An unconventional example showing how gabions can be used creatively, in this case to form fence posts

A gabion bench donated and installed by Gabion Baskets at a nursery school and after-care centre. If built with the right materials and a professional installation team, these structures are safe and sturdy, in addition to providing aesthetic appeal

Designing with stones

At first glance, building gabion structures seems like something anyone can try their hand at, but that's only true if installers and designers have the necessary training and experience. **By Alastair Currie**

In Limpopo, the local agent for Gabion Baskets supplied, trained and assisted in the construction of a 7 m high and approximately 200 m long retaining wall using galvanised woven mesh. This 500 mm stepped-backed wall provides highly effective embankment protection. Local rock was supplied from the area

Left in the wrong hands, and when incorrect materials are used, gabion structures soon lose their integrity, creating a potentially unsafe situation. This is especially the case for retaining walls.

"Gabions, in their various forms, are environmentally engineered structures, which require expert design and qualified construction supervision," explains Louis Cheyne, managing director of Gabion Baskets. "Under these controlled conditions, their assembly and installation is relatively straightforward, making them ideal for labour-intensive construction projects, and their durability means they can last for many decades."

Gabion Baskets specialises in the manufacture and supply of gabions systems, together with design advice, training and installation assistance.

Gabion retaining walls can be built to impressive heights well in excess of 20 m, using the classic stepped-back formation to shape stand-alone mass gravity structures. The alternative is a reinforced soil approach that combines compacted fill layers with specialised systems, a prime example being gab-tail gabions.

The gab-tail comprises a front-facing gabion unit interconnected at its base to an extended hexagonal woven mesh tail, which extends into the soil, normally to a width of around 80% of the height of the wall. For example, if the structure is 10 m high, the reinforced block would be 8 m wide.

The founding depth is always 10% of the height, irrespective of whether it's a mass gravity wall (constructed entirely of gabions) or one that incorporates a reinforced soil design. The key difference is that a reinforced soil wall requires a much larger footprint, and therefore more gabion fill material. In mass gravity walls, the base width will be approximately 55% of the height, depending on soil parameters. So if the height is 4 m, the founding depth is around 400 mm. This ensures the passive resistance at the wall toe needed to prevent the wall from sliding.

"Generally, when your gabion structure is higher than 4 m, and built in a fill situation, the reinforced gabion soil system becomes more economical and faster to install," Cheyne explains.

With gab-tails, the front-facing baskets provide internal stability, while the mesh tails improve the lateral shear resistance, providing improved overall stability. "The selected backfill material needs to be at least a G6 or G7 specification. Normally, this material is compacted in layers of not more than 150 mm, normally to 95% Mod Aashto," he expands.

A low-level bridge crossing constructed in rural KwaZulu-Natal: these structures are built using a combination of gabions and reno mattresses

Three modes of failure

When installation procedures go wrong, there are generally three modes of failure that occur for all gabion retaining wall structures: overturning, sliding forward and overall slip stability.

A case in point is a project for a mining operation in the DRC where an approximately 8 m high mass gravity tip wall was constructed to form a truck tipping platform for the primary crusher. In this instance, the incorrect use of a large vibratory roller on the successive layer works led to an excessive load on the gabion wall's front face. The end result was that the gabion wall tilted forward and came into contact with the crusher.

"The gabion wall could not be pulled back and the entire system had to be dismantled and rebuilt from scratch," explains Cheyne. "The lesson learnt here is that, at lower levels, it's permissible to use a vibratory roller, but not closer than 2 m from the back of the wall. Once the height increases, only light compaction is required."

Low-level bridge crossings

Alongside retaining walls, river erosion and allied works are a very common application. For example, gabions and their reno mattress derivatives are a perfect choice for low-level bridge crossings. This is a more economical alternative to a purely concrete structure. The roadway is protected on either side by gabion wing walls, with reno mattresses on the upstream and downstream ends to provide effective erosion control.

Designers have the option of selecting a gravel, asphalt or concrete surface for the roadway; however, on shorter crossings, the mattress can form the surface of the roadway, covered by a gravel layer to protect the mesh from vehicle tyre damage.

"Once a purely civils application, we are seeing an increasing cross-over into the architectural and building markets for design elements that include facades, walling elements, stairways and public seating. The key advantage of gabions is their endless flexibility," Cheyne concludes. 35