

開口鋼筋混凝土牆 補強設計

報告人：曾建創

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大綱

1. 研究動機：提出開口牆補強工法
2. 試體規劃與試體設計
3. 試驗結果
4. 側力-位移評估曲線
5. 補強示範例：後甲國中
6. 結論

現有補強方法

擴柱補強



翼牆補強



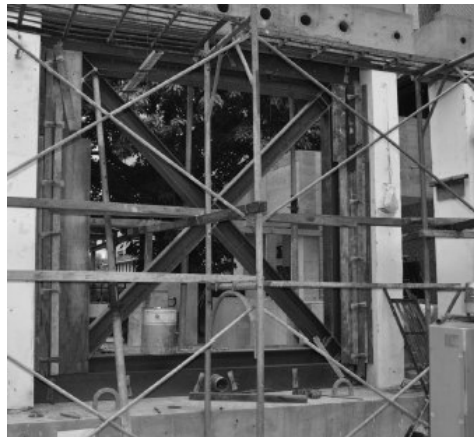
剪力牆補強



複合柱補強



鋼斜撐補強



鋼板包覆補強



RC剪力牆補強工法

優點：

1. 高強度
2. 高勁度
3. 改善軟弱層

缺點：

1. 補強位置需謹慎設計
2. 難以滿足通風採光需求



提出開口RC牆補強工法

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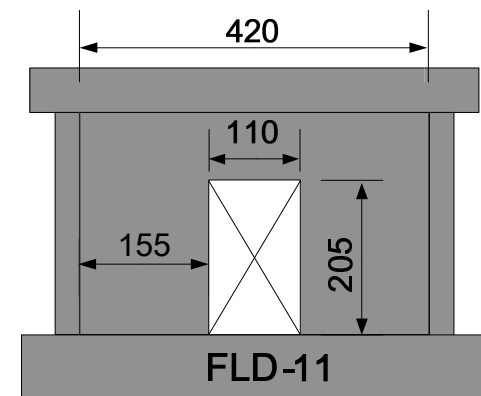
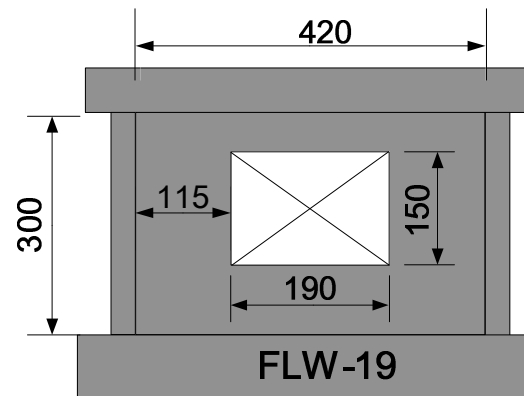
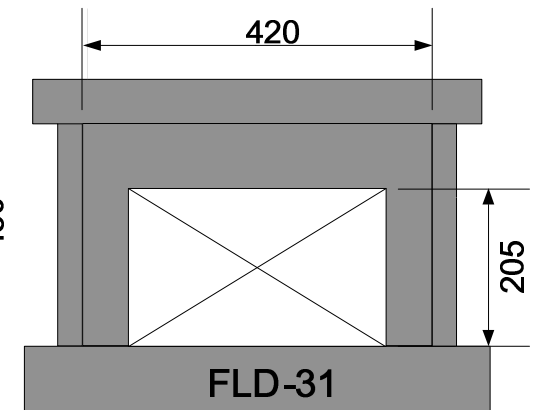
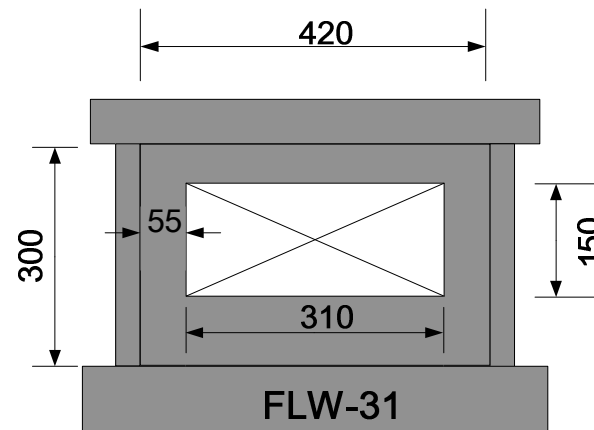
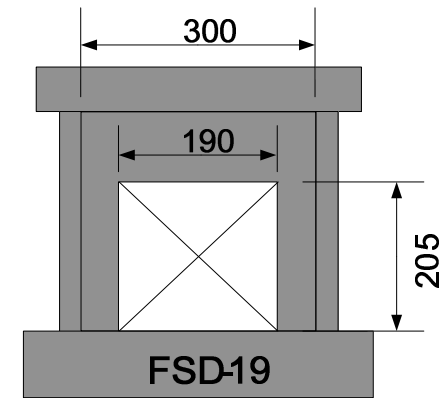
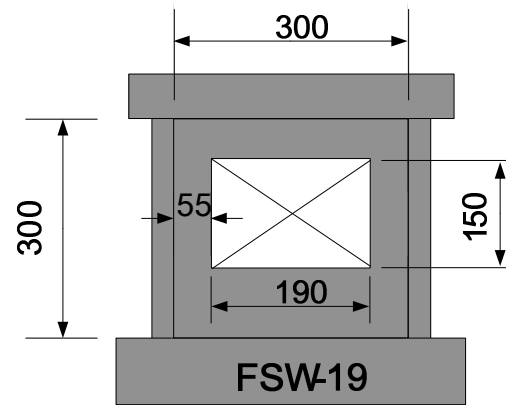
試體規劃

1. 試體特色：

- 以使用者為導向
- 大面積開口
- 對稱開口

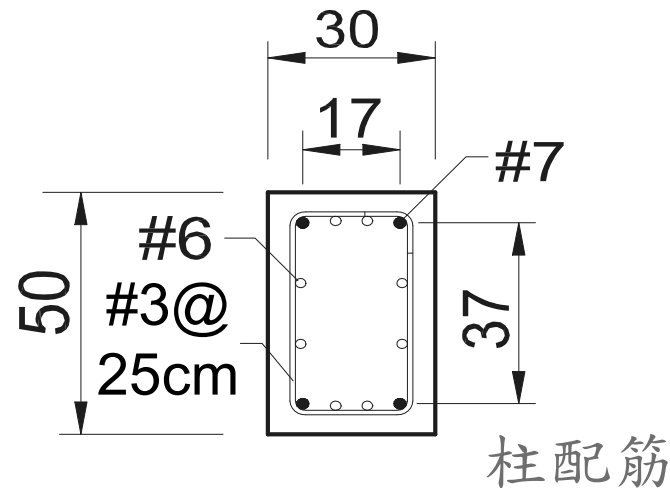
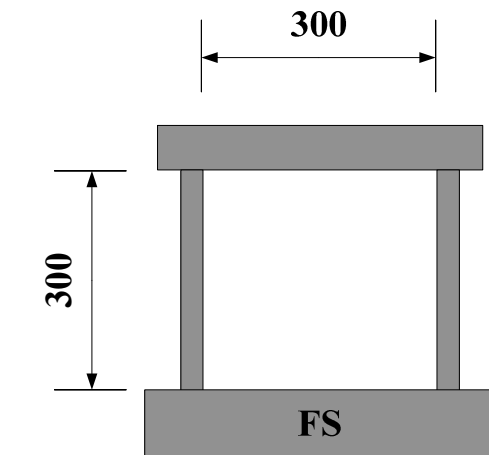
2. 比較參數：

- 跨度
- 水平拉力筋
- 開口大小
- 植筋差異
- 角隅鋼筋差異



試體構架設計

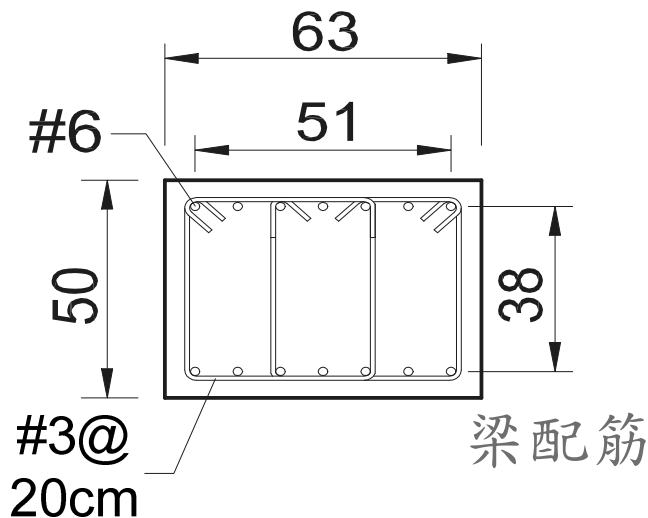
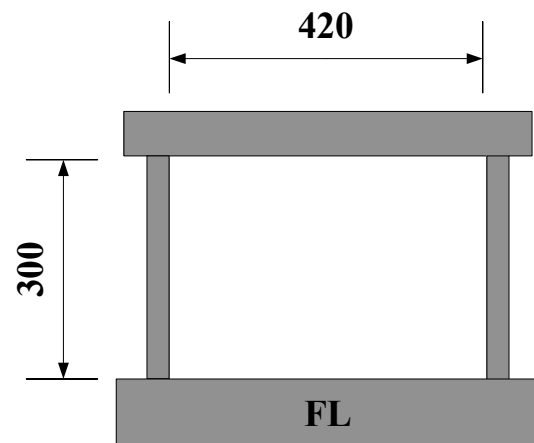
以校舍常見的兩種跨度(淨跨度300 cm及淨跨度420 cm)作為標準



$$\rho = 2.55 \%$$

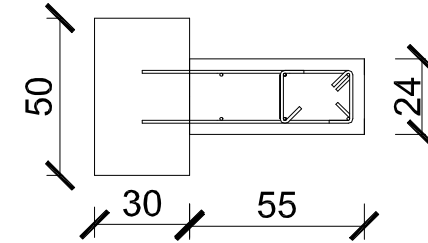
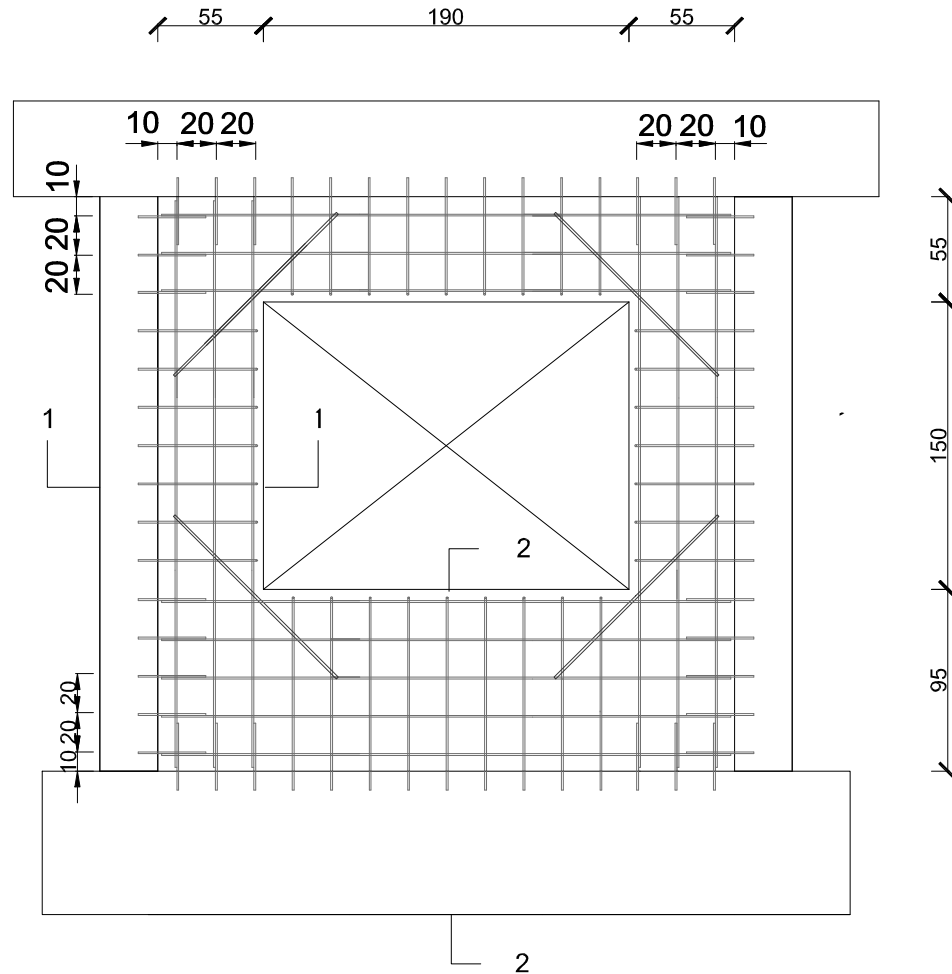
$$f_y = 4200 \text{ kgf/cm}^2$$

$$f_c' = 160 \text{ kgf/cm}^2$$

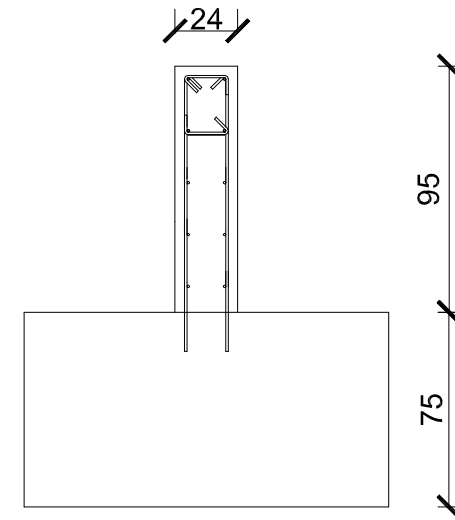


不為觀察重點
採耐震配筋

補強牆筋配筋

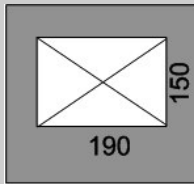
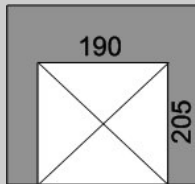
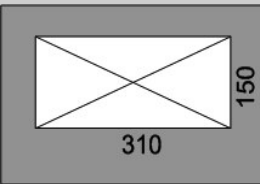
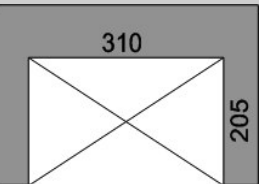
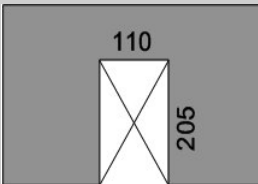
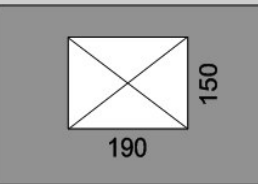


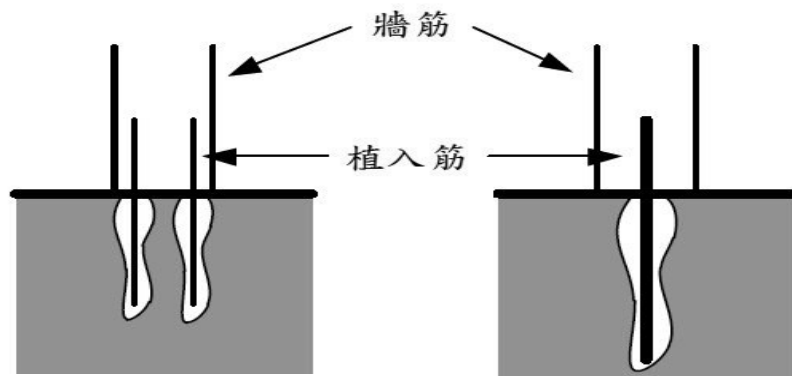
Section 1-1



Section 2-2

試體規劃-植筋變異

	FSW-19	FSD-19	FLW-31	FLD-31	FLD-31-2	FLD-11	FLD-11-2	FLW-19
								
植筋 (間距20cm)	#3 雙排	#3 雙排	#4單排	#4單排	#4單排 (牆底 #4雙排)	#4單排	#4單排 (牆底 #4雙排)	#4單排
植筋深度	10 cm (有刨除保護層)		13 cm (有刨除保護層)					



#3 2800 kgf/cm²
雙排植筋

#4 4200 kgf/cm²
單排植筋

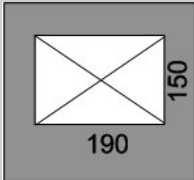
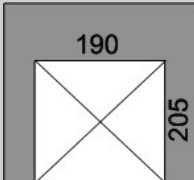
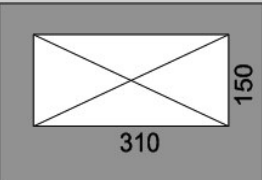
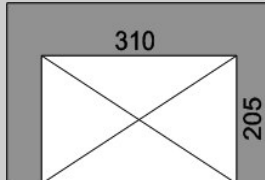
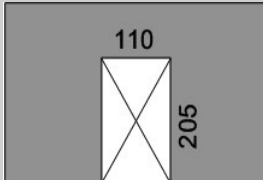
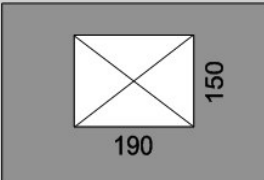
單排植筋

優點：減少一半植筋量

缺點：

1. 植入深度需加深
2. 間接搭接行為未知

試體規劃-角隅鋼筋

	FSW-19	FSD-19	FLW-31	FLD-31	FLD-31-2	FLD-11	FLD-11-2	FLW-19
								
角隅鋼筋	#4 雙層 單排 (2根)	#4 雙層 單排 (2根)	#4 雙層 單排 (2根)	#4 雙層 單排 (2根)	#5 雙層 雙排 (4根)	#4 雙層 單排 (2根)	#5 雙層 雙排 (4根)	#4 雙層 單排 (2根)

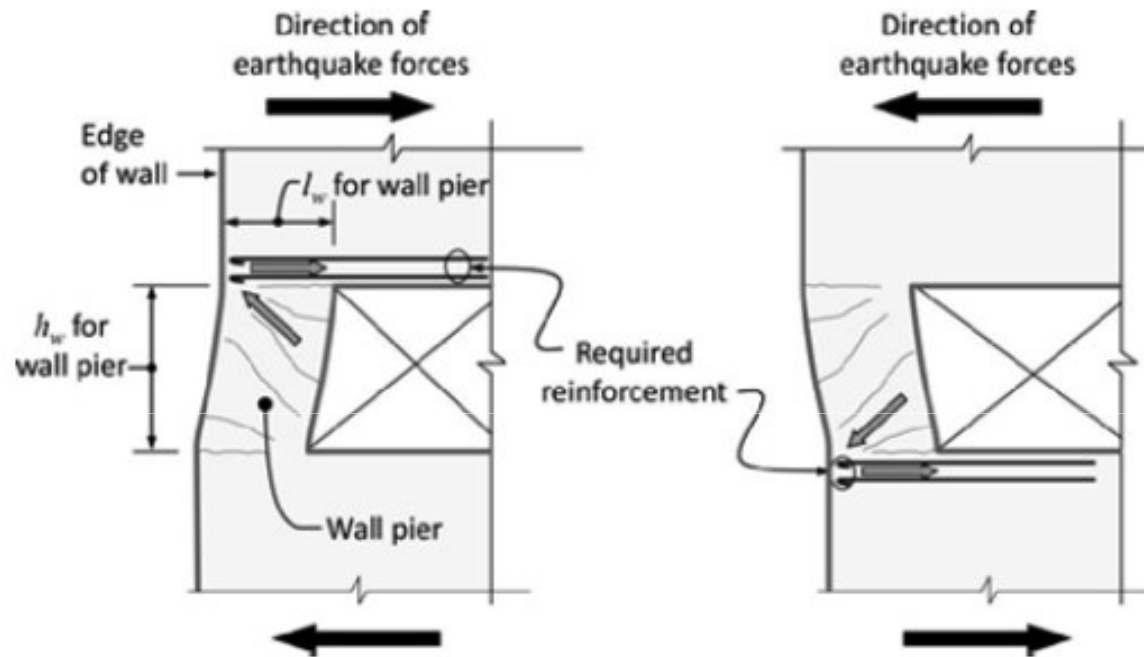
以往業界習慣???

角隅鋼筋採用比牆筋大一號。牆筋為#3，因此採用#4雙層單排(2根)

土木401-100規定

7.4.7 牆內若有門窗開孔者，開孔之四周須加置不少於 2 根 D16 (#5) 之鋼筋，此等鋼筋須延伸至孔角外至少 60 cm，並不得小於其伸展長度。

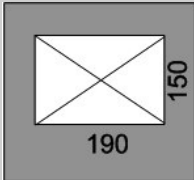
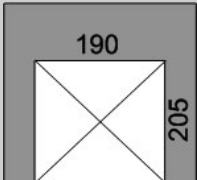
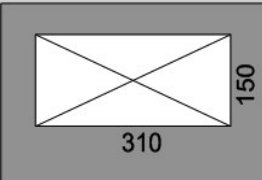
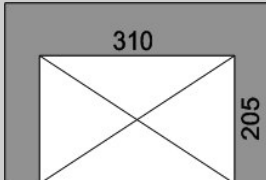
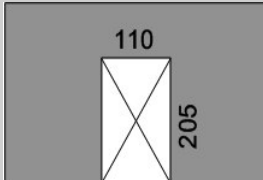
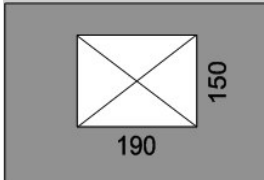
試體規劃- ACI 318-11 水平拉力鋼筋

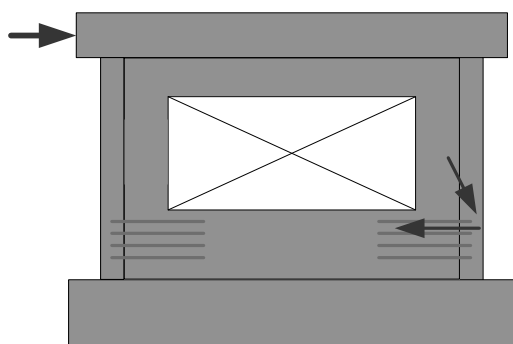


21.9.8.2 — For wall piers at the edge of a wall, horizontal reinforcement shall be provided in adjacent wall segments above and below the wall pier and be proportioned to transfer the design shear force from the wall pier into the adjacent wall segments.

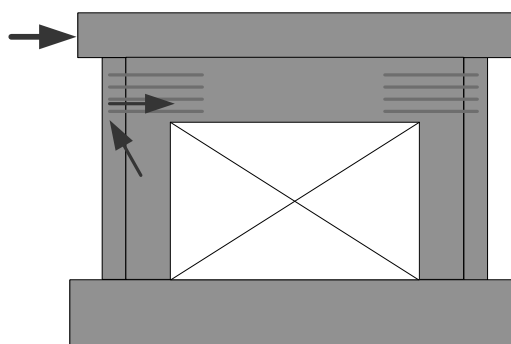
Section 21.9.8.2 addresses wall piers at the edge of a wall. Under in-plane shear, inclined cracks can propagate into segments of the wall directly above and below the wall pier. Unless there is sufficient reinforcement in the adjacent wall segments, shear failure within the adjacent wall segments can occur. The length of embedment of the provided reinforcement into the adjacent wall segments should be determined considering both development length requirements and shear strength of the wall segments. See Fig. R21.9.8.

試體規劃- ACI 318-11 水平拉力鋼筋

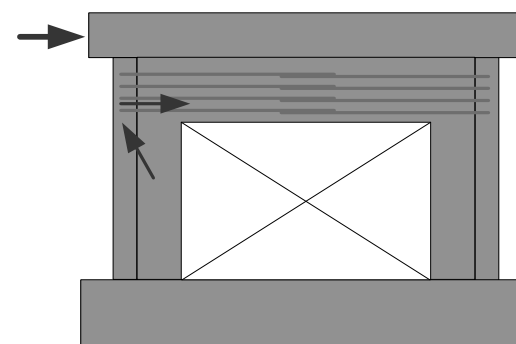
	FSW-19	FSD-19	FLW-31	FLD-31	FLD-31-2	FLD-11	FLD-11-2	FLW-19
								
水平 拉力筋			有 (局部)	有 (局部)	有			



FLW-31

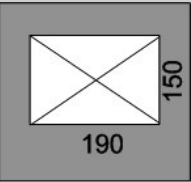
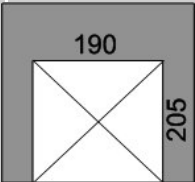
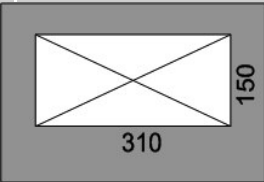
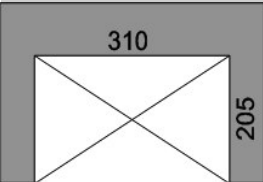
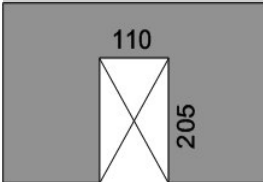
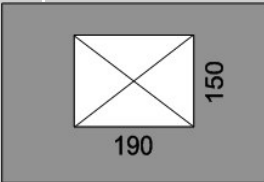


FLD-31

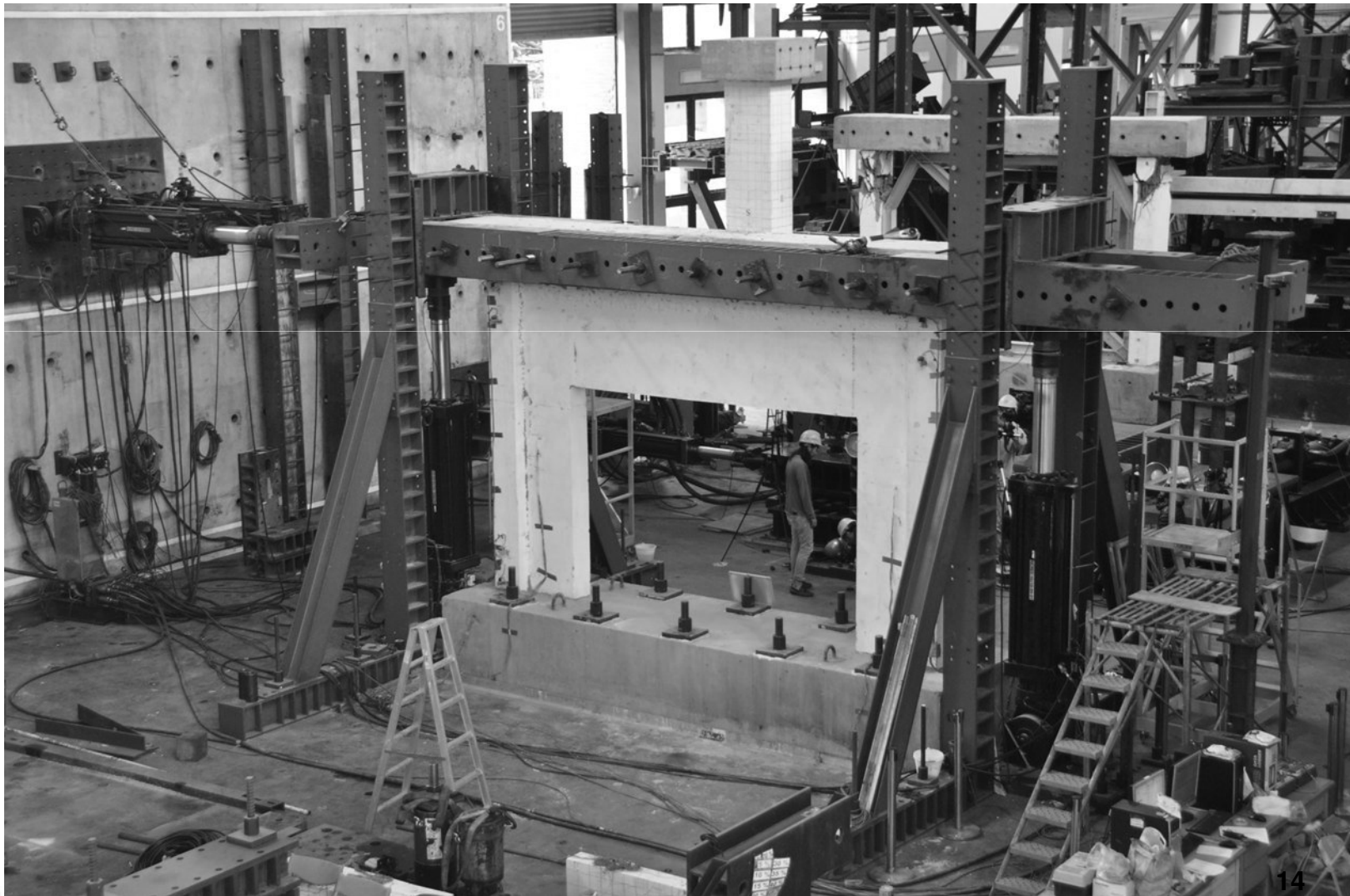


FLD-31-2

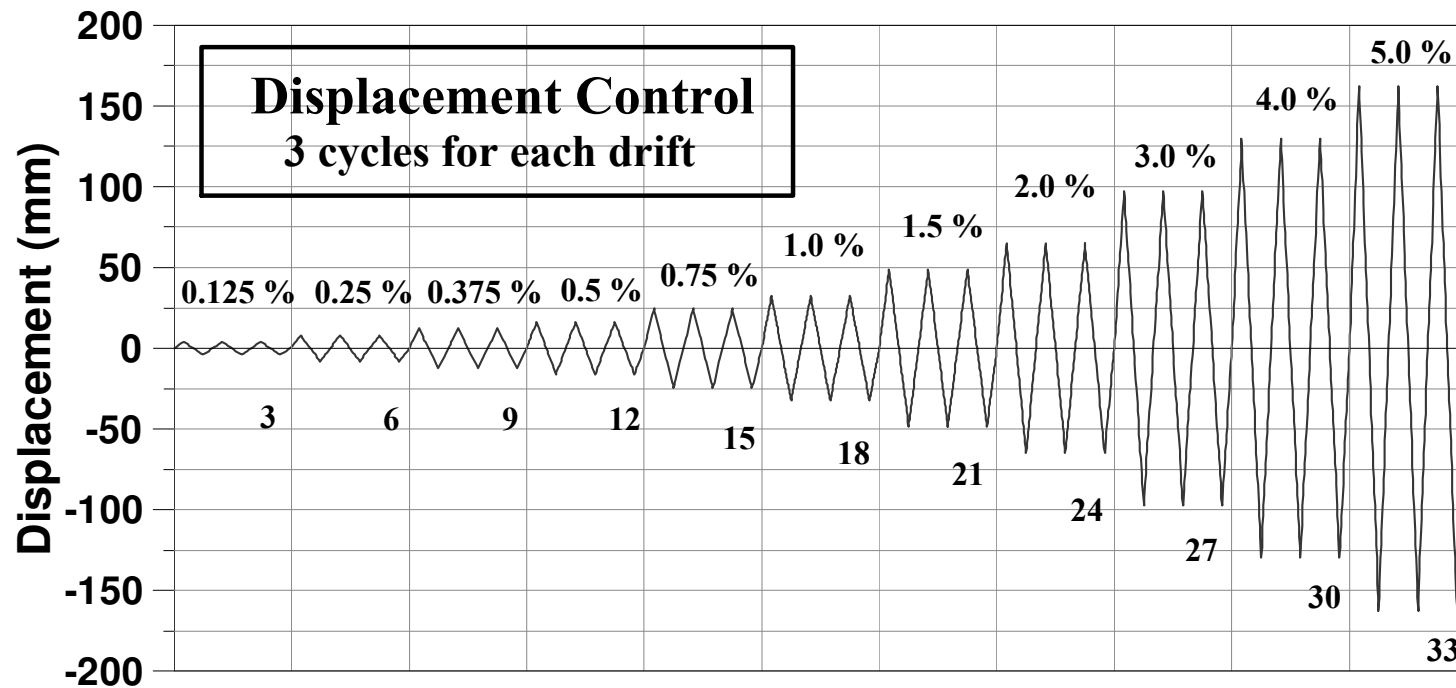
試體規劃

	FSW-19	FSD-19	FLW-31	FLD-31	FLD-31-2	FLD-11	FLD-11-2	FLW-19
								
牆體大小	300x300		420x300					
開口大小	190x150	190x205	310x150	310x205		110x205		190x150
植筋 (間距20cm)	#3 雙排	#3 雙排	#4單排	#4單排	#4單排 (牆底 #4雙排)	#4單排	#4單排 (牆底#4 雙排)	#4單排
植筋深度	10 cm (有刨除保護層)		13 cm (有刨除保護層)					
角隅鋼筋	#4 雙層 單排	#4 雙層 單排	#4 雙層 單排	#4 雙層 單排	#5 雙層 雙排	#4 雙層 單排	#5 雙層 雙排	#4 雙層 單排
水平 拉力筋			有 (局部)	有 (局部)	有			

