TYPICAL DURA-HOLD SINGLE CRIB WALL SAMPLE CALCULATIONS

Note: Calculations shown below are short form preliminary design analysis for the typical DURA-HOLD single crib wall section shown on Plate No. DH-6. Calculations are performed using the Coulomb Analysis Method for retaining wall design.

Given:

H	=	15'-0"
i	=	18.43° (Backfill at 1:3 slope)
H_a	=	15'-0" + 1'-8" = 16'-8"
h	=	1'-0"
b	=	6'-0"
γwall	=	145 pcf
q	=	No surcharge
f	=	0.6
ϕ	=	30°
α	=	7.13° (Wall at natural 8:1 batter)
β	=	82.87°
δ	=	2/3 ϕ = 20°
γsoil	=	130 pcf (saturated)
γstone	=	135 pcf (compacted)

1. Determine forces acting on wall:

a. **Find K_a and K_p:**

$$K_a = \left[\frac{\operatorname{cosec} \beta \, \sin(\beta - \phi)}{\sqrt{\sin(\beta + \delta)} + \sqrt{\dfrac{\sin(\delta + \phi)\sin(\phi - i)}{\sin(\beta - i)}}} \right]^2$$

$$= \left[\frac{\dfrac{\sin(82.87 - 30)}{\sin 82.87}}{\sqrt{\sin(82.87 + 20)} + \sqrt{\dfrac{\sin(20 + 30)\sin(30 - 18.43)}{\sin(82.87 - 18.43)}}} \right]^2$$

$$K_a = .33$$

$$K_p = \left[\frac{\text{cosec } \beta \sin (\beta + \phi)}{\sqrt{\sin (\beta - \delta)} \; - \sqrt{\dfrac{\sin (\delta + \phi) \sin (\phi + i)}{\sin \beta - i}}} \right]^2$$

K_p Will not be used

b.   **Find P_a, P_s and P_p:**

P_a = $1/2 \, K_a \, \gamma \, H_a^2$

       = $(.5) \, (.33)(130)(16.66)^2$

       =   5953.57 lbs.

P_s = $K_a \, q \, H_a$

       = $.43 \, (0) \, (7.75)$

       =   0 lbs. (No surcharge)

P_p Will not be used

Note: Passive resistance will be ignored to provide an additional safety factor during construction. Depending upon construction supervision, backfilling against the front of the wall may not be performed until after the wall has been completed.

2. Determine stability against sliding along the base:

a.   **Find F_s, F_r and FS_s**

F_s =   (Σ Horizontal sliding forces)

       = $P_a \cos (\delta + \beta - 90) + P_s \cos (\delta + \beta - 90)$

       = $5953.57 \, (.97) + 0 \, (.97)$

       =   5774.96 lbs

$$F_r = (\Sigma \text{ Vertical forces}) \times f$$

Type	W_x	d_x	M_x
Front Wall	4350.00 lbs	2.00	8700.00
Rear Wall	3480.00 lbs	5.75	20010.00
Tie Backs	121.80 lbs	3.75	456.75
Stone	3142.80 lbs	3.75	11785.50
Footing	1015.00 lbs	----	-----
Backfill	2340.00 lbs	5.84	13665.60
	$\Sigma W_x = 14{,}449.60$ lbs		$\Sigma M_x = 54{,}617.85$

$$F_r = [P_a \sin(\delta + \beta - 90) + P_s \sin(\delta + \beta - 90) + \Sigma W_x] (f)$$

