DESIGN AND DETAILING FOR A RETAINING WALL IN TWIMALIK

DESIGNED BY

ENG.FALAH HASSAN MOHAMMED

ID NO.8571

Retaining walls are structural members used to provide stability for soil or other materials and to prevent them from assuming their natural slope. In this sense, the retaining wall maintains unequal levels of earth on its two faces. The retained material on the higher level exerts a force on the retaining wall that may cause its overturning or failure. Retaining walls are used in bridges as abutments, in buildings as basement walls, and in embankments. They are also used to retain liquids, as in water tanks and sewage treatment tanks.

PROPORTIONS OF RETAINING WALLS

The design of a retaining wall begins with a trial section and approximate dimensions. The assumed section is then checked for stability and structural adequacy. The following rules may be used to determine the approximate sizes of the different parts of a cantilever retaining wall.

1. Height of Wall. The overall height of the wall is equal to the difference in elevation required plus 3 to 4 ft, which is the estimated frost penetration depth in northern states.

2. Thickness of Stem. The intensity of the pressure increases with the depth of the stem and reaches its maximum value at the base level. Consequently the maximum bending moment and shear in the stem occur at its base. The stem base thickness may be estimated as $\frac{1}{12}$ to $\frac{1}{10}$ of the height h. The thickness at the top of the stem may be assumed to be 8 to 12 in.

Because retaining walls are designed for active earth pressure, causing a small deflection of the wall, it is advisable to provide the face of the wall with a batter (taper) of $\frac{1}{4}$ in. per foot of height, h, to compensate for the forward deflection. For short walls up to 10 ft high, a constant thickness may be adopted.

3. Length of Base. An initial estimate for the length of the base of $\frac{2}{5}$ to $\frac{2}{3}$ of the wall height, h, may be adopted.

4. Thickness of Base. The base thickness below the stem is estimated as the same thickness of the stem at its base, that is, $\frac{1}{12}$ to $\frac{1}{10}$ of the wall height. A minimum thickness of about 12 in. is recommended.

The wall base may be of uniform thickness or tapered to the ends of the toe and heel, where the bending moment is 0.

The approximate initial proportions of a cantilever retaining wall are shown in Fig.1

