MULTI-CUT REBAR(9)

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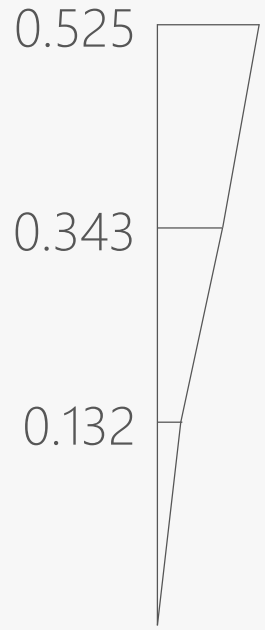
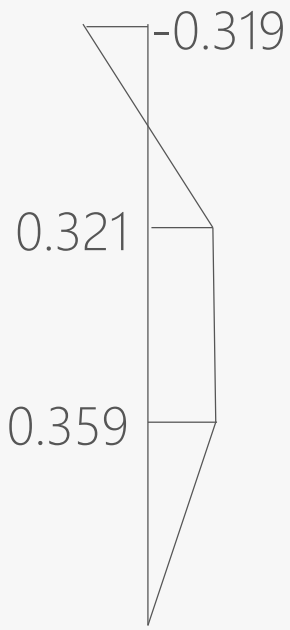
Presenters : You-Ran Nai

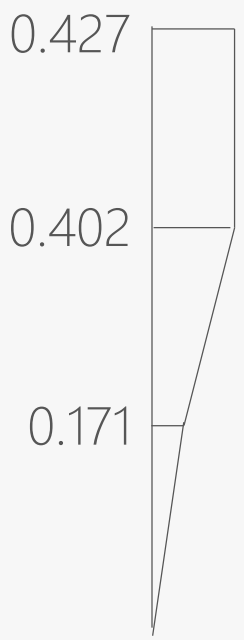
Mode Pushover



$Mode\ 1$



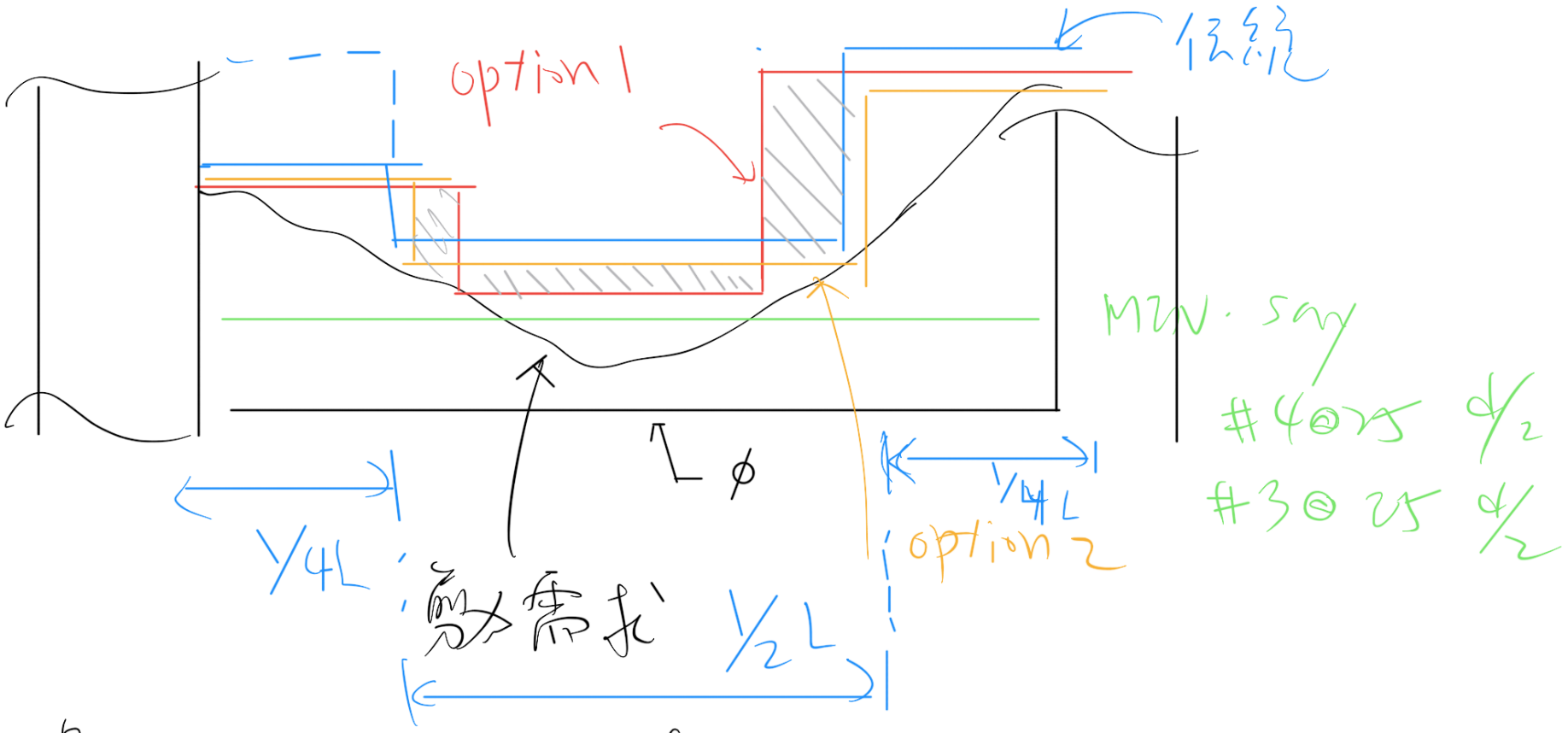
$Mode\ 2$



MMC

$$Mode1 * 0.81 + Mode2 * 0.15 + Mode3 * 0.04$$

$$F_j = \sum_{n=1}^{N} \Gamma_n \phi_{n\,j}$$



Best = Optimized (optim 1, 2, ···)

—— : 传统面筋 even 左右对撑

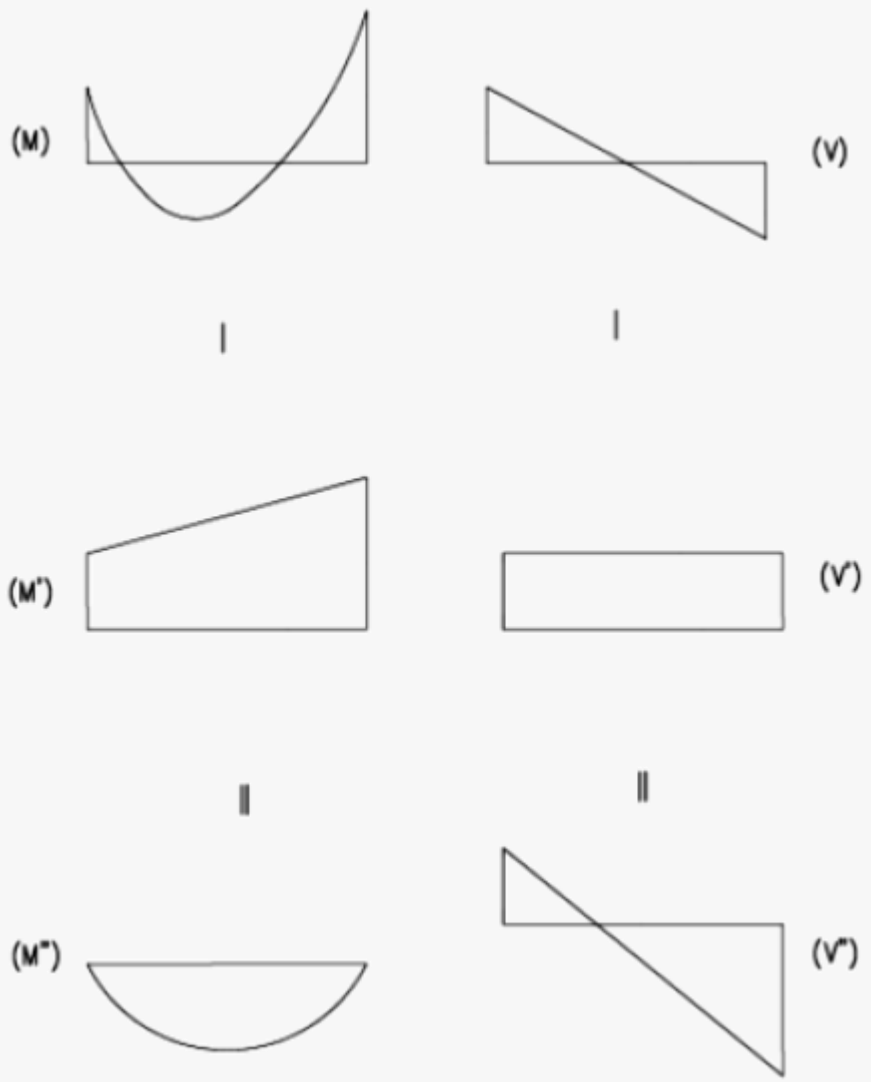
Sway Special

The design shear force is then given by (ACI 21.3.4.1, IBC 2003)

$$V_u = \max\{V_{e1}, V_{e2}\} \qquad \text{(ACI 21.3.4.1, Fig R21.3.4)}$$

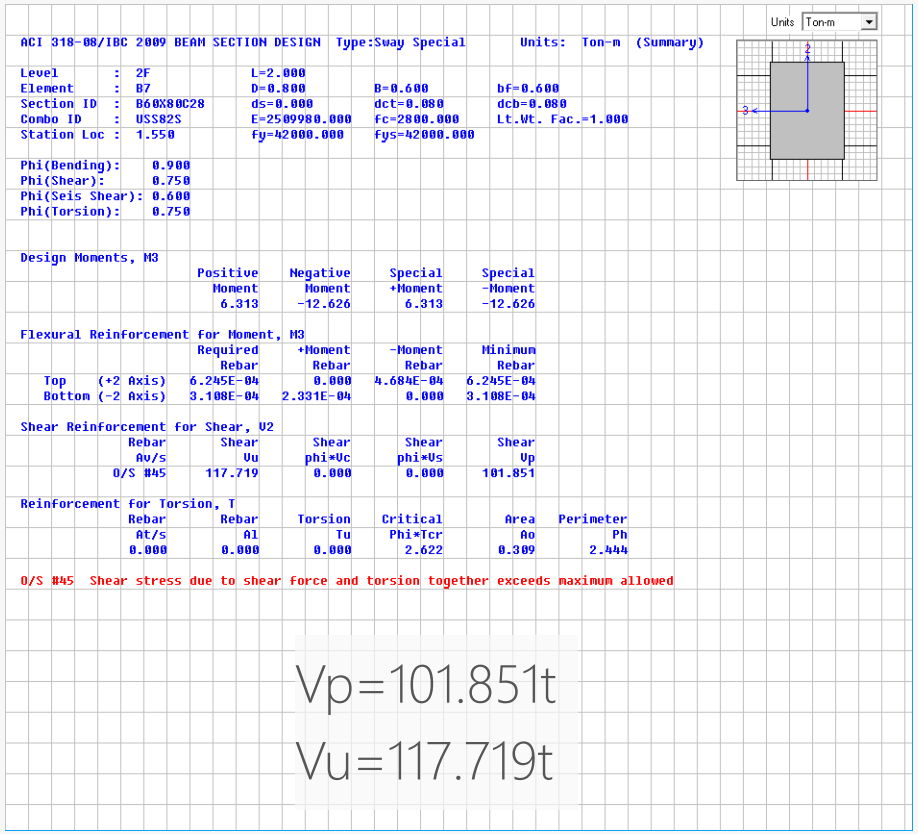
$$V_{e1} = V_{p1} + V_{D+L} \qquad \text{(ACI 21.3.4.1, Fig R21.3.4)}$$

$$V_{e2} = V_{p2} + V_{D+L} \qquad \text{(ACI 21.3.4.1, Fig R21.3.4)}$$



Shear Design

Sway Special　Consider Vp



ACI 318-08/IBC 2009 BEAM SECTION DESIGN Type:Sway Special Units: Ton-m (Summary)

Level	: 2F	L=2.000			
Element	: B7	D=0.800	B=0.600	bf=0.600	
Section ID	: B60X80C28	ds=0.000	dct=0.080	dcb=0.080	
Combo ID	: USS82S	E=2509980.000	fc=2800.000	Lt.Wt. Fac.=1.000	
Station Loc	: 1.550	fy=42000.000	fys=42000.000		

Phi(Bending):	0.900
Phi(Shear):	0.750
Phi(Seis Shear):	0.600
Phi(Torsion):	0.750

Design Moments, M3

	Positive Moment	Negative Moment	Special +Moment	Special -Moment
	6.313	-12.626	6.313	-12.626

Flexural Reinforcement for Moment, M3

	Required +Moment Rebar	-Moment Rebar	Minimum Rebar
Top (+2 Axis)	6.245E-04	0.000	4.684E-04	6.245E-04
Bottom (-2 Axis)	3.108E-04	2.331E-04	0.000	3.108E-04

