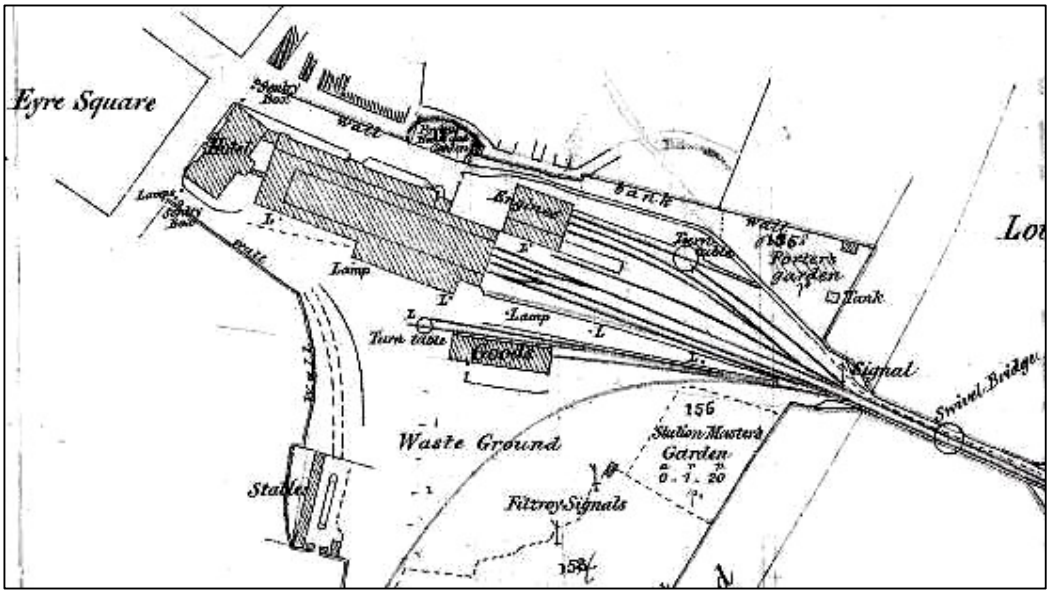
Archaeological Report on Lough Atalia Underbridge (UBG170), Galway, including Monitoring of Trial Hole.

Reference: Pre-Planning

Client: Tobin Consulting Engineers, Fairgreen House, Galway



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General Introduction

This report was prepared by the writer on behalf of Tobin Consulting Engineers, Galway. It concerns an architectural report on the railway underbridge at Lough Atalia (UBG 170) and the monitoring of the excavation of a single trial hole adjacent to the bridge.

It has been proposed that the surface of the road running under the railway line at Lough Atalia be lowered, to facilitate the safer movement of large vehicles under the bridge. In response to this proposal, Galway City Council requested that an architectural conservation assessment be undertaken on the underbridge and that trial holes be excavated in order to ascertain the extent of the sub-surface masonry associated with the bridge. A single trial hole was excavated adjacent to the bridge on Tuesday, 29th June, 2010[1]. A further four engineering trial holes were excavated on 9-10th June, 2011.

Brief

Dr Jim Higgins, Heritage Officer, Galway City Council, in response to the proposed development, requested an architectural conservation report on the underbridge and also requested that trial holes be excavated to establish the nature and extent of the sub-surface element of the bridge structure. Dr Higgins recommended that the monitoring of the excavations should be carried out by an archaeologist.

Historical Information[2]

Though it is almost unimaginable today to separate the two concepts, railways and steam locomotion developed independently of each other until they were successfully paired in the early decades of the nineteenth century. The use of rails, sometimes stone-cut but also of wood, were known some 2000 years ago, from Greece and parts of the Roman Empire, where they were used as guide-lines for horse-drawn wagons.