試驗佈置



位移歷時

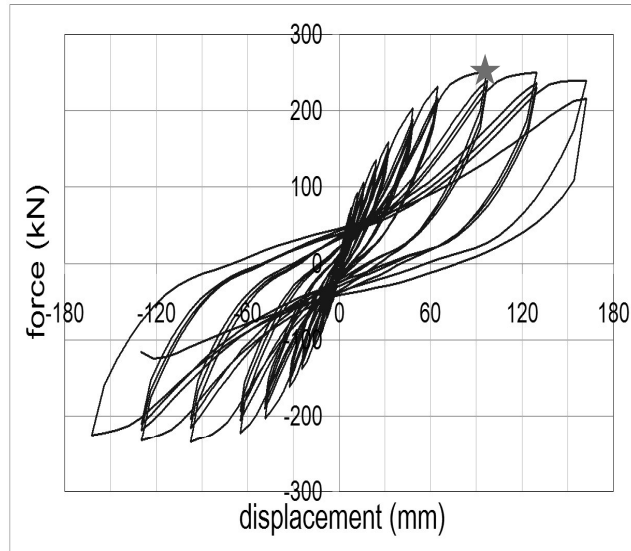


符合 ACI T1.1R-01之規定

大綱

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短跨空構架試體 (FS)

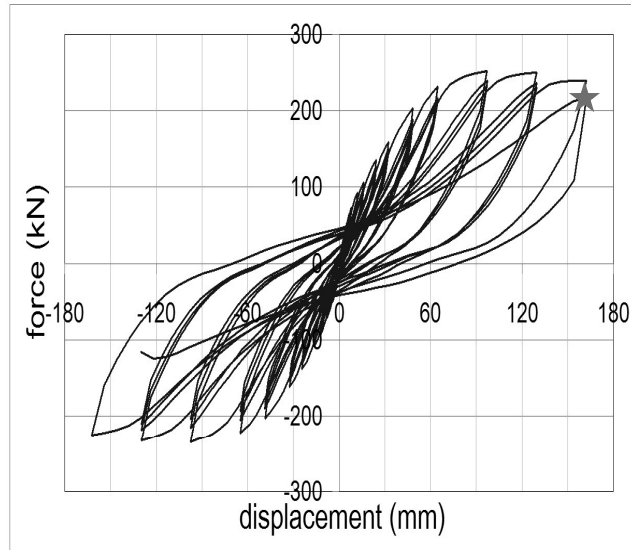


Drift Ratio = 3%

最大強度點
252.08 kN



短跨空構架試體 (FS)

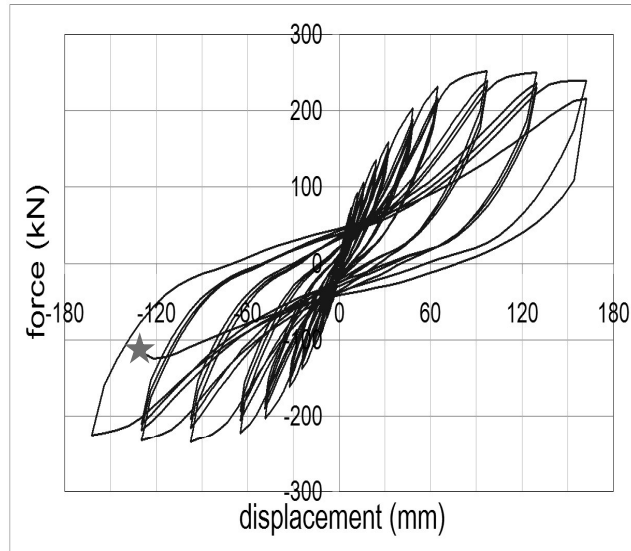


Drift Ratio = 5%

產生明顯
剪力裂縫



短跨空構架試體 (FS)

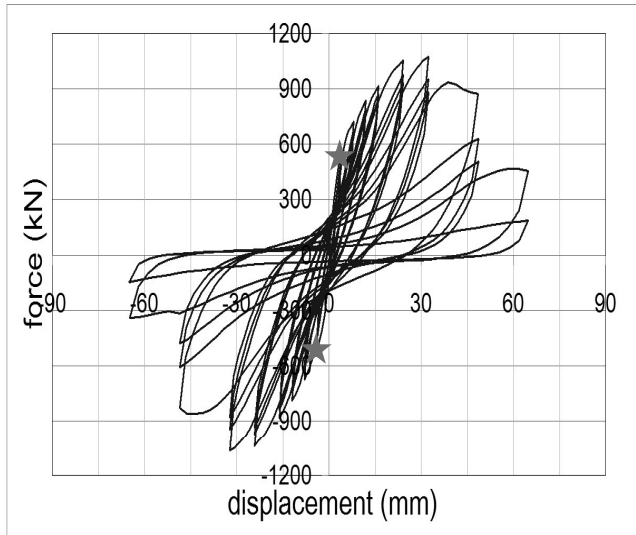


Drift Ratio = -5%

無法抵抗
垂直軸力



短跨開窗試體 (FSW-19)

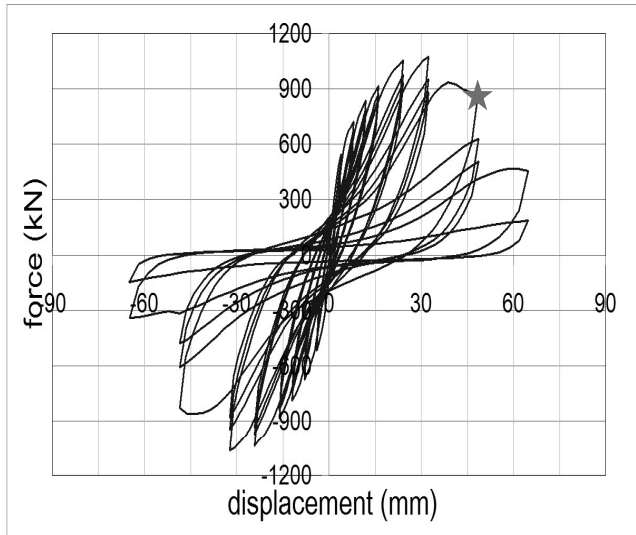


Drift Ratio
0.125%

開口四個角隅
產生裂縫



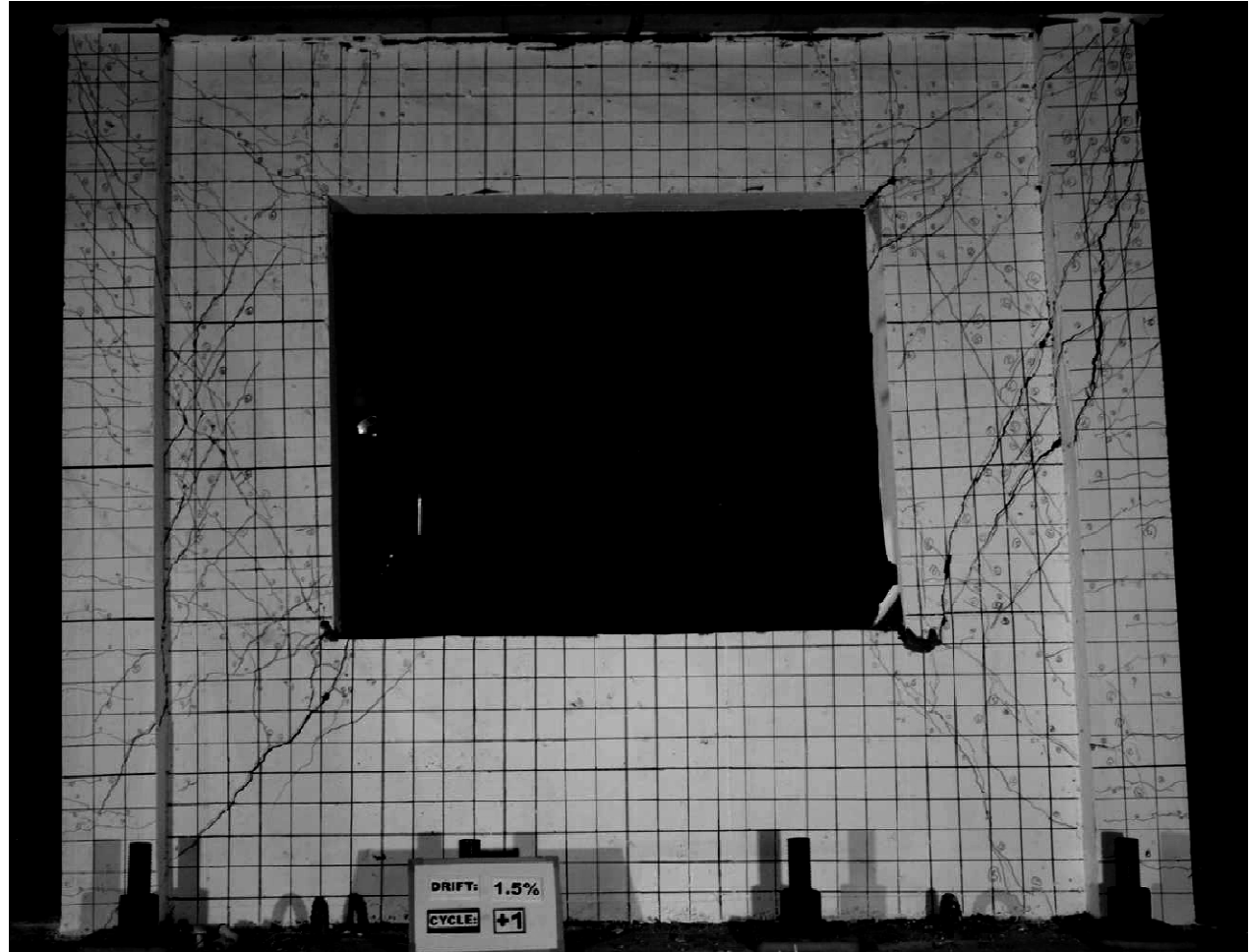
短跨開窗試體 (FSW-19)



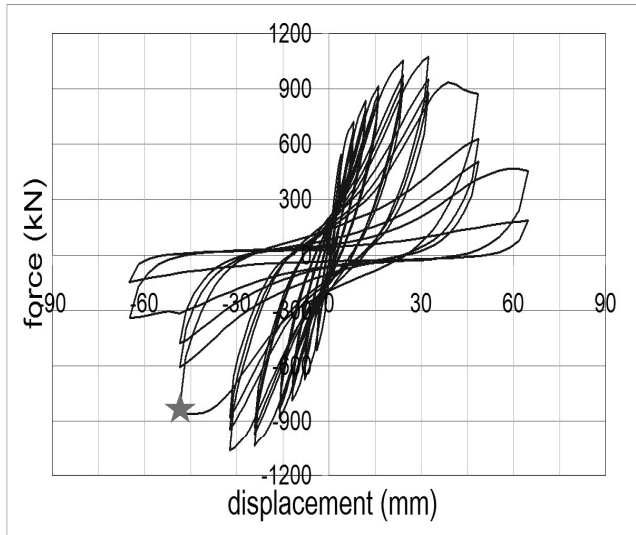
Drift Ratio=1.5%

Cycles: +1

開口右側產生
主要剪力裂縫



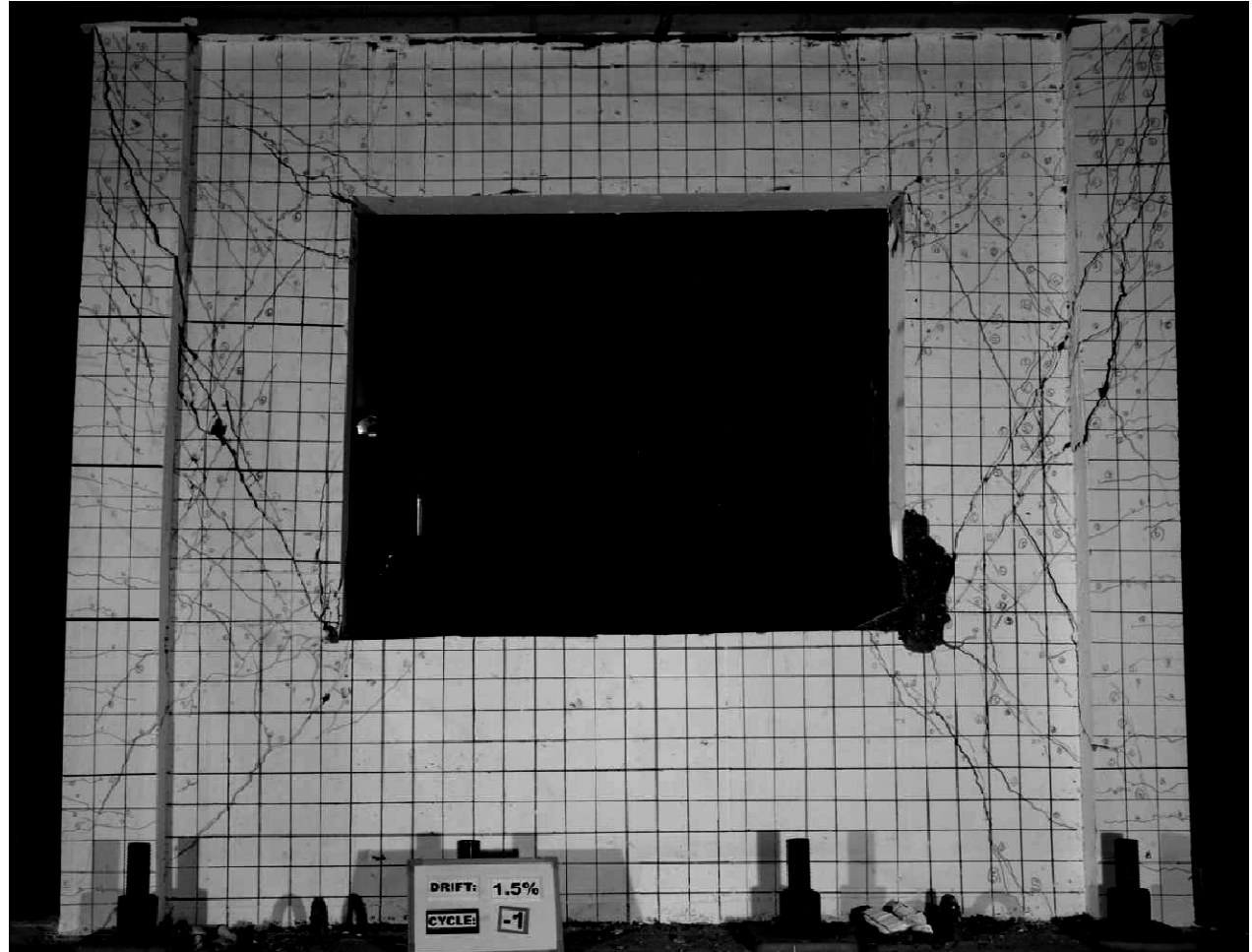
短跨開窗試體 (FSW-19)



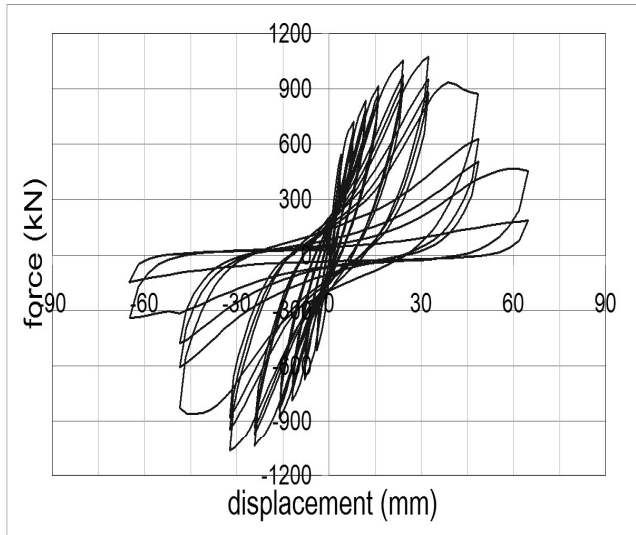
Drift Ratio=1.5%

Cycles: -1

開口左側產生
主要剪力裂縫



短跨開窗試體 (FSW-19)

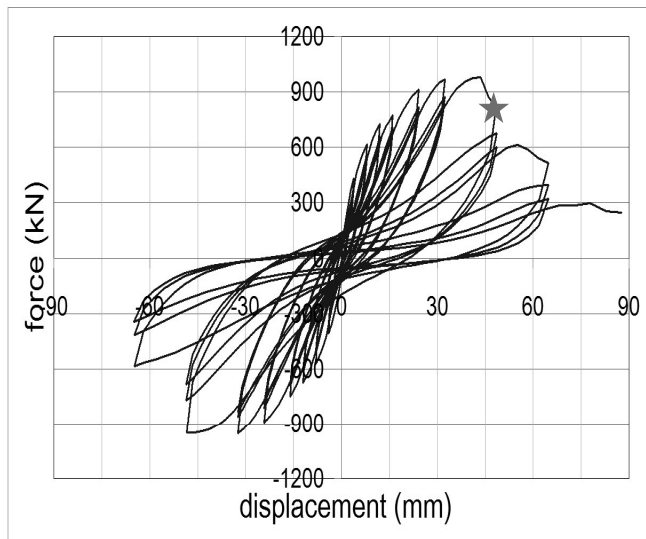


Drift Ratio=2%

最後破壞照片



短跨開門試體 (FSD-19)

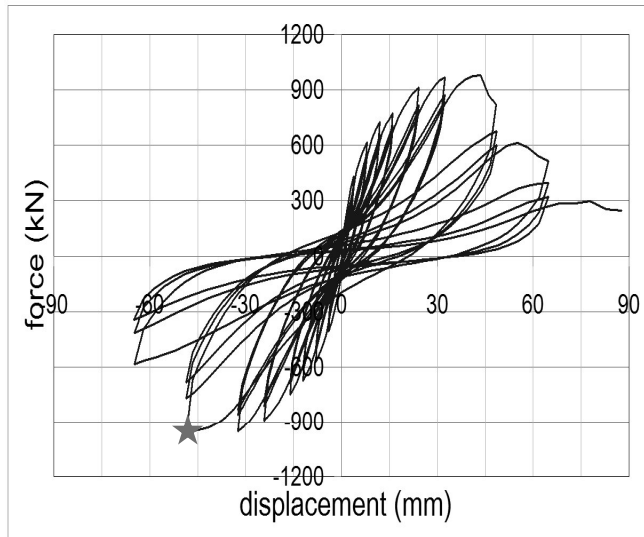


Drift Ratio 1.5%

開口左側
主要剪力裂縫
產生



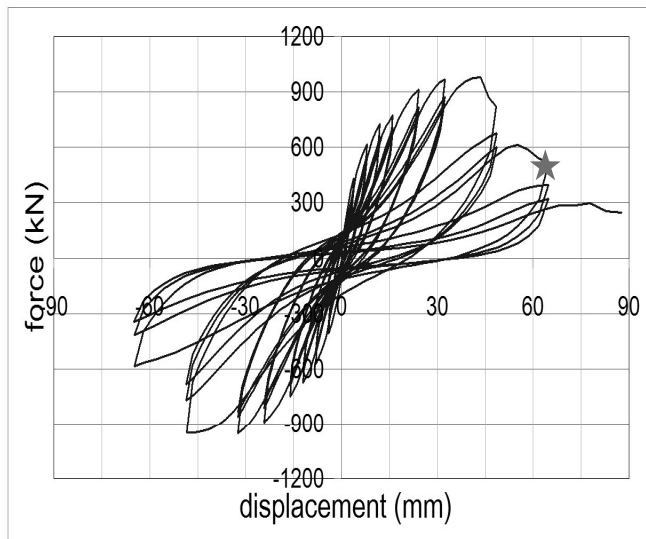
短跨開門試體 (FSD-19)



Drift Ratio -1.5%



短跨開門試體 (FSD-19)

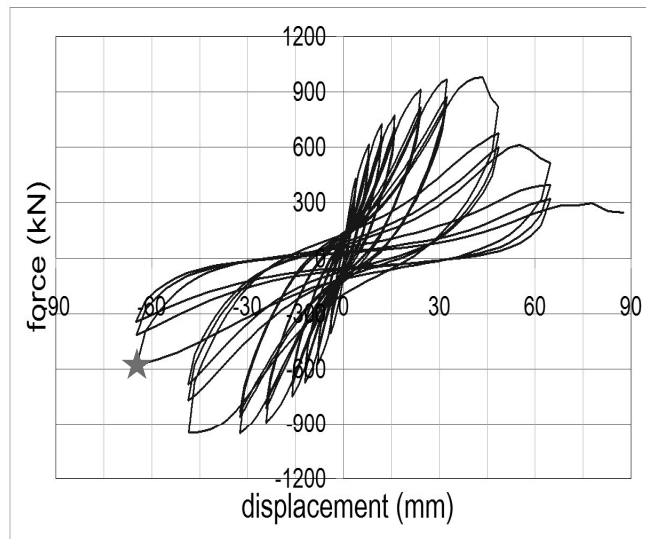


Drift Ratio 2%

開口兩側
皆產生主要
剪力裂縫



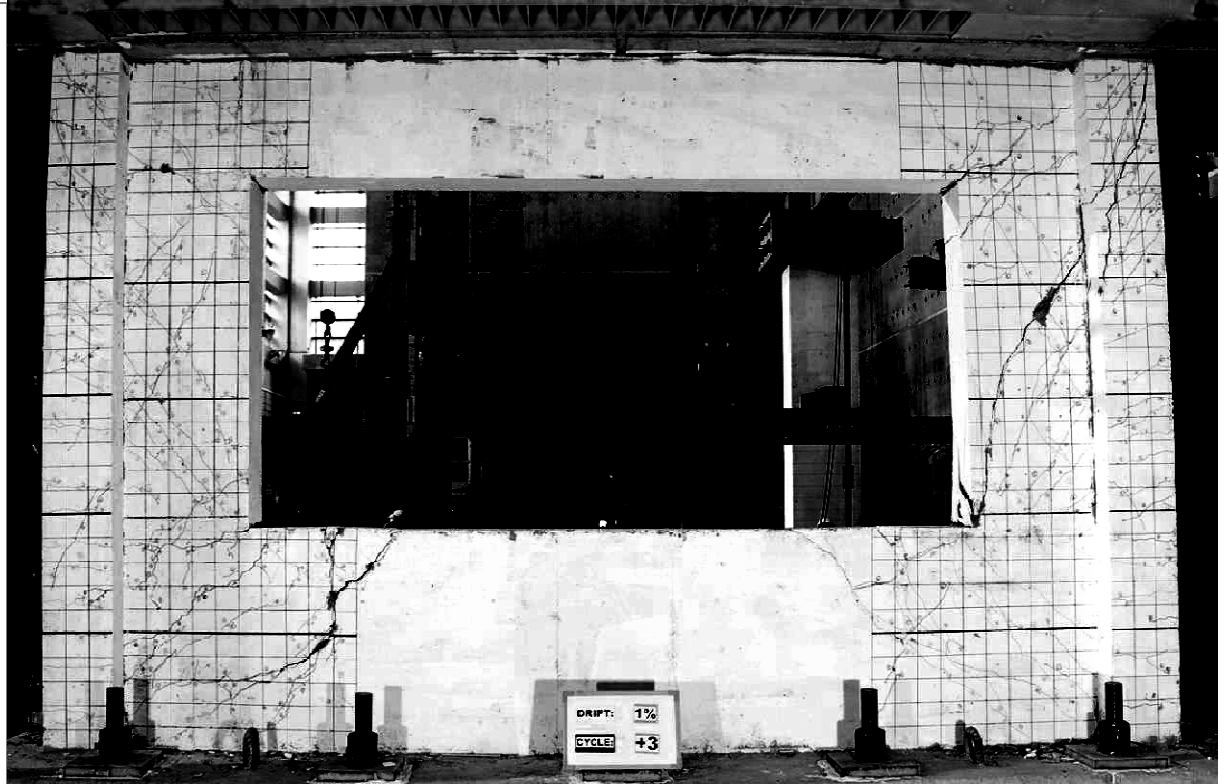
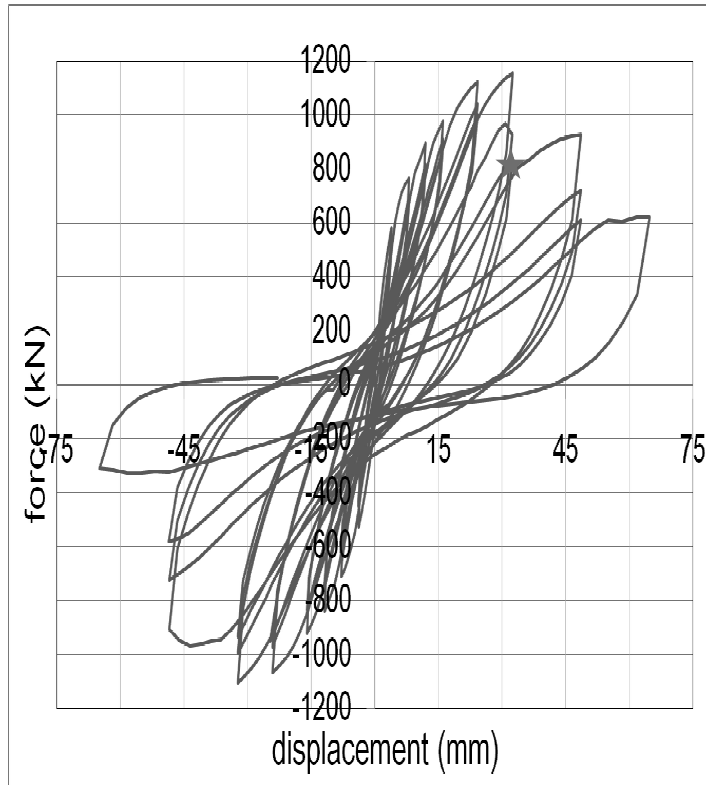
短跨開門試體 (FSD-19)



