Jacaranda Flame
Consulting

HANLON
INDUSTRIES

PROJECT CHARTER

Tekla Structures - 3D Optimisation Project (Phase IV)

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1. Purpose

The project charter exists to define the overall framework for the project. Within this document, success is measured by how intertwined and attainable project elements such as scope and objectives are. More so, it gives a sense of purpose and is to be closely referenced throughout the entirety of the project. This document conveys the scope which details what the project entails for stakeholder understanding. This scope involves integrating all current features into the design of curved billboards. This is necessary to further streamline Hanlon Industries' drafting processes and has proved to be greatly beneficial in regard to their productivity. Additionally, more minor features are expected to be implemented for their existing application to further accommodate a variety of designs.

Hanlon Industries, an independent and family-owned company founded in the 2000s, has established themselves to be a highly renowned business specialising in manufacturing static and digital billboards and provides construction solutions in end-to-end and out-of-home solutions.
With a vision to be a premier steel business and construction solutions partner, the company has set out to explore ways of improving and polishing their production process through incorporating technology such as leveraging the BIM software for drafting constructions.

1.1. Problem Statement

The BIM software, Tekla Structures, has been in use by Hanlon Industries as a design modelling operator for the steel structure of customised billboards. The current version is widely used for designing plan billboards. However, more features should be added and implemented to achieve higher accuracy and efficiency. Also, the ability to model curved members should be developed for the trend of curved billboards.

1.2. Business Need

The automatisation of the design process using the BIM software, Tekla Structure, has significantly reduced the time and cost of designing the steel structure of a billboard. Hanlon Industries is expecting to maximise these benefits by further improving this software. The main expected impacts of the development include the following:

- Reduces the overall time required for creating and drafting billboards through the continued development of the streamlined drafting process.
- Enhance the accuracy in billboard design and construction, minimising the likelihood of errors and rework.
- Improve the overall operational efficiency by eliminating manual tasks and optimising resource allocation.
- Reduce the project costs by minimising rework, enhancing productivity, and expediting project completion.

2. Executive Summary

With Hanlon Industries striving to maintain their status as the leading billboard manufacturer in Australia, it is necessary to further streamline their operations. With the recent implementation of an efficient Tekla Structures Open API, the company can typically save a minimum of two days of drafting work in regard to designs for clients. Further potential has been identified with the conceptualisation of applying the existing streamlined drafting process and applying it to curved billboard designs which target a more focused demographic in line with concurrent trends further improving the diversity of their services.

To achieve this deliverable, it is necessary to integrate the current features alongside mathematical modelling to accommodate the migration of curved billboards. Understanding previous iterations of the OpenAPI is critical in order to effectively build upon it and thus consultants must strive to develop sufficient C# and Tekla Structures technical skills. Since the curved billboard design is different from the pre existing design, several assumptions have been made. These assumptions are logical in order to simplify the design process.

There are also several risks applicable to the project during its lifecycle. These primarily consist of time constraints, technology limitations and lack of necessary technical skills. There are no additional costs as a result of the project.

3. Project Overview and Approach

3.1. Overview

The project is the 4th phase to continue the evolution of the program of 3D billboard models in Tekla Structures for Hanlon Industries. In the previous phases, a model was created to allow users to easily customise their billboard structures. By utilising an Open API plug-in application for Tekla Structures and developing a C# program coding that seamlessly integrates with the modelling software, a 3D model of the customised billboard structure can be autonomously generated in Tekla Structure. The model generation program significantly reduced the original time required to design the steel structure for billboards. Further improvements are expected in Phase IV of the project to simplify and enhance the process of creating and drafting billboards for Hanlon Industries.

3.2. Approach

The nature of this project means that it is subject to constant change. We need an approach that allows us to adapt to changes and make changes with no compromises to budget, time and functionality, thus we have decided to follow a spiral model as shown in the figure below.

