

# Passive Structural Control Project I

## - Design of passive energy dissipation devices -

### 1. Structure Information

- (1) Site location : Chia-Yi City (East Part)
- (2) Soil type II, near fault considered ( $N_A = 1.37$ ,  $N_V = 1.44$ ,  $N_{A-M} = 1.30$ ,  $N_{V-M} = 1.48$ )
- (3) Size : 6 stories with 1 basement
- (4) Function : Office building
- (5) Steel frame structure
- (6) Structural system : SMRF
- (7) Structural plan and elevation as follows (the dead load provided on the table already consider the structure dead load and any additional dead load, so you don't have to include self-weight of structure members)

Table 1. Story data and design loading (Unit : t 、m<sup>2</sup>)

Story	Height (m)	Area (m <sup>2</sup> )	Dead load		Live load (t/m <sup>2</sup> )
			Weight (t)	(t/m <sup>2</sup> )	
RF	-	1215	911.25	0.75	0.5
6F	4.0	1215	850.5	0.7	0.3
5F	4.0	1215	850.5	0.7	0.3
4F	4.0	1215	850.5	0.7	0.3
3F	4.0	1215	850.5	0.7	0.3
2F	4.5	1215	850.5	0.7	0.3
Total weight : 5163.75 t					

Table 2. Beam and girder section table

Story	Section #	Dimension (mm)	A36 Steel
2F ~ RF	B1	H 600 x 250 x 12 x 18	$F_y = 2500 \text{ kg/cm}^2$
	B2	H 600 x 200 x 9 x 12	
	G1, G2	H 600 x 250 x 12 x 22	
	sb1	H 450 x 200 x 9 x 14	

Table 3. Column section table

Story	Section #	Dimension (mm)	A36 Steel
1F ~ 2F	C1	Box 700 x 700 x 22 x 22	$F_y = 2500 \text{ kg/cm}^2$
3F ~ 6F	C1	Box 600 x 600 x 25 x 25	
1F ~ 2F	C2	Box 650 x 650 x 22 x 22	
3F ~ RF	C2	Box 600 x 600 x 20 x 20	

## 2. Design Objectives

Design the passive energy dissipation devices for the specified design earthquakes. The maximum story drift ratio should not exceed the value listed in the following table. Attached are three time histories (TCU067, TCU078, and TCU109) compatible with the code spectrum for the calculation. Then you should pick the critical result.

## 3. Project Contents

### (1) Describe design objectives and individual responsibilities of team members.

#### (2) Structural information

Such as the structural system, site condition, structure loading, section dimensions, material properties and parameters of energy dissipation devices, etc.

#### (3) Design principles and procedures

The design principles and procedures of structures with energy dissipation devices.

#### (4) Design results of the energy dissipation devices

The viscoelastic damper, linear viscous damper and nonlinear viscous damper should be considered individually.

#### (5) Numerical results of the structural responses

(a) Response spectrum analyses and discussion.

(b) Show the comparisons of displacement and acceleration responses between the bare frame and the frame with dampers, and discuss the energy dissipation history.

(c) Show the hysteretic loop of your design damper.

(d) Structure response from nonlinear time history analysis under TCU052, TCU072 and HWA011( optional) earthquake.

#### (6) Summary and Discussion

(a) The three dampers design results

(b) Comparison of the three passive energy dissipation devices.

(c) Comparison of structure response between SMRF and SMRF+dampers.

