# A470 BLAENAU TO CANCOED IMPROVEMENT

# ARCHAEOLOGICAL RECORDING PHASE 1 PANT YR AFON GIRDER BRIDGES AND ROAD EMBANKMENT

G1874



Report number : 591

Prepared for White Young Green plc July 2005

Ymddiriedolaeth Archaeolegol Gwynedd Gwynedd Archaeological Trust

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By

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# ARCHAEOLOGICAL RECORDING – PHASE 1 – PANT YR AFON GIRDER BRIDGES AND ROAD EMBANKMENT

#### Summary

This report contains the results of the first phase of archaeological recording at Pant yr Afon, Llechwedd Quarries comprising detailed recording of the superstructure of the girder bridges leading from the former LNWR line to the exchange yard and detailed recording of the revetment wall and associated tunnels beneath the present A470.

## **1. INTRODUCTION**

Gwynedd archaeological Trust was contracted by White Young Green on behalf of Gwynedd Council to carry out a programme of archaeological mitigation in advance of improvement works on the A470 between Blaenau and Cancoed.

An initial survey of the proposed improvements was undertaken in 1992 (GAT project G1070), as part of a wider assessment that examined the proposed improvements from Blaenau Ffestiniog to Betws y Coed. The assessment was updated in 1995 to take into account minor changes to the improvements, changes in site condition, and to ensure conformity with *Design Manual for Roads and Bridges, Volume 11, Section 3, Part 2* (GAT Project G1286). Subsequent field visits were made in 1996, 1999 and 2000 (GAT Projects G1413 and G1614). The results of the final assessment formed Technical Appendix B *Cultural Heritage* of Volume 2 of the Environmental Statement (July 2003).

Llechwedd Exchange sidings and the hydroelectric power station are part of a nationally important complex of industrial structures and transport systems (Fig. 1). The Power Station is Grade II\* listed and the girder bridges Grade II. The area is included in the Cadw, ICOMOS & CCW Register of Landscapes of Special Historic Interest in Wales.

This report contains the results of the first phase of this programme comprising: Detailed recording of the superstructure of the girder bridges leading from the former LNWR line to the exchange yard and detailed recording of the revetment wall and associated tunnels beneath the present A470.

## 2. METHODOLOGY

The Llechwedd Exchange Sidings contain over 30 different elements. This stage of the project entails detailed recording of the girder bridge superstructures, the road revetment and the three tunnels running beneath the road along with a plan of the area.

Detailed recording is defined in the project design as:

Detailed recording requires a photographic record, surveying and the production of a measured drawing prior to the commencement of the works on site. Plans and elevation drawings will be completed for standing structures, though these will not consist of a stone-by-stone record, though specific features will be noted. Archaeological excavation works may also be required depending upon the particular feature and the extent and effect of the impact. Some of the sites would require additional recording if they are to be subsequently dismantled by hand, to provide a detailed record of the method of construction and in the case of a listed structure, for re-use and re-building.

A full and detailed photographic record and elevation drawing of the revetment wall was not produced at this stage because parts of the structure are obscured by trees. The following techniques and levels of recording of the required features are noted below.

#### Girder bridges

A plan was produced using a total station with additional details added by hand (Figs 2 and 5). A photographic and hand drawn record was made of all accessible elevations. Written descriptions were produced.

## Revetment wall

Gwynedd Council drawing 192/52/1 was used as a basic reference and outline elevation and details were added by hand. A photographic record was made of all accessible elevations and written descriptions were made of all details of the elevation and tunnels. A full and detailed total station survey is still required for this feature.

#### Area plan

A detailed plan was produced, as noted above, of the girder bridges along with the general area of the sidings. This was supplemented by details taken from Gwynedd Council plan 192/DIV/1 in order to allow outlying features to be tied into the detailed plan of the sidings and bridges. The plan of the road embankment was based on the GC plan with additional measured details added by hand.

# **3. RESULTS**

A specialist report describing the two girder bridges was produced by Dr Ron Fitzgerald of Structural Perspectives as part of the preparation of the Conservation Management Plan for the Pant yr Afon Site (Govannon consultancy 2005). This has informed the descriptions of the two bridges that follow. Specific details quoted from the report are referenced accordingly.

