Concrete Masonry DESIGNS

AUGUST 2007

HARDSCAPE ISSUE

Concrete Masonry DESIGNS

ON THE COVER:

The Loop 375 overpass in El Paso, Texas, is constructed of concrete masonry segmental retaining walls. Here is one of five planters protruding from the walls, which displays a star symbolizing the Lone Star state. The other planters have a gecko and sun.

Hardscape Issue | August 2007

FEATURES

DEPARTMENTS

PROJECT CREDITS

"El Paso Overpass": Dan Williams Company and Texas Department of Transportation, El Paso, Tex.; Scott Miller Consulting Engineer, North Little Rock, Ark.

"Retail with a View": All Season Landscaping, Eleva, Wis., Ayres Associates, Oakwood Business Park LLC, and Shoppes at Oakwood, Eau Claire, Wis.; Mattsen Construction, Knapp, Wis.

Concrete Masonry Designs magazine showcases the qualities and aesthetics of design and construction using concrete masonry.

Concrete Masonry Designs is devoted to design techniques using standard and architectural concrete masonry units, concrete brick, unit concrete pavers, segmental retaining walls, and other concrete masonry products around the world. We welcome your editorial comments, ideas, and submissions.

Concrete Masonry Designs is published monthly by the National Concrete Masonry Association (NCMA), and distributed to advance and support the concrete masonry industry and public interest.

Send address corrections and subscription inquiries to:
NCMA Sales and Marketing Department
13750 Sunrise Valley Drive
Herndon, VA 20171-4662
703-713-1900 Fax 703-713-1910
www.ncma.org

NATIONAL CONCRETE MASONRY ASSOCIATION
Sustainable Concrete Products for Structures and Hardscapes

Publisher:
Mark B. Hogan, P.E., NCMA President

Editor:
Michele R. Bupp, mbupp@ncma.org

Associate Editors:
Dennis W. Graber, P.E., Harry W. Junk, Rodger R. Prunty II, P.E., Robert D. Thomas, Michael F. Werner, P.E.

Advertising:
Ron Churchill, rchurchill@ncma.org

"We found the price [of segmental retaining units] comparable, if not cheaper, than precast....We could never have achieved the planters with precast."

— Jorge Gomez, Texas Department of Transportation

el Paso overpass

EL PASO is an anomaly. While most TEXAS cities have plenty of elbow room, since the state spreads out for hundreds of miles around, EL PASO sits tightly wedged in TEXAS'S westernmost corner.

Mexico lies to the south, New Mexico to the west. Sprawling Fort Bliss and the El Paso International Airport cover most of the north side of town.

"For those reasons, all the development—residential, commercial, recreational, medical, industrial—is spreading east," says Jorge Gomez, planning director at the Texas Department of Transportation, Austin.

To help reduce traffic congestion, the state's transportation department committed $90 million dollars to build a series of four overpasses and one underpass along a 12-mile (19 km) corridor on the east side of Loop 375, a highway which circles the city.

Drivers along the corridor don't see a typical intersection. The overpasses were built using concrete masonry segmental retaining walls and other concrete masonry products. So not only do they carry traffic, they lend color and texture to the flat, scrub desert landscape. Concrete masonry's ease of use helped speed construction time. And, its flexibility let the builders achieve an overall consistency of style at each intersection, while allowing them to adapt to individual situations.

"For this project, we developed architectural elements that depict the Southwest," says Mr. Gomez, who was the project design architect on the corridor. "We wanted consistency of look along the corridor."

To assure that consistency, "we first came up with an architectural master plan, even before we designed the engineering," he recalls. "We chose the colors, the textures, the patterns."

Concrete masonry provided the consistency the designers were looking for. "We used segmental block for the whole corridor [because] we could shape those walls to any height, any curvature."

Importance of Aesthetics

Loop 375 displays patterns and colors that make most other highways look like dull cousins. Why were aesthetics so important on this project?

