Strengthened Soil™ Wall Construction Manual

(For use with Friction Strip Soil Reinforcement)

This information has been prepared by Shaw Technologies, Inc. as an aid in constructing their Strengthened Soil™ Wall system. Final determination of the suitability of any information or material for the use contemplated, and it's manner of use, is the sole responsibility of the user and does not relieve the user of responsibility to adhere to contract documents.

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A. INTRODUCTION

Shaw technologies, Inc. has developed the Strengthened Soil™ Wall system which is a retaining wall system consisting of precast concrete facing panels connected to Friction Strip geosynthetic soil reinforcement which strengthens the granular, free draining soil producing a composite mass that resists lateral earth pressure.

Table 1 lists the components provided by Shaw Technologies, Inc. in the Strengthened Soil™ Wall package. Table 2 lists the tools and materials required by the installing contractor to successfully construct the Strengthened Soil™ Wall.

Table 1

Components provided by Shaw Technologies, Inc.

Item 1.	Precast Panel Moulds & Form Liners (if applicable)
Item 2.	Soil Reinforcement Material (Friction Strips)
Item 3.	Pocket Formers to be embedded in Concrete to form the slot
Item 3.	Lifting Anchors to be embedded in Concrete to form lifting void
Item 4.	Poly Pads
Item 5.	Filter Cloth (150 – 200 GSM)
Item 6.	Lifting Anchor (re-usable)

Table 2

Materials Supplied by the Contractor & Scope of Work

1. Hardwood Wedges / Plastic shims.
2. Spacer Bar for tensioning Friction Strip
3. Positioning Clamps
4. All Cast in Place Concrete and Re-bars as per STI-BSS Design Drawings
5. Lifting Equipment for unloading, placing, and storing Panels
6. Backfill compaction equipments; slings or cable lifts for unloading panels
7. Crow Bars, Shovels,
8. Hammers & Spanner set.
9. Rod cutting set.
10. Dye for steel bending work.
11. Hook for steel binding work.
12. Water pump for curing.
13. Shuttering Oil.
14. Concrete blocks or MS beams (As required).
15. Jute bags for curing.
16. 4' Level
17. 2x4 Lumber for Bracing the first course of Panels
18. Chalk Line
19. Brooms
20. Plumbbob
21. Spray Paint / Bitumen paint.(As required)
22. Filter cloth adhesive.

B. DELIVERY, STORAGE, AND HANDLING

1. Facing Panels

Casted panels are to be delivered in stacks on flatbed trucks. If the panels are not to be erected directly from the delivery truck to the wall by using the lifting inserts, then the panels should be unloaded to a staging area by the use of a sling capable of handling the weight of a full stack. It should be noted that most freight companies allow one-hour time limit per load. If the panels are ever re-stacked, they should be placed face down on top of the plastic pads attached to the dunnage. Panels should never be placed directly on to the dunnage or ground as this can cause staining of the face .

Care should be taken to protect the panels from damage during handling. When placing the panels in the wall from the stack, wooden blocks should be used as shown in Figure 1 to protect the bottom edge of the panel from damage. All unused dunnage should be collected and returned to Shaw Technologies, Inc. or its precaster.

2. Components

Friction Strip– the Friction Strip comes to the jobsite bundled in coils and can be placed directly on the ground as long as care is taken not to damage it.

Poly Pads, Filter Cloth, and Adhesive – these components should be stored in a secured storage area to prevent theft. The poly pads are boxed in quantities that facilitate easy handling. The filter cloth comes in rolls and should be cut to length in the field and applied to the back of the panels utilizing the adhesive.

C. CONSTRUCTION PROCEDURES

1. Site Preparation

Excavation – the site should be excavated for the entire length, width and depth specified on the shop drawings. All unsuitable material should be removed and replaced with compacted fill if necessary. The base foundation should be proof rolled to a density suitable for the bearing pressure as per the project plans and specifications prior to forming the leveling pad.

