Cairngorm funicular railway: Written submission from Graham Garfoot, 17 December 2025

PAC MEETING SUBMISSION.

My name is Graham Garfoot. I learnt to ski at Cairn Gorm in 1964. In the ski season we used to travel every weekend from our home in Whitley Bay, working as break time cover for free ski passes. I also worked f/t on the mountain in 1975.

My experience in mechanical engineering started from 1969/70 with an interest in British motorcycles and later in 1982 completed a course in Heavy Goods Vehicle Repair and Maintenance. I am registered with the Royal Yachting Association as a recreational craft boat builder and Tohatsu Marine as their North East representative. At one time I ran the only business in the N.E. remanufacturing articulated lorry trailers from two to three axles, all having to pass certification by the D.O.T.

In this submission I would like to explain one of the many problems with the funicular railway using the scale models I have made. These problems range from inadequate geotechnical surveys to lack of maintenance of the rails themselves.

First a bit of history.

The planning application for the funicular was submitted to the Highland Council in 1994 and approved in 1997. Subsequently the WWF with the help of the RSPB contested the application before inexpicably dropping the case. In January 1999 tenders were invited for the construction work as this had to commence before December 1999 in order to secure the E.U. grant. Morrison Construction had the lowest tenders for two parts of the build and were therefore engaged to carry out the work. They were asked to bring in some “cost cutting” measures. One of these has resulted in the problem I am going to demonstrate today and was the change of specification from the use of steel to concrete. The change was made as concrete was supposed to be cheaper than steel which was completely untrue as I demonstrated in a Parkswatch post, https://parkswatchscotland.co.uk/2023/08/02/concrete-v-steel-2-hie-and-the-financial-cost-of-constructing-the-funicular-out-of-concrete/, and which was confirmed by a number of civil engineers. It is believed that

the original design by A.F Crudens was for a steel structure which had to be hurriedly changed to concrete before the ERDF deadline for construction to start.

The Present.

I have been unable to determine how the funicular was supposed to be built as there appears to be no publicly available planning documents for the original steel or subsequent concrete designs.

Galvanised steel can be guaranteed for 50 years with very little maintenance. Concrete needs special treatment to cope with Scotland's sub-arctic conditions both at the time of build and continuing maintenance, another ever increasing cost.

The following pictures are of scale models, 1/5th actual size, of the cross section of the

(1) The three different sized "I" beams in use,

(2) For comparison

The larger model is of an “I” beam as recommended by a university rail lecturer and a senior civil engineer who has built bridges, while the smallest is of a steel beam as used on the Frachey funicular, next photo,

at Champoluc in Italy.

The difference in size between the larger “I” beam and the beams in current use is due to the beams being classed as “simply supported”, something which I will explain later.

The next photo show stainless steel and brass rods made to the same scale, representing the reinforcing bar, or rebar as it is more commonly

known, and how the structure should have looked,

The left side model is of a Type 3 “I” beam with the right being of a Type 2 “I” beam. The outer two bars are obviously of a larger diameter than the other three. There are original drawings that show ALL of the rebars being the same size at 40mm! At some time again that specification was altered so that the inner bars were only 32mm. This effectively weakened the join.

This next photo shows how the lengths of rebar were overlapped to form the join.

I have removed the centre bar to make it easier to understand the join

The next two pictures are of a bottle screw, also known as a turnbuckle or tensioner. Both ends of the turnbuckle represent the rebars to be joined, the centre is the tensioning part. This tensions because it uses opposite threads to pull the two ends together as can be seen in the second of the two pictures

I will now come back to a point I made earlier about the beams being classed as “simply supported” because of the method of joining two of them together.

Each section of the track between the anchor blocks was designed to be "continuous". While the track **is** continuous in that all the beams in one section are joined together, in civil engineering terms they are not and are therefore classed as "simply supported". To be classed as continuous every beam was supposed to be connected to the next using specialist couplers similar in operation to the turnbuckle. As part of the cost cutting exercise couplers were not used in the connections of a number of beams, instead the reinforcing bars were overlapped and welded, confirmed in discussions with the welder, destroying the tensile strength of the rebar and therefore weakening the steel. Furthermore, because of the depth of the "I" beams, the supporting piers should be no more than 9m apart NOT the current 18m.

