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 / 0179 / 19** 修改版次：**-**

工程編號 ：**J - 837** 工程名稱 ：觀塘裕民坊

工程項目 ：幕牆 修補方案用配件 **(HST3-R M16)**

案收件人 ：林哥 發件人 ： **Ant Yeung** 日 期 ：**28/01/2019**

☐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 ：

本地盆的修補方案(Remedial) 已計數，只有一款 HST3-R M16 。(已出信 MC38761)(比原計數)

有 2 個方案，Case 1 ：Load Width 大於 1000mm (MC38760)(比力數)

Case 2 ：Load Width 少於 1000mm

*Load Width = 預留碼左右兩倉相加，然後除 2

按則師 2019.01.18 對 3rd Curtain Wall Shop Dwg comment，

現附上 BM，請訂購修補方案用配件送地盆使用。

請在 **2019 / 02 / 15** 前完成上列要求。

附：**6** 頁文件，**1** 頁 **BM.** ，**12** 頁 **+ MC**

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 永利 ( )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 梅

( )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 林哥 ( )地盤科文☐連附件 炳哥 / 有哥 / 豪 / 民

( )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：

HK 0298 / 19

發件人簽署：

項目經理簽署：

美特鋁質有限公司	工程號: J-837		計算:		日期:	2019.01.28	送呈:	
MIDI Aluminium Fabricator Ltd.	地盤名稱: 觀塘裕民坊		核對:		日期:		副本:	
地盤用配件B.M.表	項目類別: 修補方案		批准:		日期:			
BM編號:837-CW-M01-S-HP03B	A/C Code	EI0179						

序號	修改標示	配件圖號	物料編號	配件名稱	顏色	實用	後備	總數	單位	備注
1			HILTI HST3-R	M16x135mm拉爆	A4-70	234	66	300	粒	幕牆修補方案用

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:	*18/01/2019*	REPORT NO:	*J837-03D*

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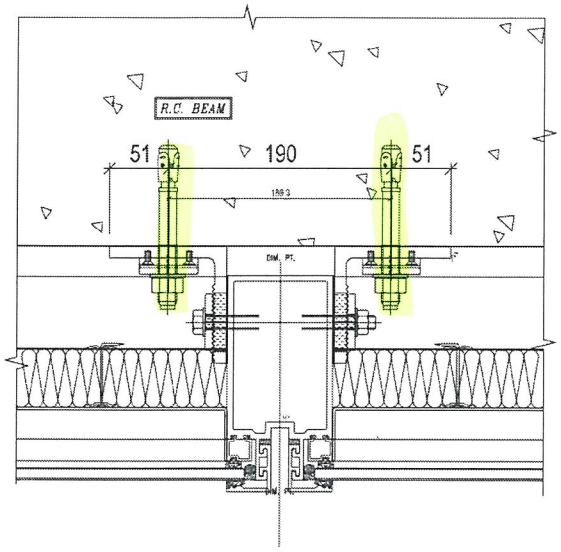
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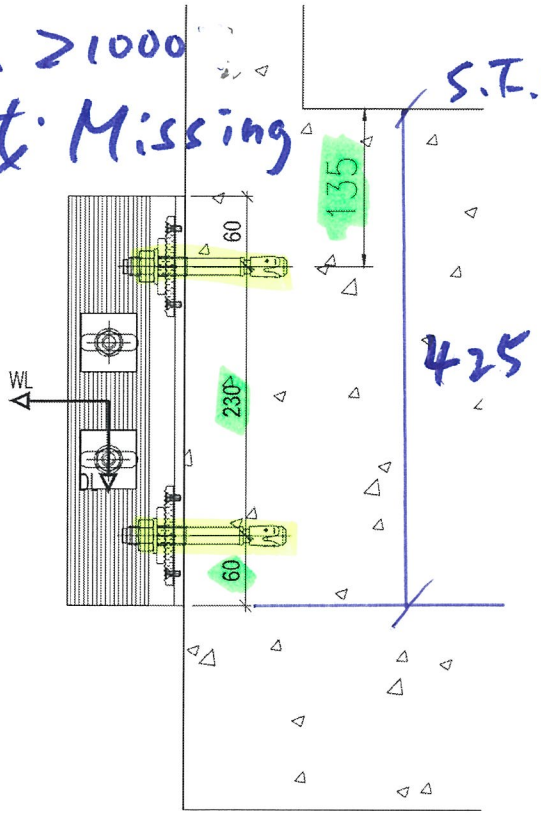
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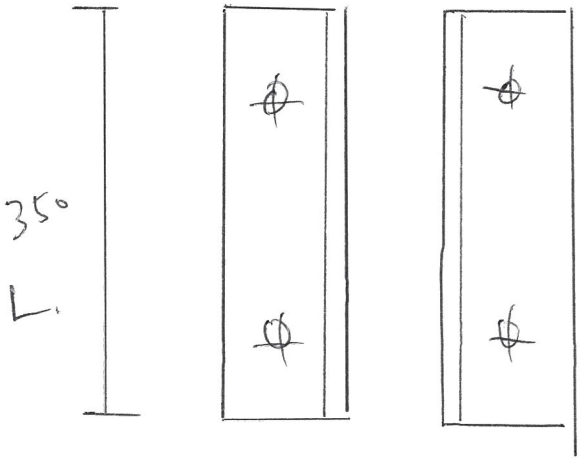
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美特鋁質有限公司 MIDI ALUMINIUM FABRICATOR LTD.	PROJECT:	URA KWUN TONG TOWN CENTRE REDEVELOPMENT (AREA 2 & 3) AT NKIL 6514, KWUN TONG, KOWLOON		
	REPORT DATE:	18/01/2019	REPORT NO:	J837-03D

RD-1 Load Width ≥1000 或 Missing







① HST3-R M16 X 4 牙长

② 加長錨碼 200 → 350

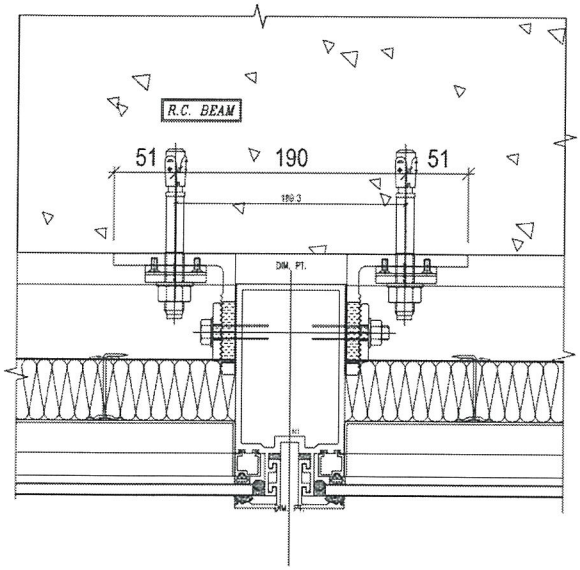
③ S.T.L T 135

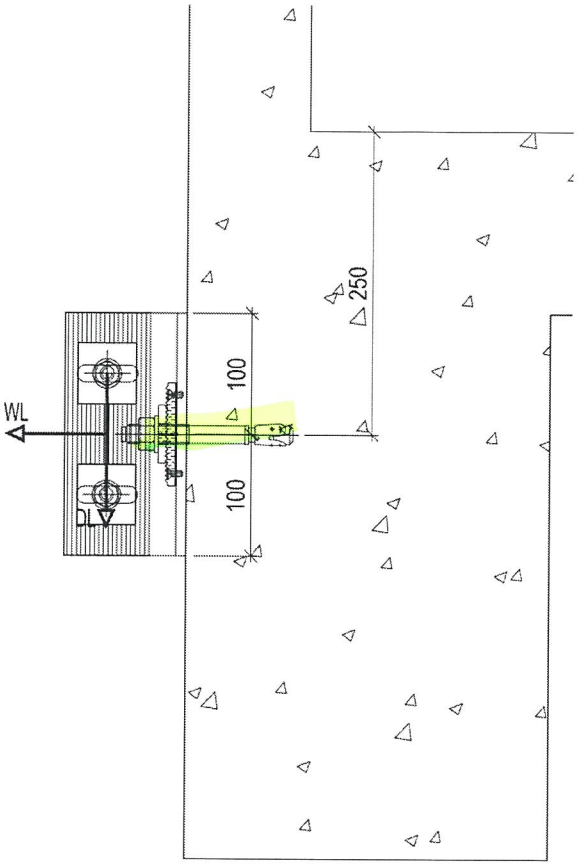
再下 230.

2

1.1.3 RD2-Central Cast in Channel (Missing, 2 NOS HST3-R M16 For 1000 LOAD WIDTH)

RD-2

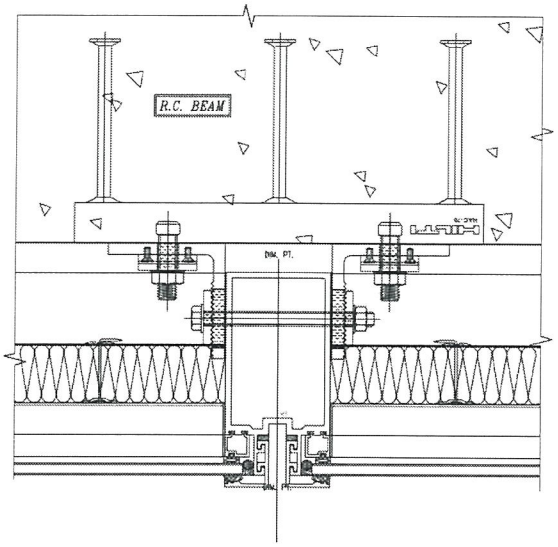




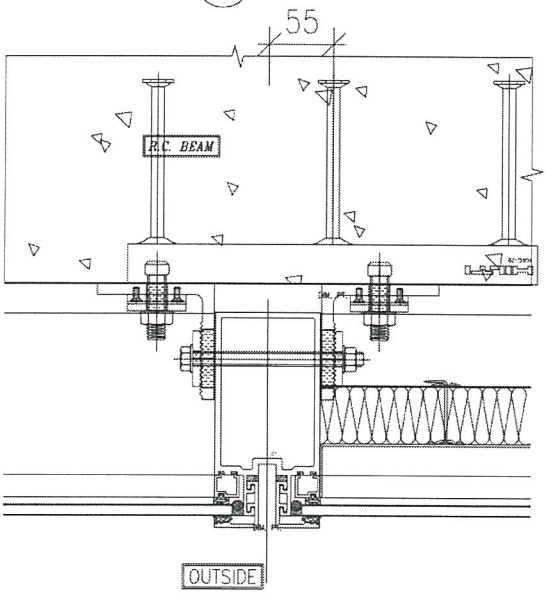
HST3-R M16 x2

3

1.1.4 *RD3-Central Cast in Channel (Shft Horizontal 55mm)*



3 / 5003 TYPICAL MULLION DETAIL CURTAIN WALL



3 / 5003 TYPICAL MULLION DETAIL CURTAIN WALL

X = ±55

channel 可用.

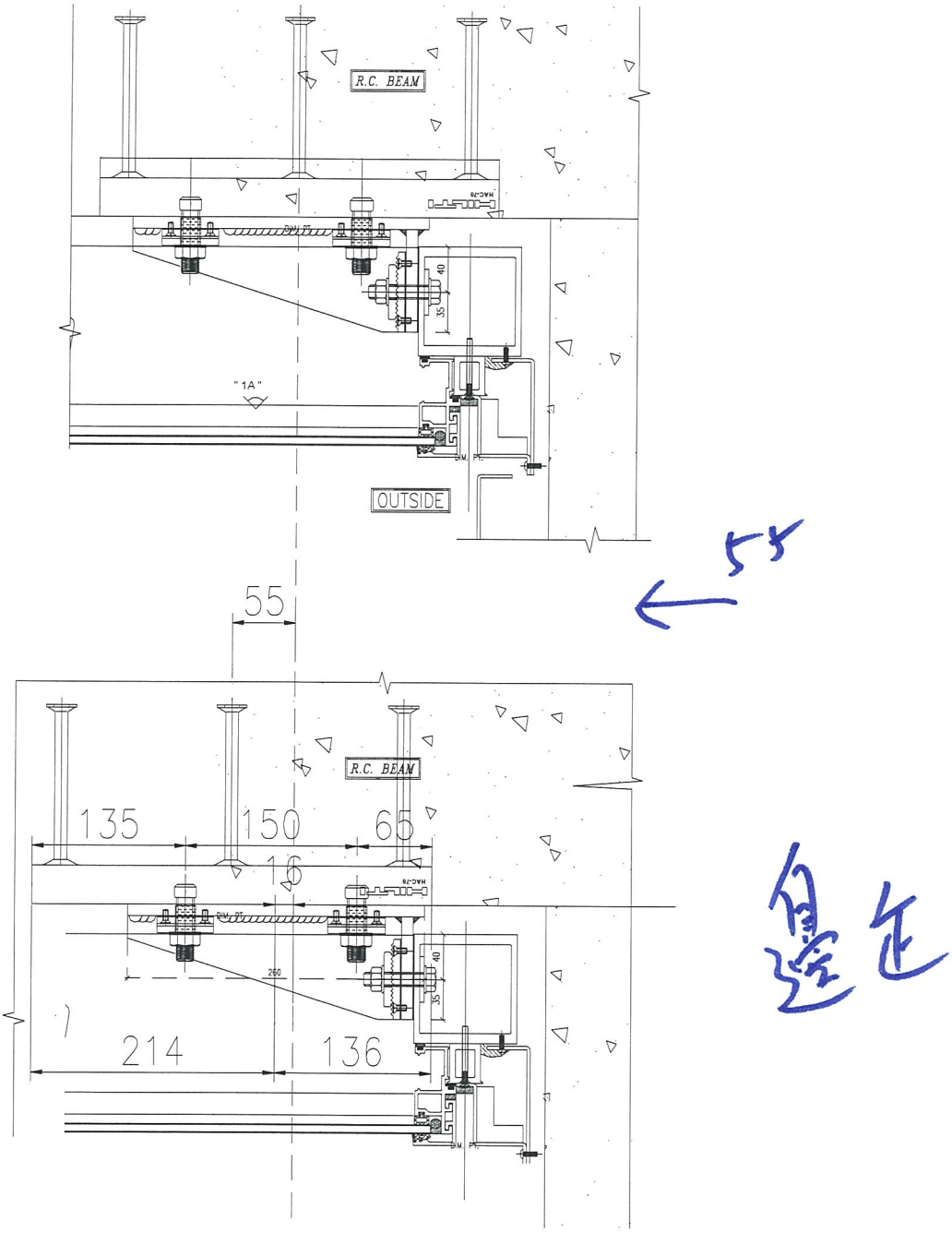
不需打粒爆

擦邊位

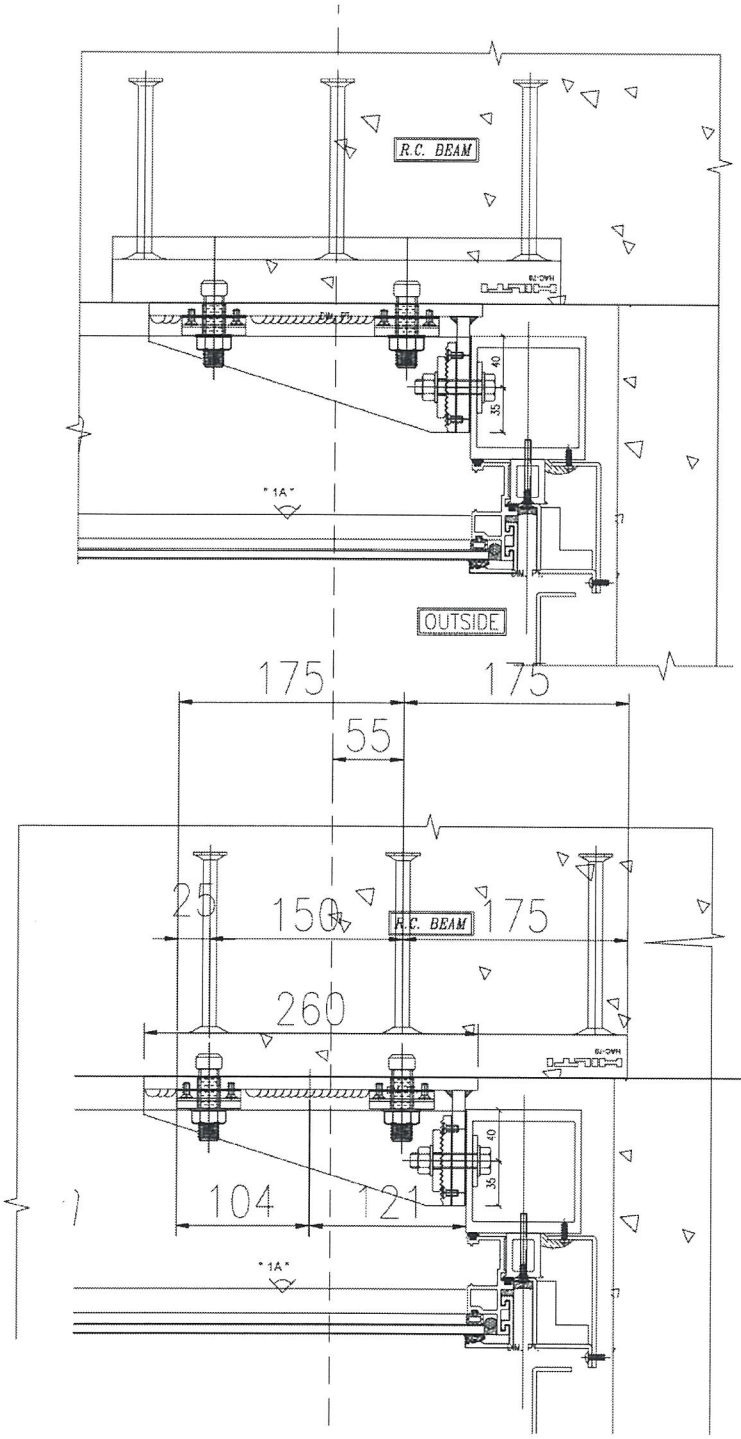
TYPICAL CENTRAL MULLION

X- MAX LEFT RIGHT 55mm
Y- MAX 25mm UPWARD
Z- MAX 25mm INWARD

1.1.5 *RD4-Edge Cast in Channel (Shft Horizontal Left 55mm)*



1.1.6 *RD5-Edge Cast in Channel (Shft Horizontal Right 55mm)*



55

下Z179
HK298

JB37

2-4F 1.18

則師對 CW 3rd Shop Dwg

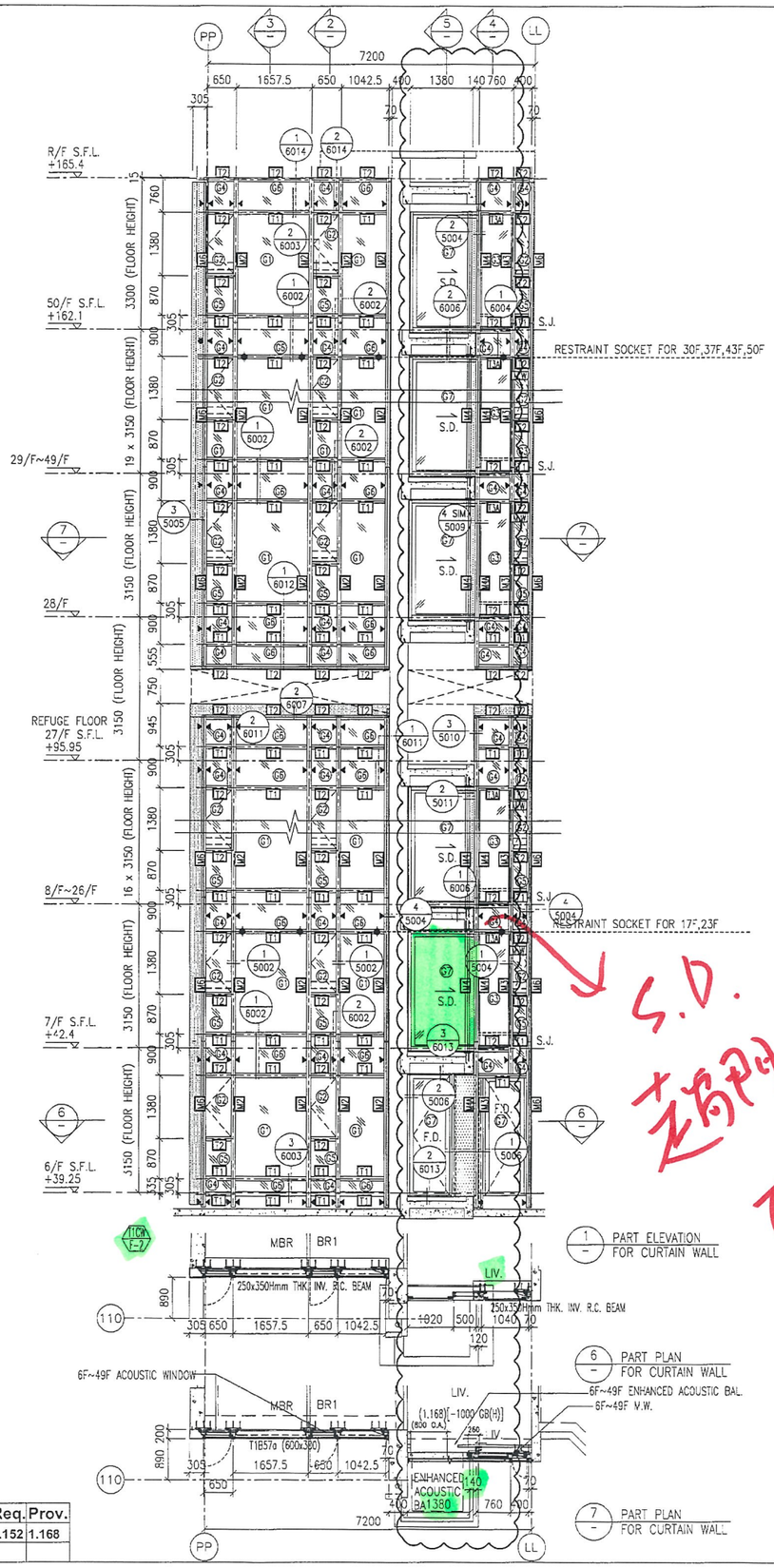
最後確定更修改的 Elevation. 給倉.

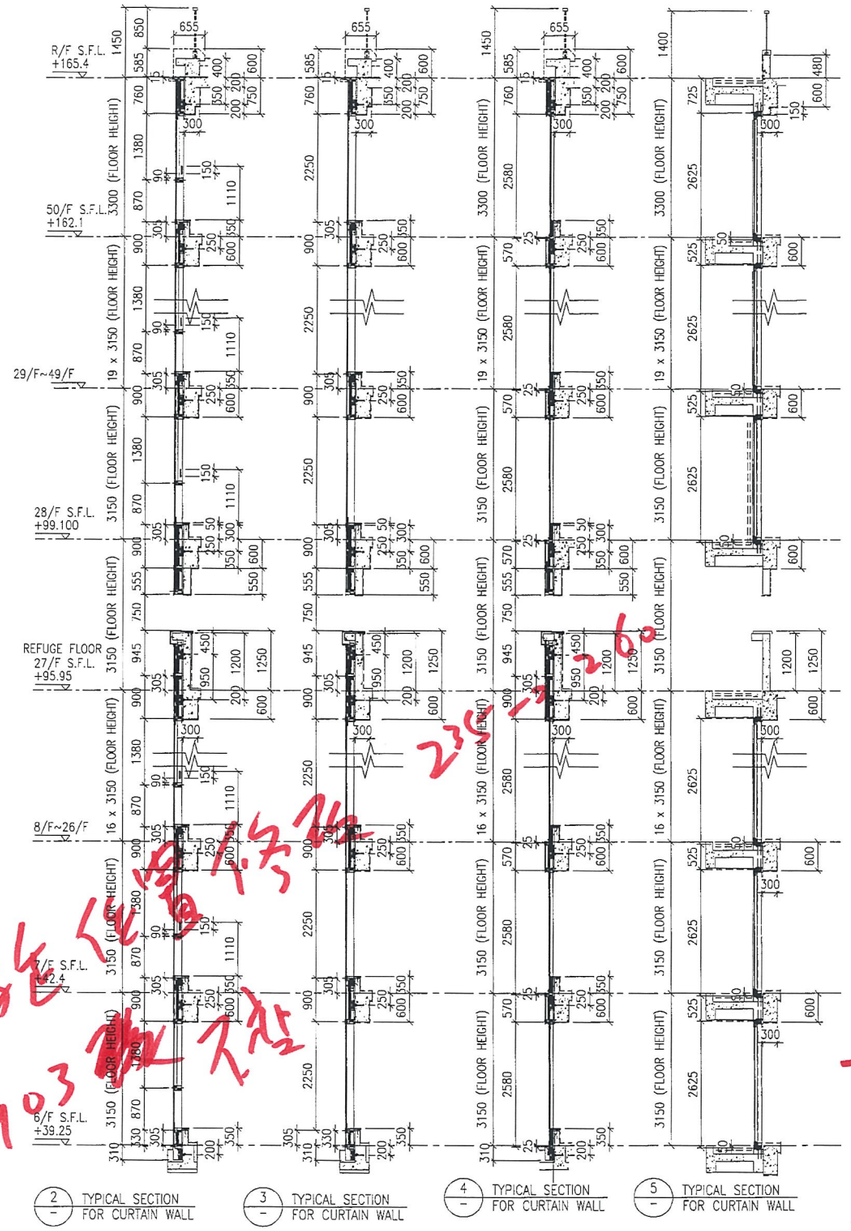
22/下	T1.	T1F	T1E	T1J.K		四個等位
26/下	T2	T2H	T2N	T2L	T2KJ	三個等位
25/下	T5	T5K				1個等位

T5G 不設

30+6.+36+36
+32
=234.

2103
2105
2112
2201
2209
2211
2212
2506
2509





2 TYPICAL SECTION FOR CURTAIN WALL

3 TYPICAL SECTION FOR CURTAIN WALL

4 TYPICAL SECTION FOR CURTAIN WALL

5 TYPICAL SECTION FOR CURTAIN WALL

1 PART ELEVATION FOR CURTAIN WALL

6 PART PLAN FOR CURTAIN WALL

6F~49F ENHANCED ACOUSTIC BAL.

6F~49F W.W.

7 PART PLAN FOR CURTAIN WALL

Flat	Room	Req.	Prov.
T1F	LIV.+M.BATH	1.152	1.168

LEGEND:

- G1+ – 10 mm THK. TEMPERED BLUE TINTED GLASS (OUTER) + 9 mm AIR SPACE + 8 mm THK. TEMPERED CLEAR GLASS (INNER)
- G2+ – 8 mm THK. HEAT STRENGTHENED TINTED GLASS (OUTER)+ 9 mm AIR SPACE + 8 mm THK. HEAT STRENGTHENED CLEAR GLASS (INNER)
- G3+ – 10 mm THK. HEAT STRENGTHENED BLUE TINTED GLASS (OUTER)+ 9 mm AIR SPACE + 8 mm THK. TEMPERED CLEAR GLASS (INNER)
- G4+ – 8 mm THK. HEAT STRENGTHENED BLUE TINTED GLASS (SPANDREL GLASS)
- G5+ – 8 mm THK. HEAT STRENGTHENED BLUE TINTED GLASS (OUTER)+ 9 mm AIR SPACE + 8 mm THK. TEMPERED CLEAR GLASS (INNER)
- G6+ – 8 mm THK. TEMPERED BLUE TINTED GLASS (SPANDREL GLASS)
- G7+ – 8 mm THK. HEAT STRENGTHENED TINTED GLASS (OUTER)+ 1.52PVB + 8 mm THK. HEAT STRENGTHENED CLEAR LAMINATED GLASS (INNER)
- 10 mm THK. TEMPERED GLASS (INTERNAL PROTECTIVE BARRIER)
- 3 mm THK. ALUM. CLADDING
- M.W. – MAINTENANCE WINDOW
- S.J. – STACK JOINT
- A-01 – ALUM. EXTRUSION DIE NO.
- ▲ – SUPPORT POINT
- ◆ – RESTRAINT SOCKET

B.D. REF :

CLIENT :
信和置業有限公司
Sino Land Company Limited

ARCHITECT :
WONG TUNG & PARTNERS LIMITED
ARCHITECTS & PLANNERS

MAIN CONTRACTOR :
CR Construction Company Limited

STRUCTURAL ENGINEER :
AECOM

FACADE CONSULTANT:
AECOM

NOTE :
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2. ALL ELEVATIONS ARE VIEWED FROM OUTSIDE.
3. ALL DIMENSIONS TO BE VERIFIED ON SITE BEFORE FABRICATION.

