美 特 鋁 質 有 限 公 司
MIDI ALUMINIUM FABRICATOR LTD.

工程指示 / 要求簡箋(E.I.)

工程指示編號：EI /9982/ 18　　修改版次：-

工程編號　：J - 837　　工程名稱　：觀塘裕民坊

工程項目　：Glass Cladding 預留碼 (佛沙場用)

收件人　：Maggie　　發件人　：Eric Liu　　日　期　：29/11/2018

☐要求提供 / ☐確認 事項 ：

( ) 初步鋁料 B.M.　( ) 加工拆圖，然後生產　( ) 尺寸表

( ) 正式鋁料 B.M.　( ) 技術上資料 / 指示　( ) 報價

( ) 配件 B.M.　( ) 樣辦或貨品說明書　( ) 分判合約

( ) 其他 ：_____

內容 ：

請按加工圖生產 Precast glass cladding 用預留碼，送佛沙廠

請留意: 1) 因報關問題，預留碼只能從香港送上中威佛沙廠，不能由大陸送廠

2) T1,3 樓層:由 18/F 開始， T2,5 樓層:由 25/F 開始

3) Precast Glass Cladding 位置: T1E, T3F, T5H

4) 驗焊: Visual: 100%， MPI : 10% (FOR Glass Cladding)

謝謝！ EM01, EM02

請在 2018/ 12 / 21 前完成上列要求。 王良-安排收貨-謝

附： 1 頁 B.M.，1 頁圖登，2 頁加工圖，3 頁位置圖

以上項目為:

☐ 原合約工程包　☐ 原合約工程加 / 減賬　☐ 新工程報價

原因 :-_____

分發東莞各部門 ：

( )生產技術總監☐連附件 ( )技術部 ☐連附件 ( )生產部 ☐連附件 ( )機械設計部☐連附件

( )採購部 ☐連附件 ( )生產統籌部☐連附件

( )質檢部 ☐連附件 ( )會計部 ☐連附件 ( )報關組 ☐連附件 ( )其他 楊榮輝 ☐連附件

分發香港各部門 ：

( )行政部☐連附件 ( )會計部☐連附件 ( )統籌部☐連附件 ( )工程部地盤科文 ☐連附件 文雨/祥哥

( )採購部☐連附件 ( )QS 部 ☐連附件 ( )維修部☐連附件 ( )其他 _____☐連附件

傳遞編號：　　發件人簽署：

HK/828 /18　　項目經理簽署：

美特鋁質 有限公司 MIDI Aluminium Fabricator Ltd.	工程號:	J-837	計算:	羅志光	日期:	2018.11.28	送 呈:	胡哥
	地盤名稱:	觀塘裕民坊	核對:	謝永林	日期:	2018.11.28	副 本:	
地盤用鐵件BM表	項目類別:	Glass Cladding	批准:		日期:			
BM編號： 837-GC-M01-S-PP01	修改版次：	E19982	A/C Code:		鐵件總重量KG：	4462.03	此BM依據資料計算	

序號	修改內容	鐵件圖號	鐵件名稱	顏色	實用	後備	總數	單位	單件/件 (kg)	總重量 (kg)	備注
1		GC-EM01	預留碼拆圖	熱浸鋅+瀝青油	316	4	320	件	6.259	2002.76	
2		GC-EM02	預留碼拆圖	熱浸鋅+瀝青油	622	8	630	件	3.904	2459.28	
				合计:			950			4462.034	

圖則登記表
DRAWING REGISTER

工程名稱 Project Title:	觀塘裕民坊 Precast GC預埋碼拆圖
工程編號 Project No:	J-837

接收日期 Receiving Date (適用於客戶圖則)

年										
月										
日										

分發予 Distributed To

發出日期 Issued Date

年	18									
月	11									
日	28									

圖則編號 Drg. No.	圖則名稱 Drawing Title		修訂編號 Revision No.								
GC-EM01	預留碼拆圖	1									
GC-EM02	預留碼拆圖	2									
RP/J1802/SD/0192	預留碼位置圖	3									
RP/J1802/SD/0170	預留碼位置圖	4									
RP/J1802/SD/0109	預留碼位置圖	5									

2.5度：25/F封上
1.3度：18/F封上

美特鋁質 有限公司
MIDI Aluminium Fabricator

工程號	J-837	地盤	觀塘裕民坊

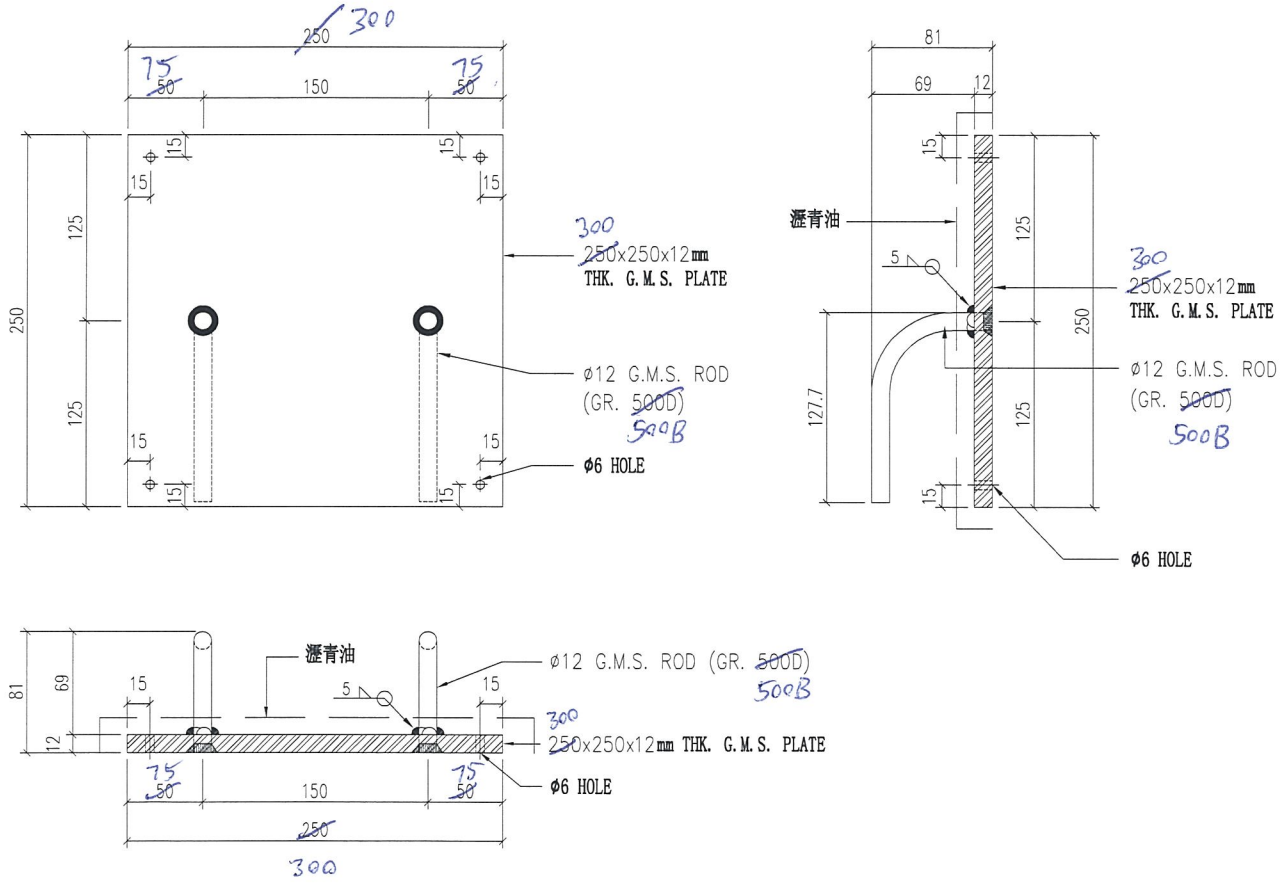
地盤用

單件重量：6.259KG

佛山場用

圖號	數量	位置	樓層	件/層	樓層數
GC-EM01	~~10~~	T5GC-H	~~6/F~~	~~10~~	~~1~~
	~~16~~ 136	25/F	~~7/F~~~26/F	~~8~~ 18	~~17~~ 2
	8		27/F	8	1
	168		28/F~50/F	8	21
	~~5~~	T3GC-F	~~6/F~~	~~5~~	~~1~~
	~~68~~ 32	18/F	~~7/F~~~26/F	4	~~17~~ 8
	4		27/F	4	1
	92		28/F~52/F	4	23
小計：	~~491~~ 316				
後備：	4				
合計：	~~495~~ 320				

