MATERIAL DATA SHEET

OPEN STONE ASPHALT (OSA)

HESSELBERG
EROSION PROTECTION

Material Description:

A gap-graded mixture of 32mm aggregate and bituminous mastic providing a porous, flexible and robust material used for erosion protection revetments.
Typical 125 – 300mm layer thickness, depending on hydraulic loads.

Primary Uses:

- Armour layer against hydraulic loads
- Flexible erosion protection in all dam and marine environments

Common Alternative to:

- Concrete or stone blocks
- Concrete slabs and articulated concrete mattresses
- Rip rap and Rock armour

Constituents:

- 80-83% 20/32mm Coarse Aggregate
- 17-20% Bituminous Mastic (Bitumen, Sand, Cellulose Fibers & Filler)

Properties:

- Porous, flexible, robust
- Resistant against wave impacts
- up to 3m
- Resistant to water velocities of at least 8.6m/s
- Placed density of 2.0 t/m^3
- Permeability 10^{-2}

Durability:

- OSA has been placed in various locations throughout the UK including in the Scottish Highlands at an altitude of around 400m with no degradation through winter freeze/thaw cycles.
- Recognized design life of 50 years (in most locations) with over 35 years of the continued performance across the UK with virtually zero maintenance.

Production & Installation:

- Produced in standard asphalt plants and delivered in standard 8-wheel lorries
- Placed with standard or long reach excavators
- Delivered at around 145°C
- Can be placed in rain and cold but not underwater (unless as mattress)
- Does not require compaction or need construction or movement joints

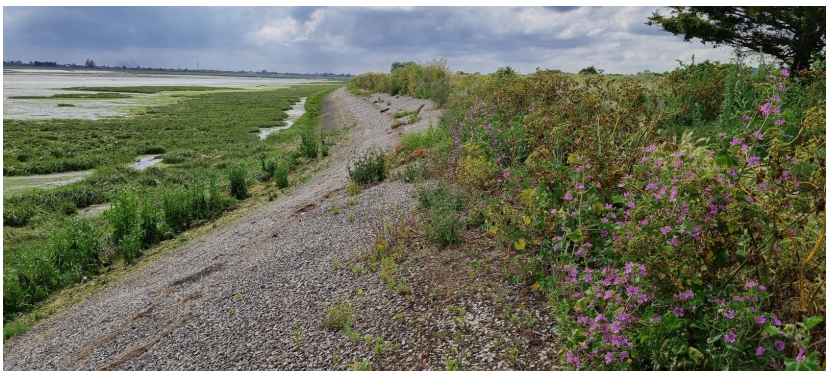
Maintenance:

In estuaries and reservoirs, the material has had very nominal to zero maintenance requirements for over 35 years.

In areas of high abrasion (gravel loaded wave impacts) maintenance may be required within 15-20 years. If joints with existing structures or surface cracks open up these can be easily repaired with a hot-poured bitumen mastic solution.

For abraded areas, the surface can be cleaned and a fresh layer of OSA placed over the existing – reducing waste to be removed.

Part of 3km coastal revetment completed on Canvey Island



OSA revetment 19 years after installation on Two Tree Island

Environmental Compatibility:

- The life carbon content has been calculated independently as being approximately 4 times less than the equivalent concrete products.
- Asphalt has been used by all main water companies in the UK. Water exposed to OSA has been found to contain no harmful chemical above the UK limits for potable water. Individual water companies conduct their own monitoring, and HEP have had repeat business from them all.
- Asphalt is compatible with the environment and has been used within many SSSIs. Its surface is open and provides a suitable environment for plants to establish.
- At the end of its life, or if the material is removed, it is easily recycled. The material can be processed and added to RAP (Reclaimed Asphalt Pavement) for use in new asphalt materials
- Plants grow within the OSA and cause no damage to the OSA layer due to its thermoplastic properties and the void ratio

Key Performance Information:

- OSA will function as a homogenous plate when installed.
- There are no cold joints created and no movement or constructions joints are required.
- Once cooled below 100oC it can be inundated with water.

Resistance to Wave Impacts:

OSA has been calculated and demonstrated to withstand wave impacts with a design wave height (Hs) of up to 3.0m.

To achieve a similar resistance with rock armour would require many multiples of increase in layer thickness.

Resistance to Water Flow:

In 2008 overtopping testing was commissioned by the Sea Defences Project Office – a Netherlands government body to determine the performance of hard and soft revetments in significant storms.

They set up a test simulator using a 22,000l tank dropping water down a 15m long & 4m wide test panel which could reach a maximum water velocity of 8.6m/s or 125l/s per meter.

The test for OSA used a 150mm layer placed on Geotextile. There was no damage observed to the OSA by the test and as yet a practicable test has yet to be developed that can determine an upper value of OSA's resistance to water flow.

Formation/Filter	Layer Thickness	Approx. Hs Resisted (Allow 50yr fatigue)
150mm OSA	125mm	1.2m
	200mm	1.6m
	300mm	2.1m
	550mm	3.0m
Clay/ Geotextile	125mm	0.9m
	200mm	1.2m
	300mm	1.5m
	550mm	3.0m

Calculations using formula in Communications – The Use of Asphalt in Hydraulic Engineering by Technical Advisory Committee on Water Defences (Rijkswaterstaat – Netherlands Government) plus adding a factor for fatigue.

Creating an eel pass and pump low flow channel in OSA on the Humber

OSA placed on raw water reservoir in Abberton

Limitations:

- OSA cannot be placed in situ under water (OSA mattresses must be used), in heavy rain or strong winds (Force 6 and above)
- OSA does not perform well under continued track or wheel loading
- OSA should be placed on a formation with a lower permeability than that of OSA – Lean Sand Asphalt is the ideal formation layer for OSA

Sources:

Revetments Against Wave Attack by HR Wallingford
Factual Report – Wave Overtopping Tests Zeeland Sea Dikes commissioned by Sea Defences Project Office (Rijkswaterstaat – Netherlands Government).
Communications – The Use of Asphalt in Hydraulic Engineering by Technical Advisory Committee on Water Defences (Rijkswaterstaat – Netherlands Government).