DESIGN FOR SWIMMING POOL

RENOVATION PROJECT, 1845 COMOX ST. Vancouver

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APEX ENGINEERING LTD

CHECK BY:

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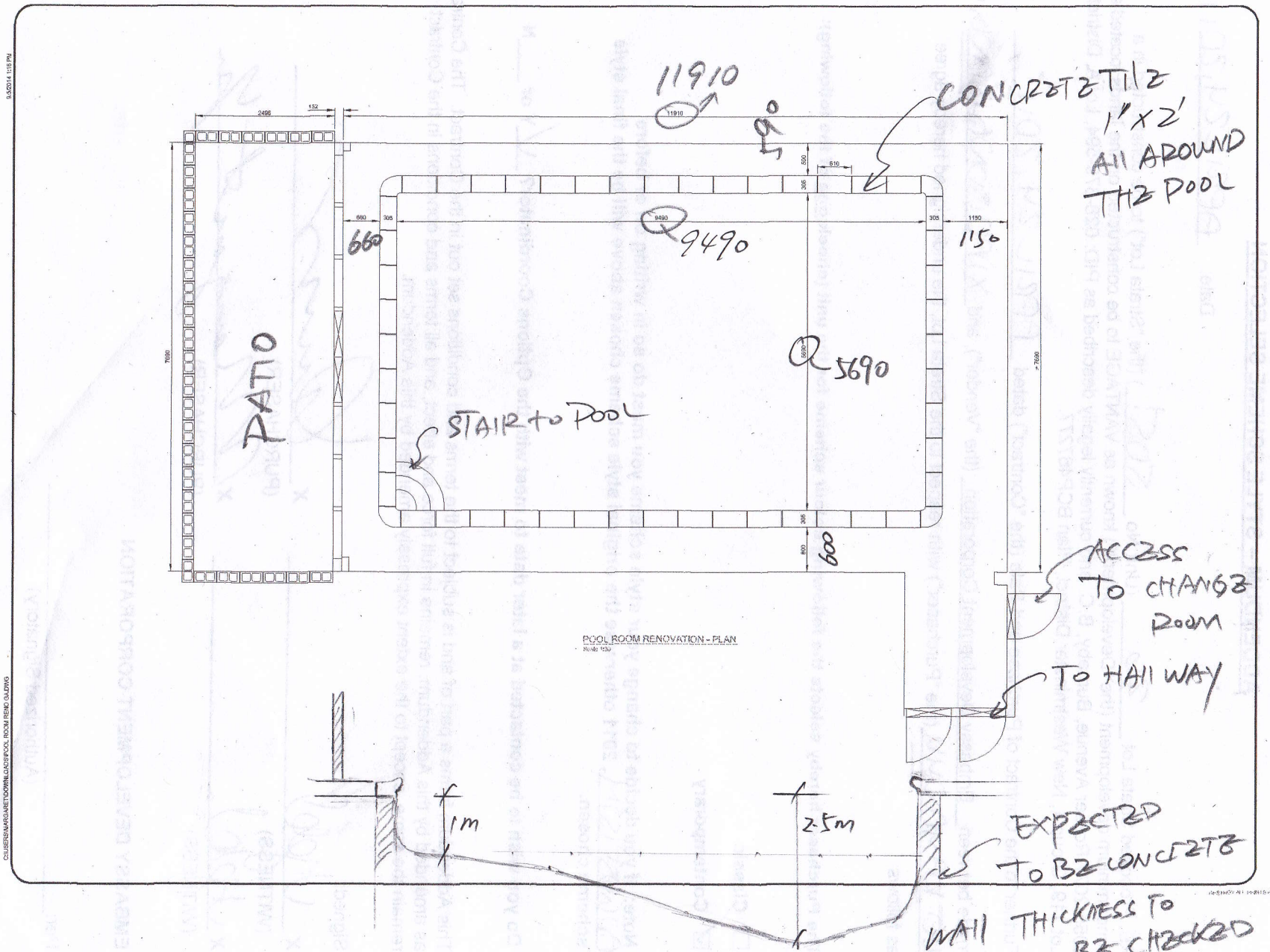
INTRODUCTION :

