



# JOHN EDMONDSON HIGH SCHOOL

## Assessment Notification

**Faculty:** Industrial Arts      **Course:** Engineering Studies      **Year:** 12

**Assessment Task:** Civil Structures Bridges - Analysis Report

**Assessment Weighting:** 20%      **Due:** Term 4 Week 10      **Date:** 13/12/2023

**Task Type:** Hand in Task     In Class Task     Practical Task

| Outcomes assessed (NESA)  |
|---|
| H2.1 - determines suitable properties, uses and applications of materials, components and processes in engineering<br>H3.1 - demonstrates proficiency in the use of mathematical, scientific and graphical methods to analyse and solve problems of engineering practice<br>H5.2 - selects and uses appropriate management and planning skills related to engineering<br>H6.2 - demonstrates skills in analysis, synthesis and experimentation related to engineering |
| Task Description/Overview   |
| An Engineering Report which is an analysis of your constructed bridge   |
| Detailed Assessment Task Description  |
| Students are to design, test and analyse their constructed bridge. Team bridge but an individual report is required.<br><b>Report printed B&amp;W plus submitted on Canvas before 8.20am 13/12/23, Term 4, <u>Week 10</u></b><br>## See the following pages including the assignment expectations supplied for a detailed overview of what is expected ##   |

| Assessment Criteria    |   |               |
|------------------------|---|---------------|
| Grade                  | Description   | Mark Range    |
| <b>Outstanding (O)</b> | The student has demonstrated an outstanding ability in analysing, researching, experimenting and problem solving in engineering. In addition, the student has achieved a very high level of competence in the preparation and presentation of detailed engineering reports using appropriate means. | <b>90-100</b> |
| <b>High (H)</b>        | The student has demonstrated a high ability in analysing, researching, experimenting and problem solving in engineering. In addition, the student has achieved a high level of competence in the preparation and presentation of detailed engineering reports using appropriate means.              | <b>80-89</b>  |
| <b>Sound (S)</b>       | The student has a sound ability in analysing, researching, experimenting and problem solving in engineering. In addition, the student has achieved a decent level of competence in the preparation and presentation of engineering reports using appropriate means.                                 | <b>60-79</b>  |
| <b>Basic (B)</b>       | The student has a basic ability in analysing, researching, experimenting and problem solving in engineering. In addition, the student has produced a basic presentation of engineering reports using appropriate means.   | <b>30-59</b>  |
| <b>Limited (L)</b>     | The student has a limited ability in analysing, researching, experimenting and problem solving in engineering. In addition, the student has struggled to prepare and present an engineering report using necessary means.   | <b>0-29</b>   |

### Satisfactory completion of courses

A course has been satisfactorily completed, when the student has:

- Followed the course developed/endorsed by the NSW Educational Standards Authority (NESA)
- Applied himself/herself with diligence and sustained effort to the set tasks and experiences provided in the course.
- Achieved some or all of the course outcomes

# HSC Engineering Studies Assessment Task 1

## Civil Structures Bridges – Analysis Report

**Due Date: Term 4, Week 9 (Testing), Report Due Week 10, Wed 13<sup>th</sup> Dec**

### **Assessment Outcomes** A student:

H2.1 determines suitable properties, uses and applications of materials, components and processes in engineering

H3.1 demonstrates proficiency in the use of mathematical, scientific and graphical methods to analyse and solve problems of engineering practice

H5.2 selects and uses appropriate management and planning skills related to engineering

H6.2 demonstrates skills in analysis, synthesis and experimentation related to engineering

### **Assessment Components**

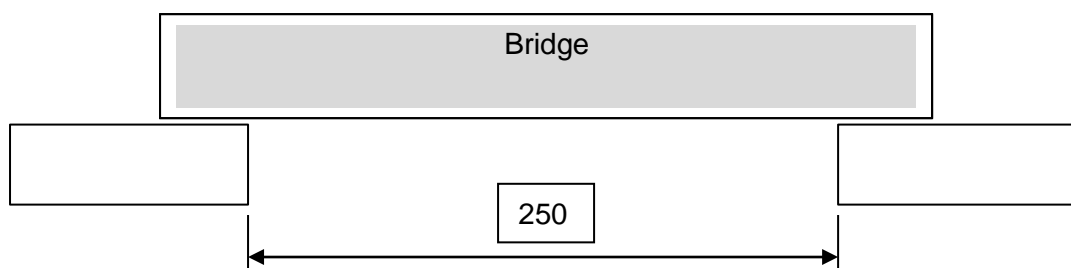
- A. Design
- B. Testing
- C. Analysis
- D. Marking Criteria

### **A. Design**

- Students are to work in pairs to research, design and construct a trussed bridge using the balsa wood supplied (5mm x 5mm strips).
- The balsa bridge must **not** be longer than 297mm. You are permitted to have under trussing.
- All balsa bridges will have a width of 100mm for the inside deck (will be using the 300mm x 100mm deck supplied)
- It must be able to have a wooden block (100mm wide and 70mm high) slide through the bridge.
- You will also submit all your design sketches and full-size templates with your analysis.
- You will have a maximum of 3 weeks to design **and** construct your bridge ready for testing.