"In our dry climate, the natural vegetation is very dark, an earth tone. So we had to decorate with colors and other elements. We wanted to make it interesting to the eye," asserts Mr. Gomez, adding that the Texas Department of Transportation regularly dedicates up to two percent of its construction budget to aesthetics.

The style developed for Loop 375 is emblematic for El Paso; so much so, that it is being adapted elsewhere along the roadway.

In the past, the transportation department used mechanically stabilized earth precast retaining walls on its projects. "This time, we wanted to do something different," Mr. Gomez says. "We found the price [of segmental retaining walls] comparable, if not cheaper, than precast."

Segmental retaining units, he says, were less expensive than another building option: cast-in-place concrete walls. Plus, the units gave Mr. Gomez and his team "more freedom of color and textures" than other building systems. He adds, "We could never have achieved the planters with precast."

Planters—Project's Signature Detail

Five planters protrude from the retaining walls 20 feet (6 meters) apart at each intersection. At the center of each planter is a medallion, measuring 5 feet by 5

CONTINUING EDUCATION AIA

Project
Loop 375, El Paso, Texas

Architect
Texas Department of Transportation, El Paso

Engineer
Scott Miller Consulting Engineer, North Little Rock, Arkansas

Masonry and General Contractor
Dan Williams Company, El Paso

feet (1.5 meters by 1.5 meters), with the look of terracotta, but constructed of light weight concrete. Each medallion is decorated with a symbol of the southwest desert and the surrounding region: a gecko living in the Texas desert; star symbolizing the Lone Star state; and sun representing El Paso's nickname of Sun City.

The designers selected two colors of masonry for the planters—terracotta and a sand color. Smooth-faced buff-colored masonry framed the medallions. The remaining planters were built with textured terracotta-colored concrete masonry units. The blocks measure 8-inches (203-millimeters) high, 17-inches (432-millimeters) wide, and extend 20-inches (508-millimeters) behind the face into the retaining wall.

"We used segmental block for the whole corridor [because] we could shape those walls to any height, any curvature.

— Jorge Gomez, Texas Department of Transportation

It was vital for each planter to stand as one complete structure. So the segmental units on the planters' front face were filled with concrete and vertically reinforced with half-inch (13-millimeters) steel bars, 10 inches (254 millimeters) apart. "Structurally, we didn't need it because we had the geogrid [geosynthetic reinforcement]," Mr. Gomez comments, referring to the material that reinforces the retaining wall soils. But the additional reinforcement protects the medallions from cracking or failing if there is any planter movement.

Tri-face units

For the retaining walls, Mr. Gomez chose a buff-colored tri-face unit, which is beveled at each corner. "It gives the look different shades and shadows," Mr. Gomez explains. "We love to use the tri-face, especially on long, long walls." The tri-face units are the same size as the other segmental retaining units used in the project.

Construction on the first of the overpasses began in 2002. After the sub-grade was in place, the builders set a leveling pad at the bottom of the wall, and began placing the first rows of segmental retaining units.

"At the same level, we placed engineering fill for drainage purposes," Mr. Gomez recalls. "Behind that fill we have our compacted soil."

Then the geogrid was placed behind the wall in the compacted soil zone. Another geogrid layer was laid every third course of the wall. At the same time, more soil was added in layers and compacted. "We just keep going up to the top of the wall."

The height of the wall varies, and can reach 18 feet (5 meters). The planters rise to 20 feet (6 meters). Cast-in-place coping, with grooves in the front, tops the walls and planters. A swale behind the retaining wall collects water and directs the runoff to PVC downspouts between the planters.

The segmental system kept construction moving at a fast clip, Mr. Gomez points out. "Once the contractor got the hang of it, they were lifting those units as one piece. Using mechanical equipment, they were lifting three blocks at a time."

General and masonry contractor, Dan Williams Company, in El Paso, looked to another El Paso business, Del Norte Masonry Products, to supply the segmental retaining units used in the project.