2. Leveling Pad Construction

All organics, soft soils or debris must be removed from the leveling pad location. The project engineer should inspect the leveling pad excavation prior to casting. The leveling pad shall be cast to lines and grades designated on the construction drawings. Steel reinforcement is not required in the leveling pad unless shown on the construction drawings. Care should be taken that the leveling pad is not cast above grade as high spots cause mis-alignment during construction. The leveling pads should be smooth and all stone, debris; etc. should be removed so that the pad is clean upon placement of the panels. A chalk line should be snapped on the surface of the pad to set the construction line of the wall.

3. Panel Layout

Close attention to detail and accuracy will help insure rapid and trouble free construction. The leveling pad should be surveyed to indicate high and low areas so that shims may be placed underneath panels in low spots so that the top of the panel is to the correct grade.

Lift the panels from the stacked position as shown in Figure 1 by use of the lifting pickup device as shown in Figure 2.

Once the panel is lowered into place along the stringline, a spacer pad is used to set the correct spacing between the panel previously set and the panel that is being erected. Once the panels are in place the panel sequence should be constructed using the sequence shown in Figure 4. The wood wedges and clamps as shown in Figure 3 are used to secure the panels together. Care should be taken to inspect the gap between adjacent panels to visually check the alignment and joint spacing around each panel. Adjustment should be made with a crowbar on the fill side of the panel on the bottom course of panels, and any shimming should be done to keep the panels at the same elevation. The vertical elevation of the panels should be checked and adjusted to ensure that these panels are at the same elevation. A four-foot level is used to verify both horizontal and vertical alignment.

The next step is to set the batter of the full height panels designated as panels two, four, and six in Figure 4. These panels are given a slight batter toward the backfill side of the wall system to compensate for outward rotation caused by backfilling placement and compaction. Batter is usually measured using a four-foot level with a shim taped to the top of the level. Once the desired batter is achieved, the wedges are driven into the joints at the face of the wall. Additional clamps are secured to the top of the full height panel as shown in Figure 5. The batter boards are set in place by driving a stake into the natural ground and securing one end of the batter board to the stake and nailing the other end to the clamp secured at the top of the full height panels. It should be noted that external bracing is only required for the first row of panels. It should also be noted that the wedges for each course of panels should remain in place during the construction of three subsequent courses and then removed. If the wedges remain in place for longer, they can be extremely difficult to remove.

The amount of batter will vary depending upon the type of backfill used. Course backfills require less batter while fine backfills require more batter. The contractor should monitor the actual rotation of the panels during the initial phases of construction and adjust the batter accordingly. During construction, the overall vertical alignment of the structure should be checked periodically with the plumbbob.

Once the initial course of panels has been erected and secured, the vertical joints should be covered by the filter cloth with the supplied adhesive as shown in Figure 6. As noted in Figure 5, the backfill should not be placed against the panel until the first layer of soil reinforcement has been secured and backfilled over. At that point, it is permissible to backfill against the face of the panel.

4. Soil Reinforcement Connection and Backfill Placement

Place the approved backfill to the bottom of the soil reinforcement as shown in Figure 5. Backfill can be compacted to within three feet of the panels by use of a large vibratory roller. Within the three-foot zone directly behind the panels, a small hand operated compactor should be used to avoid excess panel movement. Once the backfill placement and compaction has reached the first layer of soil reinforcement, the type and length of reinforcement as designated on the plans shall be secured to the back of the precast panel. The Friction Strips are placed in the slots on the back of the panel as shown in Figure 7. The Spacer Bar is then placed at the required distance from the back of the panel and the Friction Strip is looped around this as shown in Figure 8. Short pieces of rebar can be used after the Friction Strip is tensioned to remove any slack in the soil reinforcement. Backfill placement should continue similar to the technique used for the first lift of backfill to lock the Friction Strip into place but not bury the wedges. Once the first lift over the Friction Strip has been compacted, the wedges should be removed prior to the second lift being placed.