Drift Ratio -2%



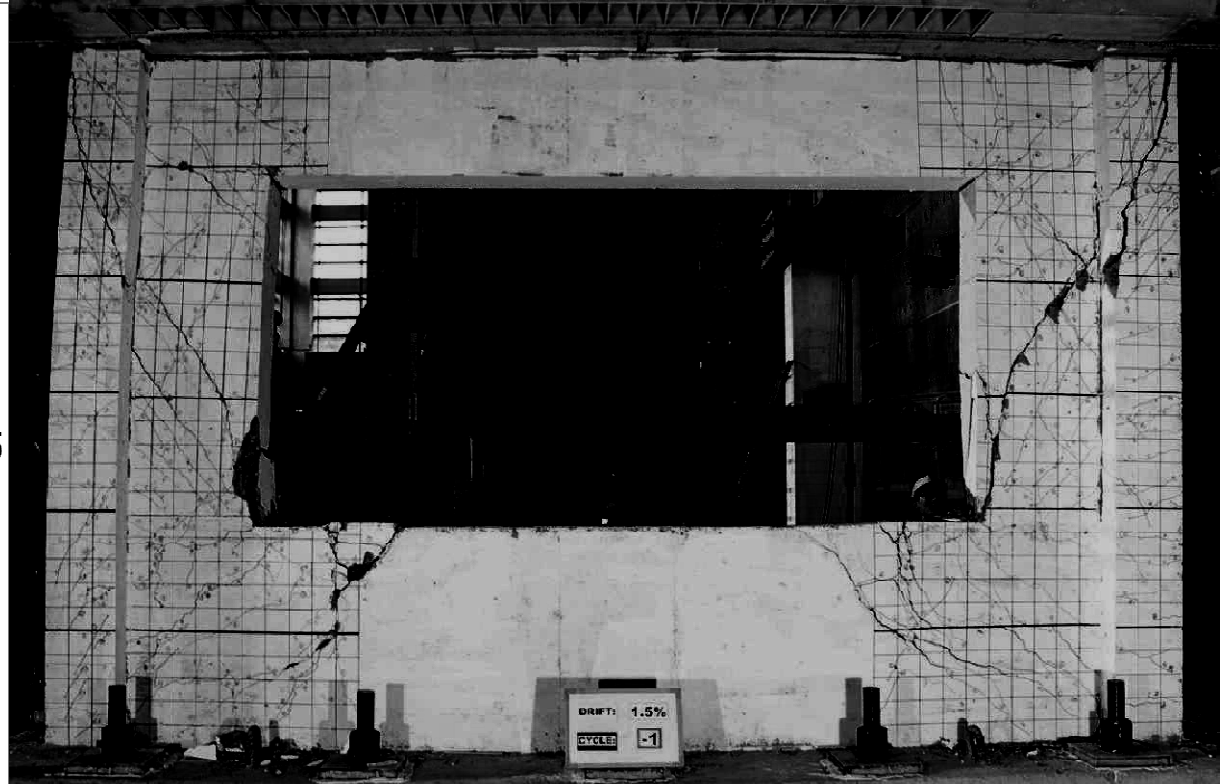
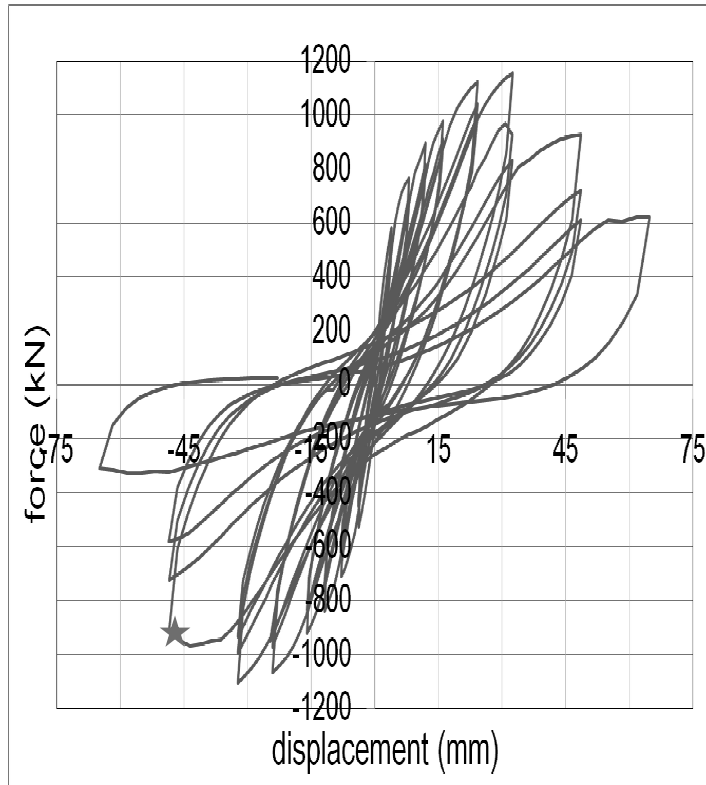
長跨開窗試體 (FLW-31)



Drift Ratio=1%
Cycles: +3

開口右側產生
明顯剪力裂縫

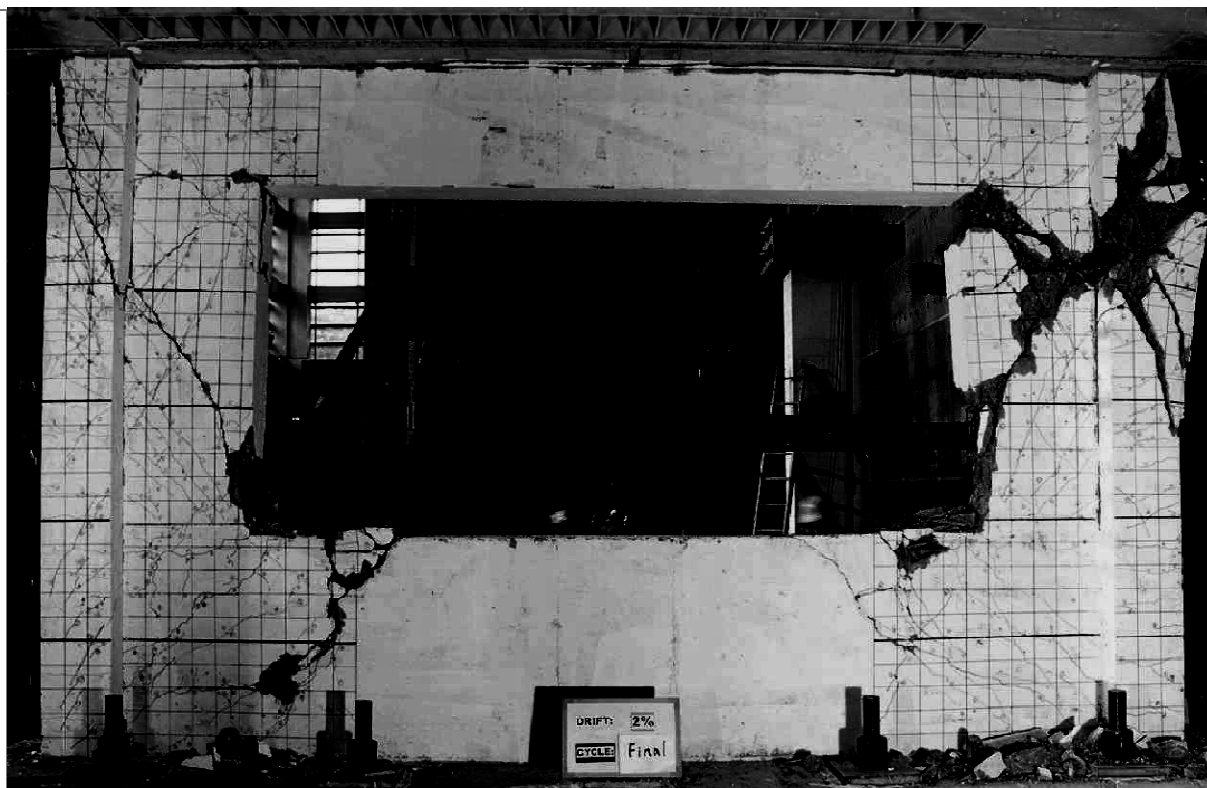
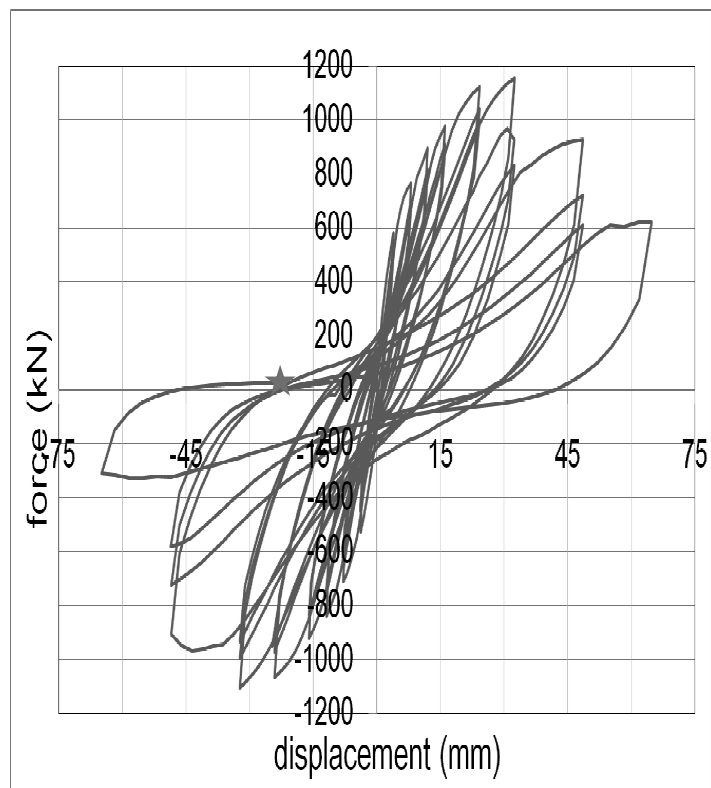
長跨開窗試體 (FLW-31)



Drift Ratio=1.5%
Cycles: -1

開口左側產生
明顯剪力裂縫

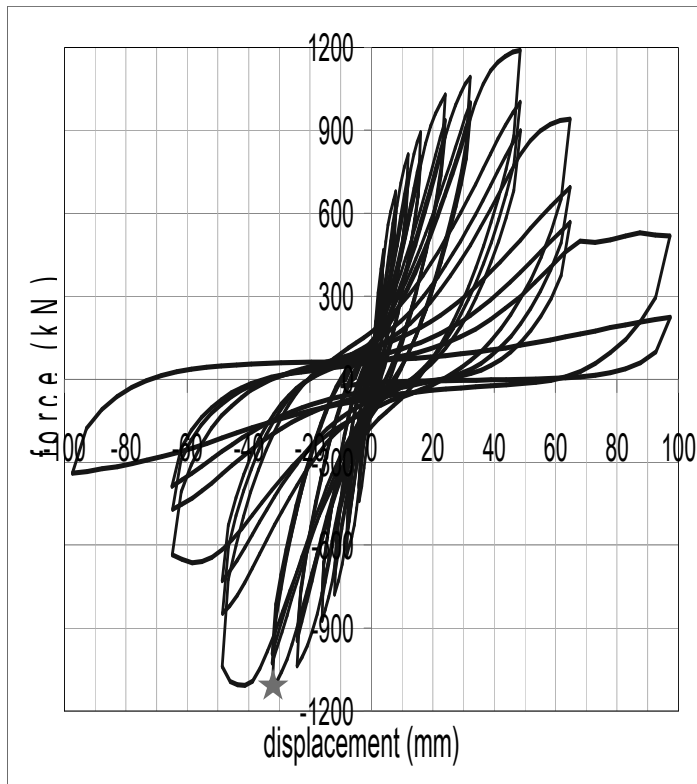
長跨開窗試體 (FLW-31)



Drift Ratio= 2%
Final

開口右側喪失
垂直承載能力

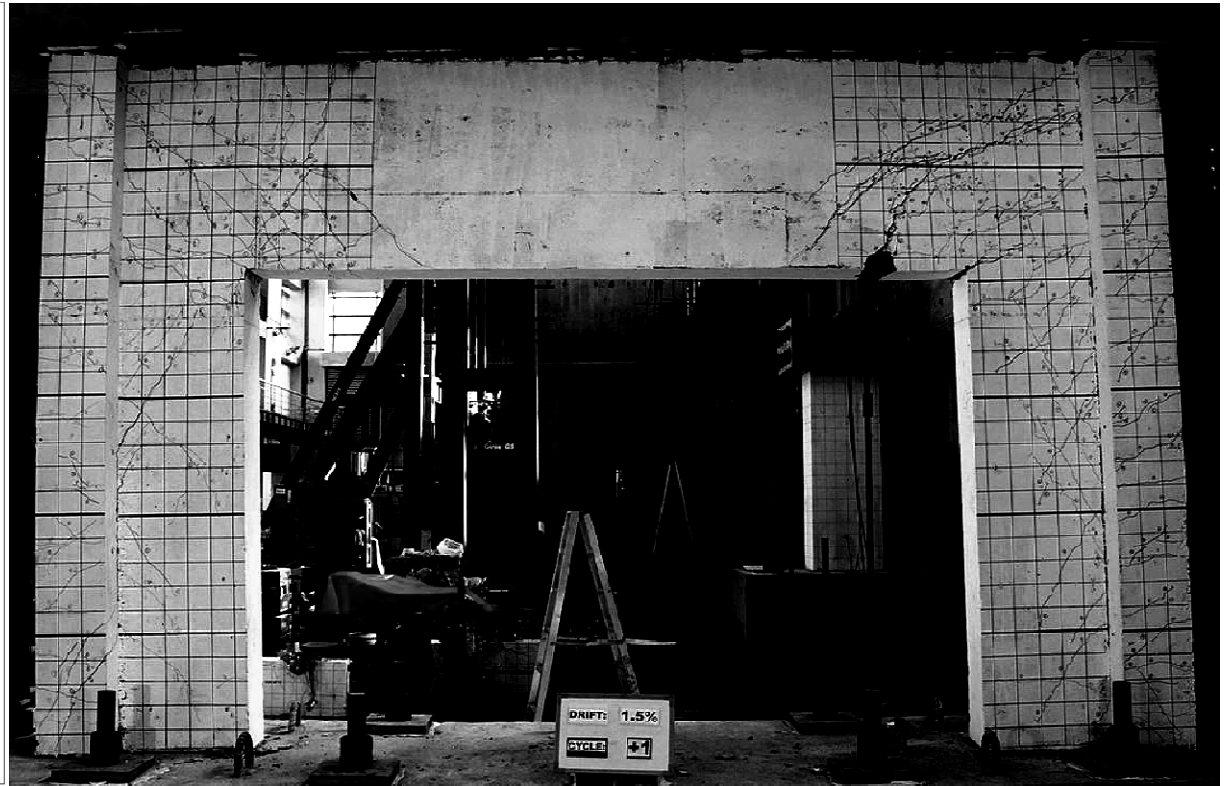
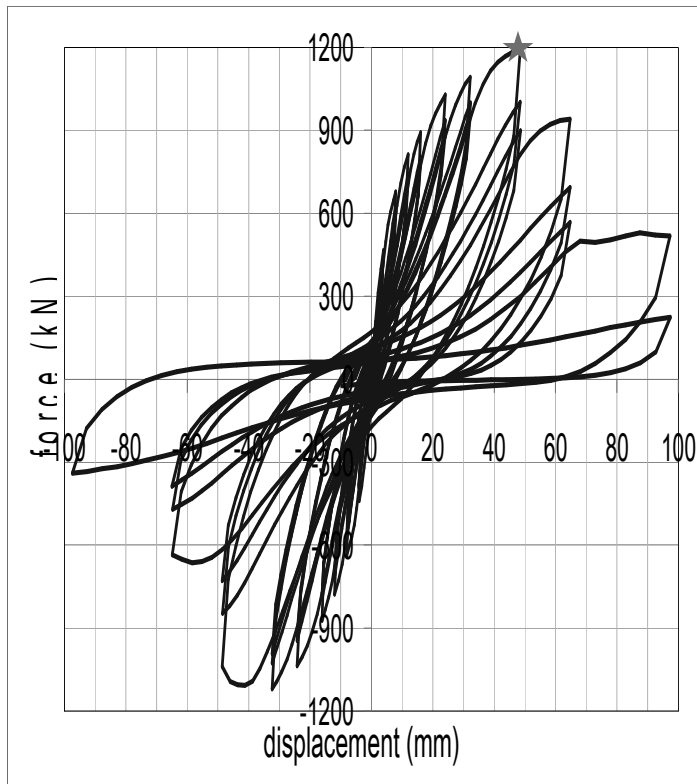
長跨開門試體 (FLD-31)



Drift Ratio= -1%

最大強度點
-1120 kN

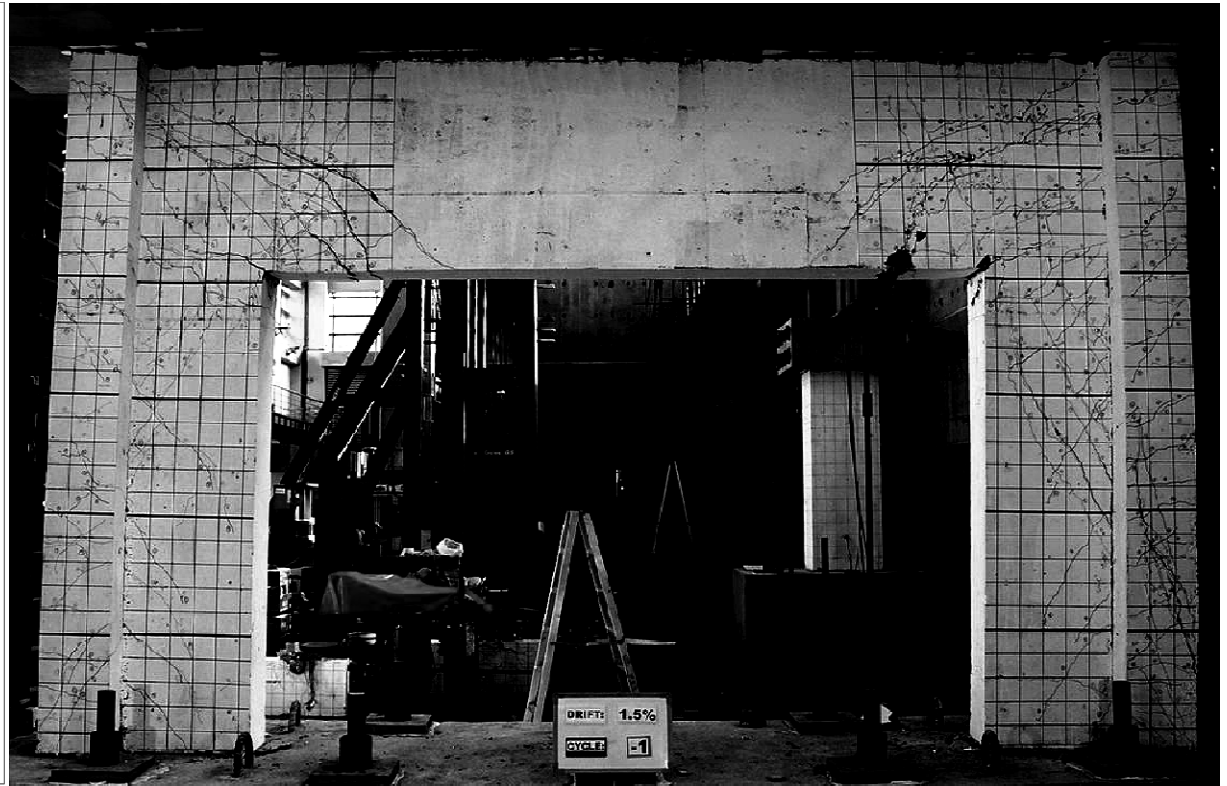
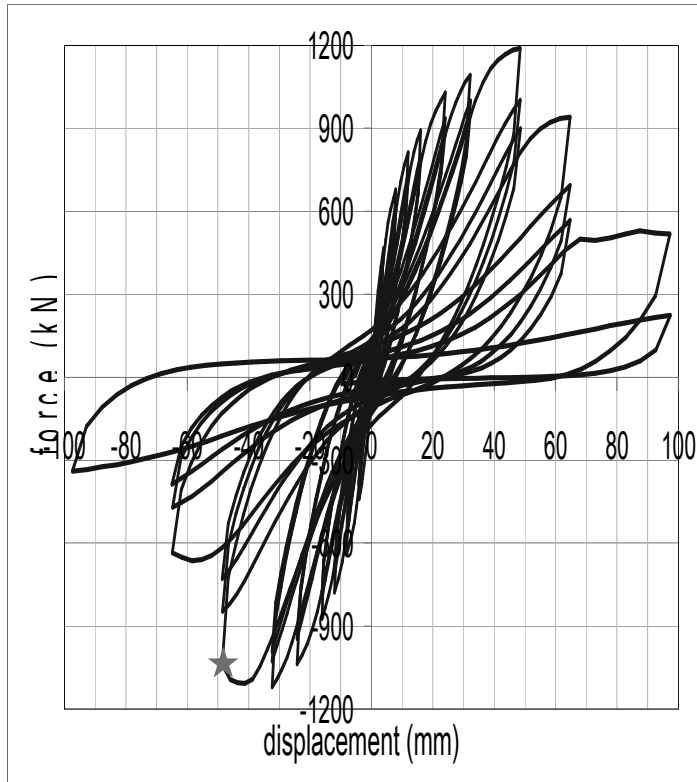
長跨開門試體 (FLD-31)



Drift Ratio=1.5%
Cycles: +1

最大強度點
1190 kN

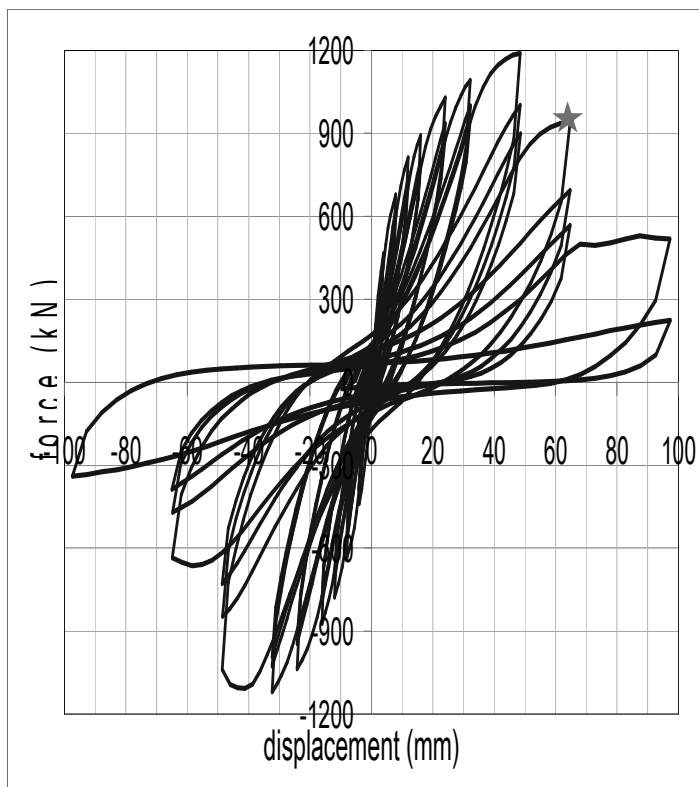
長跨開門試體 (FLD-31)



Drift Ratio=1.5%
Cycles: -1

開口右側明顯
產生剪力裂縫

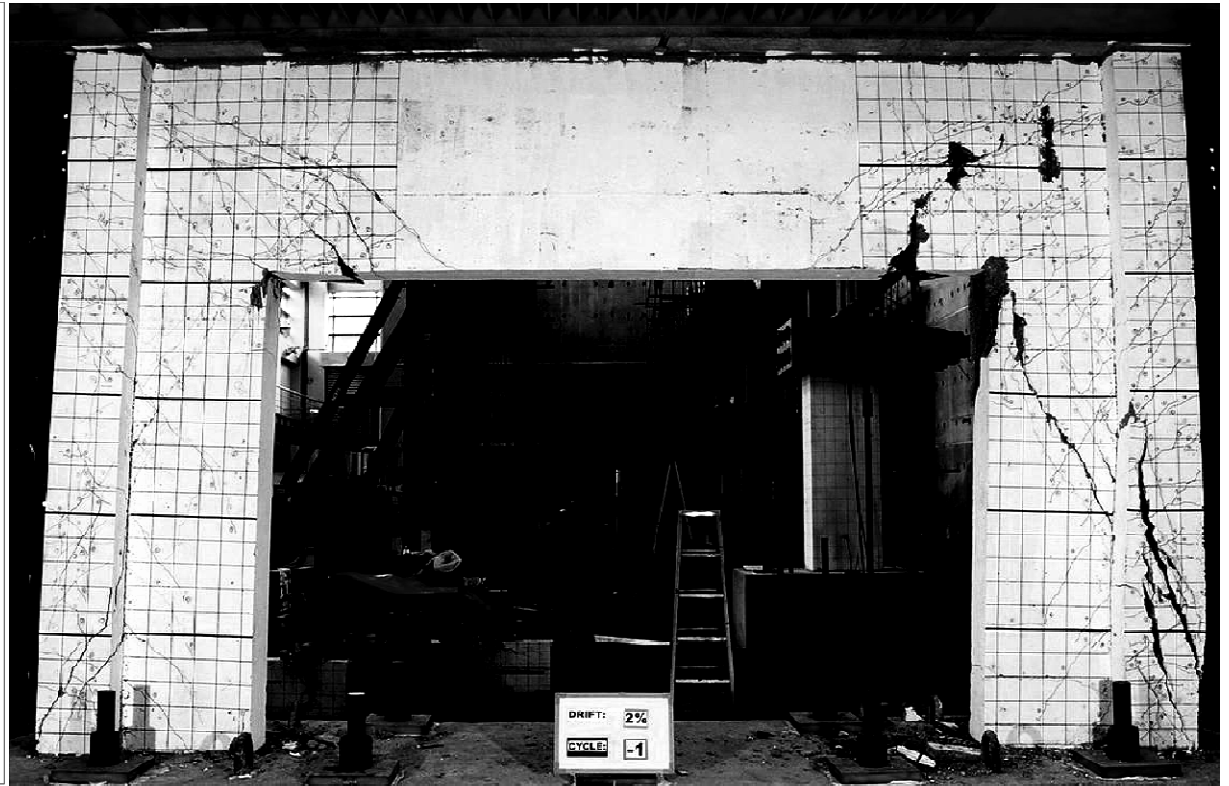
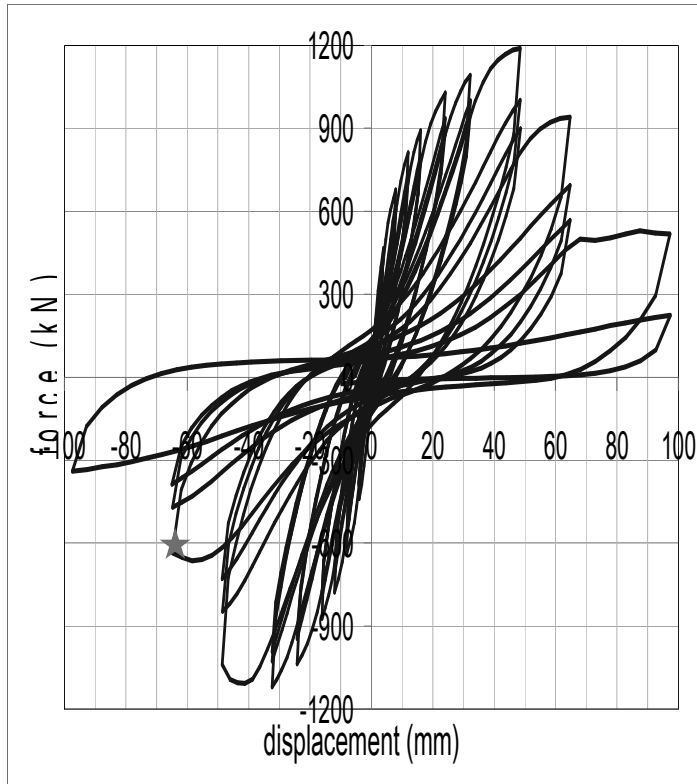
長跨開門試體 (FLD-31)