1 The writer would like to acknowledge the assistance of Mr Brendan Rudden, Tobin Consulting Engineers.

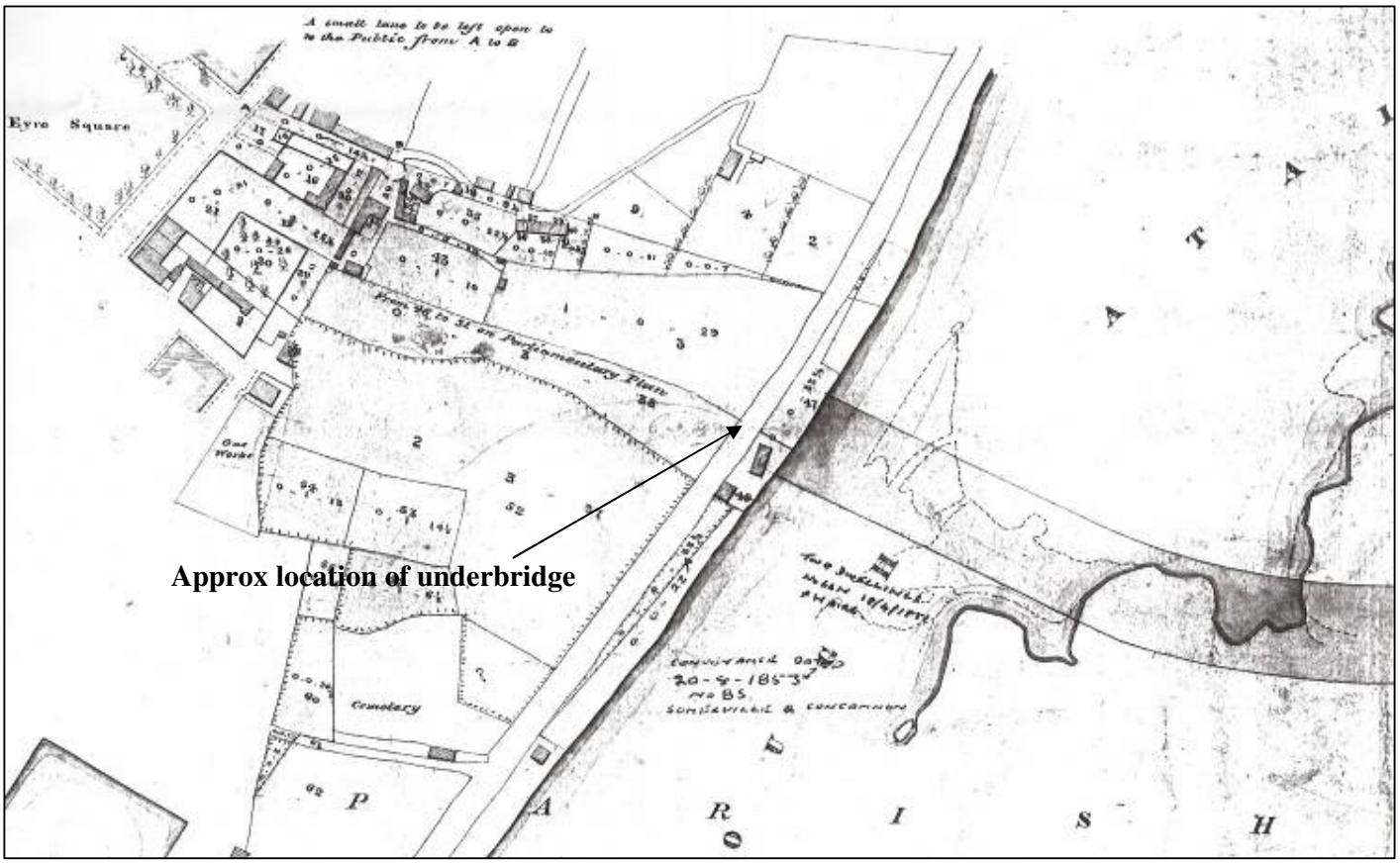
2 The writer is indebted to Rev. Dr. Norman Gamble, Hon. Secretary of the Irish Railway Record Society and to Mr Liam Conny, Senior Technical Executive, Irish Rail, for their generosity and interest. Thanks are also due to Mr Paul Duffy for his information on the bridge.

