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Hot Mix Asphalt - An Environmentally Diverse Material
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Hot mix asphalt (HMA) has been used successfully on a wide range of environmental projects throughout the Pacific Northwest. From liners for environmentally sensitive fish rearing ponds to the wearing surface at industrial sites, HMA is the material of choice by both designers and owners.

Fish Rearing Ponds

Over 35 fish rearing ponds lined with HMA are operated by the Oregon and Washington Departments of Fish and Wildlife, as well as by several Indian tribes in Washington State. These asphalt-lined ponds, used to raise fish from the fingerling stage until they are ready for release into adjacent rivers, have consistently produced quality fish; and they are environmentally compatible to the sensitivity of small fish. More than 1.5 million chinook salmon are released from Oregon's McCiver State Park Hatchery into the Clackamas River each spring.

A typical Washington State hatchery pond is 5-to-7-feet deep covering a one-half-acre surface area. The pond liner is constructed of 2 or 3 inches of HMA on 8 inches of granular base. Most liner surfaces are sealed with an asphalt

emulsion to fill surface voids. Unfilled, these voids provide a habitat for bacteria detrimental to the fish.

Pressure relief valves in the bottom of the ponds relieve any hydrostatic pressure that may occur under the liner when the pond is empty. These liners have low permeability, but also have the structural capability to sustain the heavy equipment needed to clean the ponds when they are drained.

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Hatchery Owners with HMA liners

- Oregon Department of Fish and Wildlife
- Washington Department of Fish and Wildlife
- Chelan County Public Utility District
- Nisqually Indian Tribe
- Puyallup Indian Tribe
- Lower Elwa Indian Tribe
- Northwest Trout Unlimited

Domestic Water Reservoirs

More than 20 domestic water reservoirs lined with hot mix asphalt have been constructed in California during the last 40 years. These reservoirs provide a safe environment for storing both untreated and "finished" water. The capacity of the existing reservoirs range from 30 million to 145 million gallons of water, volumes that show the magnitude of the reservoirs and the need for a high quality liner.

The composite liners required for a large water reservoir are typically designed using both dense-graded and open-graded HMA. Most importantly, HMA provides a liner that is environmentally safe for the storage of domestic drinking water. The design of a reservoir liner must address permeability, durability, flexibility, resistance to weather, the ability to absorb stresses during rapid filling and draw-down cycles and long term loading stresses caused by settlement in the supporting subgrade. Open-graded HMA interlayers are used in the liner

structure to monitor and intercept any leakage that may occur. Hot mix asphalt meets all the required design criteria and can be economically constructed as a liner.

Landfill Caps

HMA not only provides a safe environment for small fish and drinking water, but it also protects our environment by providing impermeable caps for abandoned landfills and deposits of hazardous materials. This diversity of use is illustrated by a three-acre HMA cap on a portion of an abandoned landfill owned by the City of Tacoma, Washington.

This cap had to meet stringent permeability standards, sustain heavy axle loads, and be environmentally acceptable. The maximum permeability of 1×10^{-7} cm/sec allowed by federal and state regulatory agencies was easily attained. The permeability of cores extracted from the completed cap was 9×10^{-10} cm/sec or less. After the cap was in use one year, a 5×10^{-8} cm/sec permeability reading was registered using a sealed double ring infiltrometer. In addition to minimizing the intrusion of surface water into the fill material, the cap serves as the paved surface for a high volume solid waste transfer station.

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Waterproof Waste Site

Waterproofing a hazardous waste site with HMA at the Port of Tacoma minimized the expenditure of public funds and satisfied environmental requirements. Petroleum contaminated material was consolidated on-site rather than being hauled to a distant, designated hazardous waste site.

After the contaminated soil was isolated and a drainage system was in place, an impermeable cap was constructed over the entire area. The composite cap included "hydraulic" HMA, paving fabric, permeable HMA and crushed aggregate. Currently, the site is being used as a training area for high-risk driving techniques. Ultimately, this site will be used for industrial purposes associated with the adjacent salt water port facilities.

Recreational Trails

Recreational rails throughout the northwest paved with HMA are providing a recreational environment and a means of non-motorized commuting. Many of these trails are located on trackbeds left behind when rail lines were abandoned. These recycled trackbeds have become popular and valuable asset to bicyclists, runners, walkers, in-line rollerbladers and commuters. The railroad rights-of-way are established corridors, often through scenic terrain, and the trackbeds provide gentle grades with an existing foundation for constructing HMA pathways.

One extensively used rail-trail is the 15-mile-long Burke Gilman Trail in the Seattle area. This 8-foot-wide HMA pathway offers scenic views of downtown Seattle, Lake Union and Lake Washington. The Burke-Gilman Trail connects four public parks and is a recreational treasure in a large metropolitan area.