地盤：安裝鐵角時只燒左右焊



名稱	預留碼拆圖	制圖	羅志光	2018.11.28	修改			
材料	如圖	復核	謝永林		日期			
顏色	熱浸鋅+澀青油	批準			圖號	GC-EM01		

2.5座 = 25/F 打上
1.3座 = 18/F 打上

美特鋁質 有限公司
MIDI Aluminium Fabricator

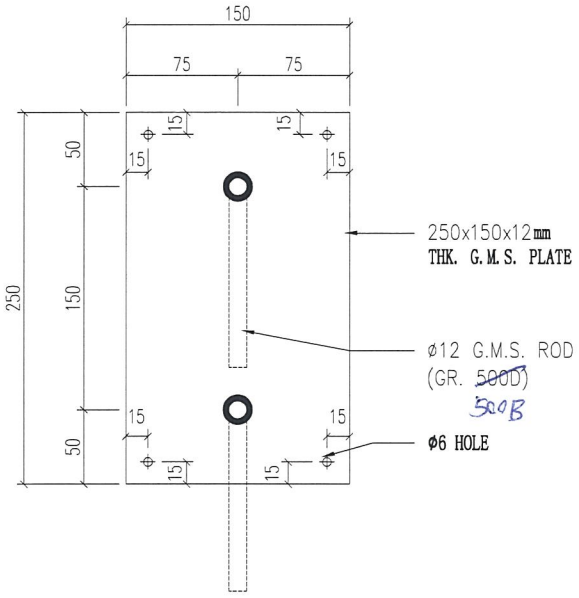
工程號	J-837	地盤	觀塘裕民坊

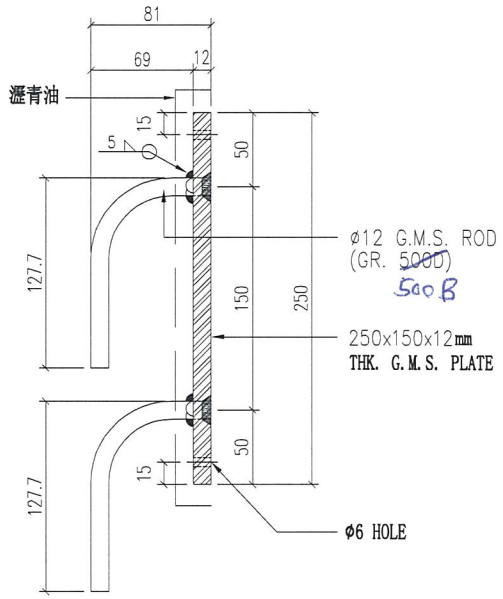
地盤用 (佛山場用)

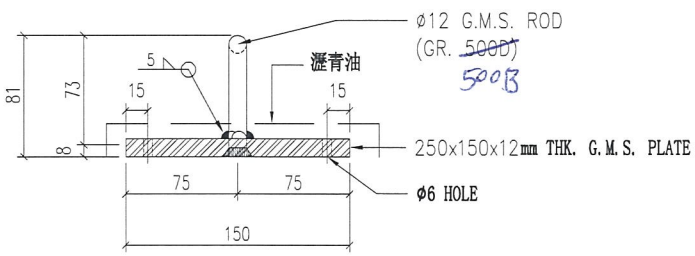
單件重量：3.904KG

圖號	數量	位置	樓層	件/層	樓層數
GC-EM02	~~20~~	T3GC-F	~~6/F~~	~~20~~	~~1~~
	~~128 272~~		~~7/F~~ 18/F~26/F	16	~~17~~ 8
	4		27/F	4	1
	368		28/F~52/F	16	23
	~~5~~	T1GC-E	~~6/F~~	~~5~~	~~1~~
	~~68 32~~		~~7/F~~ 18/F~26/F	4	~~17~~ 8
	4		27/F	4	1
	84		28/F~50/F	4	21
	2		R/F	2	1
小計：	~~827~~ 622				
後備：	~~3~~ 8				
合計：	~~830~~ 630				

注意：安裝鐵角時只燒左右焊







名稱	預留碼拆圖	制圖	羅志光	2018.11.28	修改			
材料	如圖	復核	謝永林		日期			
顏色	熱浸鋅+澀青油	批準			圖號	GC-EM02		

LEVEL	PANEL MARK	QTY.
6/F-26/F, 28/F-50/F	T5PF-H-1	39
WITHOUT 13/F, 14/F, 24/F, 34/F & 44/F		

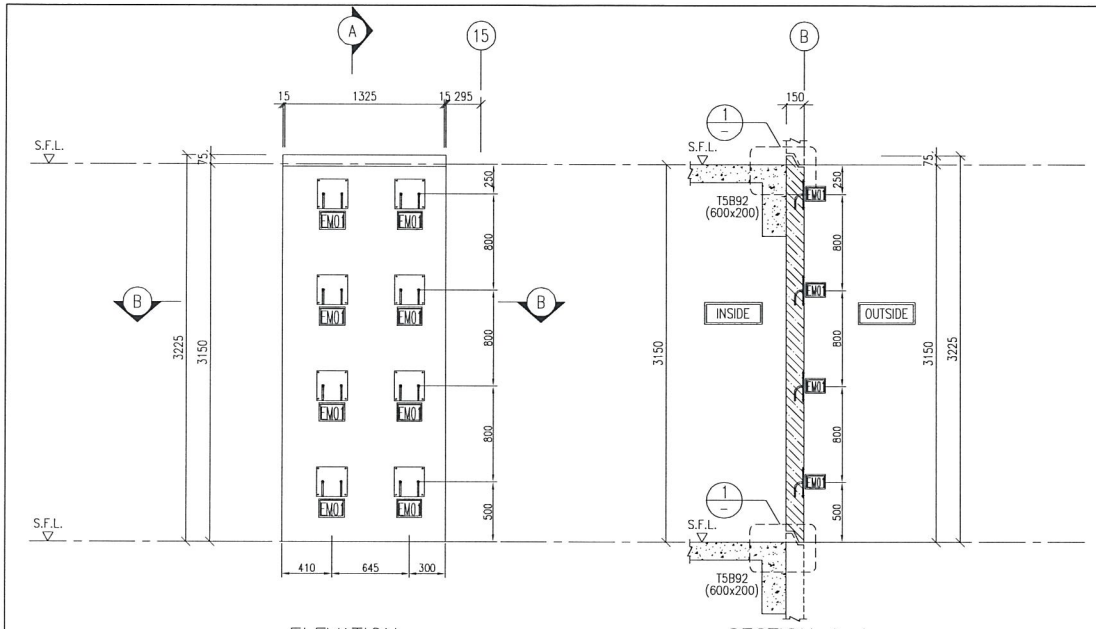
NOTES:

1. THIS DRAWING SHALL BE READ IN CONJUNCTION WITH THE PRECAST CONCRETE GENERAL ARRANGEMENT (GA) PLAN.

LEGEND:

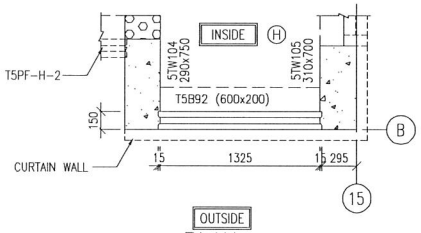
- INSITU CONCRETE
- PRECAST FACADE
- --- ROUGH SURFACE C.J. FACE

T5-H

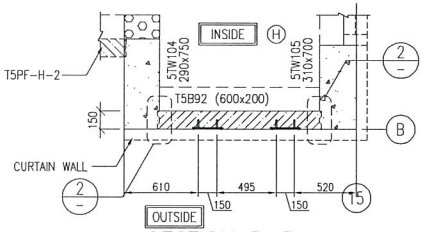


ELEVATION
SCALE 1:40

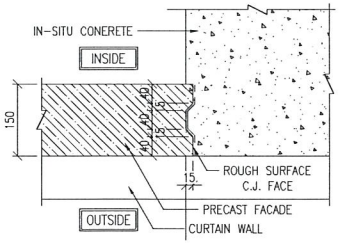
SECTION A-A
SCALE 1:40



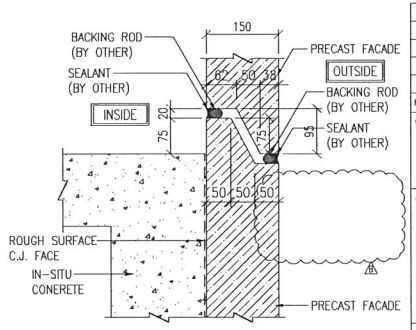
PLAN
SCALE 1:40



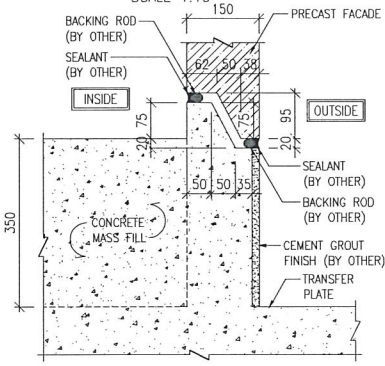
SECTION B-B
SCALE 1:40



DETAIL "2"
SCALE 1:10



DETAIL "1"
SCALE 1:10



DETAIL "1"
(FOR 6/F ONLY) SCALE 1:10

Rev	Amendment	By	Chk.	App.	Date
B	AS CLOUDED	CAD	AC	LL	18.05.18
A	AS CLOUDED	CAD	AC	LL	16.04.18
-	FIRST ISSUE	CAD	AC	LL	15.02.18

CLIENT :

ARCHITECT :

WONG TUNG & PARTNERS LIMITED
ARCHITECTS & PLANNERS

STRUCTURE :

AECOM

MAIN CONTRACTOR :

CR Construction Company Limited

PRECAST SUPPLIER :

REDLAND PRECAST
CONCRETE PRODUCTS (CHINA) LIMITED
中威預制混凝土產品(中國)有限公司

Unit04-05, 18/F., Energy Plaza, 92 Granville Road, T.S.T. East, Kowloon, Hong Kong
Tel: (852) 2280 6328 Fax: (852) 2542 9428 http://www.redlandprecast.com

PROJECT :

URA KWUN TONG TOWN CENTRE
REDEVELOPMENT (AREA 2 & 3) AT
NKIL 6514, KWUN TONG, KOWLOON

TITLE :

SHOP DRAWING
PRECAST CONCRETE FACADE
T5PF-H-1 (6/F-26/F, 28/F-50/F ONLY)

Drawn	CAD	Checked	AC	Approved	LL
Scale	1 : 40(A1)	CAD File No.		Date	15.02.2018
First Issued	15.02.2018	Drawing No.	RP/J1802/SD/0192		Rev. B

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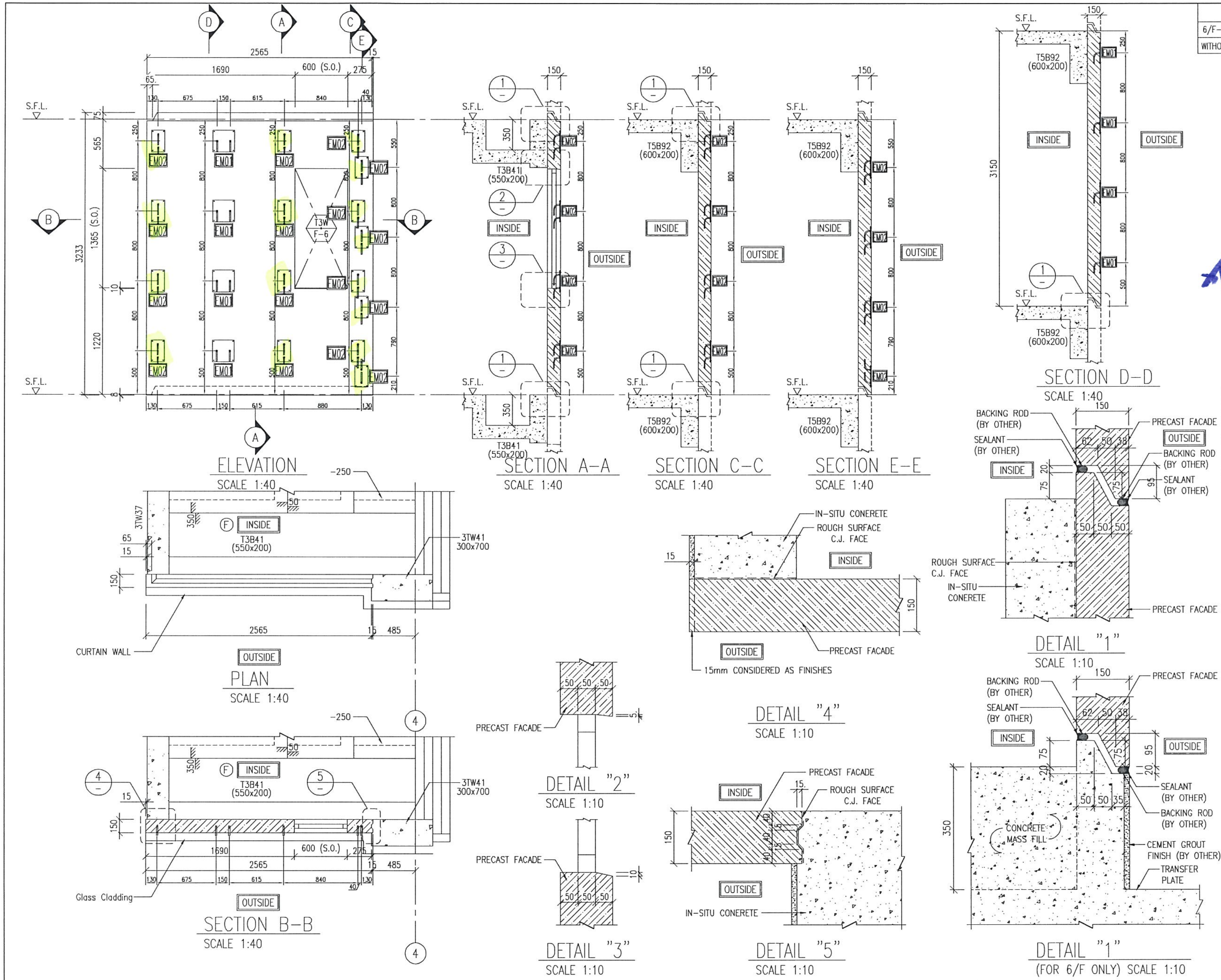

ELEVATION
SCALE 1:40
SECTION A–A
SCALE 1:40
SECTION C–C
SCALE 1:40
SECTION E–E
SCALE 1:40
SECTION D–D
SCALE 1:40
PLAN
SCALE 1:40
SECTION B–B
SCALE 1:40
DETAIL "1"
SCALE 1:10
DETAIL "2"
SCALE 1:10
DETAIL "3"
SCALE 1:10
DETAIL "4"
SCALE 1:10
DETAIL "5"
SCALE 1:10
DETAIL "1"
(FOR 6/F ONLY) SCALE 1:10
S.F.L.
INSIDE
OUTSIDE
T3W F–6
T3B41I (550x200)
T5B92 (600x200)
T3B41 (550x200)
3TW41 300x700
3TW37
CURTAIN WALL
Glass Cladding
EM01
EM02
PRECAST FACADE
BACKING ROD (BY OTHER)
SEALANT (BY OTHER)
ROUGH SURFACE C.J. FACE
IN–SITU CONERETE
15mm CONSIDERED AS FINISHES
CONCRETE MASS FILL
CEMENT GROUT FINISH (BY OTHER)
TRANSFER PLATE
T3F

LEVEL	PANEL MARK	QTY.
6/F–26/F, 28/F–51/F	T3PF–F–1	40
WITHOUT 13/F, 14/F, 24/F, 34/F & 44/F		

NOTES:

1. THIS DRAWING SHALL BE READ IN CONJUNCTION WITH THE PRECAST CONCRETE GENERAL ARRANGEMENT (GA) PLAN.

LEGEND:

- INSITU CONCRETE
- PRECAST FACADE
- ROUGH SURFACE C.J. FACE

Rev	Amendment	By	Chk.	App.	Date
C	AS CLOUDED	CAD	AC	LL	13.06.18
B	AS CLOUDED	CAD	AC	LL	02.05.18
A	AS CLOUDED	CAD	AC	LL	09.04.18
–	FIRST ISSUE	CAD	AC	LL	15.02.18

CLIENT :

ARCHITECT :

WONG TUNG & PARTNERS LIMITED

STRUCTURE :

AECOM

MAIN CONTRACTOR :