All subsequent lifts should be carried up to the next level of reinforcement. The Friction Strip should be fully supported by the compacted backfill for its full length prior to placing the next lift. The soil reinforcement should be level with no kinks or abrupt changes in direction.

After the initial layer of reinforcement is secured, backfilling shall commence utilizing the same procedures as the previous steps. Extreme care must be exercised when placing backfill in the (3) three-foot area behind the initial course of panels through the reinforcing so that the Friction Strip and connection is not damaged (see Figure 5). The backfill should be spread by pushing the pile parallel to the panels and windrowing it toward the free ends of the soil reinforcement. If the embedment length of the soil reinforcement is long enough to require more than one dumping operation, the dumping should begin close to the panel and proceed away from the panel. In no event should a secondary dump be placed until the preceding backfill has been spread. Metal track earth moving equipment must never come in contact with the Friction Stip. Rubber tired vehicles may operate directly on the Friction Strips if backfilling conditions permit and care is taken not to turn the equipment while directly on top of the Friction Stip. Backfilling shall continue to the top of the first panel at which time the poly pads that are used as the horizontal joint material should be placed on top of the panels. These should be placed at approximately third points along the width of the panel to distribute the load equally.

5. Subsequent Courses

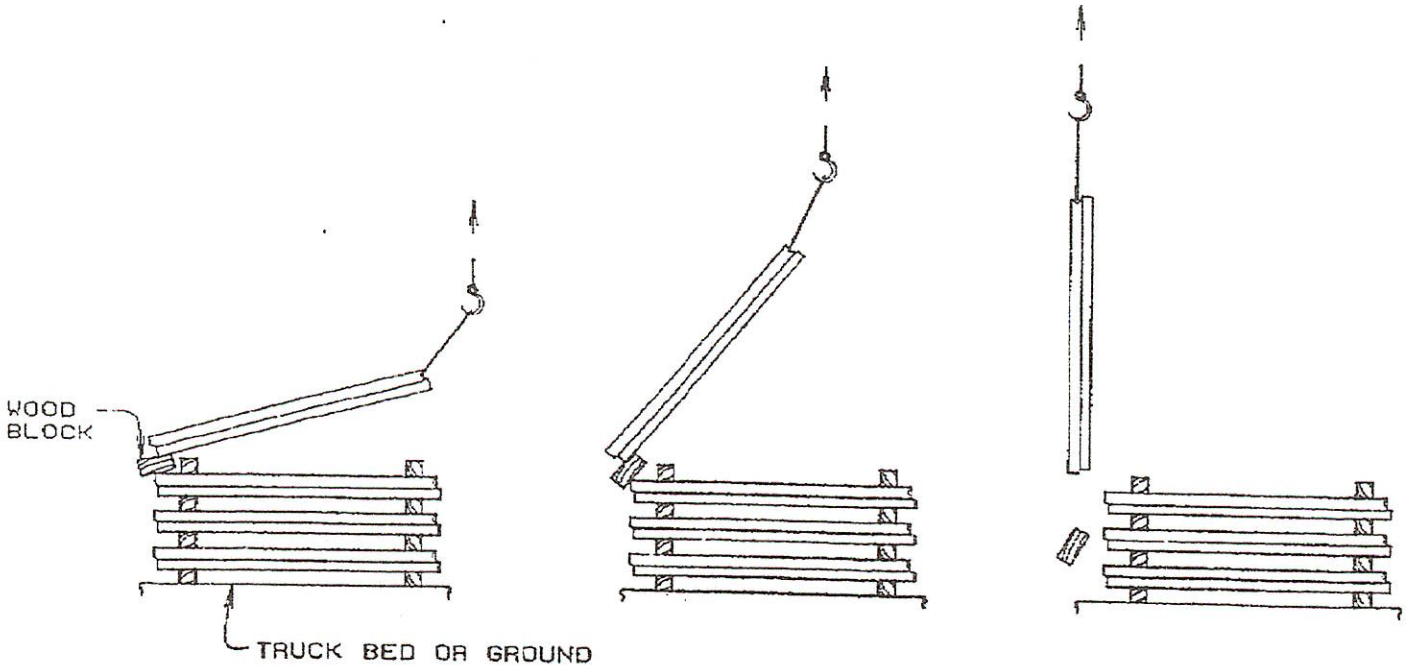
Prior to placing subsequent course of panels, the clamps should be removed from the lower corners similar to panels two, three and four as shown in Figure 4. When each subsequent course of panels is complete and the vertical joint material is installed, backfilling shall continue as previously constructed. After each level of backfilling, the batter and alignment should be checked and adjusted accordingly to ensure that the wall is constructed within the specified tolerances.