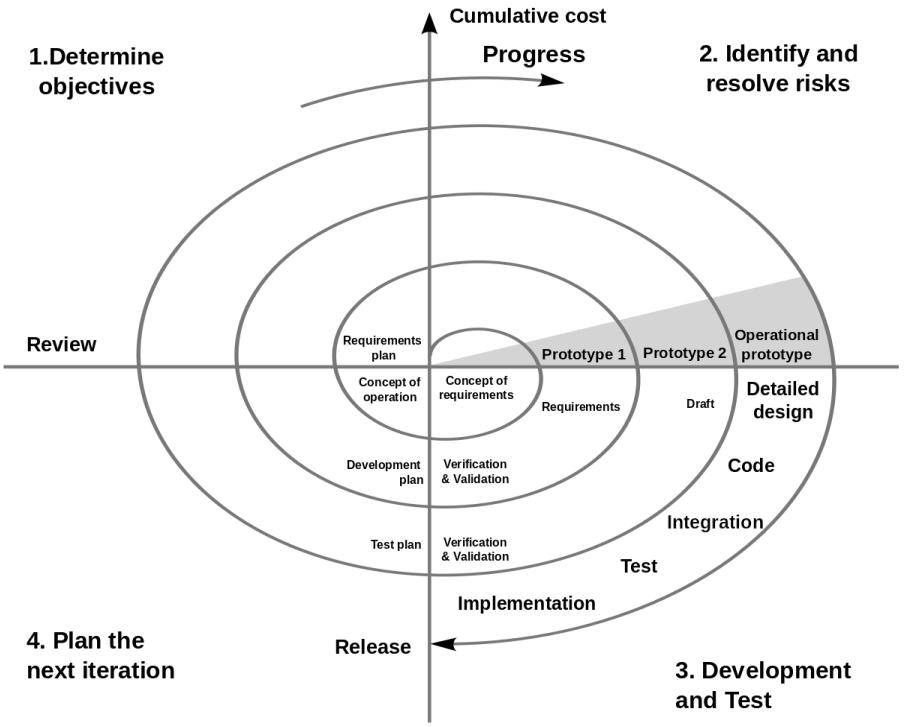

Figure 1: Spiral Model For Project Management

1. **Determine Objectives:** In the first stage of the spiral model, we aim to collectively familiarise ourselves with the Tekla Structures software and the source code from phase III regardless of each member's coding experience and coding background. This will likely be a gradual learning process that cannot be done in one continuous period, thus for each loop in the spiral model we will continue to learn and understand concepts that may appear as a requirement for the development of the plugin software.

2. **Identify and resolve risks:** In this stage of the spiral model, we aim to identify risks that could affect the progress and success of this project. For each identified risk, a plan on how to eliminate or mitigate that risk will be established as a collective so each team member knows what to do when in situations relative to a certain risk.

3. **Development and test**: In this stage of the spiral model, we aim to develop a prototype relative to the objectives we have determined in the same loop iteration. The prototype will be implemented and tested to confirm whether we have met the requirements or if further development is required (possibly in a later loop).

4. **Plan the next iteration:** In this phase of the spiral model, we aim to plan the next iteration with all the information that we have accumulated at this point. The results from testing a prototype will be also assessed and used to plan our next iteration and possibly the iterations that follow.

4. Scope

4.1. Goals and Objectives

GOALS	OBJECTIVES
- **Additional Functionality:** Further develop the Tekla billboard aid plugin software to possess the capability of modelling curved billboards, with as many existing functionalities working as possible (refer to criteria 4.6). - **Increase Accuracy:** Further increase accuracy and consistency of the program in the context of generating a dimensionally accurate billboard by performing bug fixes (refer to criteria 4.6). - **Intuitive User Experience:** Change the user interface to be more intuitive for both new and experienced users (refer to criteria 4.6).	- **Curved Billboards:** Develop the capability for the plugin program to model curved billboards. - **Debugging:** Fix existing bugs from previous phases. - **User Interface:** Improve the user experience through changing the user interface.

Table 1: Goals and Objectives Table

4.2. In Scope

• **Integrate all current features (refer to criteria 4.6.) for curved billboards** - curved billboards are now a trend in the billboard manufacturing industry. A complete integration of all existing features is required which may require mathematical modelling to ensure all functions can be easily migrated to accommodate curved billboards. This would probably be achieved by developing a separate application since modifying the current application may cause a lot of existing functions to break.

4.3. In-Between Scope

• **2D braced fascia frame** - although completed in Phase III, this requires optimisation for accuracy when placing bolts

• **Galvanising holes for enclosed steel members**

• **Explore and implement further User-interface improvements** - The software's user interface still has room for improvement. A real-time change reflection on the UI page is required for future versions to enhance the billboard design and modelling process.