CR Construction Company Limited

PRECAST SUPPLIER :

REDLAND PRECAST CONCRETE PRODUCTS (CHINA) LIMITED

PROJECT :

URA KWUN TONG TOWN CENTRE REDEVELOPMENT (AREA 2 & 3) AT NKIL 6514, KWUN TONG, KOWLOON

TITLE :

SHOP DRAWING
PRECAST CONCRETE FACADE
T3PF-F-1 (6/F-26/F, 28/F-51/F ONLY)

Drawn	Checked	Approved
CAD	AC	LL
Scale 1 : 40(A3)	CAD File No.	Date 15.02.2018
First Issued 15.02.2018	Drawing No. RP/J1802/SD/0170	Rev. C

LEVEL	PANEL MARK	QTY.
6/F-26/F, 28/F-49/F	T1PF-E-1	38
WITHOUT 13/F, 14/F, 24/F, 34/F & 44/F		

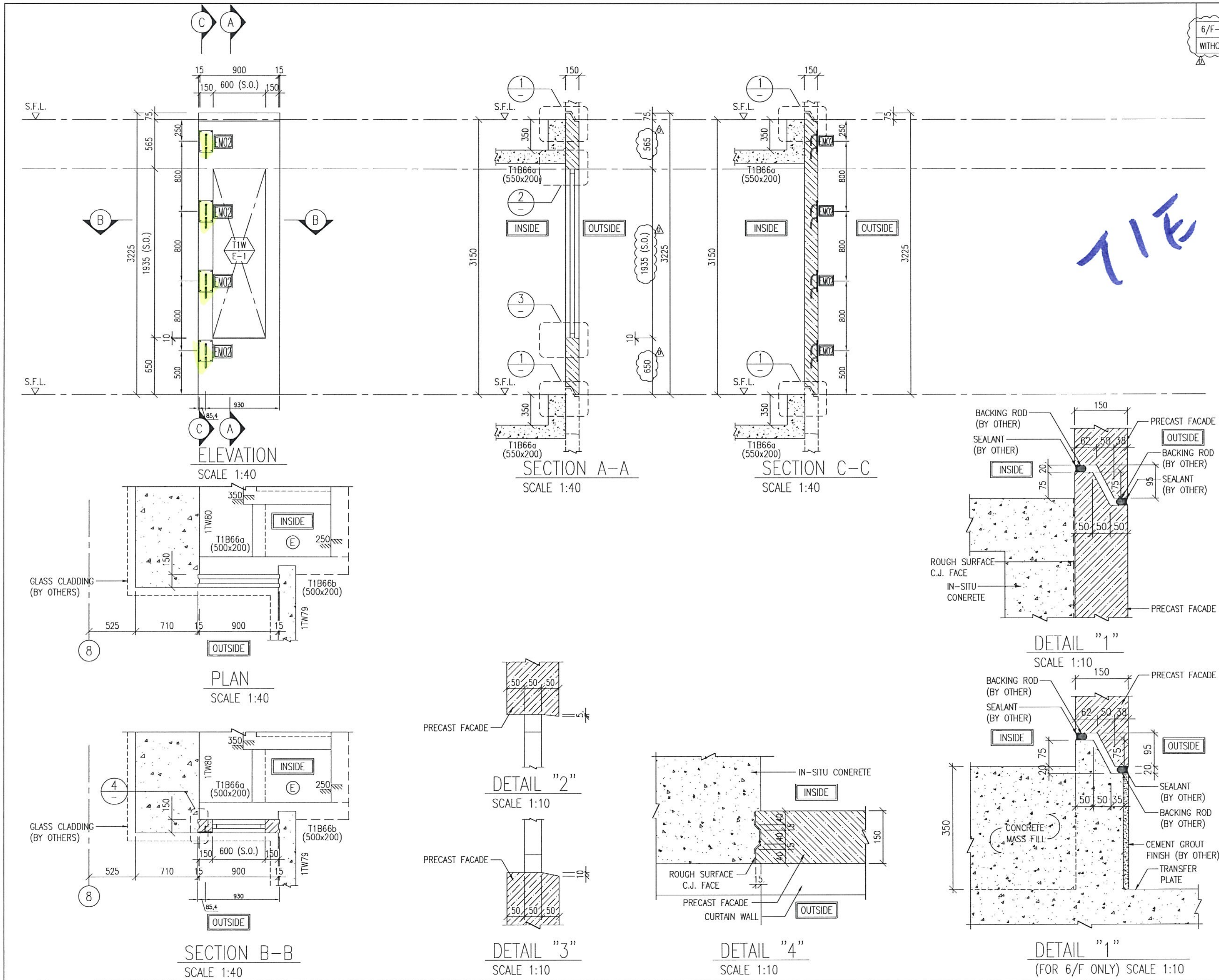
NOTES:

1. THIS DRAWING SHALL BE READ IN CONJUNCTION WITH THE PRECAST CONCRETE GENERAL ARRANGEMENT (GA) PLAN.

LEGEND:

- INSITU CONCRETE
- PRECAST FACADE
- --- ROUGH SURFACE C.J. FACE

T1E



ELEVATION
SCALE 1:40
SECTION A-A
SCALE 1:40
SECTION C-C
SCALE 1:40
PLAN
SCALE 1:40
SECTION B-B
SCALE 1:40
DETAIL "2"
SCALE 1:10
DETAIL "3"
SCALE 1:10
DETAIL "4"
SCALE 1:10
DETAIL "1"
SCALE 1:10
DETAIL "1"
(FOR 6/F ONLY) SCALE 1:10
S.F.L.
EM02
T1W E-1
INSIDE
OUTSIDE
T1B66a (550x200)
T1B66a (500x200)
T1B66b (500x200)
1TW80
1TW79
GLASS CLADDING (BY OTHERS)
PRECAST FACADE
BACKING ROD (BY OTHER)
SEALANT (BY OTHER)
ROUGH SURFACE C.J. FACE
IN-SITU CONERETE
CONCRETE MASS FILL
CEMENT GROUT FINISH (BY OTHER)
TRANSFER PLATE
CURTAIN WALL

Rev	Amendment	By	Chk.	App.	Date
D	AS CLOUDED	CAD	AC	LL	06.06.18
C	AS CLOUDED	CAD	AC	LL	27.04.18
B	AS CLOUDED	CAD	AC	LL	26.03.18
A	AS CLOUDED	CAD	AC	LL	13.02.18
–	FIRST ISSUE	CAD	AC	LL	08.02.18

CLIENT :

ARCHITECT :

WONG TUNG & PARTNERS LIMITED
ARCHITECTS & PLANNERS

STRUCTURE :

AECOM

MAIN CONTRACTOR :

CR Construction Company Limited

PRECAST SUPPLIER :

REDLAND PRECAST
CONCRETE PRODUCTS (CHINA) LIMITED

Unit04-05, 10/F., Energy Plaza, 92 Granville Road, T.S.T. East, Kowloon, Hong Kong
Tel: (852) 2580 0328 Fax: (852) 2562 9428 http://www.redlandprecast.com

PROJECT :

URA KWUN TONG TOWN CENTRE REDEVELOPMENT (AREA 2 & 3) AT NKIL 6514, KWUN TONG, KOWLOON

TITLE :

SHOP DRAWING
PRECAST CONCRETE FACADE
T1PF-E-1 (6/F-26/F, 28/F-49/F ONLY)

Drawn	Checked	Approved
CAD	AC	LL
Scale 1 : 40(A3)	CAD File No.	Date 08.02.2018
First Issued 08.02.2018	Drawing No. RP/J1802/SD/0109	Rev. D

美特鋁質有限公司
MIDI ALUMINIUM FABRICATOR LTD.

