

(Excerpt) Tennis Court Surface Blemishing

Effects of Contaminants in Asphalt Pavement (Hot Mix Asphalt - HMA)

Sheldon Westervelt, P.E.

Abstract: Newly built or recently rehabilitated tennis courts should last for many years; however, some playing surfaces are cosmetically damaged or structurally impacted by the effects of aggregate contamination. This paper provides a brief history and discusses causes of ferrous particle (pyrite) contamination in naturally occurring aggregates. The author further explores the results of such contaminants and provides some remedial approaches for eliminating these effects in tennis courts constructed with hot mix asphalt concrete pavement (HMA). Included in this discourse are suggestions for preventing contamination in both new construction and renovation projects.

DEFINITIONS.

Hot mix asphalt, commonly called “asphalt pavement” or “asphalt concrete pavement” and referred to in engineering and construction documents as “HMA,” is used as a construction material for many hard court tennis facilities throughout the world. Asphalt pavement can be defined as “*A high-quality, thoroughly controlled, engineered mixture made by heating asphalt cement and mixing it with aggregates and mineral fillers. Typical proportions are 94 to 96 percent aggregate and 4 to 6 percent asphalt cement.*”¹

Aggregate, the major component of HMA, refers to a mixture of particles, sized in specific proportions of dimensions within a mixed batch of HMA, consisting of hard, inert mineral materials, such as crushed rock or stone (e.g., limestone and traprock), gravel, and sand. Although the load bearing performance is greatly determined by the proportions of particle size contained in the typical HMA mix formula, tennis facility design focuses on other mixtures which produce a flexible, smooth, easily maintained, and durable playing surface.

Asphalt cement, commonly referred to as asphalt, combines with the aggregate mix to produce “asphalt pavement.” This cement or glue is derived from the fossil fuel refinement process and may sometimes be called “tar” in colloquial use. Specific formulations of asphalt cement are designated for use in varying geographic locations to provide superior tennis playing surfaces. For example, we pioneered the use of the WESCO emulsified asphalt leveling course system of construction, resulting in properly and specifically designed courts having lifespans greater than 20 years.²

¹ As defined by the National Asphalt Pavement Association. Refer to <http://beyondroads.com>.

² Refer to http://globaltennisdesign.com/rehabilitation/rehab_westchester.htm

DESCRIPTION OF THE PROBLEM.

Rust blemishes on the surface of acrylic coated HMA tennis courts are a condition that is unfortunately observed too often in many geographical regions of the United States. Caused by pyrite (iron particle) contamination of the aggregate used in the manufacture of the HMA, these cosmetically undesirable spots and streaks on the playing surface detract from the beauty of courts so affected, even becoming a distraction to players, and are sometimes capable of causing localized surface failures (see Figure 2).

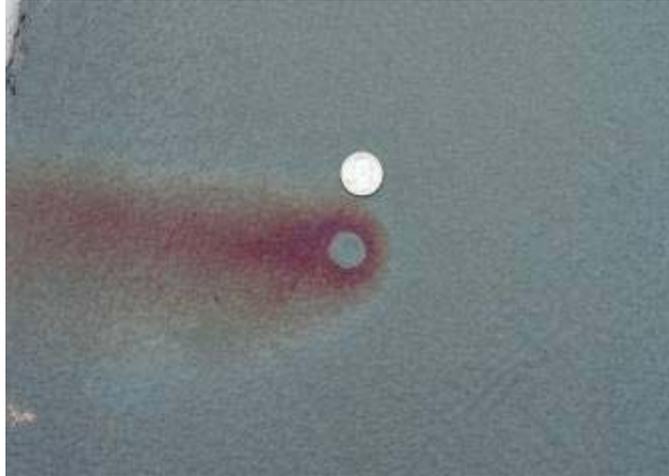


Figure 1 - *Pyrite surfacing through acrylic coated HMA*

Contaminated aggregate rust spots are usually observed beginning six (6) to twelve (12) months after the courts are completed and will continue to increase in number over the next twelve (12) months or more. As rain falls on the courts (depending inversely upon the rate of evaporation: more rapid in summer at high temperatures and sunshine than in winter months, when water tends to lay on the court surface for longer periods of time), the moisture penetrates the acrylic color surface system and moistens the aggregate in the HMA. If pyrites are present, the oxidation (rust) process is initiated and with time the rust particles migrate to the court surface and become evident by the rust color observed above these contaminated aggregate particles. Ultimately rust streaks form in the direction of the slope of the tennis courts.

Origin of Pyrites.

The aggregate used in the production of HMA is usually a quarried stone such as limestone or traprock, or a gravel, all of which occur in natural geologic deposits in the earth. Pyrites are most commonly found in crushed stone and are not discernable in an aggregate pile by observation. Although there are tests for determining the presence of pyrites in aggregates, the difficulty is finding a representative sample of the crushed aggregate that contains pyrite. The ferrous bearing particle could be one-in-one-thousand or more particles - making it extremely difficult to detect by random testing of aggregate samples.



Figure 2 - *HMA Failure: Pyrite eruption through acrylic coated HMA*

Fortunately, ferrous bearing aggregate is well-known by geographical source and each HMA producer should be aware of the presence of aggregate contaminants based upon each source as well as documented by local historical evidence. Some HMA producers are insensitive to such issues because they provide asphalt pavement primarily for roadways and parking lots where the presence of pyrite

contamination is little noticed. However, if their aggregate is used for sidewalks (Portland Cement Concrete – PCC) or sports play surfaces, it will be noticed by many.

PREVENTIVE MEASURES

Over the years, Global has witnessed these contaminants (along with others) wreak havoc on newly constructed courts. Having repaired these damaged systems, it is clear that prevention is the best mitigation strategy. Toward that objective, Global crafted our Specification 02514 ASPHALT CONCRETE TENNIS COURT PAVING, Section 2.02, Note 2 that states in part:

“The aggregates used in the mix shall be free from mineral pyrites, marcasite, wood particles, clay or dust “balls” or other deleterious materials which may cause staining/discoloration or interfere with the planarity, structural stability or aesthetics of the playing surface.”

Properly informed HMA producers who, through the course of time, have been shown to supply aggregate in their Job Mix Formula that does not meet this specification should be held accountable.

REMEDICATION – A PROCESS.

Remediation of the pyrite contamination problem will depend upon the severity and quantity of the rust spots and resulting streaks. Sometimes only a rust streak will appear, while at other times there is an actual swelling of the aggregate as it oxidizes causing a slight raised area in the HMA. The severity is usually directly related to the size of the contaminated particle. For more information on your remediation options, please contact your local Global Representative.