



## ***DESIGN CONCRETE SYSTEMS LTD.***

### **HISTORY**

Design Concrete Systems Limited was incorporated in 1979. The company is located in Seaforth, Ontario, Canada. It is a CSA certified pre cast facility, which produces both wet cast and dry cast products.

Over the last 29 years Design Concrete has manufactured a wide variety of products including septic tanks, agricultural products, flooring systems, Canada Post "Super Mail box" pads, retaining wall systems and fencing.

Design Concrete Systems began as a division of C.J. Pink and Son Limited, a pre cast concrete company located in London, Ontario, Canada. C.J. Pink was founded in 1932.

### **RETAIN-A-ROCK**

Retain-A-Rock is a true gravity wall system and is quickly becoming a standard in the retaining wall industry. Retain-A-Rock offers many advantages over other retaining wall systems. It is an economical, proportional and esthetically pleasing system. Retain-A-Rock is a fully engineered retaining wall, which makes it the first choice for project engineers, landowners and installers.

Retain-A-Rock makes efficient use of contractor's equipment and eliminates intense labor that is required for average retaining wall systems. Retain-A-Rock has the ability to create 9-12 foot high walls without the use of geo-grid in most applications. This eliminates future conflict with utility easements. Higher walls can be achieved without mechanical connections, using geo-grid.

Retain-A-Rock is a complete system designed around a 24 square foot block. Accessories are readily available to complete almost any wall, including end blocks, top caps, and half blocks.

The blocks are cast in a high quality mould precision formed to maintain accuracy on every piece. The quality of pre cast versus poured in place concrete ensures the long life of the product. Upon installation, the blocks are filled with specified aggregate to create a self-draining wall system.

The system is produced in a CSA certified facility and is designed to comply with the Ontario Highway Bridge Design Code.

Retain-A-Rock will benefit the owner, engineer and installer throughout the project. We are looking forward to assisting you with your future retaining wall applications. Please contact us or visit our website at [www.designconcrete.ca](http://www.designconcrete.ca)



***Design Details and Recommended Practices***

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**GENERAL NOTES**

**G1**

**1. GENERAL**

- 1.1 **General:** The contractor is solely responsible for safety. The Architect/Engineer and Owner shall not be responsible for means or methods of construction or for the safety of workers or the public.
- 1.2 **Submittals:** If a complete design is not depicted in the plans, submit for review two (2) sets of shop drawings for the retaining wall system prepared by a Professional Engineer registered in the Province where the project is located. The shop drawings shall indicate the layout, height, and geo grid reinforcement (if applicable) of the retaining wall system. Design shall conform to the Canadian Highway and Bridge Design Code. Upon request, design calculations shall also be submitted.
- 1.3 **Geo Grid:** If Geo Grid reinforcement is required by the shop drawings, submit manufacturers literature and test data for geo grids to be used in segmental wall system. Test data shall include connection strength for segmental units and geo grids to be used determined in accordance with ASTM D6638 as well as geo grid tensile strength and creep data in accordance with ASTM D4595 and ASTM D5262.
- 1.4 **Aggregates:** Submit grain size test results in accordance with ASTM C136 for aggregates to be used for the wall base, for unit fill, and for select reinforced fill (if applicable).
- 1.5 **Fill:** Submit test results on borrow soil to be used for backfill and for the reinforced fill (if permitted) including Atterberg limits and Proctor by ASTM D4318 and ASTM D698.
- 1.6 **Delivery, Handling and Storage:**  
Contractor shall check the materials upon delivery to ensure that proper materials have been received. Contractor is responsible for protecting the materials from damage. Damaged material shall not be incorporated into the wall or the reinforced soil embankments. Contractor shall prevent excessive mud, concrete, adhesives and other substances from coming into contact with the product. Exposed faces of retaining wall shall be reasonably free of chips, cracks and stains.
- 1.7 **Quality Assurance:** Owner shall employ services of a material engineering firm to provide quality control testing during embankment construction.



**2. MATERIALS**

**2.1 Wall Units:** Segmental units shall be *Retain-A-Rock* units manufactured under license from Design Concrete Systems Ltd. Units shall be made in accordance with CSA A23.4, and designed in accordance with the Canadian Highway Bridge Design Code. Concrete for segmental units shall have a minimum 28-day strength of 35 MPA. Entrained air content shall be between 5-7% unless otherwise specified on drawings. Reinforcing steel shall have minimum yield strength of 400 MPa. Welded wire mesh shall conform to the requirements of ASTM A497. Galvanized reinforcing and welded wire fabric shall be hot dip galvanized after fabrication in accordance with CSA Standard G164-M. Then minimum concrete cover is to be no less than 1.5” unless otherwise specified on drawing. Block design shall be sealed by a Professional Engineer. The color of the units shall be concrete gray. A concrete stain may be applied to color the units if specified by the Architect/Engineer or Owner.

**2.2 Geo Grid:** If geo grid reinforcement is required, it shall be shown in the plans or as detailed in the shop drawings. Substitution of a different type of geo grid shall not be allowed unless approved by the site engineer after submittal of shop drawings and test data.