6. Completion of the Wall

The location of specific top panels is shown on the construction drawings. When installing a coping, the panels come in two variations. With cast-in-place coping, normally the panels will have rebar protruding from the tops to tie into the cast-in-place coping. With precast coping a level up strip should be cast to allow an even surface for setting the precast coping. In this instance, the top panels will not have rebar protruding from the top.

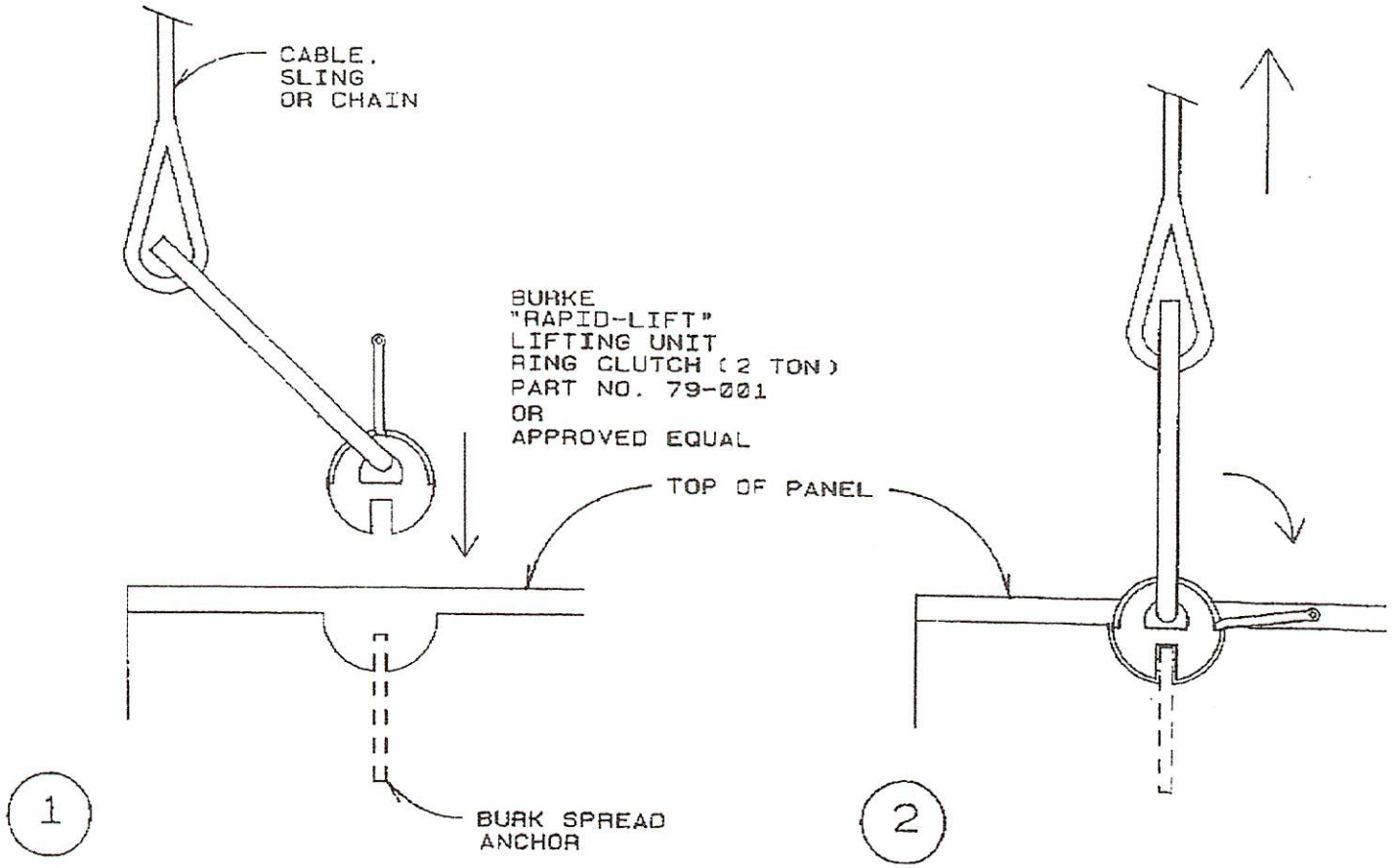
After backfilling is complete and the coping is installed, all clamps and wedges should be removed from the wall. Consistency is the key to a satisfactory final wall alignment. When possible, specific crews should be assigned for the various operations to standardize procedures.