Mr. Gomez and his engineering team even walked through the local manufacturing facility at Del Norte. "Our inspectors were there to quality-control the materials. Once they were delivered, they were inspected for proper texture, colors and shapes. For us and for the contractor, it was definitely a lot easier and a lot quicker."

Desert-hued palette

The overpass design includes U-turn lanes on grade level below the overpass and before traffic reaches the intersection, what Mr. Gomez calls "the famous Texas turnaround." A walkway of interlocking concrete pavers allows pedestrian access to the turnaround and "brings in more color" to the interchange.

At the center of the walkway is a gold-colored stripe, surrounded by clay-colored pavers. Green pavers at the edges complete the desert-hued palette.

On the west side of the loop, the first phase of a four-level interchange with Interstate 10 is under construction. Its long segmental retaining wall units are decorated with triangular patterns in four colors.

"I wanted to give depth to the walls," Mr. Gomez explains. "The prime colors are almost the same as on the east side," although there are no planters on the west side project.

It's clear to Mr. Gomez that the Loop-375 style has begun to spread beyond El Paso's roadways.

"Yesterday, I stopped at a commercial development under construction at an intersection on the 12-mile corridor. It was a 30-acre [12-hectare] site. There was a Super Target and other stores. We noticed the development was using medallions. The overall architectural elements reflected what we used on Loop-375—the colors and textures, the medallions and landscaping."

It's an aesthetic made possible by the ease and flexibility of concrete masonry segmental retaining walls. CMD

The segmental system kept construction moving at a fast clip.

RETAIL *with a View*

"The retaining walls could look imposing, but instead they add character."
–Disa Wahlstrand, P.E., Ayres Associates, Eau Claire, Wisconsin

Project
Shoppes at Oakwood Retaining Walls, Eau Claire, Wisconsin

Owner
Oakwood Business Park LLC, Eau Claire

Architect, Engineer
Ayres Associates, Eau Claire

Masonry Contractor
Mattsen Construction, Knapp, Wisconsin; All Season Landscaping, Eleva, Wisconsin

TERRACING HAS BEEN USED FOR THOUSANDS OF YEARS TO TURN SHEER HILLSIDES INTO PRODUCTIVE AGRICULTURAL LAND. IN EAU CLAIRE, WISCONSIN, THEY ADAPTED THE CONCEPT TO MAKE A STEEP SLOPE FIT FOR RETAIL SHOPPING.

When developers of the Shoppes at Oakwood searched for a site near a new mall in a growing commercial section of the western Wisconsin city, they found no flat land available. They settled on 7.3 acre (3 hectare) site with a significant slope along the street side of the property. And from the street, a steep hill rose toward the back of the site.

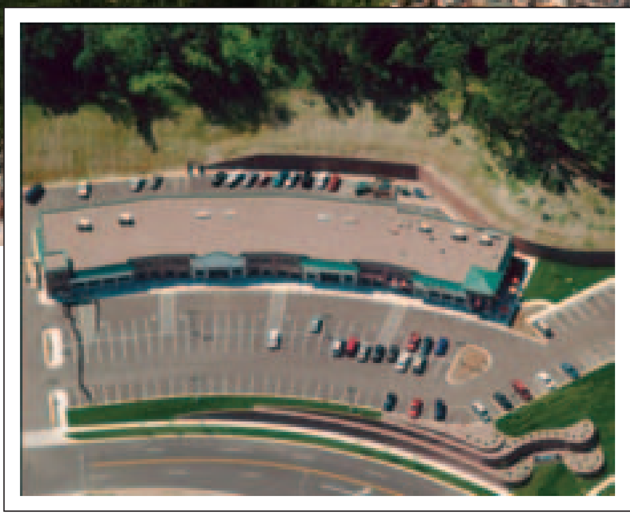
"From front to back, the grade increases 50 feet [15 meters]," says Disa Wahlstrand, P.E., manager of municipal services for Ayres Associates, a national architectural and engineering consulting firm providing services for the Shoppes of Oakwood project. "That city street climbs up a hill, a 60-80-foot [18-24-meter] incline—an 8-10-degree slope."

