
</tr>
<tr>
<td>6.4 %</td>
<td>1.5%</td>
<td>12.2%</td>
<td>87.7%</td>
</tr>
<tr>
<td>Criteria</td>
<td>4.0 %</td>
<td>$\varnothing$ 13.0%</td>
<td>65-75</td>
</tr>
</tbody>
</table>

Similar to the Marshall mix design procedure, the volumetric properties are plotted versus asphalt content. This provides a graphical means of determining the design asphalt binder content (see Figures). The design asphalt binder content is established as 4.0 % air voids ($V_a$) at $N_{\text{des}}$ of 100 gyrations. In this simulation, the design asphalt binder content is 5.4 %. All other mixture properties are checked at the design asphalt binder content to verify that they meet the criteria. The design values for the 19.0 mm nominal mixture (Trial Blend No. 1) are indicated below:
Asphalt Product and Mix Design Problems for Sports Paving
If the Asphalt Content % is not high enough will it affect the Acrylic Coatings?
The Answer is YES!!
The Acrylic Surface can be Stronger than the Asphalt Binder and will create Cracks in Acrylic Surfaces
Asphalt Stripping

- A Breakdown in the Adhesive Bond Between the Aggregate and the Asphalt Cement
- Generates at the Bottom of Asphalt Layer and Works Upward Weakening
- Cracks then Form as the Entire Structure Weakens & Disintegrates
- Symptoms of Stripping are Short Hairline Cracks & Puckering
- Cause by Too Much Moisture in Asphalt Mix or in Asphalt Substrate
Moisture in Asphalt
Remedies for Stripping

- Install Proper Surface and Subsurface Drainage
- Remove the Entire Surface Area and Start Over
- Resurfacing With Asphalt
- Apply Fiberglass Membrane
- Install Flexible Coatings
Stripping Prevention

- Provide Positive Drainage Away from Pavement Structures
- Apply Anti-Stripping Agents
- Thoroughly Compact all Pavement Structures
- Use Hot, Dry, & Clean Aggregate in Both Base and Asphalt Mix
- Use Well Compacted, Densely Graded, Full Depth Asphalt Concrete and Place it Directly Over a Properly Prepared Sub-Grade
Asphalt Cracking

- Shrinkage Cracks Caused by Oxidation. Affects adjacent Asphalt to Surface More Than Surfaced Asphalt as it is Protected From the Sun
- Shrinkage Cracks can Migrate into Surfaced Areas Causing Problems.
- Joint Cracks Are Caused by Weakness of Adjacent Paving Passes at Joints.
- Natural Tendency for Asphalt is to Become Brittle with Age, Shrink & Crack.
- Movement from Weak Base
- Penetrating Water
Types of Cracks

- **Surface Cracks Including:**
  - Hairline Cracks, Alligator Cracks, and Shrinkage Cracks

- **Pavement Cracks Including:**
  - Heat Checking, Structural Cracks, Reflection Cracks, Radial Cracks, and Settlement Cracks
Joint Crack / Heat Crack
Structural, Radial, Reflective, Brittle Aged Asphalt Cracks
Net Post Stress Cracking & Paving
Why Saw Cut into a New Court?

1. It is the nature of asphalt to shrink.
2. Asphalt will crack at its weakest point.
3. Let’s tell it where we want it to crack.
4. The purpose of saw cutting is to keep the playing area free of cracks.
1. At the NET LINE from Fence to Fence.

2. The most stress on an asphalt court is due to the tension from the net cable.

3. In BETWEEN COURTS because it is out of the playing area.
Control Joint
After Maintenance
Blistering & Bubbling/Delamination

- Caused by Water Trapped between the Asphalt & the Coating or All Weather Surface.
- Caused by Water Trapped in Asphalt below Surface.
- Impermeable Surface/ Maintenance of Permeable Track and Tennis Surfaces or Impermeable Track Surfaces
- Contamination of Base Materials. Oil Spills, Clays, Salts & Minerals, Curing Agents, Uncured Asphalt or Concrete, & Improper Surface Preparation
Blistering
Blistering
Blistering
Remedies for Blisters/ Delamination

- Take Care not to Layer up too Many Coating or Maintenance Cycles of Coating or All Weather Surface Especially Latex Track Surface.
- Install Good Drainage Systems
- Install Proper Base Construction under Asphalt
- Take Care to Properly Prepare the Asphalt for Coatings or Surface.
- Asphalt Curing of 14 to 30 days/ 40-50 Days for Concrete
- Vapor Barrier Along with Acid Etch for Concrete
Pyrites/ Impurities

