Ministry of Higher Education and Scientific Research
University of Al-Muthanna
College of Engineering
Civil Engineering Department

Subject: Structural Analysis
Class: Forth Year
Year: 2020 / 2021
Dr. Basim Jabbar Almusawi

Lecture (8) 18/1/2021

One-storey concrete building is shown in figures (1) below, depending on following data: Dead load 4 kN/m^2, Live load 6 kN/m^2, Beam dimension (0.4 ×0.6 m), column dimension (0.4 × 0.6 m), slab thickness 0.2 m, **height of floor 4m, cover 40mm, No. of division 5 × 5, *f_y= 350 MPa, f_u= 550 MPa, fc= 25 MPa*, γ_c= 24 kN/m^3,** $E_c = 4700\sqrt{fc}$ and the supports are considered fixed**.** Construct a model by using SAP2000 and answer on the following:

1- Find the maximum and minimum reactions with unit in (kN).
2- Find the deflections of **X1**and **X2** in millimeters (mm).
3- Find the maximum positive moments in Slab (S) in (kN.m) at X and Y directions.
4- Find the maximum moments, shears in beams (**B1-1 and B2-2**).
5- Find the moment and shear in section (**a-a**) at 1m from column.

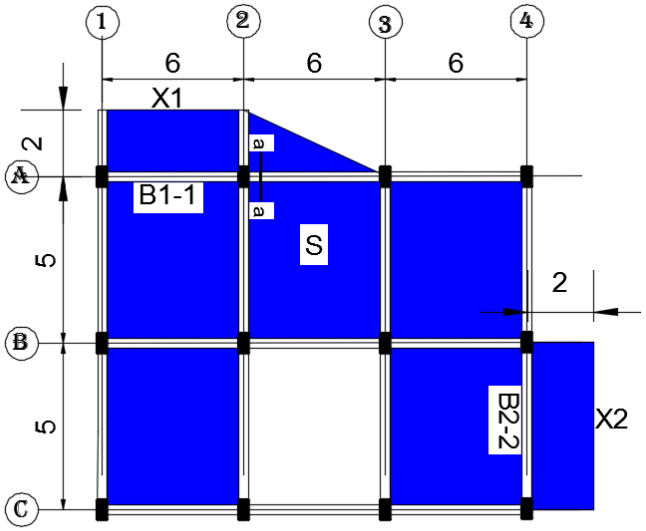

Figure (1) Top view

ملاحظات مهمة:

١- عدد المحاور بالاتجاه x هو 5 وعدد المحاور باتجاه z هو 4.

٢- المحاور باتجاه x وy يحتاج الى تغيير ليكون كما يلي:

y	x
0	0
5	6
10	12
12	18
	20

٣- الاعمدة تحتاج الى تغيير بالمحاور بزاوية 90.

1- The maximum Reaction with unit in (kN) = 661.1 minimum= 170.49

2- The deflection of X1= 4.44 mm X2 = 3.21 mm

3- The maximum positive moment in Slab (S) x direction = 13.52 kN.m y = 18.23 kn.m

4- The maximum moments, shear and in beams (**B1-1 and B2-2**).

B1-1	
Moment	Shear
205.5 kN.m	174.5 kN

B2-2	
Moment	Shear
161.1 kN.m	173.3 kN

5- Find the moments and shear in section (**a-a**) at 1m from column

Section a-a	
Moment	Shear
55.3 kN.m	121.5 kN

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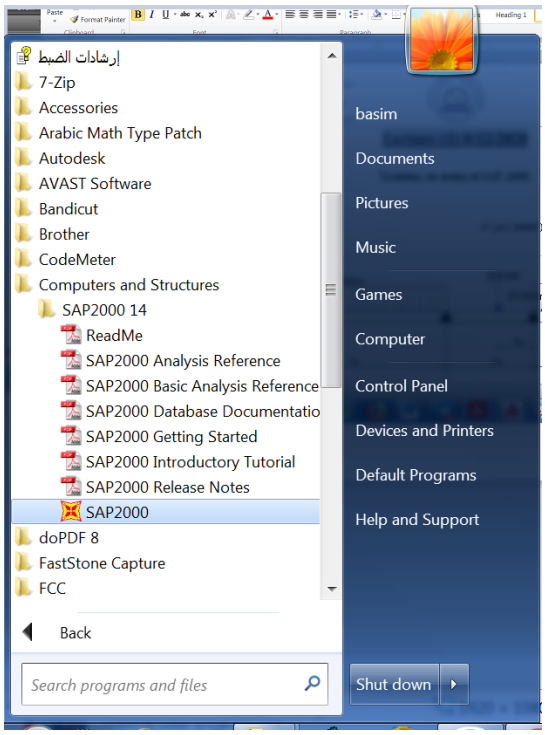
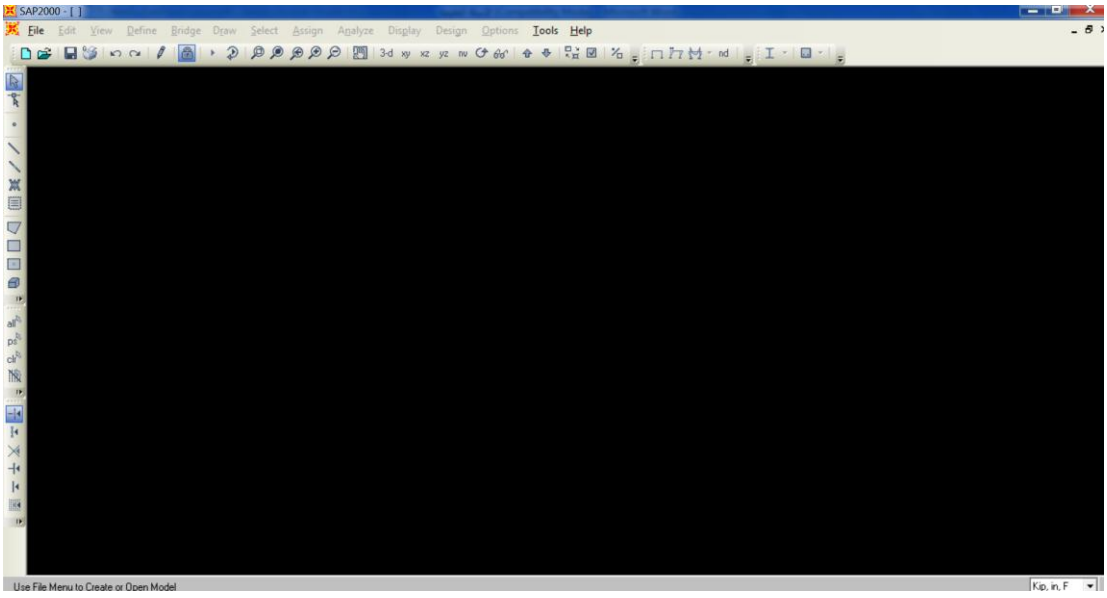
Lecture (1) 8/12/2020

Structural Analysis using of SAP 2000.

