

**Operation & Maintenance Guide**  
**For**  
**Belgard Segmental Retaining Wall Systems**



Belgard segmental retaining wall (SRW) products are produced by Oldcastle Architectural Products Group (APG) plants throughout North America and are manufactured in accordance with ASTM C1372 *Standard Specification for Standard Specification for Dry-Cast Segmental Retaining Wall Units*.

SRW structures are constructed of concrete masonry units, geogrid soil reinforcement fabric, and compacted backfill. The structure's performance is sensitive to any post construction activities that may damage components, increase loading conditions, and/or reduce overall stability. SRWs, like all types of earth retaining structures, require periodic inspection and maintenance to ensure long-term performance throughout the design life of the system

This document addresses the key inspection and maintenance requirements for Belgard SRW systems and includes recommendations for cleaning and sealing facing wall block. Belgard recommends that a site-specific Operations & Maintenance (O&M) Manual be developed, based on guidelines presented in this document, for large commercial and municipal projects.

Visit [www.BelgardCommercial.com](http://www.BelgardCommercial.com) for a full collection of resources related to Belgard SRW systems including typical details, guide specifications, laying patterns, and other reference material.

Oldcastle APG, a part of CRH International, is committed to delivering sustainable products that provide environmental benefits, including concrete products for stormwater management. Belgard SRW products are used throughout North America as a cost-effective solution for land development. In many cases SRWs offer design flexibility to protect sensitive eco systems and create more useable outdoor space. For more information about Oldcastle's commitment to the environment, go to <http://www.crh.com/sustainability/>

**Table of Contents**

Basic SRW Construction Guidelines.....

SRW Construction Tolerances.....

Post-Construction Inspection, Meeting and Close-out Documents.....

Types of SRW Maintenance/Repair Issues.....

    Cracked Blocks.....

    Loss of Aggregate at SRW Face.....

    Differential Settlement.....

    Negative Batter.....

Cleaning SRW.....

    Efflorescence.....

    Mold.....

    Vegetation.....

    Graffiti.....

Sealing SRW.....

Winter Considerations.....

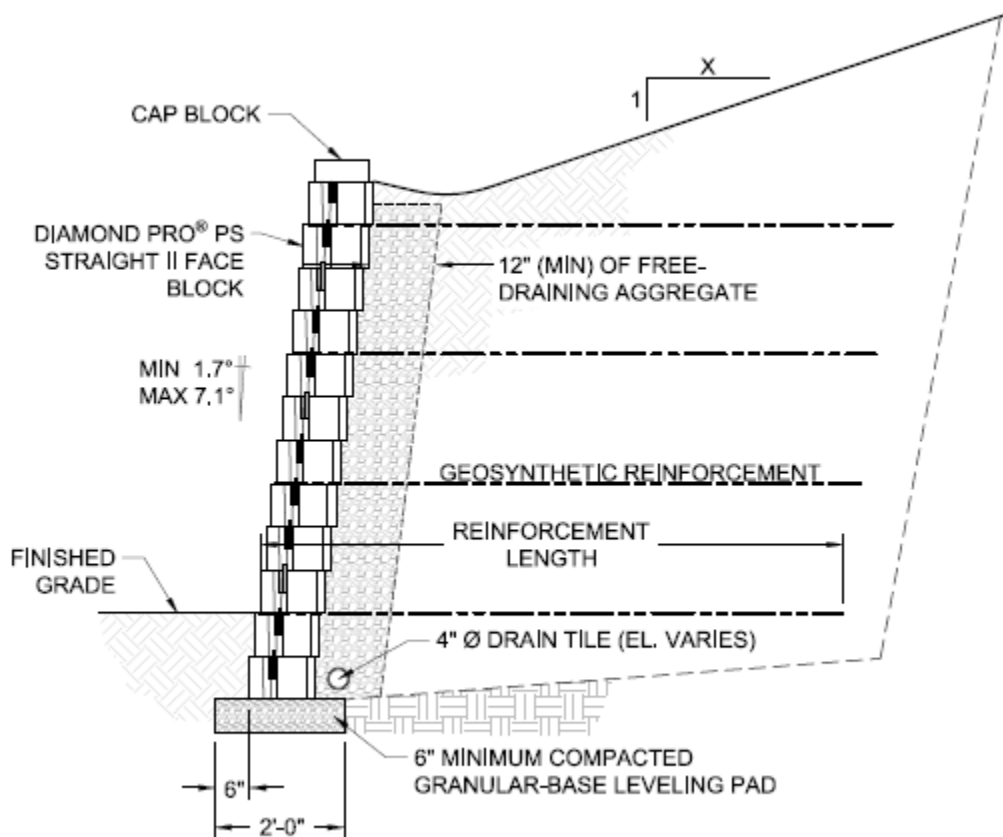
Annual Inspection & Routine Maintenance Program .....