Shear Reinforcement for Shear, V2

Rebar Av/s	Shear Vu	Shear phi*Vc	Shear phi*Vs	Shear Vp
O/S #45	117.719	0.000	0.000	101.851

Reinforcement for Torsion, T

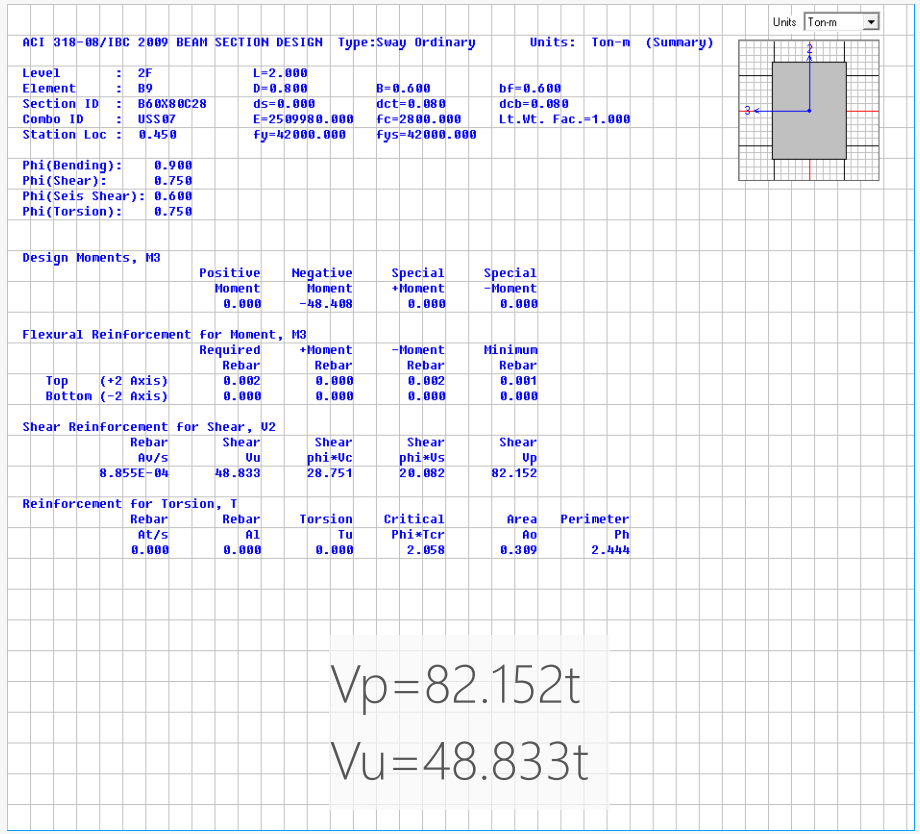
Rebar At/s	Rebar Al	Torsion Tu	Critical Phi*Tcr	Area Ao	Perimeter Ph
0.000	0.000	0.000	2.622	0.309	2.444

O/S #45 Shear stress due to shear force and torsion together exceeds maximum allowed

Vp=101.851t

Vu=117.719t

Sway Ordinary　No Consider Vp



ACI 318-08/IBC 2009 BEAM SECTION DESIGN Type:Sway Ordinary Units: Ton-m (Summary)

Level	: 2F	L=2.000			
Element	: B9	D=0.800	B=0.600	bf=0.600	
Section ID	: B60X80C28	ds=0.000	dct=0.080	dcb=0.080	
Combo ID	: USS07	E=2509980.000	fc=2800.000	Lt.Wt. Fac.=1.000	
Station Loc	: 0.450	fy=42000.000	fys=42000.000		

Phi(Bending):	0.900
Phi(Shear):	0.750
Phi(Seis Shear):	0.600
Phi(Torsion):	0.750

Design Moments, M3

	Positive Moment	Negative Moment	Special +Moment	Special -Moment
	0.000	-48.408	0.000	0.000

Flexural Reinforcement for Moment, M3

	Required Rebar	+Moment Rebar	-Moment Rebar	Minimum Rebar
Top (+2 Axis)	0.002	0.000	0.002	0.001
Bottom (-2 Axis)	0.000	0.000	0.000	0.000

Shear Reinforcement for Shear, V2

Rebar Av/s	Shear Vu	Shear phi*Vc	Shear phi*Vs	Shear Vp
8.855E-04	48.833	28.751	20.082	82.152

Reinforcement for Torsion, T

Rebar At/s	Rebar Al	Torsion Tu	Critical Phi*Tcr	Area Ao	Perimeter Ph
0.000	0.000	0.000	2.058	0.309	2.444

