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MEET THE NEIGHBORS

Everything You Wanted To Know About Asphalt Facilities


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WHAT IS

ASPHALTIC CEMENT?

Asphaltic cement is a highly viscous, black substance comprised of a complex mixture of hydrocarbons. Some asphaltic cement comes from natural asphalt lakes such as the La Brea Tar Pits. Most of the asphaltic cement used in road building is actually a by-product of crude oil refining. Asphaltic cement is the residual material remaining after lighter fractions, or grades of oils, have been distilled from crude oil. It can be further processed for use in paving mixtures or other industries such as roofing. Asphaltic cement is a thermoplastic, which means it is hard at ambient temperatures, but thick and sticky when heated. It may be referred to as "binder" or bitumen (a term commonly used outside North America). It is the material in pavement that coats aggregate and glues (or binds) the mix together. Eighty percent of the asphaltic cement used in the United States is for paving mixtures.

ASPHALT

IS TAR THE

SAME AS ASPHALTIC CEMENT?

No. Tar is a black or brown mixture comprised of hydrocarbons and free carbon. It typically results from the destructive distillation of organic matter. Though it can be produced from petroleum, most often it is produced from coal as a by-product of coke production. It was once used to seal roadways, roofing shingles, and wooden ship hulls. However, since the 1970s, asphaltic cement has completely replaced the use of tar in paving mixtures.

WHAT IS

ASPHALT PAVEMENT?

Pavement is a hard, smooth surface that facilitates vehicular and pedestrian transportation. It consists of a highly controlled mixture of asphalt cement and aggregate. Prior to placement, this mixture is referred to as asphaltic concrete, or bituminous concrete. Mix can be further classified as Hot Mix Asphalt (HMA) or Warm Mix Asphalt (WMA) based on the mix temperature at which it is produced. Typical paving mixtures contain 95% aggregate and 5% asphaltic cement. Asphalt pavements produced at temperatures below 300°F are referred to as Warm Mix Asphalt (WMA). Paving mixtures produced at temperatures between 300°F and 350°F are termed Hot Mix Asphalt (HMA).

WHAT IS THE DIFFERENCE

BETWEEN HMA AND WMA?

Hot Mix Asphalt (HMA) is asphaltic concrete produced at mix temperatures of 300°F and higher. Warm Mix Asphalt (WMA) is asphaltic concrete produced at mix temperatures below 300°F. WMA is produced by modifying the viscosity of the asphalt cement, typically by mechanically foaming the binder through water injection. This allows the mixing process to be conducted at lower temperatures. Production of WMA reduces energy consumption, which results in lower emissions.

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HOW MANY ASPHALTIC CONCRETE FACILITIES