THE project LOCATES AT 1845 COMOX ST. VANCOUVER. DESIGN objective is TO cover a INDOOR SWIMMING POOL with HEAVY Timber Material which REQUIED BY BUILDING CODE (BCBC) DIFFERENT OPTIONS WERE CONSIDERED, including FILLING THE POOL WITH SEASONED SAND, AND GRANULAR THE HEAVY TIMBER IS SELECTED BECAUSE of SITE CONDITION, CONSTRUCTION DIFFICULTIES, AND ECONOMY CLIENT PREFERENCE. AN ACCESS HOLE OPENING IS PROVIDED IN THE DESIGN FOR LONGTERM ACCESS AND MAINTANENCE.

FOLLOWINGS ARE THE SKETCHES SHOWING OVERALL GEOMETRY, AND DESIGN CONCEPTS.



DRAWING REFERENCE

NO.	DATE	BY	ISSUED FOR
A	2014/05/04	IDN	TOOL ROOM

JOB NUMBER:	XXXXXX
DRAWN:	ZDHARMA
APPROVED:	
DATE:	
SCALE:	AS NOTED
SEAL:	

CONSULTANT:
APOC Engineering Ltd.
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DRAWING TITLE:
POOL TO FITNESS RENO
M.A. SECTIONS & DETAILS

PROJECT TITLE:
POOL TO FITNESS RENO

PROJECT LOCATION:
COQUITLAM, VANCOUVER, B.C.

DRAWING No.	REV.	SHEET
	A	1/2

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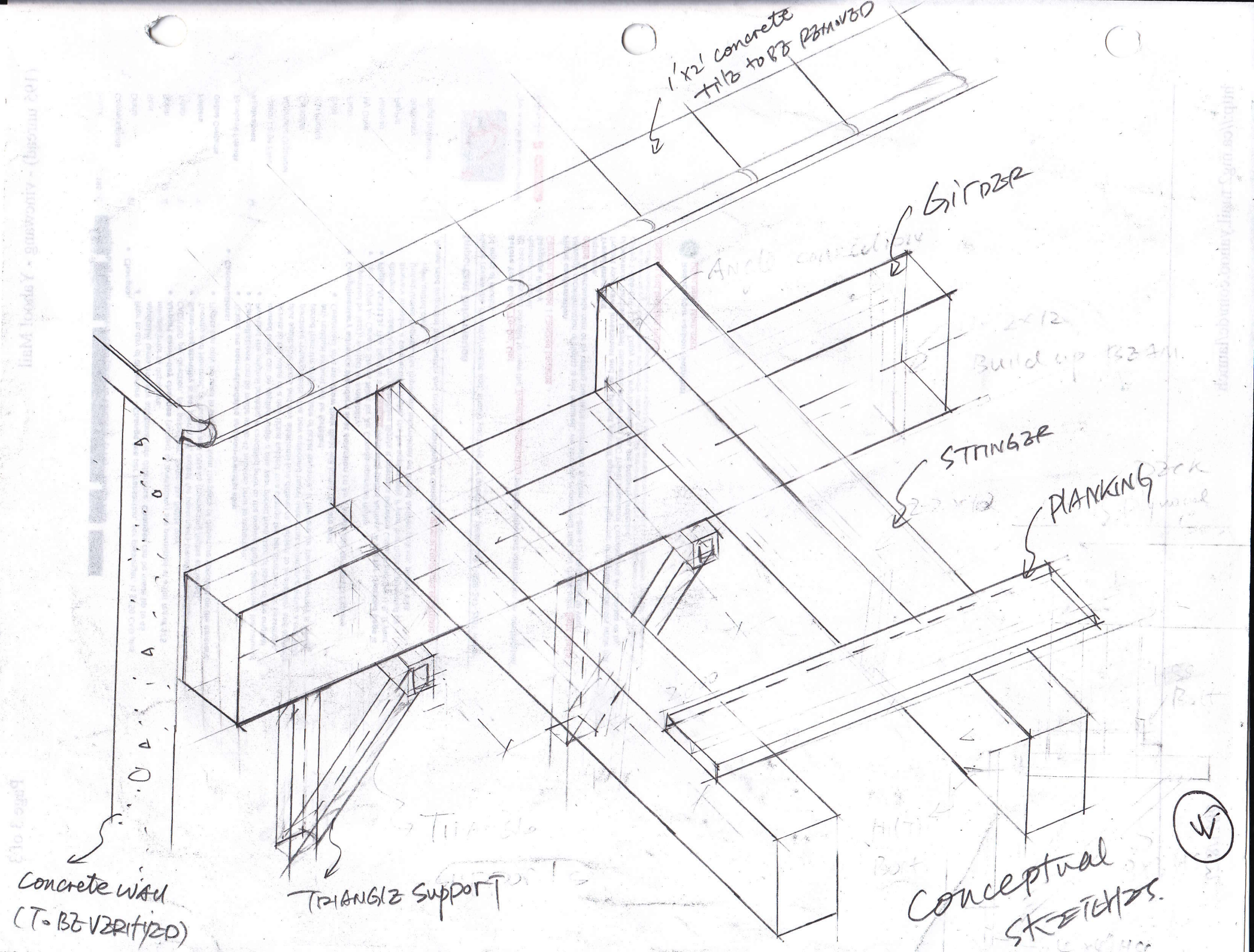
1'x2' concrete
tilt to be planned
Girder
Stringer
Planking
Concrete wall
(To be verified)
Triangle support
Conceptual
sketches.