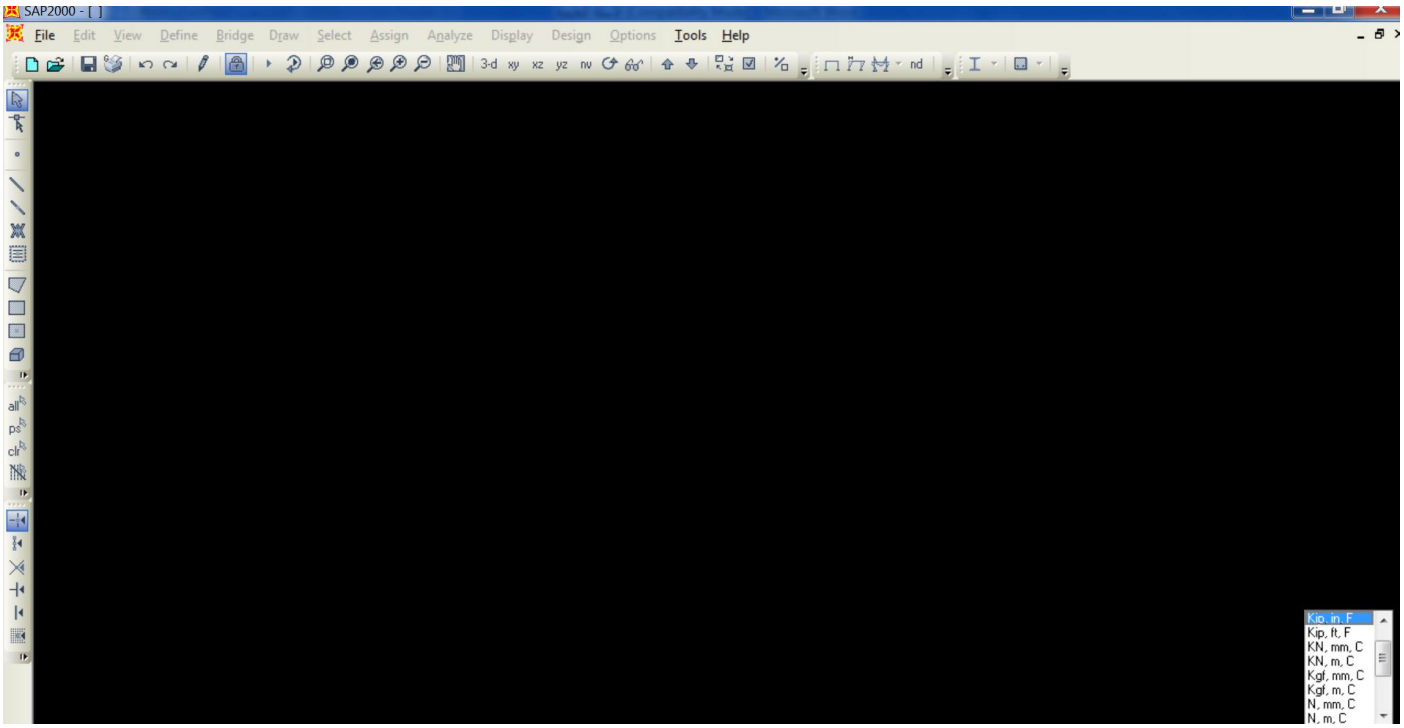
١- فتح البرنامج عن طريق ابدا (start) ومن ثم computer and structure ومن ثم SAP2000



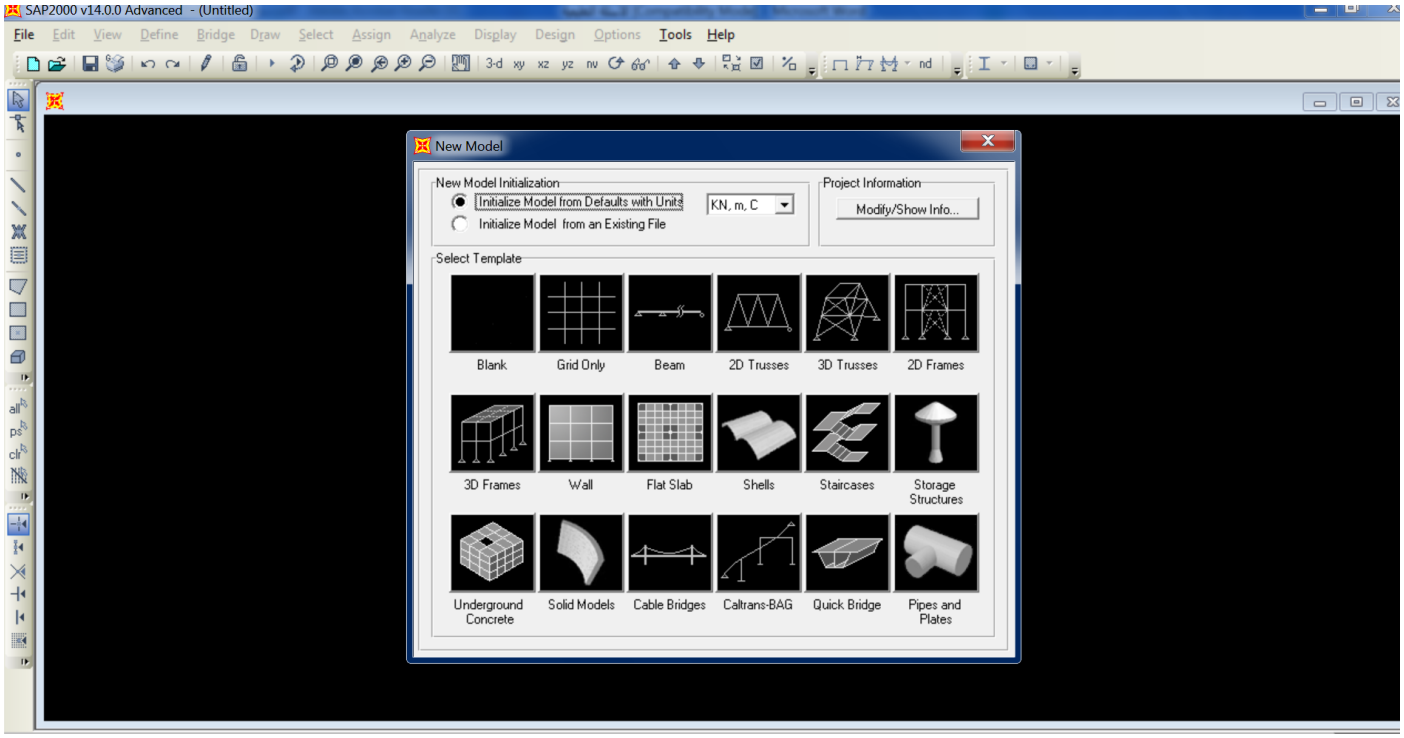
٢- التعرف على واجهة البرنامج



٣- من قائمة نختار new model مع تغيير الوحدات الى kN.m



٤- نختار Beam لاختار تحليل لجسر اعتيادي



٥- بعد اختيار Beam تظهر لنا القائمة التالية:

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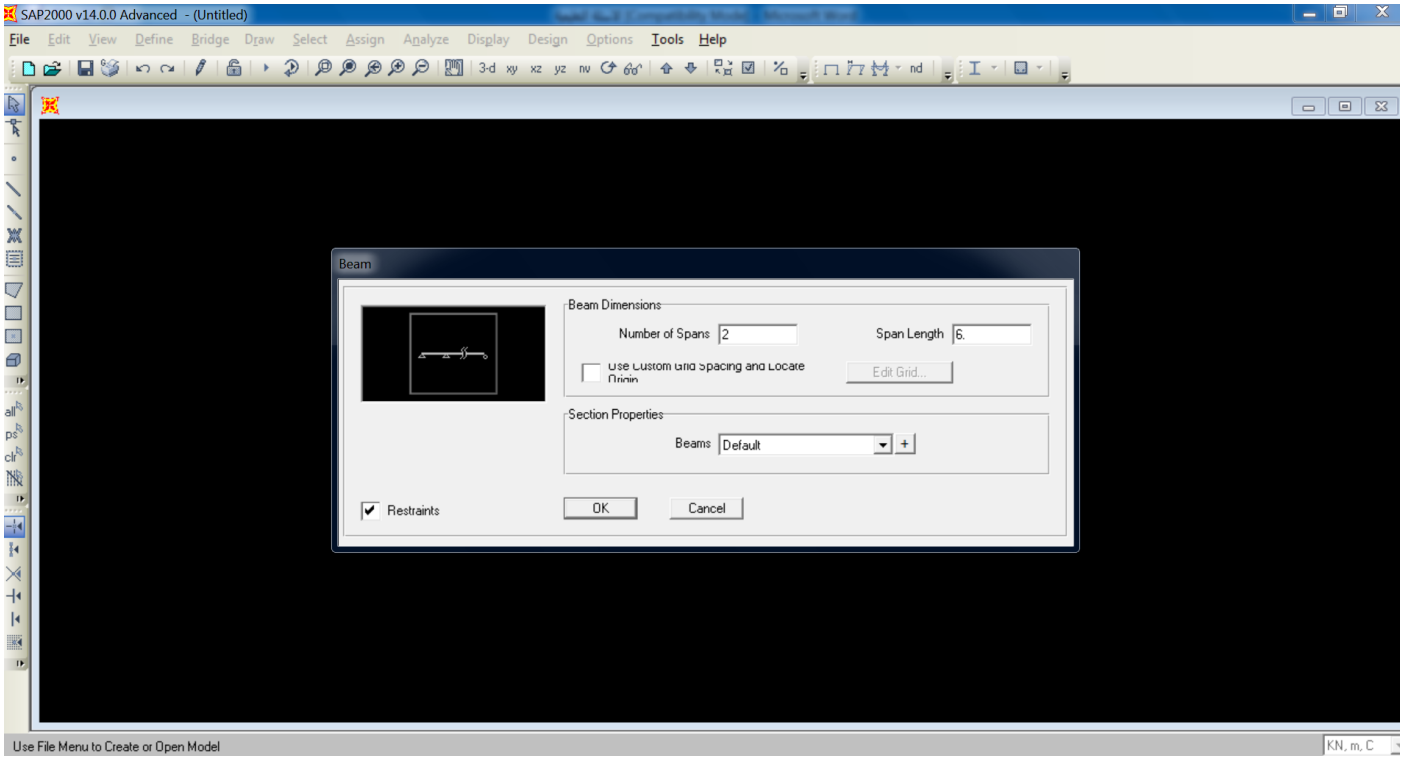
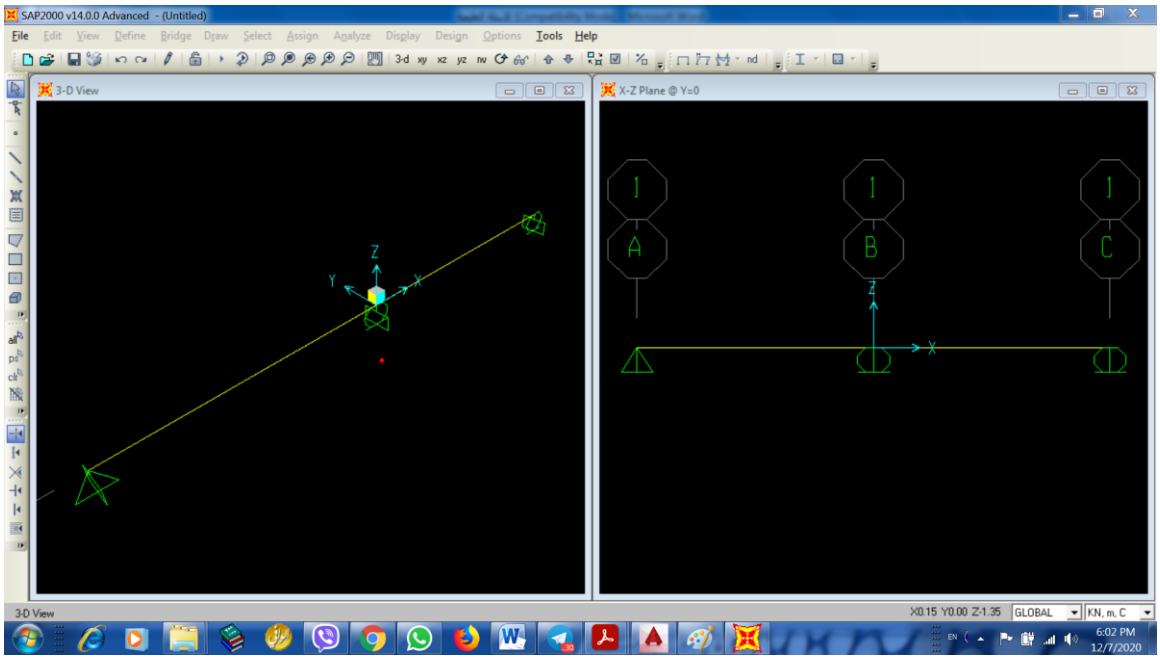


