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Asphalt in Hydraulic Engineering

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Abstract. Asphalt has proven its worth in hydraulic engineering for the construction of canals, dams, reservoirs and coastal protection as a building material for the construction of bottom and slope seals for around nine decades. Due to its relatively low layer thickness combined with enormous flexibility in terms of absorbing settlements and deformations, asphalt is the optimal solution for sealing any type of water basin. Despite its flexibility, asphalt has good stability even on steep slopes.

Keywords: asphalt, bitumen, dam, hydraulic engineering, water reservoir

Introduction

Basics

The often flowing geometries of ponds, snow storage reservoirs and even large pumped storage reservoirs can be reliably lined with asphalt by machine, both in the bottom and in the slope. Stresses caused by large temperature and load changes are absorbed and relieved by the sealing asphalt. Watertight connections to inlet structures are realised by special joint constructions with expansion elements[1].

The construction of asphalt seals is carried out in strips on steeper slopes, guided by cables, using road pavers or so-called bridge pavers and compaction equipment, and is the state of the art for companies working in this field. The embankments have been constructed in asphalt hydraulic engineering with slopes of up to 1:1.2 without any problems of stability being observed (Arand, Haas, & Steinhof, 1992).

Asphalt layers are physiologically harmless and are therefore also used to seal drinking water reservoirs. Bitumen is odourless, tasteless and chemically insensitive to water-soluble substances. Bitumen and dense asphalt layers have a long service life. Asphalt construction methods have proven themselves in hydraulic engineering for many decades (DGGT, 2008).

Asphalt sealing systems are characterised by high impermeability, good deformability, erosion resistance as well as good control possibilities. Asphalt sealing systems for exterior (surface) and interior sealing can be comprehensively controlled by suitable equipment. Compared to natural sealing materials, the installation of asphalt seals is less dependent on weather conditions. The sealing effect of an asphalt seal is based on the fact that the voids in the mineral mixture are largely filled by filler and bitumen. The dense bedding is achieved by sufficient compaction work during installation (Gestrata, 2010).

Stresses on Asphalt in Hydraulic Engineering

General

Asphalt structures in hydraulic engineering are essentially subject to mechanical, chemical and biological as well as climatic stresses during production and operation. Depending on the area of application, specific stresses must be taken into account (DGGT, 2008).

Mechanical stresses

Asphalts in hydraulic engineering are stressed by static loads from dead weight, superimposed load, water pressure and buoyancy as well as by dynamic loads. This affects all areas of application and types of sealing. The loads acting on the asphalt seal are transferred

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[1] Walo Bertschinger AG, Asphaltwasserbau, Schweiz, Dietikon, https://www.walo.ch/de-ch/

to the subsoil via the asphalt base layer and the substructure. Particularly in the embankment area, higher shear stresses occur in the construction state than in the operational state due to the shear force of the self-weight on the embankment. Any excess groundwater pressure on the underside of the seal (e.g. due to slope water) must be counteracted by suitable design measures (e.g. drainage). In addition to the dead weight of the asphalt construction, hydrostatic pressure on a sealing construction is another static stress in the operating state. This leads to subsidence of the subsoil and consequently to deformation of the asphalt seal. Exterior seals are stressed by mechanical forces such as hydrostatic pressure, wave action and ice formation. They must therefore have a "deformability" characterised by the extent to which the deformations do not lead to leaks Dynamic loads such as wave impact can lead to redistributions in the subsoil that result in deformations in the asphalt. The dynamic loads due to cyclic repetitions normally have no influence on the asphalt. Impacts caused by flotsam, ice floes and ships must also be taken into account (DGGT, 2008).

Biological and chemical stresses

Exterior asphalt seals are exposed to biological and, to a lesser extent, chemical stresses. It should be noted that roots can grow through both permeable and impermeable asphalt revetments and seals. The growth of plants impairs the sealing effect of asphalt sealing layers and must be prevented. If the subsoil contains germinable components and other plant components, such as rhizomes that can sprout, these can grow through the asphalt layers and impair the impermeability or durability of the system. The growth through from below is to be prevented above all by a sufficiently thick layer. For example, root penetration has been observed in canals with layer thicknesses of up to 20 cm. In coastal protection, no more root penetration was observed with layer thicknesses of 15 cm or more of asphalt concrete. In order to prevent regrowth and root penetration, maintenance of asphalt revetments, especially in the water exchange zone, is necessary in any case (DGGT, 2008).