LEGEND :
- X1 / X001 – DETAIL MARK NO. / REFER SHEET NO.
1. F.F.L. --FINISHED FLOOR LEVEL
2. S.F.L. --STRUCTURAL FLOOR LEVEL
3. /R --REVERSED DETAIL

NO.	DATE	REVISED	BY
D	22/12/2018	GENERAL REVISED	
C	04/12/2018	GENERAL REVISED	
B	24/11/2018	GENERAL REVISED	
A	10/9/2018	GENERAL REVISED	

JOB NO. : J-837

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

TITLE :
PART ELEVATION OF CURTAIN WALL AT TOWER 1

DATE : 04-JUL-18 | SCALE : 1:60 (A1)

DRAWN BY : ASING | CHECKED BY : -

美特鋁質有限公司
MIDI ALUMINIUM FABRICATOR LTD.
Units 6-8, Sunray Industrial Centre, 1/F
610 Cha Kwo Ling Road, Kowloon
Tel:23489211-4 Fax:(852)27727666

DWG NO. : J837-CW-2103 | REV. : D

2

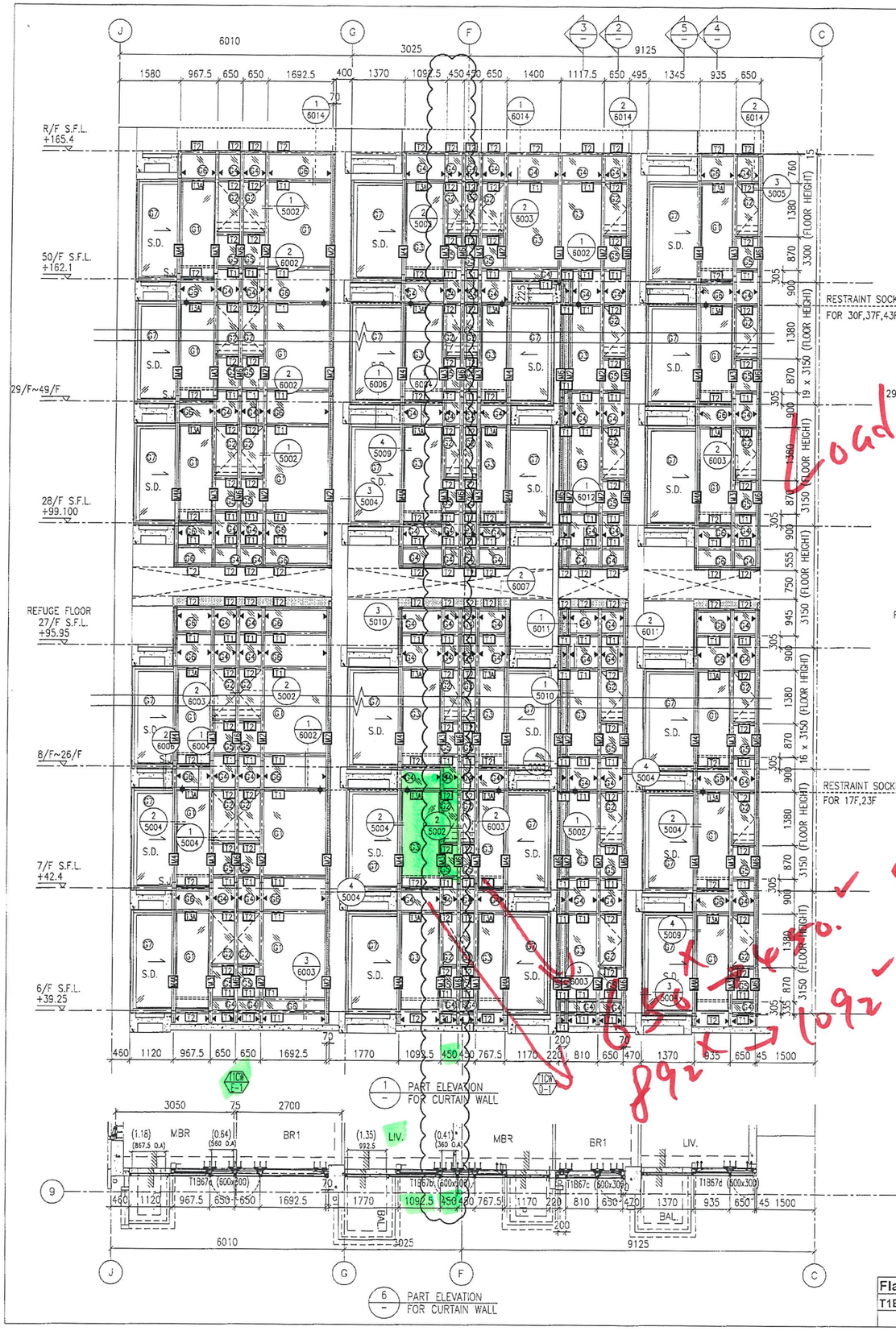
6-24/F Remedial

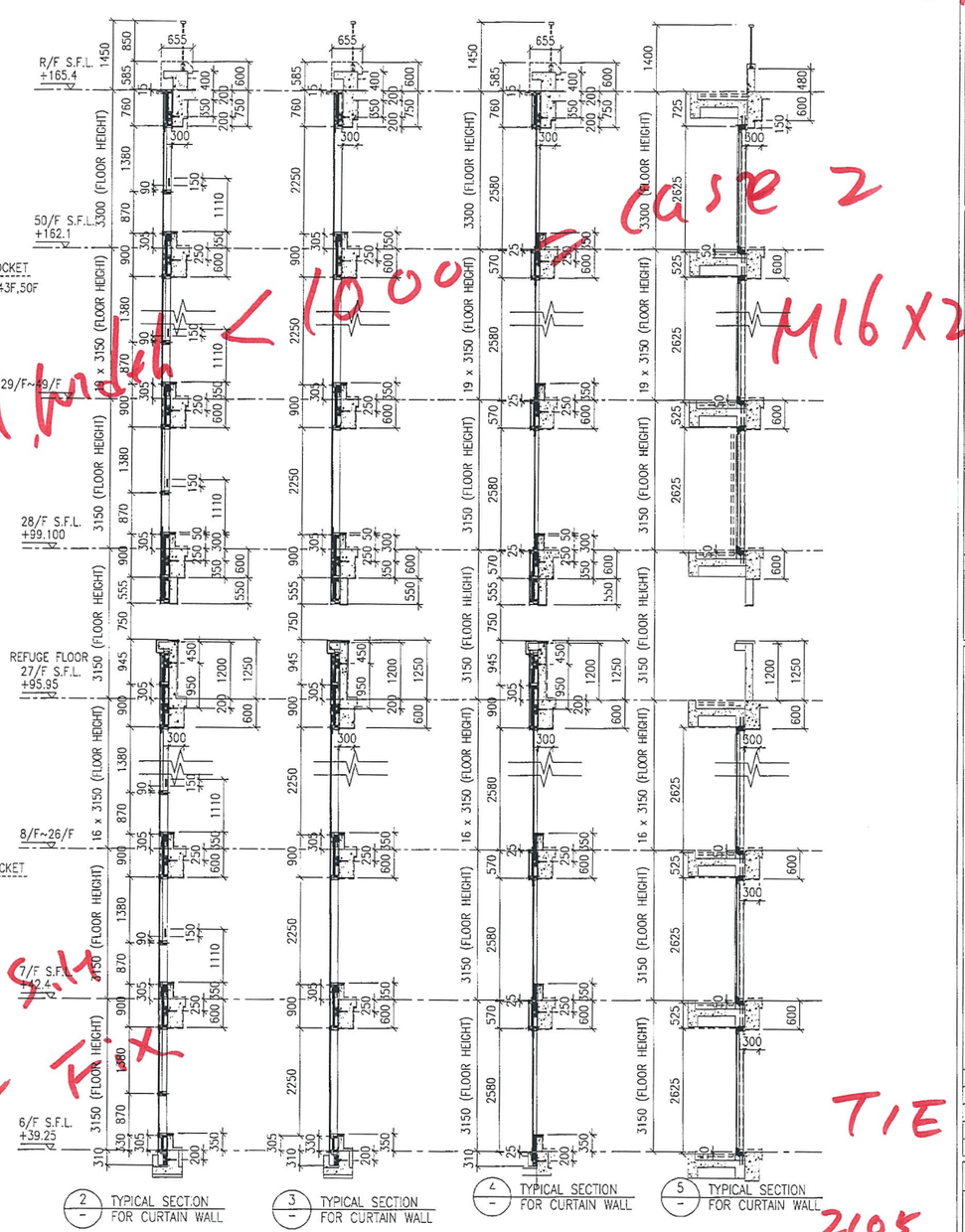
15層

15×2=30 塊

Load Width < 10000 ← case 2

M16×2





T1E

210s

Flat	Room	Req.	Prov.
T1E	LIV.	0.968	1.76
	MBR	0.675	1.82

LEGEND:

- G1+ – 10 mm THK. TEMPERED BLUE TINTED GLASS (OUTER) + 9 mm AIR SPACE + 8 mm THK. TEMPERED CLEAR GLASS (INNER)
- G2+ – 8 mm THK. HEAT STRENGTHENED TINTED GLASS (OUTER)+ 9 mm AIR SPACE + 8 mm THK. HEAT STRENGTHENED CLEAR GLASS (INNER)
- G3+ – 10 mm THK. HEAT STRENGTHENED BLUE TINTED GLASS (OUTER)+ 9 mm AIR SPACE + 8 mm THK. TEMPERED CLEAR GLASS (INNER)
- G4+ – 8 mm THK. HEAT STRENGTHENED BLUE TINTED GLASS (SPANDREL GLASS)
- G5+ – 8 mm THK. HEAT STRENGTHENED BLUE TINTED GLASS (OUTER)+ 9 mm AIR SPACE + 8 mm THK. TEMPERED CLEAR GLASS (INNER)
- G6+ – 8 mm THK. TEMPERED BLUE TINTED GLASS (SPANDREL GLASS)
- G7+ – 8 mm THK. HEAT STRENGTHENED TINTED GLASS (OUTER)+ 1.52PVB + 8 mm THK. HEAT STRENGTHENED CLEAR LAMINATED GLASS (INNER)
- 10 mm THK. TEMPERED GLASS (INTERNAL PROTECTIVE BARRIER)
- 3 mm THK. ALUM. CLADDING
- M.W. – MAINTENANCE WINDOW
- S.J. – STACK JOINT
- AF01 – ALUM. EXTRUSION DIE NO.
- ▲ – SUPPORT POINT
- ◆ – RESTRAINT SOCKET

B.D. REF :

CLIENT :
信和置業有限公司
Sino Land Company Limited

ARCHITECT :
WONG TUNG & PARTNERS LIMITED
ARCHITECTS & PLANNERS

MAIN CONTRACTOR :
CR Construction Company Limited

STRUCTURAL ENGINEER :
AECOM

FACADE CONSULTANT:
AECOM

NOTE :
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2. ALL ELEVATIONS ARE VIEWED FROM OUTSIDE.
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LEGEND :
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2. S.F.L. -- STRUCTURAL FLOOR LEVEL
3. (R) -- REVERSED DETAIL

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C	04/12/2018	GENERAL REVISED	
B	24/11/2018	GENERAL REVISED	
A	10/9/2018	GENERAL REVISED	

JOB NO. : J-837

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

TITLE :
PART ELEVATION OF CURTAIN WALL AT TOWER 1

DATE : 04-JUL-18 | SCALE : 1:60 (A1)

DRAWN BY : ASING | CHECKED BY : -

美特鋁質有限公司
MIDI ALUMINIUM FABRICATOR LTD.
Units 6-8, Sunray Industrial Centre, 1/F
610 Cha Kwo Ling Road, Kowloon
Tel:23489211-4 Fax:(852)27727666

DWG NO. : J837-CW-2105 | REV. : D

3

Load Width < 1000

M16 X2

6 - 27/F Remedial 15层

2X15X2 = 60

S.D. → F.D.

S.M+Fix → T.H



Flat	Room	Req.	Prov.
T1K	MBR	0.585	1.705
T1J	MBR	0.599	1.705

LEGEND:

- G1 – 10 mm THK. TEMPERED BLUE TINTED GLASS (OUTER) + 9 mm AIR SPACE + 8 mm THK. TEMPERED CLEAR GLASS (INNER)
- G2 – 8 mm THK. HEAT STRENGTHENED TINTED GLASS (OUTER)+ 9 mm AIR SPACE + 8 mm THK. HEAT STRENGTHENED CLEAR GLASS (INNER)
- G3 – 10 mm THK. HEAT STRENGTHENED BLUE TINTED GLASS (OUTER)+ 9 mm AIR SPACE + 8 mm THK. TEMPERED CLEAR GLASS (INNER)
- G4 – 8 mm THK. HEAT STRENGTHENED BLUE TINTED GLASS (SPANDREL GLASS)
- G5 – 8 mm THK. HEAT STRENGTHENED BLUE TINTED GLASS (OUTER)+ 9 mm AIR SPACE + 8 mm THK. TEMPERED CLEAR GLASS (INNER)
- G6 – 8 mm THK. TEMPERED BLUE TINTED GLASS (SPANDREL GLASS)
- G7 – 8 mm THK. HEAT STRENGTHENED TINTED GLASS (OUTER)+ 1.52PVB + 8 mm THK. HEAT STRENGTHENED CLEAR LAMINATED GLASS (INNER)
- 10 mm THK. TEMPERED GLASS (INTERNAL PROTECTIVE BARRIER)
- 3 mm THK. ALUM. CLADDING
- M.W. – MAINTENANCE WINDOW
- S.J. – STACK JOINT
- AE01 – ALUM. EXTRUSION DIE NO.
- ▲ – SUPPORT POINT
- ◆ – RESTRAINT SOCKET

B.D. REF :

CLIENT : 信和置業有限公司 Sino Land Company Limited

ARCHITECT : WONG TUNG & PARTNERS LIMITED ARCHITECTS & PLANNERS

MAIN CONTRACTOR : CR Construction Company Limited

STRUCTURAL ENGINEER : AECOM

FACADE CONSULTANT: AECOM

NOTE :
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C	04/12/2018	GENERAL REVISED	
B	24/11/2018	GENERAL REVISED	
A	10/9/2018	GENERAL REVISED	

T1K
T1J

2112

JOB NO. : J-837

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

TITLE : PART ELEVATION OF CURTAIN WALL AT TOWER 1

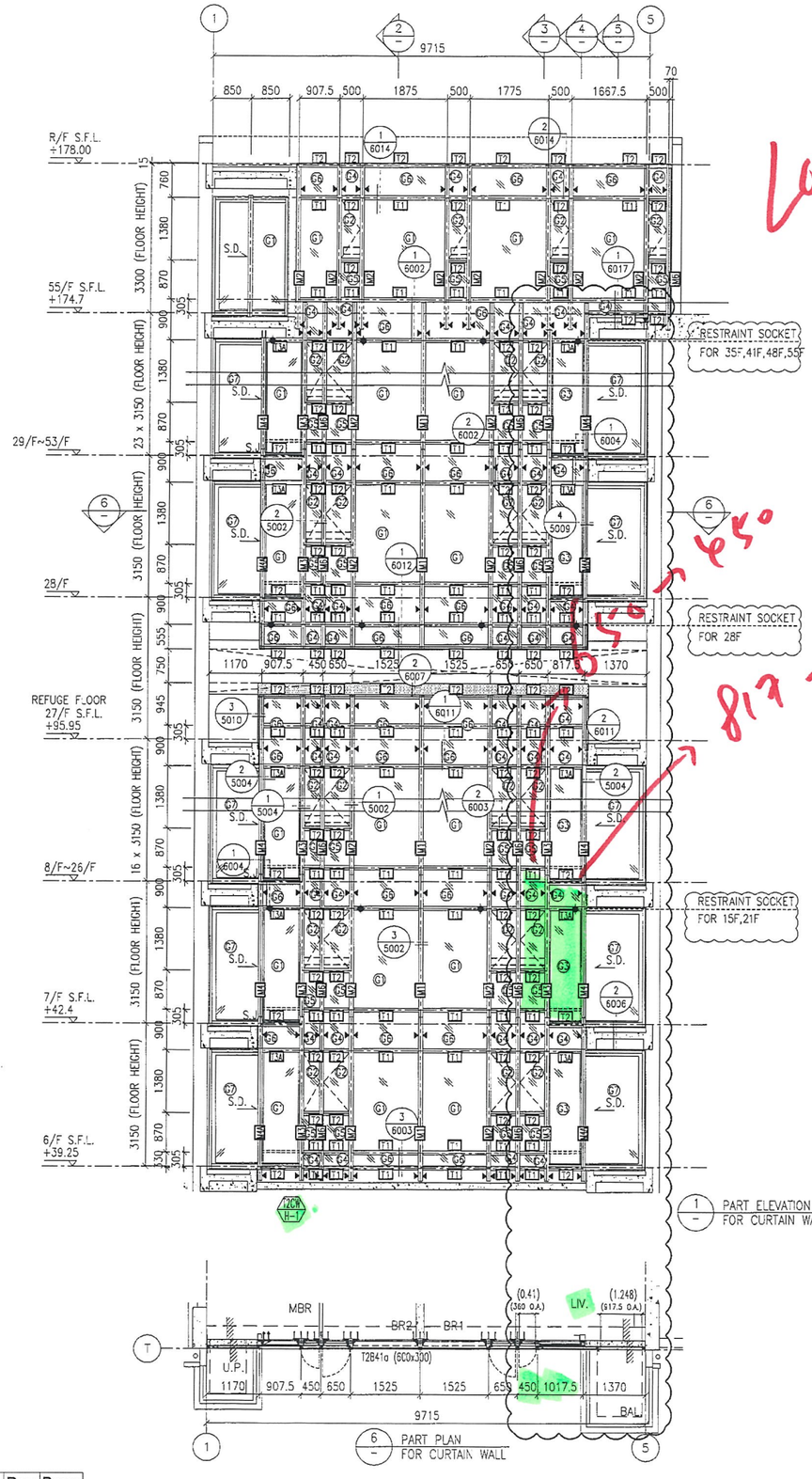
DATE : 04-JUL-18 | SCALE : 1:60 (A1)

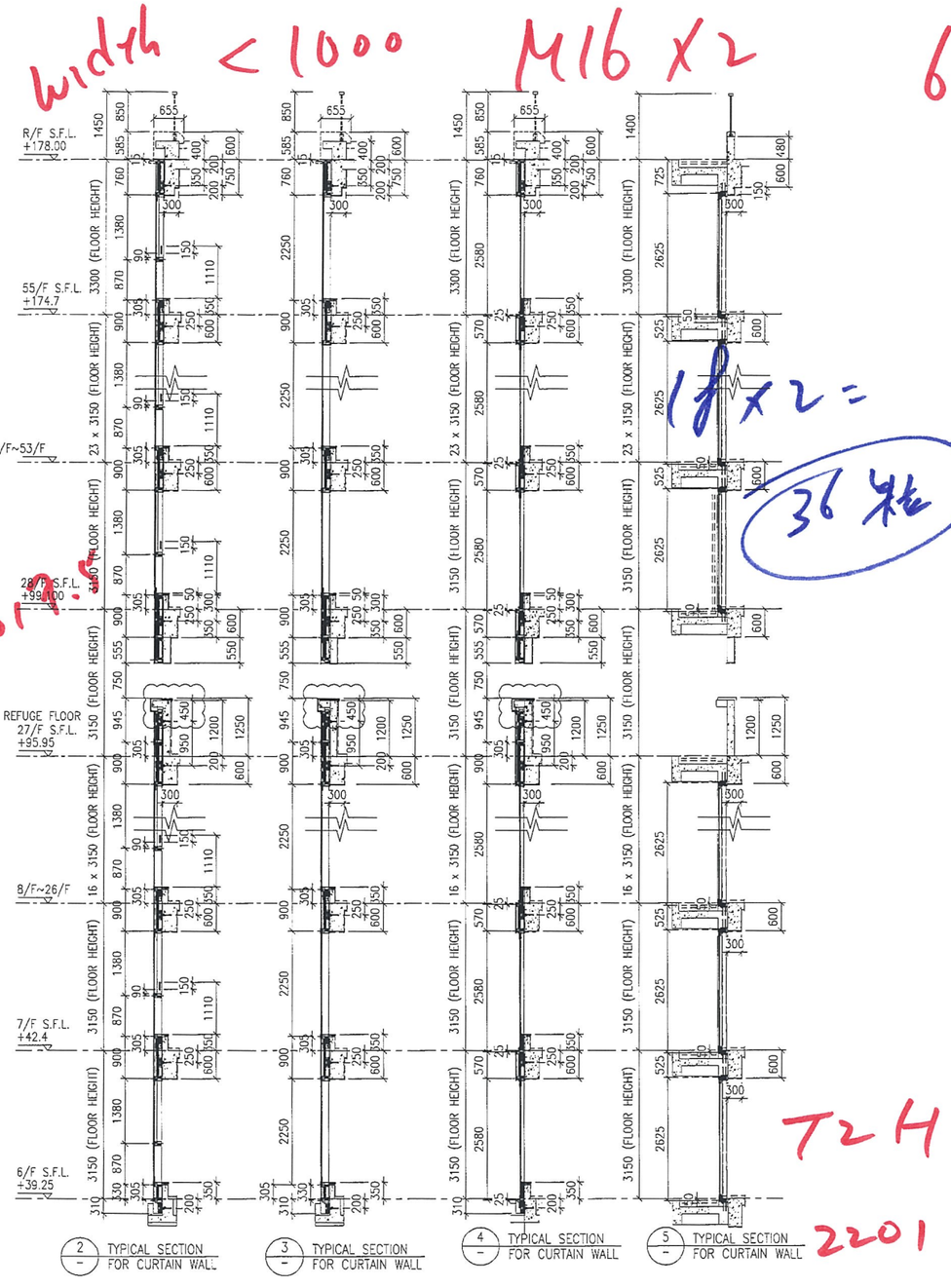
DRAWN BY : ASING | CHECKED BY : –

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Units 6-8, Sunray Industrial Centre, 1/F
610 Cha Kwo Ling Road, Kowloon
Tel:23489211-4 Fax:(852)27727666

DWG NO. : J837-CW-2112 | REV. : D

4





Flat	Room	Req.	Prov.
T2H	LIV.+M.BATH	1.535	1.658

LEGEND:

- G1 – 10 mm THK. TEMPERED BLUE TINTED GLASS (OUTER) + 9 mm AIR SPACE + 8 mm THK. TEMPERED CLEAR GLASS (INNER)
- G2 – 8 mm THK. HEAT STRENGTHENED TINTED GLASS (OUTER)+ 9 mm AIR SPACE + 8 mm THK. HEAT STRENGTHENED CLEAR GLASS (INNER)
- G3 – 10 mm THK. HEAT STRENGTHENED BLUE TINTED GLASS (OUTER)+ 9 mm AIR SPACE + 8 mm THK. TEMPERED CLEAR GLASS (INNER)
- G4 – 8 mm THK. HEAT STRENGTHENED BLUE TINTED GLASS (SPANDREL GLASS)
- G5 – 8 mm THK. HEAT STRENGTHENED BLUE TINTED GLASS (OUTER)+ 9 mm AIR SPACE + 8 mm THK. TEMPERED CLEAR GLASS (INNER)
- G6 – 8 mm THK. TEMPERED BLUE TINTED GLASS (SPANDREL GLASS)
- G7 – 8 mm THK. HEAT STRENGTHENED TINTED GLASS (OUTER)+ 1.52PVB + 8 mm THK. HEAT STRENGTHENED CLEAR LAMINATED GLASS (INNER)
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- S.J. – STACK JOINT
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- ▲ – SUPPORT POINT
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2. S.F.L. --STRUCTURAL FLOOR LEVEL
3. (R) --REVERSED DETAIL

NO.	DATE	REVISED	BY
D	22/12/2018	GENERAL REVISED	
C	04/12/2018	GENERAL REVISED	
B	24/11/2018	GENERAL REVISED	
A	10/9/2018	GENERAL REVISED	

JOB NO. : J-837

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

TITLE :
PART ELEVATION
OF CURTAIN WALL
AT TOWER 2

DATE : 04-JUL-18 | SCALE : 1:60 (A1)

DRAWN BY : ASING | CHECKED BY : -

美特鋁質有限公司
MIDI ALUMINIUM FABRICATOR LTD.
Units 6-8, Sunray Industrial Centre, 1/F
610 Cha Kwo Ling Road, Kowloon
Tel:23489211-4 Fax:(852)27727666

DWG NO. : J837-CW-2201 | REV. : D

Load width < 1000

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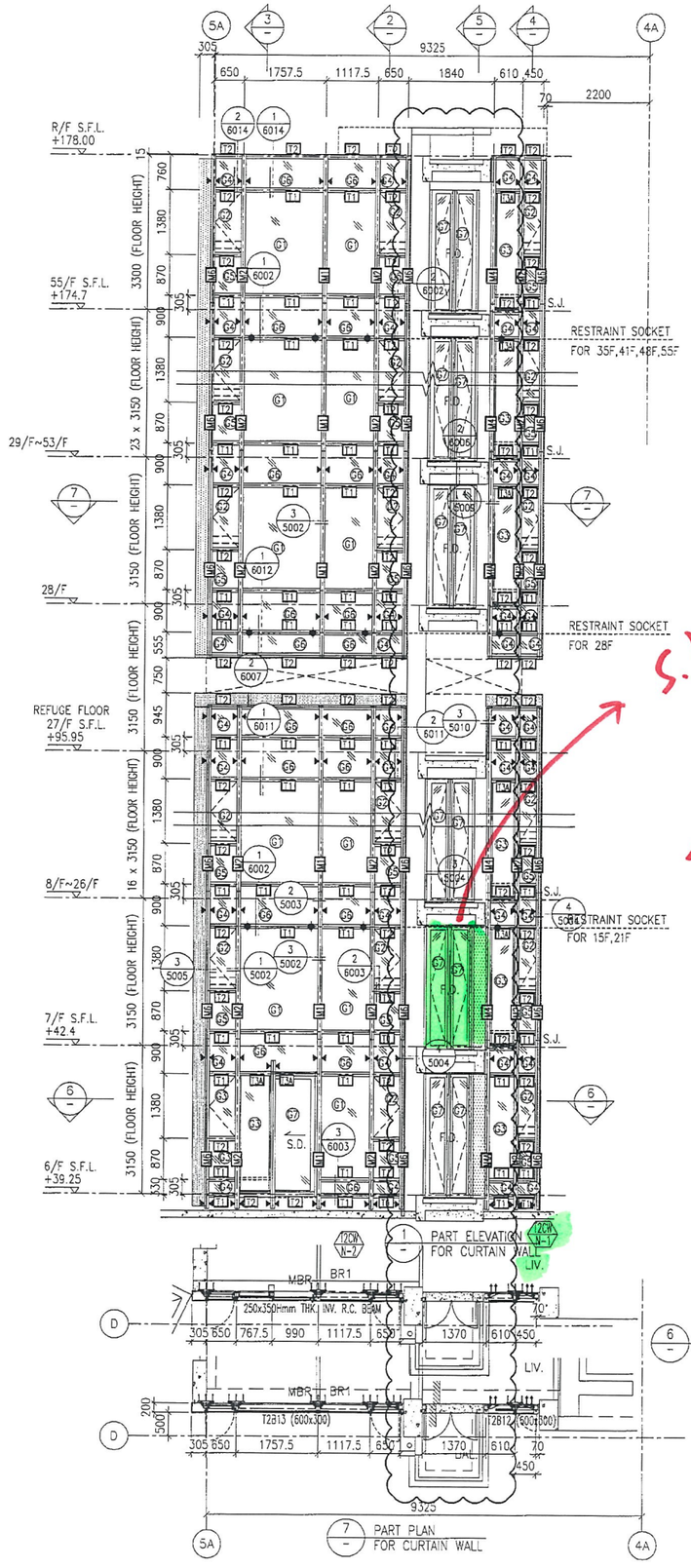
6-26/F Remdial.

18層

18 x 2 = 36 粒

T2H

2201





LEGEND:

- 10 mm THK. TEMPERED BLUE TINTED GLASS (OUTER) + 9 mm AIR SPACE + 8 mm THK. TEMPERED CLEAR GLASS (INNER)
- 8 mm THK. HEAT STRENGTHENED TINTED GLASS (OUTER)+ 9 mm AIR SPACE + 8 mm THK. HEAT STRENGTHENED CLEAR GLASS (INNER)
- 10 mm THK. HEAT STRENGTHENED BLUE TINTED GLASS (OUTER)+ 9 mm AIR SPACE + 8 mm THK. TEMPERED CLEAR GLASS (INNER)
- 8 mm THK. HEAT STRENGTHENED BLUE TINTED GLASS (SPANDREL GLASS)
- 8 mm THK. HEAT STRENGTHENED BLUE TINTED GLASS (OUTER)+ 9 mm AIR SPACE + 8 mm THK. TEMPERED CLEAR GLASS (INNER)
- 8 mm THK. TEMPERED BLUE TINTED GLASS (SPANDREL GLASS)
- 8 mm THK. HEAT STRENGTHENED TINTED GLASS (OUTER)+ 1.52PVB + 8 mm THK. HEAT STRENGTHENED CLEAR LAMINATED GLASS (INNER)
- 10 mm THK. TEMPERED GLASS (INTERNAL PROTECTIVE BARRIER)
- 3 mm THK. ALUM. CLADDING
- M.W. – MAINTENANCE WINDOW
- S.J. – STACK JOINT
- AC01 – ALUM. EXTRUSION DIE NO.
- ▲ – SUPPORT POINT
- ◆ – RESTRAINT SOCKET

B.D. REF :

CLIENT : 信和置業有限公司 Sino Land Company Limited

ARCHITECT : WONG TUNG & PARTNERS LIMITED ARCHITECTS & PLANNERS

MAIN CONTRACTOR : CR Construction Company Limited

STRUCTURAL ENGINEER : AECOM

FACADE CONSULTANT: AECOM

NOTE :
1. ALL DIMENSIONS ARE IN mm.
2. ALL ELEVATIONS ARE VIEWED FROM OUTSIDE.
3. ALL DIMENSIONS TO BE VERIFIED ON SITE BEFORE FABRICATION.

LEGEND :
- X1 / X00 – DETAIL MARK NO. / REFER SHEET NO.
1. F.F.L. --FINISHED FLOOR LEVEL
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C	04/12/2018	GENERAL REVISED	
B	24/11/2018	GENERAL REVISED	
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JOB NO. : J-837

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

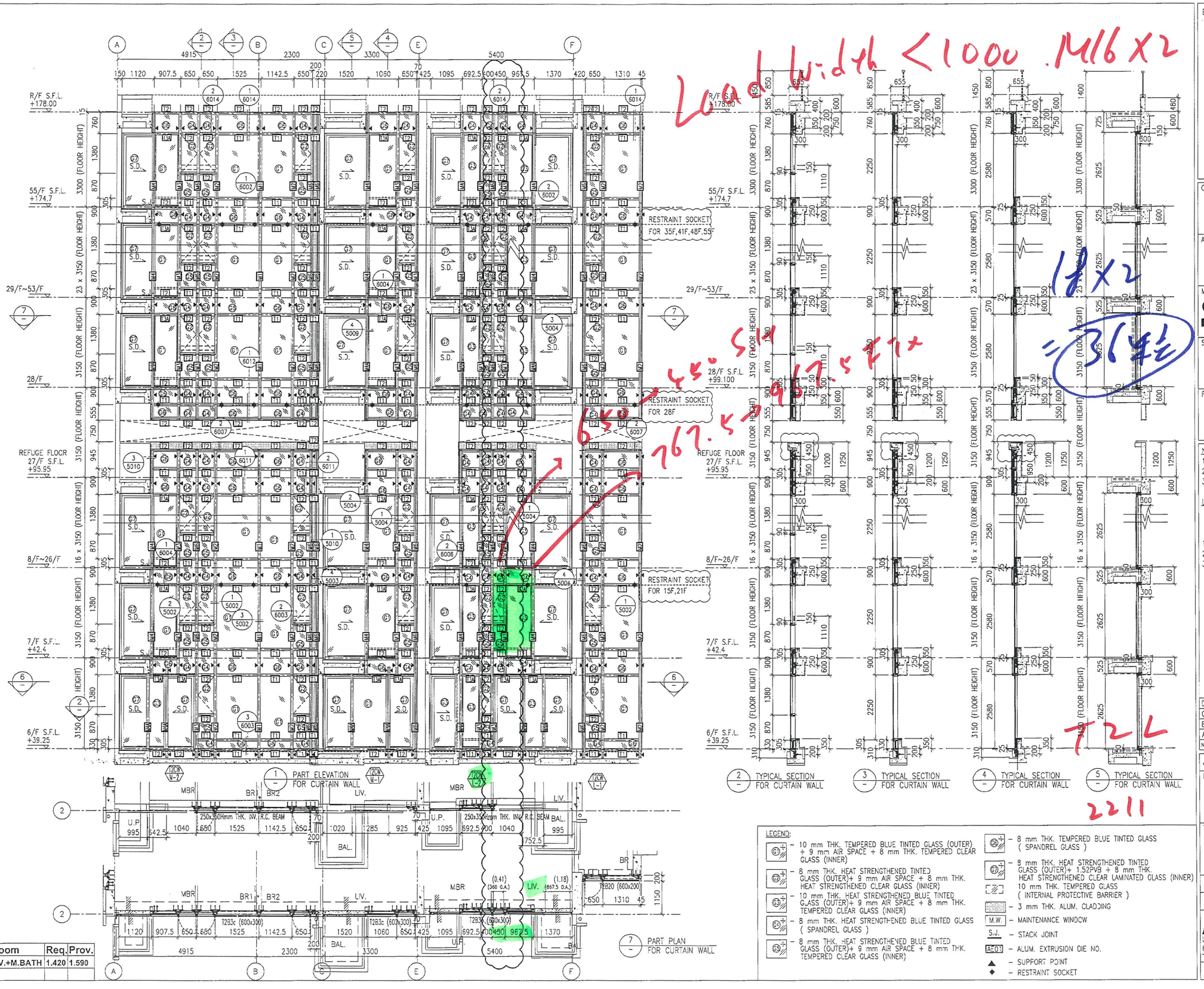
TITLE : PART ELEVATION OF CURTAIN WALL AT TOWER 2

DATE : 04-JUL-18 | SCALE : 1:60 (A1)

DRAWN BY : ASING | CHECKED BY : –

美特鋁質有限公司 MIDI ALUMINIUM FABRICATOR LTD.
Units 6-8, Sunray Industrial Centre, 1/F
610 Cha Kwo Ling Road, Kowloon
Tel:23489211-4 Fax:(852)27727665

DWG NO. : J837-CW-2209 | REV. : D



Flat	Room	Req.	Prov.
T2L	LIV.+M.BATH	1.420	1.590

LEGEND:

- G1+ – 10 mm THK. TEMPERED BLUE TINTED GLASS (OUTER) + 9 mm AIR SPACE + 8 mm THK. TEMPERED CLEAR GLASS (INNER)
- G2+ – 8 mm THK. HEAT STRENGTHENED TINTED GLASS (OUTER)+ 9 mm AIR SPACE + 8 mm THK. HEAT STRENGTHENED CLEAR GLASS (INNER)
- G3+ – 10 mm THK. HEAT STRENGTHENED BLUE TINTED GLASS (OUTER)+ 9 mm AIR SPACE + 8 mm THK. TEMPERED CLEAR GLASS (INNER)
- G4+ – 8 mm THK. HEAT STRENGTHENED BLUE TINTED GLASS (SPANDREL GLASS)
- G5+ – 8 mm THK. HEAT STRENGTHENED BLUE TINTED GLASS (OUTER)+ 9 mm AIR SPACE + 8 mm THK. TEMPERED CLEAR GLASS (INNER)
- G6+ – 8 mm THK. TEMPERED BLUE TINTED GLASS (SPANDREL GLASS)
- G7+ – 8 mm THK. HEAT STRENGTHENED TINTED GLASS (OUTER)+ 1.52PVB + 8 mm THK. HEAT STRENGTHENED CLEAR LAMINATED GLASS (INNER)
- 10 mm THK. TEMPERED GLASS (INTERNAL PROTECTIVE BARRIER)
- 3 mm THK. ALUM. CLADDING
- M.W. – MAINTENANCE WINDOW
- S.J. – STACK JOINT
- AE01 – ALUM. EXTRUSION DIE NO.
- ▲ – SUPPORT POINT
- ◆ – RESTRAINT SOCKET

B.D. REF :

CLIENT :
信和置業有限公司
Sino Land Company Limited

ARCHITECT :
WONG TUNG & PARTNERS LIMITED
ARCHITECTS & PLANNERS

MAIN CONTRACTOR :
CR Construction Company Limited

STRUCTURAL ENGINEER :
AECOM

FACADE CONSULTANT:
AECOM

NOTE :
1. ALL DIMENSIONS ARE IN mm.
2. ALL ELEVATIONS ARE VIEWED FROM OUTSIDE.
3. ALL DIMENSIONS TO BE VERIFIED ON SITE BEFORE FABRICATION.