Drift Ratio=2%
Cycles: +1

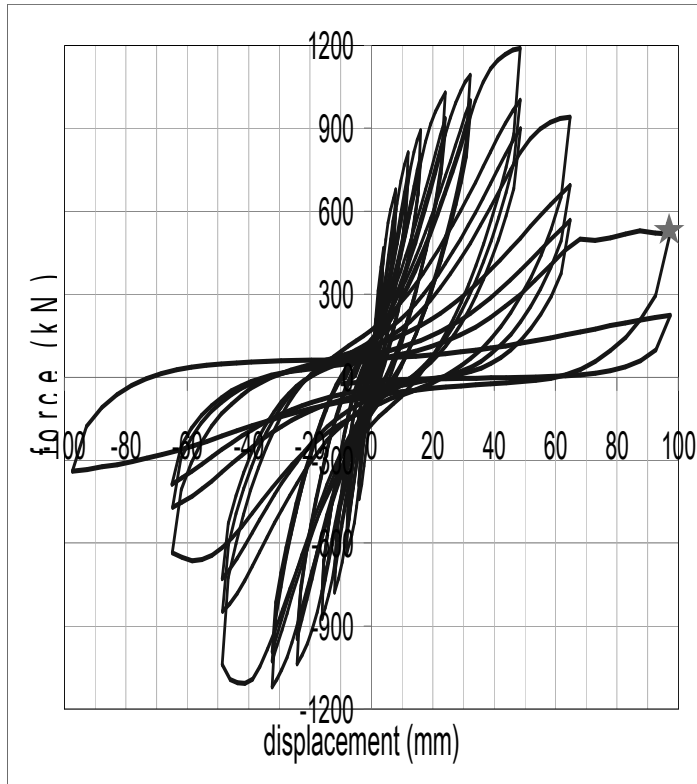
開口左側明顯
產生剪力裂縫

長跨開門試體 (FLD-31)



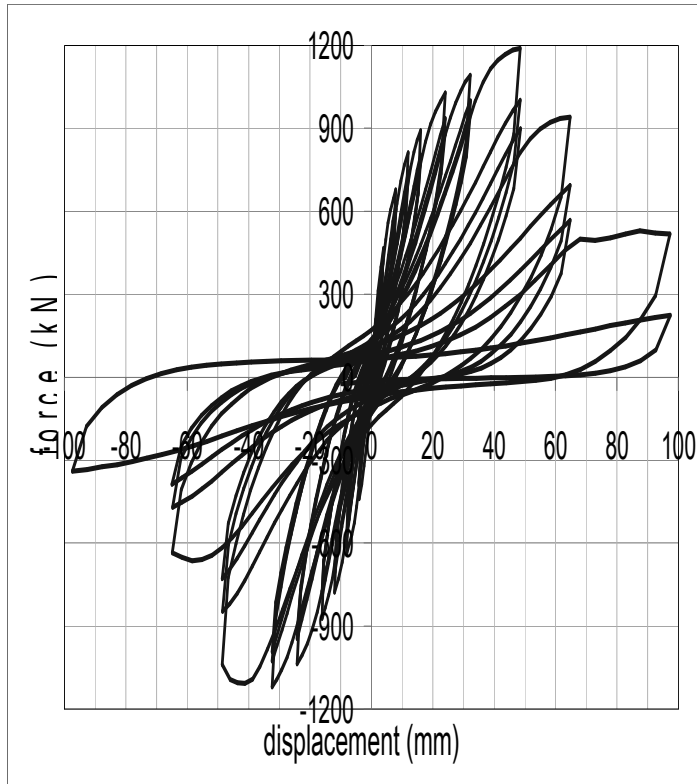
Drift Ratio=2%
Cycles: -1

長跨開門試體 (FLD-31)



Drift Ratio=3%
Cycles: +1

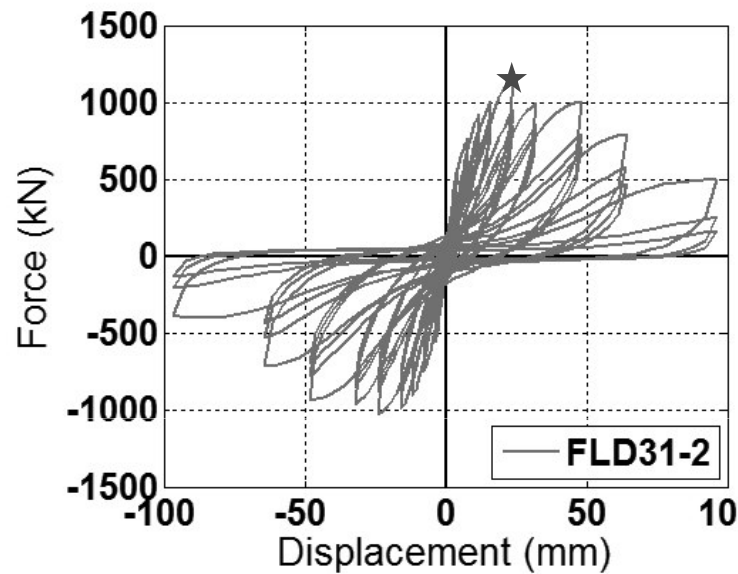
長跨開門試體 (FLD-31)



Drift Ratio= 3%
Final

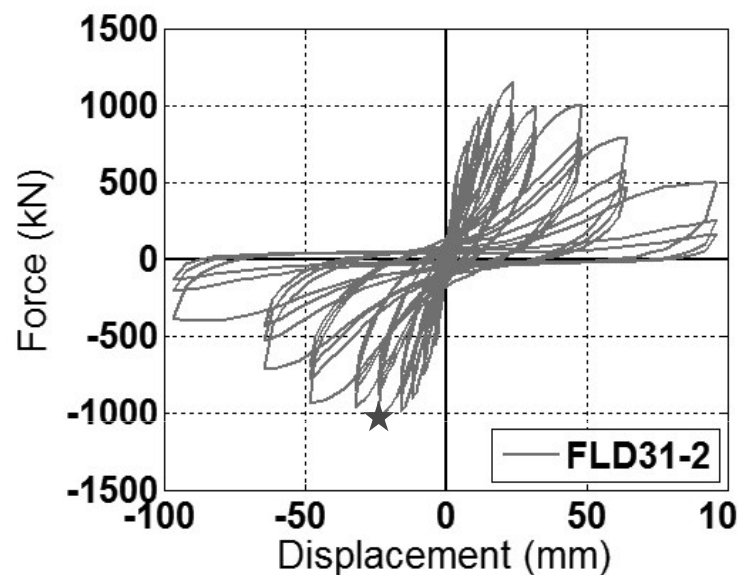
開口右側喪失
垂直承載能力

長跨開門試體 (FLD-31-2)



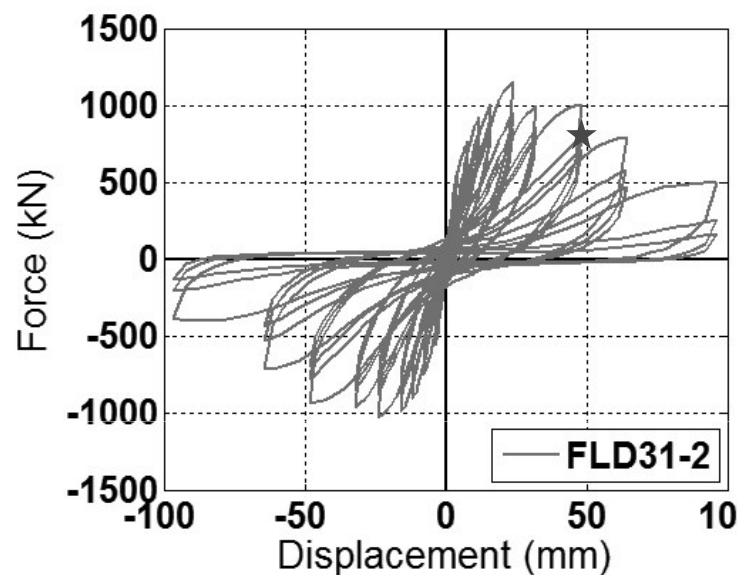
Drift Ratio=0.75%
Cycles: +1

長跨開門試體 (FLD-31-2)



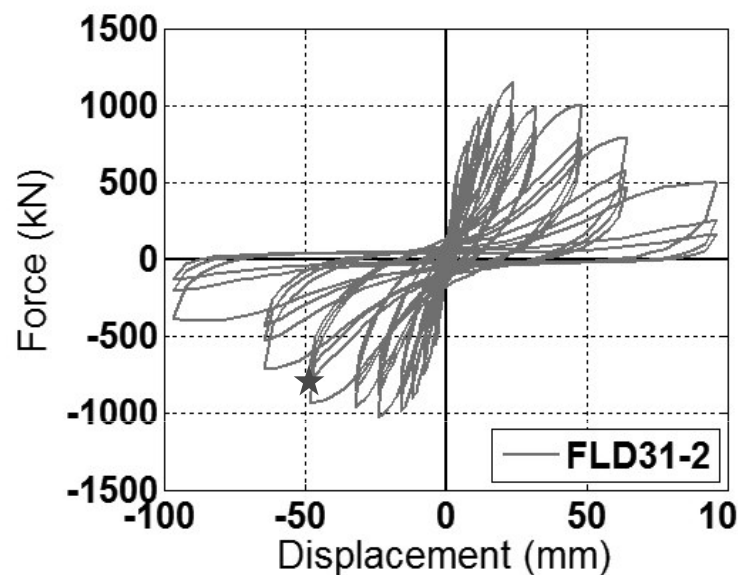
Drift Ratio=0.75%
Cycles: -1

長跨開門試體 (FLD-31-2)



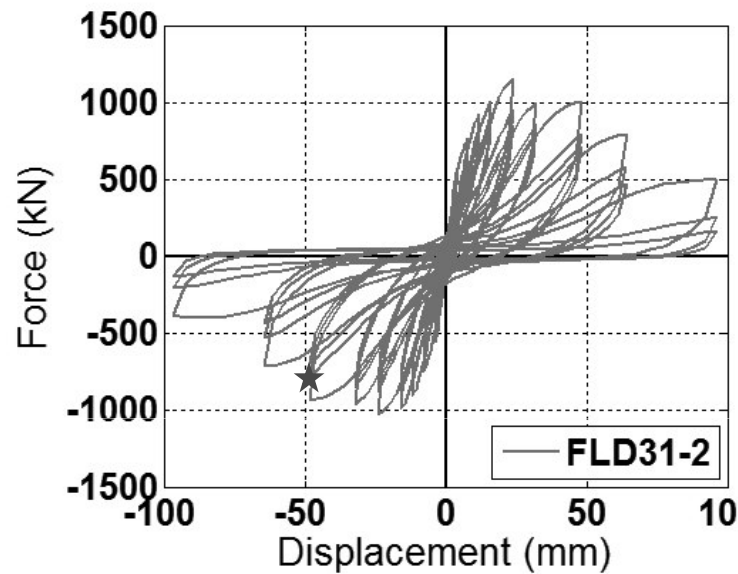
Drift Ratio=1.5%
Cycles: +2

長跨開門試體 (FLD-31-2)



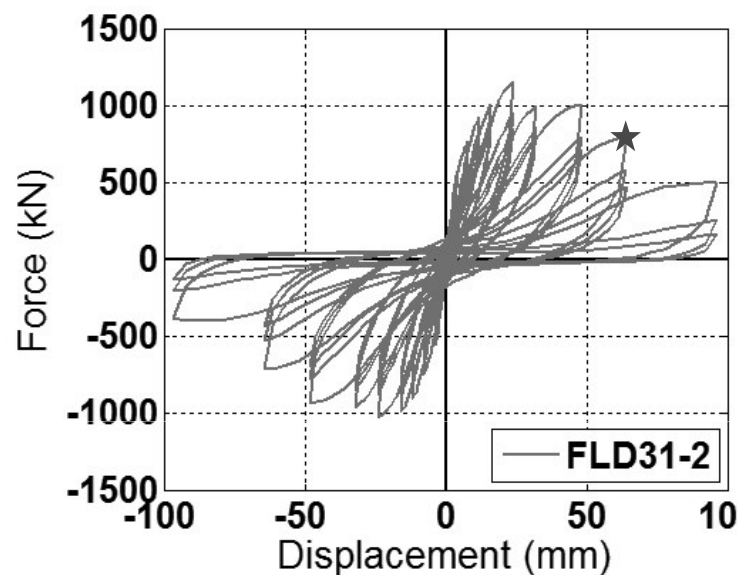
Drift Ratio=1.5%
Cycles: -2

長跨開門試體 (FLD-31-2)



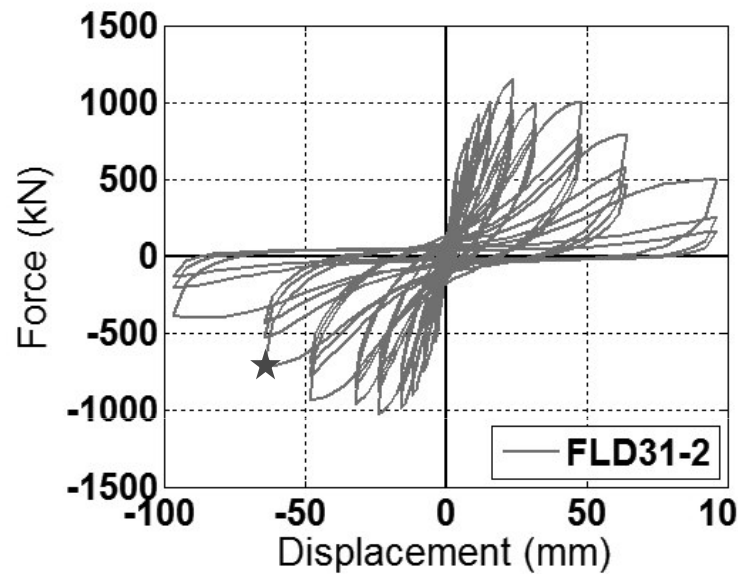
Drift Ratio=1.5%
Cycles: -2

長跨開門試體 (FLD-31-2)



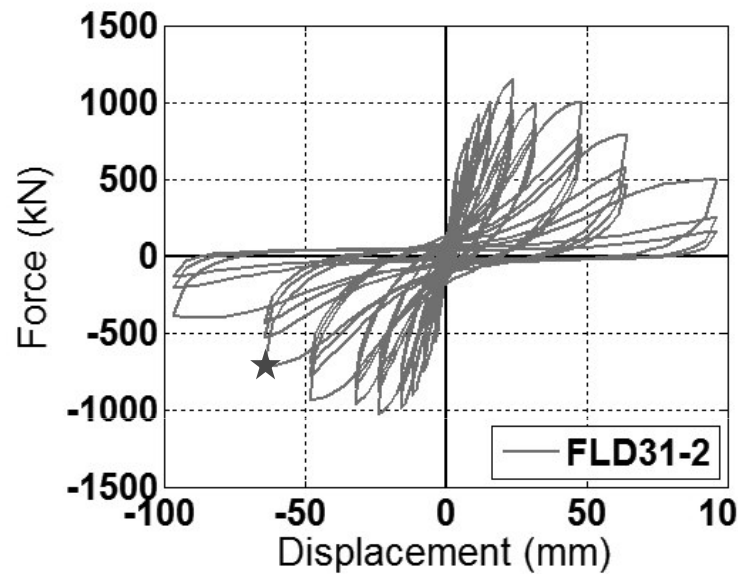
Drift Ratio=2.0%
Cycles: +1

長跨開門試體 (FLD-31-2)



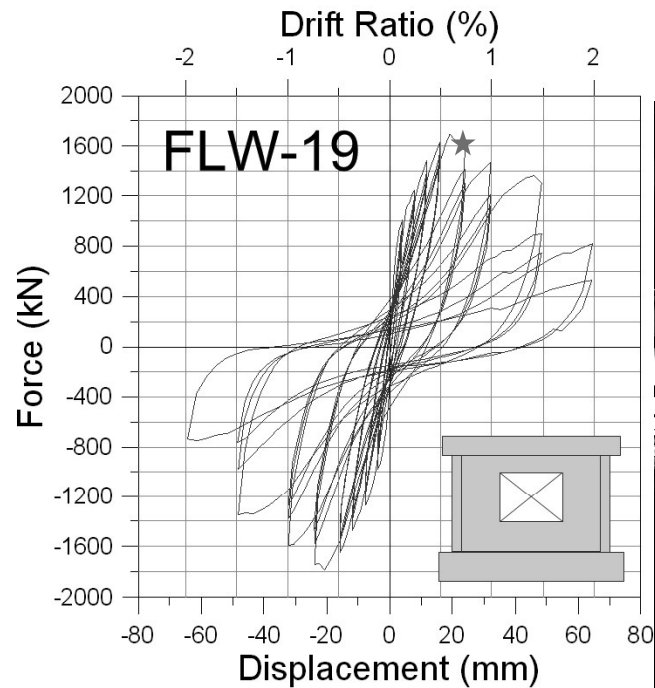
Drift Ratio=2.0%
Cycles: -1

長跨開門試體 (FLD-31-2)



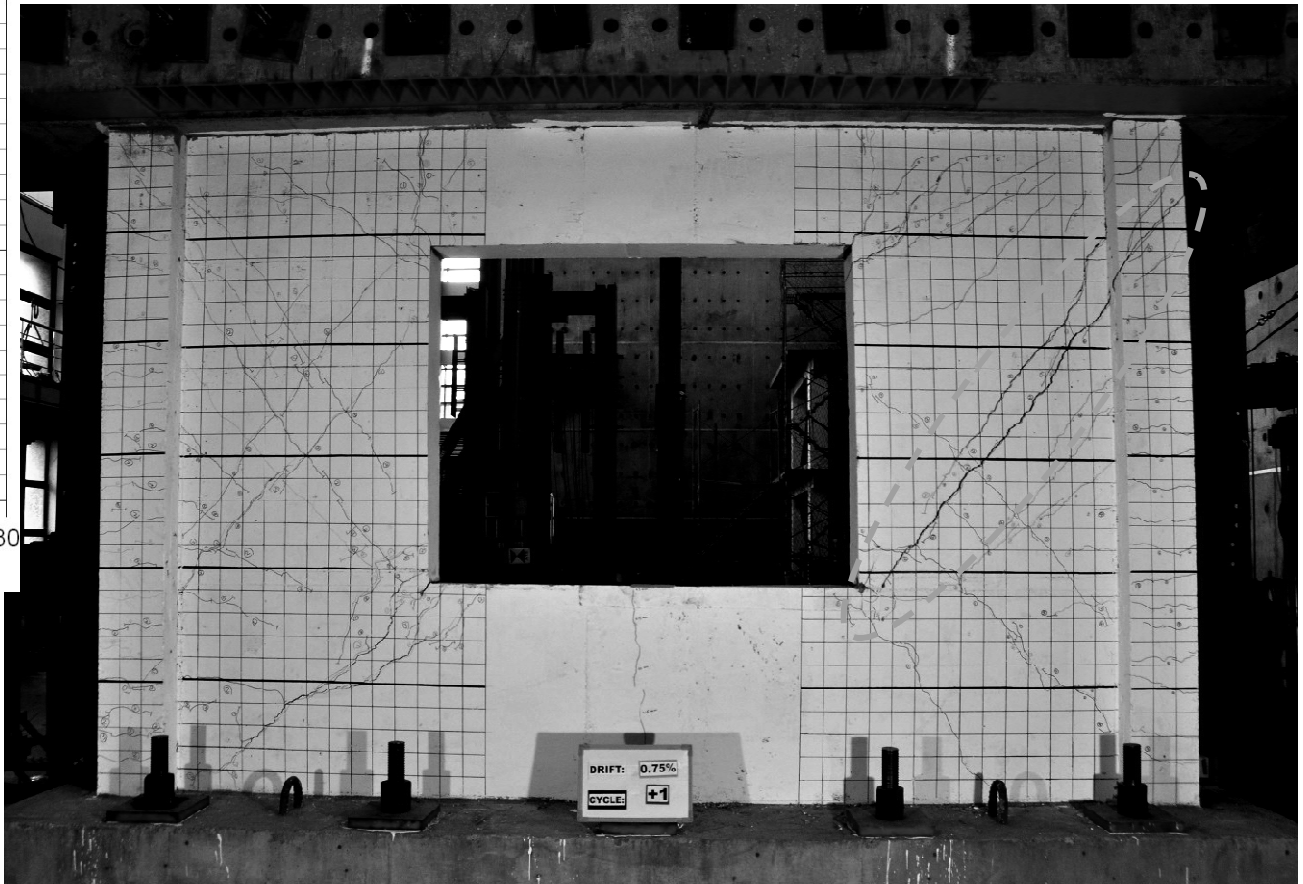
Drift Ratio=3.0%
Final

長跨小開窗試體 (FLW-19)



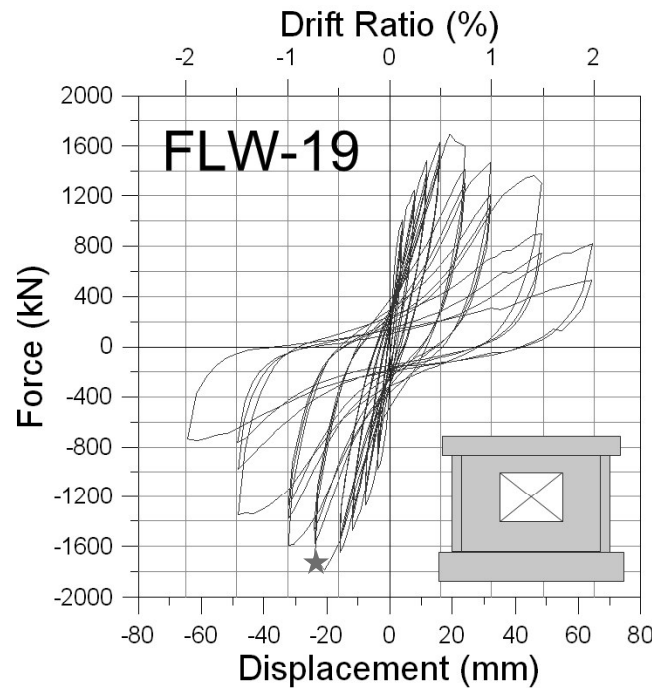
Drift Ratio=0.75%

開口右側出
現主要剪力
裂縫



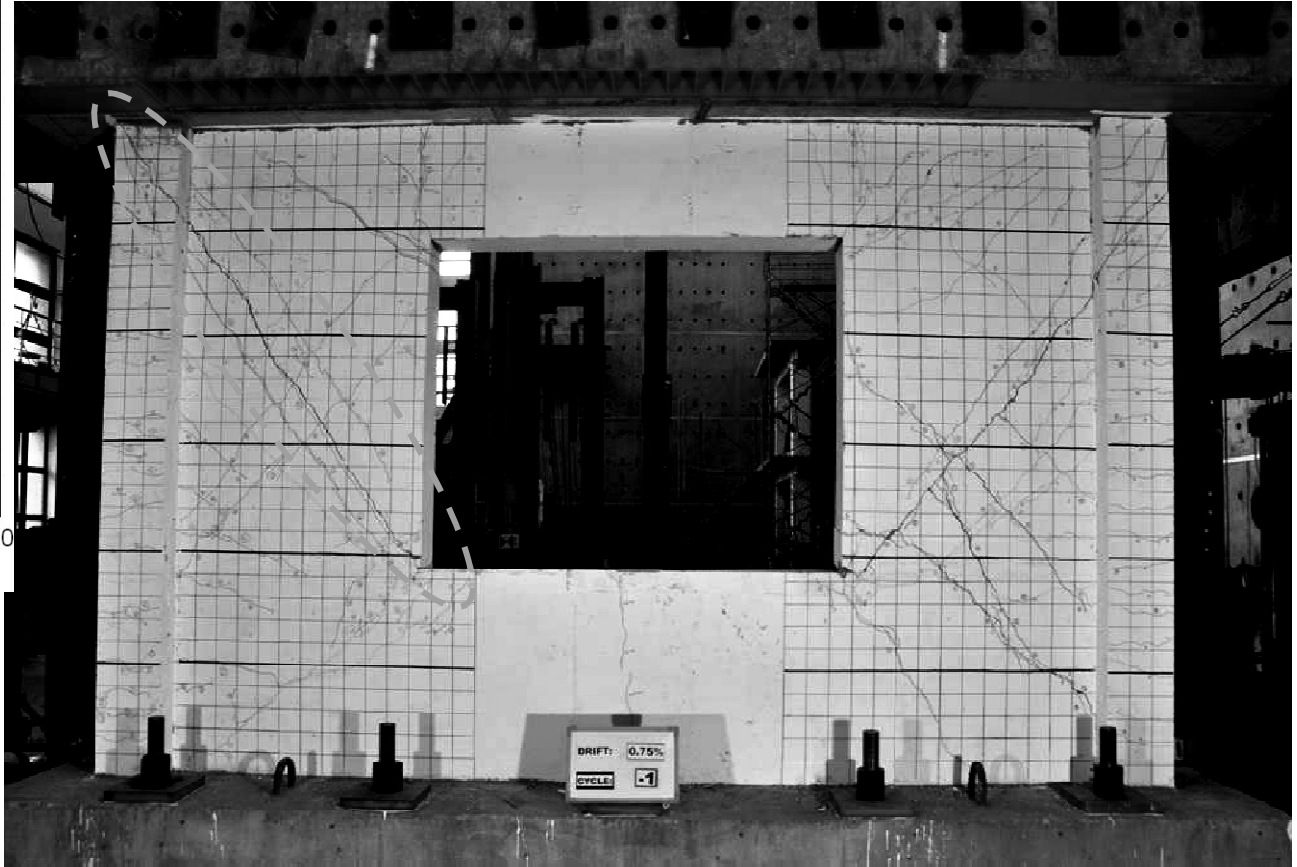
Max. Force = 1692.80 (kN)

長跨小開窗試體 (FLW-19)



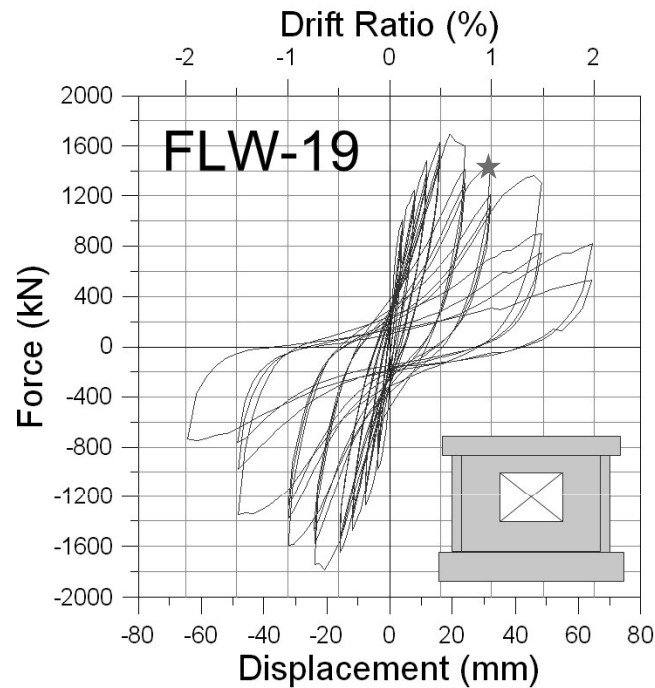
Drift Ratio= -0.75%

開口左側反向亦
出現主要剪力裂
縫



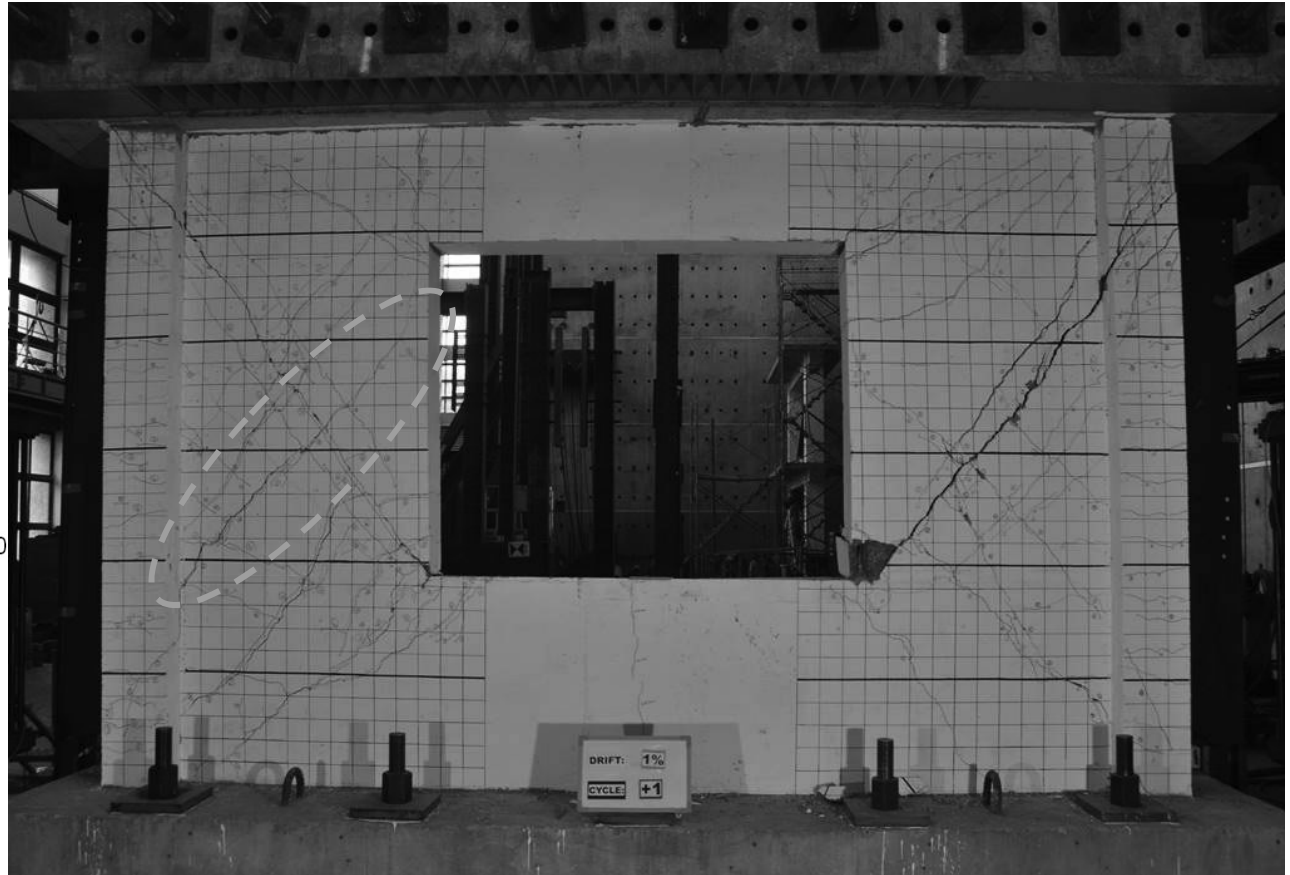
Max. Force = 1788.40 (kN)