In coastal protection structures, algae find their living conditions on asphalt concrete and mastic gravel surfaces in the water change zone under certain conditions, especially in tidal areas. The algae growth endangers the walkability of a wet surface on steeper slopes. The coating formed by this can contract when it dries out. Due to the adhesion of such a coating to the asphalt surface, contraction forces then act to detach and roll up the superficial mortar layer (about 1 mm) in smaller areas. This process generally comes to a standstill due to the blocking effect of the grain structure of the asphalt concrete. The same phenomenon occurs when suspended matter is deposited (*mud curling*) (DGGT, 2008).

Climatic stresses

Climatic stresses occur in exterior asphalt constructions. The asphalt layers are affected by water, air, UV rays, heat and frost. The seasonal temperature fluctuations can range from -30 °C to + 80 °C in the asphalt layers near the surface. The temperature stresses are relieved by the plasticity of the asphalt with appropriate dimensioning and composition, but temperature fluctuations, the oxidising effect of atmospheric oxygen (especially during transport, storage and installation of hot asphalt-concrete mixtures) and UV radiation in and above the water change zone are nevertheless a major cause of ageing of the bitumen in the asphalt and thus a cause of the necessary care and maintenance as well as the not unlimited long-term stability of unprotected asphalt layers (DGGT, 2008).

Technical Requirements for Sealing Asphalt

The main requirements for seals are generally as follows:

1. The seal must be practically impermeable to water under the expected maximum water pressure.
2. The seal must be able to withstand all stresses that may occur.

3. The seal must be filter-stable, i.e. under the prevailing water pressure it must not be able to be pressed into the neighbouring zone; even its fine-grained parts must not be squeezed out.

4. The sealing asphalt mixture must be able to be installed and sufficiently compacted under the given conditions (Gestrata, 2010).

Water impermeability

The waterproofing asphalt with a voids content of <3Vol. % is to be considered impermeable.

Stability and shear strength of the pavement

With regard to stability, construction-specific mix formulations must be prepared, as slope gradients differ for individual structures.

Smoothness - evenness

A smooth and even surface must be achieved, especially when producing asphalt seals in headrace channels, as the structure of the asphalt surface influences the flow rate of the water.

Durability

The durability of an asphalt seal depends on the mortar content, the binder and the quality of the aggregates.

Deformability

Asphalt seals must be deformable, they must withstand certain settlements of the base without damage to the surface.

Frost and weather resistance

Sealed asphalt is frost resistant, provided that the aggregates used are frost resistant.

Resistance to ageing

Seal asphalt is more resistant to ageing than conventional asphalt for road construction due to the high bitumen content and the particularly dense structure (Gestrata, 2010).

Surface Sealing at Waterworks

Surface sealing for dams

Asphalt concrete can also be formed as a surface seal (Figure 1). The first bituminous sealing of reservoirs was carried out in the middle of the last century. At that time, however, the production of mixes and the installation technology had not yet been optimised and there was a lack of the coordinated equipment and installation machines that are common today. The external climatic and mechanical influences acting on the seal in half a century are the reason why today many bituminous surface seals require aftercare or renewal of the sealing surface (Strobl & Zunic Wasserbau, 2006).

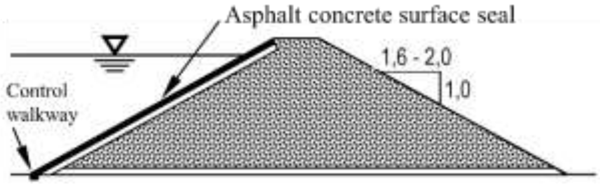

Figure 1. Asphalt concrete surface seal (Strobl & Zunic Wasserbau, 2006)

Surface sealing for pumped storage water reservoirs

Asphalt concrete has become established worldwide, especially in the upper reservoirs of pumped storage plants (Figure 2). Despite daily changes, sometimes several times a day, between damming and emptying the basin and the associated intensive climatic effects, the seals fulfil their requirements over many decades. Even the deformations of the subsoil resulting from the alternating impoundment of an upper basin are well absorbed by the seal due to its flexibility.

Figure 2. Upper reservoir of the Vianden pumped storage power plant in the Grand Duchy of Luxembourg[2]

Further advantages of a surface seal made of asphalt concrete are:

- Installation of water-sensitive fill materials is possible in the entire supporting body;
- Additional surcharging from the water pressure results in a favourable introduction of the water pressure forces onto the supporting body;
- Frequent and rapid lowering of the water level is possible without any problems;
- The dam filling and the seal installation are separated in time;
- In case of necessary repair work, there is good accessibility to the surface seal.