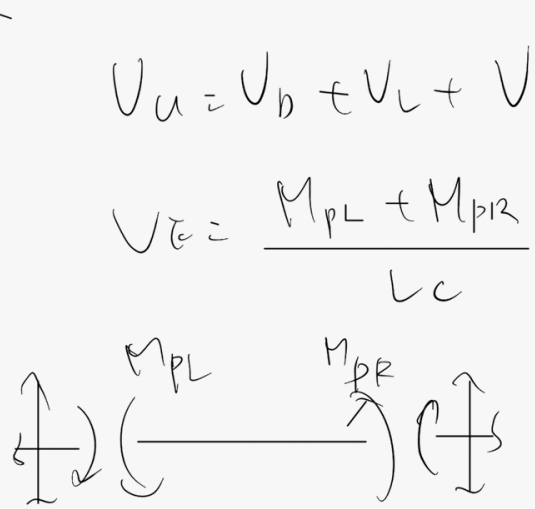
Vp=82.152t

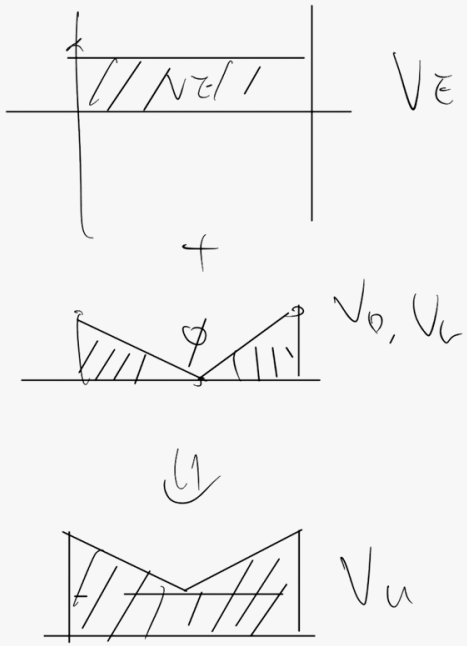
Vu=48.833t

Shear Design

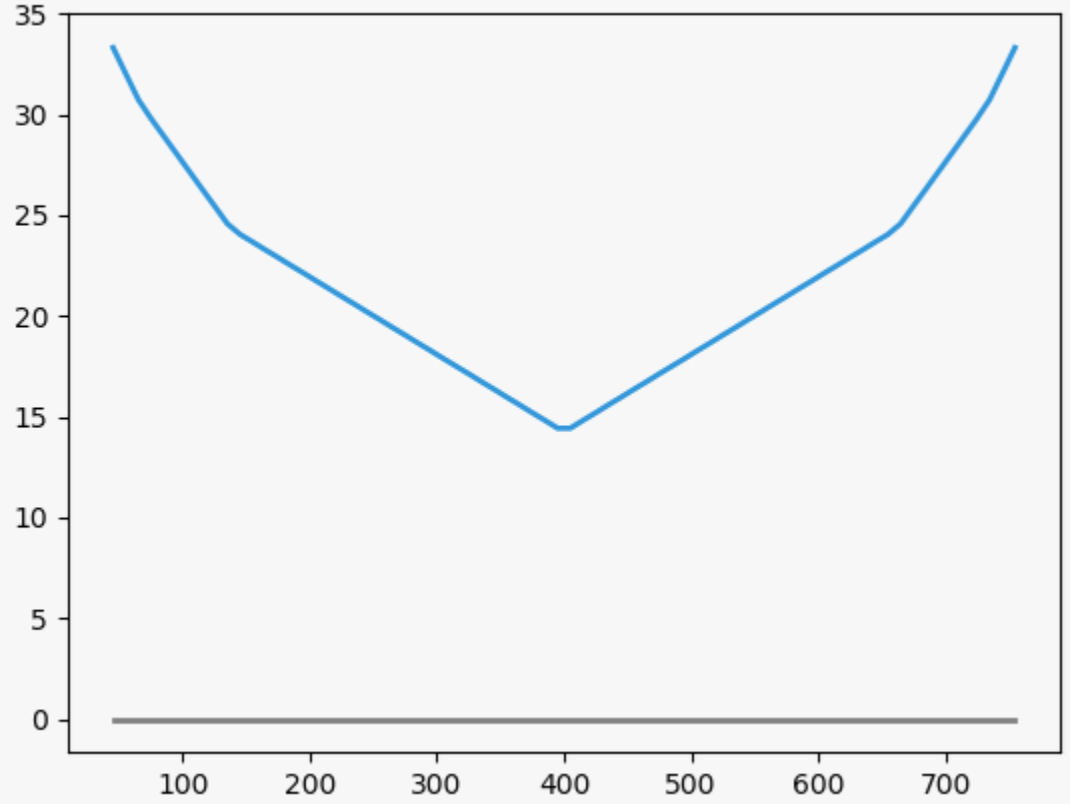
$$V_u = V_D + V_L + V_E$$

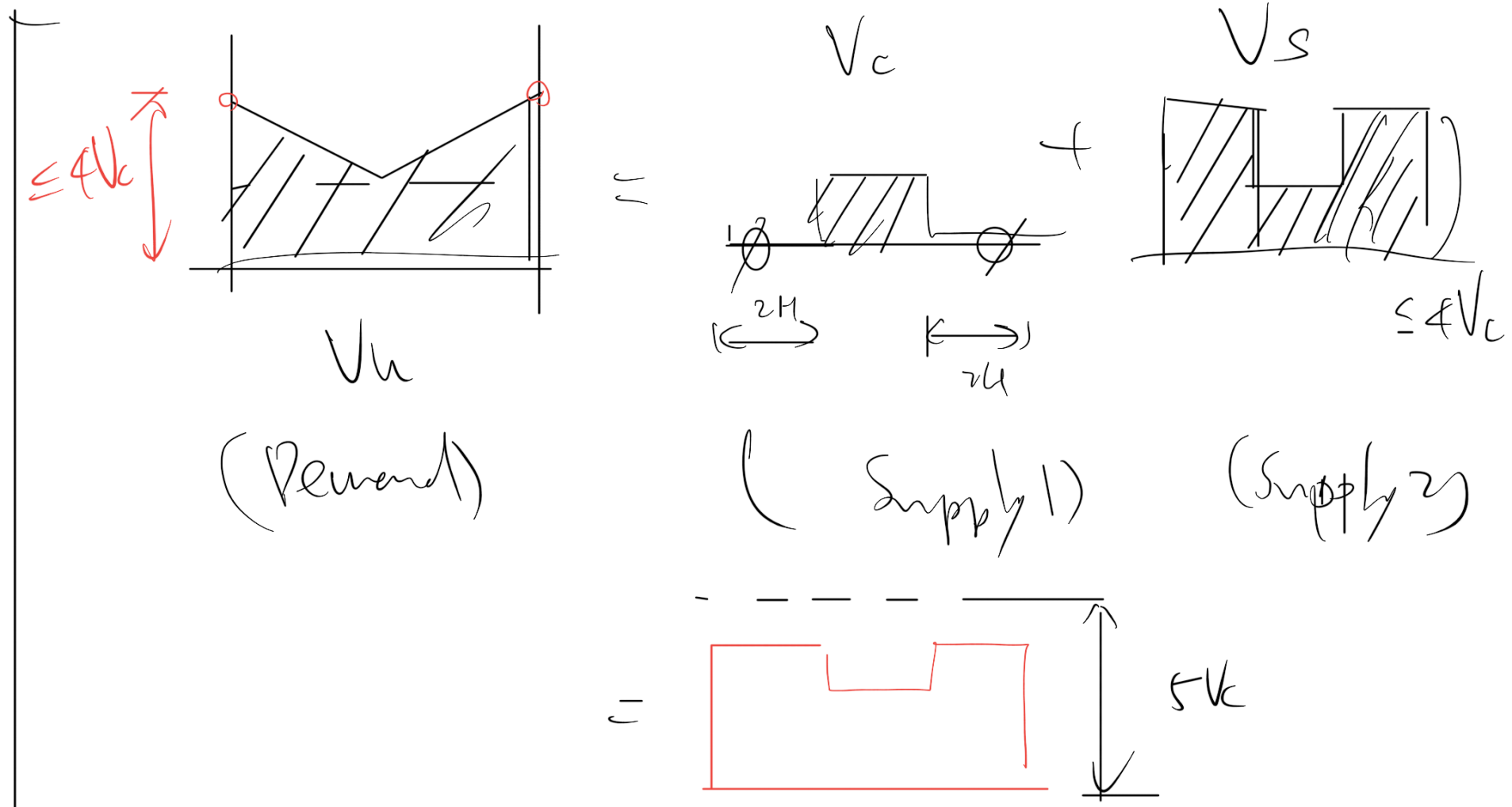
$$V_E = \frac{M_{pL} + M_{pR}}{L_C}$$

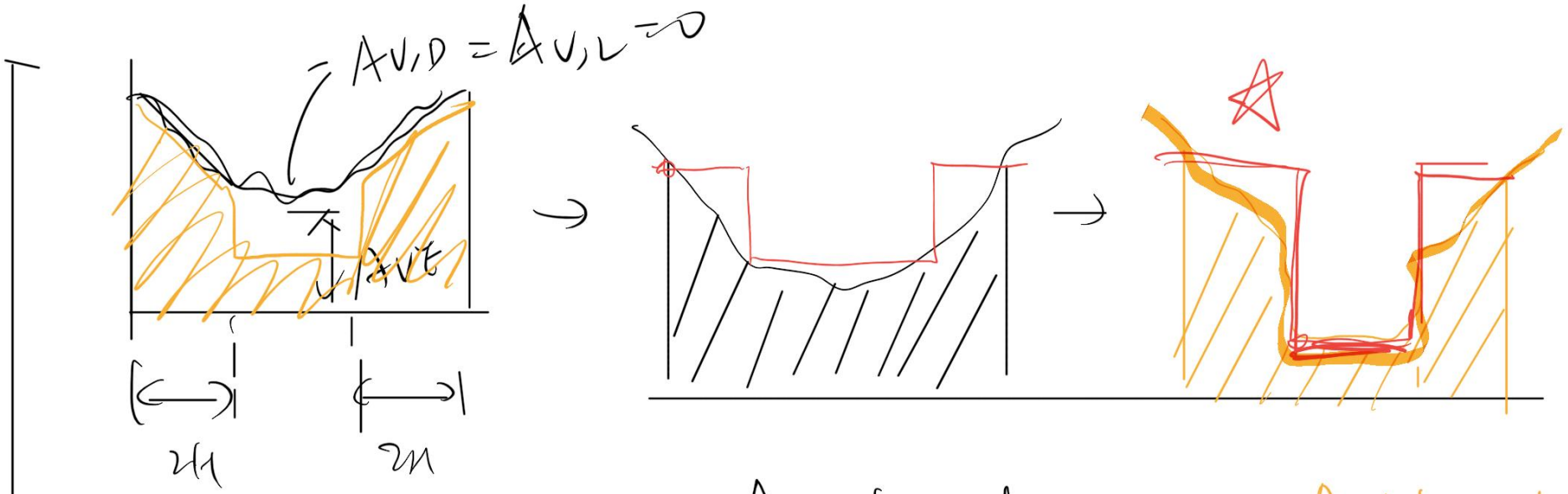




Easbs Shear Rebar Area




≤ 4Vc
Vh
=
Vc
2H
2H
+
Vs
≤ 4Vc
(Demand)
(Supply 1)
(Supply 2)
=
4Vc

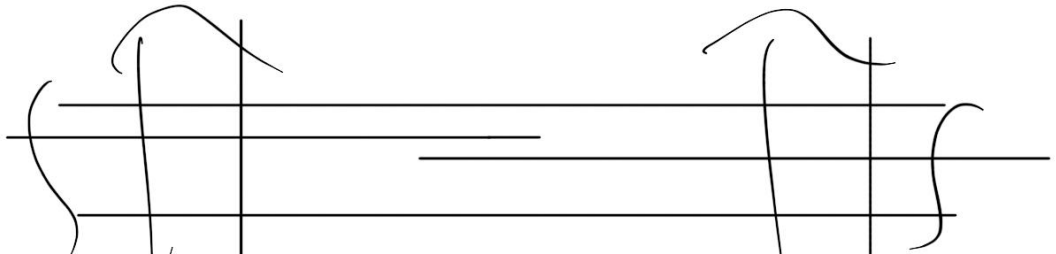


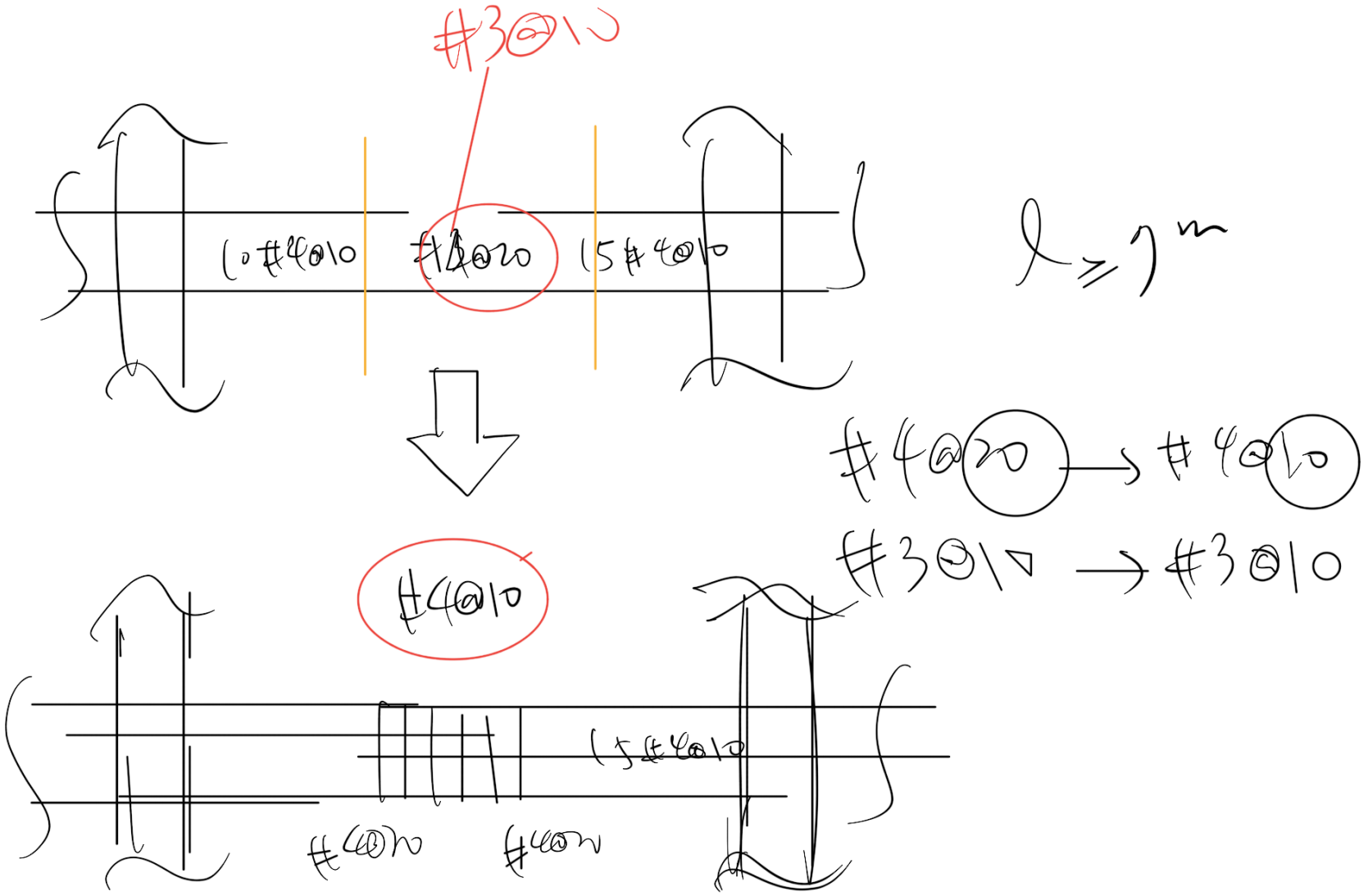
Δv, devant

$(V_c = 0)$

Δv, derrière

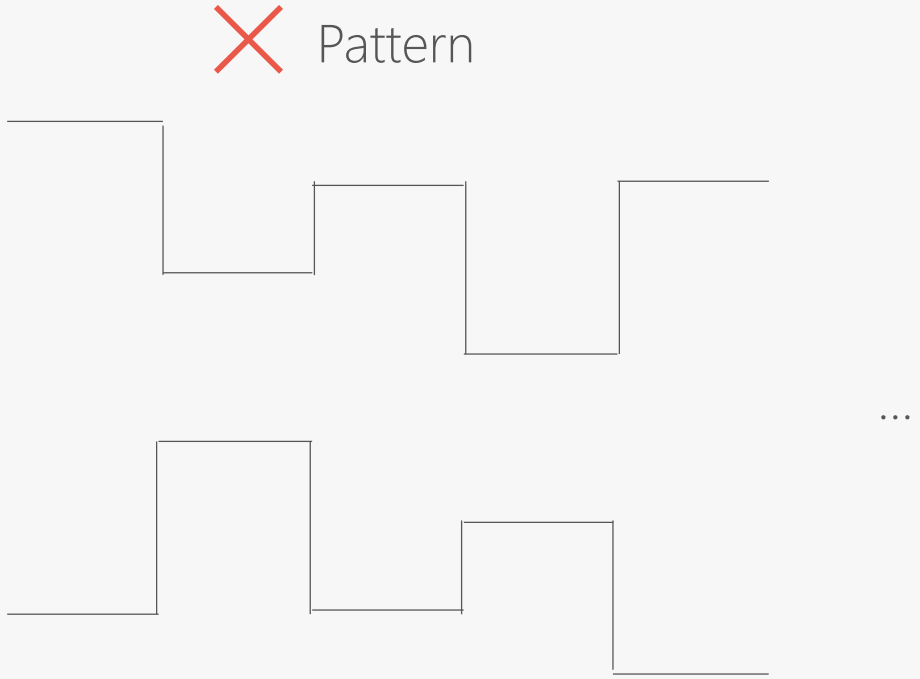
$(V_c \neq 0)$

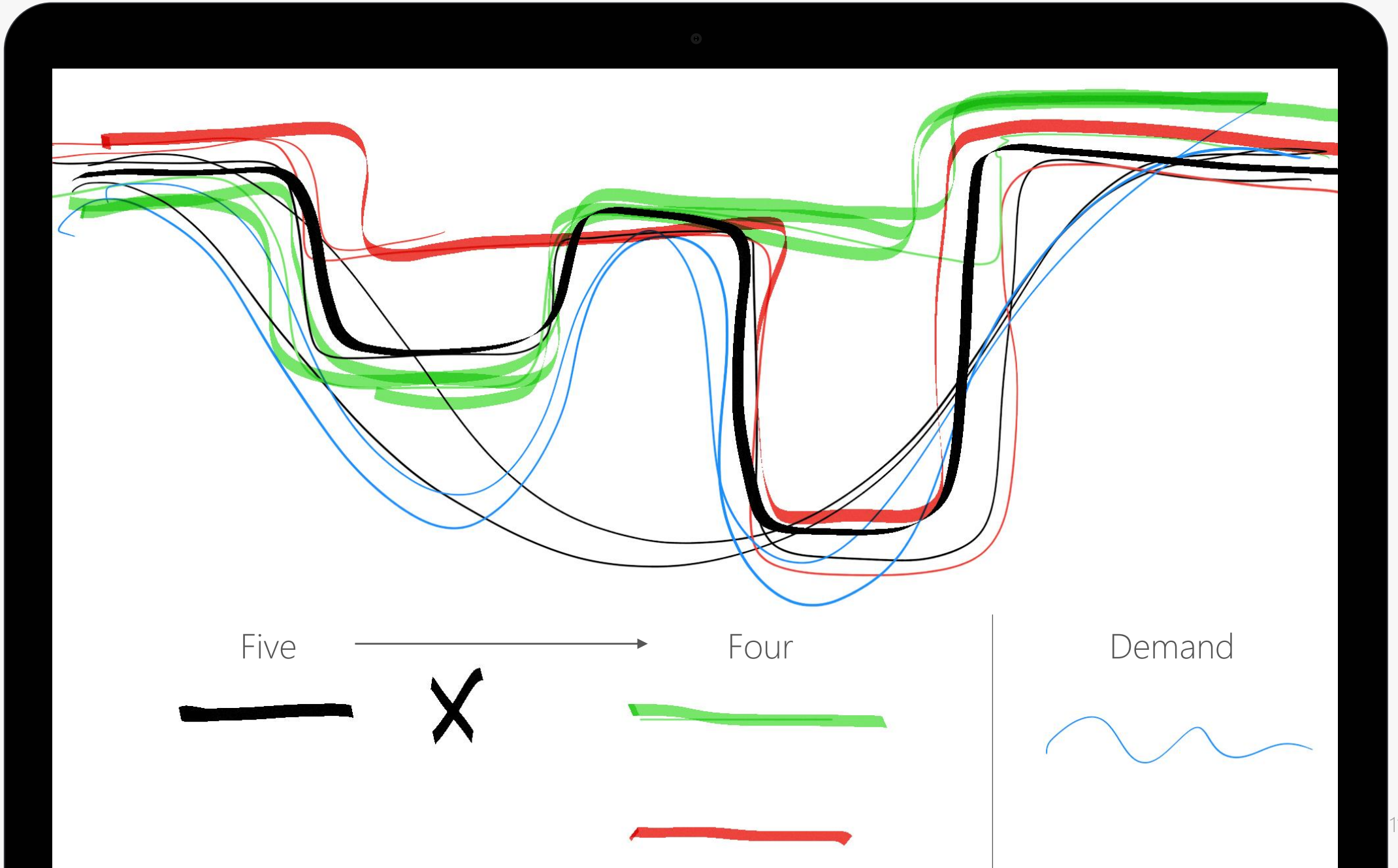



#3@10
10#4@10
#4@20
15#4@10
l ≥ 7m
#4@20 → #4@10
#3@10 → #3@10
#4@10
15#4@10
#4@20
#4@20