The development of the coal mining industry in Europe in the sixteenth century saw the re-introduction of animal-powered railways and they are first known in Britain from 1604. Though coal mining was not as widespread in Ireland as in Britain, such wooden railways were also known from sites where coal was extracted, principally in the north of the country, in Counties Antrim and Tyrone, as early as the mid-eighteenth century. Private collieries in Britain built their own railways with rails of oak which ran from the pithead to the nearest canal or navigable water, to transport coal. Later these wooden railways were strengthened with, and eventually replaced by, iron. The strength and durability of wrought iron in particular allowed the railway lines to cover longer distances and in 1803 the first public railway, the Surrey Iron Railway, was opened for mixed freight, all of which was transported by horse-drawn wagons.

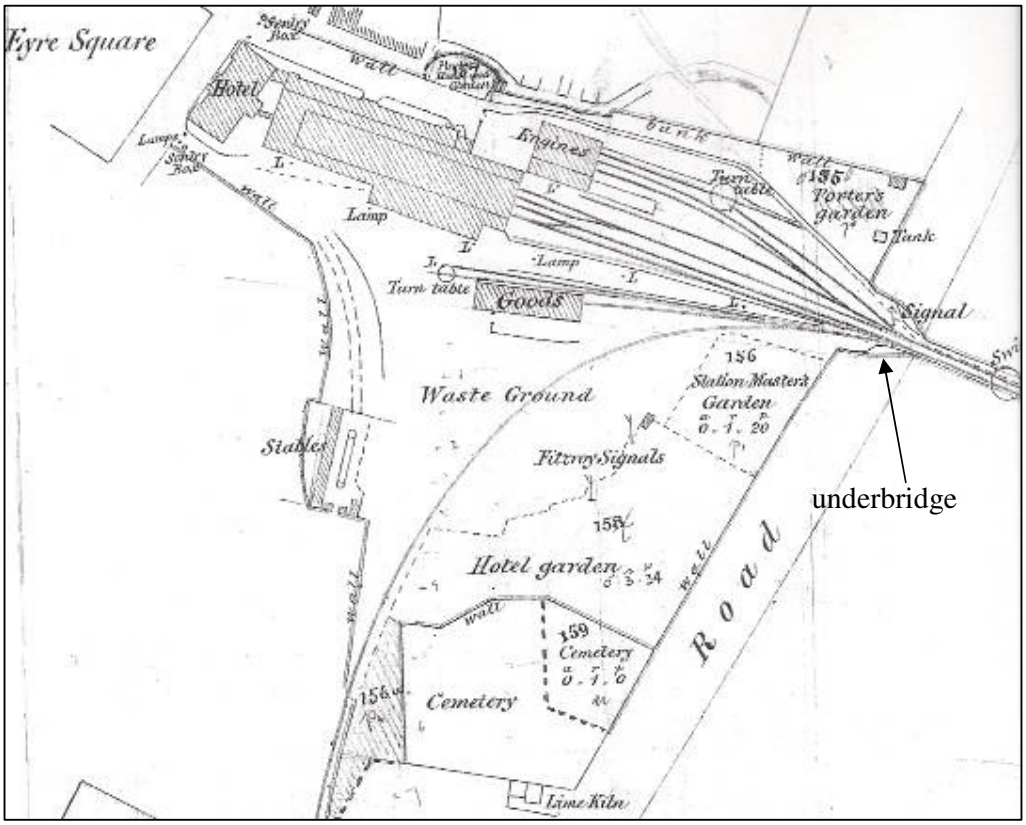
The development of the steam engine was also associated with the coal industry where it was developed as a stationary engine and was first used to pump water from deep mine shafts. Using the technology of steam, in the early nineteenth century a 'road locomotive' was tested by a Cornish engineer, Robert Trevisthick and in 1804 it was mounted on rails. Despite the success of this initial test there was no funding available for immediate development. This design inspired others in the north of England and there were several attempts to build similar machines. It was not until 1814 that George Stephenson, a colliery worker, built a more successful steam engine and by 1822 had built the first railway to operate without animal power.