FIGURE 1



PANEL LIFTING

FIGURE 2



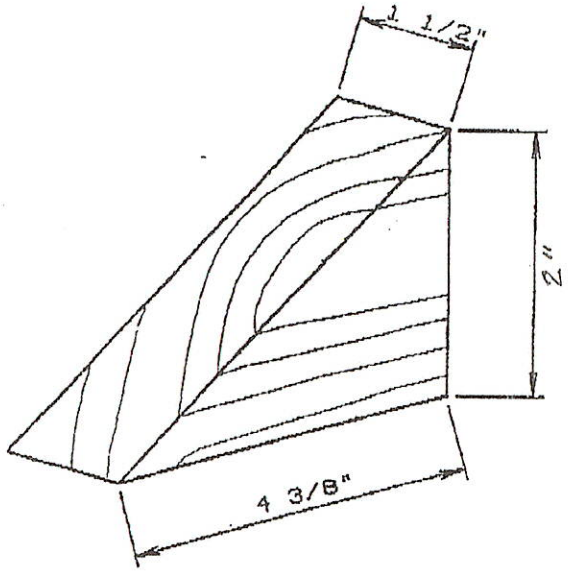
ATTACHMENT AND USE OF LIFT DEVICE

(BACK FACE OF PANEL SHOWN)

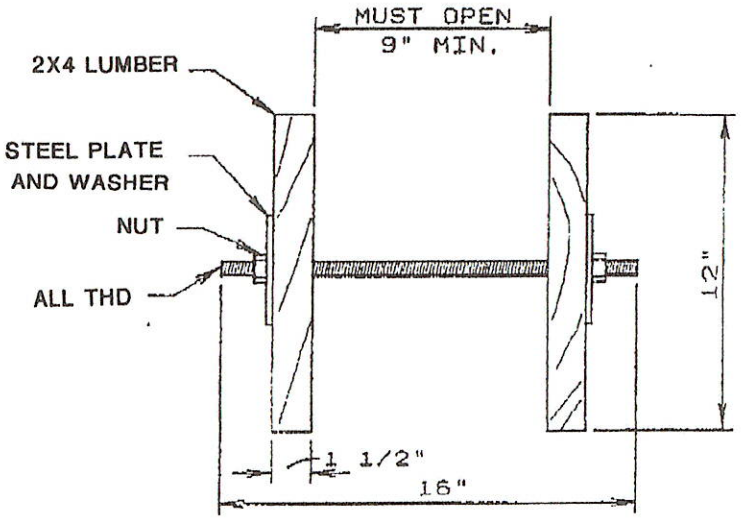
1) ALIGN SLOTTED RING CLUTCH OVER SPREAD ANCHOR AT TOP OF PANEL.