SRW Resources.....



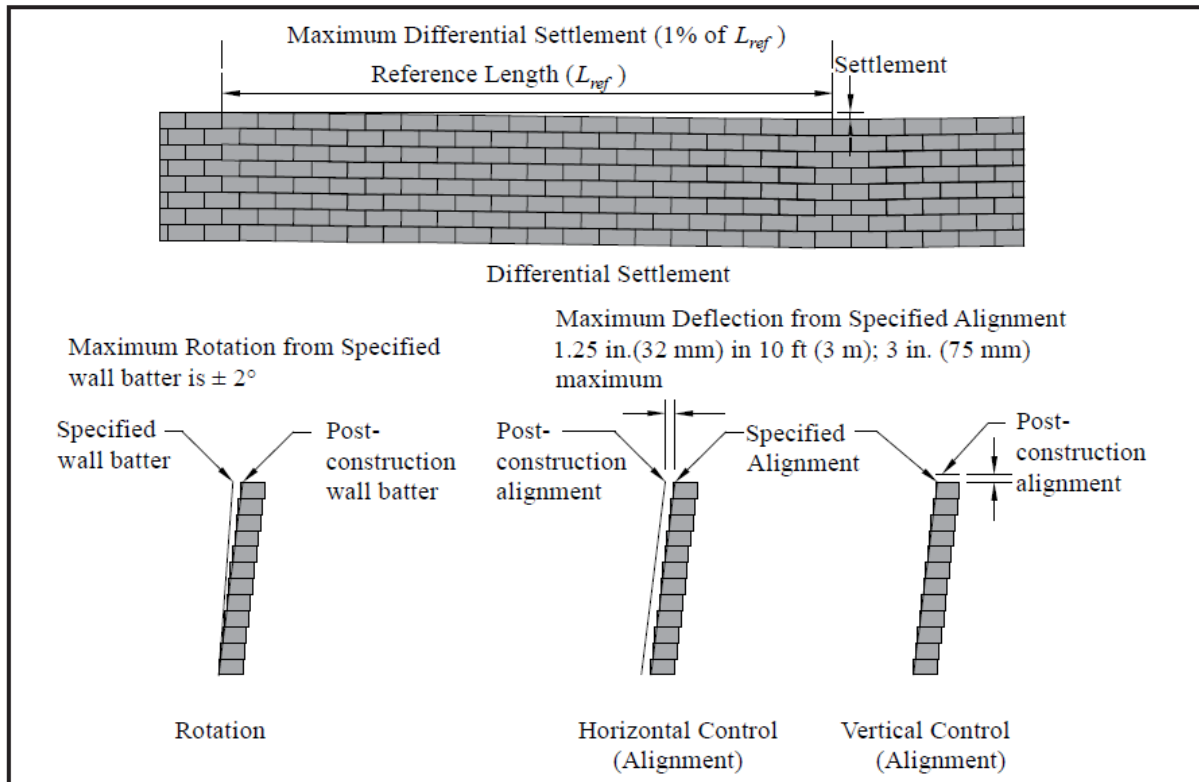
## Basic SRW Construction Guidelines

SRW construction should be consistent with information and guidance presented in Section 15.3, Construction & Inspection Checklist in the National Concrete Masonry Association (NCMA) *Segmental Retaining Walls Best Practices Guide*. Construction compliance with approved stamped and sealed wall design drawings is critical and should be confirmed. An important component to design conformity is the use of specified soils, SRW units, drainage materials and geosynthetics. Correct wall layout including alignment and elevations should also be confirmed. During construction, the owner's representative should confirm compacted lift thicknesses were maintained and minimum compaction requirements were achieved and documented. A typical reinforced SRW detail is shown below. Project specific conditions will dictate minimum geogrid embedment lengths, specific drainage requirements, soil and aggregate types and capping and fencing details.



## Construction Tolerances

As with any constructed work, some deviation from construction drawing alignments will occur. As opposed to cast-in-place concrete walls, alignment of SRWs can be simply corrected or modified during construction. The NCMA has developed the following recommended maximum construction tolerances for SRW:



## Post-Construction Inspection, Meeting and Close-out Documents

When the SRW construction is complete, the owner or their representative should confirm that the newly built SRW was installed in general conformance with the construction documents. Confirmation that the proper materials and drainage were installed, through site visits and/or photographs, is recommended to ensure the long-term performance of the SRW system.

Project close-out documentation should include all required information listed in the project specifications (inspection test reports, material certifications, etc.). A SRW post-construction Inspection and meeting should be conducted with the owner, geotechnical engineer, quality assurance firm, SRW design engineer, SRW installer, and any other interested parties. Key topics to verify and consider include:

- o Evaluate adherence to the construction drawings, plans, and specifications.
- o Review inspection logs and quality control/quality assurance reports.
- o Identify any items requiring correction.
- o Discuss long-term maintenance needs with the owner.