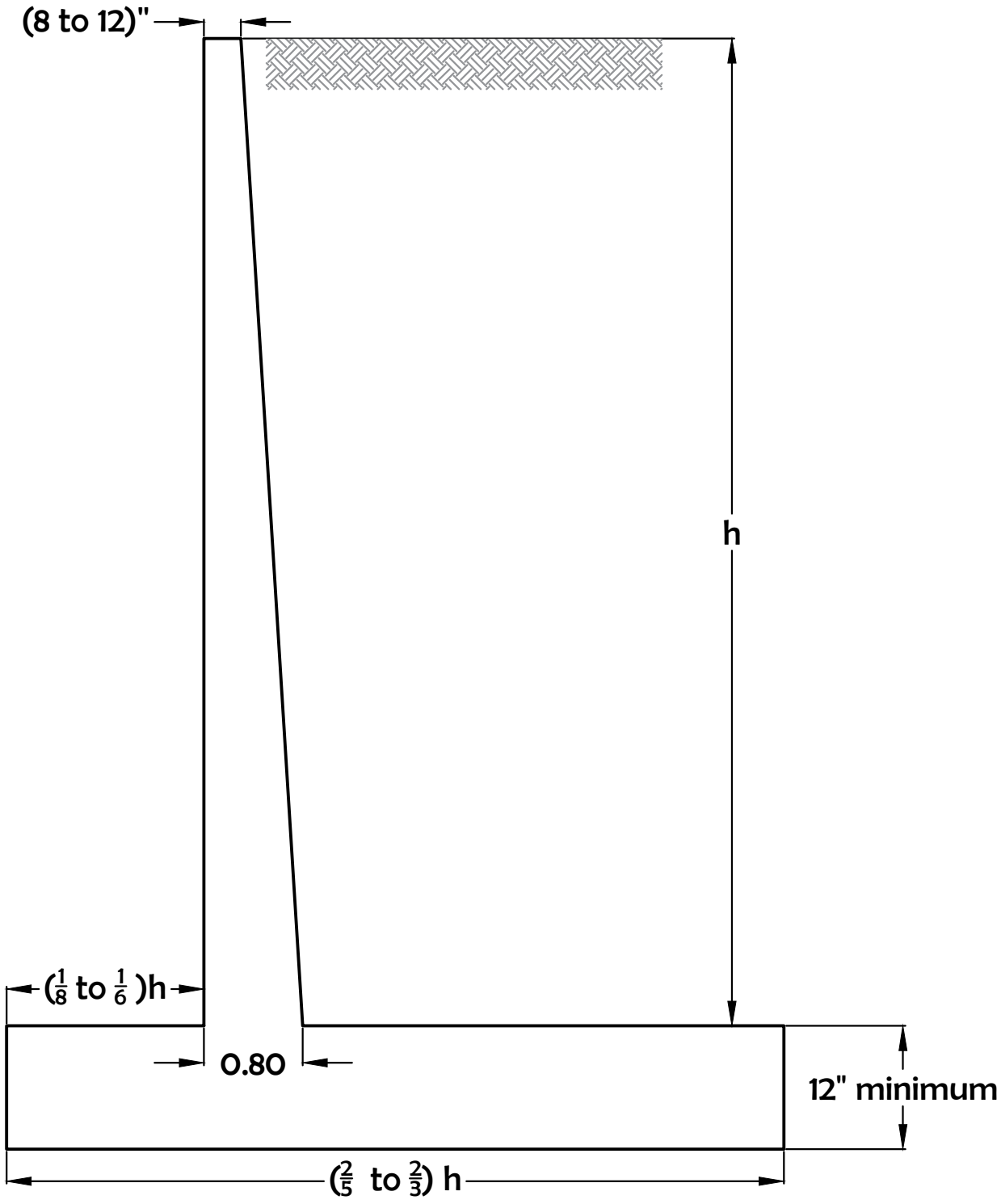


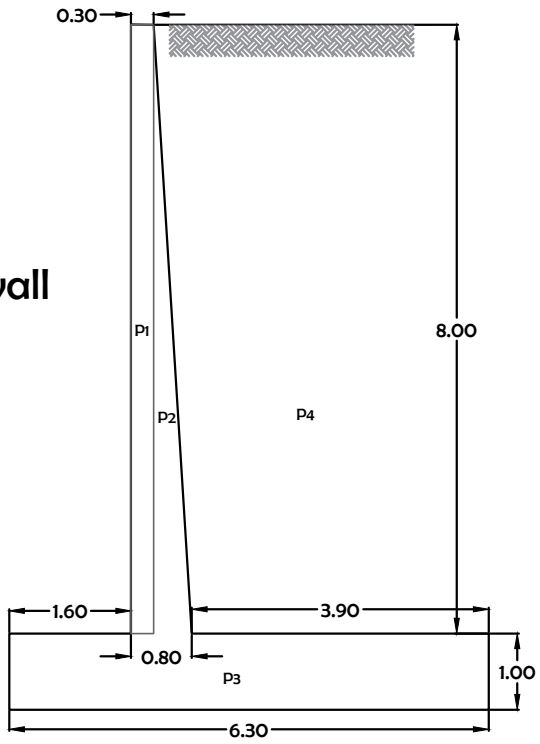
Fig.1

fcu=40Mpa
fy=420Mpa
A.B.C=300Kpa

P=Ca*W*h

Ca=1-sine Φ /1+sine Φ

P1 =weight of rectangular portion of concrete wall



P1=24*0.3*8

P1=57.6Kn

P2=Weight of triangle portion of concrete wall

P2=24*0.5*0.5*8

P2=48Kn

P3=Weight of Wall Footing

P3=24*1*6.3

P3=151.2Kn

P4=Weight of Soil

P4=16*8*3.9

P4=499.2Kn

R=Resultant of gravity loads

R=756Kn

The self weight of the retaining wall and the soil above the heel tend to counteract the overturning moment . moment taken the front edge of a base (toe):

