Precast Concrete Retaining Wall Products

NPCA

National Precast Concrete Association

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ON THE COVER:

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MECHANICALLY STABILIZED EARTH (MSE)

Photo courtesy of The Reinforced Earth Company

MSE Systems

A common retaining wall used in recent years is the MSE wall system (Mechanically Stabilized Earth). It's classified as a retaining wall that is designed to withstand lateral earth and water pressures, and any live and dead load surcharges by using straps, grid or other types of reinforcing in the backfill zone. Mechanically stabilized earth walls are built from individual panel sections or Precast Modular Blocks (PMB).

Precast Panel Walls

MSE panel wall systems have interlocking panels and are supported by straps or grid that are mechanically attached to the back of the precast and extend back from the panel into the retained soil, resulting in a reinforcing zone behind the wall.

The reinforced soil's mass, along with the facing, acts as an improved retaining wall. The reinforced mass must be built large enough to retain the pressures from the soil behind it. MSE walls usually must be a percentage as deep or thick as the height of the wall. If there is a slope or surcharge on the wall, then larger height-to-depth ratios will be recommended.

Precast Modular Block (PMB) Walls

Modular block, or segmental, retaining walls employ interlocking concrete block units connected back into the earth to efficiently resist loads. These pre-engineered modular systems are made to ASTM C1776 and are an attractive, economical, and durable alternative to stone or poured concrete retaining walls. The inherent design flexibility can accommodate a wide variety of site constraints, project sizes, and aesthetic preferences.

Large Precast Modular Block – Gravity Wall

Large precast modular walls are built from individual large concrete blocks and generally stacked in a running bond fashion. Large precast modular block systems usually have an interlocking feature or shear key mechanism that locks one course of block to the next. Large precast modular block systems retain the soil by virtue of their size and weight. There is typically not a need for additional soil reinforcement.

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MODULAR BLOCK WALL SYSTEMS

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Photo courtesy of Utility Concrete Products LLC

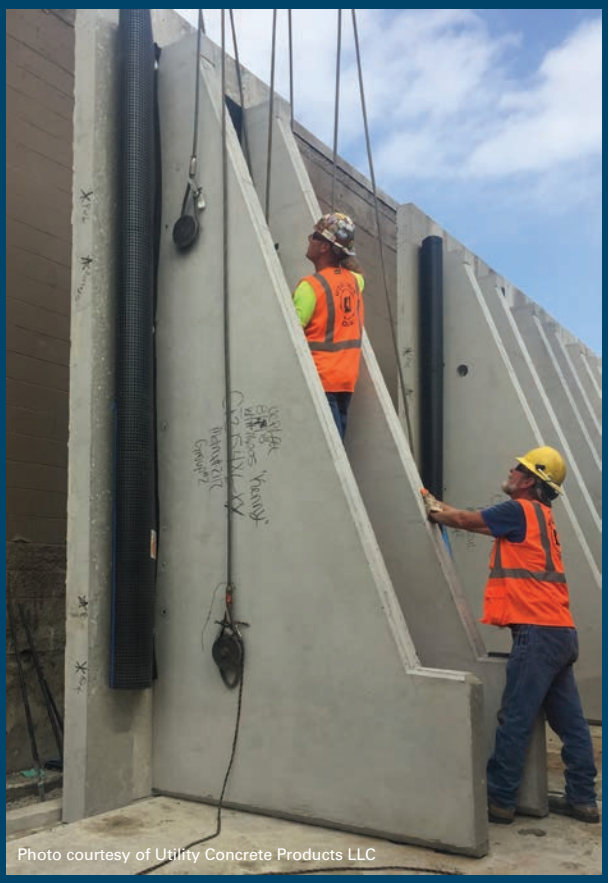
Photo courtesy of Utility Concrete Products LLC


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Cantilever/Counterfort Wall

A cantilever retaining wall is made up of a horizontal base slab and a vertical face panel that can utilize counterforts to efficiently increase the stiffness. This type of gravity wall does not require straps or special backfill, but instead uses a combination of self-weight along with the weight of the soil above the base slab to achieve stability. Traditionally, this was a cast-in-place wall design that had limitations due to cost and the time it takes to form counterforts on site; however, through recent innovations with precast connections, it can now be built partially or completely out of precast.


Photo courtesy of Redi-Rock International


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SYSTEM INFORMATION

What should a civil engineer, architect, general contractor or developer know about retaining walls and precast concrete wall systems in particular?

The quality of a retaining wall is generally equal to the strength of the weakest link in the retaining wall chain. That chain includes upfront planning and design, quality of the retaining wall product chosen, quality of the site-specific engineering for the wall, quality of the information regarding the soils at the site, and the quality of the construction of the wall.