No "strip shopping center"

The owners planned an upscale 21,000-square-foot (1,951-square-meter) retail center, with a design and aesthetic that the term strip shopping center doesn't accurately describe. That meant cutting terraces into the hillside with enough level area to support the shops and parking.

To support the terraces, designers needed to erect a series of retaining walls. They chose a concrete masonry segmental retaining wall system—dry-stacked, mortarless walls made of low-absorption, high-strength, dry-cast concrete masonry units. "The system was selected over other options for cost, constructability, and aesthetics," explains Ms. Wahlstrand, who served as project manager responsible for the site civil design.

Masonry contractors Mattsen Construction in Knapp, Wisconsin, and All Season Landscaping, Eleva, Wisconsin, relied on a segmental retaining wall system.



Three acres (1.2 hectares) of the site have been preserved as a hillside conservancy, offering a buffer between the development and neighboring residences.

Concrete masonry in many colors, textures

The ease of the segmental system allowed construction to proceed swiftly. Because production of concrete masonry units is so flexible, the designers were able to choose colors and textures that complemented surrounding environment. The result is a shopping center unique to Eau Claire—one highly visible to traffic below, providing a picturesque view to shoppers.

Designers had other requirements to consider, in addition to the topographical challenges: A new road was under construction in front of the site. "That soaked up a lot of right-of-way," Ms. Wahlstrand comments. "The clients wanted space for some outdoor seating. And both the clients and the city had expectations of landscaping." Each of these increased the importance of a reliable retaining wall system.

Even with those requirements met, 3 acres (1.2 hectares) of the site remained and have been preserved as a hillside conservancy. The wooded area offers a buffer between the development and neighboring houses. It has a 20-degree slope and remains untouched. "We're not even putting new trees in," Ms. Wahlstrand asserts. The conservancy area, too, needed a retaining wall to protect it.

SRW-A key to success

Segmental retaining walls, then, are key to assuring success of the design. They were constructed in three areas: along the roadway at the entrance to the shopping center, on the hill on the east side of the development, and at the rear of the development—beyond which the hillside conservancy area rises.

The front of the property features three-tiered stepped retaining walls, running about 250 feet (76 meters). At the intersection of the two main thoroughfares, the walls end in a playful curve, which draws attention to the signage and landscaping. The two lower walls are 6-feet (1.8-meters) high at their maximum, while the top wall is a maximum 4-feet (1.2-meters) high.

"That saves you from having a 12-foot-high [3.6-meter-high] wall, and you avoid the feeling like you're driving through a tunnel," Ms. Wahlstrand ascertains.

The site has an 8-10° slope along the street. From front to back, the grade increases 50 feet (15 meters).

As the road slopes upward, three walls taper off until a single wall remains. The designers took advantage of concrete masonry's flexibility on these walls. The segmental units were laid in a mosaic pattern—giving the walls a random, informal presence. The reddish-blown concrete segmental units have a weathered texture.

It only seems random

The result may appear random, but the walls actually were constructed in panels of four units, using three types of block: two accent blocks, one cobble unit, and one standard unit. Each mosaic panel measures 10-inches (254-millimeters) high, 24-inches (609-millimeters) wide, and 12-inches (305-millimeters) deep.

"Compared to, say, a poured wall, this is more attractive. The walls could look imposing; instead they add character," Ms. Wahlstrand points out. A 100-foot (30-meter) wall facing the street uses the four-unit mosaic pattern.

The final retaining wall runs between the retail center and the wooded hillside for some 430 feet (131 meters). It was built from reddish-brown standard, segmental units laid in a running bond pattern. The standard blocks measure 6-inches (152-millimeters) high, 16-inches (406-millimeters) wide, and 12-inches (305-millimeters) deep. The wall rises to 13 feet (4 meters).