PROJECT : **URA KWUN TONG TOWN CENTRE**
REDEVELOPMENT (AREA 2 & 3)
AT NKIL 6514 KWUN TONG
KOWLOON

TITLE : **STRUCTURAL CALCULATION OF**
GLASS CLADDING & ALUM FEATURE
Pre-cast Glass Cladding

DATE: **28 NOV 2018**

Address **Unit 6-8, 1st Floor, Sunray Ind. Centre, 610 Cha Kwo Ling Road Kln.**
Tel: **2348 9200** **Fax:** **2772 7666**

TABLE OF CONTENTS

1 Check cast in Embed

1.1 Check Embed EM01 for Central Member

美特鋁質有限公司 MIDI ALUMINIUM FABRICATOR LTD.	PROJECT:	URA KWUN TONG TOWN CENTRE REDEVELOPMENT (AREA 2 & 3) AT NKIL 6514, KWUN TONG, KOWLOON		
	REPORT DATE:	03/09/2018	REPORT NO:	J837-04

D) CHECK EMBED SUPPORT ON PRECAST CONCRETE

LOADS

Support reactions (unfactored)

$WL = 3.5 \cdot kN$

$DL = 1.2 \cdot kN$

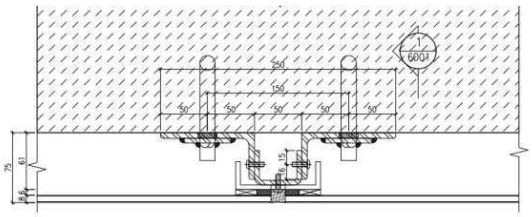
Force on the anchor group (Unfactored)

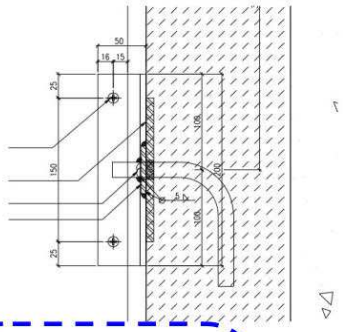
$R_z := WL = 3.5 \cdot kN$

$R_y := DL = 1.2 \cdot kN$

$e_d := 86mm$

$M_x := DL \cdot e_d = 0.1 \cdot kN \cdot m$





Reaction force on Embed (Unfactored)

$R_x := 0kN$

$R_y = 1.2 \cdot kN$

$R_z = 3.5 \cdot kN$

$M_x = 0.1 \cdot kN \cdot m$

$M_y := 0kN \cdot m$

$M_z := 0kN \cdot m$

Reaction force on Embed(factored)

$R_{xf} := 0kN$

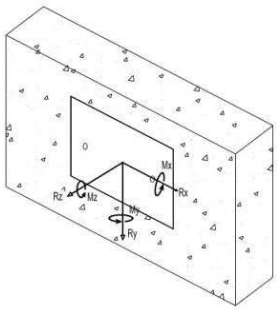
$R_{yf} := 1.4 \cdot R_y = 1.68 \cdot kN$

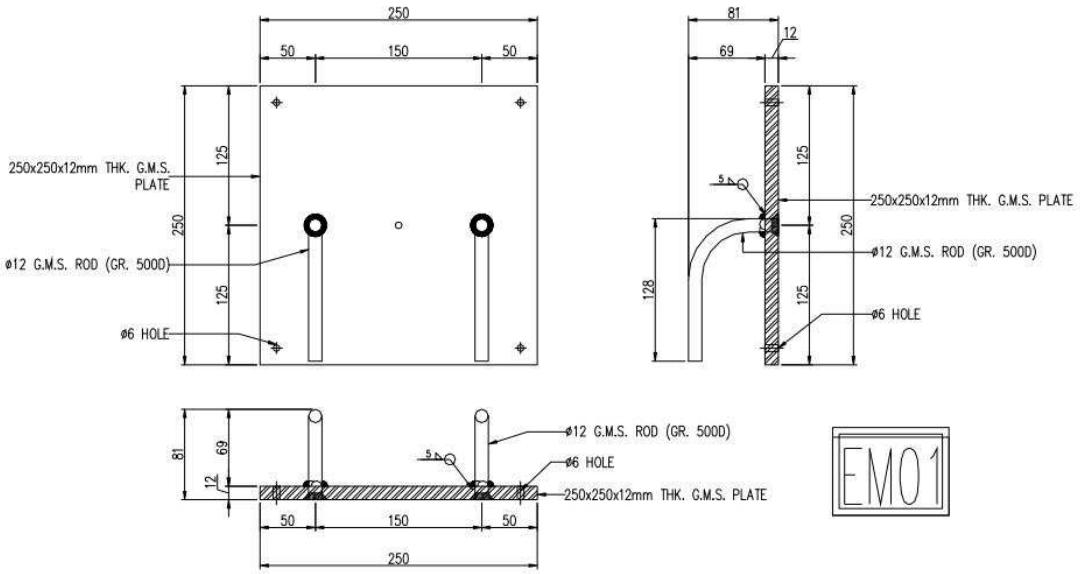
$R_{zf} := 1.4 \cdot R_z = 4.9 \cdot kN$

$M_{xf} := 1.4 \cdot M_x = 0.14 \cdot kN \cdot m$

$M_{yf} := 1.4 \cdot M_y = 0 \cdot kN \cdot m$

$M_{zf} := 1.4 \cdot M_z = 0 \cdot kN \cdot m$




250
50
150
50
125
250
125
250x250x12mm THK. G.M.S. PLATE
ø12 G.M.S. ROD (GR. 500D)
ø6 HOLE
81
12
69
5
128
81
69
12
ø12 G.M.S. ROD (GR. 500D)
ø6 HOLE
250x250x12mm THK. G.M.S. PLATE
EM01

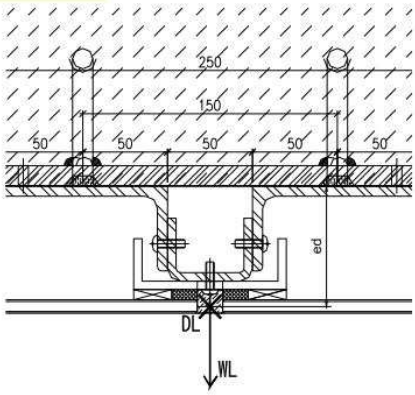
CHECK EMBED EM01 SUPPORT ON PRECAST CONCRETE

LOADS

Support reactions (unfactored)

$WL = 3.5 \cdot kN$

$DL = 1.2 \cdot kN$



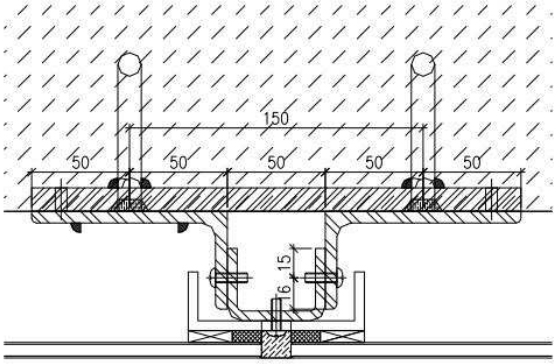
Force on the anchor group (Unfactored)

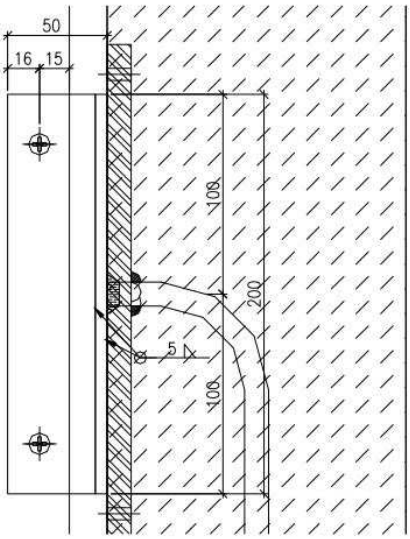
$R_z := WL = 3.5 \cdot kN$

$R_y := DL = 1.2 \cdot kN$

$e_d := 70mm + 25mm$

$M_x := DL \cdot e_d = 0.11 \cdot kN \cdot m$





Reaction force on Embed (Unfactored)

$R_x := 0kN$

$R_y = 1.2 \cdot kN$

$R_z = 3.5 \cdot kN$

$M_x = 0.11 \cdot kN \cdot m$

$M_y := 0kN \cdot m$

$M_z := 0kN \cdot m$

Reaction force on Embed(factored)

$R_{xf} := 0kN$

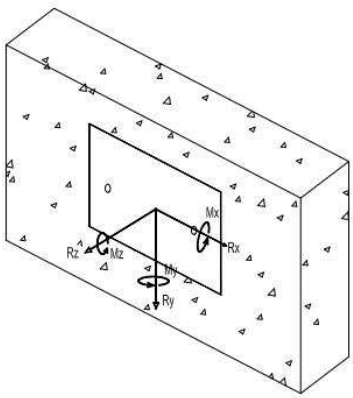
$R_{yf} := 1.4 \cdot R_y = 1.68 \cdot kN$

