



Keystone Retaining Wall Systems, Inc.



Figure 4: Roadway Application

6. Availability & Cost

AVAILABILITY

Contact Keystone for information on local availability of the retaining wall system components.

COST

Material costs and budget installed cost information may also be obtained through local Keystone representatives.

7. Warranty

The information set forth in Keystone technical literature is for general information only. It should not be relied upon for any specific application without

Refer to design charts in the Keystone Design and Construction Manual for the requirements of gravity walls and soil reinforced walls up to 11' 0" (3.4 m). For structures taller than this or walls in a critical application, contact your local Keystone Representative.

PRECAUTIONS

Pea gravel should not be used as a backfill material. Comply with jobsite safety requirements of authorities having jurisdiction.

BUILDING CODES

Current data on building code requirements and product compliance may be obtained from your local Keystone representative. Installation must comply with the requirements of all applicable local, state and national code jurisdictions.



Figure 5: Industrial Application

independent professional examination and verification of its accuracy, suitability and applicability. The user assumes any and all liability resulting from its use. Keystone Retaining Wall Systems disclaims any and all express or implied warranties of merchantability fitness for any general or particular purpose, or freedom from infringement of any patent, trademark, or copyright in regard to the information or products contained or referred to herein. A limited product warranty is available upon request from Keystone Retaining Wall Systems.

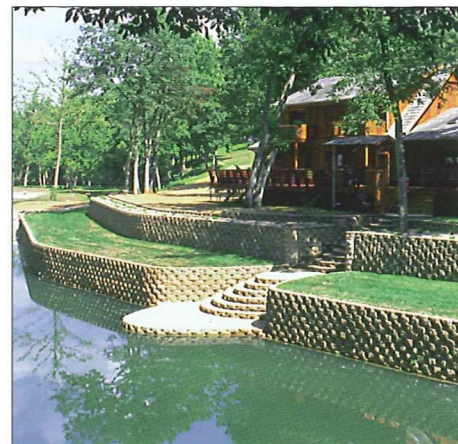


Figure 6: Water Application



Figure 7: Roadway Application

8. Maintenance

When properly designed and installed, these retaining wall systems typically require almost no maintenance. Like any concrete surface they may be pressure washed periodically to remove soiling or stains.

9. Technical Services

Trained service personnel are available to offer design assistance and technical support. Contact Keystone Retaining Wall Systems or your local Keystone representative for more information.

10. Filing Systems

- Architects' First Source for Products
- MANU-SPEC®
- Sweet's Catalog Files
- Additional product information is available from the manufacturer upon request.



Keystone Retaining Wall Systems, Inc.



The first. To last.

1. Product Name

Keystone Retaining Wall Systems

2. Manufacturer

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3. Product Description

BASIC USE

A retaining wall is a structural system which, when properly designed, retains a soil mass and safely supports any surcharge loading applied to the structure. The Keystone Retaining Wall System replaces boulder, timber tie and cast-in-place concrete retaining walls. Keystone is structurally sound, aesthetically appealing, easy to install and economical.

As a gravity wall system, the original Keystone Standard Unit provides the weight and stability to resist applied earth pressures for walls up to 6' (1.8 m) (assumes no surcharge loads and soils are



Figure 1: Commercial Application

sand/gravels). Reinforced walls over 50' (15.3 m) have been constructed. A wide range of unit sizes, colors and textures is possible.

These walls are suitable for curves, 90° corners, terraces, planters and structural walls in commercial and residential applications. Governmental projects, roads and highways, waterways, golf courses, swimming pool landscaping, lake walls, drainage channels and creative landscaping designs are all within the capabilities of the system. Detail elements such as guardrails, handrails, copings, steps and commercial signage can be incorporated into the system.

COMPOSITION & MATERIALS

Keystone Retaining Wall Systems are made from specially designed and shaped modular concrete masonry units. Keystone's patented pin system features high strength pultruded fiberglass pins that provide a shear connector, a proof positive geogrid holder and alignment device all in one piece. The pin system ensures a positive mechanical connection between structural wall units and geogrids.

Units are easy to install and feature dry stacked assembly. No mortar is required, allowing free flow of water and release of hydrostatic loads. Rapid installation reduces construction time compared to alternative wall construction methods.

TYPES

- Standard Units - Used for tall walls and critical structures
- Compac Units - Lighter weight than Standard Units and easy to handle for smaller walls
- Mini Units - Ideal for smaller non-critical applications and residential scale
- Cap Units - Features a smooth top surface without openings to give a coping appearance (angled and straight sides)

SIZES

Unit weights, dimensions and colors may vary by region.

