EROSION CONTROL

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The Versatility of Gabions

In combination or on its own, this age-old technique holds fast.

By Dan Rafter

The engineers with Kennedale, TX–based Ark Contracting Services faced a challenge: They needed to shore the walls of Texas's Turtle Creek to prevent further erosion of the waterway as it wound past three residences in one of the most affluent sections of Dallas. The challenge? The homes, if they went on the market, would each command price tags of more than $1 million. Their owners demanded that the restoration work be aesthetically pleasing. This isn't surprising: The sprawling backyards behind these homes add to their value. Any work on the creek as it ran through these yards, then, had to be visually appealing enough so that it wouldn't detract from the yards' professional landscaping.

That is one of the reasons why Ark Contracting turned to gabions as a key component of the company's erosion control plan. When installed properly, gabions are one of the most attractive erosion control devices. The reason is simple: Gabions, wire or metal baskets or cages filled with rock, easily support vegetation. Unlike solid blocks or concrete, gabions have open spaces between the rocks inside them, spaces that allow for future plant growth. Contractors often add soil between the rocks to encourage this vegetation.

Gabions also have history on their side. The products are some of the oldest erosion control devices. In fact, people have been using them in one form or another for thousands of years. But even with this lengthy history, and with all the benefits that gabions bring to erosion control work, the manufacturers of these products say that contractors, engineers, and designers still don't rely on gabions as much as they should.

The key to changing this, erosion control specialists say, is for gabion manufacturers to more actively promote their products. It's only then, many pros say, that highway departments, municipalities, and private contractors will more consistently call for the products on their jobs.

"This all relies on the efforts of the gabion manufacturers," says Vahan Janoyan, general manager of Oxford, MI–based Great Lakes Fastening, a company that manufactures fastening rings that contractors use to hold the gabion baskets shut.

"We have a large gabion job we are quoting right now. The people love the price on our rings. At the end of the day, though, if we had not called them, we wouldn't have gotten this job. What was quoted in the project specifications was regular tie wires. It is a wonderful option that we have with these fasteners. But if the manufacturers don't push it, it doesn't get offered, and people don't know about it. It's the same with gabions. If the manufacturers don't constantly promote the products, they won't get as much business as they should," Janoyan says.

The reasons contractors should be turning more frequently to gabions are many: Once workers fill the products with rock and fasten them together, gabion structures are extremely stable. They offer more flexibility, though, than does a solid wall.

Gabion materials are also relatively inexpensive when compared to poured concrete or segmented blocks. Contractors can shave their costs in another way, too. It's easy for workers to transport the materials used to fill gabions, especially if rock of the proper size is already available on the construction site.

Once construction crews install them, gabions allow for good drainage from the soil or backfill that contractors place behind them. When building traditional retaining walls, engineers and construction crews often have to worry about improper drainage and a buildup of hydrostatic pressure behind the walls. This worry doesn't exist with gabions.

Finally, the open spaces between the rocks inside the gabions do provide room for soil and vegetation, making the gabions more aesthetically pleasing than retaining walls or poured concrete. These open spaces, when crews install gabions to help stabilize a streambank, for instance, provide shelter and habitats for aquatic animals.

Ark Contracting Services chose gabions for its Turtle Creek project largely because of that winning combination of aesthetics and ruggedness: Gabions look good, but they are a hard-armor erosion control solution. That means they are also strong enough to provide stable erosion control protection.

“We like gabions. We use them a lot,” says Mark North, vice president of Ark Contracting Services. “They work well in wet-ground conditions. They percolate water and are not going to build up a lot of hydrostatic pressure. That’s why they were perfect for this project.”

The creek, as it passes through this section of Dallas, features a rock bottom with natural limestone for its embankments. Several years ago, the City of Dallas built a series of weir structures to impound the creek’s waters and form a string of small lakes alongside it. The lakes each measure from 6 to 12 feet deep.