$R_{zf} := 1.4 \cdot R_z = 4.9 \cdot kN$

$M_{xf} := 1.4 \cdot M_x = 0.16 \cdot kN \cdot m$

$M_{yf} := 1.4 \cdot M_y = 0 \cdot kN \cdot m$

$M_{zf} := 1.4 \cdot M_z = 0 \cdot kN \cdot m$



Adopt 2 nos. ϕ12 Grade 500B Cast in Bolt

Nos. of bolts per cast-in $n := 2$

Diameter of bolt $d_b := 12mm$

Shear/tensile area of bolt $A_s := \frac{\pi \cdot d_b^2}{4} = 113.1 \cdot mm^2$

Anchorage length $L := 200mm$

a) Shear force

Shear per bolt due to DL $V_d := \frac{R_{yf}}{n} = 840\,N$

Resultant shear per bolt (factored) $V := V_d = 840\,N$

b) Check Tension

Direct Tensile force $T_w := \frac{R_{zf}}{n} = 2.45 \times 10^3\,N$

Cube strength of concrete at 28 days $f_{cu} := 35MPa$

Bearing strength of concrete $p_c := 0.4 \cdot f_{cu} = 14 \cdot MPa$

Modular ratio = m = modulus of elasticity of steel / modulus of elasticity of concrete $m_o := 15$

Tensile strength of Grade 8.8 bolt $p_t := 0.87 \cdot 500MPa = 435 \cdot MPa$

Consider bending moment about x-axis

$d_x := 125mm$ $d_x = 125 \cdot mm$

$dn_x := \left(\frac{p_c \cdot m_o}{p_c \cdot m_o + p_y}\right) \cdot d_x$ $dn_x = 54.12 \cdot mm$

$la_x := d_x - \frac{dn_x}{3}$ $la_x = 106.96 \cdot mm$

Moment $M_{xf} = 0.16 \cdot kN \cdot m$

Compressive force due to Mx (factored) $C_x := \frac{M_{xf}}{2la_x}$ $C_x = 0.75 \cdot kN$

Tensile force per rod due to Mx (factored) $T_{mx} := C_x$ $T_{mx} = 0.75 \cdot kN$

Total tension per bolt (factored) $T := T_w + T_{mx}$

$T = 3.2 \cdot kN$

3) Check Grade 500B ϕ12 Cast in Bolt

a) Check Shear

Shear per bolt (factored) $V = 840 \cdot N$

Design shear strength of rod $p_s := \frac{0.87 \cdot 500MPa}{\sqrt{3}} = 251.15 \cdot MPa$

Shear capacity of bolt $P_s := p_s \cdot A_s$

$P_s = 2.84 \times 10^4 \cdot N$ > $V = 840 \cdot N$ **OK**

b) Check Tension

Tension per bolt (factored) $T = 3.2 \times 10^3 \cdot N$

Design tensile strength of rod $p_t = 435 \cdot MPa$

Tensile capacity of bolt $P_t := 0.8 \cdot p_t \cdot A_s$

$P_t = 3.94 \times 10^4 \cdot N$ > $T = 3.2 \times 10^3 \cdot N$ **OK**

c) Check Combined Actions

Combined actions $\left(\frac{V}{P_s}\right)^2 + \left(\frac{T}{P_t}\right)^2 = 0.007$ < 1.0 **OK**

4) Check Concrete against Tension from GMS Rods to HKSC 2011

Tension per rod (factored) $T = 3.2 \times 10^3 \cdot N$

Diameter of rod $d_b = 12 \cdot mm$

Depth of embedment $L = 200 \cdot mm$

Design anchorage bond stress per rod $f_b := \frac{T}{\pi \cdot d_b \cdot L}$ *to Cl. 9.4.2(a)(i)*

$f_b = 0.42 \cdot MPa$

Cube strength of concrete at 28 days $f_{cu} = 35 \cdot MPa$

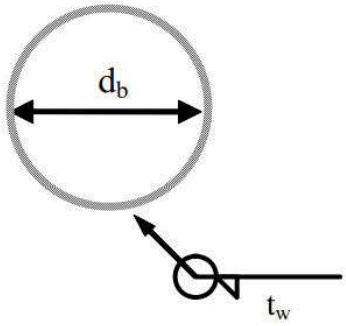
Design ultimate anchorage bond stress $f_{bu} := 0.5 \cdot \sqrt{MPa} \cdot \left(\sqrt{f_{cu}}\right)$ *to Cl. 9.4.2(a)(i)*

$f_{bu} = 2.96 \cdot MPa$ > $f_b = 0.42 \cdot MPa$ **OK**

5) Check Weld Connection on the Angle Bracket

Resultant force on weld (factored) $R_w := \sqrt{V^2 + T^2}$

$R_w = 3.3 \times 10^3 \cdot N$



Thickness of weld $t_w := 5mm$

Diameter of rod $d_b = 12 \cdot mm$

Weld length $L_w := \pi \cdot d_b$ $L_w = 37.7 \cdot mm$

Stress from resultant force $P_r := \frac{R_w}{L_w}$

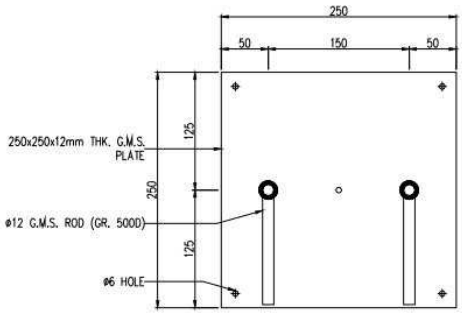
$P_r = 87.66 \cdot N \cdot mm^{-1}$

Design strength of weld $p_w := 220MPa$

Weld capacity $W_c := 0.7 \cdot t_w \cdot p_w$

$W_c = 770 \cdot N \cdot mm^{-1}$ > $P_r = 87.66 \cdot N \cdot mm^{-1}$ **OK**

6) CHECK LOCAL BENDING OF GMS ANGLE



Tension per Bolt (factored) $T = 3.2 \cdot kN$

Thickness of section $t := 12mm$

Eccentricity $e := \frac{150mm}{2} = 0.08\,m$

Eccentric moment (factored) $M_e := T \cdot e$

$M_e = 2.4 \times 10^5 \cdot N \cdot mm$

Dia. of bolt $d_f := 12mm$

Edge distance of bolt $e_g := 125mm$

Spacing of anchor $s := 150mm$

Effective breadth (assume 60 deg load spread) $b_{eff} := \min\left(e \cdot \tan(60deg), \frac{s}{2}\right) + \min\left(e \cdot \tan(60deg), e_g\right)$

$b_{eff} = 200 \cdot mm$

Elastic modulus $Z := \frac{b_{eff} \cdot t^2}{6}$ $Z = 4800 \cdot mm^3$

Plastic modulus $S := \frac{b_{eff} \cdot t^2}{4}$ $S = 7200 \cdot mm^3$

Design strength for S275 steel $p_y := 275MPa$

Bending capacity $M_c := \min\left(p_y \cdot S, 1.2 p_y \cdot Z\right)$

$M_c = 1.58 \times 10^6 \cdot N \cdot mm$ > $M_e = 2.4 \times 10^5 \cdot N \cdot mm$ **OK**

1.2 *Check Embed EM02 for Edge Member*

美特鋁質有限公司 MIDI ALUMINIUM FABRICATOR LTD.	PROJECT:	URA KWUN TONG TOWN CENTRE REDEVELOPMENT (AREA 2 & 3) AT NKIL 6514, KWUN TONG, KOWLOON		
	REPORT DATE:	03/09/2018	REPORT NO:	J837-04

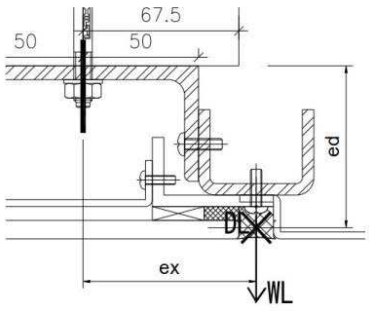
D) CHECK EMBED SUPPORT ON PRECAST CONCRETE

LOADS

Support reactions (unfactored)

$WL = 1.78 \cdot kN$

$DL = 0.61 \cdot kN$



Force on the anchor group (Unfactored)