Standard

- Dimensions - 8" high x 18" wide x 21" deep (200 x 450 x 533 mm)
- Exposed face area per 1 sq ft (0.093 m²) - 8" x 18" (200 x 450 mm)
- Weight - 105 lbs (48 kg)

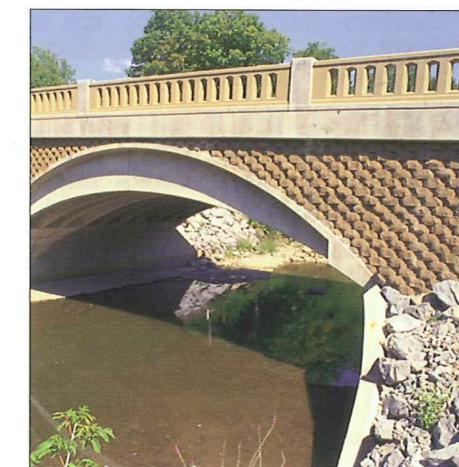


Figure 2: Government Application

Compac

- Dimensions - 8" high x 18" wide x 12" deep (200 x 450 x 300 mm)
- Exposed face area per 1 sq ft (0.093 m²) - 8" x 18" (200 x 450 mm)
- Weight - 85 lb (39 kg)

Mini and Cap

- Dimensions - 4" high x 18" wide x 10 1/2" deep (100 mm x 450 mm x 260 mm)
- Exposed face area per 1/2 sq ft (0.047 m²) - 4" x 18" (100 x 450 mm)
- Weight - 45 lbs (20 kg)

Fiberglass pins

- Dimensions - 1/2" x 5 1/4" (13 x 133 mm)

FINISHES

The surface is the texture of rough concrete. Finish options include:

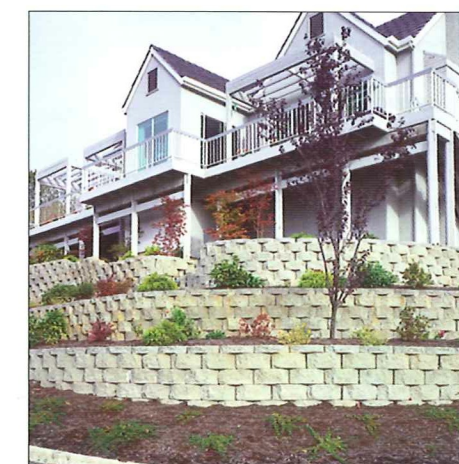


Figure 3: Residential Application





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- Three-Plane Split - creates the look of natural stone
- Straight Split - Offers clean refined lines

COLORS
There are multiple color options. Colors are typically earthtones. Consult manufacturer literature and color chart.

SHAPES
Three plane split angle face textures allow a natural appearance with heavy shadows.

LIMITATIONS
Structural retaining walls are design dependent. A design professional such as an architect, structural engineer or geotechnical engineer familiar with the product and the project requirements should determine the requirements for any specific wall installation.

4. Technical Data

APPROVALS
Consult manufacturer for current information on compliance with requirements of specific agencies and/or building code jurisdictions.

ENVIRONMENTAL CONSIDERATIONS
Materials are non-corrosive and safe for the environment.

PHYSICAL/CHEMICAL PROPERTIES
Test reports and design data are available to design professionals upon request. Fiberglass pins flexural strength 128,000 psi (881.9 MPa), tensile strength 110,000 psi (757.9 MPa), short beam shear strength 6400 psi (44.1 MPa).

FIRE RATING
Concrete units are non-combustible.

5. Installation

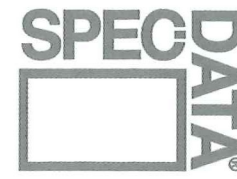
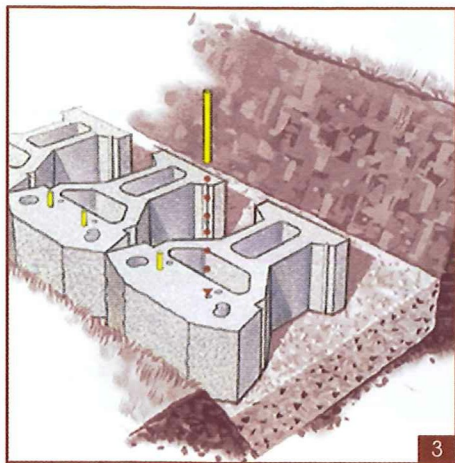
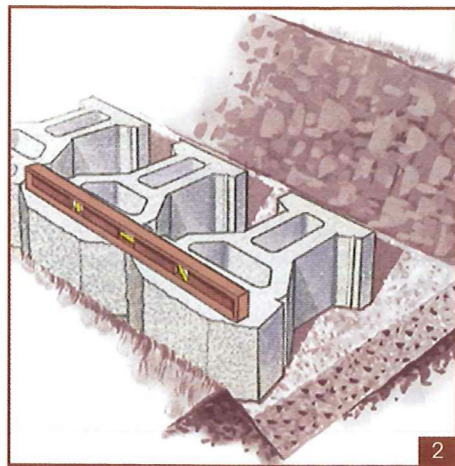
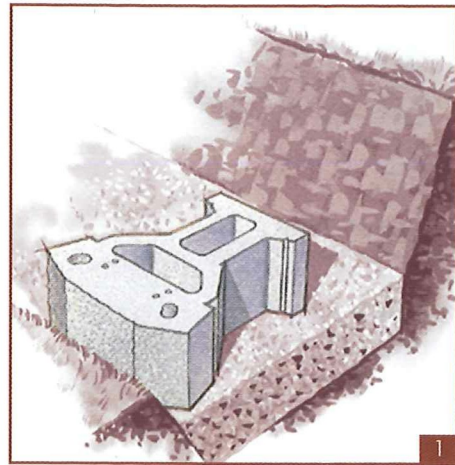
STEPS
The Keystone Retaining Wall System was developed with simplicity of construction in mind. These step-by-step instructions will guide you through the basic process from start to finish. If more detailed information is required to meet your specific site situation, consult your local Keystone representative.