$$= [5953.57\,(.22) + 0 + 14449.60]\,(.60)$$

$$= 9455.63 \text{ lbs}$$

$$FS_s = \frac{F_r}{F_s} = \frac{9455.63}{5774.96} = 1.6 \geq 1.5 \text{ O.K.}$$

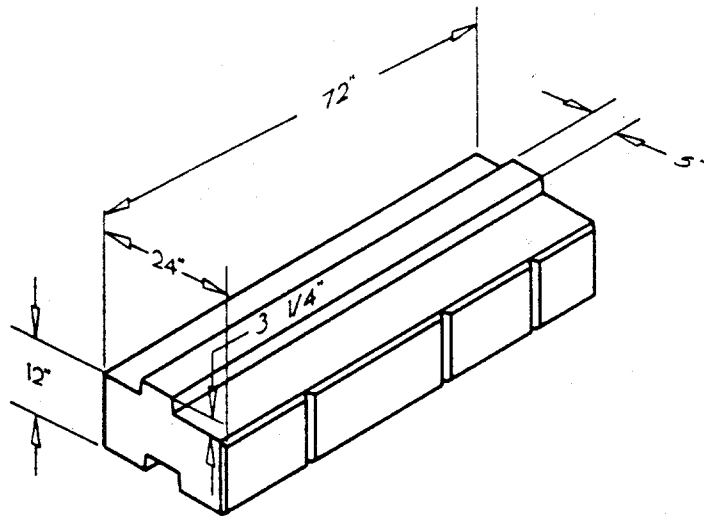## 3. Determine stability against overturning about the toe:
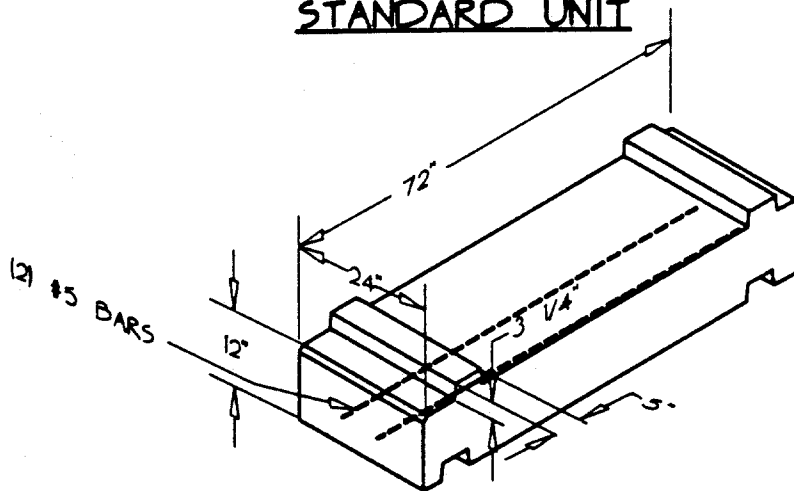
a.   Find M_o, M_r and FS_o:

$$M_o = [P_a \cos(\delta + \beta - 90)](H_a/3) + [P_s \cos(\delta + \beta - 90)](H_a/2)$$

$$= 5953.57\,(.97)\,(5.5) + 0$$

$$= 31{,}762.29 \text{ ft. lbs}$$

$$M_r = (W_x)(d_x) + [P_a \sin(\delta + \beta - 90)](d_a) + [P_s \sin(\delta + \beta - 90)]\,d_s$$

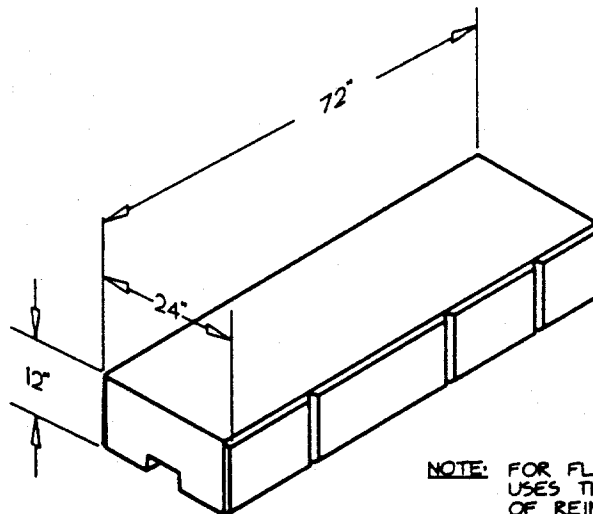$$= 54617.85 + 5953.57\,(.22)\,(6.7) + 0$$

$$= 63{,}393.41 \text{ ft. lbs.}$$

$$FS_o = \frac{M_r}{M_o} = \frac{63{,}393.41}{31{,}762.29} = 2.0 \geq 2.0 \text{ O.K.}$$

72"

24"

3 1/4"

12"

5"