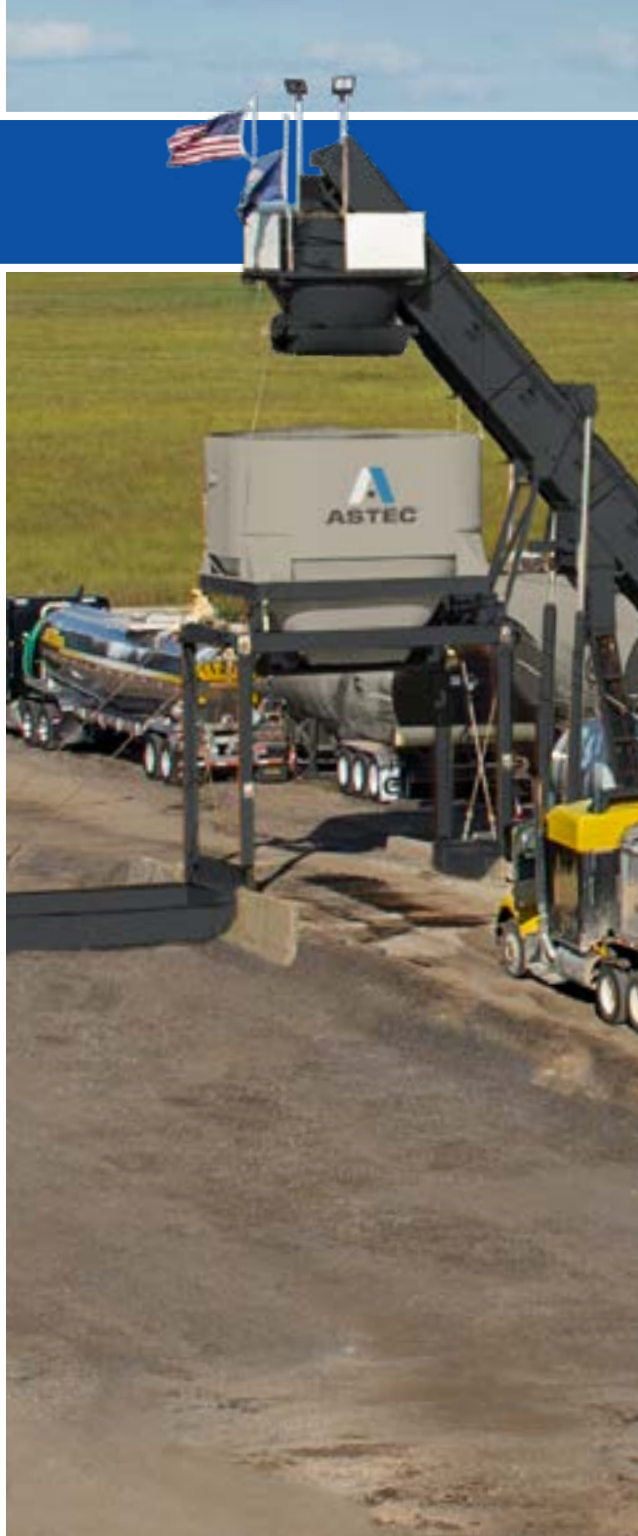
ARE IN THE UNITED STATES?

According to the EPA industry estimates, there are approximately 4,000 asphaltic concrete production facilities operating throughout the country.

WHY ARE SO MANY

FACILITIES NEEDED?

Considering how large the United States is, there really are not a lot of facilities. This amounts to only one facility per 950 square miles. Approximately 2.68 million miles of U.S. roadways are paved, 94% of which are surfaced with asphaltic concrete. Road maintenance and new construction projects require between 650 and 750 million tons of asphaltic concrete each year. Asphaltic concrete must be laid quickly after being loaded into the haul truck, because it hardens as it cools. Cooling occurs during transport from the facility to the paving site. The haul distance needs to be as short as possible to minimize the amount of heat lost during transport, because mixes become harder to lay down by a paving machine and compact with rollers as they cool. Ambient air temperature greatly effects how long the mix is "workable" and can be properly installed on the roadway. In addition, trucking is a large part of road maintenance and construction costs. Minimizing haul distances lowers road paving costs to the community.



FACILITIES

HOW IS ASPHALTIC
CONCRETE MADE?

Aggregate is divided and placed into bins according to size. Depending on the mixture of aggregate called for, the bins automatically meter out the appropriate volume of each size needed onto a conveyor belt. The belt deposits the aggregate into a rotary dryer. This machine tumbles and veils the aggregate through hot air to dry it thoroughly. A fuel burner is located at one end of the drum to provide a flame for heat. It is necessary to remove the moisture from the aggregate so the asphaltic cement will adhere to the rock. Remember, water and asphalt do not mix. After drying, the aggregate is then coated with heated asphaltic cement and thoroughly mixed. Production of asphaltic paving mixtures does not entail harmful chemical reactions.

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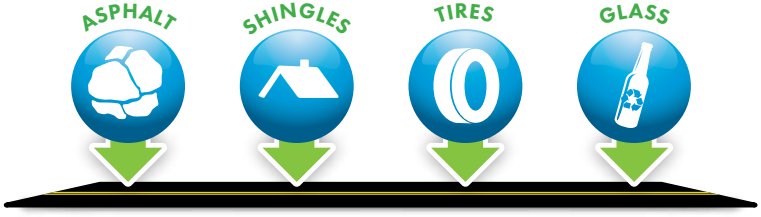
CAN ASPHALTIC CONCRETE PAVEMENT

BE RECYCLED?