長跨小開窗試體 (FLW-19)



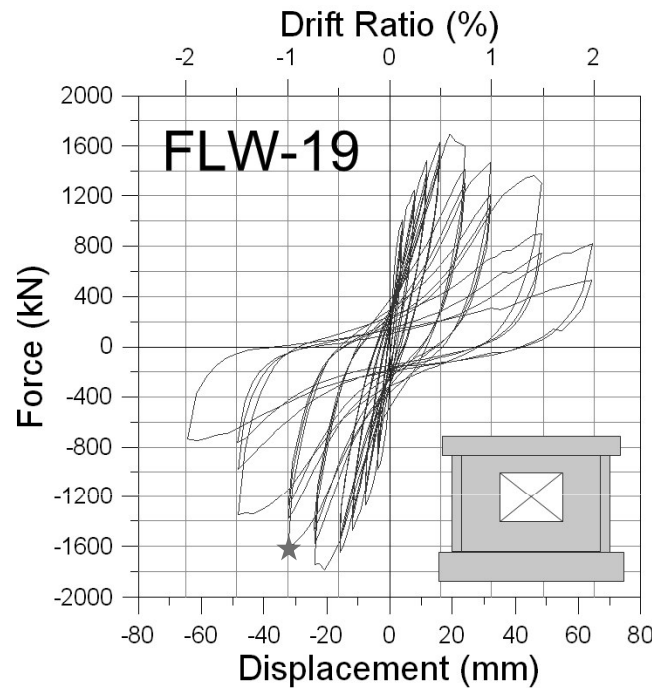
Drift Ratio = 1.0 %

開口左側正向第
二條主要剪力裂
縫生成



Max. Force = 1467.2 (kN)

長跨小開窗試體 (FLW-19)

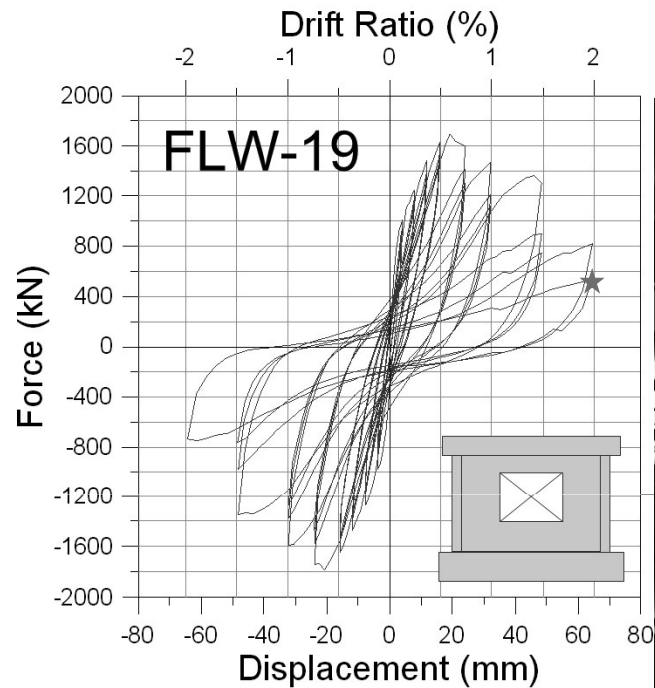


Drift Ratio = -1.0 %
西側第二主要
剪力裂縫生成



Max. Force = 1591.6 (kN)

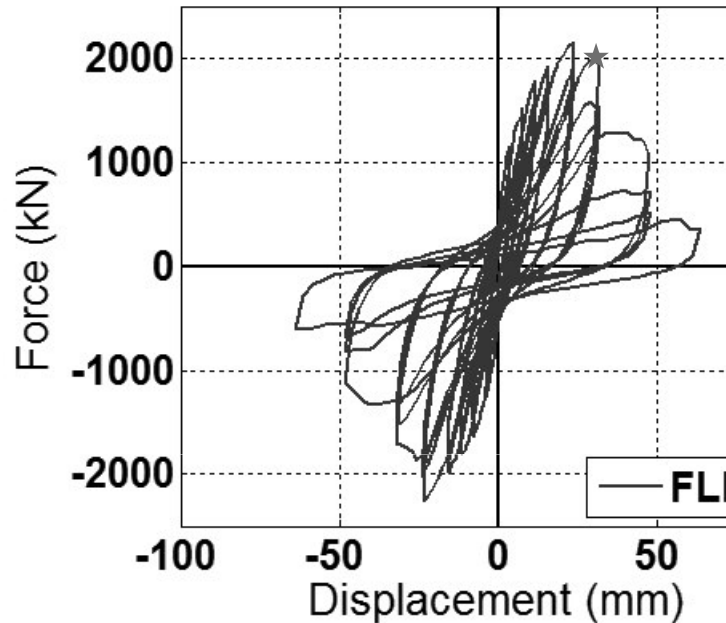
長跨小開窗試體 (FLW-19)



試驗最後終止於
Drift Ratio=2% +2
開口右側牆體喪失
垂直承載能力



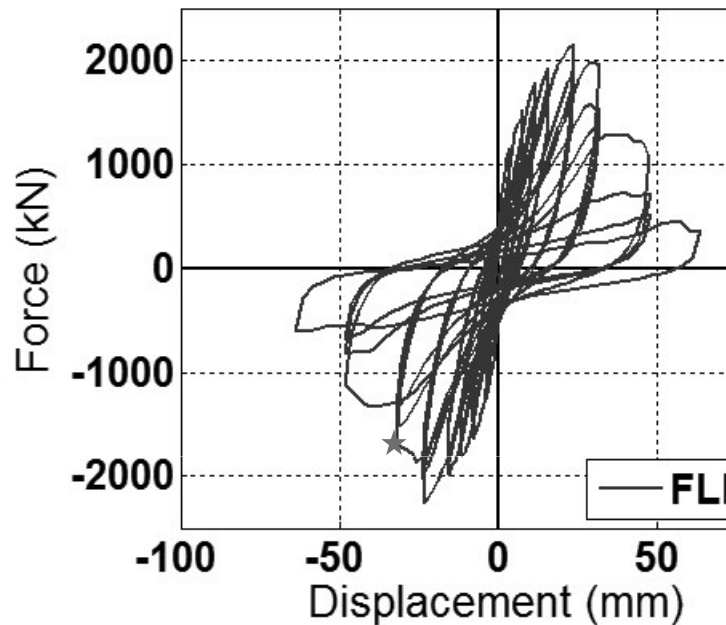
長跨小開門試體 (FLD-11)



Drift Ratio = 1.0 %

開口右側角隅裂縫
寬度擴大、開口左
側剪力剪縫生成

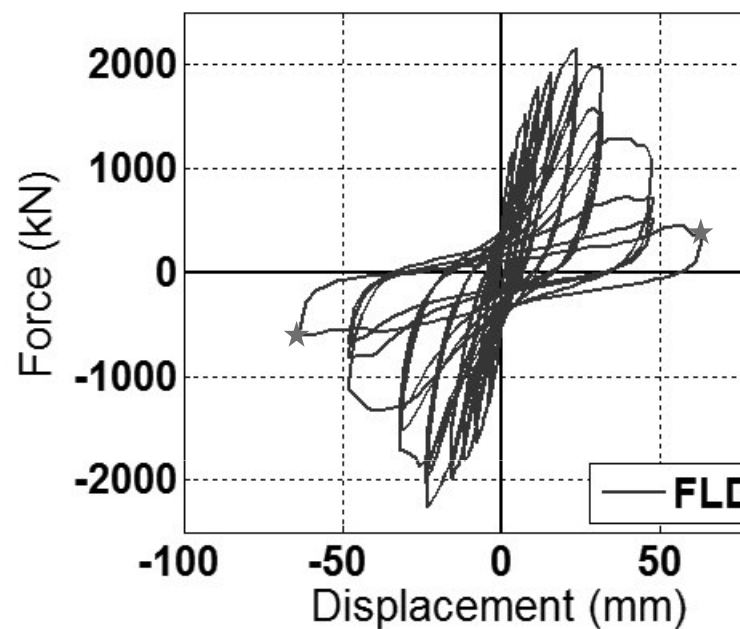
長跨小開門試體 (FLD-11)



Drift Ratio = -1.0 %

開口左側角隅裂縫
寬度擴大、開口右
側剪力剪縫生成

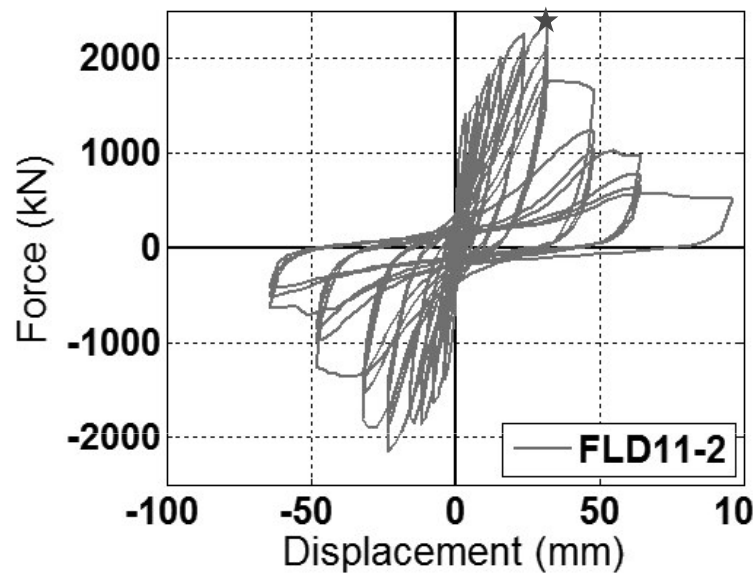
長跨小開門試體 (FLD-11)



Drift Ratio = 2.0 %

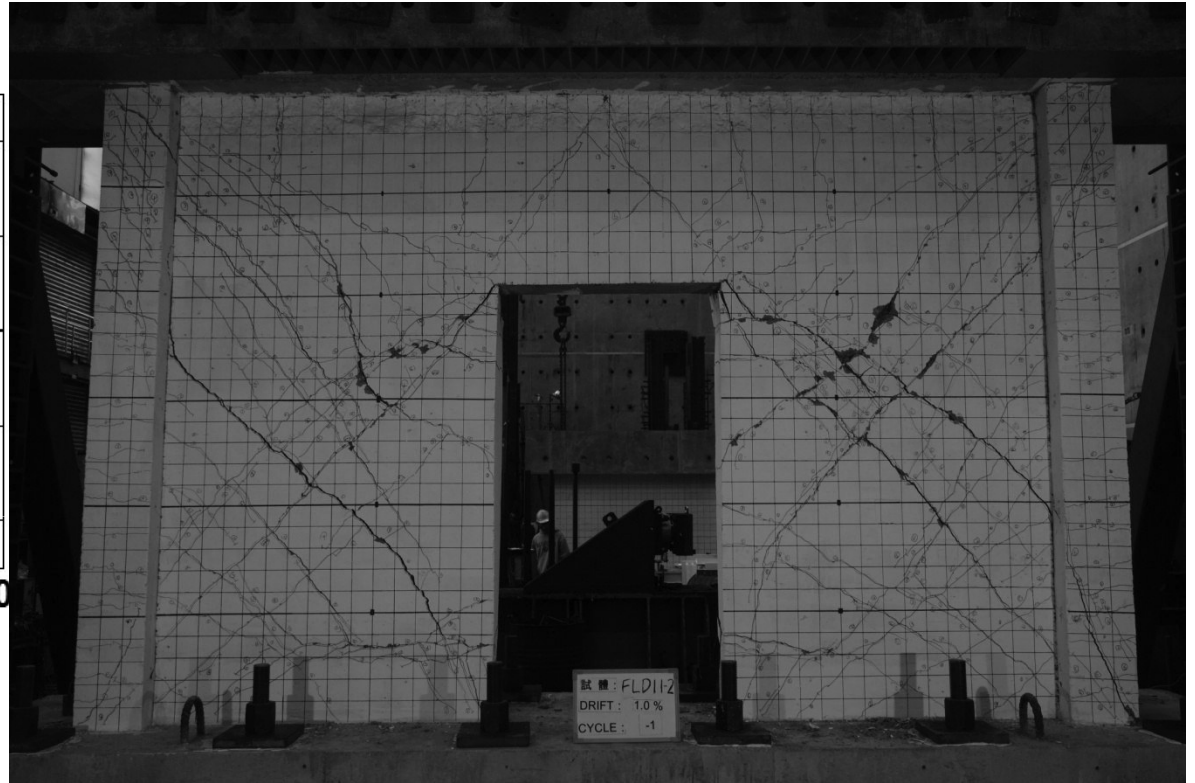
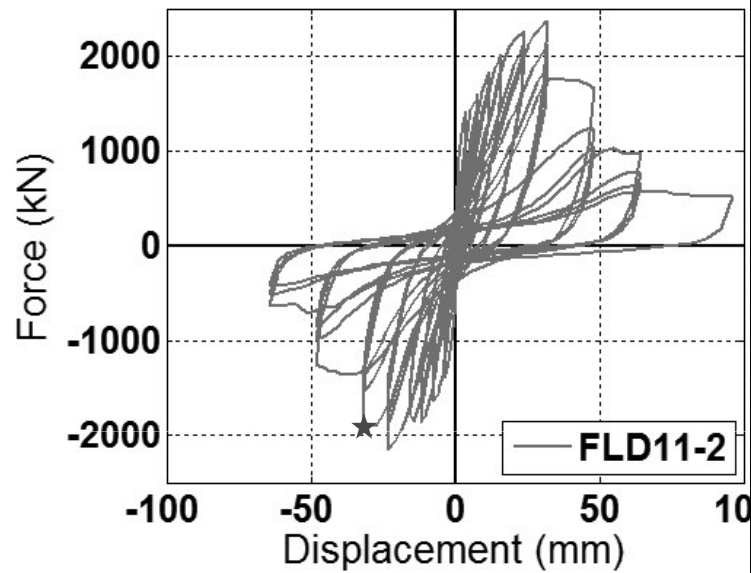
最後破壞情形

長跨小開門試體 (FLD-11-2)



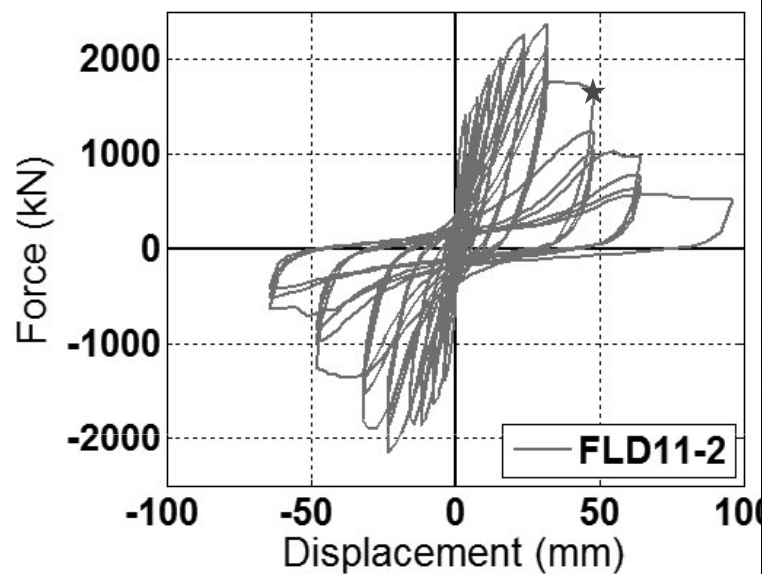
Drift Ratio = 1.0 %

長跨小開門試體 (FLD-11-2)



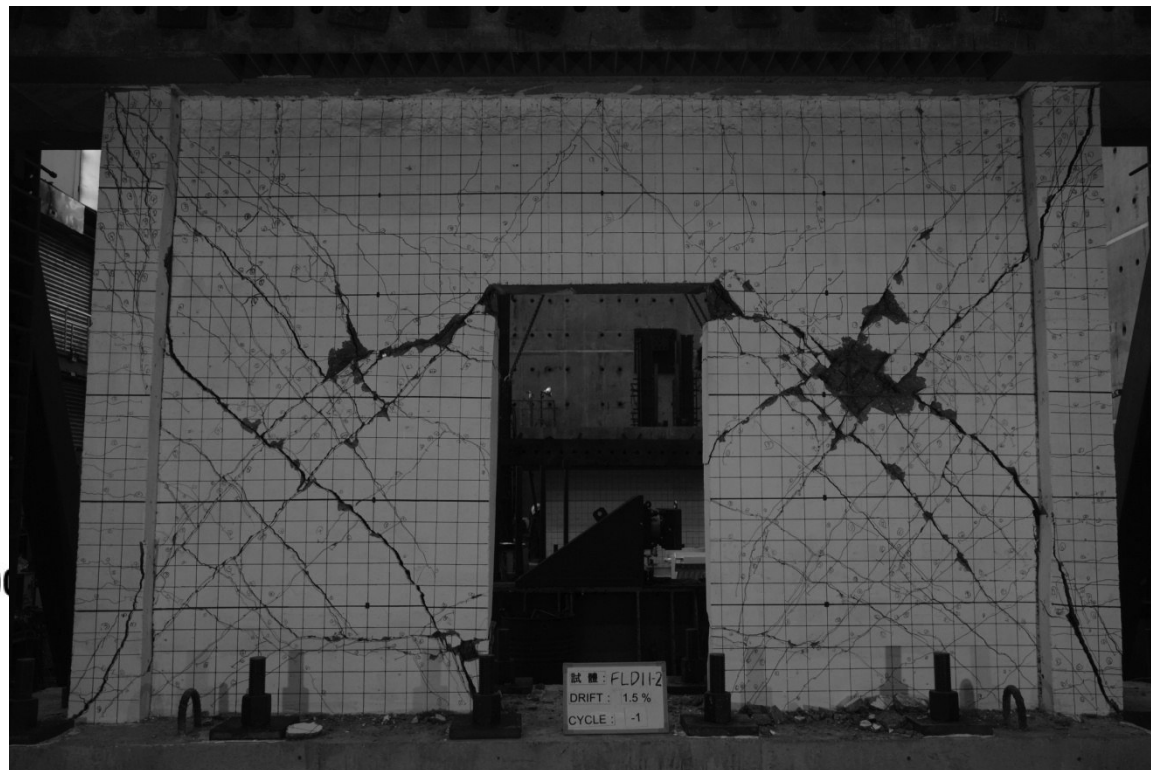
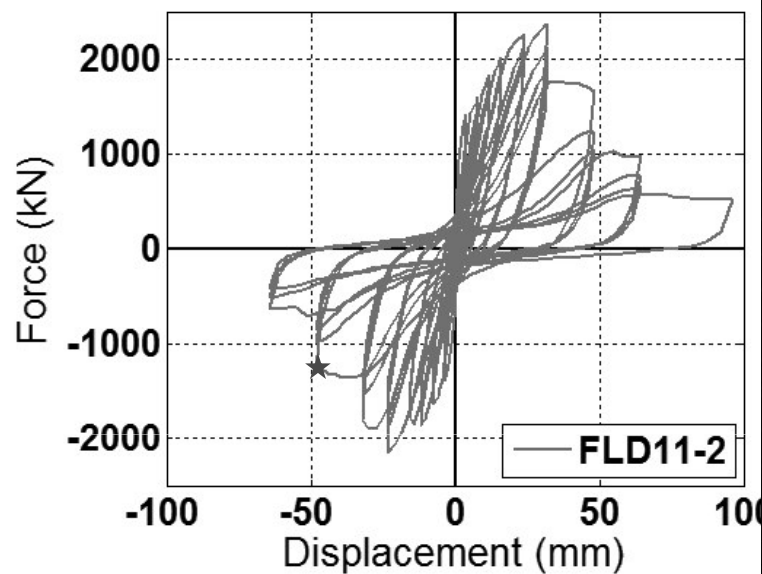
Drift Ratio = -1.0 %

長跨小開門試體 (FLD-11-2)



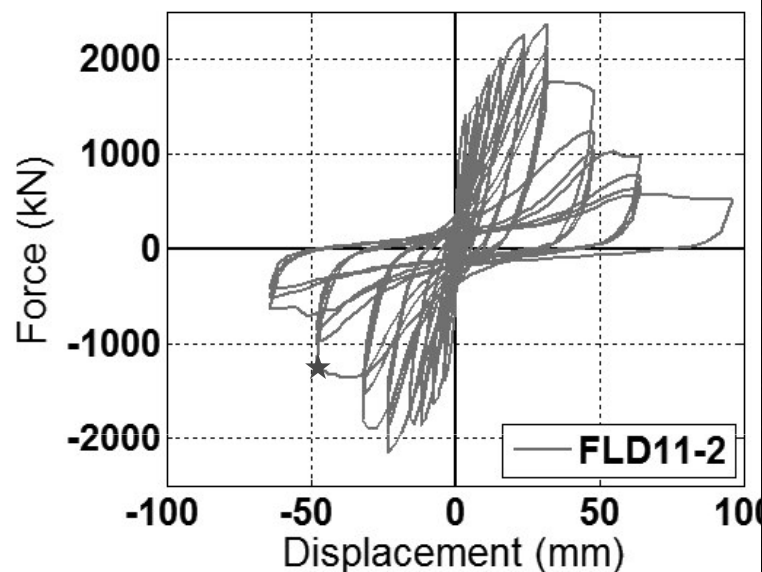
Drift Ratio = 1.5%

長跨小開門試體 (FLD-11-2)



Drift Ratio = -1.5%

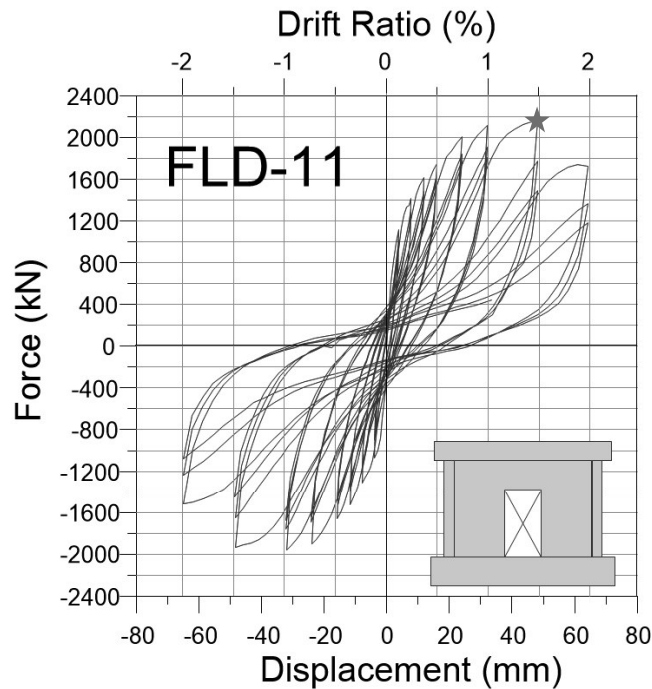
長跨小開門試體 (FLD-11-2)



Drift Ratio = 3.0%

最後破壞情形

長跨小開門試體 (FLD-11-B)



Drift Ratio=1.5 %

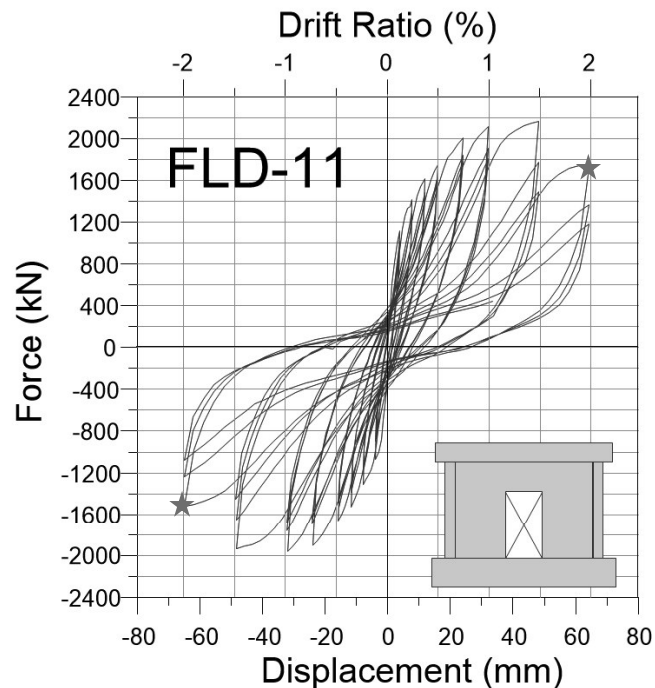
達試體極限強度，但無
新的剪力裂縫生成，基
礎產生嚴重破壞



Max. Force = 2168.4 (kN) at +1



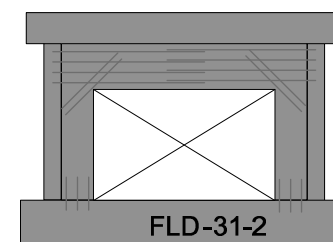
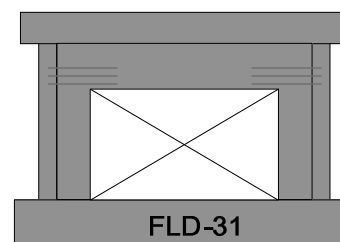
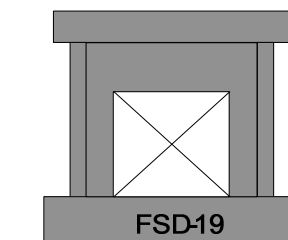
長跨小開門試體 (FLD-11-B)