Since the upper reservoirs of pumped storage plants are often located on a high plateau (Figure 3), possible adverse effects on the landscape when lowering the dam are usually not significant.

Construction of an asphalt concrete surface seal with drainage layer for water basins

The standard structure of an asphalt concrete surface seal with drainage layer is shown in Figure 3. If the seal cannot be controlled, the drainage layer can be omitted. This then logically also applies to the lower layer of asphalt concrete (Strobl & Zunic Wasserbau, 2006).

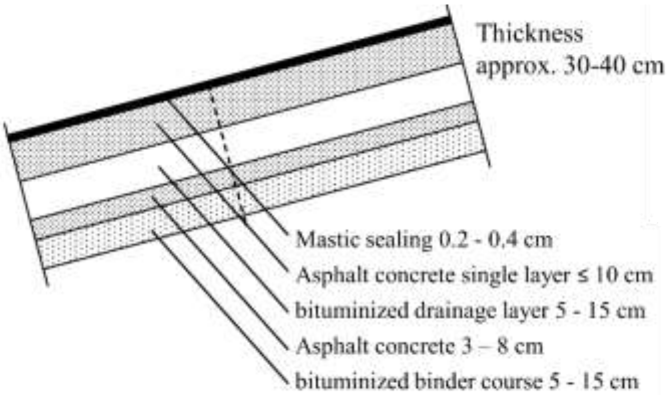

Figure 3. Seal with drainage layer (controllable seal) (Strobl & Zunic Wasserbau, 2006)

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[2] https://www.stolzembourg.lu/files/69691.jpg

Construction of an asphalt concrete surface seal with drainage layer of a shipping channel

The asphalt mixtures are used for waterways both for permeable revetments (protective pavements) and for impermeable revetments (seals). The following recommendations have been developed for navigation canals. They can also be applied mutatis mutandis to other waterways, e.g. in river engineering. The seal must be appropriately designed or specially protected against the attack of water currents, waves, ice, ship impact and anchor throw (DGGT, 2008).

Asphalt concrete, which is installed in the dry, is usually used for the construction of seals. In the construction, three parts are distinguished according to the task, namely the substructure, the actual sealing layer and the protective layer. All three layers are to be connected with each other in such a way that, with regard to stability, compressive and shear forces can be transmitted in their contact areas. In the water change zone, a roughened zone is usually constructed in a width of 5 m to slow down the wave run-up and to enable people and animals to get out of the water (Figure 4). The sealing layer and the protective layer often have the same composition and, if installed in the same way, also the same sealing properties. The minimum thickness of each layer must be 6 cm (DGGT, 2008).

The protective layer is primarily to be designed in such a way that it keeps all damaging influences, such as screw jet, anchor throw and ship impact, away from the seal. *The rough zone* (Figure 4) should start at least 0.50 m below the normal water level and extend to the upper edge of the sealing layer. For the construction of the rough zone, a riprap layer with asphalt grouting has proven successful (DGGT, 2008).

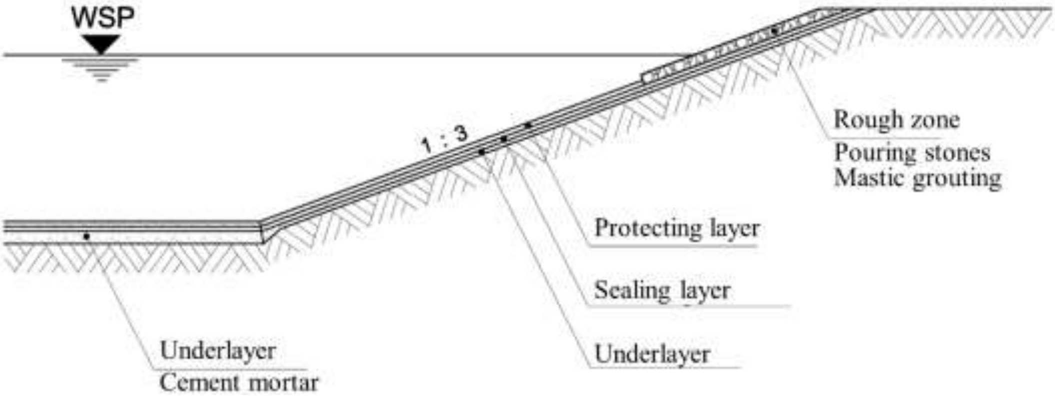


Figure 4. Sealing of a shipping canal (Main-Danube Canal 1965-1992) (DGGT, 2008)

Power station channels

Power plant canals supply the operating water to hydropower plants as headrace canals and discharge it as tailrace canals. They differ from navigation canals in that they have smaller bed widths and steeper embankments. Asphalt linings are used as seals in power plant canals. Only impermeable power plant canals are constructed. Asphalt seals have the task of preventing flow through the canal embankments and invert and at the same time protecting against stresses. A typical structure of an asphalt seal for a power plant canal is shown in Figures 5, 6 and 7.