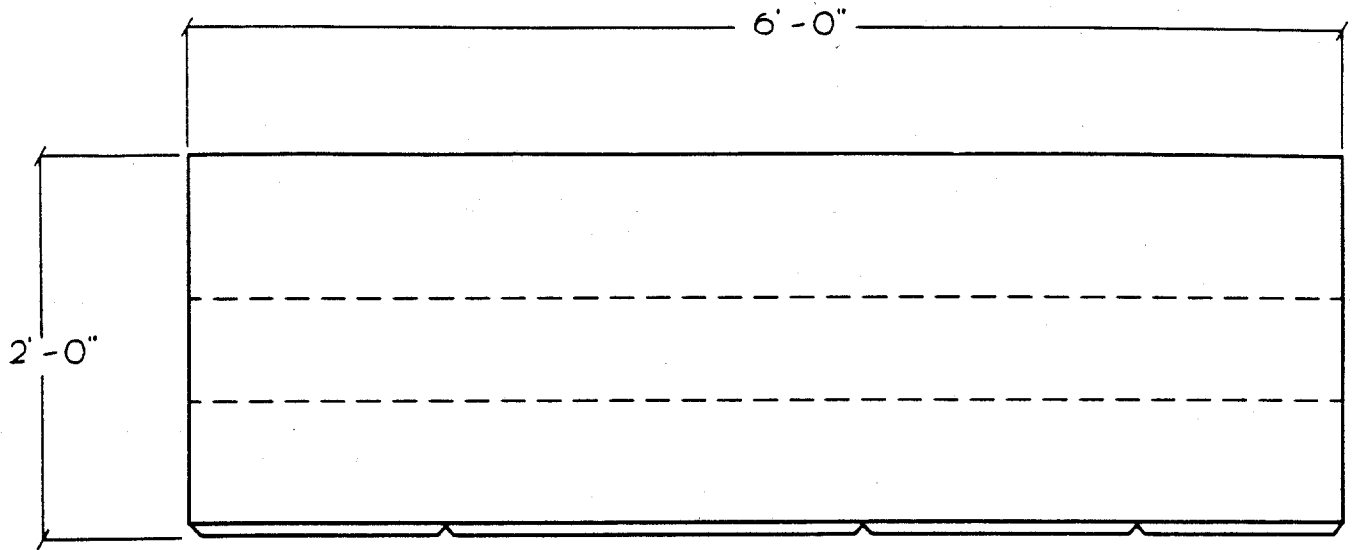## STANDARD UNIT

72"

24"

(2) #5 BARS

12"

3 1/4"

5"

TIE-BACK UNIT

72"

24"

12"
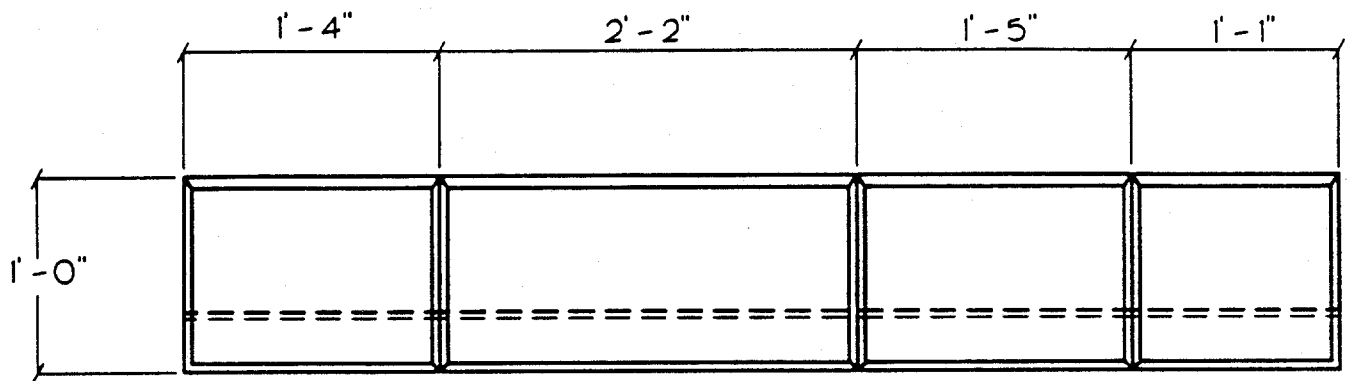
NOTE: FOR FLEXIBILITY IN CONSTRUCTION
USES THE LOCATION NUMBER AND SIZE
OF REINFORCING MAY BE DESIGNED
BASED ON SPECIFIC PROJECT REQUIREMENTS.

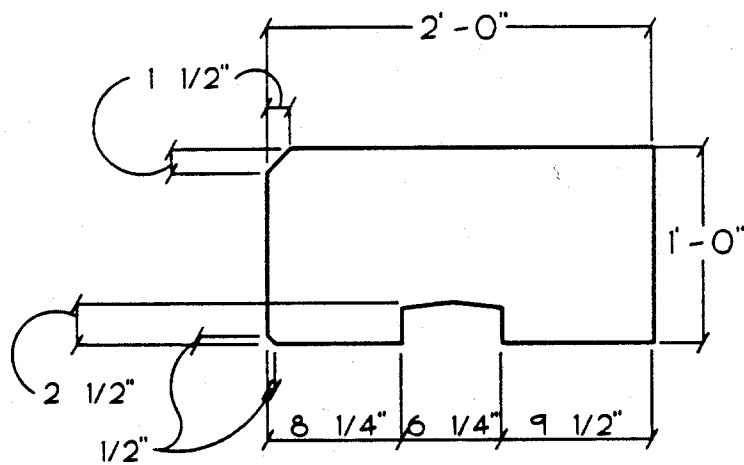## COPING UNIT

SHOP DRAWING FOR DURA-HOLD
TYPICAL UNITS

Scale: 3/8"=1'-0"