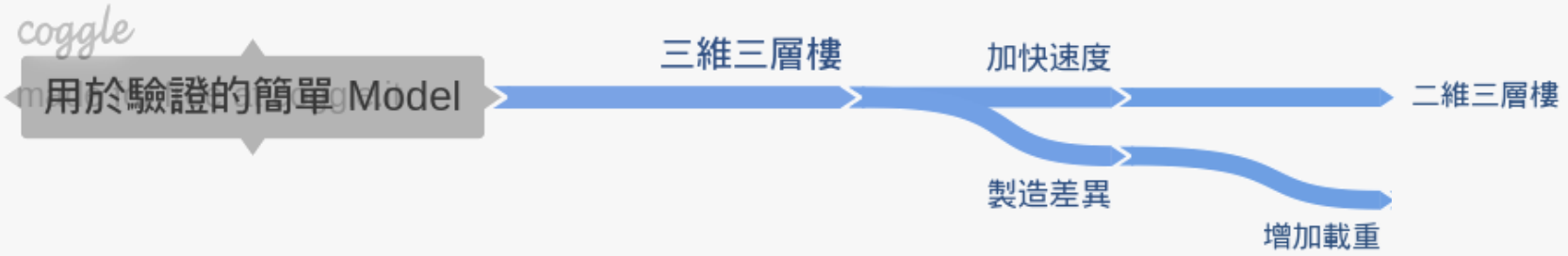
5 MULTI CUT

	主筋					長度				
	左1	左2	中	右2	右1	左1	左2	中	右2	右1
上層 第一排	2-#7	2-#7	3-#7	3-#7	3-#7	50	307	49	10	49
上層 第二排	0	0	0	0	0					
下層 第二排	0	0	0	0	0					
下層 第一排	2-#7	2-#7	2-#7	2-#7	2-#7	50	10	346	10	49
上層 第一排	3-#7	3-#7	3-#7	2-#7	2-#7	60	80	350	10	60
上層 第二排	0	0	0	0	0					
下層 第二排	0	0	0	0	0					
下層 第一排	2-#7	2-#7	2-#7	2-#7	2-#7	60	10	420	10	60