M1=57.6*1.75
M1=100.8 Kn.m

M2=48*2.06

M2=99.2Kn.m

M3=151.2*3.15

M3=476.28

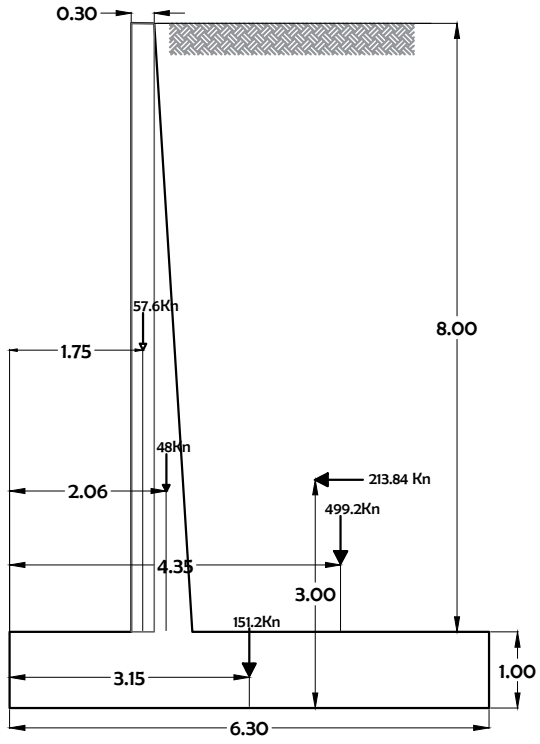
M4=499.2*4.35

M4=2171.52

Restoring moment :

MR=M1+M2+M3+M4

MR=2847.8Kn.m
Horizontal Pressure :



H=Ca*w*h*h/2

H=0.33*16*9*$\frac{9}{2}$

H=213.84 Kn

Lateral force tends to overturn the retaining wall about the front edge of the toe:

M0=H*h/3

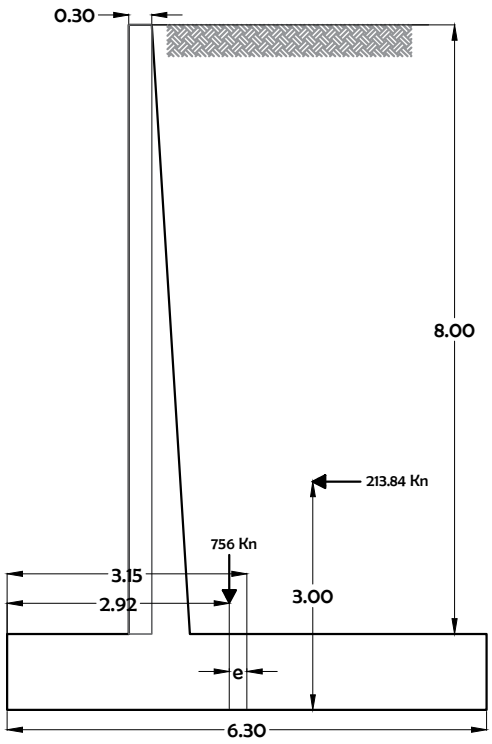
Mo=213.84*3 , Mo=641.52

Checking the Wall against Overturning

factor of safety against overturning

F.S=MR/Mo

F.S=4.4>2 O.K



X=MR-Mo/R

X=2206.28/756

X=2.92m

e=3.15-2.92

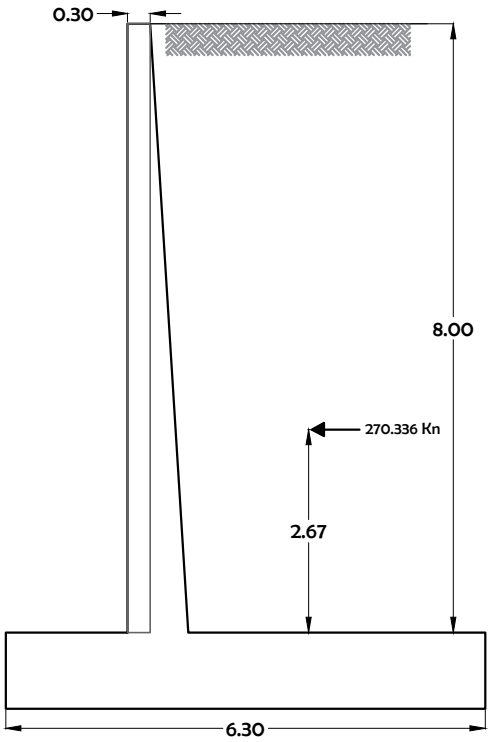
e=0.23
6.3/6 > 0.23

q1=R/A+R*e*c/I

q1=146.28Kpa<300Kpa O.K

Soil bearing pressure is acceptable

factor of safety against sliding