Plate No.   DH-1

6'-0"

2'-0"

PLAN

1'-4"   2'-2"   1'-5"   1'-1"

1'-0"

ELEVATION

2'-0"

1 1/2"

1'-0"

2 1/2"

1/2"

8 1/4"   6 1/4"   9 1/2"

SECTION

Scale: 1"=1'-0"	

SHOP DRAWING FOR DURA-HOLD
TYPICAL COPING UNIT

Plate No.   DH-3

6'-0"

2'-0"

PLAN

1'-4" 2'-2" 1'-5" 1'-1"

1 3/4"

1'-0"

ELEVATION

1 3/4"

1 3/4"

9 3/4" 6" 8 1/4"

5"

1/2"

1 3/4"

1'-0"

2 1/2"

1/2"

8 1/4" 6 1/4" 9 1/2"
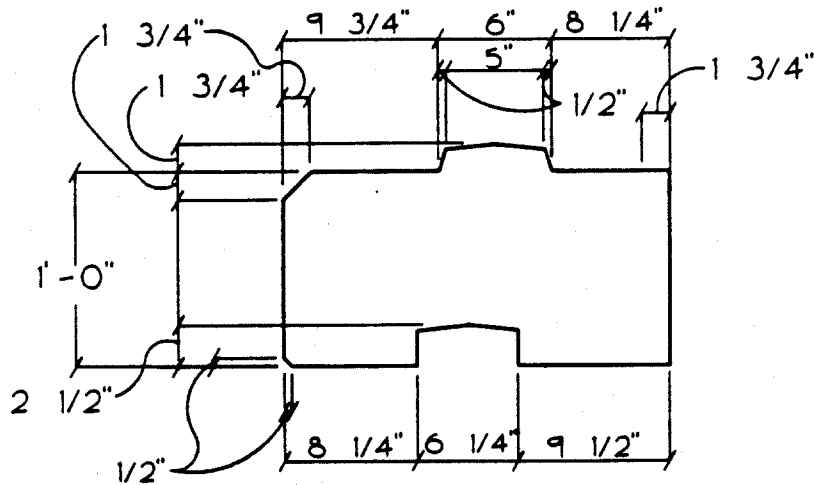
SECTION

SHOP DRAWING FOR DURA-HOLD
TYPICAL STANDARD UNIT

6'-0"

2'-0"

PLAN

1 1/2"

1 3/4"

9 3/4"

6"

5"

1/2"

1/2"

6"

5"

8 1/4"

1'-0"

1/2"

2 1/2"

8 1/4"

6 1/4"

9 3/4"

6 1/4"

ELEVATION

1 3/4"

1 1/2"

1'-0"

