

Ways to outflank rivers

Gabions, in their many forms, such as baskets and mattresses, and their sausage and allied configurations, have been with us for centuries, and for good reason. They remain one of the most successful intervention and prevention measures to counter factors like erosion. They also perform exceptionally well as retaining systems in a variety of applications, from road embankments to marine coastal protection, rivers and weirs.

“A key benefit of gabion installations is the way they blend in with the environment, because an essential ingredient is their natural rock composition, which intentionally lends itself to some level of permeability, in conjunction with geotextiles that are there to counter soil retention loss,” explains Louis Cheyne, managing director of Gabion Baskets and a qualified construction materials specialist.

“The alternative is to go the mass concrete route for structures like weirs and irrigation channels. However, this will result in a much higher construction cost since specialist equipment and tradesmen will be required. Gabions, on the other hand, are perfect for labour-intensive applications under the guidance of an experienced consulting engineer and contractor.”

In addition to being a manufacturer of gabion systems, Gabion Baskets provides design recommendations and on-site training for installation teams, many of whom are sourced from local communities and have limited initial skills. However, after they've completed the training and applied this in practice, Cheyne says that these community members are then well prepared to work on other short-term projects, which could potentially serve as a launching point for SMME subcontractor businesses.

Wetlands preservation

These job-creation opportunities were well illustrated recently during the construction of three weirs within an expansive floodplain in the Brakpan area. The works were completed by the contractor for the City of Ekurhuleni. These weirs are between 1 m and 1.5 m high. Two of these structures have a wall length of approximately 12 m, while the third measures 9 m.

Their purpose here is, first, to reduce water velocities and ensuing erosion and, second, to

Rivers follow their own course and will challenge any natural or man-made barrier. That's a top-of-mind consideration for environmental engineers designing gabion structures and a key deliverable for the contractors that build these structures.

By Alastair Currie



capture water, thereby minimising its loss within neighbouring wetland zones.

Gabion Baskets assisted with a design proposal. "Gabions are never a 'one-size-fits-all' solution, so one of the things we always recommend is a pre-site inspection prior to the design stage," explains Cheyne. "Once on-site, the final design proposal often needs some adaptation as the excavations and establishment of the foundations begins."

With any weir structure, the correct height and length of the wings on the side walls is essential. This ensures that the water is effectively channelled through the centre, or notch zone. "To cater for the hydraulic jump on the downstream side, we always stress the need to include a counter spilling basin that's slightly higher on the upstream approach. This creates a ponding effect that significantly reduces water velocity," says Cheyne.

The notch zone is always covered with a concrete layer, as is the first 2 m of the spillway, to prevent damage to the

mesh, which is very important. The concrete layer formed is normally between 75 mm to 100 mm thick.

"The wall designs must ensure that the structure extends adequately into the banks by at least 2 m to 3 m," Cheyne continues. "The last thing you want is the 'pebble in the river' effect, where the river ends up outflanking the weir structure and undermining it. To prevent this, contractors need to construct an upstream berm with side notches to control water direction through the centre. Otherwise, the water hits directly against the obstacle, creating turbulence build-up and subsequent soil erosion."

Best gabion materials

When it comes to selecting the materials used to fill gabion baskets or mattresses, non-negotiable rules apply in terms of rock hardness.

"It might surprise some readers, but a few years back on a remote rural wetlands project,

I experienced a situation where broken brick discards from a local manufacturer were being included in the rock mix to reduce material costs: definitely not the right approach," says Cheyne. "Unless fired very hard and blue, which was not the case there, these non-fired and rejected bricks will dissolve in a few weeks. Even sandstone or shale materials are too porous. In all cases, you have to use selected shot rock, such as dolerite or basalt."

In situ river rocks should also never be used: first, because of their rounded shape, which prevents the effective interlock required for gabion designs – i.e. controlled porosity – and, second, because it contravenes environmental legislation.

"What these discussions and the above-mentioned project illustrate is that gabion designs and their installation are an exact science within the highly innovative field of environmental engineering," Cheyne concludes. **35**

AS GOOD AS NEW



at a fraction of the cost.

When your components need an overhaul, a rebuild or exchange, Komatsu Reman can assist in minimising downtime and reducing costs, by offering you cost-effective component solutions. Every remanufactured component is built to global factory specifications, and all remanufactured engines and transmissions come with a 2 year/10 000 hour warranty*.

After all, 100 years of engineering expertise can't be wrong.



KOMATSU

TOGETHER WE INNOVATE

www.komatsu.co.za . 0860 566 2878 . Reman: 011 923 1275

*All other remanufactured components come with a 1 year/unlimited hours warranty.



1

2

BRAKPAN WEIR PROJECT

3

4



1 One of the weir structures at an advanced stage of construction. To ensure longer-term integrity, the best approach is to use gabion baskets constructed using Class A galvanised and PVC-coated hexagonal mesh. This offers maximum corrosion resistance

2 First stage of wall construction: excavation operations in progress. For the weir wall foundation, a geotextile layer is placed on a 90% minimum MOD AASHTO soil-compacted layer, followed by

another geotextile layer above this, on which the ensuing gabion baskets are formed

3 The first layer of gabions resting on a geotextile layer: these baskets will be laced, braced, filled with rock and then closed

4 The design for each installation features a first and second counter weir to minimise damage to the gabion mattresses

“The rock material is typically a third of the price of the contract.”



FAILED RIVER WALL, JOHANNESBURG

Following a spate of heavy rainfall, the foundations of a riverfront property came under threat when a gabion wall installation failed. Gabion Baskets was called in to provide technical advice and a cost-effective intervention solution. No records were available concerning the contractor responsible for the original installation.

Upon closer inspection, it was discovered that the original gabion structure did not have a concrete footing/foundation: a reno mattress would not have sufficed in this section of the river due to there being a substantial amount of bedrock.

It was also noticed that the bottom gabion layer was made out of welded mesh, which has a much thinner wire diameter than the recommended 3.15 mm specification. On top of this observation, it should be noted that welded mesh is not recommended in any water situation.

Gabion Baskets' determination was that this river wall failed due to the following reasons:

- the absence of a concrete footing/foundation, which allowed for erosion under the structure, causing it to fall over
- an incorrect mesh product applied in a water situation.

The following was decided upon to ensure the prevention of a recurrence of this failed structure:

- the construction of a 500 mm wide and 500 mm deep concrete foundation
- the first layer of gabions, being continuously immersed in water, should be rebuilt with Class A galvanised hexagonal woven mesh with a PVC coating, which gives the structure a longer lifespan
- this specification should also apply to the remaining gabions forming the normally above-water structure.