LEGEND :
- X1 / XC01 – DETAIL MARK NO. / REFER SHEET NO.
1. F.F.L. -- FINISHED FLOOR LEVEL
2. S.F.L. -- STRUCTURAL FLOOR LEVEL
3. (R) -- REVERSED DETAIL

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D	22/12/2018	GENERAL REVISED	
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B	24/11/2018	GENERAL REVISED	
A	10/9/2018	GENERAL REVISED	

JOB NO. : J-837

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

TITLE :
PART ELEVATION OF CURTAIN WALL AT TOWER 2

DATE : 04-JUL-18 | SCALE : 1:60 (A1)

DRAWN BY : ASING | CHECKED BY : –

美特鋁質有限公司
MIDI ALUMINUM FABRICATOR LTD.
Units 6-8, Sunray Industrial Centre, 1/F
610 Cha Kwo Ling Road, Kowloon
Tel:23489211-4 Fax:(852)27727666

DWG NO. : J837-CW-2211 | REV. : D

Load Width < 1000 2M16 X2

B.D. REF :

6-26/F

18層 Remedial

CLIENT :
信和置業有限公司
Sino Land Company Limited

ARCHITECT :
WONG TUNG & PARTNERS LIMITED
ARCHITECTS & PLANNERS

MAIN CONTRACTOR :
CR Construction Company Limited

STRUCTURAL ENGINEER :
AECOM

FACADE CONSULTANT:
AECOM

NOTE :
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3. ALL DIMENSIONS TO BE VERIFIED ON SITE BEFORE FABRICATION.

LEGEND :
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X001 — REFER SHEET NO.
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B	24/11/2018	GENERAL REVISED	
A	10/9/2018	GENERAL REVISED	

JOB NO. : J-837

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

TITLE :
PART ELEVATION OF CURTAIN WALL AT TOWER 2

DATE : 04-JUL-18 | SCALE : 1:60 (A1)

DRAWN BY : ASING | CHECKED BY : –

美特鋁質有限公司
MIDI ALUMINIUM FABRICATOR LTD.
Units 6-8, Sunray Industrial Centre, 1/F
610 Cha Kwo Ling Road, Kowloon
Tel:23489211-4 Fax:(852)27727666

DWG NO. : J837-CW-2212 | REV. : D

R/F S.F.L. +178.00
55/F S.F.L. +174.7
29/F~53/F
28/F
REFUGE FLOOR 27/F S.F.L. +95.95
8/F~26/F
7/F S.F.L. +42.4
6/F S.F.L. +39.25
23 x 3150 (FLOOR HEIGHT)
16 x 3150 (FLOOR HEIGHT)

RESTRAINT SOCKET FOR 35F,41F,48F,55F
RESTRAINT SOCKET FOR 28F
RESTRAINT SOCKET FOR 15F,21F

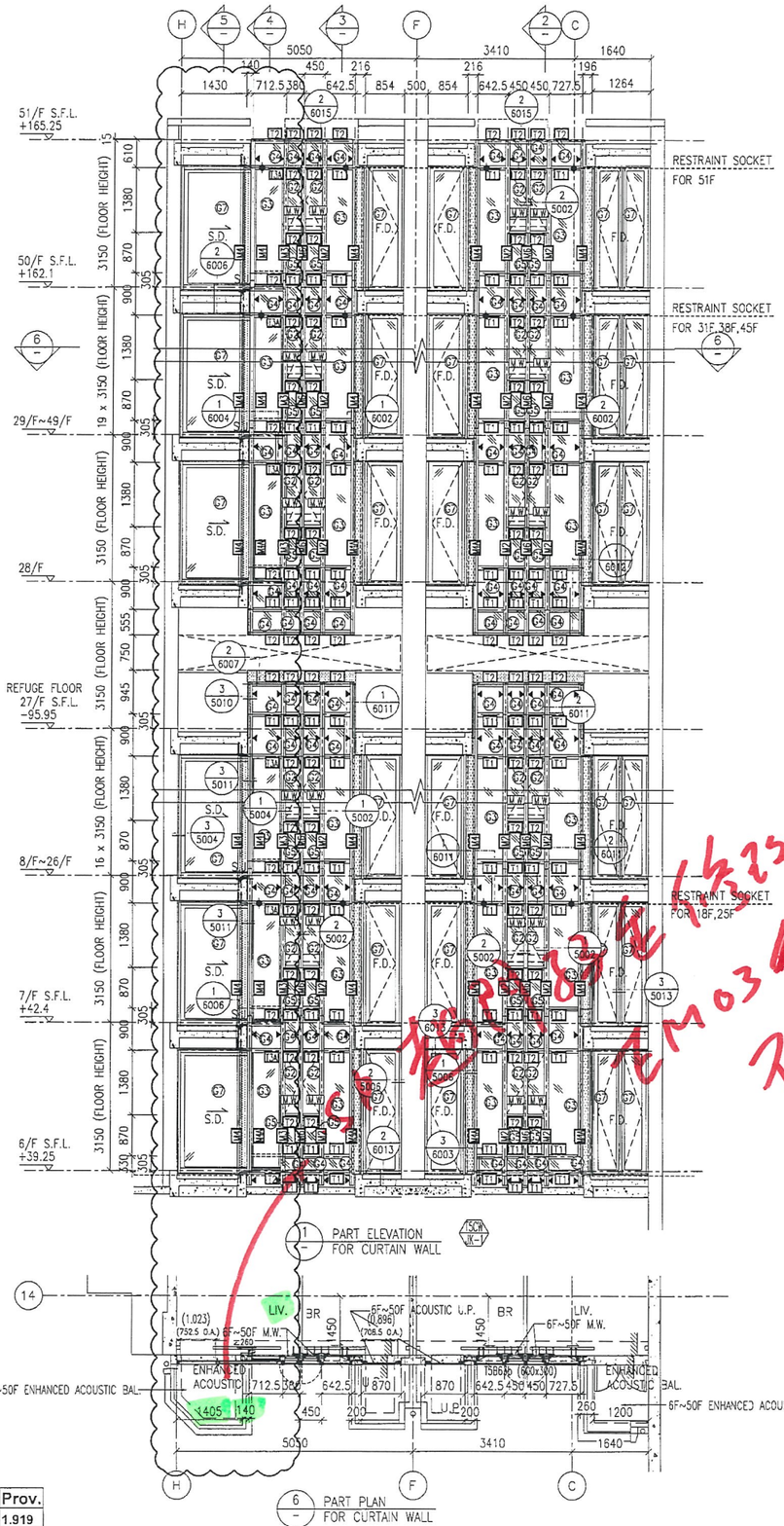
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3 TYPICAL SECTION FOR CURTAIN WALL
4 TYPICAL SECTION FOR CURTAIN WALL
5 TYPICAL SECTION FOR CURTAIN WALL

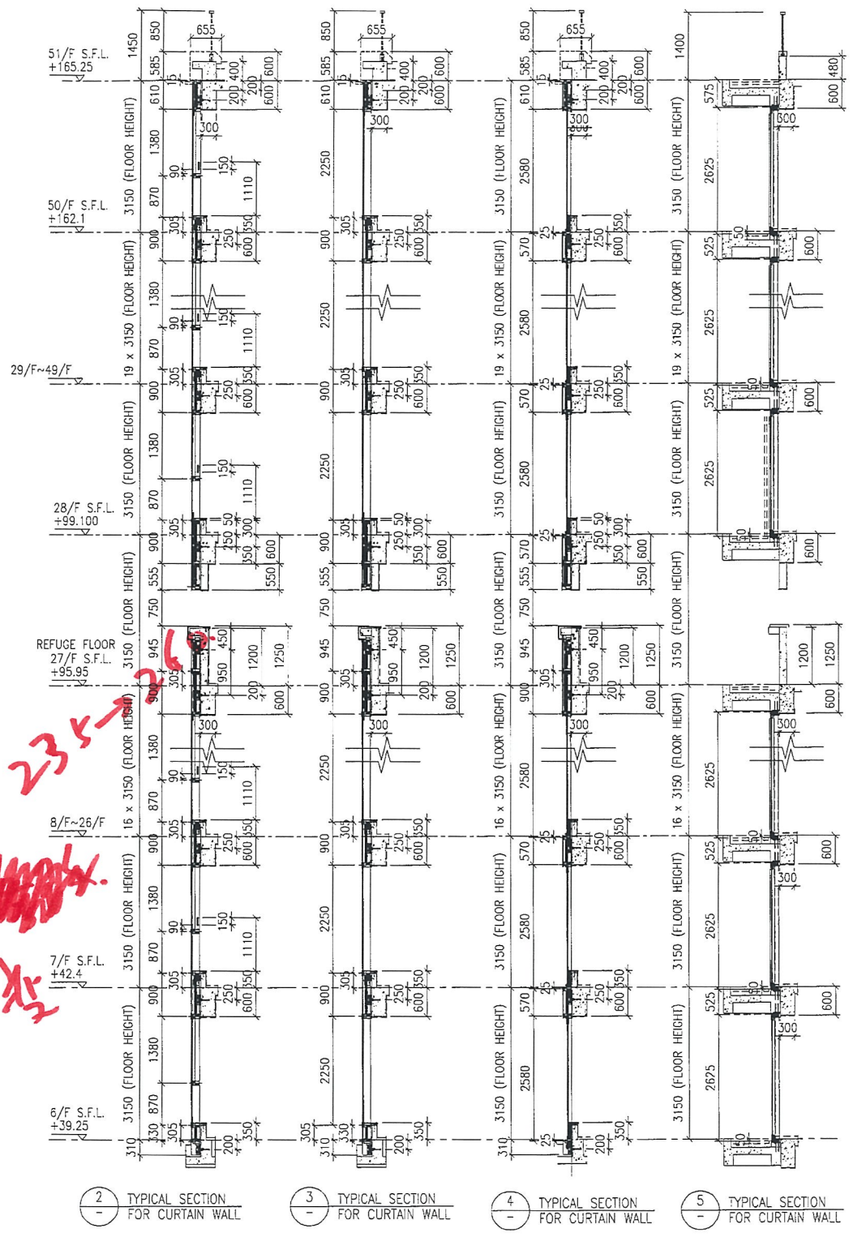
7 PART PLAN FOR CURTAIN WALL

T2K, T2J

Flat	Room	Req.	Prov.
T2K	LIV.+M.BATH	1.414	1.590
T2K	MBR	0.391	1.205
T2J	MBR	0.592	1.205
T2J	LIV.+M.BATH	1.360	1.444

LEGEND:
- G1+ – 10 mm THK. TEMPERED BLUE TINTED GLASS (OUTER) + 9 mm AIR SPACE + 8 mm THK. TEMPERED CLEAR GLASS (INNER)
- G2+ – 8 mm THK. HEAT STRENGTHENED TINTED GLASS (OUTER)+ 9 mm AIR SPACE + 8 mm THK. HEAT STRENGTHENED CLEAR GLASS (INNER)
- G3+ – 10 mm THK. HEAT STRENGTHENED BLUE TINTED GLASS (OUTER)+ 9 mm AIR SPACE + 8 mm THK. TEMPERED CLEAR GLASS (INNER)
- G4+ – 8 mm THK. HEAT STRENGTHENED BLUE TINTED GLASS (SPANDREL GLASS)
- G5+ – 8 mm THK. HEAT STRENGTHENED BLUE TINTED GLASS (OUTER)+ 9 mm AIR SPACE + 8 mm THK. TEMPERED CLEAR GLASS (INNER)
- G6+ – 8 mm THK. TEMPERED BLUE TINTED GLASS (SPANDREL GLASS)
- G7+ – 8 mm THK. HEAT STRENGTHENED TINTED GLASS (OUTER)+ 1.52PVB + 8 mm THK. HEAT STRENGTHENED CLEAR LAMINATED GLASS (INNER) 10 mm THK. TEMPERED GLASS (INTERNAL PROTECTIVE BARRIER)
- 3 mm THK. ALUM. CLADDING
- M.W. – MAINTENANCE WINDOW
- S.J. – STACK JOINT
- A5.01 – ALUM. EXTRUSION DIE NO.
- ▲ – SUPPORT POINT
- ◆ – RESTRAINT SOCKET





Flat	Room	Req.	Prov.
T5K	LIV.+M.BATH +BR	1.904	1.919

LEGEND:

- G1+ – 10 mm THK. TEMPERED BLUE TINTED GLASS (OUTER) + 9 mm AIR SPACE + 8 mm THK. TEMPERED CLEAR GLASS (INNER)
- G2+ – 8 mm THK. HEAT STRENGTHENED TINTED GLASS (OUTER)+ 9 mm AIR SPACE + 8 mm THK. HEAT STRENGTHENED CLEAR GLASS (INNER)
- G3+ – 10 mm THK. HEAT STRENGTHENED BLUE TINTED GLASS (OUTER)+ 9 mm AIR SPACE + 8 mm THK. TEMPERED CLEAR GLASS (INNER)
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- 3 mm THK. ALUM. CLADDING
- M.W. – MAINTENANCE WINDOW
- S.J. – STACK JOINT
- AE01 – ALUM. EXTRUSION DIE NO.
- ▲ – SUPPORT POINT
- ◆ – RESTRAINT SOCKET

B.D. REF :

CLIENT :
信和置業有限公司
Sino Land Company Limited

ARCHITECT :
WONG TUNG & PARTNERS LIMITED
ARCHITECTS & PLANNERS

MAIN CONTRACTOR :
CR Construction Company Limited

STRUCTURAL ENGINEER :
AECOM

FACADE CONSULTANT:
AECOM

NOTE :
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JOB NO. : J-837

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

TITLE :
PART ELEVATION
OF CURTAIN WALL
AT TOWER 5

DATE : 04-JUL-18 | SCALE : 1:60 (A1)

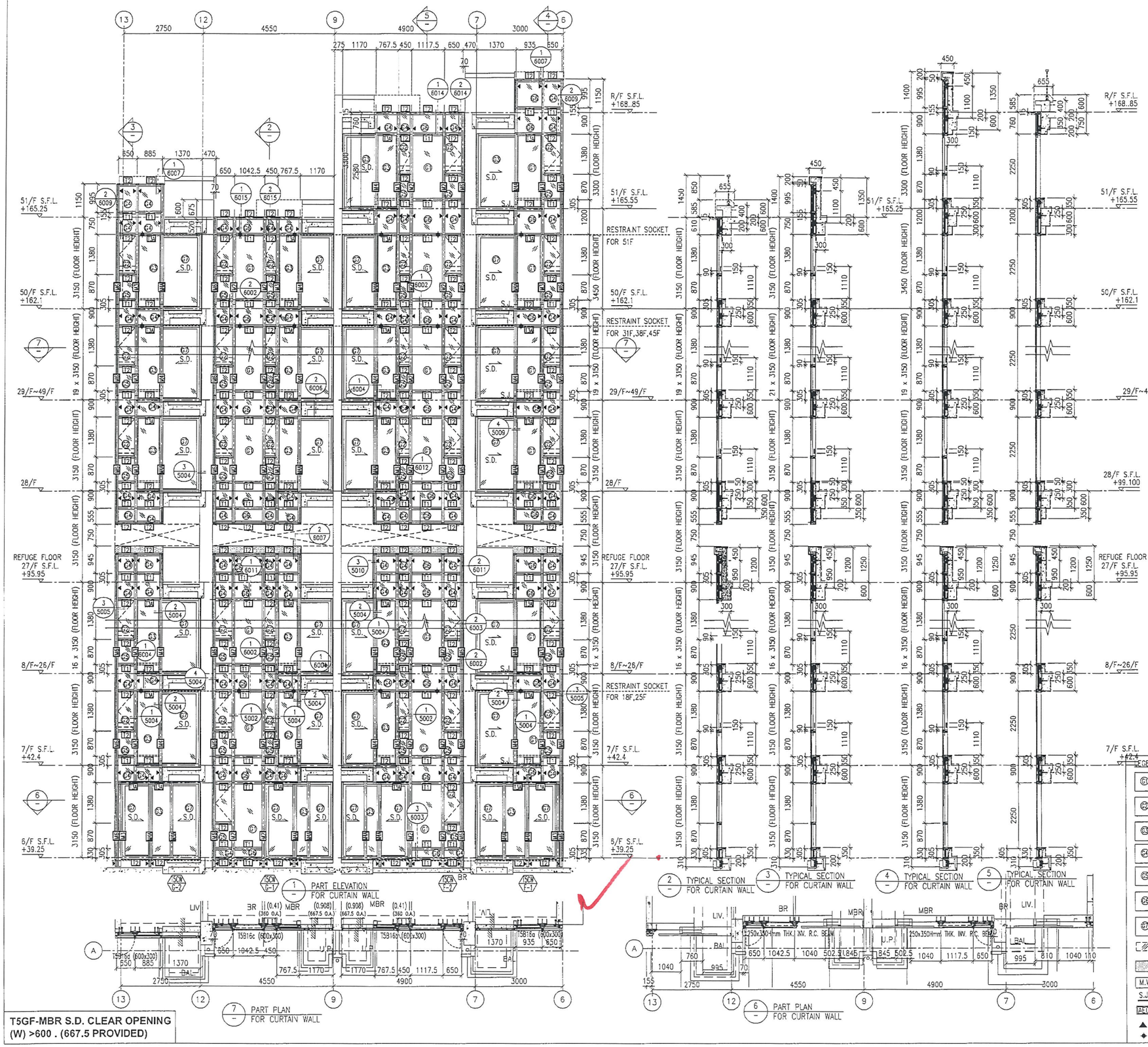
DRAWN BY : ASING | CHECKED BY : –

美特鋁質有限公司
MIDI ALUMINIUM FABRICATOR LTD.
Units 6-8, Sunray Industrial Centre, 1/F
610 Cha Kwo Ling Road, Kowloon
Tel:23489211-4 Fax:(852)27727666

DWG NO. : J837-CW-2506 | REV. : D

9

Flat	Room	Req.	Prov.
T5G	MBR	0.581	1.318
T5F	MBR	0.558	1.318



T5GF-MBR S.D. CLEAR OPENING (W) >600 . (667.5 PROVIDED)

EGEND:

- G1 – 10 mm THK. TEMPERED BLUE TINTED GLASS (OUTER) + 9 mm AIR SPACE + 8 mm THK. TEMPERED CLEAR GLASS (INNER)
- G2 – 8 mm THK. HEAT STRENGTHENED TINTED GLASS (OUTER)+ 9 mm AIR SPACE + 8 mm THK. HEAT STRENGTHENED CLEAR GLASS (INNER)
- G3 – 10 mm THK. HEAT STRENGTHENED BLUE TINTED GLASS (OUTER)+ 9 mm AIR SPACE + 8 mm THK. TEMPERED CLEAR GLASS (INNER)
- G4 – 8 mm THK. HEAT STRENGTHENED BLUE TINTED GLASS (SPANDREL GLASS)
- G5 – 8 mm THK. HEAT STRENGTHENED BLUE TINTED GLASS (OUTER)+ 9 mm AIR SPACE + 8 mm THK. TEMPERED CLEAR GLASS (INNER)
- G6 – 8 mm THK. TEMPERED BLUE TINTED GLASS (SPANDREL GLASS)
- G7 – 8 mm THK. HEAT STRENGTHENED TINTED GLASS (OUTER)+ 1.52PVB + 8 mm THK. HEAT STRENGTHENED CLEAR LAMINATED GLASS (INNER)
- 10 mm THK. TEMPERED GLASS (INTERNAL PROTECTIVE BARRIER)
- 3 mm THK. ALUM. CLADDING
- M.W. – MAINTENANCE WINDOW
- S.J. – STACK JOINT
- AE01 – ALUM. EXTRUSION DIE NO.
- ▲ – SUPPORT POINT
- ◆ – RESTRAINT SOCKET

B.D. REF :

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Sino Land Company Limited

ARCHITECT :
WONG TUNG & PARTNERS LIMITED
ARCHITECTS & PLANNERS

MAIN CONTRACTOR :
CR Construction Company Limited

STRUCTURAL ENGINEER :
AECOM

FACADE CONSULTANT:
AECOM

NOTE :
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2. S.F.L. --STRUCTURAL FLOOR LEVEL
3. (R) --REVERSED DETAIL

(沒有修改)
此為最後版
T5G.
2509
2/1/19

NO.	DATE	REVISED	BY
D	22/12/2018	GENERAL REVISED	
C	04/12/2018	GENERAL REVISED	
B	24/11/2018	GENERAL REVISED	
A	10/9/2018	GENERAL REVISED	

JOB NO. : J-837

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

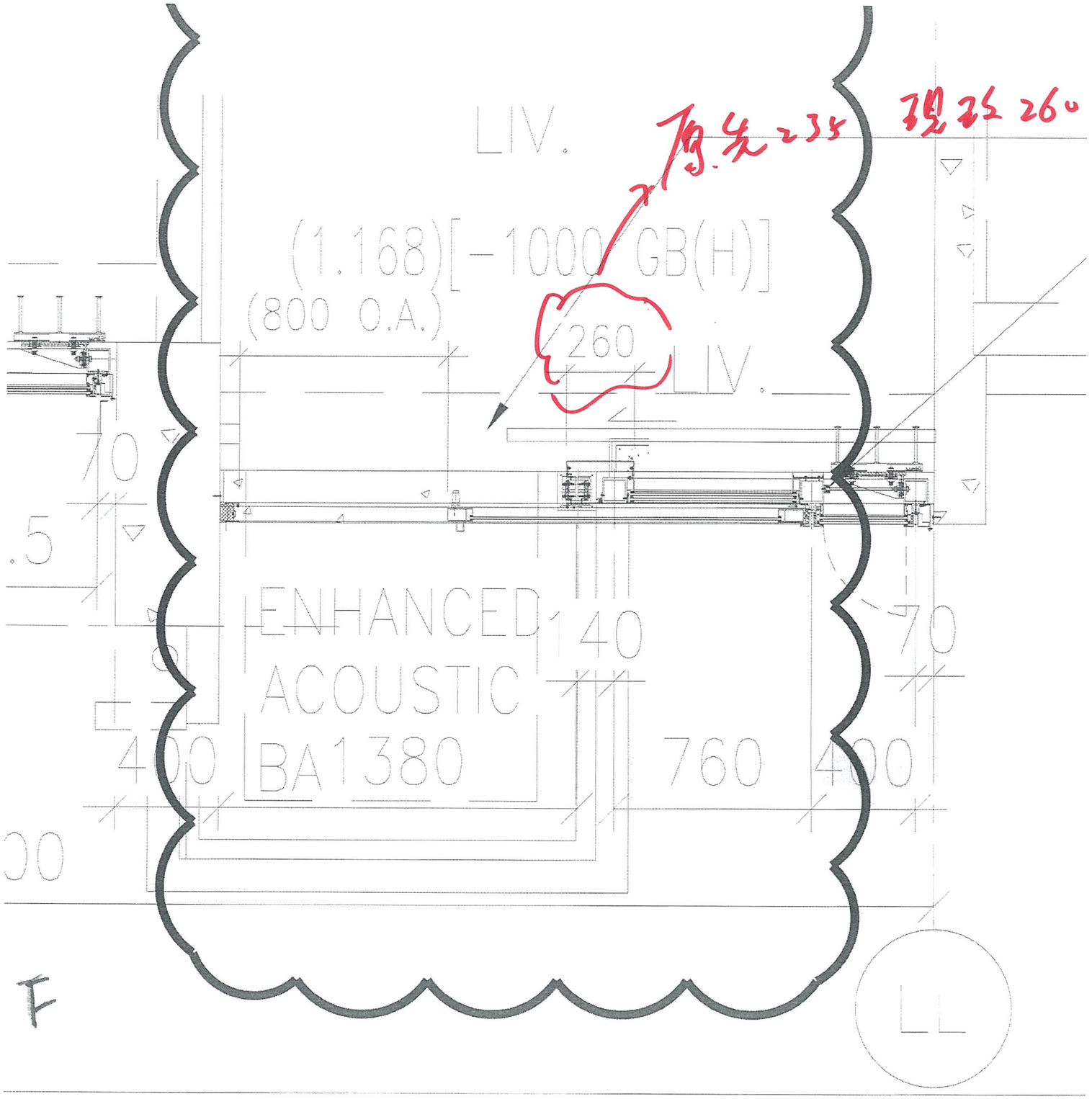
TITLE :
PART ELEVATION OF CURTAIN WALL AT TOWER 5

DATE : 04-JUL-18 | SCALE : 1:60 (A1)

DRAWN BY : ASING | CHECKED BY : –

美特鋁製有限公司
MIDI ALUMINIUM FABRICATOR LTD.
Units 6-8, Sunray Industrial Centre, 1/F
610 Cha Kwo Ling Road, Kowloon
Tel:23489211-4 Fax:(852)27727566

DWG NO. : J837-CW-2509 | REV. : 10



原先 235

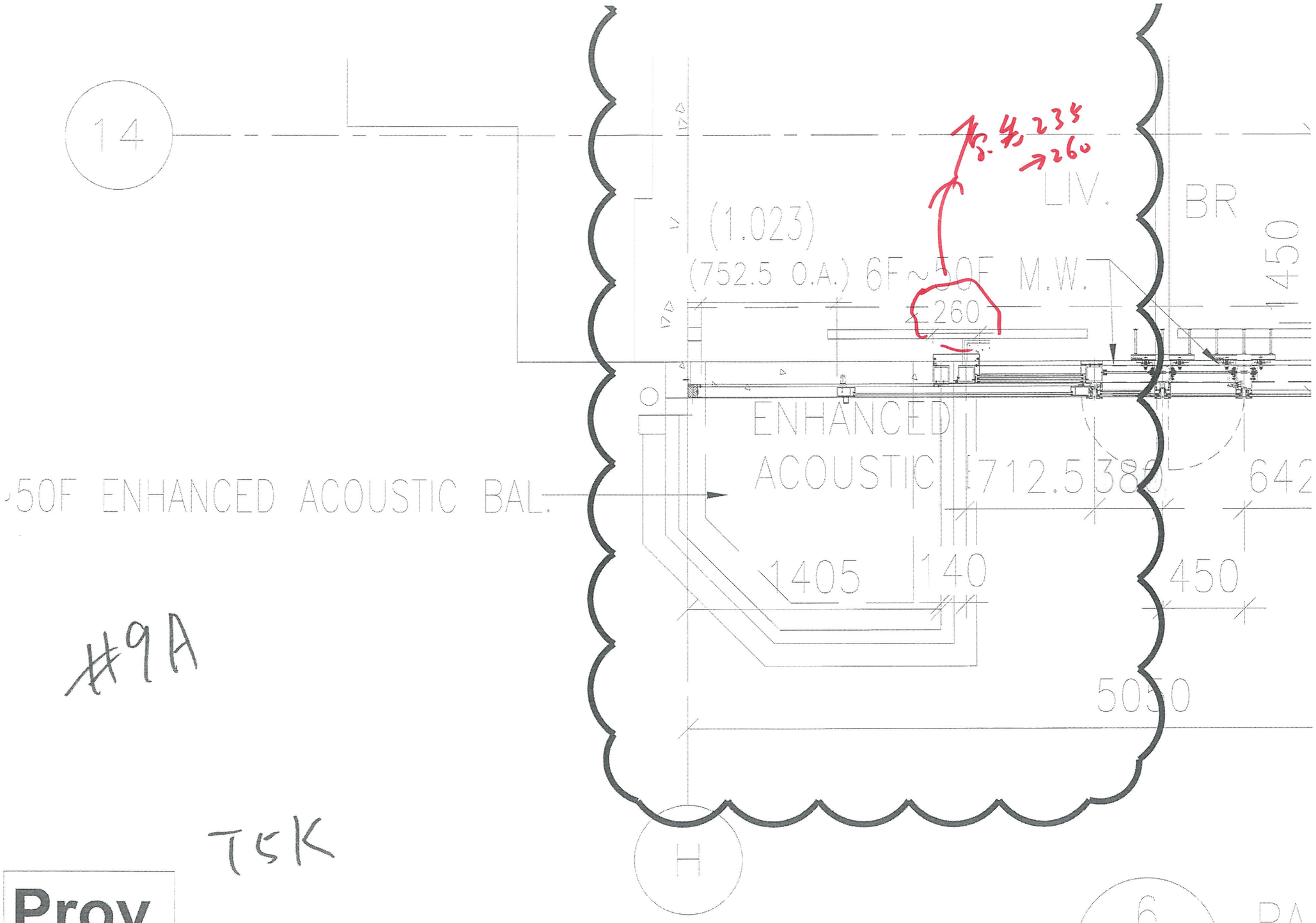
現改 260

118A

TIF

Require 1.152
provide 1.168

Blow up



#9A

T&K

Prov.
1.919

Required 1.904
Provided 1.919

Blow up.

12

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

Our ref. MC/38761/837 21st January 2019

CR Construction Company Limited
Unit No. 1-16, Level 32,
Standard Chartered Tower of Millennium City 1,
No. 388 Kwun Tong Road,
Kwun Tong, Kowloon, Hong Kong

By Email & Hand

M16 抗燥計數
(急)

Attn.: Mr. Frankie S. W. Cheung

Dear Sir,

Re: Design, Supply and Installation of Curtain Wall, Aluminium Window & Door to Tower for N.K.I.L. 6514, Kwun Tong Town Centre (Development Areas 2 & 3), Kwun Tong, Kowloon.
Submission of Structural Calculation of Remedial Proposal(HST3-R M16) for Curtain Wall

Regarding the captioned project, we would like to submit Structural Calculation of Remedial Proposal(HST3-R M16) for Curtain Wall for your review and comment.

Thank you for your kind attention.

Yours faithfully,
MIDI ALUMINIUM FABRICATOR LTD.

p.p.

Marco Tam
Director

Encl

FM/MT/JL/JC/AY/EL/BL/yl

九龍茶果嶺道610號生利工業中心1樓6-8號
Units 6-8, 1st Floor, Sunray Industrial Centre, 610 Cha Kwo Ling Road, Kln.
TEL. (電話) : 2348 9211 FAX. (傳真) : 2772 7666 E-mail Address (電郵) : midi@midiltd.com.hk.

ISO 9001 : 2008
Certificate No: CC 1795

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

Our ref. MC/38760/837 21st January 2019

CR Construction Company Limited
Unit No. 1-16, Level 32,
Standard Chartered Tower of Millennium City 1,
No. 388 Kwun Tong Road,
Kwun Tong, Kowloon, Hong Kong

By Email & Hand

M16拉爆拉力數
(參考)

Attn.: Mr. Frankie S. W. Cheung

Dear Sir,

Re: Design, Supply and Installation of Curtain Wall, Aluminium Window & Door to Tower for N.K.I.L. 6514, Kwun Tong Town Centre (Development Areas 2 & 3), Kwun Tong, Kowloon.
Submission of Method Statement for Pull Out Test (HST3-R M16)(1hr) for Curtain Wall

Regarding the captioned project, we would like to submit the Method Statement for Pull Out Test (HST3-R M16)(1hr) for Curtain Wall for your review and comment.

Thank you for your kind attention.

Yours faithfully,
MIDI ALUMINIUM FABRICATOR LTD.

Marco Tam
Director

Encl - 5 page(s)

FM/MT/JL/JC/AY/EL/BL/yl

九龍茶果嶺道610號生利工業中心1樓6-8號
Units 6-8, 1st Floor, Sunray Industrial Centre, 610 Cha Kwo Ling Road, Kln.
TEL. (電話) : 2348 9211 FAX. (傳真) : 2772 7666 E-mail Address (電郵) : midi@midiltd.com.hk.