(d) Etc (anything you want to discuss)

## 4. Additional Information

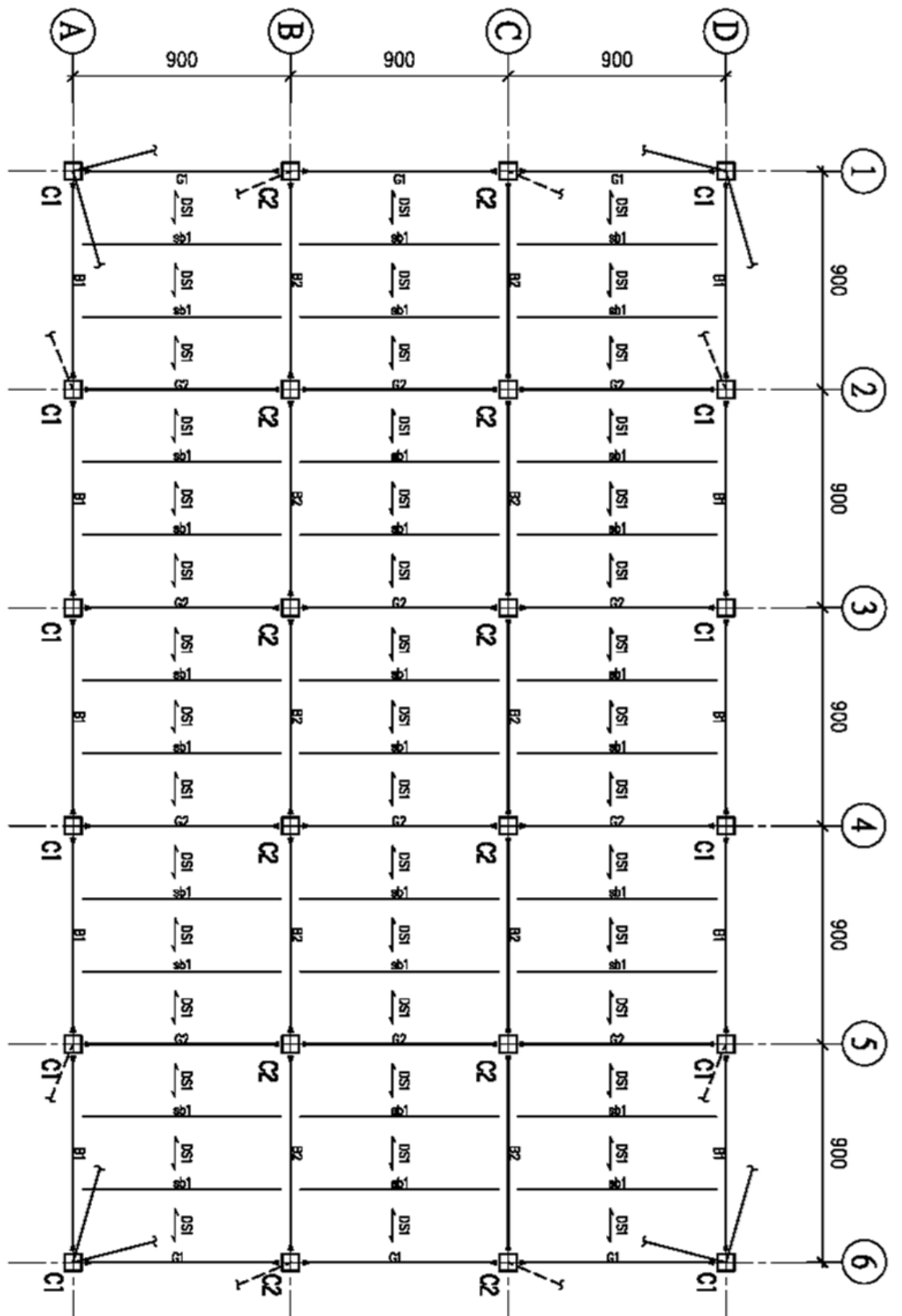
- (1) Please save and hand over team project files (including the written PDF file, the PPT files and the model files) in a CD disk copy. The dates will be announced later.
- (2) Please refer to the following table for the design object and parameters for the calculations. Also you can write down other sensible assumptions you needs.