• **Back bracings** - was started in Phase III but not fully completed due to the diverse styles of bracing and measurement. Will need to fix on endpoints placement and cutting planes insertion.

4.4. Out of Scope

• **Refactor the entire code base for optimisation and modularity for future development** - A well-structured codebase is the backbone of any robust software. As the program's features grow, there's an imminent need to optimise and modularise the code to ensure easy maintenance, quick troubleshooting, and efficient future developments.

4.5. Project Deliverables

Materials and products that will be available for the client at the completion stage of the project include:

- Updated and executable Tekla Billboard Aid plugin
- Updated program source code
- Updated Tekla Billboard Aid user documentation
- Updated Tekla Billboard Aid technical documentation
- Final report
- Final presentation

4.6. Success Criteria

Below is the proposed success criteria for this project, with a main success criteria and secondary criteria that is made up of items in-between and out of scope.

Main criteria:

- **The current software features successfully implemented for curved billboards without compromising their performance and functionality for linear billboards, as well as without increasing the drawing time required for:**
    - Horizontal and vertical Beams
    - Side bracing
    - Back bracing
    - 2D braced fascia frame
    - Installation of ladders
    - Installation of hatches
    - Camera arm
    - Billboard box rear door

Secondary criteria:

- **Rework time reduced by successfully performing a number of bug fixes:** Bug fixes must be performed without compromising the functionality of other sections/features of the program (i.e. without creating new bugs). Bugs fixes are listed below:
    - Improving accuracy when placing bolts for a 2D braced fascia frame
    - Correcting endpoints placement and cutting planes insertion for back bracings
    - Correcting placement of galvanising holes for enclosed steel members
    - Changing default option for Galvanising Holes to “none”
    - Correcting top and bottom cuts on diagonal bracing to include 1mm clearance for welding
    - Correcting ladder dimensions to be to the back of ladder rung (as described in “Box Program Bugs (1).pdf”
    - Correcting walkway mesh input not being filled
    - Correcting unknown bug where Tekla restarts but box program stays open when build is pressed
    - Correcting walkway mesh EA support clearance dimension inaccuracy
    - Correcting parts in model not correctly named

- **Improving the UI in a meaningful way:** Enhancing the usability of the app interface in terms of ease of access and being easy to understand for both new and experienced users. UI improvements:
    - Intuitive colour coding
    - Intuitive dropdown menus
    - Intuitive functional grouping
    - Removing loops for error messages

4.7. Benefits

In this project, the improvements to be made on the Tekla billboard aid plugin will allow for Hanlon Industries to draft 3D models of curved billboards, and flat billboards with increased accuracy and consistency. This can significantly reduce the initial design and drafting time required for both flat and curved billboards and subsequently improve business by enabling Hanlon Industries to provide their products and services in a more consistent and efficient manner.

The program will generate dimensionally accurate curved models on top of also being able to generate dimensionally accurate linear models. This eliminates human error and saves time in initial drafting for curved billboard designs. The program will also allow the user to generate curved and linear models in the same Tekla project, which the user can connect together to form more complex shapes for contexts such as a corner curve billboard.

4.8. Project Constraints

Constraints that may prevent or impact the success of the project:

- **Time (External):** 9 weeks may not be sufficient in order to develop and implement all current flat billboard features for a curved billboard. This is due to the software (Tekla Structures) and C# being new tools for our team, as well as the complex nature of a curved billboard compared to the linear flat billboard.

- **Coding background (External):** Only 2 out of 5 members of our team have experience coding in the past, thus, they will likely be the only members who will have a deep understanding of the code and coding design. As this project is entirely coding based, this may heavily affect our productivity.

- **Hardware for running Tekla structures software (External):** Some members of our team do not have a Windows laptop, meaning they need to spend time finding an alternative way to access and use Tekla Structures.

- **Manpower (External):** The entire team consists of only 5 members, the small team size restricts the amount of work that can be completed concurrently, making efficient task allocation and clear communication critical for project success.

- **NDA (Internal):** If any member of the team does not sign and adhere to the NDA, manpower may be further reduced and legal consequences may be incurred depending on context.

4.9. Assumptions

These assumptions aim to assist in defining the project scope:

- **Only horizontal members are curved:** Curved billboards will only curve about the vertical axis, thus all vertical members like columns will remain linear.

