**NZQA**

**Approved**

Achievement standard: 91348 Version 3

Standard title: Demonstrate understanding of advanced concepts related to structural frameworks

Level: 2

Credits: 3

Resource title: No fear pier

Resource reference: Construction and Mechanical Technologies VP-2.24 v2

Vocational pathway: Manufacturing and Technology

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| Quality assurance status | These materials have been quality assured by NZQA. NZQA Approved number A-A-02-2015-91348-02-8232 |
| Authenticity of evidence | Assessors/educators must manage authenticity for any assessment from a public source, because learners may have access to the assessment schedule or exemplar material.Using this assessment resource without modification may mean that learners’ work is not authentic. Assessors/ educators may need to change figures, measurements or data sources or set a different context or topic to be investigated or a different text to read or perform. |

Vocational Pathway Assessment Resource

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Learner instructions

# Introduction

This assessment activity requires you to demonstrate your understanding of advanced concepts related to structural frameworks of a jetty.

You are going to be assessed on how comprehensively you demonstrate your understanding of advanced concepts related to structural frameworks of a jetty.

The following instructions provide you with a way to structure your work so you can demonstrate what you have learnt and achieve success in this standard.

Assessor/educator note: It is expected that the assessor/educator will read the learner instructions and modify them if necessary to suit their learners.

# Task

The jetty you will focus on is a pin-jointed structure, for example a pier, a marina, etc. Investigate the design of this jetty so that you understand the basis of its structural integrity. You need to show that you are able to process and interpret information, and prepare a presentation that includes the jetty member profiles and forms and where they are used, and how safety factorshave been applied to ensure the integrity of the jetty.

Create a presentation in which you do the following:

* Describe where pin and moving joints are used in the jetty, and the effects of load on fixed joints.
* Explain types of framework members used in structural frameworks and how members combine to resist loads and transfer forces.
* Explain forces that work within framework members:
	+ for example you could explain where pin and moving joints are used, and the effects of loads on framework members in the focus jetty, and how members react to the load to ensure that the jetty maintains its integrity (i.e. maintains equilibrium)
	+ include calculation of forces using vector diagrams.
* Explain the framework member profiles and forms, and where they are used in your jetty, for example:
	+ the profile and form, and use of diagonal timber struts and ties in the jetty
	+ the profile and form, and use of vertical timber piles placed in the seabed, and pin-jointed horizontal beams attached to the piles.
* Discuss how safety factors would have been applied to ensure the integrity of your jetty.
	+ For example you could compare and contrast examples of structural frameworks found in different jetty construction methods.
	+ 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.
	+ You could also discuss the difference between working load and the load at failure, and the formulas that are used to determine the working load.

Refer to relevant New Zealand Building Code and publications for weather, wind and earthquake resistance requirements.

Collect evidence that explains the relevant concepts, for example annotated sketches, mock-ups, models, photographs, quotes, etc. Keep a record of all sources so that you can acknowledge them in your presentation.

# Resource A

These definitions are reprinted from the Standard (Construction and Mechanical Technologies 2.24).

* Structural frameworks are made up of combinations of pin jointed members acting as struts and/or ties.
* Framework member profiles may include but are not limited to: I-beam, channel, round, and rectangular.
* Framework member forms may include but are not limited to: solid, tube, linked, and multi-strand cable.
* Forces are limited to tension, compression, torsion and shear forces.
* Loads acting on a framework are limited to static point loads.
* Explanation of forces that exist within framework members includes calculation of the forces acting in members using vector diagrams.
* Safety factors may include but are not limited to considerations due to static and dynamic loadings, and the effects of wind and earthquake.
* The integrity of a framework is reliant on but is not limited to the form and profile of framework members, and the combination and means by which framework members are joined.

# Resource B

## Useful websites:

<http://www.technologystudent.com/forcmom/force1.htm>

<http://www.diydoctor.org.uk/projects/forces.htm>

<http://www.pbs.org/wgbh/buildingbig/lab/forces.html>

<http://www.mos.org/etf/force.html>

<http://www.archive.org/details/elementarygraphi00wighrich>

## Useful books:

Jackson, E, 1975, *Advanced Level Technical Drawing*, Longman, United Kingdom.

Sinclair, R and Guy, T, 1974, *Technical and Professional Drawing*, book 2, Hicks Smith, Wellington, New Zealand.

Kamphius, JW, 2010, *Introduction to Coastal Engineering and Management* (2nd Edition – Advanced Series on Ocean Engineering), World Scientific, Singapore.

Sorum, A, 2006, *Northern Harbors and Small Ports: Operation and Maintenance*, Alaska Sea Grant, United States.

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Assessor/Educator guidelines

# Introduction

The following guidelines are supplied to enable assessors/educators to carry out valid and consistent assessment using this internal assessment resource.

As with all assessment resources, education providers will need to follow their own quality control processes. Assessors/educators must manage authenticity for any assessment from a public source, because learners may have access to the assessment schedule or exemplar material. Using this assessment resource without modification may mean that learners' work is not authentic. The assessor/educator may need to change figures, measurements or data sources or set a different context or topic. Assessors/educators need to consider the local context in which learning is taking place and its relevance for learners.

Assessors/educators need to be very familiar with the outcome being assessed by the achievement standard. The achievement criteria and the explanatory notes contain information, definitions, and requirements that are crucial when interpreting the standard and assessing learners against it.