Number of span= عدد الفضاءات فاذا على سبيل المثال ٢ يكون عدد المساند ٣

Span length= المسافة بين مسند واخر فعند اختيار مثلا ٥ م يكون طول الجسور هو ١٠ متر باعتبار اختيار عدد الفضاءات هو ٢

Beams= نوعية المقطع كونكريت او حديد او غيرها ويمكن تعريفه لاحقا بعد الضغط على موافق

بعد الضغط على موافق تظهر القائمة ادناه وتبين عدد الفضاءات ٢ وعدد المساند ٣



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Lecture (2) 16/12/2020

Structural Analysis using of SAP 2000.

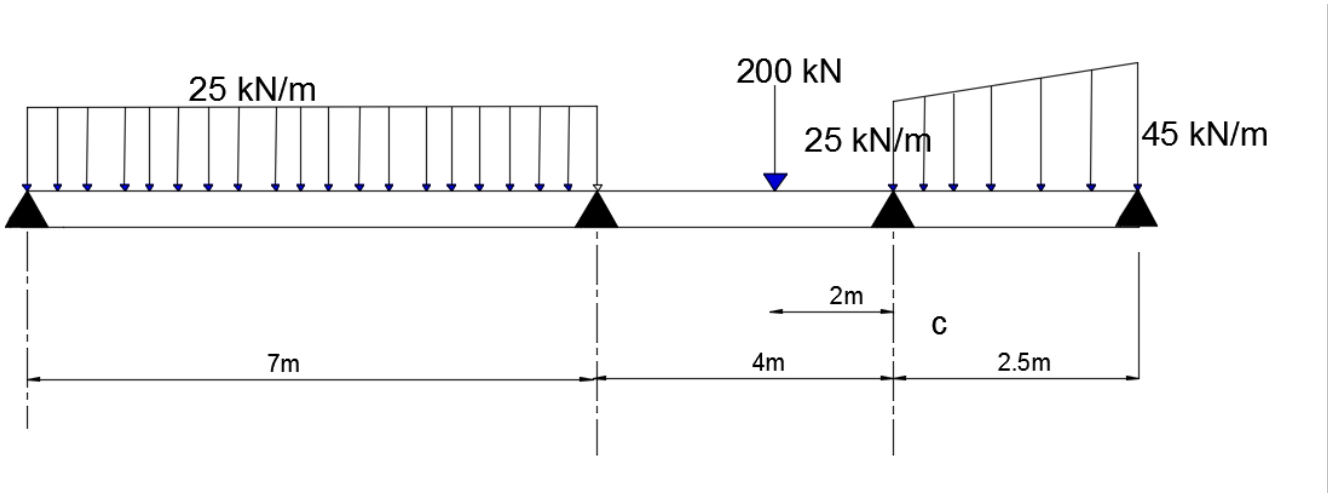
A two-dimension concrete beams as shown in figures below, a dead loads were applied on this frame. Depending on the following assumptions:

Beam dimension (0.25 × 0.5 m), and dead load factor 1.4, answer on the following:

1- Find the maximum Reaction with unit in kN.

2- Find the maximum deflection in millimeter (mm).

3- Find the maximum moment and shear in the beams.



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Lecture (5) 29/12/2020

A two-dimension concrete frame as shown in figures (1) below, a dead loads were applied on this frame. Depending on the following assumptions:

Beam dimension (0.3 × 0.5 m), column dimension (0.3 × 0.3 m), dead load factor 1.4 and the supports are considered hinge, answer on the following:

1- Find the maximum Reaction with unit in kN.

2- Find the maximum deflection in millimeter (mm).

3- Find the maximum moment and shear in the beams.

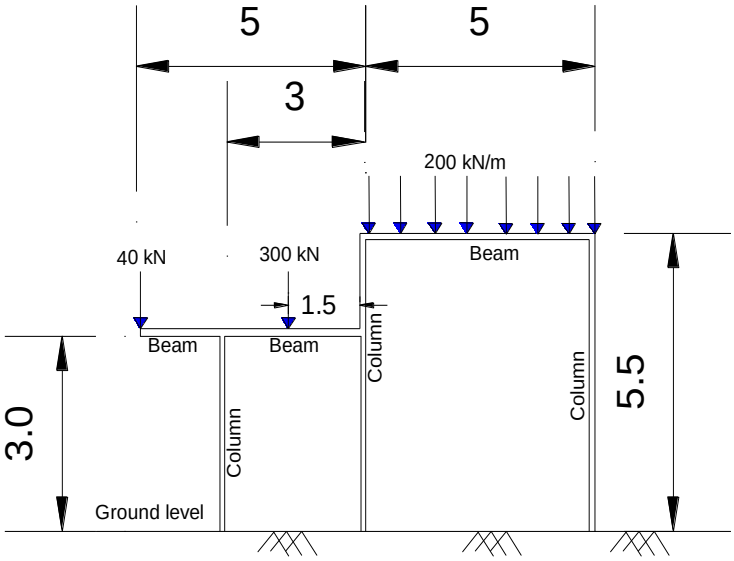

Figure (1)

Dr.Bassim Jabbar Abass

ملاحظات مهمة:

١- عدد المحاور بالاتجاه x هو 4 وعدد المحاور باتجاه z هو 3

٢- المحور الاخير باتجاه z يحتاج الى تغيير ليكون 3+2.5= 5.5 متر

٣- المحاور باتجاه x تحتاج الى تغيير ليكون

0
2
5
10

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Lecture (4) 23/12/2020

A two-dimension concrete frame as shown in figures (1) below, a dead loads were applied on this frame. Depending on the following assumptions:

Beam dimension (0.3 × 0.5 m), column dimension (0.3×0.3 m) and dead load factor 1.4, answer on the following:

1- Find the maximum Reaction with unit in kN.
2- Find the maximum deflection in millimeter (mm).
3- Find the maximum moment and shear in the beams.