During the last seven years, soil and other debris has collected in these small lakes. The city took action, removing all the silt from the creek’s bottom.

uring the work, though, a portion of Turtle Creek’s bank collapsed. Ark Contracting Services crews spent about six weeks last summer building gabion retaining walls to repair the embankment and protect it from future erosion.

The biggest challenge Ark Contracting faced was in making the gabion walls look attractive enough to satisfy the owners of the expensive homes sitting alongside the creek in one portion of its length. To do this, crews attached limestone slabs measuring nearly 4 feet wide and 12 inches thick and ranging in length from 6 to 8 feet to the top of the gabion walls. That way, the backyards lining the creek would end alongside a well-defined and attractive limestone edge. This edge provides a natural and aesthetically pleasing endpoint for the yards.

Ark even installed a planter about 18 inches below the surface of the creek’s water for one of the three residents. The resident planned to fill the planter with water lilies, cattails, and other water plants to provide a visually pleasing landscape.

“Each resident had something a little different that they wanted,” North says.

“They each had different objectives. That one homeowner in particular wanted a more natural look with the water plants.”

Gabions aren’t the only erosion control devices that Ark Contracting used on the Turtle Creek project. Crews also installed riprap and reinforced earth walls. Combining these other measures with gabions provided the best solution to Turtle Creek’s erosion problems, North says. In all, crews installed about 600 linear feet of channel protection in the creek.

“We do use gabions a lot,” North comments. “Over the years, we’ve relied on them for so many interesting projects. They are versatile, and they work well. They’re strong, and they offer flexibility, too. They are a product we look to use.”

Such a testimonial is good news to the companies that manufacture gabions. After all, contractors can choose from an ever-increasing variety of erosion control products.

Gabions are just one more tool to which contractors can turn. Manufacturers, though, are quick to point out that gabions offer several advantages over competing erosion control measures. For instance, gabions are sturdy enough to provide structural integrity to a variety of erosion control projects, with contractors often relying on them to stabilize channels, streambanks, and steep slopes.

The products are relatively inexpensive and are generally one of the more aesthetically pleasing of the hard-armor erosion control solutions available. Contractors can easily cover installed gabions with soil and vegetation. Over time, gabions naturally vegetate, a plus for many clients both municipal and private.

Because they are hard-armor products—unlike such products as erosion control blankets—gabions are not always the first choice among highway departments, municipalities, and some private landowners. Permitting bodies often recommend that contractors rely on softer erosion control products such as blankets and mats.

But for certain jobs, gabions are truly the best solution. For example, contractors often turn to gabions for riverbank stabilization jobs with high water flows. Such projects need hard-armor solutions. Gabions, because they are what many in the erosion control industry consider the most attractive of the hard-armor options, make sense for such jobs.

Gabions have the benefit of being not only affordable but also easy to install. They also have a longer lifespan than many erosion control products. For these reasons, contractors often turn to gabions when building gravity retaining walls, building

mechanically stabilized earth walls, performing slope stability jobs, completing channel-lining projects, and providing streambank protection.

One of the greatest strengths of gabions, though, sometimes presents problems to the manufacturers hoping to promote their use. The versatility of gabions—construction crews can use them in so many ways—means that sometimes engineers don't fully understand the varied uses of the products and then don't call for gabions in jobs for which they'd have a unique but important use.

Colin Glass of Fort Smith, AR–based Terra Aqua Gabions, a manufacturer of gabions, hopes to help change this. Officials with Terra Aqua have rebuilt the company's Web site to include free design software, complete tutorials, and a host of standard drawings explaining the many uses of gabions. The hope, Glass says, is that the site can show engineers just how versatile gabions can be.

"There are so many applications and ways to use gabions," he says. "Some of the more obscure applications are typically not thought of by engineers.

ntil they see previous applications or get some assistance, they may not consider gabions as the appropriate solution. We think that this gives us an opportunity to really promote the ways in which engineers can use gabions."

