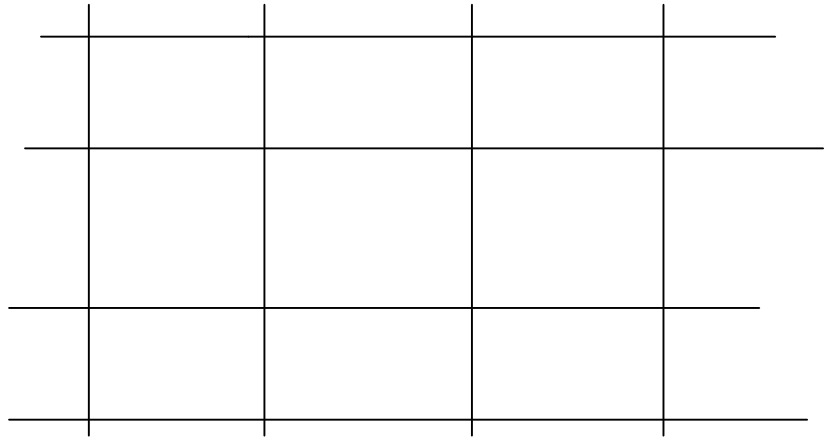
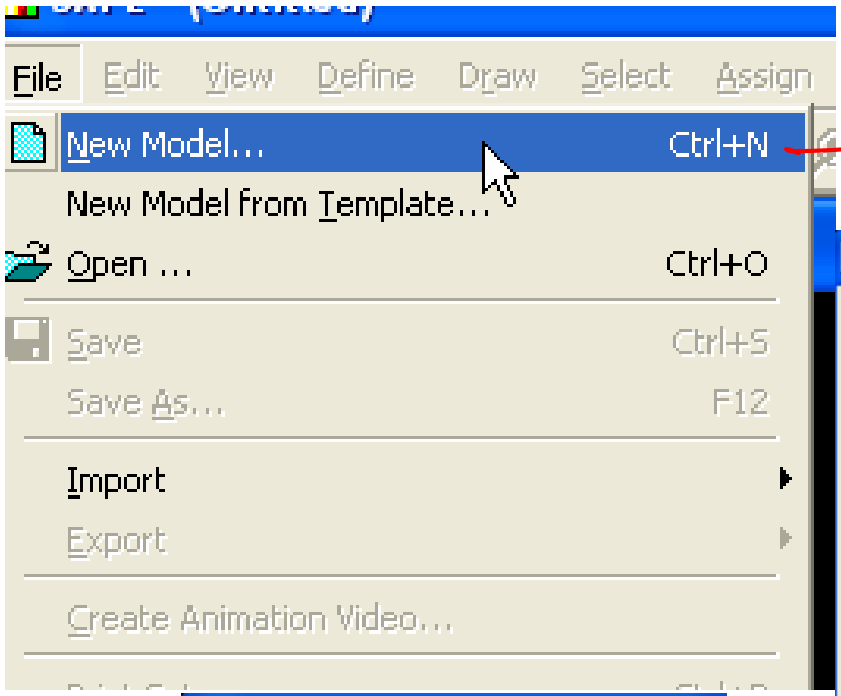
CSI_SAFE_V8.0.8_UPDATE-LND:
-=-=-=-=-=-=-=-=-=-=-=-=-=-=-

1) copy "README.TXT" and "Safe.exe" into your install dir, overwrite when prompted

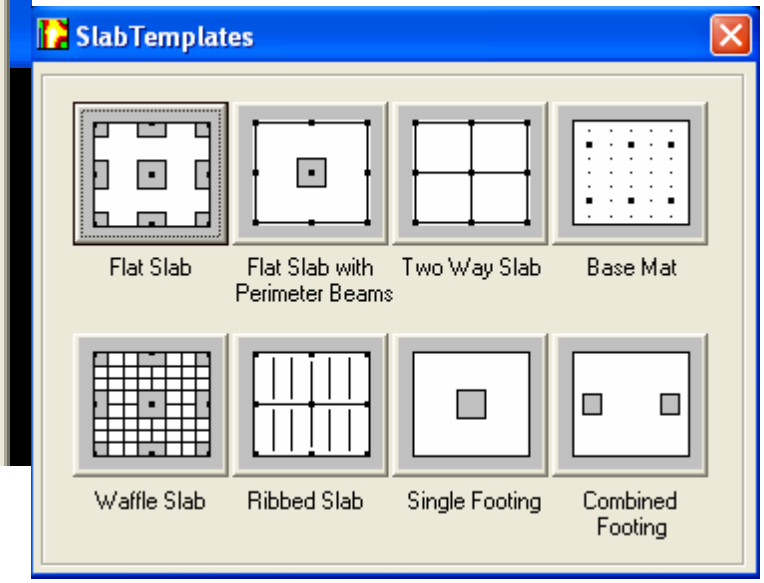
2) run "CsiSafe808.exe" from "\LEGEND" dir and apply patch, use "lservrc" when needed

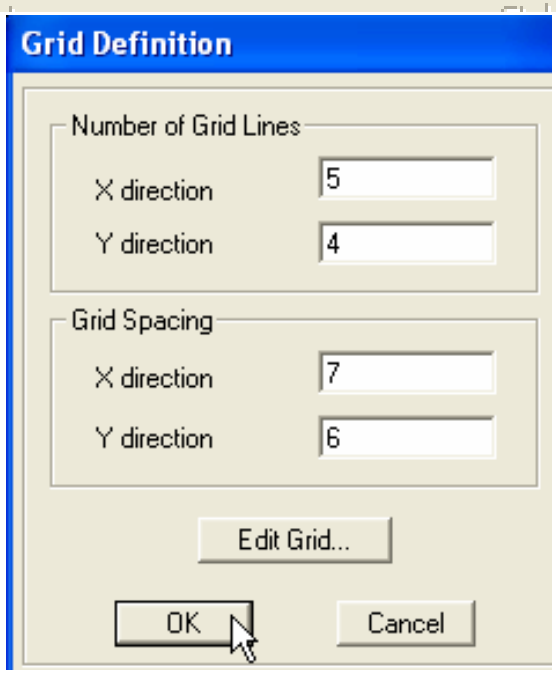
3) enjoy another fine LEGEND-release!

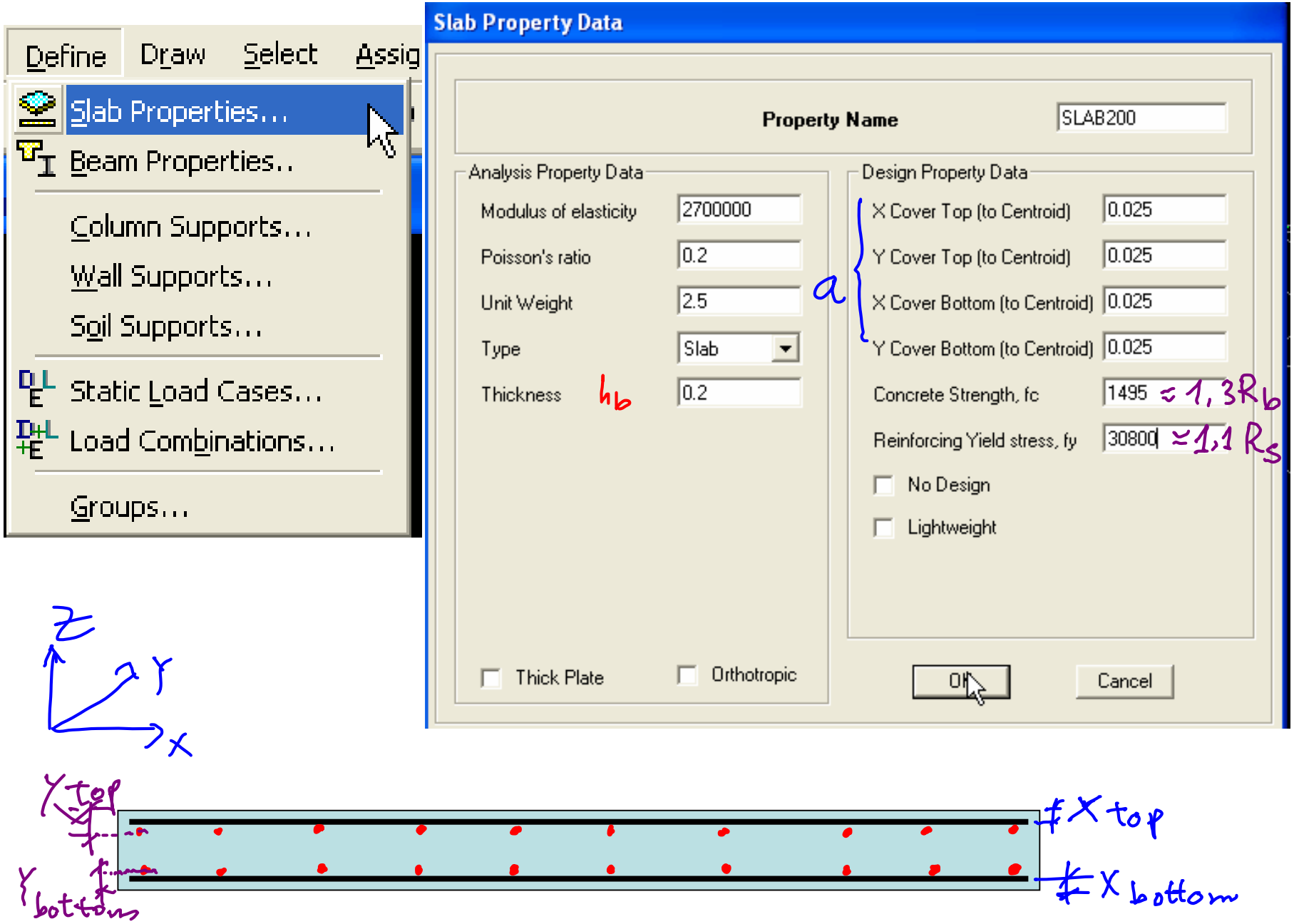


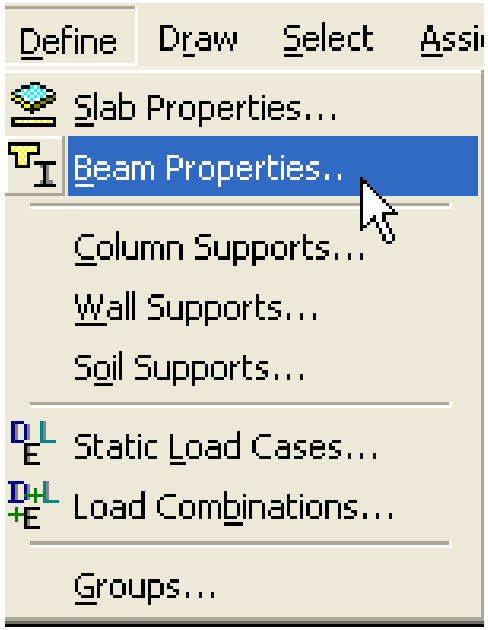

File
Edit
View
Define
Draw
Select
Assign
New Model... Ctrl+N
New Model from Template...
Open ... Ctrl+O
Save Ctrl+S
Save As... F12
Import
Export
Create Animation Video...

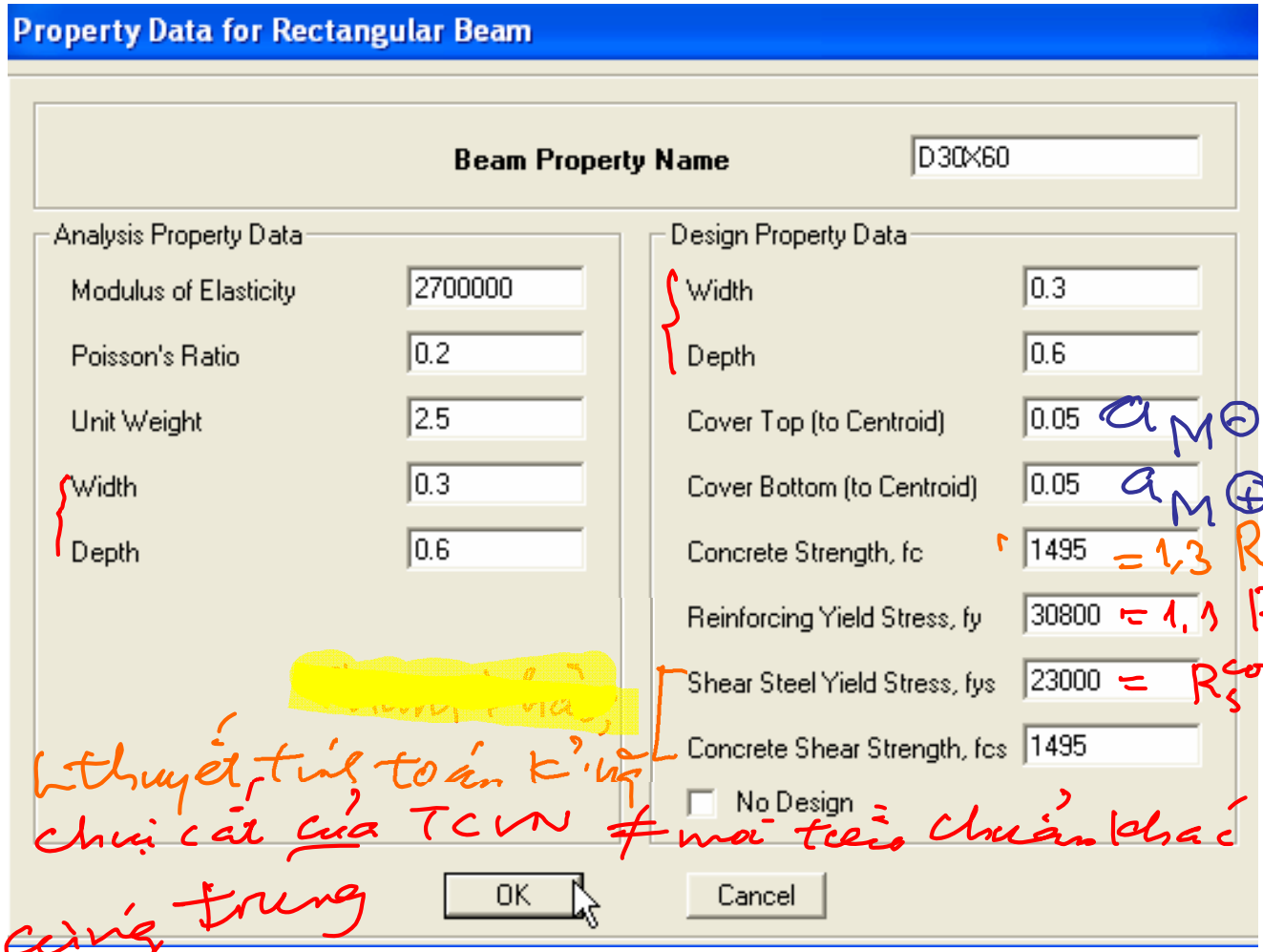
Tạo Lưới

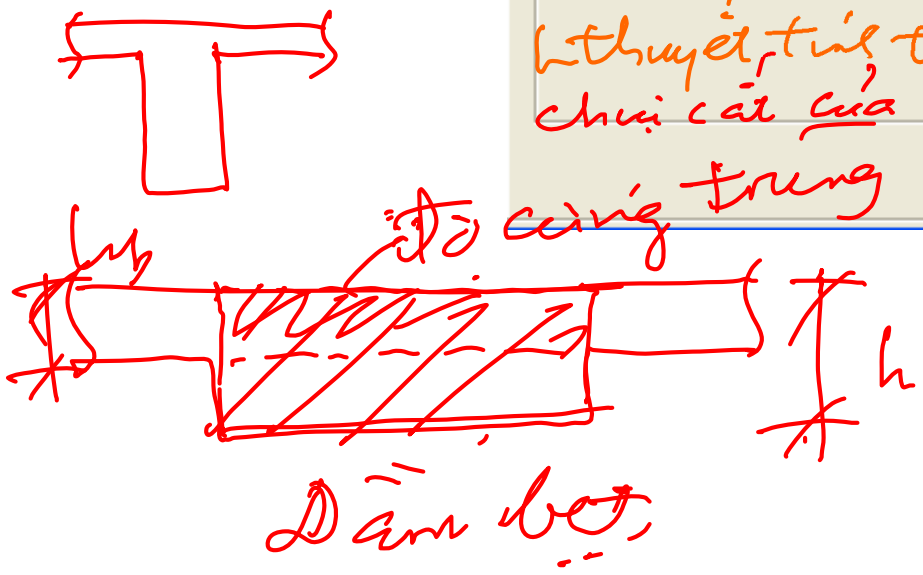

SlabTemplates
Flat Slab
Flat Slab with Perimeter Beams
Two Way Slab
Base Mat
Waffle Slab
Ribbed Slab
Single Footing
Combined Footing


Grid Definition
Number of Grid Lines
X direction 5
Y direction 4
Grid Spacing
X direction 7
Y direction 6
Edit Grid...
OK
Cancel


Define
Draw
Select
Assig
Slab Properties...
Beam Properties..
Column Supports...
Wall Supports...
Soil Supports...
Static Load Cases...
Load Combinations...
Groups...
Slab Property Data
Property Name
SLAB200
Analysis Property Data
Modulus of elasticity
2700000
Poisson's ratio
0.2
Unit Weight
2.5
Type
Slab
Thickness
0.2
Design Property Data
X Cover Top (to Centroid)
0.025
Y Cover Top (to Centroid)
0.025
X Cover Bottom (to Centroid)
0.025
Y Cover Bottom (to Centroid)
0.025
Concrete Strength, fc
1495
Reinforcing Yield stress, fy
30800
No Design
Lightweight
Thick Plate
Orthotropic
OK
Cancel
Z
Y
X
Y top
Y bottom
f X top
f X bottom


Define
Draw
Select
Slab Properties...
Beam Properties...
Column Supports...
Wall Supports...
Soil Supports...
Static Load Cases...
Load Combinations...
Groups...

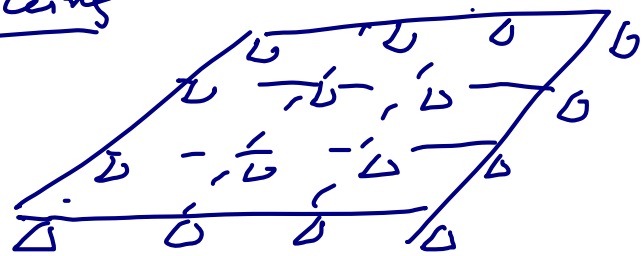

Property Data for Rectangular Beam
Beam Property Name
D30X60
Analysis Property Data
Modulus of Elasticity
2700000
Poisson's Ratio
0.2
Unit Weight
2.5
Width
0.3
Depth
0.6
Design Property Data
Width
0.3
Depth
0.6
Cover Top (to Centroid)
0.05
Cover Bottom (to Centroid)
0.05
Concrete Strength, fc
1495
Reinforcing Yield Stress, fy
30800
Shear Steel Yield Stress, fys
23000
Concrete Shear Strength, fcs
1495
No Design
OK
Cancel


Độ cứng trung
h
Dầm bờ

"Chân"

Gối

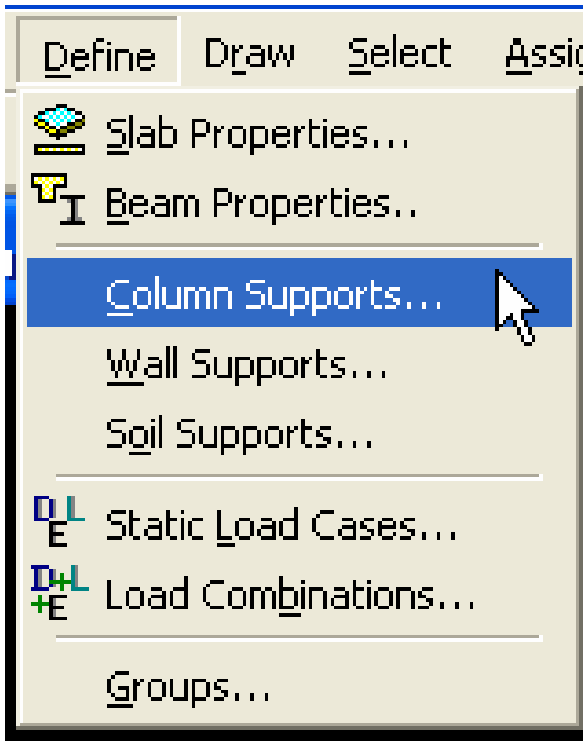
(1) gối cứng



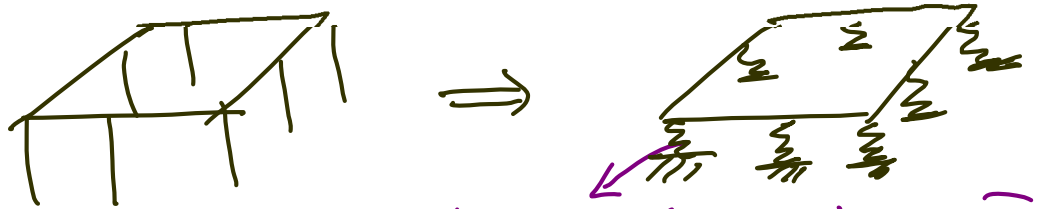
Point Restraint { Ngàm / Khớp

(2) gối đàn hồi (kN/m)

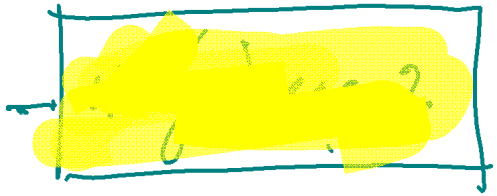
a) Tại 1 nút



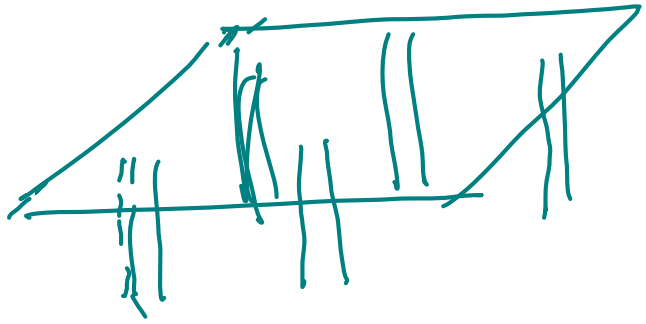
– mô tả cột đỡ sàn



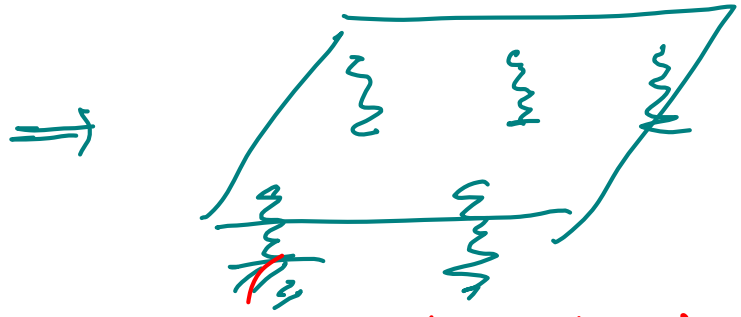
độ cứng của gối đàn hồi này được tính từ { (EJ) cột / # tầng nhà



nền cọc

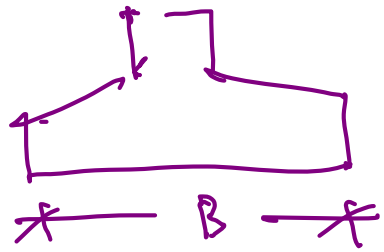


Cọc ép



$$K_{\text{Column support}} = \frac{\text{Lực tác dụng lên cọc}}{\text{Độ lún cọc}} \quad (T/m)$$

MÓNG BĂNG

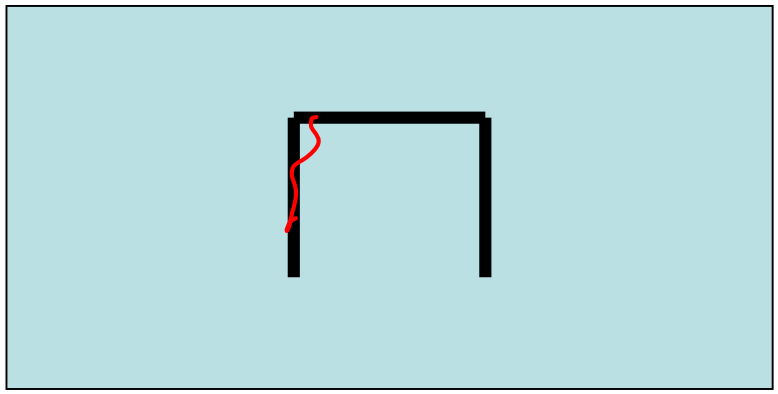


a

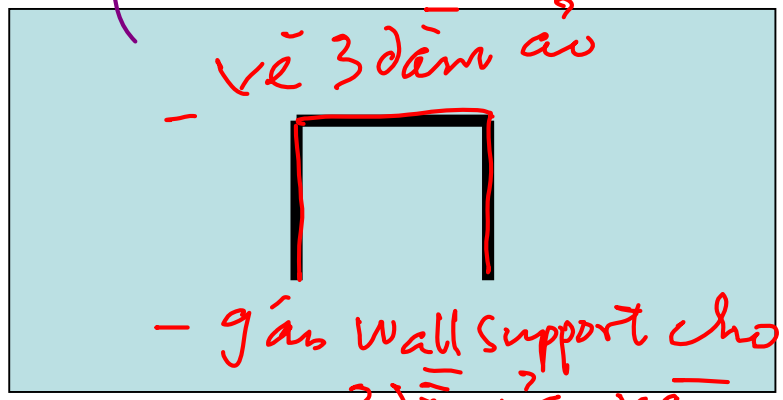
$$K = C_z \times B a$$

b) Wall Support (đường) (kN/m²)

vẽ sàn



Thật



- vẽ 3 dầm ảo
- gán wall support cho 3 dầm ảo này

Vẽ trong Safe

⇒ máy hiểu

có gối xuy quanh vách cứng

K wall support ⇒ máy tính, tiết $\left\{ \begin{array}{l} E; \nu, \\ \delta_{dầy} \\ H_{tầng} \end{array} \right\}$

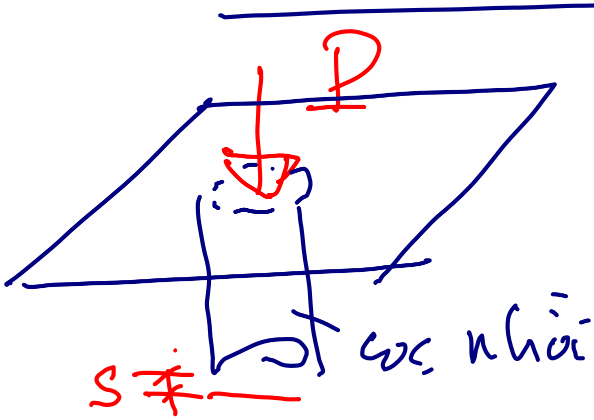
c) Soil support (kN/m³)

(1) nền đàn hồi ≡ Móng bè trên nền thiên nhiên,
gia cố cọc cát,
cừ tràm

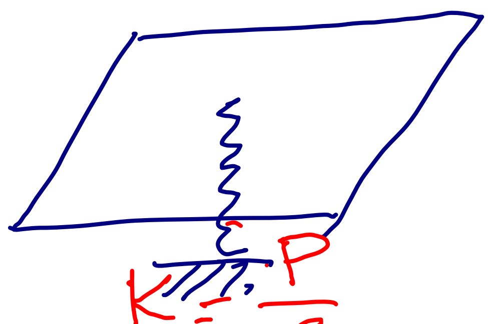
$$K = \boxed{C_z}$$

(2) nền đàn hồi ≡ diện tích cọc

$$K = \frac{P}{S F_{cọc}}$$

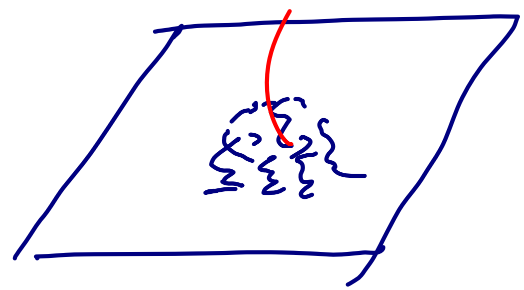


kN/m



Dùng Column support

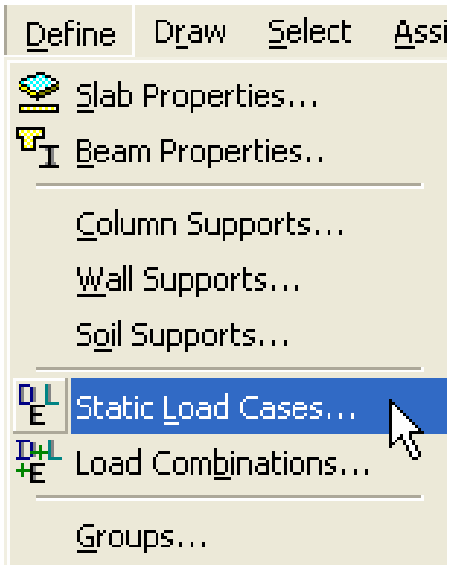
kN/m

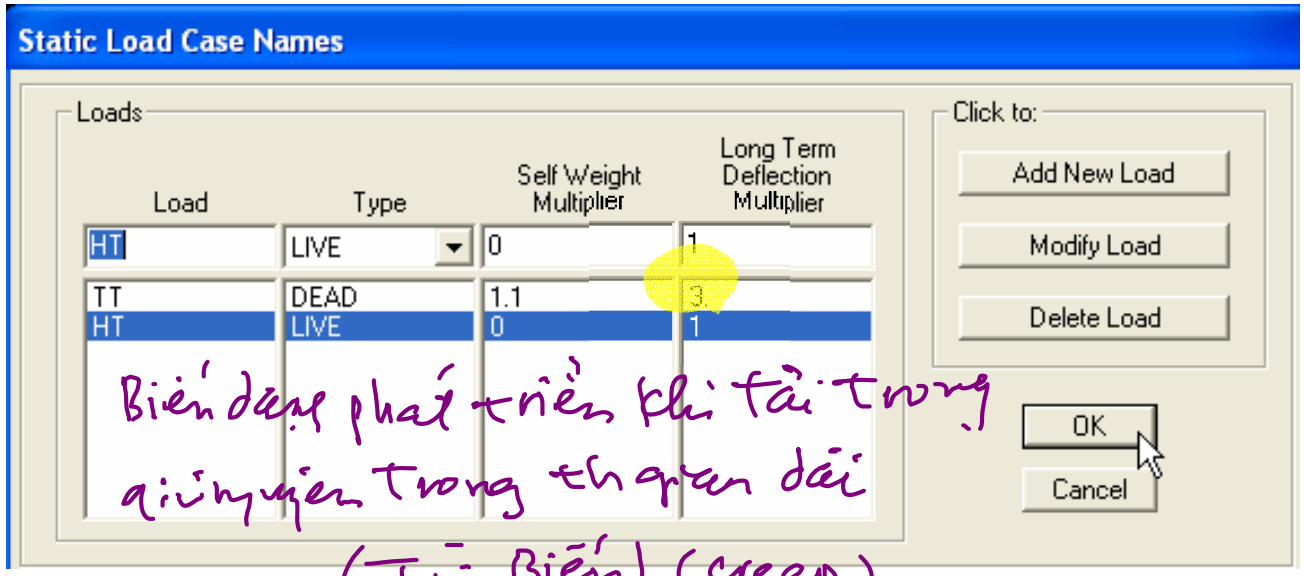


Soil support

kN/m³

$$F_{cọc} = \frac{\pi D^2_{cọc}}{4}$$





Biến dạng phát triển khi tải trọng giữ nguyên trong th gian dài

(Từ Biến) (creep)

Đàn hồi - độ võng $f = \dfrac{\text{HÀm (Tải, sơ đồ, nhịp)}}{EJ}$

BTCT $f = \dfrac{\text{HÀm (Tải, sơ đồ, nhịp)}}{B}$

Thường $B \ll EJ$

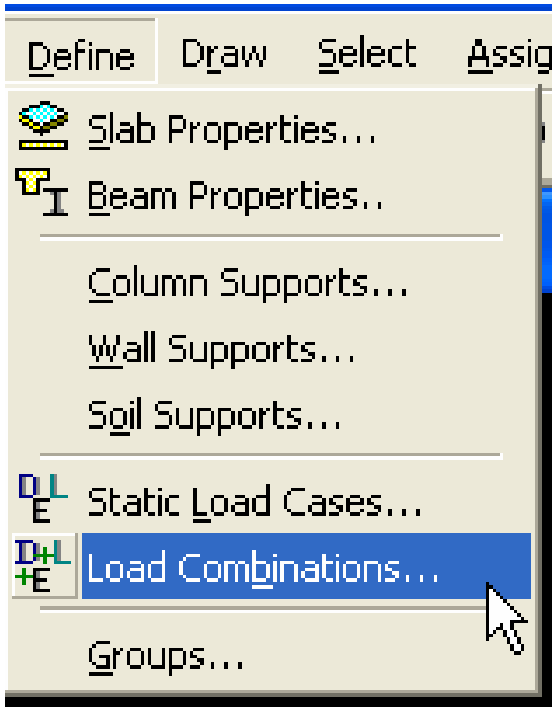
$\rightarrow f^{(EJ)}_{máy} \ll f^{(B)}_{thật}$

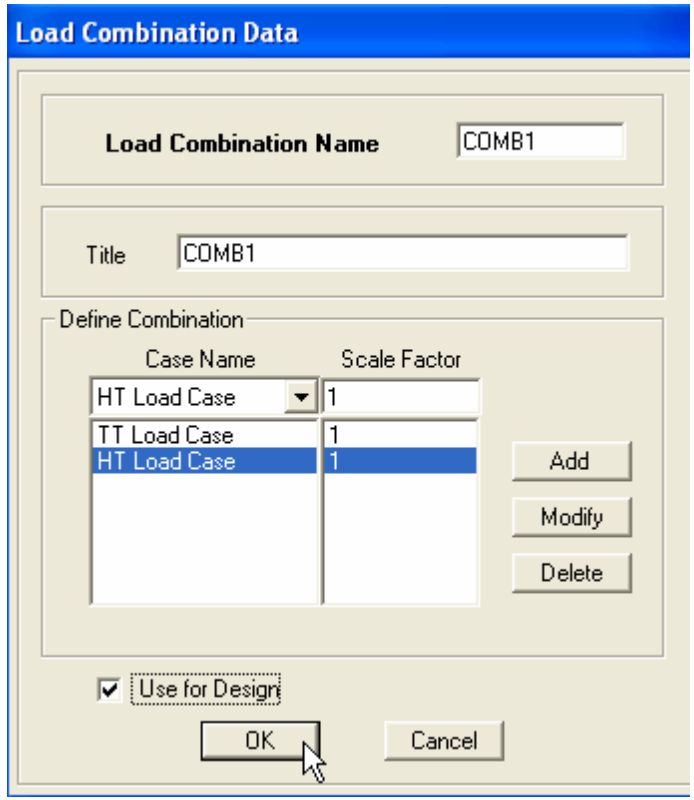
$\rightarrow$ không thực tế

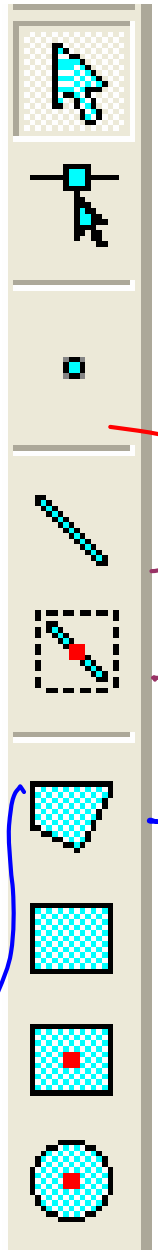
B → độ cứng của c kiện BTCT

+ vật liệu, KTCD, cốt thép

+ Tải trọng ngắn hạn / dài hạn

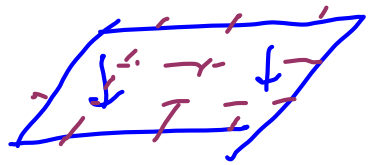

Define
Draw
Select
Assig
Slab Properties...
Beam Properties..
Column Supports...
Wall Supports...
Soil Supports...
Static Load Cases...
Load Combinations...
Groups...


Load Combination Data
Load Combination Name
COMB1
Title
COMB1
Define Combination
Case Name
Scale Factor
HT Load Case
1
TT Load Case
1
HT Load Case
1
Add
Modify
Delete
Use for Design
OK
Cancel



chuyển đổi chế độ chọn / vẽ

Reshape → điều chỉnh hình dạng đối tượng bằng cách kéo các nút của nó

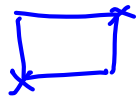
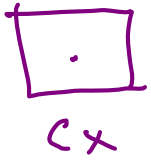


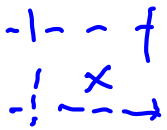
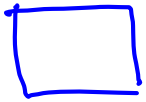
→ vẽ nút (ảo) | gán gói
| gán tải tập trung

→ vẽ dầm → click 2 nút (trái → phải
(dưới → trên

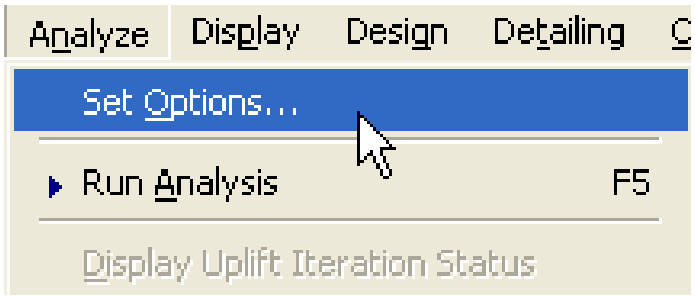
→ vẽ nhanh dầm

→ vẽ sàn đa giác

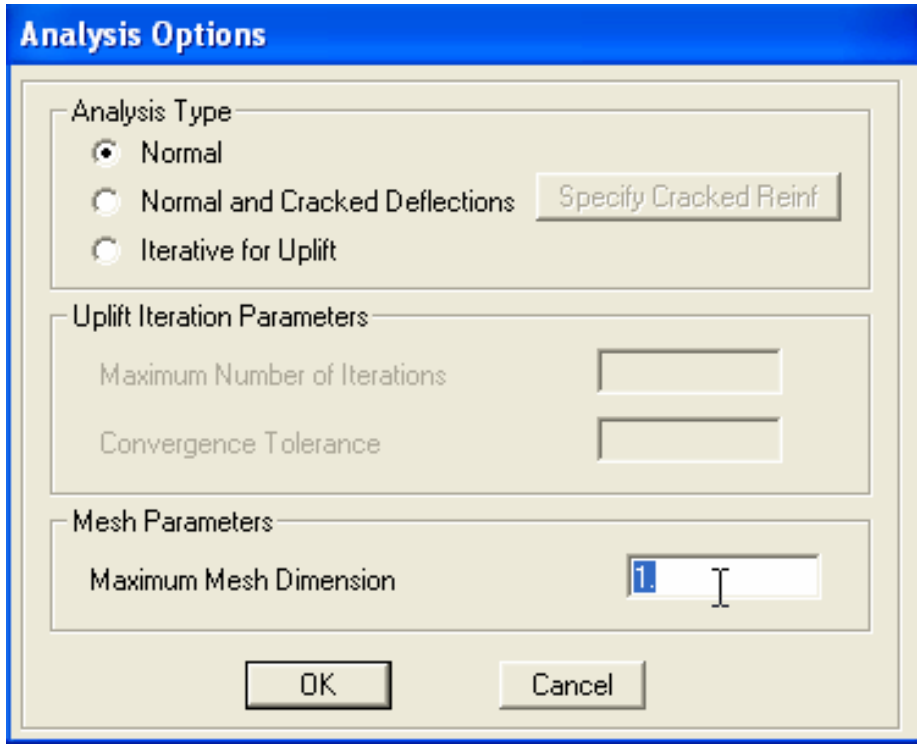
→ vẽ  ; hoặc cho | -Tâm
- cx
- cy
⇒ 

→ vẽ nhanh  ⇒ 

→ vẽ sàn tròn


Analyze
Display
Design
Detailing
Set Options...
Run Analysis
F5
Display Uplift Iteration Status

chia lưới ảo


Analysis Options
Analysis Type
Normal
Normal and Cracked Deflections
Specify Cracked Reinf
Iterative for Uplift
Uplift Iteration Parameters
Maximum Number of Iterations
Convergence Tolerance
Mesh Parameters
Maximum Mesh Dimension
1.
OK
Cancel

Gán

Assign | Analyze | Display | De

- Slab Properties.. — Đặc trưng sàn
- Slab Offset...
- Slab Rib Locations...
- Beam Properties... — Đặc trưng dầm
- Beam Offset...
- Opening — Ô trống

Gối

- Point Restraints... → gối cứng
- Column Supports...
- Wall Supports...
- Soil Supports...