Step 1. Prepare the Base Leveling Pad. Remove all surface vegetation and debris. Do not use this material as backfill. After selecting the location and length

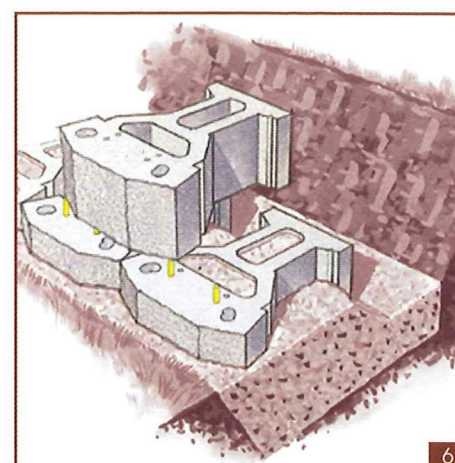
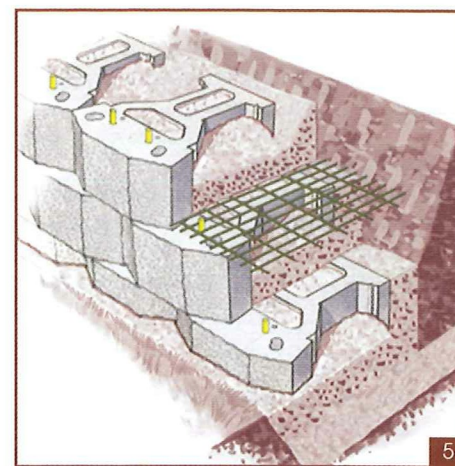
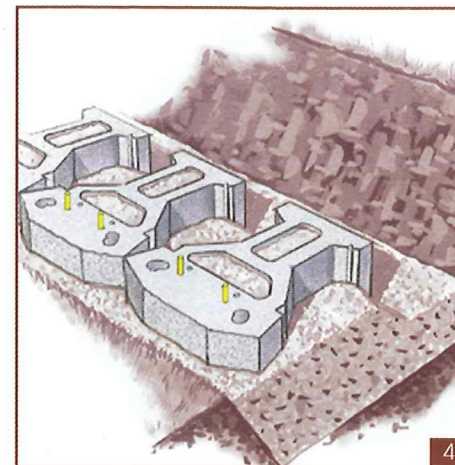
of the wall, excavate the base trench to the designed width and depth. Start the leveling pad at the lowest elevation of the wall. Level the prepared base with 6" of well-compacted granular fill (gravel, road base, or 1/2" to 3/4" (13 - 20 mm) crushed stone). Compact to 95% Standard Proctor or greater. Keystone recommends additional trench depth for below grade placement of Keystone units on a ratio of 1" (25 mm) below grade for each 8" (200 mm) of wall height above grade (to a maximum of 3 units buried). This lowers the base course below grade locking the wall in place and also helps prevent erosion and scouring at the base of the wall. The base trench should be wide enough to allow for the Keystone unit and drainage zone. An option to a compacted, granular material leveling pad is to use a non-reinforced concrete leveling pad. In some cases, contractors find this is a time-saving approach. Walls built to a level condition on a sloping grade require a stepped base. It is best to work out the stepped base as the wall steps up in elevation. If a concrete leveling pad is used, the step-up height needs to exactly match the Keystone unit height.