Asphaltic concrete pavement is completely recyclable. Before repaving an existing road, the upper asphaltic concrete surface is milled off. The removed material is called Reclaimed (or Recycled) Asphalt Pavement (RAP) and is added to new mix while it is being made at the asphaltic concrete facility. Recycling asphaltic concrete pavement reduces the quantity of new material required, lessens environmental impacts from the facility, and minimizes disposal of old pavement in community landfills. Asphaltic concrete pavement is the most widely recycled product in the U.S., both in terms of tonnage and percentage. Over 99% of asphaltic concrete pavement removed from roadways during maintenance is recycled each year. Other recyclable products, such as glass, rubber tires, and recycled asphalt shingles (RAS), are used in the production of hot mix asphalt. Paving mixtures containing RAP are referred to as recycled asphalt mix (RAM). Advances in technology are leading to increased RAP usage.



WHAT POLLUTANTS ARE EMITTED DURING

THE PRODUCTION PROCESS?

The burners of most aggregate dryers run on fuel oils or natural gas. These fuels are hydrocarbons (compounds containing hydrogen and carbon atoms) and produce carbon dioxide (CO_2) and water (H_2O) during complete combustion. However, no actual combustion process ever completely burns all of the fuel. Thus, the exhaust stream will include water, particulate matter, products of combustion, and unconsumed nitrogen and oxygen molecules from the air. The products of combustion generally include carbon monoxide (CO), oxides of nitrogen (NOx), sulfur dioxide (SO_2), and hydrocarbons. These hydrocarbons can fall into several categories, including volatile organic compounds (VOCs). All of these pollutants are measured in the exhaust stream in parts per million (ppm). Pollutant emission rates depend on fuel type and aggregate source, as well as plant design. Modern asphalt facility burners are extremely efficient and, therefore, typically produce low emissions that conform to local and state regulations.

VOC emissions may also result from heating the asphalt cement. Many of the compounds generated during the mixing process are incinerated by the dryer burner and are not exhausted into the atmosphere.

RECYCLING

IS ASPHALTIC CEMENT A TOXIC HAZARD TO

ANYTHING IN THE ENVIRONMENT?

No. Asphaltic cement is insoluble and does not react with water. In fact, asphaltic concrete has been used to line surfaces of fish hatchery ponds and community water reservoirs. For example, the Metropolitan Water District of Southern California has used hot mix asphalt liners in its reservoirs for over four decades. Asphaltic cement is also used to seal potable water supply pipes. Another important use of asphaltic concrete is industrial retention ponds and landfill liners. Asphaltic liners prevent harmful substances from leaching into the soil and possibly contaminating ground water.

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IS AN ASPHALTIC CONCRETE FACILITY

A LARGE SOURCE OF EMISSIONS?

No. In fact, studies show that emissions from the asphalt paving industry have decreased over 97% since 1970, despite a 250% increase in production. All emission concentrations from asphaltic concrete production facilities are well below the established threshold limit values set forth by the American Conference of Governmental Industrial Hygienists. The EPA delisted asphaltic concrete production facilities from the Maximum Available Control Technology standard in February, 2002, because such facilities are not major sources of air pollutants. The asphalt paving industry continues to develop new technologies to further minimize emissions during mix production and paving operations. Mix production facilities must be permitted through local or state air quality agencies. The permits establish operating limits for the facilities to strictly control emissions generated during mix production, in order to prevent degradation of ambient air quality.

WHAT IS

"PARTICULATE MATTER"?

Particulate matter is a term used to denote microscopic liquid or solid particles much smaller than the diameter of human hair. Particle size is measured in microns, which is equal to one-millionth of a meter. Particulate matter results from the drying process at an asphaltic concrete production facility. In the case of such facilities, the particulate is almost entirely stone dust. Stone dust is a valuable part of the product that the facility owner does not want to lose. It is collected by a large air filtering unit called a baghouse and returned to the mixer for inclusion in the paving mixtures.