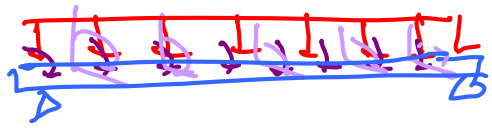
gối đàn hồi: Tại nút / theo đường / theo mặt

K
Lực/Dài
Lực/Dài²
Lực/Dài³

- Releases... — Gỡ bỏ momen Lđầu thanh

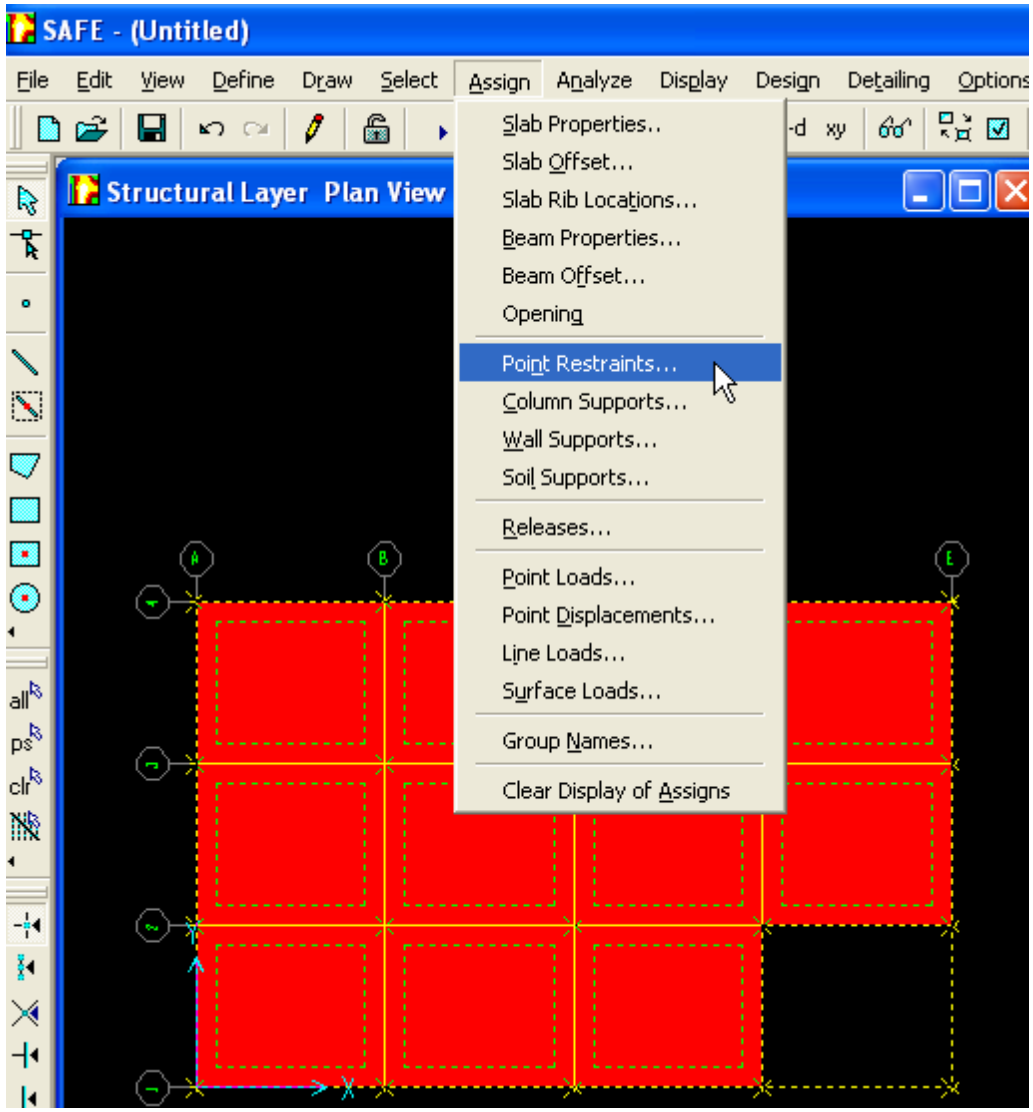
Tải

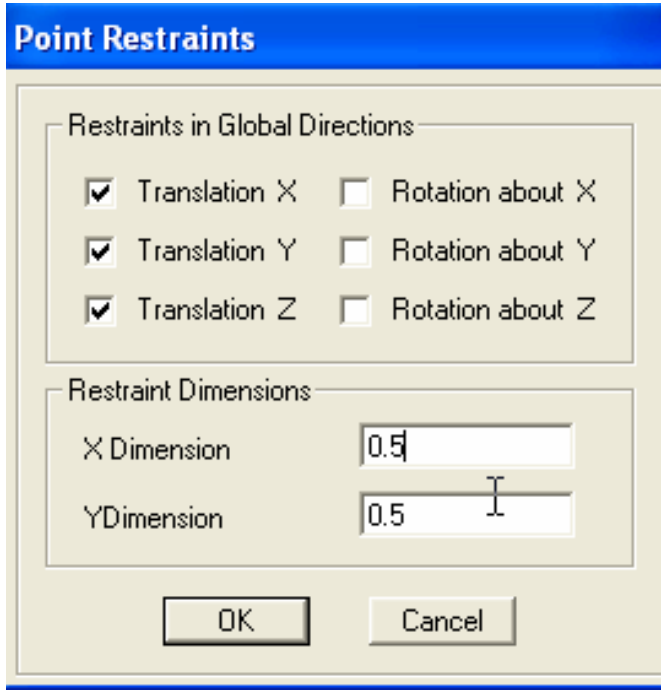
- Point Loads... — Tập trung Tại Nút ← Pz, Mx, My
- Point Displacements... — chỉ vị cưỡng Bức
- Line Loads... — Tải fân bố đều trên dầm
- Surface Loads... — Tải fân bố trên Sàn

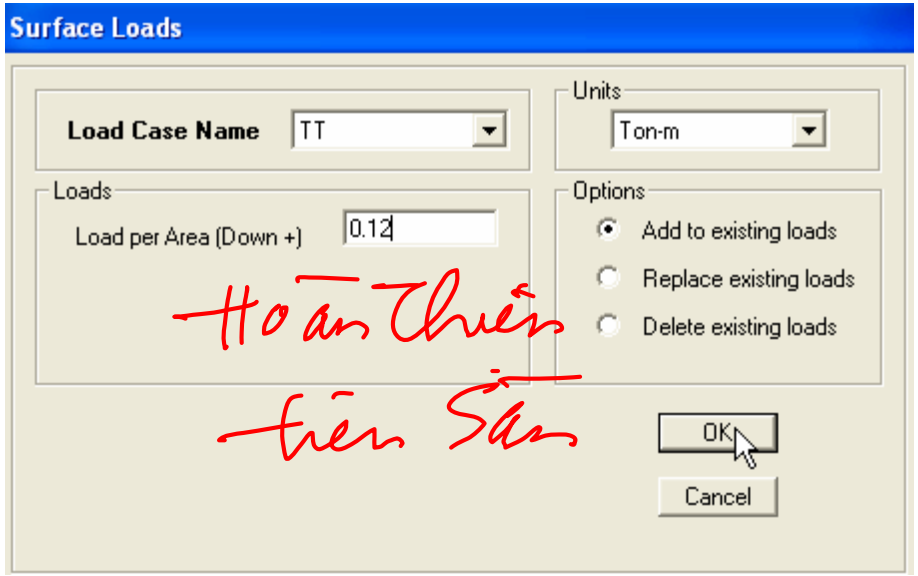


Tải ↓ M. uốn, M. xoắn

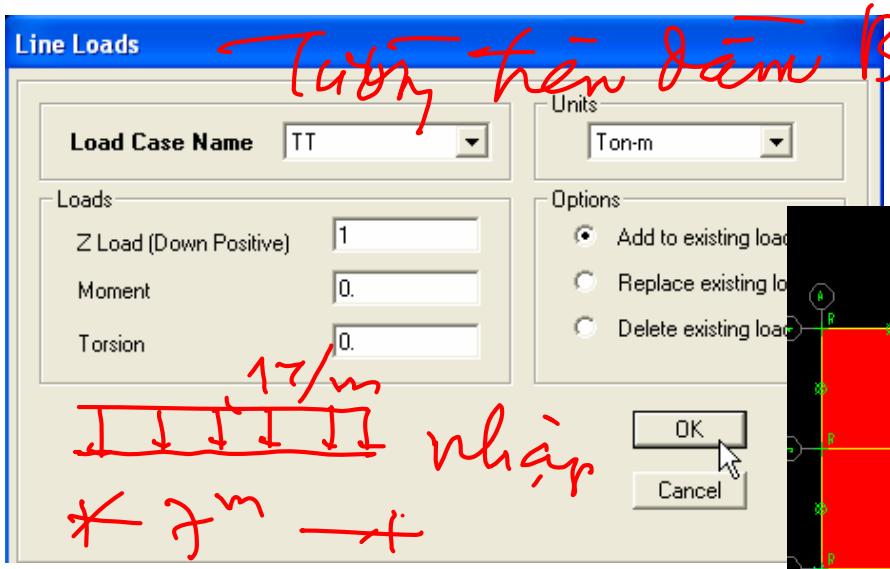
- Group Names... — gán nhóm: Vẽ m/h nhanh, gán nhanh; Lấy cùng kquả t.kế, mặc dù Nội Lực ≠ nhau
- Clear Display of Assigns

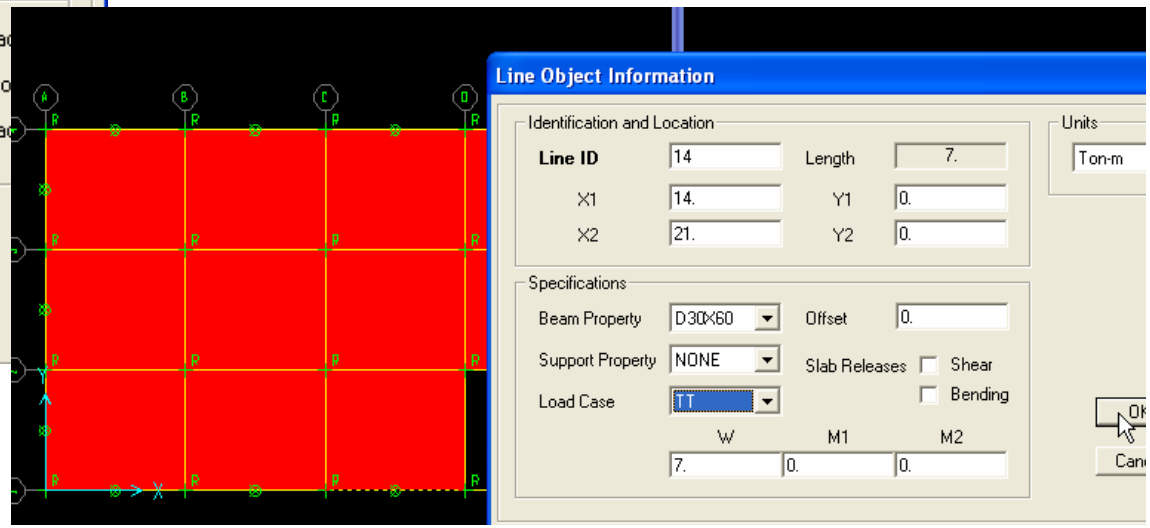

SAFE - (Untitled)
File Edit View Define Draw Select Assign Analyze Display Design Detailing Options
Structural Layer Plan View
Slab Properties...
Slab Offset...
Slab Rib Locations...
Beam Properties...
Beam Offset...
Opening
Point Restraints...
Column Supports...
Wall Supports...
Soil Supports...
Releases...
Point Loads...
Point Displacements...
Line Loads...
Surface Loads...
Group Names...
Clear Display of Assigns


Point Restraints
Restraints in Global Directions
Translation X
Translation Y
Translation Z
Rotation about X
Rotation about Y
Rotation about Z
Restraint Dimensions
X Dimension
0.5
YDimension
0.5
OK
Cancel


Surface Loads
Load Case Name
TT
Units
Ton-m
Loads
Load per Area (Down +)
0.12
Options
Add to existing loads
Replace existing loads
Delete existing loads
OK
Cancel
Hoàn thiện
tiền sàn

Surface Loads
Load Case Name
HT
Units
Ton-m
Loads
Load per Area (Down +)
.24
Options
Add to existing loads
Replace existing loads
Delete existing loads
OK
Cancel
Hoạt tải sàn

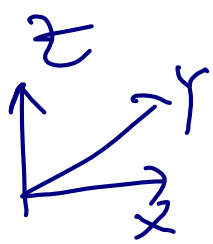

Line Loads
Tường tiền dầm Biên
Load Case Name
TT
Units
Ton-m
Loads
Z Load (Down Positive)
1
Moment
0.
Torsion
0.
Options
Add to existing loa
Replace existing lo
Delete existing loa
OK
Cancel
17/m
nhập
* 7m
17(T)
hiện

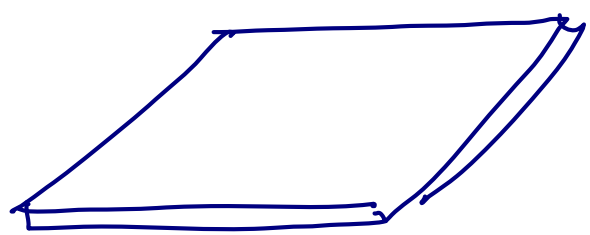

Line Object Information
Identification and Location
Line ID
14
Length
7.
X1
14.
Y1
0.
X2
21.
Y2
0.
Units
Ton-m
Specifications
Beam Property
D30X60
Offset
0.
Support Property
NONE
Slab Releases
Shear
Bending
Load Case
TT
W
M1
M2
7.
0.
0.

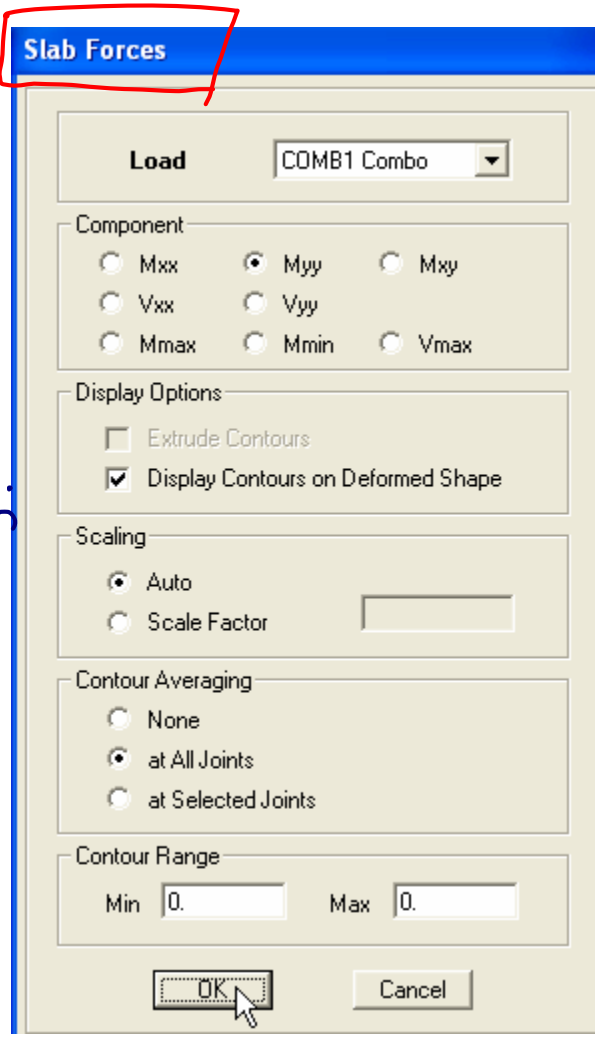
Nội Lực

- Nội lực của Shell
(≡ Sap, Etabs)

→ cho dải Rộng = 1 đvị







Khó sdụng để tính cháp sàn ở đâm

↓

ơn trung

↑

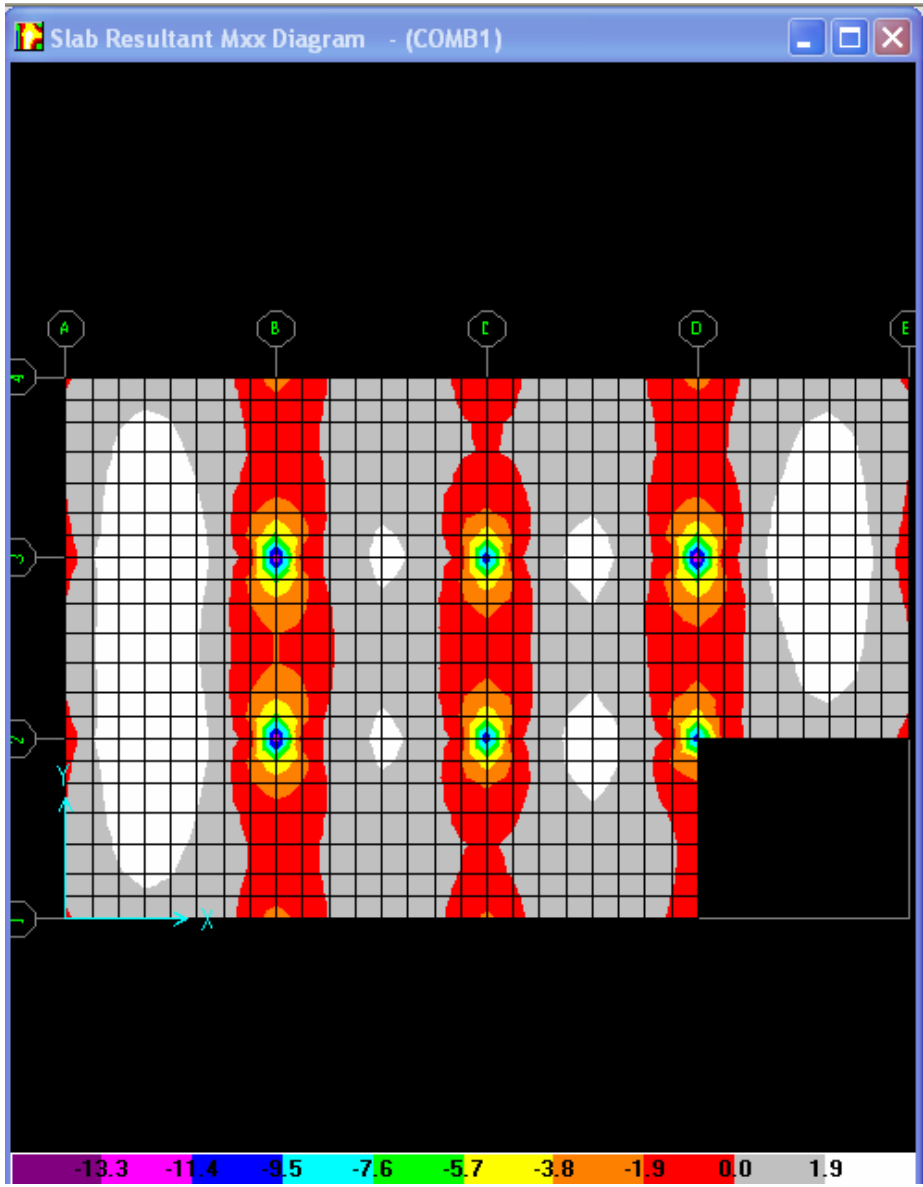
ứng suất

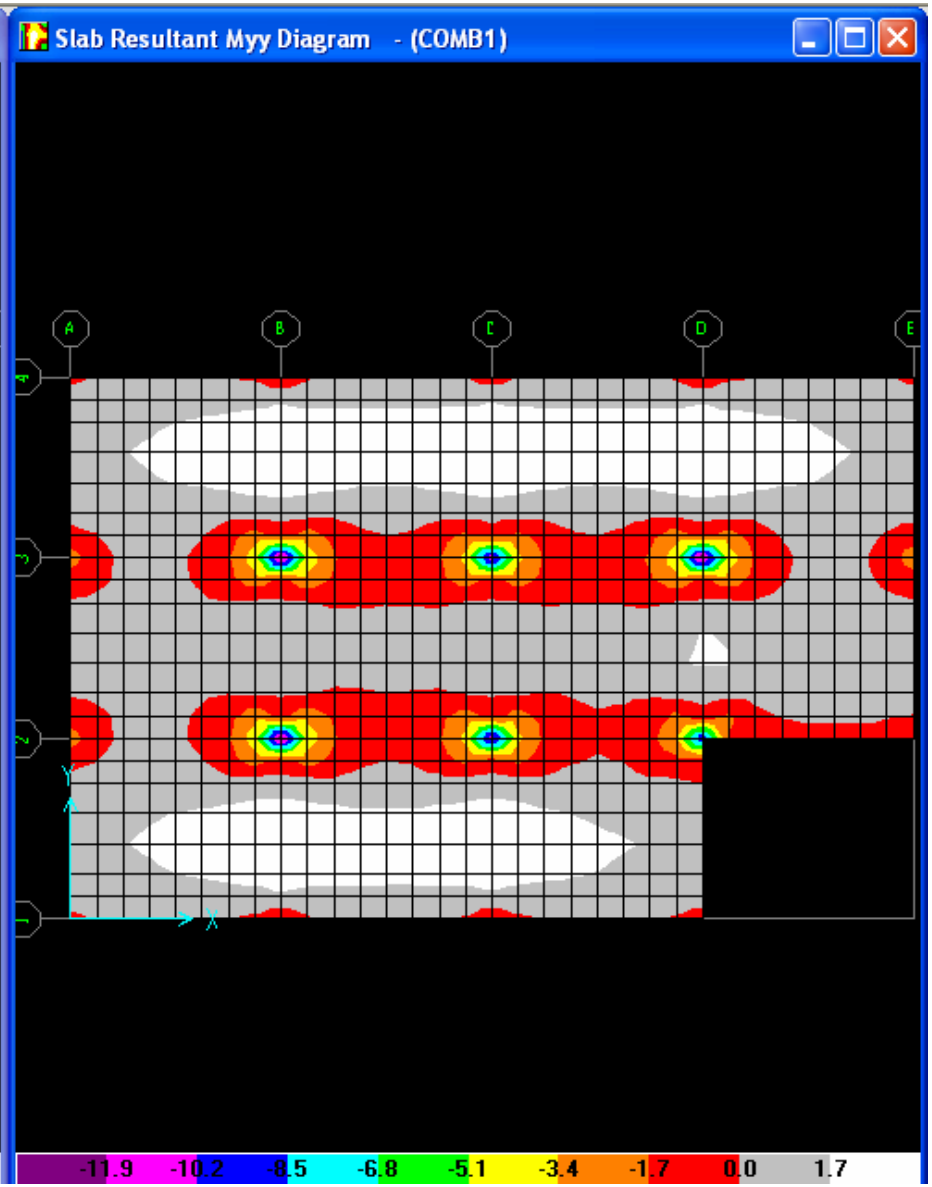
M_{xx} → momen uốn theo chiều x

M_{yy} - - - - - - - - - - - - - y

V_{xx} lực cắt - - của dải 1m trọng x

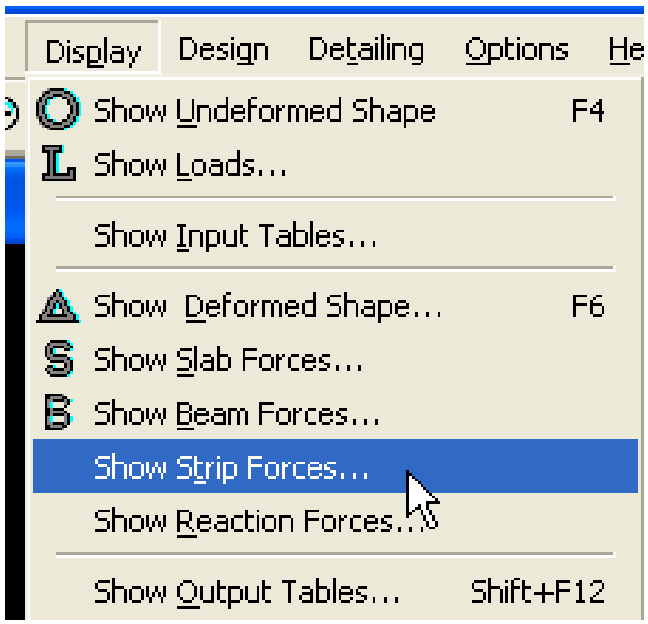
V_{yy} - - - - - - - - - - - - - - - - - y

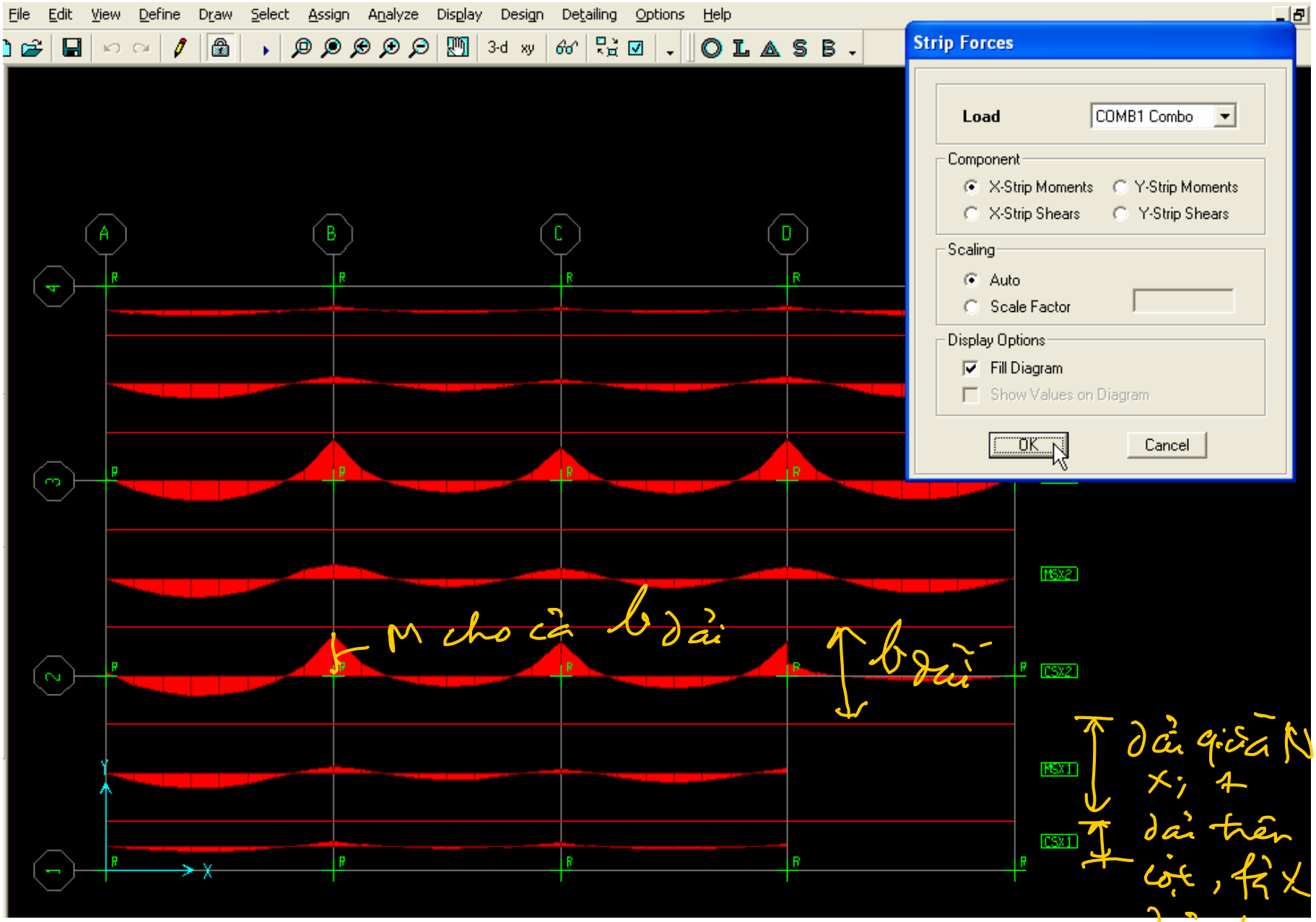

Slab Resultant Mxx Diagram - (COMB1)
A
B
C
D
E
-13.3
-11.4
-9.5
-7.6
-5.7
-3.8
-1.9
0.0
1.9

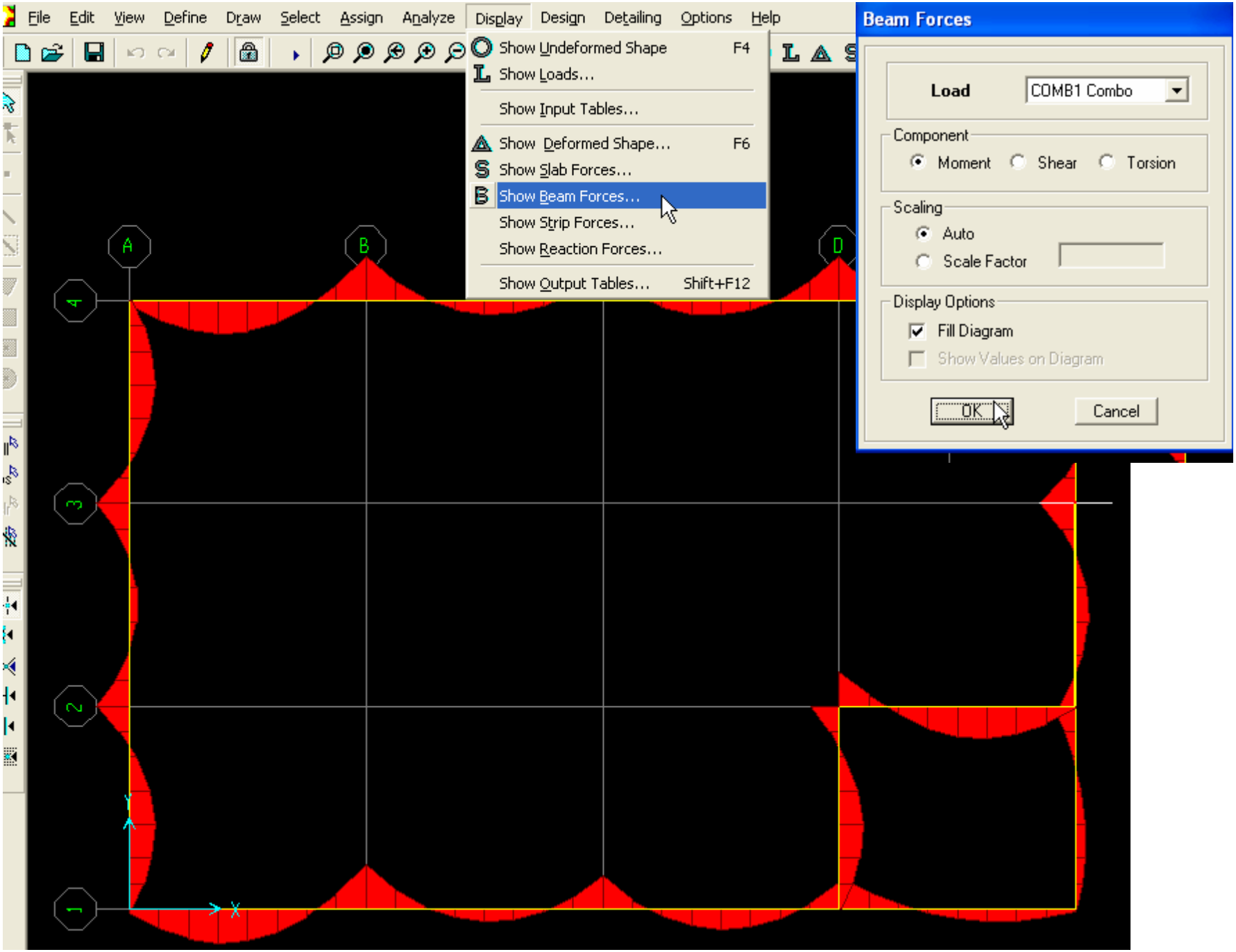

Slab Resultant Myy Diagram - (COMB1)
A
B
C
D
E
-11.9
-10.2
-8.5
-6.8
-5.1
-3.4
-1.7
0.0
1.7

- Cho Mesh Chia dải { theo X { dải trên cột / dải giữa nhịp
theo Y { dải trên cột / dải giữa nhịp

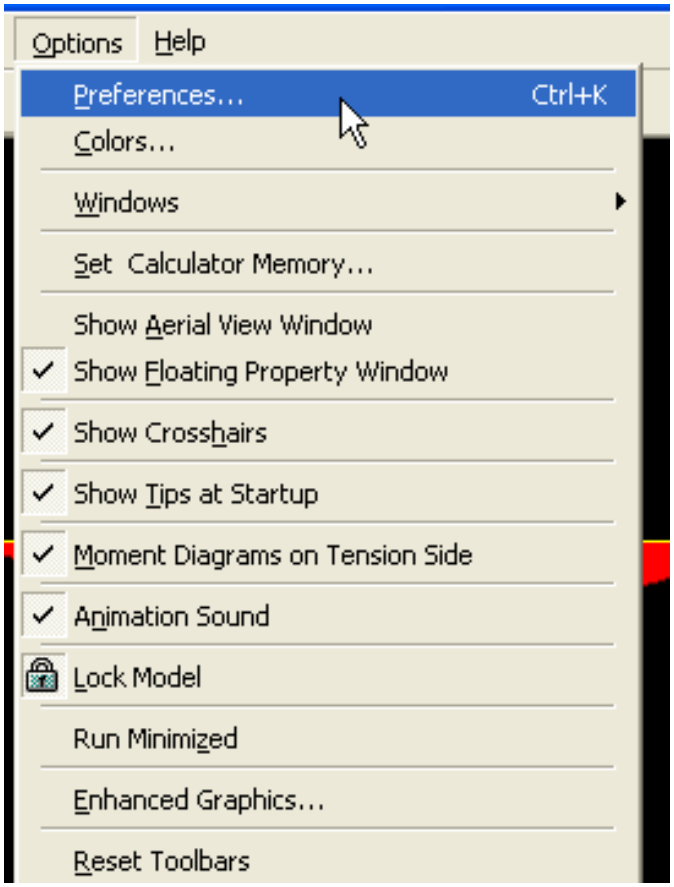
- Tiết diện Nội lực của các Shell trong từng dải thường Nội lực của cả dải có dạng tương tự như dầm.

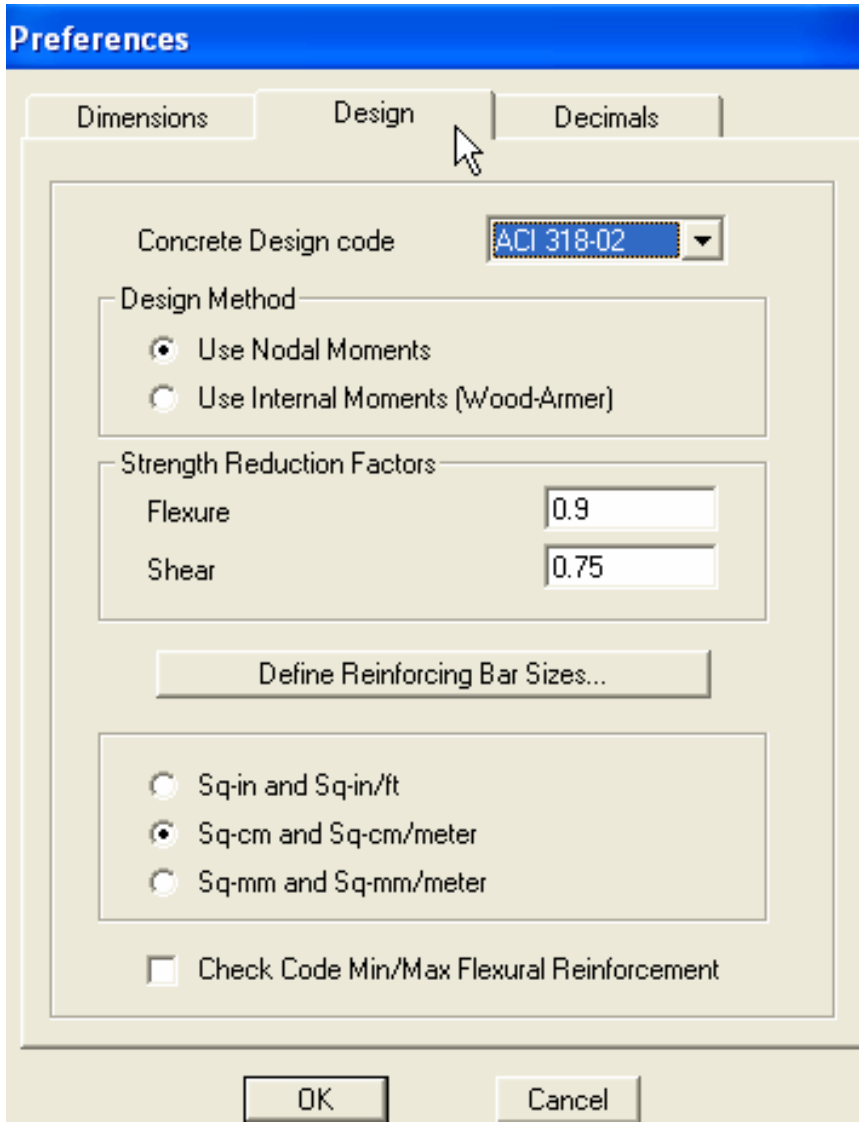


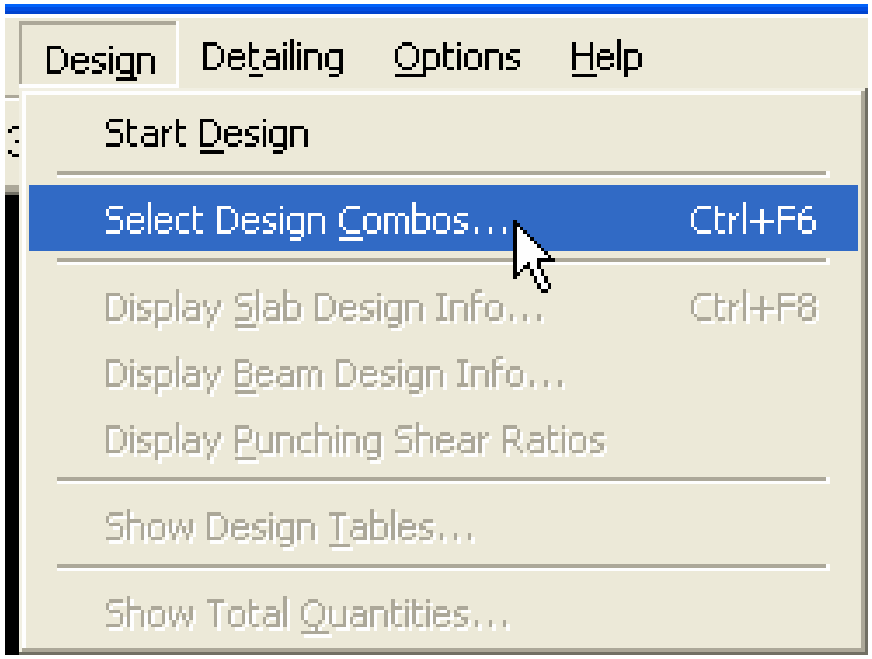

File Edit View Define Draw Select Assign Analyze Display Design Detailing Options Help
Strip Forces
Load
COMB1 Combo
Component
X-Strip Moments
Y-Strip Moments
X-Strip Shears
Y-Strip Shears
Scaling
Auto
Scale Factor
Display Options
Fill Diagram
Show Values on Diagram
OK
Cancel
A
B
C
D
4
3
2
1
MSX2
CSX2
MSX1
CSX1
M cho cả b dải
b dải
dải giữa Nhịp
x; 1
dải trên
cột, fà x,
dải 1

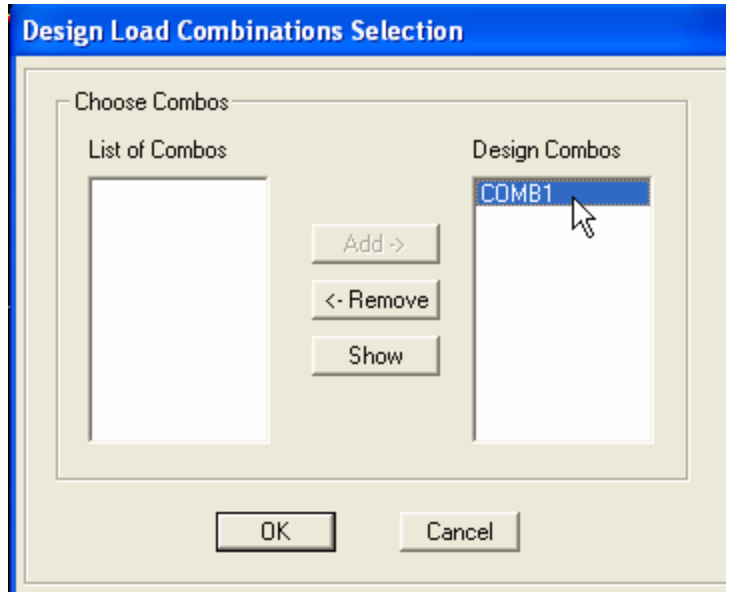

File Edit View Define Draw Select Assign Analyze Display Design Detailing Options Help
Show Undeformed Shape F4
Show Loads...
Show Input Tables...
Show Deformed Shape... F6
Show Slab Forces...
Show Beam Forces...
Show Strip Forces...
Show Reaction Forces...
Show Output Tables... Shift+F12
A
B
D
4
3
2
1
Y
X
Beam Forces
Load
COMB1 Combo
Component
Moment
Shear
Torsion
Scaling
Auto
Scale Factor
Display Options
Fill Diagram
Show Values on Diagram
OK
Cancel

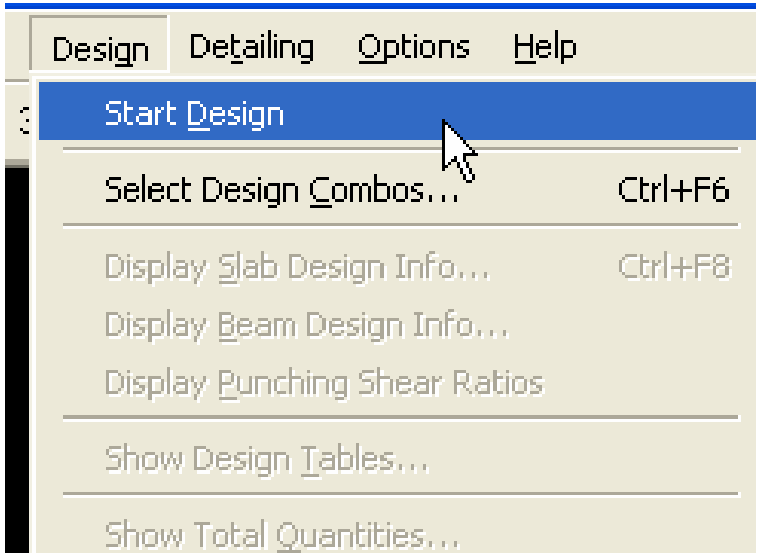
TÍNH CỐT THÉP.

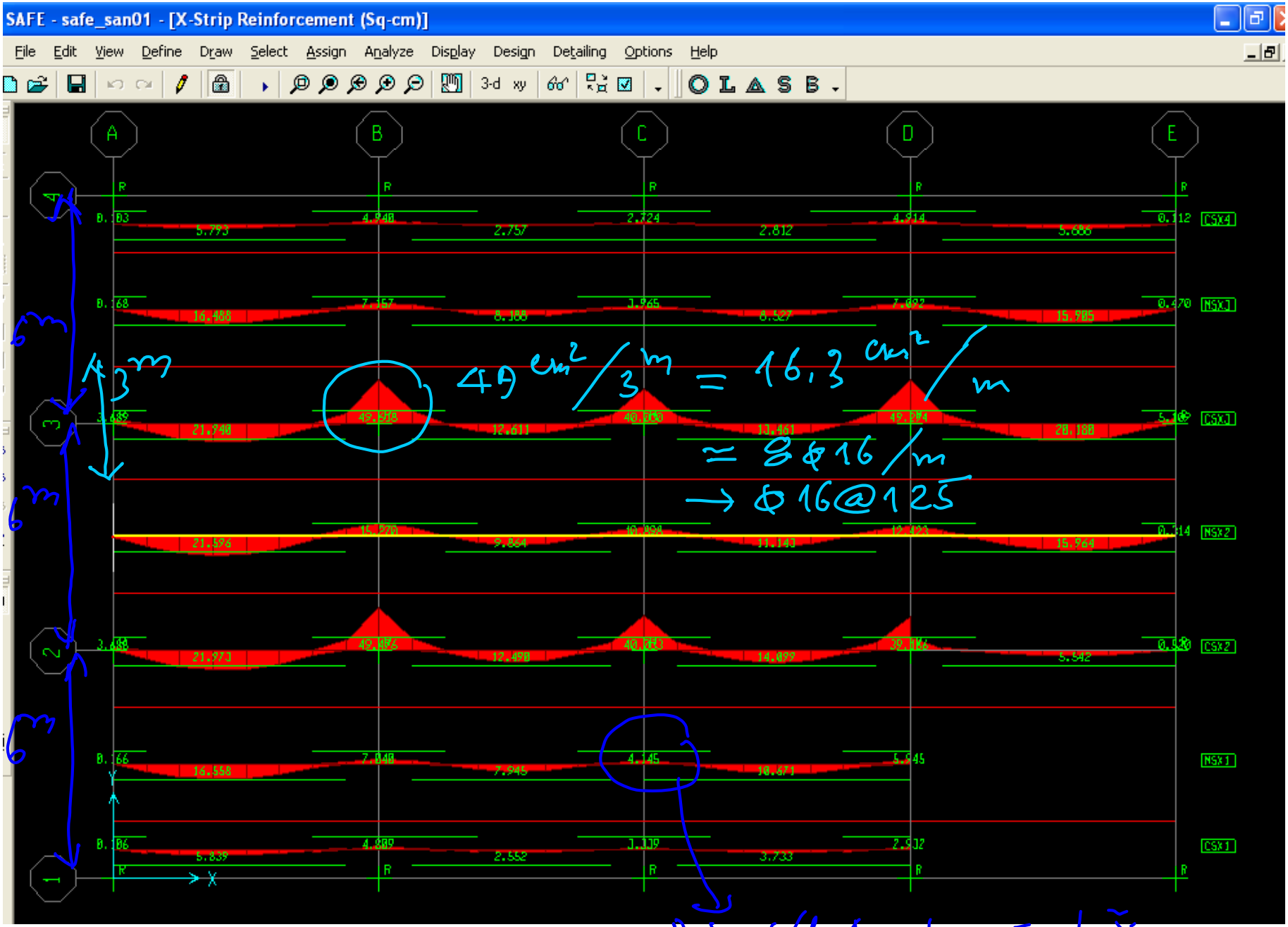


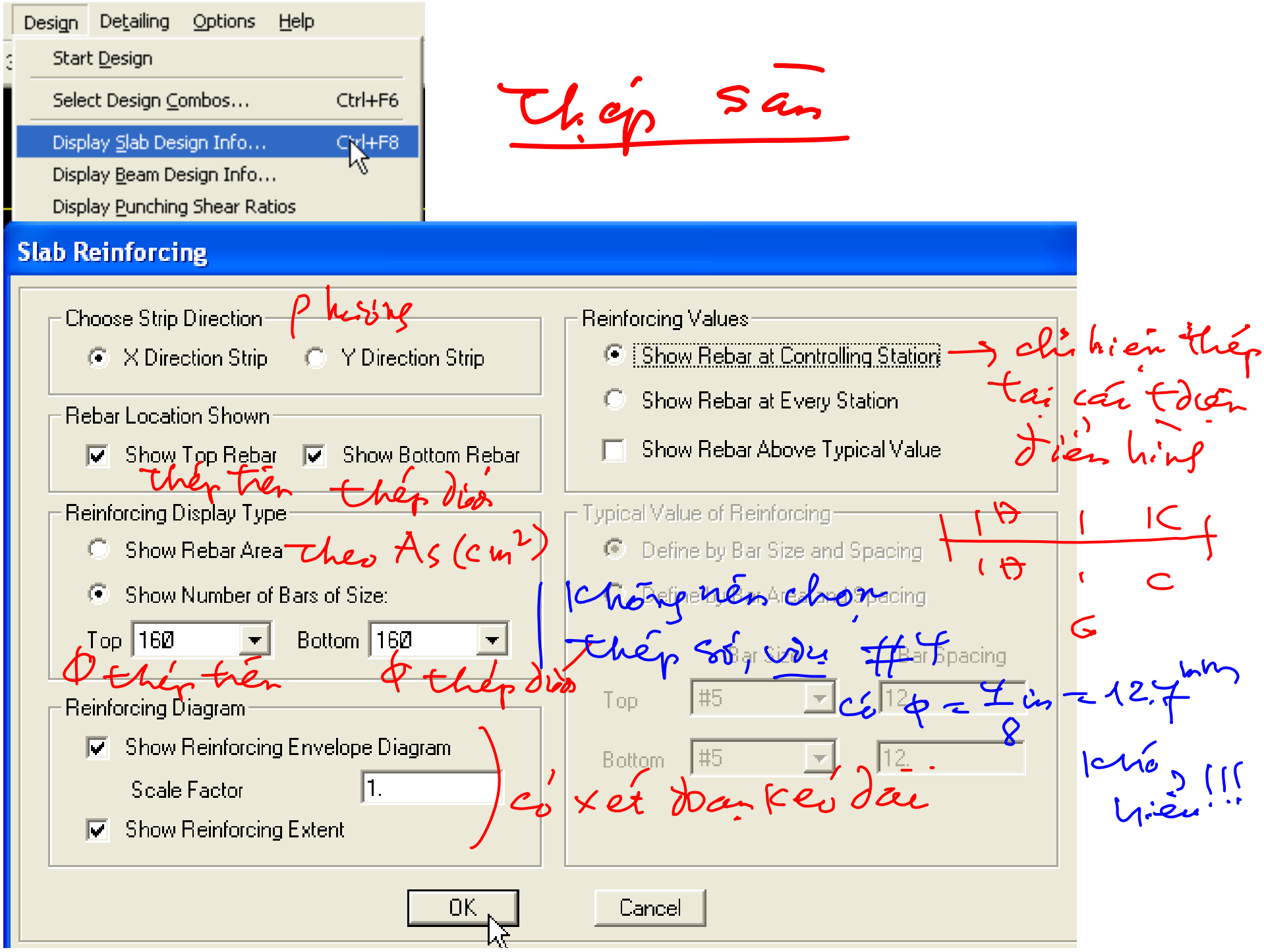


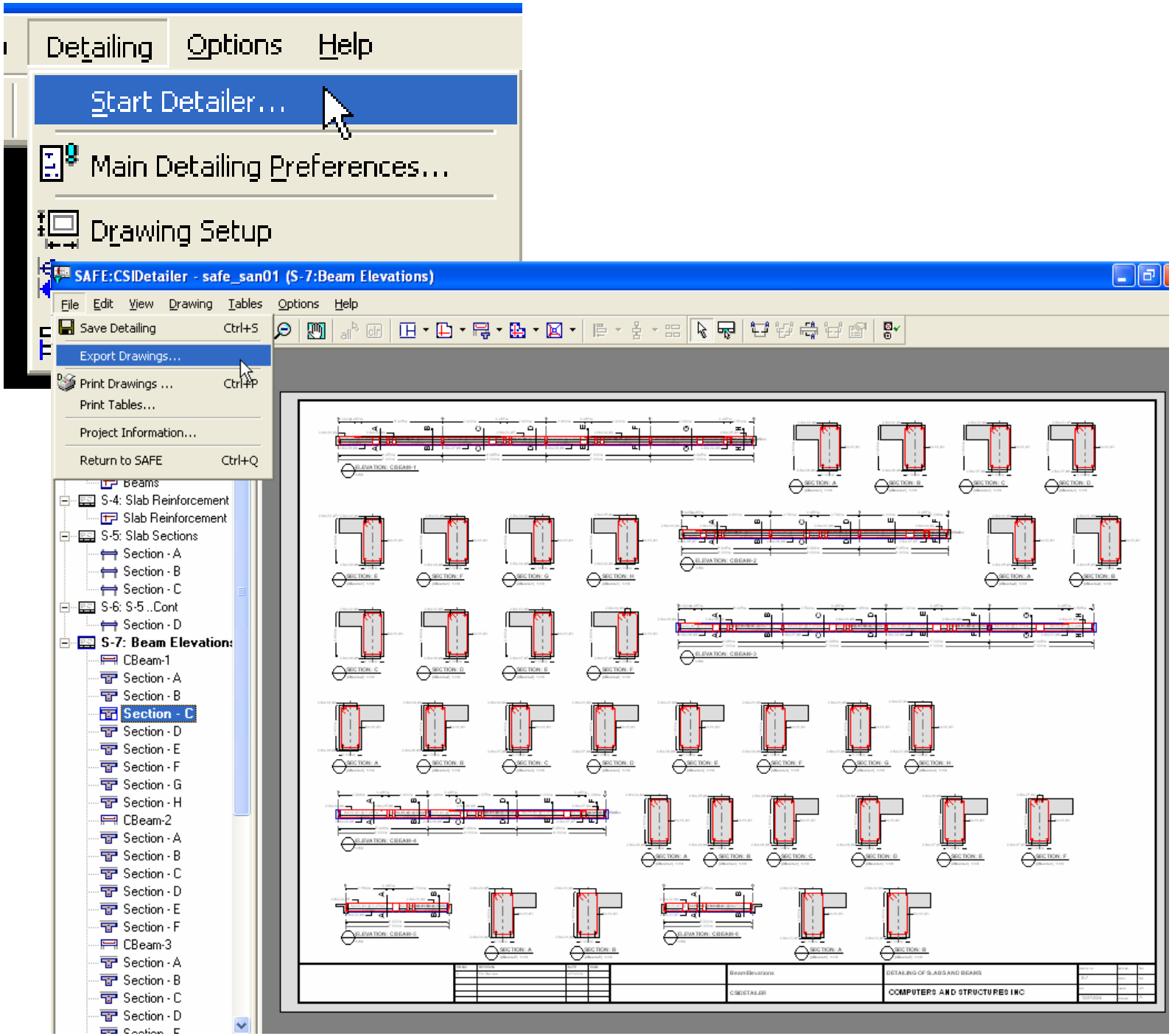

Design
Detailing
Options
Help
Start Design
Select Design Combos... Ctrl+F6
Display Slab Design Info... Ctrl+F8
Display Beam Design Info...
Display Punching Shear Ratios
Show Design Tables...
Show Total Quantities...

