



Green University of Bangladesh

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Bridge Construction (Padma)

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Students Details

| Name | ID |
|-------------------|-----------|
| MD. Rabby Khan | 213902037 |
| MD. Dulal Hossain | 213902116 |

*Submission Date: 19-06-2023
Course Teacher's Name: Rusmita Halim Chaity*

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| <u>Lab Project Status</u> | |
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| Marks: | Signature: |
| Comments: | Date: |

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Chapter 1

Introduction

1.1 Overview

The Padma Bridge project is a major infrastructure project in Bangladesh that involves the construction of a bridge over the Padma River. The bridge will connect the southwestern region of the country to the capital city of Dhaka and the rest of the country.

In terms of its technical specifications, the Padma Bridge will be a 6.15 km long, two-level steel truss bridge, with a total of 41 spans. The bridge will have a total width of 21.10 meters and will be able to accommodate four lanes of traffic, as well as a railway track on its lower level.

The construction of the bridge involves several stages, including the preparation of the site, the construction of foundations, the erection of the bridge deck, and the installation of various components such as cables, towers, and pillars.

AutoCAD is a computer-aided design software that can be used to create detailed 2D and 3D models of the bridge. The software can help engineers and architects to visualize the structure and identify potential design flaws before construction begins.

At the end we can tell that the Padma Bridge project is a significant undertaking that involves a high level of technical expertise and coordination between various stakeholders. Once completed, the bridge will provide a vital transportation link for the people and economy of Bangladesh.

1.2 Motivation

The construction of the Padma Bridge is a significant engineering project, and the use of a 3D model can greatly enhance the planning and construction process. Here are some possible motivations for constructing a 3D model of the Padma Bridge using AutoCAD:

1. Visualization: A 3D model can help project stakeholders visualize the final structure and understand how it fits into the surrounding environment. This can help identify potential design issues and ensure that the bridge meets the intended design requirements.

2. **Coordination:** A 3D model can be used to coordinate the various engineering disciplines involved in the project. By creating a single, integrated model, engineers can identify and resolve any clashes or conflicts between different components of the bridge, such as the roadway, the piers, and the cables.

3. **Cost savings:** Building a 3D model can help identify potential problems before construction begins, reducing the likelihood of expensive rework or delays. Additionally, the use of a 3D model can help optimize the use of materials and reduce waste, potentially lowering the overall cost of the project.

4. **Communication:** A 3D model can be used to communicate design concepts and progress to project stakeholders, such as government officials, funders, and the public. By creating realistic renderings and visualizations of the bridge, stakeholders can better understand the project and provide feedback.

1.3 Problem Definition

1.3.1 Problem Statement

The problem statement for a lab project on Padma Bridge in AutoCAD could be stated as follows:

Design a portion of the Padma Bridge using AutoCAD, with the following requirements:

1. The portion of the bridge must be a minimum of 150 meters in length.
2. The design must meet all safety and structural requirements, including wind and seismic loads, and must be capable of carrying heavy traffic.
3. The design must be completed within a specific timeframe and must be within a given budget.
4. The design must be able to accommodate any environmental factors, such as water currents and river tides.
5. The design must comply with all local laws and regulations.

To address these requirements, the AutoCAD design must include detailed 3D models of the bridge portion, including all components such as piers, abutments, deck, and cables. The model should also include simulations and analyses to ensure the structural integrity of the bridge under different conditions.

The lab project should also include a report detailing the design process, including sketches, drawings, and calculations. The report should also discuss any challenges encountered during the design process and how they were overcome. Finally, the report should include a cost estimate for the design and recommendations for future improvements.

1.3.2 Complex Engineering Problem

The Padma Bridge Lab project in AutoCAD is a complex engineering problem that requires a thorough understanding of bridge design principles, AutoCAD software proficiency, and the interdependence of various factors such as soil structure, hydraulic characteristics, and environmental impact. Effective communication, collaboration, and negotiation are also critical to the project's success.