HEALTH

DO ASPHALTIC CONCRETE FACILITIES

CAUSE CANCER?

Numerous agencies worldwide have conducted extensive testing on asphaltic cement fumes from paving and roofing applications. The International Agency for Research on Cancer classified asphaltic cement fumes from occupational exposure as Group 2B. This designation is used for substances, mixtures, and exposure circumstances for which there is limited evidence of carcinogenicity in humans. Other items designated as Group 2B include aloe vera (whole leaf extract) and cell phones (radio frequency electromagnetic fields).

The American Conference of Governmental Industrial Hygienists has designated asphalt cement fumes as A4, which are agents not classifiable as a human carcinogen due to lack of data indicating evidence of carcinogenicity.

IF THERE IS NO DANGER OF CANCER,

WHY HAVE THERE BEEN SO MANY STUDIES?

Hundreds of tests have been conducted primarily because of the apparent similarity of asphalt to tar. What the tests have proven is that these are two completely different materials from completely different sources and with completely different health effects. Coal tar does have some harmful health effects. Those same effects have not been found to be associated with asphaltic cement.

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CLEAN AIR

WHAT IS A **BAGHOUSE?**

A baghouse is a large air filtering device that removes particulate matter from the aggregate drying process in an asphaltic concrete production facility. A large fan on the outlet end of the baghouse pulls dust-laden air from the drying drum into the filter unit. Hundreds of long cylindrical cloth bags hang in rows within the filter section. The air is pulled through the bags and dust particles collect on the bags' outer surface. Filtered air is released into the atmosphere through the exhaust stack. Collected dust is periodically removed from the bags and conveyed to the mixer to be added to the asphalt pavement mixture. Baghouses filter out virtually all of the particulates from the air stream (over 99.9%). The Clean Air Act states that asphaltic concrete production facilities cannot emit more than 0.04 grains (grain = 1/7000th of a pound) of particulate matter per dry standard cubic foot of air. Most baghouses routinely emit less than half of the federal allowable particulate matter. Many states have enacted particulate emission standards for asphaltic concrete facilities that are more stringent than the Clean Air Act.

ARE ASPHALTIC CONCRETE FACILITIES **EMISSIONS REGULATED?**

The Clean Air Act of 1990 requires that all stationary emission sources obtain air permits in order to operate, including asphaltic concrete production facilities. An air permit contains the operating conditions that must be met by the facility. Particulate emissions and opacity are regulated on a federal basis, though many state and regional air quality agencies have implemented tighter requirements. Individual states and local authorities regulate other pollutants, including the products of combustion. Facilities must maintain extensive records to demonstrate compliance with those regulations. This includes production and fuel consumption rates from which emission levels can be calculated. Failure to comply with operating permit conditions results in fines and/or facility shut down.

ARE ASPHALTIC CONCRETE **FACILITIES TESTED?**

Federal requirements in the Clean Air Act mandate that all permitted emission sources must be stack tested within 180 days of startup. Many states require testing in as little as 60 days after initial startup. Subsequent testing requirements are determined by individual states and permitting authorities. For example, some states require yearly testing, while others may only require the initial test, as long as permit operating conditions are met.