The site, Glass says, provides engineers with everything they need to design their own gabion-related projects in 30 minutes or less. Such help from the industry can only boost the popularity of the products. During the last decade, the products have faced more competition from newer erosion control products, Glass adds. But because gabions come with so many inherent benefits, they still compare well with the newer erosion control products on the market.

"Gabions as a solution have become more viable. More folks are aware of the product and its capabilities," he says. "And there has been a lot of new product innovations in the last eight to 10 years or so. Gabions, I think, remain as a mainstay as a solution because they work so well and have such a long history of success."

For Glass, the biggest benefits of gabions are how easy they are to design and implement. They are also inexpensive, a key factor on many jobs.
Then there are the aesthetic reasons for gabions' popularity.

"They will vegetate," Glass notes. "That makes such a difference when it comes to aesthetics. In fact, we have an entire bioengineering section touting the ability of our gabions to vegetate. More clients are aware of this, and more are wanting this."

Looking ahead, Glass sees even more growth in the popularity of gabions. "As population growth continues, development will, too. Engineers need solutions like gabions. We don't see a lot of competing products that can do everything that gabions can do. As they build more drainage channels, as they impact more drainage, we would have to think that the usage of gabions would only increase based on their past success."

Not all gabions are alike, however. Engineers and contractors can choose from a variety of gabions for their products, picking and choosing those that make the most sense for each job.

For instance, Hilfiker Retaining Walls, based in Eureka, CA, specializes in welded-wire gabions, which employ a welded mesh to create a stiffer gabion form. Hilfiker also uses pre-bent crossties so that contractors don't have to run wires through the middle of their gabion baskets. Contractors can then add a larger amount of rock to the baskets' centers.

This design makes life easier for contractors, says Bill Hilfiker, owner of Hilfiker Retaining Walls. Contractors can work faster when using sturdier gabions, he notes.

"We prefer to go with a premium, heavier basket," he says. "Basically, if you are filling up a form with rock, the stiffer the form you have, the faster you can fill the basket and the straighter the basket is when you're done. With welded mesh, the gabions are always the right length and height. It's just a better form."

Because the gabions are so sturdy, contractors use them for a large number of projects, he says. Some use them to build retaining structures designed to head off erosion, but contractors also turn to them to build guardrails, dividers, and fencing. Some even use the products as landscaping features.
For example, Hilfiker says he's seen contractors use his company's gabions as backstops for gun ranges or as decorative features at the base of large road signs.

These are certainly not the uses most associate with gabions. But when it comes to using gabions, builders and contractors are limited only by their own creativity, Hilfiker says.

“I’ve seen people fill these with recycled glass and put lights in them for decorations,” he notes. “People like the looks of them. There are some cool things you can do with them.”

When contractors install them in the right situations, gabions provide benefits when compared to other erosion control products, Hilfiker says. Other products, such as riprap, tend to cost more. And gabions, because they are installed as interlocking pieces, generally are as powerful as any other form of hard-armor erosion control, he says.

“You can cover a large area with gabions because everything is tied together,” he comments. “The water is not going to pick up a gabion and tumble it down the river. Each gabion is tied to the next one. There is strength in numbers. That’s why gabions work so well in water conditions.”

Finis Corum Jr. knows all about the versatility of gabions. An erosion control specialist with Phoenix-based Specialty Companies Group, Corum has relied on gabions to help complete a host of erosion control projects.

Gabions, for instance, played a large role in an erosion control project centered on the construction of the new Chaparral Water Treatment Plant in Scottsdale, AZ. The facility, which began producing potable water in March 2006, treats 30 million gallons of water a day. Located in Scottsdale’s Chaparral Park and surrounded by residential neighborhoods, the innovative plant features a buried 5.5-million-gallon finished-water reservoir and pump station. This makes it an unusual plant because it takes up only 9 acres of a 29-acre site. Conventional water treatment plants usually require two to three times more space.