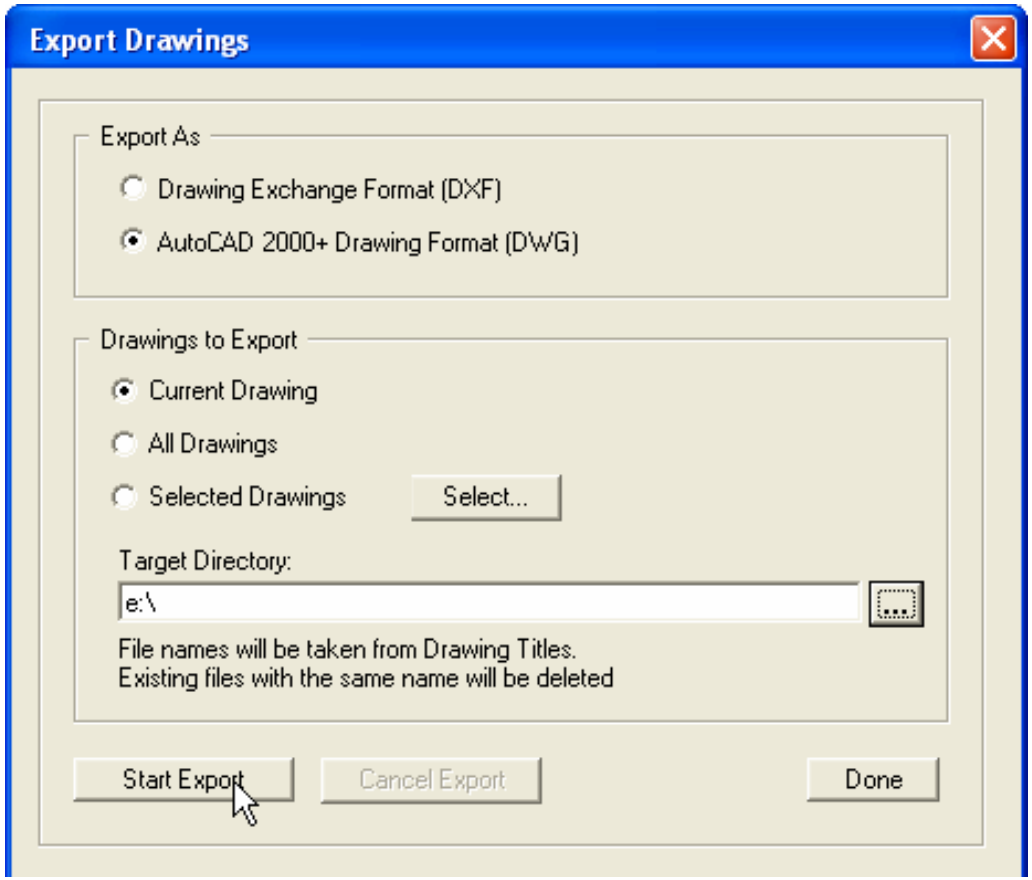

Design Load Combinations Selection
Choose Combos
List of Combos
Design Combos
COMB1
Add ->
<- Remove
Show
OK
Cancel


Design
Detailing
Options
Help
Start Design
Select Design Combos... Ctrl+F6
Display Slab Design Info... Ctrl+F8
Display Beam Design Info...
Display Punching Shear Ratios
Show Design Tables...
Show Total Quantities...

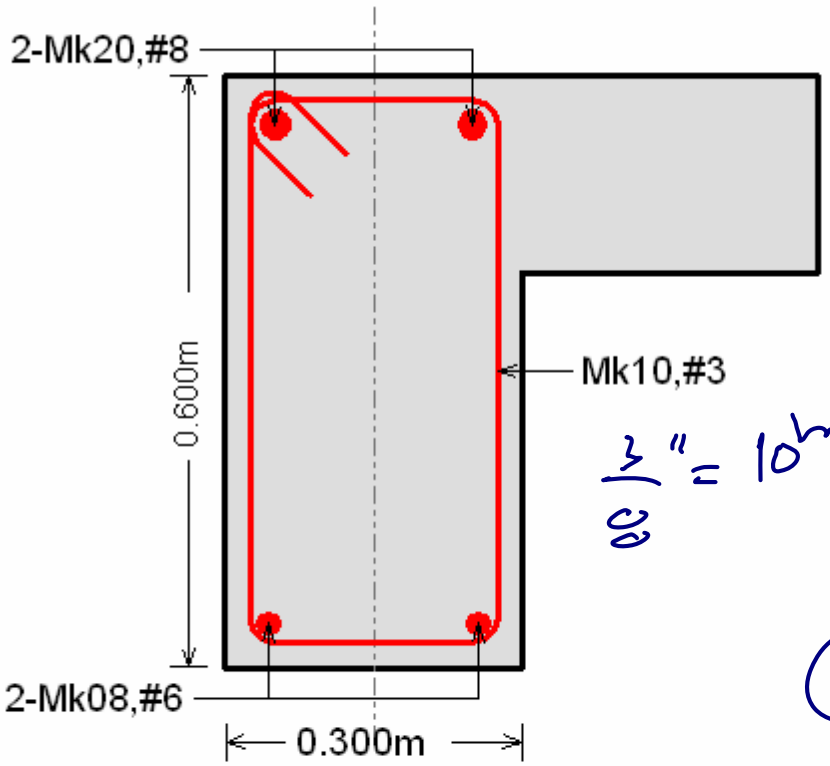

SAFE - safe_san01 - [X-Strip Reinforcement (Sq-cm)]
File Edit View Define Draw Select Assign Analyze Display Design Detailing Options Help
A
B
C
D
E
6m
3m
6m
6m
49 cm²/3m = 16,3 cm²/m
≈ 8Φ16/m
→ Φ16@125
Thép sàn; phương x;
Diện tích As cho mỗi dải


Design
Detailing
Options
Help
Start Design
Select Design Combos... Ctrl+F6
Display Slab Design Info... Ctrl+F8
Display Beam Design Info...
Display Punching Shear Ratios
Thép sàn
Slab Reinforcing
Choose Strip Direction
phương
X Direction Strip
Y Direction Strip
Rebar Location Shown
Show Top Rebar
Show Bottom Rebar
thép trên
thép dưới
Reinforcing Display Type
Show Rebar Area
theo As (cm²)
Show Number of Bars of Size:
Top 160
Bottom 160
Ø thép trên
Ø thép dưới
Reinforcing Diagram
Show Reinforcing Envelope Diagram
Scale Factor 1.
Show Reinforcing Extent
có xét đoạn kéo dài
Reinforcing Values
Show Rebar at Controlling Station
chỉ hiển thép tại các tiết diện tính
Show Rebar at Every Station
Show Rebar Above Typical Value
Typical Value of Reinforcing
Define by Bar Size and Spacing
Top #5
Bottom #5
không nên chọn thép số, vd: #4
có Φ = 1 in = 12.7 mm
8
khó hiểu!!!
OK
Cancel

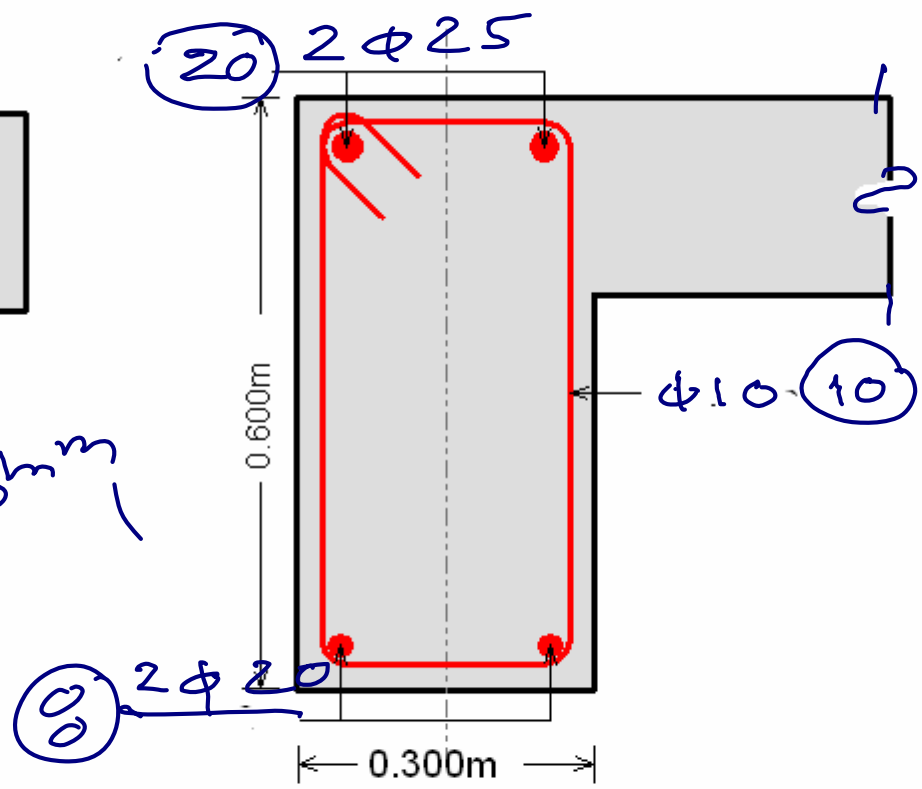

Detailing
Options
Help
Start Detailer...
Main Detailing Preferences...
Drawing Setup
SAFE:CSIDetailer - safe_san01 (S-7:Beam Elevations)
File
Edit
View
Drawing
Tables
Options
Help
Save Detailing Ctrl+S
Export Drawings...
Print Drawings ... Ctrl+P
Print Tables...
Project Information...
Return to SAFE Ctrl+Q
S-4: Slab Reinforcement
Slab Reinforcement
S-5: Slab Sections
Section - A
Section - B
Section - C
S-6: S-5 ..Cont
Section - D
S-7: Beam Elevations
CBeam-1
Section - A
Section - B
Section - C
Section - D
Section - E
Section - F
Section - G
Section - H
CBeam-2
Section - A
Section - B
Section - C
Section - D
Section - E
Section - F
CBeam-3
Section - A
Section - B
Section - C
Section - D
COMPUTERS AND STRUCTURES INC


Export Drawings
Export As
Drawing Exchange Format (DXF)
AutoCAD 2000+ Drawing Format (DWG)
Drawings to Export
Current Drawing
All Drawings
Selected Drawings
Select...
Target Directory:
e:\
File names will be taken from Drawing Titles.
Existing files with the same name will be deleted
Start Export
Cancel Export
Done

#8 = 8/8" = 25 mm



3/8" = 10 mm



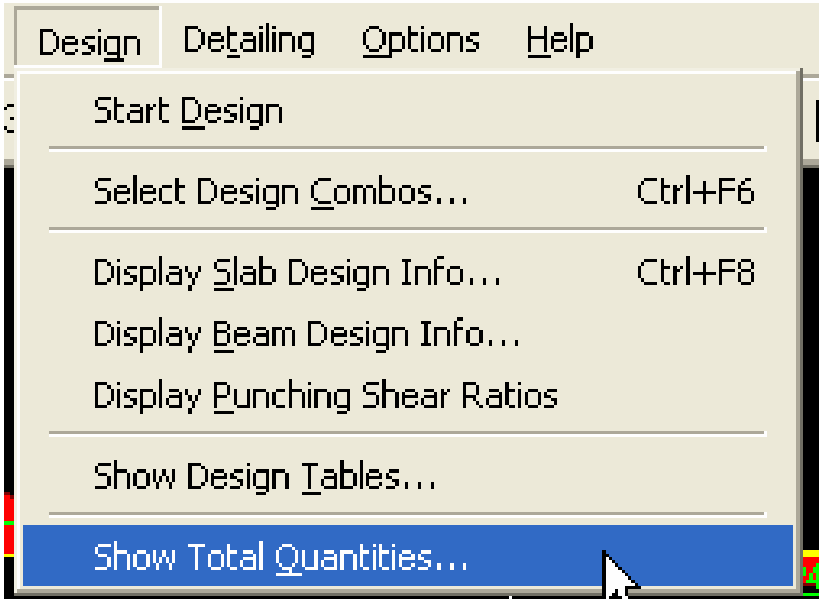
SECTION: E

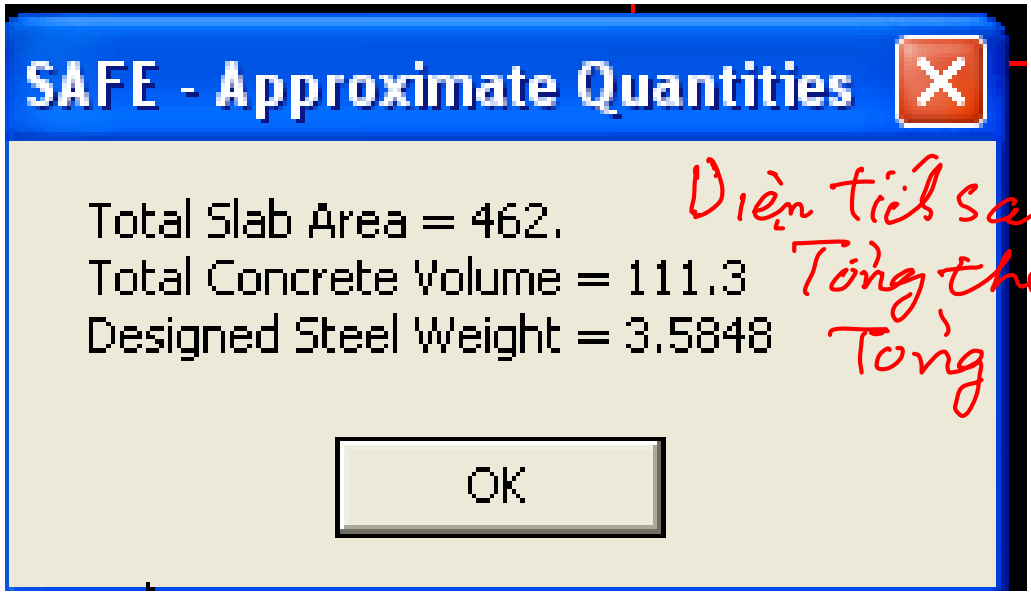
(CBeam-3) 1:10

SECTION: E

(CBeam-3) 1:10

#6 = 6/8 in" = 6×25/8 = 20





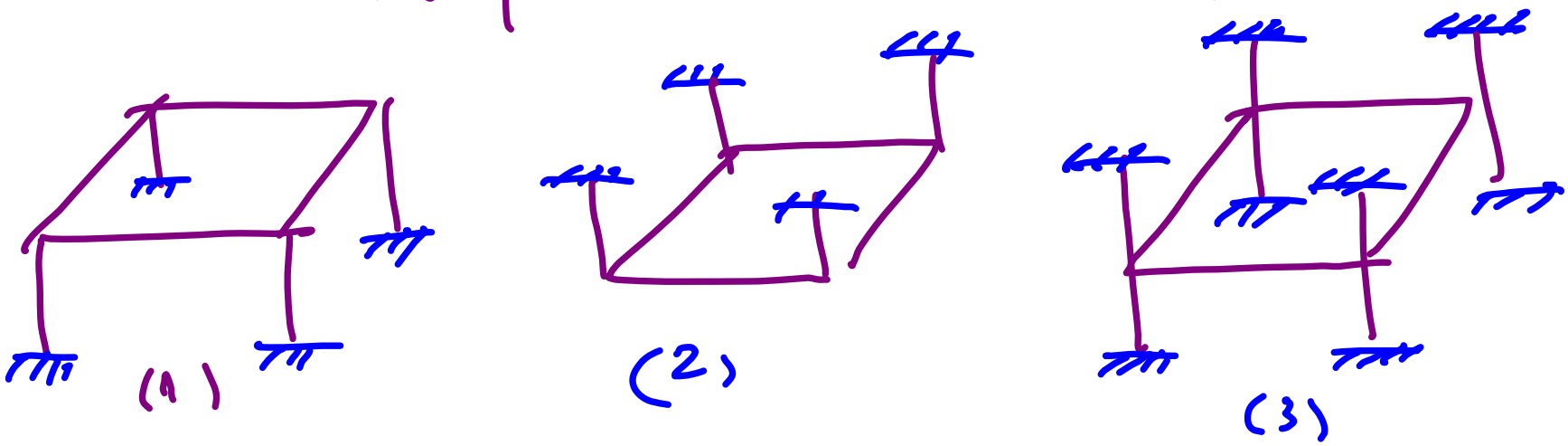
Diện tích sàn
Tổng thể tích bê tông (m^3)
Tổng trọng lượng thép (T)

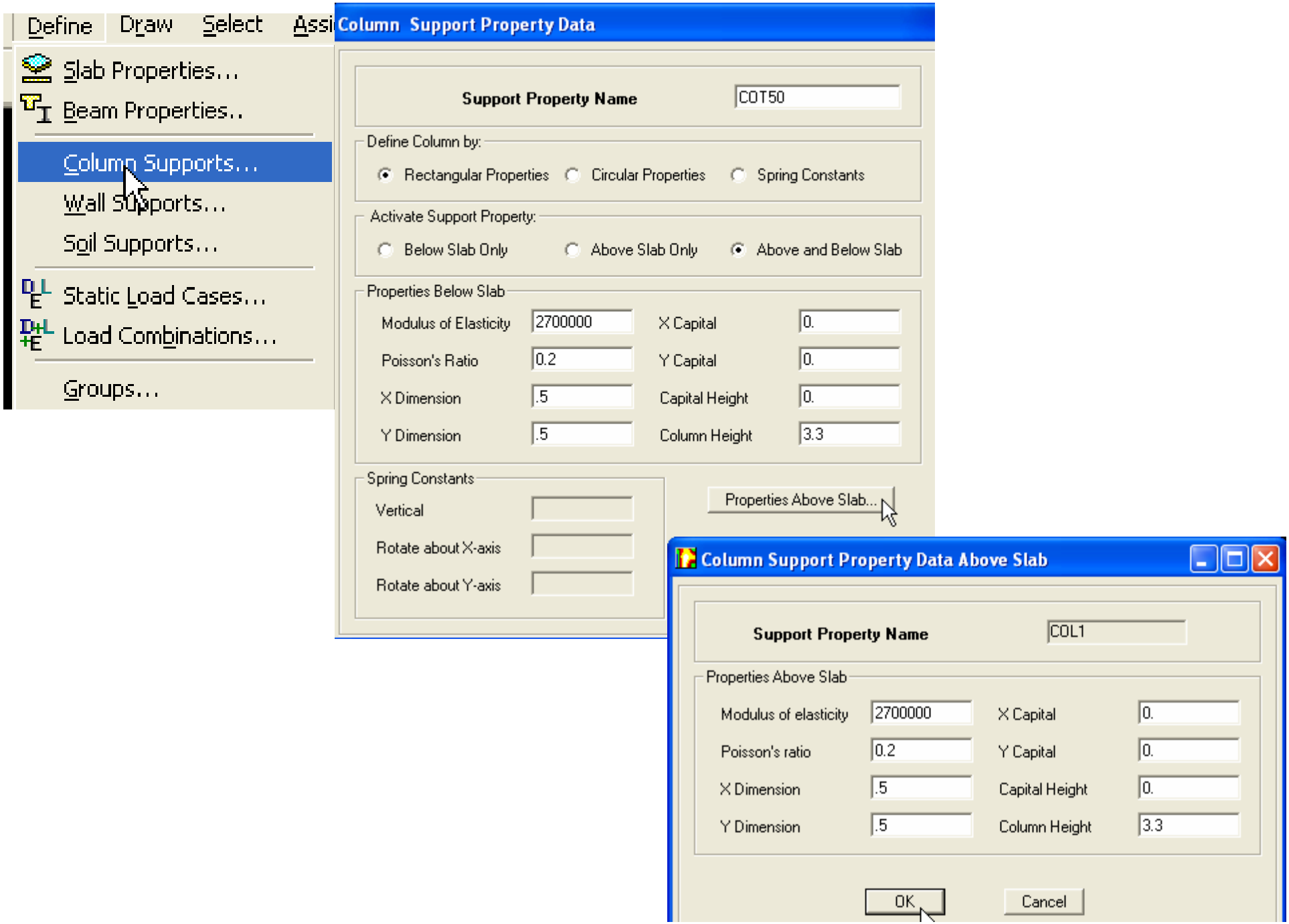
Mở rộng

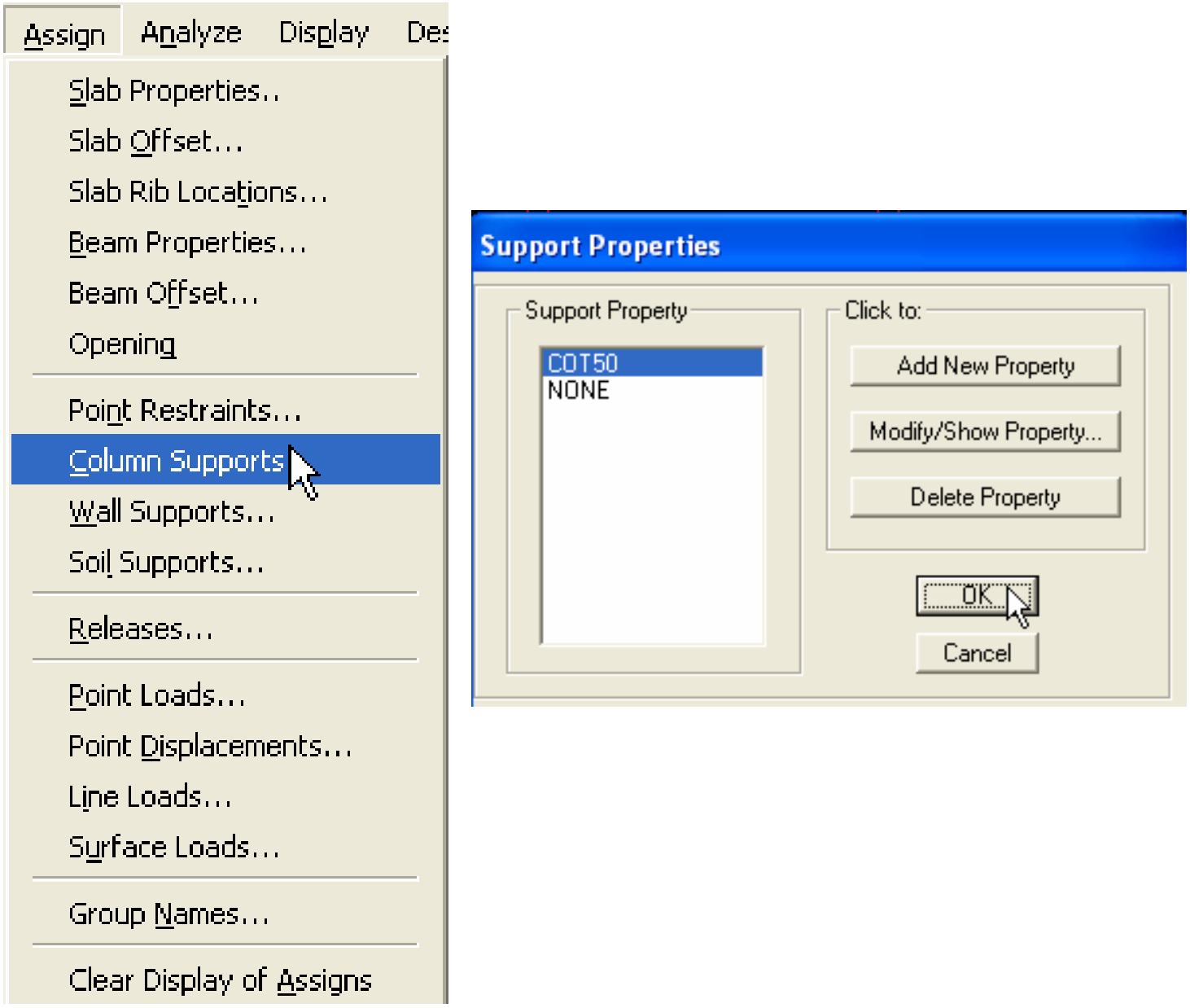
(1) Bỏ các gối cứng (Point Restraint)

(2) gán Column Support tại vị trí cột đỡ sàn.

Máy cho xét 3 t/hợp

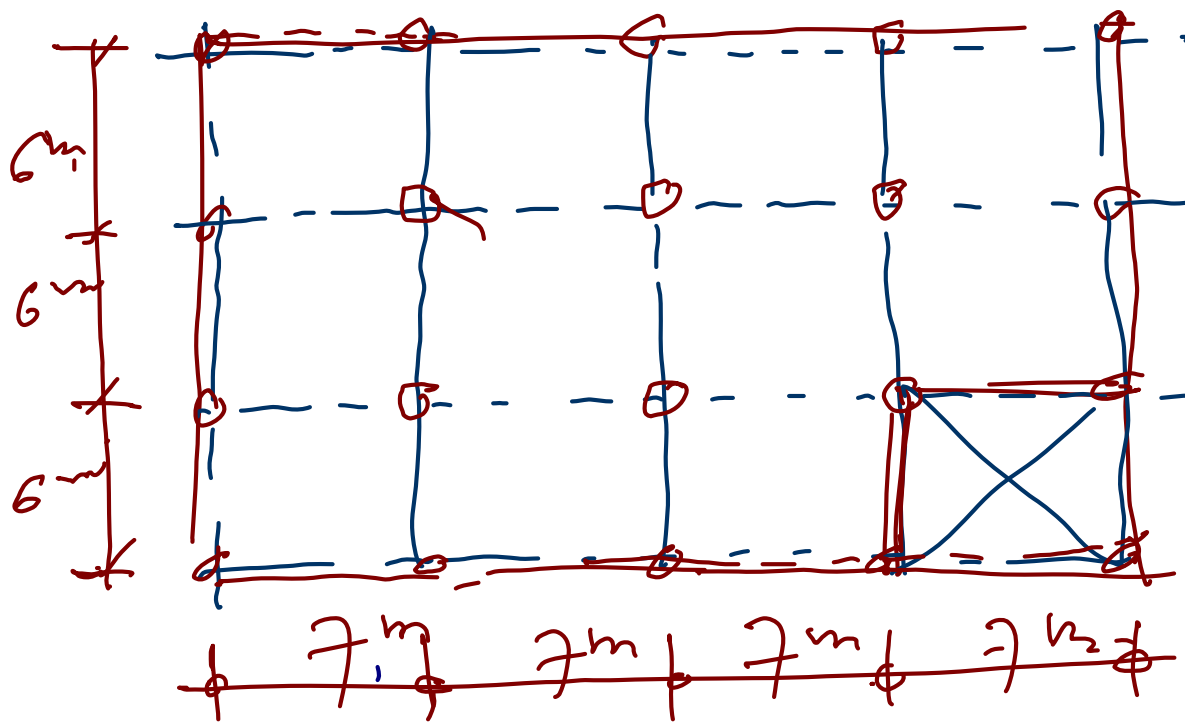



Define
Draw
Select
Assi
Slab Properties...
Beam Properties..
Column Supports...
Wall Supports...
Soil Supports...
Static Load Cases...
Load Combinations...
Groups...
Column Support Property Data
Support Property Name
COT50
Define Column by:
Rectangular Properties
Circular Properties
Spring Constants
Activate Support Property:
Below Slab Only
Above Slab Only
Above and Below Slab
Properties Below Slab
Modulus of Elasticity
2700000
Poisson's Ratio
0.2
X Dimension
.5
Y Dimension
.5
X Capital
0.
Y Capital
0.
Capital Height
0.
Column Height
3.3
Spring Constants
Vertical
Rotate about X-axis
Rotate about Y-axis
Properties Above Slab...
Column Support Property Data Above Slab
Support Property Name
COL1
Properties Above Slab
Modulus of elasticity
2700000
Poisson's ratio
0.2
X Dimension
.5
Y Dimension
.5
X Capital
0.
Y Capital
0.
Capital Height
0.
Column Height
3.3
OK
Cancel


Assign
Analyze
Display
Des
Slab Properties...
Slab Offset...
Slab Rib Locations...
Beam Properties...
Beam Offset...
Opening
Point Restraints...
Column Supports...
Wall Supports...
Soil Supports...
Releases...
Point Loads...
Point Displacements...
Line Loads...
Surface Loads...
Group Names...
Clear Display of Assigns
Support Properties
Support Property
COT50
NONE
Click to:
Add New Property
Modify/Show Property...
Delete Property
OK
Cancel

Safe

① Sàn không dầm

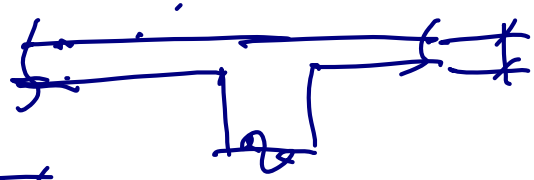


- $h_b = 22^{cm}$
- Dầm Biên 50×50^{cm}
- Cột 50×50^{cm}

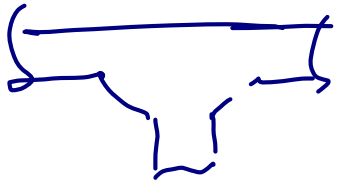
Tải trọng

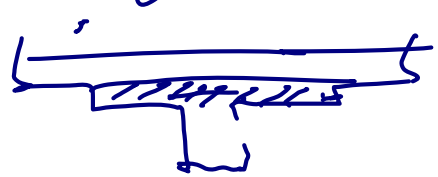
- Tính tải
  - TLB thân
  - Tường dầm Biên, trên sàn
  - Hoàn thiện

- chiều dày bản sàn



$h_b = (1/33 \div 1/30)\, l_2$



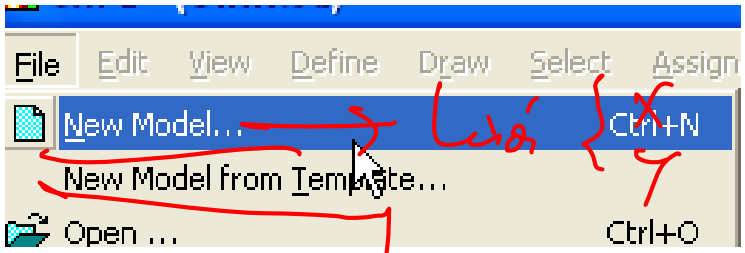


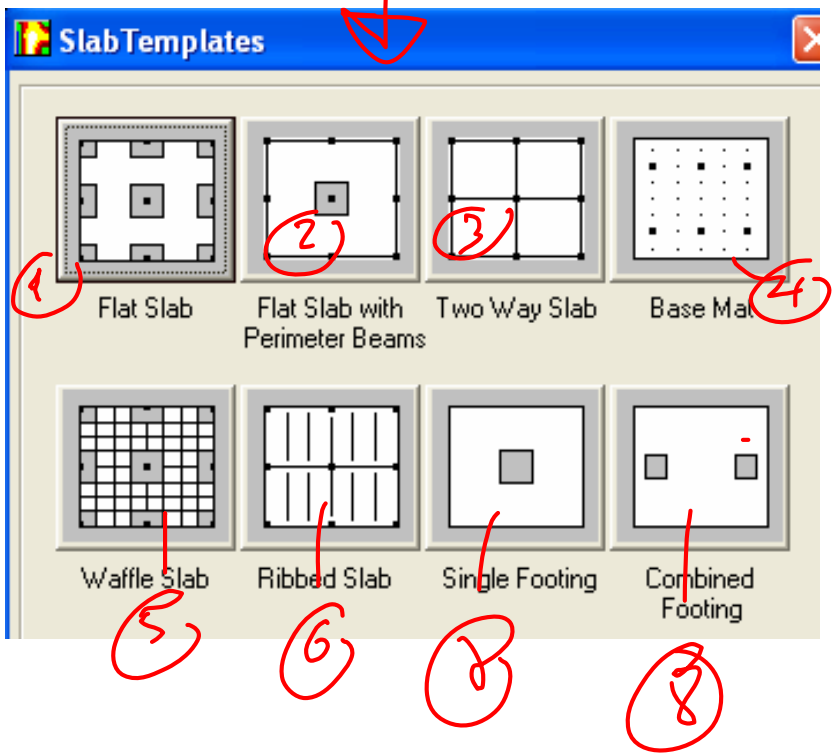
$h_b = (1/36 \div 1/33)\, l_2$

Hoạt tải

vphòng

$240\ kG/m^2$





Sàn Nhiều có sẵn.

(1) Sàn không dầm.

(2) Có dầm, có dầm biên

(3) Sàn sườn 2 phương

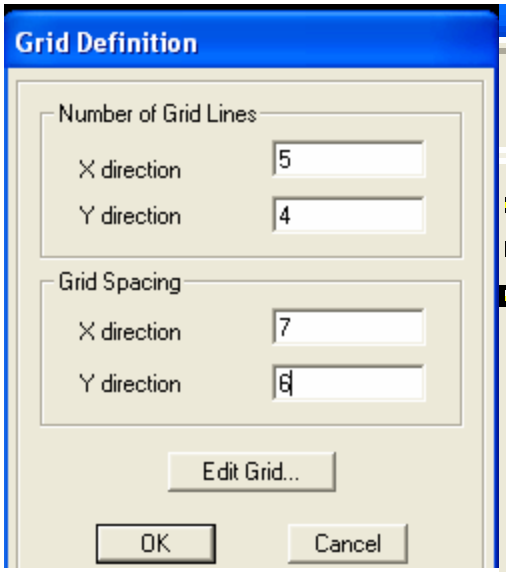
(4) Bản móng Bè

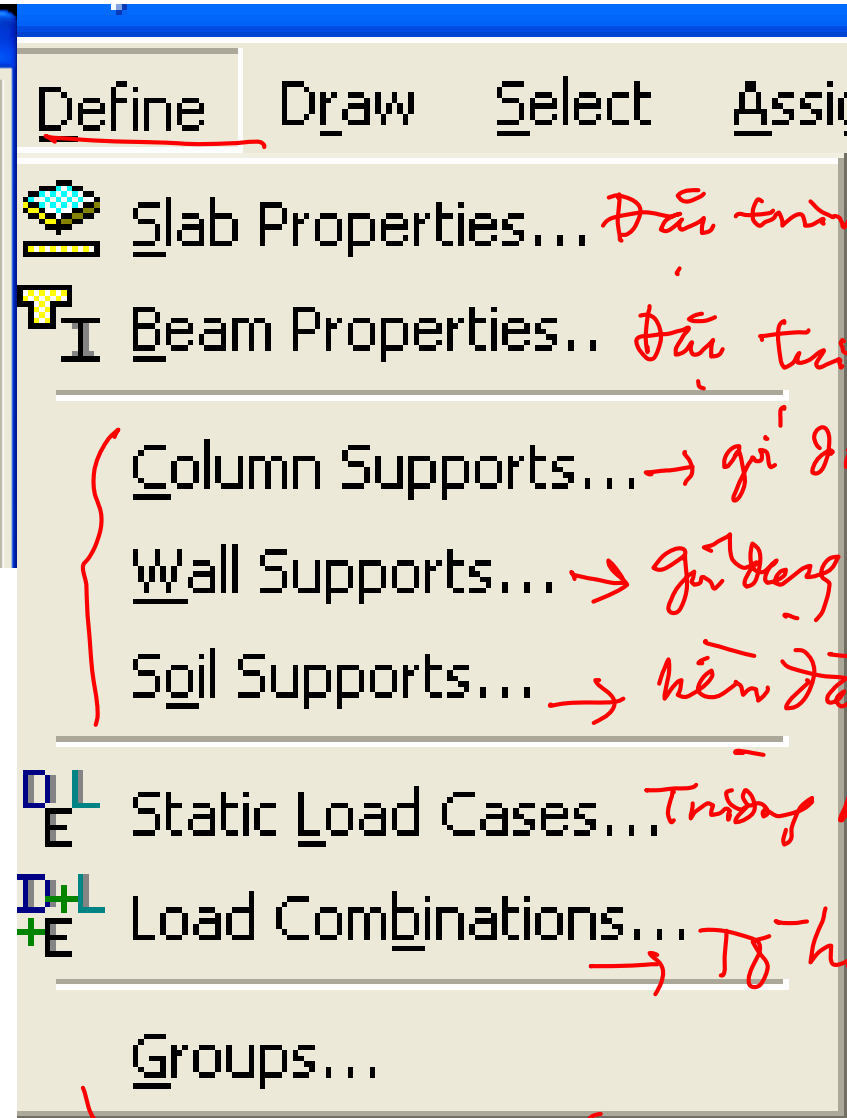
(5) Sàn dày sườn

(6) Sàn có dầm phụ,

(7) Móng đơn (đối xứng, không đối xứng)

(8) Móng kép (chia việt).





Đặc trưng sàn – vật liệu / tdiện

Đặc trưng của dầm

Column Supports... → gối dạng điểm (cột)

Wall Supports... → gối dạng đường (vách)

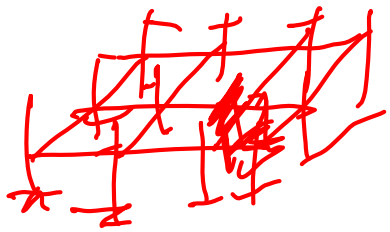
Soil Supports... → nền đàn hồi (mặt → Cz)

Static Load Cases... Trường hợp tải trọng

Load Combinations... → Tổ hợp tải trọng

Groups...

Dl nghĩa gối



Có thể gán group cho 1 số đối tượng (dầm, tấm sàn) thì các thượng này sẽ có cùng 1 kquả thkế (cthép) mặc dù nội lực của chúng khác nhau.