Passenger railways were first established in Britain in 1825 with the opening of the Stockton & Darlington Railway, a 26-mile line that was initially seen as a method of transporting coal in horse-drawn trucks from inland coal mines to the river at Stockton-on-Tees in Northern England. Thanks to the work of George Stephenson, provision was also made on the line for the use of steam locomotives and for the carriage of passengers. The initial years of passenger transport were difficult and rife with disputes and breakdowns but it was the success of the Liverpool and Manchester Railway, opened in 1830, that inspired widespread support for this method of travel.

The railway age came to Ireland shortly after its difficult first steps in Britain. The first line to be built in Ireland was the Dublin and Kingstown Railway (D&KR), which received Royal assent in September, 1831. The engineer, Alexander Nimmo



Illus. 1 Pre-construction survey of Lough Atalia and adjacent lands.

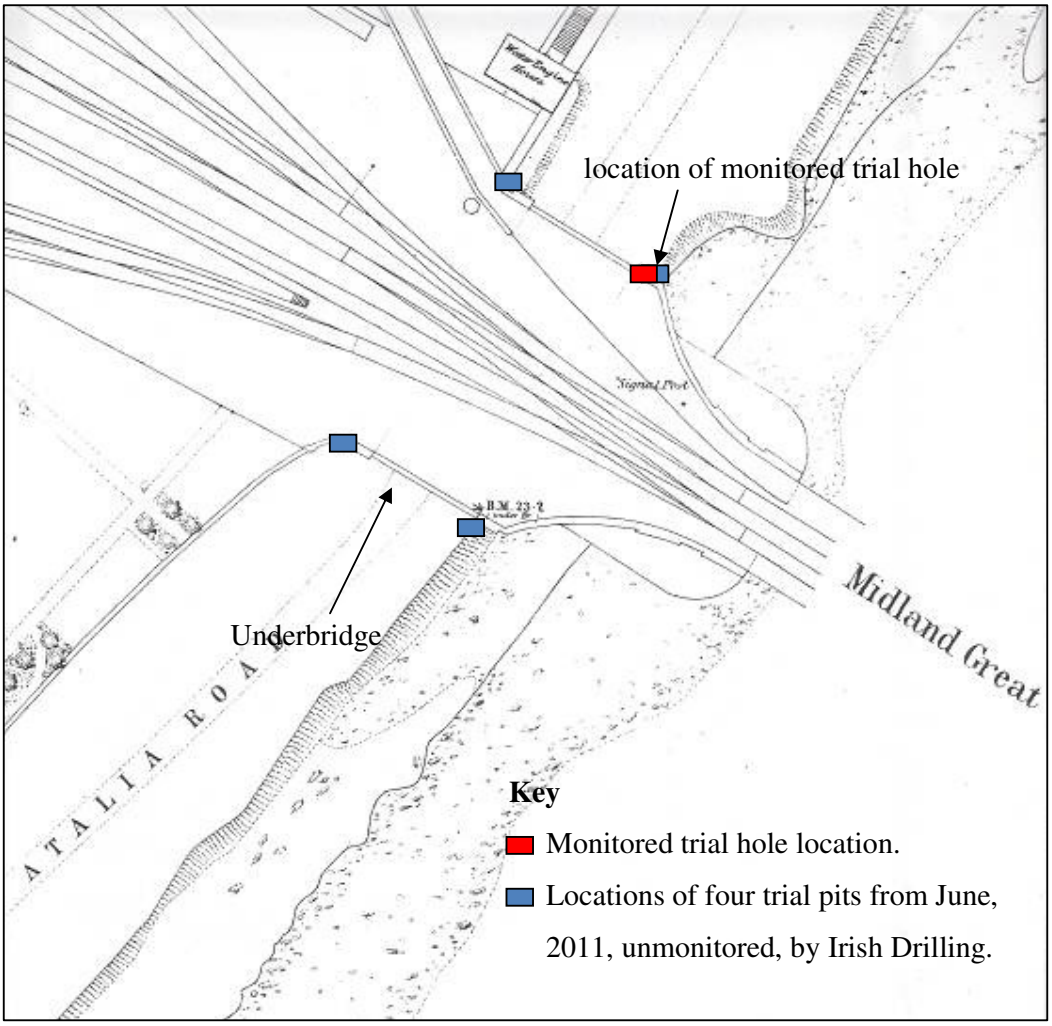


Illus. 2 Map dating to 1864, showing Lough Atalia Road and underbridge.