Team	Max. Drift Ratio	VE $\gamma=300\%$	Linear Viscous Damper	Nonlinear Viscous Damper
1	0.010	VE-1 , T=20°	$\alpha=1.0$	$\alpha=0.3$
2	0.010	VE-2		$\alpha=0.6$
3	0.012	VE-1 , T=30°		$\alpha=0.3$
4	0.012	VE-2		$\alpha=0.6$
5	0.015	VE-1 , T=20°		$\alpha=0.3$

- (3) Please refer to the following design charts for the parameters with VE materials (3M ISD 110 、VEM Material).

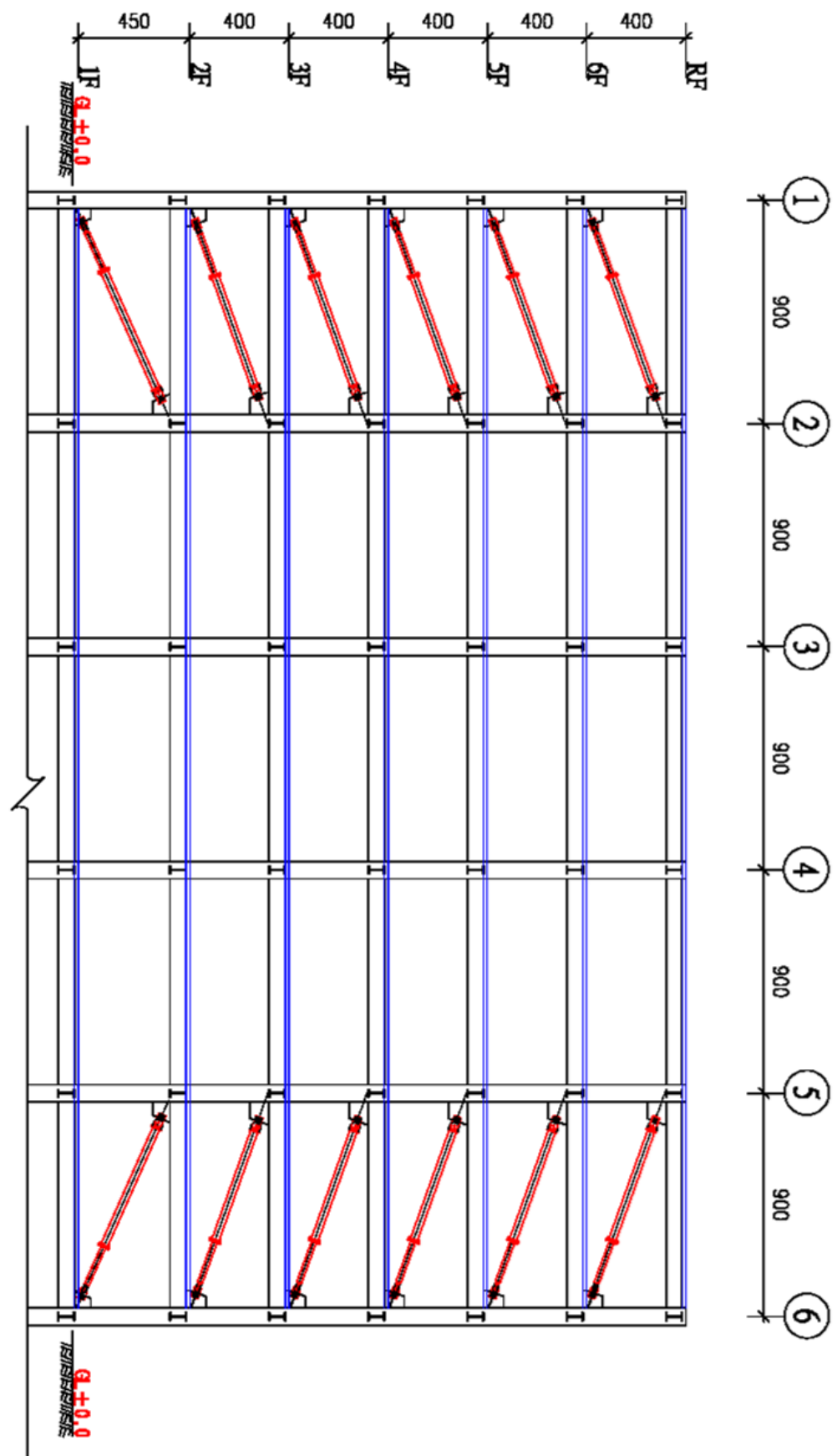
## 5. Group Members (5 groups for 4 students)

