Asphaltic Concrete for Hydraulic Structures
STRABAG has more than 60 years of experience in the field of asphaltic concrete for hydraulic structures. Initially focused on sealing dams with exterior bituminous sealant, we soon moved on to reservoirs, waterways and other asphalt hydraulic structures.

Dams with asphalt core seals have been a key component of our portfolio since the construction of the Kleine Dhünntalsperre in the year 1962. This type of seal has been undergoing a global renaissance in recent years even in dams with heights of 100 m and more. Intensive material research at company laboratories has since contributed to continually optimising asphalt for this special field of hydraulic engineering and to making asphalt an invaluable sealant in the present day.

All the while, we have kept our equipment fleet up to date with the constant technological changes and latest environmental standards.

Our perfectly trained and highly motivated team, together with our careful work planning, are a guarantee for top quality and professionalism in all of our hydraulic asphalt projects. Building on our wealth of experience, and as part of a modern and competitive European-based construction group, we remain a leader in the field of asphaltic concrete for hydraulic structures.
The development and production of special winches of all types and sizes is an example of our engineers’ pronounced potential for innovation and experience in the field of asphaltic concrete for hydraulic structures. Besides the mandatory safety standards (e.g., redundant winch systems), the focus is also on modern steering methods and the fulfillment of environmental standards, for example through motors using biodegradable hydraulic oil. Our winch cables have a length of up to 200 m, making it possible to seal dams with a crest level significantly above 70 m.

The design of the crestroad for dams and reservoirs differs significantly from project to project. Roadways are often restricted in their width, and a tight radius can make the geometry more complex. STRABAG is well-equipped to handle these challenges and responds to such difficulties through individual planning of the needed equipment and by showing flexibility in equipment use.
Asphalt sealings/Equipment

The asphalt sealing is applied using state-of-the-art asphalt pavers. These machines are individually adapted for use on inclined surfaces with special anchors on which to attach the winch cables.

The main compaction of the bituminous mixture occurs directly by the paver using a high compaction screed with two tampers to guarantee a compaction degree of up to 94%. Operator comfort is ensured through angled work platforms and seats.

The paver is fed with the bituminous mixture through a feeder wagon which – also winch-operated – can transport up to 14 t of material. The exact interaction of the various pieces of equipment (winch, feeder, paver) ensures the smooth, high-quality application on inclined surfaces.

Pavers
The sealing of power plant waterway systems or reservoirs is achieved with seamless application using the STRABAG bridge paver. Depending on the need, this paver can be assembled on a modular basis for different application widths of 8 m to 20 m.

This special equipment allows us to create water-impermeable asphalt seals on inclined surfaces with a slope gradient of up to 1:1.25. This avoids the need for especially sensitive horizontal seams, thus substantially reducing the need for post-treatment and the risk of leaks.
Asphalt sealings/Compaction and Renovation Works

In recent years, there has been an increasing need to rework asphalt sealings produced between 1950 and 1970 due to signs of bitumen aging.

As the complete removal of the asphalt package is too expensive and generally not necessary, it is common practice to simply remove the top portion of the sealant layer through milling. When renovation works take place under complete drainage, the milled material is largely transported downward and collected there for disposal. Partial renovation under reduced reservoir levels requires the milled material to be transported to the crest of the dam and transported to disposal from there.

Existing equipment can be adapted or new equipment developed and deployed on the construction site on a project-specific basis.

Rollers

Compared with conventional road construction works, roller compaction after application on inclined surfaces occurs at a significantly later stage due to equipment constraints. Double vibrating rollers, with a dead weight of up to 4.5 t and sustained from special winches, handle the final post-paving compaction and ironing of the asphalt surface. The compaction energy depends on the geometry of inclination and on the material composition. It is therefore usual to determine the number of roller passes in a specially set-up trial area before the actual paving begins.

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**Connections**

The connection of an asphalt sealing to other concrete structures, such as inspection galleries, emergency spillways, dykes or the dam crest road, requires experienced experts as well as detailed planning and preparatory works.

Connecting structures with copper sheets have been the standard for years to absorb various movements within the structure without damage. Elastomeric joint tapes and connecting structures without expansion elements are also possible.

**Mastic**

Mastic applied as UV protection to the asphalt sealant layer generally consists of 25–30 % bitumen and 70–75 % limestone. Cement may also be used as a filler and sometimes wax additives are added as a stabilising agent.

