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Why Use a Fog Seal?

Terra Fog - Benefits

Definitions:

- **Asphalt**: Can come from natural sources (such as the tar pit on the island of Trinidad and Tabago).

Definitions:

- **Asphalt**: In the US, Asphalt mainly comes from oil refineries. It is the sticky black residue that is left over from the processing of crude oil. It has been used in paving for more than a hundred years.

Energy Insights By McKinsey defines asphalt as follows:

Asphalt *Also known as: bitumen, road oil:*

Asphalt is the densest liquid refined product produced by a refinery, but it only stays liquid if stored and transported heated. It becomes a solid if allowed to cool to normal atmospheric temperatures….

Only a very limited number of refineries produce any asphalt because of the relatively small end market, so it is generally considered to be one of the specialty products.

Definitions:

- **Asphalt Cement**: When asphalt is used to make an asphalt concrete…the Asphalt is referred to as asphalt cement. In other words, the asphalt is cementing the concrete together.
- Cement (Noun) :
  - (1) a substance to make objects adhere to each other
  - (2) something serving to unite firmly

Definitions:

According to the Virginia Asphalt Association:

Asphalt Concrete is a composite material commonly used in construction of roads, highways, airports, parking lots, and many other types of pavement. **It is commonly called simply *asphalt*** or ***blacktop*.**

The terms "asphalt concrete", "bituminous asphalt concrete" and the abbreviation ***"AC"*** *are typically used only in engineering and construction documents and technical literature* where the definition of "concrete" is any composite material composed of mineral aggregate glued together with a binder, whether that binder is Portland cement, asphalt or even epoxy.

To the layperson *Asphalt Concrete pavements* is most often called just "asphalt".

Definitions:

Types of Asphalt Cement:

- **Hot Mix Asphalt (HMA)** : This Concrete is Asphalt mixed with sand and stone. There can be more or less stone depending on how dense the required final product needs to be. Hot mix is applied at very high temperatures >300°F in order to be workable laid down smoothly.

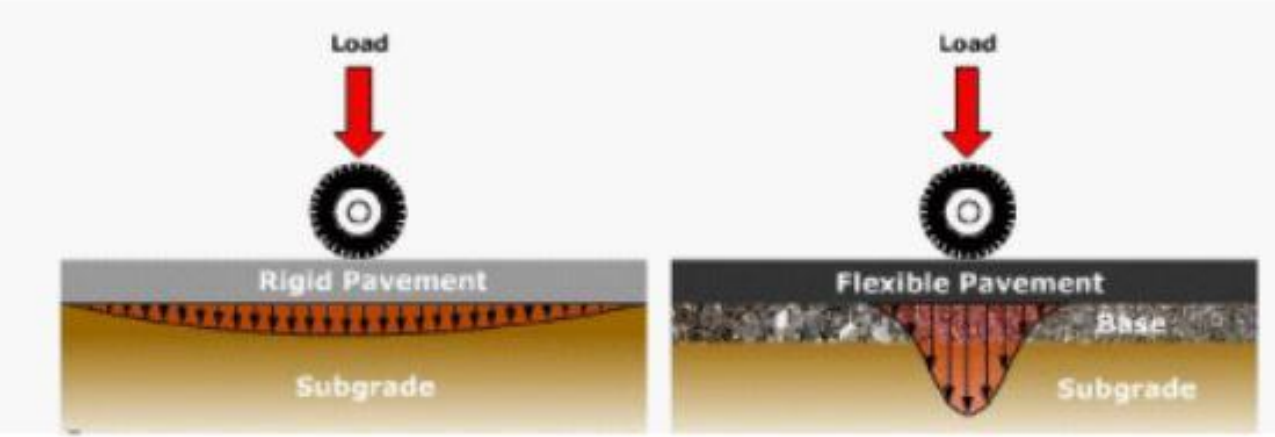
- **Warm Mix Asphalt (WMA):** This Concrete is also Asphalt mixed with sand and stone, but the Asphalt is modified chemically to allow the mixture to be workable at a temperature 100°F lower than hot mix Asphalt concrete (~200°F) .

- **Cold Mix Asphalt (Cold Mix):** This Concrete is a combination of emulsified asphalts, aggregate and water. It can be applied and worked at ambient temperature. It is not as strong as hot mix asphalt or warm mix asphalt. It is mainly used for small repair jobs and very light traffic road ways.

- **Millings (reclaim):** Asphalt millings (reclaim) is an asphalt concrete material that is removed from an existing road by a milling machine. It is somewhat reactivated by putting an asphalt solvent (AEP for example) on it to help it adhere to itself. Millings are applied at ambient temperature.