Group 1	劉文學	謝旻竹
	黃子柔	江亭瑩
Group 2	黃昱竣	陳 雋
	鍾侑津	林芃妤
Group 3	林佑蔓	黃仲均
	郭珈均	鄧凱文
Group 4	蔡東樺	乃宥然
	劉德謙	高翊書
Group 5	林廣杰	謝孟益
	林偉聖	

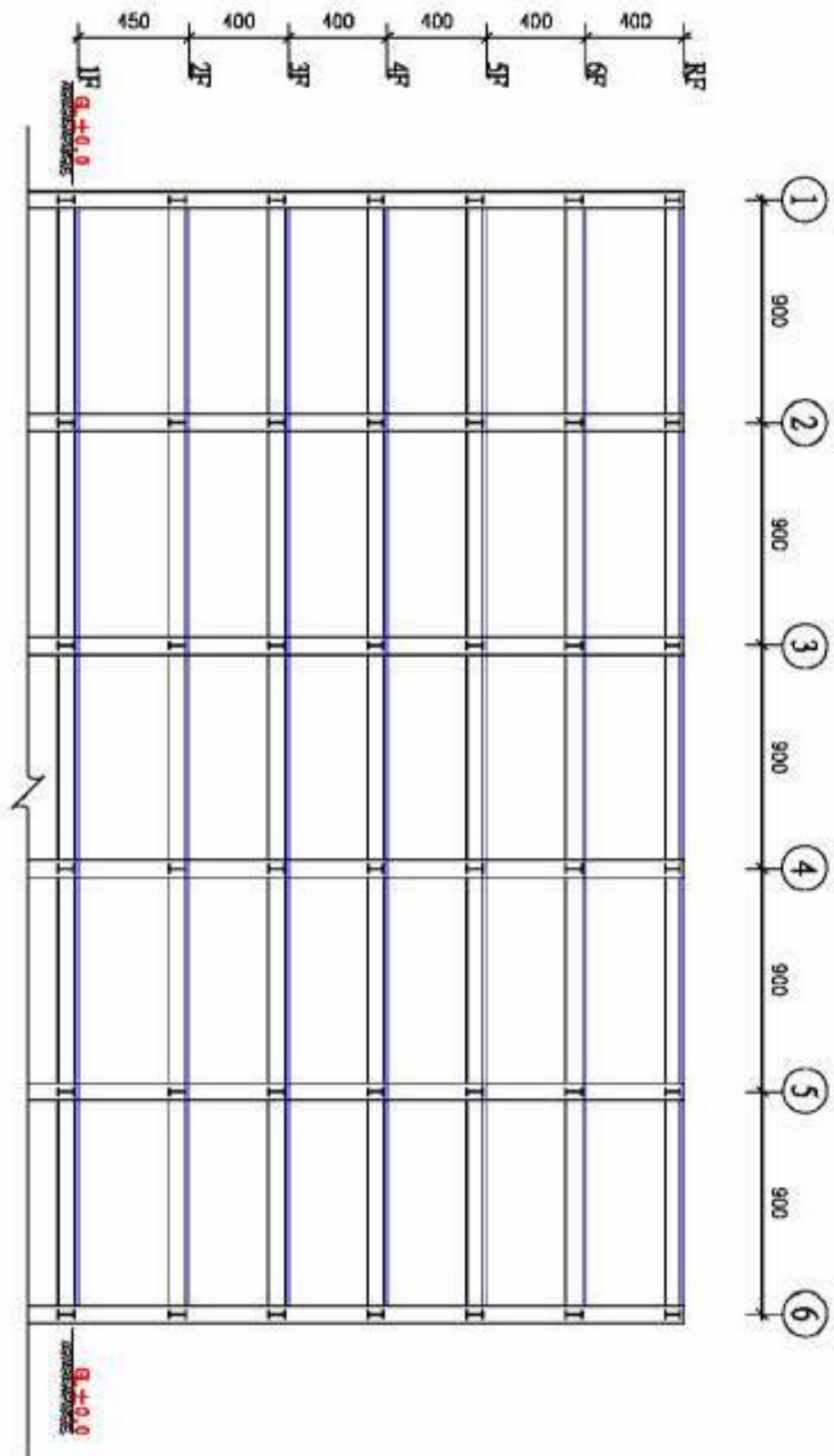


**標準層結構平面圖** S:1/250

Typical Floor Plan

