

41193 Calculate and assess industrial rope haulage using rigging theory

Kaupae Level	5
Whiwhinga Credit	5
Whāinga Purpose	This standard is intended for people who are working in a range of work settings that require the use of advanced level industrial rope access skills when working at height or in places with difficult access. People with this skill standard will be able to calculate and assess industrial rope haulage using rigging theory. This skill standard contributes to credentials for industrial rope access services.
Whakaakoranga me mātua oti Pre-requisites	Skill standard 41191 <i>Operate as an intermediate level industrial rope access technician</i> , or evidence of equivalent knowledge and skills.

Hua o te ako me Paearu aromatawai | Learning outcomes and assessment criteria

Hua o te ako Learning outcomes	Paearu aromatawai Assessment criteria
1. Calculate and assess industrial rope haulage using rigging theory.	a. Calculate mechanical advantage in rope systems, including actual values for pulley configurations.
	b. Apply lever classes to calculate leverage and counterbalance effects and configure counterweighted needles safely.
	c. Analyse friction and system efficiency by calculating its impact on load distribution in different circumstances.
	d. Determine tension distribution and component forces in rope systems, including vectors, resultants and loading conditions for tension lines and skate blocks.
	e. Configure and assess tripods and gantries using resultant force calculations to ensure safe and stable rigging.
	f. Evaluate risk factors related to excessive component forces, vectors, resultants, and dropped object hazards in different load conditions.

Pārongo aromatawai me te taumata paearu | Assessment information and grade criteria***Assessment specifications:***

Candidates must be capable of performing calculations needed for the verification of a haulage system. They must be able to design pulley systems, confirm the safety of those systems, and operate a haulage systems hauling less than 240kg maximum.

Ngā momo whiwhinga | Grades available

Achieved

Ihirangi waitohu | Indicative content

- Sources of mechanical advantage and the exchange that is made.

Mechanical advantage in levers

- Lever classes
- Calculations using different lever classes.
- Levers and counterweights when using needles in rope access.

Mechanical advantage in pulley systems

- Pulley classes, configurations and Newtons 3rd Law
- Identifying pulley features and applications
- Pulley system types (Simple, Compound, Complex)
- Pulleys reeved to advantage/disadvantage.

Simple pulley systems

- Calculating mechanical advantage (MA) in simple pulley systems
- Simple pulley system constraints.

Compound pulley systems

- Calculating MA in compound pulley systems (T-Method)
- Advantages and Disadvantages of compound systems
- Progress capture in hauling, lowering and arresting configurations.

Complex pulley systems

- Calculating with Complex pulley systems
- Advantages and disadvantages of complex systems.

Pulley friction and hauling efficiency

- Friction calculations “Mew”
- Pulley efficiency, bearing types, and friction losses
- Friction Contact pressure
- Friction Resultant forces
- Calculating actual MA using efficiency losses.

Force and direction

- Vectors and Components
- MA losses due to vectors
- Vector in Rope systems
- Calculating with vectors
- Tension line dynamics and calculating forces at a component level
- Calculating Vector forces using a ruler
- Calculations for diagonal guidelines and skate blocks.

Implied forces and consequences

- Resultant forces
- Tripod configurations and resultant force risks.
- Dynamic and static loading.

Understand falling and dropped objects

- Fall force calculations, limits and mitigation strategies
- Fall arrest calculations and attenuation function and capacity
- Time and velocity in free fall calculation
- Calculating potential energy using velocity
- Fall factors in depth, peak loading, plastic and elastic deformations.

Safety and error

- Key configurations/situations in hauling, MA and tension line systems where failure is most likely to occur
- Designing hauling systems that are safe, efficient, and appropriately rated for loads
- Applying principles that ensure rescue haul systems and load movements are stable and controlled within acceptable load limits for static and dynamic forces.

Rauemi | Resources

Legislation, regulations and/or industry standards relevant to this skill standard include but are not limited to:

- Industrial Rope Access in New Zealand: Best Practice Guidelines available on <https://www.worksafe.govt.nz/>
- Rope Access Certificate of Competence Scaffolding, Access and Rigging New Zealand <https://www.sarnz.co.nz/cocs/rope-access-certificate-of-competence/rope-access-certificates-of-competence>
- WorkSafe. (2019). *Best practice guidelines for working at height in New Zealand*. <https://www.worksafe.govt.nz/topic-and-industry/working-at-height/working-at-height-in-nz/>
- EN361 Personal protective equipment against falls from a height: Full body harnesses, available at <https://www.en-standard.eu/>
- AS/NZS ISO 22846.2:2020 Personal equipment for protection against falls - Rope access systems, Part 2: Code of practice <https://www.standards.govt.nz/shop/asnzs-iso-22846-22020>.

Where the resources have been updated, please refer to the latest version.

Pārongo Whakaū Kounga | Quality assurance information

Ngā rōpū whakatau-paerewa Standard Setting Body	Construction and Specialist Trades Industry Skills Board
Whakaritenga Rārangi Paetae Aromatawai DASS classification	Service Sector > Lifting Equipment > Industrial Rope Access
Ko te tohutoro ki ngā Whakaritenga i te Whakamanatanga me te Whakaōritenga CMR	0120

Hātepe Process	Putanga Version	Rā whakaputa Review Date	Rā whakamutunga mō te aromatawai Last date for assessment
Rēhitatanga Registration	1	28 May 2026	N/A
Kōrero whakakapinga Replacement information	N/A		
Rā arotake Planned review date	31 December 2031		

Please contact the Construction and Specialist Trades Industry Skills Board at info@cstisb.nz if you wish to suggest changes to the content of this skill standard.