2) ENGAGE RING CLUTCH BY SLIDING CURVED BOLT THOUGH THE EYE OF THE ANCHOR. MAKE SURE RING CLUTCH IS SECURELY ATTACHED BEFORE LIFTING.

FIGURE 3

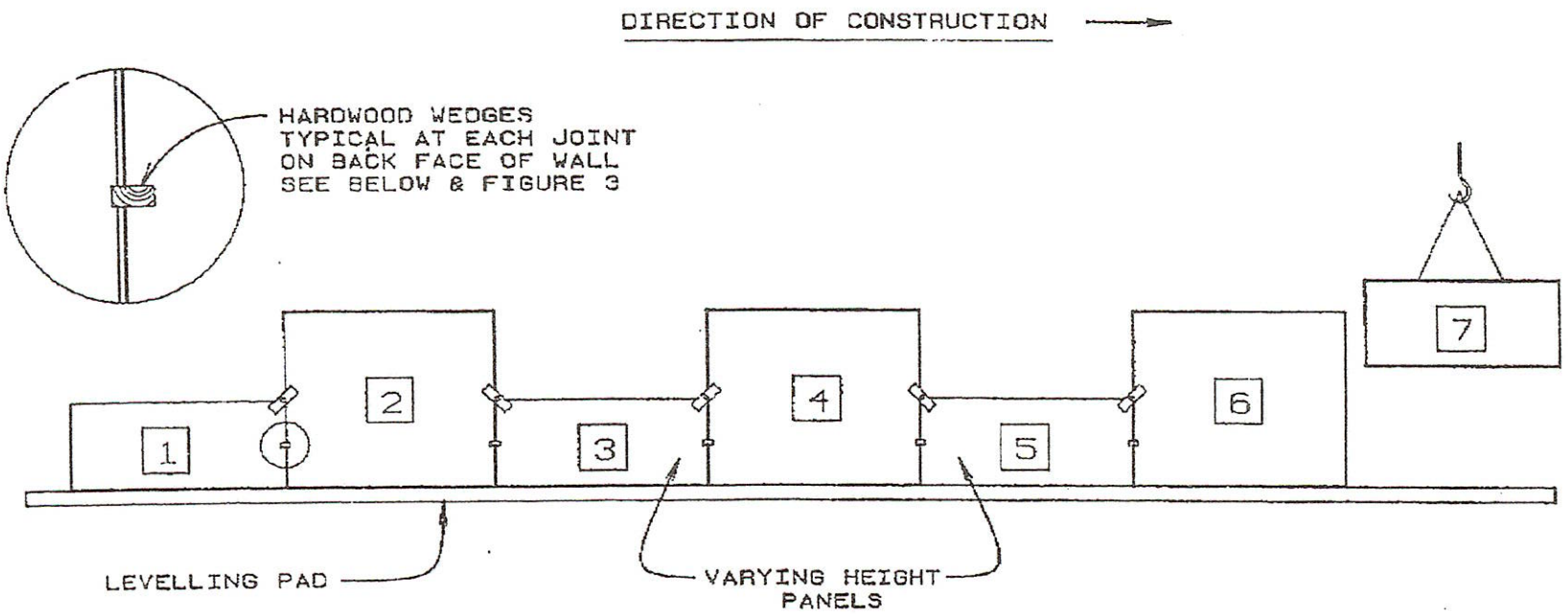


