

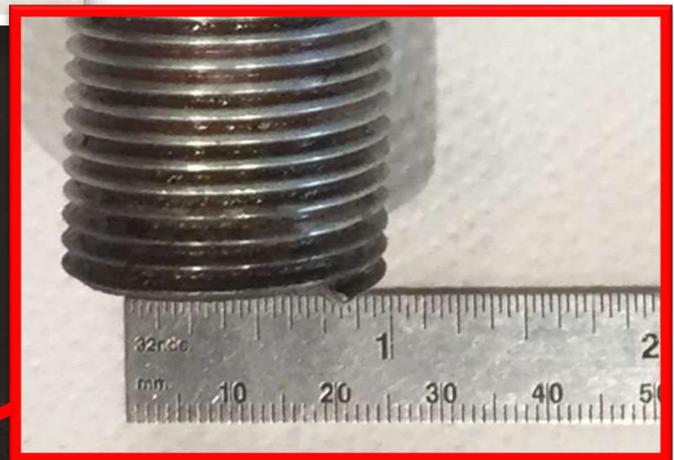
Incident Summary #II-1526459-2023 (#33813) (FINAL)

SUPPORTING INFORMATION	Incident Date	March 22, 2023	
	Location	Lower Mainland	
	Regulated industry sector	Passenger ropeways - Above surface ropeway	
	Impact	Qty injuries	0
		Injury description	N/A
		Injury rating	None
	Damage	Damage description	A bolt used to align a sheave assembly was found to be broken during a periodic inspection.
		Damage rating	Moderate
	Incident rating	Moderate	
Incident overview	While maintenance staff were performing a routine periodic inspection, a tower alignment bolt was found to be broken. The bolt was replaced as per manufacturers specifications and procedures, and after testing, the ropeway was returned to normal operations.		
INVESTIGATION CONCLUSIONS	Site, system and components	<p>In this ropeway configuration, tower sheave assemblies are aligned using two bolts. These bolts are used to align sheave assemblies on the vertical and horizontal plane to ensure the haul rope runs in the centre of the assembly sheaves and position the ropeway cable so it can be monitored by the ropeway's safety circuit tower mounted switches.</p> <p>Specifications and procedures for the use and setting of the alignment bolts are provided by the ropeway manufacturer.</p>	
	Failure scenario(s)	<ul style="list-style-type: none"> March 22, 2023, while performing monthly periodic tower inspection, maintenance staff found the broken bolt Tower 32 downhill side. Bolt was replaced as per manufacturers specifications and procedures and the ropeway was put back in normal operation. 	
	Facts and evidence	<ul style="list-style-type: none"> 2012 Safety Order SO-PR-2012-2 was issued to all duty holders with this configuration of ropeway. May 16, 2013, Safety Order Response Form received from the duty holder verifying that all X/Y bolts had been changed to rolled thread. 2015 Tower 32 downhill side assembly was rebuilt, and X/Y bolts were replaced again at this time. Safety order response form was received as per the requirements of the Safety Order for this ropeway. Work order was produced by the duty holder from the rebuild of Tower 32 downhill side in 2015. Tower 32 is a compression tower, where the haul rope is held down by the sheave assemblies. As the raised profile of the carrier grip passes through the sheave assembly, vibration is created. This vibration is accounted for in the design. 	

- Manufacturer provided specifications and procedures for installation and alignment of tower assemblies using the X/Y bolts.
- Independent laboratory report produced from analysis of the broken bolt attributes the broken bolt to a resonant vibration condition.

Causes and contributing factors

The failure of the X/Y bolt was likely caused by sustained vibrations caused by normal operating conditions of the ropeway.



X/Y bolt - The bolt broke off at the root of the threaded section of the bolt, the other section of the broken bolt was destroyed during extraction.