(2) #5 REBAR
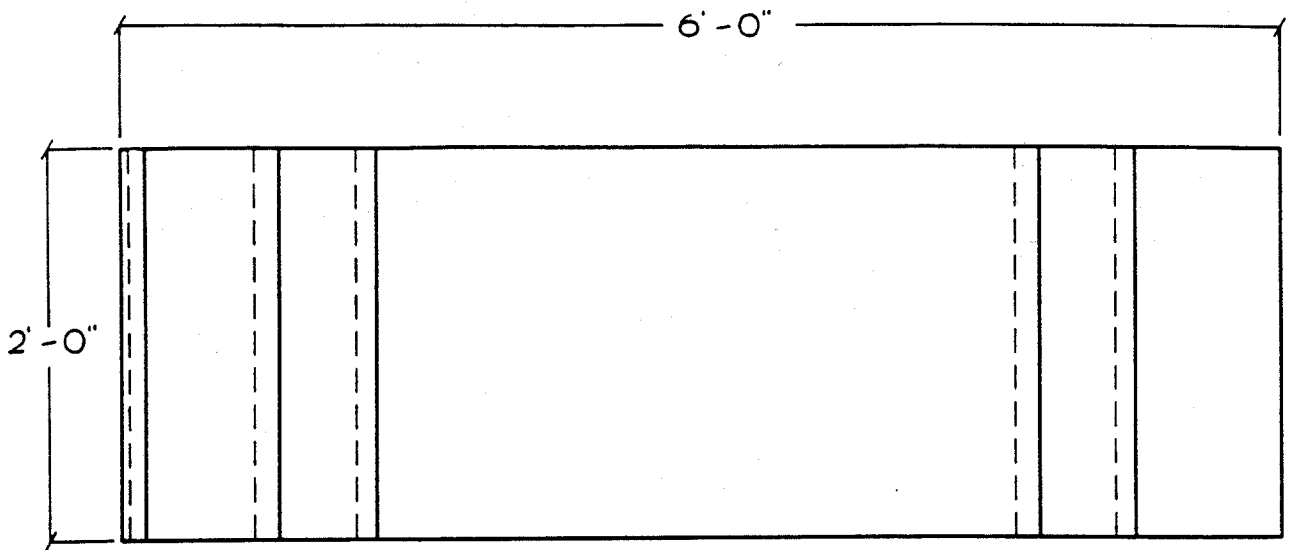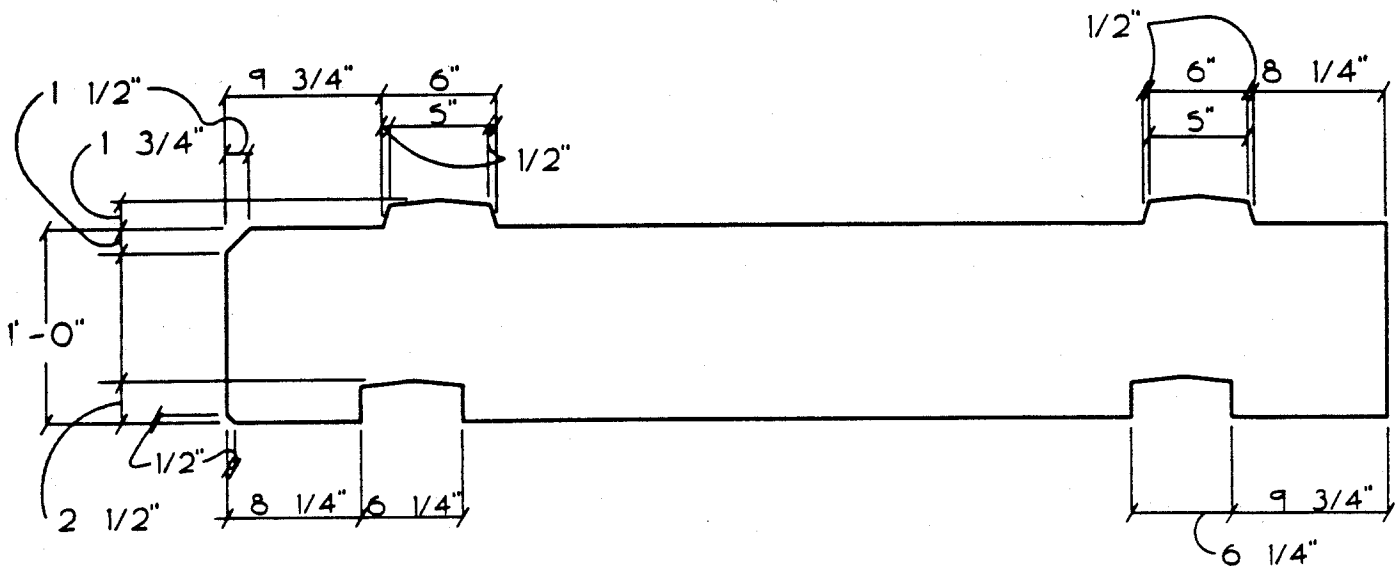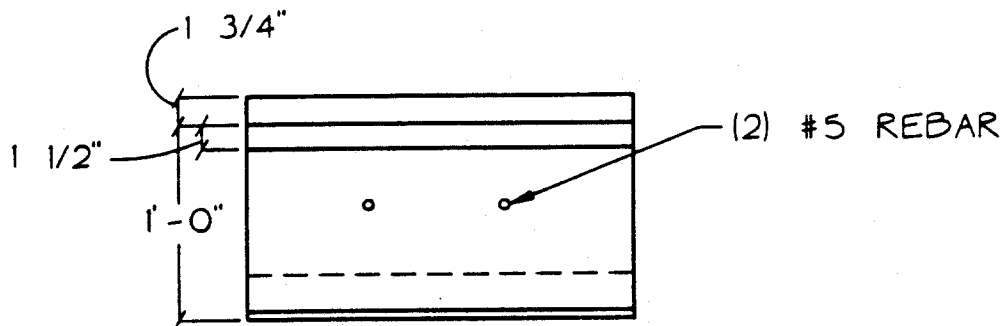
SECTION

