SEAA4223-04
STAADPro Group Project

Faculty of Civil Engineering
Universiti Teknologi Malaysia

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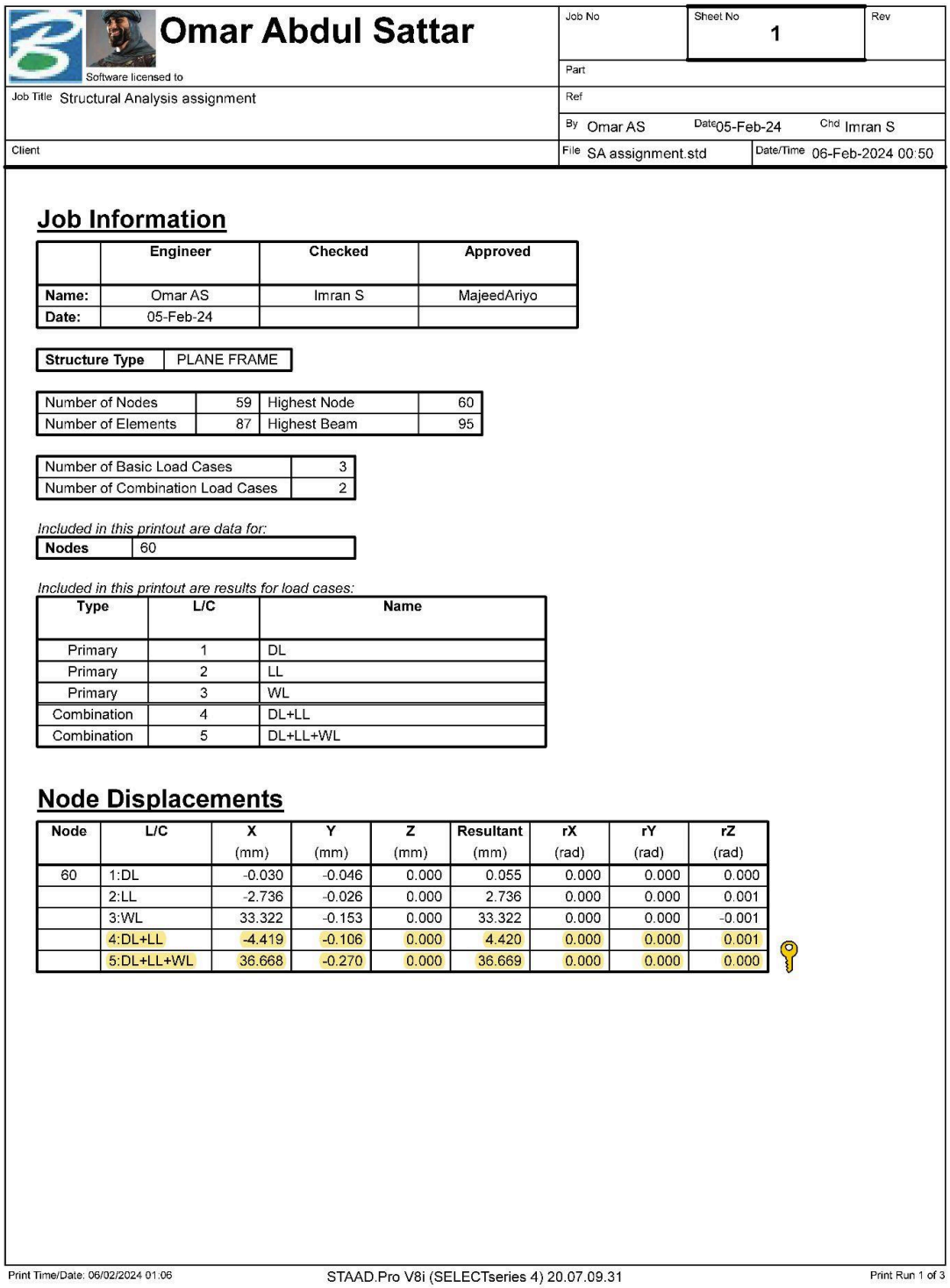
Q1) Analyse the structure based on the 2D model. What are the deflections at Point A? Please refer to Figure 2.