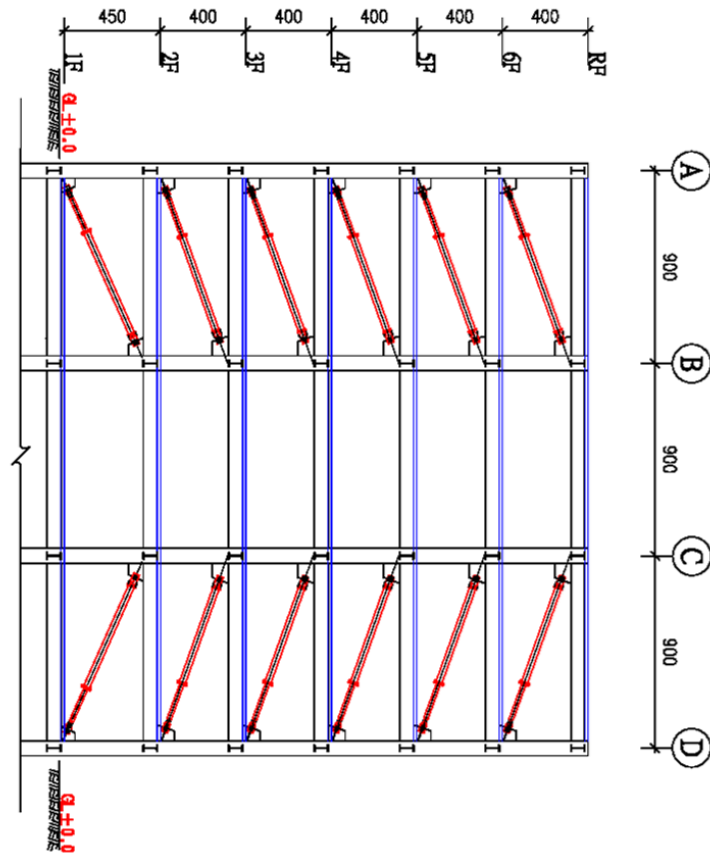


Line-A and Line-D Elevation



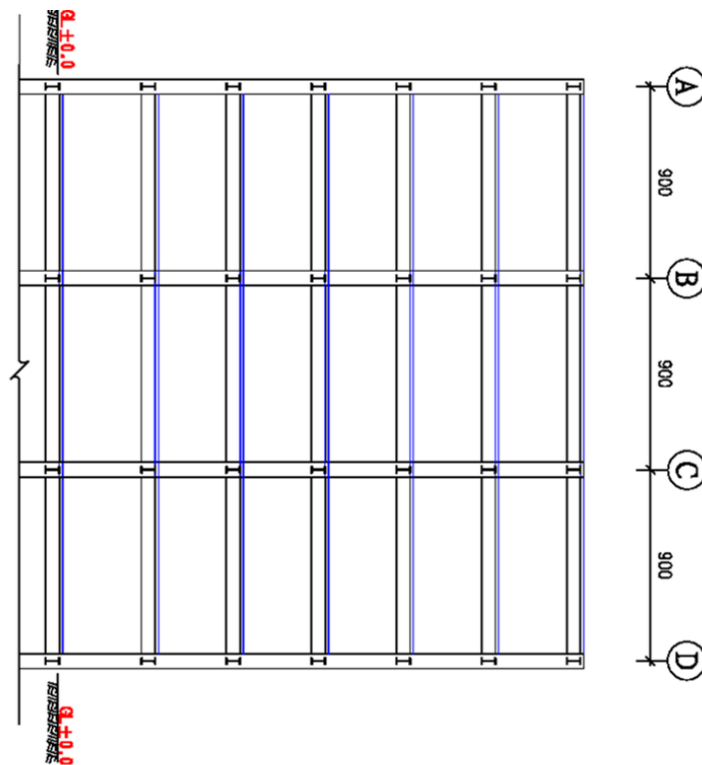
Line-B and Line-C Elevation

**LINE 1、6 結構立面圖** S:1/250  
 註：1.樓板高低差詳建築圖，梁高徑以建築圖為準。