Purpose of Asphalt Concrete on a Road

(from TXDOT Pavement manual)



- When hot-mix asphalt (HMA) is used as the surface course, it typically is the stiffest (as measured by elastic modulus) layer and may contribute the most (depending upon thickness) to pavement strength. The underlying layers are less stiff but are still important to pavement strength as well as drainage and frost protection.
- Thicker HMA sections and or sections with stabilized bases behave as a semi-rigid system under traffic loading, whereby loads are spread to a greater degree over the natural subgrade than conventional flexible pavements. See “Rigid and Flexible Pavement Characteristics” above.

Base Failure Causes

- Water – Water enters the base through cracks and unsealed portions of the top wear layer. The water washes the fine particles out of the base structure leaving large gaps between the larger rocks in the base structure. The large gaps allow the rocks to collapse on each other which causes pot holes etc.
- Poor compaction – if the base is not compacted well, or if it was compacted with an excess amount of water, it will have voids. Similar to the water case above. The movement of traffic over these areas will collapse the voids and cause road failure.
- Sub-base (natural ground) Deformation – clay soils expand and contract extensively in drought and wet conditions. The movement of the soil causes the base to move and or have pressure points that will not support the movement of traffic above.

Road Surface Failure Causes

- Loss of aggregate on the top of the road allows traffic to start wearing away the asphalt seal on the surface of the base. It also takes away some of the load spreading ability of the top layer, and allows more force to bear down on the base.
- Loss of aggregate also leaves areas of the surface without asphalt because the asphalt is carried away on the aggregate. This allows water to start penetrating the base.
- Oxidation - Asphalt gets brittle over time, even when it is hot outside. The oxidation of asphalt causes cracks, because the asphalt is no longer flexible. Instead of flexing with the traffic it cracks. These cracks allow water to the base. Oxidation is caused by water and UV rays from the sun.
- Water – Water also speeds oxidation of asphalt.

What is a Fog Seal?

According to the TXDOT Seal Coat Manual (section 6):

- A fog seal is a light application of Asphalt (usually emulsion) applied to retain aggregate. It is …used over an asphalt concrete surface or a new seal coat, particularly if a porous aggregate has been used as the cover aggregate…
- Fog seal is used on an asphalt concrete surface that is exhibiting raveling. In some cases, a fog seal is applied to a seal coat that is exhibiting aggregate shelling. Aggregate shelling can often occur during the first cold spell after a seal coat. A light fog seal immediately applied at this time can minimize further shelling of seal coat aggregate.

What is Terra Fog

- Terra Fog is a polymer based fog seal.
- Terra Fog is 100% Eco Friendly.
- Terra Fog is applied at Ambient Temperature.
- Terra Fog is water based and can be applied with a water truck since it will not pose any environmental hazards after the application is complete. The truck can still be used for any non-potable purposes it had been used before.
- Fog Seals Can Correct Roads exhibiting:
  - Oxidization
  - Raveling
  - Pitting
  - Cracks <1/8”

Why Use Terra Fog

- Terra Fog is 100% soluble in water. Therefore it can more easily and more deeply penetrate cracks in the asphalt surface.
- Terra fog prevents asphalt oxidation and therefore prevents more cracks from forming.
- Terra fog forms a film over the road surface and helps keep the aggregate on the road. Aggregate retention prevents the sealing surface below from wearing away. Aggregate retention on the surface helps in a way to take some of load of traffic and keep the base stronger.
- Aggregate retention also help keep the skid resistance high for the safety of traffic on the road.
- Terra fog is easily applied and dries in 15 minutes allowing traffic to resume more quickly.
- Terra Fog is a bridge between a chip seal coat and a Fog coat. It performs as a seal coat but is sprayed on as a fog coat.

Where Not to Use Terra Fog

- **Terra Fog should not be used on a road that is exhibiting flushing or excessive loss of aggregate.**
  - Terra Fog preserves aggregate and seals the road. Skid resistance on a road way is very important. If there is no aggregate there will be no skid resistance. A new seal coat will be required on a road with flushing or large loss of aggregate (smooth spots on the road).
- **Terra fog is not designed to fill large cracks in the road (>1/8”)**.
  - Terra fog seals small cracks in the road. If there are large cracks in the road (larger than 1/8” wide). The road is already failing. If it is wished to seal a road with large cracks, it is best to fill the cracks with rubber asphalt sealer first. Then the road can be sealed.