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Job No	Sheet No 1	Rev	
Part			
Job Title: Structural Analysis assignment	Ref		
	By: Omar AS	Date: 05-Feb-24	Chd: Imran S
Client	File: SA assignment.std	Date/Time: 06-Feb-2024 00:50	

Job Information

	Engineer	Checked	Approved
Name:	Omar AS	Imran S	MajeedAriyo
Date:	05-Feb-24		

Structure Type	PLANE FRAME

Number of Nodes	59	Highest Node	60
Number of Elements	87	Highest Beam	95

Number of Basic Load Cases	3
Number of Combination Load Cases	2

Included in this printout are data for:

Nodes	60

Included in this printout are results for load cases:

Type	L/C	Name
Primary	1	DL
Primary	2	LL
Primary	3	WL
Combination	4	DL+LL
Combination	5	DL+LL+WL

Node Displacements

Node	L/C	X (mm)	Y (mm)	Z (mm)	Resultant (mm)	rX (rad)	rY (rad)	rZ (rad)
60	1:DL	-0.030	-0.046	0.000	0.055	0.000	0.000	0.000
	2:LL	-2.736	-0.026	0.000	2.736	0.000	0.000	0.001
	3:WL	33.322	-0.153	0.000	33.322	0.000	0.000	-0.001
	4:DL+LL	-4.419	-0.106	0.000	4.420	0.000	0.000	0.001
	5:DL+LL+WL	36.668	-0.270	0.000	36.669	0.000	0.000	0.000

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Q2) Analyse the structure based on the 3D model. What are the internal forces for member 1 at Point A and B? Please refer to Figure 8.

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Part			
Job Title Structural Analysis assignment	Ref		
	By Omar AS	Date 05-Feb-24	Chd Imran S
Client	File v2.std	Date/Time 06-Feb-2024 15:36	

Job Information

	Engineer	Checked	Approved
Name:	Omar AS	Imran S	MajeedAriyo
Date:	05-Feb-24		

Structure Type	SPACE FRAME

Number of Nodes	285	Highest Node	288
Number of Elements	635	Highest Beam	643

Number of Basic Load Cases	3
Number of Combination Load Cases	2

Included in this printout are data for:

Beams	34

Included in this printout are results for load cases:

Type	L/C	Name
Combination	4	DL+LL
Combination	5	DL+LL+WL

Beam End Forces

Sign convention is as the action of the joint on the beam.

L/C	Beam	Node	Axial Fx (kN)	Shear Fy (kN)	Shear Fz (kN)	Torsion Mx (kNm)	Bending My (kNm)	Bending Mz (kNm)
4:DL+LL	34	40	14.365	6.427	1.311	-0.002	0.613	2.871
		41	-10.816	-6.427	-1.311	0.002	-4.545	16.411
5:DL+LL+WL	34	40	23.816	10.607	0.717	-0.002	1.596	7.159
		41	-20.774	-10.607	-0.717	0.002	-3.747	24.661

Answer Q3:

In order to reduce deflection in a beam or frame, there are two common ways to do so, either through proper material selection or through optimized structural design.

1. Material Selection and Reinforcement:

Higher Strength Materials: Using materials with enhanced strength qualities, such as high-strength steel or reinforced concrete, can significantly minimize deflection. These materials have a greater modulus of elasticity and yield strength, making them less susceptible to deformation under applied stresses.
Cross-Sectional Reinforcement: Increasing the cross-sectional area of a beam or frame, either by making it thicker or by adding reinforcing components such as ribs, flanges, or trusses, can improve stiffness and load-bearing capacity, reducing deflection.
Composite Materials: Composite materials, which mix two or more elements with differing qualities, can provide higher stiffness and strength when compared to conventional materials. For example, carbon fibre reinforced polymers (CFRP) can dramatically reduce deflection while keeping a lightweight construction.

2. Structural Design Optimization:

Optimized Beam/Frame Geometry: Changing the geometry of the beam or frame, such as its span length, depth, or form, can improve its load-carrying capacity and stiffness. For example, deeper beams or frames are more resistant to deflection.
Redistribution of Loads: Excessive deflection can be mitigated by transferring applied loads across the structure. This can be accomplished by structural adjustments such as adding more supports or shifting loads to other structural parts.
Prestressing and Post-Tensioning: These methods entail adding forces to the structure before or after the loads are imposed in order to offset the effects of external loads. Prestressing and post-tensioning are useful methods for reducing deflection and improving structural performance, particularly in concrete constructions.