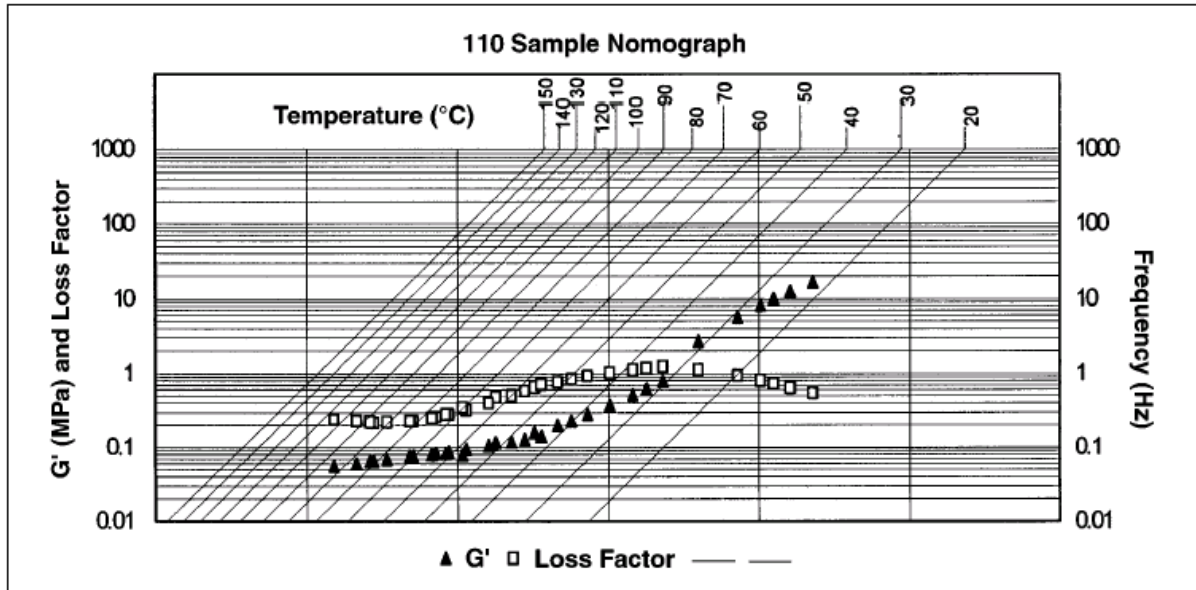
Line-1 and Line-6 Elevation

**LINE 2~5 結構立面圖** S:1/250  
 註：1.樓板高低差詳建築圖，梁高徑以建築圖為準。



Line-2-5 Elevation

## VE-1



## VE-2

