ASPHALT CORE DAMS

An embankment dam with asphaltic concrete core “is an appropriate dam type for the very highest future dams”

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Asphalt Concrete Core for Embankment Dams (ACC)

For more than 50 years, asphalt concrete has been used as an impermeable central (core) wall in embankment dams with a perfect no-leakage record. The very first asphaltic core dam was built in Germany in 1962. As of today, worldwide, more than 130 asphalt core embankment dams have been built. The interest in asphalt core technology has been bolstered by comprehensive technological research and the development of modern machinery. During the last 5 years, nine such dams have been built in North and South America.

2012, construction of the second Asphalt Core Dam in Brazil - Jirau Hydropower Project 3.750 MW.
Advantages

Asphalt is a viscoelastic-plastic, flexible and ductile material with a self-healing ability if there is tendency to crack formation caused by differential displacements or earthquake loads.

Inside the dam body the asphalt core exists under near ideal environmental conditions. It will remain flexible and impervious over the dams lifetime.

Placements of asphaltic cores are to a great extent independent of the weather conditions. In areas with much rain, the overall construction when choosing an asphalt core design, is simplified and construction time shortened when compared with the construction of clay cores, or asphalt- or concrete face dams. In cold climates the construction season can be prolonged.

Asphalt is completely non-harmful to fresh water- and irrigation water reservoirs.

Bitumen, the binder element in asphaltic concrete, is a natural product and contains no additives that can pollute the environment or the water itself.

A dam with asphaltic core, permits impounding during construction allowing potential seasonal water to be collected prior to full completion of works. Cofferdam design can often be simplified.

Asphalt cores in the interior of dams provide the highest protection against damage caused by acts of war or sabotage.

With asphaltic cores, the many scars from clay borrow pits are eliminated.

Performance records from all existing ACED show no leakage through the core, and properly designed and built asphalt core dams are maintenance free.

Asphalt core dams have proven to be a very competitive alternative to other dam types.

1981–1987, Storvatn dam, Norway
Fairly standard mix-design criteria have been developed for the asphaltic concrete in asphaltic cores. The most economical mix, which has the necessary workability, complies with the Fuller’s gradation curve for the aggregates improved with a fine grade component smaller than 0.063 mm (filler content). To eliminate segregation and to improve workability, maximum aggregate size should be less than 18 mm. Both gravel and crushed rock may be used. Normal binder content lies between 6.5 and 7.5%.

The properties of asphalt concrete can to a great extent be tailored to satisfy specific design criteria. More and/or softer binder improves ductility and the self-healing properties of the core. This makes asphaltic cores especially suited for dams on compressible foundations or in earthquake regions.

A rule of thumb has previously called for a core thickness at any level of 1% of the water head. With modern construction procedures and quality control this seems unduly conservative for high dams. For Storglomvatn Dam on the Svartisen scheme in Northern Norway the 125 m high dam had a core that gradually tapered from 0.95 m to 0.5 m.

The machinery for placement of the asphalt core in layers has been greatly improved over the last 30 years. Mobility is better, the extent of required hand placement is reduced, and transportation and loading of the asphalt are simplified, increasing the capacity, reducing heat loss and improving quality.

The adjacent transition zones are placed simultaneously with the asphalt giving the core immediate lateral support.

Three rollers, two on the transition zones working in parallel and one on the asphalt core, normally carry out the compaction

The level of the screed is automatically controlled by a rotating laser which ensures a horizontal base for the next layer.

The centerline is marked for each layer and fixed by means of a thin metal string. A video camera mounted in front of the machine and a monitor inside the cab enable the operator to steer with precision following the string.

In front the machine is supplied with a gas fired infrared heater which dries and heats the previous layer if required.

No tack coat is applied between the asphalt concrete layers, as core sampling has proved that the joint is tight and hardly detectible.
Asphalt core impermeability

The single most important property of a core or facing is its impermeability. Impermeability is achieved in asphalt core dams by strict quality control and quality assurance of air void content in the asphalt mix – a measurement quickly and easily performed.

The relationship between permeability and void content in compacted asphalt cores is well documented in numerous research projects and studies. Technical specifications generally stipulate a void content of < 3% in Marshall samples, at which point asphalt is effectively rendered impervious.

2008, construction of Nemiscu-1 Dam, first Asphalt Core Rockfill Dam in North-America.

It is common practice during the design phase to use triaxial tests to investigate the stress-strain-strength properties of the compacted asphalt core mix. The mix may have to be changed if the triaxial results are not satisfactory.
Veidekke, with 30 years of experience, is internationally recognized as the world’s leading Asphalt Core Dam contractor and is well renowned for its excellent cooperation with clients, consultants and local contractors. Veidekke’s scope of expert services includes advisory services, feasibility studies, initial testing, mix designs, supervision, on-site training, and special equipment leasing.