Answer Q4:
A 2D model and a 3D model are both systems that represent an object in a multitude of planes. However, they have several differences among each other in dimensions, how they can be represented, complexity and applications.

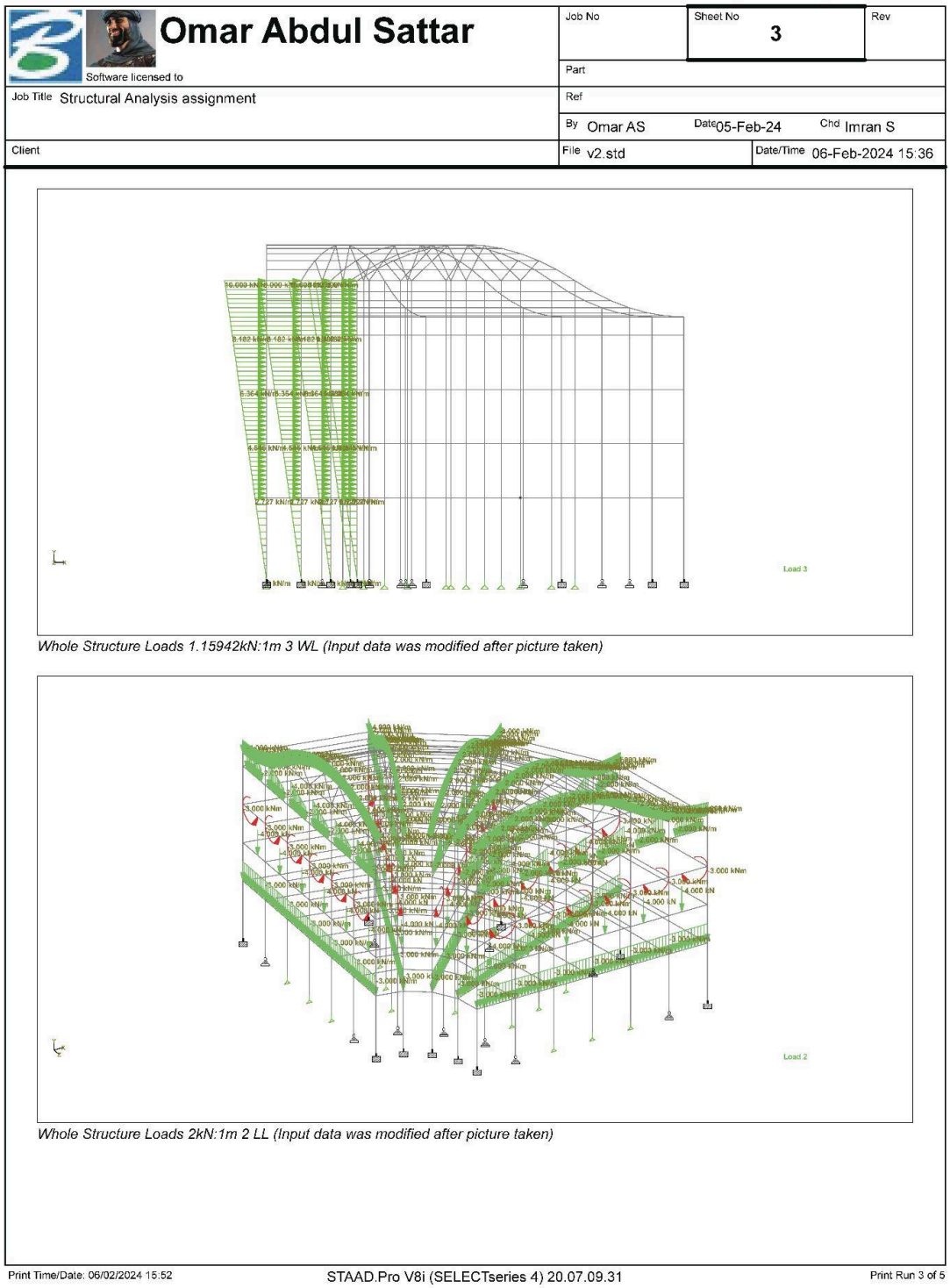
Dimensionality:
2D Model: A 2D model depicts things or systems in two dimensions, often length and breadth. It lacks depth information, which means it cannot represent things in their third dimension (height and depth).
3D Model: A 3D model portrays things or systems in three dimensions: length, breadth, and depth. This provides for a more complete depiction of the item, including its spatial and volumetric features.