- Foreign Material in Asphalt Aggregate (Stains Athletic Surfaces and Causes Holes in Surface of Tennis Courts Causing Deflection of Balls)
- Found in Gravel Mix
- Gravel Mix Also Contains More Moisture (Usually)
- In Ohio 100% Limestone Mix Preferred for Sports Facility Paving
- No Recycle of Asphalt or Concrete Accepted
Rust Spots due to Metals in Mix
Rust Spots due to Metals in Mix
Drainage Systems

Since water is the most common causes of surface failures, Adequate Drainage is one of the most important considerations is selecting a site, and in selecting proper drainage system to move water away for the site.
Drainage Systems

Types of Drainage Systems are for Surface & Sub Surface Drainage.
Surface Drainage Systems Include

- Precast Channel Drains
- Open Pan Drains
- Swales
- Swales with Catch Basins
- Catch Basins
Subsurface Drainage is Primarily a French Drain
PERIMETER TRENCH / FRENCH DRAIN

FIGURE 2-10

5" TOPSOIL AND SEED

24" MIN. TO EDGE OF ASPHALT

18" MIN.

3/4" WASHED STONE

4" OR 5" PERFORATED PVC W/ NYLON Sock

COMPACTED SUBGRADE

TRACK SURFACING

ASPHALT

BASE
Sub Surface Drainage Repair
Surface Drainage

Channel Drain

ASBA TECHNICAL MEETING & TRADE SHOW
NOVEMBER 30 - DECEMBER 4 | SCOTTSDALE, ARIZONA
Surface Drainage
Surface Drain in “D” Area

Slot Drain
Sub Base & Base Construction

- Sport Facility Paving and Base Construction Consideration:
  "Maintaining Planarity of the Surface is a Higher Priority Than its Load-Carrying Ability." (Running Tracks Construction & Maintenance Manuel 2012)
- Tolerance vs. Strength: Goal is a flat surface for performing sports activates on, however; the surface has to be to be strong enough to maintain paving equipment and trucks in order to maintain the desired planarity.
- The finished asphalt also has to be strong enough to support maintenance equipment in future years.
- IAAF & Colligate Maximum Lateral Inclination is 1:100 & Longitudinal (in the running direction) is 1:1000.
- High School Maximum Lateral Inclination is 2:100 & Longitudinal is 1:1000 or same as IAAF.
Sub Base & Base Construction

- Base Materials & Dot Thicknesses
- Laser Grading
- Compaction (Base & Sub Base)
- Herbicide
- Primecoat
- Base & Sub Base Failures
- Fabrics & Stabilization Methods (Limestone & Cement)
Laser Grade Stone Base
Laser Grade Stone Base
Base Failure
Excavated site to sub-grade
Stabilization fabric above sub-base
Sports Vs. Commercial & Road Paving

- Emphasis is on Planarity vs. Strength
- Drainage is a Higher Priority Because of Surfaces Being Applied on the Asphalt
- Specific Asphalt Mixes are Needed to Prevent Stains, Surface Holes & Bumps
- Increased Stringent Planarity Spec’s Require Higher Expertise & Experience
Asphalt Paving Techniques

- Refurbish Existing Asphalt Surfaces
- Fabrics
- Asphalt Milling
- Paving Patterns
- Achieving Strict Tolerance Using Laser & Ultrasound Screed Controls
- Thickness
- Compaction/ Rolling and Roller Marks
- Paving Successive Passes in the Same Plane
Options for Asphalt Repair or Replacement

1. Paving Fabric with Asphalt overlay
2. Stone Dust Overlay then Pave Asphalt Binder & Top
3. Mill in Place use millings as Base Asphalt Binder & Top
4. Mill & Remove Asphalt from site Asphalt binder & Top
5. Optional to Add Paving Fabric between Binder & Top Course
Asphalt Paving Fabric Illustration

Paving fabrics to help reduce reflective and fatigue cracking of the new Asphalt Surface Layer
Reclaiming Asphalt for Reuse as Base
Asphalt Removal
Regrade & Compact Stone Base
Asphalt Binder Course
Asphalt Paving Complete
Asphalt Paving @ Seams & Curbs
Matching the Curb
Important to Check Screed for Level
Check the Seams for Level
Paving on Different Planes
Makes for High Joints
Checking Planarity by Digital Level
Laser Paving Tennis Courts or Tracks
Proper Rolling Methods
Are you nervous when this guy shows up on your job
Paving Events
Additional Asphalt Problems/Low Spots
Acrylic Patching
Question & Answers