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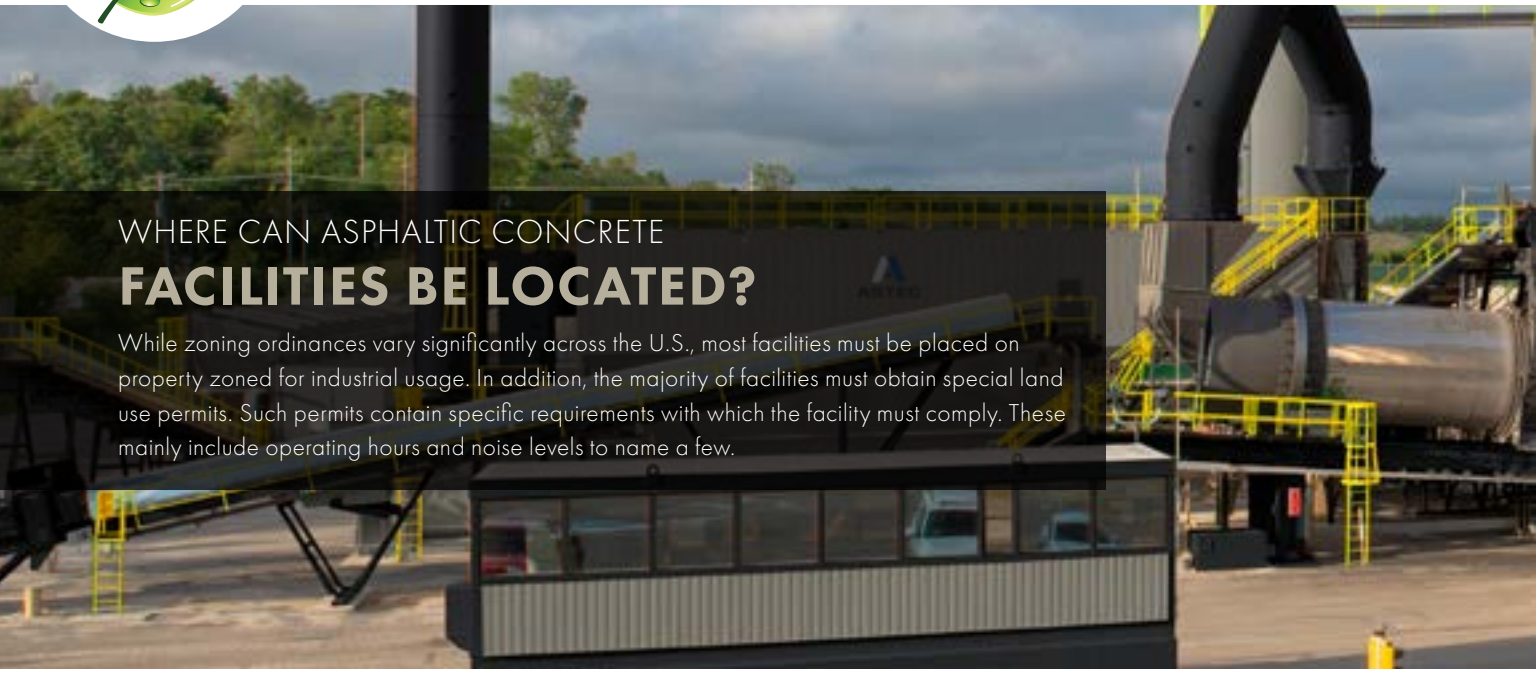

WHERE CAN ASPHALTIC CONCRETE

FACILITIES BE LOCATED?

While zoning ordinances vary significantly across the U.S., most facilities must be placed on property zoned for industrial usage. In addition, the majority of facilities must obtain special land use permits. Such permits contain specific requirements with which the facility must comply. These mainly include operating hours and noise levels to name a few.

WHAT CAUSES THE ODORS ASSOCIATED WITH

THE PRODUCTION OF ASPHALTIC CONCRETE?

The most common odor detected at an asphaltic concrete facility comes from the hydrocarbons driven off the liquid asphalt cement at elevated temperatures. Overheating materials during the drying process is the primary cause. As fuel has become more and more expensive, most owners and operators have become more aware of the cost of overheating materials and have learned to control temperature with greater precision. The fumes, known as "blue smoke," have a characteristic petroleum-type odor. Blue smoke forms as the hydrocarbons condense in the ambient air. Its formation is highly dependent on temperature and the facility configuration. Minimizing opportunities for the fumes to enter the ambient air and lowering mix/storage temperatures decreases odor levels from the facility. Odors are largely eliminated during the production of WMA, because the mix temperature is lower than the boiling point of the hydrocarbons.

PERMITS

WHAT ARE THE DIFFERENT TYPES

OF FACILITIES IN USE TODAY?