**2.3 Wall Base:** The wall base shall be a high angularity coarse material. Wall base material shall consist of 100% crushed aggregate, with the following gradation:

<u>Standard Sieve Size</u>	<u>Percent Passing</u>
1.5”	80-100
.75”	50-90
#4	0-40
#200	0-10

The contractor may substitute lean concrete with a minimum 28-day compressive strength of 20 MPa for the granular base material.

**2.4 Block Fill:** Fill should be a clean coarse aggregate with high angularity. The unit shall be screened 100 percent crushed aggregate meeting the following gradation.

<u>Standard Sieve Size</u>	<u>Percent Passing</u>
1.5”	100
.75”	60-100
#4	0-40
#200	0-5



**GENERAL NOTES**

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- 2.5 **Backfill:** If a select granular reinforced zone is indicated, it shall consist of fill sand or other clean aggregate meeting the following gradation.

<u>Standard Sieve Size</u>	<u>Percent Passing</u>
.75	100
#200	0-5

All other backfill behind and in front of the wall shall consist of suitable on-site soil or imported borrow approved by the Geo Technical Engineer. Backfill shall generally consist of sands, silts, or lean clays with a liquid limit less than 45 and a plasticity index less than 20. Fat clay soils, cobbles, and large rock should generally be avoided unless approved by the Geo Technical Engineer based on local practices. Frozen soils, excessively wet or dry soils, debris and deleterious materials should not be used.

- 2.6 **Drain Tile:** Drain tile should be used if shown on the plans or if indicated by local practices and conditions. If used, the drain tile should be a perforated or slotted PVC or corrugated HDPE pipe. The drain tile should be connected to storm drains or “day lighted” at low points and/or periodically along the wall alignment.
- 2.7 **Geo Textile Fabric:** If shown on the plans or the shop drawings, provide a geo textile filter for separation from backfill at the tails of the blocks. The geo textile shall be a needle punched non-woven fabric with a minimum grab tensile strength of 120 pounds according to ASTM D4632.

**3. EXECUTION**

- 3.1 **Excavation:** Excavate as required for installation of the retaining wall system. Excavate to the base level for a sufficient distance behind the face to permit installation of the base and geo grid reinforcement (if applicable). Slope or shore as necessary for safety and conformation to applicable Health and Safety Standards.
- 3.2 **Wall Base:** Foundation soils shall be excavated to the dimensions shown on the plans. Foundation shall be observed by the Geo Technical Engineer to confirm that the bearing soils are similar to the design conditions or assumptions. Construct the wall base to the lines and grades as indicated on the plans. Place granular base material to the minimum dimensions indicated. Over excavated areas shall be filled with additional granular base material. Compact the base to provide a hard and level surface to support the wall units. Base materials shall be



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3.2(cont.)

compacted to a minimum of 95 percent Standard Proctor. Prepare and smooth the granular material to ensure complete contact of the first course with the base material. Contractor may substitute lean concrete for some or all of the base material. Concrete may be placed full thickness or as a topping to level the base. If used as a topping, the concrete shall have a minimum thickness of three (3) inches.

**3.3 Unit Installation:** Place the first course directly on the wall base. Check units for level and alignment. Adjacent units should be in contact. If possible, begin setting the units at the lowest part of the wall. Fill voids between and within the blocks with granular block fill. The block fill shall extend a minimum of six (6) inches behind the tails of the facing units, unless a geo textile filter is placed on the back of the blocks.

Place backfill behind the units in maximum loose lifts of eight (8) inches and compact. If select granular fill is required, it should extend the full length of the geo grid reinforcement. Compact all fill to a minimum of 95% Standard Proctor. For cohesive soils, the moisture content at the time of compaction should be adjusted to within -3 and +4 percent of the optimum. Place backfill in successive lifts until it is level with the top of the facing unit.

Remove all excess aggregate and other materials from the top of the units before setting the next course.

For geo grid reinforced walls, place the correct geo grid at the locations and elevations shown on the plans or the shop drawings. Geo grid reinforcement shall be placed horizontally on compacted backfill. The length of the geo grid is measured from the front face of the wall. Extend the grid onto the front face flange of the facing unit. Orient the geo grid with the strong axis (machine direction) placed perpendicular to the wall face. Geo grid shall not be spliced by any means in the roll direction.

Geo grids shall be placed side by side to provide complete coverage along the wall face. No overlap is required between adjacent grids on straight sections of wall. On convex curves, place a minimum of three (3) inches of backfill material between overlapping geo grid layers.

Place the next course of segmental units in running bond with the previous course. Place the web notch over the alignment hoop protruding from the unit below and pull the unit below, and pull the unit forward to contact the hoop.

For geo grid reinforced walls, pull geo grids taught and stake the loose end before placing the next course of backfill. Backfill shall be placed, spread and compacted in such a manner as to minimize the development of wrinkles or movement in the geo grid. A minimum back fill depth of six (6) inches should be placed before operating equipment over the grids.

Continue placing successive courses to the elevations as shown on the plans. Construct the wall levels in stages, placing the units at each course for the entire



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### **GENERAL NOTES**

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3.3(cont.)

length of the wall whenever possible. **Block fill and backfill should be placed to the level of the top of the facing unit before placing the next course.**

Provide temporary swales to divert runoff away from wall excavation and away from face.

Final grade above and below the retaining wall shall provide for positive drainage and prevent ponding. Protect completed wall from other construction. Do not operate large equipment or store materials above the wall that exceed the design surcharge loads.