

COWI

Cairngorm Funicular Railway

Railway Dismantling Budget



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Cairngorm Mountain Funicular Railway

Preparation of an Indicative Budget & Programme for Dismantling of the Railway

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Introduction

COWI have been commissioned by Highlands and Islands Enterprise (HIE) to carry out consultancy services in relation to the Cairngorm Funicular Railway.

The Cairngorm Funicular Railway was opened in 2001 and has a 2km route from a base station at an elevation of 635m to a top station at an elevation of 1,097m.

The railway is owned by HIE and was operated under a long-term lease arrangement by Cairngorm Mountain Limited (CML), a subsidiary of Natural Retreats. During inspections in 2018 aspects of the condition of the asset caused concern and COWI has been engaged to carry out a detailed engineering assessment of the railway and recommend remedial works. Such is the concern about the condition that the railway has been closed to the public in October 2018, with the operator (CML) subsequently placed into administration.

BAM has provided technical and budgetary advice to COWI in relation to the proposed repair works and has now been requested to provide an indicative cost for the dismantling of the railway at end of life in order to inform the investment decision making process by owner HIE.

This report summarises the work done by BAM and the conclusions reached in regard to the cost and time required for dismantling of the railway.

Background and purpose

The Cairngorm Funicular Railway was opened in 2001 and has a 2km route from a base station at an elevation of 635m to a top station at an elevation of 1,097m.

As the owner of the asset HIE have an obligation to dismantle and remove the funicular railway at the end of its operational life.

Currently HIE have only limited information on the likely cost of this work and wish to have a clearer understanding of this as part of the current decision making process for the future of the railway on Cairngorm Mountain.

The budget study will look at the operations needed to dismantle the railway infrastructure from rail level down on the basis that certain initial operations will be undertaken by the staff of Cairngorm Mountain, who are most familiar with these activities.

Extent of the Dismantling Work

The extent of the dismantling work considered by BAM is:

- Removal of rails, plus electrical and communication systems.
- Removal of all beams between the base station and the tunnel
- Removal of all crossheads.
- Removal of all piers to foundation base level and reinstatement of existing ground over bases
- Removal of all anchor blocks to 0.2m below existing ground level
- Demolition of mid station passenger drop off infrastructure
- Demolition of the tunnel to the top station, including the cast insitu concrete base slab.

Scope of work undertaken by BAM

The scope of works undertaken by BAM is;

- Attend site visit with Cairngorm Mountain.
- Review design drawings provided by COWI for the existing structure.
- Undertake basic planning of the dismantling operations
- Prepare an outline programme for the dismantling works
- Engage with their supply chain to determine budget prices for specialist services.
- Develop a budget price for undertaking these works, including a sensitivity analysis for variations in production rates and weather downtime.
- Prepare a list of key assumptions and clarifications that have been used in the development of the outline programme and budget price.

Input data

In undertaking this commission BAM has relied upon the following documents:

- CA150/2/11 to 17 Longitudinal section Sheets 1 to 7.
- CA150/2/31 to 33 Funicular Plan Sheets 1 to 3
- CA150/2/80 to 85 Detailed Plan of Funicular Railway Sheets 1 to 7
- CA150/2/55 Earthworks / Landscaping at Tunnel Entrance
- CA150/2/44 & 45 Tower Elevations
- CA150/2/51 & 52 Tunnel Details

In order to arrive at the quantities of work involved in the dismantling we have relied upon these drawings and have, where necessary scaled from the drawings in order to determine approximate quantities for the work to be done.

Deliverables

BAM has prepared the following deliverables, which are included in the Appendices to this report:

- Schedule of assumptions used in preparing the programme and budget for the proposed remedial works (Appendix A)
- Outline programme for undertaking the dismantling work (Appendix B)
- Budget price for undertaking the dismantling work (Appendix C)

Summary of Conclusions

Based on the work done to date BAM has determined that:

- The cost of dismantling the funicular railway, excluding the removal of the carriages and rope system, is expected to lie in the following range (based on current prices):

Probably Best Case	£8,500,000	Assumes 4 weeks weather downtime. 2 seasons required.
Most Likely	£10,500,000	Assumes 7 weeks weather downtime 2 seasons required.
Probably Worst Case	£13,300,000	Assume 11 weeks weather downtime 3 seasons required.

- It is expected that two seasons will be required for the dismantling work, based on a contract award being made in the autumn of the preceding year.

The cable crane supplier has advised us that there is an option for a larger cable crane, which would then allow the beams to be removed from the structure in pairs, thereby speeding up the dismantling process. It is possible that this will allow the work to be completed more rapidly such that it can be undertaken in a single season; however it is thought that this would be very challenging to achieve. In order to assess the feasibility of this option a more detailed analysis would need to be undertaken of the work involved in rigging the crane, with further input from the crane supplier, plus the likely time saving that could be achieved with the greater lifting capacity.