Storm water runoff is directed around the building, through pipes beneath the parking lot, into the city's storm sewer system. Altogether, some 20,000-square feet (1,858-square meters) of concrete segmental units were used for the Shoppes of Oakwood, costing $250,000. Site work added $300,000; landscaping was $60,000, remarks Ms. Wahlstrand.

'Like putting Legos together'

"The project was atypical, in that the walls were designed before anything more than the building footprint was determined," she says.

"The wall color, texture, and block type were selected first, using earthen tones and weathered texture to blend into the hillside and surroundings. Then came time for the building exterior design: When selecting materials, the architect picked up on those earthen wall colors and carried them through on the building to complement the wall and vice versa." The building exterior employed concrete masonry units. "Construction of the wall itself was like putting Legos together," she adds.

The project took three months to complete. "It really went fast," she exclaims. The construction site had "great sandy soil," so grading flat areas went smoothly. After the segmental units were laid, pins were used for alignment. One of the advantages of segmental retaining walls is the ability to use site soils for backfill, especially in areas where the soils are predominantly sand.

The builders reinforced the hillside soils with geogrid (geosynthetic reinforcement). Then, they backfilled the area, further strengthening the wall.

"The geogrid was laid horizontally from the top of the block back into the hillside, starting near the front face of the block and secured with staples or stakes. It was then covered with fill and compacted," Ms. Wahlstrand recalls. "The contractor had to excavate the hillside as much as the required length of geogrid reinforcement. In our conditions, this was approximately 60 percent of the height of the wall section it was to stabilize."

The shopping center has become something of an attraction in this straight forward midwestern city. "People say it doesn't look like a strip center. This was pretty classy for Eau Claire."

And that was the idea: An upscale retail center that towers above the rest. Concrete masonry walls are integral to the center's aesthetic. Without them, the Shoppes at Oakwood would merely be on the same footing as everyone else. CMD

Retaining Walls – A Building Guide and Design Gallery

The essential resource to constructing segmental retaining walls with detailed, easy-to-follow, complete diagrams /charts for do-it-yourself homeowners and landscape contractors.
Order number TR212.
Professional price $24.95

Segmental Retaining Wall Installation Guide

Educates contractors and owners in the proper techniques to install segmental retaining wall systems. This resource addresses the specific installation steps for engineered and non-engineered systems, and includes technical information regarding excavation, geosynthetic grids, and more.

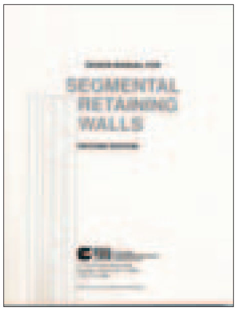
Order number TR146.
Professional price $4.00

e-TEK and e-Details

NCMA's TEK series and Details provide architects, engineers, and specifiers up-to-date information on concrete masonry. TEKs include more than 130 technical bulletins on various topics related to the industry. A new TEK is published monthly, while others are revised to reflect code or building design changes, as necessary.

Electronic versions—called e-TEKs and e-Details—are free through select NCMA member websites. Find a member sponsoring e-TEKs and e-Details at ncma.org. All drawings in e-Details are downloadable electronically in DWG for AutoCAD and DXF, among other formats. Obtain hard copies of e-TEKs or e-Details at ncma.org or call the Publications Department at 703-713-1900.

Design Manual and Software for Segmental Retaining Walls



This manual provides a standardized, generic engineering approach for analysis and design of segmental retaining wall units.

A segmental retaining wall is constructed of dry, stacked units (without mortar) that are usually connected through concrete shear keys or mechanical connectors. NCMA members provide a variety of proprietary units. Included in the manual is the latest design methodology for gravity and soil-reinforced earth walls, as well as design criteria, design tables, illustrations, installation procedures, and sample specifications. 289 pages; second edition, third printing (2002).
Order number TR127A.
Professional price $66.00

Design Software for Segmental Retaining Walls

SRWall version 3.22 covers design of both conventional gravity and soil reinforced walls, in accordance with NCMA's second edition Design Manual for Segmental Retaining Walls (TR127A) and Segmental Retaining Walls: Seismic Design Manual (TR-160) for walls subjected to earthquake loading. Users are highly encouraged to read the manuals for the respective procedures before using the program. Windows 95 or newer (2001).