S.S=μR/H

F.S=378/213.84

F.S=1.76>1.5 O.K

Hu=1.6*Ca*w*h*h/2

Hu=270.336 Kn

Mu=720.88 Kn.m

Mu=ØAs*fy(d-a/2)
As=5000 mm2
fy=420Mpa
a=102.94

d required=432.41mm<730mm O.K

Shear check

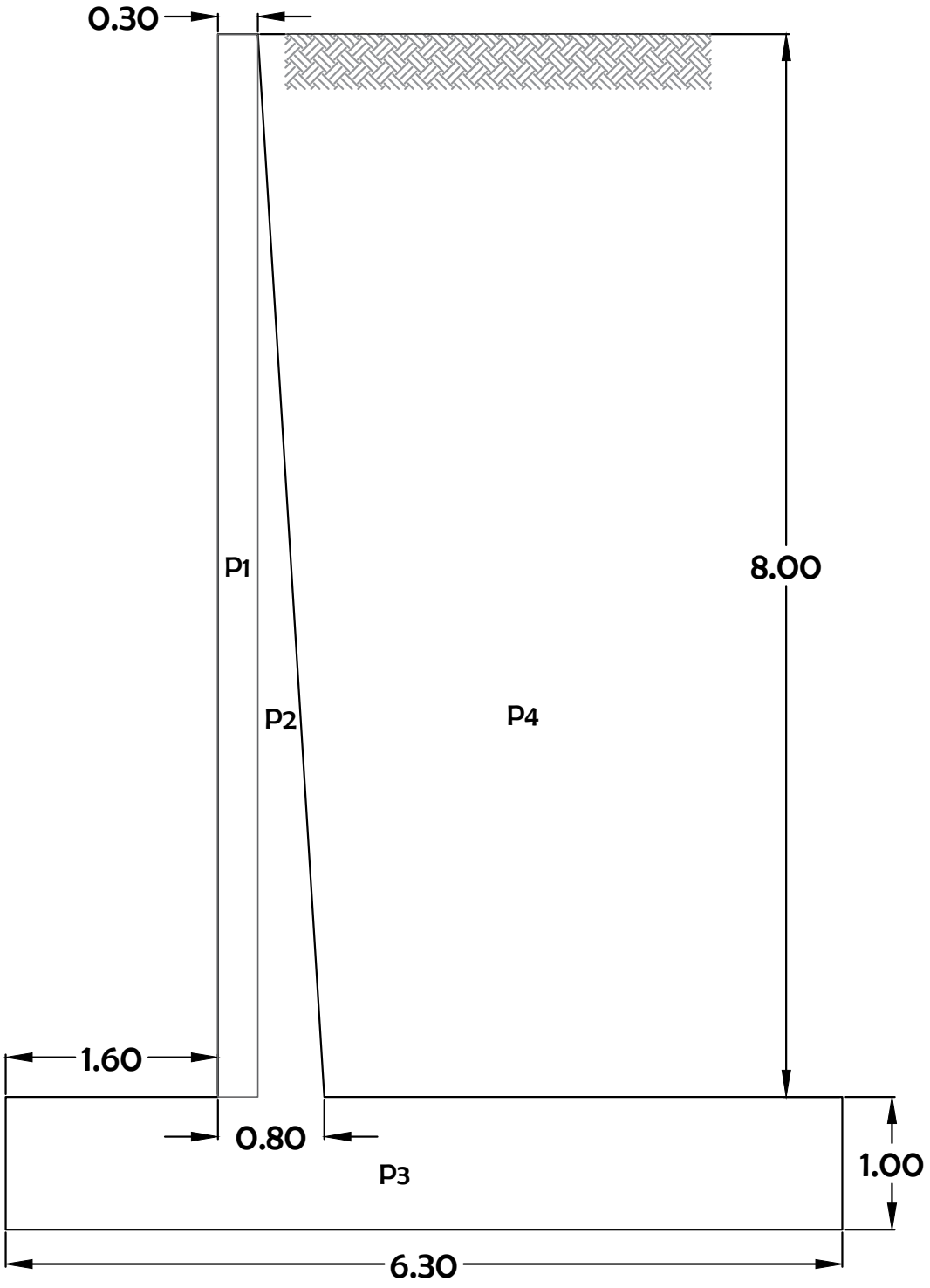
Vu=270.33Kn

ØVn=Ø(α*μ*(fc)^0.5 +ρ*fy)Acv<Ø8*(fc)^0.5 *Acv

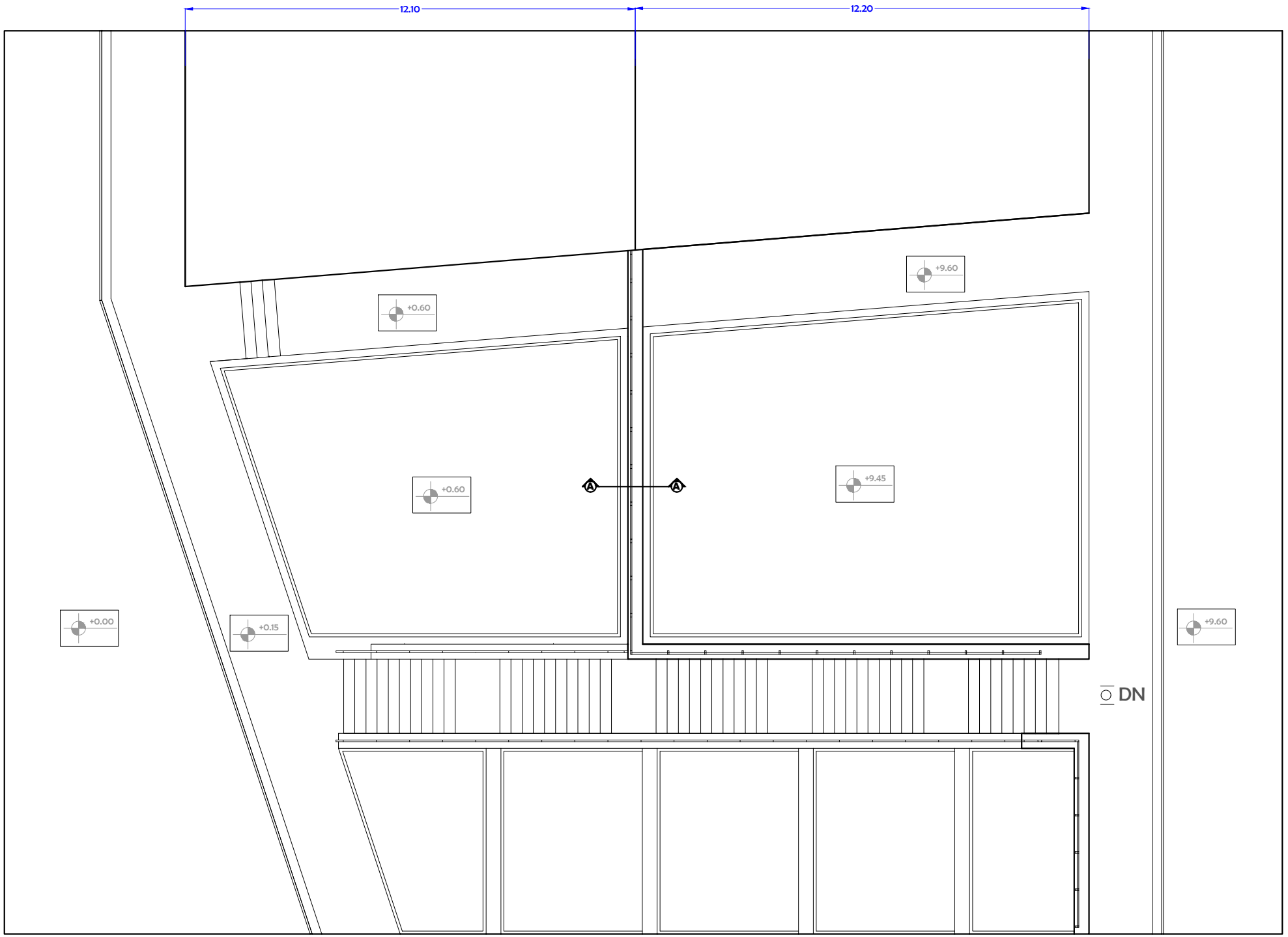
ØVc=Ø0.66*μs*μ*(ρw)^$\frac{1}{3}$*(fc)^0.5 +Nu/6Ag)b*d