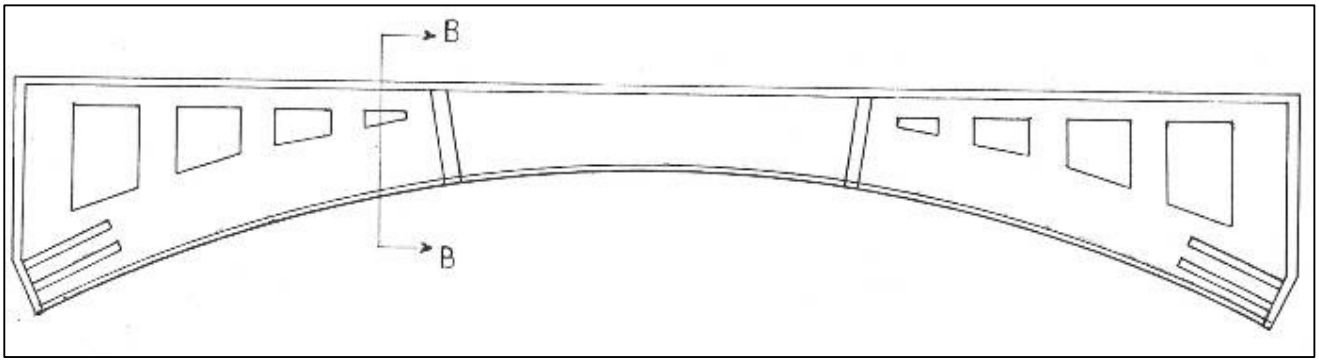
prepared an initial plan for the line but he died in 1832. Construction of the D&KR began in 1833 under Charles Vignoles. The contractor for this first railway enterprise was William Dargan and the line opened in 1834. Both Vignoles and Dargan had previously worked in Britain on railway projects. Following the success of D&KR line further railway developments were planned, such as the Belfast to Lisburn line, which was completed in August 1839, and the Dublin to Drogheda line, which opened in May 1844.

One of the features and indeed, one of the problems, with railway development in Ireland as in Britain was the prevalence of private railway companies and the rivalries between them. The line to the west was to provide one such battle ground as several schemes were proposed to cross the midlands of Ireland to the west, such as the Grand Atlantic Railway and Steam Packet Company (to reach Blacksod Bay), the Irish Western (to Galway) and the Great Central Irish Railway, proposed by Charles Vignoles in 1837. It was envisaged that such a railway would connect with a Trans-Atlantic passenger company, departing from a western point rather than from the port of Cobh. The Acts of 1846 and 1847 settled that the Midland Great Western Railway (MGWR) would construct the route, though conflict with the larger Great Southern and Western Railway (GS&WR) would continue long after the line was finished. Construction started on the first part of the line from Broadstone station in Dublin to Mullingar in January 1846 and this part of the line opened in October 1848. George Hemans was the Chief Engineer with the Midlands Great Western Railway and he encountered some difficulties in the construction of the line between Enfield and Mullingar due to deep bog but overcame them with innovative engineering.

The Mullingar to Galway part of the contract lapsed during the Great Famine but a government loan of £500,000 was secured in 1849 and works commenced in July of that year with William Dargan winning the contract. In December, 1849 the Directors of the MGWR announced that plans for a railway hotel adjacent to the station in Galway had been drawn up by John Skipton Mulvany, who was the MGWR architect and had also designed the Broadstone station in Dublin and the railway station in Galway. The Railway Hotel, now the Hotel Meyrick, was constructed as part of the contract by William Dargan and it was completed in 1851. The Mullingar to Galway line also brought engineering challenges, with the need for two large bridges, one



Illus. 3 Map of Galway City. 1872, showing Lough Atalia underbridge.