## 1.1. Bridge 67 (Figs 2 to 4)

Bridge 67 (Plate 1) crosses the tramway cutting. The sides of the tramway cutting are revetted with dry slate walls. The abutment masonry of the bridge is of a similar type. The span of the bridge is 3.43m and it crosses at an angle of  $43^{\circ}30$ ' to the normal (Fitzgerald, *c*.2005). It is 4.57m wide (deck width). Parapet turrets of mortared, roughly dressed slate stand above the abutments

The bridge consists of six cast iron girders. The outer two girders are 7.01 long with an inverted T cross-section. The upper flange is 0.23m wide and 0.025m deep and the lower is 0.25m wide and 0.038m deep. The total depth of each girder is 0.42m. The outer face is divided into four equal sized, decorative panels, emulating wooden panel-work (Plate 2). Each panel is 1.52m long and they are divided by vertical stiffener ribs. Two further, smaller, panels project into the parapet turret masonry and are thus largely obscured. The girders support a parapet railing consisting of three cast iron stanchions (0.92m high) on the south-western side and five on the north-eastern. All are bolted onto the girder with the base straddling the stiffener ribs. Three railings run through holes in the stanchions. On the north-eastern side they terminate in the holes in the turrets and on the south-east they are free. Three of the turrets are hexagonal in plan along with an irregular pentagonal turret that is shared with the former LNWR line bridge. All have their longest side parallel to the track bed. They stand to a height of about 1.05m above the top of the girders and are typically 1.23m wide (Plates 3 and 4). They are built from roughly dressed slate blocks with distinctive chisel cut corners and a large capstone with chamfered upper corners. The turret adjacent to the former LNWR line is 1.6m long and stands above the girders of both bridge 67 and the LNWR line bridge.

The four central cast iron girders are the live load bearing elements of the superstructure. Each girder is 7.01m long and 0.42m deep. The lower flange is 0.31m wide and 0.076m deep and the upper 0.079 wide and 0.025 deep. This inverted T shape is termed a Hodgkinson Section (Fitzgerald, *c*.2005) and Tower 1874). The upper flange is extended down to the lower at he ends of the girders producing a distinctive chamfered termination (Plate 5). Most of the rest of the superstructure is of wood, much of which is now in a poor condition (Plate 1). This does however allow further constructional details to be seen. A single track passed across the bridge and each rail was laid on a continuous longitudinal timber baulk (Fitzgerald, *c*.2005) set between each pair of main load bearing girders and resting on the lower flange. Each girder/baulk assembly is held together by three transverse tie bars running through the girder web and the timber baulk. The rest of the width of the bridge is infilled with three plank walkways supported by transverse timber joists. The central walkway has now largely collapsed.

## 3.2 Bridge 68 (Figs 6 to 8)

The Afon Barlwyd is 5.18m wide and runs between dry-slate rubble walls, until a point about 3m to the south of bridge 68. The bridge abutments are earlier than the slate walls and are constructed from roughly dressed slate blocks intermixed with slate rubble. The walls are mortared. Chisel cut corners are again a feature of the construction. The upper course of the abutment is of more precisely dressed slate. The bridge span stands 2.29m above the river bed. The width of the deck is 6.48m and the bridge is skewed across the river at an angle of 55°00'

The superstructure (Plate 6) is more substantial than that of bridge 67 although they share many constructional details such as the presence of 6 cast iron girders. Bridge 68 is in much better condition and details of the 4 central girders carrying the line load are not visible due to the presence of crushed slate ballast above and brickwork below.

The outer pair of girders have a visible length of 6.91m (south-eastern side) and 7.17 (north-western side) and both extend into the masonry of the superstructure for an unknown distance. The upper flange of the girder is 0.2 wide and 0.04m deep and the lower flange 0.38m wide and 0.05 deep. The total depth of each girder is 0.72m. The outer faces of the girders are divided into five 1.67m wide decorative panels simulating wooden panel-work and are divided by vertical stiffener ribs (Plate 8).

Only the bottoms of the inner 4 girders are visible (Plate 9). The lower flange is 0.46m wide and 0.05 deep indicating that the main load bearing girders are, as in bridge 67, of a different design to the outer. The 6 girders are equally spaced and are linked by brick

arches springing from their lower flanges. The rise of the arch is probably 6 inches (0.15m) (Fitzgerald, c.2005).