The plant is also far less of an eyesore than some traditional water treatment facilities. The park surrounding the treatment plant is a true neighborhood amenity, complete with sculptures, landscaped terraces, small ponds, and a 10-acre lake. Irrigation and stormwater runoff from the neighborhoods adjacent to the park flow through the terraces and ponds and then empty into the lake.

The problem was, as this storm and irrigation water finally made its way through the storm drain, out the headwall, and into the lake, it was eroding the lake’s banks. The situation had gotten bad enough that the banks had eroded down to the edge of the lake’s shotcrete bottom. The city needed to stop the erosion. If stormwater managed to flow under the edge of the shotcrete basin, it could buckle the entire bottom of the lake.

In 2006, Specialty Companies Group tackled the problem with the help of gabions. Construction crews created a weir made out of gabions. The weir held back the water until it reached a certain height. One the other side of the weir, crews had dug a small pond and covered its bottom with a 1-foot erosion control mattress that was 18 inches thick. After building to the proper height, the stormwater would then flow over the top of the weir and into this dissipation basin. It would fill the basin before finally reaching the lake.

This weir-and-basin design slowed the flow of stormwater to a trickle so that it was no longer powerful enough to erode the banks of the 10-acre lake.

For Corum, the Chaparral project just offers more proof of the versatility of gabions.

“In my opinion, not enough erosion control specialists use gabions,” Corum says. “They are getting more popular here, but I think they should be used a lot more. A lot of contractors would rather put 3 inches of shotcrete down than use gabions. The gabions are more expensive than that shotcrete, but in my opinion they do a much better job. Shotcrete can crack, and that allows water to get under it. The gabions naturally allow the water to go through. But if you have a filter fabric under them, you’ll have no erosion. The water leeches through the fabric but then dissipates and is absorbed instead of rushing through and causing erosion.”

Janoyan of Great Lakes Fastening has a vested interest in the health of the gabion market. His company manufactures fastening rings that contractors use to clamp their gabion baskets shut. If gabions are selling well, and if more engineers are including them in their plans, his business, too, thrives.

Janoyan says that gabions should be an easy sell because they offer a host of advantages over other hard-armor solutions. “I’ve never seen anything to match a gabion,” he says. “When it comes to ease of use, nothing measures up to gabions.”

Contractors, for example, can cut and change gabions so that they fit snugly against a particular streambank or channel bottom. If contractors need a wall of gabions to stand 3 feet tall in one location and 4 feet tall farther downstream, they can cut and

shape the product to make this happen. Doing the same thing with poured concrete or retaining walls presents more of a challenge, Janoyan says.

Engineers looking for product innovations with gabions don't even have to look at only the gabions themselves. Great Lakes Fastening, for example, has introduced a new fastener made of 95% galvanized steel and 5% aluminum. This product provides a good step between fasteners made of high-tensile stainless steel and high-tensile galvanized steel. Such fasteners will last longer than galvanized steel versions while costing less than sturdier stainless steel fasteners.

"It's a good middle ground," Janoyan says. "So far, clients are responding well to the product." He says it's now up to the manufacturers working in the gabion and gabion accessories industries to promote their products. It's the only way, he says, to encourage more engineers to include gabions in their project specifications.

Gabion experts say that the products are especially effective when contractors are shoring up a streambank that requires vertical or near-vertical sideslopes. The critical design issue in such applications is the foundation of the gabion. A strong foundation can make the difference between a successful project and one that fails, says Ray Moore, vice president of engineering for Submar Inc., a Houma, LA–based company that manufactures articulated mats. These mats are often used in conjunction with gabions in projects focusing on shoreline protection.

"Gabions work well in combination with articulating concrete mats when the mats are used to protect the foundation of the gabions from erosion or scour," Moore notes. "The gabion bank protection and articulating concrete mats as streambed protection make a powerful combination."

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