Modern asphaltic concrete facilities fall into two categories: batch and continuous mix facilities. As the name implies, batch facilities make individual batches of material. All the ingredients for the batch are fed into a mixer. When mixing is complete, the mixer is emptied, most often into a waiting haul truck. Batch facilities usually have smaller hourly production capacities than continuous mix facilities. They are suitable for small production runs or frequent changes in mix type.

Drum mix facilities operate on a continuous basis. The mix is stored in storage silos and discharged into haul trucks as needed. They can be either parallel-flow or counterflow, which is an indication of the material flow versus the airflow within the drum. Material moves in the same direction as the airflow in a parallel-flow drum, whereas the material moves against the airflow in a counterflow drum. Modern drum mix facilities almost exclusively include counterflow drums, because they use less fuel and generate lower hydrocarbon emissions than parallel-flow drums.

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ARE ALL PAVEMENTS

THE SAME?

No. Asphalt paving mixtures are designed according to the traffic they will handle. Therefore, an interstate paving mixture will be very different from one used for a residential driveway. Differences may include types and sizes of aggregate, as well as the grade of liquid asphaltic cement selected. Additionally, some paving mixtures may contain various recycled products, while others are comprised entirely of virgin materials.

IS THE BINDER USED IN PAVEMENT

THE SAME AS IN ROOF APPLICATIONS?

No, though they are both by-products of petroleum refining. Paving asphaltic cement is typically softer and more pliable than roofing asphaltic cement. Also, liquid cement at asphaltic concrete production facilities is not heated to temperatures as high as in roofing applications. That means that emissions and odors produced by paving operations are lower and not the same types of compound as those produced by roofing operations.

PAVEMENT

CAN ASPHALTIC CONCRETE BE USED FOR

ANYTHING OTHER THAN ROADWAYS?

Yes! Asphaltic concrete is used in a variety of applications. Because it is a non-toxic, impermeable material, asphaltic concrete is commonly used to line fish hatchery ponds, commercial water reservoirs, landfills, and industrial retention ponds. It is also used to pave recreational paths (for running & bicycling), golf cart paths, airport runways, and tennis courts. Asphaltic concrete has been used in commercial livestock applications, such as paving feedlots and lining barn and poultry house floors for easy cleaning. Additional uses include creation of sea walls and dikes to manage beach erosion. Specially designed permeable paving mixtures are increasingly being used to manage storm water. These porous pavements allow water to drain through them. Contaminants on the surface are drawn though the mixture where they are filtered through a rock sub-base, thus using natural processes to cleanse the water.

WHAT CAUSES NOISES ASSOCIATED WITH THE

PRODUCTION OF ASPHALTIC CONCRETE?

There are a few common sources of noise emanating from a hot or warm mix facility. Some are derived directly from the mix production components, including the burner and exhaust fan. Others are generated from movement of the product, including trucks and loaders. Recent advancements in asphalt mix production equipment design have drastically reduced sound levels. Astec has worked to reduce sound from the mix process by providing quieter components in a facility. Likewise, some facility owners have initiated on-site quiet operations and practices for movement of the product. It is often possible to participate in conversations using normal speaking tones while adjacent to most facility components at new facilities.

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WHAT HAPPENS

IF THE ASPHALTIC CEMENT SPILLS?

Asphaltic cement is hard at ambient temperatures and liquid only when heated. It is kept hot at an asphaltic concrete production facility so that it can be mixed with the aggregate to form pavement. Should the asphaltic cement spill onto the ground, it will quickly harden because it is no longer being heated. Once completely set, it can be picked up and disposed of. For additional safety, asphalt storage tanks, as well as the facility fuel tanks, are typically set-up within a concrete wall to contain spills should they ever occur.

WHAT EQUIPMENT MAKES UP AN

ASPHALTIC CONCRETE FACILITY?