HARDWOOD WEDGE



CLAMP

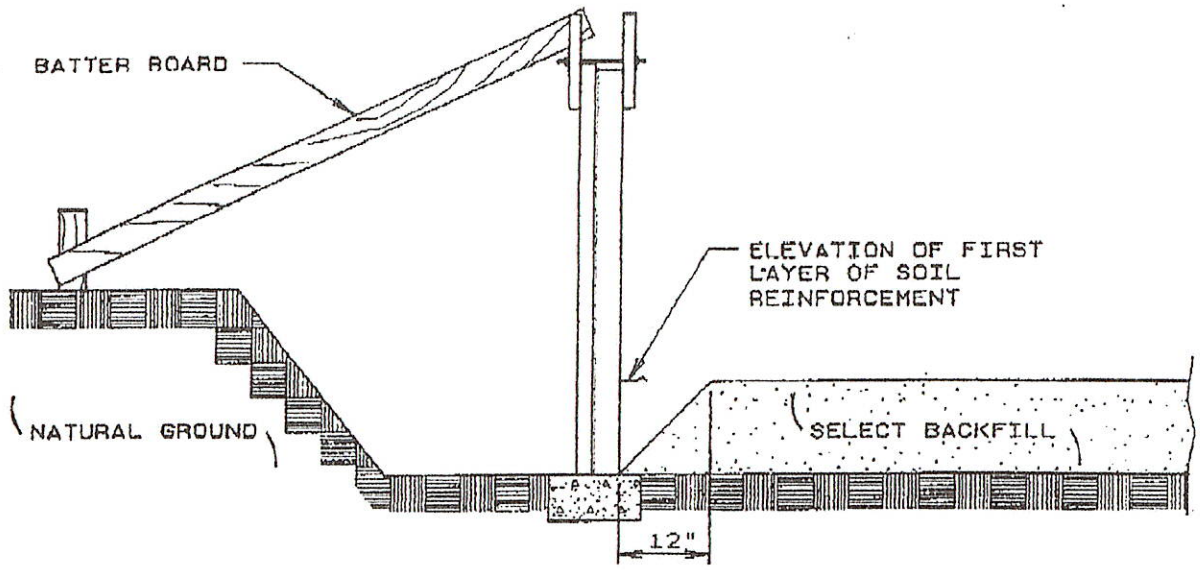
FIGURE 4



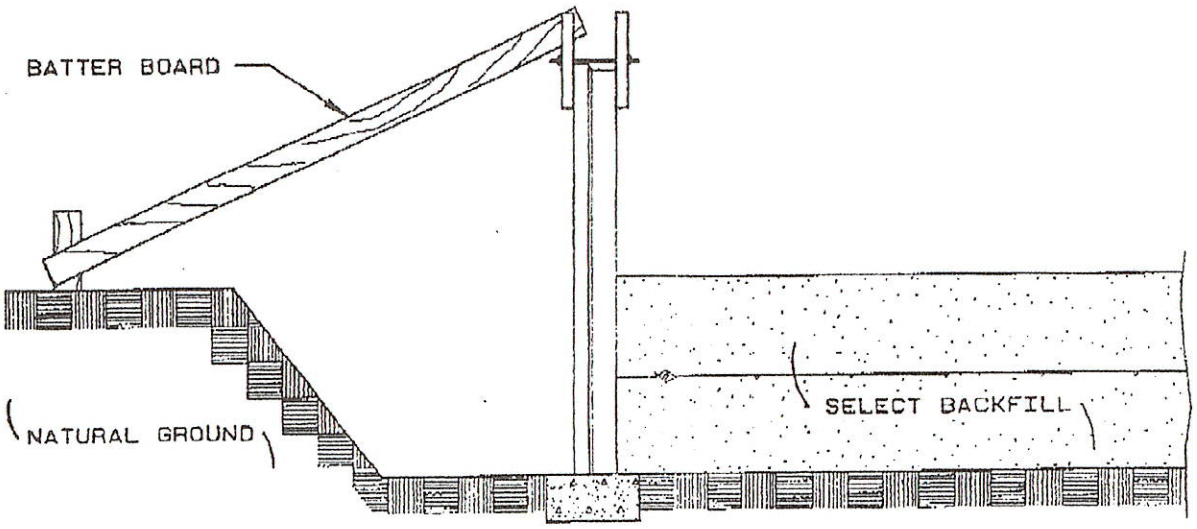
PANEL PLACEMENT SEQUENCE

NOTE: NUMBERS IN SQUARES SHOW