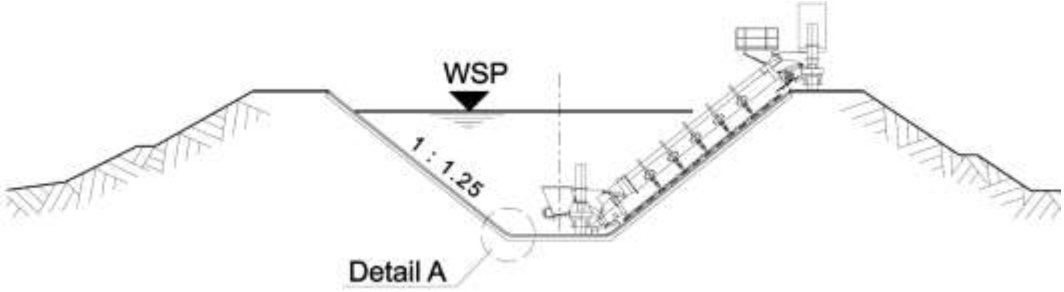


Figure 5. Power plant canal, cross-section with bridge paver (DGGT, 2008)

Figure 6. Paving with a bridge paver in a water channel[1]

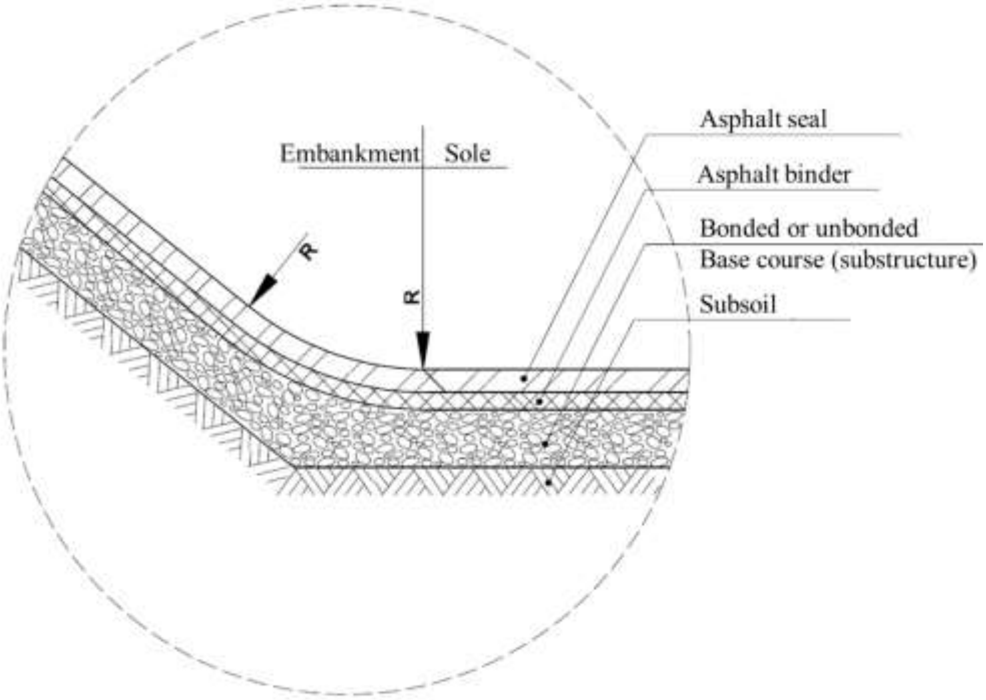


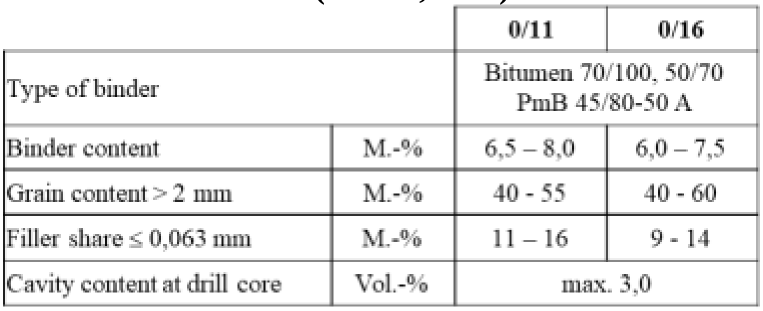
Figure 7. Asphalt outer seal of a power plant channel (detail of Figure 6) (DGGT, 2008)

Composition of the Asphalt Mixture

Composition of the asphalt mixture for asphalt sealing layers

The guideline values of Table 1 apply to asphalt sealing layers made of asphalt concrete (DGGT, 2008).