Illus. 4 Detail of Bridge from CIE works file, 1970.

over the Shannon at Athlone and the second over Lough Atalia almost at the terminus in Galway (Illus 1-3). A third bridge was needed over the River Suck in east Galway.

The bridge over the River Shannon was contracted to Fox and Henderson and Co. and by September, 1849 was under construction. The firm of Mssrs Fairbairn of Manchester were retained as ironworker contractors and they constructed the viaduct at Lough Atalia. Both firms were based in Britain and were highly regarded not only in railway engineering but in other areas of construction and engineering. Fox and Henderson were involved in railway and other engineering works in Europe, Australia, North America and South Africa as well as having constructed the famous Crystal Palace in London, also in 1851. The founder of Fairbairn's, William Fairbairn, conducted the first important studies into metal fatigue of wrought and cast iron and was an innovative ship designer and bridge engineer.

The works at Lough Atalia involved the construction of a swivel bridge across the tidal salt water lake to the east of the city[3] (Plate 2). At the insistence of the Admiralty the Lough Atalia Viaduct had to have a swinging span 157 feet long on a central column. It was opened once, for inspection and was never opened again (Rowledge, 1995, p153). It became apparent over succeeding decades that the viaduct would not be required to swing open and in 1890 it was fixed. The section of the works at Lough Atalia comprising the underbridge was carried out by James Stephen's Foundry in Merchant's Road, Galway, possibly to the patented design specified by Fairbairn[4] (Plates 1, 3-6), though is not certain that Fairbairn were involved in the design of this section[5]. It was of arch rib construction in cast iron and it spanned the road with a 40 feet 10 inch span and 78 feet in width, consisting of twenty girders, 7.5 tons each. The sides of the bridge were of masonry quarried at Merlin Park. Two plates on the bridge bear the name of James Stephens and the date, 1851 (Plate 5).

[3] There was no record of original drawings of the Lough Atalia Viaduct in the archive of the Irish Railway Record Society.

[4] Irish Architectural Archive notes that Fairbairn designed a box girder for this bridge and that Stephen's Foundry carried out the works to this design. The bridge is in fact of arch rib construction.

[5] Pers. comm. Paul Duffy.

The line was completed by July 20th 1851 with the laying of the last rail on the Shannon bridge, supervised by Hemans who then drove the locomotive *Venus* over the Viaduct. The line was further tested by running a train of ballast wagons across it with two locomotives and the inspection of the whole line was carried out on July 28th when a train ran from Dublin, double-headed by the locomotives *Juno* and *Pelican*.

The line opened without an official opening ceremony on Friday 1st August, 1851. At 76 miles from Galway to Mullingar, it was the largest section of line to open on a single day. Though some works to the underbridge at Lough Atalia have been carried out by CIE/Irish Rail over the years, partly due to damage suffered due to high vehicles striking the underside of the arches, it is still largely intact.

Plate 1 Underbridge (UBG170), from north east.

Plate 2 Lough Atalia Viaduct, from north.

Architectural Description

a. Locational Information

Name and Address of Site:	Lough Atalia Underbridge (UBG170)
O S Map No.:	Sheet Galway 094
Forms of Protection:	RPS 10002

b. Description

The underbridge at Lough Atalia is a component of the larger Lough Atalia Viaduct, which stretches over the water at the entrance to the lake to the east. Both the underbridge and the viaduct have the fine cut-stone piers, with the piers for the underbridge rising without footings or abutments. The locally quarried limestone walling is evenly coursed and the piers have been faced with rusticated stone, with ashlar finish to the eastern wing. There is a fine ashlar string at deck level and cut stone coping to the parapet. The underbridge is spanned by arched cast iron girders, in an arch rib construction, and finished with a metal railing to each side (Plates 1-6). Under the bridge the public road is a tarmaced single carriageway with a footpath on each side.

Plate 3 Underbridge (UBG170), from south west.

Plate 4 Underbridge (UBG170), from north east.

Plate 5 Detail of plate to north east side, 'James Stephens Iron Works Galway 1851'.