Slab Property Data

Property Name SLAB220

Analysis Property Data

Modulus of elasticity	2.9e6 E_b
Poisson's ratio	0.2 ν
Unit Weight	2.5 γ
Type (Loại sàn)	Slab
Thickness h_b	0.22

$R_b = 130\ kG/cm^2 = 1300\ T/m^2$

$R_s = 2800\ kG/cm^2 = 28000\ T/m^2$

☐ Thick Plate ☐ Orthotropic

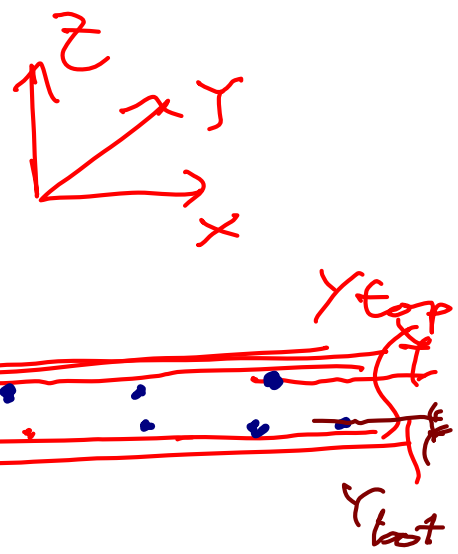
Design Property Data

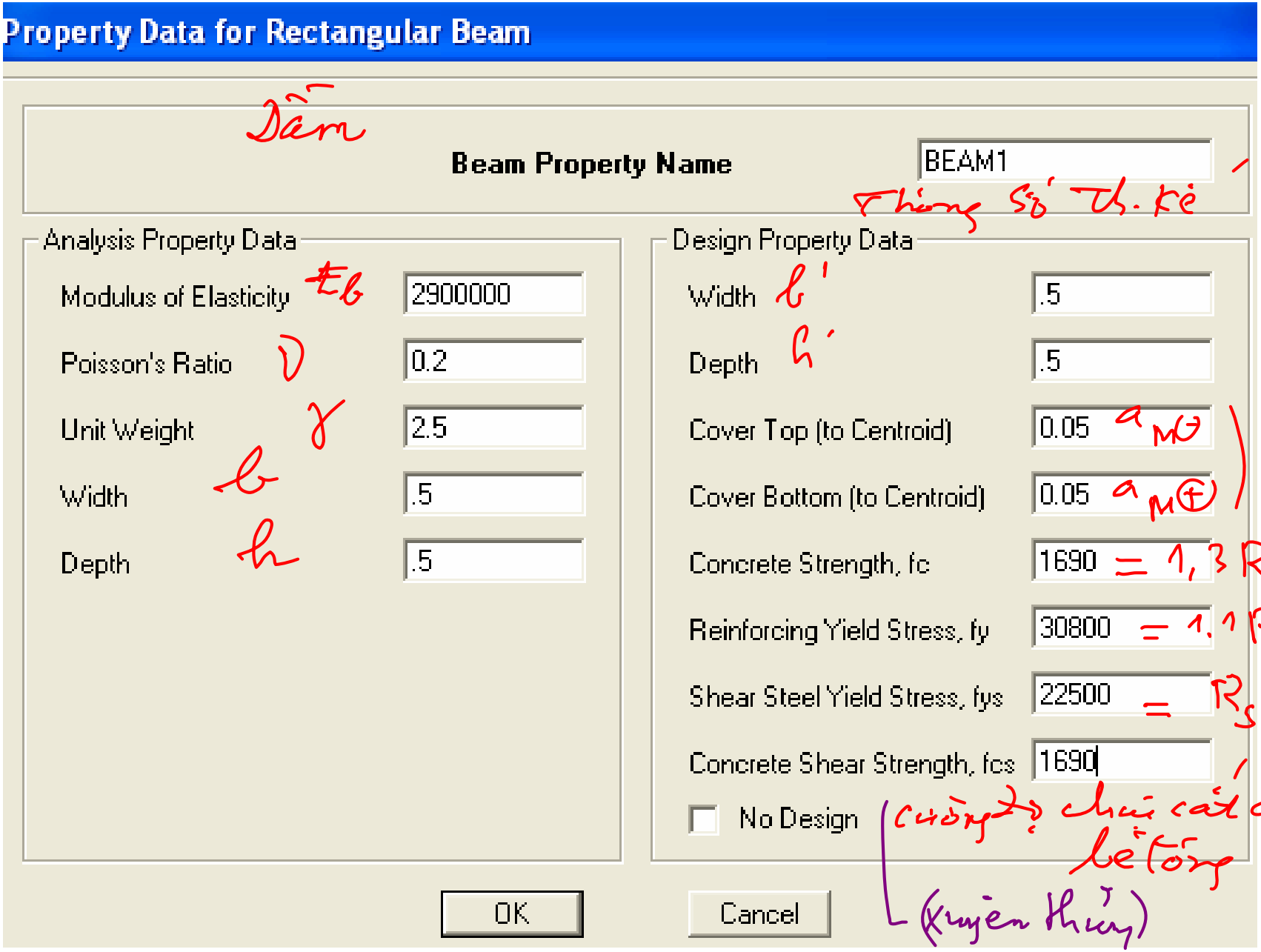
X Cover Top (to Centroid)	0.03
Y Cover Top (to Centroid)	0.03
X Cover Bottom (to Centroid)	0.03
Y Cover Bottom (to Centroid)	0.03
Concrete Strength, fc	1690 $= 1.3 R_b$
Reinforcing Yield stress, fy	30800 $= 1.1 R_s$

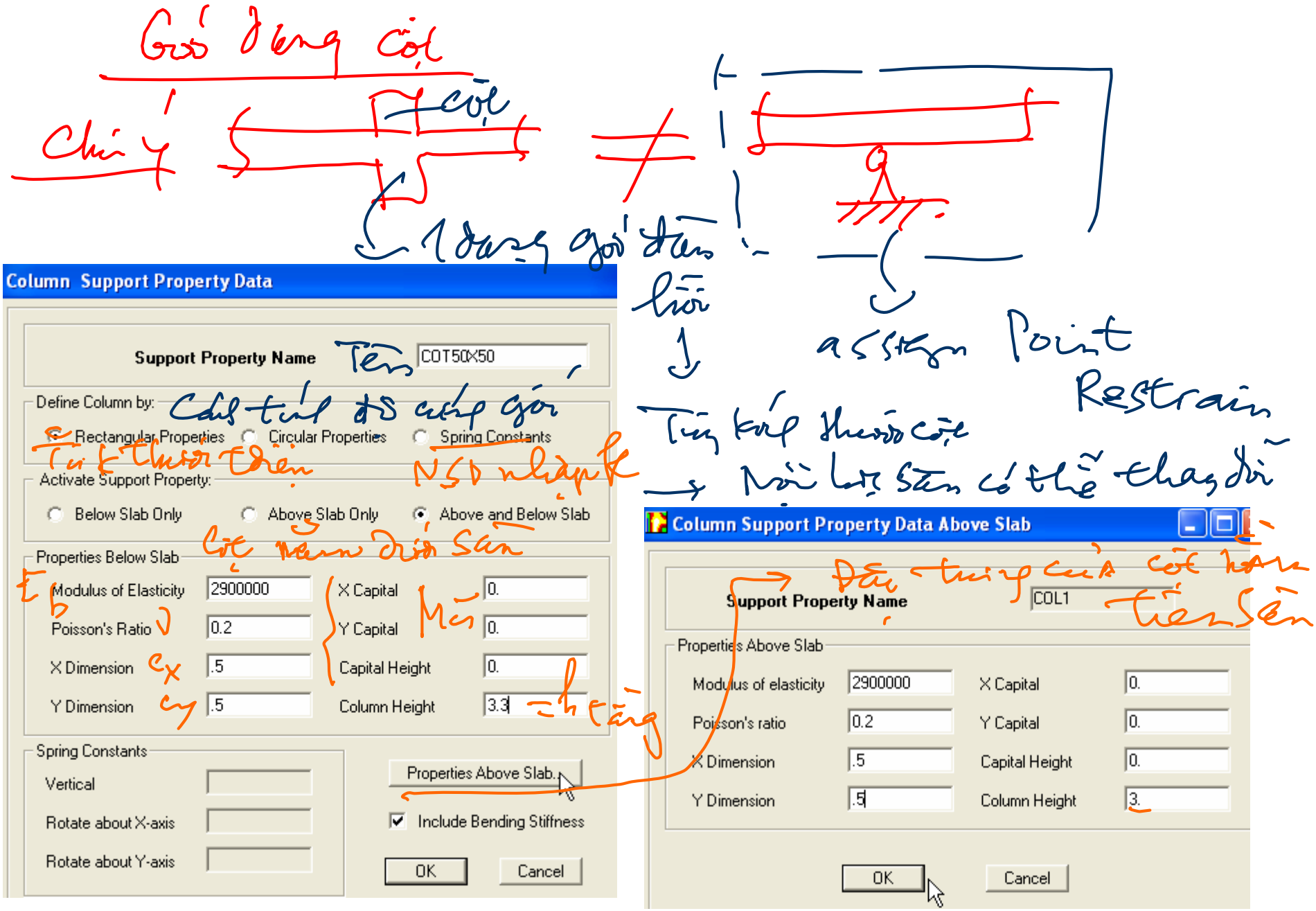
☐ No Design

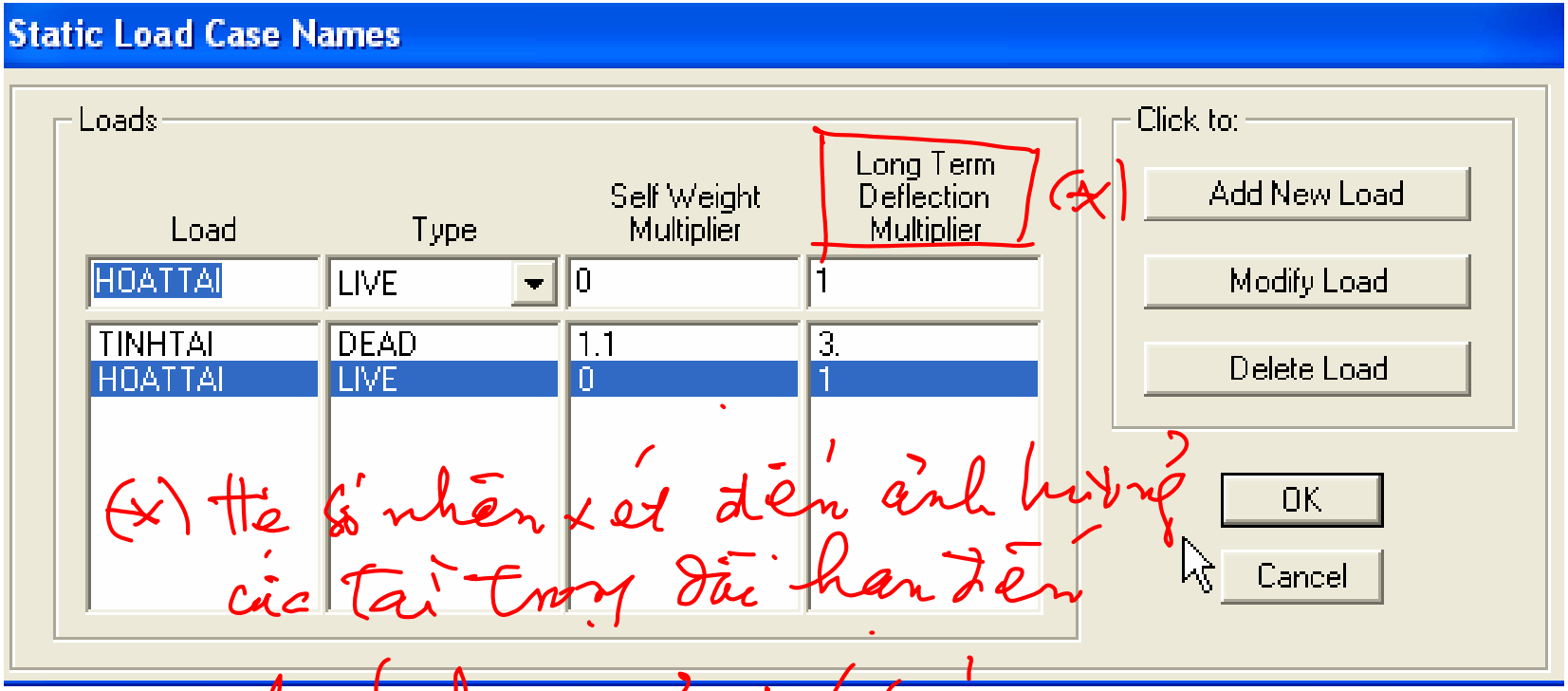
☐ Lightweight

OK Cancel




Property Data for Rectangular Beam
Dầm
Beam Property Name
BEAM1
Thông số Th. kê
Analysis Property Data
Modulus of Elasticity
Eb
2900000
Poisson's Ratio
ν
0.2
Unit Weight
γ
2.5
Width
b
.5
Depth
h
.5
Design Property Data
Width
b'
.5
Depth
h'
.5
Cover Top (to Centroid)
0.05
a M⊖
Cover Bottom (to Centroid)
0.05
a M⊕
h0 = h - a
Concrete Strength, fc
1690
= 1,3 Rb
Reinforcing Yield Stress, fy
30800
= 1.1 Rs
Shear Steel Yield Stress, fys
22500
= Rsw
Concrete Shear Strength, fcs
1690
No Design
cường độ chịu cắt của bê tông
(xuyên thủy)
OK
Cancel


Gối đàng cột
Chú ý
cột
≠
Column Support Property Data
Support Property Name
COT50X50
Define Column by:
Rectangular Properties
Circular Properties
Spring Constants
Activate Support Property:
Below Slab Only
Above Slab Only
Above and Below Slab
Properties Below Slab
Modulus of Elasticity
2900000
Poisson's Ratio
0.2
X Dimension
.5
Y Dimension
.5
X Capital
0.
Y Capital
0.
Capital Height
0.
Column Height
3.3
Spring Constants
Vertical
Rotate about X-axis
Rotate about Y-axis
Properties Above Slab...
Include Bending Stiffness
OK
Cancel
Column Support Property Data Above Slab
Support Property Name
COL1
Properties Above Slab
Modulus of elasticity
2900000
Poisson's ratio
0.2
X Dimension
.5
Y Dimension
.5
X Capital
0.
Y Capital
0.
Capital Height
0.
Column Height
3.
OK
Cancel



(*)

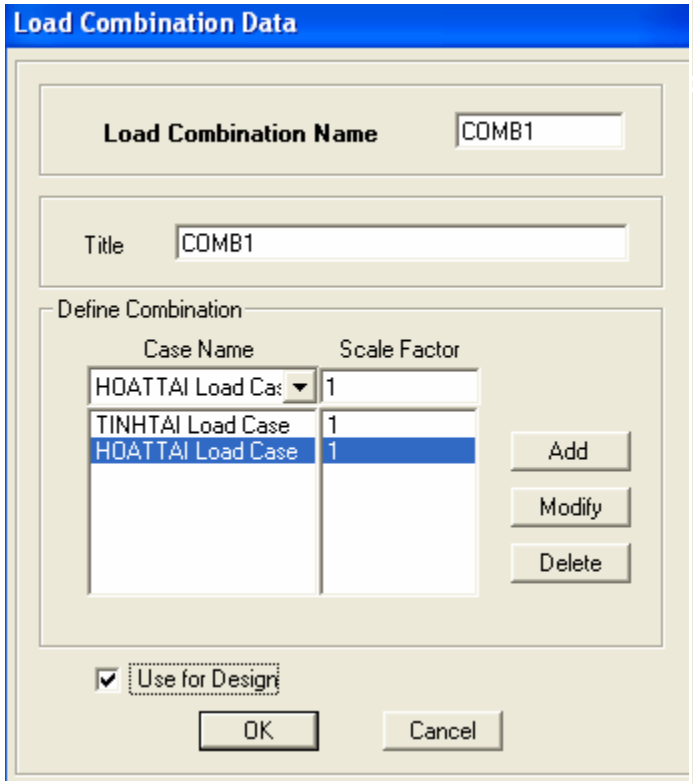
(*) Hệ số nhân xét đến ảnh hưởng của tải trọng dài hạn đến biến dạng của k/cấu

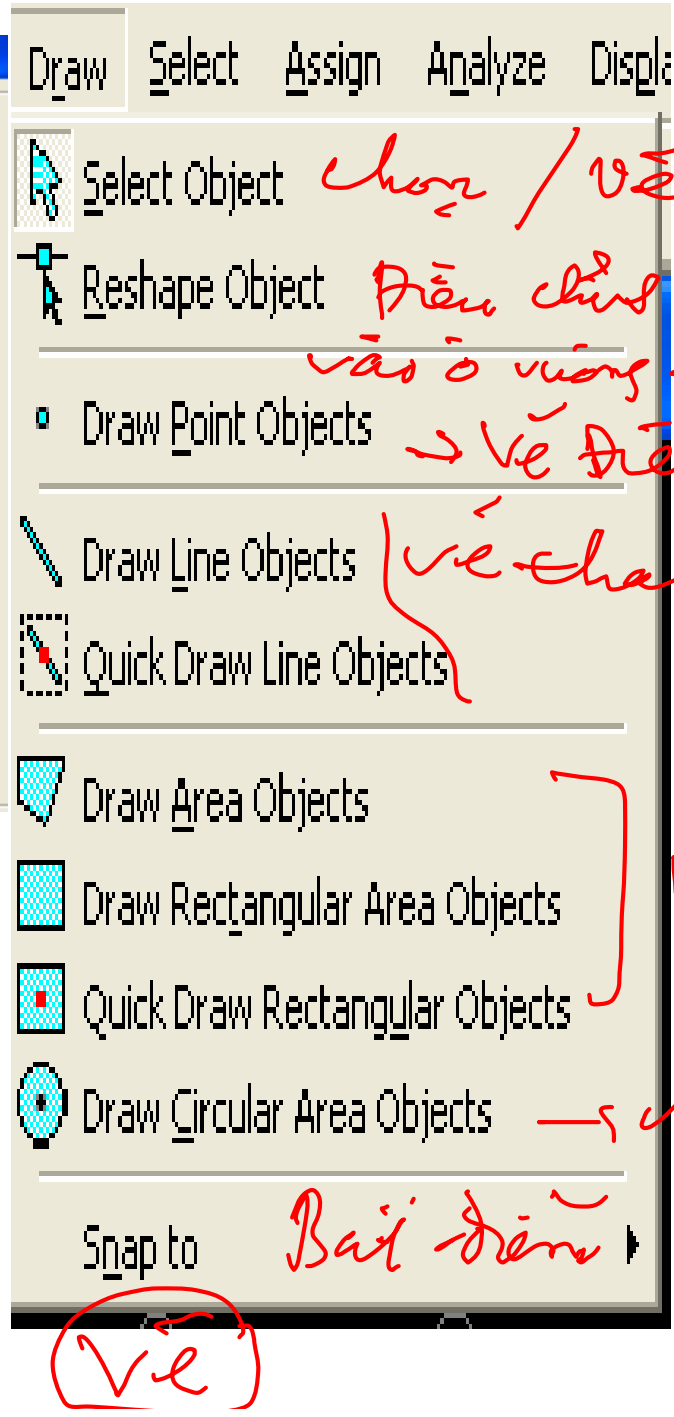
$\boxed{\text{Tải trọng}}$ { dài hạn → tỉ biến → f Es khi g = const
ngắn hạn

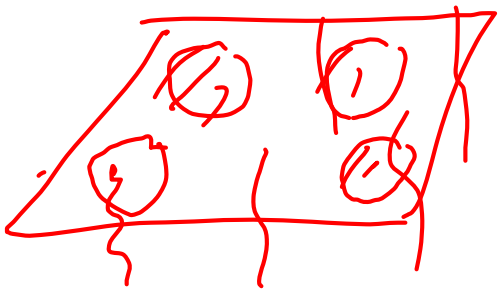
$$f = f\left(\frac{q}{EJ}\right) < f = f\left(\frac{q}{B}\right)$$

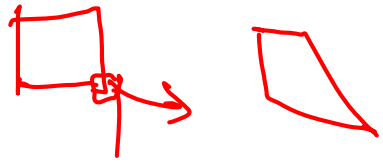
SBVL

$\boxed{B \ll EJ}$









chọn / vẽ

Điều chỉnh bằng cách click vào ô vuông → kéo

→ vẽ điểm nút

vẽ thanh (dầm)

vẽ tấm sàn chữ nhật, đa giác

vẽ sàn tròn

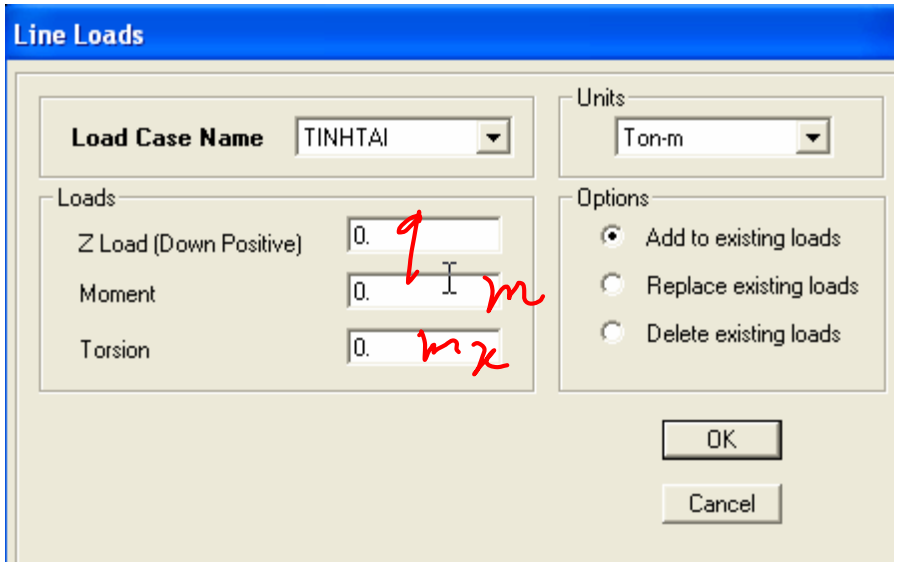
Bắt điểm

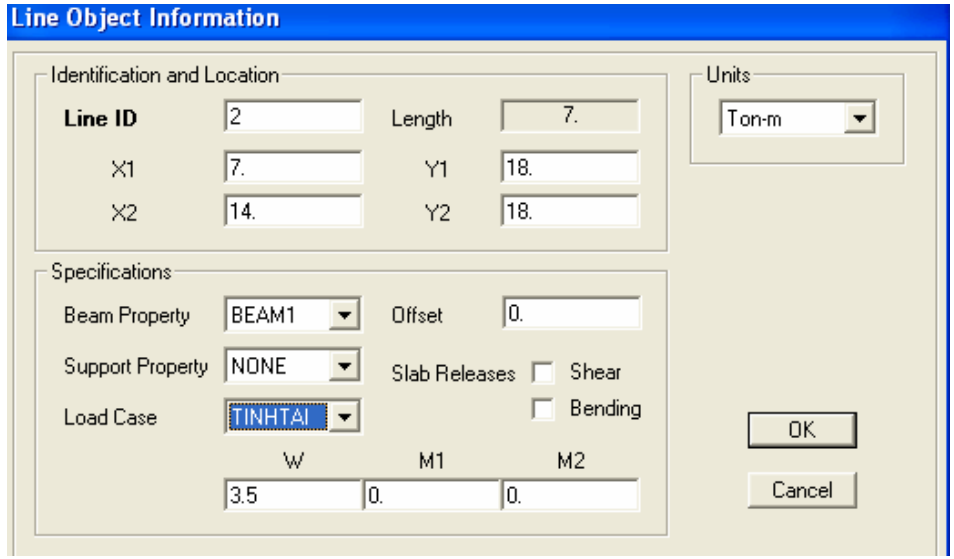
Vẽ

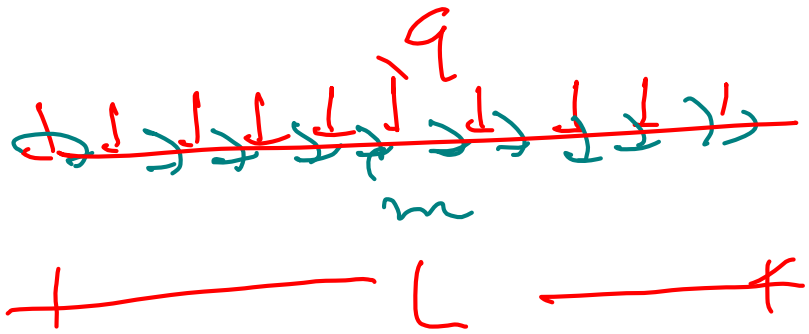
Assign | Analyze | Display | De

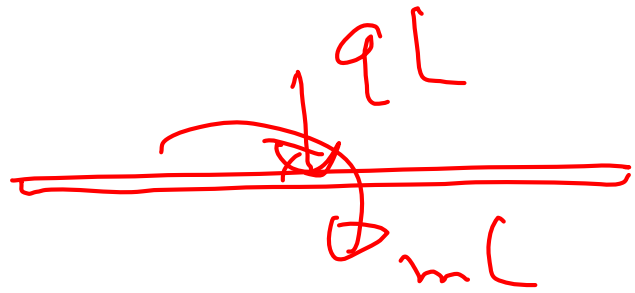
- Slab Properties.. — Gán đặc trưng khoạ, cơ học của sàn
- Slab Offset...
- Slab Rib Locations... → vị trí các gân, sườn (dầm phụ)
- Beam Properties... → Đặc trưng dầm
- Beam Offset... → gán vùng cứng cho dầm → ít dùng
- Opening → Vẽ gán lỗ trống cho sàn
- Point Restraints... → gán gối cứng (khớp lý tưởng, ngàm)
- Column Supports... → k tính từ tiết diện cột
- Wall Supports... — gối đầu → k .. — chiều dày vách
- Soil Supports... — hỏi → k tính từ hệ số nền có độ cứng k
- Releases... — giải phóng mômen
- Point Loads... → Tải tập trung tại nút
- Point Displacements... — Chuyển vị cưỡng bức tại nút
- Line Loads... → Tải phân bố trên dầm
- Surface Loads... → ——— — - Mặt (sàn)

Tải trên dầm



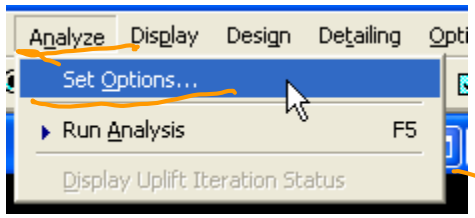


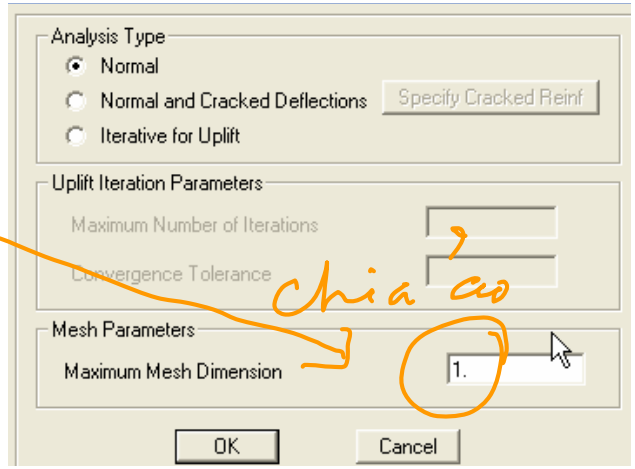




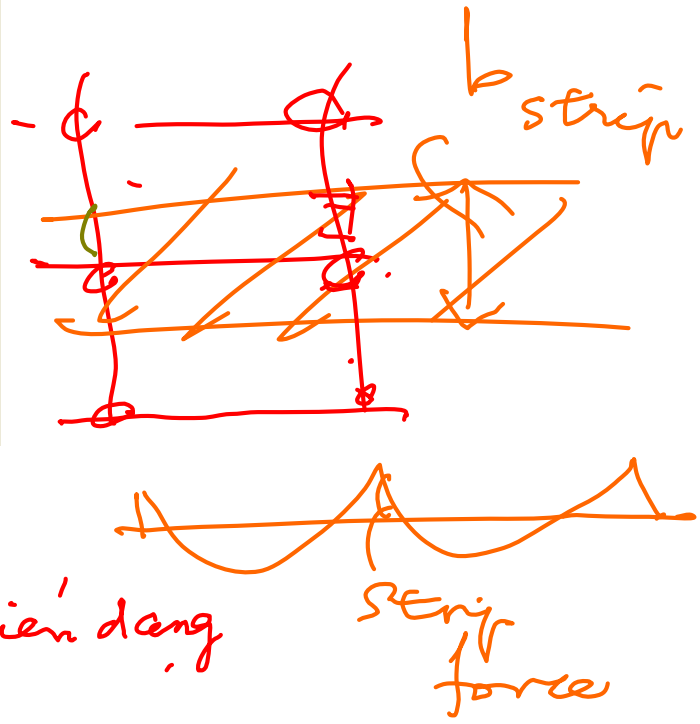
nhập

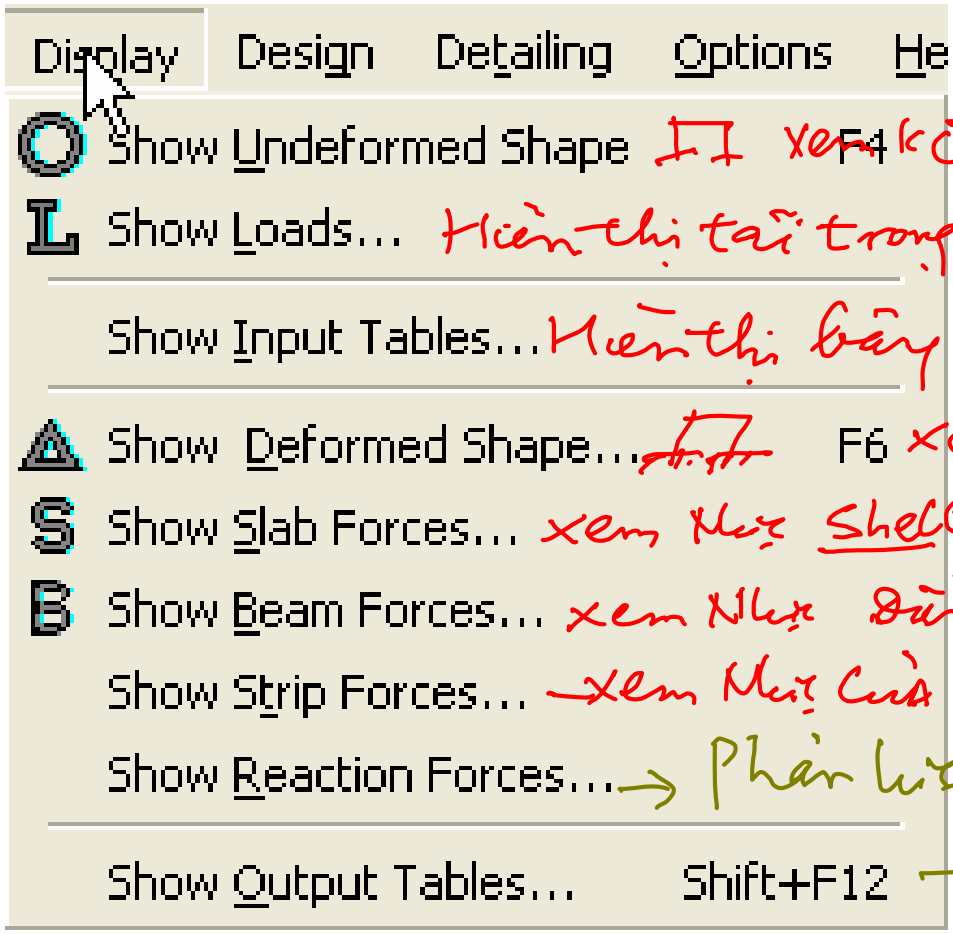
máy hiển thị





chia cao





Hiển thị kết cấu chưa biến dạng

Hiển thị tải trọng đã nhập

Hiển thị bảng số liệu đầu vào

xem b dạng k/cấu

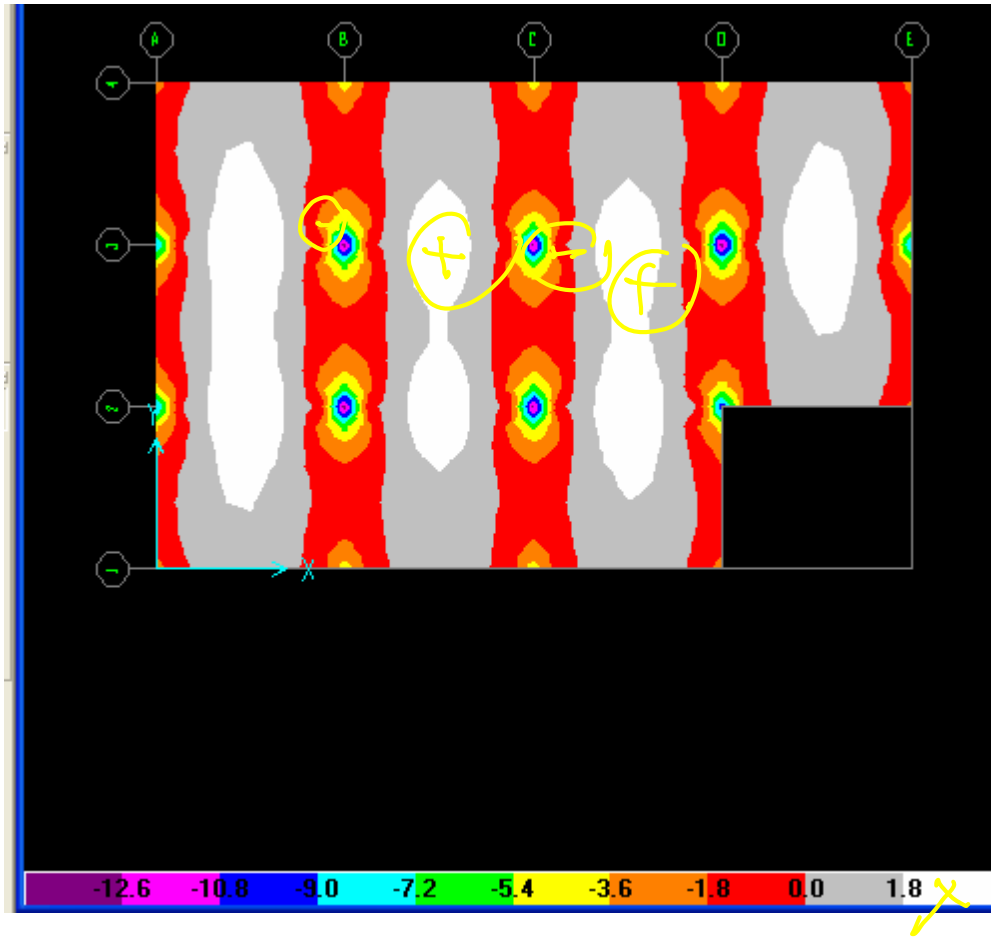
xem Nội Shell ~ Sap, Etabs → cho tiền dải rộng = 1

xem Nội dầm

xem Nội của dải sàn (trên cột nhịp)

Phản lực

Bảng kết quả.



Slab Forces

Load COMB1 Combo

Component

- (•) Mxx ( ) Myy ( ) Mxy
- ( ) Vxx ( ) Vyy
- ( ) Mmax ( ) Mmin ( ) Vmax

Display Options

- [ ] Extrude Contours
- [x] Display Contours on Deformed Shape

Scaling

- (•) Auto
- ( ) Scale Factor

Contour Averaging

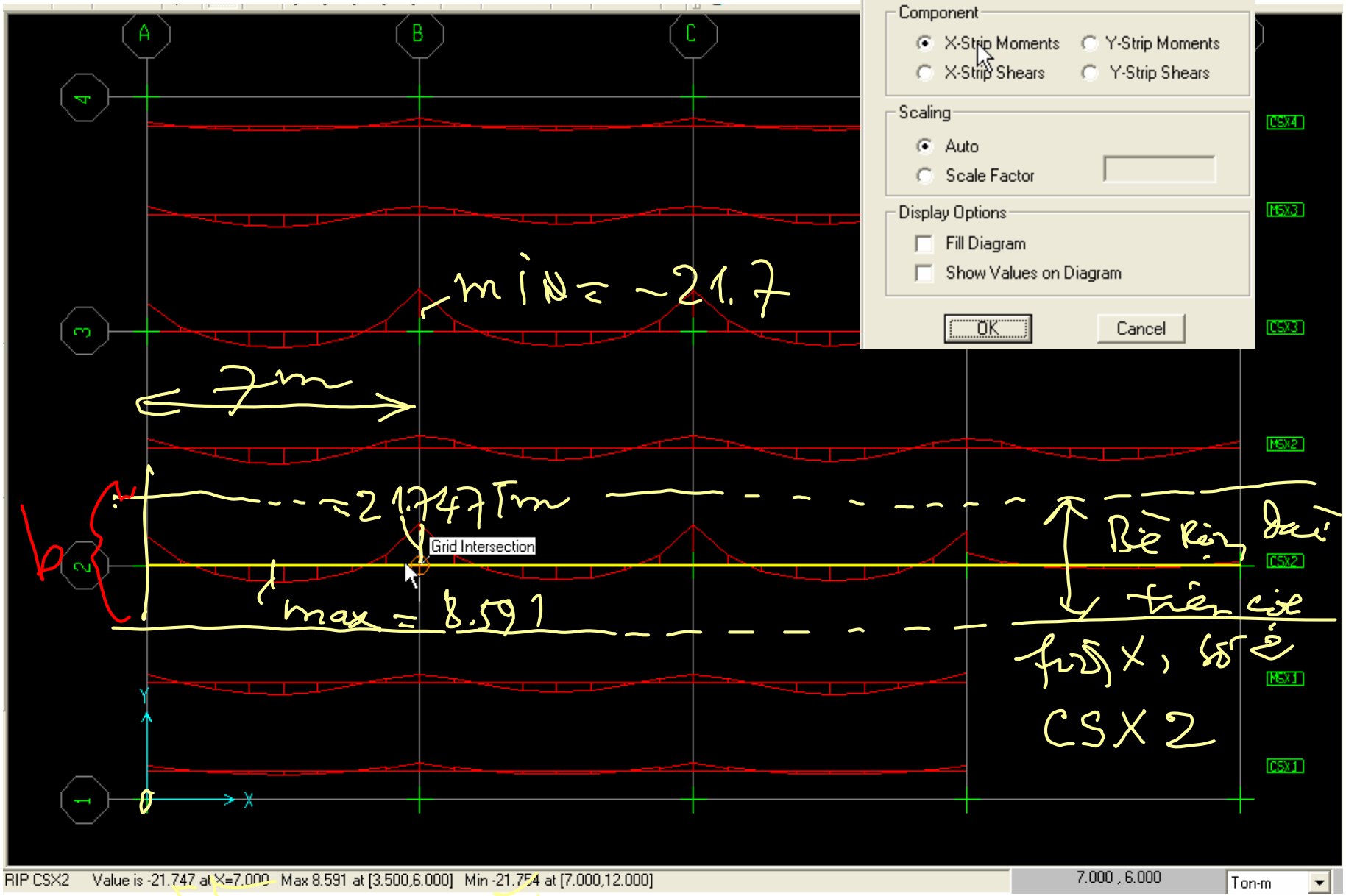
- ( ) None
- (•) at All Joints
- ( ) at Selected Joints

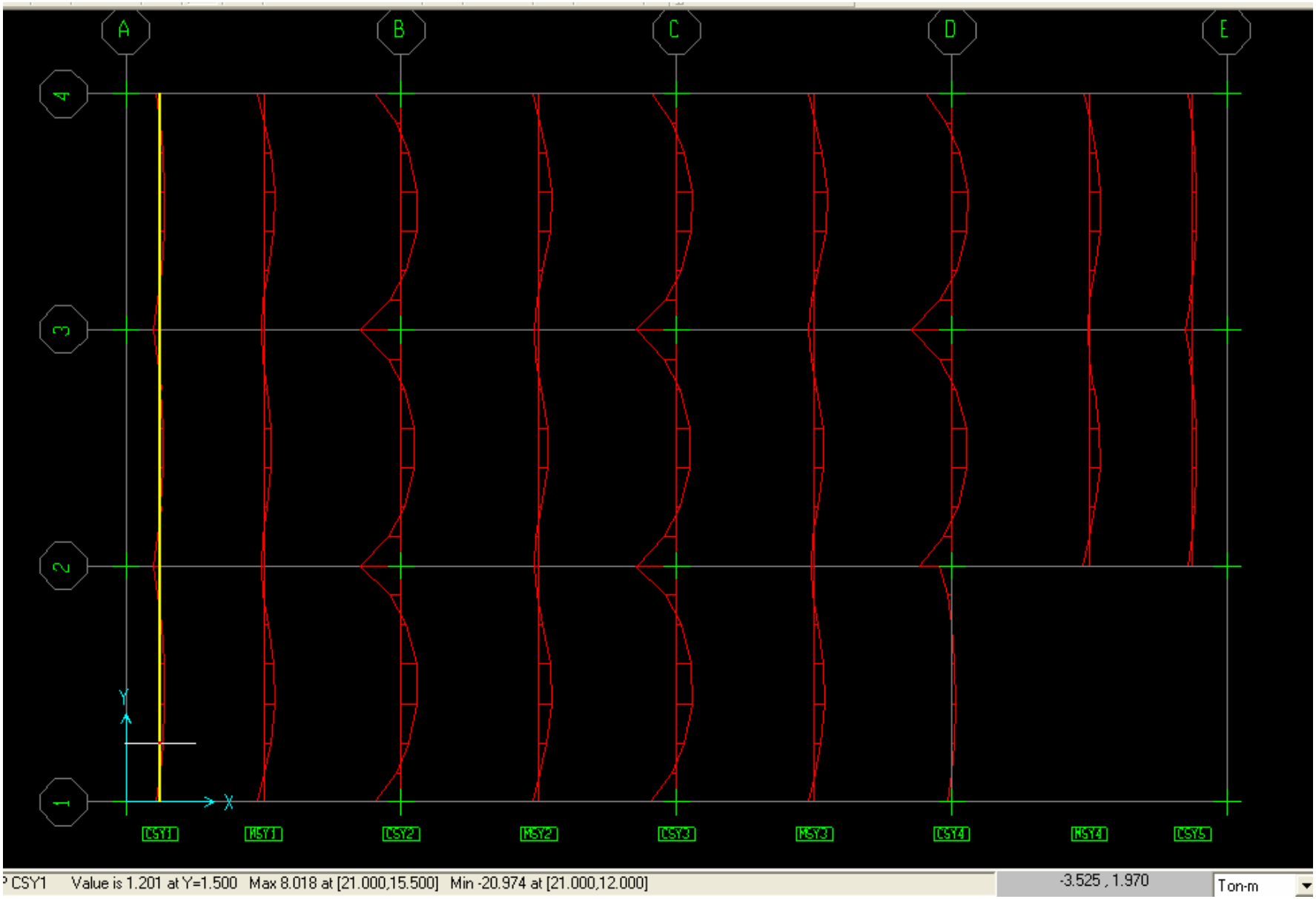
Contour Range

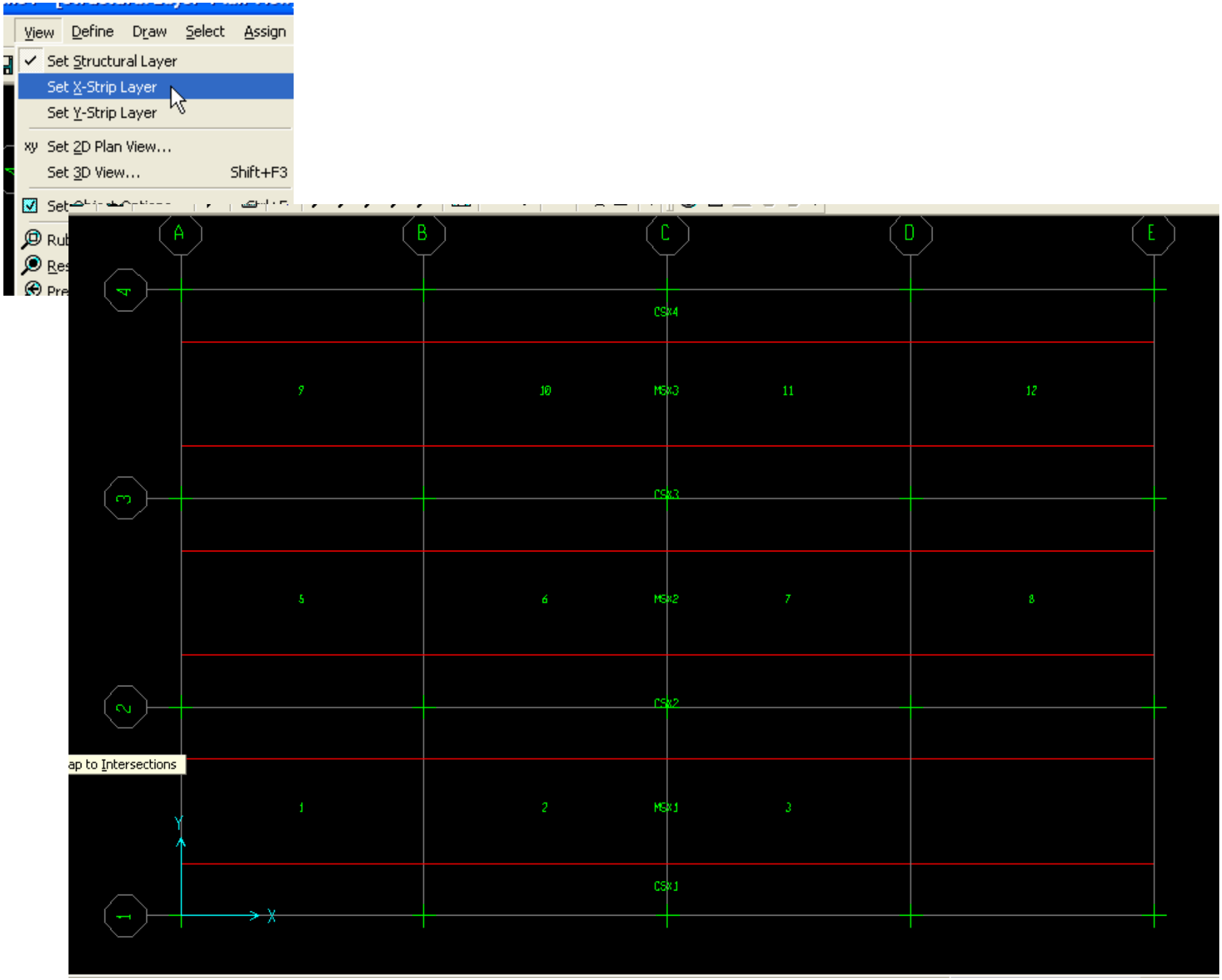
Min 0. Max 0.