Table 1. Guide values for asphalt sealing layers of asphalt concrete 0/11mm and 0/16 mm (DGGT, 2008)

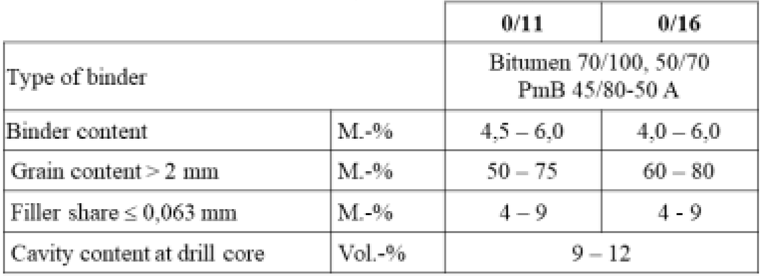


		0/11	0/16
Type of binder		Bitumen 70/100, 50/70 PmB 45/80-50 A	
Binder content	M.-%	6,5 – 8,0	6,0 – 7,5
Grain content > 2 mm	M.-%	40 - 55	40 - 60
Filler share ≤ 0,063 mm	M.-%	11 – 16	9 - 14
Cavity content at drill core	Vol.-%	max. 3,0	

Composition of the asphalt mix for asphalt binder courses

Asphalt binder courses are usually asphalt concretes. They consist of an aggregate mixture of graded grain size with road bitumen or polymer-modified bitumen as a binder and, if necessary, additives; the asphalt mixture is laid and compacted in the hot state. The asphalt binder courses should have a voids content of 9 to 12% by volume when laid. The guide values in Table 2 apply to the asphalt binder courses (DGGT, 2008).

Table 2. Guide values for asphalt binder courses made of asphalt concrete 0/11 mm and 0/16 mm (DGGT, 2008)



		0/11	0/16
Type of binder		Bitumen 70/100, 50/70 PmB 45/80-50 A	
Binder content	M.-%	4,5 – 6,0	4,0 – 6,0
Grain content > 2 mm	M.-%	50 – 75	60 – 80
Filler share ≤ 0,063 mm	M.-%	4 – 9	4 - 9
Cavity content at drill core	Vol.-%	9 – 12	

Composition of the asphalt mix for asphalt drainage layers

Asphalt drainage layers are usually asphalts with a precipitated aggregate (drainage layer). They consist of an aggregate mixture of graded grain size with road bitumen or polymer-modified bitumen as a binder and, if necessary, additives; the asphalt mixture is laid and compacted in the hot state. The asphalt drainage layers should have a void content of between 10 and 25 % by volume when laid. The guideline values in Table 3 apply to the asphalt drainage layers (DGGT, 2008).

Table 3. Guide values for asphalt drainage layers 0/16 mm and 0/22 mm (DGGT, 2008)

		0/16	**0/22**
Type of binder		Bitumen 70/100, 50/70 PmB 45/80-50 A	
Binder content	M.-%	3,5 – 5,5	3,5 – 5,5
Grain content > 2 mm	M.-%	75 – 85	70 – 85
Grain content > 11 mm	M.-%	≥ 30	-
Grain content > 16 mm	M.-%		≥ 30
Filler share ≤ 0,063 mm	M.-%	2 – 9	2 – 9
Cavity content at drill core	Vol.-%	10 - 25	

Composition of the surface sealant

Surface sealers made of bitumen-rich sealing mastic are applied to protect the asphalt sealing layer. They consist of filler and road bitumen as a binder and, if necessary, additives. The guide values in Table 4 apply to bitumen-rich sealing mastic (DGGT, 2008).

Table 4. Guide values for bitumen-rich sealing mastic (DGGT, 2008)

Type of binder		Bitumen 70/100, 50/70
Binder content	M.-%	25,0 – 30,0
Filler share ≤ 0,63 mm	M.-%	70,0 – 75,0
Softening point Wilhelmi	°C	≥ 90

Inner Seal Made of Asphalt

Inner seals made of asphalt - also called core seals - are installed during the pouring process of the dam. The inner seal is held statically by the supporting bodies on both sides. A transition zone is arranged on both sides of the seal, which can act as a drainage or control layer on the air side (Gestrata, 2010). If natural sealing material is not available in sufficient quantities near a dam construction site, dams can be sealed with the help of artificial materials. This also applies to unfavourable climatic conditions, e.g. in high mountains, where natural materials are less suitable due to high humidity and frequent precipitation. Here, the sealing with the help of asphalt concrete is presented first (Figure 8) (Strobl & Zunic Wasserbau, 2006).

