Is a thunderbolt about to finish the funicular pantomime?

Description

Included in the press statement Highlands and Islands Enterprise (HIE) released on Xmas Eve about the funicular not re-opening as planned by the end of the year (see here) was the following:

> Once the remediation works have been concluded, a series of mechanical safety testing, trial runs and staff training will follow. At the same time, HIE will maintain ongoing dialogue with the Health and Safety Executive.

As recently explained (see here) *"Safety testing, trial runs, staff training"* all take place AFTER the remediation works are finished and assuming that everything is properly certified, this is a process that could take weeks. It took 5½ weeks in 2022/2023.

A response to a freedom of information request from the Department for Transport (DfT) in February 2023 (see here) explains the role of the Health and Safety Executive (HSE) in respect of the funicular. While the DfT authorises "the installation and commissioning of entering into passenger service of a cableway transport installation, such as the Cairn Gorm cableway" responsibility for inspections thereafter lies with the HSE. With new problems having been identified before the current repairs were even finished, and with the original repairs having only last seven months, that suggests HSE may need to visit Cairn Gorm on a weekly basis if the funicular ever re-opens!

Just before Xmas I was contacted by someone who had read the posts I have written about the funicular and who happens to be an expert in fire safety. This gentleman had recently walked up the line of the funicular and noted a complete absence of lightning conductors, something I had failed to appreciate when I walked up to the passing loop, and alerted me to the risks.

Further research brought me to a specialist website (see here) from which I have extracted the following information:-

Lightning Protection of Rail Systems

Lightning is a natural atmospheric phenomenon that occurs as an electrical discharge between clouds or between clouds and the ground. This event contains millions of volts of electrical charge and causes a large release of energy within seconds. The metal structure of rail systems also becomes a potential target for lightning strikes due to its good conductivity. As a result of lightning strikes, serious problems such as disruption of signalling systems, power outages and even melting of rails can occur in rail systems.

Protection of railway systems from lightning strikes is important not only against direct strikes but also against internal overvoltage impulses. Railway stations, especially when they are located in open terrain, can be affected by travelling impulses, even without the direct effect of lightning. This means that transient voltages and switching pulses are frequently experienced and can pose a serious threat to electronic systems, disrupting sensitive electronic equipment such as railway signalling and communication systems. Lightning protection strategies of railway systems must therefore be effectively designed and implemented, not only against direct lightning strikes, but also against such *transient voltage surges and switching pulses.*

Earthing in Rail Systems

Earthing in rail systems is one of the basic components of system safety and operation. Earthing ensures that electrical overloads are safely transferred to the ground. This is particularly vital during lightning strikes. Earthing in rail systems protects both people and equipment by ensuring that high current is transferred to earth in the event of a direct lightning strike or electrical leakage.

In the construction stages of earthing, the effectiveness of connection points and metal evenings plays an important role. The preferred method for the durability and reliability of the connection points is usually thermowelding applications. Thermowelding increases the effectiveness of the earthing system by making the connection points more durable and long-lasting. In addition, every metal component in rail systems must be connected to the same earthing system.This ensures that an equipotential condition is maintained along the entire track and station, thus minimising electrical hazards. In particular, keeping the rail earth resistance as low as 10 ohms allows fault currents to flow more quickly and thus more effectively manage potential hazards in the system. (Red highlight is mine)

When lightning strikes a building it very rarely causes major damage because of the use of lightning conductors, but in the case of the funicular it would appear that the use of suitable conductors has been missed and there is certainly no earth bonding between every metal component! This has been raised with HIE and Cairngorm Mountain (Scotland) Ltd whose response so far is that the funicular rails were earthed in the bottom and top stations. That fails the address the issues being raised.

With steel construction, such as was originally intended for the funicular (see here), although all the disparate metal parts would need to be bonded to each other and then to a common earth, this would be much easier to do because of the metal support structure that runs the whole length of the railway. Making those links is far less simple with a concrete structure, as can be seen from the following pictures around the passing loop:

The repairs have involved the additions of multiple separate steel supports and brackets to the existing steel cross members between the concrete beams. Photo credit Gordon Bulloch.

Multiple unearthed steel components. Photo credit Gordon Bulloch.

To determine how much earth bonding is required to make the structure lightning proof, a qualified electrical technician will first have to check for electrical resistance between **every** support bearing, bolt, cross member, plate, strengthening bracket, length of studding, steel prop etc. The plus side is that if the props were used as part of the lightning conductor arrangement, it may be that only the top and bottom of one prop would need to be connected to all the other bits of steel near it with a lightning rod at the bottom.

Reinforced concrete, as used in the funicular structure, does not safely conduct lightning. In fact if lightning struck it could cause internal damage to an "I" beam or pier as a result of the excessive heat generated by the reinforcing steel melting causing the concrete to exploded internally without showing any external signs of this. Lightning has been known to melt rails and if by some misfortune a chance lightning strike was to hit the ropeway with the train in motion that would cause the carriages to instantly stop as the safety brakes engaged.

Funiculars on the continent are generally supported by steel structures with lightning conductors at the metal piers to earth the metal component – a relatively simple and cheap job. It appears, however, that when the design of the funicular was changed from steel to concrete the need for additional measures to protect the structure from lightning was overlooked and by luck HIE has got away with this for almost 20 years.

The addition of all the extra steel, however, means that the likelihood of the structure being hit by lightning, as happened to a house in Aviemore on 12th August (see here) will have increased significantly. That leaves HIE two options:

Option 1: link up and then earth all the various bits of steel being used to prop up the structure which is likely to be time-consuming and expensive, or

Option 2: try and persuade the DfT and HSE that the funicular is unlike other railways as there is no need for it to run in a storm.

The second option would require HIE to check the entire funicular structure after every electric storm and could, if the structure was hit, result in the funicular being taken out of commission for months.

All this may help explain some of the reasons for HIE's press statement on Xmas Eve. Besides the other problems with the repairs, HIE need more time to work out what to do about lightning strikes!

Category

1. Cairngorms

Tags

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