NOTE: FOR FLEXIBILITY IN CONSTRUCTION USES THE LOCATION, NUMBER AND SIZE OF REINFORCING MAY BE DESIGNED BASED ON SPECIFIC PROJECT REQUIREMENTS.
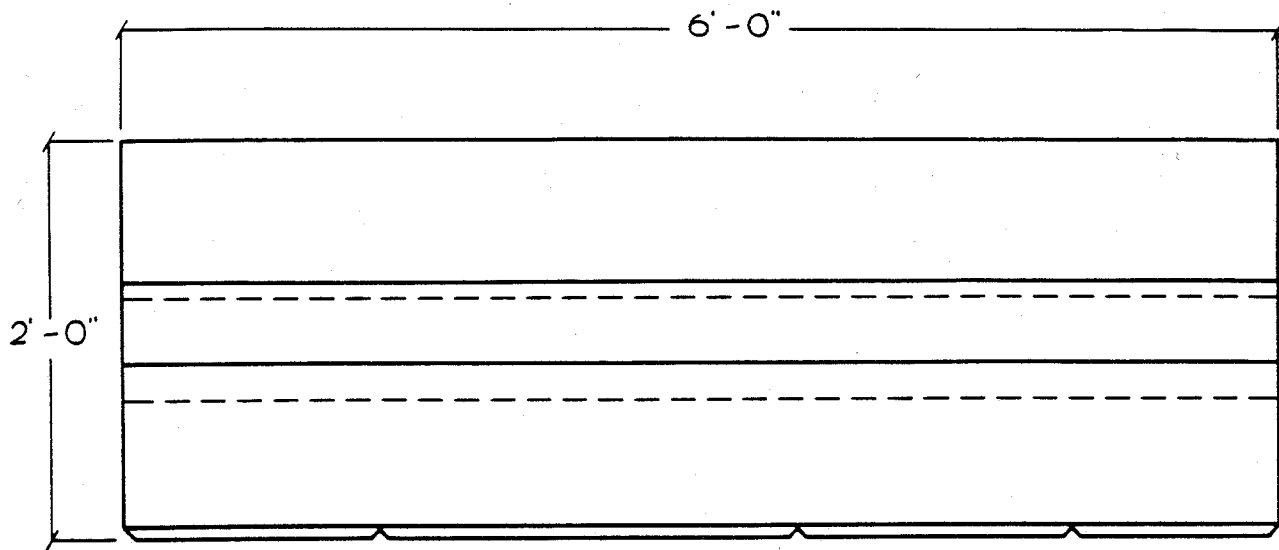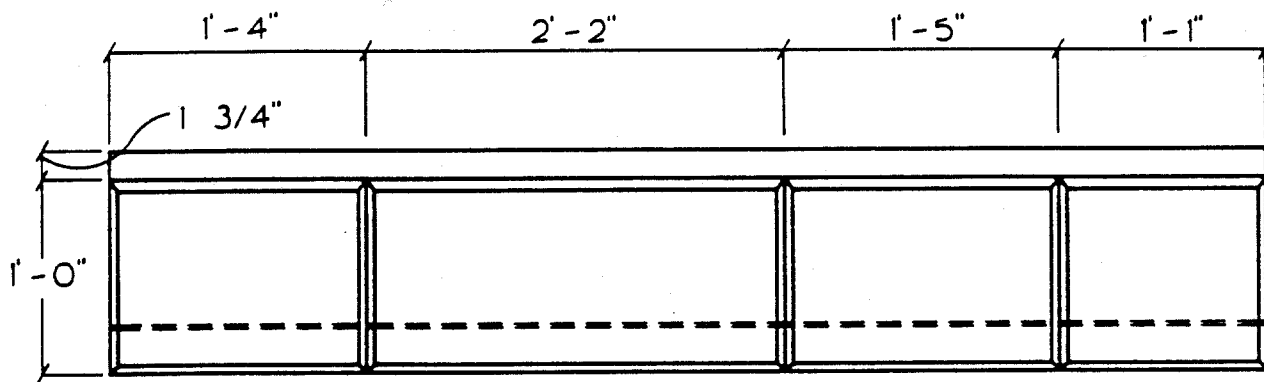
SHOP DRAWING FOR DURA-HOLD TYPICAL TIEBACK UNIT

Scale: 1"=1'-0"

Plate No.   DH-5

WALL SECTION
SCALE: 1/4"=1'-0"

