

A Study in Segmental Retaining Walls

An in-depth look at segmental retaining walls (SRWs) and what builders should expect from SRW vendors and subcontractors.

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Those who look at a segmental retaining wall and say "that just looks like a bunch of cinder blocks holding the dirt back" need to read this. First and foremost, segmental retaining wall (SRW) units are not "cinder blocks." They are machine-made concrete masonry units composed of portland cement, water and suitable mineral aggregates. Another important distinction is SRWs are systems comprising two products: Segmental Block facing and (almost always) geosynthetic soil reinforcement. The "wall" becomes the combination of the block facing and the reinforced soil behind the facing (reinforcement is achieved by using layers of geogrid and compacting the soil - see sidebar).



SRWs have been with our industry in earnest for nearly 15 years now and they continue to offer serious advantages to homebuilders, especially as new products and technologies come to the market. They are so popular that there are many companies that do nothing but produce these concrete masonry units and others that do nothing but install them.

Even though it may seem like the SRW aspect of the homebuilding industry may be reaching something that resembles maturity, there is still a need for builders and contractors to understand the advantages these walls can provide and the engineering principals behind them. Also, there is a need to recognize that a number of proof-positive SRW "best practices" have bubbled to the surface. Anyone not familiar with the National Concrete Masonry Association's (NCMA) minimum requirements for SRWs set forth in their Design Manual for Segmental Retaining Walls should understand that there's no more to these walls than just providing a very powerful and cost effective tool to builders and contractors. "A segmental retaining wall structure is as critical as a frame for a house and should be treated with the same level of respect and competence," says Kan Erik Jansson, president of Soil Retention Systems, and Oceanside, CA 92054 California-based SRW company that has been installing walls in Southern California since 1987.

However, before getting too deep into what you should expect from the people who manufacture and install SRWs, take a fresher look at the advantages they offer builders. "One of the biggest advantages of SRWs is they can be installed at lower cost than conventional retaining wall systems," says Lance Carter, manager of engineered landscape products for the NCMA. "The placement of the materials requires a smaller labor force compared with what would be required for a poured-in-place concrete retaining wall." The installation of an SRW will usually require only lightweight equipment, like Bobcats, small front-end loaders and walk-behind compaction equipment. Larger projects might require heavier, ride-on compaction equipment. There's also a timesaving advantage to SRWs.

"Typically, an SRW can be installed very quickly with a three to four person crew installing 200 to 400 square feet per day," Carter says. "With a poured-in-place wall, it regularly takes seven days until you can put any appreciable load on it and backfill it with soil." Also, SRWs can be built to be aesthetically pleasing (which makes the Coastal Commissions happy) and are easier to curve than poured-in-place walls, which require extensive and complicated framework.

The Vendor/Subcontractor Lowdown

There are many outfits that specialize in the fabrication of SRW units and installation. Typically, if a project requires an earthworks contractor to come in for grading and earth removal, they will sub-contract the SRW installation to a company they have an ongoing relationship with. Or, in some cases, they will install the wall themselves. The caveat to the builder is to be sure that the planning and design of the project is done in accordance with the guidelines set by the NCMA and local codes, which will help ensure safety, performance and adherence to the Uniform Building Code. It would also be worth the builder's time to check up on the SRW installer's performance record.



"There is no one entity or association certifying the companies that are installing these products," Carter says, because, others say, the risk of liability is too high. "You want a contractor who has experience with SRW construction and can provide some kind of performance record. You should also look for a company that can provide or has access to technical design assistance, in the event the site conditions vary from those assumed in the preparation of construction plans or unforeseen obstacles are encountered."

If a builder wants to find an SRW outfit on its own, a good place to start is with the people who manufacture the blocks themselves. These companies typically have relationships with the local contractors who install their products. Or, in some cases, they may diversify their operations to deliver on both, such as Soil Retention Systems, which installs SRWs, and its sister company, Soil Retention Products, Inc., which manufactures SRW units. Some other popular products used in Southern California include the Allan Block Corporation, and Keystone Retaining Wall Systems, Inc., both of which license their products to regional distributors. These companies typically require the outfits that distribute and install their products to have strong performance records.

It's also often desirable to create a bidding environment to keep costs at a minimum. "To create competition for the installed wall system, the developer should use contractors who are skilled at building several different types of wall systems," says Steve Miller, president of Santa Ana, California-based Stable Earth Systems, Inc., a licensed Keystone distributor. "A contractor tied to only one system is sole-sourced. Having multiple contractors who use systems that have more than one local manufacturer bid on the project creates competition advantageous to the builder."

Reinforcement, Compaction and Drainage

If there are three things every builder should understand about SRWs, they are reinforcement, compaction and drainage. Geogrid soil reinforcement is the re-bar of SRWs. Many building codes require permitting for walls taller than 4 feet, which typically results in a design submittal of some form. Furthermore, depending on the size and weight of the SRW unit, geogrid soil reinforcement might be necessary to ensure stability of the entire structure. A minimum rule of thumb is the geogrid reinforcement should go into the soil from the back of the block at least 60 percent of the height. A 20-foot wall means at least 12 feet of geogrid. The frequency of geogrid layers depends on several factors, soil conditions being a main one. A good rule of thumb, assuming an average block height of 6 inches to 8 inches, is that geogrid be laid a minimum of 6 inches to 8 inches apart and a maximum of 24 inches apart, assuming an SRW unit depth of 12 inches. "There are many considerations that are required in the proper design and construction of an SRW beyond minimum reinforcement length or frequency of reinforcement placement," Carter says. "Our minimum guidelines provide the owner, designer and contractor the framework for a structurally sound SRW."

In order for the geogrid and soil to work together to form a retaining wall structure, the soil must be compacted to a specific density. "We recommend light-weight, walk behind compaction equipment be used from the back of the block to three feet away - and that sufficient compaction is accomplished to achieve a 90 percent relative compaction by the Modified Proctor method [ASTM D-1557] in that area," Carter says. "Behind that you can compact with larger, full-size compaction equipment." Also, 12 inches of drainage stone are recommended behind the block, which serves two purposes. It provides drainage, because it's a free draining product, and it helps facilitate compaction. "A suitable aggregate material, during it's placement, will compact to between 80 percent and 90 percent density - then it takes very little effort to achieve 90 percent compaction," Carter says.

So, while it's easy to see that SRWs offer tremendous advantages to builders, it's still important to understand these are complex structures that require great attention to detail during the planning and design stages as well as during installation. Don't settle for less.

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