Representation:
2D Model:A 2D model depicts items as flat forms or outlines on a two-dimensional plane. This depiction is frequently used for floor plans, elevations, schematics, and diagrams.
3D Model: In a 3D model, things are represented as solid bodies or depth-filled surfaces, allowing for a more accurate depiction of their geometry, proportions, and spatial connections. 3D models may be seen from any angle and rotated in space to explore various viewpoints.

Complexity and Detail:
2D Model: 2D models are often simpler and less detailed than their 3D counterparts. They are appropriate for expressing basic forms, contours, and flat surfaces, but may lack the complexities and depth of 3D models.
3D Model: 3D models can accurately depict complicated geometry, subtle features, and surface textures. They can represent objects with realistic depth, curvature, and surface properties, making them suitable for visualization, simulation, and rendering.

Application:
2D Model: 2D models are widely utilized in drafting, engineering drawings, architectural plans, circuit diagrams, and graphic design tasks that require a simpler depiction.
3D Model: 3D models are used in a variety of industries, including product design, industrial design, animation, gaming, virtual reality (VR), augmented reality (AR), simulation, and engineering analysis. They offer a more immersive and engaging experience, allowing users to explore and engage with virtual worlds in three dimensions.

Q5. Show the plan view of live loads and wind loads only on your 3D model. :



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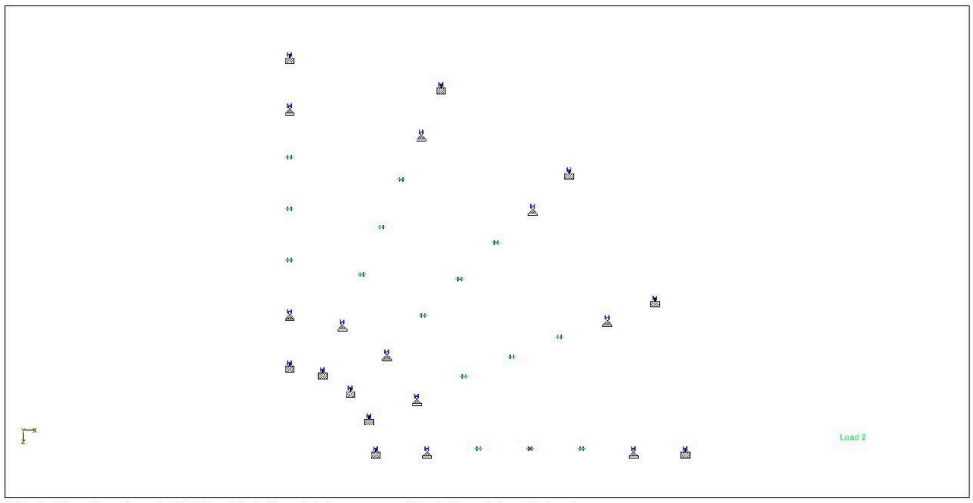
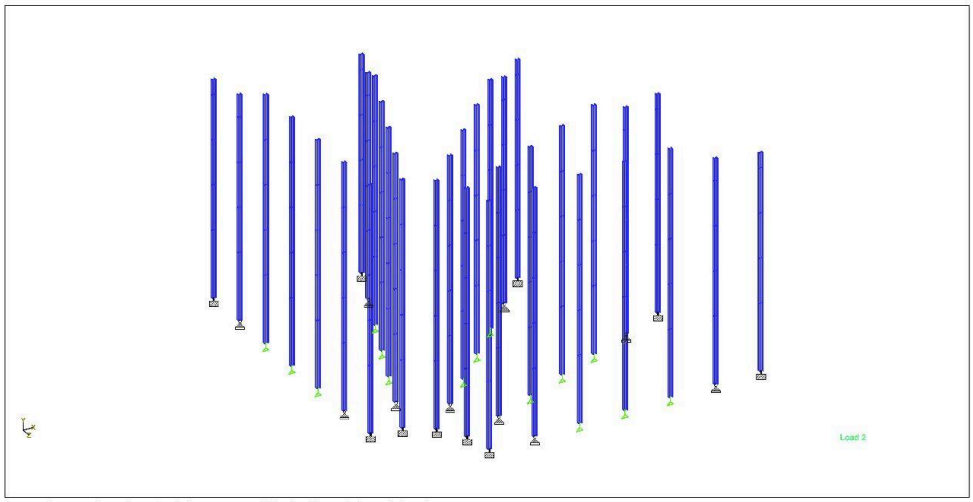
Whole Structure Loads 1.15942kN:1m 3 WL (Input data was modified after picture taken)