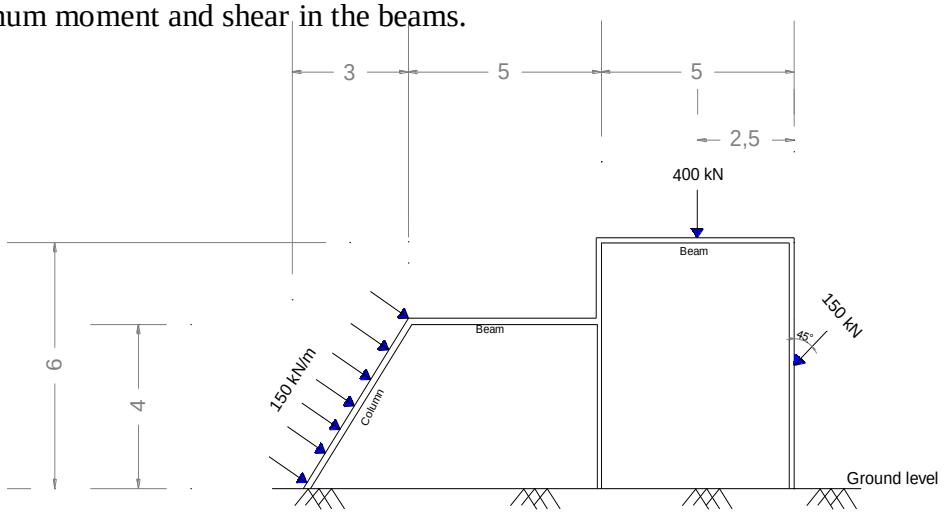

Figure (1)

ملاحظات مهمة:

١- عدد المحاور بالاتجاه x هو 4 وعدد المحاور باتجاه z هو 3

٢- المحور الاخير باتجاه z يحتاج الى تغيير ليكون 4 + 2= 6 متر

٣- المحاور باتجاه x تحتاج الى تغيير ليكون

0
3
8
13

٤- القوة ١٥٠كن يتم تحليلها الى قوتين عمودية وافقية والعمودية يكون اتجاه القوة الى الاسفل والافقية الي اليسار كما مبين ادناه

150 Cos 45 = 106 ↓

150 Sin 45 = 106 ←

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Lecture (6) 5/1/2021

Q.7 A two-dimension concrete frame as shown in figures (1) below, a live loads were applied on this frame. Depending on the following assumptions:

Beam dimension (0.3 × 0.5 m), column dimension (0.3×0.3 m), the dead load factor 1.2 and live load factor 1.6 and the supports are fixed answer on the following:

1- Find the maximum Reaction with unit in kN.
2- Find the maximum deflection in millimeter (mm).
3- Find the maximum moment and shear in the beams.

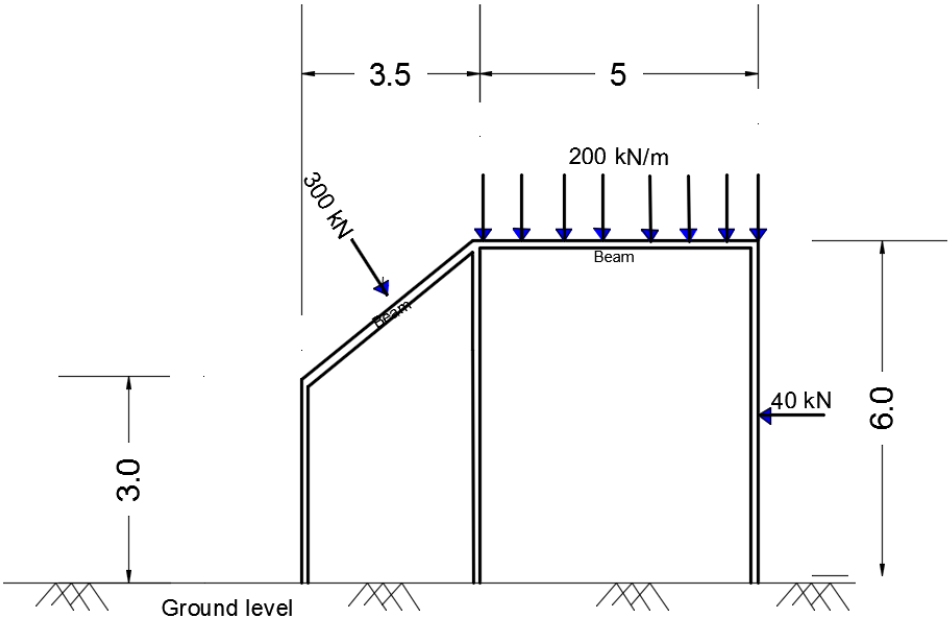

Figure (1)

Dr.Bassim Jabbar Abass

ملاحظات مهمة:

١- عدد المحاور بالاتجاه x هو 3 وعدد المحاور باتجاه z هو 3

٢- المحور الاخير باتجاه z =6 متر

٣- المحاور باتجاه x تحتاج الى تغيير ليكون

0
3.5
8.5

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Lecture (9) 19/1/2021

A concrete building is shown in figures (1) below, depending on following data: Dead load 6 kN/m^2, Live load 4 kN/m^2, Beam dimension 0.3 × 0.6 m, column dimension 0.3 × 0.3 m and slab thickness 0.2 m, No. of division 4 × 4, cover 40mm, *f_y= 350 MPa, f_u= 500 MPa, fc= 25 MPa*, γ_c= 24 kN/m^3, $E_c = 4700\sqrt{fc}$ and the supports are considered fixed.

1- Find maximum moment, shear and torsion in B1-1.

2- Find the deflection at X in millimeter.

3- Find maximum negative and positive moments in X and Y directions for S.

4- Find maximum and minimum reactions.

Use 1.2 × dead load and 1.6 × live load

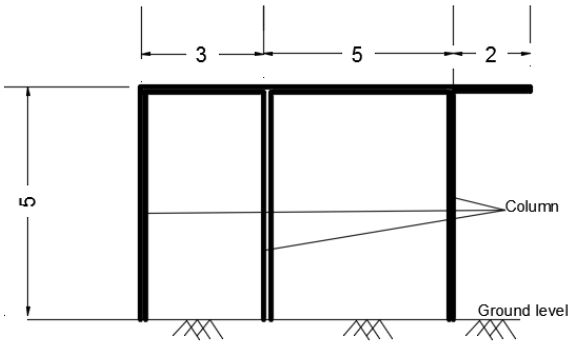

Figure (1b)