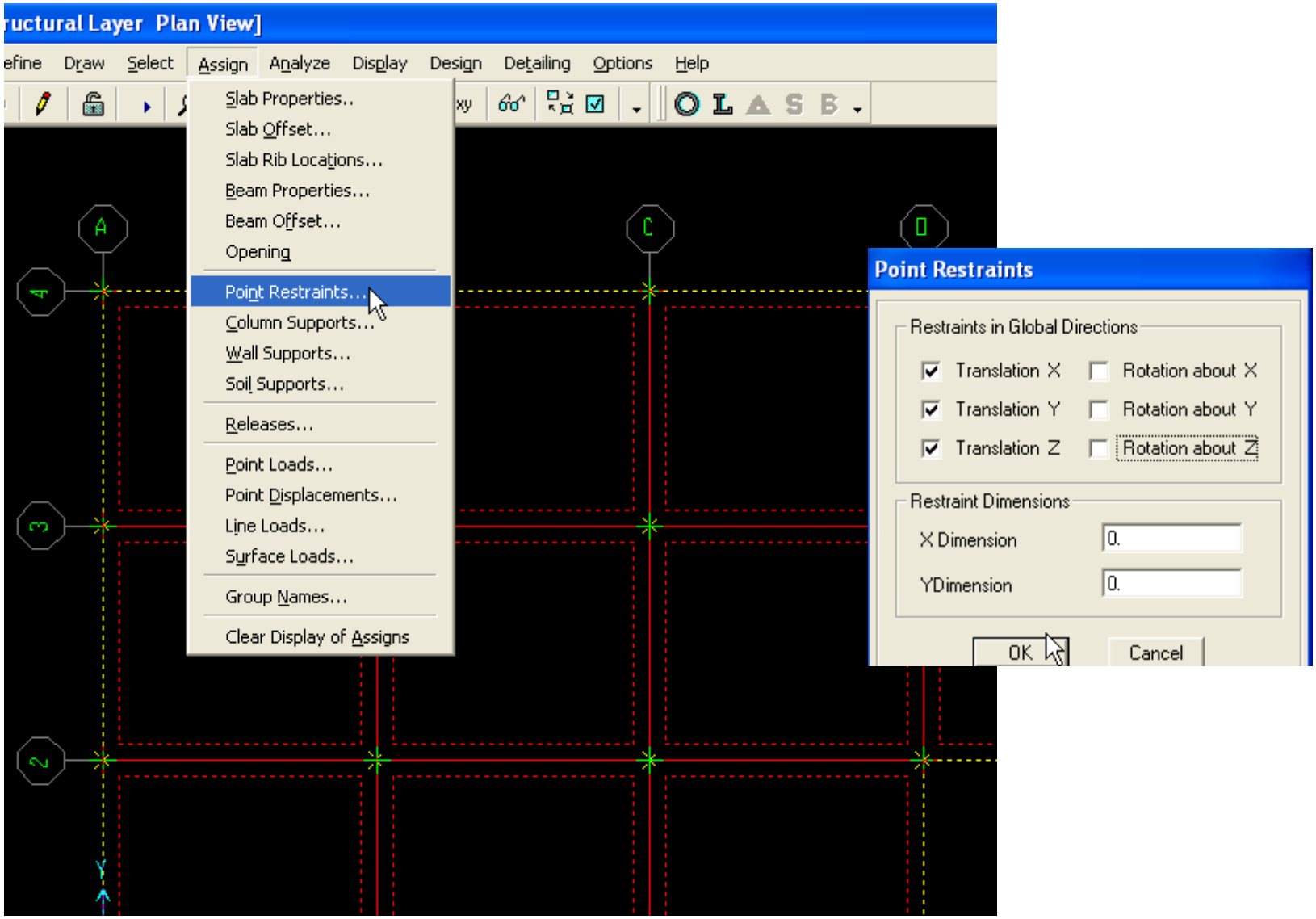
OK Cancel

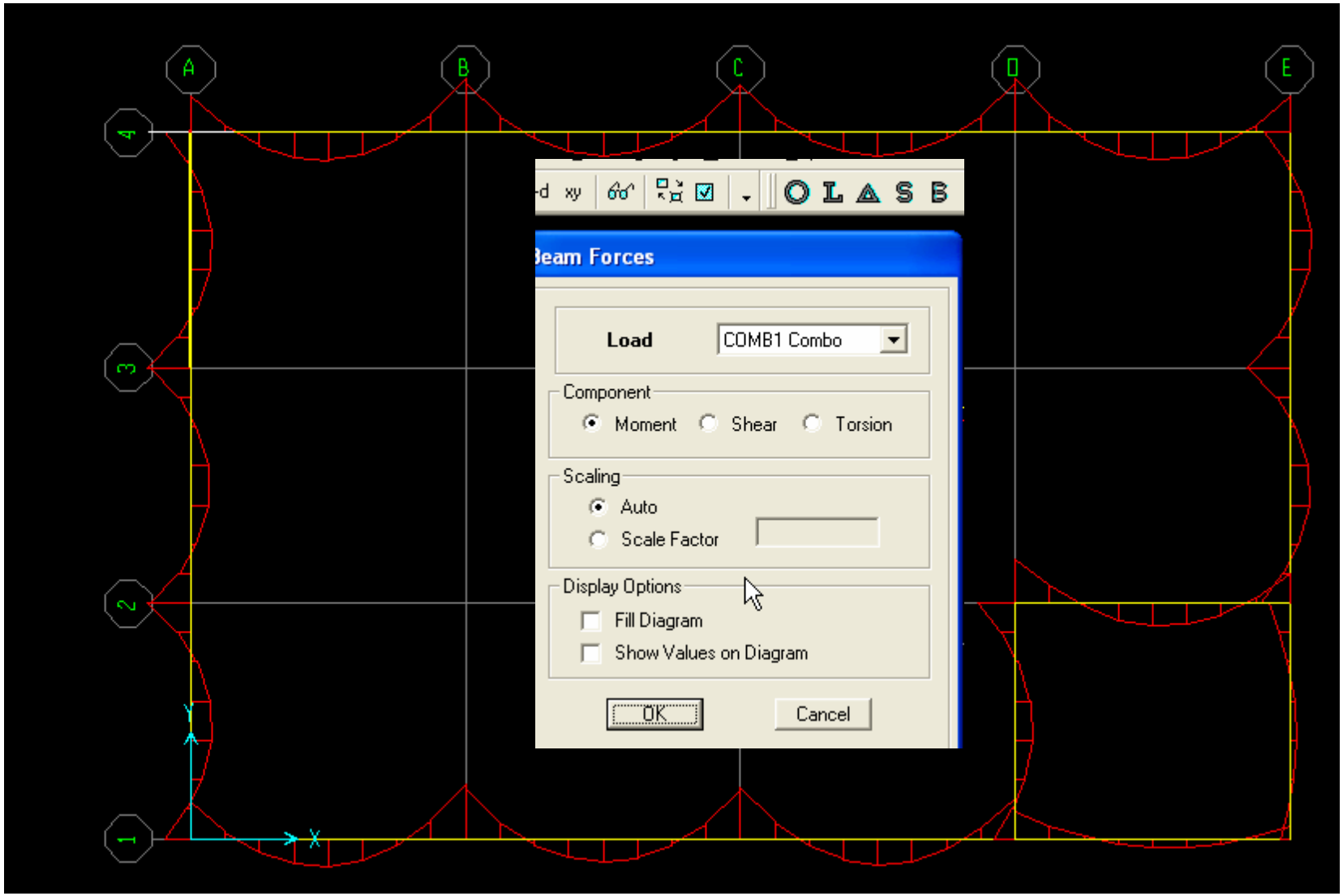
$$\alpha_m = \frac{M}{R_b b h_0^2}$$




A
B
C
D
E
4
3
2
1
Y
X
CSY1
MSY1
CSY2
MSY2
CSY3
MSY3
CSY4
MSY4
CSY5
CSY1 Value is 1.201 at Y=1.500 Max 8.018 at [21.000,15.500] Min -20.974 at [21.000,12.000]
-3.525 , 1.970
Ton-m

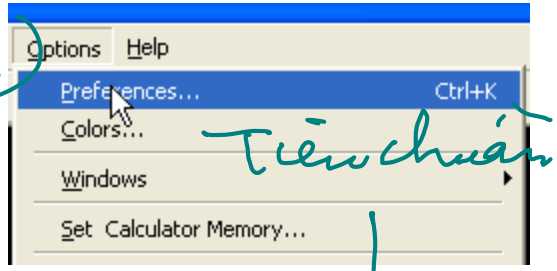

View
Define
Draw
Select
Assign
Set Structural Layer
Set X-Strip Layer
Set Y-Strip Layer
Set 2D Plan View...
Set 3D View...
Shift+F3
A
B
C
D
E
4
3
2
1
CSX4
CSX3
CSX2
CSX1
MSX3
MSX2
MSX1
9
10
11
12
5
6
7
8
1
2
3
ap to Intersections
Y
X


uctural Layer Plan View]
efine Draw Select Assign Analyze Display Design Detailing Options Help
Slab Properties..
Slab Offset...
Slab Rib Locations...
Beam Properties...
Beam Offset...
Opening
Point Restraints...
Column Supports...
Wall Supports...
Soil Supports...
Releases...
Point Loads...
Point Displacements...
Line Loads...
Surface Loads...
Group Names...
Clear Display of Assigns
A
C
D
4
3
2
Point Restraints
Restraints in Global Directions
Translation X
Rotation about X
Translation Y
Rotation about Y
Translation Z
Rotation about Z
Restraint Dimensions
X Dimension
0.
YDimension
0.
OK
Cancel

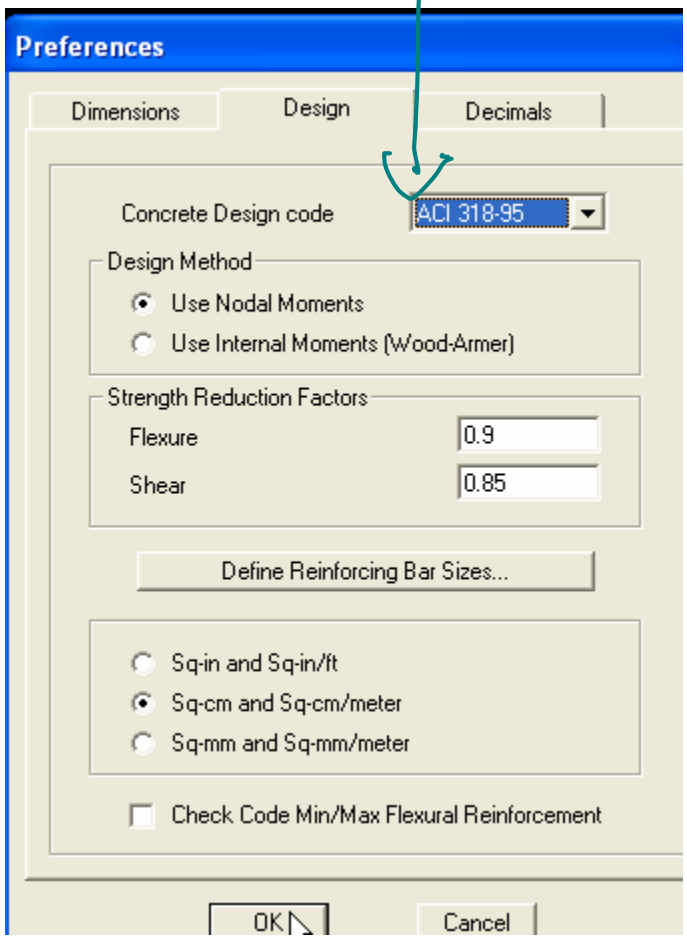

A
B
C
D
E
1
2
3
4
Y
X
Beam Forces
Load
COMB1 Combo
Component
Moment
Shear
Torsion
Scaling
Auto
Scale Factor
Display Options
Fill Diagram
Show Values on Diagram
OK
Cancel

Thiết kế cột thép

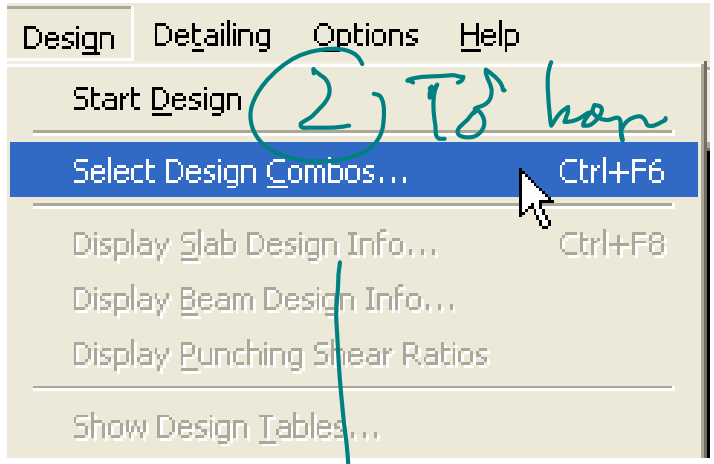
1

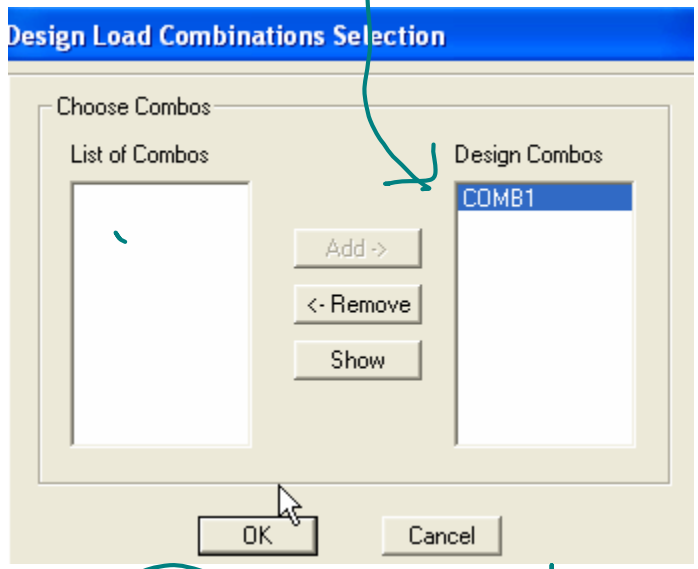


Tiêu chuẩn

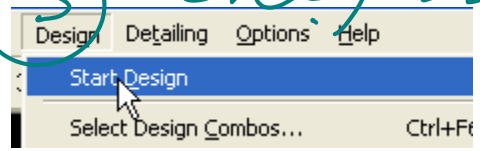


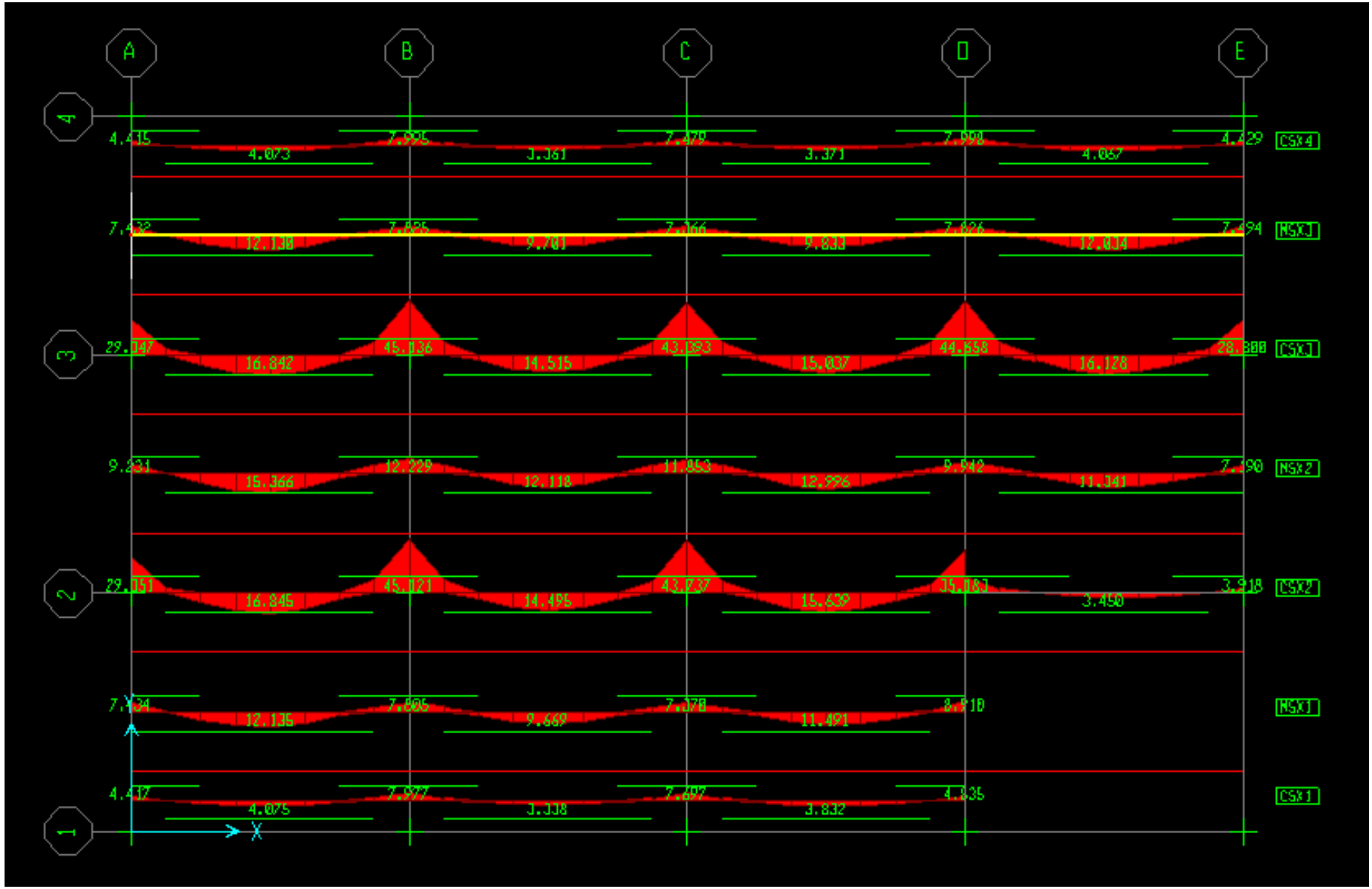
2) Tổ hợp

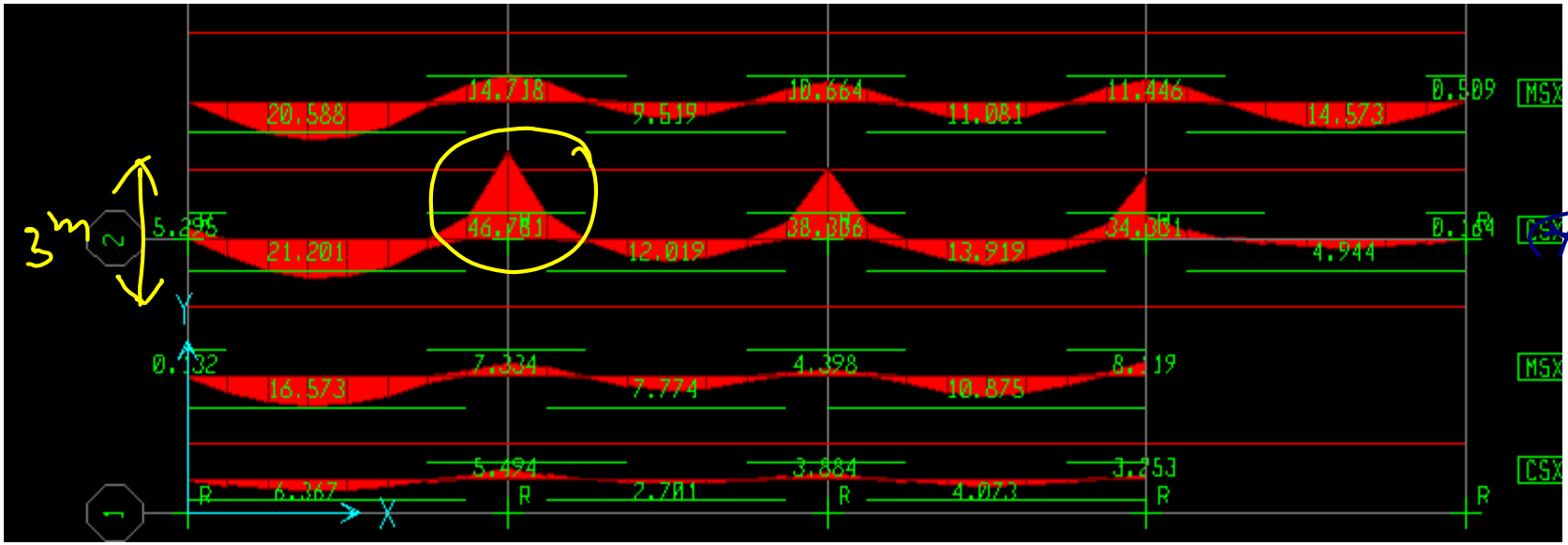




3) Chạy bài thiết




A
B
C
D
E
4
3
2
1
4.073
3.361
3.371
4.067
12.130
9.701
9.833
12.034
16.842
14.515
15.037
16.128
16.366
12.118
12.996
11.141
16.845
14.495
15.639
3.450
12.135
9.669
11.491
4.075
3.338
3.832
CSX4
MSX3
CSX3
MSX2
CSX2
MSX1
CSX1



Ví dụ dầm trên cốt (*), rộng 3m

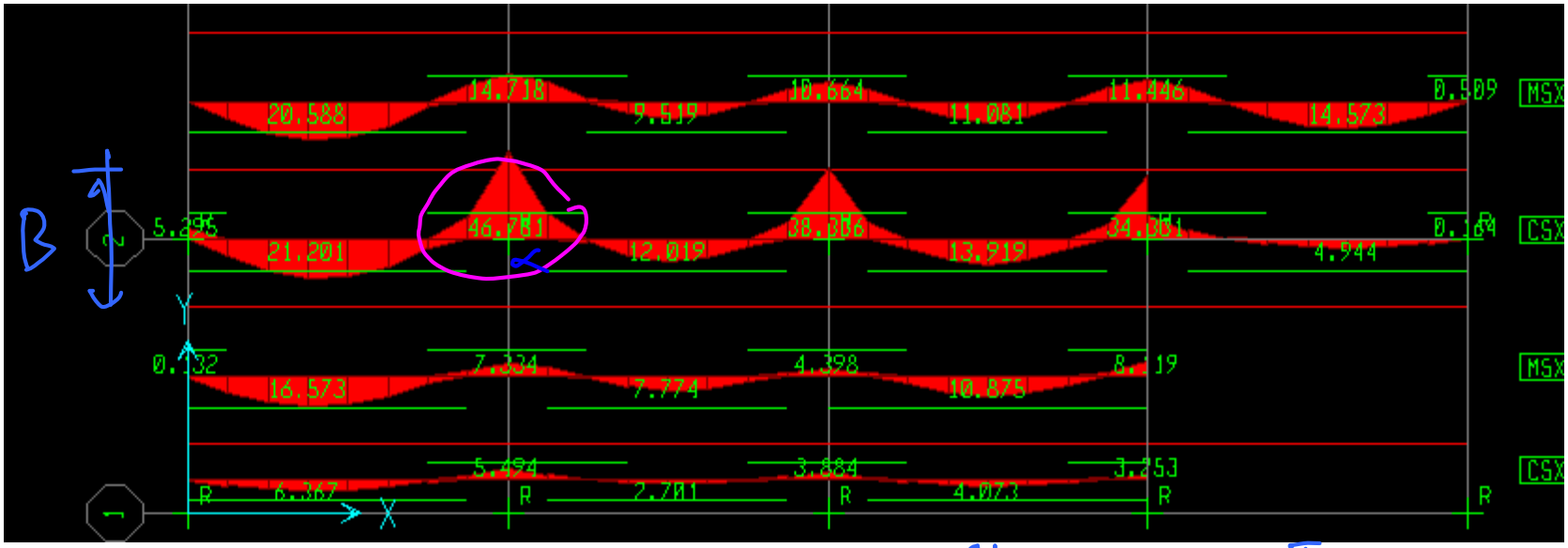
$A_s = 46{,}8\ cm^2 / 3^m$

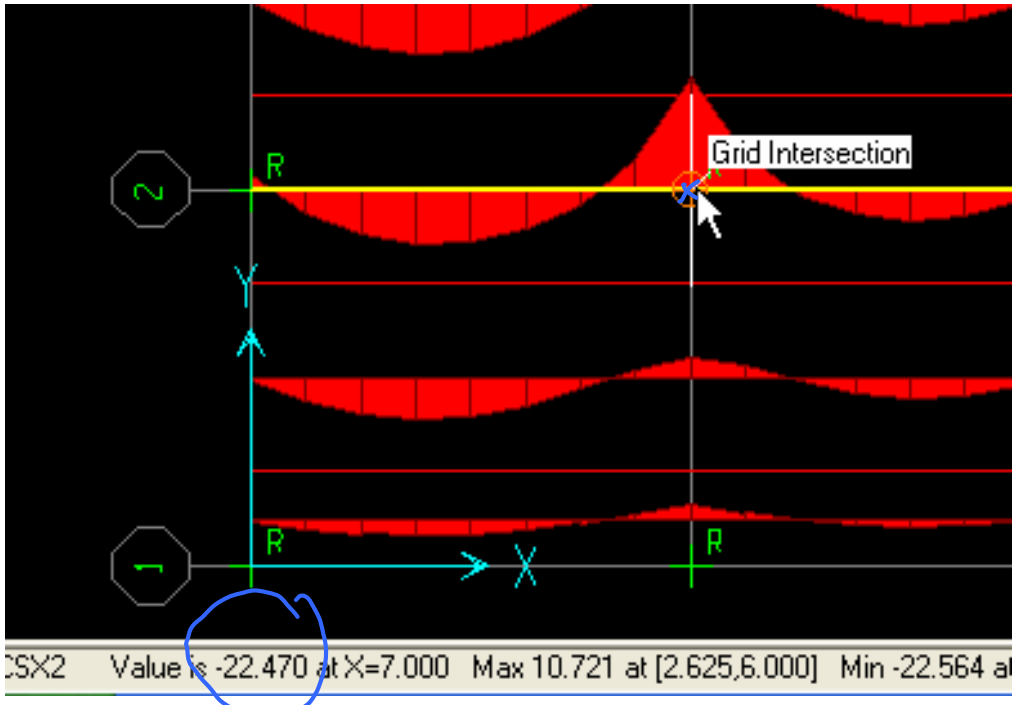
$= 15{,}5\ cm^2 / 1^m$

Muốn Φ16 (2,01 cm^2)

→ 8 Φ16/m

→ $\boxed{\Phi 16@125}$





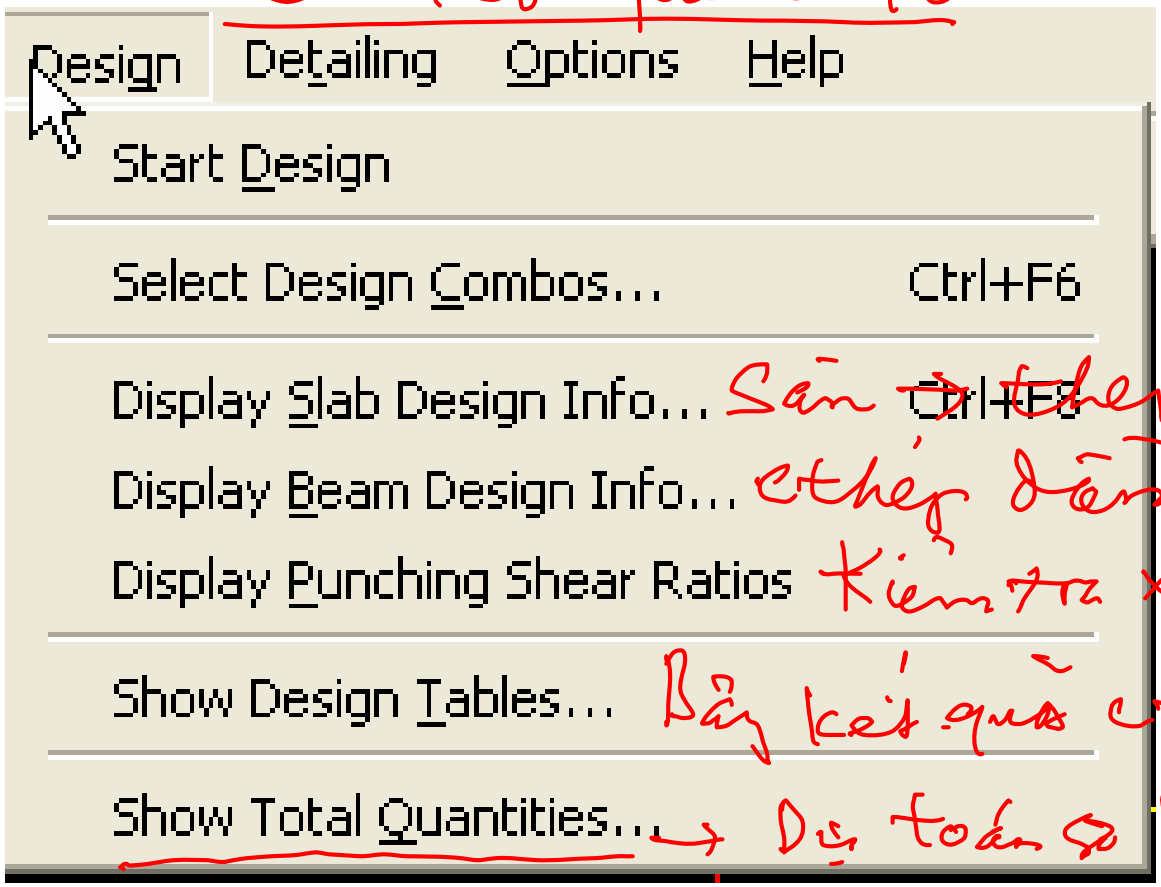
$$\begin{cases} M = 22.47\ Tm \\ R_b = 130\ kG/cm^2 \\ R_s = 2900\ kG/cm^2 \\ b = 3^m = 300\ cm \\ h_0 = h - a = 22 - 3 = 19\ cm \end{cases}$$

$$\alpha_m = \frac{M}{R_b b h_0^2} = 0{,}160$$

$$\zeta = 0{,}5\left(1 + \sqrt{1 - 2\alpha_m}\right) = 0{,}912$$

$$A_s = \frac{M}{\zeta R_s h_0} = 46{,}3\ cm^2$$

Xem kết quả thiết kế:



Sàn → thép sàn

thép dầm

kiểm tra xuyên thủng

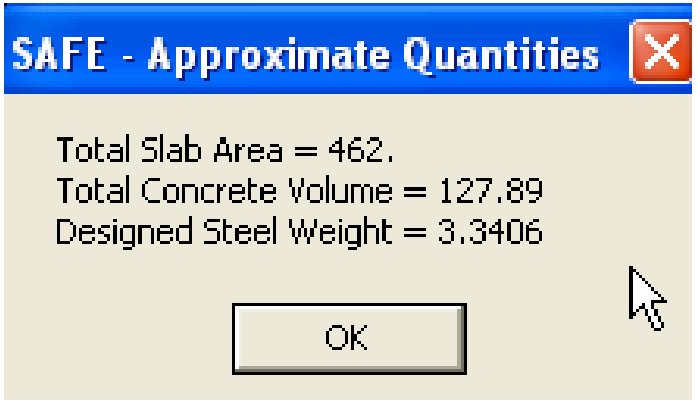
$\frac{P_{x\,thực}}{[P]}$

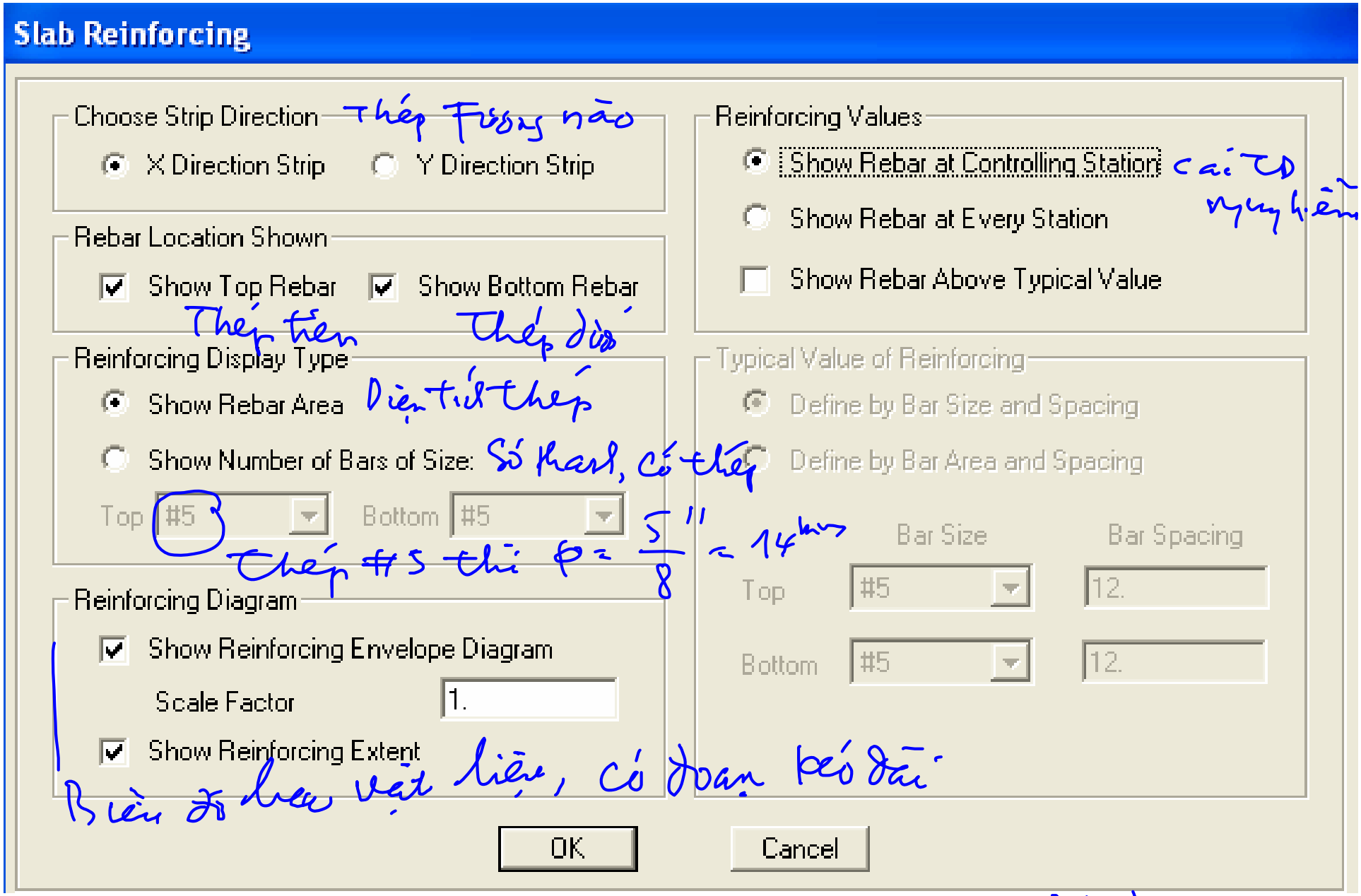
Bảng kết quả thép

→ Dự toán sơ bộ

+ Thể tích bê tông.

+ Trọng lượng cốt thép





Thép Fương nào

cái CD nguy hiểm

Thép trên

Thép dưới

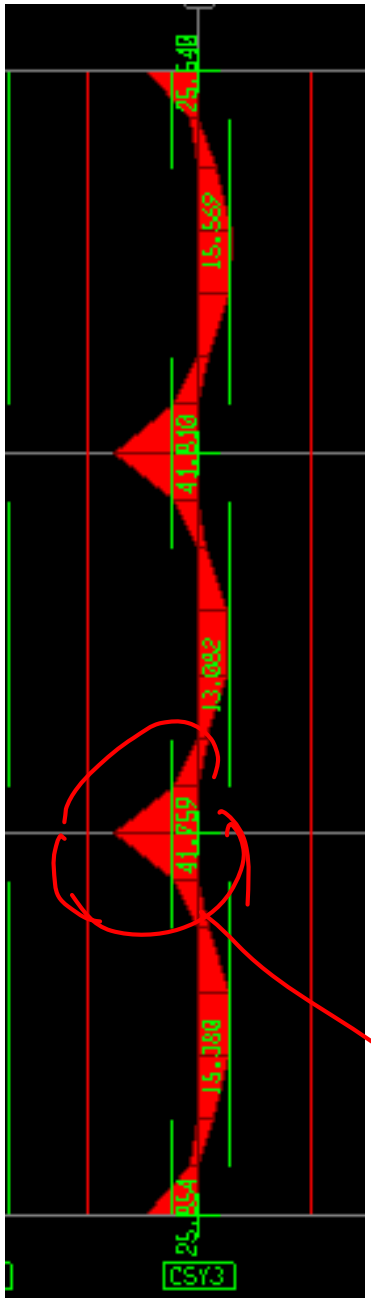
Diện tích thép

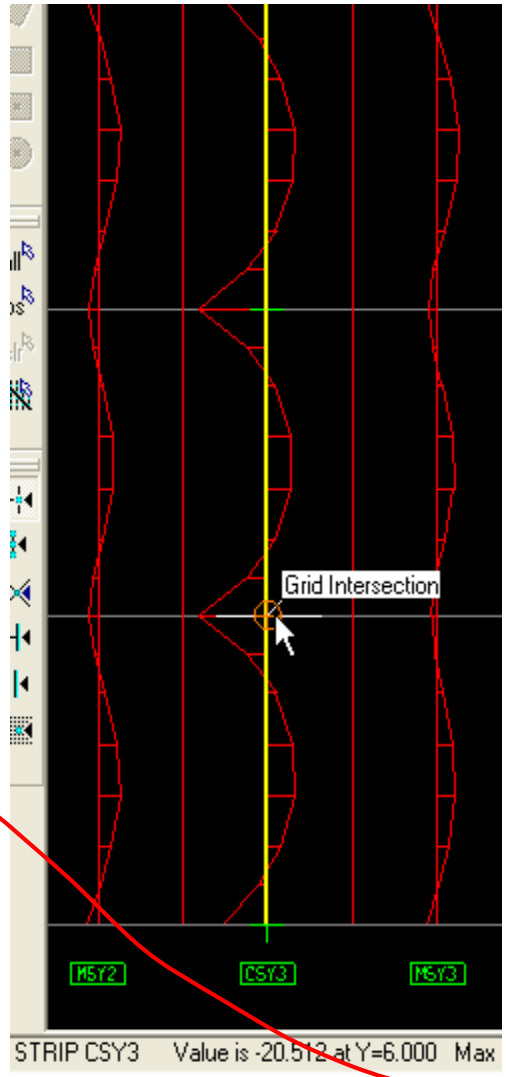
Số thanh, có thép

Thép #5 thì $\Phi = \frac{5}{8}'' = 14^{mm}$

Biểu đồ bao vật liệu, có đoạn kéo dài

Kết quả thép sàn (cho từng dải)





Dải cột CSY3, tại gối

$b = 3{,}5\ m$

$h = 22\ cm$ | $h_0 = 19\ cm$

$a = 3$

$R_b = 130\ kG/cm^2$

$R_s = 2800\ kG/cm^2$

$$\alpha_m = \frac{M}{R_b b h_0^2} = \frac{20{,}512 \times 10^5}{130 \times 350 \times 19^2}$$

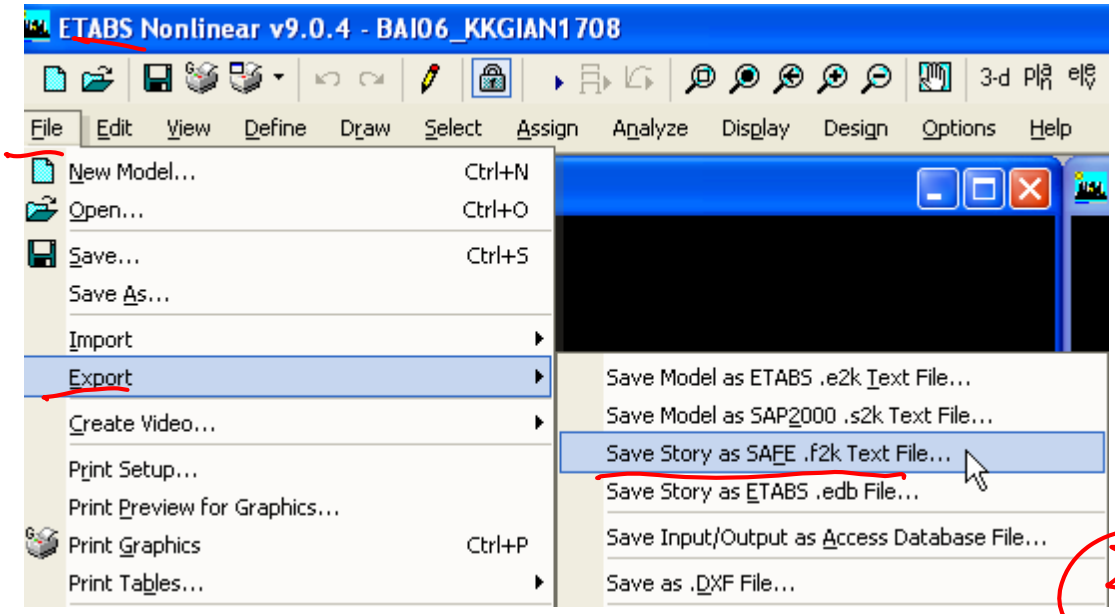
$$= 0{,}125$$

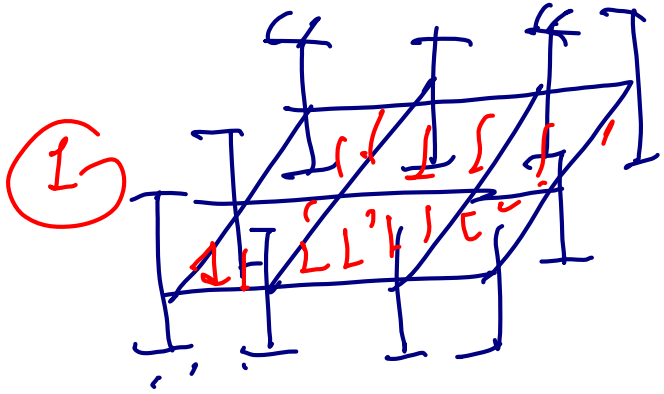
$$\xi = 0{,}5(1 + \sqrt{1 - 2\alpha_m}) = 0{,}933$$

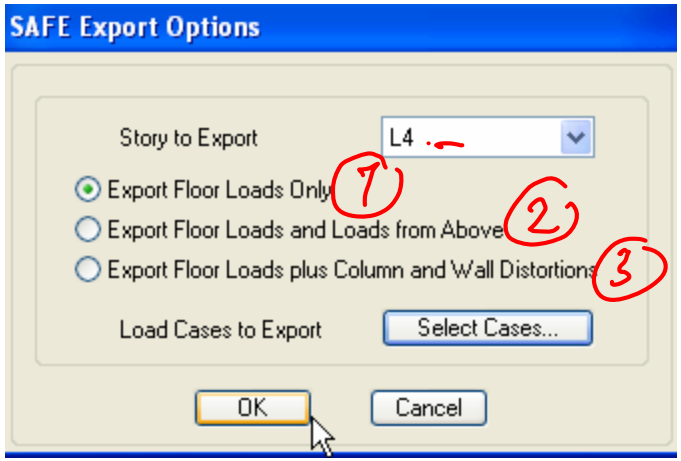
$$A_s = \frac{M}{\xi R_s h_0} = \frac{20{,}512 \times 10^5}{0{,}933 \times 2800 \times 19}$$

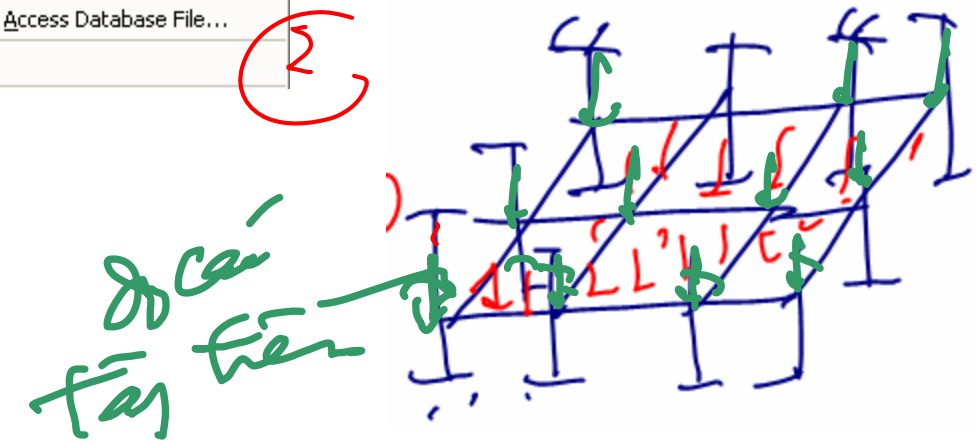
$$= 41{,}325\ cm^2$$

Chuyển mô hình sàn đã nhập ở Etabs sang Safe.