DESIGN LOAD AND LOAD FACTOR

1. HEAVY TIMBER AVERAGE UNIT WEIGHT 0.0024 LB/CU.IN FOR DEAD LOAD
2. LIVE LOAD : 4.8 KPa AS PER BCBC-TABLE 4.1.5.3
3. CONCENTRATED LOAD : 9 KN FOR 750mm x 750 mm AS-PER BC-BC-TABLE 4.1.5.10
4. NO WIND, SNOW, LOAD AS BUILT IN DOOR
5. SEISMIC LOAD, USING HILTI-SEISMIC ANCHOR
6. DEAD LOAD FACTOR 1.25, NO COMPADION LOAD
7. LIVE LOAD FACTOR 1.5, NO COMPATION LOAD
8. BOUYANCE LOAD TO BE CONSIDERED AFTER CONFIRMED WITH CITY REGARDING HIGH WATER LEVEL ?

PLANKING CHECK

FOR S-P-F 64 x 113 x 1200 PLANKING (COM. GR)

SINCE THE SPAN IS ONLY 600mm, THE FACTOR STRENGTH will BE MUCH HIGHER THAN SPECIFIED IN THE WOOD DESIGN MANUAL,

CHECK if CONCENTRATED LOAD WILL GOVERN.

$$M_{uf} = \frac{0.113}{0.75} \times \frac{9}{0.75 \times 0.75} \times 0.75 = 1.8 \text{ kNm} << \text{Capacity}$$

THE SELECTION of PLANK IS DETERMINED BY the RATING REQUIREMENT, NOT STRUCTURAL SAFETY!

STRINGER CHECK

STARTING WITH STRINGER BRACING 800 m/m

$\Rightarrow 4.8\,kPa \times 0.8 = 3.84\ kN/m$

STRINGER SPAN CROSSING THE POOL TRANSVERSELY

$L = 5.6\ m \Rightarrow M_{uf}, V_{uf}$

$M_{uf} = \frac{1}{8} \times 3.84 \times 5.6^2 = 15.05\ kN.m$

$V_{uf} = \frac{1}{2} 8l = \frac{1}{2} \times 3.84 \times 5.6 = 10.752\ kN$

FACTORED $M_f = 15.05 \times 1.5 = 22.58$

$V_f = 10.75 \times 1.5 = 16.13$

LOAD EFFECTS ARE TOO BIG FOR STRINGER 140 x 241

REDUCING SPACING 0.6m SPACING

$4.8 \times 0.6 = 2.88\ kN/m$

$M_{uf} = \frac{1}{8} \times 2.88 \times 5.6 = 11.29\ m.m \Rightarrow M_f = 16.94\ kN.m$