# Context/setting

This activity requires learners to demonstrate their comprehensive understanding of advanced concepts related to structural frameworks focusing on a marine industry structure such as a jetty structure.

# Conditions

The learners could gather and analyse their evidence independently or in groups, but they need to create their presentation independently, and will be assessed individually.

Decide on the format of the final presentation. You may wish to take learners’ preferences into account in deciding on the format.

# Resource requirements

The assessor/educator will provide opportunities for learners to develop their evidence.

Learners will require access to the internet for research.

# Additional information

None.

## Other possible contexts for this vocational pathway

These include any structural framework relevant to a manufacturing context, for example a furniture item (furniture making), gazebo or scaffolding (building).

# Assessment schedule: Construction and Mechanical Technologies 91348 – No fear pier

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| Evidence/Judgements for Achievement | Evidence/Judgements for Achievement with Merit | Evidence/Judgements for Achievement with Excellence |
| The learner demonstrates understanding of advanced concepts related to structural frameworks by:* describing where pin and moving joints are used

For example:The learner describes examples of where pin joints are used in the construction methods of a jetty.The learner may need to go beyond the context of a jetty, and describe examples such as pin joints found in a folding camp chair, collapsible gazebo frame, etc.* describing the effects of load on fixed joints

For example the learner describes:* + the effect of load on structural frameworks found in a jetty, and how loads are shared between framework members
	+ how some members are placed in tension and others in compression.

Diagrams are included to assist descriptions.* explaining types of framework members and how members combine to resist loads and transfer forces

For example the learner uses:* + structural framework examples found in a jetty to explain different types of framework members (e.g. struts, ties, beams, columns)
	+ vector diagrams to explain how framework members resist and transfer loads, through graphical analysis and representation of framework members that include: notations, polar diagrams and/or shear force diagrams to explain the types of forces acting.
* explaining how safety factors are determined

For example:The learner explains how safety factors may include considerations due to static and dynamic loadings, and the possible effects of failure due to lack of maintenance, corrosion, metal fatigue, wind or earthquake. The learner explains the difference between working load and the load at failure and the formulas that are used to determine the working load. This will cover at least one application of the safety factor. Reference may be made to relevant New Zealand Building Code or relevant marine industry safety publications for weather, wind and earthquake resistance requirements.*The above expected learner responses are indicative only and relate to just part of what is required.* | The learner demonstrates in-depth understanding of advanced concepts related to structural frameworks by:* explaining forces that exist within framework members

For example the learner explains:* + where pin and moving joints are used, and the effects of loads on framework members in the jetty; the learner uses vector diagrams to assist with the explanation of how the equipment achieves equilibrium when under load from the people using it
	+ how members react to the load to ensure that the jetty maintains its integrity (e.g. how a jetty frame uses connectors, pin joints, multi-strand cable (rope) and anchor points to remain in a state of equilibrium).

The learner may use some of the following terms: ties, struts, triangulation, trapezium, square structure, redundant members, compression, tension and shear.* explaining framework member profiles and forms, and where they are used

For example:The learner explains the profiles and forms of framework members in relation to the load they carry in a jetty (e.g. the profile and form, and use of diagonal timber struts and ties; the profile and form, and use of timber piles placed in the seabed).* explaining how safety factors are determined

For example:The learner explains how safety factors may include considerations due to static and dynamic loadings, and the possible effects of failure due to lack of maintenance, corrosion, metal fatigue, wind or earthquake. The learner explains the difference between working load and the load at failure and the formulas that are used to determine the working load. This will cover at least one application of the safety factor. Reference may be made to relevant New Zealand Building Code or relevant marine industry safety publications for weather, wind and earthquake resistance requirements.*The above expected learner responses are indicative only and relate to just part of what is required.* | The learner demonstrates comprehensive understanding of advanced concepts related to structural frameworks by:* explaining forces that exist within framework members

For example the learner explains:* + where pin and moving joints are used, and the effects of loads on framework members in the jetty. The learner uses vector diagrams to assist with the explanation of how the equipment achieves equilibrium when under load from people using it
	+ how members react to the load to ensure that the equipment maintains its integrity (e.g. how a jetty frame uses connectors, pin joints, multi-strand cable (rope) and anchor points to remain in a state of equilibrium).

The learner may use some of the following terms: ties, struts, triangulation, trapezium, square structure, redundant members, compression, tension and shear.* explaining framework member profiles and forms, and where they are used

For example:The learner explains the profiles and forms of framework members in relation to the load they carry in a jetty (e.g. the profile and form, and use of diagonal timber struts and ties; the profile and form, and use of timber piles placed in the seabed).* discussing how safety factors have been applied to ensure the integrity of a structural framework

For example:The learner compares and contrasts examples of structural frameworks found in different jetty structures, and discusses 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. The learner discusses the difference between working load and the load at failure, and the formulas that are used to determine the working load. This will cover at least one application of the safety factor. Reference may be made to relevant New Zealand Building Code or relevant marine industry safety publications for weather, wind and earthquake resistance requirements.*The above expected learner responses are indicative only and relate to just part of what is required.* |

Final grades will be decided using professional judgement based on an examination of the evidence provided against the criteria in the Achievement Standard. Judgements should be holistic, rather than based on a checklist approach.