The outer girders are again surmounted by iron parapet railings. The railings are similar to those on bridge 67 but are 1.06m tall, the lower section having been extended in order to reach above a timber baulk laid on top of the outer girders. This retains the trackbed ballast. The current timbers are re-used sleepers but this arrangement dates back to when the siding was operational; an identical layout can be seen on Bleasdale's photograph of 1879 (Fig 10 from Spooner Album plate 38).

The upper part of the parapet turrets are hexagonal and similar to those on Bridge 67. Below this level, however, the turrets step out by 0.08m at the height of the trackbed and again to form one side of the bridge abutment. A consistent masonry style is used throughout consisting of roughly dressed slate blocks with more ornate chiselled edges marking the corners of the various changes in width of masonry. The masonry is mortared although most of the joints have separated in the turrets of both bridges.

Three wooden sleepers are still present on the top of the bridge. It is not clear whether if these are *in situ*. Two concrete gate posts standing between bridges 67 and 68 mark the former boundary of LNWR and Greaves' property.

#### 3.3. The revetment wall and tunnels (Figs 9 to 11)

The current A470 is carried through Pont yr Afon on a raised embankment standing to a maximum of 7.3m in height (Plates 13 and 14). The walls of the embankment contain two basic masonry styles (Plate 15) with later modifications. The lower 2 to 3 metres consists of large irregular blocks of mixed stone (mainly low-grade slate) built to a rough face. This is only visible on the western side because a later dwarf wall obscures the lower part of the eastern elevation. The upper part of the wall, up to the level of the roadbed consists of irregular slate slab masonry built to a good face but incorporating fairly regularly spaced, protruding stones. The roadside parapet is of dry-laid slate slab masonry but without the protruding stones (Plate 16). The coping varies between large flat slabs, edge-set blocks and irregular edge-set rough slabs. The parapet is a drystone construction but all of the rest of the masonry is either pointed or rendered with spray concrete (Plate 17). A part of the eastern elevation was, until recently obscured by slate spoil. This has been eroded away during recent floods revealing dry-slate-slab masonry with obvious signs of modern pointing above (Plate 18). The currently visible pointing is clearly not a feature of the original masonry and it is possible that the entire embankment was originally drystone and that it has been pointed and rendered fairly recently. The facing walls are built to a fairly pronounced batter. The top of the western side is estimated to be set back about 0.5m from the base. There are two pairs of shallow rectangular piers (see Plate 13) extending from the face of the embankment. These appear to mark straight unbonded joints in the facing and clearly extend into the body of the viaduct. These may indicate that the embankment, or at least its facing, was constructed in series of sections. A series of six narrow (0.22m wide) strips of unrendered facing (see Plate 14) on the eastern side of the embankment seem to indicate that structures or timbers were formerly attached to this face. Nothing remains to indicate their form or function.

Three tunnels run under the base of the embankment. The incline and Ffestiniog Railway/Llechwedd connecting link tunnel is at the north, the Afon Barlwyd tunnel in the centre and the tunnel carrying the  $1'11'/_2$ " railway from the incline to the sidings is at the south. The latter also contains the pipeline running to the power house. The individual tunnels are described below.

#### 3.4. The incline tunnel

This stands close to the base of the incline from the Llechwedd quarry and carried the 1'11½" railway to a link with the Ffestiniog Railway. The arch on the western side is still open (Plate 19). This consists of very rough uncut slate voussoirs (stones forming the arch) with an equally rough uncut keystone. The arch is set at a slight angle to the embankment wall, the southern side undercuts some of the masonry and is set back by 0.9m. The arch springs from rough black masonry of the same style as the lower 2m of the embankment. The inside of the tunnel has been spray concrete rendered and partially blocked 3.0m from the tunnel mouth by a reinforced concrete deck. This reduces the height of the tunnel to 1.5m. There are several pieces of ironwork protruding through the deck at the centre of the tunnel but their function is unknown. The space above the deck is apparently infilled with stone (Plate 20).

The reduced tunnel can be followed until it emerges from beneath the dwarf wall (Plate 21). This end of the tunnel is 2m wide and mostly below the current ground level and is almost completely blocked with slate rubble. Only a small opening, level with the upper part the tunnel and the also the current ground surface is now present. The side-walls continue beyond the tunnel mouth but are now buried beneath slate waste. This indicates that access to the tunnel was through a cutting below the level of the current ground surface. The modification to the tunnel may have been a result of instability in the arch. A date of 1935 is painted on the tunnel roof close to the eastern end.

