2025 S2 ENGG2000-3000 SPINE Engineering Project

Opening Bridge Project Specifications

Tower bridge, London opening for a ferry, Tropical1979, Wikimedia Commons, CC BY-SA 4.0, https://commons.wikimedia.org/wiki/File:Tower_bridge,_London_opening_for_a_ferry.jpg

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1. Document History

Revision	Release Date	Author	Changes
1.0	9 Jul 2025	Alan Kan	Initial Release
1.1	22 Jul 2025	Alan Kan	Updated requirements
1.2	25 Jul 2025	Iain Collings	General edits

2. Introduction

The Team project is to build a sensor-driven and remotely-controllable opening bridge that spans an imaginary river. Each Team will consist of two Groups. One Group will be a STRUCTURES (Civil and Mechanical students) Group, and the other Group will be a SYSTEMS (Software, Mechatronics and Electrical & Electronics students) Group.

The Team will work together to decide on an overall design, and allocate subsystem design tasks between the Groups, and subsequent sub-division of tasks within each Group.

Each Group must **design**, **prototype**, **build** and **iterate** on one or more subsystems of the bridge. Groups must **integrate** their subsystems together with the other Groups in their Team to complete the bridge.

Given the nature of class enrolment, in some cases a STRUCTURES Group may be paired with multiple SYSTEMS Groups, or vice versa. Hence, it is very important that the interface between STRUCTURES and SYSTEMS Groups in a team be clearly defined early in the design process.

Groups are to clearly define and document the requirements, scope of work, interfaces, technical performance measures, designs and prototypes, justification of final design, and test plans and results of testing undertaken to ensure their subsystem(s) meets requirements. Groups must also provide (as appropriate) documentation of calculations, CAD diagrams, schematics, simulations, and URLs to repositories of source code as a part of their deliverables. Groups and Teams will be required to present their work and demonstrate that the final product fully meets the customer's requirements.

In designing the subsystem(s) and final product, Teams should demonstrate that they have considered one or more of the following "design for" attributes:

- Modularity: Given the nature of the project and the number of Groups, modular subsystems with well-defined interfaces will help with project management.
- Reliability and Robustness: It is crucial that the design can withstand extended use and repeated operation.
- Manufacturability and Assembly: It is essential to consider the available equipment, and limited time and budget for producing the final product. Aim for intuitive assembly and avoid overly complicated solutions.
- Maintainability: Clear explanations and logical labelling of wiring, code, and physical components will be essential for physical repairs, quick fixes, and expandability.

- Sustainability: Avoid unnecessary material usage and think about re-usability as you iterate through and come up with your designs.
- Human-Centredness: Consider the user experience of your system and how it can be enhanced.

3. Project Details

The task is to design and build a scaled down (ie. model) version of a pedestrian and vehicular traffic bridge that has the ability to raise the roadway to allow ships to pass underneath.

An opening bridge is required to span across an imaginary river that is 250 mm wide. The main structural elements of the bridge are to be constructed from 3 mm MDF board. The bridge will enable both pedestrian and vehicular traffic (appropriately scaled down) to cross the river. It should have a roadway for vehicular traffic that is 200 mm wide and be able to support at least 3 kg of weight when centred on the roadway. The roadway approaching and departing from the bridge must not have a slope greater than 20°. When closed, the roadway on the bridge is to be at least 50 mm from the surface of the river. When open, the bridge must provide a minimum clearance of 200 mm from the surface of the river and the span of the opening should be at least 200 mm. The bridge must fit on a 600 mm by 400 mm piece of wood that will be supplied as the base plate.

The bridge is to have an automatic control system that detects the arrival of shipping traffic. When shipping traffic arrives, it should signal for the boat to wait, safely signal vehicular and pedestrian traffic to stop, and then open the bridge. Once the shipping traffic has passed through safely, the bridge should close and allow vehicular and pedestrian traffic to resume crossing the river. The control system must provide some form of local visual indication of the state of the sensors and system. It must also provide a remote user interface on a computer that shows the state of the bridge, sensors and system, and allow the control of all bridge operations including overriding sensor inputs. Ideally, the user interface will be wirelessly connected to the control system via Wi-Fi.

The bridge (excluding the remote user interface) must be powered by a 12V 5A power supply as it's only source of energy. All wiring and electronics must be concealed. The bill of materials for building the bridge must not exceed AUD$100 (excluding base plate).

4. Approved Suppliers

All components ordered MUST be sourced from the approved suppliers listed below. No exceptions. When ordering, you should take note of stock availability and lead times for

restocking. It is highly recommended that you only order components that are in stock and have a reasonable quantity remaining. Ordering and purchasing is to be done by submitting a Bill of Materials in iLearn.

Supplier	URL
Bunnings	https://www.bunnings.com.au/
RS Online	https://au.rs-online.com/web/
Core Electronics	https://core-electronics.com.au/
Jaycar	https://www.jaycar.com.au/

5. Assessment Tasks

1. **Prototype Demonstration (due Week 8):** This will consist of (1) a Group Progress Report for each Group and (2) a short video presentation in which subsystem Prototypes are demonstrated.

   The Group Progress Report will be a document that describes the project being undertaken by the Team, the specific subprojects being undertaken by the Group, scope of work, interfaces, requirements and constraints, performance measures, discussion and justification of the chosen design and alternatives considered, and details of the work and prototype testing that has been accomplished to date.

   Enough detail must be provided so that the work can be reproducible by someone external to the group. When discussing the design, it should include details of a minimum viable product (MVP), as well as a final design.

   The document should also contain details of team integration work that has been done towards achieving a fully working bridge.

   Details of the project planning and management processes that were employed during the project should also be included.

   The video presentation should be no longer than 5 minutes and briefly cover the design and how it meets the customer's requirements, and the parts of the design that have been completed as a part of the prototyping process. It may also show how the subsystem prototypes integrate to form a working MVP.

2. **Final Project (due Week 13)**: This will consist of (1) a final Group Report for each Group and (2) an in-person demonstration.

   The Group report will be a document that describes the project that has been undertaken by the group, scope of work, interfaces, requirements and constraints, performance measures, and final design with explanation of how it meets the customer's requirements and constraints. It should contain a discussion detailing changes that were made due to lessons learned from the prototyping process and other iterations of the design. Details of testing and results should also be included. The document should also highlight and provide evidence that one or more of the "design for" attributes have been considered and accomplished in the final product. Details of the project planning and management processes that were employed during the project should also be included.

   The in-class demonstration will consist of a short presentation explaining how the final product meets customer requirements and highlight any novel features that have been included in the final product. A series of tests will also be conducted on the final product to ensure that it meets the customer requirements.

3. **Individual Portfolio (due Week 13)**: Each student is to submit: (1) a PDF of their individual log book, (2) two pieces of reflective writings, (3) URL to their LinkedIn page, and (4) a written description of what has been updated on their LinkedIn page over the course of this semester.