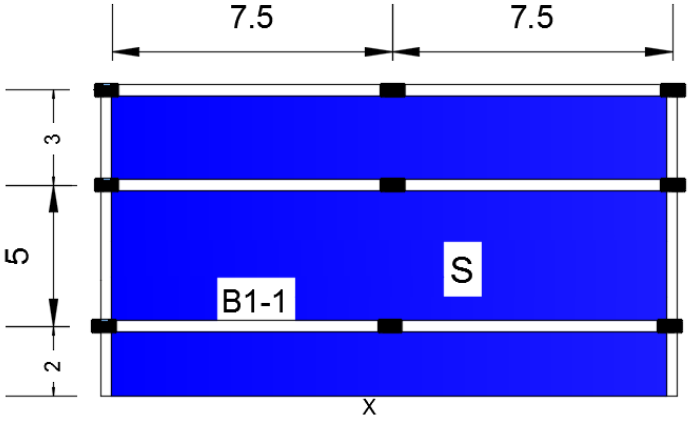

Figure (1a)

ملاحظات مهمة:

١- عدد المحاور بالاتجاه x هو 3 وعدد المحاور باتجاه y هو 4 وعدد المحاور باتجاه z هو 2

٢- المحاور اباتجاه y تكون كما يلي:

0

2

7

10

٣- الاعمدة لا تحتاج الى تغيير بالمحاور بزاوية ٩٠:

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Lecture (3) 22/12/2020

A two-dimension concrete frame as shown in figures (1) below, dead loads were applied on this frame. Depending on the following assumptions:

Beam dimension (0.25 × 0.5 m), column dimension (0.25×0.3 m) and dead load factor 1.4, answer on the following:

1- Find the maximum Reaction with unit in kN.
2- Find the maximum deflection in millimeter (mm).
3- Find the maximum moment and shear in the beams.

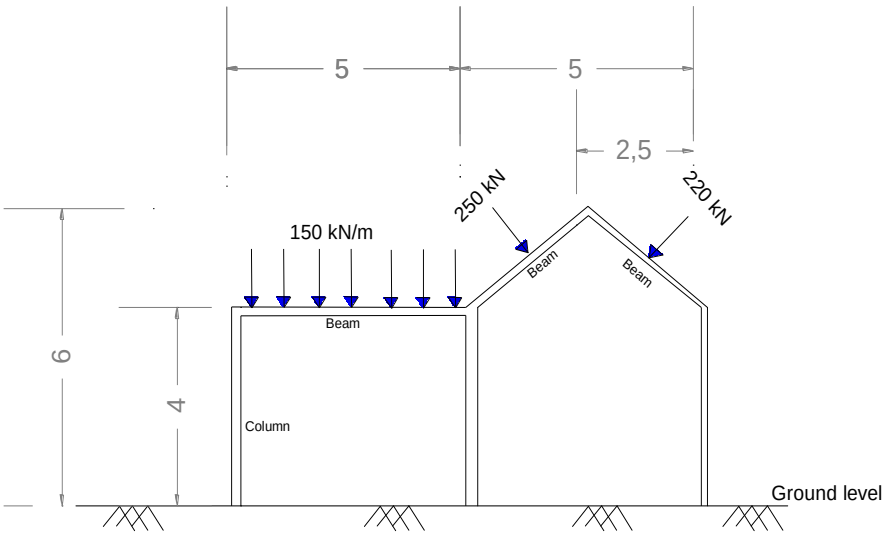

Figure (1)

ملاحظات مهمة:

١- عدد المحاور بالاتجاه x هو 4 وعدد المحاور باتجاه z هو 3

٢- المحور الاخير باتجاه z يحتاج الى تغيير ليكون 4+2=6 متر

٣- المحاور باتجاه x تحتاج الى تغيير ليكون

0
5
7.5
10

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Lecture (10) 26/1/2021

One-storey concrete building is shown in figures (1) below, depending on following data: Dead load 5 kN/m^2, Live load 7 kN/m^2, Beam dimension (0.4 × 0.6 m), column dimension (0.4 × 0.6 m), slab thickness 0.2 m, floor height 4 m, dead load factor 1.2, live load factor 1.6, No. of division 4 × 4 and the supports are considered fixed. ***f_y= 350 MPa, f_u= 550 MPa, fc= 21 MPa*****, γ_c= 24 kN/m^3, $E_c = 4700\sqrt{fc}$ and cover 30 mm.**

Answer on the following:

1- Find the deflection of X1 and X2 in millimeters (mm).

2- Find the maximum and minimum reactions.

3- Find moment, shear and torsion in 1m from the lower support and at the mid span for B1_1.

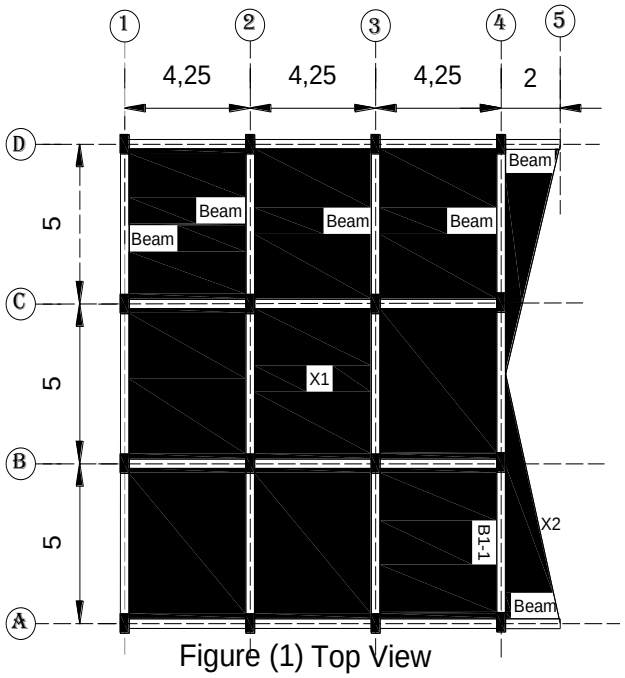

Figure (1) Top View

ملاحظات مهمة:

١- عدد المحاور بالاتجاه x هو 5 وعدد المحاور باتجاه y هو 4 وعدد المحاور باتجاه z هو 2

٢- المحور الاخير باتجاه x يحتاج الى تغيير ليكون 4.25+4.25+4.25+2= 14.75 متر

٣- جميع الاعمدة الوسطية تحتاج الى تغيير بالمحاور بزاوية 90

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Lecture (11) 2/2/2021

One-storey concrete building is shown in figures (1) below, depending on following data: Dead load 5 kN/m^2, Live load 7 kN/m^2, Beam dimension 0.3 × 0.6 m, column dimension 0.3 × 0.5 m and slab thickness 0.2 m, height of floor 4m, cover 30mm, the supports are considered fixed No. of division 5 × 5, *f_y= 350 MPa, f_u= 550 MPa, fc= 21 MPa*, γ_c= 24 kN/m^3 and $E_c = 4700\sqrt{fc}$.