$R_z := WL = 1.78 \cdot kN$

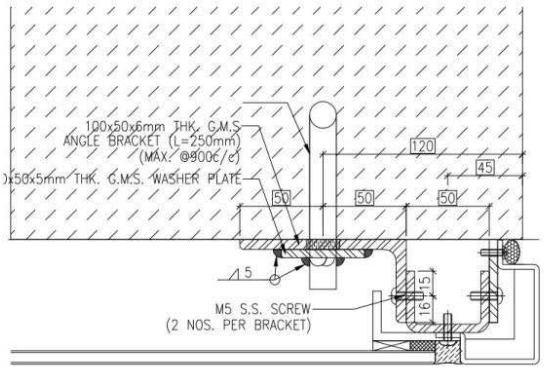
$R_y := DL = 0.61 \cdot kN$

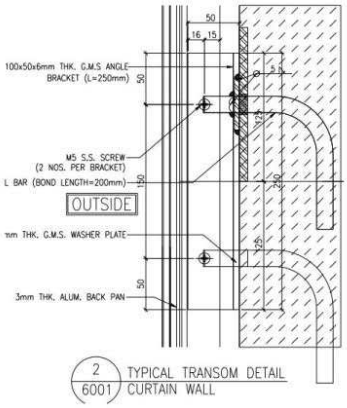
$e_x = 75 \cdot mm \quad e_d := 86mm$

$M_x := DL \cdot e_d = 0.05 \cdot kN \cdot m$

$M_y := WL \cdot e_x = 0.13 \cdot kN \cdot m$

$M_z := DL \cdot e_x = 0.05 \cdot kN \cdot m$





Reaction force on Embed (Unfactored)

$R_x := 0kN$

$R_y = 0.61 \cdot kN$

$R_z = 1.78 \cdot kN$

$M_x = 0.05 \cdot kN \cdot m$

$M_y = 0.13 \cdot kN \cdot m$

$M_z = 0.05 \cdot kN \cdot m$

Reaction force on Embed(factored)

$R_{xf} := 0kN$

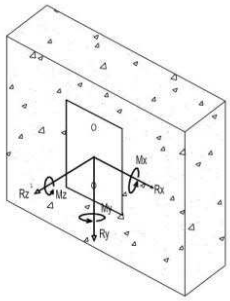
$R_{yf} := 1.4 \cdot R_y = 0.86 \cdot kN$

$R_{zf} := 1.4 \cdot R_z = 2.5 \cdot kN$

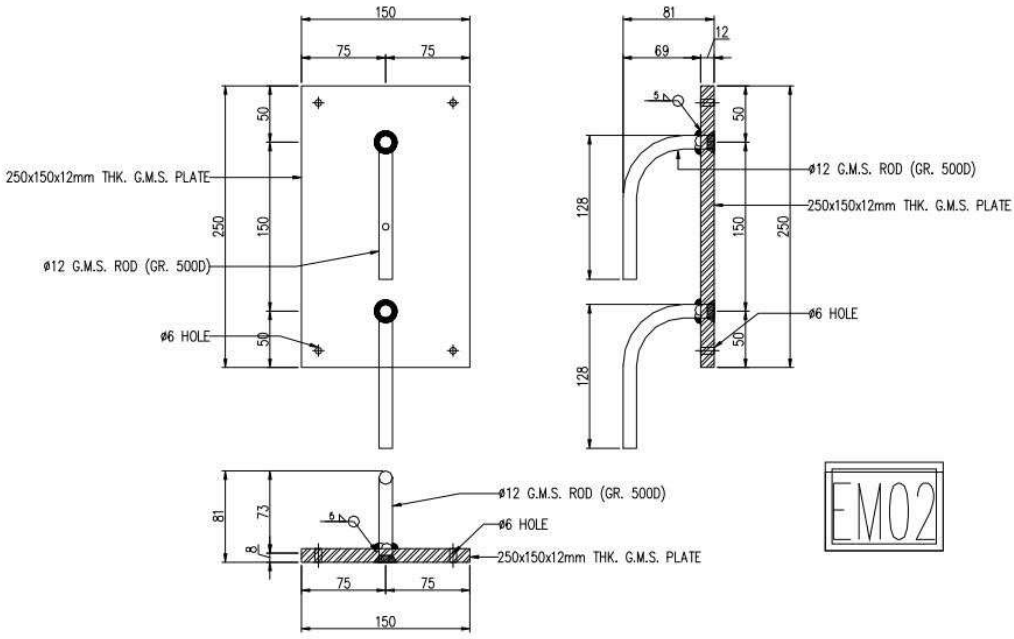
$M_{xf} := 1.4 \cdot M_x = 0.07 \cdot kN \cdot m$

$M_{yf} := 1.4 \cdot M_y = 0.19 \cdot kN \cdot m$

$M_{zf} := 1.4 \cdot M_z = 0.06 \cdot kN \cdot m$



19


150
75
75
50
250x150x12mm THK. G.M.S. PLATE
250
150
ø12 G.M.S. ROD (GR. 500D)
ø6 HOLE
50
81
12
69
ø12 G.M.S. ROD (GR. 500D)
250x150x12mm THK. G.M.S. PLATE
128
150
250
ø6 HOLE
81
73
8
ø12 G.M.S. ROD (GR. 500D)
ø6 HOLE
250x150x12mm THK. G.M.S. PLATE
75
75
150
EM02

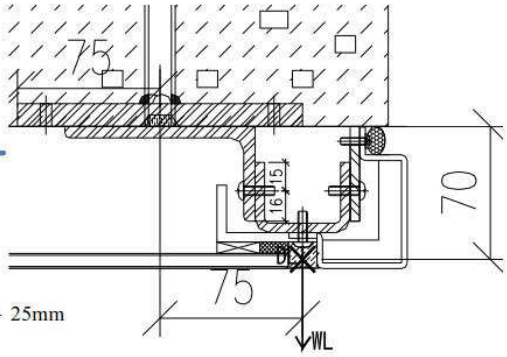
A) CHECK EMBED SUPPORT ON PRECAST CONCRETE

LOADS

Support reactions (unfactored)

$WL = 1.78 \cdot kN$

$DL = 0.61 \cdot kN$



Force on the anchor group (Unfactored)

$R_z := WL = 1.78 \cdot kN$

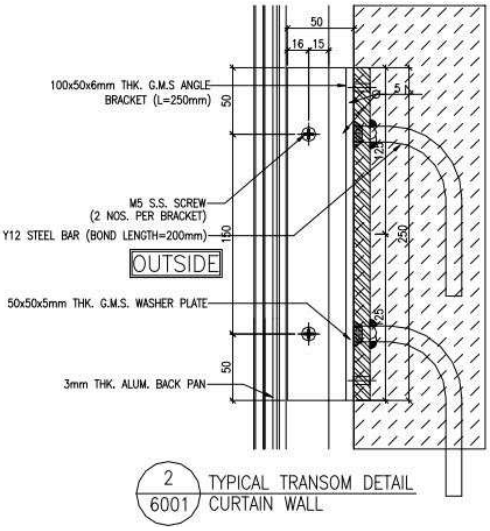
$R_y := DL = 0.61 \cdot kN$

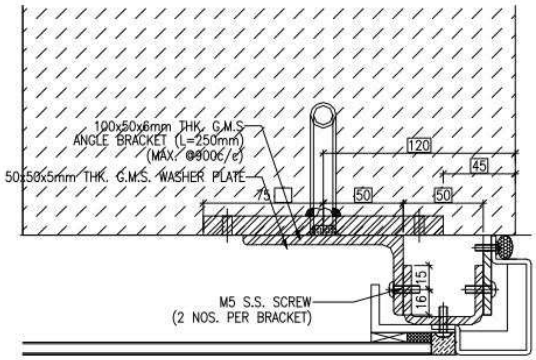
$e_x := 75mm + 25mm \quad e_d := 70mm + 25mm$

$M_x := DL \cdot e_d = 0.06 \cdot kN \cdot m$

$M_y := WL \cdot e_x = 0.18 \cdot kN \cdot m$

$M_z := DL \cdot e_x = 0.06 \cdot kN \cdot m$





Reaction force on Embed (Unfactored)

$R_x := 0kN$

$R_y = 0.61 \cdot kN$

$R_z = 1.78 \cdot kN$

$M_x = 0.06 \cdot kN \cdot m$

$M_y = 0.18 \cdot kN \cdot m$

$M_z = 0.06 \cdot kN \cdot m$

Reaction force on Embed(factored)

$R_{xf} := 0kN$

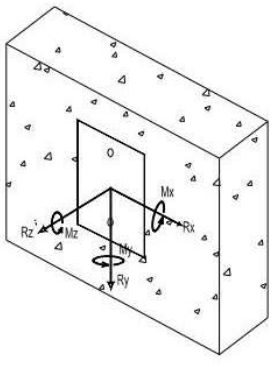
$R_{yf} := 1.4 \cdot R_y = 0.86 \cdot kN$