The lifespan of mastic ranges from 12 to 15 years depending on weather exposure.

The application of mastic requires the use of special utility vehicles equipped with a trailing rubber lip. The bitumen/filler mixture is delivered from the lip at a working temperature of about 180°C before it is removed and the surface smoothed. The application strength varies from 1.5 kg/m² to 3.0 kg/m² depending on the requirements.
Asphalt Concrete Cores

Asphalt concrete cores are characterised by the elastoplastic behaviour of the asphalt core within the dam. This property of the asphalt core can help to compensate various settlement behaviours of the dam structure without damage, cracks or leaks.

Further Advantages of an Asphalt Concrete Core Include:
- Self-healing of smaller leaks
- Resistance against aging through UV radiation
- High level of protection against destruction through vandalism, earthquakes or other natural disasters
- The production of an asphalt core seal is largely independent of climatic influences and is unproblematic even in cold, rainy and desert regions.
Quality and Laboratory

An important feature of our services is our constant self-monitoring on the construction site. For this purpose, we set up complete asphalt laboratories in construction containers on each construction site. A Laboratory Technician handles the daily quality control on site. This allows us to respond quickly to material errors and to enact the appropriate corrective measures.

Usual Laboratory Procedures:
- Extraction
- Sieve curve determination
- Determination of bitumen content and properties (R+K, Pen)
- Determination of air voids in Marshall compaction specimen and drilling core

“Non-Destructive” Inspection of the Structure:
- Radiometric sealant determination (Trxler gauge)
- Electromagnetic layer thickness determination
- Sealant inspection using vacuum bell

Home-Grown Competence

Suitability Tests
The STRABAG Group subsidiary TPA GmbH is responsible for all materials technology matters. The TPA competence centre for asphaltic concrete for hydraulic structures in Cologne has developed the suitability tests for all dams, reservoirs and waterways for over 50 years. This wealth of experience, together with state-of-the-art material and equipment developments, is a guarantee of asphalt recipes that are of the highest possible quality. We traditionally do not leave the suitability tests for bituminous sealing to the local mixing plants, but instead develop top-project specific solutions centrally in Cologne. This allows us to conduct special trials, such as van Asbeck flexibility, at our laboratories.

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Outlook

The use of asphaltic concrete as an impervious material for dams, reservoirs, waterways or landfills has been the standard for more than 60 years. Especially in regions with extreme climatic conditions, the flexible qualities of asphalt make it the material of choice.

Powerful state-of-the-art construction machinery guarantees the rapid, high-quality application at economically competitive conditions.

Asphalt sealings will therefore continue to make significant contributions in hydraulic engineering projects such as dam and reservoir construction.

STRABAG-Group

STRABAG SE is one of the leading technology groups for construction services and covers the entire construction value chain. We bring together people, materials and machinery at the right place and at the right time in order to realise even complex construction projects – on schedule, at the highest quality and at the best price. The hard work and dedication of our 73,000 employees allows us to generate an annual output volume of about € 14 billion. At the same time, a dense network of numerous subsidiaries in many European countries and, increasingly, on other continents is helping to expand our area of operation far beyond the borders of Austria and Germany. Our core areas of expertise include building construction, road construction, tunnelling, engineering groundwork and project developments.

Cologne-based STRABAG AG, the market leader in the German transportation infrastructures business, can look back on 90 years of tradition mainly in Germany. An extensive network of branches, and access to the necessary raw materials with company-owned asphalt mixing plants, quarries, crushing plants, sand and gravel pits, helps support the strong market position. Professional competence and technical expertise, an efficient organisation and innovative know-how make it possible to successfully complete even challenging projects and meet the highest client demands.

Ed. Züblin AG, the STRABAG Group’s subsidiary responsible for building construction and civil engineering in Germany, has been realising challenging construction projects nationally and internationally for nearly 120 years. With an annual output volume of about € 3.4 billion, Züblin is the number one in Germany. The fields of business include complex turnkey construction, civil engineering, bridge building, tunnelling, ground engineering and public-private partnerships.

The services offered by the STRABAG Group today go far beyond actual construction, stretching from individual solutions made to order to full service packages from a single source – from project planning to design and execution to maintenance and operation. In the field of asphalt and concrete technologies, the group is constantly working on the further development of construction materials and processes. Thanks to its many years of experience with concessionary and operating models all over the world, STRABAG holds a leading role in this field as well.