ISO 9001 : 2008
Certificate No: CC 1795

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**
CURTAIN WALL
[REMEDIAL PROPOSAL]

DATE: **18 JAN 2019**

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

Report No: J837-03D

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1.1.1 *Extracted Loading From BD Submission*

3 VERIFICATION OF ALUM MULLION

3.1.1 *Computer Analysis of Alum Mullion*

LOADS ANALYSIS
By SAP2000

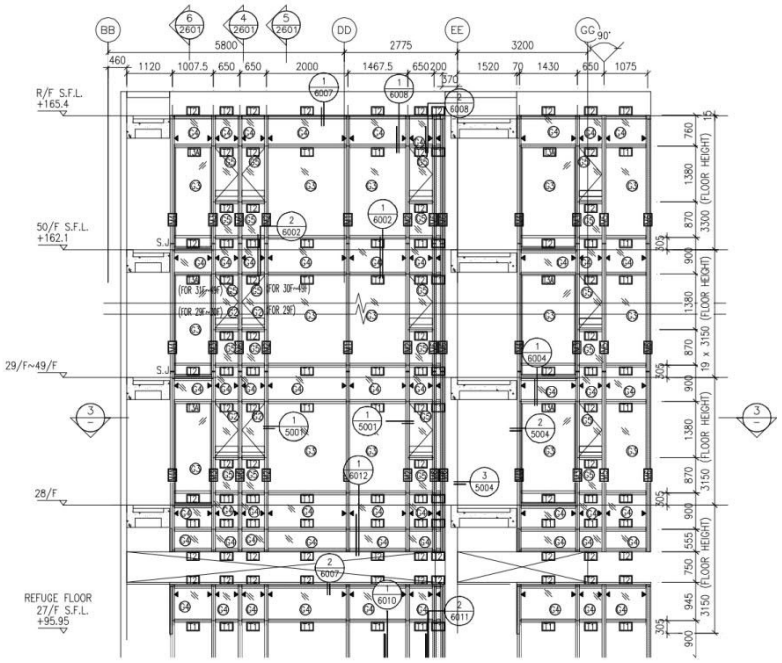
1) Wind Load

Design wind load $W_d := 1.4 \cdot 3.14kPa$ $W_d = 4.4 \cdot kPa$

Maximum Load width: $B := \frac{2000mm + 1467.5mm}{2}$ $B = 1733.75 \cdot mm$

$B := 1750mm$

UDL due to wind load $w := W_d \cdot B$ $w = 7.69 \cdot N \cdot mm^{-1}$



REF DWG : 2105

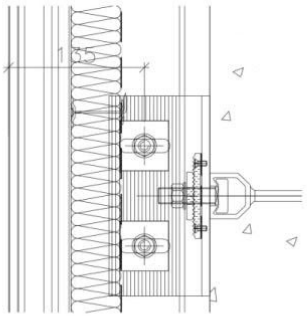
178

2) Dead Load

Dead load of a unit include the followings:-

1. Weight of glass

Density of glass	$\rho_g := 26kN \cdot m^{-3}$
Width of glass	$B = 1.75 \times 10^3 \cdot mm$
Total height of spandrel glass	$H_s := 2250mm$
Total height of vision glass	$H_v := 2250mm$
Thickness of spandrel glass	$t_s := 8mm$
Thickness of vision glass	$t_v := 10mm + 10mm$
Weight of glass	$W_g := (H_s \cdot t_s + H_v \cdot t_v) \cdot \rho_g \cdot B$
	$W_g = 2.866 \times 10^3 \cdot N$



2. Self weight of frame

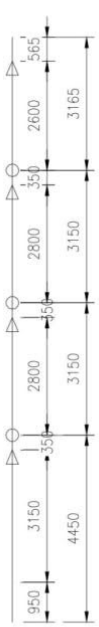
Density of aluminum	$\rho_a := 27.2kN \cdot m^{-3}$
Section area of transoms	$A_t := 3500mm^2$ (say)
Section area of mullion	$A_m := 3500mm^2$ (say)
Width of frame	$B = 1.75 \times 10^3 \cdot mm$
Height of frame	$H := 4500mm$
Self weight of frame	$W_f := 5\rho_a \cdot A_t \cdot B + \rho_a \cdot A_m \cdot H$
	$W_f = 1.261 \times 10^3 \cdot N$
Total weight of panel (with 5% allowance for fixing)	$DL := 1.05(W_g + W_f)$
	$DL = 4.334 \times 10^3 \cdot N$
	$DL := 4.5kN$ (say)
Eccentricity	$e := 135mm$
Eccentric moment	$M_e := DL \cdot e$
	$M_e = 0.61 \cdot kN \cdot m$

LOAD COMBINATIONS

Load combination 1	COMB 1 = 1.0WL + 1.0 DL

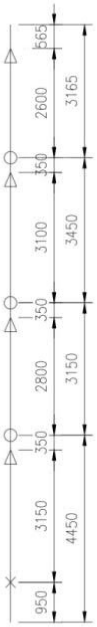
179

Dimension & Support Condition

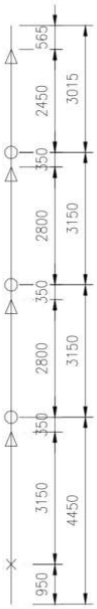




MODEL FOR T1, T2 T3 AT ROOF FLOOR

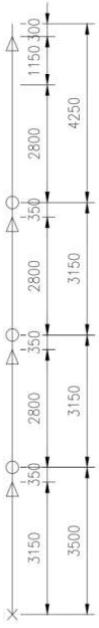


MODEL FOR T5 WITH 50/F = 3450 H 51/F = 3350 H



MODEL FOR T5 WITH ALL FLOOR HEIGHT = 3150

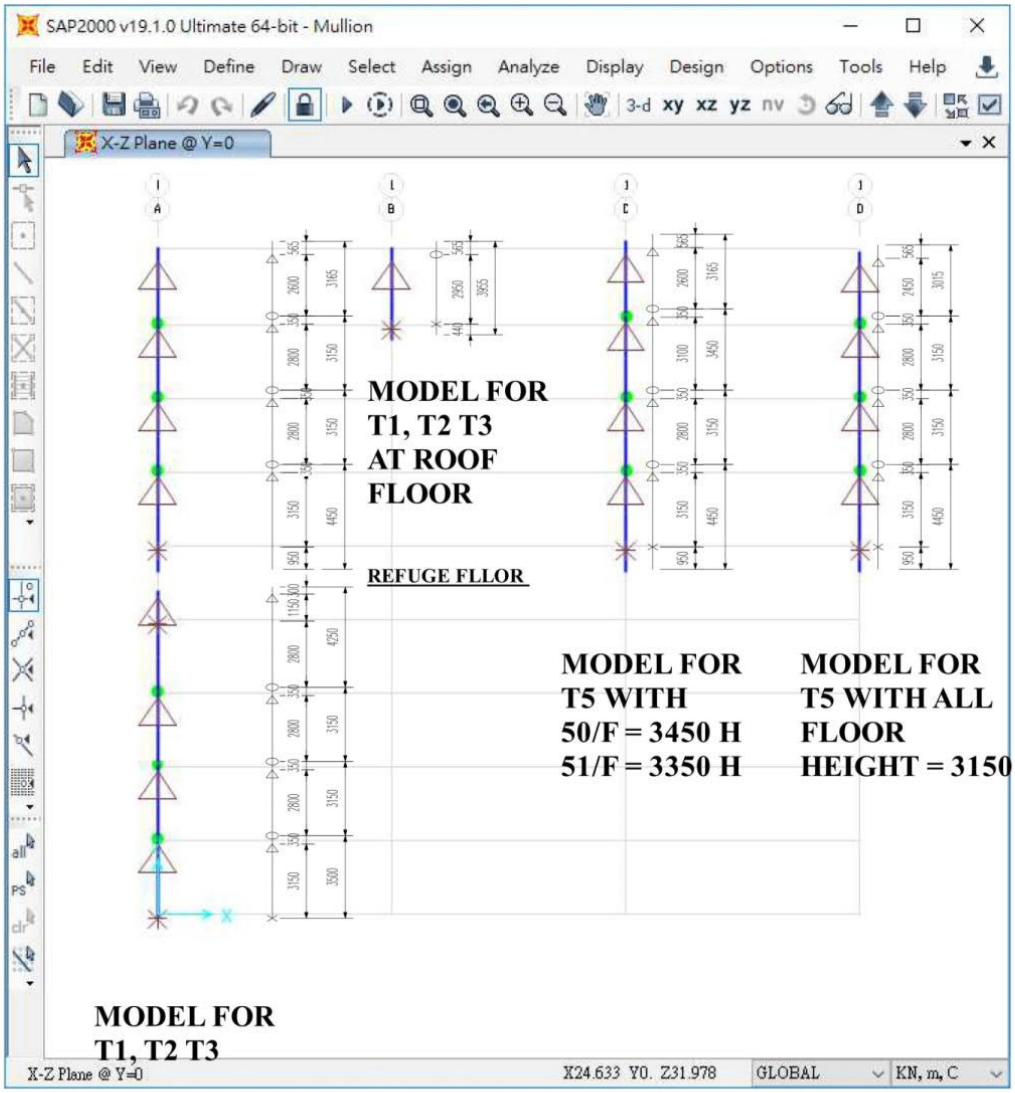
REFUGE FLLOR



MODEL FOR T1, T2 T3

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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:	20/08/2018	REPORT NO:	J837-03A



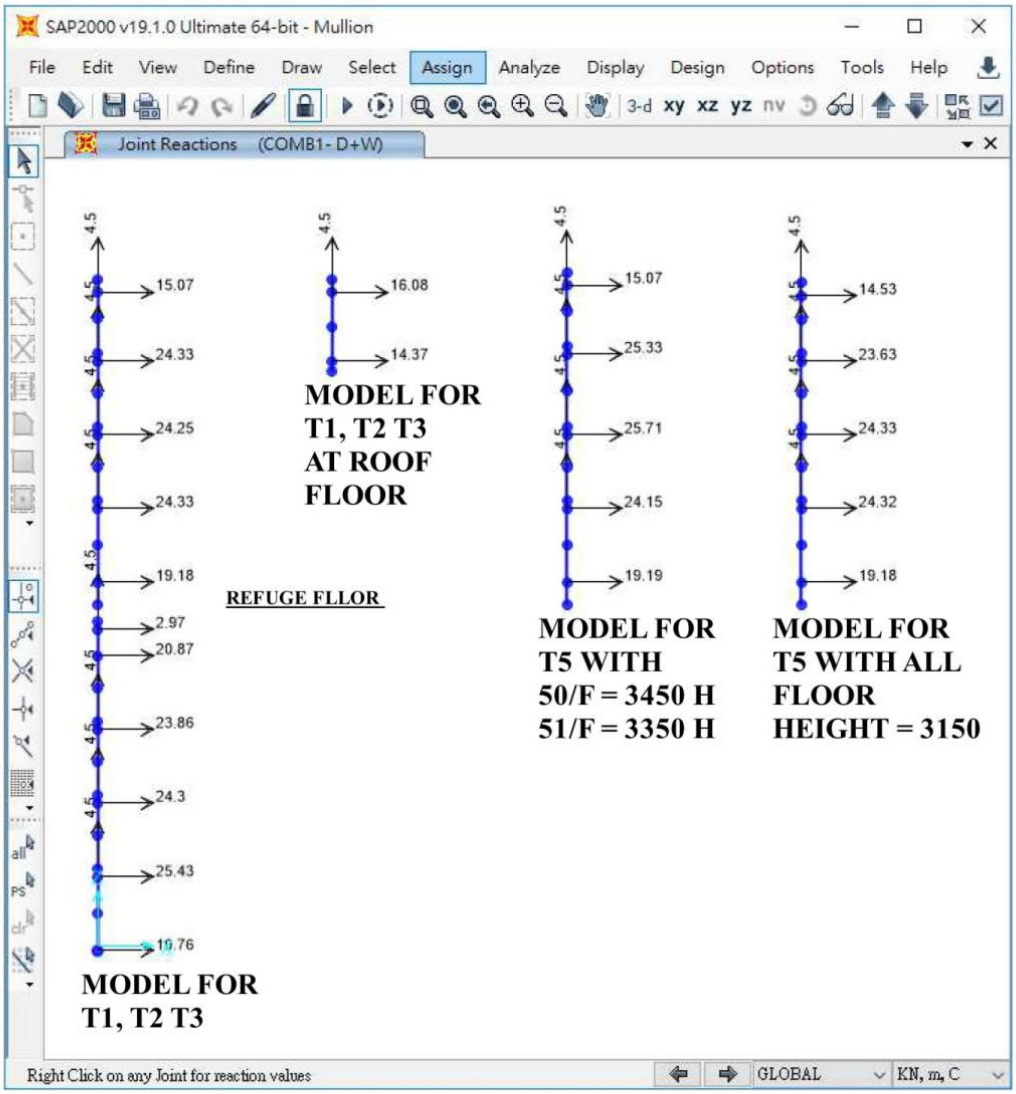
△ Restrainted at X, Y, Z direction

✳ Restrainted at X, Y direction

181

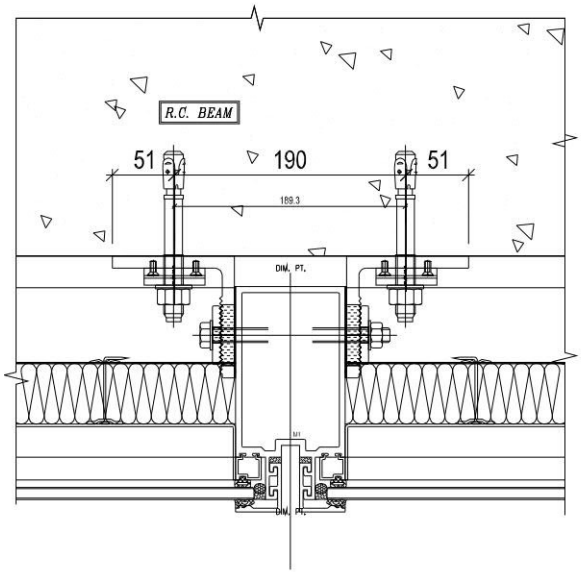
美特鋁質有限公司 MIDI ALUMINIUM FABRICATOR LTD.	PROJECT:	URA KWUN TONG TOWN CENTRE REDEVELOPMENT (AREA 2 & 3) AT NKIL 6514, KWUN TONG, KOWLOON		
	REPORT DATE:	20/08/2018	REPORT NO:	J837-03A

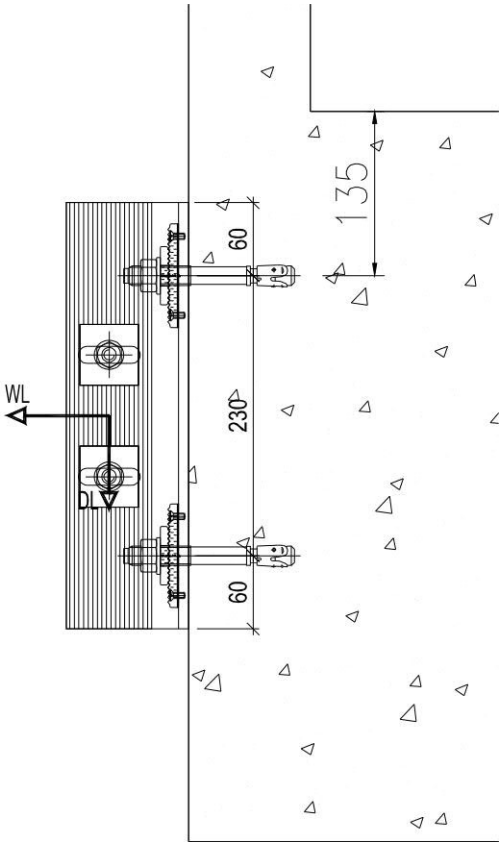
Reaction Force



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1.1.2 *RD1-Central Cast in Channel (Missing 4 NOS HST3-R M16)*


R.C. BEAM
51
190
51
189.3
DIM. PT.


135
60
230
60
WL
DL

LOADS

From computer analysis

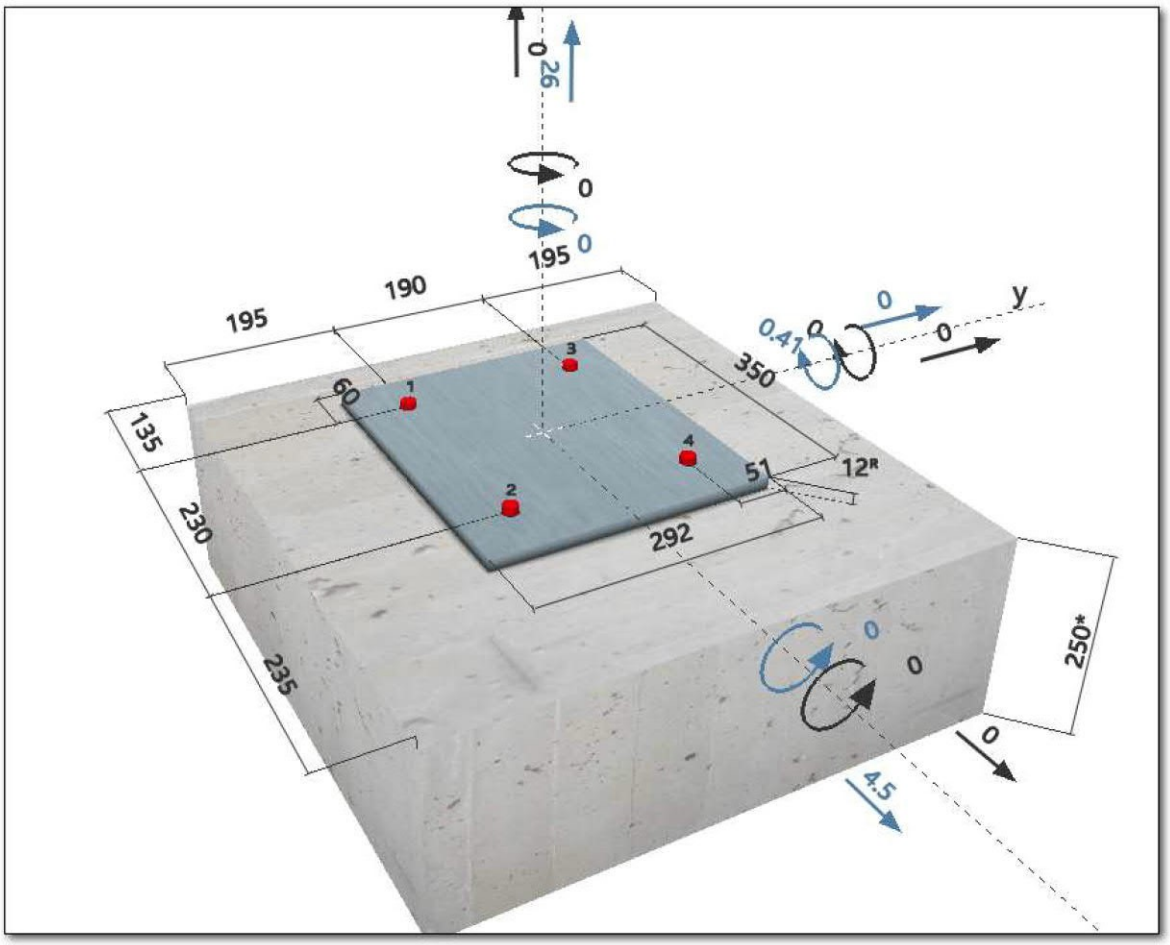
Wind load per fixing $WL := 26kN$

Dead load per fixing $DL := 4.5kN$

Eccentricity $e := 65mm + 25mm$

Moment due to WL & DL $M_x := DL \cdot e$

$M_x = 0.41 \cdot kN \cdot m$



Company:		Page:	1
Specifier:		Project:	
Address:		Sub-Project I Pos. No.:	
Phone I Fax:	|	Date:	18/1/2019
E-Mail:			

Specifier's comments:

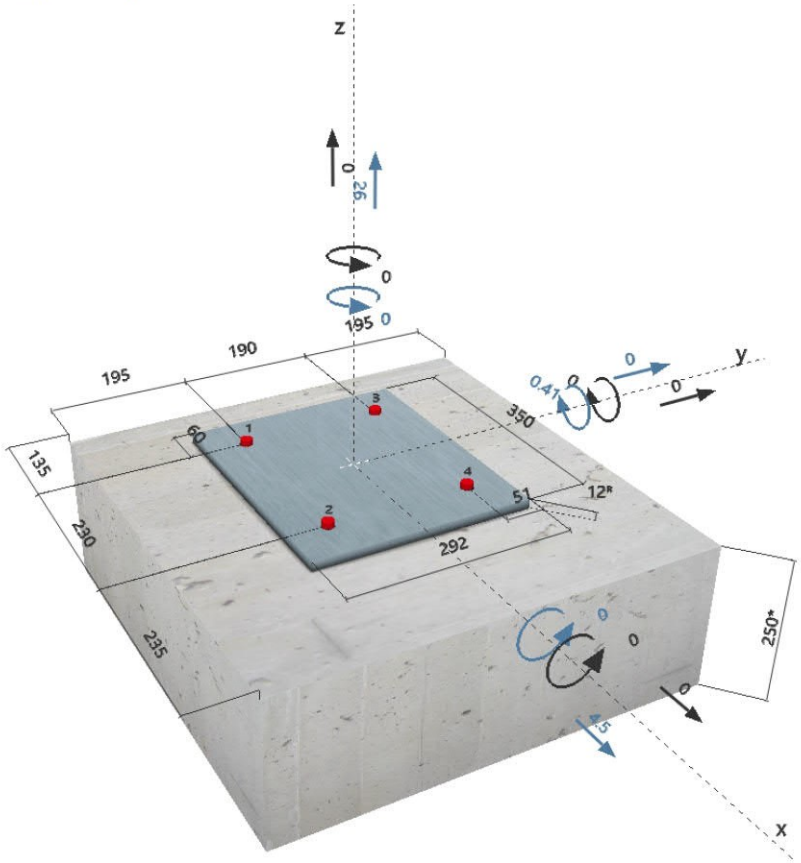
1 Input data



Anchor type and diameter:	**HST3-R M16 hef2**
Effective embedment depth:	h_{ef} = 85 mm, h_{nom} = 98 mm
Material:	A4
Evaluation Service Report:	ETA-98/0001
Issued I Valid:	9/2/2018 | -
Proof:	Design method ETAG (No. 001 Annex C/2010)
Stand-off installation:	e_b = 0 mm (no stand-off); t = 12 mm
Anchor plate:	l_x x l_y x t = 350 mm x 292 mm x 12 mm; (Recommended plate thickness: not calculated
Profile:	no profile
Base material:	cracked concrete, , $f_{c,cube}$ = 35.00 N/mm²; h = 250 mm
Installation:	**hammer drilled hole, Installation condition: Dry**
Reinforcement:	no reinforcement or reinforcement spacing >= 150 mm (any Ø) or >= 100 mm (Ø <= 10 mm) with longitudinal edge reinforcement d >= 12 + close mesh (stirrups, hangers) s <= .

R - user is responsible to ensure a rigid base plate for the entered thickness with appropriate solutions (stiffeners,...)

Geometry [mm] & Loading [kN, kNm]



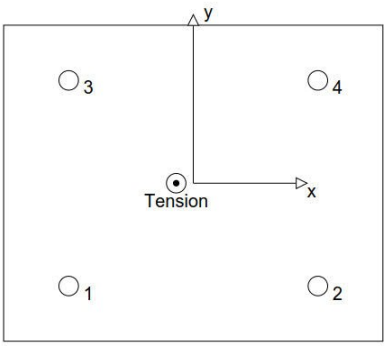
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Sub-Project I Pos. No.:
Date: 18/1/2019

2 Load case/Resulting anchor forces

Load case 1 (2.00·permanent load + 2.00·variable load)
Load case 2 (1.0·permanent load + 2.00·variable load)
Load case 3 (2.00·permanent load)



Anchor reactions [kN]
Tension force: (+Tension, -Compression)

Anchor	Tension force	Shear force	Shear force x	Shear force y
1	14.783	2.250	2.250	0.000
2	11.217	2.250	2.250	0.000
3	14.783	2.250	2.250	0.000
4	11.217	2.250	2.250	0.000

max. concrete compressive strain: - [‰]
max. concrete compressive stress: - [N/mm²]
resulting tension force in (x/y)=(-16/0): 52.000 [kN]
resulting compression force in (x/y)=(0/0): 0.000 [kN]

Anchor forces based on a rigid base plate assumption!

3 Tension load (ETAG, Annex C, Section 5.2.2)

	Load [kN]	Capacity [kN]	Utilization β_N [%]	Status
Steel Strength*	14.783	49.571	30	OK
Pullout Strength*	N/A	N/A	N/A	N/A
Concrete Breakout Strength**	52.000	65.733	80	OK
Splitting failure**	N/A	N/A	N/A	N/A

* anchor having the highest loading **anchor group (anchors in tension)

3.1 Steel Strength

$N_{Rk,s}$ [kN]	$\gamma_{M,s}$	$N_{Rd,s}$ [kN]	N_{Sd} [kN]
69.400	1.400	49.571	14.783

3.2 Concrete Breakout Strength

$A_{c,N}$ [mm²]	$A^0_{c,N}$ [mm²]	$c_{cr,N}$ [mm]	$s_{cr,N}$ [mm]		
215,825	65,025	128	255		
$e_{c1,N}$ [mm]	$\psi_{ec1,N}$	$e_{c2,N}$ [mm]	$\psi_{ec2,N}$	$\psi_{s,N}$	$\psi_{re,N}$
16	0.890	0	1.000	1.000	1.000
k_1	$N^0_{Rk,c}$ [kN]	$\gamma_{M,c}$	$N_{Rd,c}$ [kN]	N_{Sd} [kN]	
7.200	33.381	1.500	65.733	52.000	

Input data and results must be checked for agreement with the existing conditions and for plausibility!
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Date: 18/1/2019

4 Shear load (ETAG, Annex C, Section 5.2.3)

	Load [kN]	Capacity [kN]	Utilization β_V [%]	Status
Steel Strength (without lever arm)*	2.250	50.880	5	OK
Steel failure (with lever arm)*	N/A	N/A	N/A	N/A
Pryout Strength**	9.000	251.872	4	OK
Concrete edge failure in direction x+**	9.000	35.224	26	OK

* anchor having the highest loading **anchor group (relevant anchors)

4.1 Steel Strength (without lever arm)

$V_{Rk,s}$ [kN]	$\gamma_{M,s}$	$V_{Rd,s}$ [kN]	V_{Sd} [kN]
63.600	1.250	50.880	2.250

4.2 Pryout Strength

$A_{c,N}$ [mm²]	$A^0_{c,N}$ [mm²]	$c_{cr,N}$ [mm]	$s_{cr,N}$ [mm]	k-factor
215,825	65,025	128	255	3.410

$e_{c1,V}$ [mm]	$\psi_{ec1,N}$	$e_{c2,V}$ [mm]	$\psi_{ec2,N}$	$\psi_{s,N}$	$\psi_{re,N}$
0	1.000	0	1.000	1.000	1.000

$N^0_{Rk,c}$ [kN]	$\gamma_{M,c,p}$	$V_{Rd,cp}$ [kN]	V_{Sd} [kN]
33.381	1.500	251.872	9.000

4.3 Concrete edge failure in direction x+

l_f [mm]	d_{nom} [mm]	k_1	α	β
85	16.0	1.700	0.071	0.063

c_1 [mm]	c_1' [mm]	$A_{c,V}$ [mm²]	$A^0_{c,V}$ [mm²]
235	167	145,000	125,000

$\psi_{s,V}$	$\psi_{h,V}$	$\psi_{\alpha,V}$	$e_{c,V}$ [mm]	$\psi_{ec,V}$	$\psi_{re,V}$
0.934	1.000	1.000	0	1.000	1.400

$V^0_{Rk,c}$ [kN]	$\gamma_{M,c}$	$V_{Rd,c}$ [kN]	V_{Sd} [kN]
34.833	1.500	35.224	9.000

5 Combined tension and shear loads (ETAG, Annex C, Section 5.2.4)

β_N	β_V	α	Utilization $\beta_{N,V}$ [%]	Status
0.791	0.256	1.500	84	OK

$\beta_N^\alpha + \beta_V^\alpha \leq 1.0$

6 Displacements (highest loaded anchor)

Short term loading:

N_{Sk} = 7.391 [kN]
V_{Sk} = 1.125 [kN]

δ_N = 0.993 [mm]
δ_V = 0.177 [mm]
δ_{NV} = 1.008 [mm]

Long term loading:

N_{Sk} = 7.391 [kN]
V_{Sk} = 1.125 [kN]

δ_N = 0.938 [mm]
δ_V = 0.263 [mm]
δ_{NV} = 0.974 [mm]

Comments: Tension displacements are valid with half of the required installation torque moment for uncracked concrete! Shear displacements are valid without friction between the concrete and the anchor plate! The gap due to the drilled hole and clearance hole tolerances are not included in this calculation!

The acceptable anchor displacements depend on the fastened construction and must be defined by the designer!

Input data and results must be checked for agreement with the existing conditions and for plausibility!
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7 Warnings

- The anchor design methods in PROFIS Anchor require rigid anchor plates per current regulations (ETAG 001/Annex C, EOTA TR029, etc.). This means load re-distribution on the anchors due to elastic deformations of the anchor plate are not considered - the anchor plate is assumed to be sufficiently stiff, in order not to be deformed when subjected to the design loading. PROFIS Anchor calculates the minimum required anchor plate thickness with FEM to limit the stress of the anchor plate based on the assumptions explained above. The proof if the rigid base plate assumption is valid is not carried out by PROFIS Anchor. Input data and results must be checked for agreement with the existing conditions and for plausibility!
- Checking the transfer of loads into the base material is required in accordance with ETAG 001, Annex C(2010)Section 7! The software considers that the grout is installed under the anchor plate without creating air voids and before application of the loads.
- The design is only valid if the clearance hole in the fixture is not larger than the value given in Table 4.1 of ETAG 001, Annex C! For larger diameters of the clearance hole see Chapter 1.1. of ETAG 001, Annex C!
- The accessory list in this report is for the information of the user only. In any case, the instructions for use provided with the product have to be followed to ensure a proper installation.

Fastening meets the design criteria!

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8 Installation data

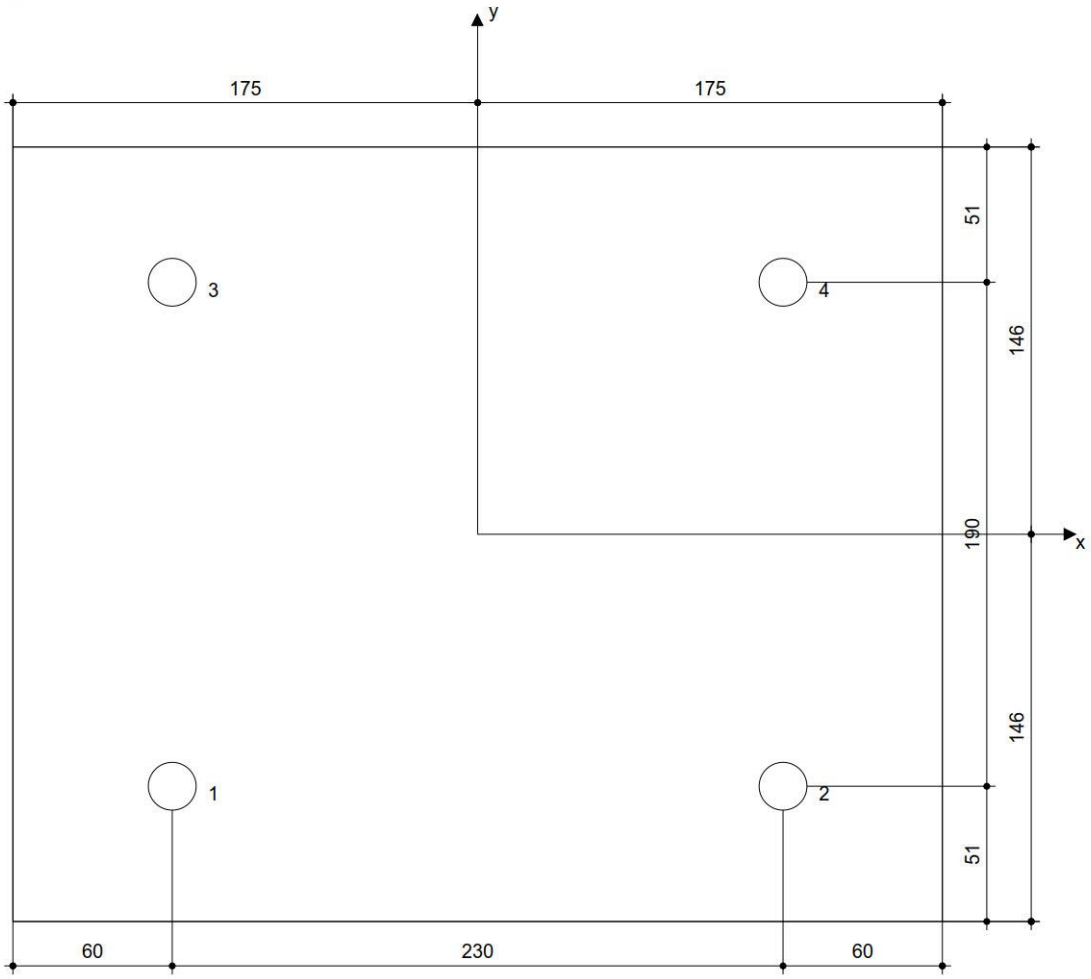
Anchor plate, steel: -
Profile: no profile
Hole diameter in the fixture: d_f = 18 mm
Plate thickness (input): 12 mm
Recommended plate thickness: not calculated
Drilling method: Hammer drilled
Cleaning: Manual cleaning of the drilled hole according to instructions for use is required.