Some of the repair works include brackets around the insitu joints. These are an attempt to compensate for the lack of the correct couplings and also to support the ends of the concrete "I" beams to stop them from breaking off as in the next photo.

(photo courtesy of COWI report Dec 2018)

I sent a picture of an “I” beam to a mould and beam manufacturer with 36years experience. His first comment was that the end of the beam would snap!!

These brackets will need continuous inspection to make sure that the tension in them is maintained at the required level.

The reports into the funicular by ADAC Structures also mention problems in the insitu concrete fills as being of poor quality

2. Executive summary:

2.1 The writer now has the insights from 4 years of inspections. The structures condition is disappointing for its age, regardless of its environment. There are various defects appearing that demonstrating an ongoing deterioration of the structure. The writer cannot project forward with certainty for 25 years but he is concerned for the Client if they are fully exposed to the maintenance and repairs liabilities of this structure for this length of time.

2.2 The writer feels there is a differential to be drawn between maintenance, repair of direct damage and repair of construction defects.

2.2.1 A concrete structure of this age should not require wholesale maintenance, occasional random repairs may be reasonable, but systemic defects are not. The exception to this may be the plinths due to the nature of loading experienced.

2.2.2 Repair of direct damage is clearly required. Examples would include damage to the beams due to impact from snow clearing equipment.

2.2.3 Repair of construction defects. These should not exist and the writter does not regard their repair as "maintenance". The writter considers that much of the work being carried out historically and currently falls in this category.

(courtesy of ADAC Structures report July 2018).

I have spoken to a concreter who worked on the build and he has confirmed that concrete was used in the construction that should have been rejected as it would not pass a “slump” test. He specifically said that a labourer had to go in the chute to shovel the concrete down into the mould being used as it had started to set!

There is however one over-riding fault which is incurable. Ten years ago the structure was described as been in poor condition for its age. It has been deteriorating ever since.

The next picture was sent to me by the magazine “FUNIMAG”.

The comments were in reply to my question regarding funiculars built OFF the ground and in concrete:-

For the moment I only know one in France!

It is the funicular of Barèges - Pic de l'Ayré (Hautes-Pyrénées, France) built in 1935 and stopped in 2000.
All its track is made of concrete on concrete pilars.... with some sections where the rails are fixed on steel track but always on concrete pilars.

Length 1850 meters. Difference of level 768 meters. Up to 1980 m.

The funicular is stopped for 25 years but it is still there, cars, cables, concrete track on concrete pilars.... see my photos attached photos.

There is an association which is working to try to put the funicular in service again and I know very well its president.

I visited it in 2014 and I am sure the concrete elements are still in good condition without any steel brackets

Closer examination of the structure shows that some of the supporting “I” beams are steel with others of concrete, but the width of those concrete beams is far greater than the Cairn Gorm funicular

Note that, despite its 65 years of use and 25 years standing idle, there are no steel brackets holding it together.

The Cairn Gorm funicular is obviously in a condition where there can be no certainty of its longevity without more and ever increasing costs in maintenance and repairs.

There is I believe one way part of the structure could be retained.

Almost all repairs have been concentrated around the lower piers and the passing loop, the quantity of steel reinforcement at the loop demonstrating how bad it is. The solution therefore is quite simple.

Remove the structure below Anchor Block 48, by the Shieling, replacing it with a gondola or chair/ gondola hybrid. [A quote for this was received 02/08/2019 from Doppelmayr for EUR 6m with a capacity of 2400pph, twice the design capacity of the funicular and over three times its actual carrying capacity.]

Remove the passing loop replacing it with a straight section.

This would require removal of one of the carriages thereby reducing the stresses and maintenance costs BUT keeping the same uplift capacity.

The Financial Business Case presented by HIE for the reinstatement of the funicular did not include factual figures for either a single or a dual cable gondola. In 2024 I obtained quotes from both Dopplemayr, for the first, and Leitner Poma, for the second, which were substantially lower than the repair costs to the funicular and have both been submitted to the S.G.

If Cairn Gorm is to be returned to its status as Scotlands' premier ski resort, and there are people who would help to achieve this, major change needs to happen including removal of HIE as owners of the business CM(S)L. Their continuous and seemingly unlimited funding of their own business is to the detriment of every other business in their remit, **The Highlands And Islands of Scotland.**

Thank you for your consideration of this submission.

Graham Garfoot