Whole Structure Loads 2kN:1m 2 LL (Input data was modified after picture taken)

Q6. Show the plan view of your 3D model by showing the orientation of the columns ONLY (solid view):



Whole Structure Loads 2kN:1m 2 LL (Input data was modified after picture taken)



iso column view (Input data was modified after picture taken)

Q7. Show the deformed shape of your 3D model here (isometric view):

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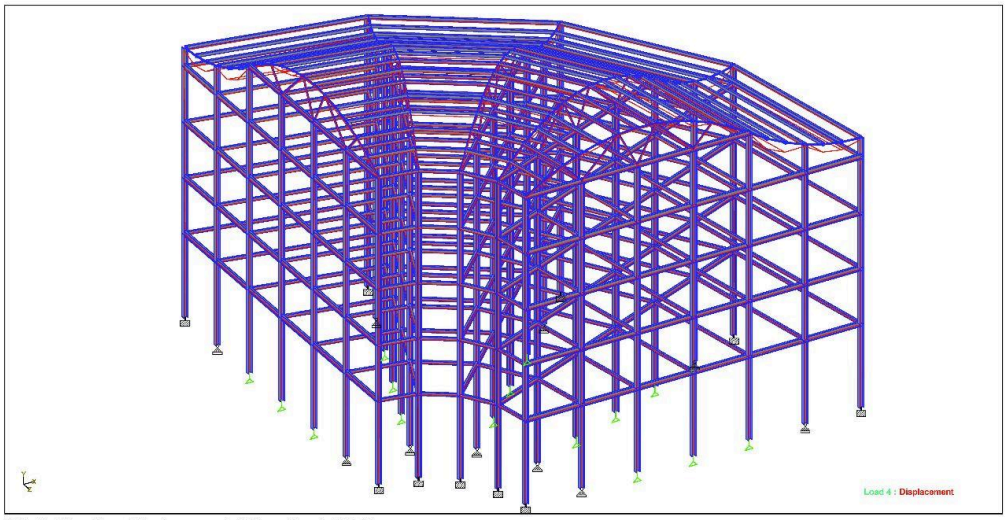
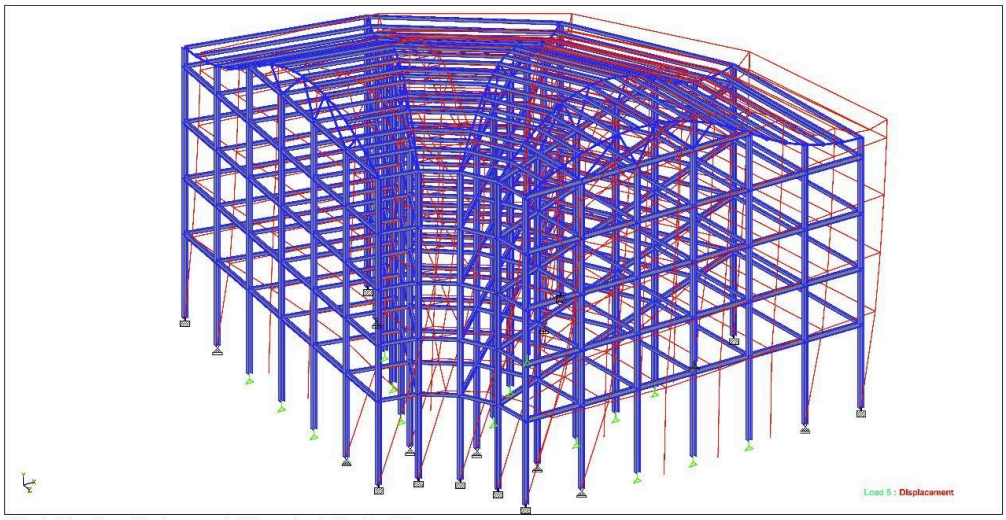


Whole Structure Displacements 30mm:1m 4 DL+LL



Whole Structure Displacements 30mm:1m 5 DL+LL+WL