Order number CMS11711.
Professional price $182.00

Buy the manual and software together and save $15.
Order CMS11711 and TR127A.
Professional price $233.00

Inspection Guide for Segmental Retaining Walls

This publication provides an easy-to-understand resource for field use by installers, designers, and inspection personnel. The guide outlines parameters for design and construction requirements of segmental retaining walls, including basic engineering requirements, a design checklist, and a construction observation checklist—all based on NCMA's design methodology for segmental retaining wall systems.
6 pages (1998).
Order number TR159.
Professional price $3.50 CMD

Prices reflect purchase price only. Shipping and handling are additional.

Building Codes and enforcement of those codes originate as far back as 1760 B.C., when Hammurabi, an ancient ruler of Babylon, had one simple code: If a builder was deemed responsible for a structural collapse that resulted in the loss of life, the builder would be put to death.

Fast forward to today—Several catastrophes have shaped the modern day building code. For example, hundreds died and thousands of structures were ruined in the Great Chicago Fire of 1871, which is one of the earliest events to emphasize fire safety in building construction. Two other examples—the San Francisco earthquake of 1906 and the 1995 quake in Kobe, Japan—led to the development and continued modification of seismic design standards. Several hurricanes, including Andrew and most recently Katrina, have certainly influenced the evolution of codes related to the effects of wind damage on structures. After all, building codes are in place to provide minimum standards to safeguard life, health, property, and public welfare. These codes regulate and control the design, construction, and quality of materials used in construction.

Over the past two decades, segmental retaining wall (SRW) technology has become the primary choice for creating and expanding useable land, due to the aesthetic appeal, durability, and competitive economic advantages compared to other wall types. For these reasons, SRW commands the interest of specifiers, developers, and contractors. Current codes and standards are in place when an SRW requires a permit, or if planned use and height warrants a structural design. In short, when the wall is higher than four feet, municipalities require a permit to build a SRW or for a site-specific engineered design. With so much focus on wall layout, design, and construction, the fall hazard SRW creates is often overlooked.

A building code to remember is the International Building Code (IBC) for railing and guards, stating that fencing and guard rails are required where there is a significant grade change and the potential for a fall hazard. The primary function of an SRW is to facilitate steep grade changes and expand useable real estate. One should easily recognize that a fall hazard is created; thereby, it is necessary to follow the building code that requires a railing. Local, national, and international codes prescribe that fences be able to resist a defined load. The IBC section 1607.7.1 states, "Handrail assemblies and guards shall be designed to resist a load of 50 plf (0.73 kN/m) applied in any direction at the top, and to transfer this load through the supports to the structure."

An SRW offers many benefits, but there is one minor limitation—The facing does not offer adequate resistance to a rotational force at the top, which is precisely the type of load that can be imparted by a fence post. In a normal fence installation, the posts are mounted in the ground, relying on the passive resistance of the soil surrounding the post to counter an applied load. A loaded fence post installed proximal to an SRW results in an interaction between the two structures. If sufficient soil resistance is unavailable to counter the load on the post, the railing foundation would mobilize, and the dry-stacked concrete unit wall face would undergo a localized outward rotation or displacement in response to the movement. Both wall and fencing failure can result from a post foundation that cannot handle the required load.

Of course, if the post is set back far enough from the wall, no load is imparted on the wall; and the two structures act independently. Valuable space at the top of the wall can be consumed in order to create the necessary separation

a building cod

between the fence post and wall. Long-term maintenance and safety concerns arise. Often, paving or stone cover prove to be unacceptable aesthetically. The location of the fence system and the limitations of an SRW system to handle a fence post load is misunderstood.