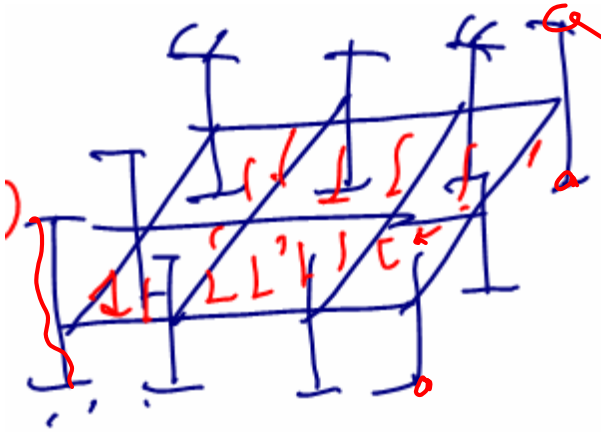








(3)



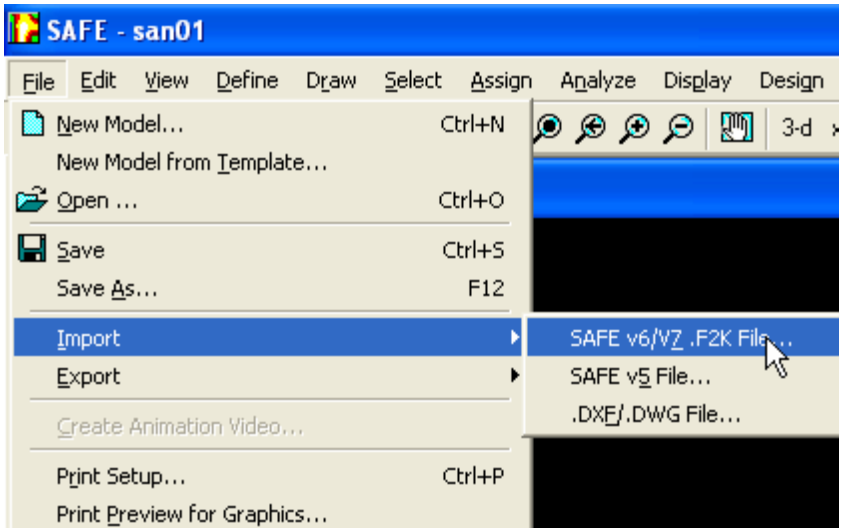
→ cho đầu cột có chuyển vị cưỡng bức

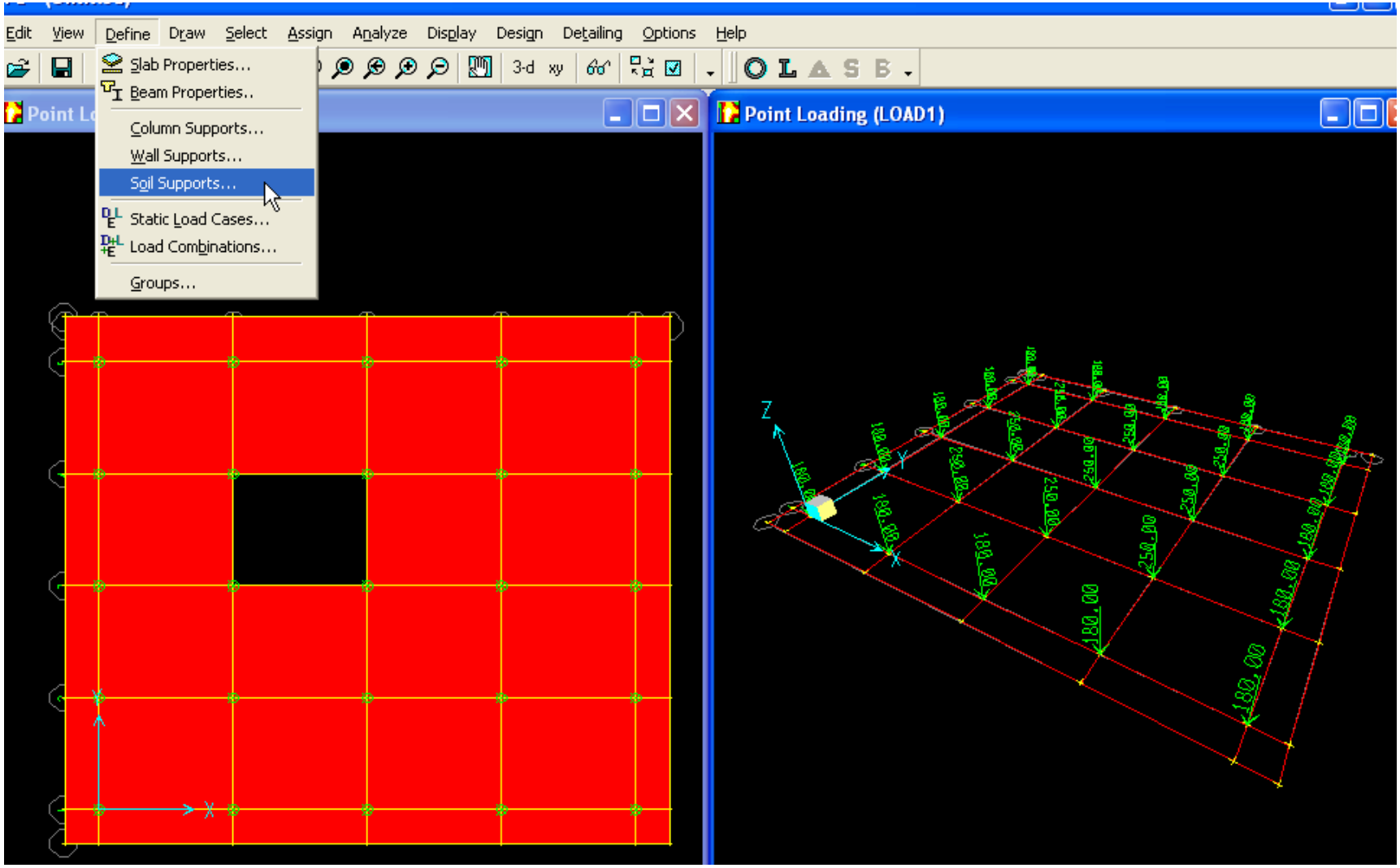
giá trị của ch/vị này

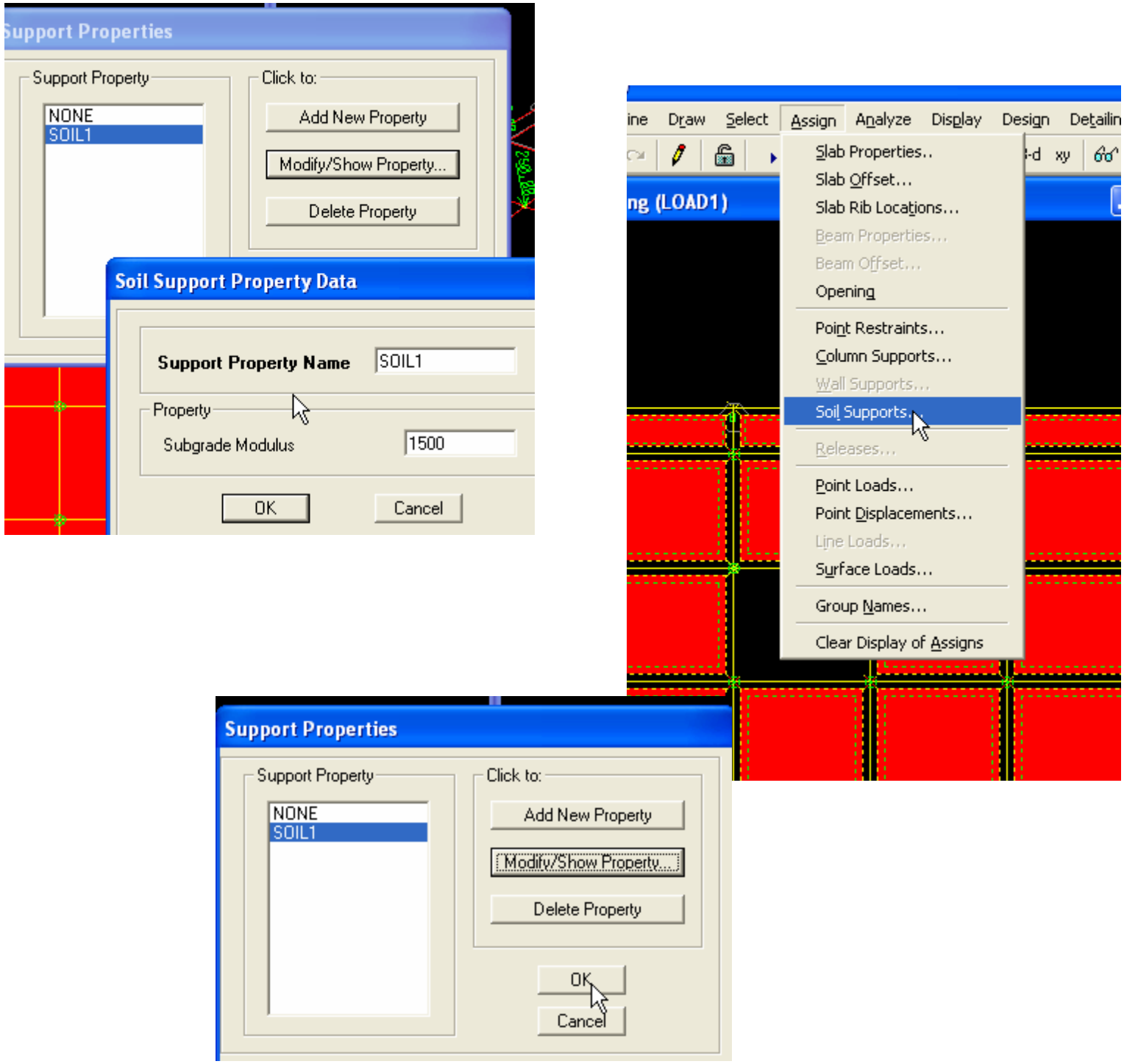
= k/quả ch/vị đã gắn trong Etabs.

nhận xét

- chuyển mô hình cánh 1: chưa cần tính gắn bản toán trong Etabs
- ——— (2) (3) tính gắn Etabs rồi → các cột đã có nhiều c/vị rồi.


SAFE - san01
File Edit View Define Draw Select Assign Analyze Display Design
New Model... Ctrl+N
New Model from Template...
Open ... Ctrl+O
Save Ctrl+S
Save As... F12
Import
Export
Create Animation Video...
Print Setup... Ctrl+P
Print Preview for Graphics...
SAFE v6/V7 .F2K File...
SAFE v5 File...
.DXF/.DWG File...
3-d


Edit View Define Draw Select Assign Analyze Display Design Detailing Options Help
Slab Properties...
Beam Properties...
Column Supports...
Wall Supports...
Soil Supports...
Static Load Cases...
Load Combinations...
Groups...
3-d xy
Point Loading (LOAD1)
Z
Y
X
180.00
250.00


Support Properties
Support Property
NONE
SOIL1
Click to:
Add New Property
Modify/Show Property...
Delete Property
Soil Support Property Data
Support Property Name
SOIL1
Property
Subgrade Modulus
1500
OK
Cancel
ine Draw Select Assign Analyze Display Design Detailin
ng (LOAD1)
Slab Properties..
Slab Offset...
Slab Rib Locations...
Beam Properties...
Beam Offset...
Opening
Point Restraints...
Column Supports...
Wall Supports...
Soil Supports...
Releases...
Point Loads...
Point Displacements...
Line Loads...
Surface Loads...
Group Names...
Clear Display of Assigns
Support Properties
Support Property
NONE
SOIL1
Click to:
Add New Property
Modify/Show Property...
Delete Property
OK
Cancel

SAFE

Một số bài toán nền móng

1

Safe. Móng.

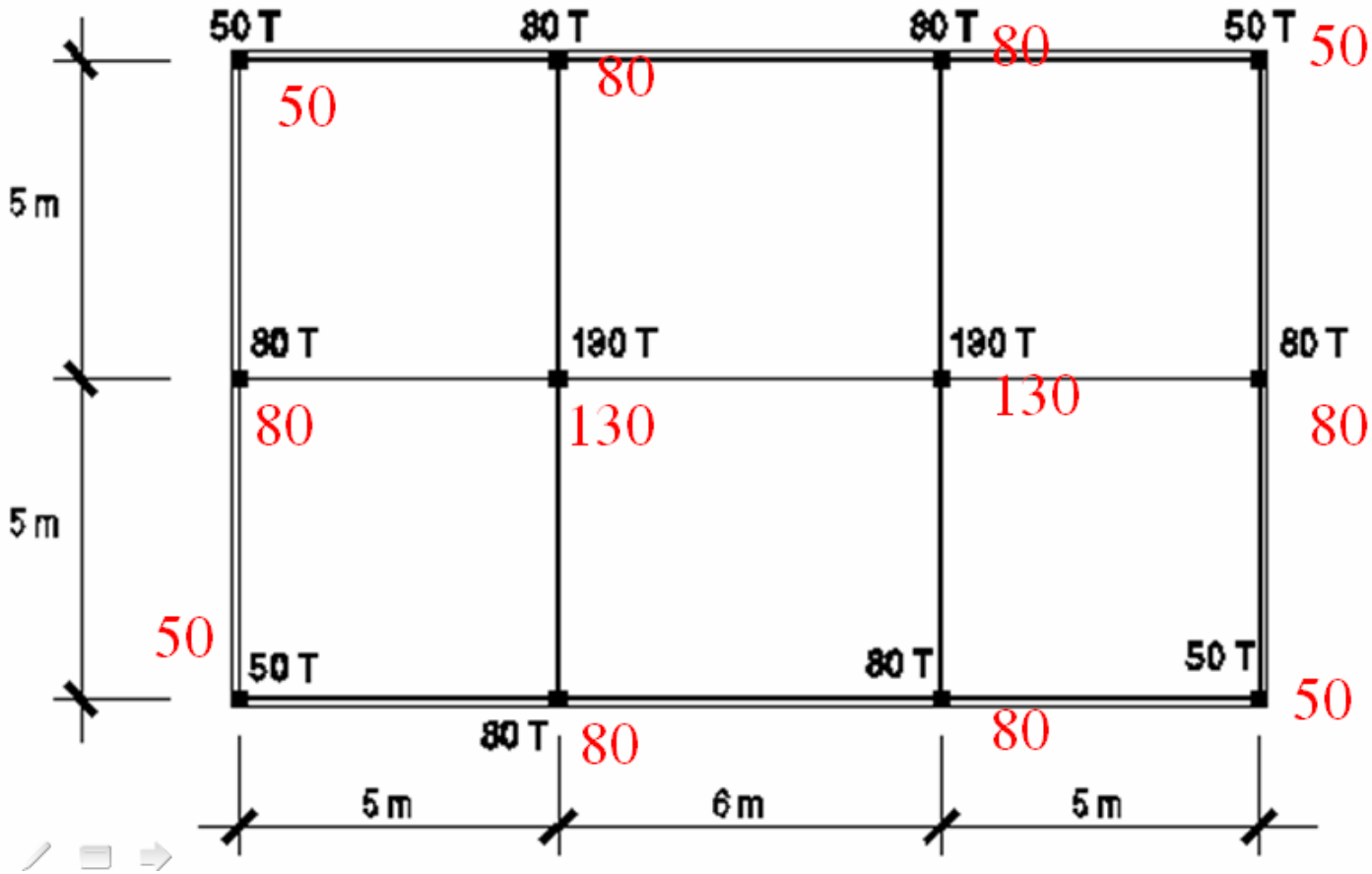
Khảo sát một móng bè có sườn với mặt bằng như hình vẽ. Bản móng dày 35cm; dầm móng có tiết diện 400×700. Tải trọng nén tại chân cột (tính bằng tấn) được thể hiện trên hình vẽ.

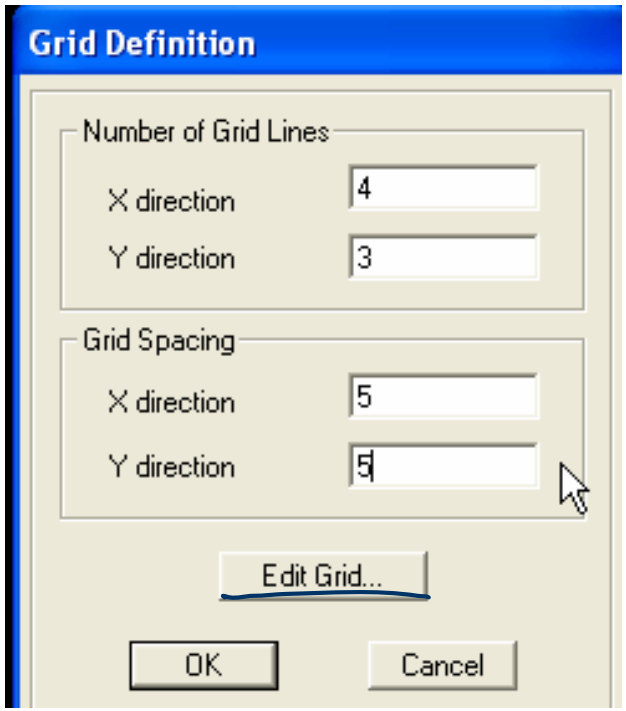
Bêtông có $E = 2.65\times10^6$ T/m^2;

Đất có hệ số nền $C_z = 1200$ T/m^3.

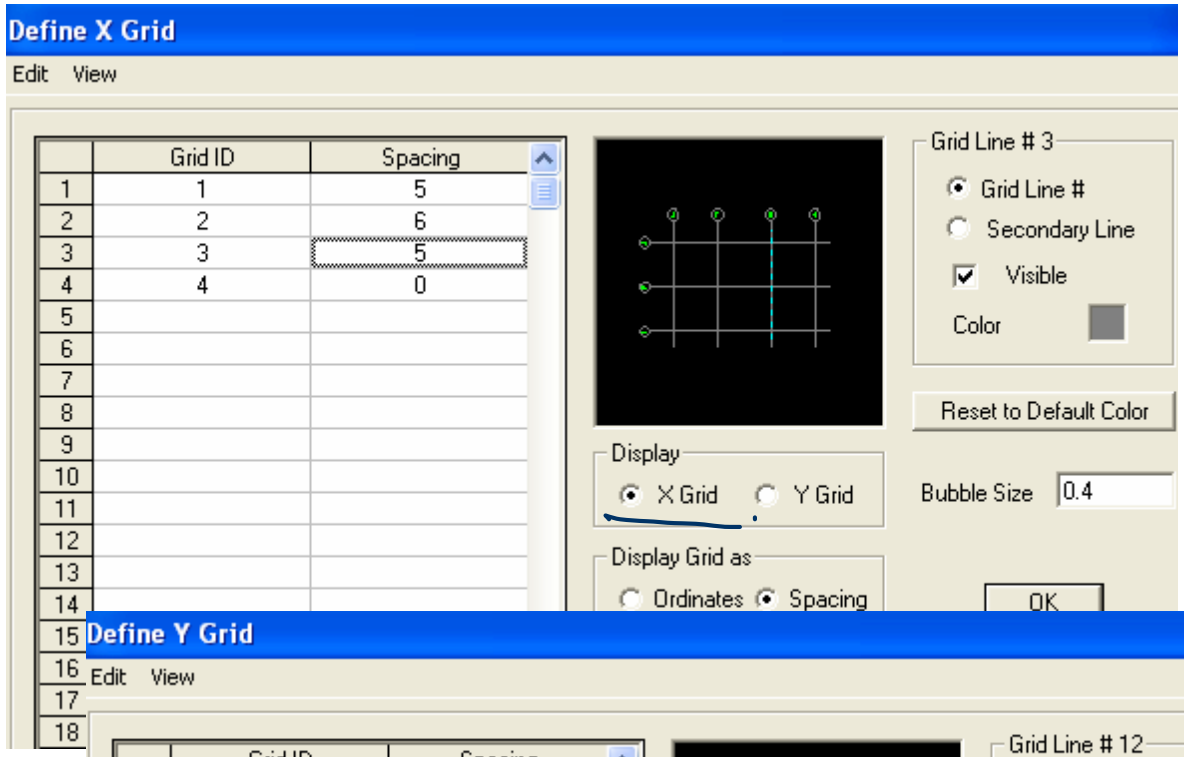
bè có sườn

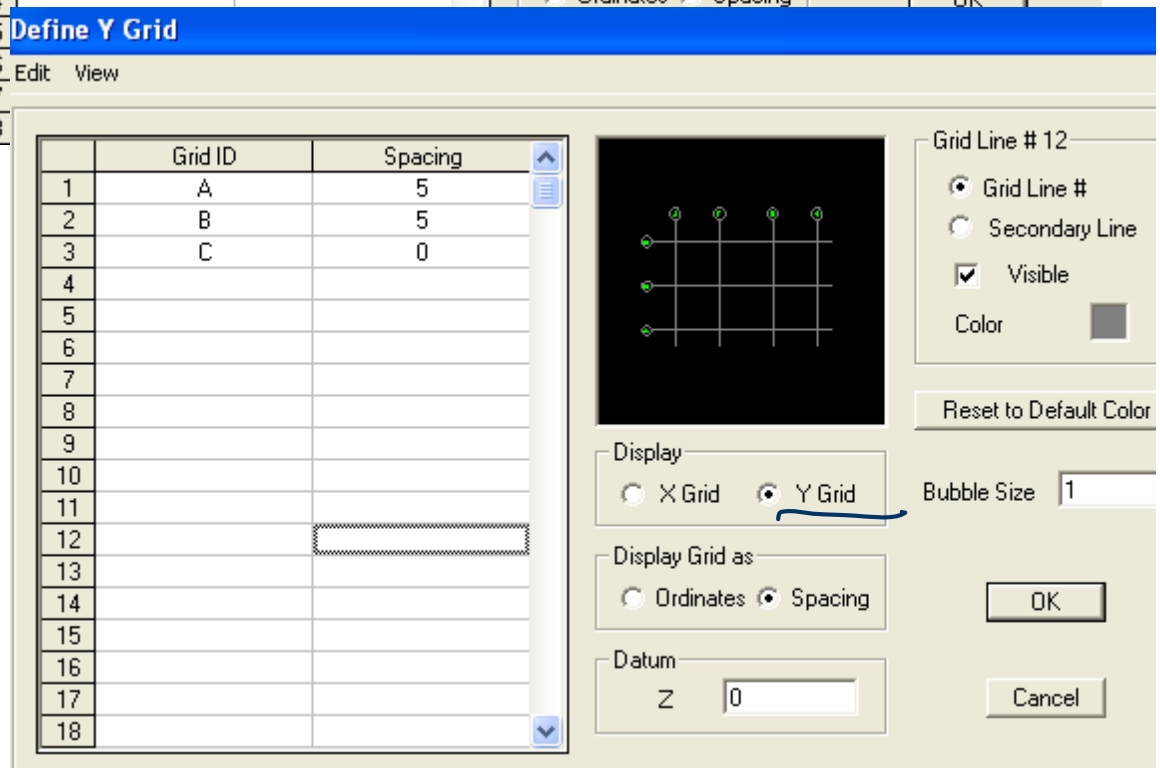
$h_b \geq (1/15 \div 1/10)L$

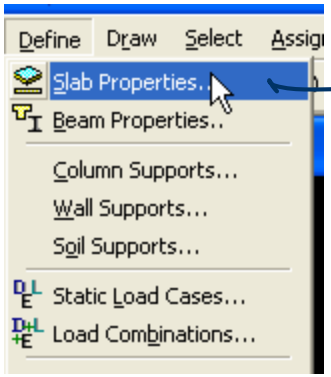


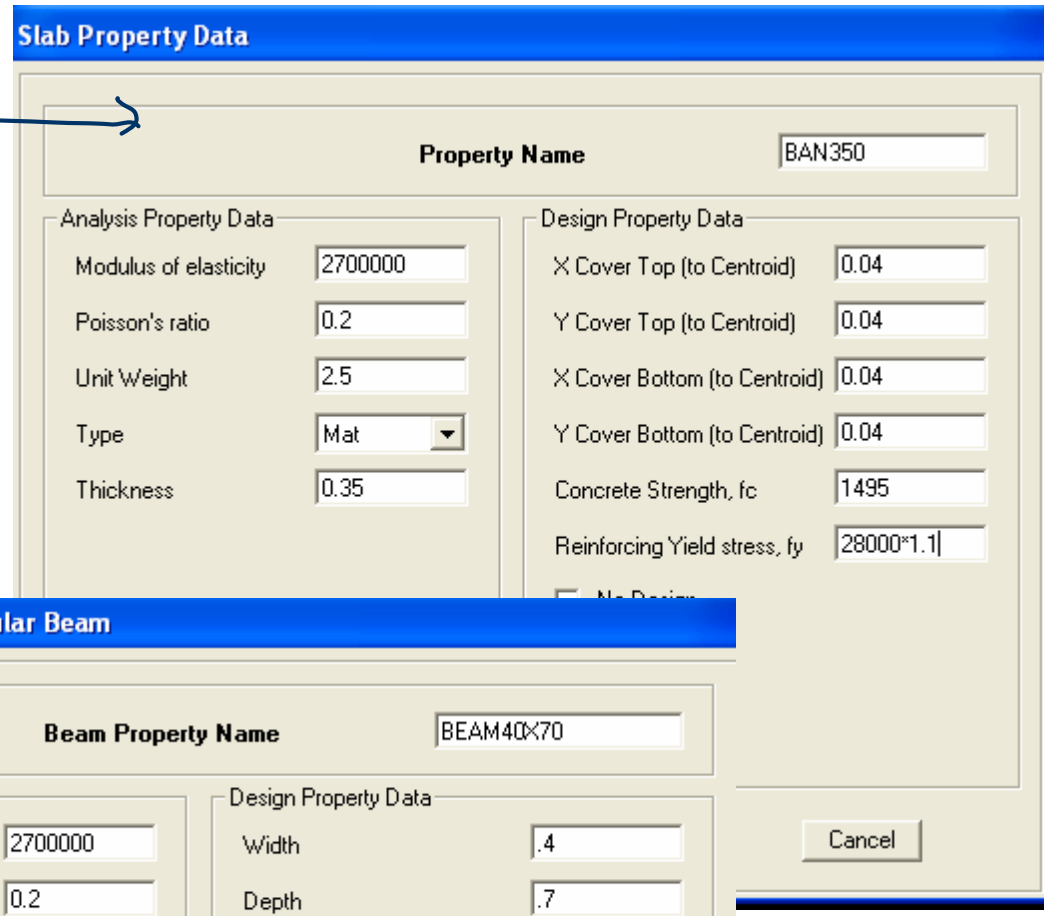

Grid Definition
Number of Grid Lines
X direction
4
Y direction
3
Grid Spacing
X direction
5
Y direction
5
Edit Grid...
OK
Cancel

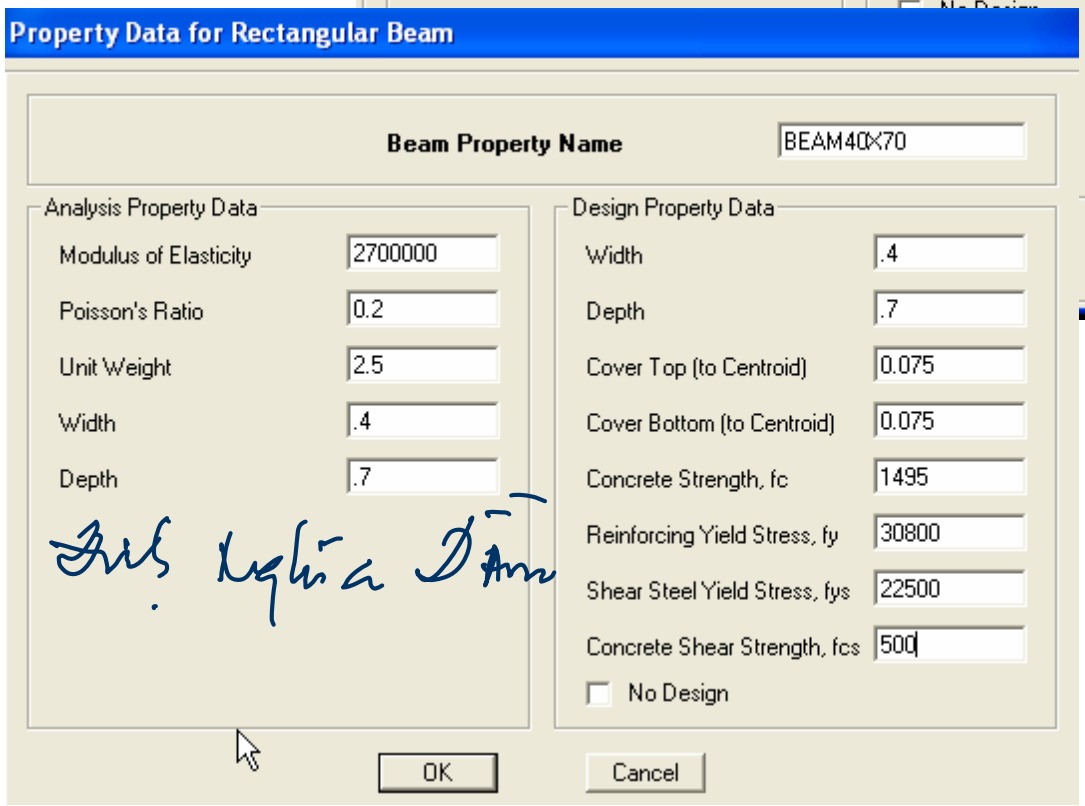
Tạo lưới


Define X Grid
Edit View
Grid ID
Spacing
1 1 5
2 2 6
3 3 5
4 4 0
Display
X Grid
Y Grid
Display Grid as
Ordinates
Spacing
Grid Line # 3
Grid Line #
Secondary Line
Visible
Color
Reset to Default Color
Bubble Size
0.4
OK

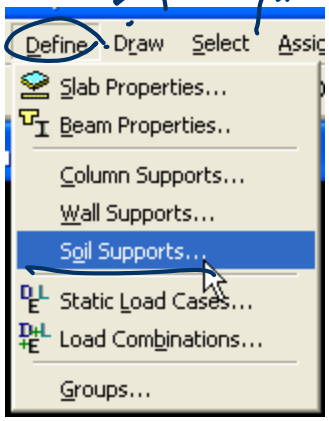

Define Y Grid
Edit View
Grid ID
Spacing
1 A 5
2 B 5
3 C 0
Display
X Grid
Y Grid
Display Grid as
Ordinates
Spacing
Datum
Z
0
Grid Line # 12
Grid Line #
Secondary Line
Visible
Color
Reset to Default Color
Bubble Size
1
OK
Cancel

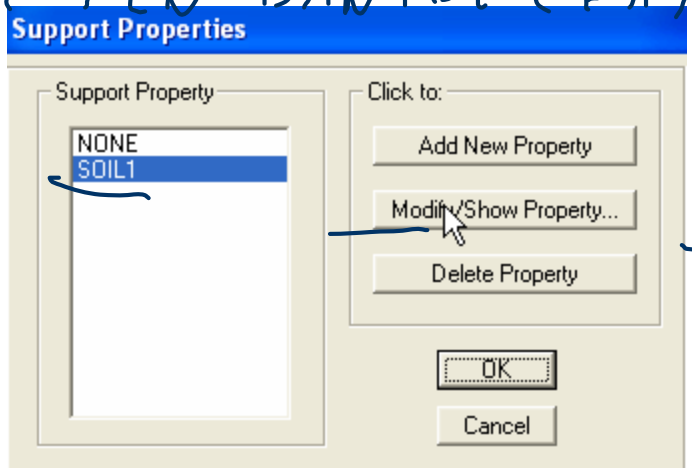

Define
Draw
Select
Assig
Slab Properties...
Beam Properties...
Column Supports...
Wall Supports...
Soil Supports...
Static Load Cases...
Load Combinations...

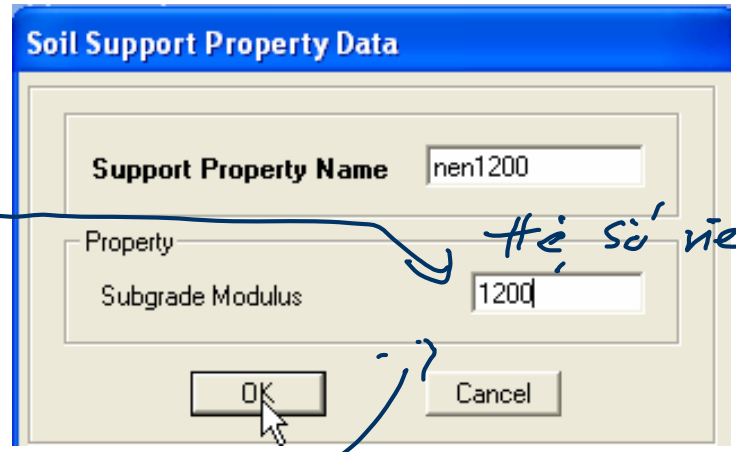

Slab Property Data
Property Name
BAN350
Analysis Property Data
Modulus of elasticity
2700000
Poisson's ratio
0.2
Unit Weight
2.5
Type
Mat
Thickness
0.35
Design Property Data
X Cover Top (to Centroid)
0.04
Y Cover Top (to Centroid)
0.04
X Cover Bottom (to Centroid)
0.04
Y Cover Bottom (to Centroid)
0.04
Concrete Strength, fc
1495
Reinforcing Yield stress, fy
28000*1.1
Cancel


Property Data for Rectangular Beam
Beam Property Name
BEAM40X70
Analysis Property Data
Modulus of Elasticity
2700000
Poisson's Ratio
0.2
Unit Weight
2.5
Width
.4
Depth
.7
Design Property Data
Width
.4
Depth
.7
Cover Top (to Centroid)
0.075
Cover Bottom (to Centroid)
0.075
Concrete Strength, fc
1495
Reinforcing Yield Stress, fy
30800
Shear Steel Yield Stress, fys
22500
Concrete Shear Strength, fcs
500
No Design
OK
Cancel

Định nghĩa nền đàn hồi (đất)