- **Ladders and hatches should remain straight:** Related to the assumption above, ladders and hatches should not curve, and should be integrated in such a way that allows for it to be linear. Regarding ladder safety standards, we assume Hanlon Industries own a copy of “AS 1657-2018 Fixed Platforms, Walkways, Stairways and Ladders - Design, Construction and installation” safety standards.

- **Side bracings should remain straight:** Since the cross section of the billboard is flat in the vertical plane and the vertical beams are relatively thin, they do not need to be curved.

- **The user is knowledgeable:** Tekla Structures is aimed for professionals in the industry, thus we assume the end user has a sufficient understanding of Tekla Structures as well as billboard design, including the specific parameters, beam/columns types, materials and bolts. Again, regarding ladder safety standards. While familiar with AS1657:2018, we assume the compliance with the standard is to be left for the design engineer.

- **The total height and length of the billboard is equal to the sum of the values added for rows and columns:** Each row added extends the billboard's height, and each row added will extend the billboard's width.

- **The Billboard only curves outwards (Convex):** A curved billboard should only be curved in such a way where the viewing side of the mounted LED screen is convex.

5. Time

5.1. High Level Schedule

Figure 2 is a Gantt Chart illustrating the tasks that are to be undertaken. A Gantt Chart is necessary as it conveys the project's schedule and related tasks in order to track progress, manage resources, and identify any dependencies as well as the risks associated with them. Ten major tasks were identified and the projected start and end dates of these tasks are in detail below.

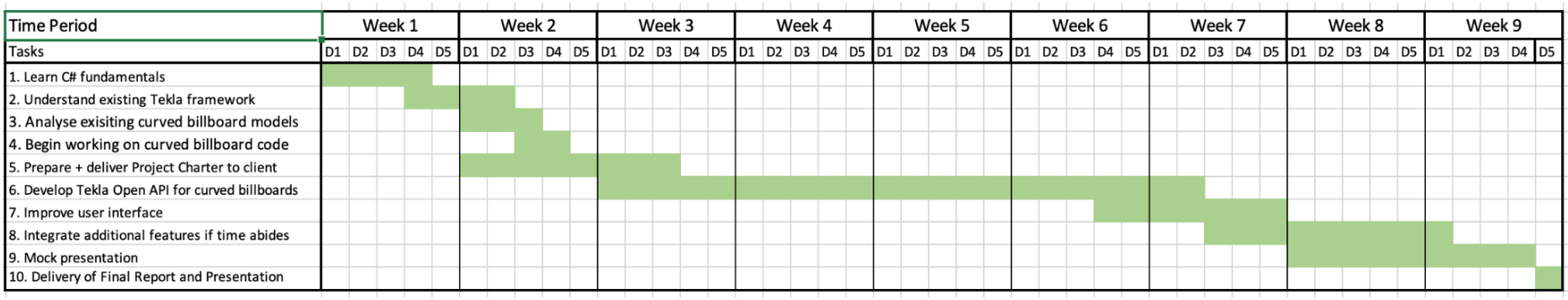

Figure 2: Gantt Chart

5.2. Project Milestones

SUMMARY MILESTONES	DEPENDENCIES	DUE DATE
Learn the necessary fundamentals of C# for project understanding (LinkedIn Learning C# Course)	Programming background	30/11/23
Understand and gain familiarity with existing Tekla framework source code from previous iterations	Complexity of source code	5/12/23
Analyse existing curved billboard models	Delivery of files from client	6/12/23
Begin working on implementing curved billboard code	Understanding of structure layout	7/12/23
Deliver Project Charter to the client and get formal approval (signed project charter)	Completion of Project Charter	13/12/23
Develop and implement fully functioning features necessary for curved billboards within the Tekla Open API as per criteria in 4.6.	Success of Open API code integration	23/1/24
Improve user interface in a beginner-friendly context as per criteria in 4.6.	User considerations + time constraints	26/1/24
Integrate additional features if time abides as per criteria in 4.6.	Time constraints	5/2/24
Mock Presentation	Completion of the project outcome	8/2/24
Delivery of Final Report, Presentation and other listed deliverables in 4.5.	Completion of the entire project	9/2/24

Table 2: Milestones table

6. Cost

It is deemed that the client, Hanlon Industries, does not take on any additional product costs as educational licences are provided for JFC consultants and it is assumed that Tekla Structures is already accessible by the client. In addition, the project is being integrated into the organisation's operations and does not induce any costs for operational and maintenance means (Tekla Open API). JFC consultants have been engaged to streamline the drafting process and are not involved in the material fabrication or construction stages, thus incurring no financial cost for this stage of work.