## 3.5. The Afon Barlwyd Tunnel

The tunnel carrying the Afon Barlwyd beneath the viaduct consists of two phases of masonry. The arch on the eastern side lies at an angle to the road embankment and protrudes by around 3.5m from the main embankment wall (Plate 22). The masonry has

been spray rendered making it difficult to see details of the stonework. The most obvious element is a large protruding keystone. The arch is 5.5m wide and stands 2.95 above the river bed. The river bed consists of pitched slate blocks, presumable to minimise erosion. The interior of the tunnel has also been roughly rendered/pointed but a corresponding keystone and a straight joint in the masonry are clearly visible within the soffit 5.5m from the western mouth (Plate 23). The eastern half of the tunnel is clearly an earlier phase of building and the fact that the arch on the eastern side is not aligned to the embankment suggests that this may be the remains of an earlier bridge, perhaps indicating the line and level of the road before the embankment was constructed. Further documentary research will be needed in order to examine further the phasing of these features. Several stubs of iron protruding from the roof indicate that gratings had been fixed across the tunnel.

The tunnel continues for a further 3.15m before exiting through an archway on the western side (Plate 24). This is of a different construction with prominent, regularly sized, either natural or roughly dressed, voussoirs and a smaller keystone than on the eastern side. The lower rough block masonry on the embankment face extends to above the archway. The embankment is not battered above the arch and is thus set back from the rest of the face by 0.5m at the base of the wall.

#### 3.6. The Llechwedd/sidings link tunnel

This tunnel is of a markedly different construction to the other two. It consists of a segmented brick arch consisting of four unbonded courses, springing from stone piers (Plates 25 and 26). The tunnel runs at an angle through the embankment. Rectangular piers extend from the facing 0.45m to either side of the archways on both the east and west side and a series of slate slabs run above the brickwork on both sides. The tunnel is 2.02m high and 4.3m wide. The roof of the tunnel is showing signs of sagging in places.

#### 4. CONCLUSIONS

The road embankment and associated tunnels has been shown to be a complex multiphase structure. The history of the road is outlined in the Conservation management plan (Govannon 2005). A roadway close to the present alignment is shown on the draft 2" to 1 mile Ordnance Survey map from 1818. An alignment that appears to match closely the present road is marked on a plan of 1863 and it is recorded that in 1854 J W Greaves paid towards the cost of a bridge for the road to cross the incline. It appears that the present embankment was engineered post-1863 under the auspices of the Porthmadog and Beaver Pool Turnpike Trust. Further documentary research is required to link these events with the various phases of masonry that have been recorded in the present report. This will be carried out in the next phase of the current project

## 5. REFERENCES

Ffestiniog Railway Heritage Group, 2003. The Spooner Album

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Fig. 2 Plan of Girder Bridge 67











Fig. 5 Plan of Girder Bridge 68



east facing elevation

parapet turret

parapet turret



Fig. 6 Girder Bridge 68, western side



Fig. 7 Girder Bridge 68, eastern side

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Plate 1 Bridge 67, general view



Plate 2 Bridge 67, girder panel E side



Plate 3 Bridge 67, parapet turret and railings E side, W facing



Plate 4 Bridge 67, parapet turret W side, E facing



Plate 5 Bridge 67, girder end fitted to baulk



Plate 6 Bridge 68, general view



Plate 7 Bridge 68, general view



Plate 8 Bridge 68, girder panel E side



Plate 9 Bridge 68, underside



Plate 10 Bridge 68, by Bleasdale 1879



Plate 11 Bridge 68, parapet turret E side, E facing



Plate 12 Bridge 68, parapet turret E side , W facing



Plate 13 Road embankment, W side



Plate 14 Road embankment, E side



Plate 15 Masonry styles; mixed stone below, slate above



Plate 16 Masonry styles; slate with spray concrete render and pointing



Plate 17 Masonry styles; earlier drystone masonry exposed by erosion



Plate 18 Masonry styles; roadside parapet, dry laid slate



Plate 19 Incline tunnel, W side



Plate 20 Incline tunnel, W side, partial blocking within tunnel



Plate 21 Incline tunnel, E side



Plate 22 Afon Barlwyd tunnel, E side



Plate 23 Afon Barlwyd tunnel, two phases of masonry within roof



Plate 24 Afon Barlwyd tunnel, W side



Plate 25 Llechwedd / sidings link tunnel, E side



Plate 26 Llechwedd / sidings link tunnel, W side

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