Stainless steel brackets and their use on the funicular

Description

Seven pairs of Type One brackets around the “I” beam are visible centre right and two of the Type 3 brackets around the insitu joint are visible left.

On Friday 04/10/2024, prompted by HIE’s announcements about the timecale for the “snagging works” being carried out and paid for by Balfour Beatty (see here), I took a walk up to the passing loop of the funicular accompanied by two friends.

Following what I had written last December (see here) I expected to see changes/ repairs that would be instantly recognisable as such, e.g. more of the type 1 brackets and/ or larger support plates under the Type 3 brackets as labelled in the following picture:-

Type 1 brackets are used around the I beams, Type two around the beams between and Type 3 around the in-situ joints.

Instead we found this:-

Photo. Type 1 brackets off the top pier of the passing loop.

and this:-

Photo. Type I brackets on the ground below Pier 47.

The Current Works

The whole point of the snagging works according to HIE was for the Type 2 & 3 strengthening rods and brackets to be re-torqued and re-tensioned, as per the following press release on 06/09/2023:-

The popular 2km ride between the Cairngorm base station and the UK's highest restaurant was withdrawn on Friday 25 August to enable a series of snagging works to be carried out.

This followed an inspection showing that some of the 'scarf joint assemblies' that link the beams at the top of the piers did not meet the required tension.

According to Highlands and Islands Enterprise (HIE), which owns Cairngorm Estate, work to increase the tension of these assemblies is progressing well.

Further inspection work has been completed and a series of trials using specialist equipment proved successful. Testing will be done continually as the tensioning work progresses.

The funicular had been relaunched in January this year, following a two-year programme of works to strengthen the viaduct that supports the railway track.

A 12-month snagging and inspection programme has been running since the relaunch, as is usual practice with complex engineering projects.

A spokesperson for HIE said: "Every effort is being made to complete these works quickly so that the funicular can be brought back into safe use as early as possible.

"Our current expectation is that the job can be completed and the train back in service again before the end of September. The timescale will be kept under close review and we'll take every opportunity to move at pace, while maintaining safety as the top priority."

Notice there is no mention of any problem with the Type 1 brackets used to strengthen the "I" beams, until another press release (see here) on 15/04/2024;-

NEWS RELEASE ISSUED JOINTLY BY HIGHLANDS AND ISLANDS ENTERPRISE AND BALFOUR BEATTY

With the snowsports season now over, multiple teams from contractor Balfour Beatty, appointed by Cairngorm Estate owner Highlands and Islands Enterprise (HIE), are set to be deployed on the mountainside.

A prime area of focus will be hundreds of 'scarf joints' linking beams and piers along the 1.7km viaduct. These were installed as part of a major reinstatement programme that ran for just over two years from November 2020.

In addition, testing is under way on tensioning works to beams and diaphragms that were also installed as part of the reinstatement programme and remedial action will be taken as required.

The funicular was initially withdrawn over safety concerns in October 2018, but came back into service in January 2023.

In August of that year, however, the service was again stopped after several scarf joints were found to be below the specified tension.

Para. 3 refers to "*tensioning works to beams and diaphragms".* "*Beams"* obviously refers to the concrete "I" beams, presumably "*diaphragms"* therefore are the insitu concrete joints. It looks as though HIE may have deliberately changed their names for different parts of the funicular structure in order to confuse the ordinary person.

You cannot test the tension, however, until **AFTER** works are completed! If the tension is not as required **THEN** you carry out adjustments until the correct tensioning is obtained. The claim in March that *"testing is under way on tensioning works"* therefore appears another load of nonsense

If that tensioning work was ever completed it now has to be done all over again as almost all of the Type 1 brackets have been removed as shown in the photos above of Type 1 brackets lying on the ground.

There were also some parts of brackets lying on the funicular beam and on the scaffolding at the passing loop:

Para 6. *“We are working hard……multiple teams…….to resume service before the next winter snowsports season”.*

We saw TWO teams working but maybe the *“multiple teams”* is because people are working at all hours and seven days a week?