Asphalt concrete is a mixture of bitumen (6 - 8 %) and minerals and has a void content of less than 3 %. Therefore, asphalt concrete can be made practically impermeable if it is professionally laid and of sufficient thickness. A thickness of the sealing layer of less than one metre (60 to 80 cm) is usually sufficient, which is why it is also referred to as a membrane seal. The thickness to be chosen depends on the height of the dam. As a rule of thumb, the thickness should be about one hundredth of the dam height. For reasons of mechanical installation, however, a minimum thickness of 60 cm must be provided, although this would not be necessary in the upper areas of a dam for the sealing effect. A transition or drainage layer of 0.60 - 0.80 m is placed on both sides of the seal to allow the membrane to be compacted during installation, to protect it from damage and to better locate any leaks. The installation of an asphalt concrete seal in the core of a dam has several advantages over a surface seal. For example, it is well protected against external influences after completion. Mechanical destruction is not possible, and weather influences such as sunlight, high and low temperatures, and ice formation, also have no effect on durability. The drainage zone located on the air side allows good control of the effectiveness of the seal. In the case of high demands on impermeability, the membrane seal must always be considered as an alternative to the natural core seal. The connection to the subsoil sealing is made with the help of a hearth wall or a control gallery (Figure 8) (Strobl & Zunic Wasserbau, 2006).

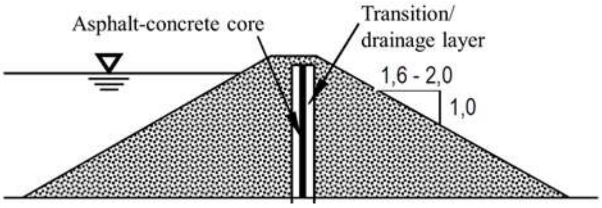


Figure 8. Inner seal (core seal) made of asphalt (Strobl & Zunic Wasserbau, 2006)

As a specialised subcontractor for the client Agder Energi, WALO worked on the construction of two such dams, which are being built for a hydropower plant in Norway. The two dams are located in Aseral, 80 km north of Kristiansand in central southern Norway, 843 m above sea level, and enclose a reservoir for the production of hydroelectric power. Asphalt concrete is used worldwide for lining upstream dam walls, reservoirs, canals and landfills. It has also been used successfully for over 50 years as a special process for producing an impermeable central core lining to seal large dams (Figure 9)[1]. We can see the guideline values for asphalt inner linings made of 0/16 mm asphalt concrete in Table 5.

Table 5. Guide values for asphalt inner seals made of asphalt concrete 0/16 mm (DGGT, 2008)

		0/16
Type of binder		Bitumen 70/100, 50/70
Binder content	M.-%	5,5 – 7,5
Grain content > 2 mm	M.-%	45 – 65
Filler share ≤ 0,063 mm	M.-%	9 - 14
Cavity content at drill core	Vol.-%	max. 3,0

Figure 9. Installation of the asphalt core seal on a dam for a hydroelectric power plant in Norway[1]

A watertight wall with DAC was constructed in the axis of the dam, which is being installed simultaneously with the earthworks of the dam. The asphalt and materials for the adjacent transition layers are placed in a core paver - a sophisticated, technologically advanced machine developed by WALO's engineers specifically for this task (Figure 10). The core paver travels along the dam axis and places both the asphalt concrete core and the two transition layers or "filter zones" in the centre of the structure in a single pass. The asphalt layers are placed in layers 200 - 250 mm thick and heated with infrared heaters so that the layers can be perfectly sealed. The core paver carries out the pre-compaction of both the asphalt core and the transition layer, and the final compaction is carried out with vibratory rollers. As the paving of the core takes place at the same time as the earthworks for the embankment, careful coordination of the various activities on the construction site is crucial. Special attention must be paid to the exact placement of the individual layers and the connection to the concrete foundation under the actual core[1].