Anchor type and diameter: HST3-R M16 hef2
Installation torque: 0.110 kNm
Hole diameter in the base material: 16 mm
Hole depth in the base material: 108 mm
Minimum thickness of the base material: 160 mm

R - user is responsible to ensure a rigid base plate for the entered thickness with appropriate solutions (stiffeners,...)

8.1 Recommended accessories

Drilling	Cleaning	Setting
• Suitable Rotary Hammer	• Manual blow-out pump	• Torque wrench
• Properly sized drill bit		• Hammer



Coordinates Anchor [mm]

Anchor	x	y	c_{-x}	c_{+x}	c_{-y}	c_{+y}
1	-115	-95	135	465	195	385
2	115	-95	365	235	195	385
3	-115	95	135	465	385	195
4	115	95	365	235	385	195

Input data and results must be checked for agreement with the existing conditions and for plausibility!
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9 Remarks; Your Cooperation Duties

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HST3 (-R) subject to:

Anchor size	M8	M10	M12	M16	M20	M24
Hammer drilling* 	TE2(-A) – TE30(-A)				TE40 – TE70	
Diamond core drilling* 	DD-30W, DD-EC1					
Setting tool* 	Setting tool HS-SC				-	
Hollow drill bit drilling* 	-		TE-CD, TE-YD			
Seismic Set/ Filling Set** 	Seismic/Filling Set M8-M20 (Carbon and Stainless Steel A4)					-

***Installation methods provided in ETA-98/0001**

**Seismic set needed to fill the annular gap between anchor and fixture:
No annular gap, double design resistance (agap=1)

B) CHECK LOCAL BENDING OF ALUM ANGLE BRACKET

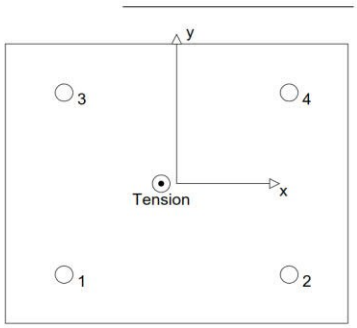
2 Load case/Resulting anchor forces

Load case 1 (2.00·permanent load + 2.00·variable load)
Load case 2 (1.0·permanent load + 2.00·variable load)
Load case 3 (2.00·permanent load)

Anchor reactions [kN]
Tension force: (+Tension, -Compression)

Anchor	Tension force	Shear force	Shear force x	Shear force y
1	14.783	2.250	2.250	0.000
2	11.217	2.250	2.250	0.000
3	14.783	2.250	2.250	0.000
4	11.217	2.250	2.250	0.000

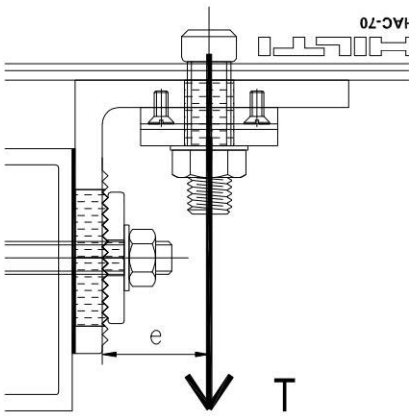
max. concrete compressive strain: - [‰]
max. concrete compressive stress: - [N/mm²]
resulting tension force in (x/y)=(-16/0): 52.000 [kN]
resulting compression force in (x/y)=(0/0): 0.000 [kN]



Material factor $\gamma_{mc} := 1.5$

Safety factor $FOS := 3$

Tension per Bolt $T := 14.8kN\frac{\gamma_{mc}}{FOS} = 7.4\cdot kN$



Eccentricity $e := 40mm$

Moment $M_e := T\cdot e = 0.3\cdot kN\cdot m$

Thickness of section $t := 12mm$

Edge / end distance $ed_1 := 60mm$

Spacing of bolt $s_f := 230mm$

Diameter of bolt $d_b := 16mm$

Angle of load spreading $\theta := 60deg$

Effective breadth $b_{eff} := \min\left(e\cdot\tan(60deg), ed_1\right) + \min\left(e\cdot\tan(60deg), \frac{s_f}{2}\right)$

$b_{eff} = 129\cdot mm$

Elastic modulus $S := \frac{b_{eff}\cdot t^2}{4} = 4.65\times10^3\cdot mm^3$

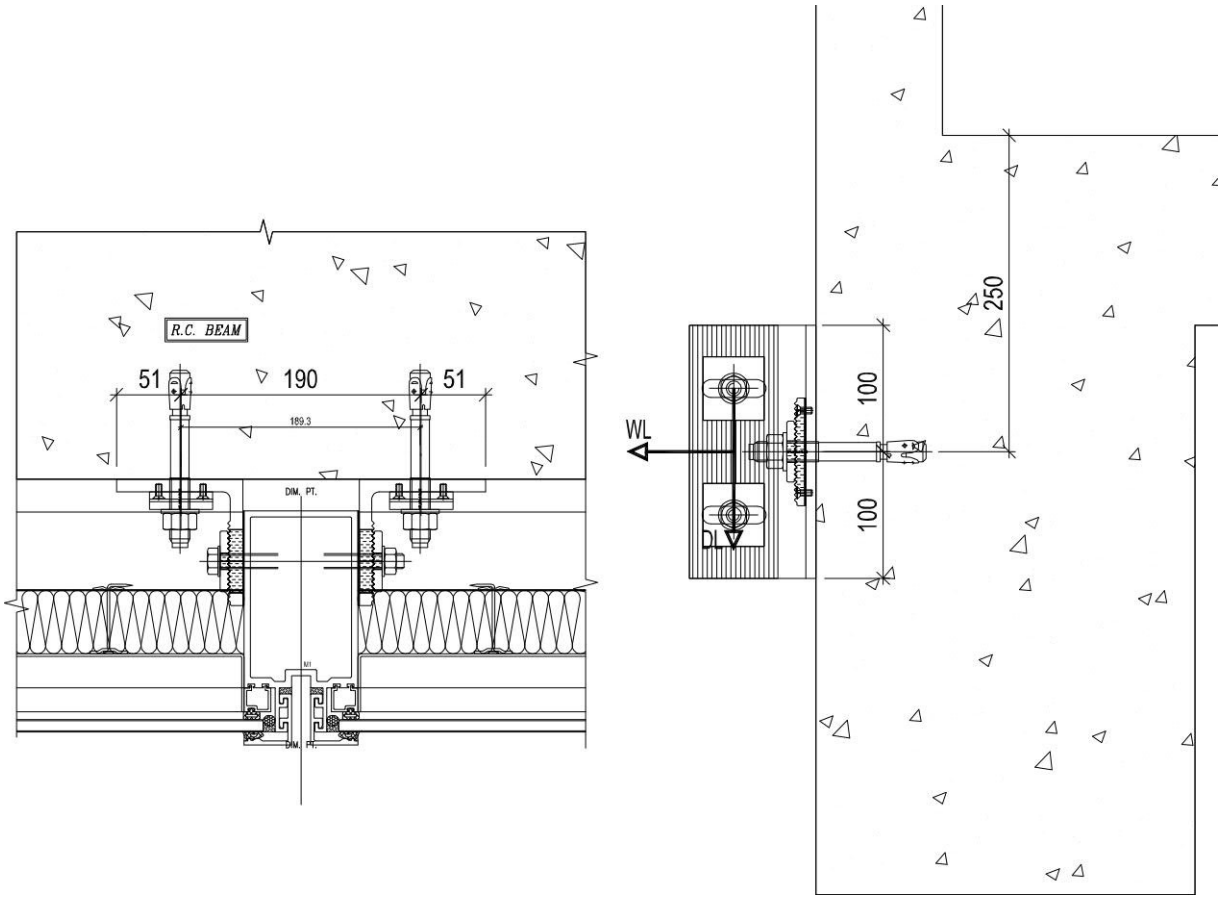
$\gamma_{f1} := 1.4 \qquad \gamma_m := 1.2$

Design strength of 6061-T6 $p_{o61} := 240MPa$

Factored moment resistance $M_{RS} := \frac{p_{o61}\cdot S}{\gamma_{f1}\cdot\gamma_m}$

$M_{RS} = 6.65\times10^5\cdot N\cdot mm \quad > \quad M_e = 2.96\times10^5\cdot N\cdot mm$ **OK**

1.1.3 *RD2-Central Cast in Channel (Missing, 2 NOS HST3-R M16 For 1000 LOAD WIDTH)*



LOADS

From computer analysis

Wind load per fixing $WL_o := 26kN$

Dead load per fixing $DL_o := 4.5kN$

1) Wind Load

Original tributary width of panel $W_o := 1750mm = 1.75\,m$

Tributary width of panel $W_1 := 1000mm$

Wind load perfixing $WL_1 := WL_o \cdot \frac{W_1}{W_o} = 14.86 \cdot kN$

2) Dead Load

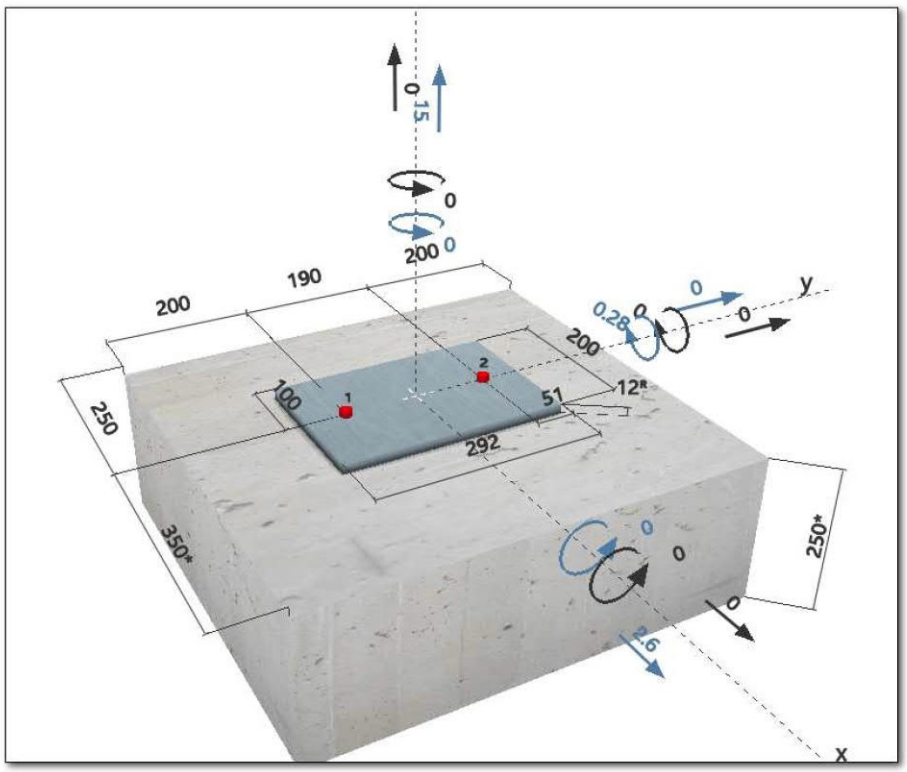
Original Dead load per fixing $DL_o = 4.5 \cdot kN$

Dead load per fixing $DL_1 := DL_o \cdot \frac{W_1}{W_o} = 2.57 \cdot kN$

Eccentricity $e := 65mm + 25mm$

Moment due to WL & DL $M_x := DL_1 \cdot e$

$M_x = 0.23 \cdot kN \cdot m$



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Profis Anchor 2.7.9

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Specifier:		Project:	
Address:		Sub-Project I Pos. No.:	
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E-Mail:			

Specifier's comments:

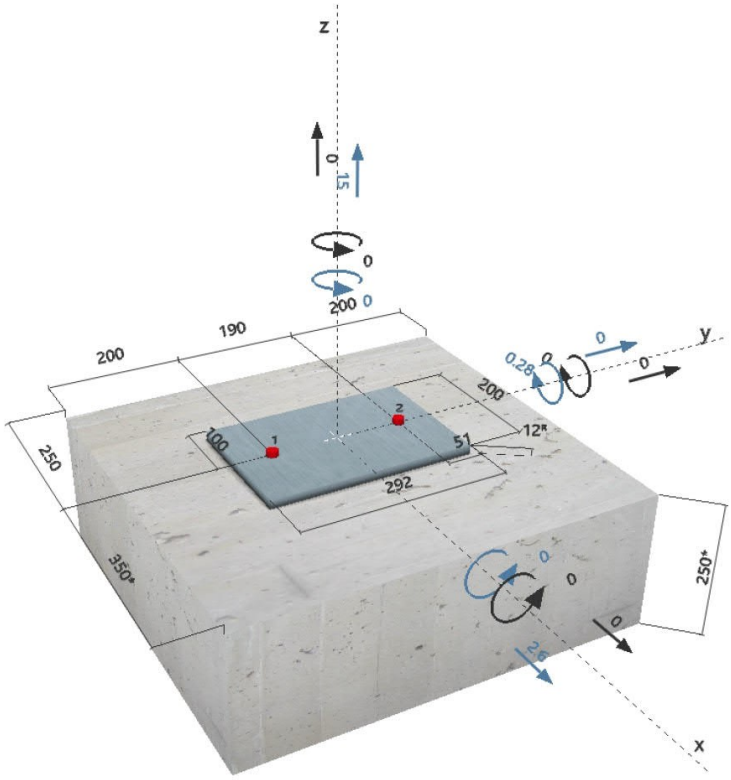
1 Input data



Anchor type and diameter:	**HST3-R M16 hef2**
Effective embedment depth:	h_{ef} = 85 mm, h_{nom} = 98 mm
Material:	A4
Evaluation Service Report:	ETA-98/0001
Issued I Valid:	9/2/2018 | -
Proof:	Design method ETAG (No. 001 Annex C/2010)
Stand-off installation:	e_b = 0 mm (no stand-off); t = 12 mm
Anchor plate:	l_x x l_y x t = 200 mm x 292 mm x 12 mm; (Recommended plate thickness: not calculated
Profile:	no profile
Base material:	cracked concrete, , $f_{c,cube}$ = 35.00 N/mm²; h = 250 mm
Installation:	**hammer drilled hole, Installation condition: Dry**
Reinforcement:	no reinforcement or reinforcement spacing >= 150 mm (any Ø) or >= 100 mm (Ø <= 10 mm) with longitudinal edge reinforcement d >= 12 + close mesh (stirrups, hangers) s <=

R - user is responsible to ensure a rigid base plate for the entered thickness with appropriate solutions (stiffeners,...)

Geometry [mm] & Loading [kN, kNm]



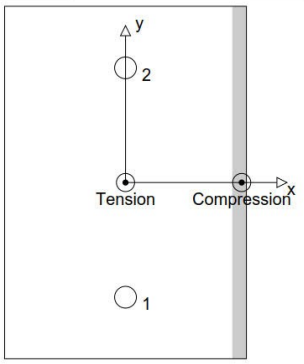
Input data and results must be checked for agreement with the existing conditions and for plausibility!
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2 Load case/Resulting anchor forces

Load case 1 (2.00·permanent load + 2.00·variable load)
Load case 2 (1.0·permanent load + 2.00·variable load)
Load case 3 (2.00·permanent load)



Anchor reactions [kN]
Tension force: (+Tension, -Compression)

Anchor	Tension force	Shear force	Shear force x	Shear force y
1	17.913	2.600	2.600	0.000
2	17.913	2.600	2.600	0.000

max. concrete compressive strain:	0.11 [‰]
max. concrete compressive stress:	3.42 [N/mm²]
resulting tension force in (x/y)=(0/0):	35.827 [kN]
resulting compression force in (x/y)=(96/0):	5.827 [kN]

Anchor forces based on a rigid base plate assumption!

3 Tension load (ETAG, Annex C, Section 5.2.2)

	Load [kN]	Capacity [kN]	Utilization β_N [%]	Status
Steel Strength*	17.913	49.571	37	OK
Pullout Strength*	N/A	N/A	N/A	N/A
Concrete Breakout Strength**	35.827	38.835	93	OK
Splitting failure**	N/A	N/A	N/A	N/A

* anchor having the highest loading **anchor group (anchors in tension)

3.1 Steel Strength

$N_{Rk,s}$ [kN]	$\gamma_{M,s}$	$N_{Rd,s}$ [kN]	N_{Sd} [kN]
69.400	1.400	49.571	17.913

3.2 Concrete Breakout Strength

$A_{c,N}$ [mm²]	$A^0_{c,N}$ [mm²]	$c_{cr,N}$ [mm]	$s_{cr,N}$ [mm]
113,475	65,025	128	255

$e_{c1,N}$ [mm]	$\psi_{ec1,N}$	$e_{c2,N}$ [mm]	$\psi_{ec2,N}$	$\psi_{s,N}$	$\psi_{re,N}$
0	1.000	0	1.000	1.000	1.000

k_1	$N^0_{Rk,c}$ [kN]	$\gamma_{M,c}$	$N_{Rd,c}$ [kN]	N_{Sd} [kN]
7.200	33.381	1.500	38.835	35.827

Input data and results must be checked for agreement with the existing conditions and for plausibility!
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4 Shear load (ETAG, Annex C, Section 5.2.3)

	Load [kN]	Capacity [kN]	Utilization β_V [%]	Status
Steel Strength (without lever arm)*	2.600	50.880	6	OK
Steel failure (with lever arm)*	N/A	N/A	N/A	N/A
Pryout Strength**	5.200	132.427	4	OK
Concrete edge failure in direction x+**	5.200	36.061	15	OK

* anchor having the highest loading **anchor group (relevant anchors)

4.1 Steel Strength (without lever arm)

$V_{Rk,s}$ [kN]	$\gamma_{M,s}$	$V_{Rd,s}$ [kN]	V_{Sd} [kN]
63.600	1.250	50.880	2.600

4.2 Pryout Strength

$A_{c,N}$ [mm²]	$A^0_{c,N}$ [mm²]	$c_{cr,N}$ [mm]	$s_{cr,N}$ [mm]	k-factor	
113,475	65,025	128	255	3.410	
$e_{c1,V}$ [mm]	$\psi_{ec1,N}$	$e_{c2,V}$ [mm]	$\psi_{ec2,N}$	$\psi_{s,N}$	$\psi_{re,N}$
0	1.000	0	1.000	1.000	1.000
$N^0_{Rk,c}$ [kN]	$\gamma_{M,c,p}$	$V_{Rd,cp}$ [kN]	V_{Sd} [kN]		
33.381	1.500	132.427	5.200		

4.3 Concrete edge failure in direction x+

l_f [mm]	d_{nom} [mm]	k_1	α	β	
85	16.0	1.700	0.071	0.063	
c_1 [mm]	c'_1 [mm]	$A_{c,V}$ [mm²]	$A^0_{c,V}$ [mm²]		
350	167	147,500	125,000		
$\psi_{s,V}$	$\psi_{h,V}$	$\psi_{\alpha,V}$	$e_{c,V}$ [mm]	$\psi_{ec,V}$	$\psi_{re,V}$
0.940	1.000	1.000	0	1.000	1.400
$V^0_{Rk,c}$ [kN]	$\gamma_{M,c}$	$V_{Rd,c}$ [kN]	V_{Sd} [kN]		
34.833	1.500	36.061	5.200		

5 Combined tension and shear loads (ETAG, Annex C, Section 5.2.4)

β_N	β_V	α	Utilization $\beta_{N,V}$ [%]	Status
0.923	0.144	1.000	89	OK

$(\beta_N + \beta_V) / 1.2 \leq 1.0$

6 Displacements (highest loaded anchor)

Short term loading:

N_{Sk} = 8.957 [kN] δ_N = 1.203 [mm]

V_{Sk} = 1.300 [kN] δ_V = 0.204 [mm]

δ_{NV} = 1.220 [mm]

Long term loading:

N_{Sk} = 8.957 [kN] δ_N = 1.136 [mm]

V_{Sk} = 1.300 [kN] δ_V = 0.304 [mm]

δ_{NV} = 1.176 [mm]

Comments: Tension displacements are valid with half of the required installation torque moment for uncracked concrete! Shear displacements are valid without friction between the concrete and the anchor plate! The gap due to the drilled hole and clearance hole tolerances are not included in this calculation!

The acceptable anchor displacements depend on the fastened construction and must be defined by the designer!

Input data and results must be checked for agreement with the existing conditions and for plausibility!
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7 Warnings

- The anchor design methods in PROFIS Anchor require rigid anchor plates per current regulations (ETAG 001/Annex C, EOTA TR029, etc.). This means load re-distribution on the anchors due to elastic deformations of the anchor plate are not considered - the anchor plate is assumed to be sufficiently stiff, in order not to be deformed when subjected to the design loading. PROFIS Anchor calculates the minimum required anchor plate thickness with FEM to limit the stress of the anchor plate based on the assumptions explained above. The proof if the rigid base plate assumption is valid is not carried out by PROFIS Anchor. Input data and results must be checked for agreement with the existing conditions and for plausibility!
- Checking the transfer of loads into the base material is required in accordance with ETAG 001, Annex C(2010)Section 7! The software considers that the grout is installed under the anchor plate without creating air voids and before application of the loads.
- The design is only valid if the clearance hole in the fixture is not larger than the value given in Table 4.1 of ETAG 001, Annex C! For larger diameters of the clearance hole see Chapter 1.1. of ETAG 001, Annex C!
- The accessory list in this report is for the information of the user only. In any case, the instructions for use provided with the product have to be followed to ensure a proper installation.

Fastening meets the design criteria!

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8 Installation data

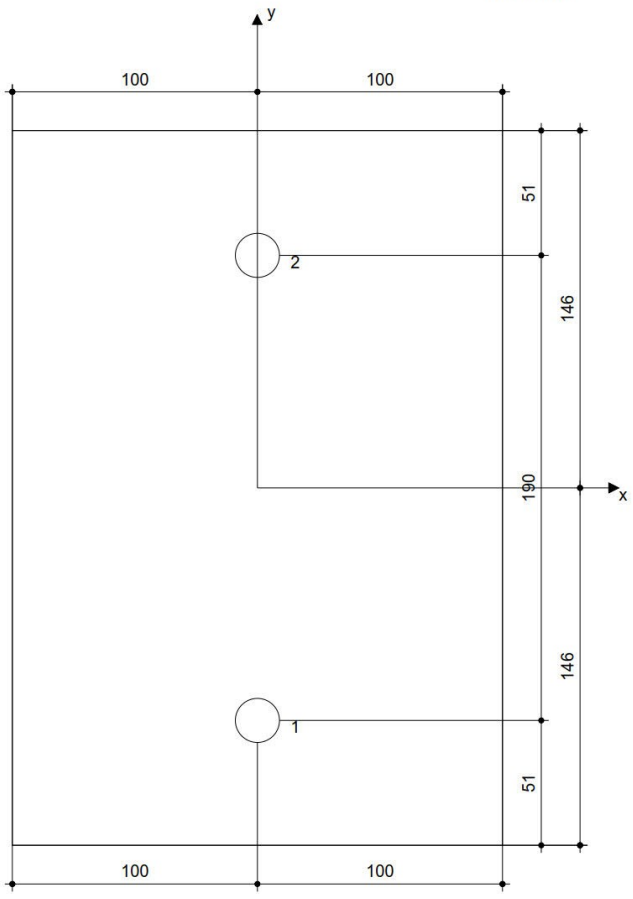
Anchor plate, steel: -
Profile: no profile
Hole diameter in the fixture: d_f = 18 mm
Plate thickness (input): 12 mm
Recommended plate thickness: not calculated
Drilling method: Hammer drilled
Cleaning: Manual cleaning of the drilled hole according to instructions for use is required.

Anchor type and diameter: HST3-R M16 hef2
Installation torque: 0.110 kNm
Hole diameter in the base material: 16 mm
Hole depth in the base material: 108 mm
Minimum thickness of the base material: 160 mm

R - user is responsible to ensure a rigid base plate for the entered thickness with appropriate solutions (stiffeners,...)

8.1 Recommended accessories

Drilling	Cleaning	Setting
• Suitable Rotary Hammer	• Manual blow-out pump	• Torque wrench
• Properly sized drill bit		• Hammer



Coordinates Anchor [mm]

Anchor	x	y	c_{-x}	c_{+x}	c_{-y}	c_{+y}
1	0	-95	250	350	200	390
2	0	95	250	350	390	200

Input data and results must be checked for agreement with the existing conditions and for plausibility!
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9 Remarks; Your Cooperation Duties

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HST3 (-R) subject to:

Anchor size	M8	M10	M12	M16	M20	M24
Hammer drilling* 	TE2(-A) – TE30(-A)				TE40 – TE70	
Diamond core drilling* 	DD-30W, DD-EC1					
Setting tool* 	Setting tool HS-SC				-	
Hollow drill bit drilling* 	-		TE-CD, TE-YD			
Seismic Set/ Filling Set** 	Seismic/Filling Set M8-M20 (Carbon and Stainless Steel A4)					-

***Installation methods provided in ETA-98/0001**
**Seismic set needed to fill the annular gap between anchor and fixture:
No annular gap, double design resistance (agap=1)

B) CHECK LOCAL BENDING OF ALUM ANGLE BRACKET

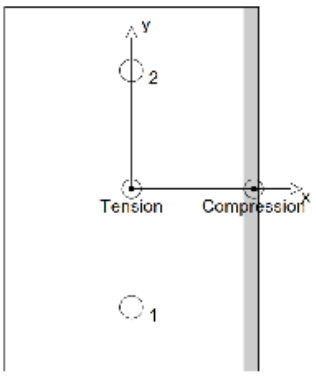
2 Load case/Resulting anchor forces

Load case 1 (2.00·permanent load + 2.00·variable load)
Load case 2 (1.0·permanent load + 2.00·variable load)
Load case 3 (2.00·permanent load)

Anchor reactions [kN]
Tension force: (+Tension, -Compression)

Anchor	Tension force	Shear force	Shear force x	Shear force y
1	17.913	2.600	2.600	0.000
2	17.913	2.600	2.600	0.000

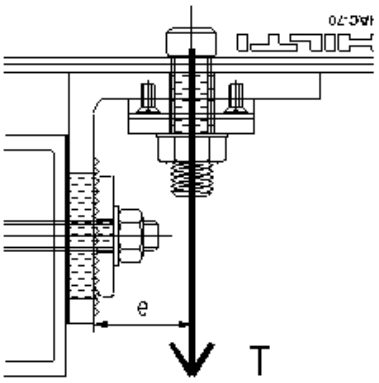
max. concrete compressive strain: 0.11 [‰]
max. concrete compressive stress: 3.42 [N/mm²]
resulting tension force in (x/y)=(0/0): 35.827 [kN]
resulting compression force in (x/y)=(96/0): 5.827 [kN]



Material factor $\gamma_{mc} := 1.5$

Safety factor $FOS := 3$

Tension per Bolt $T := 18kN\frac{\gamma_{mc}}{FOS} = 9\cdot kN$



Eccentricity $e := 40mm$

Moment $M_e := T\cdot e = 0.36\cdot kN\cdot m$

Thickness of section $t := 12mm$

Edge / end distance $ed_1 := 100mm$

Diameter of bolt $d_b := 16mm$

Angle of load spreading $\theta := 60deg$

Effective breadth $b_{eff} := \min(e\cdot\tan(60deg), ed_1) + \min(e\cdot\tan(60deg), ed_1)$

$b_{eff} = 139\cdot mm$

Elastic modulus $S := \frac{b_{eff}\cdot t^2}{4} = 4.99\times10^3\cdot mm^3$

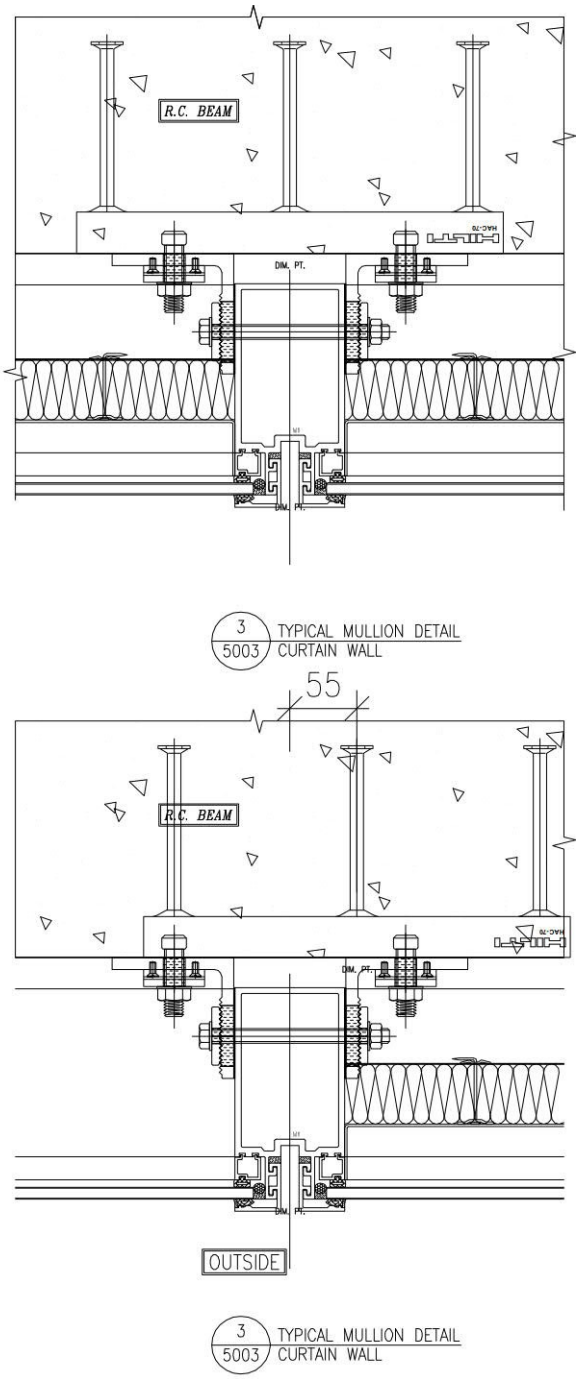
$\gamma_{f1} := 1.4 \qquad \gamma_m := 1.2$

Design strength of 6061-T6 $p_{o61} := 240MPa$

Factored moment resistance $M_{RS} := \frac{p_{o61}\cdot S}{\gamma_{f1}\cdot\gamma_m}$

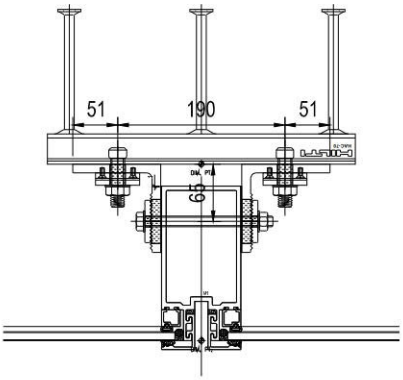
$M_{RS} = 7.13\times10^5\cdot N\cdot mm \quad > \quad M_e = 3.6\times10^5\cdot N\cdot mm$ **OK**

1.1.4 *RD3-Central Cast in Channel (Shft Horizontal 55mm)*



TYPICAL CENTRAL MULLION

X- MAX LEFT RIGHT 55mm
Y- MAX 25mm UPWARD
Z- MAX 25mm INWARD



LOAD

support reaction (unfactored)

$WL = 26 \cdot kN$

$DL = 4.5 \cdot kN$

Eccentricity

$e := 65mm + 25mm$

Moment due to WL & DL

$M_x := WL \cdot 25mm + DL \cdot e$

$M_x = 1.06 \cdot kN \cdot m$

Loading Input for Hilti Programme for Cast In Channel Analysis

To achieve factor of safety of 3.0 (with material factor of 1.8 already included in the program.) the factored reaction input into the program is:

Material factor

$\gamma_{mc} := 1.8$

Safety factor

$FOS := 3$

Horizontal Load

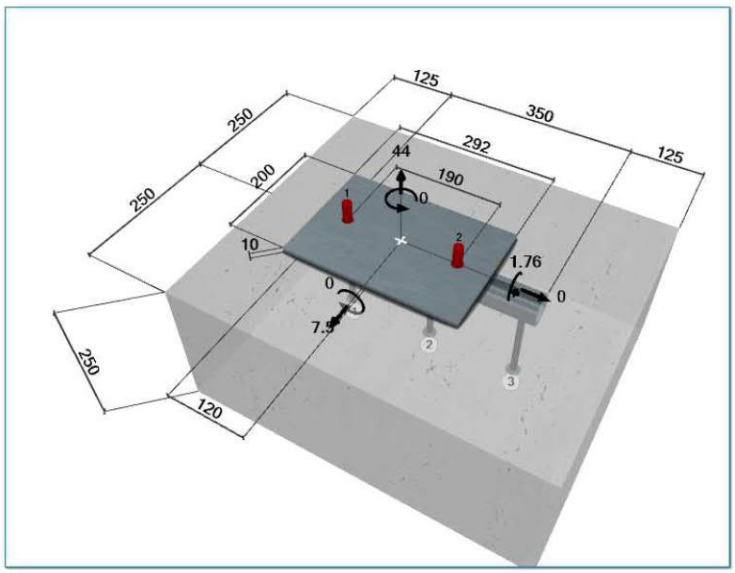
$$T := \frac{WL \cdot FOS}{\gamma_{mc}} = 43.33 \cdot kN$$

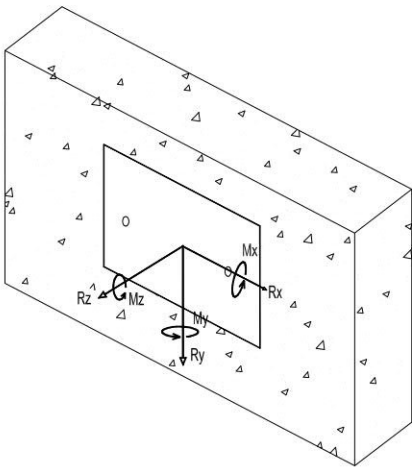
Vertical Load

$$V := \frac{DL \cdot FOS}{\gamma_{mc}} = 7.5 \cdot kN$$

Moment

$$M_{xx} := \frac{M_x \cdot FOS}{\gamma_{mc}} = 1.76 \cdot kN \cdot m$$





Reaction force on Channel (Unfactored)

$R_x := 0kN$

$R_y := DL = 4.5 \cdot kN$

$R_z := WL = 26 \cdot kN$

$M_x = 1.06 \cdot kN \cdot m$

$M_y := 0kN \cdot m$

$M_z := 0kN \cdot m$

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Specifier:		Project:	
Address:		Fastening point:	
Phone | Fax:	|	Location | Date:	18/01/2019
E-Mail:			

Specifier's comments:

1 Input data



Channel type	**HAC-70 175/350 F**
Bolt	**HBC-C 8.8F, M16 x 50 mm**
Effective embedment depth	h_{ef} = 175 mm
Channel specification	Length: 350 mm, anchor spacing: 150 mm, projection: 25 mm, width: b_{ch} = 45 mm, height: h_{ch} = 40 mm
Material	Anchor & Channel: hot-dip galvanized Bolt: hot-dip galvanized
Europ. Tech. Assessment (ETA)	-
Issued I Valid	- | -
Standard	Hilti method based on CEN/TS 1992-4-3
Base material	cracked, , $f_{ck,cube}$ = 35.0 N/mm^2, h = 250 mm
Reinforcement	Exist. Reinf.: Widely spaced Edge reinf. and stirrups present Reinf. to control splitting present
Tolerance data	tolerance interval: -300 mm/300 mm most unfavorable tolerance: 0 mm

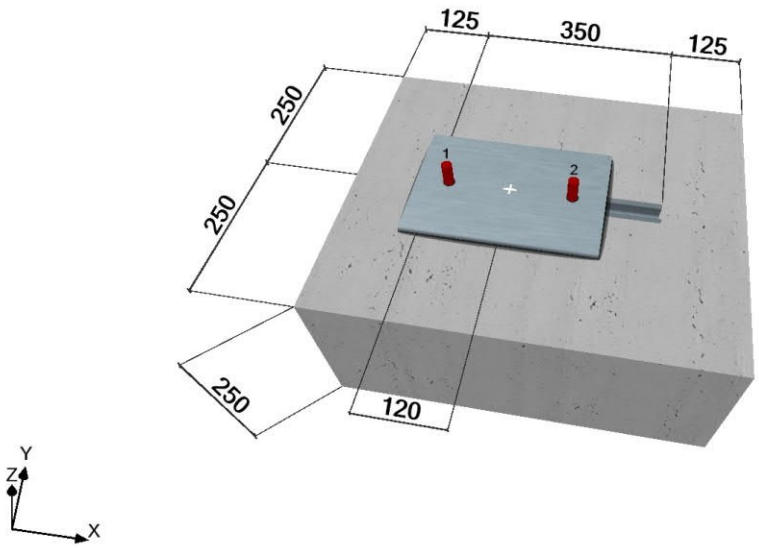
2 Overall Result

Design ok! (Maximum utilization: 86%)

Input data and results must be checked for agreement with the existing conditions and for plausibility!
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3 Geometry

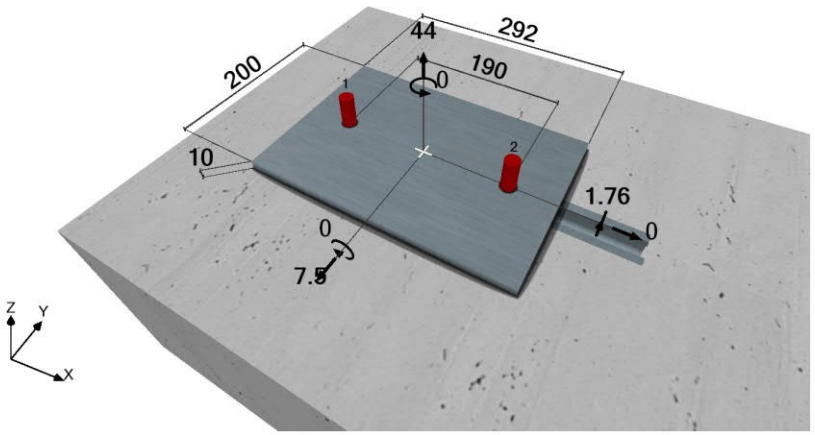


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E-Mail:			

3.1 Fixtures / Bolt groups / Loads

Fixture 1



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4 Load case / Resulting bolt forces

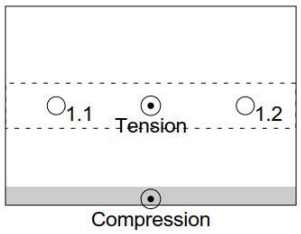
Load case: Design load

4.1 Load distribution

4.1.1 Fixture 1: Bolt: HBC-C 8.8F, M16 x 50 mm

Profile: -
Standoff: No standoff
Plate dimensions: 292 mm x 200 mm x 10 mm
Anchorplate design calculated: no

Bolt	N [kN]	V [kN]	V_x [kN]	V_y [kN]
1.1	31.383	3.750	0.000	-3.750
1.2	31.383	3.750	0.000	-3.750



4.2 Derivation of forces acting on anchor channels

$N^a_{Ed,i}$ $= k \cdot A_i' \cdot N_{Ed}$ [kN]

A_i' Ordinate at the position of the anchor *i* of the loadtriangle with load *N* and the base length $2l_i$

k $= \frac{1}{\sum_1^n A_i'}$

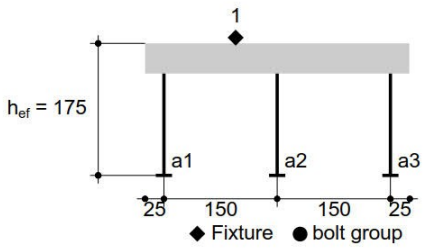
l_i $= 13 \cdot l_y^{0.05} \cdot s^{0.5} \approx 282$ [mm] ≥ s

l_y $= 95457$ [mm^4]

s $= 150$ [mm]

$V^a_{Ed,i}$ $= k \cdot A_i' \cdot V_{Ed}$ [kN]

$M_{Ed,y,max}$ $= 0.921$ [kNm]



Anchor forces [kN]

Anchor	N	V
a1	27.083	-3.236
a2	25.015	-2.989
a3	10.667	-1.275

Input data and results must be checked for agreement with the existing conditions and for plausibility!
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5 Verifications

5.1 Verifications for anchor channels under tension loading

	Load [kN], [kNm]	Resistance [kN], [kNm]	Utilization [%]	Status
Anchor	27.083	42.339	64	ok
Connection anchor-channel	27.083	40.556	67	ok
Local flexure of channel lip	31.383	40.556	78	ok
Bolt	31.383	83.733	38	ok
Flexure	0.921	2.666	35	ok
Pull-out	27.083	49.845	55	ok
Concrete cone	27.083	33.114	82	ok
Concrete splitting	N/A	N/A	N/A	N/A
Concrete blow-out	N/A	N/A	N/A	N/A
Suppl. reinf. - steel	N/A	N/A	N/A	N/A
Suppl. reinf. - anchorage	N/A	N/A	N/A	N/A

5.1.1 Steel failure (CEN/TS 1992-4-3:2009 section 6.2.3)

5.1.1.1 Anchor strength (Anchor a1, Channel a)

$$N_{Ed}^{a} \le N_{Rd,s,a} = \frac{N_{Rk,s,a}}{\gamma_{Ms,a}}$$

$$\gamma_{Ms,a} = 1.2 \cdot \frac{f_{uk,a}}{f_{yk,a}} \ge 1.4$$

N_{Ed}^{a} [kN]	$N_{Rk,s,a}$ [kN]	$\gamma_{Ms,a}$	$f_{uk,a}$ [N/mm²]	$f_{yk,a}$ [N/mm²]	$N_{Rd,s,a}$ [kN]
27.083	76.000	1.795	905.0	605.0	42.339

5.1.1.2 Connection between anchor and channel (Anchor a1, Channel a)

$$N_{Ed}^{a} \le N_{Rd,s,c} = \frac{N_{Rk,s,c}}{\gamma_{Ms,c}}$$

N_{Ed}^{a} [kN]	$N_{Rk,s,c}$ [kN]	$\gamma_{Ms,c}$	$N_{Rd,s,c}$ [kN]
27.083	73.000	1.800	40.556

5.1.1.3 Local flexure of channel lip (Fixture 1, Bolt 1.1, Channel a)

$$N_{Ed}^{s} \le N_{Rd,s,l} = \frac{N_{Rk,s,l}}{\gamma_{Ms,l}}$$

s_s = 190 [mm]

b_s = 19 [mm]

h_{ch} = 40 [mm]

$N_{Rk,s,l}$ = 73.000 [kN]

N_{Ed}^{s} [kN]	$N_{Rk,s,l}$ [kN]	$\gamma_{Ms,l}$	$N_{Rd,s,l}$ [kN]
31.383	73.000	1.800	40.556

Input data and results must be checked for agreement with the existing conditions and for plausibility!
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5.1.1.4 Bolt (Fixture 1, Bolt 1.1, Channel a)

$$N_{Ed}^{s} \le N_{Rd,s} = \frac{N_{Rk,s}}{\gamma_{Ms,N}}$$

$$N_{Rk,s} = A_s \cdot f_{uk,s}$$

$$\gamma_{Ms,N} = 1.2 \cdot \frac{f_{uk,s}}{f_{yk,s}} \ge 1.4$$

N_{Ed}^{s} [kN]	A_s [mm²]	$N_{Rk,s}$ [kN]	$\gamma_{Ms,N}$	$f_{uk,s}$ [N/mm²]	$f_{yk,s}$ [N/mm²]	$N_{Rd,s}$ [kN]
31.383	157	125.600	1.500	800.0	640.0	83.733

5.1.1.5 Flexure of channel (Channel a)

$$M_{Ed} \le M_{Rd,s,flex} = \frac{M_{Rk,s,flex}}{\gamma_{Ms,flex}}$$

$$M_{Rk,s,flex} = \frac{\alpha_r}{4} \cdot W_{pl,y} \cdot f_{yk,c}$$

M_{Ed} [kNm]	α_r	$W_{pl,y}$ [mm³]	$f_{yk,c}$ [N/mm²]	$M_{Rk,s,flex}$ [kNm]	$\gamma_{Ms,flex}$	$M_{Rd,s,flex}$ [kNm]
0.921	7.500	6540	250.0	3.066	1.150	2.666

5.1.2 Pull-out (Anchor a1, Channel a) (CEN/TS 1992-4-3:2009 section 6.2.4)

$$N_{Ed}^{a} \le N_{Rd,p} = \frac{N_{Rk,p}}{\gamma_{Mp}}$$

$$N_{Rk,p} = 6 \cdot A_h \cdot f_{ck,cube} \cdot \psi_{ucr,N}$$

$$A_h = \frac{\pi}{4} \cdot (d_h^2 - d_a^2)$$

d_h [mm]	d_a [mm]	A_h [mm²]
24	11	356

N_{Ed}^{a} [kN]	$f_{ck,cube}$ [N/mm²]	$\psi_{ucr,N}$	$N_{Rk,p}$ [kN]	γ_{Mp}	$N_{Rd,p}$ [kN]
27.083	35.0	1.000	74.768	1.500	49.845

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5.1.3 Concrete cone (Anchor a1, Channel a) (CEN/TS 1992-4-3:2009 section 6.2.5)

$$N_{Ed}^{a} \le N_{Rd,c} = \frac{N_{Rk,c}}{\gamma_{Mc,c}}$$

$$N_{Rk,c} = N_{Rk,c}^{0} \cdot \alpha_{s,N} \cdot \alpha_{e,N} \cdot \alpha_{c,N,1} \cdot \alpha_{c,N,2} \cdot \psi_{re,N} \cdot \psi_{ucr,N}$$

$$N_{Rk,c}^{0} = 8.5 \cdot \alpha_{ch} \cdot \sqrt{f_{ck,cube}} \cdot h_{ef}^{1.5}$$

$$\alpha_{ch} = \left(\frac{h_{ef}}{180}\right)^{0.15}$$

$$\alpha_{s,N} = \frac{1}{1 + \sum_{i=1}^{n}\left[\left(1 - \frac{s_i}{s_{cr,N}}\right)^{1.5} \cdot \frac{N_i}{N_0}\right]} \le 1.0$$

$$s_{cr,N} = 2 \cdot (2.8 - 1.3 \cdot h_{ef} / 180) \cdot h_{ef} \ge 3 \cdot h_{ef}$$

$$\alpha_{e,N} = \left(\frac{c_1}{c_{cr,N}}\right)^{0.5} \le 1.0$$

$$c_{cr,N} = 0.5 \cdot s_{cr,N} \ge 1.5 \cdot h_{ef}$$

$$\alpha_{c,N,1} = \left(\frac{c_{2,1}}{c_{cr,N}}\right)^{0.5} \le 1.0$$

$$\alpha_{c,N,2} = \left(\frac{c_{2,2}}{c_{cr,N}}\right)^{0.5} \le 1.0$$

$$\psi_{re,N} = 0.500 + \frac{h_{ef}}{200} \le 1.0$$

α_{ch}	$f_{ck,cube}$ [N/mm²]	h_{ef} [mm]	$N_{Rk,c}^{0}$ [kN]
0.996	35.0	175	115.924

s [mm]	$s_{cr,N}$ [mm]	$\alpha_{s,N}$	c_1 [mm]	$c_{cr,N}$ [mm]	$\alpha_{e,N}$
150	538	0.595	250	269	0.964

$c_{2,1}$ [mm]	$c_{2,2}$ [mm]	$\alpha_{c,N,1}$	$\alpha_{c,N,2}$
450	150	1.000	0.747

$\psi_{re,N}$	$\psi_{ucr,N}$
1.000	1.000

N_{Ed}^{a} [kN]	$N_{Rk,c}$ [kN]	$\gamma_{Mc,c}$	$N_{Rd,c}$ [kN]
27.083	49.671	1.500	33.114

Input data and results must be checked for agreement with the existing conditions and for plausibility!
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5.2 Verifications for anchor channels under shear loading

	Load [kN], [kNm]	Resistance [kN], [kNm]	Utilization [%]	Status
Bolt w/o lever arm	3.750	50.240	8	ok
Flexure of channel lip w/o lever arm	3.750	43.889	9	ok
Flexure of channel lip w/o lever arm parallel	N/A	N/A	N/A	N/A
Bolt lever arm	N/A	N/A	N/A	N/A
Flexure of channel lip w/ lever arm	N/A	N/A	N/A	N/A
Anchor	N/A	N/A	N/A	N/A
Pryout	3.236	66.228	5	ok
Concrete edge failure	3.236	13.747	24	ok
Concrete edge failure parallel	N/A	N/A	N/A	N/A
Suppl. reinf. - steel	N/A	N/A	N/A	N/A
Suppl. reinf. - anchorage	N/A	N/A	N/A	N/A

5.2.1 Steel failure (CEN/TS 1992-4-3:2009 section 6.3.3)

5.2.1.1 Bolt - without lever arm (Fixture 1, Bolt 1.1, Channel a)

$$V_{Ed}^{s} \leq V_{Rd,s} = \frac{V_{Rk,s}}{\gamma_{Ms,V}}$$

$$V_{Rk,s} = \alpha_s \cdot A_s \cdot f_{uk,s}$$

$$\gamma_{Ms,V} = \frac{f_{uk,s}}{f_{yk,s}} \geq 1.25$$

α_s	A_s [mm²]	$f_{uk,s}$ [N/mm²]	$f_{yk,s}$ [N/mm²]
0.500	157	800.0	640.0
V_{Ed}^{s} [kN]	$V_{Rk,s}$ [kN]	$\gamma_{Ms,V}$	$V_{Rd,s}$ [kN]
3.750	62.800	1.250	50.240

5.2.1.2 Local flexure of channel lip - without lever arm (Fixture 1, Bolt 1.1, Channel a)

$$V_{Ed}^{s} \leq V_{Rd,s,l} = \frac{V_{Rk,s,l}}{\gamma_{Ms,l}}$$

V_{Ed}^{s} [kN]	$V_{Rk,s,l}$ [kN]	$\gamma_{Ms,l}$	$V_{Rd,s,l}$ [kN]
3.750	79.000	1.800	43.889

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5.2.2 Concrete pryout (Anchor a1, Channel a) (CEN/TS 1992-4-3:2009 section 6.3.4)

$$V_{Ed}^{a} \le V_{Rd,cp} = \frac{V_{Rk,cp}}{\gamma_{Mc,p}}$$

$$V_{Rk,cp} = k_5 \cdot N_{Rk,c}$$

$$N_{Rk,c} = N_{Rk,c}^{0} \cdot \alpha_{s,N} \cdot \alpha_{e,N} \cdot \alpha_{c,N,1} \cdot \alpha_{c,N,2} \cdot \psi_{re,N} \cdot \psi_{ucr,N}$$

$$N_{Rk,c}^{0} = 8.5 \cdot \alpha_{ch} \cdot \sqrt{f_{ck,cube}} \cdot h_{ef}^{1.5}$$

$$\alpha_{ch} = \left(\frac{h_{ef}}{180}\right)^{0.15}$$

$$\alpha_{s,N} = \frac{1}{1 + \sum_{i=1}^{n}\left[\left(1 - \frac{s_i}{s_{cr,N}}\right)^{1.5} \cdot \frac{V_i}{V_0}\right]} \le 1.0$$

$$s_{cr,N} = 2 \cdot (2.8 - 1.3 \cdot h_{ef} / 180) \cdot h_{ef} \ge 3 \cdot h_{ef}$$

$$\alpha_{e,N} = \left(\frac{c_1}{c_{cr,N}}\right)^{0.5} \le 1.0$$

$$c_{cr,N} = 0.5 \cdot s_{cr,N} \ge 1.5 \cdot h_{ef}$$

$$\alpha_{c,N,1} = \left(\frac{c_{2,1}}{c_{cr,N}}\right)^{0.5} \le 1.0$$

$$\alpha_{c,N,2} = \left(\frac{c_{2,2}}{c_{cr,N}}\right)^{0.5} \le 1.0$$

$$\psi_{re,N} = 0.5 + \frac{h_{ef}}{200} \le 1.0$$

α_{ch}	$f_{ck,cube}$ [N/mm²]	h_{ef} [mm]	$N_{Rk,c}^{0}$ [kN]		
0.996	35.0	175	115.924		
s [mm]	$s_{cr,N}$ [mm]	$\alpha_{s,N}$	c_1 [mm]	$c_{cr,N}$ [mm]	$\alpha_{e,N}$
150	538	0.595	250	269	0.964
$c_{2,1}$ [mm]	$c_{2,2}$ [mm]	$\alpha_{c,N,1}$	$\alpha_{c,N,2}$		
450	150	1.000	0.747		
$\psi_{re,N}$	$\psi_{ucr,N}$				
1.000	1.000				
V_{Ed}^{a} [kN]	k_5	$N_{Rk,c}$ [kN]	$V_{Rk,cp}$ [kN]	$\gamma_{Mc,p}$	$V_{Rd,cp}$ [kN]
3.236	2.0	49.671	99.342	1.500	66.228

Input data and results must be checked for agreement with the existing conditions and for plausibility!
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5.2.3 Concrete edge failure, direction y- (Anchor a1, Channel a) (CEN/TS 1992-4-3:2009 section 6.3.5)

$$V_{Ed}^{a} \le V_{Rd,c} = \frac{V_{Rk,c}}{\gamma_{Mc,e}}$$

$$V_{Rk,c} = V_{Rk,c}^{0} \cdot \alpha_{s,V} \cdot \alpha_{c,V,1} \cdot \alpha_{c,V,2} \cdot \alpha_{h,V} \cdot \alpha_{90°,V} \cdot \psi_{re,V}$$

$$V_{Rk,c}^{0} = \alpha_p \cdot \sqrt{f_{ck,cube}} \cdot c_1^{1.5}$$

$$\alpha_{s,V} = \frac{1}{1 + \sum_{i=1}^{n}\left[\left(1 - \frac{s_i}{s_{cr,V}}\right)^{1.5} \cdot \frac{V_i}{V_0}\right]} \le 1.0$$

$$s_{cr,V} = 4 \cdot c_1 + 2 \cdot b_{ch}$$

$$\alpha_{c,V,1} = \left(\frac{c_{2,1}}{c_{cr,V}}\right)^{0.5} \le 1.0$$

$$\alpha_{c,V,2} = \left(\frac{c_{2,2}}{c_{cr,V}}\right)^{0.5} \le 1.0$$

$$c_{cr,V} = 0.5 \cdot s_{cr,V} = 2 \cdot c_1 + b_{ch}$$

$$\alpha_{h,V} = \left(\frac{h}{h_{cr,V}}\right)^{0.5} \le 1.0$$

$$h_{cr,V} = 2 \cdot c_1 + 2 \cdot h_{ch}$$

α_p	$f_{ck,cube}$ [N/mm²]	c_1 [mm]	$c_1^{'}$ [mm]	$V_{Rk,c}^{0}$ [kN]	
4.000	35.0	250	202	68.091	
s [mm]	$s_{cr,V}$ [mm]	$\alpha_{s,V}$	$c_{2,1}$ [mm]	$c_{2,2}$ [mm]	$c_{cr,V}$ [mm]
150	900	0.522	450	150	450
$\alpha_{c,V,1}$	$\alpha_{c,V,2}$				
1.000	0.577				
h [mm]	$h_{cr,V}$ [mm]	$\alpha_{h,V}$	$\alpha_{90°,V}$	$\psi_{re,V}$	
250	485	0.718	1.000	1.400	
V_{Ed}^{a} [kN]	$V_{Rk,c}$ [kN]	$\gamma_{Mc,e}$	$V_{Rd,c}$ [kN]		
3.236	20.621	1.500	13.747		

* special case

5.3 Combined tension and shear loads (CEN/TS 1992-4-3:2009 section 6.4)

Proof of interaction calculated independently for acting load and load distribution

5.3.1 Bolt (Fixture 1, Bolt 1.1)

$\beta_{N,s}^{\alpha} + \beta_{V,s}^{\alpha} = 0.774^{2.0} + 0.085^{2.0} = 0.606 \le 1.000$
$\beta_{N,s}$: governing failure mode - tension: Local flexure of channel lip (Fixture 1, Bolt 1.1)
$\beta_{V,s}$: governing failure mode - shear: Flexure of channel lip w/o lever arm (Fixture 1, Bolt 1.1)

5.3.2 Anchor channel (Anchor a1)

$\beta_{N,a}^{\alpha} + \beta_{V,a}^{\alpha} = 0.818^{1.5} + 0.235^{1.5} = 0.854 \le 1.000$
$\beta_{N,a}$: governing failure mode - tension: Concrete cone (Anchor)
$\beta_{V,a}$: governing failure mode - shear: Concrete edge failure (Anchor)

Input data and results must be checked for agreement with the existing conditions and for plausibility!
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Remarks and warnings

- The transfer of the loads acting on the fixture to the supports of the structure shall be considered in the design of the structure taking account of the requirements of CEN-TS 1992-4-1, Chapter 4.1.6 respectively Annex A, and the structurally required reinforcement has to be provided.
- The calculation of the acting forces is based on the simplified assumption of a rigid anchorplate/bracket. The anchorplate has to be designed accordingly. The design of the anchorplate/bracket must be done seperatly (outside the PROFIS software) by the engineer.

Design ok! (Maximum utilization: 86%)

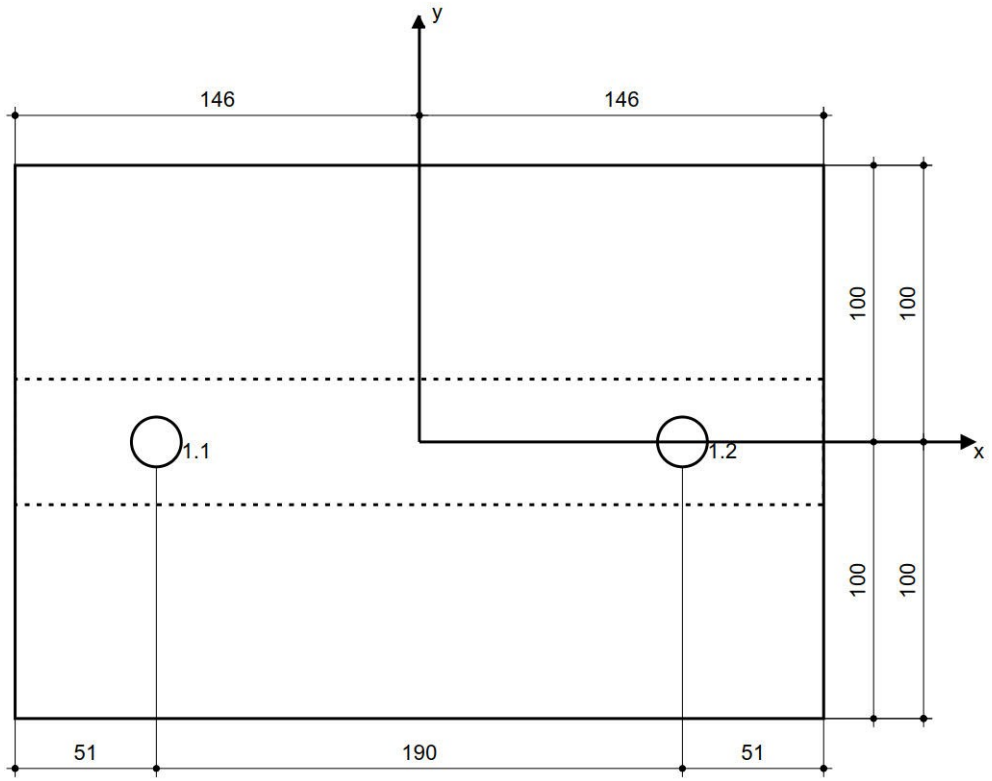
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6 Installation data

6.1 Fixture 1

Plate type: -
Plate dimensions: 292 mm x 200 mm x 10 mm
Profile: -
Anchorplate design calculated: no

Bolt type: HBC-C 8.8F, M16 x 50 mm
Bolt length: 50 mm
Bolt diameter: 16 mm
Diameter hole: 18 mm
Installation torque: 0.060 kNm



7 Remarks; Your Cooperation Duties

- Any and all information and data contained in the Software concern solely the use of Hilti products and are based on the principles, formulas and security regulations in accordance with Hilti's technical directions and operating, mounting and assembly instructions, etc., that must be strictly complied with by the user. All figures contained therein are average figures, and therefore use-specific tests are to be conducted prior to using the relevant Hilti product. The results of the calculations carried out by means of the Software are based essentially on the data you put in. Therefore, you bear the sole responsibility for the absence of errors, the completeness and the relevance of the data to be put in by you. Moreover, you bear sole responsibility for having the results of the calculation checked and cleared by an expert, particularly with regard to compliance with applicable norms and permits, prior to using them for your specific facility. The Software serves only as an aid to interpret norms and permits without any guarantee as to the absence of errors, the correctness and the relevance of the results or suitability for a specific application.
- You must take all necessary and reasonable steps to prevent or limit damage caused by the Software. In particular, you must arrange for the regular backup of programs and data and, if applicable, carry out the updates of the Software offered by Hilti on a regular basis. If you do not use the AutoUpdate function of the Software, you must ensure that you are using the current and thus up-to-date version of the Software in each case by carrying out manual updates via the Hilti Website. Hilti will not be liable for consequences, such as the recovery of lost or damaged data or programs, arising from a culpable breach of duty by you.

