



A CASE STUDY IN A HOME OWNERS P

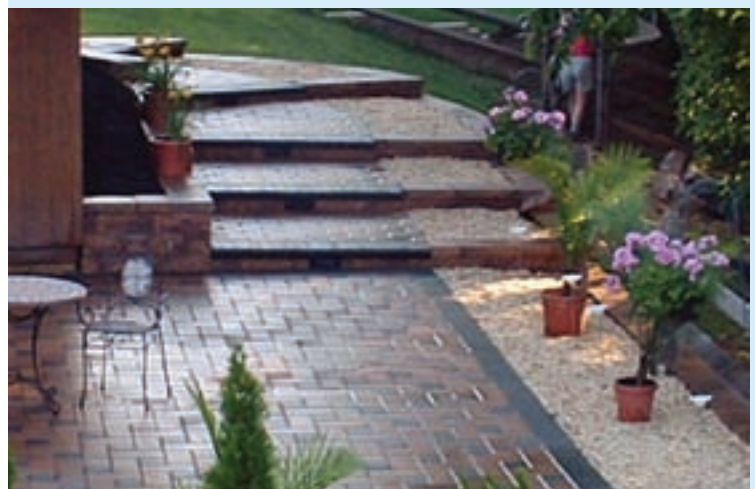




With usable—not to mention most available—land at a premium today, many homeowners and builders have to settle for building sites that are less than optimum when it comes to level acreage, especially for new homes with large land parcels.

The ability of segmental retaining walls to provide not only earth retention capabilities but also aesthetic accentuation makes these systems ideal for problems faced by both builders and homeowners when faced with a severely sloping terrain.

Raised patios using segmental concrete retaining walls and interlocking concrete pavers are a growing trend in the United States and Canada and give homeowners the beauty of natural stone at surprisingly modest prices with virtually maintenance-free service. There are a number of practical reasons why raised patios have become a favorite gathering place in so many homes for family and friends. Patios using manufactured concrete products are not only beautiful; they can be easily installed and are known for their durability. Also,



N RAISED PATIO CONSTRUCTION PERSPECTIVE—

raised patios with segmental retaining walls create new space in sloped backyards, and can even extend an existing raised deck. Raised patios create great places to entertain and they can incorporate free standing walls, built in seating, an in-ground hot tub or pool, a barbecue or a fire pit and ground-level lighting.

AMONG the truly great aspects of segmental retaining walls (SRWs) are the almost limitless possibilities available to designers by virtue of the adaptability of these versatile masonry products as well as special features that manufacturers are providing as enhancements to their products. While the primary purpose of segmental retaining walls is to retain earth, acting in conjunction with other masonry products such as stair treads, interlocking pavers and capstones help to connect the dots in complex landscape designs that seek to create multi-use areas for outdoor living. **SEGMENTAL** retaining walls and interlocking concrete paving systems enable the combination of straight or curved walls and steps in patios. One of the unique benefits of raised patios is that they are well-suited for steeply sloped

land. Sometimes that land is unsuitable for wooden decks or is impossible to access with ready-mix concrete trucks. Integrated segmental retaining wall and interlocking paver systems offer superior structure, durability and ease of repair when compared with other options such as lumber or cast-in-place concrete. The key to successful integration and performance of these two systems is attention to design detail and construction practices. A recently completed residential project in New Jersey highlights the versatility of these products when acting in conjunction with imaginative design. **WHEN** engineering such problematic sites, careful consideration must be given to soil composition, drainage, grades and matching alignments along property lines. The flexibility of SRWs allow for determining whether the desired height of earth



AIA/ASLA Learning Objective

After reading this article, you will be able to answer the questions on page 14.