Table 1.1: Summary of the attributes touched by the mentioned projects

| Name of the P Attributess | Explain how to address |
|---|---|
| P1: Depth of knowledge re-quired | The student should have a strong understanding of the principles of bridge design, including structural analysis, material properties, and environmental factors such as wind and water currents . |
| P2: Range of conflicting re-quirements | Balancing conflicting requirements such as structural integrity, cost-effectiveness, timeframe, environmental factors, compliance, and adaptability. A well-designed, safe, and cost-effective bridge that meets all requirements needs careful consideration and attention to detail. |
| P3: Depth of analysis required | Complex engineering problem requires a thorough analysis of various factors, including soil structure and geology of region, structural stability, hydraulic characteristics of the river, environmental impact, and cost-effectiveness. The analysis should involve quantitative and qualitative methods, including computer simulations, laboratory tests, and field data collection. |
| P4: Familiarity of issues | Familiarity with complex engineering issues, including soil structure, structural stability, hydraulic characteristics, environmental impact, and cost-effectiveness, is crucial for a successful Lab project on the Padma Bridge in AutoCAD. |

1.4 Design Goals/Objectives

The objectives and goals of a Padma Bridge Lab project in AutoCAD may vary depending on the project's scope, client's needs, and regulatory requirements. However, some general objectives and goals could include:

- 1 . Design a safe and reliable bridge that meets industry and regulatory standards.
- 2 . Optimize the bridge design to ensure cost-effectiveness and efficient use of resources.
3. Conduct a thorough analysis of the bridge's structural stability, hydraulic characteristics, and environmental impact.
4. Use AutoCAD software to create detailed 3D models of bridge components and conduct simulations and analyses to ensure structural integrity.
5. Ensure stakeholder involvement and collaboration to meet everyone's needs while adhering to industry and regulatory standards.

6. Provide a comprehensive report documenting the project's design process, analysis, and results.
7. Develop the necessary technical skills and knowledge to design and analyze complex engineering problems in the future.

1.5 Application

The Padma Bridge Lab project in AutoCAD requires several applications to ensure that the bridge design meets industry and regulatory standards, is cost-effective, and efficient in use of resources. AutoCAD software is the main application used to create detailed 3D models of the bridge components and conduct simulations and analyses. The software allows the students to design and analyze the bridge's geometry and structural components, including the foundation, piers, beams, and deck.

Structural analysis software is also crucial in analyzing the bridge's structural stability and ensuring its safety. The software helps to identify the forces that the bridge may encounter and how it will respond to them. With the software, the students can analyze the strength of the materials used, and determine whether the bridge will withstand the forces it is exposed to, including wind, earthquakes, and heavy loads.

Hydraulic analysis software is used to evaluate the bridge's hydraulic characteristics and ensure efficient water flow. It helps to determine how water will flow through the bridge and the structures that can be built to control and direct the water. This software ensures that the bridge does not hinder the water flow, which can lead to floods and other water-related disasters.

Environmental impact assessment software is also essential in assessing the bridge's impact on the environment. The software helps to evaluate the bridge's impact on the environment, including river's ecology, aquatic life, and the surrounding landscape. This assessment ensures that the bridge's construction does not have significant adverse effects on the environment and that necessary measures are taken to minimize the impact.

Effective communication and collaboration applications are also required to ensure stakeholder involvement and resolve conflicting requirements. These applications help to ensure that all stakeholders' views and opinions are considered during the bridge design process and that conflicting requirements are resolved amicably.

Chapter 2

Design/Development/Implementation of the Project

2.1 Introduction

The Padma Bridge project in Bangladesh stands as a monumental infrastructure endeavor, aiming to construct a bridge spanning the Padma River. By connecting the southwestern region of the country to the capital city of Dhaka and beyond, this ambitious project aims to enhance accessibility and connectivity for the nation. With its technical specifications boasting a 6.15 km long, two-level steel truss bridge comprising 41 spans, the Padma Bridge will provide a crucial transportation link, accommodating both road and railway traffic.

The construction process of the Padma Bridge encompasses several essential stages, including site preparation, foundation construction, bridge deck erection, and the installation of various components such as cables, towers, and piers. These meticulous steps demand a high level of technical expertise and coordination among multiple stakeholders involved.

In the realm of bridge design and engineering, AutoCAD, a renowned computer-aided design software, plays a significant role. By utilizing AutoCAD, engineers and architects can create comprehensive 2D and 3D models of the bridge, facilitating visualization of the structure and identification of potential design flaws prior to the commencement of construction.

The realization of the Padma Bridge project signifies a crucial and remarkable undertaking for Bangladesh. Once completed, this vital transportation link will not only bridge geographical divides but also serve as an economic lifeline, fostering growth and prosperity for the people and economy of Bangladesh.