Too often those involved in the project are unaware. The civil engineer or architect may not even realize there is a problem, the wall installer is not focused on fencing requirements, and the fence contractor does not know how the wall system works. Frequently, fencing is not even shown on the site plan itself, but is instead relegated to an obscure construction detail in the back of the plan set. The detail often shows a fence post installed directly through the top of the wall itself or touching the back of the wall blocks, with a note indicating, "Designed by Others" or "Per Wall Manufacturer's Specifications." These solutions are not achievable without additional design considerations, and it is costly to design and construct an engineered solution that does not involve moving the fence post back several feet. In any event, the construction plans get reviewed and approved without much thought to this, because the focus on code conformance is often on the building structure itself and not items, such as SRW. Consequently, many fence systems are installed incorrectly at the top of walls, if installed at all.

There is an alternative to the standard rule of offsetting the fence at the top, which is a pre-engineered fence post foundation solution, available to specifiers and installers of SRW systems. The product is installed during wall construction as an accessory component, ensuring that the railing at the top meets the code requirements while preventing any damage to vital wall components. There are innovative foundation devices that provide the specifier with a code compliant solution and reduces the wall designer's liability related to fence integration. The product ensures the developer maximum use of real estate while allowing the wall installer to maintain peak production. Most importantly, it eliminates the fence contractor's concerns of affecting the integrity of the SRW.

These systems use a traditional cantilever design to engage the overlying soil mass; thereby providing resistance to a load imparted on the fence post. The construction community cannot afford to let a catastrophe make us realize that an SRW creates a fall hazard.

For instance, DHL, an express mail service company, used such a device when constructing its new distribution facility in Allentown, Pennsylvania. With several site walls and a chain link security fence around the entire complex, the foundation device allowed for an easy transition from SRW construction to fence installation. Over 3,000 linear feet of fence line the top of the SRW on this site. By using a fence integration device, DHL gained an additional 9,000 square feet of land that would have otherwise been trapped between the fence and the top of the wall.

In Denver, Centex Homes had a decision to raise the grade to the first floor with an SRW or build a series of lengthy stairs to reach the front porch elevation. They opted for a great-looking, ashlar-blended SRW, and quickly realized that a safety issue was created with a sidewalk planned above the wall. The foundation device saved valuable real estate at the top, allowing Centex to have ample room for the sidewalk and landscaping while building these model homes per plan.

If Hammurabi was still around, this is one building code no one would forget! **CMD**

The soil wedge between the face blocks and post foundation provide a buffer, allowing the two structures to remain independent.

e to remember

Concrete Masonry's AIA Continuing Education Learning Program

Learning Units Reporting Form

Return this form to the National Concrete Masonry Association. Only original forms are accepted for learning unit credit.

Return forms before August 2008 to receive learning unit credits.

☐ I am a non-AIA architect or design professional. Please mail me a certificate stating that the learning units earned can be used to fulfill other continuing education requirements.

Send completed Report Form to: AIA CES, National Concrete Masonry Association, 13750 Sunrise Valley Drive, Herndon, VA 20171-4662. If you have questions, please contact NCMA at 703-713-1900.

August 2007

AIA Questions: (Check the correct answer)

1. Segmental retaining wall systems can be used for:
- ☐ Structural grade changes.
- ☐ Converting unusable sloped land to level surfaces.
- ☐ Water retention and drainage.
- ☐ Both A and B.

2. Sand soils are discouraged to be used as backfill in SRW applications.
- ☐ True
- ☐ False

3. An acceptable method to stabilize a SRW system is:
- ☐ Add water to the soils.
- ☐ Use geogrid to stabilize the soil mass behind the wall.
- ☐ Use clay as a backfill material.
- ☐ All of the above.