FINISHED GRADE

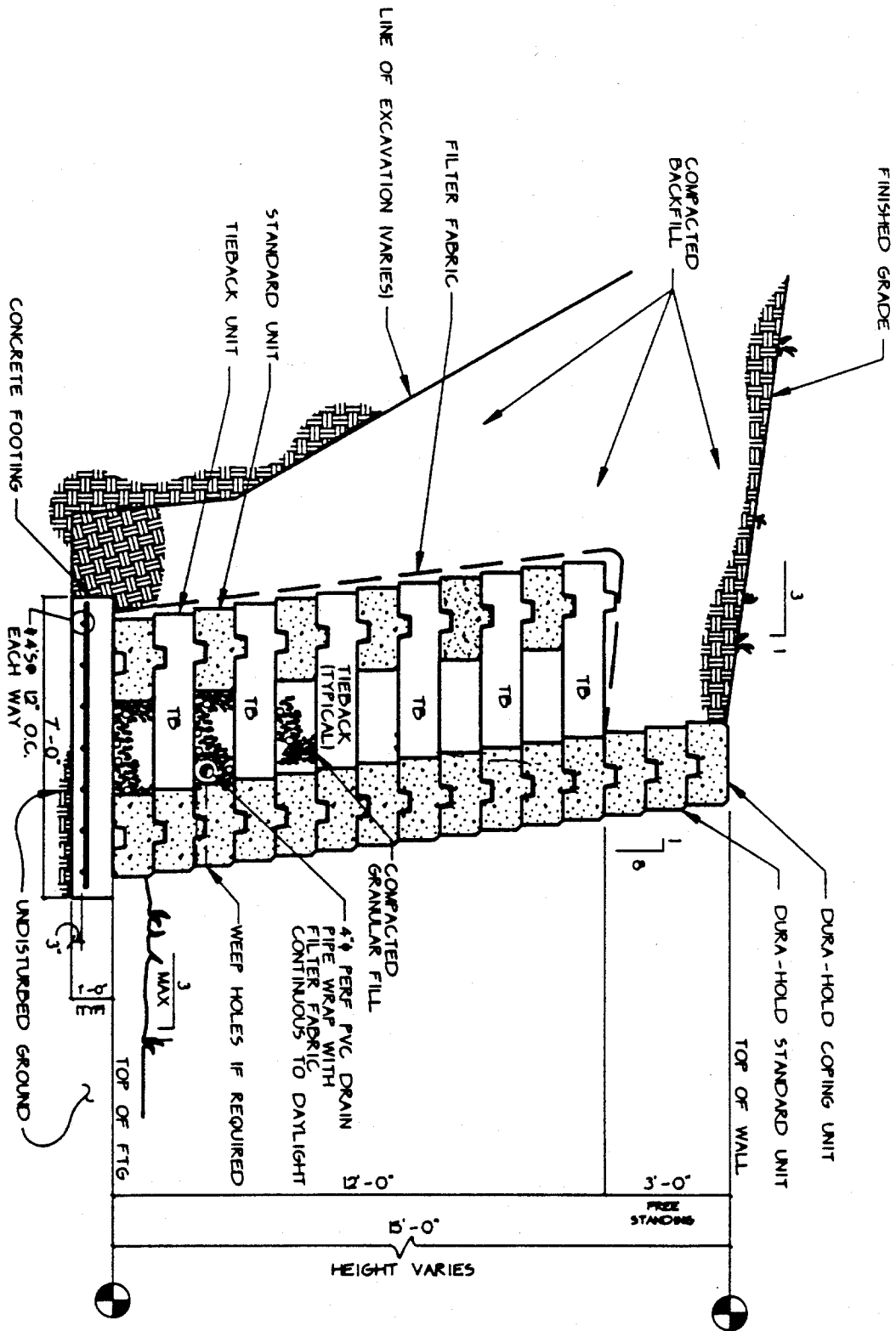LINE OF EXCAVATION (VARIES)

FILTER FABRIC

STANDARD UNIT

TIEDACK UNIT

COMPACTED BACKFILL

CONCRETE FOOTING

#4,5∅ 12" O.C. EACH WAY

TIEDACK (TYPICAL)

TD

DURA-HOLD COPING UNIT

DURA-HOLD STANDARD UNIT

TOP OF WALL

COMPACTED GRANULAR FILL

4"∅ PERF PVC DRAIN
FILTER FABRIC WRAP WITH
CONTINUOUS TO DAYLIGHT

WEEP HOLES IF REQUIRED

TOP OF FTG

UNDISTURBED GROUND

3"

1'-9"

3'-0"
FREE STANDING

12'-0"

5'-0"

HEIGHT VARIES

NOTE: DEPTH OF EMBEDMENT, FOOTING TYPE, SIZE AND REINFORCING DEPENDS UPON CONDITIONS.

