Environmental Impact

Asphalt is an excellent paving product but has significant environmental weaknesses such as rainfall and U.V. that give it a limited lifespan. There are serious environmental issues with the heat produced by asphalt. E-Krete is considered a green technology and environmentally friendly. E-Krete is unaffected by UV, water, automotive fluids and fuels. Asphalt retains and absorbs heat whereas E-Krete reduces heat in asphalt. Asphalt cannot successfully be colored because the bitumen is black. E-Krete can be made in all the primary colors and is currently being used in Singapore as a red exit road for airports. E-Krete overlay could lower the costs and problems related to hot pavements.

The Cost of Hot Pavements

Urban Heat Islands: High temperatures during summertime lead to increased demand for air conditioning driving up energy usage. Heat Islands affect communities by increasing summertime peak energy demand, air conditioning costs, air pollution, greenhouse gas emission and heat related illness.

Hot Pavements and Increased Energy Use: Elevated temperatures in cities increase energy demand for cooling. Research shows that electricity demand rises 2% for every 1°F rise in daily temperature.

Urban Heat Island Mitigation

Many communities are taking action to reduce Urban Heat Islands. Through increased utilization of cool pavements, these communities are realizing the benefits of Heat Island Mitigation such as lower ambient air temperatures, reduction of air pollution, reduced energy consumption, lower greenhouse gas emissions, improved water quality, increased pavement surface durability and enhanced night time illumination.

Hot Pavements and Smog:

Hot pavements have an impact on air quality. Elevated temperatures increase the formation of ground level ozone, the main cause of smog pollution. Urban Heat Islands are not only uncomfortably hot, they are also smoggier. Higher ambient temperatures in Heat Islands increase air conditioning energy use. As power plants burn more fossil fuels, they increase both pollution levels and energy costs. The impact of these pollution levels is seen as smog. Formation of smog is highly sensitive to temperature; for every half degree Fahrenheit above 70°F, the probability of smog increases by 5%.

Hot Pavements and Water Quality:

We usually think of water pollution is terms of the discharge of oils and chemicals but there is also the consideration of Thermal Pollution. During summer rains, runoff flows over hot pavements raising the temperature of the receiving water body. Water temperature has direct and indirect effects on all aspects of stream ecology. For example, cold water can hold more oxygen than warm water. Abrupt rise in water temperature is known as Thermal Shock.

Hot Pavements and Distressed Pavements:

Service life cycles of asphalt pavements are shortened by the stresses associated with excessive heat. Lower pavement temperatures lead to longer lifetimes for the pavement. Examples of the effects of temperature on pavement durability are rutting, permanent shear strain (shoving) and aging of viscosity (loss of binder).

Rutting:

Water that remains on the roadway surface contributes to vehicle hydroplaning. In winter, standing water can freeze and cause skidding. –Federal Highway Administration.

The number of traverses of an applied load before a 1.3 centimeter rut is created is much larger when the pavement temperature is lowered from 122°F to 104°F. This indicates that failure due to rutting can be substantially delayed if the pavement is kept cooler by a reflective coating. – Institute of Transportation Studies, U.C. Berkeley.

Permanent Shear Strain:

Pavement subjected to repeated shear permanently deforms over time. For example where vehicles apply shear when they brake and shove the pavement. This deformation dramatically decreases as the temperature of the pavement is decreased. Permanent deformation due to shear strain can be decreased if the pavement is kept cooler. Source: Dr. John Harvey, Institute of Transportation Studies, U.C. Berkeley.

Aging of Viscosity:

Even in the absence of traffic, asphalt binder deteriorates. The stiffening of asphalt is seen to increase by an order of magnitude when the asphalt is merely exposed in a sunny, hot climate compared to a more moderate climate where the average annual temperature is only 10°F less. This suggests that if sunlight was reflected and the samples were cooler, the asphalt would retain its quality. - California Department of Transportation. Loss of asphalt binder leads to stiffening of the pavement, dislodging of fine aggregate particles, loss of coarse aggregate and ultimately to a very rough and pitted surface with diminished surface friction, fatigue cracking and eventual base failure.