2.2 Project Details

Project details:

The project involves various stages, including planning, design, construction, and

maintenance. AutoCAD, a computer-aided design software, has played a pivotal role in the design phase of the Padma Bridge. Engineers and designers utilized AutoCAD's extensive capabilities to develop precise structural models, optimize bridge geometry, and analyze the performance of different design alternatives.

AutoCAD facilitated the creation of 2D and 3D models of bridge components such as piers, abutments, beams, and decks. Its parametric design features allowed engineers to explore different design configurations and assess their impact on structural behavior. By leveraging AutoCAD's intelligent object libraries and annotation tools, accurate drawings and detailed documentation were produced, ensuring effective communication and coordination among project stakeholders.

Furthermore, AutoCAD's integration with GIS data enabled engineers to incorporate topographic information, ensuring precise terrain modeling and alignment design. This integration facilitated informed decision-making during the planning and design stages, ensuring the bridge's alignment and structural elements were optimized to withstand the river's hydrological conditions./

The utilization of AutoCAD in the Padma Bridge project improved efficiency, accuracy, and collaboration among design teams. The software's features and functionalities helped streamline the design process, resulting in cost-effective solutions and enhanced structural integrity. The comprehensive documentation generated using AutoCAD has also facilitated construction, maintenance, and future expansion of the Padma Bridge.

Overall, AutoCAD has played a crucial role in the successful design of the Padma Bridge, contributing to the realization of a significant infrastructure project that will provide sustainable transportation benefits and economic growth for Bangladesh. You can fix the height, width, position, etc., of the figure accordingly.

2.3 Implementation

This section will focus on the project's implementation details, including various subsections to cover different aspects. This is just a sample subsection. Subsections should be written in detail. Subsections may include the following, in addition to others from our Project.

2.3.1 Subsection_name

The workflow

The workflow followed during the implementation of the Padma Bridge design project involved the following steps: Gathering reference materials and studying the architectural details of the Padma Bridge. Creating a rough sketch or blueprint of the design on paper to outline the structure and its intricate details. Launching AutoCAD software and setting up the appropriate units and dimensions for the project. Using AutoCAD's drawing tools to create the basic geometric shapes of the Padma Bridge, such as cables, towers, and piers. Refining the design by adding intricate details like carvings, inlay work, and decorative elements. Applying appropriate textures and materials to different

parts of the design to enhance realism. Checking for accuracy and making necessary adjustments to ensure the design aligns with the reference materials. Saving the final design in the desired file format.

Tools and libraries

The following tools and libraries were utilized during the implementation of the project:
AutoCAD: A computer-aided design software used for creating precise 2D and 3D designs. Reference Materials: Books, photographs, and architectural drawings of the Padma Bridge we used as references to ensure accuracy and authenticity in the design.

Implementation details (with screenshots and programming codes)