$R_{zf} := 1.4 \cdot R_z = 2.5 \cdot kN$

$M_{xf} := 1.4 \cdot M_x = 0.08 \cdot kN \cdot m$

$M_{yf} := 1.4 \cdot M_y = 0.25 \cdot kN \cdot m$

$M_{zf} := 1.4 \cdot M_z = 0.09 \cdot kN \cdot m$



Adopt 2 nos. ϕ12 Grade 500B Cast in Bolt

Nos. of bolts per cast-in $n := 2$

Diameter of bolt $d_b := 12mm$

Shear/tensile area of bolt $A_s := \frac{\pi \cdot d_b^2}{4} = 113.1 \cdot mm^2$

Anchorage length $L := 200mm$

a) Shear force

Shear per bolt due to DL $V_d := \frac{R_{yf}}{n} = 428.17\,N$

Torsional moment $M_{zf} = 0.09 \cdot kN \cdot m$

Spacing of bolt $s := 150mm$

Shear per bolt due to DL $V_m := \frac{M_{zf}}{s} = 570.89\,N$

Resultant shear per bolt (factored) $V := \sqrt{V_d^2 + V_m^2} = 713.61\,N$

b) Check Tension

Direct Tensile force $T_w := \frac{R_{zf}}{n} = 1.25 \times 10^3\,N$

Cube strength of concrete at 28 days $f_{cu} := 35MPa$

Bearing strength of concrete $p_c := 0.4 \cdot f_{cu} = 14 \cdot MPa$

Modular ratio = m = modulus of elasticity of steel / modulus of elasticity of concrete $m_o := 15$

Tensile strength of Grade 8.8 bolt $p_t := 0.87 \cdot 500MPa = 435 \cdot MPa$

Consider bending moment about x-axis

$d_x := 150mm$ $d_x = 150 \cdot mm$

$dn_x := \left(\frac{p_c \cdot m_o}{p_c \cdot m_o + p_y}\right) \cdot d_x$ $dn_x = 64.95 \cdot mm$

$la_x := d_x - \frac{dn_x}{3}$ $la_x = 128.35 \cdot mm$

Moment $M_{xf} = 0.08 \cdot kN \cdot m$

Compressive force due to Mx (factored) $C_x := \frac{M_{xf}}{la_x}$ $C_x = 0.63 \cdot kN$

Tensile force per rod due to Mx (factored) $T_{mx} := C_x$ $T_{mx} = 0.63 \cdot kN$

Consider bending moment about y-axis

$d_y := 75mm$ $d_y = 75 \cdot mm$

$dn_y := \left(\frac{p_c \cdot m_o}{p_c \cdot m_o + p_y}\right) \cdot d_y$ $dn_y = 32.47 \cdot mm$

$la_y := d_y - \frac{dn_y}{3}$ $la_y = 64.18 \cdot mm$

Moment $M_{yf} = 0.25 \cdot kN \cdot m$

Compressive force due to My (factored) $C_y := \frac{M_{yf}}{la_y}$ $C_y = 3.89 \cdot kN$

Tensile force per rod due to My (factored) $T_{my} := \frac{C_y}{2}$ $T_{my} = 1.95 \cdot kN$

Total tension per bolt (factored) $T := T_w + T_{mx} + T_{my}$

$T = 3.83 \cdot kN$

3) Check Grade 500B ϕ12 Cast in Bolt

a) Check Shear

Shear per bolt (factored) $V = 713.61 \cdot N$

Design shear strength of rod $p_s := \frac{0.87 \cdot 500MPa}{\sqrt{3}} = 251.15 \cdot MPa$

Shear capacity of bolt $P_s := p_s \cdot A_s$

$P_s = 2.84 \times 10^4 \cdot N$ > $V = 713.61 \cdot N$ **OK**

b) Check Tension

Tension per bolt (factored) $T = 3.83 \times 10^3 \cdot N$

Design tensile strength of rod	$p_t = 435 \cdot MPa$			
Tensile capacity of bolt	$P_t := 0.8 \cdot p_t \cdot A_s$			
	$P_t = 3.94 \times 10^4 \cdot N$	>	$T = 3.83 \times 10^3 \cdot N$	**OK**

c) Check Combined Actions

Combined actions	$\left(\frac{V}{P_s}\right)^2 + \left(\frac{T}{P_t}\right)^2 = 0.01$	<	1.0	**OK**

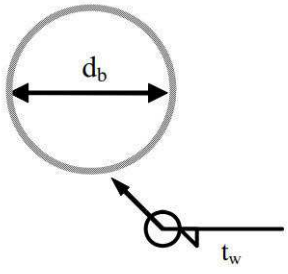
4) Check Concrete against Tension from GMS Rods to HKSC 2011

Tension per rod (factored)	$T = 3.83 \times 10^3 \cdot N$			
Diameter of rod	$d_b = 12 \cdot mm$			
Depth of embedment	$L = 200 \cdot mm$			
Design anchorage bond stress per rod	$f_b := \frac{T}{\pi \cdot d_b \cdot L}$			*to Cl. 9.4.2(a)(i)*
	$f_b = 0.51 \cdot MPa$			
Cube strength of concrete at 28 days	$f_{cu} = 35 \cdot MPa$			
Design ultimate anchorage bond stress	$f_{bu} := 0.5 \cdot \sqrt{MPa} \cdot \left(\sqrt{f_{cu}}\right)$			*to Cl. 9.4.2(a)(i)*
	$f_{bu} = 2.96 \cdot MPa$	>	$f_b = 0.51 \cdot MPa$	**OK**

5) Check Weld Connection on the Angle Bracket

Resultant force on weld (factored) $R_w := \sqrt{V^2 + T^2}$

$R_w = 3.89 \times 10^3 \cdot N$



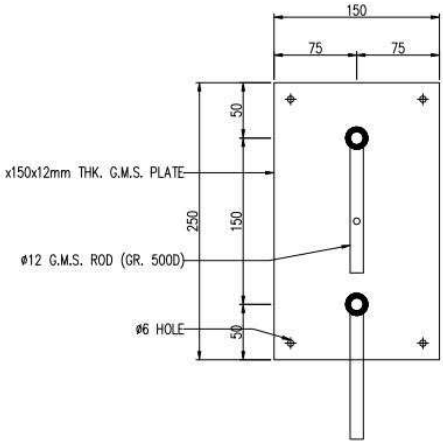
Thickness of weld	$t_w := 5mm$			
Diameter of rod	$d_b = 12 \cdot mm$			
Weld length	$L_w := \pi \cdot d_b$			
	$L_w = 37.7 \cdot mm$			
Stress from resultant force	$P_r := \frac{R_w}{L_w}$			
	$P_r = 103.31 \cdot N \cdot mm^{-1}$			
Design strength of weld	$p_w := 220MPa$			
Weld capacity	$W_c := 0.7 \cdot t_w \cdot p_w$			
	$W_c = 770 \cdot N \cdot mm^{-1}$	>	$P_r = 103.31 \cdot N \cdot mm^{-1}$	**OK**

6) CHECK LOCAL BENDING OF GMS ANGLE

Tension per Bolt (factored) $T = 3.83 \cdot kN$

Thickness of section $t := 12mm$

Eccentricity $e := \frac{150mm}{2} = 75 \cdot mm$



Eccentric moment (factored) $M_e := T \cdot e$

$M_e = 2.87 \times 10^5 \cdot N \cdot mm$

Edge distance of bolt $e_g := 75mm$

Spacing of anchor $s := 150mm$

Effective breadth (assume 60 deg load spread) $b_{eff} := \min\left(e \cdot \tan(60deg), \frac{s}{2}\right) + \min\left(e \cdot \tan(60deg), e_g\right)$

$b_{eff} = 150 \cdot mm$

Elastic modulus $Z := \frac{b_{eff} \cdot t^2}{6}$ $Z = 3600 \cdot mm^3$

Plastic modulus $S := \frac{b_{eff} \cdot t^2}{4}$ $S = 5400 \cdot mm^3$

Design strength for S275 steel $p_y := 275MPa$

Bending capacity $M_c := \min\left(p_y \cdot S, 1.2 p_y \cdot Z\right)$

$M_c = 1.19 \times 10^6 \cdot N \cdot mm$ > $M_e = 2.87 \times 10^5 \cdot N \cdot mm$ **OK**