$V_{uf} = \frac{1}{2} \times 8l = \frac{1}{2} \times 2.88 \times 5.6 \Rightarrow 8.06, \Rightarrow V_f = 12.09\ kN.m$

OK with S-P-F GRADE No. 1 140 x 241

(7)

NOW CHECK WITH PLANKING DEAD LOAD AND DEFLECTION $l/360$ AND $1/180$ L

PLANKING USE 64x113 COMMERCIAL GRADE

TIMBER UNIT WEIGHT $0.024 Lb/in^3 \simeq 6.675 KN/m^3$

$= 0.66 Kg/m^3$

SO $\Rightarrow$ DEAD WEIGHT FROM PLANKING

$64 \times 600 \times 10^{-6} \times 6.675 = 0.26 KN/m$

So $\Rightarrow 1.25 \times 0.26 + 2.88 \times 1.5 = 4.65 KN/m$ (Factored)

$\Rightarrow Mf = \frac{1}{2} \times 4.65 \times 5.6^2 = 18.21 KN\,m < 19.1 KN\,m$

$\Rightarrow Vf = \frac{1}{2} \times 4.65 \times 5.6 = 13.02 KN < 39.8 KN$

(S-P-F NO 1 GRADE)

191x241

DEFLECTION CHECK:

SLS with FACTOR of 1.0

$\Rightarrow 0.26 + 2.88 = 3.14 KN/m$

ESIRE 360 BASED ON LIVE LOAD

$360 \times \frac{5wl^3}{384} = 360 \times \frac{5 \times 2.88 \times 5.600^3}{384}$

$= 2370 \times 10^9 \Rightarrow 1670$ (191x241)

SO WE NEED BETTER TIMBER

CHOOSE HEM-FIR 140x292 No.1 or BETTER

(MR=23.0, V_r=32.4, EsI=2900x10^9) OK !!

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GIRDER CHECK

Girder SPACING 2250mm (support SPACING)

LIVE LOAD $\frac{1}{2} \times 5.65 \times 4.8 = 13.56$ KN/m

DEAD LOAD $6.675 \times 0.064 \times 5.65/2 = 1.21$ KN/m

We need 10 stringers so

$5.65 \times 0.14 \times 0.21 \times 0.075 = 1.54$ KN

$1.54 \times 10/2/9 = 0.81$ KN/m

$(13.56 \times 1.5 + (1.21 + 0.81)) \times 1.25 = 22.85$ KN/m

$\Rightarrow M_f = \frac{1}{8} \times 22.85 \times 2.25^2 = 14.66$ KN.m

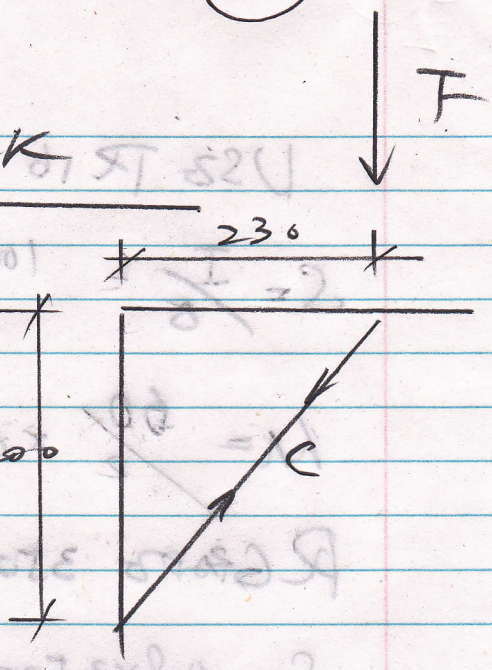
$\Rightarrow V_f = \frac{1}{2} \times 22.85 \times 2.25 = 25.7$ KN

SLS $\Rightarrow$ $13.56 + 2.1 = 15.66$ KN/m

DEFLECTION $360.5 w l^3 / 384 = 8.30 \times 10^9$

$\Rightarrow$ Use SP-F 191x241 GRADE NO.1 or Better.

