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Asphalt Used for Environmental Caps in Texas

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First time use of hot-mix asphalt (HMA) for environmental land caps has been recently approved by the Texas Water Commission (TWC).

As part of a remedial action program developed with the Water Commission, PPG Industries, Inc. needed to cap five areas around an active chemical plant in Beaumont, Texas. The caps were required to provide impermeable barriers to prevent infiltration of rain water, which could carry contaminants into the groundwater.

Conventional capping techniques, such as requiring three feet of compacted clay, placed with minimum slopes of 5 percent would have seriously impaired plant traffic and operations. The environmental consultants, together with PPG, proposed that TWC use hot-mix asphalt to construct the required caps in a way which would not interfere with plant activities.

The Approach

In each of the five areas, the contractor was required to remove the top two feet of topsoil and dispose of it at a hazardous waste landfill. Clean backfill was placed in each area to create an appropriate subbase.

Four of the areas were relatively simple to cap because contamination levels in the shallow soils were low. In these areas the subbase was constructed from clean, select fill which was proof-rolled and compacted before placing the HMA cap.

The fifth area was a 400-foot-long by 50-foot-wide strip along two railroad tracks that serviced the shipping and receiving area of the plant. Environmental considerations called for an expedient approach to backfilling. A low-strength concrete was used to create a subbase, then cement-stabilized sand was placed above the concrete to build the appropriate slopes. The HMA cap was then placed on top of the stabilized sand.

HMA Design

The consulting engineers asked Asphalt Institute Regional Engineer R. B. McGennis of Austin for guidance and suggestions on the best design for a cap that would have the following qualities:

- very low permeability with a free-draining surface;
- sufficient strength to support light plant vehicle traffic;
- durability with low maintenance; and
- ease of construction.

In order to achieve these characteristics, McGennis suggested:

- dense-graded surface course (100 percent passing the 1/2-inch sieve) conforming to Texas Department of Transportation master gradings;
- two percent maximum design air void content;
- minimum 95 percent in-place compaction; and
- measured permeability lower than 1×10^{-7} cm/sec.

Environmental Standards

To meet the strict environmental standards of the TWC, the environmental consultants implemented a rigorous quality assurance/quality control program. They required temperature checks of each truck load and extraction and gradation tests at specific intervals. In-place density and air voids were checked on a tightly spaced grid. A simple field indicator showing that air voids approached zero was the tendency for the asphalt to bleed slightly at the surface at the termination of pneumatic compaction.

Although hydraulic asphalt with 8 percent asphalt cement had been used for pond liners in the past with EPA approval the design team needed special approval by TWC to use hot-mix asphalt for an impermeable cap. So they set up a special test to gain TWC's final approval.

They used a flexible wall permeameter to measure the permeability of a specimen prepared to the asphalt mix specifications proposed for the caps. The test lasted several weeks, and resulted in a permeability measurement of 6×10^{-11} cm/sec. This value significantly exceeded the regulatory requirements for environmental caps and consequently won the TWC's approval.

Although the environmental cap was a first for the TWC, its use opens the door for a number of environmental and landfill purposes.

Dr. Jean Audibert and Dr. Laurence Lew are owner-managers of Enviroplex in Houston, Texas. They also worked on the development of the environmental cap in a previous affiliation with Woodward-Clyde Consultants. They would like to thank PPG Industries, Inc. for its willingness to assume leadership in developing this innovative environmental technique.

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