Activities/Deliverables	Due Date	Cost
N/A	N/A	N/A
TOTAL		$0

Table 3: Costs table

7. Project Governance

The figure below shows the project governance structure for this project, which consists of several key stakeholders. Dean Talbot and Dustin Popp being both clients and Project support, provide guidance and direction. Our Supervisor Anthony Dumbrell provides support, strategic advice and oversees the project. The Client Liaison will ensure effective communication between the client, the team and the supervisor, providing frequent progress updates. The Developer Lead will lead the code design and implementation for the API, and delegate coding related tasks to other team members. Quality Control members will ensure adherence to quality standards and contribute to process compliance, risk management and fostering communications as well as training to sustain project quality.

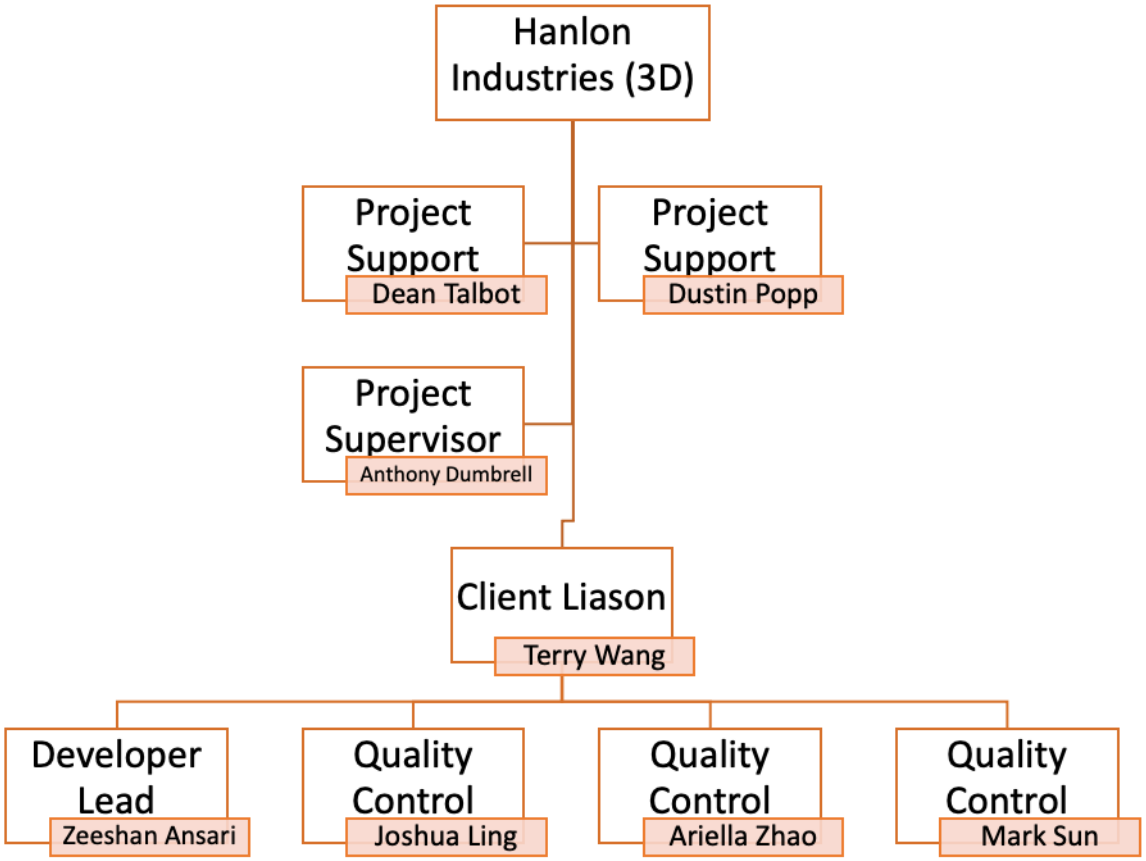

Figure 3: Project Governance Structure

8. Stakeholder Management

The project involves several key stakeholders who will be impacted by or have influence over the project outcomes. Identifying and understanding these stakeholders is important for effective stakeholder management