There are several components found at asphaltic concrete production facilities, whether they are a batch or continuous mix plant. Aggregate is separated according to size and fed, usually by a front-end loader, into cold feed bins. These bins are used to meter the virgin aggregate to the dryer. The dryer is used to drive off the surface moisture and heat the aggregate in preparation for mixing with the asphaltic cement. Mixing may occur within a variety of devices, depending on the type of facility. Environmental controls include a baghouse, which is typically preceded by a primary collector such as a cyclone or inertial separator. Dust augers return the collected particulate matter to the mixer. Liquid asphalt cement is stored in heated tanks that are connected via piping to the mixer. Finished mix is held in storage silos, which are typically insulated and heated to maintain product temperature until it is loaded into a haul truck. Mix can often be stored for days before being loaded into haul trucks.

WILL AN ASPHALTIC CONCRETE FACILITY

AFFECT GROUNDWATER?

No. Asphaltic concrete production facilities do not generate industrial wastewater, because water is not required during the production process. Storm water discharge permits and retention ponds may be required in some locations to handle runoff from rainfall. Stack emissions from a facility do not contaminate groundwater.

COMPONENTS

WILL THIS FACILITY AFFECT

MY PROPERTY VALUE?

Most asphaltic concrete production facilities are located within community regions zoned for industrial use, away from residential land uses. On occasion, such facilities may be constructed near residential properties. Many erroneous claims of dramatic property devaluation abound on the Internet based on a flawed "study" conducted by an environmental organization. However, legitimate studies conducted by licensed real estate professionals in communities across the United States consistently show that the installation of an asphaltic concrete production facility in a community does not cause a decrease in surrounding land use property values. In fact, many neighborhoods have been built adjacent to existing facilities.

WHAT ABOUT

TRUCK TRAFFIC?

Materials used to produce asphaltic concrete are typically delivered to the production facility via truck. Rail lines are used in some locations. Asphaltic concrete is transported to the construction site via truck. The actual quantity of trucks entering and leaving the facility is dependent on the production requirements for active paving projects. Egress to and from the site falls under the authority of local government agencies. Traffic patterns and flow may be addressed by the land use permits required for most facilities.

PRODUCTION

DO ASPHALTIC CONCRETE FACILITIES

OPERATE CONTINUALLY?

No. Though asphaltic concrete production facilities can operate on a continual basis, mix production is highly dependent on weather conditions and product demand for paving projects. Facilities operate at their highest capacity during the summer, when paving conditions are most favorable. Facilities located in temperate climates may operate year-round, while those located in colder climates shut down during winter months. Routine equipment maintenance is typically scheduled during the shut down. Some facilities may operate at night, as many paving projects on busy thoroughfares must occur when there will be the least commuter impact.

WHAT ARE SOME

BENEFITS OF ASPHALTIC CONCRETE?

There are many benefits to using asphaltic concrete. Road construction and reconditioning projects can be completed faster and at lower cost when paving with asphaltic concrete. Studies show that asphalt pavements have a lower life cycle cost (cost of installation and maintenance over the life of the product) than Portland cement concrete pavement and are engineered to last decades with little to no maintenance. This generates savings to taxpayers for road construction and maintenance projects in a community. Asphaltic concrete pavements are smoother to drive on, which results in greater fuel efficiency, less vehicular wear and tear, and a quieter ride.

MEET THE **NEIGHBORS** GLOSSARY

AGGREGATE
Inert material such as sand, gravel, crushed stone and slag used as the chief ingredient of asphaltic concrete. Unwashed aggregates will also contain some amount of dust and process fines material.

ASPHALT
Commonly used as a shortened term for asphalt cement, but may also refer to asphalt pavement.

ASPHALT CEMENT
(AC; also known as bitumen.) The binder or "glue" in asphaltic concrete. Commonly abbreviated AC. At ambient temperatures, asphalt cement is a black, sticky, highly-viscous, semi-solid substance.

Asphalt cements used in asphaltic concrete are made by distillation of crude oil and are available in various grades. They are more suited for asphaltic concrete than asphalt made from other materials or asphalt obtained from native deposits in various parts of the world.

Use of coal tar is avoided by the asphaltic concrete industry because its fumes are known to be carcinogenic, posing a health hazard for anyone working with asphaltic concrete. Coal tar and asphalt cement are not the same substance.

ASPHALTIC CONCRETE
A paving mixture comprised of aggregate and asphalt cement. Also called bituminous concrete.