Plate 6 Stone pier from north east.

c. Excavation of Trial Hole

A 2.7m (north west-south east) x 1.1m (north east-south west) trial hole was mechanically excavated adjacent to the north east wall of the underbridge, to assess the foundations of the masonry walls of the bridge (Illus. 3, marked in red). Four further trial holes were excavated in June, 2011 (Illus. 3, marked in blue), which were not monitored but for which the engineer's reports were made available allowing a partial retrospective assessment of the ground conditions.

Plate 7 Site of trial hole, pre-excavation, from north east.

Plate 8 Trial hole, fully excavated, from north east.

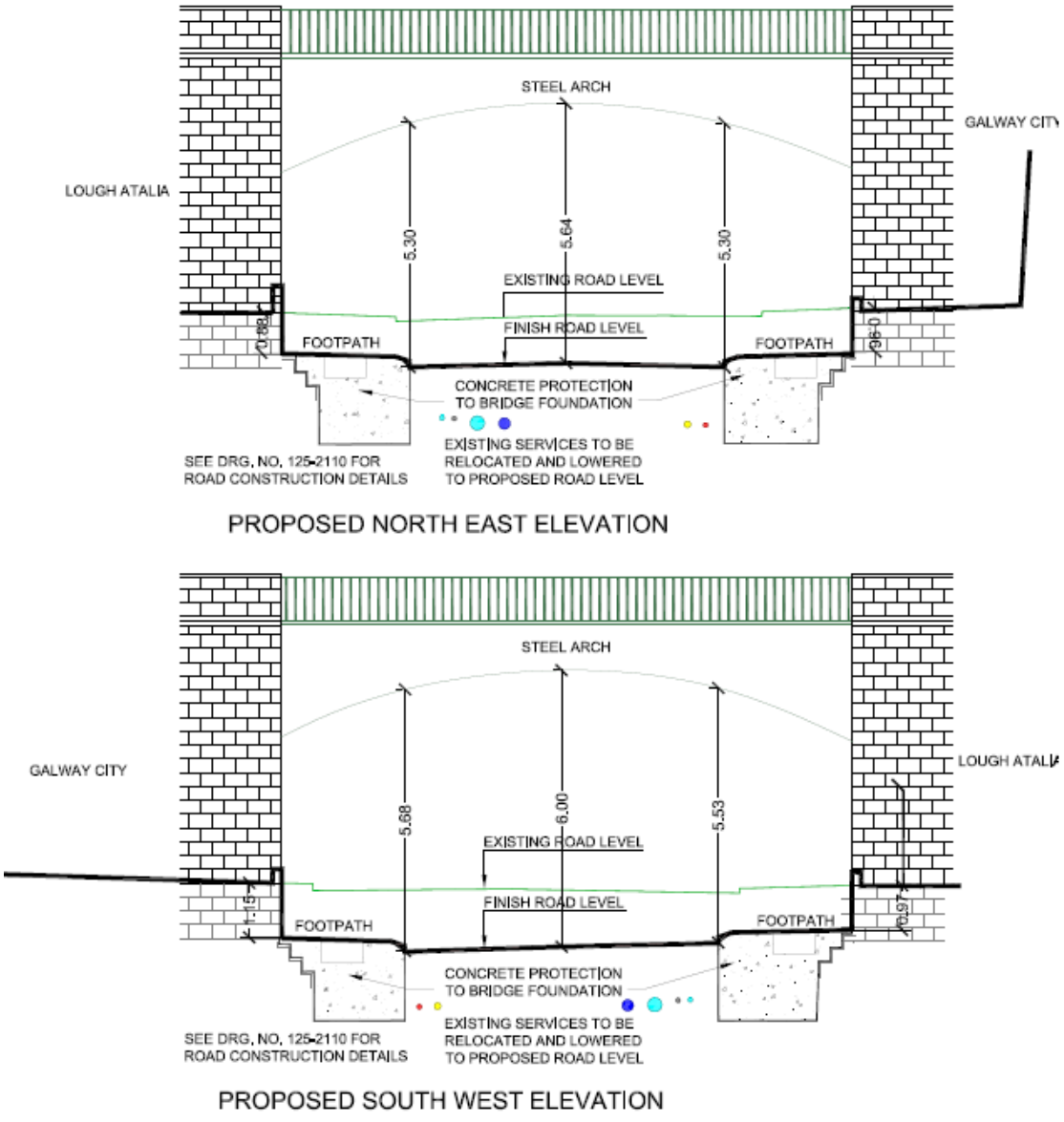
The excavations revealed that one further course of the bonded masonry of the pier continued below ground level. Immediately underlying this walling was a shallow, rough stone foundation, of c. 500mm in depth (Plate 8). The stone foundation extended only c. 100mm to 115mm from the face of the overlying wall. The foundation was laid directly onto a compact, stone-filled yellow boulder clay. Unfortunately a waven pipe was laid directly in front of the wall and foundation, while not preventing the excavation of the trial hole, made it difficult to photograph the resulting trench.