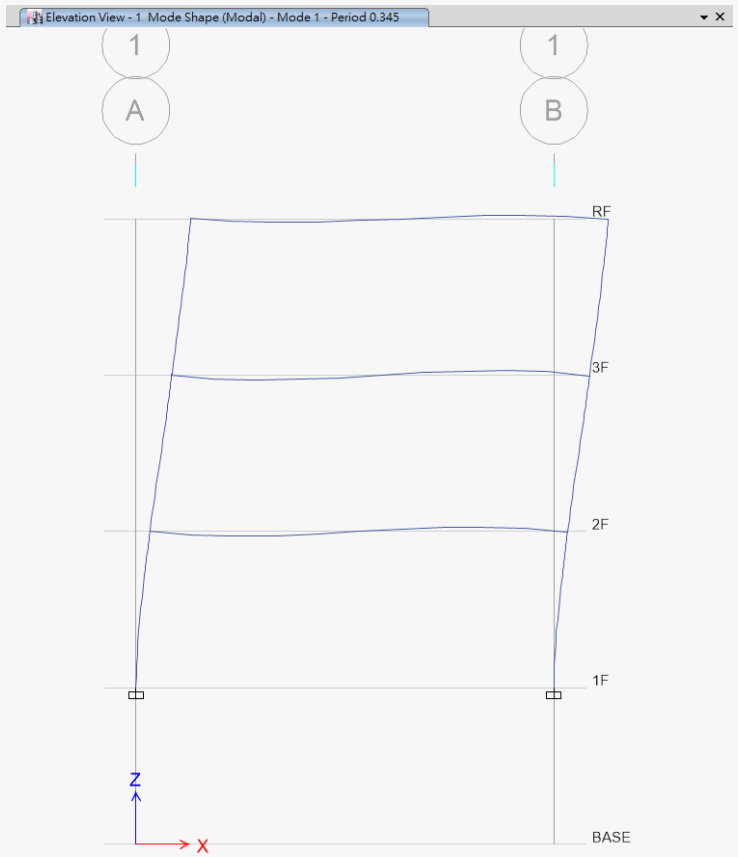

Five
Four
Demand

Nonlinear
Simple Model



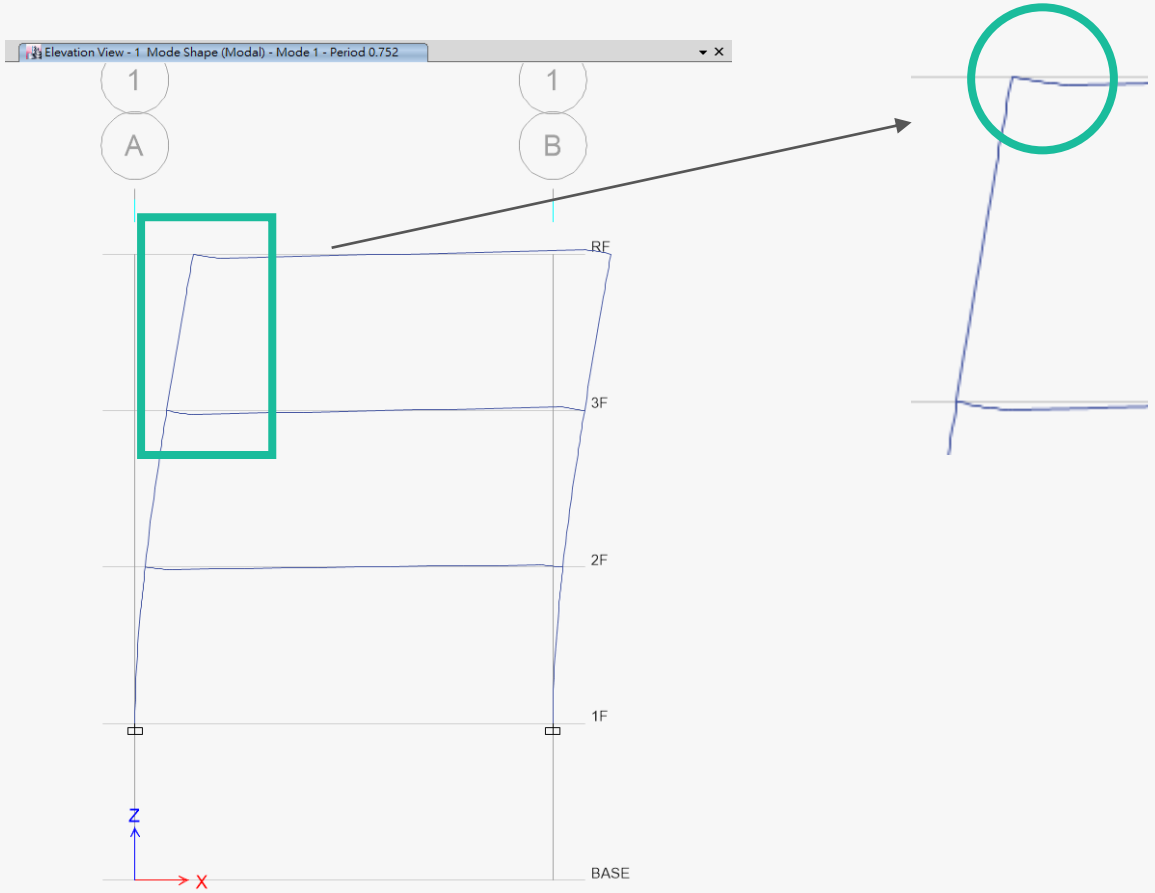
T=0.345

No Nonlinear Beam Hinge

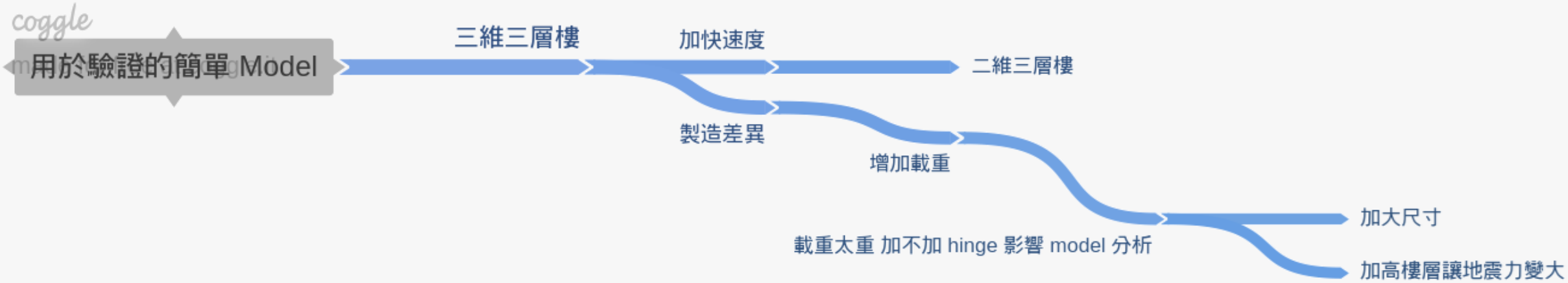


T=0.752

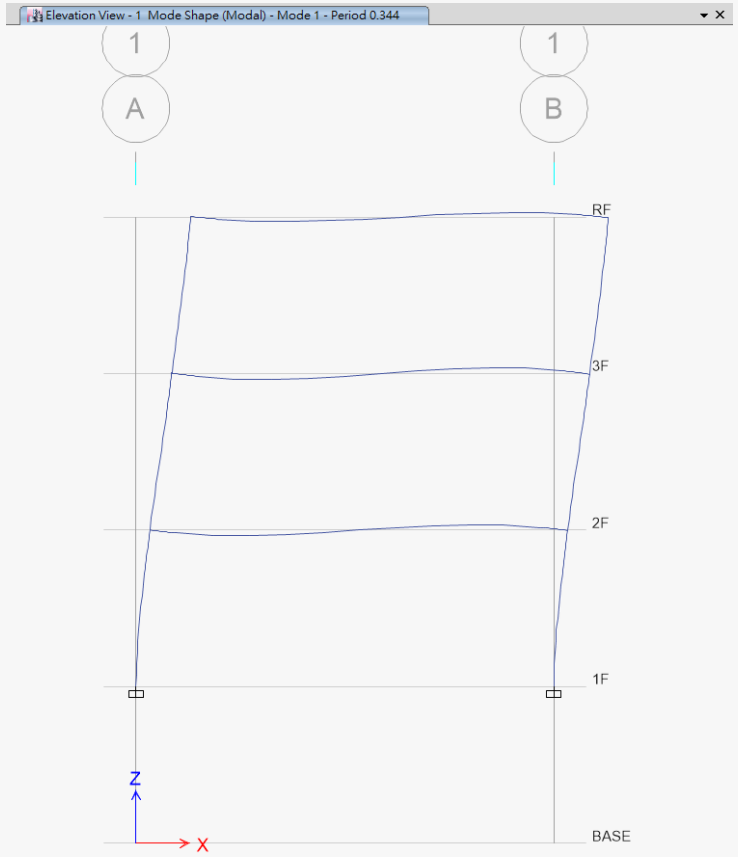
Nonlinear Beam Hinge



Nonlinear
Simple Model

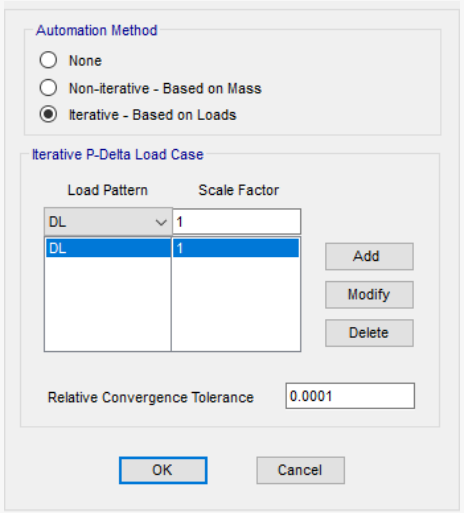


P-Delta



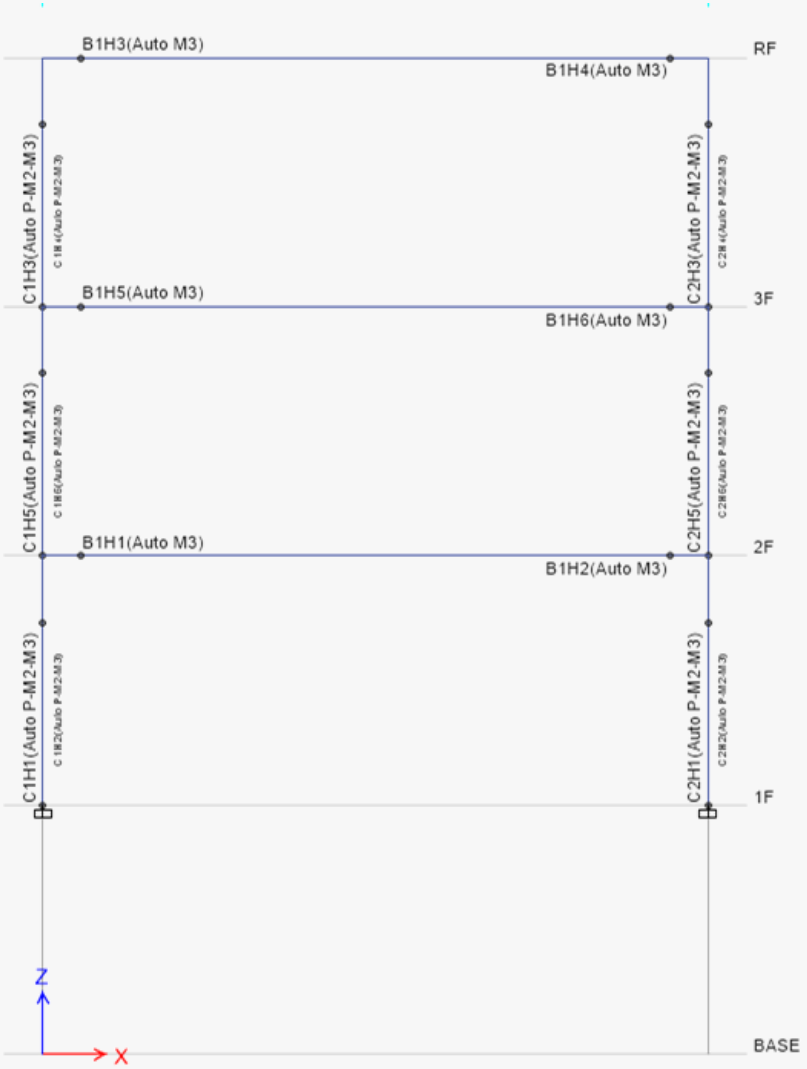
1. **Non-iterative Based on Mass**, in which load is automatically computed from the mass at each level. Th providing for faster computation. P-Delta is considered by treating the structure as a simplified stick moc Local buckling is not captured as effectively.

   The benefit of this non-iterative method is that P-Delta may be considered in load cases which do not sp Iterative Based on Load Cases method.
2. **Iterative Based on Load Cases**, in which load is computed from a specified combination of static load which considers P-Delta on an element-by-element basis. Local buckling is captured more effectively. A fraction of a live load case.