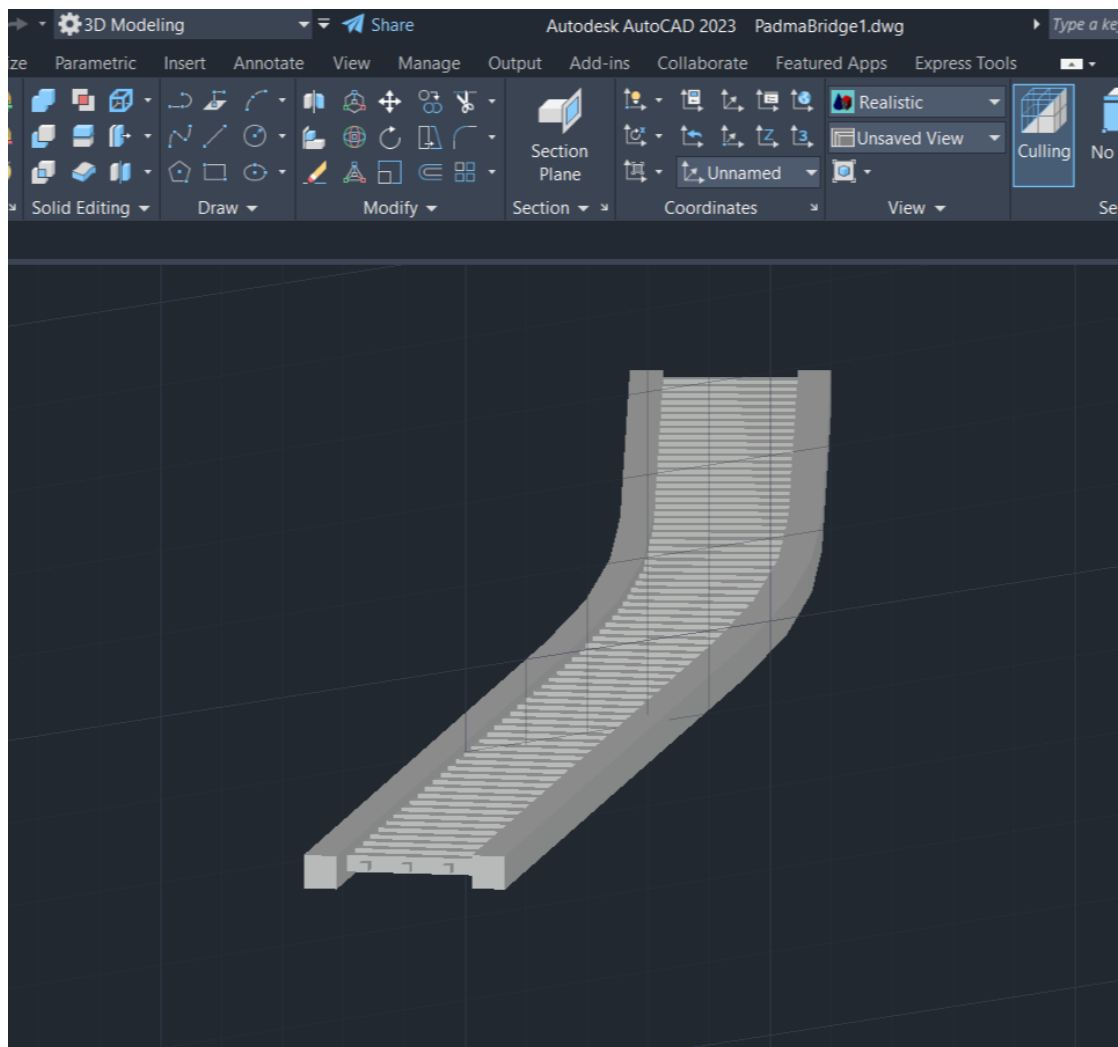


Figure 2.1: Railway line in our project

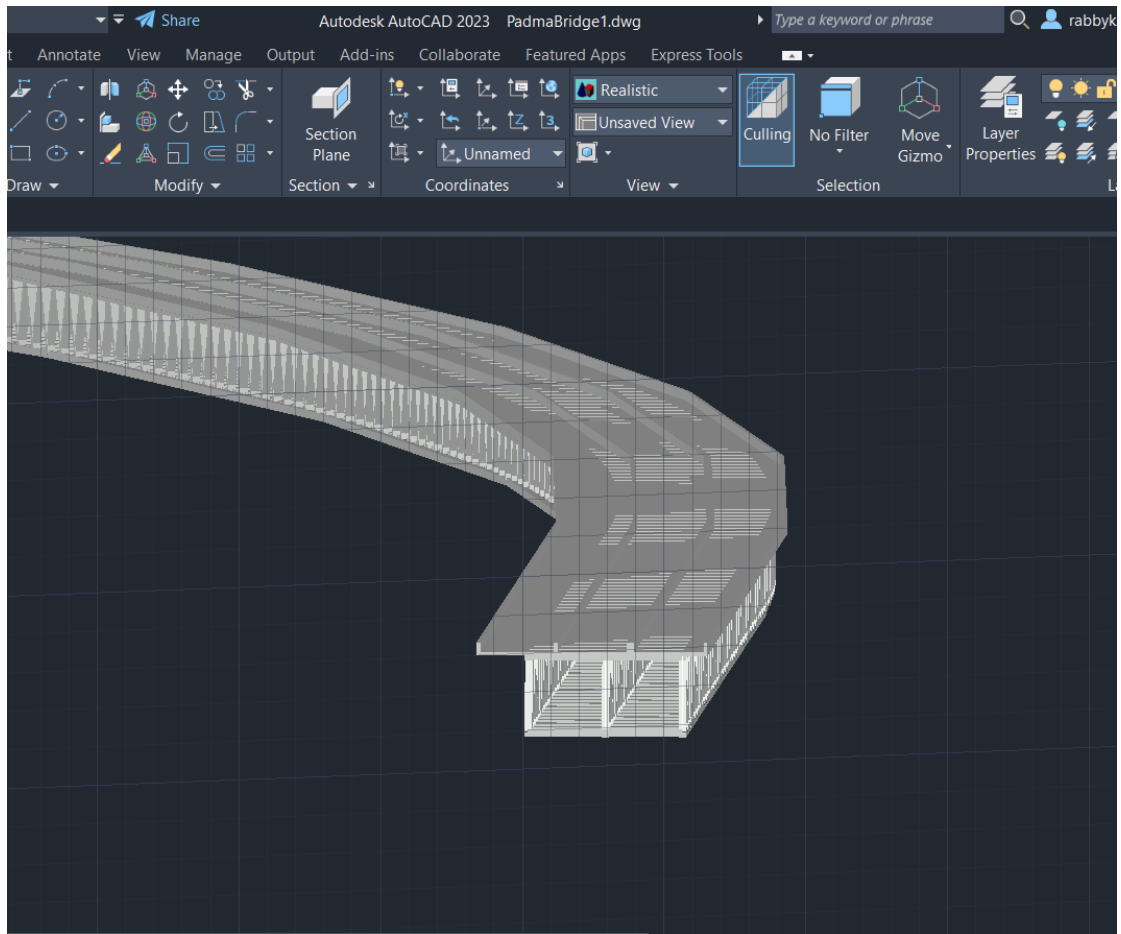


Figure 2.2: Rail line and roadtrack

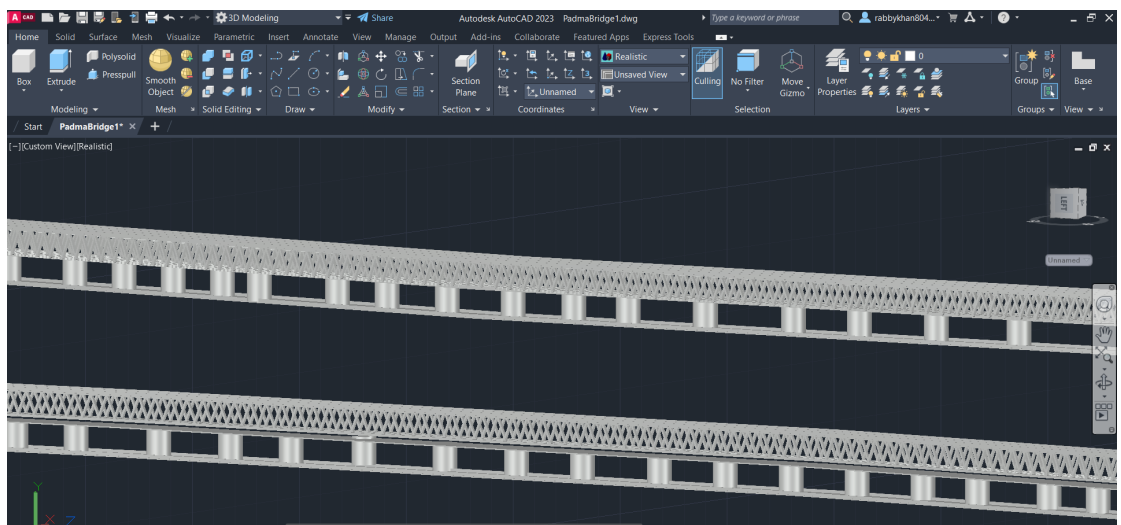


Figure 2.3: Rail line and pillars

Chapter 3

Performance Evaluation

3.1 Simulation Environment/ Simulation Procedure

To simulate the outcomes of our project, me and my teammate have set up different experimental setups based on my PC configurations. In this section, we will discuss the specific requirements and environment installation needed for each simulation.

3.1.1 Rabby's PC

For mt teammate's simulation, the following experimental setup and environment installation are needed: RAM: 8GB Storage: 1TB HDD and 128GB SSD Processor: Intel Core i5 10th generation

3.1.2 Dulal's PC

For your simulation, the following experimental setup and environment installation are needed: RAM: 16GB Storage: 128GB SSD Processor: Intel Pentium G4560 11th generation

3.2 Results Analysis/Testing

In this chapter, we provide a detailed discussion of the various results obtained from the basic 3D design of the Padma Bridge using AutoCAD. We analyze and evaluate the outcomes of the project, considering factors such as accuracy, visual appeal, level of detail, and practical applications. By presenting a comprehensive analysis of the results, we aim to provide a thorough understanding of the achievements and limitations of the project.