Drift Ratio=2.0 %
兩側角隅裂縫明顯
擴大，並有大量混
凝土剝落

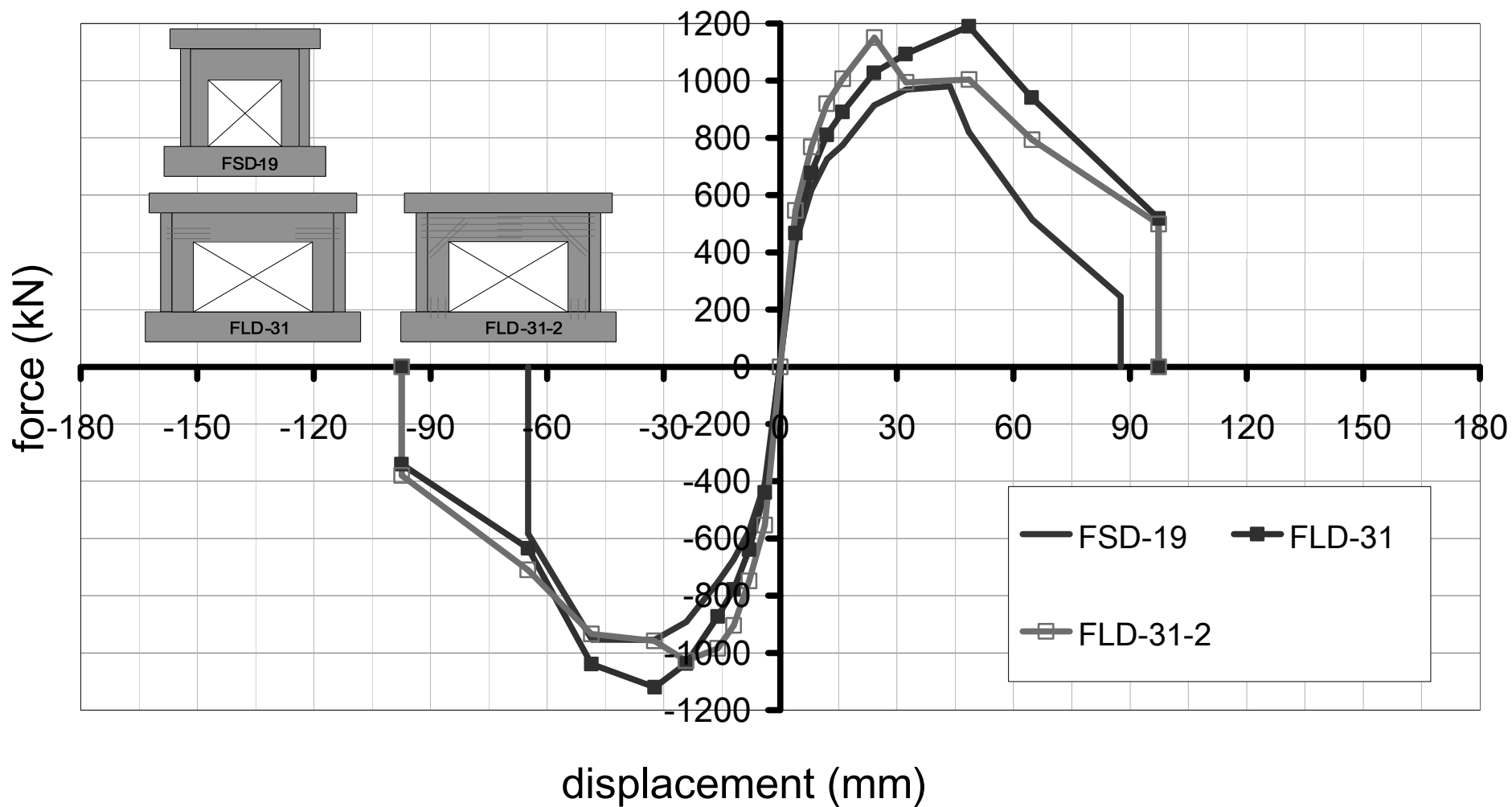


大開門試體破壞比較

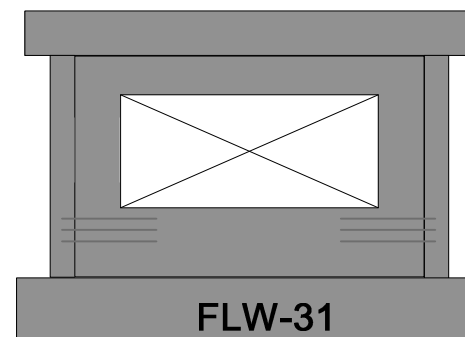
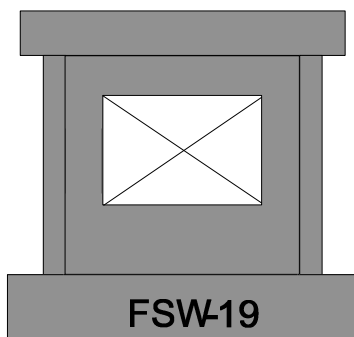
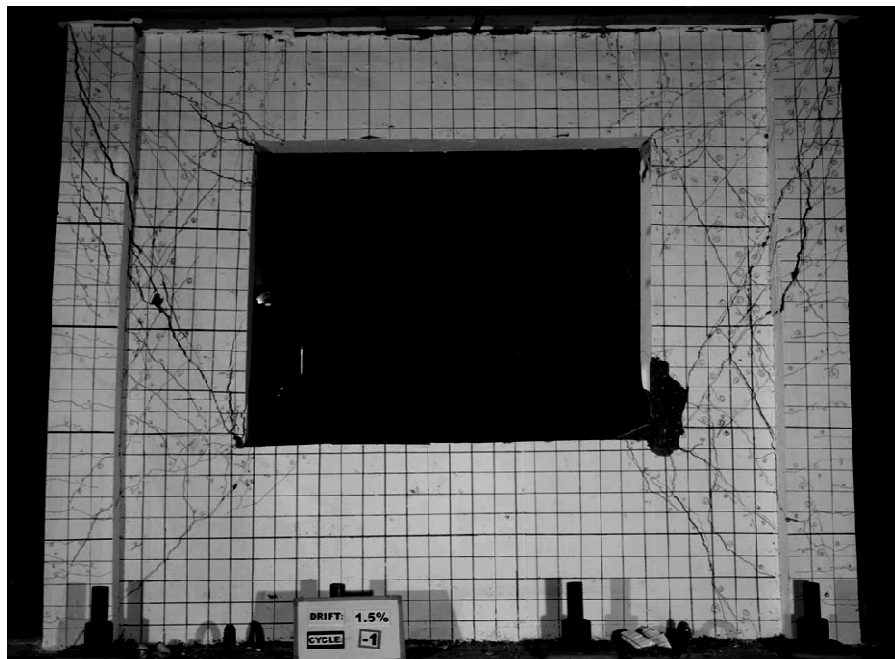


大開門試體載重-位移包絡線比較

試體載重-位移包絡線比較

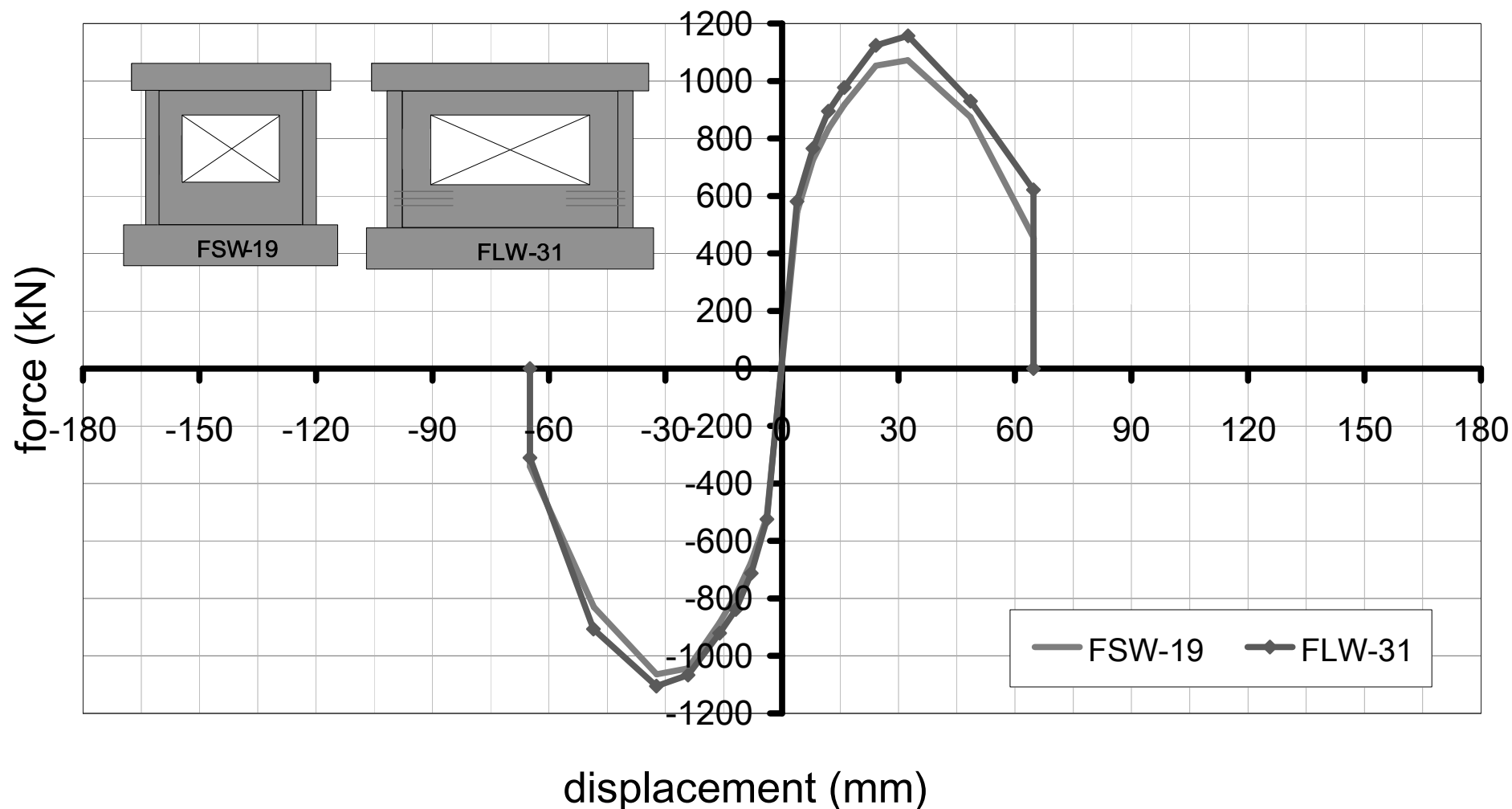


大開窗試體破壞比較



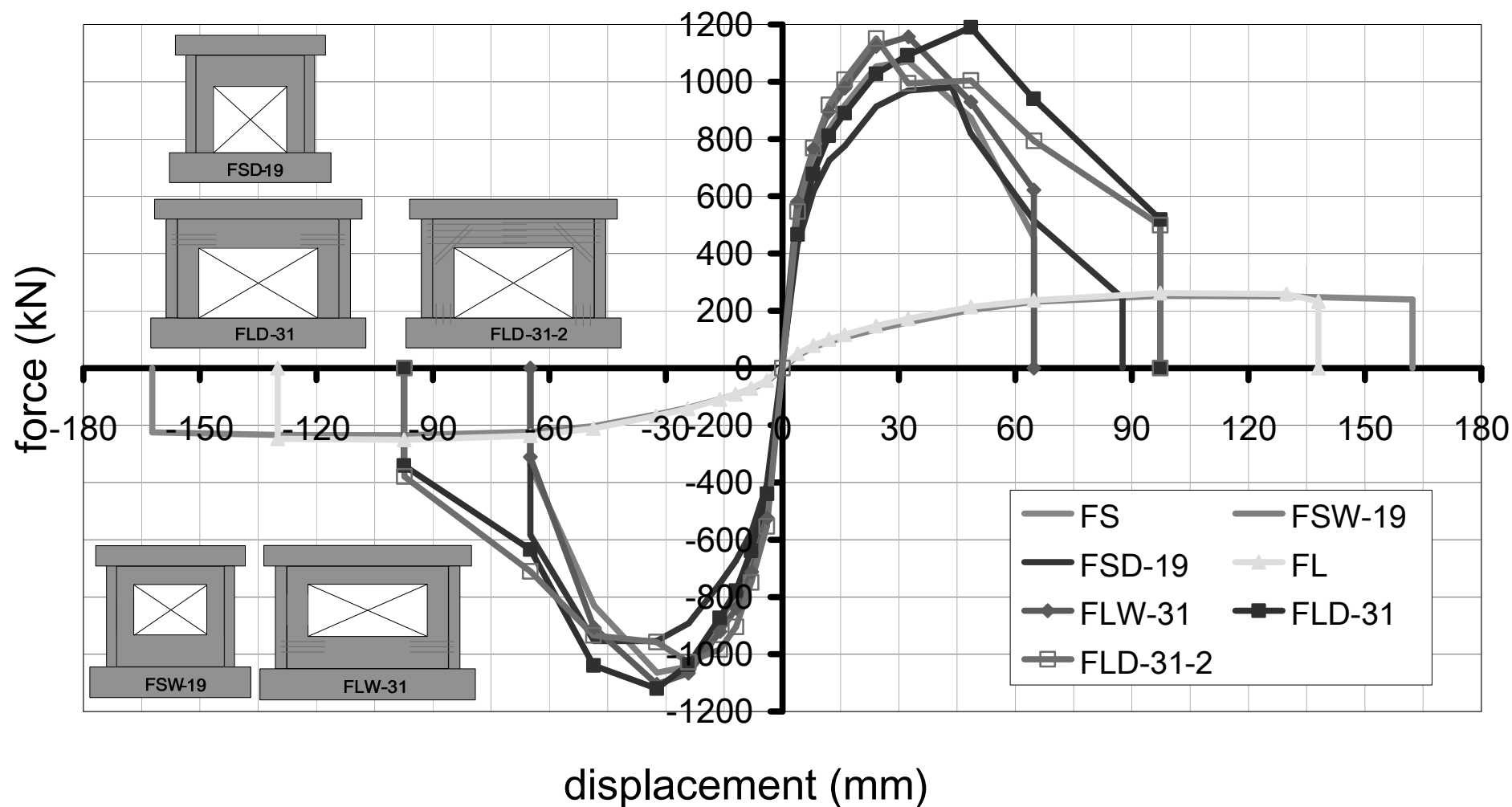
大開窗試體載重-位移包絡線比較

試體載重-位移包絡線比較

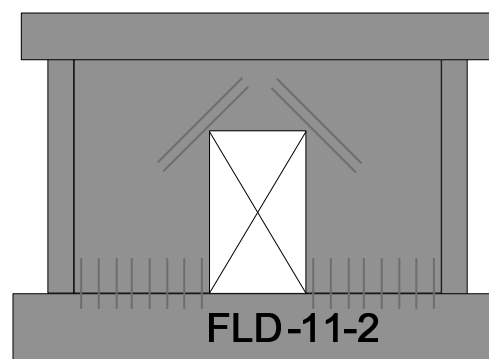
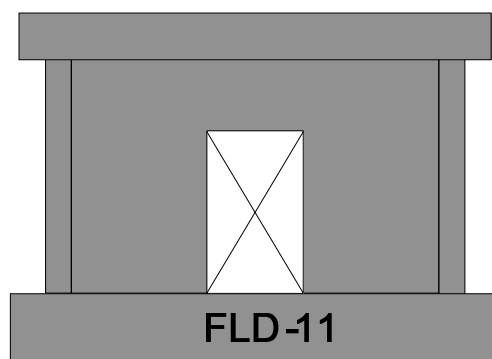


大開口試體載重-位移包絡線比較

試體載重-位移包絡線比較

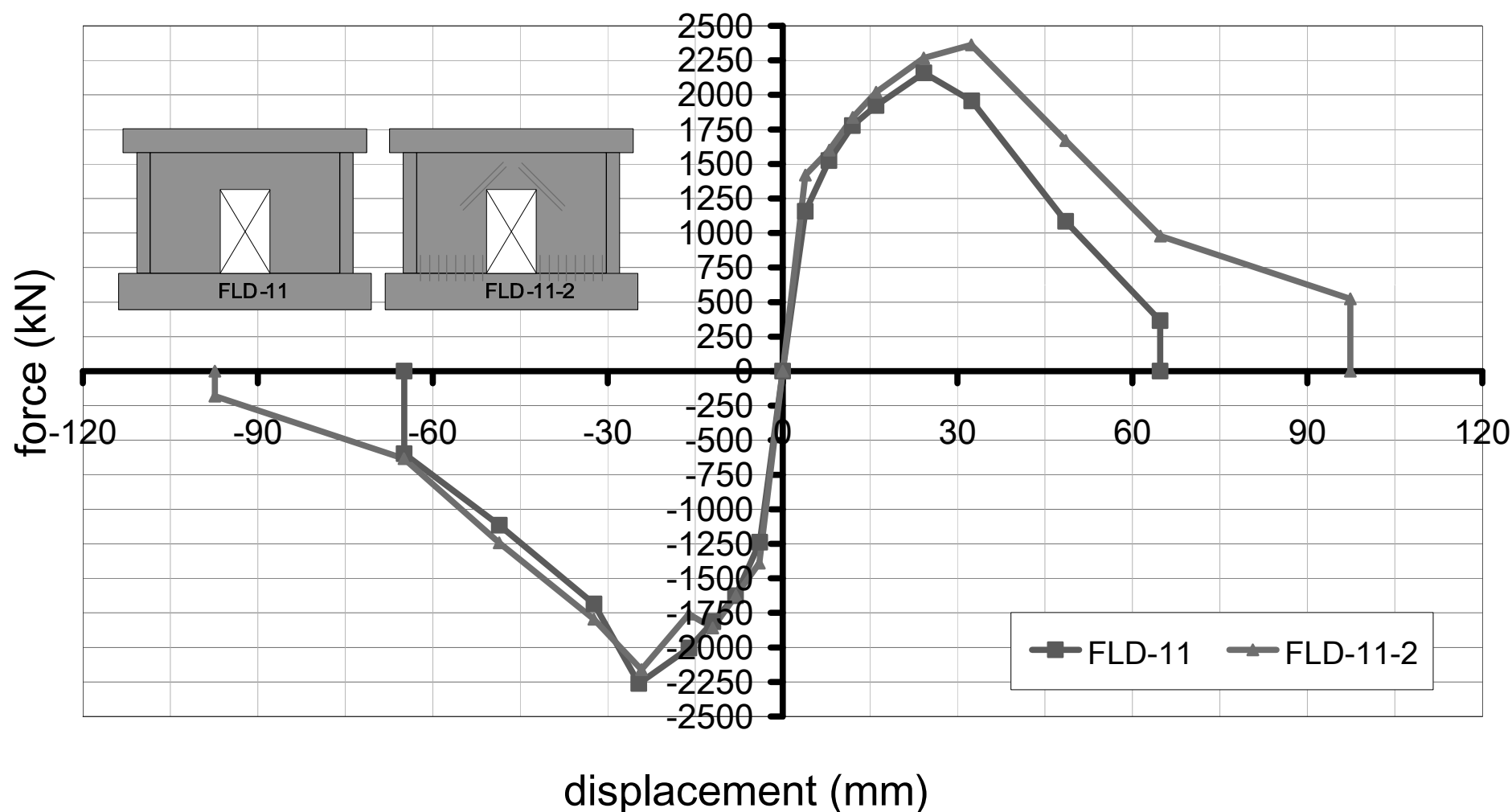


長跨小開門試體破壞比較

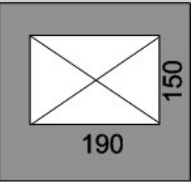
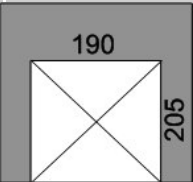
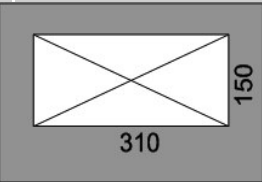
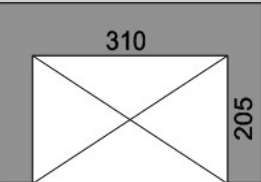
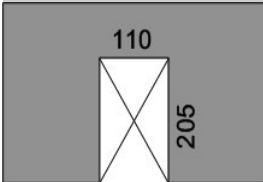
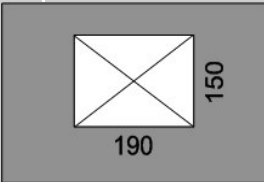


小開門試體載重-位移包絡線比較

試體載重-位移包絡線比較

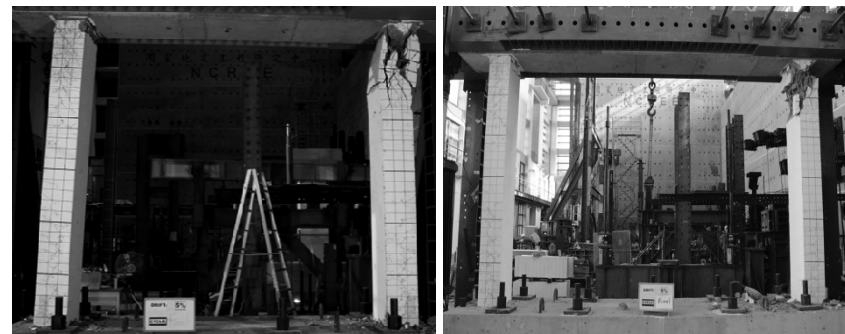
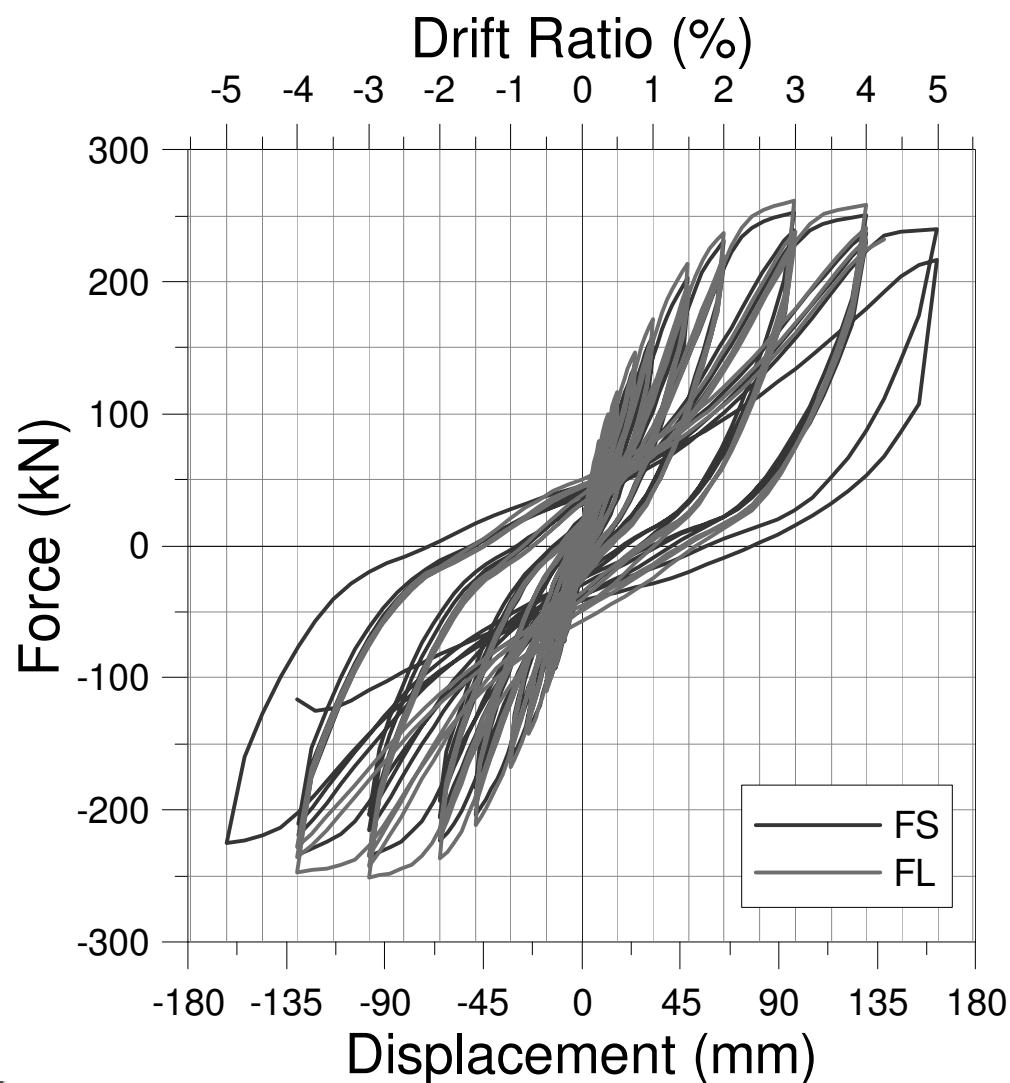


試體規劃

	FSW-19	FSD-19	FLW-31	FLD-31	FLD-31-2	FLD-11	FLD-11-2	FLW-19
								
牆體大小	#3 雙排	#3 雙排	#4單排	#4單排	#4單排 (牆底 #4雙排)	#4單排	#4單排 (牆底#4 雙排)	#4單排
開口大小	190x150	190x205	310x150	310x205	310x205	110x205	110x205	190x150
植筋 (間距20cm)	#3 雙排	#3 雙排	#4單排	#4單排	#4單排 (牆底 #4雙排)	#4單排	#4單排 (牆底#4 雙排)	#4單排
植筋深度	10 cm (有刨除保護層)		13 cm (有刨除保護層)					
角隅鋼筋	#4 雙層 單排	#4 雙層 單排	#4 雙層 單排	#4 雙層 單排	#5 雙層 雙排	#4 雙層 單排	#5 雙層 雙排	#4 雙層 單排
水平 拉力筋			有 (局部)	有 (局部)	有			

參數比較：

1. 跨度
2. ACI Code水平筋
3. 開口大小
4. 植筋差異

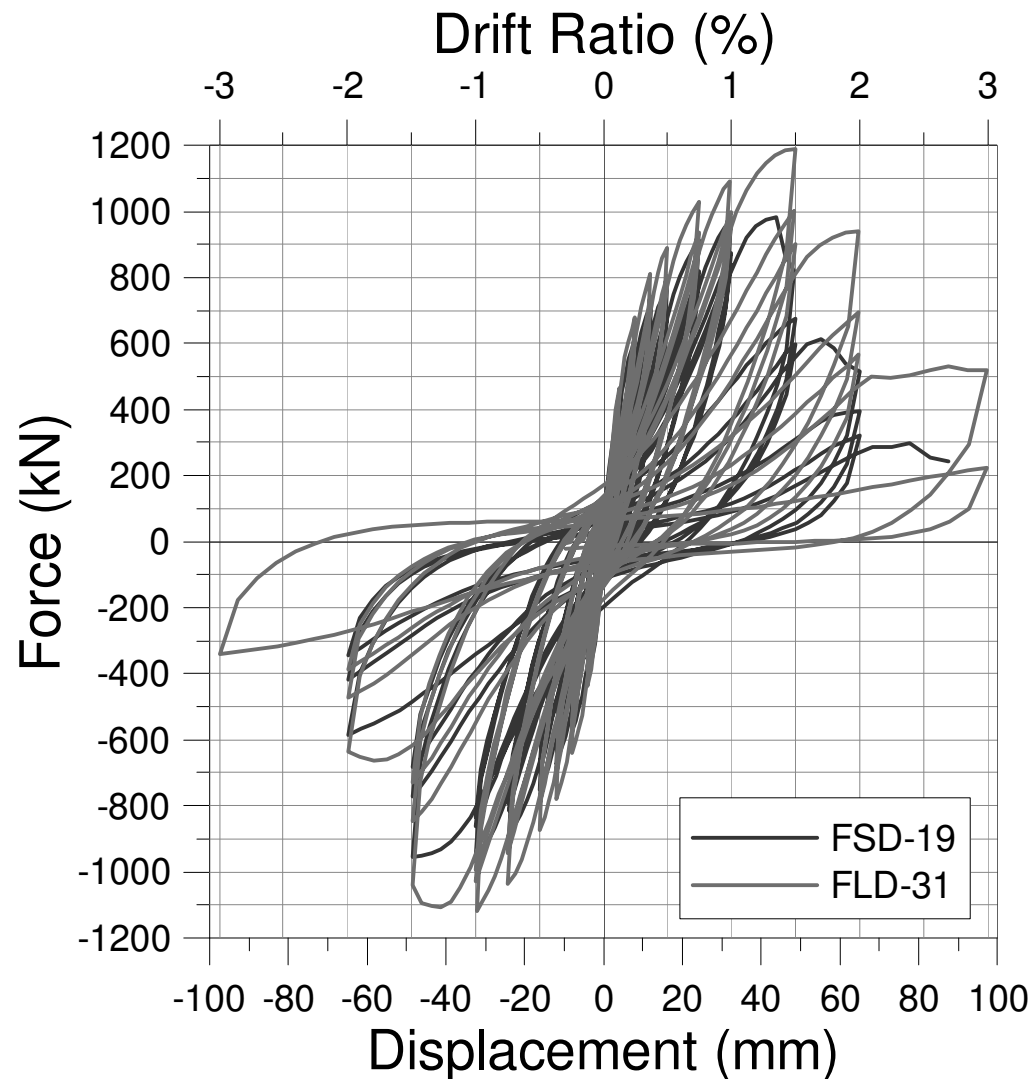


	FS	FL
V_{max}	252.1	261.6
$\Delta_{u,max}$	97.21	97.30
Δ_u	162.25	138.01
K	4.44	4.77
R	3.01	2.69