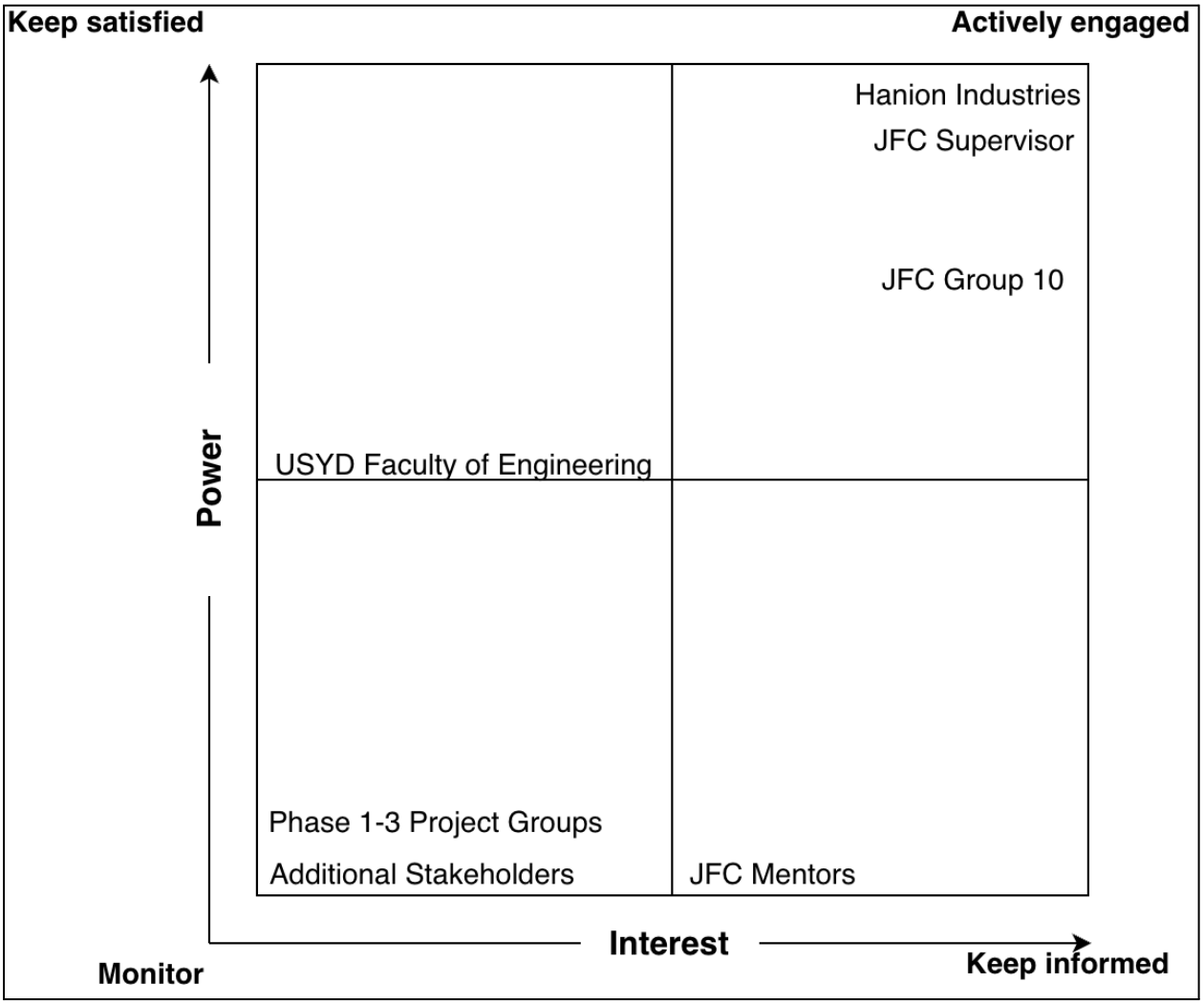

Figure 4: Stakeholder Matrix

Hanlon Industries

As the client, Hanlon Industries plays a very active role in defining project goals and scope. Their needs and requirements are the main drivers of the project. Ensuring high quality deliverables that meet their needs is a top priority.

