Application of a retained earth system

Application of a Retained Earth System

Application d'un système de soutènement de la terre

Anwendung der bewehrten Erde

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1. GENERAL DESCRIPTION

VSL RETAINED EARTH Walls are relatively simple, economical earth retaining structures which have gained widespread acceptance as a major new construction system. The system consists of precast concrete facing panels, galvanized steel soil reinforcing mesh, and granular backfill material as shown in Figure 1. These components produce a stable, unified gravity mass widely used as highway bridge abutment walls, approach walls, and standard grade separation walls used in construction site development.

The precast concrete panels form an attractive vertical facing while the mesh reinforcement carries the tensile stresses and the granular fill provides the mass of the structure. Bearing pads placed in the horizontal panel joints provide a small joint pattern around the perimeter of each panel. These joints allow for drainage of water through the granular fill and make the system capable of withstanding differential settlements on the order of one percent without distortion of the facing. Approximately 500,000 square meters of RETAINED EARTH walls have been constructed on 185 projects throughout the United States.

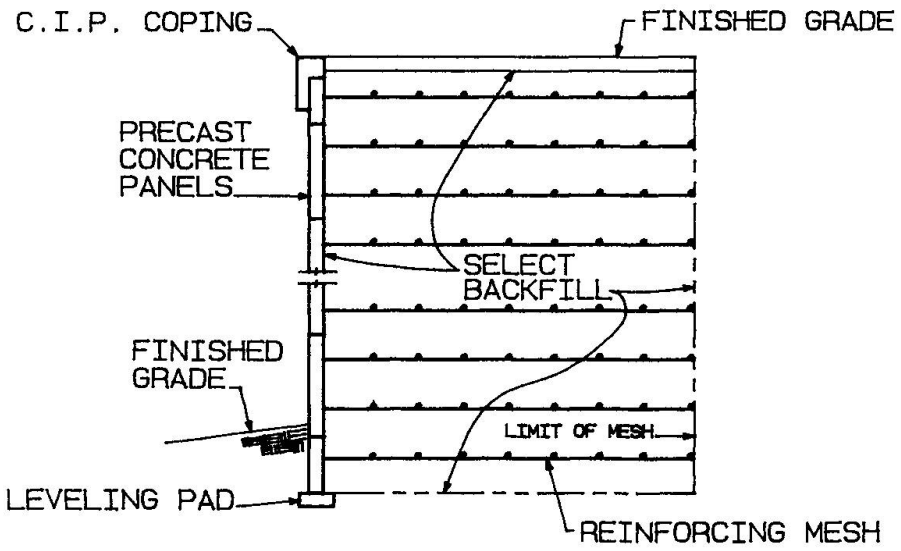

FIGURE 1. TYPICAL SECTION THROUGH R.E. WALL

2. DESIGN PRINCIPLES

External stability and bearing pressure of the RETAINED EARTH volume is determined through standard soil mechanics principles. Mass overturning and sliding are checked by balancing the driving and resisting forces with appropriate safety factors applied.

The effective principle of internal stability involves the transfer of stresses from the soil to the reinforcing mesh through bearing. Bearing pressure is developed on the projected areas of the mesh crossbars, and the pressure is in turn transferred to the longitudinal bars. The longitudinal bars are thus placed in tension, which enables the soil mass to withstand loads in the direction of the reinforcement.

When calculating internal stability, the vertical soil pressure is multiplied by the coefficient of earth pressure to determine the horizontal load on each concrete panel. This load is applied directly to the steel reinforcement to check the tensile stress safety factor. The resistance against mesh pullout through the soil is found by applying the vertical soil pressure over the crossbar area and multiplying by an anchorage factor to determine pullout resistance. The pullout resistance is divided by the horizontal load on the panel to determine the safety factor. Safety factors for stress and pullout can be increased by using wider or longer sheets of mesh.

3. CONSTRUCTION

Since no footing is required for RETAINED EARTH walls, a 30 cm x 15 cm concrete pad is poured to provide a level base for the panels. Panels are then set using a small crane as full size panels weigh less than 1 ton each. Care must be taken to level the panels, maintain proper alignment, and set a slight inward batter which comes out to near vertical when compacting the fill.

After the first course of panels are in place, geotextile filter fabric is glued to the back face of the panels covering the joint between adjacent panels. This fabric permits drainage through the joints while retaining the soil particles. Granular backfill is then placed, leveled, and compacted in 20 to 30 cm lifts up to the first layer of mesh. Small walk behind compaction equipment is used within one meter from the panels, and heavy rollers used for the remainder of the fill. This prevents misalignment of the facing panels due to compaction forces. Reinforcing mesh is spaced 0.76 m vertically and 1.3 m horizontally. After mesh is attached, backfilling continues, the second course of panels is placed and the sequence continues to the top of the wall. Generally either a cast in place or precast cap is placed at the top of the wall for aesthetic purposes, or a traffic barrier is incorporated where required.

With a relatively simple and repetitive construction procedure, up to 90 square meters of wall can be set per shift with an equipment operator and 5 man crew using standard construction equipment.