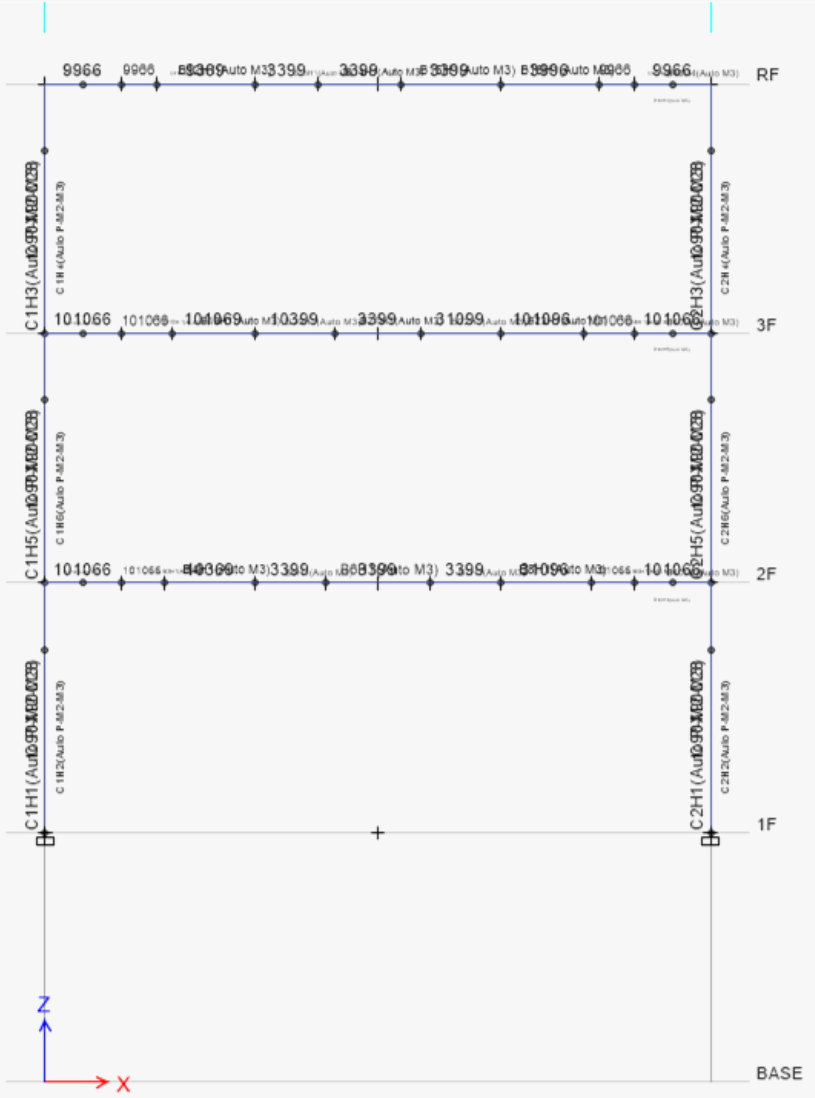


Local Buckling

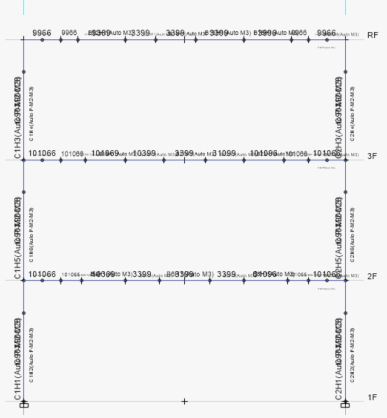
Normal Nonlinear Hinge



Multi Nonlinear Hinge



Multi Nonlinear Hinge



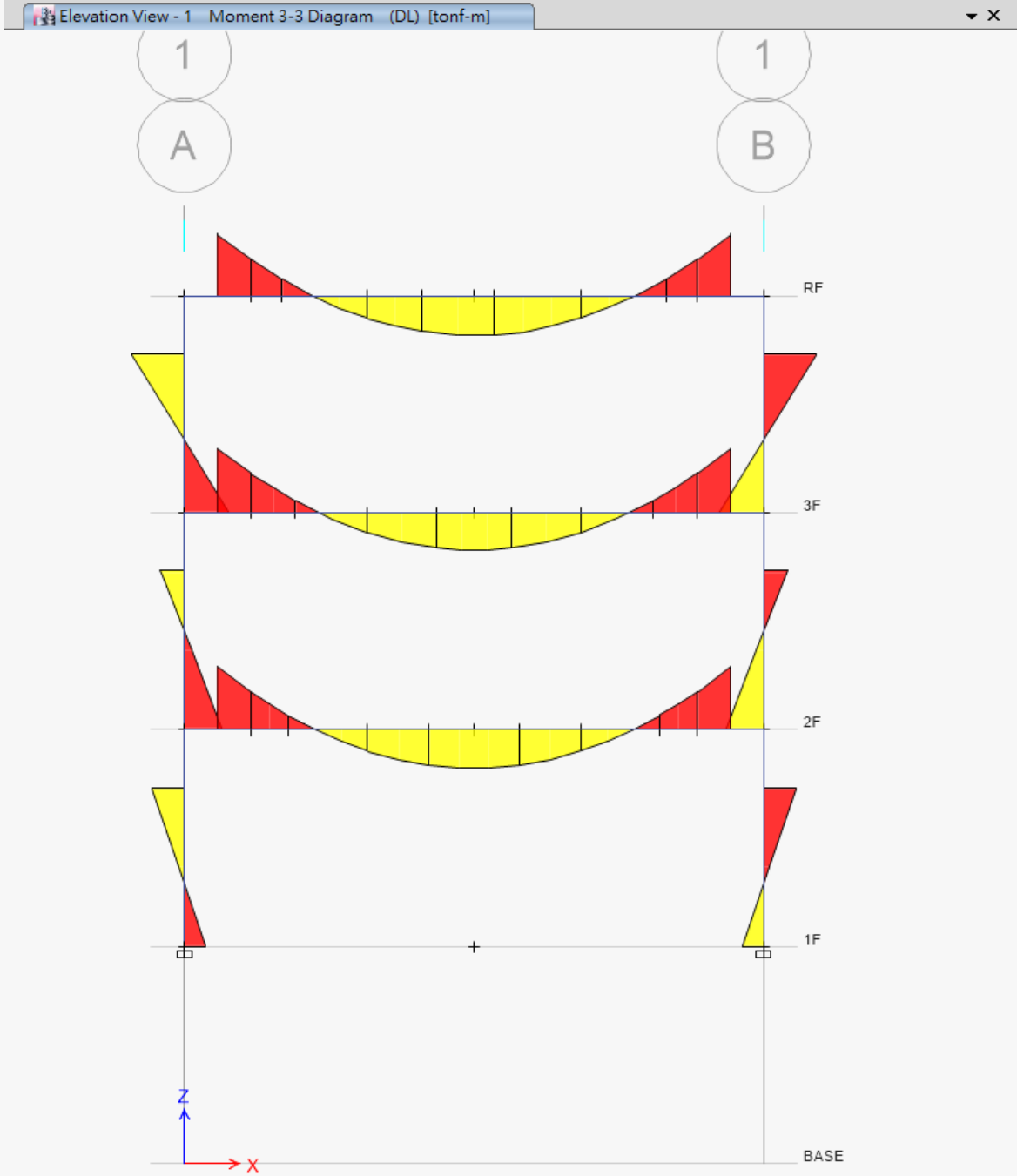
1 Multi Rebar

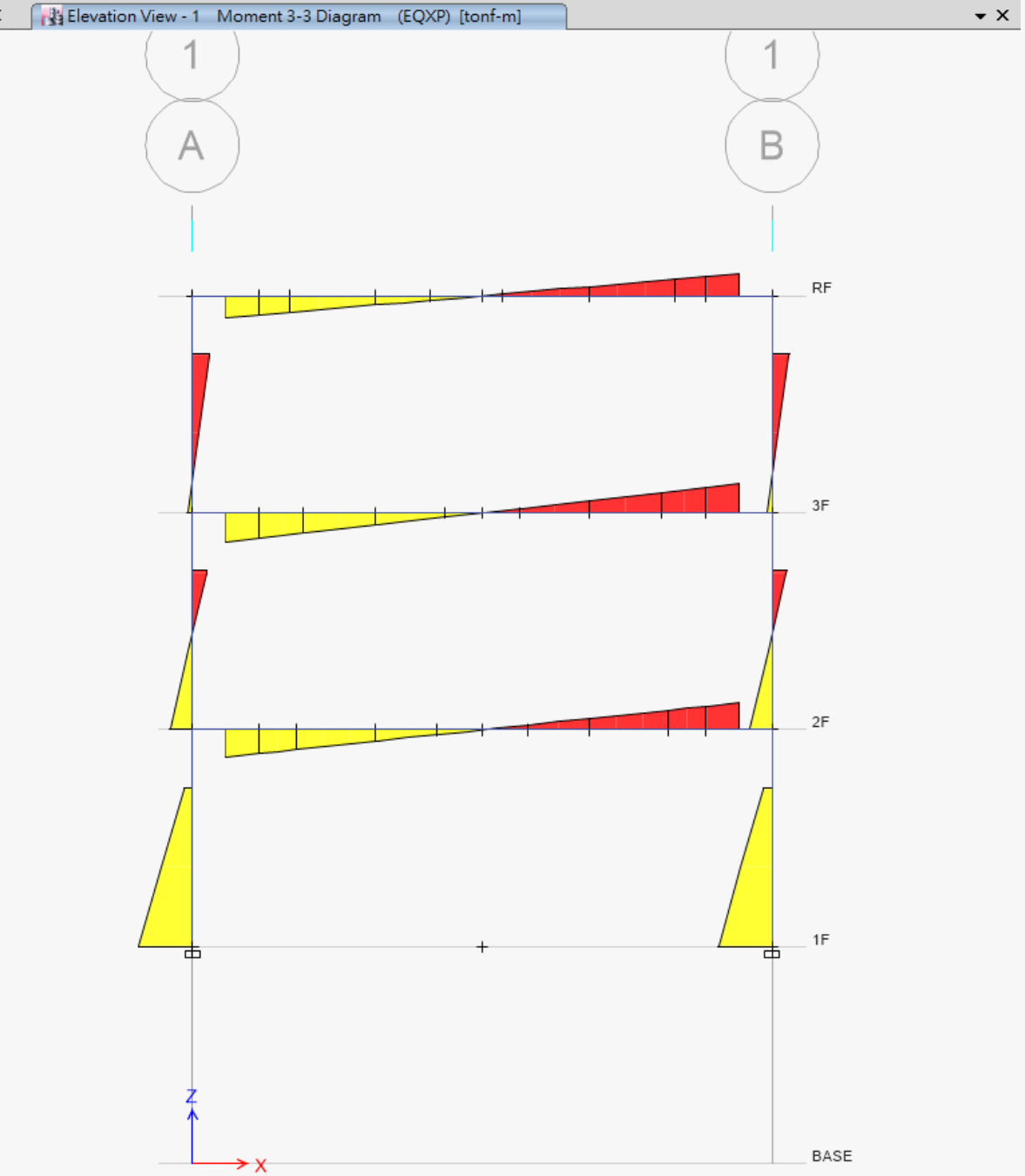
2 Calculate Ld

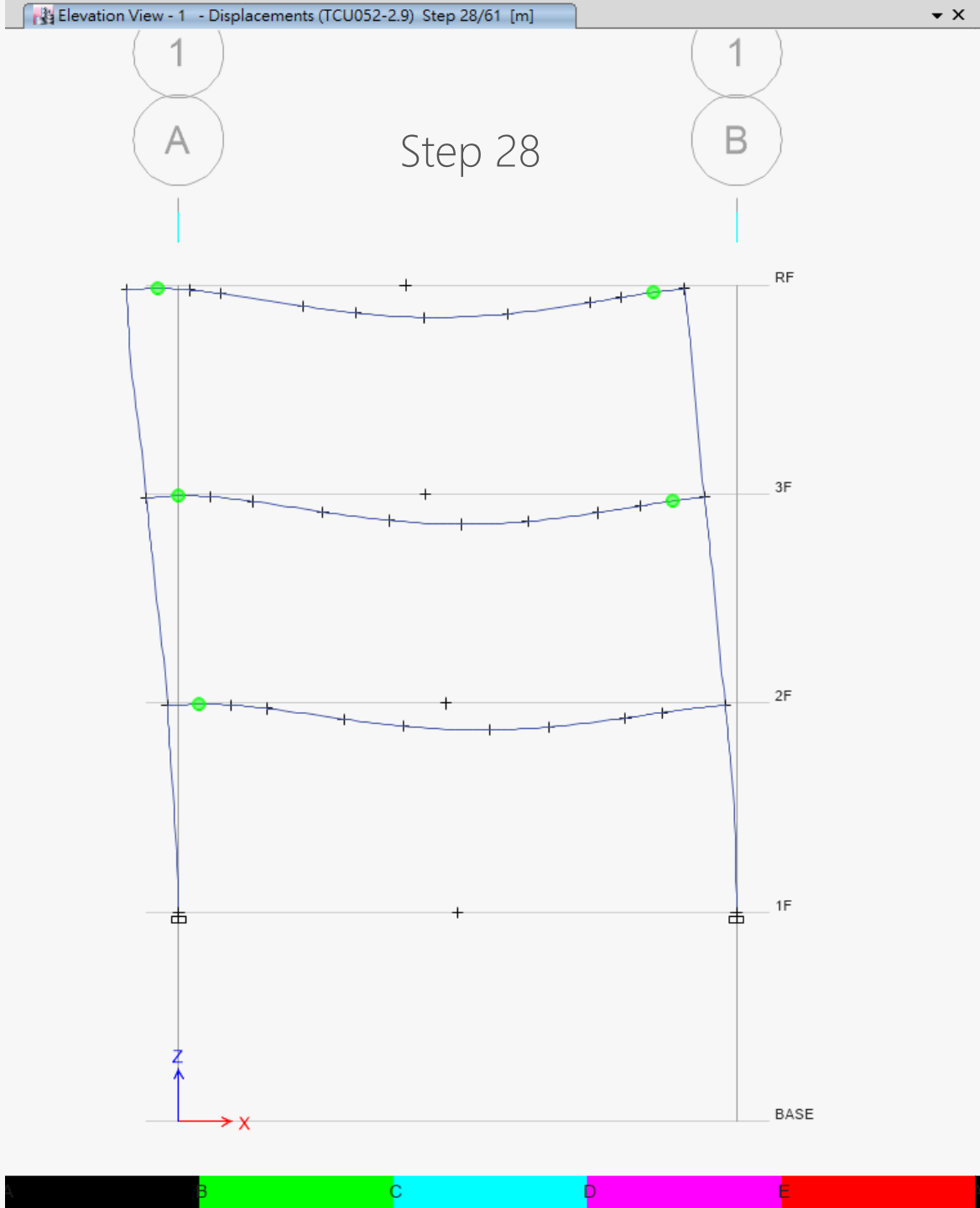
3 Divide Beam

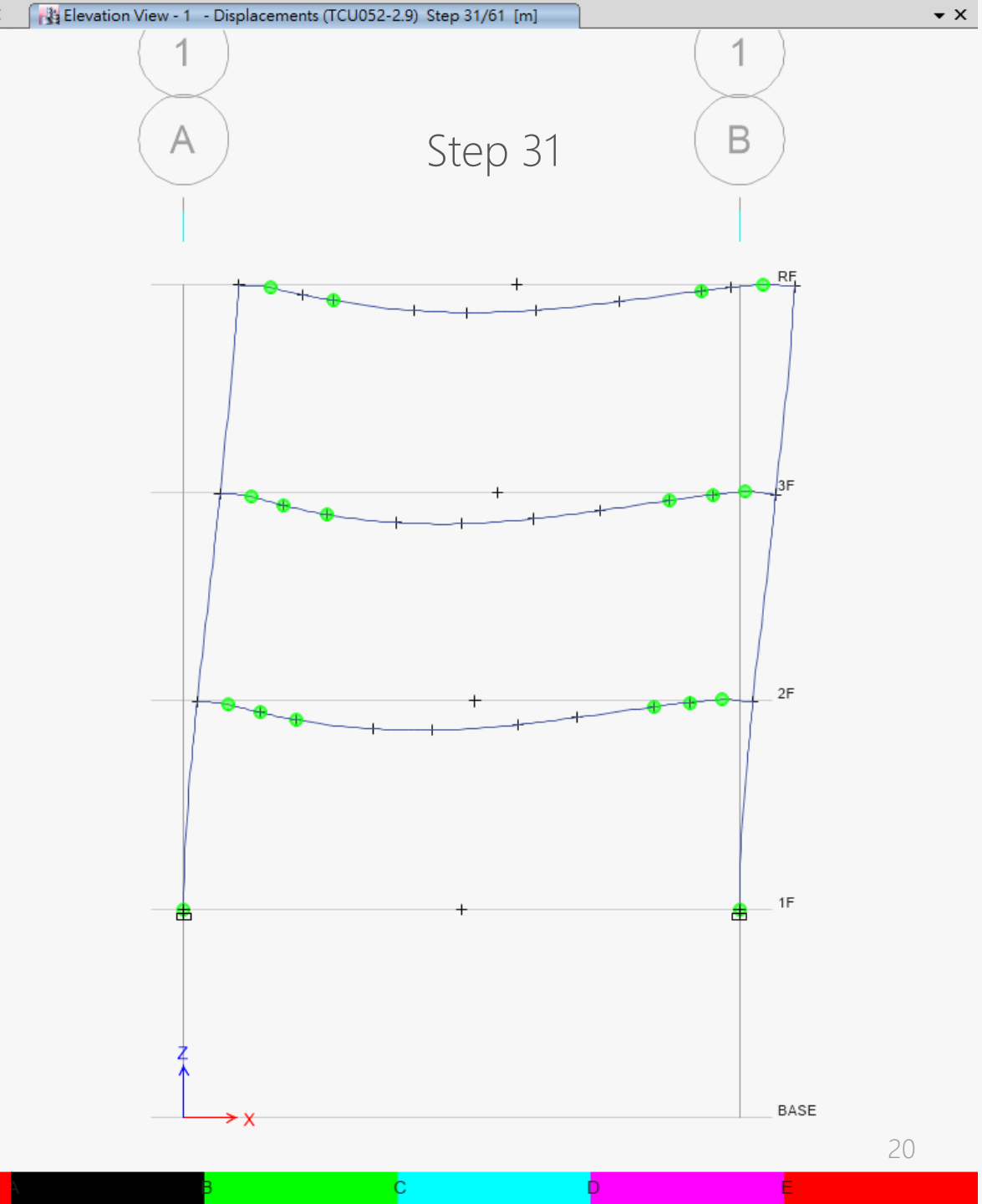
4 Define Section

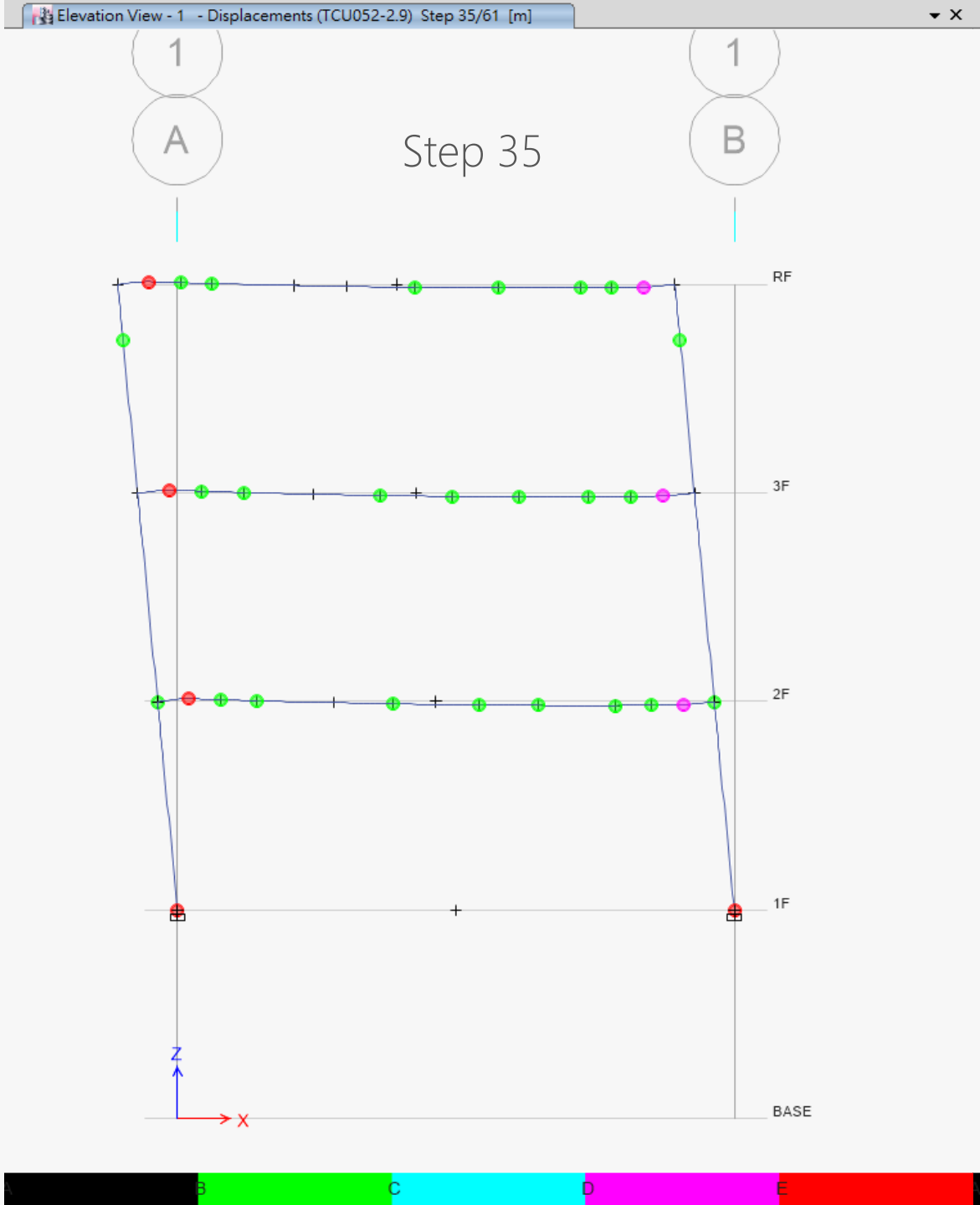
5 Assign Hinge

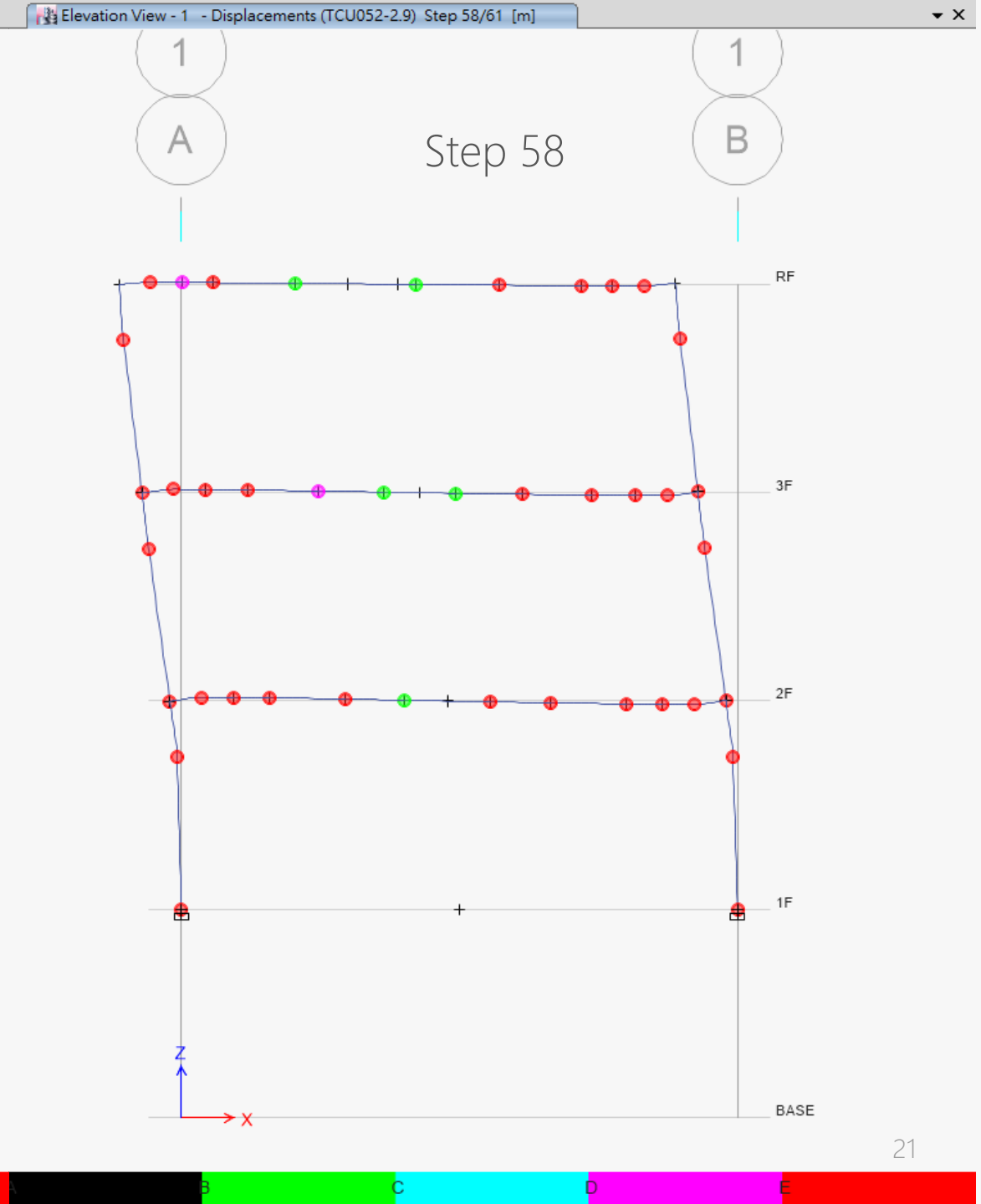