JFC Supervisor

The JFC Supervisor oversees the overall project progress and provides guidance to the project team. They help navigate any challenges and make decisions that impact timelines and deliverables.

Group 10 Project Team

The project team is responsible for implementing the project plan and delivering the agreed upon outputs. Good communication and collaboration between the team members is essential for success.

Phase 1-3 Project Team

The work done in previous phases provides context and foundations for Phase 4. The previous teams offer important insights into features developed, lessons learned, and ideas for future enhancements

JFC Mentors

JFC mentors lend their expertise and industry experience to advise and support the project team. They provide an additional perspective to draw from when challenges arise.

USYD Faculty of Engineering

As an educational institution, USYD has an interest in the project outcomes for learning purposes. They also provide resources and oversight to ensure project quality.

Additional Stakeholders

Others with interest in the project outcomes include future client employees using the software, steel fabrication suppliers involved in billboard production, and regulatory bodies establishing standards for outdoor structures. While less involved than the above stakeholders, their considerations are also factored in.

9. Communication Strategy

TARGET AUDIENCE	COMMUNICATION NEEDS & DELIVERABLE	INFORMATION (IN BOUND)	INFORMATION (OUT BOUND)
The Client (Hanlon Industries)	Share project-related documentation, progress of the project, required licence or information, project charter, final report and presentation.	Regular meetings. Project progress updates. Project Charter. Final Report. Working model. Codebase. User instruction of the software.	Licence of related software and documents. Information and tutorial of required software.
JFC Supervisor	Supervises the project and guides the team members. Ensure all milestones are achieved in the planned time frame.	Problems encountered during the development of the project. Contents shared with the client.	Suggestions regarding the project development. Necessary supportive resources corresponding to the project scope.
JFC Group Members	Share meeting minutes, project-related documentation, the progress of the project, required licence or information, the project charter, final report and presentation. Update each individual's progress and problems encountered.	Detailed process regarding the project development from the other group members.	Detailed process regarding the project development from individual group members.
JFC Mentors	Team member assistance.	Problem with teamwork	Resolving problems regarding teamwork
USYD Faculty of Engineering	To show that the JFC consultants are behaving properly to achieve the requirements of PEP 2C.	Submitting assessments in the JFC Internship Program	Program initiation and PEP hours.
Phase 1-3 Project Groups	Document sharing and clarification regarding Phase 1-3 of the project.	Questions regarding the previous phases.	Provide related documents and codebases.
Additional Stakeholders	N/A	N/A	N/A

Table 4: Communication strategy table

10. Resources

10.1. Human Resources

HUMAN RESOURCE	PRIORITY
Software Engineer	The project is entirely coding-based. Therefore, the programming skills of software engineers are essential.
Civil Engineer	Steel structure knowledge from civil engineers is required to provide a basis for the logic behind the programming code.
Client Liaison	Regular communication with the client is required to update the progress of the project and avoid any misunderstanding.
Developer Lead	Technical directions and guidance should be provided during the development of the project.
Quality Control Lead	The quality of the overall delivery needs to be accessed and controlled.

Table 5: HR table

10.2. Material Resources

MATERIAL RESOURCE	PRIORITY
Access to Microsoft Visual Studio.	Microsoft Visual Studio is used as the software for C# coding and intertwines with Tekla Structures which outputs the structural model.
Access to Tekla Structure.	Tekla Structures is used as the software to enable the users to input the customised settings and receive the output 3D model.
Microsoft Office.	Used for documentation and teamwork.
Google	Used for document updating, sharing, and storage within the team.
Github	Used for codebase updating and sharing within the team.
LinkedIn Learning C# courses.	None of the group members had experience with C# programming language before so these courses are essential for each member to gain an adequate amount of C# programming skills.
Tekla Structure tutorials.	None of the group members had experience with using Tekla Structures before so these tutorials are essential for each member to adequately operate Tekla Structures.
Phase I, II, and III reports.	Phase IV team members need to be familiar with the development progress of the project.

Codebase from Phase I, II, and III.	Most of the debugging and improvements need to be based on the current codebase.
Related Australian Standards from Techstreet.	Limitation of the structural size needs to be specified in the code and this should be according to the related standards.
ChatGPT	Might be used to polish the report or generate small parts of the codebase. Need to avoid exposing any confidential content.