In terms of stratigraphy, the excavated material comprised mainly infill, consisting of sand and soil in a highly mixed fill. This material extended to a depth of 1.2m below current ground level. At this depth, a compact stone-filled yellow clay was excavated, representing undisturbed boulder clay. There were no finds from this material and excavation ceased at 1.44m below ground level.

As part of the Irish Drilling excavations in June, 2011, a shallow plinth was revealed under the bridge, with further stonework supporting it below, in a simple stepped manner. It occurred at c. 1.13m below current ground level.

The Proposed Road Re-alignment

It is proposed to reduce the level of the roadway and footpaths running under the bridge at Lough Atalia, with a maximum depth of 1.3m below current road level below the centre of the underbridge.



Illus. 5 Elevations of the Proposed Development.

Visual Impact Assessment

The proposed development at the Lough Atalia Underbridge does not envisage any direct physical impact on the bridge itself. The works are solely concerned with lowering the surface of the carriageway and footpaths under the bridge.

The maximum depth to be achieved below current ground level is 1.3m, occurring under the bridge itself. The roadway will reach this depth through reducing the height of the road surface gradually on either side of the bridge.

The proposals will not visually injure the visual amenity of the Lough Atalia Underbridge. The existing views of the bridge from both approaches will not be impeded or altered in any way. The general setting of the bridge will remain largely unaltered. The main alteration to the site, the reduced road level and footpaths, will not negatively impact on the visual amenity of the existing bridge structure. The proposed alterations are in keeping with the industrial/functional nature of the general setting, in which the Lough Atalia Viaduct forms a central focal point.

Conclusions and Recommendations

The development of the railway in Ireland from the 1830s onwards had a significant physical and economic impact on the country. Despite the various fluctuations in the fortunes of rail in the years since the first train left Galway station, the basic infrastructure that was laid down in the Galway to Athlone section in 1849-51, is still in use. This is particularly true of the major engineering works, namely the bridge over the Shannon at Athlone and the Lough Atalia Viaduct. Though maintenance and upgrading have been necessary in the intervening years, the works themselves stand as a strong testimony to the quality of the engineering and workmanship employed during its construction.

The Lough Atalia underbridge forms the main point of intersection between the railway and road traffic in the city, with the impressive Lough Atalia Viaduct extending east beyond the city centre. The excavation of trial holes adjacent to the masonry piers of the bridge shows that the foundations for the pier are not extensive

and do not extend into the area affected by the proposed reduction in the road level. The lowering of the existing footpaths within the span of the bridge itself will not impact on the foundation, which was revealed at 1.5m below ground level. It is not intended that the underbridge itself be impacted upon by any of the works. Also, it appears from the excavations that no sub-surface element will be impacted upon.

The cast iron arch of the Lough Atalia Underbridge has been damaged in the past due to being struck by large vehicles and the current bridge height is not suitable for the type of traffic using the Lough Atalia Road, some of which comprises articulated lorries and other large vehicles. Lowering the road level will enable the traffic to continue to use this route with a reduced risk to the bridge itself.

It is recommended that during the works, the bridge is protected from all construction traffic.

Anne Carey

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