Figure 10. Installation of the asphalt core seal on a dam for a hydroelectric power plant in Norway[1]

Paving and Compaction

Paving and Compaction of Sealing Asphalt for the Seekar Storage Reservoir

The Zauchensee ski area in the province of Salzburg in Austria operates 25 lifts and has 150 km of pistes. Despite the good climatic conditions and an altitude of 1,350 m - 2,188 m, it is necessary to operate snow cannons in order to be able to offer skiers an optimal slope. What do you need to make snow?

1. The right temperature
2. The right humidity and
3. Water (Danklmaier, 2008).

In order to ensure that the pistes are always covered with snow, the Zauchensee lift company decided to build one of the largest storage lakes in Austria, the Seekar storage pond (Figure 11), at 1940 m above sea level. The Seekar reservoir has (Danklmaier, 2008):

- A capacity of 450,000 m^3
- A water surface of 38,000 m2, which corresponds to about 5 - 6 football fields
- A bed area of 5,000 m^2 and
- A water depth of 23 m (Figure 11).

Figure 11. Seekar reservoir at Zauchensee (Danklmaier, 2008)

The structure of the sealing system of the reservoir essentially consists of 3 layers (Figure 12) (Danklmaier, 2008):

- The substructure - a 20 cm thick drainage layer
- The bituminous binder layer, 6 - 8 cm thick
- The bituminous sealing layer, 6 cm thick.

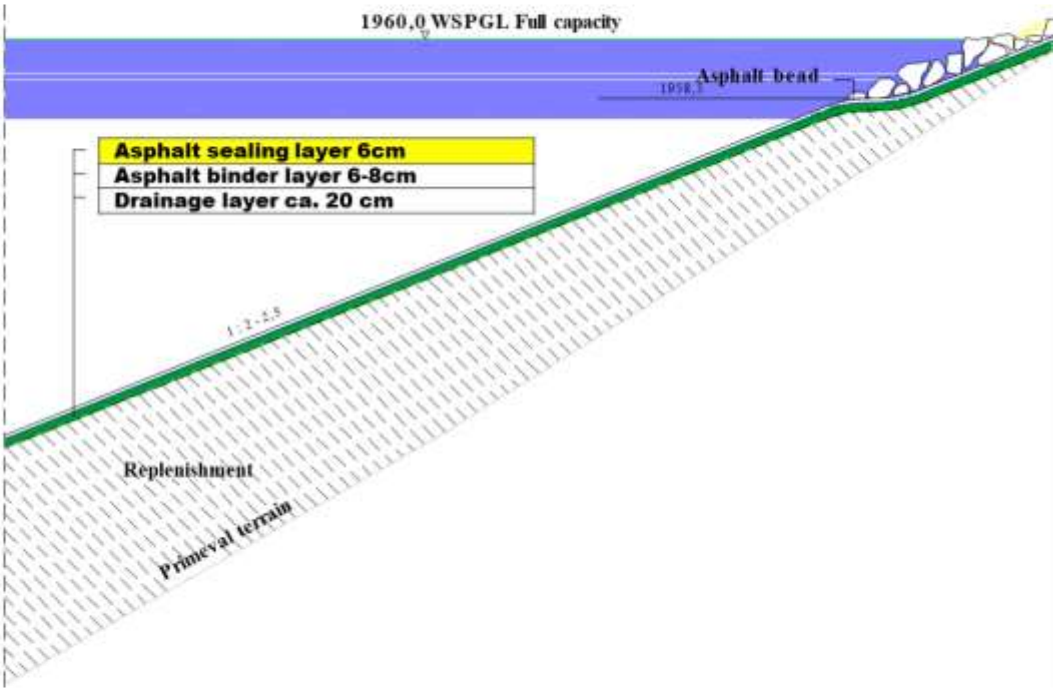


Figure 12. The structure of the sealing system of the reservoir (Danklmaier, 2008)

The drainage layer, 20 cm thick

The material for the drainage layer was produced on site using a mobile crushing plant from material obtained from the construction site. Dump trucks transported the drainage gravel to the installation site, where the material was levelled with bulldozers and slope equipment. A total of 15,000 m^3 of drainage gravel was produced and installed (Danklmaier, 2008).

The binder layer

The asphalt binder course has a thickness of 6 - 8 cm and was produced as a bituminous bound base course. The binder course was produced and delivered by Swietelsky BaugmbH in or from the PAM mixing plant. The following grain fractions were used for the recipe of the binder course (Table 6) (Danklmaier, 2008).

Table 6. Recipe of the binder layer (Danklmaier, 2008)

Filler	1,9 %
0/2	17,3 %
2/4	7,7 %
4/8	9,6 %
8/11	9,6 %
11/16	49,9 %
B 70/100	4,0 %

The sealing layer

After the binder course comes the actual core of the structure, the bituminous sealing layer. The sealing layer is 6 cm thick and was produced by Teerag-Asdag AG in the mixing plant Ennswald / Radstadt with the following grain groups (Table 7) (Danklmaier, 2008).