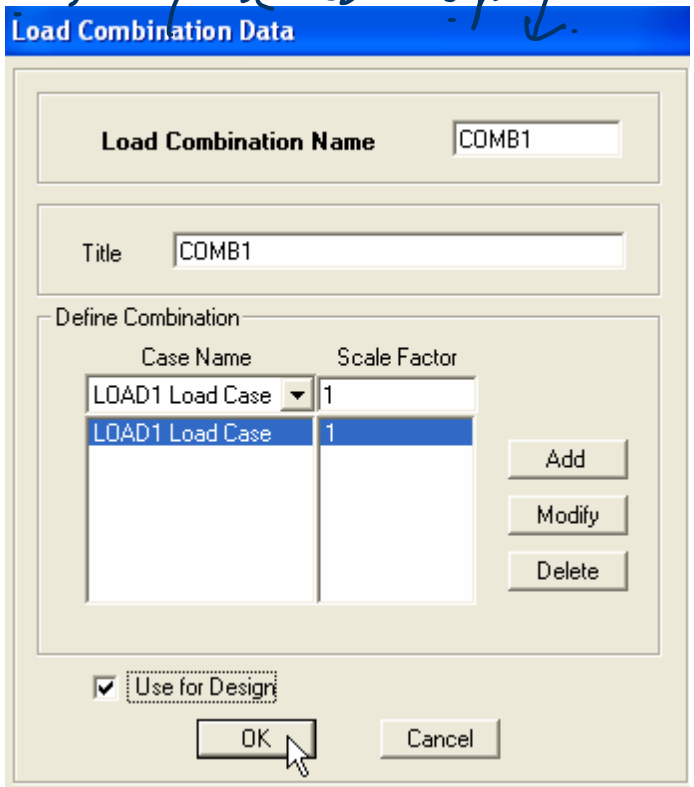


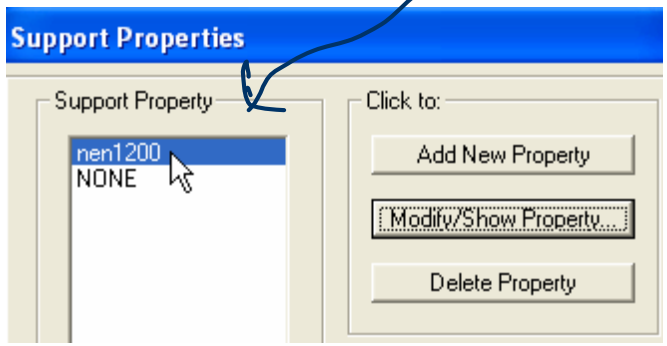




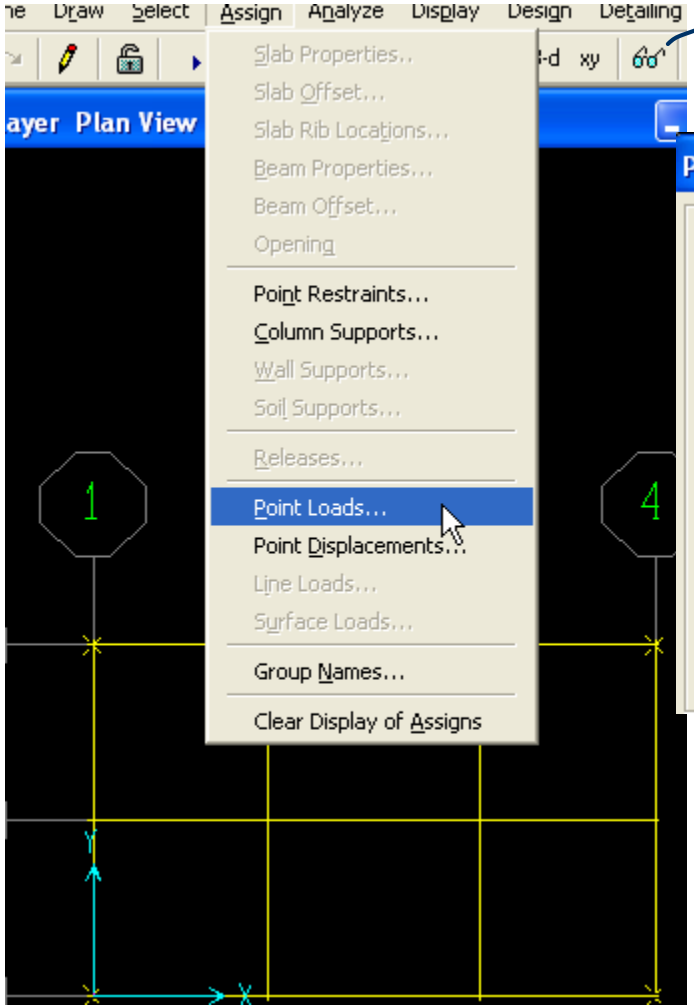
hệ số nền

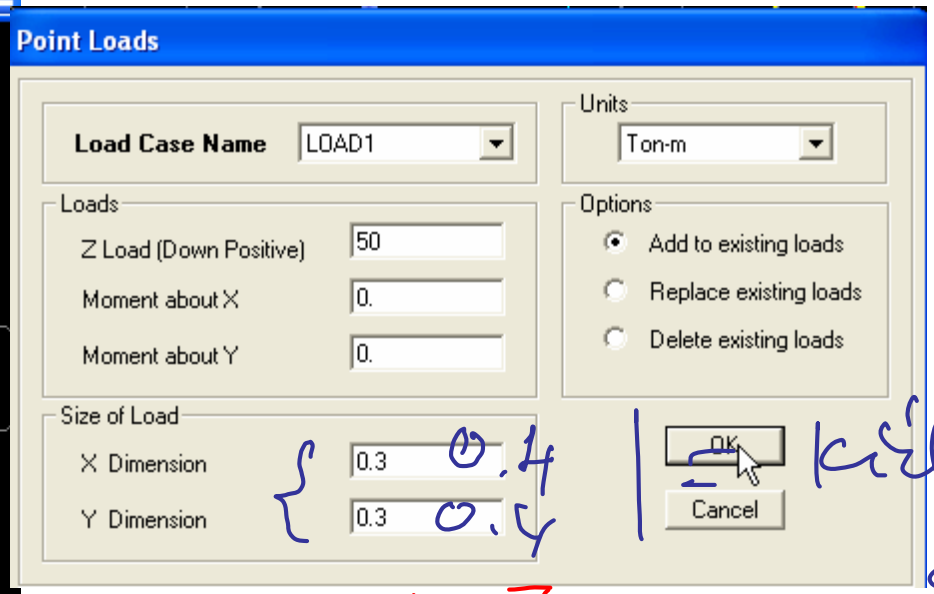
Định nghĩa tổ hợp

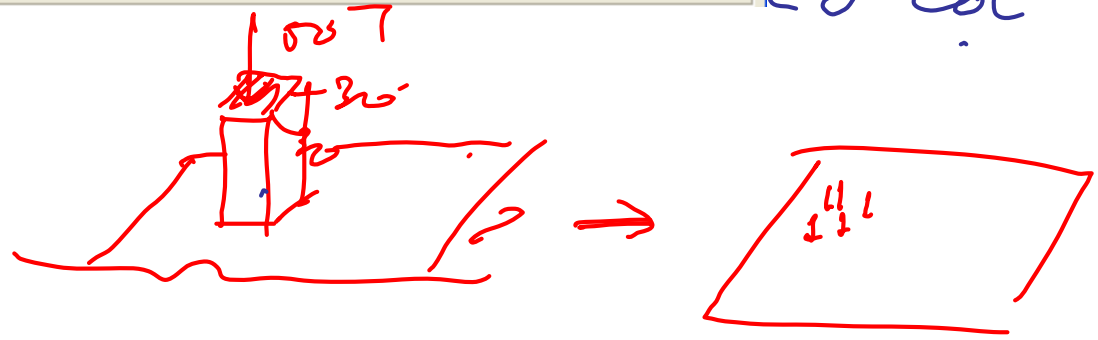


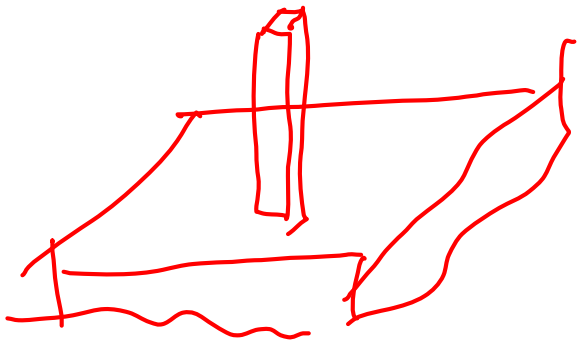


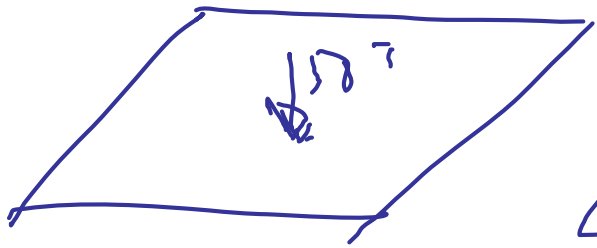
Gán Tải trọng tập trung tại chân cột

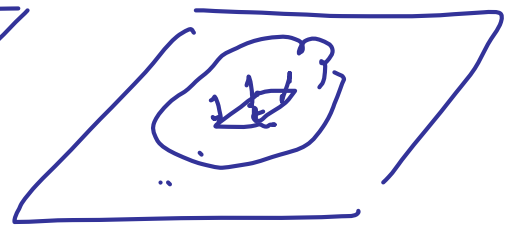




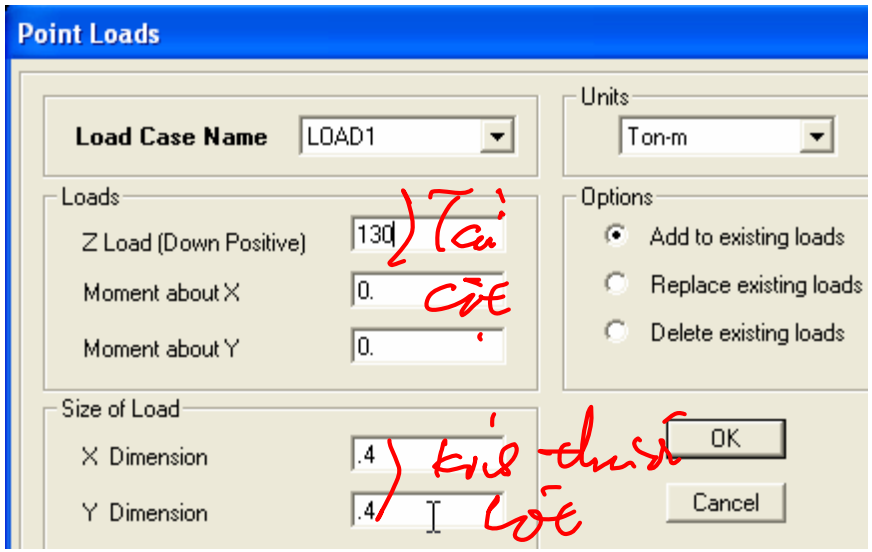


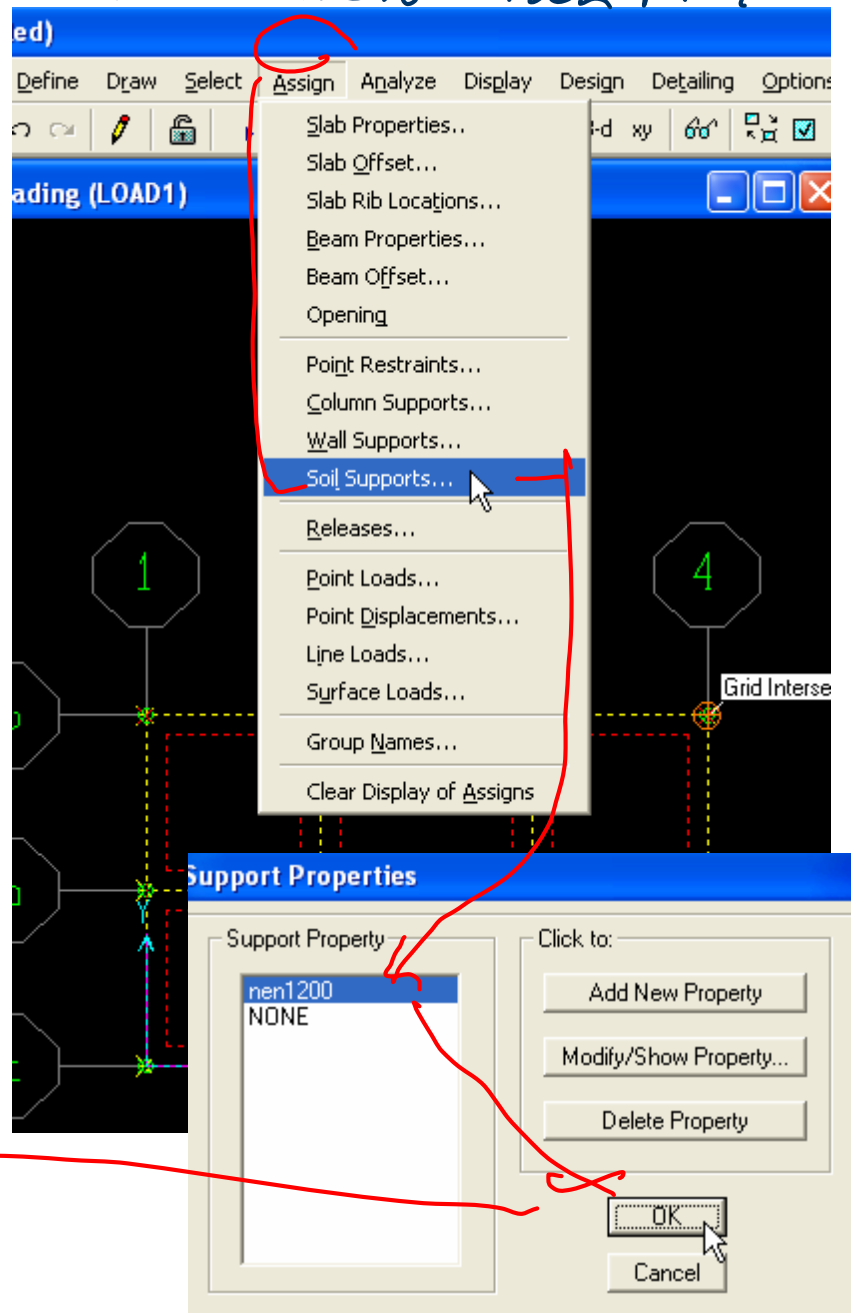


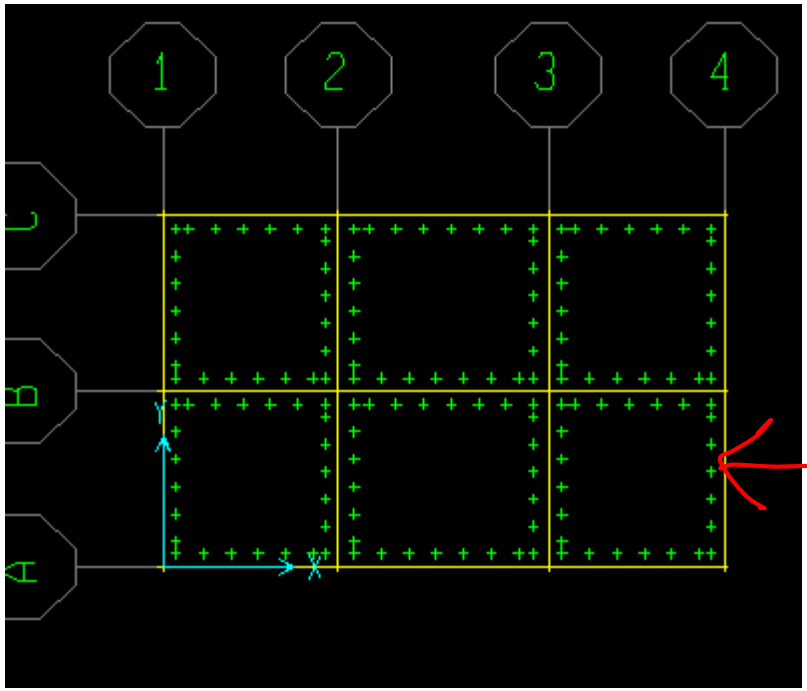


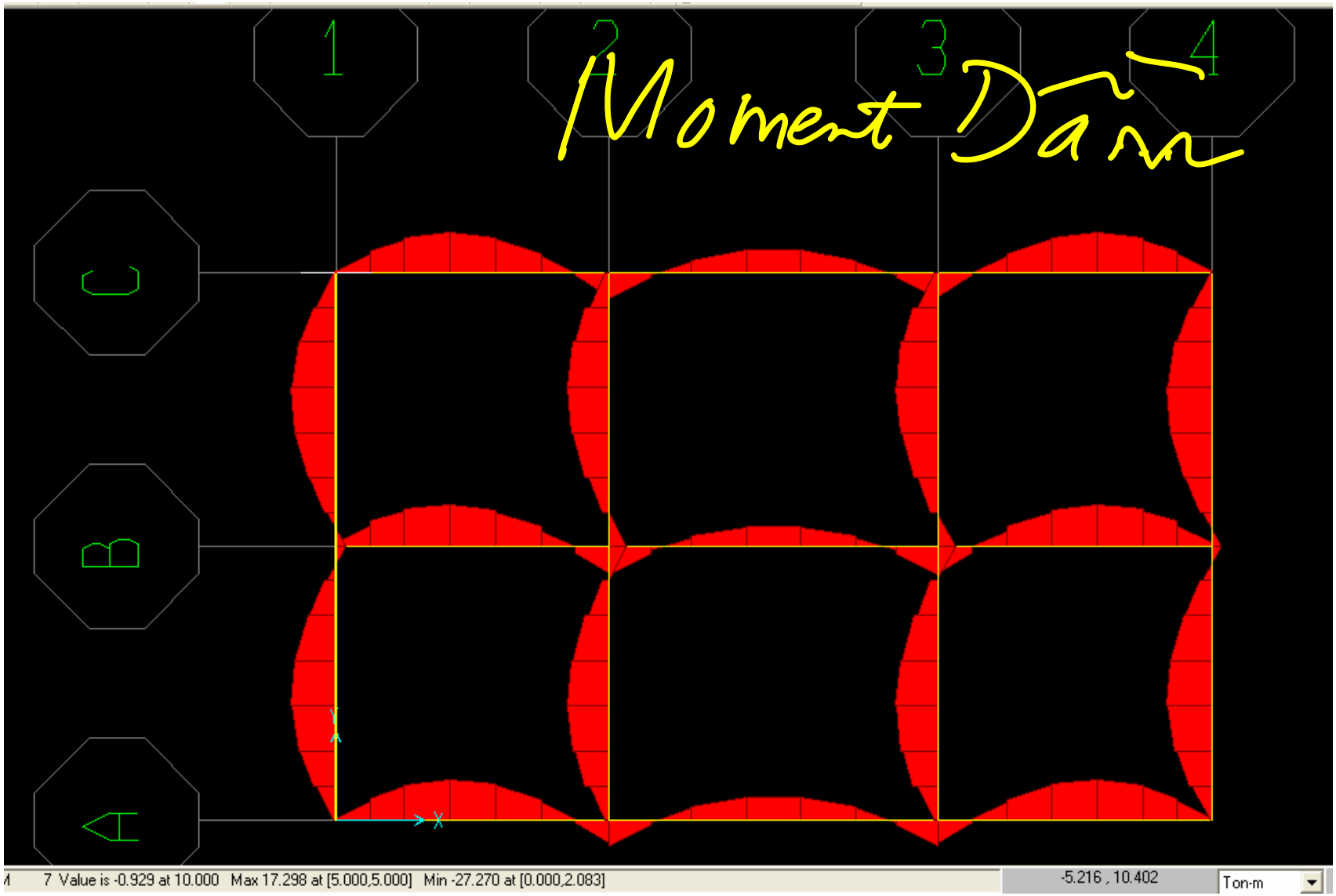


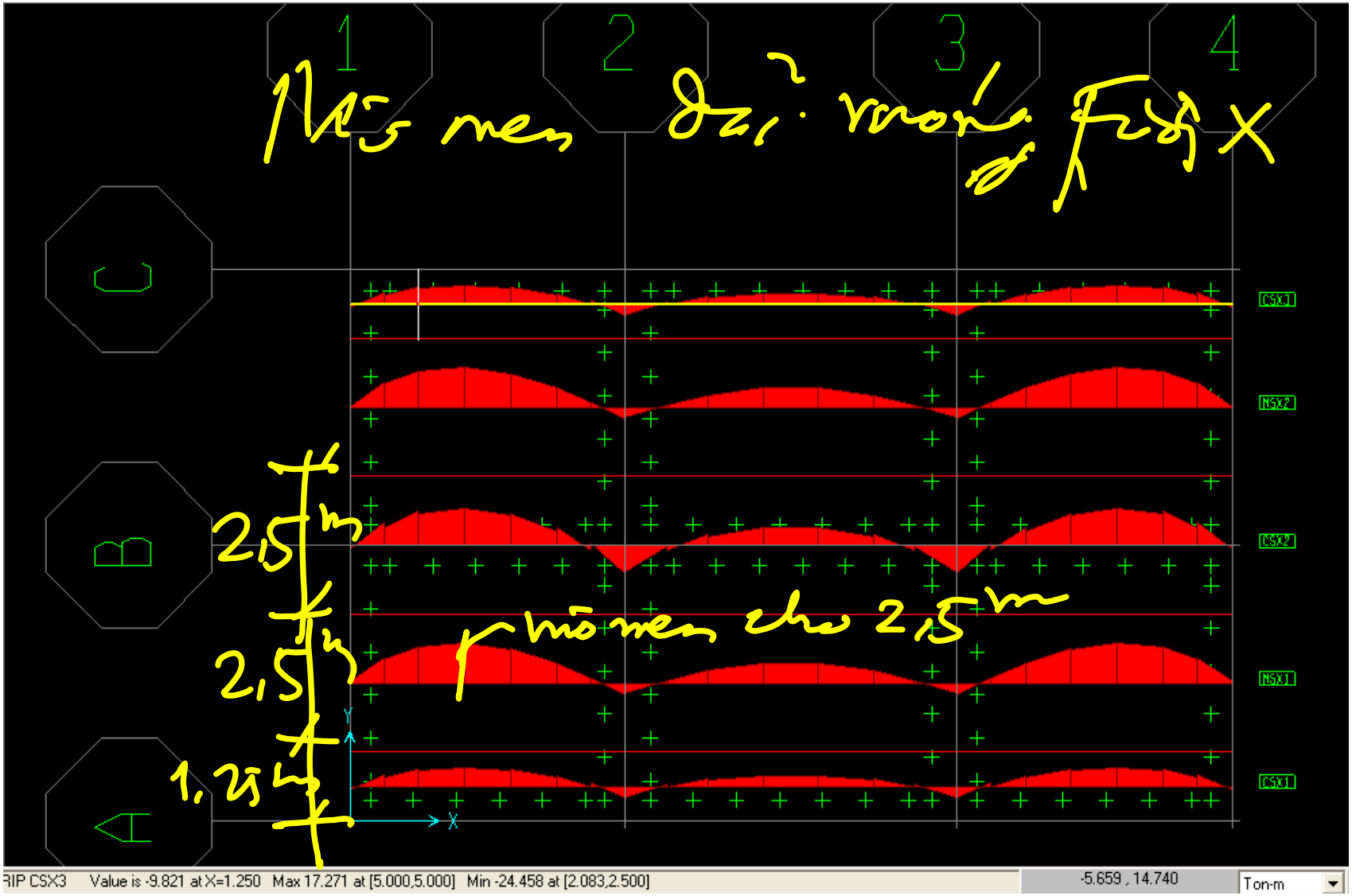
Gán nền đàn hồi

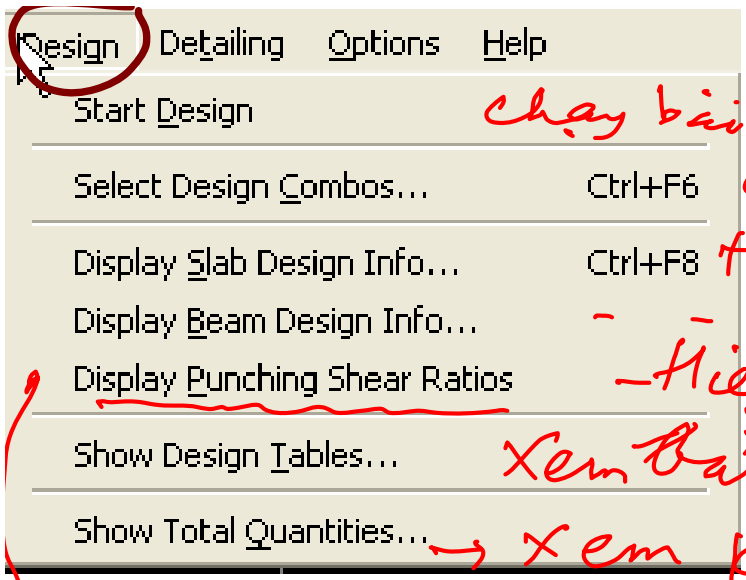







1
2
3
4
C
B
A
Moment Diagram
7 Value is -0.929 at 10.000 Max 17.298 at [5.000,5.000] Min -27.270 at [0.000,2.083]
-5.216 , 10.402
Ton-m


1
2
3
4
C
B
A
CSX1
CSX2
CSX2
CSX1
CSX1
2,5 m
2,5 m
1,25 m
momen cho 2,5 m
Y
X
RIP CSX3 Value is -9.821 at X=1.250 Max 17.271 at [5.000,5.000] Min -24.458 at [2.083,2.500]
-5.659 , 14.740
Ton-m



Thiết kế

chạy bài toán thkế

chọn tổ hợp

Hiện kqua cốt thép sàn

- - - - - - - - - dầm

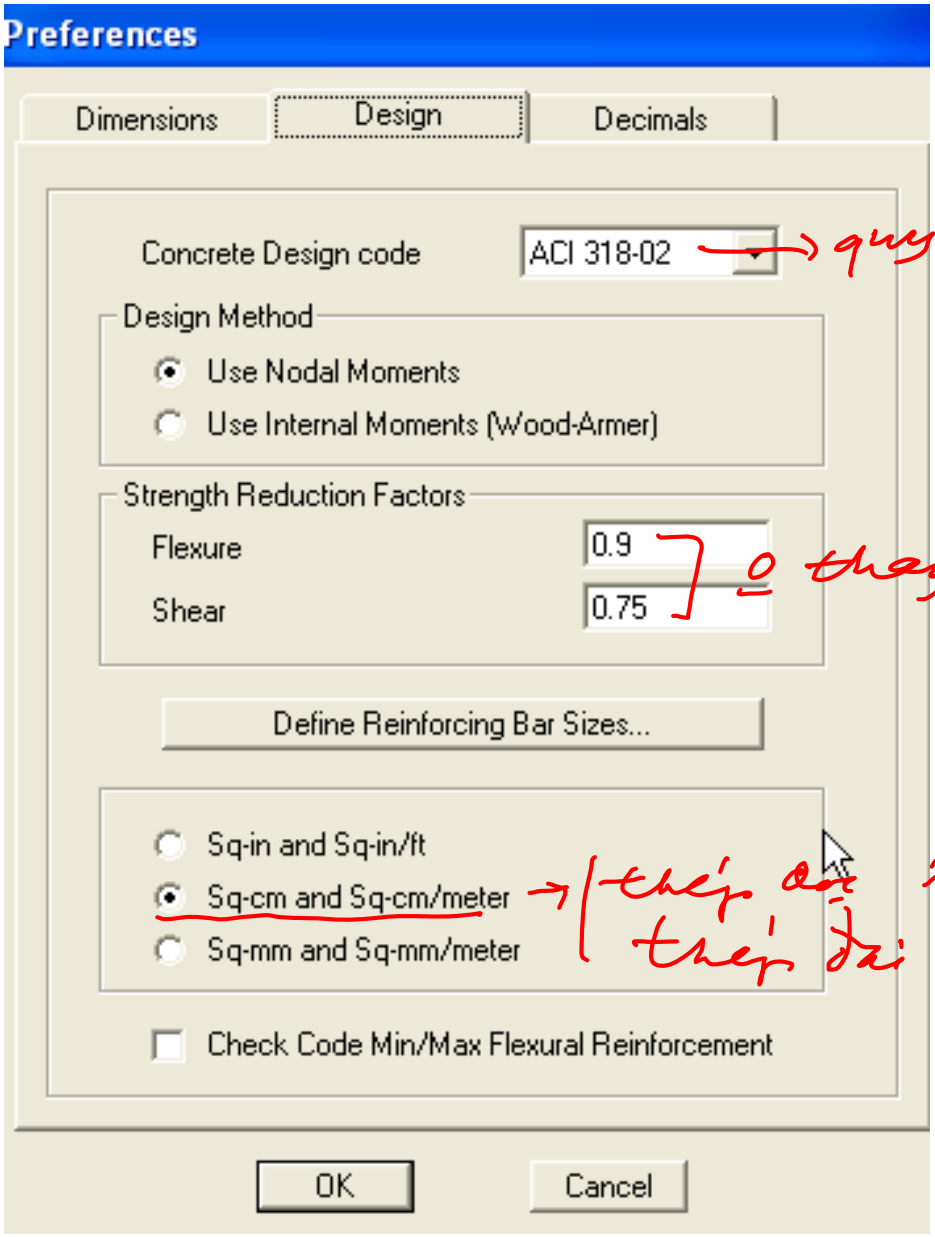
- Hiện kqua kiểm tra xuyên thủng

Xem bảng kqnđ T. kế → tx cel

→ xem khái quát { Trong lớp tập ?

V bêtông ? ?

$$\frac{P_{\text{gây xuyên thủng}}}{[P]} \leq 1 \rightarrow \text{Đạt}$$

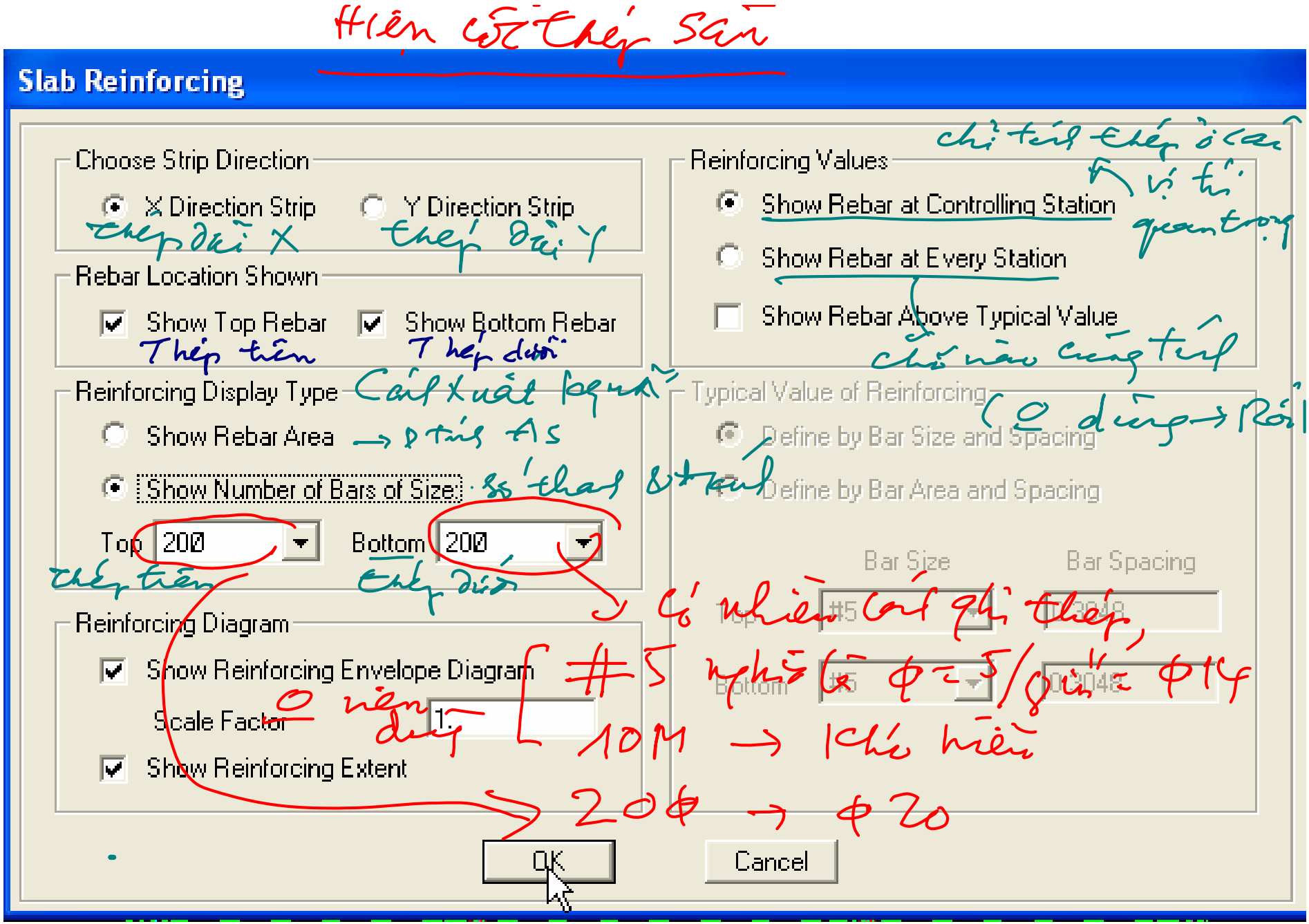


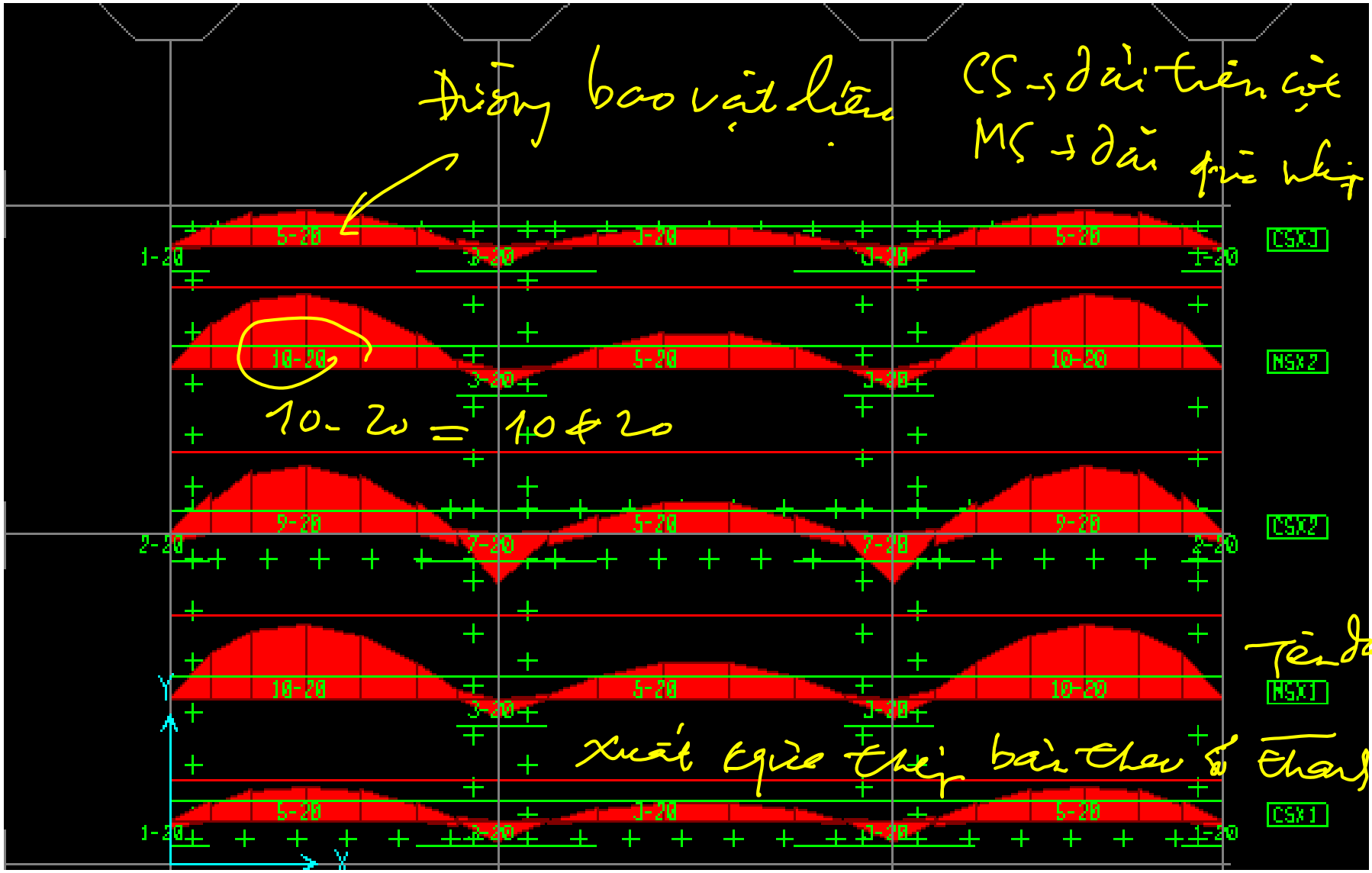
→ quy phạm

→ hệ số thay đổi

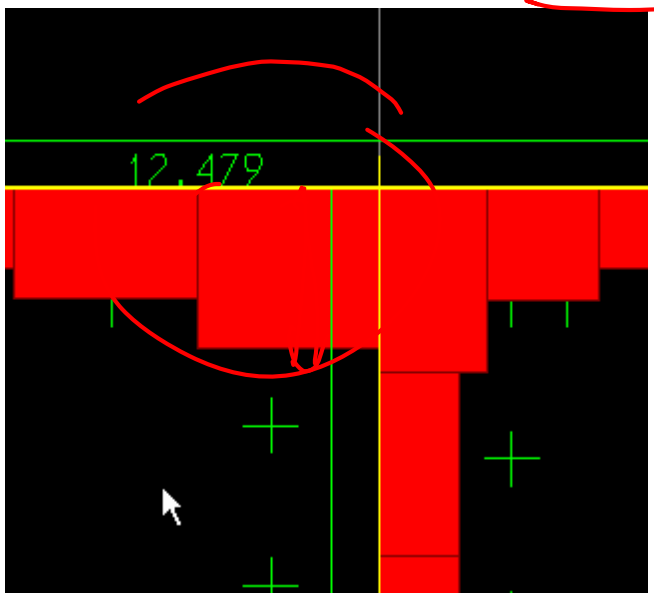
→ thép dọc xuất ra cm^2
thép đai xuất ra cm^2/m

Bấm lưu


Slab Reinforcing
Choose Strip Direction
X Direction Strip
Y Direction Strip
Rebar Location Shown
Show Top Rebar
Show Bottom Rebar
Reinforcing Display Type
Show Rebar Area
Show Number of Bars of Size
Top 200
Bottom 200
Reinforcing Diagram
Show Reinforcing Envelope Diagram
Scale Factor 1.
Show Reinforcing Extent
Reinforcing Values
Show Rebar at Controlling Station
Show Rebar at Every Station
Show Rebar Above Typical Value
Typical Value of Reinforcing
Define by Bar Size and Spacing
Define by Bar Area and Spacing
Bar Size
Bar Spacing
OK
Cancel


Đường bao vật liệu
CS → dải trên cột
MS → dải giữa nhịp
10-20 = 10 & 20
Tên dải
Xuất kiểu thép bản theo số thanh
CSX1
MSX2
CSX2
MSX1
CSX1
5-20
3-20
1-20
10-20
9-20
7-20
2-20
Y
X

Đai đầm móng



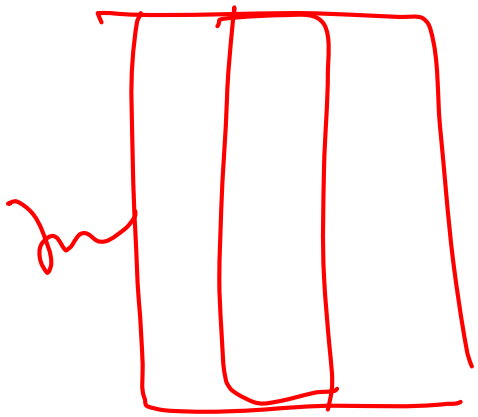
$12,5\ cm^2/m$

Vậy dùng đai $\Phi 10$, 4 nhánh

→ Diện tích 1 đai

$= 4_{\text{nhánh}} \times 0,785\ cm^2$

$= 3,2\ cm^2$



→ 1 m đầm cần

$\frac{12,5}{3,2} = 4$ đai

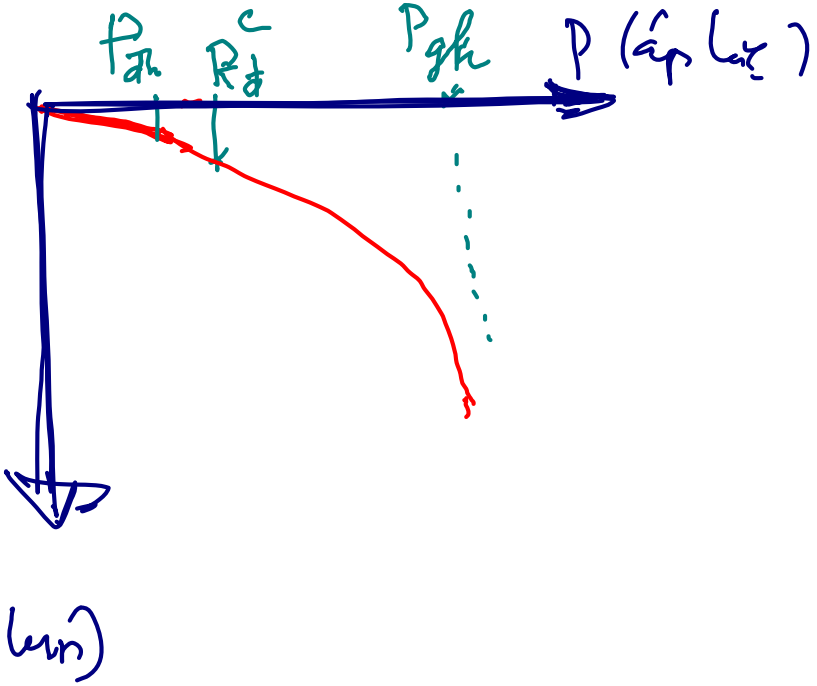
4 đai → $\Phi 10@250$

Công thức thực tiễn

$$k_s = 40\,(SF)\,q_a \qquad (kN/m^3)$$

"R_d^c"

Hệ số nền = 40 × hệ số an toàn × cường độ cho phép của nền đất



$$P_{cho\,phép} = \frac{P_{gh}}{\text{hệ số an toàn}}$$

= 2 ÷ 3

Với tham khảo:

- Đất dạng "Trung bình khô"

có $R_d^{tc} = 1,2\ kG/cm^2 = 12\ T/m^2$.

Tùy hệ số viên:

(1) Celsi $C_z = 40 \times h_{sat} \times R_d^{tc}$

(Mỹ) $= 40 \times (2 \div 3) \times 12$

$= 960 \div 1440\ T/m^3$.

(2) Tra bảng của Nga.

Đất có R	1kg/cm²	2 kg/cm²
Hệ số nền	2.000T/M³	4.000 T/M³

$\times (1/2 \div 2/3)$

3) Từ mô đun biến dạng của đất → h số nền

Vesic (1961)

$$k_s = \frac{E_s}{B(1-\mu^2)} = \frac{1000 \div 1500}{1{,}5\left[1-(0{,}3)^2\right]} =$$

Đất TB khác $R_d^c = 1{,}2\ kG/cm^2$

$\xrightarrow[\text{N Mỹ}]{\text{tra bảng}}$ $E = 100 \div 150\ kG/cm^2$

$= 1000 \div 1500\ t/m^2$

II Gia cố nền

bằng / trên nền cọc cát (đệm cát) cố tâm
lúc

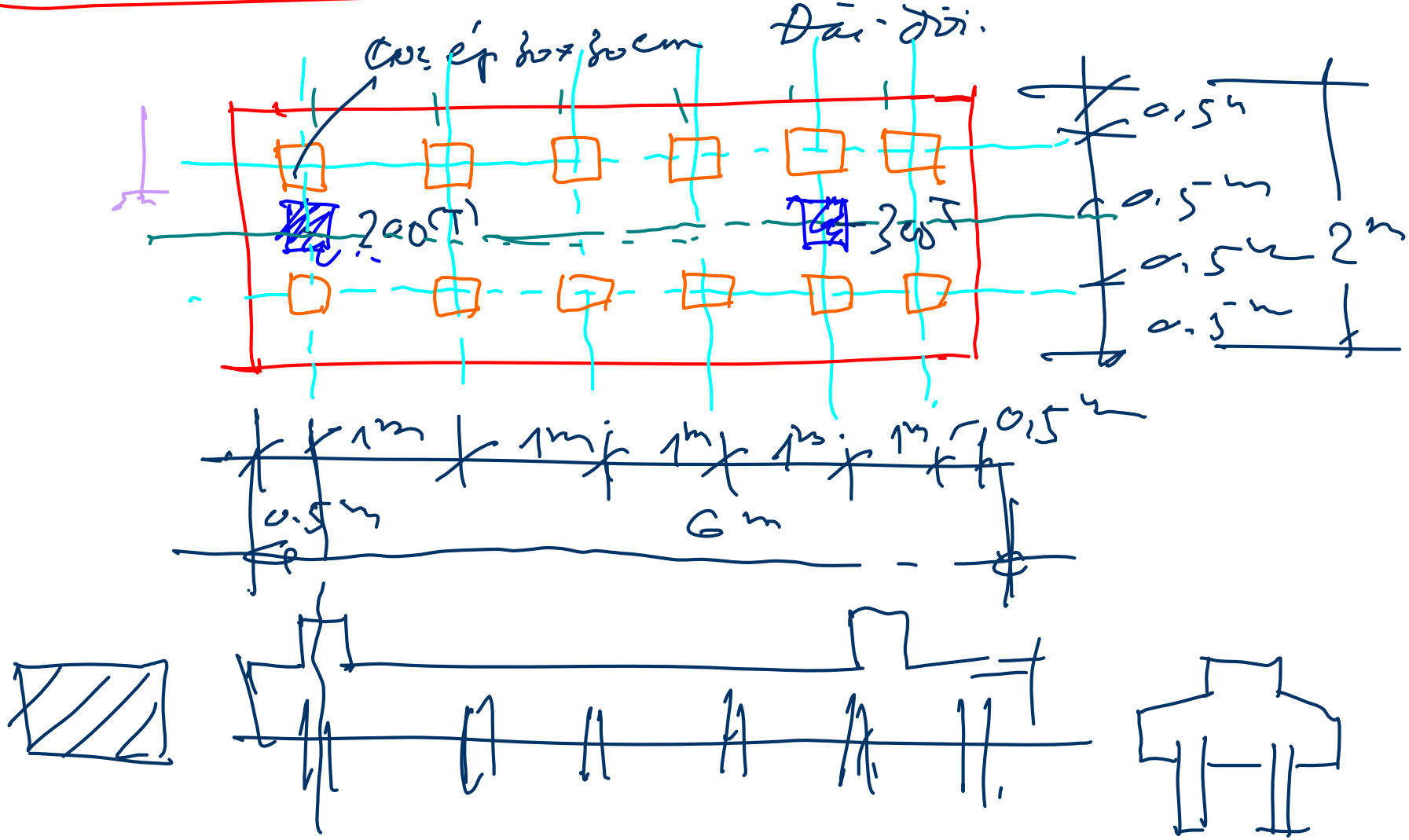
2 Mô tả thế nào?

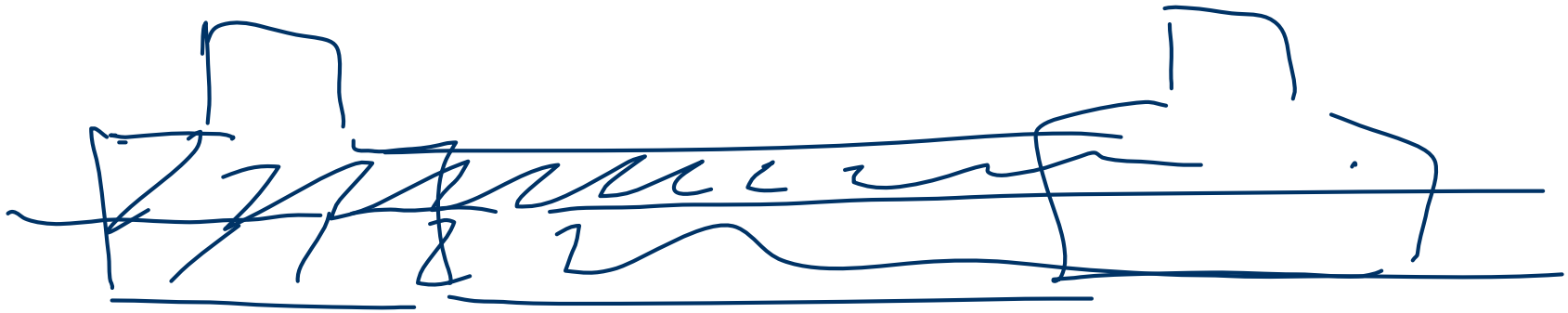
Mô tả ≡ Móng trên nền tọc nhiên

thay $C_z = \frac{P}{S}$ → tính theo nền đã gia cố rồi.

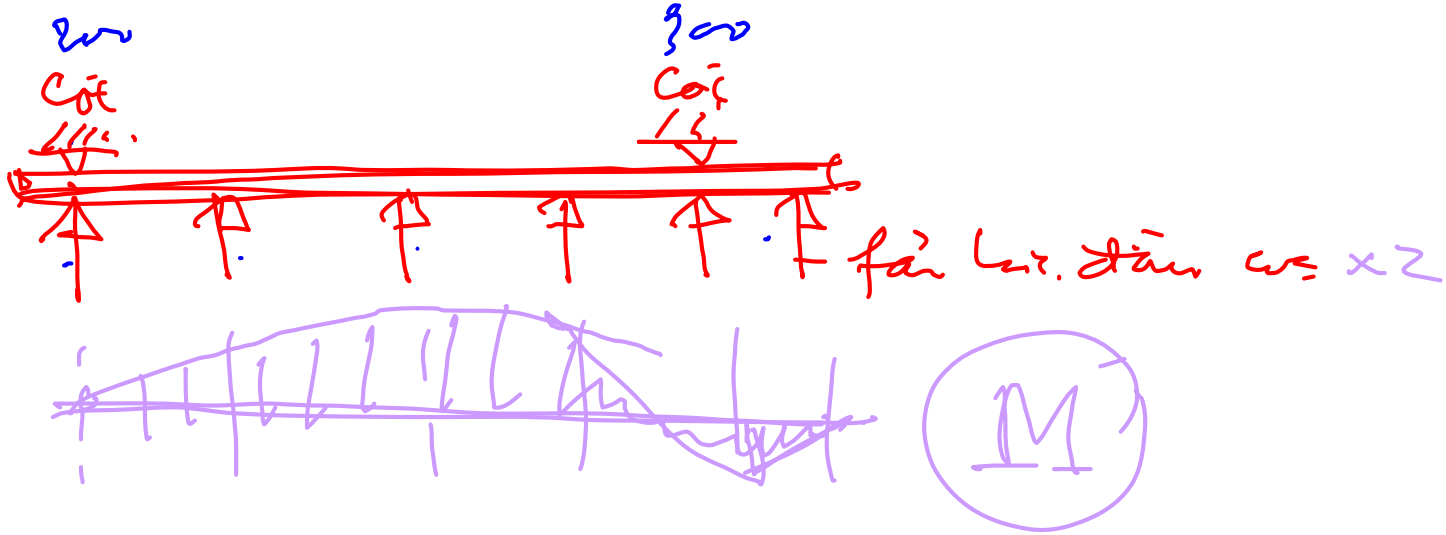
$C_z = 4c \times h_{sat} \times R_d$ → của nền gia cố rồi.

III Bảng / Bè trên nền cọc BTCT ép nhồi

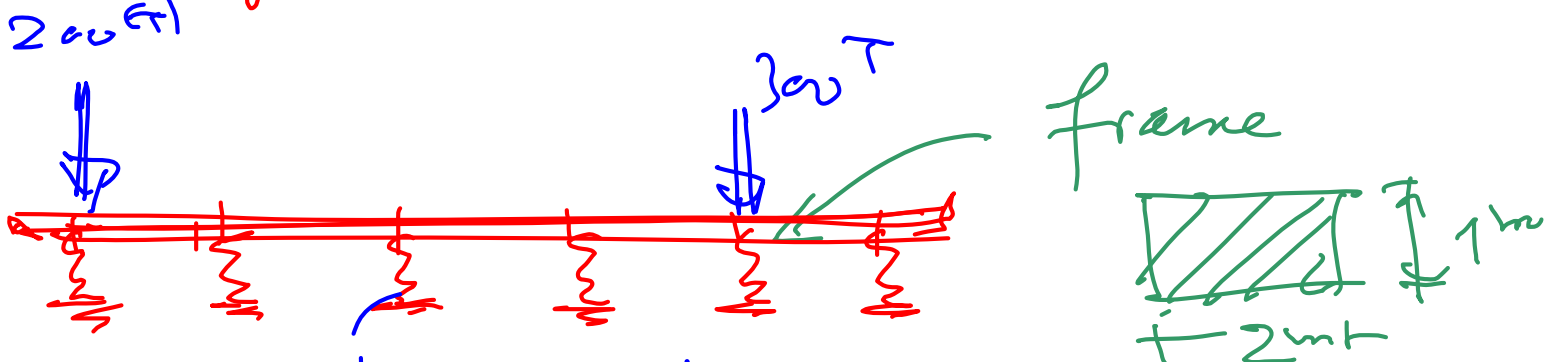




Cách 1 (Đối với SV hay tính)



Cách 2 Dùng Sap → dầm trên các gối đàn hồi.