Environmental Connector

Thurston County, Washington, is currently developing 42 miles of rail-trail. The state has completed six miles of rail-trail on trackbed once used to transport logs from surrounding forests to a log dump located on Puget Sound. The log dump is now a Natural Resources Conservation Area located at one terminus of the rail-

trail. The HMA paved trail traverses wooded areas, farmland and the urban area of the state capital while it offers views of majestic Mt. Rainier.

This trail also provides access to several public parks and lakes and interconnects three small rural communities and the urban area. The HMA pavement varies from 8 feet wide in rural areas to 12-feet-wide in the urban areas to accommodate the variety of uses made on the trail system.

The 50-mile-long Centennial Trail is an extraordinary recreational trail maintained and operated by four public agencies and the friends of the Centennial Trail. The trail begins at the historical Nine Mile Dam then follows the beautiful Spokane River through downtown Spokane, Washington, then eastward to the destination resort city of Coeur d'Alene, Idaho. This trail provides access to historical sites and parks, scenic views of the river and abounds with a diversity of geological wonders and plant life. The hot-mix asphalt pathway is an integral part of the success of this trail.

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Open-Graded Pavements

Open-graded asphalt pavements are used extensively in the Oregon Department of Transportation overlay program. Originally these open-graded pavements were used in response to concerns arising from rutting that occurred in dense-graded mixes. Quickly it was recognized that open-graded pavements also provided a safer travel environment for motorists, particularly in wet climate areas. Reduced truck spray and reduced hydroplaning improved the safety of the traveling public.

Another environmental issue addressed by open-graded pavement is the reduction of roadside noise. A number of studies in Europe and North America have determined that open-graded pavement surfaces, when compared to dense-graded asphalt pavements, reduce roadside noise levels by 33 to 7 decibels (dab's).

Less Noise, Less Spray

A 1994 study conducted by Oregon State University for the Oregon DOT concludes that open-graded pavements are 1 to 2 decibels quieter than dense-graded asphalt pavements. This study also concluded that open-graded pavements provided a 10 percent or greater reduction in truck spray than dense-graded asphalt and concrete pavements.

One note of caution in selecting the use of open-graded asphalt pavement in mountainous areas subjected to heavy snowfall. The Oregon DOT has experienced some problem with tire-chain erosion and snowplow damage where open-graded pavements are used in these areas.

Renovation of the athletic field at the Western Washington University football stadium included open-graded HMA as the base for a new surface on all all-weather track and the football field. This open-graded material, placed under a very stringent surface smoothness specification, functions as both a drainage layer and a temporary water reservoir in an area noted for significant rainfall. This project received an award from the Asphalt Paving Association of Washington for the innovative use of HMA and the superior quality of construction.

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Environmental and Performance Benefits of Open-Graded HMA Pavements

- Resistance to Deformation
- Noise Reduction
- Reduction of Truck Spray
- Improved Skid Resistance
- Minimal Reflective Glare
- Correction of Asphalt Bleeding

Industrial Sites

The use of HMA as the surface course at industrial sites provides a safer work environment for workers. Many port facilities, log yards and intermodal yards are surfaced with HMA. The HMA provides a smooth ride for operators of the large equipment needed to handle containers, truck trailers and entire truckloads of logs. Efficiency as well as safety is improved as equipment speeds can be increased on the asphalt paved surfaces.

Many log yard operations require extensive pedestrian traffic during the scaling and trimming of logs for export. The HMA surface is smooth compared to an unpaved surface and can easily be cleaned of bark and other debris. One log yard manager estimated his equipment maintenance costs were reduced \$25,000 to \$30,000 per month after the site was paved with asphalt.

Many industrial sites are now paved with larger stone mixes (1.5-inch maximum-size aggregate) to minimize the impact of the abrasive action of the heavy equipment used on the sites. Among the many log yard operators using HMA pavements are Weyerhaeuser Company, Longview Fibre, Idaho Forest Products, and the Ports of Grays Harbor and Tacoma. The intermodal yards of the Union Pacific and the Burlington Northern Santa Fe railroads in Seattle and Portland, Oregon, are paved with HMA.

Summary

Hot mix asphalt is the material of choice for a variety of projects that improve our daily lives and our environment. From liners for fish rearing ponds and domestic

water reservoirs, to recreational paths and industrial sites, HMA has proved to be a versatile, environmentally friendly construction material.

In addition to the uses described earlier, hot mix asphalt is the pavement of choice for an increasing variety of recreational and environmental purposes such as golf cart paths, sludge-drying beds, silage pits, work platforms at agricultural sites, and as revetments protecting roadway slopes and populated areas against flood damage.

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Each Application of Hot Mix Asphalt Should Incorporate Proper Design and Construction.

- Adequate Structural Design
- Selection of Quality Materials
- Appropriate Mix Design Criteria
- Implementation of a Quality Control Program
- Application of Quality Construction Standards