BAGHOUSE
An environmental control device containing filtration media used to remove particulate matter from a gas stream. These devices are used to filter the gas stream from the aggregate drying process at an asphalt mixing plant. The associated exhaust fan provides draft to support the combustion process and evacuate gases from the dryer drum.

BLUE SMOKE
(Also known as asphalt fumes.) Condensed gaseous vapors, comprised predominantly of organic compounds (light ends) generated when asphalt cement is heated. Various methods are used to minimize or eliminate blue smoke.

EMISSIONS
Substances discharged during production operations at an asphaltic concrete facility. The substances may be either gases or particulate. Federal, state, and local environmental codes usually limit the amount of emissions or pollutants that industrial and commercial operations can release into the atmosphere. Accordingly, an asphaltic concrete facility must have provisions to limit specified emissions produced or released.

HOT MIX ASPHALT

Road paving material (asphaltic concrete) produced by mixing hot, dry aggregate and liquid asphalt cement. Basic types of asphaltic concrete are dense-graded and open-graded. There are sub-types within the basic types.

The mixture is made with the ingredients heated to about 300°F, which is the temperature normally used to dry the aggregate. The liquid asphalt cement will adhere to the aggregate only if it is dry. The mix may also include dust or fines from the aggregate, ground rubber, and additives fillers, such as lime. The mixture is maintained close to 300°F until it is applied to the road.

Asphaltic concrete is called by numerous other names, such as asphaltic concrete, asphalt cement concrete, asphalt mix(ture), asphalt paving mix(ture), bituminous concrete, bituminous mix(ture), bituminous paving mix(ture), etc.

HYDROCARBON

Molecules containing hydrogen and carbon atoms arranged in structures that can vary from straight chains to branching chains to rings. The size of the atomic structure determines the properties and behavior of the hydrocarbon. The structure size is a function of the number of carbon atoms present in the molecule. Lighter structures with few carbon atoms are gaseous. Heavier chains with more carbon atoms are predominantly liquids, though some may be semi-solids or solids.

LIQUID ASPHALT CEMENT

Asphalt cement that is heated to a liquid state to make it suitable for mixing with aggregate to make asphaltic concrete. At ambient temperatures, asphalt cement is a semisolid.

PARTICULATE MATTER

(PM) Liquid or solid particles suspended in the atmosphere. PM is a complex mixture of particles, both natural and man-made, that may contain dust, smoke and pollen. Particles are classified by size. PM10 are inhalable particles measuring 10 microns in diameter and smaller. PM2.5 are fine inhalable particles with diameters of 2.5 microns and less. PM10 and PM2.5 are highly regulated because of their ability to cause serious health hazards.

PAVEMENT

A hard, smooth surface that facilitates pedestrian or vehicular travel. The most common pavement materials used in modern roads are asphaltic concrete and concrete. Pavement can also refer to the paving mixture comprising the surface.

RECLAIMED ASPHALT PAVEMENT

(RAP) Asphalt paving material recovered from old road beds either by milling or excavation by ripping. It includes aggregate as well as reusable binding material. RAP produced by milling can be hauled to the asphalt plant and recycled by adding it directly to virgin asphaltic concrete. RAP produced by excavation is usually in the form of large chunks, which must be crushed before it can be used at the asphalt plant.

VOLATILE ORGANIC COMPOUND

(VOC) Hydrocarbons with high vapor pressures and low boiling points that readily vaporize at room temperature. They are highly regulated due to their participation with NOx in the formation of ground-level ozone, or smog. Such compounds typically are not acutely toxic but can cause long-term health issues due to repeated or prolonged exposure.

WARM MIX ASPHALT

(WMA) Pavement material that has been mixed at a lower temperature. Cools more slowly, allowing successful use in lower temperatures.

WMA technologies reduce the viscosity of the asphalt binder with additives (water-based, organic, chemical, or hybrids) so that asphalt aggregates can be coated at lower temperatures.

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Please contact Astec Engineering at 423.867.4210
for additional information about asphaltic concrete facilities.

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