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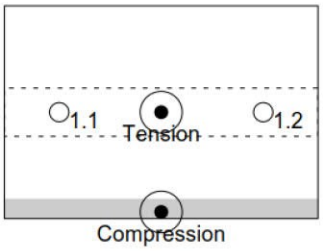
D) CHECK LOCAL BENDING OF ALUM ANGLE BRACKET

4.1 Load distribution

4.1.1 Fixture 1: bolt: HBC-C 8.8F, M16 x 50 mm

Profile: -
Standoff: No standoff
Plate dimensions: 292 mm x 200 mm x 10 mm
Anchorplate design calculated: no

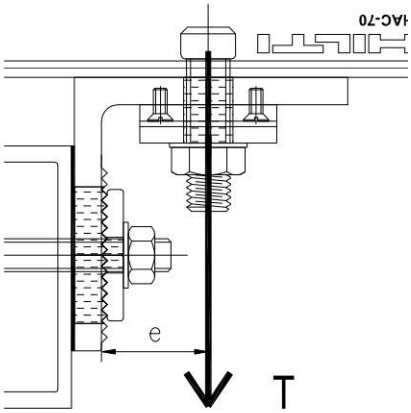
Bolt	N [kN]	V [kN]	V_x [kN]	V_y [kN]
1.1	31.383	3.750	0.000	-3.750
1.2	31.383	3.750	0.000	-3.750



Material factor $\gamma_{mc} := 1.8$

Safety factor $FOS := 3$

Tension per Bolt $T := 31.4kN\frac{\gamma_{mc}}{FOS} = 19\cdot kN$



Eccentricity $e := 40mm$

Moment $M_e := T\cdot e = 0.75\cdot kN\cdot m$

Thickness of section $t := 12mm$

Edge / end distance $ed_1 := 100mm$

Diameter of bolt $d_b := 16mm$

Angle of load spreading $\theta := 60deg$

Effective breadth $b_{eff} := \min\left(2e\cdot\tan(\theta) + d_b, 200mm\right)$

$b_{eff} = 155\cdot mm$

Elastic modulus $S := \frac{b_{eff}\cdot t^2}{4} = 5.56\times 10^3\cdot mm^3$

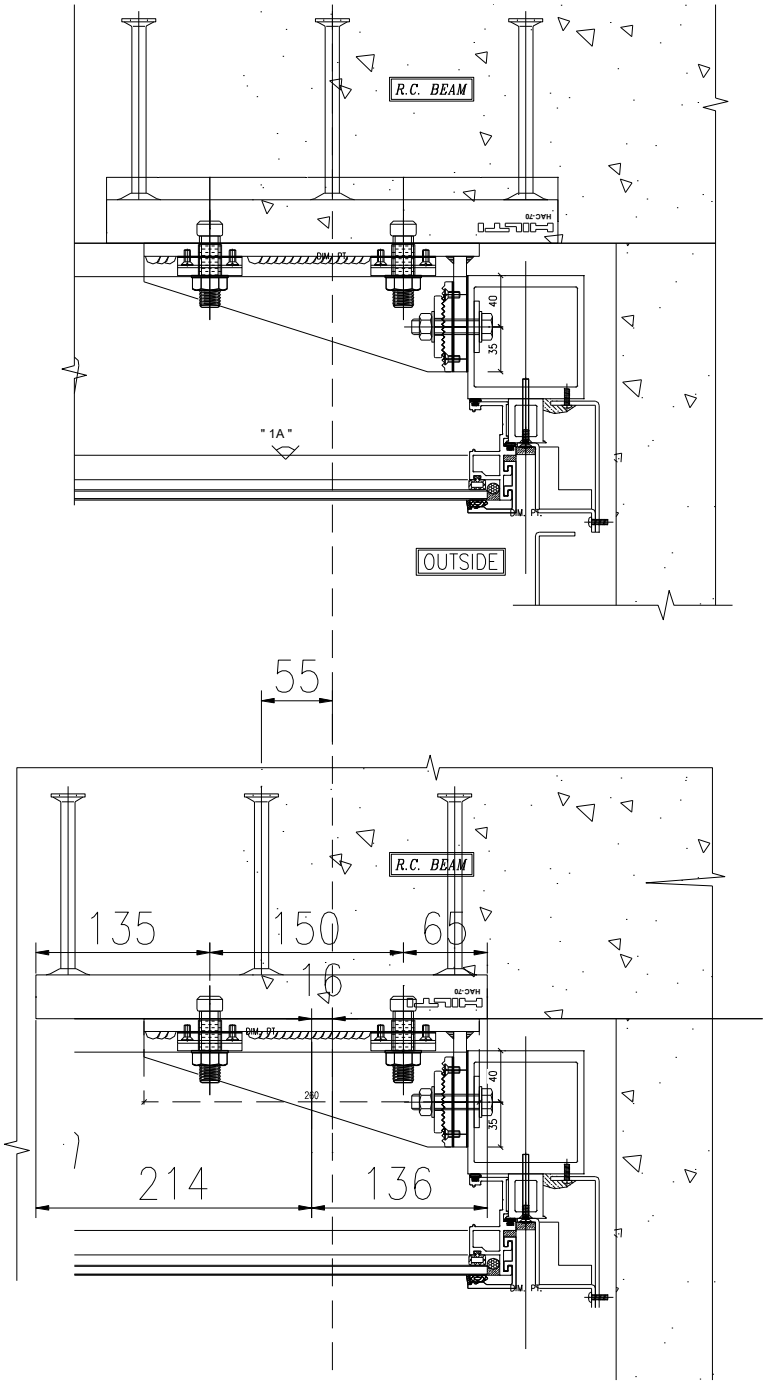
$\gamma_{f1} := 1.4 \qquad \gamma_m := 1.2$

Design strength of 6061-T6 $p_{o61} := 240MPa$

Factored moment resistance $M_{RS} := \frac{p_{o61}\cdot S}{\gamma_{f1}\cdot\gamma_m}$

$M_{RS} = 7.95\times 10^5\cdot N\cdot mm \quad > \quad M_e = 7.54\times 10^5\cdot N\cdot mm$ **OK**

1.1.5 *RD4-Edge Cast in Channel (Shft Horizontal Left 55mm)*



LOADS

From computer analysis

Wind load per fixing $WL_o := 26kN$

Dead load per fixing $DL_o := 4.5kN$

1) Wind Load

Original tributary width of panel $W_o := 1750mm = 1.75\,m$

Tributary width of panel $W_1 := \frac{1750}{2}mm$

Wind load perfixing $WL_1 := WL_o \cdot \frac{W_1}{W_o} = 13 \cdot kN$

2) Dead Load

Original Dead load per fixing $DL_o = 4.5 \cdot kN$

Dead load per fixing $DL_1 := DL_o \cdot \frac{W_1}{W_o} = 2.25 \cdot kN$

B) VERIFICATION OF CAST-IN CHANNEL

LOAD

support reaction (unfactored)

$WL_1 = 13 \cdot kN$

$DL_1 = 2.25 \cdot kN$

Eccentricity

$e_x := 121mm$

$e_y := 65mm + 25mm$

Moment due to WL & DL

$M_x := DL_1 \cdot e_y = 0.2 \cdot kN \cdot m$

$M_y := WL_1 \cdot e_x = 1.57 \cdot kN \cdot m$

$M_z := DL_1 \cdot e_x = 0.27 \cdot kN \cdot m$

Loading Input for Hilti Programme for Cast In Channel Analysis

To achieve factor of safety of 3.0 (with material factor of 1.8 already included in the program.) the factored reaction input into the program is:

Material factor

$\gamma_{mc} := 1.8$

Safety factor

$FOS := 3$

Pull out, P

$$T := \frac{WL_1 \cdot FOS}{\gamma_{mc}} = 21.67 \cdot kN$$

Shear

$$V := \frac{DL_1 \cdot FOS}{\gamma_{mc}} = 3.75 \cdot kN$$

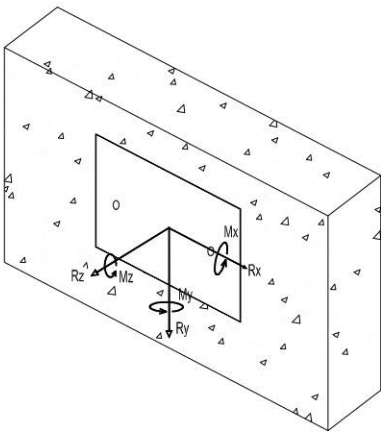
Moment

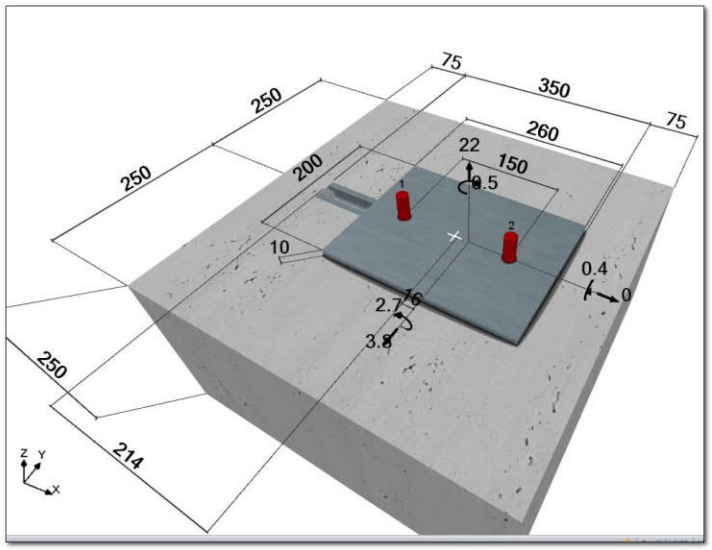
$$M_{xx} := \frac{M_x \cdot FOS}{\gamma_{mc}} = 0.34 \cdot kN \cdot m$$

$$M_{yy} := \frac{M_y \cdot FOS}{\gamma_{mc}} = 2.62 \cdot kN \cdot m$$

Torsion

$$M_{zz} := \frac{M_z \cdot FOS}{\gamma_{mc}} = 0.45 \cdot kN \cdot m$$





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Specifier's comments:

1 Input data



Channel type	**HAC-70 175/350 F**
Bolt	**HBC-C 8.8F, M16 x 50 mm**
Effective embedment depth	h_{ef} = 175 mm
Channel specification	Length: 350 mm, anchor spacing: 150 mm, projection: 25 mm, width: b_{ch} = 45 mm, height: h_{ch} = 40 mm
Material	Anchor & Channel: hot-dip galvanized Bolt: hot-dip galvanized
Europ. Tech. Assessment (ETA)	-
Issued I Valid	- | -
Standard	Hilti method based on CEN/TS 1992-4-3
Base material	cracked, , $f_{ck,cube}$ = 36.0 N/mm^2, h = 250 mm
Reinforcement	Exist. Reinf.: Widely spaced No edge reinf. present Reinf. to control splitting present
Tolerance data	tolerance interval: -300 mm/300 mm most unfavorable tolerance: 0 mm

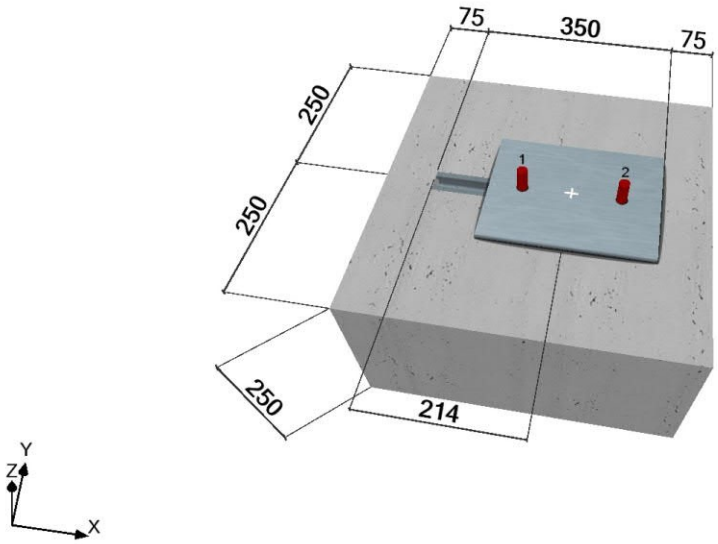
2 Overall Result

Design ok! (Maximum utilization: 72%)

Input data and results must be checked for agreement with the existing conditions and for plausibility!
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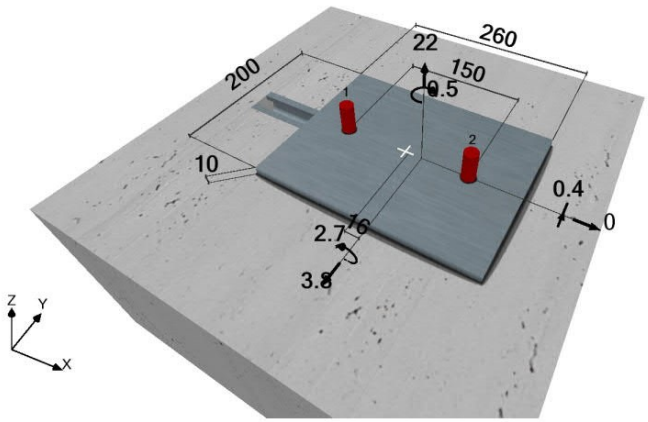
3 Geometry



Input data and results must be checked for agreement with the existing conditions and for plausibility!
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3.1 Fixtures / Bolt groups / Loads

Fixture 1



4 Load case / Resulting bolt forces

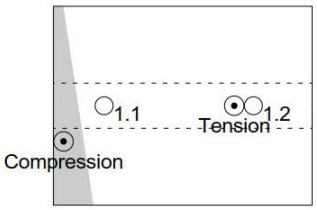
Load case: Design load

4.1 Load distribution

4.1.1 Fixture 1: Bolt: HBC-C 8.8F, M16 x 50 mm

Profile: -
Standoff: No standoff
Plate dimensions: 260 mm x 200 mm x 10 mm
Anchorplate design calculated: no

Bolt	N [kN]	V [kN]	V_x [kN]	V_y [kN]
1.1	4.254	1.940	0.000	1.940
1.2	28.898	5.740	0.000	-5.740



4.2 Derivation of forces acting on anchor channels

$N^a_{Ed,i}$ $= k \cdot A_i' \cdot N_{Ed}$ [kN]

A_i' Ordinate at the position of the anchor *i* of the loadtriangle with load *N* and the base length $2l_i$

k $= \frac{1}{\sum_1^n A_i'}$

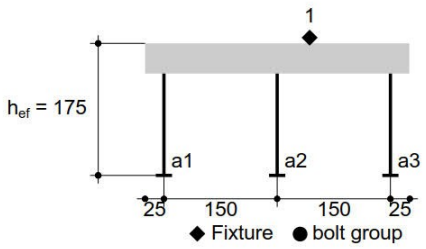
l_i $= 13 \cdot l_y^{0.05} \cdot s^{0.5} \approx 282$ [mm] ≥ s

I_y $= 95457$ [mm^4]

s $= 150$ [mm]

$V^a_{Ed,i}$ $= k \cdot A_i' \cdot V_{Ed}$ [kN]

$M_{Ed,y,max}$ $= 0.791$ [kNm]



Anchor forces [kN]

Anchor	N	V
a1	2.633	0.394
a2	13.283	-1.296
a3	17.236	-2.898

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5 Verifications

5.1 Verifications for anchor channels under tension loading

	Load [kN], [kNm]	Resistance [kN], [kNm]	Utilization [%]	Status
Anchor	17.236	42.339	41	ok
Connection anchor-channel	17.236	40.556	43	ok
Local flexure of channel lip	28.898	40.556	72	ok
Bolt	28.898	83.733	35	ok
Flexure	0.791	2.666	30	ok
Pull-out	17.236	51.269	34	ok
Concrete cone	17.236	30.396	57	ok
Concrete splitting	N/A	N/A	N/A	N/A
Concrete blow-out	N/A	N/A	N/A	N/A
Suppl. reinf. - steel	N/A	N/A	N/A	N/A
Suppl. reinf. - anchorage	N/A	N/A	N/A	N/A

5.1.1 Steel failure (CEN/TS 1992-4-3:2009 section 6.2.3)

5.1.1.1 Anchor strength (Anchor a3, Channel a)

$$N_{Ed}^{a} \le N_{Rd,s,a} = \frac{N_{Rk,s,a}}{\gamma_{Ms,a}}$$

$$\gamma_{Ms,a} = 1.2 \cdot \frac{f_{uk,a}}{f_{yk,a}} \ge 1.4$$

N_{Ed}^{a} [kN]	$N_{Rk,s,a}$ [kN]	$\gamma_{Ms,a}$	$f_{uk,a}$ [N/mm²]	$f_{yk,a}$ [N/mm²]	$N_{Rd,s,a}$ [kN]
17.236	76.000	1.795	905.0	605.0	42.339

5.1.1.2 Connection between anchor and channel (Anchor a3, Channel a)

$$N_{Ed}^{a} \le N_{Rd,s,c} = \frac{N_{Rk,s,c}}{\gamma_{Ms,c}}$$

N_{Ed}^{a} [kN]	$N_{Rk,s,c}$ [kN]	$\gamma_{Ms,c}$	$N_{Rd,s,c}$ [kN]
17.236	73.000	1.800	40.556

5.1.1.3 Local flexure of channel lip (Fixture 1, Bolt 1.2, Channel a)

$$N_{Ed}^{s} \le N_{Rd,s,l} = \frac{N_{Rk,s,l}}{\gamma_{Ms,l}}$$

s_s = 150 [mm]

b_s = 19 [mm]

h_{ch} = 40 [mm]

$N_{Rk,s,l}$ = 73.000 [kN]

N_{Ed}^{s} [kN]	$N_{Rk,s,l}$ [kN]	$\gamma_{Ms,l}$	$N_{Rd,s,l}$ [kN]
28.898	73.000	1.800	40.556

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5.1.1.4 Bolt (Fixture 1, Bolt 1.2, Channel a)

$$N_{Ed}^{s} \le N_{Rd,s} = \frac{N_{Rk,s}}{\gamma_{Ms,N}}$$

$$N_{Rk,s} = A_s \cdot f_{uk,s}$$

$$\gamma_{Ms,N} = 1.2 \cdot \frac{f_{uk,s}}{f_{yk,s}} \ge 1.4$$

N_{Ed}^{s} [kN]	A_s [mm²]	$N_{Rk,s}$ [kN]	$\gamma_{Ms,N}$	$f_{uk,s}$ [N/mm²]	$f_{yk,s}$ [N/mm²]	$N_{Rd,s}$ [kN]
28.898	157	125.600	1.500	800.0	640.0	83.733

5.1.1.5 Flexure of channel (Channel a)

$$M_{Ed} \le M_{Rd,s,flex} = \frac{M_{Rk,s,flex}}{\gamma_{Ms,flex}}$$

$$M_{Rk,s,flex} = \frac{\alpha_r}{4} \cdot W_{pl,y} \cdot f_{yk,c}$$

M_{Ed} [kNm]	α_r	$W_{pl,y}$ [mm³]	$f_{yk,c}$ [N/mm²]	$M_{Rk,s,flex}$ [kNm]	$\gamma_{Ms,flex}$	$M_{Rd,s,flex}$ [kNm]
0.791	7.500	6540	250.0	3.066	1.150	2.666

5.1.2 Pull-out (Anchor a3, Channel a) (CEN/TS 1992-4-3:2009 section 6.2.4)

$$N_{Ed}^{a} \le N_{Rd,p} = \frac{N_{Rk,p}}{\gamma_{Mp}}$$

$$N_{Rk,p} = 6 \cdot A_h \cdot f_{ck,cube} \cdot \psi_{ucr,N}$$

$$A_h = \frac{\pi}{4} \cdot (d_h^2 - d_a^2)$$

d_h [mm]	d_a [mm]	A_h [mm²]
24	11	356

N_{Ed}^{a} [kN]	$f_{ck,cube}$ [N/mm²]	$\psi_{ucr,N}$	$N_{Rk,p}$ [kN]	γ_{Mp}	$N_{Rd,p}$ [kN]
17.236	36.0	1.000	76.904	1.500	51.269

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5.1.3 Concrete cone (Anchor a3, Channel a) (CEN/TS 1992-4-3:2009 section 6.2.5)

$$N_{Ed}^{a} \le N_{Rd,c} = \frac{N_{Rk,c}}{\gamma_{Mc,c}}$$

$$N_{Rk,c} = N_{Rk,c}^{0} \cdot \alpha_{s,N} \cdot \alpha_{e,N} \cdot \alpha_{c,N,1} \cdot \alpha_{c,N,2} \cdot \psi_{re,N} \cdot \psi_{ucr,N}$$

$$N_{Rk,c}^{0} = 8.5 \cdot \alpha_{ch} \cdot \sqrt{f_{ck,cube}} \cdot h_{ef}^{1.5}$$

$$\alpha_{ch} = \left(\frac{h_{ef}}{180}\right)^{0.15}$$

$$\alpha_{s,N} = \frac{1}{1 + \sum_{i=1}^{n}\left[\left(1 - \frac{s_i}{s_{cr,N}}\right)^{1.5} \cdot \frac{N_i}{N_0}\right]} \le 1.0$$

$$s_{cr,N} = 2 \cdot (2.8 - 1.3 \cdot h_{ef} / 180) \cdot h_{ef} \ge 3 \cdot h_{ef}$$

$$\alpha_{e,N} = \left(\frac{c_1}{c_{cr,N}}\right)^{0.5} \le 1.0$$

$$c_{cr,N} = 0.5 \cdot s_{cr,N} \ge 1.5 \cdot h_{ef}$$

$$\alpha_{c,N,1} = \left(\frac{c_{2,1}}{c_{cr,N}}\right)^{0.5} \le 1.0$$

$$\alpha_{c,N,2} = \left(\frac{c_{2,2}}{c_{cr,N}}\right)^{0.5} \le 1.0$$

$$\psi_{re,N} = 0.500 + \frac{h_{ef}}{200} \le 1.0$$

α_{ch}	$f_{ck,cube}$ [N/mm²]	h_{ef} [mm]	$N_{Rk,c}^{0}$ [kN]
0.996	36.0	175	117.569

s [mm]	$s_{cr,N}$ [mm]	$\alpha_{s,N}$	c_1 [mm]	$c_{cr,N}$ [mm]	$\alpha_{e,N}$
150	538	0.659	250	269	0.964

$c_{2,1}$ [mm]	$c_{2,2}$ [mm]	$\alpha_{c,N,1}$	$\alpha_{c,N,2}$
100	400	0.610	1.000

$\psi_{re,N}$	$\psi_{ucr,N}$
1.000	1.000

N_{Ed}^{a} [kN]	$N_{Rk,c}$ [kN]	$\gamma_{Mc,c}$	$N_{Rd,c}$ [kN]
17.236	45.593	1.500	30.396

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5.2 Verifications for anchor channels under shear loading

	Load [kN], [kNm]	Resistance [kN], [kNm]	Utilization [%]	Status
Bolt w/o lever arm	5.740	50.240	12	ok
Flexure of channel lip w/o lever arm	5.740	43.889	14	ok
Flexure of channel lip w/o lever arm parallel	N/A	N/A	N/A	N/A
Bolt lever arm	N/A	N/A	N/A	N/A
Flexure of channel lip w/ lever arm	N/A	N/A	N/A	N/A
Anchor	N/A	N/A	N/A	N/A
Pryout	2.898	70.179	5	ok
Concrete edge failure	2.898	10.790	27	ok
Concrete edge failure parallel	N/A	N/A	N/A	N/A
Suppl. reinf. - steel	N/A	N/A	N/A	N/A
Suppl. reinf. - anchorage	N/A	N/A	N/A	N/A

5.2.1 Steel failure (CEN/TS 1992-4-3:2009 section 6.3.3)

5.2.1.1 Bolt - without lever arm (Fixture 1, Bolt 1.2, Channel a)

$$V_{Ed}^{s} \leq V_{Rd,s} = \frac{V_{Rk,s}}{\gamma_{Ms,V}}$$

$$V_{Rk,s} = \alpha_s \cdot A_s \cdot f_{uk,s}$$

$$\gamma_{Ms,V} = \frac{f_{uk,s}}{f_{yk,s}} \geq 1.25$$

α_s	A_s [mm²]	$f_{uk,s}$ [N/mm²]	$f_{yk,s}$ [N/mm²]
0.500	157	800.0	640.0
V_{Ed}^{s} [kN]	$V_{Rk,s}$ [kN]	$\gamma_{Ms,V}$	$V_{Rd,s}$ [kN]
5.740	62.800	1.250	50.240

5.2.1.2 Local flexure of channel lip - without lever arm (Fixture 1, Bolt 1.2, Channel a)

$$V_{Ed}^{s} \leq V_{Rd,s,l} = \frac{V_{Rk,s,l}}{\gamma_{Ms,l}}$$

V_{Ed}^{s} [kN]	$V_{Rk,s,l}$ [kN]	$\gamma_{Ms,l}$	$V_{Rd,s,l}$ [kN]
5.740	79.000	1.800	43.889

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5.2.2 Concrete pryout (Anchor a3, Channel a) (CEN/TS 1992-4-3:2009 section 6.3.4)

$$V_{Ed}^{a} \le V_{Rd,cp} = \frac{V_{Rk,cp}}{\gamma_{Mc,p}}$$

$$V_{Rk,cp} = k_5 \cdot N_{Rk,c}$$

$$N_{Rk,c} = N_{Rk,c}^{0} \cdot \alpha_{s,N} \cdot \alpha_{e,N} \cdot \alpha_{c,N,1} \cdot \alpha_{c,N,2} \cdot \psi_{re,N} \cdot \psi_{ucr,N}$$

$$N_{Rk,c}^{0} = 8.5 \cdot \alpha_{ch} \cdot \sqrt{f_{ck,cube}} \cdot h_{ef}^{1.5}$$

$$\alpha_{ch} = \left(\frac{h_{ef}}{180}\right)^{0.15}$$

$$\alpha_{s,N} = \frac{1}{1 + \sum_{i=1}^{n}\left[\left(1 - \frac{s_i}{s_{cr,N}}\right)^{1.5} \cdot \frac{V_i}{V_0}\right]} \le 1.0$$

$$s_{cr,N} = 2 \cdot (2.8 - 1.3 \cdot h_{ef} / 180) \cdot h_{ef} \ge 3 \cdot h_{ef}$$

$$\alpha_{e,N} = \left(\frac{c_1}{c_{cr,N}}\right)^{0.5} \le 1.0$$

$$c_{cr,N} = 0.5 \cdot s_{cr,N} \ge 1.5 \cdot h_{ef}$$

$$\alpha_{c,N,1} = \left(\frac{c_{2,1}}{c_{cr,N}}\right)^{0.5} \le 1.0$$

$$\alpha_{c,N,2} = \left(\frac{c_{2,2}}{c_{cr,N}}\right)^{0.5} \le 1.0$$

$$\psi_{re,N} = 0.5 + \frac{h_{ef}}{200} \le 1.0$$

α_{ch}	$f_{ck,cube}$ [N/mm²]	h_{ef} [mm]	$N_{Rk,c}^{0}$ [kN]		
0.996	36.0	175	117.569		
s [mm]	$s_{cr,N}$ [mm]	$\alpha_{s,N}$	c_1 [mm]	$c_{cr,N}$ [mm]	$\alpha_{e,N}$
150	538	0.761	250	269	0.964
$c_{2,1}$ [mm]	$c_{2,2}$ [mm]	$\alpha_{c,N,1}$	$\alpha_{c,N,2}$		
100	400	0.610	1.000		
$\psi_{re,N}$	$\psi_{ucr,N}$				
1.000	1.000				
V_{Ed}^{a} [kN]	k_5	$N_{Rk,c}$ [kN]	$V_{Rk,cp}$ [kN]	$\gamma_{Mc,p}$	$V_{Rd,cp}$ [kN]
2.898	2.0	52.635	105.269	1.500	70.179

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5.2.3 Concrete edge failure, direction y- (Anchor a3, Channel a) (CEN/TS 1992-4-3:2009 section 6.3.5)

$$V_{Ed}^{a} \le V_{Rd,c} = \frac{V_{Rk,c}}{\gamma_{Mc,e}}$$

$$V_{Rk,c} = V_{Rk,c}^{0} \cdot \alpha_{s,V} \cdot \alpha_{c,V,1} \cdot \alpha_{c,V,2} \cdot \alpha_{h,V} \cdot \alpha_{90°,V} \cdot \psi_{re,V}$$

$$V_{Rk,c}^{0} = \alpha_p \cdot \sqrt{f_{ck,cube}} \cdot c_1^{1.5}$$

$$\alpha_{s,V} = \frac{1}{1 + \sum_{i=1}^{n}\left[\left(1 - \frac{s_i}{s_{cr,V}}\right)^{1.5} \cdot \frac{V_i}{V_0}\right]} \le 1.0$$

$$s_{cr,V} = 4 \cdot c_1 + 2 \cdot b_{ch}$$

$$\alpha_{c,V,1} = \left(\frac{c_{2,1}}{c_{cr,V}}\right)^{0.5} \le 1.0$$

$$\alpha_{c,V,2} = \left(\frac{c_{2,2}}{c_{cr,V}}\right)^{0.5} \le 1.0$$

$$c_{cr,V} = 0.5 \cdot s_{cr,V} = 2 \cdot c_1 + b_{ch}$$

$$\alpha_{h,V} = \left(\frac{h}{h_{cr,V}}\right)^{0.5} \le 1.0$$

$$h_{cr,V} = 2 \cdot c_1 + 2 \cdot h_{ch}$$

α_p	$f_{ck,cube}$ [N/mm²]	c_1 [mm]	c_1^* [mm]	$V_{Rk,c}^0$ [kN]	
4.000	36.0	250	177	56.660	
s [mm]	$s_{cr,V}$ [mm]	$\alpha_{s,V}$	$c_{2,1}$ [mm]	$c_{2,2}$ [mm]	$c_{cr,V}$ [mm]
150	800	0.753	100	400	400
$\alpha_{c,V,1}$	$\alpha_{c,V,2}$				
0.500	1.000				
h [mm]	$h_{cr,V}$ [mm]	$\alpha_{h,V}$	$\alpha_{90°,V}$	$\psi_{re,V}$	
250	435	0.758	1.000	1.000	
V_{Ed}^a [kN]	$V_{Rk,c}$ [kN]	$\gamma_{Mc,e}$	$V_{Rd,c}$ [kN]		
2.898	16.185	1.500	10.790		

* special case

5.3 Combined tension and shear loads (CEN/TS 1992-4-3:2009 section 6.4)

Proof of interaction calculated independently for acting load and load distribution

5.3.1 Bolt (Fixture 1, Bolt 1.2)

$\beta_{N,s}^{\alpha} + \beta_{V,s}^{\alpha} = 0.713^{2.0} + 0.131^{2.0} = 0.525 \le 1.000$
$\beta_{N,s}$: governing failure mode - tension: Local flexure of channel lip (Fixture 1, Bolt 1.2)
$\beta_{V,s}$: governing failure mode - shear: Flexure of channel lip w/o lever arm (Fixture 1, Bolt 1.2)

5.3.2 Anchor channel (Anchor a3)

$\beta_{N,a}^{\alpha} + \beta_{V,a}^{\alpha} = 0.567^{1.5} + 0.269^{1.5} = 0.566 \le 1.000$
$\beta_{N,a}$: governing failure mode - tension: Concrete cone (Anchor)
$\beta_{V,a}$: governing failure mode - shear: Concrete edge failure (Anchor)

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Remarks and warnings

- The transfer of the loads acting on the fixture to the supports of the structure shall be considered in the design of the structure taking account of the requirements of CEN-TS 1992-4-1, Chapter 4.1.6 respectively Annex A, and the structurally required reinforcement has to be provided.
- The calculation of the acting forces is based on the simplified assumption of a rigid anchorplate/bracket. The anchorplate has to be designed accordingly. The design of the anchorplate/bracket must be done seperatly (outside the PROFIS software) by the engineer.