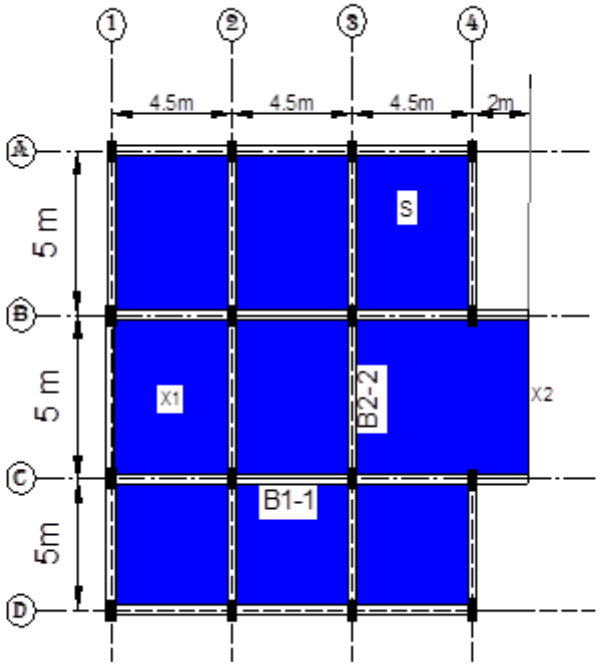
Answer on the following:

1- Find the deflection of X1 and X2 in millimeters (mm).

2- Find the maximum and minimum reactions.

3- Find moment, shear and torsion in 1m from the left support and at the mid span for B1-1 and B2-2.

4- Find maximum moments in X and Y directions for S1.



Figure(1)

Dr.Bassim Jabbar Abass

ملاحظات مهمة:

1- عدد المحاور بالاتجاه x هو 5 وعدد المحاور باتجاه y هو 4 وعدد المحاور باتجاه z هو 2

2- المحور الاخير باتجاه x يحتاج الى تغيير ليكون =4.5 + 4.5 + 4.5 = 15.5متر

3- جميع الاعمدة الوسطية تحتاج الى تغيير بالمحاور بزاوية 90

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Lecture (13) 16/2/2021

One-storey concrete building is shown in figure below, depending on following data: Dead load 6 kN/m^2, Live load 4 kN/m^2, Beam dimension (0.3 × 0.6 m), column dimension (0.3× 0.6 m) slab thickness 0.18 m, floor height 3.5 m, dead load factor 1.2, live load factor 1.6, No. of division 4 × 4 and the supports are considered bins. ***f_y= 350 MPa, f_u= 550 MPa, fc= 25 MPa*****, γ_c= 24 kN/m^3,** $E_c = 4700\sqrt{fc}$ **and cover 30 mm.**

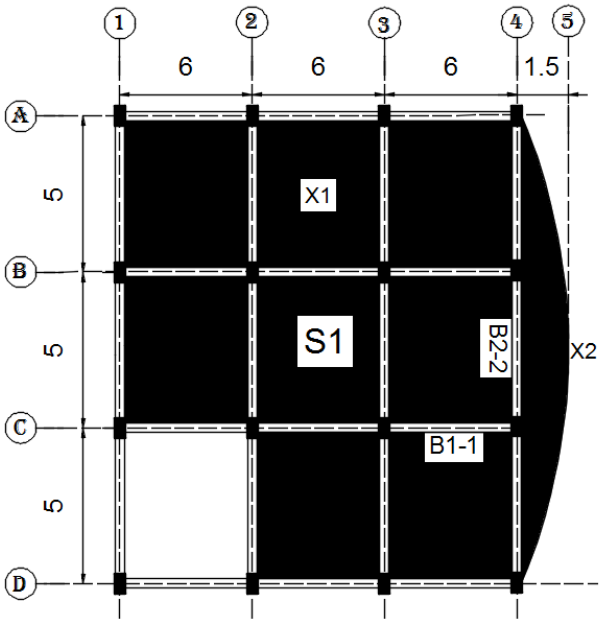
Answer on the following:

1- Find the deflection of X1 and X2 in millimeters (mm).

2- Find the maximum and minimum reactions.

3- Find moment, shear and torsion in 1m from the lower support and at the mid span for B1-1 and B2-2.

4- Find maximum moments in X and Y directions for S1.



ملاحظات مهمة:

1- عدد المحاور بالاتجاه x هو 5 وعدد المحاور باتجاه y هو 4 وعدد المحاور باتجاه z هو 2

2- المحور الاخير باتجاه x يحتاج الى تغيير ليكون 6+6+6+1.5=19.5متر

3- جميع الاعمدة الوسطية تحتاج الى تغيير بالمحاور بزاوية 90

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Lecture (14) 23/2/2021

Two-storey concrete building is shown in figures (1) below, depending on following data: Dead load 5 kN/m^2, Live load 8 kN/m^2, Beam dimension (0.4 ×0.6 m), column dimension (0.4 × 0.6 m), slab thickness 0.2 m, floor height 4.5 m, dead load factor 1.2, live load factor 1.6, No. of division 4×4, the supports are considered fixed, f_y= *350 MPa,* f_u= *550 MPa, fc= 25 MPa*, γ_c= 24 kN/m^3, cover 30 mm and $E_c = 4700\sqrt{fc}$

Construct a model by using SAP2000 and answer on the following:

1- Find the maximum Reaction with unit in (kN).

2- Find the deflection of $\mathbf{X_1}$and $\mathbf{X_2}$ in millimeters (mm).

3- Find the maximum negative moment in Slab (S) in (kN.m) at X and Y directions.

4- Find the maximum moments, shear and torsion in beams **B1-1 and B2-2**.

5- Find the moments and shear in sections (**a-a**) at the mid span and (**b-b**) at 1m from column.