Table 7. Recipe of the sealing layer (Danklmaier, 2008)

Filler	12,0 %
0/2	45,0 %
2/4	7,5 %
4/8	9,0 %
8/16	20,1 %
B 70/100	6,4 %

As can be seen from the recipe, the:

- 12 % of filler and 45 % of
- The proportion of grain group 0/2 is extremely high at 45 % (Danklmaier, 2008).

The two components should guarantee that the sealing layer is actually tight and that the void content < 2.0 % is achieved. After the recipes had been tested and approved, the somewhat more difficult task came, namely the installation of the individual layers at 1940 m above sea level. Because of the steepness of the slopes, all the paving equipment had to be secured with winches with winch carriages on the one hand and pulled with support on the other (Danklmaier, 2008).

As no conventional equipment could be used for placing the mix, the company Walo - Switzerland was commissioned with the placement with its special paving equipment. Most of the mix was brought to the site by 4-axle trucks via a 6 km long forest road (Figure 13). The mix is tipped into the gutter at the front of the paver winch train, then transported via the driver's cab into the paver feed lorry. The paver winch train has a total weight of 50 tonnes. The paver feed wagon transports the mix (approx. 8 t) to the embankment paver (Figures 14, 15, 16) (Danklmaier, 2008).

Figure 13. Most of the mix was brought to the site by 4-axle truck (Danklmaier, 2008)

- A total of 58,000 m^2 of slope surfaces were
- With a slope of 1: 2 were constructed and
- The longest slope length was 80 m (Danklmaier, 2008).

Figure 14. The mixture is tipped into the gutter at the front of the paver winch train and then transported via the driver's cab into the paver feed wagon (Danklmaier, 2008)

Figure 15. Transport of the mixture with paver charging wagons (Danklmaier, 2008)

9,700 t of binder course (Figure 17) and 8,700 t of seal course (Figure 18) were produced and installed. The daily laydown rate was between 500 and 650 t, which is a respectable laydown rate considering the long and narrow access roads and the frequent manipulation of the mixture. Due to the steepness of the paving area, the drainage layer was pre-sprayed with a bitumen emulsion to create a better bond with the binder course (Danklmaier, 2008).

Since the actual sealing structure consists of two layers, the installation was very flexible. In bad weather and low temperatures, the binder layer was installed, and in good and dry weather, the sealing layer was installed. Since the weather in the mountains can change very quickly, this was a great advantage for the construction time, because with other sealing systems, construction time is lost in bad weather. After all surfaces were asphalted, a mastic coating was applied as a final coat. The mastic coating has the task of protecting the asphalt from UV radiation (Figure 19) (Danklmaier, 2008).

Figure 16. Layered structure (Danklmaier, 2008)

Figure 17. Paving of binder course 9,700 to (Danklmaier, 2008)

Figure 18. Reservoir Seekar at Zauchensee: Installation of sealing layer 8,700 to (Danklmaier, 2008)

Figure 19. Reservoir Seekar at Zauchensee: Installation of mastic (Danklmaier, 2008)

Figure 20 shows the paving of the asphalt surface layer of a reservoir[1].

Figure 20. Installation of the asphalt surface course[1]

The accurate high-quality laying of all road surfaces is made possible by state of the art technology in the form of a highly developed bridge paver and the reliable accurate compaction by precisely controlled rollers. With the greatest precision, the bridge paver can lay asphalt courses as well as gravel base courses (and hydraulically stabilised base courses) in level, inclined and parabolic surfaces. The paving screed is replaceable and can be adapted to any width required to be able to produce the lane in one piece without any longitudinal joints[3].

Figure 21. The exact compaction of the parabolic surfaces is done by specially shaped rollers[3]

Highly-precise sensors scan the reference rails on the side next to the paver chassis horizontally and vertically and transfer this data on to the central computer. This enables the various hydraulic systems to accurately move the paver chassis and the screed to the required positions. The bridge paver is fed using the storage tank mounted on the side which is filled by either using a refilling machine or by an excavator or wheel loader. Screw feeders and conveyer belts carry the material to the paving screed, which ensures an even distribution of the mixture over the entire width[3].

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[3] SMB Construction International GmbH, https://www.smb-ci.com/leistungen/maschinentechnik

Figure 22. Asphalt paving of the parabolic surfaces by special bridge paver[3]

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