Design ok! (Maximum utilization: 72%)

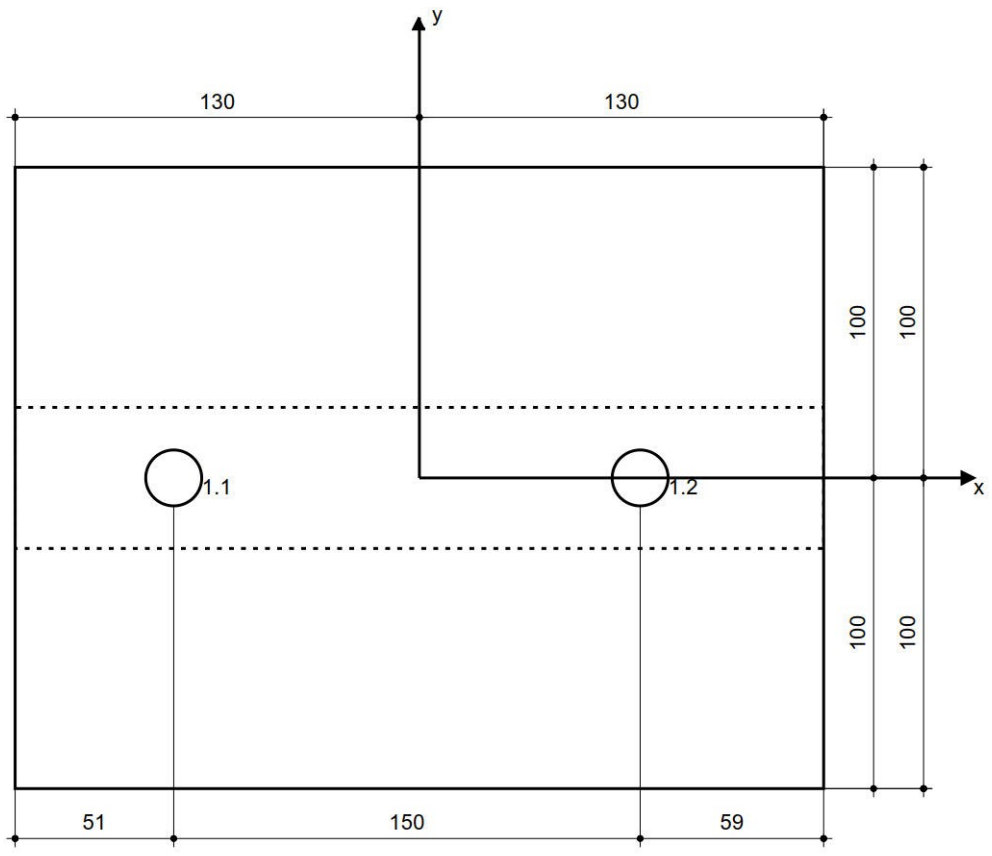
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6 Installation data

6.1 Fixture 1

Plate type:	-	Bolt type:	HBC-C 8.8F, M16 x 50 mm
Plate dimensions:	260 mm x 200 mm x 10 mm	Bolt length:	50 mm
Profile:	-	Bolt diameter:	16 mm
Anchorplate design calculated:	no	Diameter hole:	18 mm
		Installation torque:	0.060 kNm

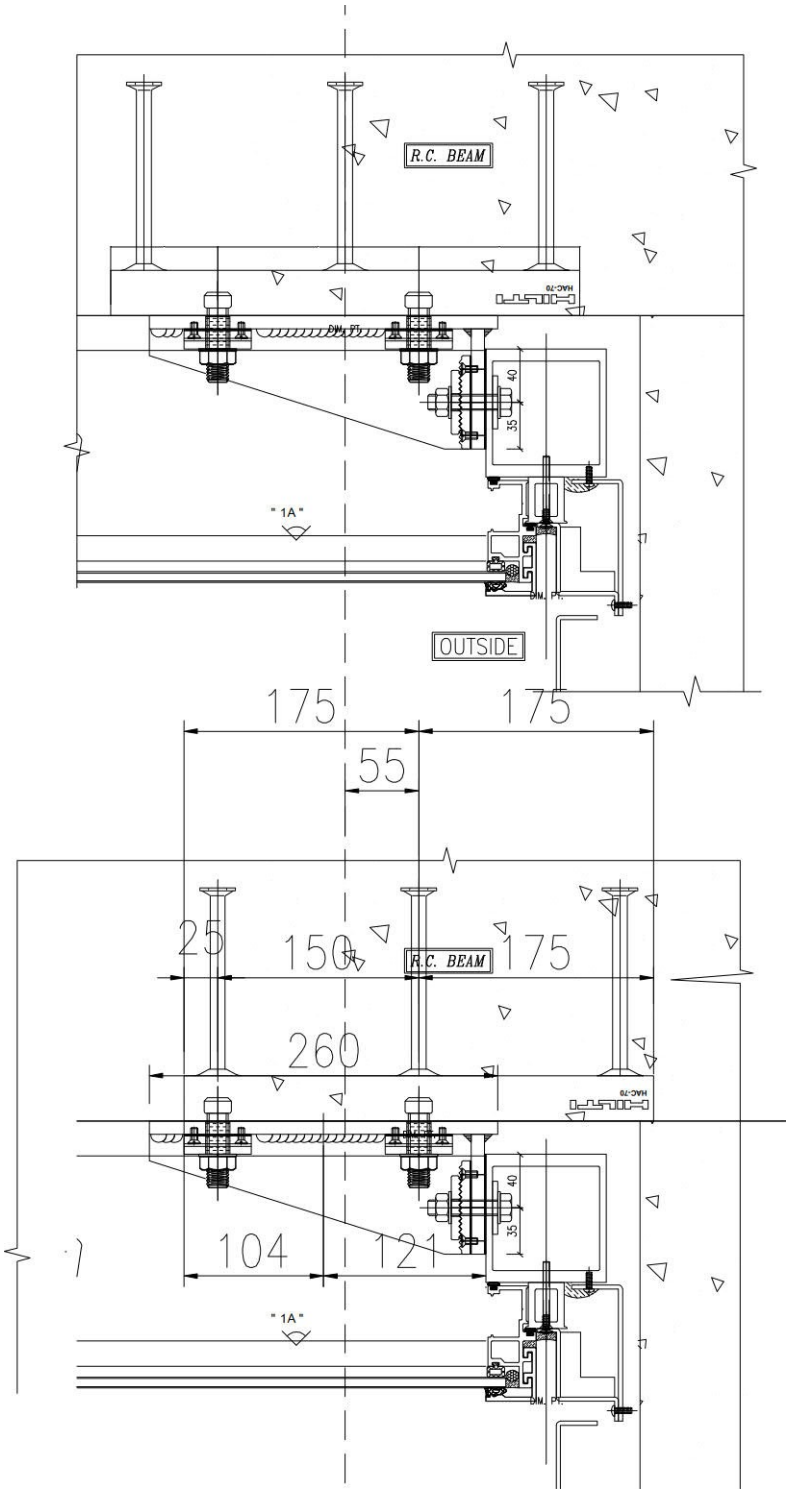


7 Remarks; Your Cooperation Duties

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1.1.6 *RD5-Edge Cast in Channel (Shft Horizontal Right 55mm)*



LOADS

From computer analysis

Wind load per fixing $WL_o := 26kN$

Dead load per fixing $DL_o := 4.5kN$

1) Wind Load

Original tributary width of panel $W_o := 1750mm = 1.75\,m$

Tributary width of panel $W_1 := \frac{1750}{2}mm$

Wind load perfixing $WL_1 := WL_o \cdot \frac{W_1}{W_o} = 13 \cdot kN$

2) Dead Load

Original Dead load per fixing $DL_o = 4.5 \cdot kN$

Dead load per fixing $DL_1 := DL_o \cdot \frac{W_1}{W_o} = 2.25 \cdot kN$

B) VERIFICATION OF CAST-IN CHANNEL

LOAD

support reaction (unfactored)

$WL_1 = 13 \cdot kN$

$DL_1 = 2.25 \cdot kN$

Eccentricity

$e_x := 121mm$

$e_y := 65mm + 25mm$

Moment due to WL & DL

$M_x := DL_1 \cdot e_y = 0.2 \cdot kN \cdot m$

$M_y := WL_1 \cdot e_x = 1.57 \cdot kN \cdot m$

$M_z := DL_1 \cdot e_x = 0.27 \cdot kN \cdot m$

Loading Input for Hilti Programme for Cast In Channel Analysis

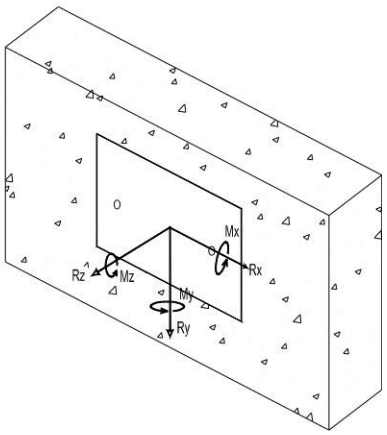
To achieve factor of safety of 3.0 (with material factor of 1.8 already included in the program.) the factored reaction input into the program is:

Material factor

$\gamma_{mc} := 1.8$

Safety factor

$FOS := 3$



Pull out, P

$$T := \frac{WL_1 \cdot FOS}{\gamma_{mc}} = 21.67 \cdot kN$$

Shear

$$V := \frac{DL_1 \cdot FOS}{\gamma_{mc}} = 3.75 \cdot kN$$

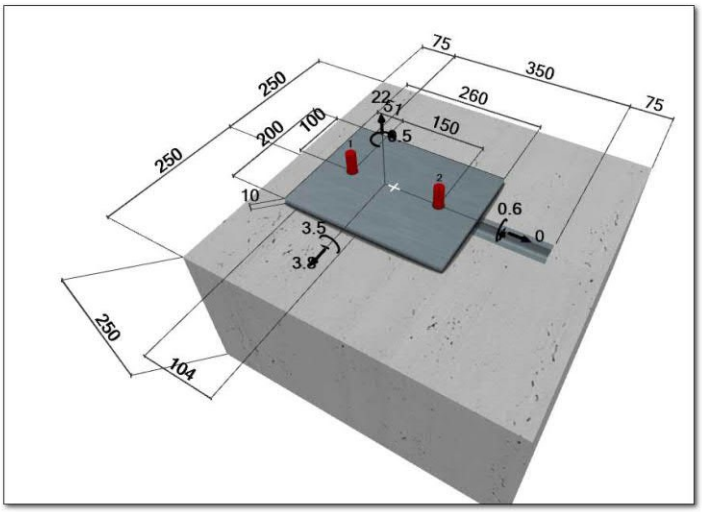
Moment

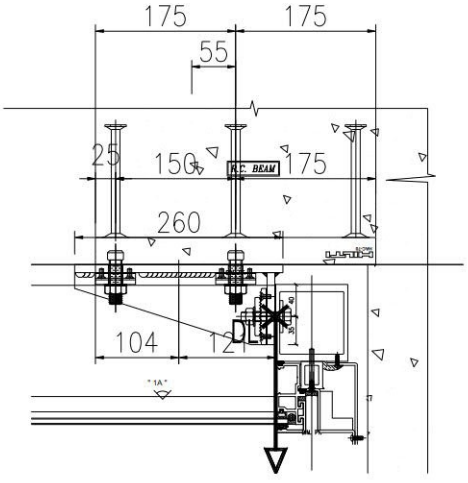
$$M_{xx} := \frac{M_x \cdot FOS}{\gamma_{mc}} = 0.34 \cdot kN \cdot m$$

$$M_{yy} := \frac{M_y \cdot FOS}{\gamma_{mc}} = 2.62 \cdot kN \cdot m$$

Torsion

$$M_{zz} := \frac{M_z \cdot FOS}{\gamma_{mc}} = 0.45 \cdot kN \cdot m$$





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PROFIS Anchor Channel 1.6.5

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Specifier's comments:

1 Input data



Channel type	**HAC-70 175/350 F**
Bolt	**HBC-C 8.8F, M16 x 50 mm**
Effective embedment depth	h_{ef} = 175 mm
Channel specification	Length: 350 mm, anchor spacing: 150 mm, projection: 25 mm, width: b_{ch} = 45 mm, height: h_{ch} = 40 mm
Material	Anchor & Channel: hot-dip galvanized Bolt: hot-dip galvanized
Europ. Tech. Assessment (ETA)	-
Issued I Valid	- | -
Standard	Hilti method based on CEN/TS 1992-4-3
Base material	cracked, , $f_{ck,cube}$ = 36.0 N/mm^2, h = 250 mm
Reinforcement	Exist. Reinf.: Widely spaced No edge reinf. present Reinf. to control splitting present
Tolerance data	tolerance interval: -300 mm/300 mm most unfavorable tolerance: 0 mm

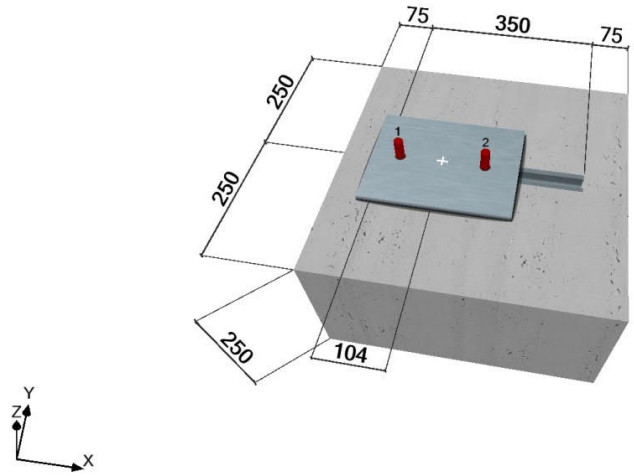
2 Overall Result

Design ok! (Maximum utilization: 79%)

Input data and results must be checked for agreement with the existing conditions and for plausibility!
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3 Geometry

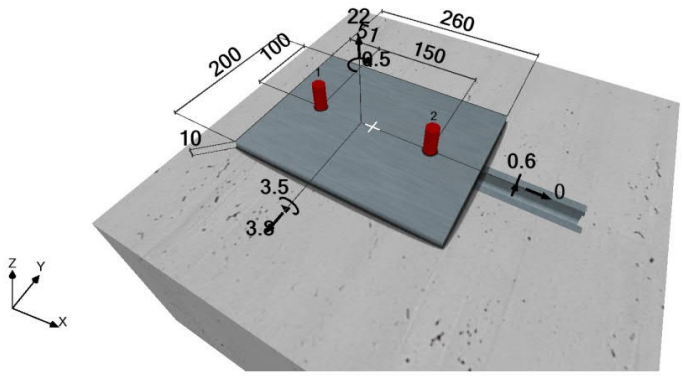


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3.1 Fixtures / Bolt groups / Loads

Fixture 1



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4 Load case / Resulting bolt forces

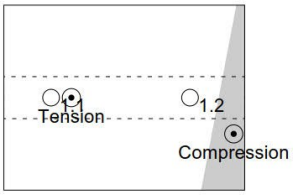
Load case: Design load

4.1 Load distribution

4.1.1 Fixture 1: Bolt: HBC-C 8.8F, M16 x 50 mm

Profile: -
Standoff: No standoff
Plate dimensions: 260 mm x 200 mm x 10 mm
Anchorplate design calculated: no

Bolt	N [kN]	V [kN]	V_x [kN]	V_y [kN]
1.1	31.863	1.028	0.000	1.028
1.2	5.453	4.828	0.000	-4.828



4.2 Derivation of forces acting on anchor channels

$N^a_{Ed,i}$ $= k \cdot A_i' \cdot N_{Ed}$ [kN]

A_i' Ordinate at the position of the anchor *i* of the loadtriangle with load *N* and the base length $2l_i$

$k = \frac{1}{\sum_1^n A_i'}$

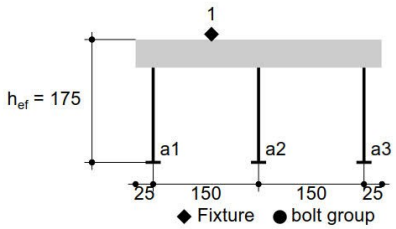
$l_i = 13 \cdot l_y^{0.05} \cdot s^{0.5} \approx 282$ [mm] ≥ s

$l_y = 95457$ [mm^4]

s = 150 [mm]

$V^a_{Ed,i}$ $= k \cdot A_i' \cdot V_{Ed}$ [kN]

$M_{Ed,y,max} = 0.124$ [kNm]



Anchor forces [kN]

Anchor	N	V
a1	22.673	-0.452
a2	13.274	-2.136
a3	1.369	-1.212

Input data and results must be checked for agreement with the existing conditions and for plausibility!
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5 Verifications

5.1 Verifications for anchor channels under tension loading

	Load [kN], [kNm]	Resistance [kN], [kNm]	Utilization [%]	Status
Anchor	22.673	42.339	54	ok
Connection anchor-channel	22.673	40.556	56	ok
Local flexure of channel lip	31.863	40.556	79	ok
Bolt	31.863	83.733	39	ok
Flexure	0.124	2.666	5	ok
Pull-out	22.673	51.269	45	ok
Concrete cone	22.673	33.499	68	ok
Concrete splitting	N/A	N/A	N/A	N/A
Concrete blow-out	N/A	N/A	N/A	N/A
Suppl. reinf. - steel	N/A	N/A	N/A	N/A
Suppl. reinf. - anchorage	N/A	N/A	N/A	N/A

5.1.1 Steel failure (CEN/TS 1992-4-3:2009 section 6.2.3)

5.1.1.1 Anchor strength (Anchor a1, Channel a)

$$N_{Ed}^{a} \le N_{Rd,s,a} = \frac{N_{Rk,s,a}}{\gamma_{Ms,a}}$$

$$\gamma_{Ms,a} = 1.2 \cdot \frac{f_{uk,a}}{f_{yk,a}} \ge 1.4$$

N_{Ed}^{a} [kN]	$N_{Rk,s,a}$ [kN]	$\gamma_{Ms,a}$	$f_{uk,a}$ [N/mm²]	$f_{yk,a}$ [N/mm²]	$N_{Rd,s,a}$ [kN]
22.673	76.000	1.795	905.0	605.0	42.339

5.1.1.2 Connection between anchor and channel (Anchor a1, Channel a)

$$N_{Ed}^{a} \le N_{Rd,s,c} = \frac{N_{Rk,s,c}}{\gamma_{Ms,c}}$$

N_{Ed}^{a} [kN]	$N_{Rk,s,c}$ [kN]	$\gamma_{Ms,c}$	$N_{Rd,s,c}$ [kN]
22.673	73.000	1.800	40.556

5.1.1.3 Local flexure of channel lip (Fixture 1, Bolt 1.1, Channel a)

$$N_{Ed}^{s} \le N_{Rd,s,l} = \frac{N_{Rk,s,l}}{\gamma_{Ms,l}}$$

s_s = 150 [mm]

b_s = 19 [mm]

h_{ch} = 40 [mm]

$N_{Rk,s,l}$ = 73.000 [kN]

N_{Ed}^{s} [kN]	$N_{Rk,s,l}$ [kN]	$\gamma_{Ms,l}$	$N_{Rd,s,l}$ [kN]
31.863	73.000	1.800	40.556

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5.1.1.4 Bolt (Fixture 1, Bolt 1.1, Channel a)

$$N_{Ed}^{s} \le N_{Rd,s} = \frac{N_{Rk,s}}{\gamma_{Ms,N}}$$

$$N_{Rk,s} = A_s \cdot f_{uk,s}$$

$$\gamma_{Ms,N} = 1.2 \cdot \frac{f_{uk,s}}{f_{yk,s}} \ge 1.4$$

N_{Ed}^{s} [kN]	A_s [mm²]	$N_{Rk,s}$ [kN]	$\gamma_{Ms,N}$	$f_{uk,s}$ [N/mm²]	$f_{yk,s}$ [N/mm²]	$N_{Rd,s}$ [kN]
31.863	157	125.600	1.500	800.0	640.0	83.733

5.1.1.5 Flexure of channel (Channel a)

$$M_{Ed} \le M_{Rd,s,flex} = \frac{M_{Rk,s,flex}}{\gamma_{Ms,flex}}$$

$$M_{Rk,s,flex} = \frac{\alpha_r}{4} \cdot W_{pl,y} \cdot f_{yk,c}$$

M_{Ed} [kNm]	α_r	$W_{pl,y}$ [mm³]	$f_{yk,c}$ [N/mm²]	$M_{Rk,s,flex}$ [kNm]	$\gamma_{Ms,flex}$	$M_{Rd,s,flex}$ [kNm]
0.124	7.500	6540	250.0	3.066	1.150	2.666

5.1.2 Pull-out (Anchor a1, Channel a) (CEN/TS 1992-4-3:2009 section 6.2.4)

$$N_{Ed}^{a} \le N_{Rd,p} = \frac{N_{Rk,p}}{\gamma_{Mp}}$$

$$N_{Rk,p} = 6 \cdot A_h \cdot f_{ck,cube} \cdot \psi_{ucr,N}$$

$$A_h = \frac{\pi}{4} \cdot (d_h^2 - d_a^2)$$

d_h [mm]	d_a [mm]	A_h [mm²]
24	11	356

N_{Ed}^{a} [kN]	$f_{ck,cube}$ [N/mm²]	$\psi_{ucr,N}$	$N_{Rk,p}$ [kN]	γ_{Mp}	$N_{Rd,p}$ [kN]
22.673	36.0	1.000	76.904	1.500	51.269

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5.1.3 Concrete cone (Anchor a1, Channel a) (CEN/TS 1992-4-3:2009 section 6.2.5)

$$N_{Ed}^{a} \le N_{Rd,c} = \frac{N_{Rk,c}}{\gamma_{Mc,c}}$$

$$N_{Rk,c} = N_{Rk,c}^{0} \cdot \alpha_{s,N} \cdot \alpha_{e,N} \cdot \alpha_{c,N,1} \cdot \alpha_{c,N,2} \cdot \psi_{re,N} \cdot \psi_{ucr,N}$$

$$N_{Rk,c}^{0} = 8.5 \cdot \alpha_{ch} \cdot \sqrt{f_{ck,cube}} \cdot h_{ef}^{1.5}$$

$$\alpha_{ch} = \left(\frac{h_{ef}}{180}\right)^{0.15}$$

$$\alpha_{s,N} = \frac{1}{1 + \sum_{i=1}^{n}\left[\left(1 - \frac{s_i}{s_{cr,N}}\right)^{1.5} \cdot \frac{N_i}{N_0}\right]} \le 1.0$$

$$s_{cr,N} = 2 \cdot (2.8 - 1.3 \cdot h_{ef} / 180) \cdot h_{ef} \ge 3 \cdot h_{ef}$$

$$\alpha_{e,N} = \left(\frac{c_1}{c_{cr,N}}\right)^{0.5} \le 1.0$$

$$c_{cr,N} = 0.5 \cdot s_{cr,N} \ge 1.5 \cdot h_{ef}$$

$$\alpha_{c,N,1} = \left(\frac{c_{2,1}}{c_{cr,N}}\right)^{0.5} \le 1.0$$

$$\alpha_{c,N,2} = \left(\frac{c_{2,2}}{c_{cr,N}}\right)^{0.5} \le 1.0$$

$$\psi_{re,N} = 0.500 + \frac{h_{ef}}{200} \le 1.0$$

α_{ch}	$f_{ck,cube}$ [N/mm²]	h_{ef} [mm]	$N_{Rk,c}^{0}$ [kN]		
0.996	36.0	175	117.569		
s [mm]	$s_{cr,N}$ [mm]	$\alpha_{s,N}$	c_1 [mm]	$c_{cr,N}$ [mm]	$\alpha_{e,N}$
150	538	0.727	250	269	0.964
$c_{2,1}$ [mm]	$c_{2,2}$ [mm]	$\alpha_{c,N,1}$	$\alpha_{c,N,2}$		
400	100	1.000	0.610		
$\psi_{re,N}$	$\psi_{ucr,N}$				
1.000	1.000				
N_{Ed}^{a} [kN]	$N_{Rk,c}$ [kN]	$\gamma_{Mc,c}$	$N_{Rd,c}$ [kN]		
22.673	50.249	1.500	33.499		

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5.2 Verifications for anchor channels under shear loading

	Load [kN], [kNm]	Resistance [kN], [kNm]	Utilization [%]	Status
Bolt w/o lever arm	4.828	50.240	10	ok
Flexure of channel lip w/o lever arm	4.828	43.889	12	ok
Flexure of channel lip w/o lever arm parallel	N/A	N/A	N/A	N/A
Bolt lever arm	N/A	N/A	N/A	N/A
Flexure of channel lip w/ lever arm	N/A	N/A	N/A	N/A
Anchor	N/A	N/A	N/A	N/A
Pryout	1.212	42.141	3	ok
Concrete edge failure	1.212	5.790	21	ok
Concrete edge failure parallel	N/A	N/A	N/A	N/A
Suppl. reinf. - steel	N/A	N/A	N/A	N/A
Suppl. reinf. - anchorage	N/A	N/A	N/A	N/A

5.2.1 Steel failure (CEN/TS 1992-4-3:2009 section 6.3.3)

5.2.1.1 Bolt - without lever arm (Fixture 1, Bolt 1.2, Channel a)

$$V_{Ed}^{s} \le V_{Rd,s} = \frac{V_{Rk,s}}{\gamma_{Ms,V}}$$

$$V_{Rk,s} = \alpha_s \cdot A_s \cdot f_{uk,s}$$

$$\gamma_{Ms,V} = \frac{f_{uk,s}}{f_{yk,s}} \ge 1.25$$

α_s	A_s [mm²]	$f_{uk,s}$ [N/mm²]	$f_{yk,s}$ [N/mm²]
0.500	157	800.0	640.0
V_{Ed}^{s} [kN]	$V_{Rk,s}$ [kN]	$\gamma_{Ms,V}$	$V_{Rd,s}$ [kN]
4.828	62.800	1.250	50.240

5.2.1.2 Local flexure of channel lip - without lever arm (Fixture 1, Bolt 1.2, Channel a)

$$V_{Ed}^{s} \le V_{Rd,s,l} = \frac{V_{Rk,s,l}}{\gamma_{Ms,l}}$$

V_{Ed}^{s} [kN]	$V_{Rk,s,l}$ [kN]	$\gamma_{Ms,l}$	$V_{Rd,s,l}$ [kN]
4.828	79.000	1.800	43.889

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5.2.2 Concrete pryout (Anchor a3, Channel a) (CEN/TS 1992-4-3:2009 section 6.3.4)

$$V_{Ed}^{a} \le V_{Rd,cp} = \frac{V_{Rk,cp}}{\gamma_{Mc,p}}$$

$$V_{Rk,cp} = k_5 \cdot N_{Rk,c}$$

$$N_{Rk,c} = N_{Rk,c}^{0} \cdot \alpha_{s,N} \cdot \alpha_{e,N} \cdot \alpha_{c,N,1} \cdot \alpha_{c,N,2} \cdot \psi_{re,N} \cdot \psi_{ucr,N}$$

$$N_{Rk,c}^{0} = 8.5 \cdot \alpha_{ch} \cdot \sqrt{f_{ck,cube}} \cdot h_{ef}^{1.5}$$

$$\alpha_{ch} = \left(\frac{h_{ef}}{180}\right)^{0.15}$$

$$\alpha_{s,N} = \frac{1}{1 + \sum_{i=1}^{n}\left[\left(1 - \frac{s_i}{s_{cr,N}}\right)^{1.5} \cdot \frac{V_i}{V_0}\right]} \le 1.0$$

$$s_{cr,N} = 2 \cdot (2.8 - 1.3 \cdot h_{ef} / 180) \cdot h_{ef} \ge 3 \cdot h_{ef}$$

$$\alpha_{e,N} = \left(\frac{c_1}{c_{cr,N}}\right)^{0.5} \le 1.0$$

$$c_{cr,N} = 0.5 \cdot s_{cr,N} \ge 1.5 \cdot h_{ef}$$

$$\alpha_{c,N,1} = \left(\frac{c_{2,1}}{c_{cr,N}}\right)^{0.5} \le 1.0$$

$$\alpha_{c,N,2} = \left(\frac{c_{2,2}}{c_{cr,N}}\right)^{0.5} \le 1.0$$

$$\psi_{re,N} = 0.5 + \frac{h_{ef}}{200} \le 1.0$$

α_{ch}	$f_{ck,cube}$ [N/mm²]	h_{ef} [mm]	$N_{Rk,c}^{0}$ [kN]		
0.996	36.0	175	117.569		
s [mm]	$s_{cr,N}$ [mm]	$\alpha_{s,N}$	c_1 [mm]	$c_{cr,N}$ [mm]	$\alpha_{e,N}$
150	538	0.457	250	269	0.964
$c_{2,1}$ [mm]	$c_{2,2}$ [mm]	$\alpha_{c,N,1}$	$\alpha_{c,N,2}$		
100	400	0.610	1.000		
$\psi_{re,N}$	$\psi_{ucr,N}$				
1.000	1.000				
V_{Ed}^{a} [kN]	k_5	$N_{Rk,c}$ [kN]	$V_{Rk,cp}$ [kN]	$\gamma_{Mc,p}$	$V_{Rd,cp}$ [kN]
1.212	2.0	31.606	63.212	1.500	42.141

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5.2.3 Concrete edge failure, direction y- (Anchor a3, Channel a) (CEN/TS 1992-4-3:2009 section 6.3.5)

$$V_{Ed}^{a} \le V_{Rd,c} = \frac{V_{Rk,c}}{\gamma_{Mc,e}}$$

$$V_{Rk,c} = V_{Rk,c}^{0} \cdot \alpha_{s,V} \cdot \alpha_{c,V,1} \cdot \alpha_{c,V,2} \cdot \alpha_{h,V} \cdot \alpha_{90°,V} \cdot \psi_{re,V}$$

$$V_{Rk,c}^{0} = \alpha_p \cdot \sqrt{f_{ck,cube}} \cdot c_1^{1.5}$$

$$\alpha_{s,V} = \frac{1}{1 + \sum_{i=1}^{n}\left[\left(1 - \frac{s_i}{s_{cr,V}}\right)^{1.5} \cdot \frac{V_i}{V_0}\right]} \le 1.0$$

$$s_{cr,V} = 4 \cdot c_1 + 2 \cdot b_{ch}$$

$$\alpha_{c,V,1} = \left(\frac{c_{2,1}}{c_{cr,V}}\right)^{0.5} \le 1.0$$

$$\alpha_{c,V,2} = \left(\frac{c_{2,2}}{c_{cr,V}}\right)^{0.5} \le 1.0$$

$$c_{cr,V} = 0.5 \cdot s_{cr,V} = 2 \cdot c_1 + b_{ch}$$

$$\alpha_{h,V} = \left(\frac{h}{h_{cr,V}}\right)^{0.5} \le 1.0$$

$$h_{cr,V} = 2 \cdot c_1 + 2 \cdot h_{ch}$$

α_p	$f_{ck,cube}$ [N/mm²]	c_1 [mm]	c_1' [mm]	$V_{Rk,c}^{0}$ [kN]	
4.000	36.0	250	177	56.660	
s [mm]	$s_{cr,V}$ [mm]	$\alpha_{s,V}$	$c_{2,1}$ [mm]	$c_{2,2}$ [mm]	$c_{cr,V}$ [mm]
150	800	0.404	100	400	400
$\alpha_{c,V,1}$	$\alpha_{c,V,2}$				
0.500	1.000				
h [mm]	$h_{cr,V}$ [mm]	$\alpha_{h,V}$	$\alpha_{90°,V}$	$\psi_{re,V}$	
250	435	0.758	1.000	1.000	
V_{Ed}^{a} [kN]	$V_{Rk,c}$ [kN]	$\gamma_{Mc,e}$	$V_{Rd,c}$ [kN]		
1.212	8.684	1.500	5.790		

* special case

5.3 Combined tension and shear loads (CEN/TS 1992-4-3:2009 section 6.4)

Proof of interaction calculated independently for acting load and load distribution

5.3.1 Bolt (Fixture 1, Bolt 1.1)

$\beta_{N,s}^{\alpha} + \beta_{V,s}^{\alpha} = 0.786^{2.0} + 0.023^{2.0} = 0.618 \le 1.000$
$\beta_{N,s}$: governing failure mode - tension: Local flexure of channel lip (Fixture 1, Bolt 1.1)
$\beta_{V,s}$: governing failure mode - shear: Flexure of channel lip w/o lever arm (Fixture 1, Bolt 1.1)

5.3.2 Anchor channel (Anchor a1)

$\beta_{N,a}^{\alpha} + \beta_{V,a}^{\alpha} = 0.677^{1.5} + 0.183^{1.5} = 0.635 \le 1.000$
$\beta_{N,a}$: governing failure mode - tension: Concrete cone (Anchor)
$\beta_{V,a}$: governing failure mode - shear: Concrete edge failure (Anchor)

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Remarks and warnings

- The transfer of the loads acting on the fixture to the supports of the structure shall be considered in the design of the structure taking account of the requirements of CEN-TS 1992-4-1, Chapter 4.1.6 respectively Annex A, and the structurally required reinforcement has to be provided.
- The calculation of the acting forces is based on the simplified assumption of a rigid anchorplate/bracket. The anchorplate has to be designed accordingly. The design of the anchorplate/bracket must be done seperatly (outside the PROFIS software) by the engineer.

Design ok! (Maximum utilization: 79%)

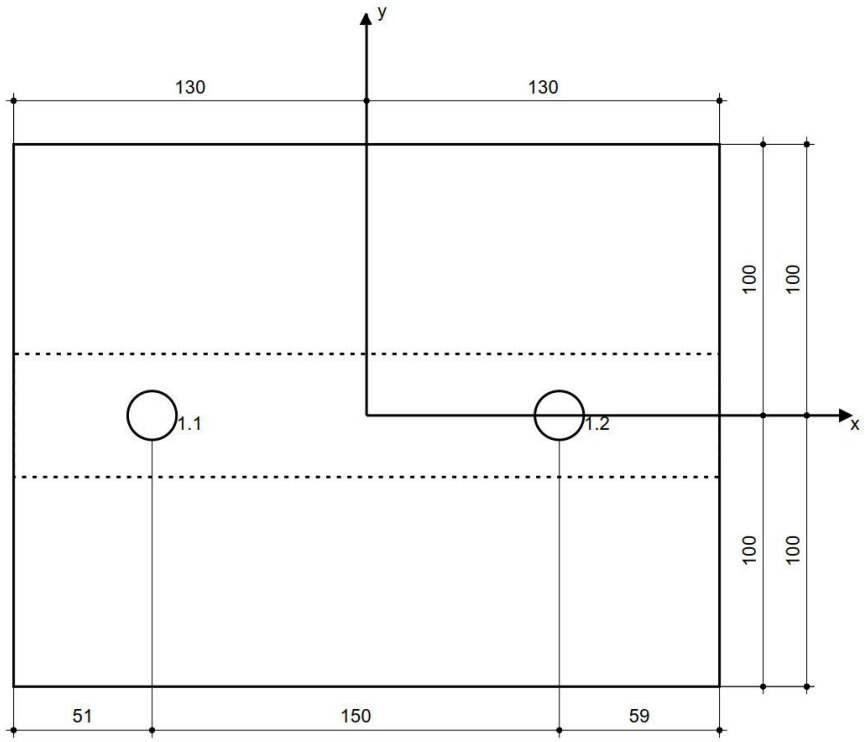
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6 Installation data

6.1 Fixture 1

Plate type:	-	Bolt type:	HBC-C 8.8F, M16 x 50 mm
Plate dimensions:	260 mm x 200 mm x 10 mm	Bolt length:	50 mm
Profile:	-	Bolt diameter:	16 mm
Anchorplate design calculated:	no	Diameter hole:	18 mm
		Installation torque:	0.060 kNm



Input data and results must be checked for agreement with the existing conditions and for plausibility!
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7 Remarks; Your Cooperation Duties

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