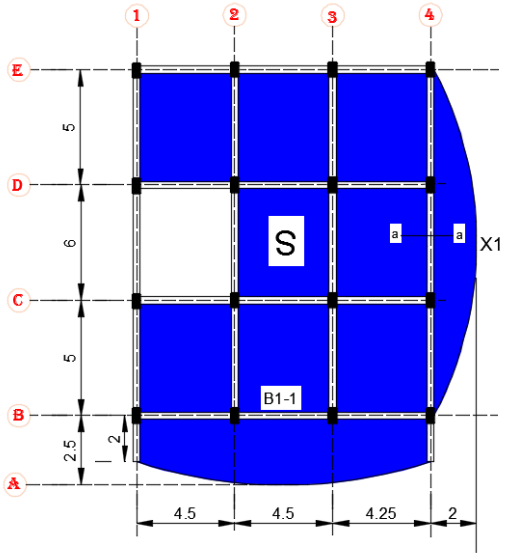

Figure (1a) first floor

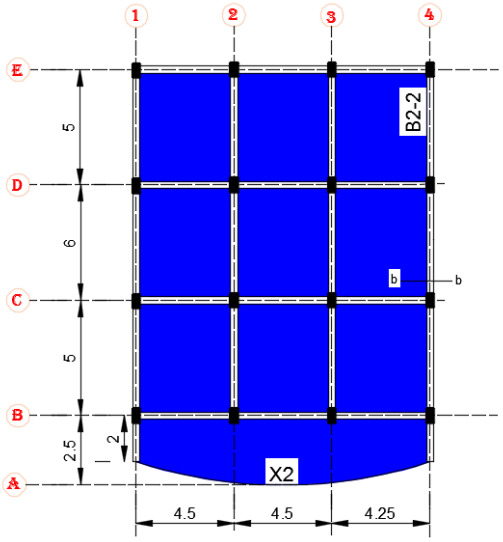

Figure (1b) second floor

ملاحظات مهمة:

1- عدد المحاور بالاتجاه x هو 5 وعدد المحاور باتجاه z هو 6 ومن الممكن عمله 5 بحيث نلغي المحور الاول 0.5 متر.

2- المحاور باتجاه x وy يحتاج الى تغيير ليكون كما يلي:

y	x
0	0
0.5	4.5
2.5	9
7.5	13.25
13.5	15.25
18.5	

3- في الطابق الاول عدد الاقواس 2 (في الجهة السفلية والجهة اليمين) بينما عدد الاقواس 1 في الطابق الثاني.

4- الانتباه الى اتجاه الاعمدة بحيث يكون كما في الرسم.

5- المطلوب يكون بعضها في سقف الطابق الاول والبعض الاخر في سقف الطابق الثاني كما موضح في الرسم.

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Dr. Basim Jabbar Almusawi

Lecture (15) 2/3/2021

Two-storey concrete building is shown in figures (1) below, depending on following data: Dead load 5 kN/m^2, Live load 8 kN/m^2, Beam dimension (0.4 ×0.6 m), column dimension (0.4 × 0.6 m), slab thickness 0.18 m, first floor height 4m and second floor height 3m, dead load factor 1.2, live load factor 1.6, No. of division 5×5, the supports are considered fixed, f_y= *350 MPa,* f_u= *550 MPa, fc= 25 MPa*, γ_c= 24 kN/m^3, cover 30 mm and $E_c = 4700\sqrt{fc}$

Construct a model by using SAP2000 and answer on the following:

1- Find the maximum Reaction with unit in (kN).

2- Find the deflection of $\mathbf{X_1}$and $\mathbf{X_2}$ in millimeters (mm).

3- Find the maximum negative moment in Slab (S1) in (kN.m) at X and Y directions.

4- Find the maximum moments, shear and torsion in beam **B1-1**.

5- Find the moments and shear in sections (**a-a**) and (**b-b**) at the mid span.

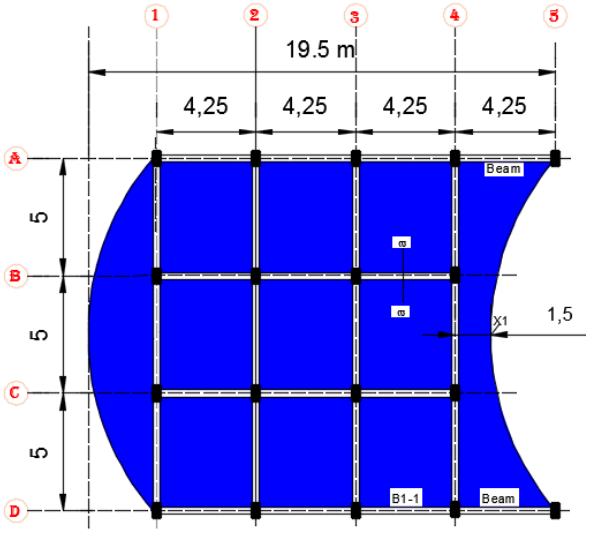

Figure (1a) first floor

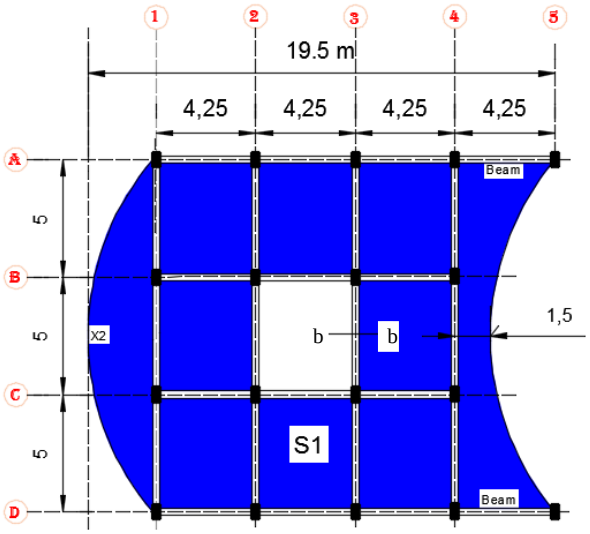

Figure (1b) second floor

ملاحظات مهمة:

1- عدد المحاور بالاتجاه x = 6 وعدد المحاور باتجاه y = 4 وعدد المحاور باتجاه Z = 3.

2- البعد الاول يمكن استخراجه من 19.5-17= 2.5

3- المحاور باتجاه x وy يحتاج الى تغيير ليكون كما يلي:

y	x
0	0
5	2.5
10	6.75
15	11
	15.25
	19.5

4- احداثيات القوس الاول على اليسار النقطة الثالثة (0 ,7.5 ,4).

5- - احداثيات القوس الثاني على اليمين النقطة الثالثة (16.75, 7.5، 4).

6- الانتباه الى اتجاه الاعمدة بحيث يكون كما في الرسم.

7- المطلوب يكون بعضها في سقف الطابق الاول والبعض الاخر في سقف الطابق الثاني كما موضح في الرسم.

Ministry of Higher Education
and Scientific Research
University of Al-Muthanna
College of Engineering
Civil Engineering Department

Subject: Structural Analysis
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Dr. Basim Jabbar Almusawi

Lecture (17) 16/3/2021

The truss showed in Figure consist of chords W 10× 30 and braces L 4 × 4 × 1/2, using AISC.PRO code and joint loads as dead load and dead load factor = 1.4, answer on the following:

1- Find the reaction.

2- Check if the sections are safe or not.