CREATE GREAT PLACES TO ENTERTAIN



making that decision. **A FLEXIBLE SYSTEM** Raised patios built with segmental concrete retaining wall units and interlocking concrete pavers work together as a flexible system. Patios should be built on a sound foundation of compacted soil and dense-graded, aggregate base. Both should be compacted to a minimum of 98% of the maximum density as determined by the standard Proctor moisture-density relationship. The compacted base acts as structural support and as a leveling pad for the segmental wall system. The leveling pad should extend no less than 6 inches (150 mm) beyond the front and back of the segmental retaining wall unit and at least 6 inches (150 mm) in depth. The depth of wall unit embedment and the thickness of the leveling pad supporting the wall depend on the soil type, drainage, wall height and whether the wall will have sloped grades above or below or other

setback walls above it. NCMA design and installation guidelines for segmental retaining wall systems provide direction for leveling pad thickness, embedment depth and installation procedures in general. Since the leveling pad is flexible, it generally does not need to be built below the frost line since it will adjust to slight soil movement during freeze-thaw cycles. **PROPER** design of a segmental retaining wall will include analysis of the walls ability to resist external and internal forces, especially hydrostatic pressure that can potentially build due to water infiltration in the soil behind the wall. There are many methods to control water within and around raised patios. These methods often involve using an open-graded drainage layer behind the wall, perforated drain pipe, blanket drains and surface water control. Like any segmental system, a raised patio needs to have proper drainage to ensure adequate performance. This helps prevent hydrostatic pressure build-up behind the wall. The drainage layer should extend a minimum of 12 in. (300 mm) behind the wall and cover the walls full height. To support the interlocking concrete paver system, compacted, dense-graded aggregate base should be placed adjacent to and behind the segmental retaining wall. Rather than using site soil, some contractors fill and compact dense-graded aggregate behind the entire depth of the retaining wall. This provides fill that is less risk of potential settlement than compacted soil or non-select materials during the life of the raised patio. If soil is used as fill behind the wall, it must be carefully compacted in maximum 8 in. (200 mm) thick lifts at its optimum moisture content and density monitored after compacting each lift. Geosynthetic separation fabric should also be placed horizontally to separate the compacted soil materials from the compacted aggregate base which supports the bedding sand and concrete pavers. **WHEN** addition to providing a drainage layer immediately behind the wall, provisions should be made for lateral reinforcement of the soil or compacted aggregate base backfill material. This is done with geosynthetic materials, commonly referred to as geogrid, connected between the wall units and extending into the

backfill. Generally, the geogrid is spaced a maximum of 2 ft (600 mm) vertically. NCMA or the segmental retaining wall manufacturers can provide guidance on the vertical spacing of geogrid within the wall coursing, as well as on the length of the geosynthetic reinforcement extending into the backfill materials. In some instances, the geogrid material is stronger in one direction than another. The stronger direction should be laid perpendicular to the wall face. **IF** the raised patio rests against the house foundation, consider waterproofing the interface between the existing building wall or foundation wall and the raised patio. Geosynthetic drainage mats may also be used to provide a means to prevent water from impacting the existing structure. The foundation drainage mat installation should follow manufacturer's recommendations including foundation wall surface preparation, method of fastening to the wall, overlapping/joining material sections and proper methods for dealing with water collected in the drainage mats. **THE** concrete pavers should be installed according to ICPI or paver manufacturer guidelines. The base should be brought up to the proper elevation and properly compacted. The top of the base will likely be below the top of the segmental retaining walls. This enables installation of bedding sand and pavers such that the caps or pavers on the walls and on the base are placed at the same elevation with no lippage. The surface of the base should be smooth and level. Bedding sand should then be screeded into place and finally, paver installation can begin. A slope in the patio surface should begin with a slope built into the foundation for the segmental retaining walls. The slope associated with a raised patio should enable the leveling pad, drainage layers, paver aggregate base and the pavers to drain water away from the building. Although 2% grade is the minimum recommended pitch for driveways, patios can be set at a minimum of 1%. This provides balance and comfort for raised patio users in chairs while maintaining drainage away from the building foundation. String lines can be used to establish the top of base and grades for drainage.

THE value of the home in this case study was increased by developing previously unusable, steeply sloping land as a raised patio. The project included utilizing segmental retaining wall units and interlocking concrete pavers to support a hot tub. This project demonstrates how an ordinary sloping backyard with a deck can be expanded and the deck space transformed into several new living spaces. The mark of quality rests in the sound installation of a well-built foundation, drainage, waterproofing, interlocking concrete pavers and segmental retaining walls.