$K_{lò\,xo} = K_{cọc} \times$ số hàng cọc

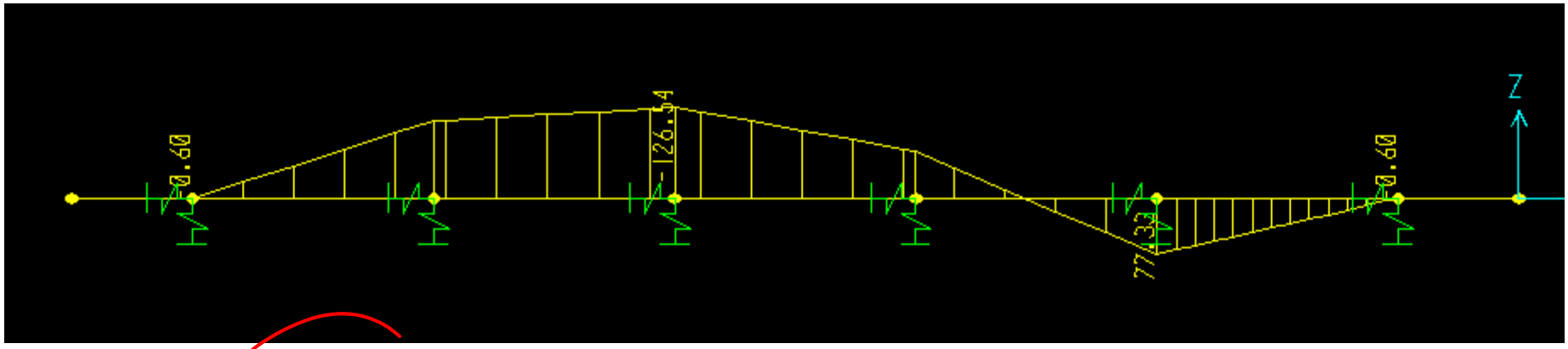
$= 5000 \times 2 = 10000$ T/m

$\boxed{\text{Joint spring}}$

$$K_{cọc} = \frac{P_{tác\ dụng\ lên\ cọc}}{S = 1\,cm} = \frac{50^{(T)}}{0{,}01} = 5000\ T/m$$

Vdụ. 2 cột = 200 + 300 = 500(T) + hình tinh (đài, đất)

600(T) → 1 cọc gánh $\frac{600}{12} = 50$ T

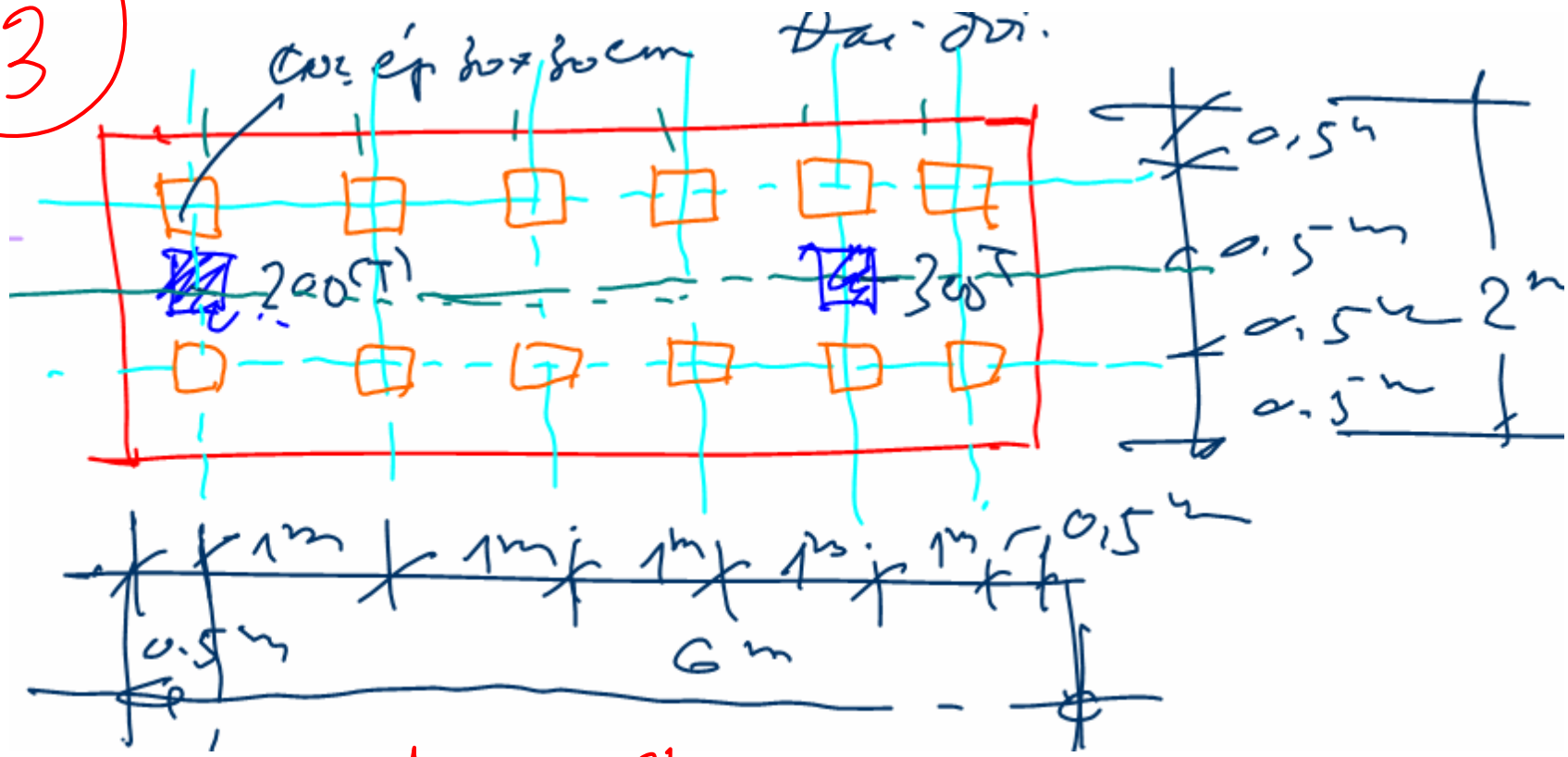


→ M_{33} → cốt thép

→ $Q = V_{22}$ → cắt 1 phương.

cho BT chịu $\boxed{Q \leq 0,8 R_k b h_0}$

3



Mô hình Shell.

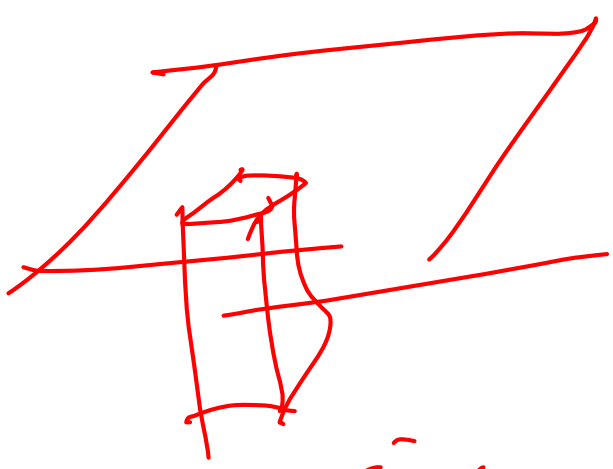
3a Đơn giản

- Vẽ đài = Shell.
- gán lò xo tại mỗi điểm có cọc
- Tải trọng → tập trọng chân cột

(3b) Vẽ đất = Shell.

∴ Vẽ cọc = Shell

gắn liền đàn hồi

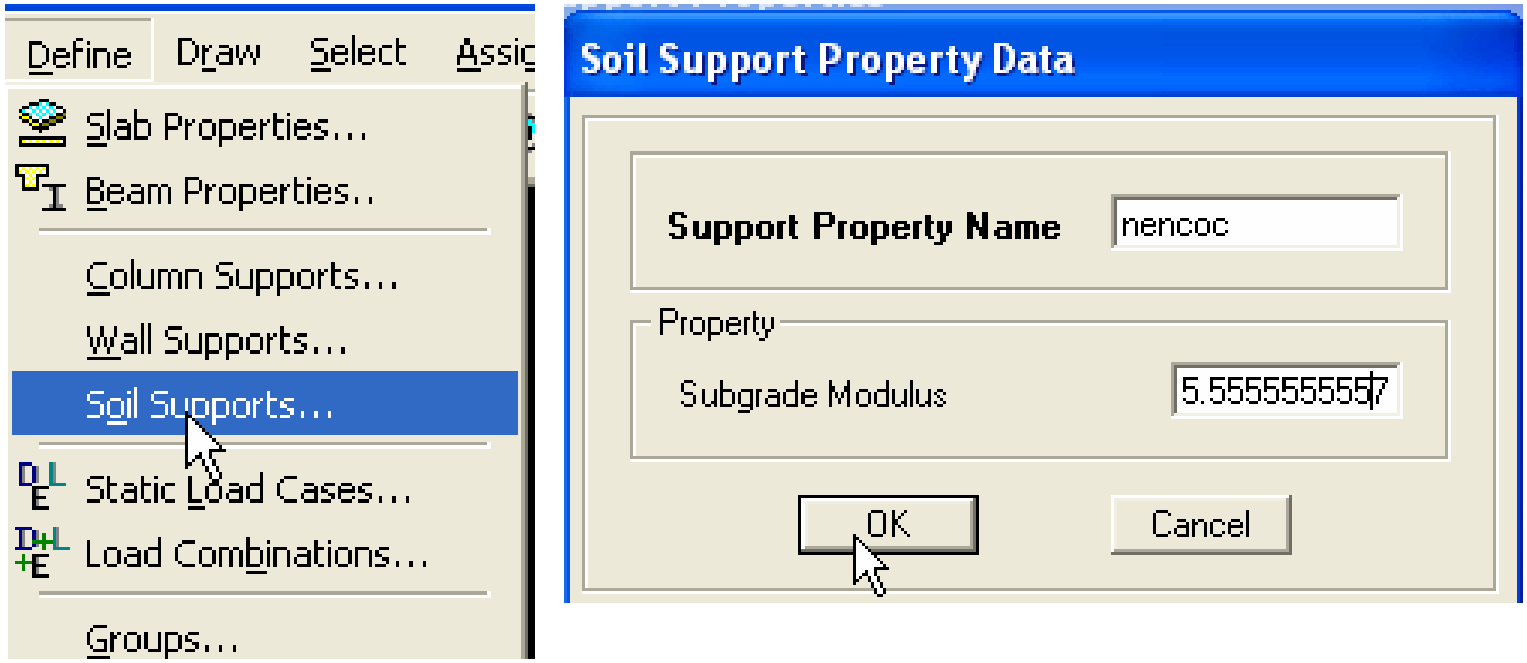


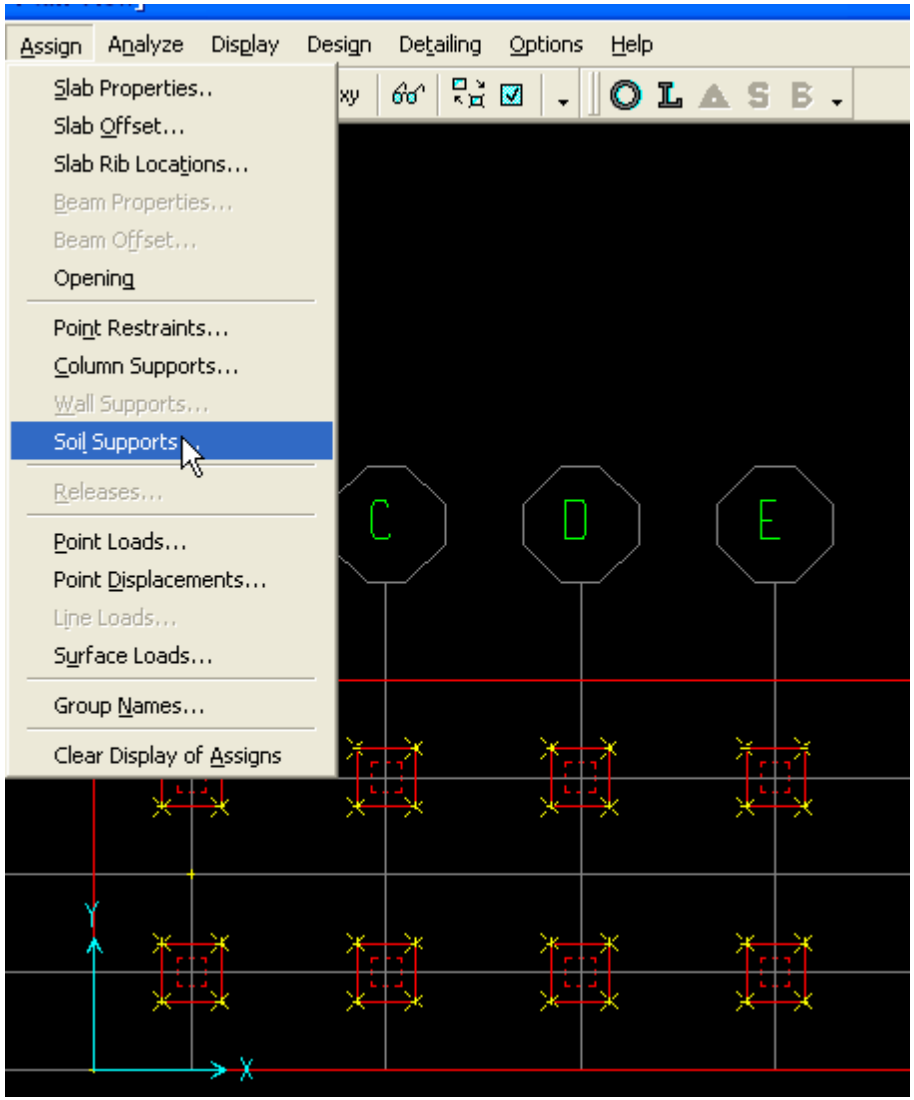
Giới cọc $F_{cọc}$

$C_{cọc}$ = kN/m³

$C_z^{liên\ cọc}$

$C_z^{liên\ cọc} = \frac{\text{Lực tác dụng xuống cọc}}{\text{Độ Lún} \times F_{cọc}} = \frac{SB^T}{0,01^m \times (0,3 \times 0,3)}$


Define
Draw
Select
Assig
Slab Properties...
Beam Properties..
Column Supports...
Wall Supports...
Soil Supports...
Static Load Cases...
Load Combinations...
Groups...
Soil Support Property Data
Support Property Name
nencoc
Property
Subgrade Modulus
5.5555555557
OK
Cancel



120 T

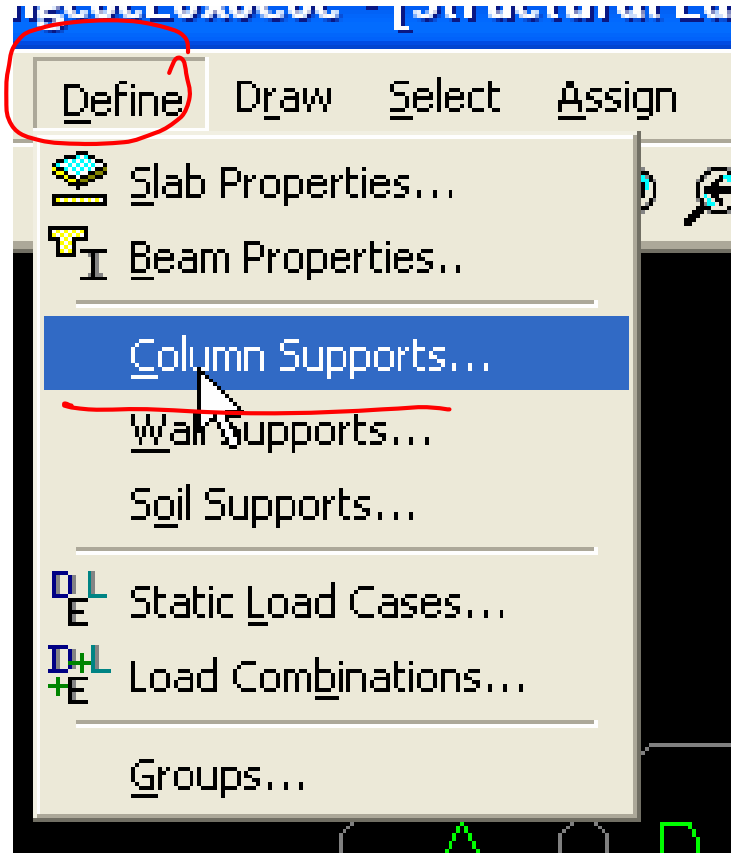
Cat

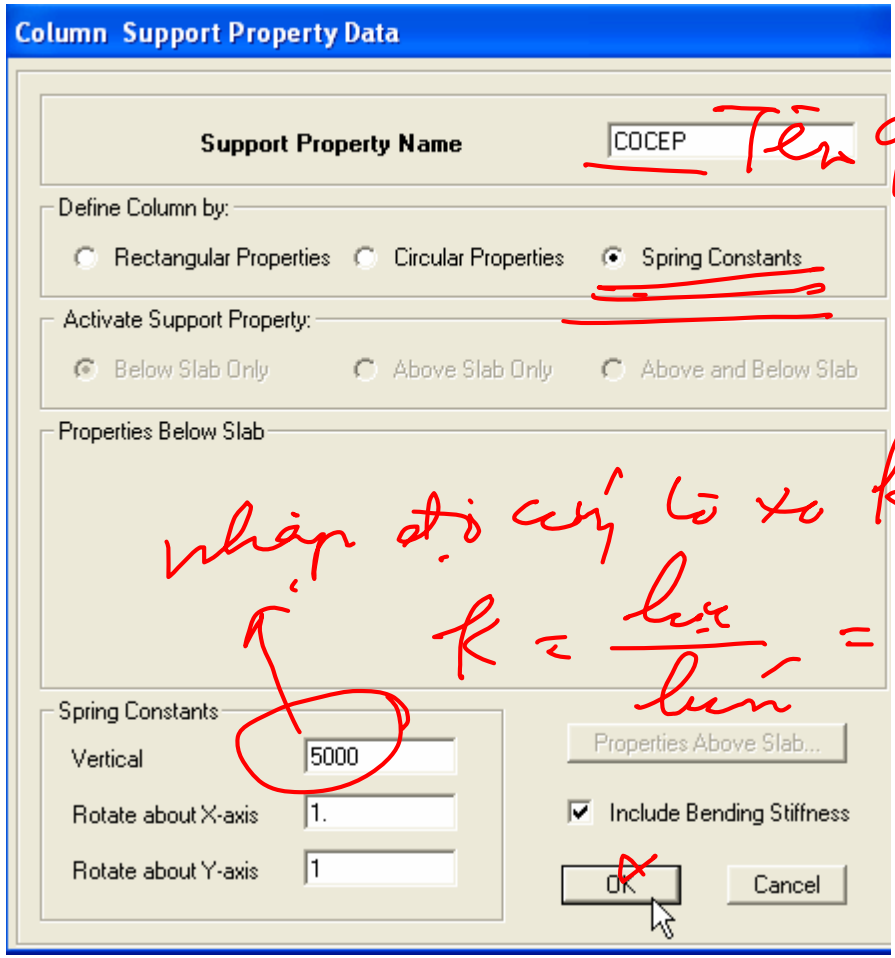
1 [illegible] $\boxed{Q \le 0{,}75 R_{bt} b h_0}$

(0,8)

$0{,}75 \times 90 \times 1 \times 0{,}9$

60 T



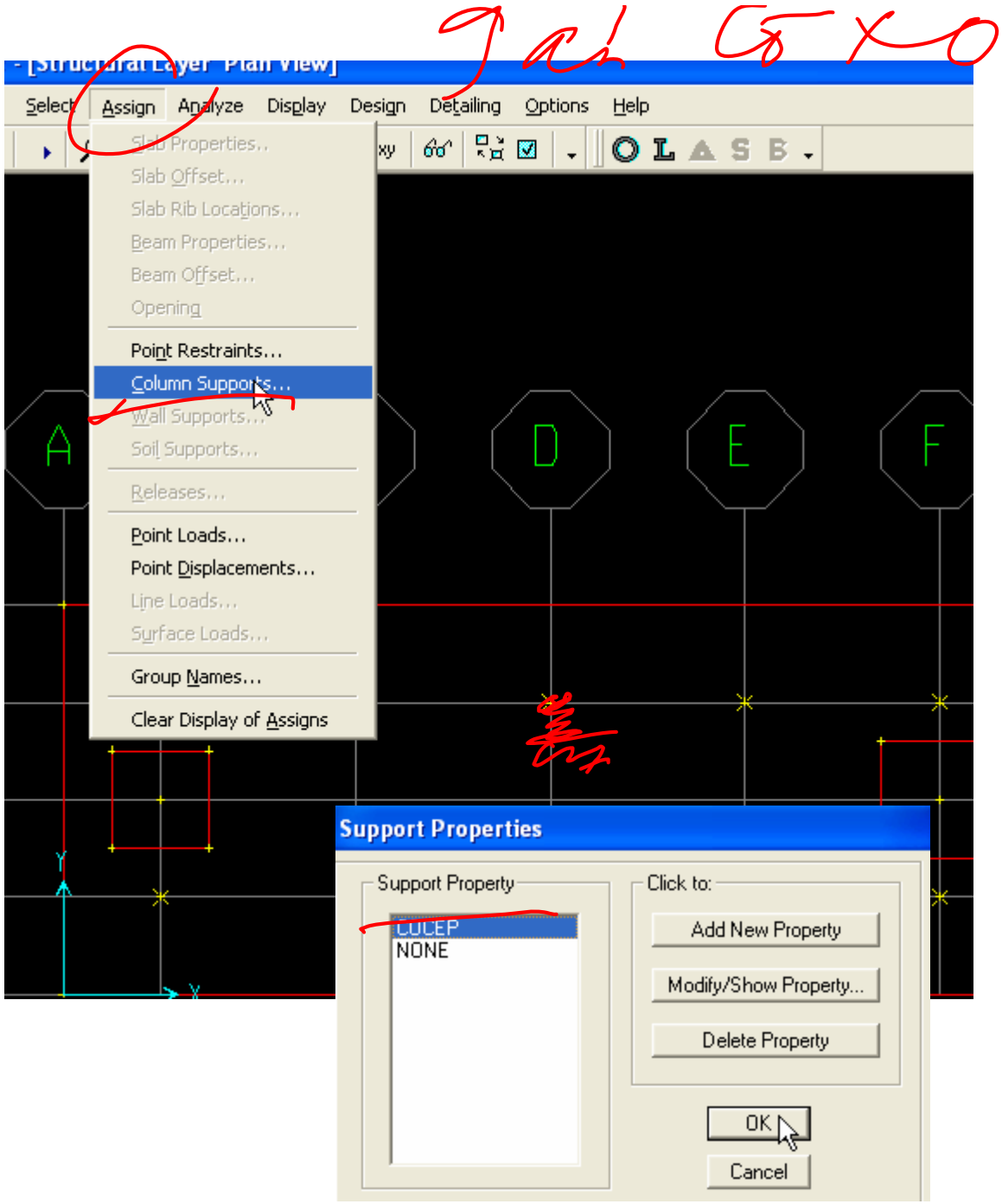


Tên gói

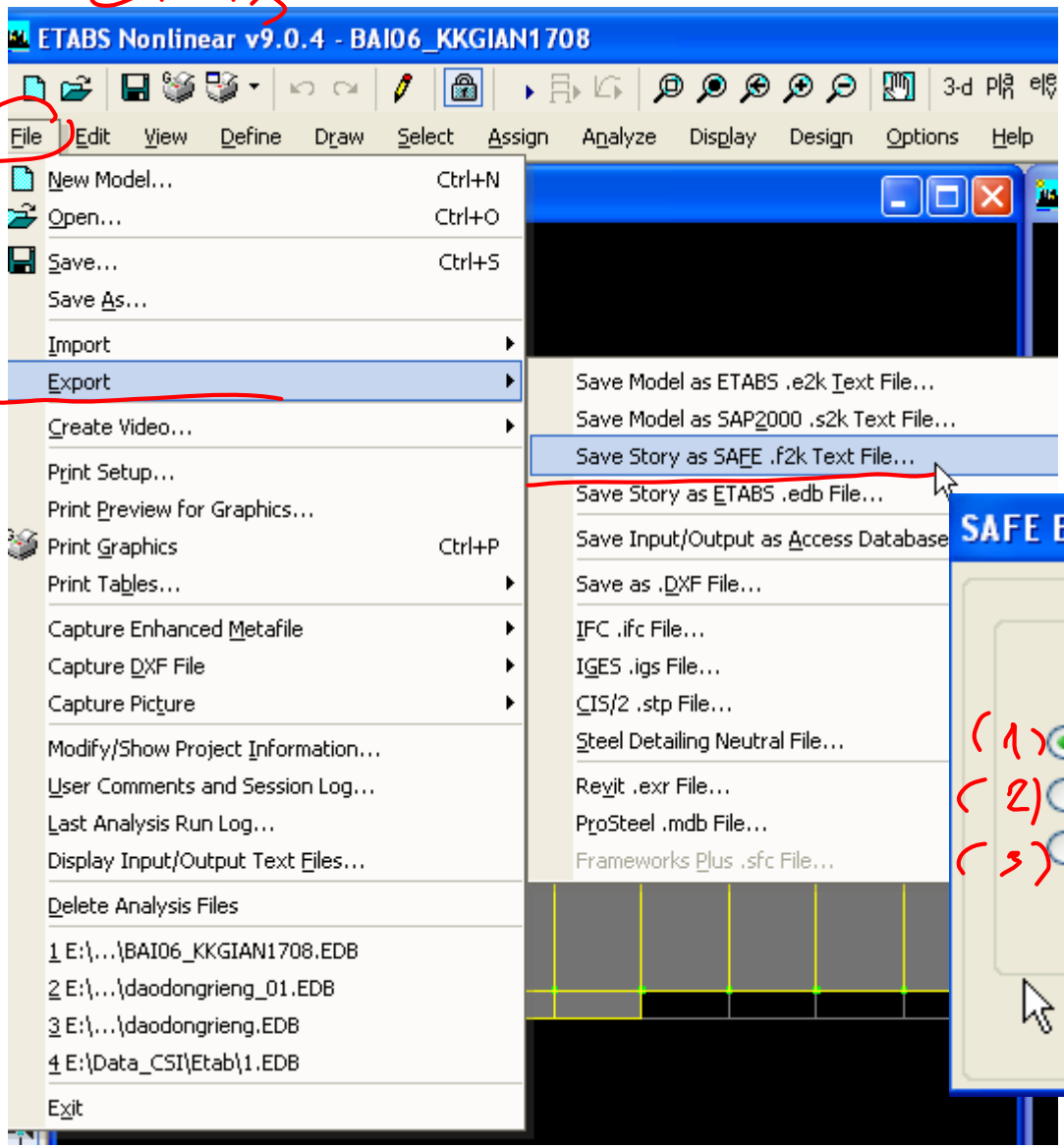
nhập độ cứng lò xo k

$k = \frac{\text{lực}}{\text{lún}} = \frac{50^T}{0{,}01^m}$

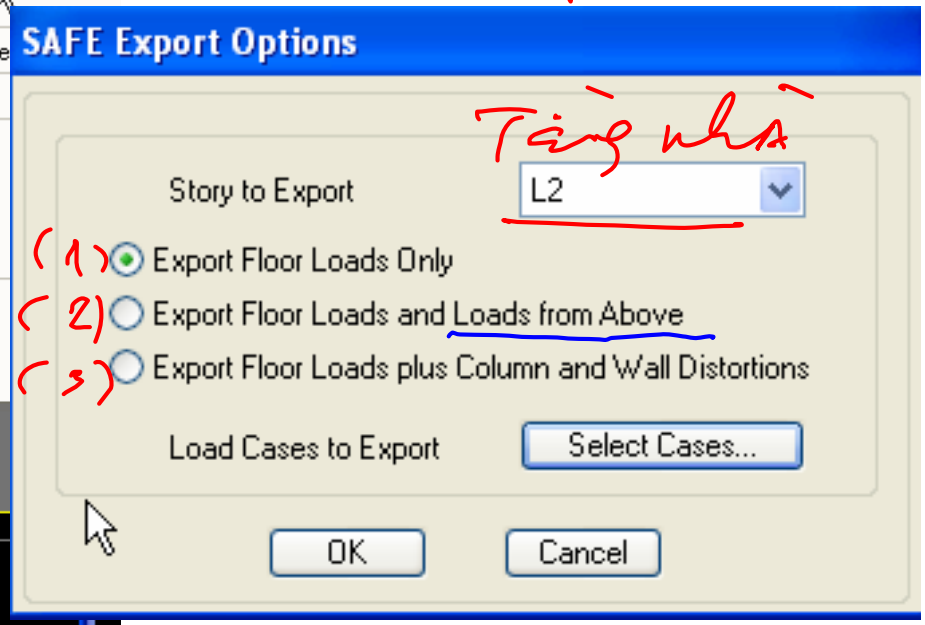
Cách định nghĩa lò xo nằm dưới mỗi nút


Select
Assign
Analyze
Display
Design
Detailing
Options
Help
Slab Properties...
Slab Offset...
Slab Rib Locations...
Beam Properties...
Beam Offset...
Opening
Point Restraints...
Column Supports...
Wall Supports...
Soil Supports...
Releases...
Point Loads...
Point Displacements...
Line Loads...
Surface Loads...
Group Names...
Clear Display of Assigns
A
D
E
F
Support Properties
Support Property
CUCEP
NONE
Click to:
Add New Property
Modify/Show Property...
Delete Property
OK
Cancel

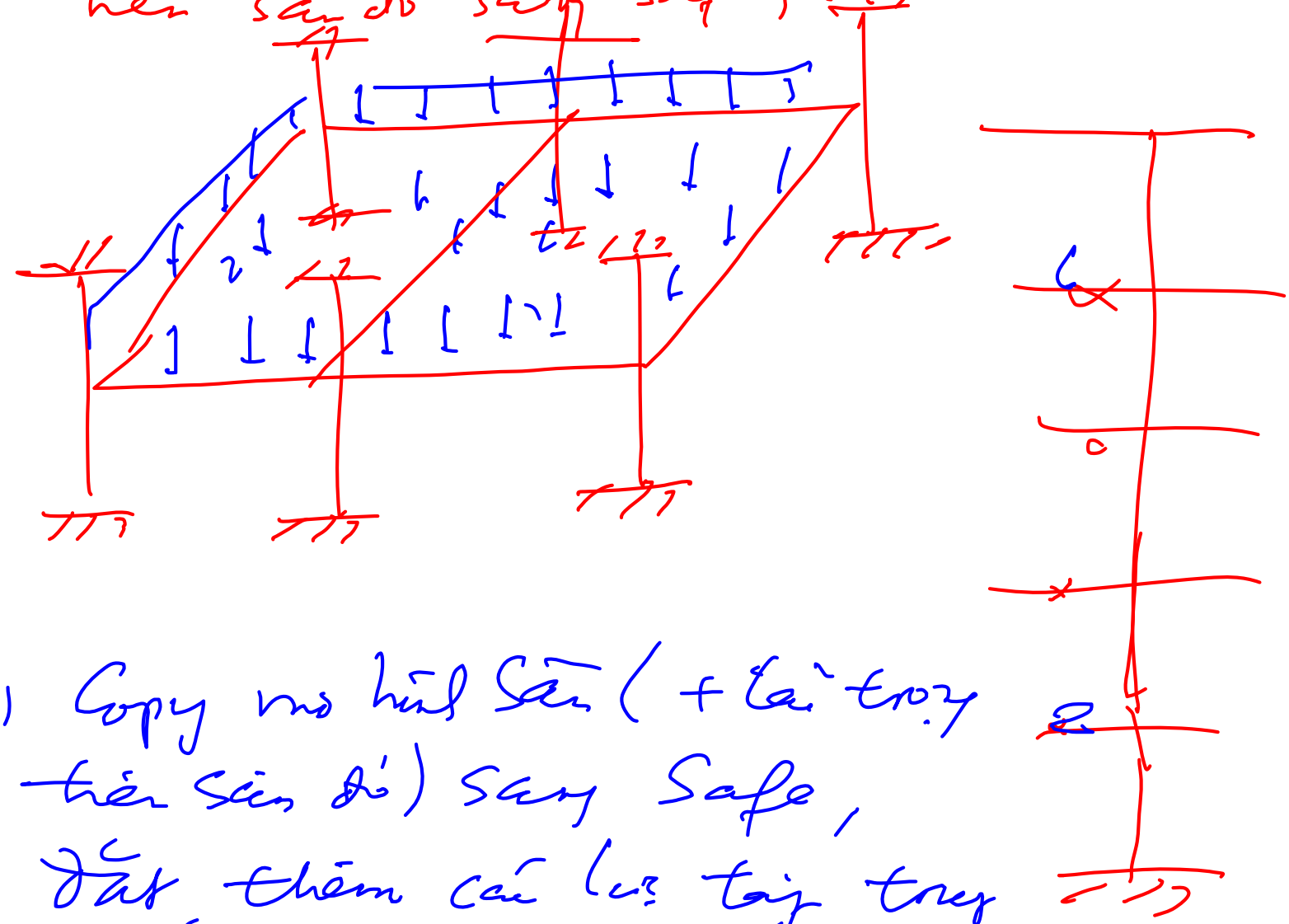
ETABS



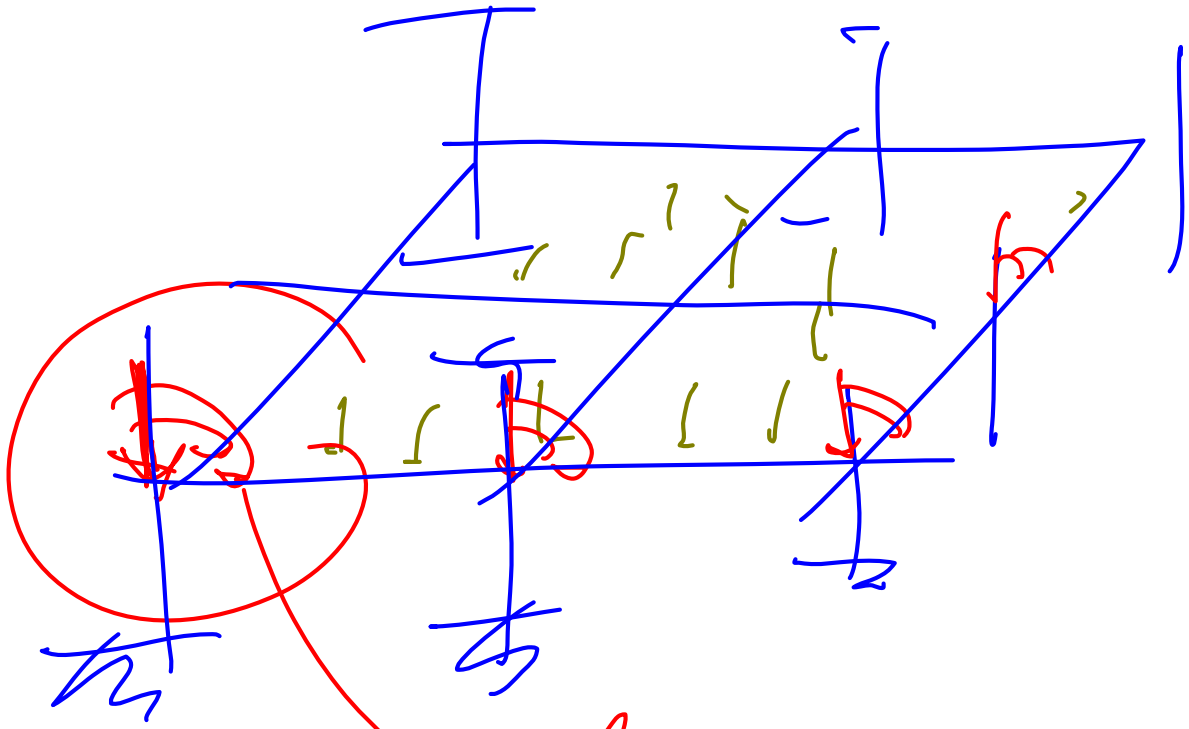
Chuyển mô hình sàn đã nhập trong Etabs sang Safe để giải nội lực và tính lượng cốt thép.



(1) Copy mô hình sàn + toàn bộ tải trọng đã nhập trên sàn đó sang Safe,



(2) Copy mô hình sàn (+ tải trọng trên sàn đó) sang Safe, đặt thêm các lực tập trung đối với tầng trên để xuống cột tầng xét.



lực đặt vào cọc tăng tay

do cái tăng trên đè xuống

→ làm 3 dạng cọc → thay đổi

Nội lực sẵn.

(3) Xuất (sàn + tải trọng sàn) sang

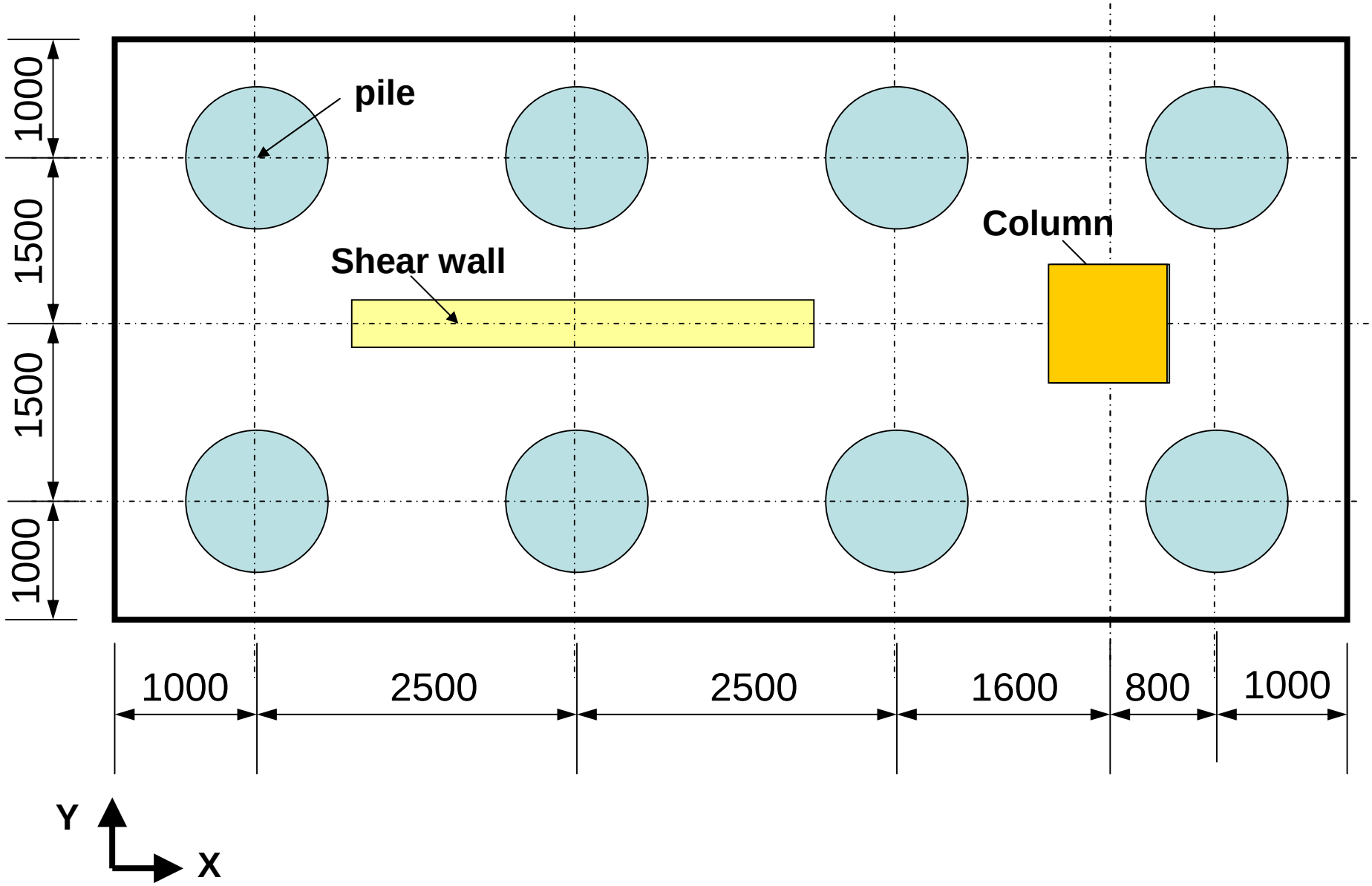
Safe; đặt thêm chuyển vị cuối bước

tại cột. Chuyển vị cuối bước này =

kết quả chuyển vị sau khi giải

Etabs.

Ví dụ SAFE: MÓNG CỌC NHỒI DƯỚI VÁCH CỨNG và CỘT



Ví dụ - Σ Tải $\begin{Bmatrix} \text{cột} \\ \text{vách} \end{Bmatrix}$ = 3000 Tấn.

- Trung bình, mỗi cọc chịu

$$\frac{3000 + TL\ Đất + TL.\ Đài}{8\ cọc}$$

$$= \boxed{500}\ \text{Tấn}.$$

- Tính lún, với độ lún $\boxed{S = 2,5\ cm}$

→ Độ cứng lò xo khi thay mỗi cọc = 1 lò xo

$$\rightarrow k = \frac{P}{S} = \frac{500}{0,025} = 20000\ T/m$$

Cách 1 : có thể dùng **Column Support** để mô tả

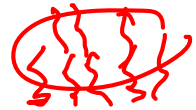
lò xo cho cọc, có độ cứng

$$k = 20000\ T/m$$

Cách 2 (chính xác hơn)

Thay mỗi cọc = 1 viên gạch = hệ lò xo

trong điện trở cọc



⇒ dùng **Soil support** có

$$C_z = \frac{k}{F_{coc}} = \frac{k}{\pi D^2/4} = \dots\ (T/m^3)$$

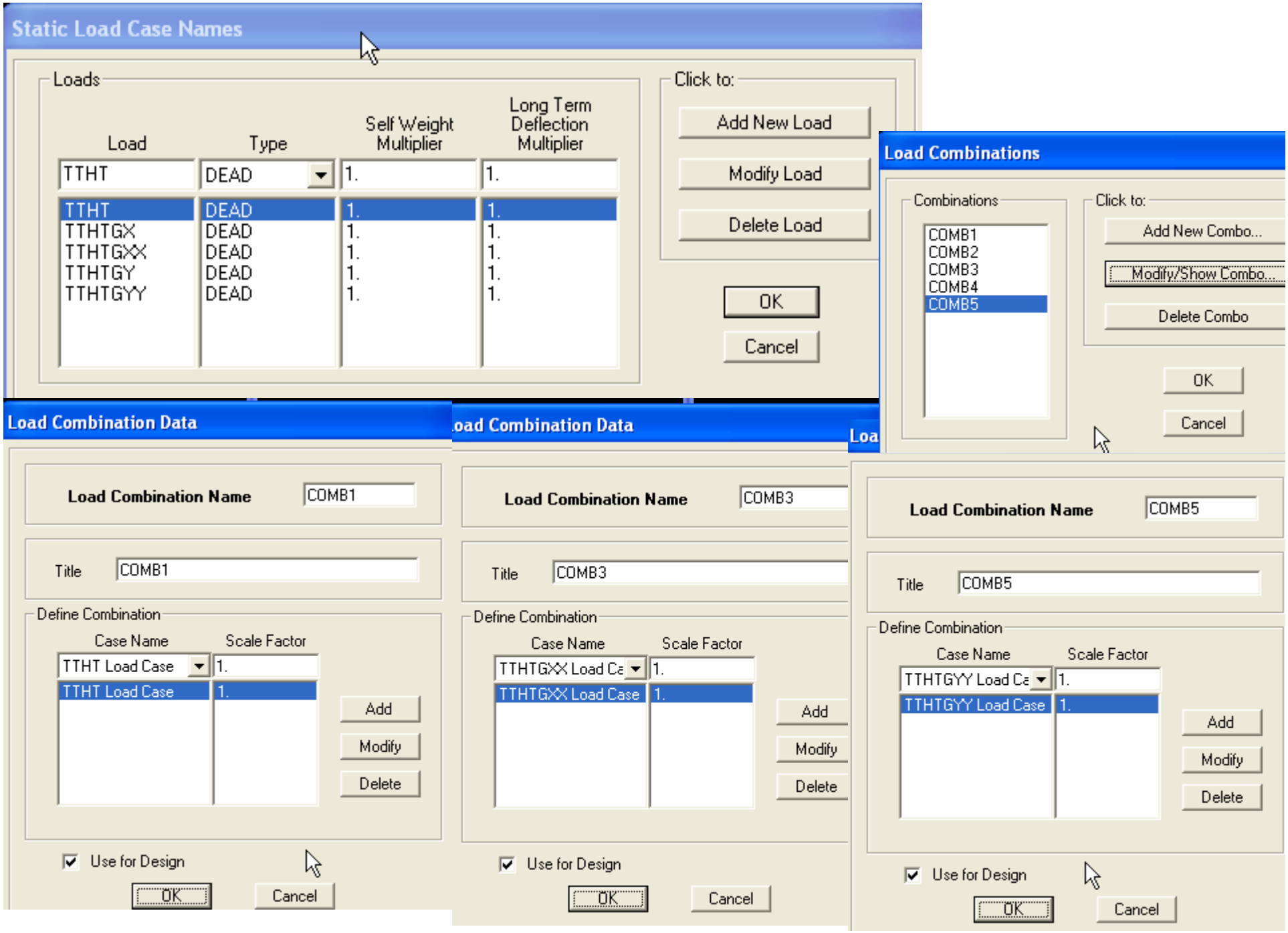
Cọc có $D = 1m$

Khung không gian

ETABS → giải xong
→ xuất ra phản lực của các combo
Scan

(1) TT + HT
(2) TT + 0.9 HT + 0.9 GX
(3) TT + 0.9 HT + 0.9 GXX
(4) TT + 0.9 HT + 0.9 GY
(5) TT + 0.9 HT + 0.9 GYY.

SAFE
- Định nghĩa 5 trường hợp tải Load cases ứng với 5 combo của etabs.
- nhập tải ứng với mỗi Load cases.
- Định nghĩa lại 5 tổ hợp trong Safe → tính cốt thép.


Static Load Case Names
Loads
Load
Type
Self Weight Multiplier
Long Term Deflection Multiplier
TTHT
DEAD
1.
1.
TTHT
DEAD
1.
1.
TTHTGX
DEAD
1.
1.
TTHTGXX
DEAD
1.
1.
TTHTGY
DEAD
1.
1.
TTHTGYY
DEAD
1.
1.
Click to:
Add New Load
Modify Load
Delete Load
OK
Cancel
Load Combinations
Combinations
COMB1
COMB2
COMB3
COMB4
COMB5
Click to:
Add New Combo...
Modify/Show Combo...
Delete Combo
OK
Cancel
Load Combination Data
Load Combination Name
COMB1
Title
COMB1
Define Combination
Case Name
Scale Factor
TTHT Load Case
1.
TTHT Load Case
1.
Add
Modify
Delete
Use for Design
OK
Cancel
oad Combination Data
Load Combination Name
COMB3
Title
COMB3
Define Combination
Case Name
Scale Factor
TTHTGXX Load Ca
1.
TTHTGXX Load Case
1.
Add
Modify
Delete
Use for Design
OK
Cancel
Load Combination Name
COMB5
Title
COMB5
Define Combination
Case Name
Scale Factor
TTHTGYY Load Ca
1.
TTHTGYY Load Case
1.
Add
Modify
Delete
Use for Design
OK
Cancel