柱構件行為
跨度影響不大

參數比較：

1. 跨度
2. ACI Code水平筋
3. 開口大小
4. 植筋差異

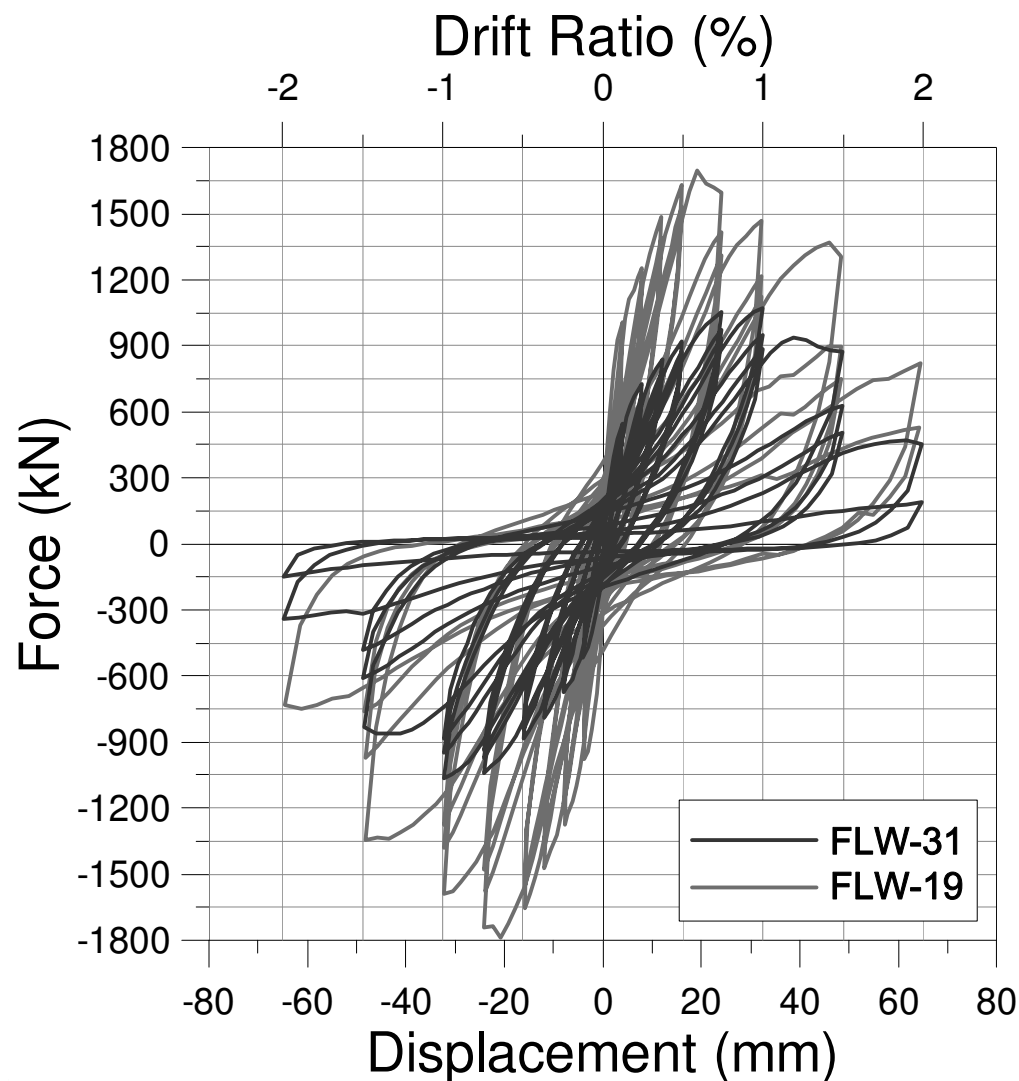


	FSD-19	FLD-31
V_{max}	980.8	1190.0
$\Delta_{u,max}$	43.65	48.54
Δ_u	87.59	97.35
K	58.62	63.41
R	3.48	3.67

通過破壞段，改善牆體破壞路徑

參數比較：

1. 跨度
2. ACI Code水平筋
3. 開口大小
4. 植筋差異

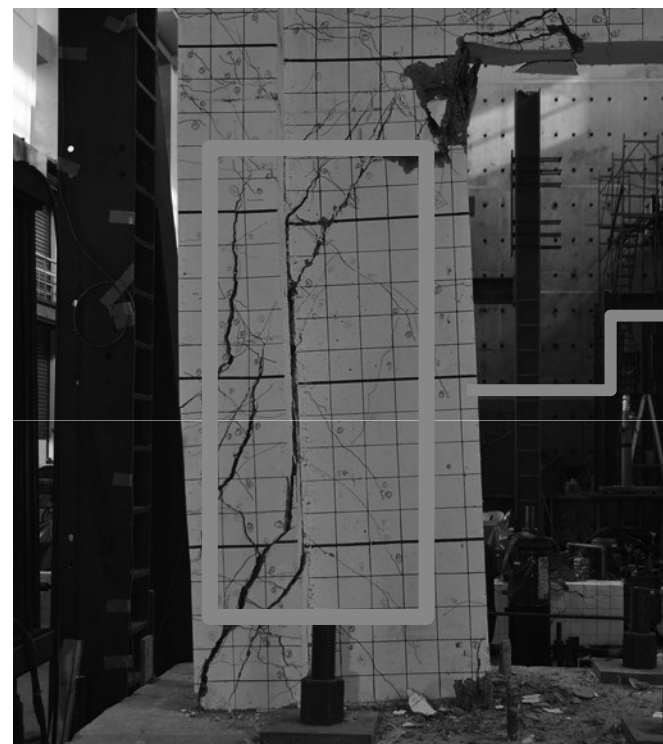


	FLW-31	FLW-19
V_{max}	1072.0	1788.4
$\Delta_{u,max}$	32.38	20.81
Δ_u	64.86	64.76
K	77.79	165.94
R	4.08	4.33

強度增加，但最後仍
能在2%才破壞

參數比較：

1. 跨度
2. ACI Code水平筋
3. 開口大小
4. 植筋差異



界面滑移

單排植筋有界面滑移的現象，但並不太影響剪力強度

大綱

1. 研究動機：提出開口牆補強工法
2. 試體規劃與試體設計
3. 試驗結果
4. 側力-位移評估曲線
5. 補強示範例：後甲國中
6. 結論

評估曲線-補強試體

手冊三版方法：

剪力開裂點 (B)

$$V_{scr} = 0.87 \sqrt{f'_c} t_w d + \frac{N_u d}{4 \ell_w}$$

$$\delta_{scr} = \delta_{s,cr} + \delta_{f,cr} + \delta_{slip,cr}$$

剪力極限點點 (C)

$$V_{s,u} = K \xi f'_c A_{str} \cos \theta$$

$$\delta_{su} = \delta_{s,su} + \delta_{f,su} + \delta_{slip,su}$$

剪力殘餘點 (D)

$$V_{s,p} = 0.4 V_{s,u}$$

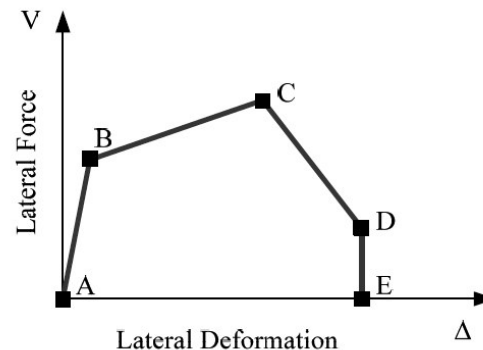
$$\delta_{sp} = 0.02 H$$

ACI Code方法：

$$V_{a,u} = V_c + V_s$$

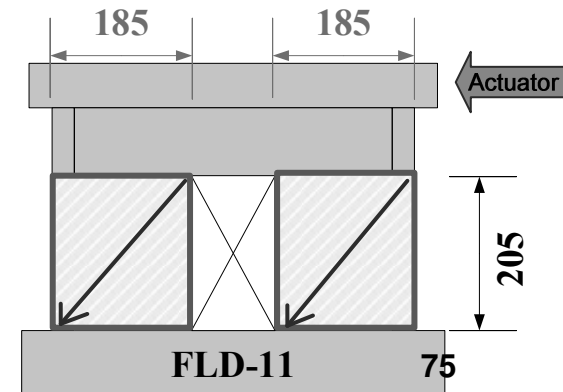
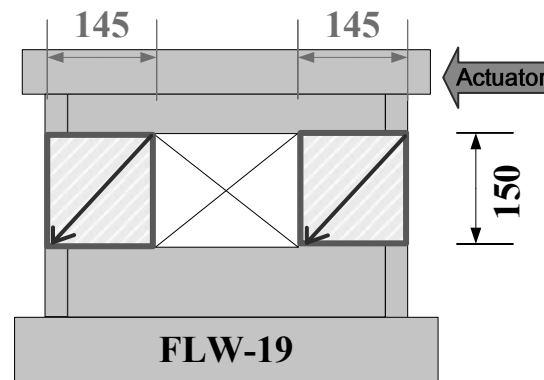
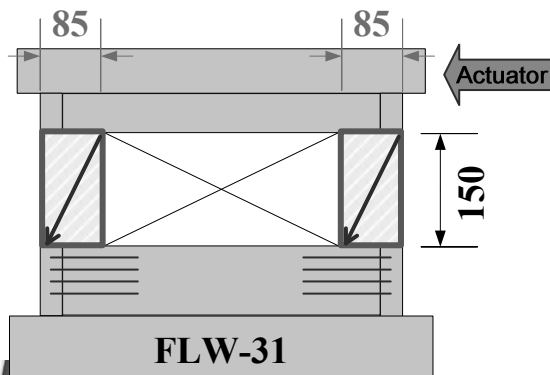
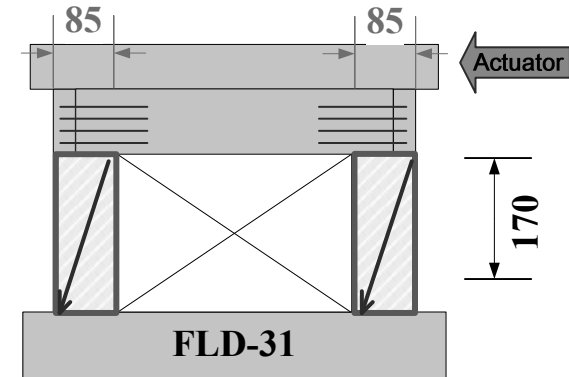
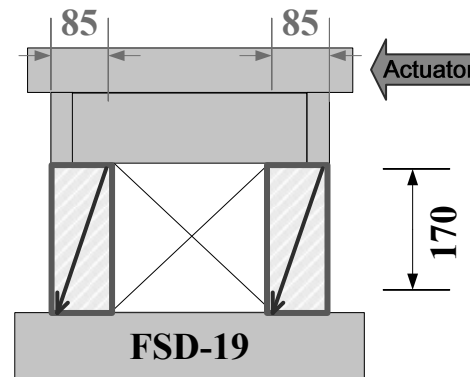
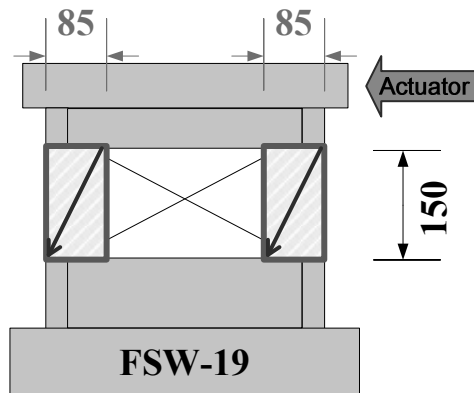
$$V_c = 0.53 \sqrt{f'_c} \left(1 + \frac{N}{140 A_g}\right) b d$$

$$V_s = \frac{A_s f_y d}{s}$$

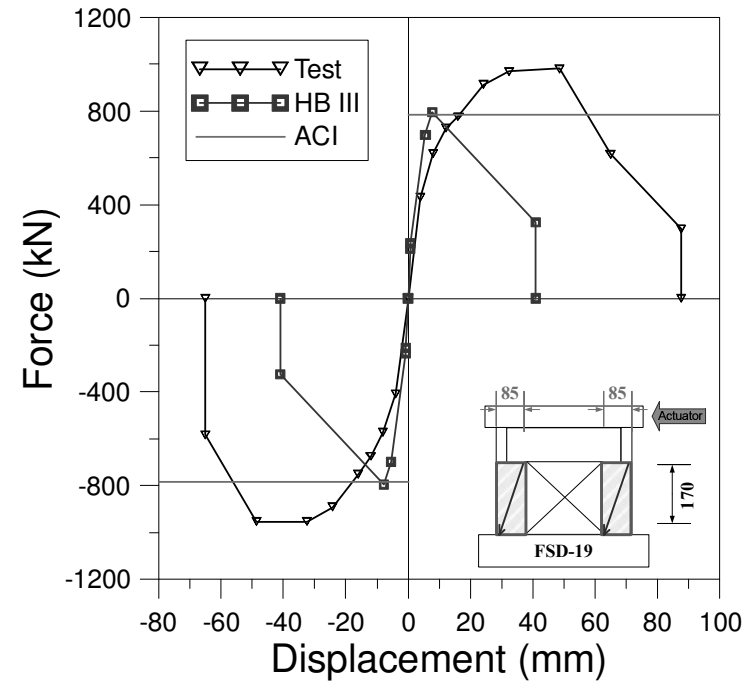
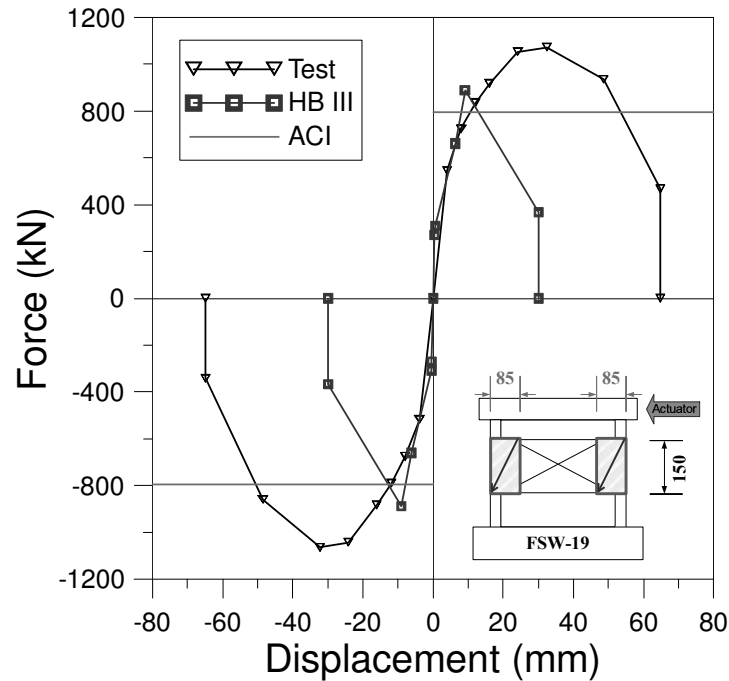


評估曲線-補強試體

以工程師慣用的剪力元素塊取決方法，取「試體兩側臨界斷面處」為元素塊進行評估

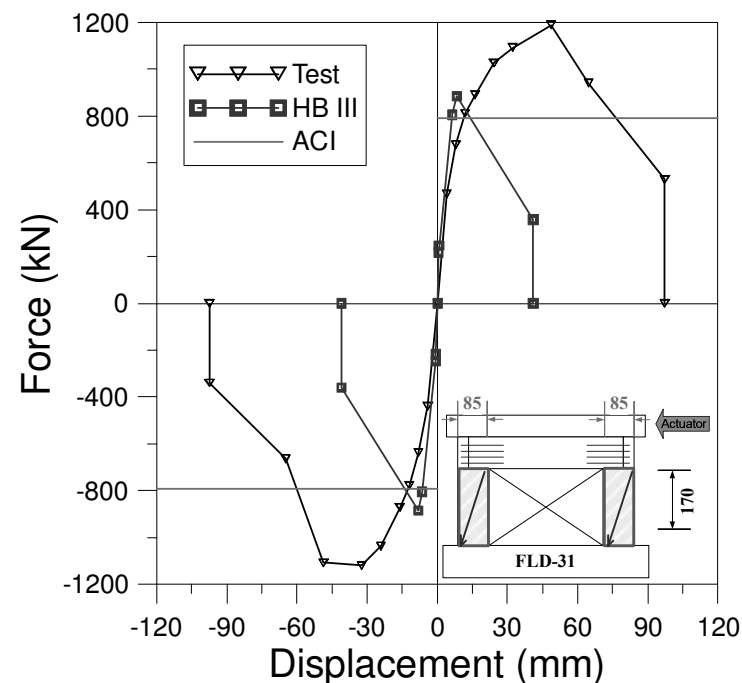
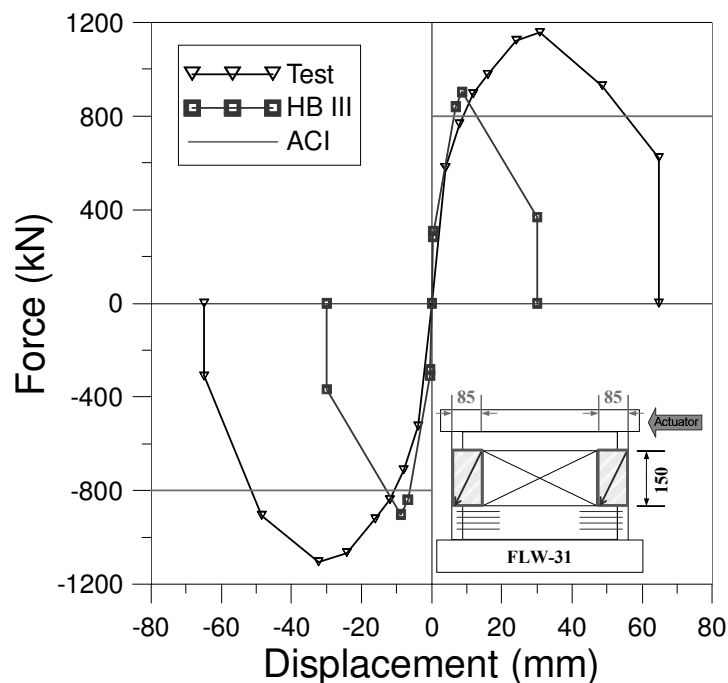


評估曲線-短跨補強試體



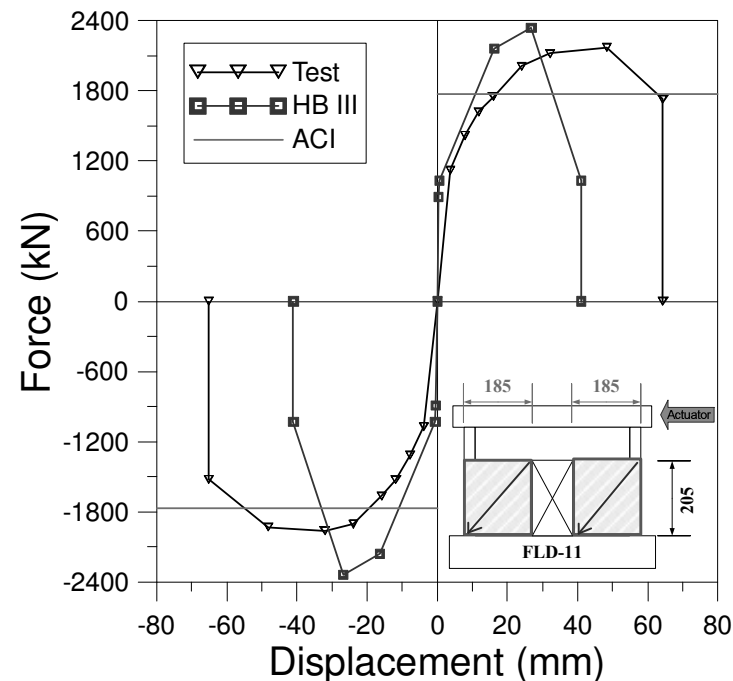
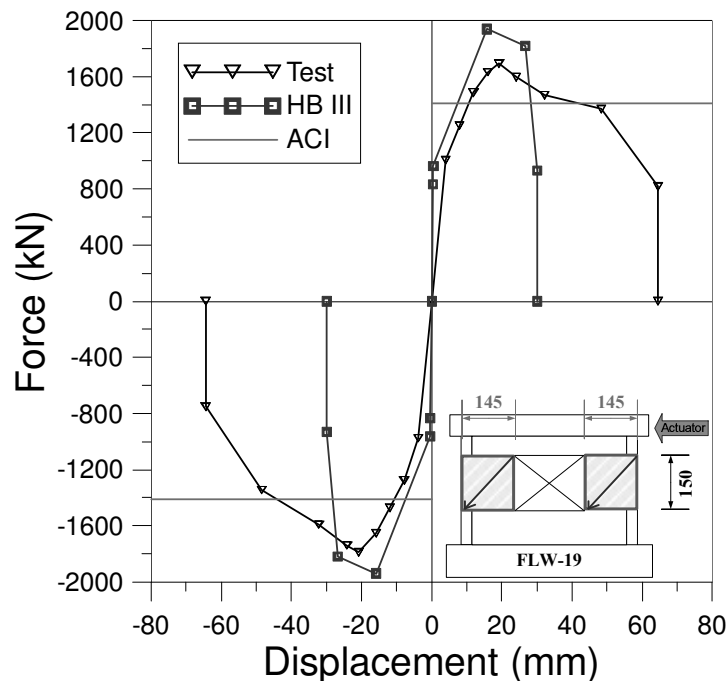
短跨補強試體	FSW-19				FSD-19			
	Disp. (mm)	Force (kN)	V_{test}/V_p	Δ_{test}/Δ_p	Disp. (mm)	Force (kN)	V_{test}/V_p	Δ_{test}/Δ_p
Test	32.38	1072	-	-	48.54	980.8	-	-
HB III	9.11	889.50	1.21	3.55	7.84	795.36	1.23	6.19
ACI	-	793.60	1.35	-	-	783.43	1.25	-

評估曲線-長跨大開口補強試體



長跨大開口補強試體	FLW-31				FLD-31			
	Disp. (mm)	Force (kN)	V_{test}/V_p	Δ_{test}/Δ_p	Disp. (mm)	Force (kN)	V_{test}/V_p	Δ_{test}/Δ_p
Test	32.46	1156.96	-	-	48.56	1190	-	-
HB III	8.68	902.87	1.28	3.56	8.22	884.11	1.35	5.91
ACI	-	797.42	1.45	-	-	792.92	1.50	-

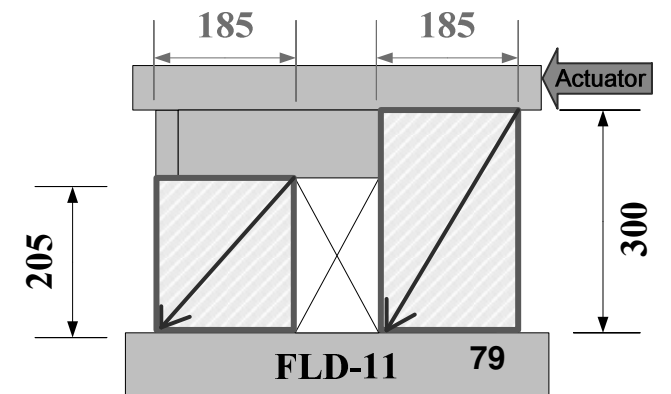
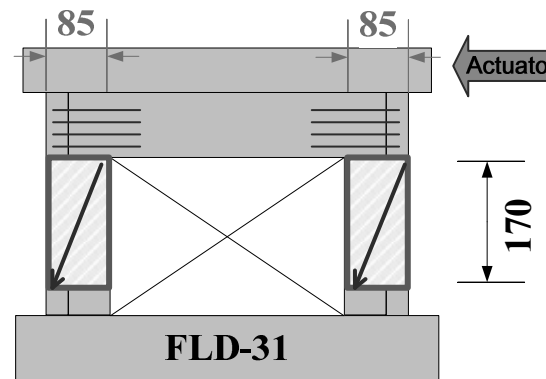
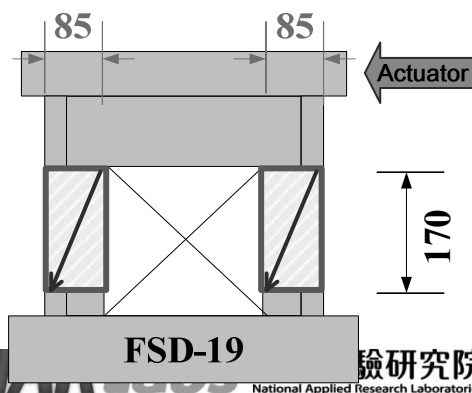
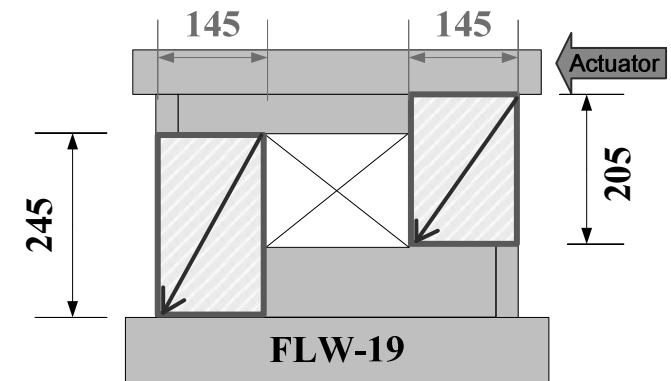
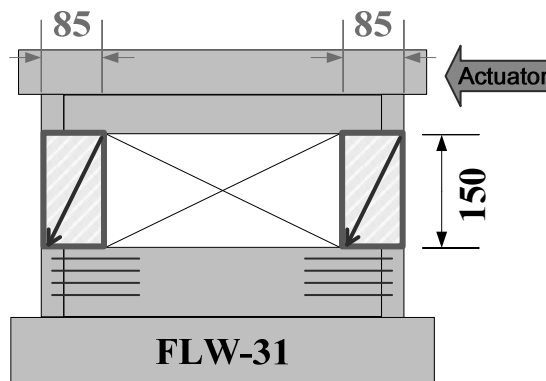
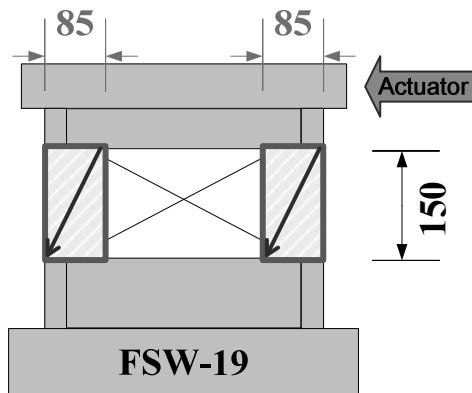
評估曲線-長跨小開口補強試體



長跨小 開口補 強試體	FLW-19					FLD-11			
	Disp. (mm)	Force (kN)	V_{test}/V_p	Δ_{test}/Δ_p		Disp. (mm)	Force (kN)	V_{test}/V_p	Δ_{test}/Δ_p
Test	20.79	1788.4	-	-		48.31	2168.4	-	-
HB III	15.77	1939.03	0.92	1.32		26.80	2336.87	0.93	1.80
ACI	-	1412.18	1.27	-		-	1771.56	1.22	⁷⁸ -

評估曲線-補強試體

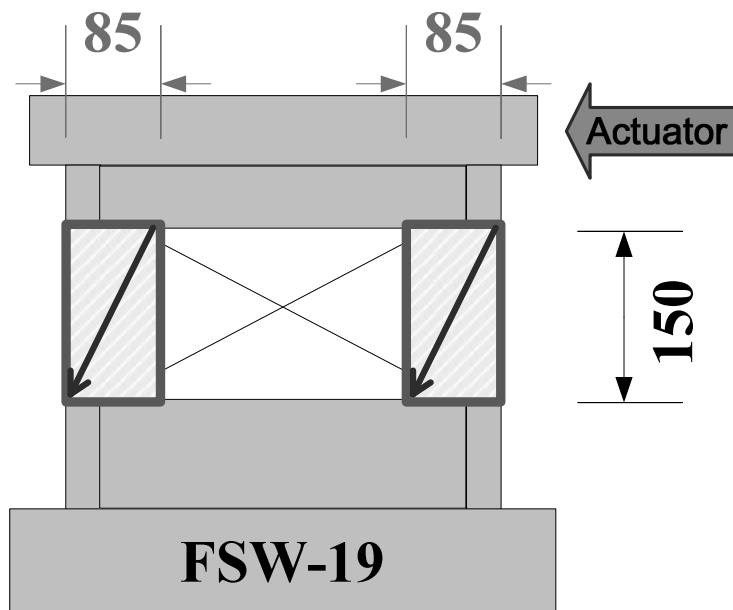
修正1：剪力元素塊選取方法為「由施力端至最近開口底部，另一側由開口頂部至構件底部，但若高寬比大於2，則取試體兩側臨界斷面處高寬比小於或等於2之剪力元素塊」