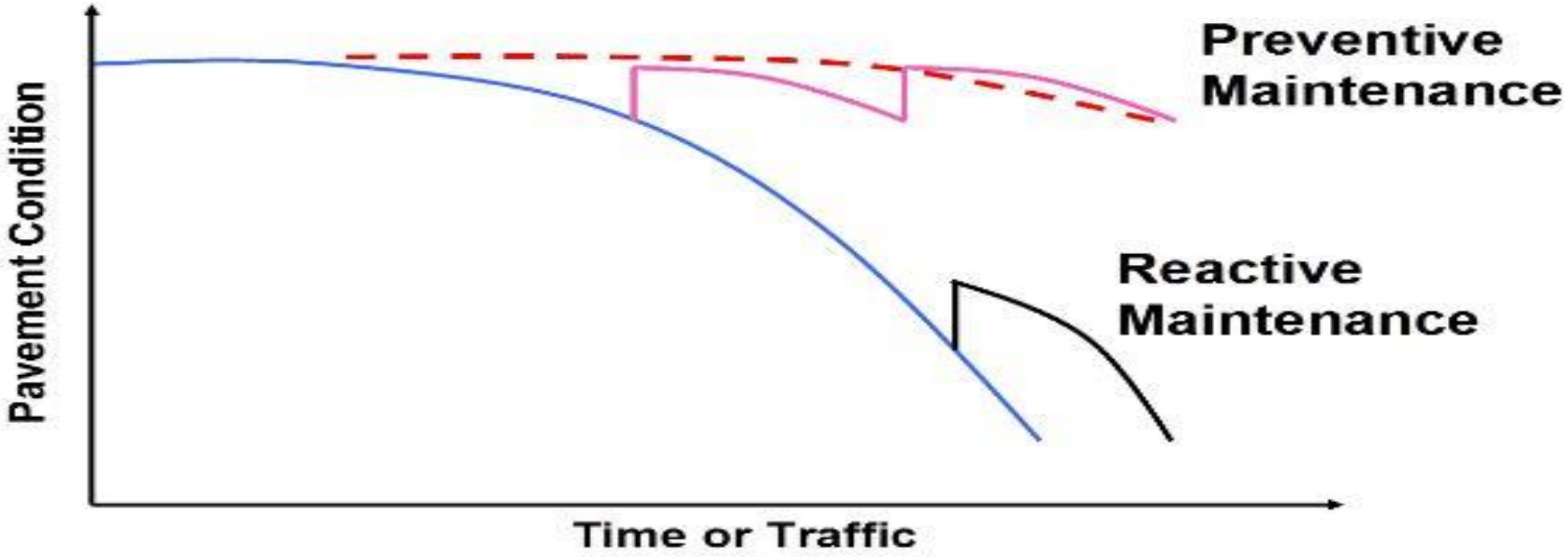
    --However, if a road with large cracks is sealed, it is only buying a little time before the road fails. Cracked roads already have a failing base infrastructure that will get worse with time and/or traffic.

Costs of Terra Fog

- Terra fog is applied at a rate of 0.02gallons/sqyd ~ 0.04gallons/sqyd.
- Higher concentrations of Terra fog are only required for applications with extremely porous surface aggragate. The more porous aggregate requires more material for a good seal.
- The sooner a fog seal is applied the better the road will be maintained. The average road requires the lower quantity.
- Terra Fog replaces the cost of a seal coat when aggregate loss is not too large. Therefore the cost comparison should be on par with a chip seal cost.
  - **Chip seal cost = ~$2.75/sqyd to $3.25/sqyd**

Preventative Maintenance Preserves Roads
--TXDOT Seal Coat Manual--

The difference between the effect of preventive and reactive maintenance is significant. Not only is the timing of application different as shown in Figure 1-1, but the effect (represented by the slopes of the after-treatment performance curves) is also disparate. A pavement that receives preventive maintenance experiences only small fluctuations in pavement condition and generally remains serviceable. The pavement condition drops to an unacceptable level, however, with reactive maintenance, then is temporarily boosted before quickly receding once more.



Conclusion

- Terra Fog retains aggregate on the surface of the road.
- Terra Fog Seals the road better than a chip seal coat
- Terra Fog is 100% environmentally friendly and can be applied with a water truck…no expensive distributor truck needed.
- Terra Fog looks good like a fresh seal coat.
- Terra Fog cannot be used on a road that is Flushed or otherwise has a lack of skid already present.
- Nither Terra Fog nor Chip seal will fix a road that is already failing (cracks larger than 1/8”)