Elevation View - 1 Moment 3-3 Diagram (DL) [tonf-m]
1
1
A
B
RF
3F
2F
1F
BASE
Z
X


Elevation View - 1 Moment 3-3 Diagram (EQXP) [tonf-m]
1
1
A
B
RF
3F
2F
1F
BASE
Z
X

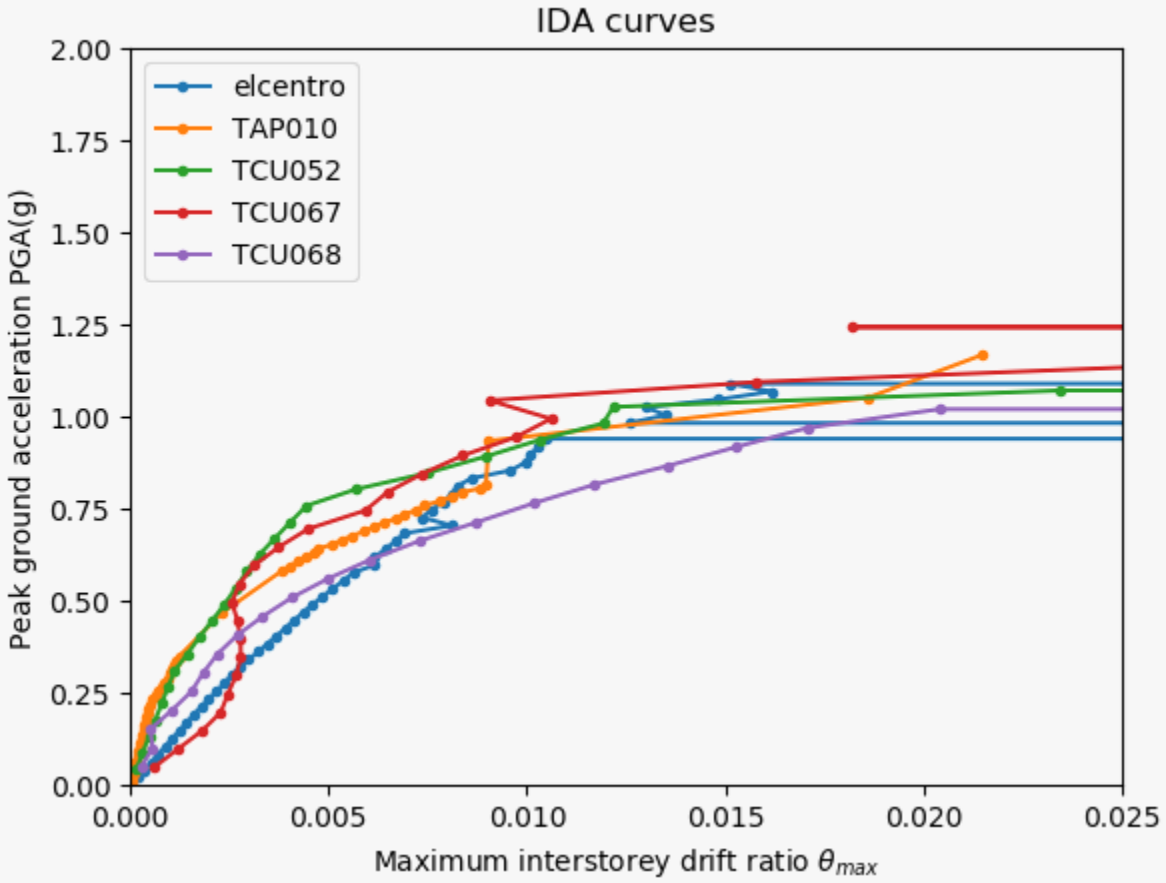

Elevation View - 1 - Displacements (TCU052-2.9) Step 28/61 [m]
1
A
1
B
Step 28
RF
3F
2F
1F
BASE
Z
X

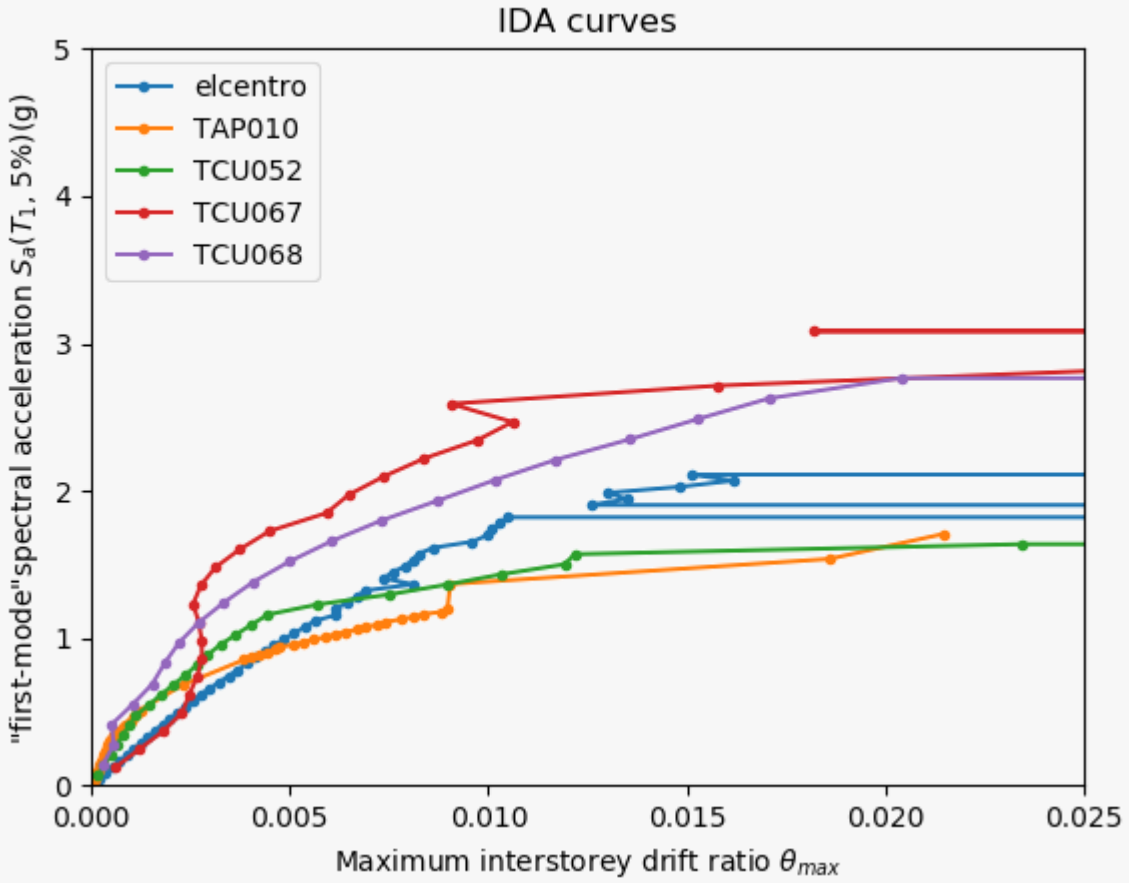

Elevation View - 1 - Displacements (TCU052-2.9) Step 31/61 [m]
1
A
1
B
Step 31
RF
3F
2F
1F
BASE
Z
X


Elevation View - 1 - Displacements (TCU052-2.9) Step 35/61 [m]
1
A
1
B
Step 35
RF
3F
2F
1F
BASE
Z
X