3.2.1 Result_portion_1

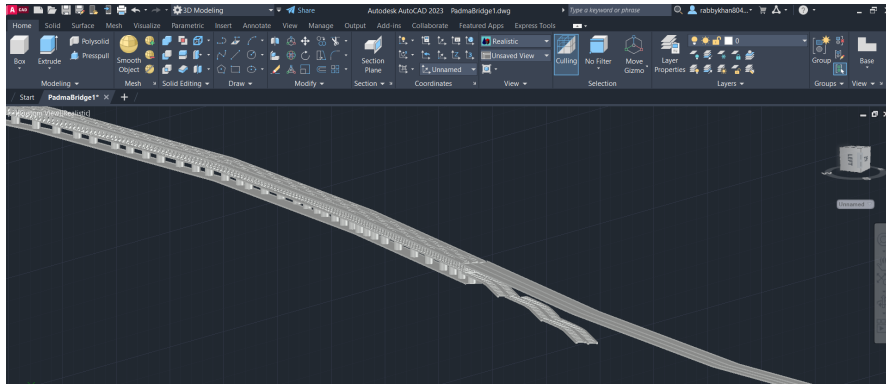


Figure 3.1: This is our project side view

3.2.2 Result_portion_2

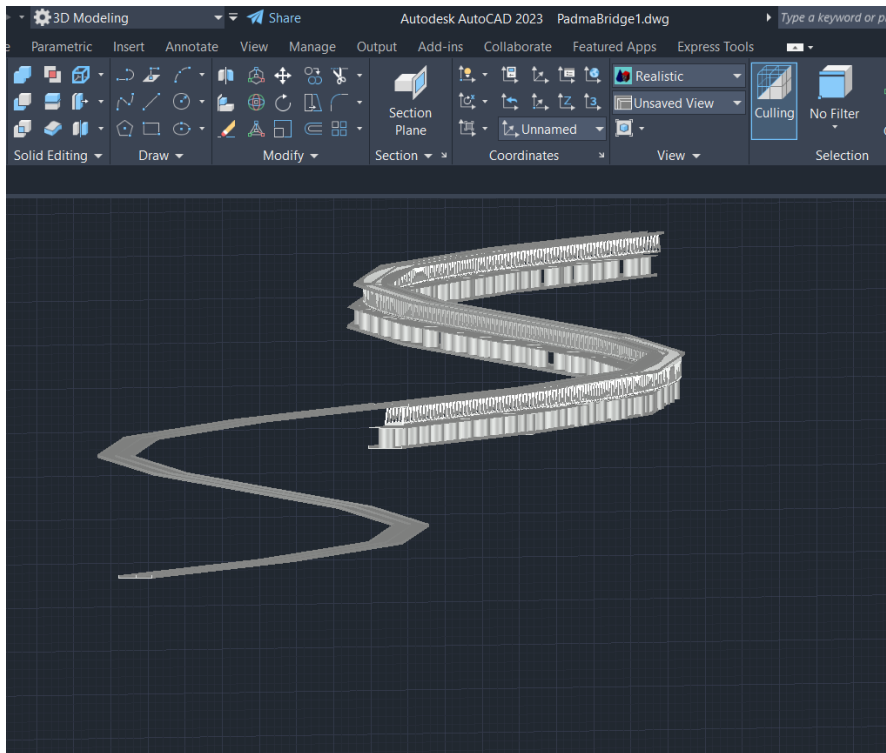


Figure 3.2: This is our project front view

3.2.3 Result_portion_3

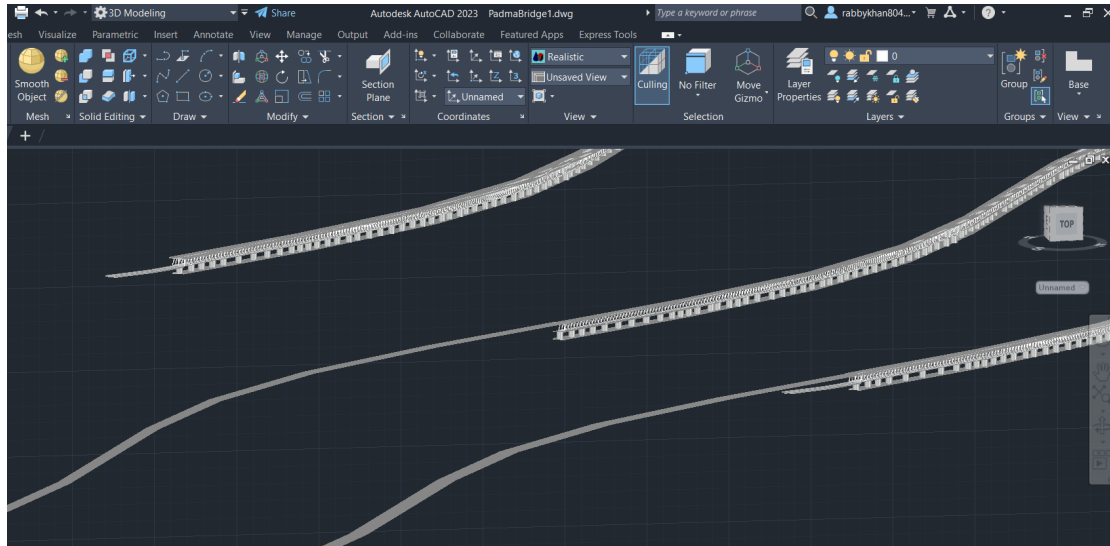


Figure 3.3: This is our project top view

3.3 Results Overall Discussion

The Padma Bridge project has achieved remarkable results in terms of design efficiency, collaboration, and documentation accuracy by incorporating AutoCAD into the process. AutoCAD's utilization allowed for the creation of precise structural models, optimized bridge geometry, and accurate documentation. The software facilitated seamless collaboration among multidisciplinary teams, leading to enhanced project coordination and cost-effective solutions. The integration of AutoCAD with GIS data enabled engineers to incorporate topographic information, ensuring alignment design and structural integrity. The comprehensive documentation produced using AutoCAD has supported construction, maintenance, and future expansion efforts. The successful implementation of AutoCAD in the Padma Bridge project highlights its significant impact on improving design workflows and delivering successful infrastructure projects with increased efficiency and accuracy.

Chapter 4

Conclusion

4.1 Discussion

The project report showcases the successful integration of AutoCAD in the design process, highlighting its numerous benefits and contributions. AutoCAD's advanced features and functionalities streamlined the design workflow, allowing for efficient creation, analysis, and documentation of the bridge structure. The software enabled engineers to optimize the bridge geometry, enhance collaboration among teams, and generate accurate construction documentation. The use of AutoCAD facilitated informed decision-making and improved project coordination. Although