For tall walls and for critical structures, annual or bi-annual inspections of the wall may be warranted, and if conducted, should be performed by a qualified firm. Similar inspections should also be performed following extreme events such as major earthquakes or storms. Any recommendations requiring remediation should be identified and discussed with the owner.

The following considerations listed below should be addressed at the project completion – close-out meeting with the owner, engineers/designers and construction team.

- All stakeholders shall be aware that the area behind the wall that contains geogrid soil reinforcement fabric (reinforced zone) is the primary structural component of the wall system. Do not, under any circumstances, excavate through, drill through, or otherwise damage this reinforcement fabric without written approval of the design engineer of record.
- Details on the SRW drainage pipe location and where it daylights or is tied to existing storm sewer system shall be communicated to all stakeholders.
- No digging or excavation shall be done within 3 feet horizontally from bottom face of wall or to such depth that would compromise the integrity of the wall foundation.
- All water must be diverted away from the base of wall to avoid erosion and undermining of the foundation after installation. This includes temporary site grading during construction and final site grading.
- Any landscape watering and surface drainage above the wall shall be designed and constructed in consultation with the Civil and Geotechnical engineer and performed in such a way to avoid standing water, water cascading over the wall, and infiltration (saturation) of the reinforced zone.
- No one shall increase the height of the existing wall as constructed with more block units without the written approval of the design engineer of record. Likewise, additional slope or increase the steepness of a back slope beyond what was considered in the original grading plan and wall design without written approval of the design engineer of record.
- No additional surcharges within a lateral distance of twice the overall height of the structure(s) without written approval of the design engineer of record or unless considered in the original wall design. This would include large trees, fences, sound walls, landscaping walls, swimming pools, buildings, garages, etc.
- Do not operate heavy equipment, within four feet of top of wall face. The surcharge from equipment weight can push the upper wall units out resulting in unacceptable misalignment.
- SRWs are flexible structures (vs. rigid CMU walls) and are subject to some post construction settlement and movement. All structures (i.e. sidewalks, pavements, curbs, trash enclosures, utility lines, etc.) should be designed to handle some ground movement and not be connected directly to the wall units.
- Retaining walls should be inspected at least once a year. Verify that:
  - drainage measures are functioning properly, erosion has not occurred along the top, ends, or bottom of wall(s),
  - landscaping planting is not interfering with the wall(s) intended performance,

- block cracking is not occurring at an unacceptable rate,
- loss of drainage aggregate is not occurring at the face or ends of the wall,
- unacceptable settlement is not occurring above or below the wall, and
- there is no unanticipated movement or deflection of the wall system (additional inspection may be necessary immediately following a catastrophic event such as a flood, heavier than normal rain event, earthquake, etc.).

## **Types of SRW Maintenance Issues**

For a complete description of SRW repair and maintenance issues the NCMA's *Assessment, Maintenance and Repairs of SRWs* is a good reference. The four most common types of issues that may warrant engineering inspection, monitoring and possibly corrective maintenance measures are summarized below.

### **Cracked Blocks**

In some cases, especially when dealing with taller walls, SRW facing units can crack. While it is warranted to document cracked blocks in a completed wall project, cracked facing units are normal and to be expected in a flexible system that is intended to withstand differential settlement. Cracked blocks do not automatically indicate deficiencies with the performance of the overall segmental retaining wall system. If the bearing surfaces of the units are not uniformly supported, the units may crack between points of support. While this cracking may present an aesthetic distraction, it does not compromise the structural stability of the system. Further, the cracking may actually help to redistribute the stresses at the wall face for increased system stability. Unless specified otherwise, the general industry practice allows a relatively small percentage of the units within an assembly to be cracked. Occasional thin cracks with no displacement are not typically a concern. Cracks that represent greater than 5% of the units, follow a pattern, or have significant displacement should be carefully assessed by a qualified segmental retaining wall engineer. When cracking is in question, have the SRW design engineer conduct a site assessment to identify the cause of the cracking and determine whether remediation is necessary.

Cracked or chipped blocks can often be patched with specialty mortar products with colorant additions to cosmetically repair SRW blocks when aesthetic appearance is important. If this type of repair is needed, contact a masonry repair specialist for an assessment on repair options available.



### **Loss of Aggregate at Wall Face**

Small amounts of movements in the face are not necessarily a sign of imminent failure, especially if horizontal and vertical alignment is maintained. However, gapping or opening between unit can cause of loss of drainage aggregate through the wall face. In no case, however, should the gap between units exceed one-half of the nominal gravel fill size. Typically, gaps  $> \frac{1}{2}$ " should be monitored and corrective actions must be taken to prevent loss of drainage stone.