TRIANGLE SUPPORT CHECK



Total Factored F

$F = 22.85 \times 2.25$ (From Girder)

$= 51.41$ KN

From Triangle Similarity

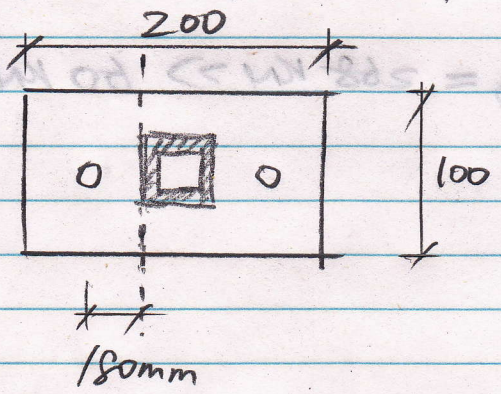
and Force Equilibrium $\Rightarrow$

$$C = 51.41 \times \frac{\sqrt{230^2+200^2}}{200} = 78.36 \text{ KN}$$

Use HSS 51x51x6.4 Grade C, A500, Fy = 345 MPa

$$T = 51.41 \times \frac{230}{200} = 60 \text{ KN}$$

Use two HILTI Bolt,



USE PR16

$$S = \frac{I}{\delta} = \frac{100 \times 16^3}{12 \times 8} = 4266.67\ mm^3$$

$$M = \frac{60}{2} \times 0.032 = 0.96\ kN.m$$

Use Grade 350W with Deduction of

So $0.9 \times 350 = 315\ MPa$

$$\sigma = \frac{0.96 \times 10^6}{4266.67} = 220\ MPa < 315 \quad OK$$

Weld Check

Uniformly 5mm Weld (Stop Weld)

Weld Line Normal to The Force

Using Weld Metal Rod 400 MPa

$\Rightarrow 5 \times 50 \times 4 \times 400 \times 0.67 = 268\ kN >> 60\ kN$. OK

HILTI ANCHOR CHECK

USE HIT-HY-200 ADHESIVE ANCHORING SYSTEM

Ø 3/8" BOLT EMBED. MIN 8.5 inch?

concrete PULL out will Govern

Say crack concrete Ø 3/8" EMBED.

Assume concrete STRENGTH TO BE 17.2 MPa

So PULLOUT STRENGTH 60.9 KN!