The next screenshot is from CMSL’s accounts which have been recently published and is part of the chairman’s statement of 31/03/2024 :-

When I was writing last year's Chairman's Statement it was looking like we were beginning to get back into a steady state; the funicular had re-opened, we were through Covid, the cost of living crisis was easing and our continuing investment in the business was showing encouraging results. The funicular was in service from 26 January 2023 to 24 August 2023, it was running for 193 days and carried 60,666 customers. Sadly, the service had to be suspended when a routine inspection found that the tension in some scarf joints was below the recommended level.

Remedial work began almost immediately, but as this progressed it became clear that with the winter weather closing in it would not be completed in 2023. If work, particularly grouting which requires a warmer temperature, is not completed in the "weather window" much of it has to wait for better conditions in the spring. The funicular is vital for the year round trips for visitors to the Ptarmigan as well as our capacity in the winter so we had to restrict ticket sales due to crowding at choke points and for health and safety reasons. Added to that, snow conditions were difficult. While there was good cover at the top, there was generally insufficient snow to allow our lower tows to operate and thus we could not get people up to the snow. Some hardy souls were walking up (and down again) but it was far from ideal.

As all the removed brackets are refitted or replaced grout needs to be inserted between them and the the concrete. An extract from the third picture shows where the grout has been:

There are four blobs of grout on each plate

If regrouting the brackets is not possible in winter as the chair of CM(S)L Peter Mearns claims, not only was his statement in March that the funicular would *"Resume service before the next winter snowsport season"* wrong, it means all the latest claims from HIE/CM(S)L that it will re-open this winter must also be untrue. So, why are they trying to convince their loyal customers to buy season passes when their chairman has effectively explained that the current work will not be finished before spring 2024?

By my reckoning over 800 of the 917 Type 1 brackets had been removed from the "I" beams by the time of my visit, all of which have to be replaced, tensioned, tested THEN adjustments made and re-tested!

Material issues with the brackets.

The nuts and studding used in the brackets are made of stainless steel which has a very low rate of heat conductivity and is a notoriously difficult material to work with:

(a) when cutting or drilling stainless steel it will eat angle grinder discs, hacksaw blades and drill bits, and/or;

(b) when fastening or removing nuts using powered equipment such as an impact driver – as in the case of the brackets on the funicular – the threads tend to overheat, deform, jam or spall which can result in either the studding snapping or having to be cut with an angle grinder.

The fact that new metal studding (see photo above) is being used suggests that this is what has happened with the brackets round the beams. The way to prevent this is to use either water or a thin oil as a lubricant, although even that can alter the tightening torques, but this would require the work to progress more slowly. Water is actually preferable as you can see the steam if the work gets too hot!

The other major problem with these works is the varying temperatures on the day a bracket is tensioned. On a hot day the steel will have expanded slightly which when cooling increases the tension and therefore pressure on the concrete that it is supposed to be strengthening. Conversely tightening/ tensioning on a cold day means the tension will be changed/ reduced again on the next hot day. This cycle could happen several times a day AND have different effects depending on which side of the beam is in shade.

Conclusion.

The fitting of the stainless steel and galvanised brackets has one function, to try to strengthen the concrete "I" beams and this could have worked in a less hostile environment. The temperature range on Cairn Gorm however can vary by as much as 58°c and that will continue to cause problems no matter how much steel is added.

Concrete was not a suitable material with which to build the funicular (see here) and there appear to be other problems with the "I" beams which I will discuss in the next post.

I'd like here to take the opportunity to thank Mr Ian Joy an experienced project manager who, at my request, gave an interview to the Press & Journal (see here) about his experience of being interviewed as manager for Cairn Gorm.

> The longtime skiier started out on the slopes at Glenshee in 1964, and regularly visited Cairngorm in the 1970s and 1980s.
>
> As someone with extensive project management expertise for several oil and gas firms, Mr Joy is dismayed by what he branded HIE's mismanagement.
>
> "There's been no oversight of quality control," he says.
>
> "There's been nobody looking over people's shoulders and seeing that the work is carried out correctly."

Extract from P and J article

I have also been in contact with other civil engineers and people who worked on the initial build and it appears that some of them may now prepared to follow My Joy's example.

Category

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Tags

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