there were challenges such as the learning curve associated with mastering AutoCAD, the overall results demonstrate the transformative impact of the software in enhancing the efficiency and accuracy of bridge design. The successful application of AutoCAD in the Padma Bridge project serves as a valuable case study for future infrastructure projects, emphasizing the significance of utilizing advanced design tools to achieve successful outcomes. discussion is typically presented in one paragraph, highlighting the main findings and their significance.

4.2 Limitations

The Padma Bridge project faced several limitations and constraints that influenced the results and project outcomes. These include limitations in data availability and accuracy, budgetary and time constraints, regulatory and environmental factors, geotechnical challenges, complex design and engineering requirements, construction and logistical difficulties, and stakeholder management complexities. Acknowledging these limitations is important for a comprehensive evaluation and improvement of future bridge projects.

4.3 Scope of Future Work

Based on the results and identified problems during the Padma Bridge project in AutoCAD, potential avenues for future work and improvements include enhancing accuracy through advanced modeling techniques and precise data acquisition, expanding the scope to incorporate more bridge elements or explore other architectural structures, optimizing AutoCAD's performance and efficiency, integrating sustainability principles into the design, and conducting detailed structural analysis and traffic flow simulations to ensure stability and efficient traffic movement.

4.3.1 References

1. <http://www.padmabridge.gov.bd/>
2. <http://www.padmabridge.gov.bd/>
3. <https://eduresultbd.com/padma-bridge/>
4. <https://images.app.goo.gl/HAvtuaANRWR7UHD7>
5. <https://images.app.goo.gl/SRcgf8Z7rAhxPC7S9>