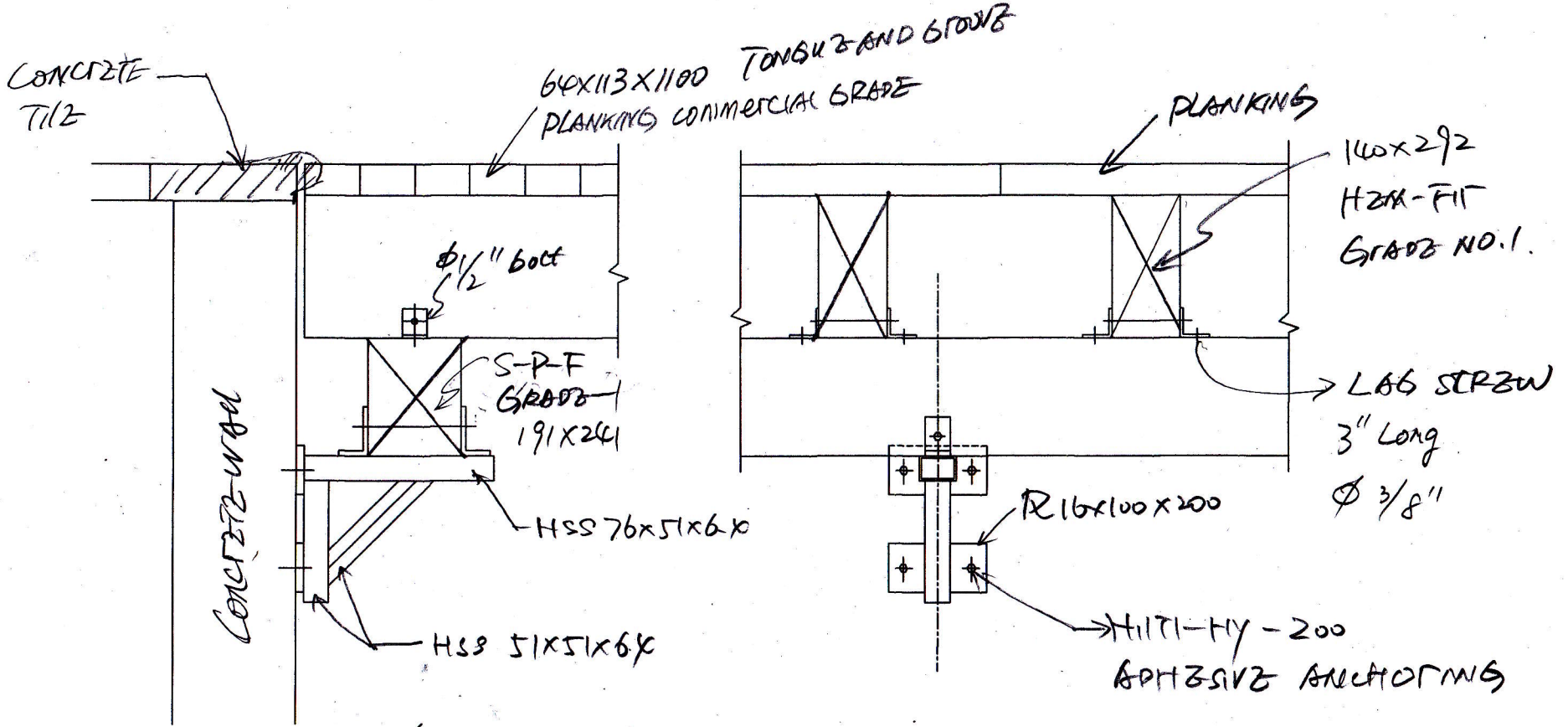
For TENSION CHECK

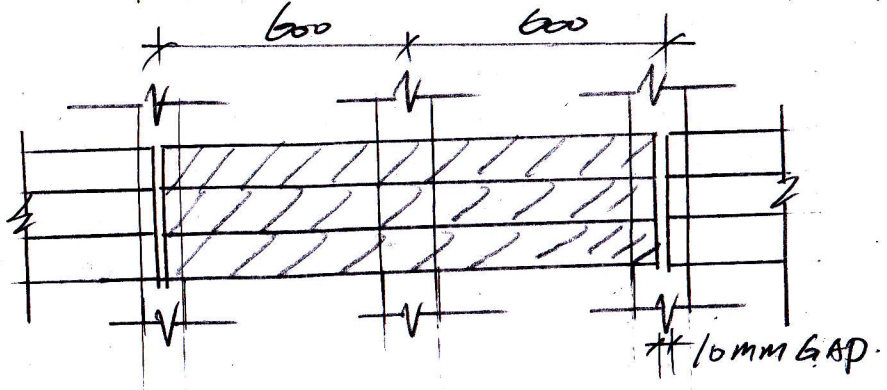
SPACE FACTOR, 0.67, Edge Distance Factor 1.0

⇒ 60.9 x 0.67 x/= 40.80 KN

EACH ANCHOR REQUIRE ≈ 30 KN Tension FORCE OK!

(CONCRETE THICKNESS AND CONDITION MUST BE CHECKED AFTER TILE DEMOLISHED.





PLANKING INSTALLATION PATTERN

2 SPAN CONTINUE

(ALL WELD TO BE 5 mm FILET WELD)