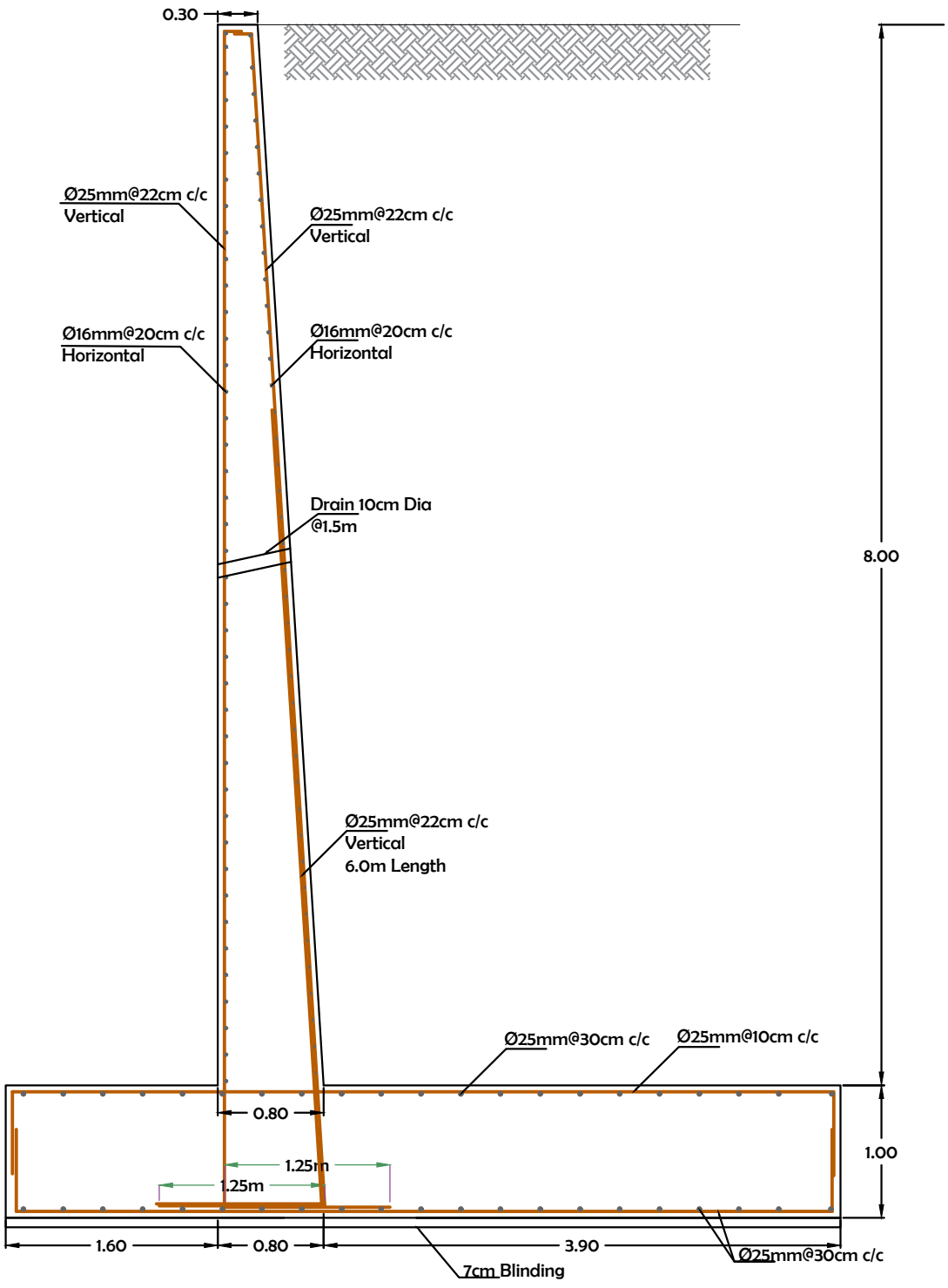
ØVc=275.8>270.33 O.K

Structural Engineer
Falah Hassan Muhammed
ID No.8571


0.30
P1
8.00
P2
P4
1.60
0.80
P3
1.00
6.30

LAYOUT PLAN




0.30
Ø25mm@22cm c/c
Vertical
Ø25mm@22cm c/c
Vertical
Ø16mm@20cm c/c
Horizontal
Ø16mm@20cm c/c
Horizontal
Drain 10cm Dia
@1.5m
8.00
Ø25mm@22cm c/c
Vertical
6.0m Length
Ø25mm@30cm c/c
Ø25mm@10cm c/c
0.80
1.25m
1.25m
1.00
1.60
0.80
3.90
Ø25mm@30cm c/c
7cm Blinding

Section (A-A)