SHOP DRAWING FOR TYPICAL
DURA-HOLD SINGLE CRIB WALL

Scale: 1/4"=1'-0"

Plate No.   DH-6

4" Φ PERFORATED PVC DRAIN
PIPE WRAP WITH FILTER
FABRIC CONTINOUS
TO DAYLIGHT

TIEBACK

TIEBACK

TIEBACK

TIEBACK

WEEP HOLES
IF REQUIRED

DURA-HOLD STANDARD
MODULAR UNIT

COMPACTED GRANULAR FILL

COMPACTED GRANULAR FILL

COMPACTED
BACKFILL

LINE OF EXCAVATION
VARIES

UNDISTURBED
GROUND

FILTER FABRIC

TIEBACK (T-WALL
CONFIGURATION)

2'-0"

6'-0"

2'-0"

2'-0" | 2'-0" | 2'-0"

6'-0"

2'-0"
TYP
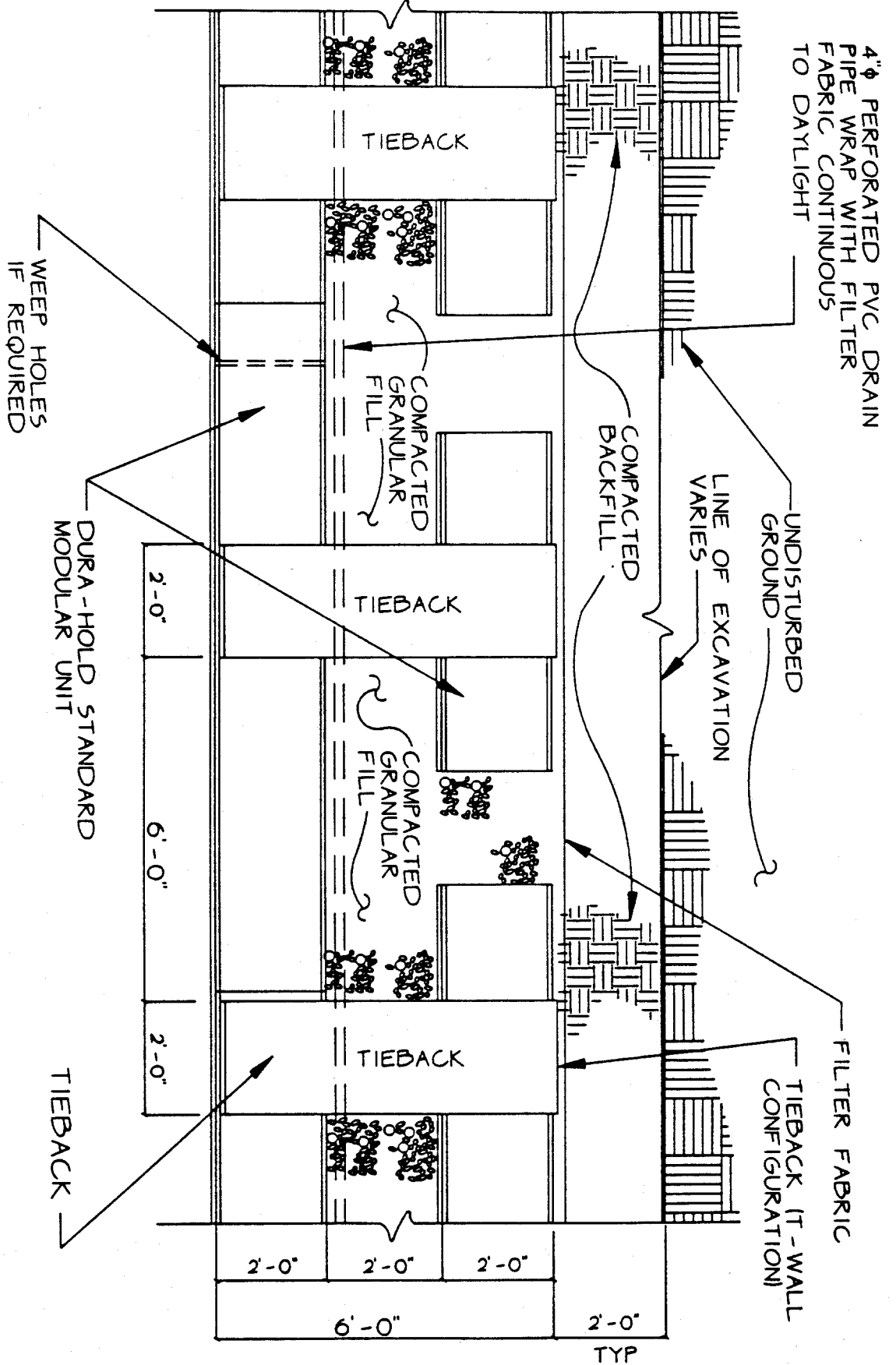
SINGLE CRIB "T" WALL PLAN
SCALE: 3/8"=1'-0"

SHOP DRAWING FOR DURA-HOLD
SINGLE CRIB "T" WALL PLAN

Scale: 3/8" = 1'-0"

Plate No.   DH-7