Step 2. Install the Base Course. Place the first course of Keystone units side by side (with sides touching) on the prepared base, with the paired pin holes facing up. Make sure each unit is level — side to side and front to back. The first course is critical for accurate and acceptable results. For alignment of straight walls, use the pins or the straight back edge of the unit. Using the front face will give irregular alignment due to the rough split texture. For constructing curved walls, use the front pin position for best results. Minimum radius for convex and concave curves is 3' 6" (1 m).

Step 3. Insert the Interlocking Fiberglass Pins (2 per Keystone unit). Place the reinforced fiberglass pins into one of the paired holes on each side of the Keystone unit. (Pins of adjoining units should be 12" (300 mm) on center.) Once placed, the pins create an automatic setback for the additional courses. According to wall requirements and design, place pins in the front holes for near vertical (1/8" or 3 mm) setback and the rear holes for 1 1/4" (32 mm) setback per course.



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Step 4. Install and Compact Backfill. Fill in all voids - in and between Keystone units - using 1/2" to 3/4" (13 - 20 mm) clean crushed stone. Place drain zone behind the units as required to achieve total 2 ft (0.6 m) depth of drainage zone from unit face. PEGRAVEL SHOULD NOT BE USED. Compact material in unit cavities appropriately to eliminate settling. Next, if economical, use existing soils for backfill behind the gravel drainage zone. (Heavy clays or organic soils are not recommended due to water-holding properties.) In some situations poor site soils will cause higher reinforcement costs, so the economics of using inport soils should be reviewed. Compact soils to a minimum of 95% Standard Proctor density, placing fill in 8" (200 mm) lifts on a course-by-course basis of as specified by a Professional Engineer. (Use only walk-behind mechanical compaction equipment within 3' (1 m) behind the units to avoid localized overstress.) Sweep off any pebbles or debris so the next keystone units rest evenly upon the layer below.

GEOGRID INSTALLATION
For taller or more critical walls that require use of geogrid soil reinforcement, continue the installation process with Step 5. If geogrid is not required, skip to Step 6.

Step 5A. Excavate Reinforced Soil Area. Remove existing soils in the reinforced soil area to the maximum embedment length of the geogrid design. Provide a level grade condition behind the wall units for the placement of each geogrid layer.

Step 5B. Cut Geogrid. Cut sections from geogrid roll to the specified length (embedment depth). Geogrid roll direction is from the wall toward the embankment. Check manufacturer's criteria for biaxial or uniaxial geogrids. In most cases correct geogrid orientation is to roll out geogrid perpendicular to the wall face.

Step 5C. Install Geogrid. Hook geogrid over the Keystone fiberglass pins to ensure a positive mechanical connection between the unit and geogrid.

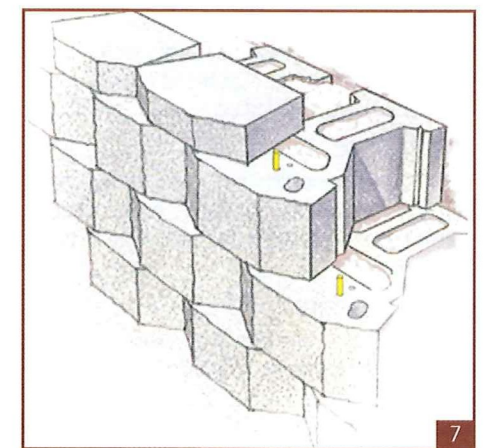
Step 5D. Secure Geogrid. Pull the connected geogrid taut to eliminate loose folds. Stake or secure back edge of geogrid before and during backfill and compaction. Remove stakes, if desired,

once backfill is placed. Place additional sections of geogrid, abutting each other, for continuous coverage at each layer.

Step 5E. Install Next Course of Keystone Units.

Step 5F. Place Compacted Backfill Over Geogrid In 8" (200 mm) Lifts. Provide a minimum of 6" (150 mm) reinforced fill coverage prior to driving equipment over the geogrid with tired equipment. Avoid driving or turning vehicles directly on geogrid to avoid excessive damage.

Step 6. Install Additional Course. Place the next course of Keystone units over the fiberglass pins, fitting the pins into the kidney-shaped recesses. Center the unit over the two underlying units as shown. Visually sight down in the kidney-shaped recess for pin positioning. Pull the Keystone unit



toward the face of the wall until it makes full contact with both pins. For each remaining course, repeat Steps 3-6.

Step 7. Install Keystone Caps. Complete your wall with Keystone Caps. In areas of high public usage, apply Keystone KapSeal™ (a construction adhesive for masonry units) on the top surface of the last course before applying cap units. Place the Keystone Cap unit over the pins on the underlying unit. Pull the Cap unit forward to the automatic setback position. Backfill and compact soils behind wall to finish grade. Finish grade with appropriate plastic soil cap or drainage swale to minimize surface water flow into the reinforced zone or over the face of the wall.