4. When placing a fence system at the top of a segmental retaining wall, which of the following is not an acceptable practice?
- ☐ Placing the fence structure a minimum of 38 inches away from the wall face.
- ☐ Using a sleeve or tube during wall construction.
- ☐ Augering through the geogrid after wall construction.
- ☐ Requiring the fence system to meet building code specifications.

5. Passive soil resistance at the top of the wall cannot be achieved to resist loads imparted by a fence system.
- ☐ True
- ☐ False

AIA Member Information:

NAME ______________________________

ADDRESS ______________________________

CITY ____________ STATE/PROVINCE ____________ POSTAL CODE ____________

PHONE ____________ FAX ____________

E-MAIL ____________ ID NUMBER ____________

I certify that the above information is true and accurate to the best of my knowledge. I have complied with the AIA Continuing Education Guidelines.

____

SIGNATURE DATE

☐ Check here to request a catalog of concrete masonry technical literature.

Properly Integrating a Fence with a Segmental Retaining Wall Starts at the Design Stage.

Proper fence integration with a segmental retaining wall (SRW) is often misunderstood or overlooked during the design and construction of an SRW. First of all, a fence and a wall are two independent structures. To design one without considering the requirements of the other can create concerns. Here are some general industry guidelines when planning for a fence above an SRW:

1 Building codes typically require a fence or guard rail, where there is the combination of a significant grade change and the potential for it becoming a fall hazard. The construction of an SRW often triggers the enforcement of this code, due to its ability to facilitate vertical grade changes and create useable space accessible by the public.

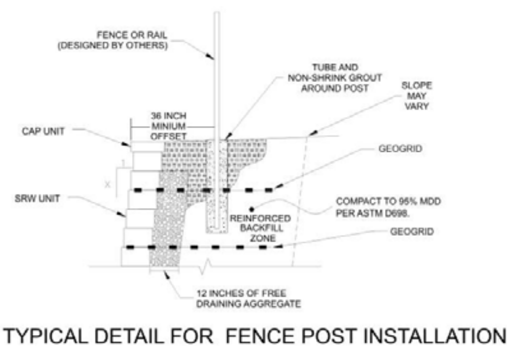
2 SRW are made up of several components, including the concrete block units, drainage gravel, geosynthetic reinforcement (geogrid), and compacted soil. Installing a fence in the traditional manner can often affect the integrity of these wall components.

3 Building codes require that a fence structure be able to resist a defined load applied at the most critical point, which is the top of the fence post. Because SRW concrete block units are dry-stacked, they are susceptible to localized overturning near the top of the wall.

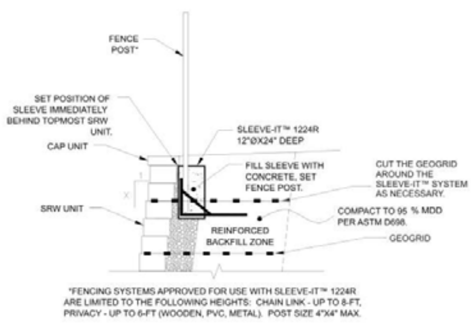
4 To allow for proper integration, a sleeve should be installed during wall construction. This enables the fence contractor to install posts without the need to auger through the reinforced soil. Auguring through the reinforced zone can potentially cause damage to the geogrid, a critical wall component.

5 The fence structure should be placed a minimum 36 inches away from the wall face. This method allows the passive resistance of the soil to counter the required loads without seeing localized bulging or overturning of the wall's top block units.

6 If the 36-inch buffer zone becomes problematic due to the additional consumption of real estate, there are some site specific engineering solutions that allow for fence placement closer to the wall face. Knowing what wall product is proposed, the local code requirements and the fence type allow the wall manufacturer to provide these alternative solution. CMD



TYPICAL DETAIL FOR FENCE POST INSTALLATION
N.T.S.



ALTERNATE FENCE POST DETAIL USING SLEEVE-IT™ 1224R
N.T.S.

Concrete Masonry DESIGNS

13750 Sunrise Valley Drive
Herndon, VA 20171-4662