1. Retaining walls are frequently structural in nature and often critical to the proper development of a site. A first step in the proper planning for a retaining wall is to collect information about the soils at the location. Soil borings and follow-up shear testing of the soils are important and perhaps critical. In addition, the expense incurred to gather this information will generally pay dividends in the long run. Without the proper soils information, wall construction will be delayed until the information is collected, or "worst case" assumptions may be made. This may result in the wall being over-engineered, which may in turn cost more than it should. Suggestion: When the rig is on site taking borings for the building pad, have the rig take borings every 50 to 75 feet along the foundation wall.
2. Develop a grading plan that shows existing grades. The plan should include: those grades immediately outside the property lines of the parcel being developed; proposed grades; location of the wall(s); top of wall and bottom of wall elevations along the proposed wall; location of existing and proposed buildings, roads, etc.; location of utilities; and location of construction/excavation limits. Proper engineering of a wall must be done not only with knowledge of the soils, but also with knowledge of slopes and surcharges that may exist at the top of the wall and any slopes that may exist at the toe of the wall.
3. Select an engineer who is experienced in retaining wall design and who is familiar with the product chosen for the project.
4. Make sure the producer of the product has a Quality Assurance program in place.
5. Make sure the product brand selected has an engineering manual available that includes testing for items such as shear, sliding, and reinforcement connection.
6. Make sure the contractor selected for installation has experience with the installation of the product chosen. Is the company a certified installer? Does it have a Quality Assurance program for wall installation? For example, will the company perform compaction testing and provide results to the customer?

What items should the retaining wall engineer take into account?**

The retaining wall engineer should consider:

1. External Factors of Safety, including Overturning, Sliding and Bearing.
2. Internal Factors of Safety, including Pull Out.
3. Local Stability, including Shear.
4. Global Stability.

Installation Procedures

The final and critical step to the completion of a precast retaining wall is proper wall installation. Each precast retaining wall system will / should have its own unique recommendations for proper wall component installation. It is essential that the precaster make available to the wall contractor wall construction guidelines. Such guidelines will generally cover site preparation, excavation, leveling pad preparation, base course installation, backfilling and compaction, drainage considerations, placement of additional courses, and geogrid placement. All site specific surface and sub-surface drainage should be identified and addressed by the wall designer.

CERTIFY EXCELLENCE

From start to finish, the NPCA Plant Certification program sets the highest standards for plant facilities, production operations and quality control procedures. NPCA certified plants are dedicated to manufacturing first-class products. To maintain their NPCA credentials, plants must pass periodic, on-site certification inspections.

The NPCA Plant Certification program enables quality-conscious agencies, architects, engineers and users to identify and select high-quality precast concrete manufacturers. At no cost to specifiers, NPCA certification prequalifies manufacturers as companies capable of superior workmanship. You save money because you do not need to spend valuable time and resources inspecting a plant to ensure that its products will meet or exceed your expectations. You also save time when you work with certified precast plants because products arrive on the job site ready for installation. Material and labor costs are kept in check because quality control starts before the work order reaches the precast plant.

The Certification Process

To become an NPCA certified plant, a precast concrete production facility must exceed a level of excellence defined by NPCA in accordance with relevant industry standards. Plant inspections are performed by an engineer from an independent, nationally accredited firm, and all certification applicants are graded on all critical aspects of plant operation. A standard grading schedule is used for all inspections to ensure uniformity. Inspections are performed during actual plant operation.

The NPCA Certified Plant

Precast concrete plant operators committed to excellence seek NPCA certification. Their certification plaques indicate the investment of time and resources necessary to meet the high standards demanded by the construction industry. Staffed by experienced personnel, plants complying with NPCA guidelines and practice quality assurance at every step of the production process. These guidelines require procedures and products to be inspected during each phase of manufacturing to ensure compliance with rigid industry requirements. As a result, products from NPCA certified plants are characterized by high quality, uniformity and consistency.

Each NPCA certified plant is also required to maintain an active plant safety program that meets or exceeds local, state, provincial, and federal laws, including Occupational Safety and Health Administration (OSHA) and Canadian Centre for Occupational Health and Safety requirements.

NPCA guidelines require certified plants to maintain extensive records to verify that materials used in the manufacturing process conform to appropriate specifications. Work orders, product drawings, equipment calibration records, aggregate and concrete test records, batching reports and product inspection reports are also required as management tools and quality assurance aids.

Industry Standards

The American Association of State Highway Transportation Officials (AASHTO) uses the FHWA Publication Number FHWA-SA 96-071 Mechanically Stabilized Earth Walls and Reinforced Soil Slopes Design and Construction Guidelines (known as Demo 82) dated October 1996.

AASHTO is generally used for public and government projects. It calls for reinforcement depths equal to the greater of 70 percent of the wall height or 8 feet, requires uniform reinforcement depths, requires imported sand or gravel in the reinforced zone, and calls for a minimum embedment depth of 2 feet. Other design methodologies may be available depending on the system used.

NPCA
CERTIFIED PLANT

FIND A PRECAST CONCRETE RETAINING WALL PRODUCER

Whether you need a custom project or standard product, visit www.precast.org to find the producers in your area. Select a zip code radius or state-specific location that will best benefit your project. The National Precast Concrete Association has proven itself a leader in the development of production and quality standards for precast products in addition to publishing manuals and underwriting research.

NPCA is happy to provide the data and support that you need to incorporate the latest precast concrete products into your design. You may contact NPCA Technical services directly either by technical@precast.org with a 48 hour response time or for more immediate needs directly at (800) 366-7731. This allows you to ask technical questions about any stage of the design or installation process.

For more information on precast concrete retaining wall products, please contact:

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