ORDER OF PLACEMENT

FIGURE 5

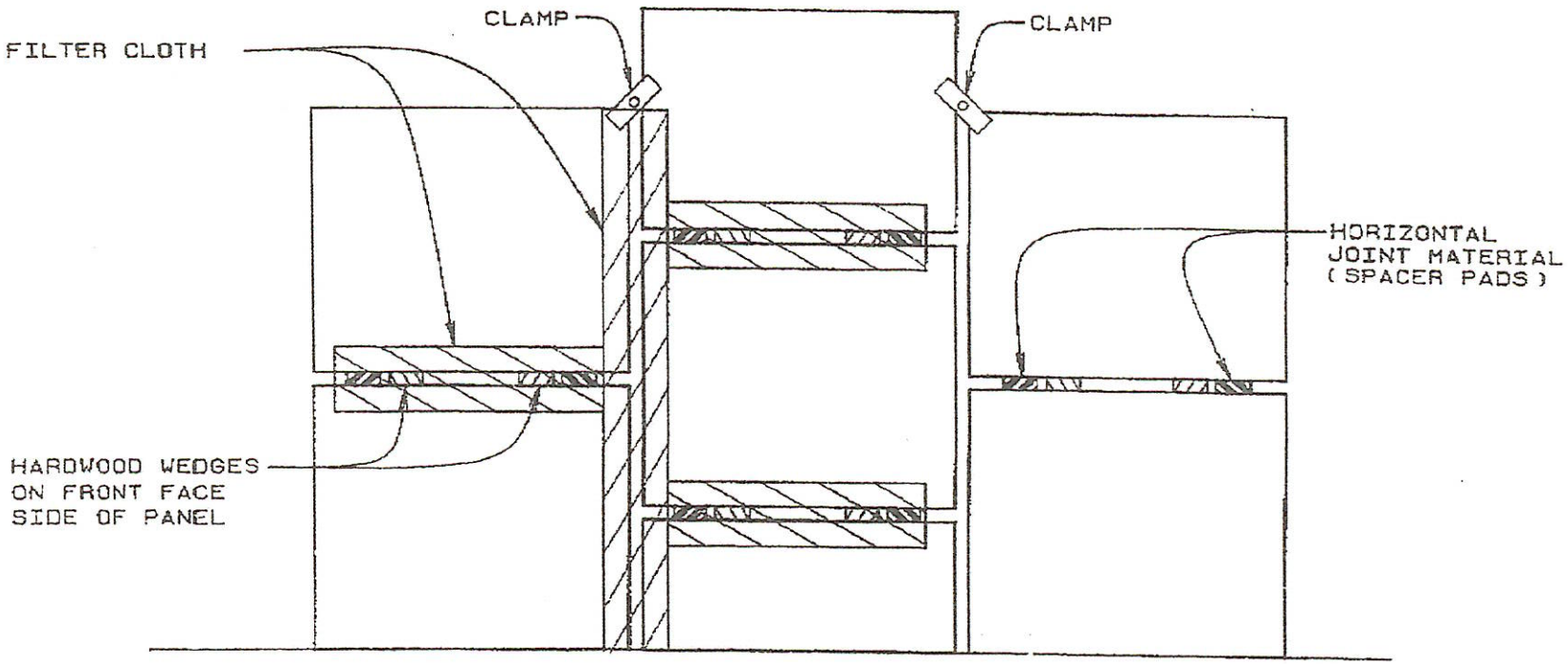


FIRST LIFT OF BACKFILL



SECOND LIFT OF BACKFILL

FIGURE 6



JOINT MATERIALS

Figure 7

Figure 8