National Certificate of Educational Achievement
TAUMATA MĀTAURANGA Ā-MOTU KUA TAEA

Exemplar for Internal Achievement Standard

Technology Level 2

This exemplar supports assessment against:

Achievement Standard 91348

Demonstrate understanding of advanced concepts related to structural frameworks

An annotated exemplar is an extract of student evidence, with a commentary, to explain key aspects of the standard. It assists teachers to make assessment judgements at the grade boundaries.

New Zealand Qualifications Authority

To support internal assessment

	Grade Boundary: Excellence
1.	For Excellence, the student needs to demonstrate comprehensive understanding of advanced concepts related to structural frameworks. This involves discussing how safety factors have been applied to ensure framework integrity. There is no student work currently available at this grade. A student at this grade may, for example, compare and contrast examples of structural frameworks found in different house deck structures. The student's work may discuss safety factors such as considerations due to static and dynamic loadings, and the possible effects of failure due to lack of maintenance, corrosion, metal fatigue, wind or earthquake damage. A student would typically discuss the difference between working load and the load at failure, and the formulas that are used to determine the working load. This would cover at least one application of the safety factor. Reference may be made to relevant New Zealand Building Code or relevant weather, wind and earthquake resistance requirements.

	Grade Boundary: Merit
2.	For Merit, the student needs to demonstrate in-depth understanding of advanced concepts related to structural frameworks. This involves: • explaining forces that exist within framework members • explaining framework member profiles, and forms and where they are used. There is no student work currently available at this grade. A student at this grade may, for example, demonstrate in-depth understanding by explaining the forces exerted on struts, ties, beams and columns that resist loads in a box truss bridge design (Auckland Harbour Bridge). The explanations would typically use graphical analysis of framework members, and may include notations, polar diagrams and/or shear force diagrams. Students could explain the use of I-beams, channel, round, and rectangular beams used in building a large house deck. They could refer to existing plans and add notes and explanations where they are used. Students may typically use some of the following terms: ‘ties’, ‘struts’, ‘triangulation’, ‘trapezium’, ‘square structure’, ‘redundant members’, ‘compression’, ‘tension’ and ‘shear’.

	Grade Boundary: Achieved
3.	For Achieved, the student needs to demonstrate understanding of advanced concepts related to structural frameworks. This involves: • describing where pin and moving joints are used • describing the effects of load on fixed joints • explaining types of framework members and how members combine to resist loads and transfer forces • explaining how safety factors are determined. There is no student work currently available at this grade. The following paragraphs give examples of different contexts in which the student might address these criteria. The contexts that a student selects might vary for the different criterion. A student could describe where pin and moving joints are used in a folding camp chair, or a collapsible gazebo frame. The student could describe the effect of load on a structural framework such as the box truss Auckland Harbour Bridge (i.e. loads that are shared between framework members – some members are placed in tension and others in compression). The student could use diagrams to assist their descriptions. The student could explain the combination of struts, ties, beams and columns that resist loads in a box truss bridge design. The explanations will typically use graphical analysis of framework members that may include: notations, polar diagrams and/or shear force diagrams. The student may explain safety factors in a house design, determined due to the additional static and dynamic loadings needed for safety during strong wind and an earthquake. The student could explain the difference between ‘working load’ and the load at failure, and the formulas that are used to determine the ‘working load’. The explanation may refer to relevant NZ building/bracing codes for wind and earthquake requirements.