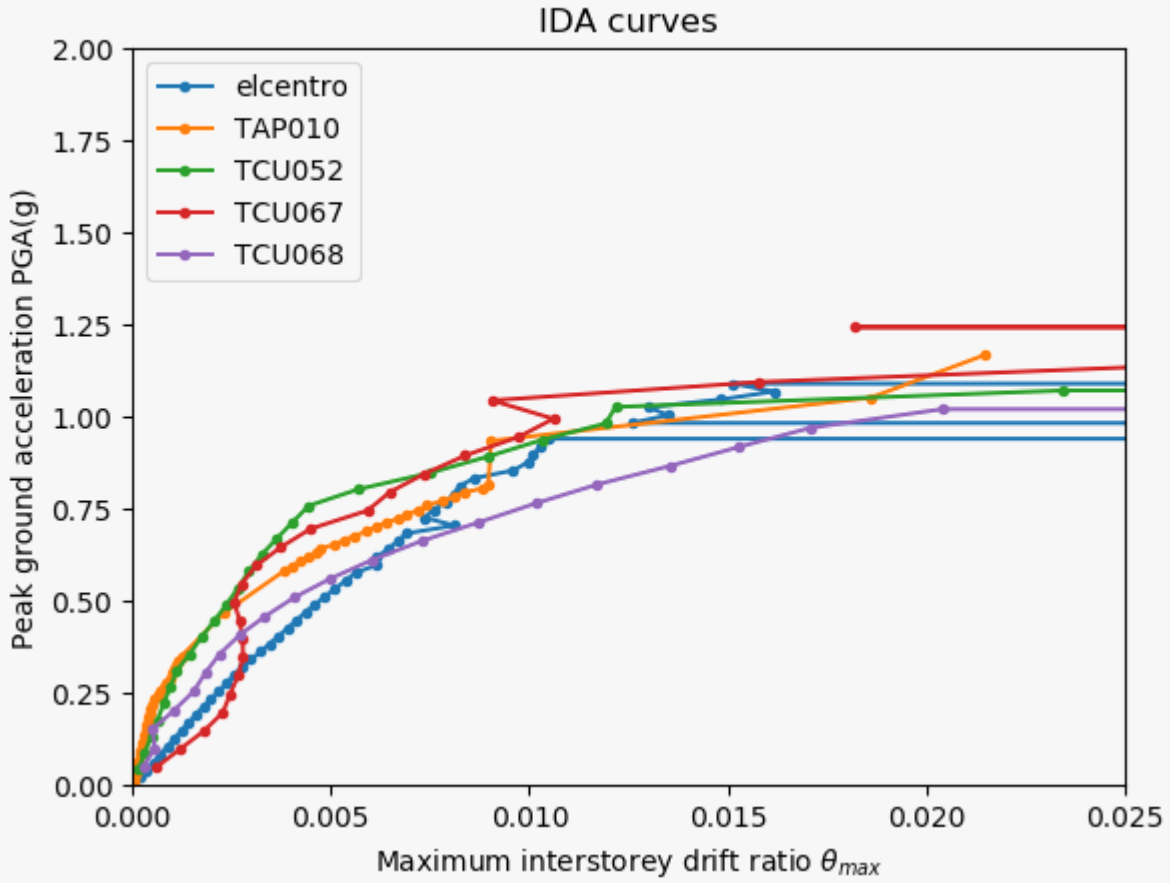

Elevation View - 1 - Displacements (TCU052-2.9) Step 58/61 [m]
1
A
1
B
Step 58
RF
3F
2F
1F
BASE
Z
X

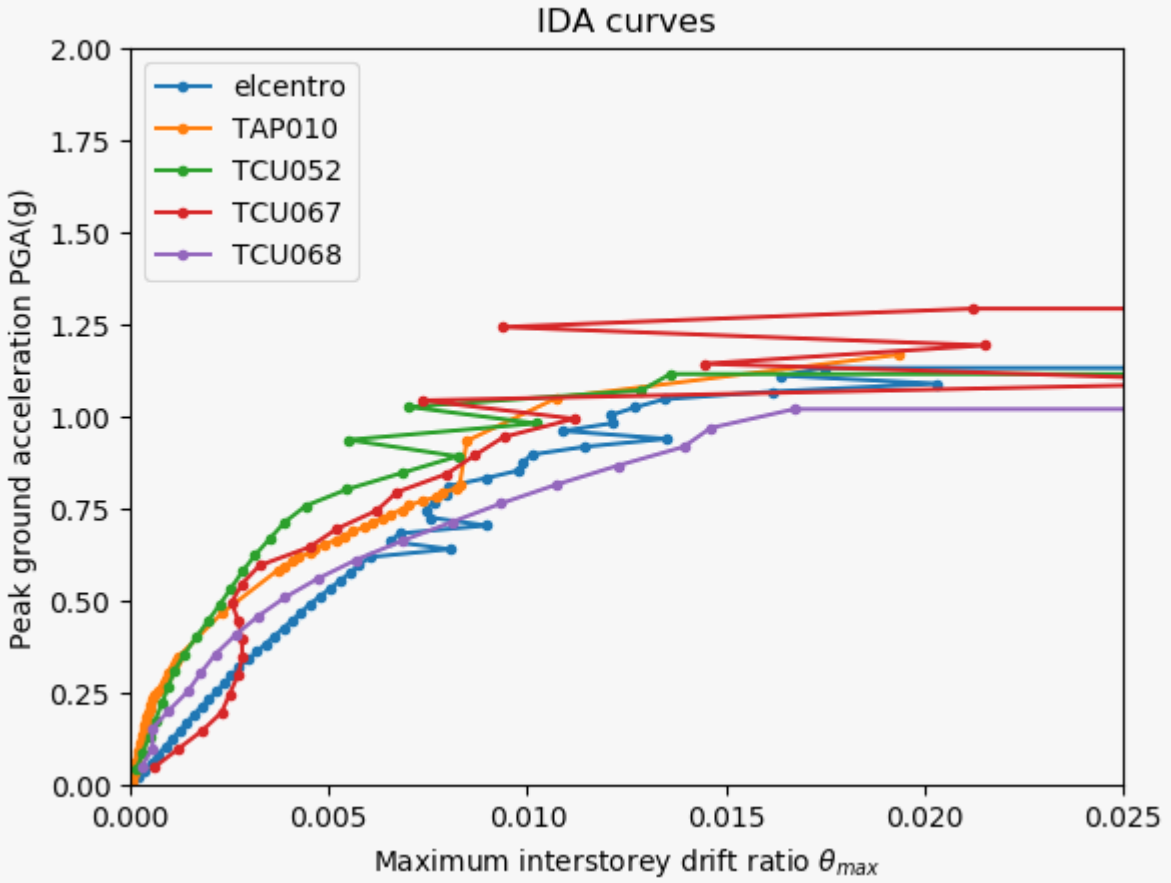
PGA vs First Mode



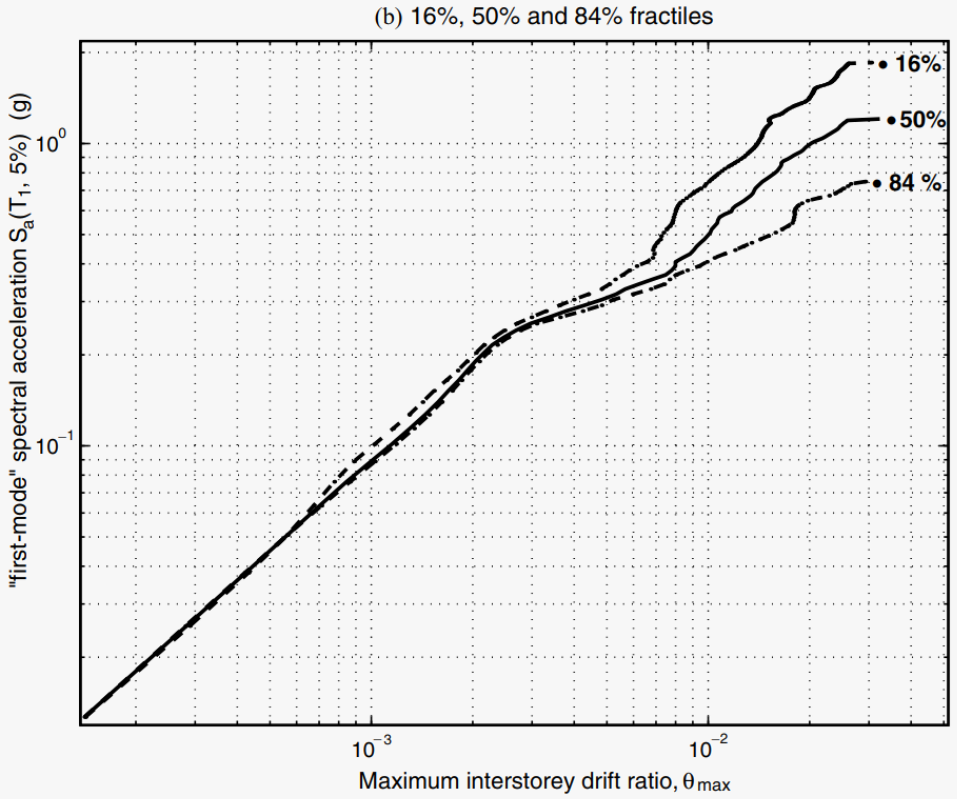


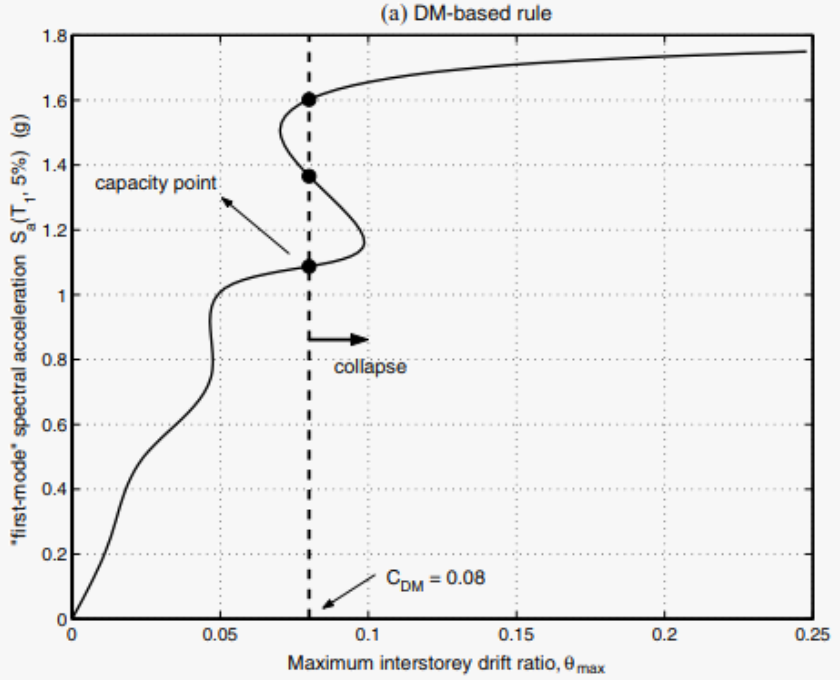
Normal vs Multi

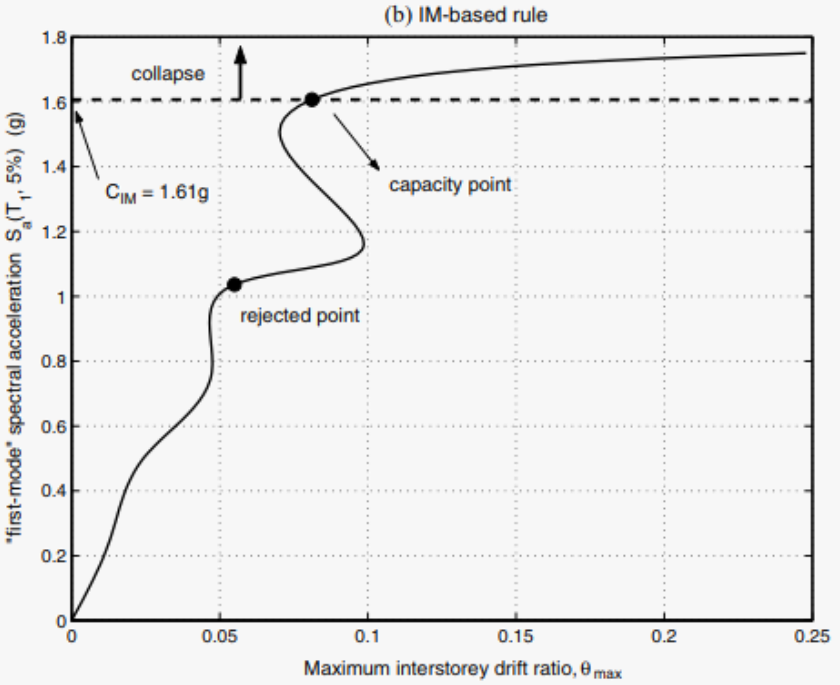




Next to Do


(b) 16%, 50% and 84% fractiles
"first-mode" spectral acceleration $S_a(T_1, 5\%)$ (g)
10^0
10^{-1}
16%
50%
84 %
10^{-3}
10^{-2}
Maximum interstorey drift ratio, θ_{max}


(a) DM-based rule
"first-mode" spectral acceleration $S_a(T_1, 5\%)$ (g)
capacity point
collapse
C_{DM} = 0.08
0
0.05
0.1
0.15
0.2
0.25
Maximum interstorey drift ratio, θ_{max}


(b) IM-based rule
"first-mode" spectral acceleration $S_a(T_1, 5\%)$ (g)
collapse
C_{IM} = 1.61g
capacity point
rejected point
0
0.05
0.1
0.15
0.2
0.25
Maximum interstorey drift ratio, θ_{max}

Roadmap


coggle
made for free at coggle.it
目的：節省鋼筋量
多點斷筋
非線性驗證
Pushover
Higher Mode
MMC
APA
MPA
First Mode
FEMA(NSP)
ATC-40
Time History
IDA
Performance Base Design
彎矩多點斷筋
三點簡化算法
三點精確算法
五點精確算法
施工成本
剪力多點斷筋
三點精確算法