### **B. Testing**

- Each completed bridge will be tested to failure (failure is when any joint or timber part fractures).
- The distance between supports for testing will be 250mm



- Prior to testing
  - Photograph the completed bridge.
  - Weigh the bridge and record the weight in grams.

### C. **Analysis**

- Each student will prepare an individual, **analysis report** which will document:
  - a) The research, design, construction and problem solving carried out prior to testing (photos of the construction are encouraged).
  - b) The weight of the completed bridge
  - c) The total load (in kilograms) that the bridge carried just before failure
  - d) Calculations – the **reaction** forces at each support (loaded just before failure)
    - The strength to weight **ratio** (total load before failure/initial weight)
    - An analysis of the **forces** in each member of the truss (left hand side to centre only). These calculations contribute to a large portion of the marks.
  - e) An **evaluation** of your team's design – did it carry the greatest weight?
    - You should include a photo of the bridge after failure indicating the major break points.
    - Explain what you perceive as the flaws in your bridge design.
    - Explain the modifications you would make to improve the performance of your design and why.
    - Draw a side view of the new design indicating the changes you would make.

### D. **Limitations**

- a) All groups will and shall have a bridge deck of constant thickness (using the plywood deck supplied).
- b) No bridge deck shall be placed underneath the truss
- c) Ensure when testing, that the test jig is freely standing
- d) Place large weights first
- e) Only PVA glue will be used to join balsa wood at the joints.

### E. **Presentation/Communication**

- The assessment must be done on a computer, using Microsoft office or equivalent, & must be be uploaded to CANVAS plus presentedneatly in an A4 plastic sleeve or binder.
- The report should have a title page, contents page, headings, sub-headings and page numbers.
- The report must have adequate and appropriate use of labelled **diagrams** and **pictures**.
- The assessment must be free of spelling and grammatical errors.
- The assessment must have adequate & accurate bibliographic **references** for all sections of the assessment.
- The bibliography must be presented on a separate page at the end of the assessment.
- Figures must be captioned.

| Civil Structures Bridges Testing Analysis Report -<br>Marking Criteria |   | Marks<br>Achieved               |
|--|---|---------------------------------|
| Team Names: .....  |   | <b>TOTAL</b><br><br><b>/100</b> |
| 1. Design  | <b>Accurate &amp; detailed documentation of the research, design and construction</b> 20-30<br>Documentation of most of the design components 10-20<br>Inadequate design documentation 0- 10                            | <b>/30</b>                      |
| 2. Testing   | <b>Accurate &amp; detailed documentation of all points</b> 15 - 20<br>Documentation of most points 8 - 15<br>Documentation of few points 0- 7   | <b>/20</b>                      |
| 3. Analysis  | <b>Accurate &amp; detailed analysis of the bridge design documenting all areas</b> 30-40<br>Accurate & reasonable analysis with some areas omitted 15-30<br>Inaccurate or poor analysis with few areas documented 0- 15 | <b>/40</b>                      |
| 4. Presentation/Communication  | <b>Presentation follows assignment expectations and is well laid out</b> 0 - 5<br><b>Communication uses diagrams, pictures &amp; is well referenced</b> 0 - 5   | <b>/10</b>                      |

**Comments:**

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## **ASSIGNMENT Expectations - Elaboration on what is expected!!**

For your assignment, I expect the following:

- Abstract
  - It is a brief but concise summary of the contents and purpose of the report
- Acknowledgements
  - Recognise those people and organisations who have made significant contributions to the project
- Table of contents
  - Must be properly laid out
- List of figures
- List of tables
- Introduction
  - Introduce the importance of bridges to society
  - The role of Engineers when it comes to building bridges
  - Brief intro on what you will be doing and how you will analyse
- Research
  - Research 3 different trusses with an insight into their characteristics and a comparison on the 2 advantages and 2 disadvantages
- Design
  - Mention the characteristics of your bridge design and the reasons behind it.
- Construction and Problems Encountered
  - Outline the construction of the bridge by mentioning the tools and materials used.
  - Problems encountered during the construction and ways you were able to overcome these problems
- Testing and Results
  - Mention how testing took place along with a comparison table of your results against your peers then mention explicitly your results ie. Weight of Bridge, Max Load, Strength to Weight Ratio and your rank in class.
- Calculations and Truss Analysis
  - If members are statically indeterminate, you can analyse a simplified diagram. From this calculations can be made. Place result of each member in a table. Show your calculations in an appendix at the end of your report.
- Evaluation
  - Evaluate your design by stating what went wrong and why.
  - State how you would improve this flaw in the future. This is where your analytical skills come to the fore.
  - Include fracture point images and state why you think that particular member fractured.
  - State other reasons why your design failed
  - Things you could improve:
    - Testing Procedure
    - Method of joining the members together
- Conclusion
  - Provide a conclusion by stating your results and the improvements that could be made for your bridge to hold more load
- References
- Place your final scaled bridge design in the appendix at the end of the report

The above points are the minimum required. Please execute whatever you feel like is necessary to excel in this assignment.