Table 6: Material Resources table

11. Risks

RISK	RISK RATING	MITIGATION STRATEGIES	PRIORITY
Time: The project time frame is insufficient for achieving all the deliveries in scope	12	Set detailed milestones and deadlines to manage the workload and ensure all deliveries are achievable.	High
Manpower: The project team is not adequately staffed, or the responsibilities are unclear.	10	Allocate clear and specific tasks to each team member and set detailed milestones.	High
Hardware: Significant technical limitations. Eg. software does not operate in the OS, or has insufficient capabilities to download and operate the software.	20	Have a sufficient number of Windows system laptops or PCs. Find alternative software that can operate on Macbooks. Connect to external hard drives.	Extreme
Coding background: Unable to meet the requirements in scope or unable to finish the delivery within the deadline due to the lack of coding skills.	15	Complete LinkedIn Learning courses to ensure each team member has adequate C# programming skills. Go through the Tekla tutorials to become familiar with the use of Tekla Structures.	Extreme
NDA: Exposure of confidential content.	5	Make sure all team members sign the non-disclosure agreement (NDA). Never input detailed information into ChatGPT.	Medium

Table 7: Risks Table

12. Draft Report Structure

A draft structure of the final report is listed below. Note that this outline may vary slightly in the actual report.

- **Introduction**: Provide background information regarding the project in Phase I, II and III. Introduce the content of the project in Phase IV.
- **Project overview**: Assumptions, scopes, stakeholders analysis, and risk assessment will be included in this section.
- **Methodology**: The method of achieving the deliveries in-scope will be introduced in this section, including the summary of the coding process.
- **Challenges**: Determination of the issues encountered during the progression of the project and explanation of the failure if there is any delivery in-scope was not achieved.
- **Project outcome**: Demonstration with texts and figures of what is developed in the project.
- **Future improvements**: Suggest what can be improved in the future phases of the project.
- **Conclusion**: Briefly conclude the entire final report.

13. Authorisation

POSITION	NAME	SIGNATURE	DATE

Table 8: Authorisation table

14. Appendix A

1.1. Risk Likelihood Rating

The likelihood rating was allocated based on the scale seen below in table 1

LIKELIHOOD	CODE	DESCRIPTION
ALMOST CERTAIN	**5**	Expected to be the most likely outcome
LIKELY	**4**	Will probably occur in most circumstances
POSSIBLE	**3**	Might occur at some time
UNLIKELY	**2**	Not expected to occur in normal circumstances, but could occur.
RARE	**1**	Rare that this would occur - no previous occurrence in similar circumstances

Table 1: Risk Likelihood Rating

1.2. Risk Impact Rating

The risk impact rating was allocated based on the scale seen below in table 2.

IMPACT	CODE	DESCRIPTION
INSIGNIFICANT	**1**	A risk event, should it occur, that will have little to no impact on achieving the desired result of the project.
MINOR	**2**	A risk event, should it occur, that will have minor impact on achieving the desired result of the project.
MODERATE	**3**	A risk event, should it occur, that will have a moderate impact on achieving the desired result of the project.
MAJOR	**4**	A risk event, should it occur, that will have a significant impact on achieving the desired result of the project.
EXTREME	**5**	A risk event, should it occur, that will have severe impact on achieving the desired result of the project.

Table 2: Risk Impact Rating

1.3. Risk Rating

The risk rating is calculated using the likelihood and impact ratings (i.e. risk likelihood x risk impact = risk rating) and rated as low, medium, high or extreme based on the range the rating was within as seen in table 3 below.

RATING	RANGE	DESCRIPTION
E	**15-25**	**Extreme** – Immediate action required. Detailed control measures and responsibility specified.
H	**8-12**	**High** – Immediate action required. Detailed control measures and responsibility specified.
M	**4-6**	**Medium** – Control measures and responsibility specified.
L	**1-3**	**Low** – Manage by routine procedures.

Table 3: Risk Rating

1.4. Risk Priority

The risk priority was allocated based on the scale seen below in table 4.

PRIORITY	RANGE	DESCRIPTION
High	**12-25**	**Extreme** – Immediate action required. Detailed control measures and responsibility specified.
Medium	**4-10**	**Medium** – Control measures and responsibility specified.
Low	**1-3**	**Low** – Manage by routine procedures.

Table 4: Risk Priority