Appendix A – Schedule of Assumptions & Clarifications

- 1 The working season will run from the start of April to the end of October each year.
- 2 Adequate storage and welfare areas will be made available at the Lower Carpark, Shieling and if necessary the Ptarmigan area.
- 3 Dismantling will be undertaken using a cable crane system similar to the one used for construction as the primary lifting device. This comprises two separate cranes with a tran time saving that could be achieved with the greater lifting capacitysituation area near the mid station.
- 4 The journey time for a load on the cable crane system is expected to be circa 30 minutes from top to bottom.
- 5 Each cable crane requires a three person crew to operate it.
- 6 Costs for cable crane rigging are provisional only as it has not been possible to develop details of the foundations and towers required for this part of the work.
- 7 Whilst ground disturbance will be kept to a minimum, we have made no provision for other environmental constraints beyond the use of spider excavators, low ground pressure (LGP) equipment and run-off silt screens
- 8 We have made provision for setting aside the top peat for reinstatement at the end of the work.
- 9 The two railway carriages and the rope system for propelling them will be removed by the Cairngorm Mountain team and no allowance has been made for this work in the estimate.
- 10 Steel cross bracings will be removed using a purpose built access platform lifted in by the cable crane, similar to that used during construction.
- 11 The concrete structure will be cut into sections small enough to be lifted out by the cable crane using dry concrete cutting techniques. This will require encapsulation of the access scaffolds in order to contain the dust from the operations for removal offsite.
- 12 All materials will be recovered to the car park at the base station. There they will be stockpiled before being moved offsite to a location in Strathspey where the materials can be processed and recycled.
- 13 Notwithstanding our obligation to mitigate noise, we have not made provision for specific noise reduction measures beyond those usually expected in urban areas.
- 14 Beams will be lifted out individually, but with power cables and rail track still attached for final dismantling
- 15 Temporary propping will be required to all piers during cutting operations to ensure stability
- 16 Cross heads will be lifted out with the piers as a single item, other than for the largest piers, where the pier will be cut at part height in order to reduce the weight of the lift.
- 17 Excavation will be undertaken to expose the pier foundations and the piers cut at foundation level.
- 18 We have assumed the ground is sufficiently stable for the excavation sides to be battered, with no need for temporary support equipment
- 19 For this operation we have assumed the use of LGP excavation plant below the Shieling and spider type excavation equipment above it.
- 20 Pier foundations will be left in place and covered with the excavated material and topsoil. No allowance has been made for importing fill material to these locations.
- 21 Anchor blocks will be broken out to ~0.25m below existing ground level and backfill placed over them.
- 22 The tunnel structure will be removed in full between the tunnel mouth and chainage 1750m. The resulting void will then be backfilled up to original ground level for this area.
- 23 The roof of the tunnel only will be removed from chainage 1750m to the Ptarmigan restaurant and the resulting void backfilled up to existing ground level.

- 24 The concrete and steel material removed as part of the tunnel demolition will be removed from the hill via the access road using AT dumper trucks.
- 25 The material required to backfill the tunnel section following removal of the tunnel structure can be sourced from the area around the tunnel using the material originally excavated. No allowance has been made for importing material to this area.
- 26 An allowance for weather downtime has been made as follows:
 - 4 weeks in year 1
 - 3 weeks in year 2

Appendix B – Outline Programme

Attached separately. Titled: 190502 CAIRNGORM FUNICULAR RAILWAY DISMANTLING v1

Cairngorm Funicular Track & Tunnel Dismantling -Outline Programme

Programme commentary:

Cable Crane

Rigging of the cable crane will be undertaken at the start of the first season, with the lower crane being erected first and the upper crane installed as soon as the snow conditions permit.

The scope of the primary towers and associated foundations for the crane are unclear at present, therefore an 8 week period has been allowed for the operation to erect the cranes and to commission them.

At the end of the first season the cable crane will be secured for the winter, the mobile plant placed off hire and the office and accommodation units left in position in the lower car park.

Track Dismantling

The logic adopted in the sequencing of the works is that two fronts will be established for the purpose of dismantling the track.

One will work from the tunnel entrance down to the mid station and one from the mid station down to the base station.

The sequence of the works will be as follows using a number of different squads:

- Squad Type 1:
 - Strip out steel cross bracing from between beams
 - 2 No. squads required
- Squad Type 2:
 - Cut cross braces at each end and lift clear
 - Cut beams at downhill end (other than for first pair of beams) and lift clear
 - 2 No. squads required
- Squad Type 3:
 - Cut piers at foundation level (additional cut at part height may be required for some piers)
 - These squads will also undertake the demolition of the anchor blocks to below ground level.
 - 2 No. squads required
- Squad Type 4:
 - Provision of scaffold access to above teams
 - 1 No. squad required
- Squad Type 5:
 - Logistics support to above teams
 - 1 No. squad required
- Squad Type 6
 - Operation of cable cranes
 - 2 No. squads required

Tunnel Demolition

The tunnel demolition sequence will be:

- Remove overburden to expose corrugated steel tunnel roof
- Break out concrete tunnel mouth structure
- Break out concrete tunnel walls and base slab up to chainage 1750m
- Reinstate along the line of the tunnel using material previously excavated during forming of tunnel

Appendix C – Indicative Budget Price

Our estimated budget is for the dismantling of the railway is:

Probable Best Case	£8,500,000	Assumes 4 weeks weather downtime. 2 seasons required.
Most Likely	£10,500,000	Assumes 7 weeks weather downtime 2 seasons required.
Probable Worst Case	£13,300,000	Assume 11 weeks weather downtime, plus third season required

We have included 5% for General Contractors Risk, plus weather risk as noted in the table above.