評估曲線-補強試體

修正2：

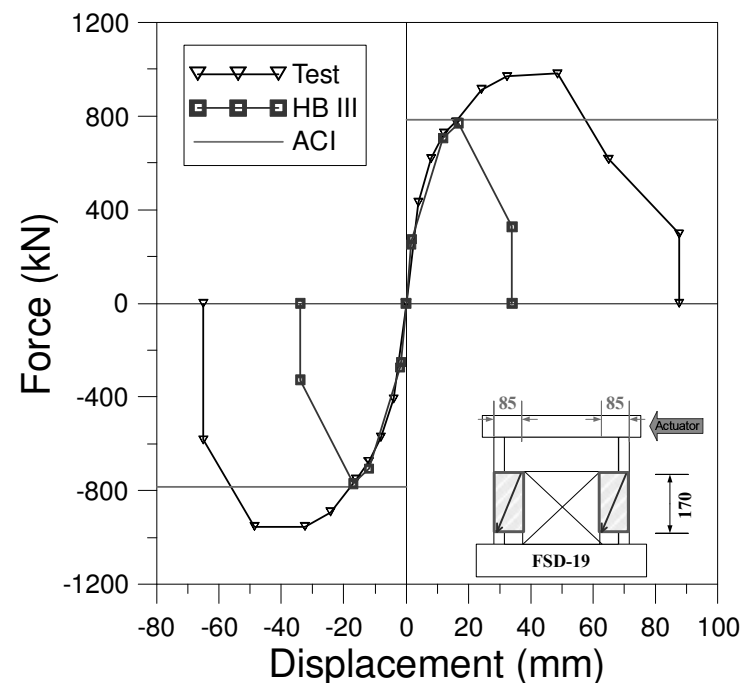
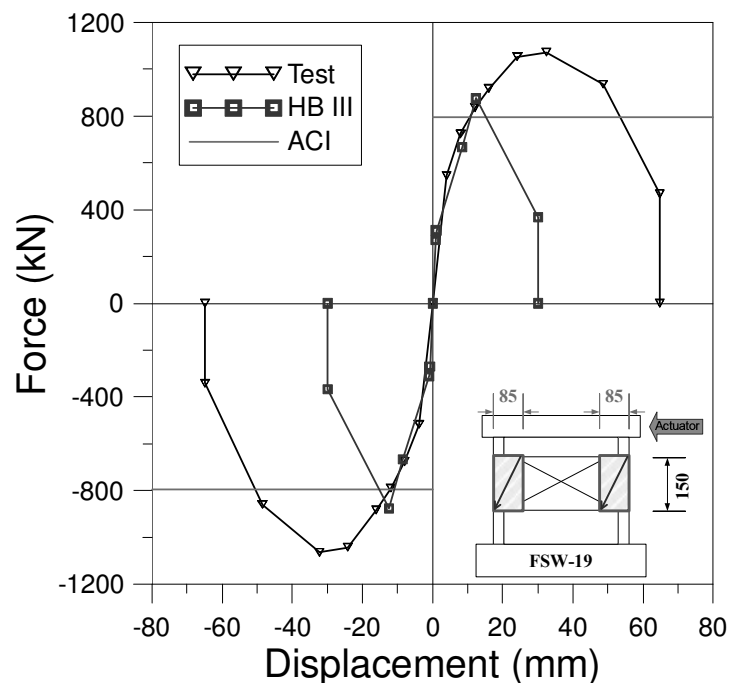
於試驗觀察中，牆體臨界斷面會於反覆載重下沿裂縫通過面旋轉，於此行為下，牆體較接近單曲率行為



$$\delta_{f,cr} = \frac{V_{scr} H^3}{3E_c I}$$

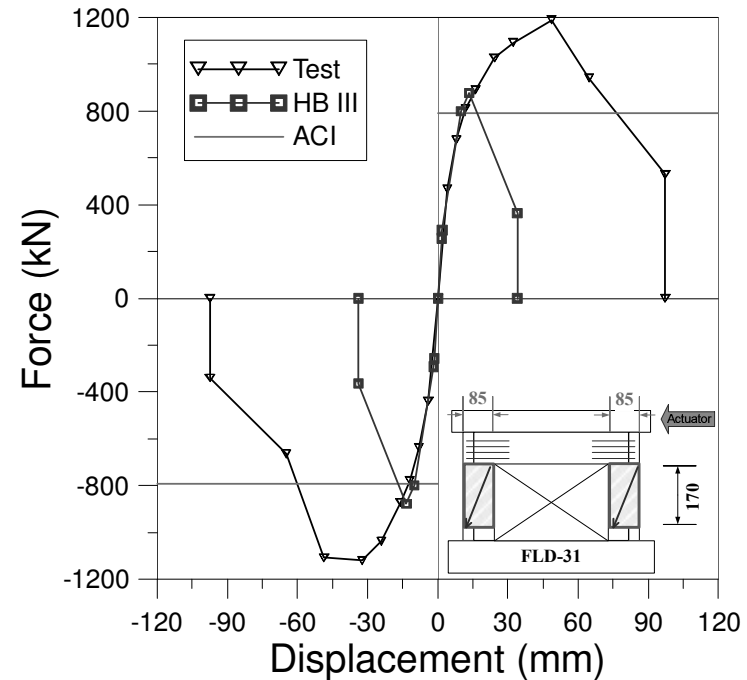
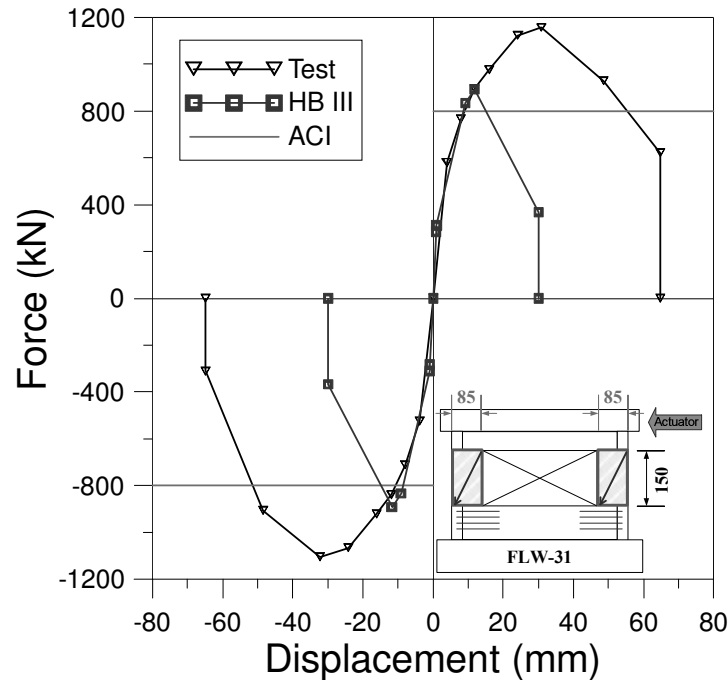
$$\delta_{f,su} = \frac{V_{su} H^3}{3E_c I}$$

改良評估曲線-短跨補強試體



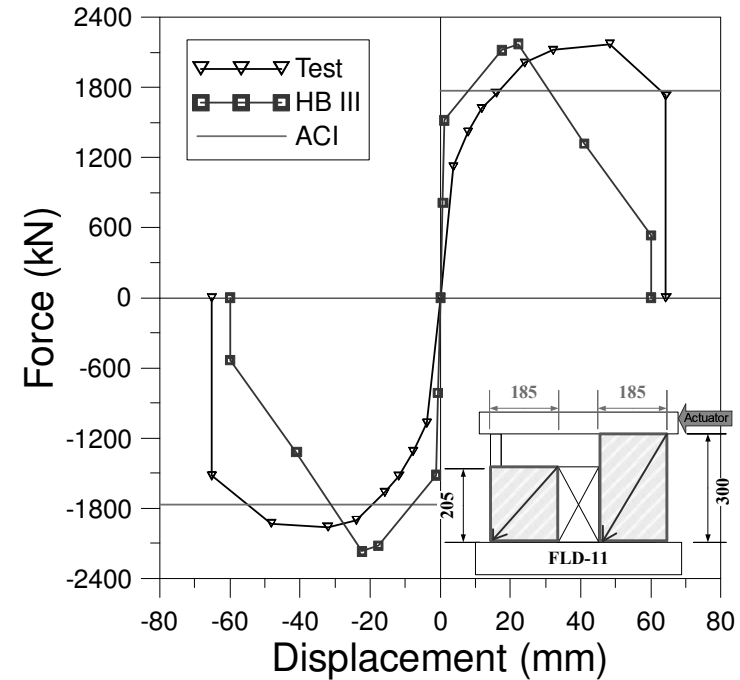
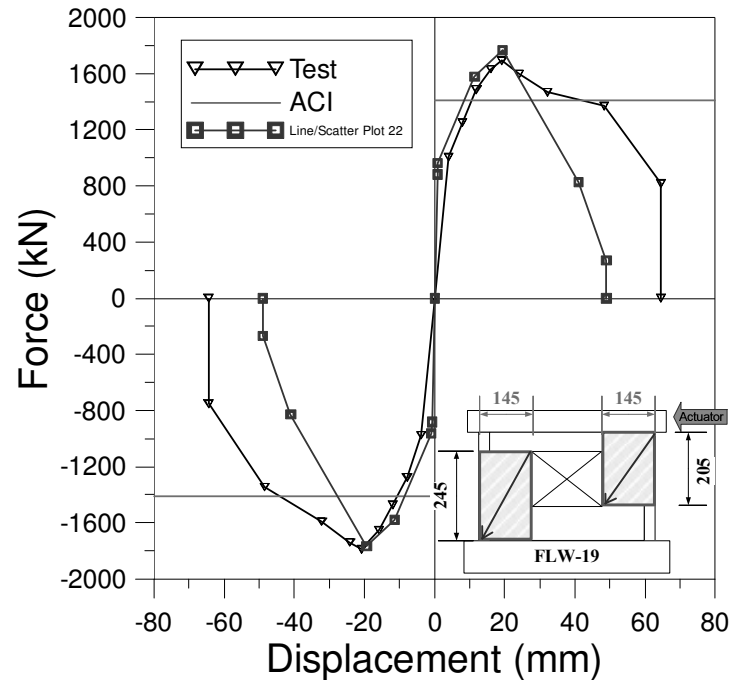
短跨補強試體	FSW-19				FSD-19			
	Disp. (mm)	Force (kN)	V_{test}/V_p	Δ_{test}/Δ_p	Disp. (mm)	Force (kN)	V_{test}/V_p	Δ_{test}/Δ_p
Test	32.38	1072	-	-	48.54	980.8	-	-
HB III	9.11	889.50	1.21	3.55	7.84	795.36	1.23	6.19
改良法	12.36	875.75	1.22	2.62	16.95	770.12	1.27	2.86

改良評估曲線-長跨大開口補強試體



長跨大開口補強試體	FLW-31				FLD-31			
	Disp. (mm)	Force (kN)	V_{test}/V_p	Δ_{test}/Δ_p	Disp. (mm)	Force (kN)	V_{test}/V_p	Δ_{test}/Δ_p
Test	32.46	1156.96	-	-	48.56	1190	-	-
HB III	8.68	902.87	1.28	3.56	8.22	884.11	1.35	5.91
改良法	11.75	892.38	1.30	2.63	13.37	877.21	1.36	3.63

改良評估曲線-長跨小開口補強試體

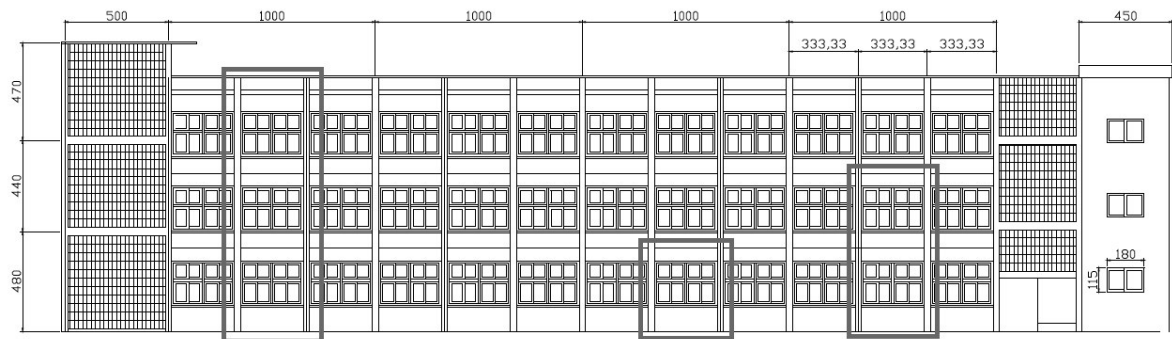


長跨小開口補強試體	FLW-19				FLD-11			
	Disp. (mm)	Force (kN)	V_{test}/V_p	Δ_{test}/Δ_p	Disp. (mm)	Force (kN)	V_{test}/V_p	Δ_{test}/Δ_p
Test	20.79	1788.4	-	-	48.31	2168.4	-	-
HB III	15.77	1939.03	0.92	1.32	26.80	2336.87	0.93	1.20
改良法	-19.34	-1768.88	1.01	1.08	22.30	2170.13	1.00	83 1.44

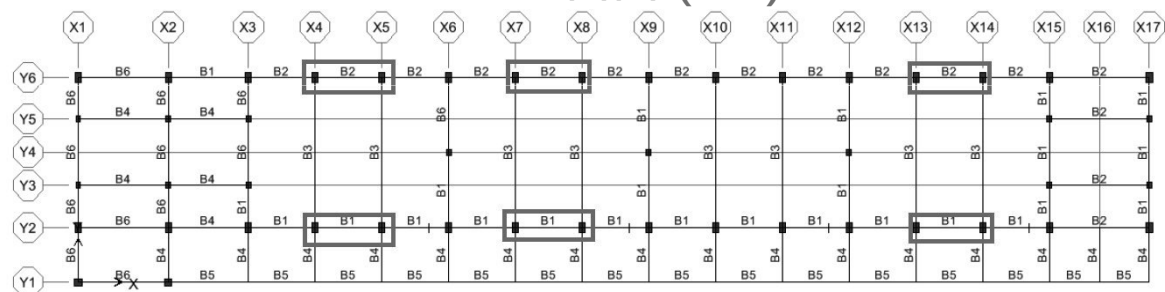
大綱

1. 研究動機：提出開口牆補強工法
2. 試體規劃與試體設計
3. 試驗結果
4. 側力-位移評估曲線
5. 補強示範例：後甲國中
6. 結論

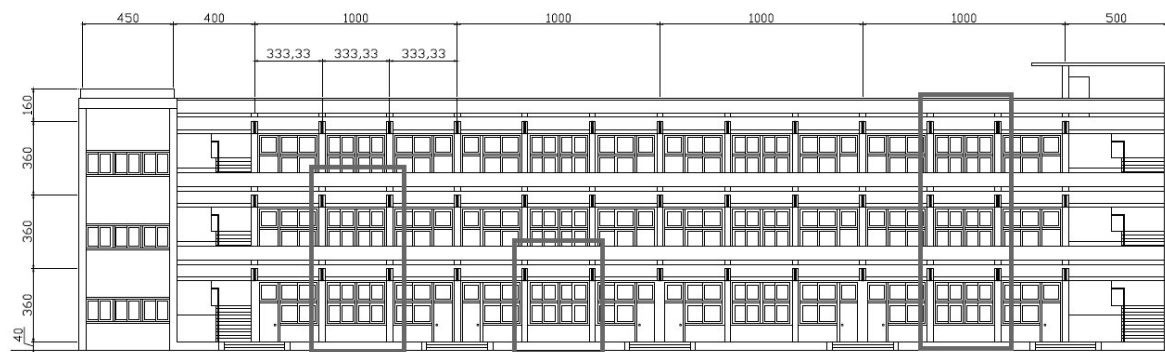
補強示範例：後甲國中



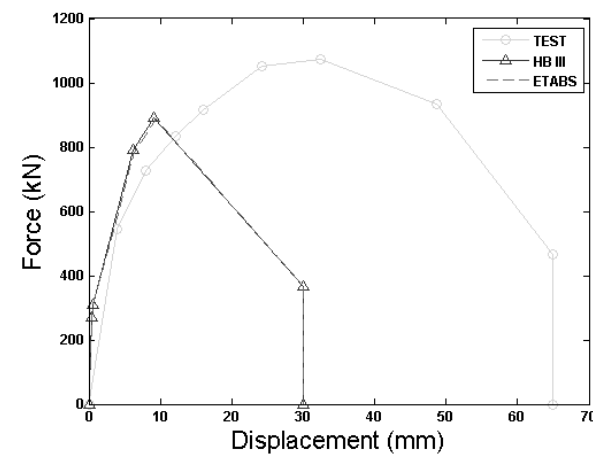
立面圖 (Y6)



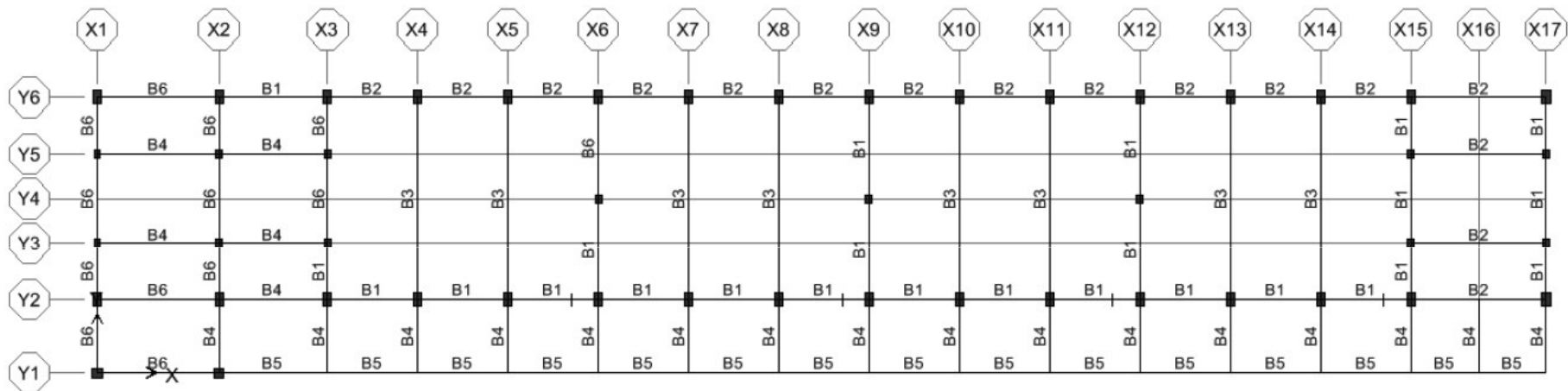
平面圖



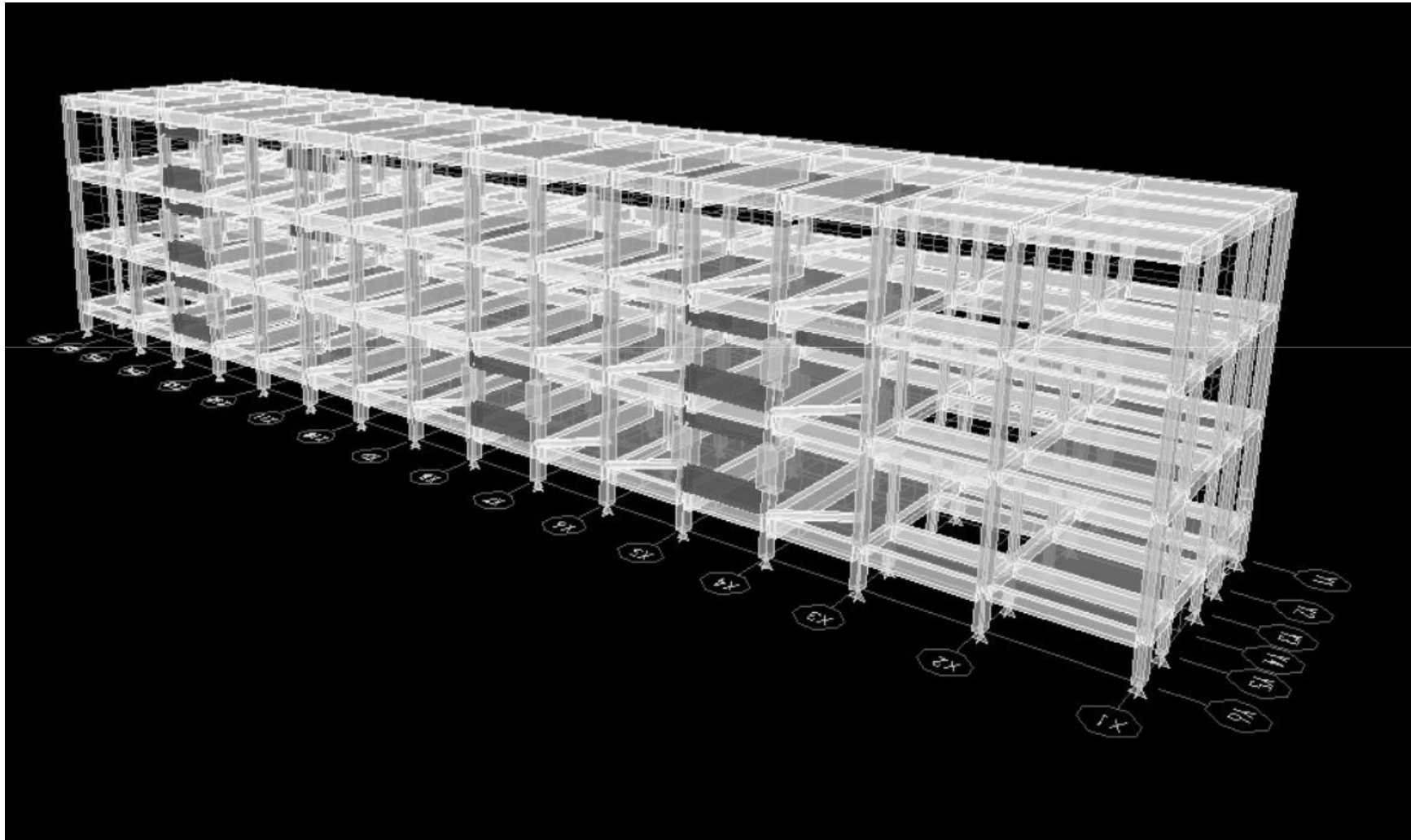
立面圖 (Y2)



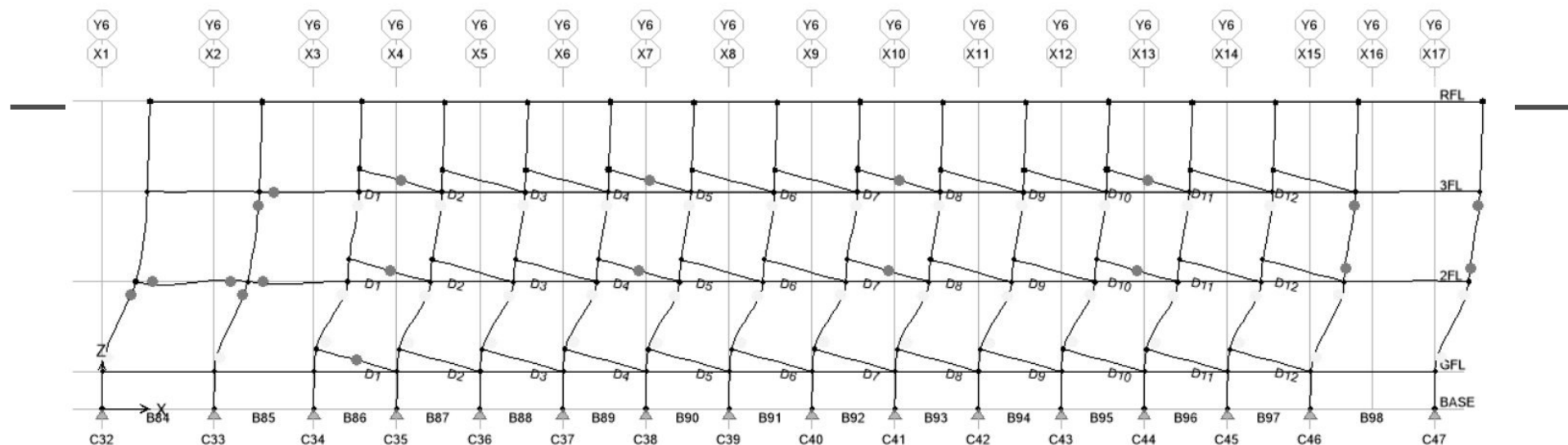
待補強試體平面配置圖(後甲國中)



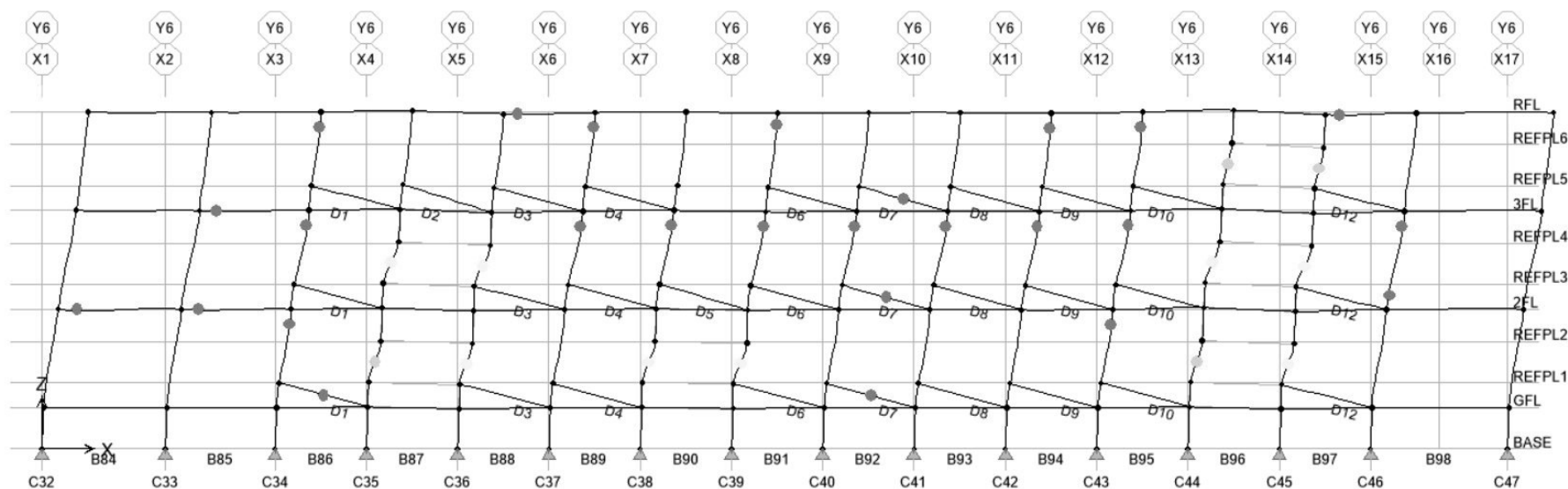
ETABS結構分析模型3D立體圖



NAR Labs 國家實驗研究院
National Applied Research Laboratories



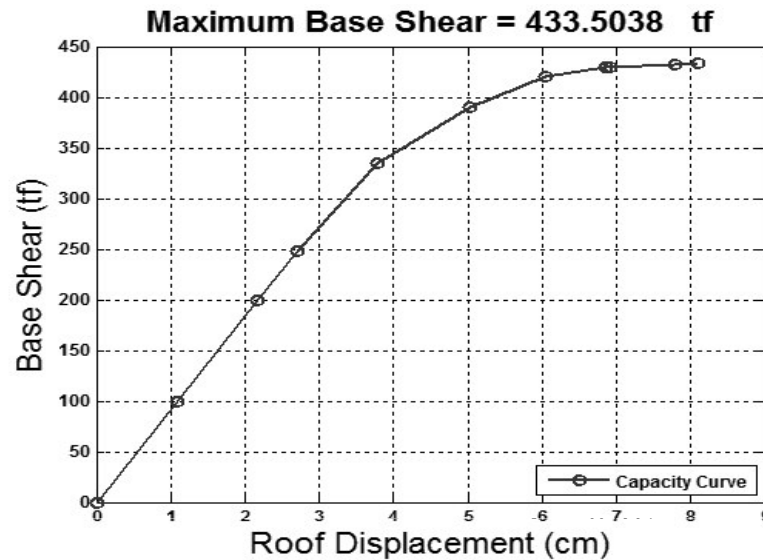
補強前側推分析破壞塑鉸分布圖



補強後側推分析破壞塑鉸分布圖

補強示範例：後甲國中

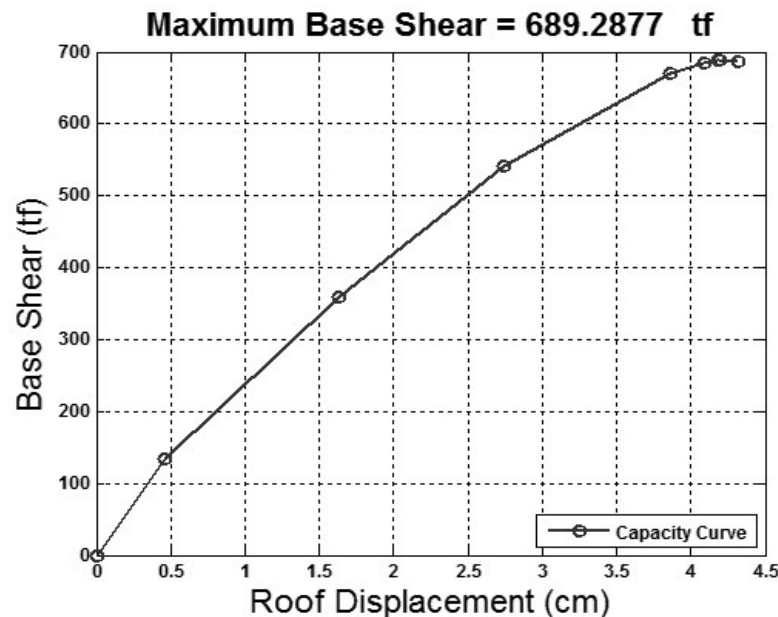
補
強
前



最大基底剪力 (@8.1cm)
 $V = 434 \text{ tf}$

最大性能地表加速度
 $A_p = 0.215g$

補
強
後



最大基底剪力 (@4.2cm)
 $V = 689 \text{ tf}$ (增加 59%)

最大性能地表加速度
 $A_p = 0.289g$ (增加 34%)

結論

1. 將#3雙排(2800kgf/cm²)植筋改成#4單排(4200kgf/cm²)可減少一半植筋數量，且仍保有雙排植筋成效。
2. 對既有校舍補強一大面積開口的開口剪力牆，其抗側力強度至少能提升4倍，而其勁度約能提升13倍。
3. 對既有校舍補強一小面積開口的開口剪力牆，其抗側力強度至少能提升6.8倍，而其勁度約能提升34倍。

結論

4. 於開口處增設ACI 318-11 建議之水平拉力鋼筋，會使破壞集中在臨界斷面內，可提高剪力強度。
5. 試驗結果其試驗最大層間位移角Drift Ratio 至少可達2%，表示適合用於強度及勁度補強為主的低矮型建築物上。
6. 未來可應用在傳統街屋補強上。

**THANKS FOR
YOUR ATTENTION**