### **Differential Settlement**

SRWs are relatively flexible structures that can tolerate movement and settlement without causing significant structural distress because the SRW units move and adjust relative to each other. When an SRW is built correctly there is little chance of differential settlement occurring if the foundation soils are strong and homogeneous. Poor compaction in the reinforced or foundation zones can play a big part in SRW settlement. If the SRW block is constructed on a rigid poured foundation of concrete, compacted fill in the reinforced zone could settle over time while the SRW units will not. Different support stiffnesses can lead to differential movements which can cause openings in the block facing or cracked block due to concentrated stresses. A qualified engineer should inspect the wall and make recommendations if needed.



### **Negative Batter**

All SRWs should be constructed with a batter as called for in the wall design and consistent with the product batter settings. Even a near-vertical wall should batter slightly against the retained earth. In rare cases, often due to near-vertical batter plus construction activity behind the wall, SRW blocks can move horizontally in one or more courses. This is easily observed if a plumb line from the top of the wall falls freely not contacting the wall (not possibly in a properly constructed wall with batter). In some cases, isolated negative batter is not a concern unless it continues to grow. A qualified engineer should inspect the wall and make recommendations if needed.

### **Cleaning SRWs**

SRW systems will require little to no maintenance over its design life. Routine maintenance cleaning items to consider include: control of vegetation and removal of soil and construction dirt and debris. At the end of construction, the wall face should be washed to remove loose soil that may have accumulated during construction. If vegetation does grow, spraying with a weed killer will stop further growth. During the life of a SRW, the need to address cleaning efflorescence, mold, vegetative growth or even graffiti may arise.

### **Efflorescence**

Efflorescence is a deposit of soluble salts usually white in color, that sometimes appear on the surfaces of SRW. Efflorescence is strictly an aesthetic issue and will not affect structural performance. SRW units Efflorescence is caused by leaching of the free salts by water. Because of their exposure, it is virtually impossible to remove SRW assemblies from moisture exposure, either in the form of precipitation or moisture in the soil behind the wall. While only an aesthetic concern, in cases where there is a desire to remove the efflorescence, additional information is available in NCMA's TEK 8-3A, *Control and Removal of Efflorescence*. In many cases given time the issue will resolve itself. There are efflorescence cleaning products specifically designed for concrete masonry products like SRWs. Belgard recommends Techniseal's Paver prep [Heavy Duty Efflorescence Cleaner](#).

### **Mold**

Mold is not detrimental to the structural integrity of the wall. In areas where the wall face remains damp from groundwater seeping through the face or spray from lawn irrigation systems, mold can develop, but can easily be removed with over-the-counter commercial cleaners and by power washing.

### **Vegetation**

Vegetation in contact with the face of the wall is not detrimental to the wall. Vegetation on the face of the wall can be treated with a weed killer to stop its growth. If the source of the vegetation is roots coming from trees or bushes from behind the wall, an arborist can make recommendations to minimize the root growth through the wall face.

## **Graffiti**

Paint on masonry products can be removed, although special paint removal chemicals are required. Application involves scrubbing with nylon brushes and rinsing with pressure washers. Belgard recommends Techniseal's [Paint, Tar and Rubber Remover](#) product for most applications.

## **Annual Inspection & Routine Maintenance Program**

An annual inspection is recommended in the spring after snow events have subsided for the year. The purpose of the annual inspection is to assess the functional condition of the SRW as an earth retaining structure. Once the annual inspection is completed, routine maintenance activities should be performed to correct any deficiencies.

## **SRW Resources**

The following resources address SRW design and maintenance and may provide additional guidance:

1. *Design Manual for Segmental Retaining Walls*, 3rd Edition, Publication No. TR 127B, National Concrete Masonry Association, Herndon, VA, 2010
2. TEK 18-11B, *Inspection Guide for Segmental Retaining Walls*, National Concrete Masonry Association, Herndon, VA, 2012
3. *Assessment, Maintenance and Repairs of SRWs*, SRW History Article Series, National Concrete Masonry Association, Herndon, VA, 2017
4. TEK 8-3A, *Control and Removal of Efflorescence*, National Concrete Masonry Association, Herndon, VA, 2018
5. *Segmental Retaining Walls Best Practices Guide*, EP2, National Concrete Masonry Association, Herndon, VA, 2019
6. Belgard Technical Note, *SRW Block Cracking*, 2020

Go to [BelgardCommercial.com](http://BelgardCommercial.com) to download the following resources for Belgard SRW:

- Guide specifications
- Typical details
- Project Profiles
- Product Data Sheets (cut sheets)
- Color options
- Installation guidelines