

Mike Ashworth, Strategic Director Economy, Transport and Communities

LEA ROAD RAMP

DRONFIELD

HERITAGE IMPACT ASSESSMENT

Project ref. no. 15-01-05-05



REPORT ref. no. 37123/3/HIA

NOVEMBER 2016

Structures Design Section

Highways Division

Report Title:			Report Ref No:
Heritage Impact Assessment – Lea Road Ramp			37123/3/HIA
Approvals:	Name:	Date:	Comment:
Author/ Editor:	T.J.Jeffery	28/11/2016	
Project manager:	T.J.Jeffery	28/11/2016	
Technical reviewer:	M.D.Lander	29/11/2016	
Quality reviewer:	M.D.Lander	29/11/2016	

Version History:			
Revision no:	Issue date:	Author/ Editor	Reason for change:
0	29/11/2016	T.J.Jeffery	Initial version
A	23/02/2017	T.J.Jeffery	Description of props added
B	16/01/2019	T.J.Jeffery	Double kerb vehicle restraint and steeple coping justification added to recommendations

This report is not to be used for contractual or engineering purposes unless the above is signed where indicated by the author, the project manager, the technical reviewer and the quality reviewer of the report.

This document has been prepared for the sole use for which it was intended as expressed within the client's brief. It has been prepared by Derbyshire County Council's Economy Transport and Communities QMS in accordance with the requirements set out within the client's brief. The use of this document for any reason other than those expressed within the client's brief, or by anyone other than the client is not permitted.

Recommendations or comments contained within this report should only be read and relied upon within the context of the entire document.

Contents	Page
Introduction	1
Historical development of Lea Road Ramp	2
Summary of the developments affecting Lea Road Ramp	16
Description of extant structure	17
Statutory Designation	21
Assessment of historical significance of the Lea Road Ramp	22
Recommendations	25
Bibliography	26

List of Figures

Figure 1 – Location of Lea Road Ramp.....	1
Figure 2 – Extract from Burdett’s Map of Derbyshire 1791 – note the Duffield to Sheffield turnpike road passing through Coal Aston	2
Figure 3 - Extract from Dronfield Enclosure Map of 1846 showing Dronfield Centre note the Turnpike Road running along Chesterfield Road	3
Figure 4 – Bridge Inn showing Dyer’s Bridge in the bottom left corner (pre 1870)	3
Figure 5 – twin arch spans of Lea Road Bridge over the railway	4
Figure 6 – twin arch spans of Lea Road Bridge and ramp carrying Lea Road along the line of the River Drone	4
Figure 7 – Soaper Lane Railway Bridge	5
Figure 8 – Railway retaining wall on right hand side of photograph with culvert under Dronfield Station in the distance	6
Figure 9 – Training walls to River Drone underneath Lea Road Ramp	7
Figure 10 – Opening in railway retaining wall – probably representing a socket for prop opposite Pier C	7
Figure 11 – Dronfield Centre – OS 1 st Edition 1 to 2500 map 1879 (Surveyed 1875).....	8
Figure 12 – Lea Road Ramp – OS 1 st Edition 1 to 2500 map 1879 (Surveyed 1875).....	9
Figure 13 – Drawing of steps from Lea Road Bridge to the Sheffield Platform dated 1880.....	9
Figure 14 – Lea Road Ramp – OS 2 nd Edition 1 to 2500 - Surveyed 1875 Revised 1897.....	10
Figure 15 – view looking south down Chesterfield Road with Lea Road Ramp in its present polygonal arch form circa 1910	10
Figure 16 – OS Edition of 1918 1 to 2500 - Surveyed 1875 Revised 1914-15.....	11
Figure 17 – repair scheme to timber ramp carried out December 1922.....	12
Figure 18 – 1921 scheme for replacement parapet and decking	12
Figure 19 – Dronfield Station and timber footbridge circa 1900 – note Lea Road Ramp in background	13
Figure 20 – Lucas’s Works from Lea Road Bridge	13
Figure 21 – Butler’s Foundry at western end of Lea Road Bridge	14
Figure 22 – Demolition of timber station buildings in 1973	15
Figure 23 – View looking north towards Pier B.....	17
Figure 24 – view looking south towards Span AB.....	18
Figure 25 – View looking west of Span DE and Lea Road Bridge abutment	18
Figure 26 - Survey of polygonal arch members	19
Figure 27 - View from Chesterfield Road looking back towards the ramp circa 1910	20
Figure 28 – View from Chesterfield Road looking back towards the ramp 2015	20
Figure 29 - Ogilvie Halt Footbridges (West left, East right)	24
Figure 30 - Aulnaslanach Viaduct (before load bearing structure inserted)	24

List of Tables

Table 1 – Extant or recently demolished timber railway bridges in Great Britain	22
Table 2 – Other notable extant or recently demolished timber bridges in Great Britain	23

Introduction

Lea Road Ramp is a timber structure which provides access between Lea Road Bridge and Chesterfield Road in Dronfield (Figure 1). Lea Road Bridge is a Grade II listed building. The listing for Lea Road Bridge specifically excludes Lea Road Ramp and this has been confirmed with a Certificate of Immunity from listing dated 11th April 2016. Lea Road Ramp however falls within Dronfield Conservation Area and a scheme to replace the ramp is the subject of a planning application (Derbyshire County Council, 2016).

The ramp is now beyond the state of reasonable economic repair and this Heritage Impact Assessment has therefore been carried out to support and inform a planning application for a scheme to replace the ramp.

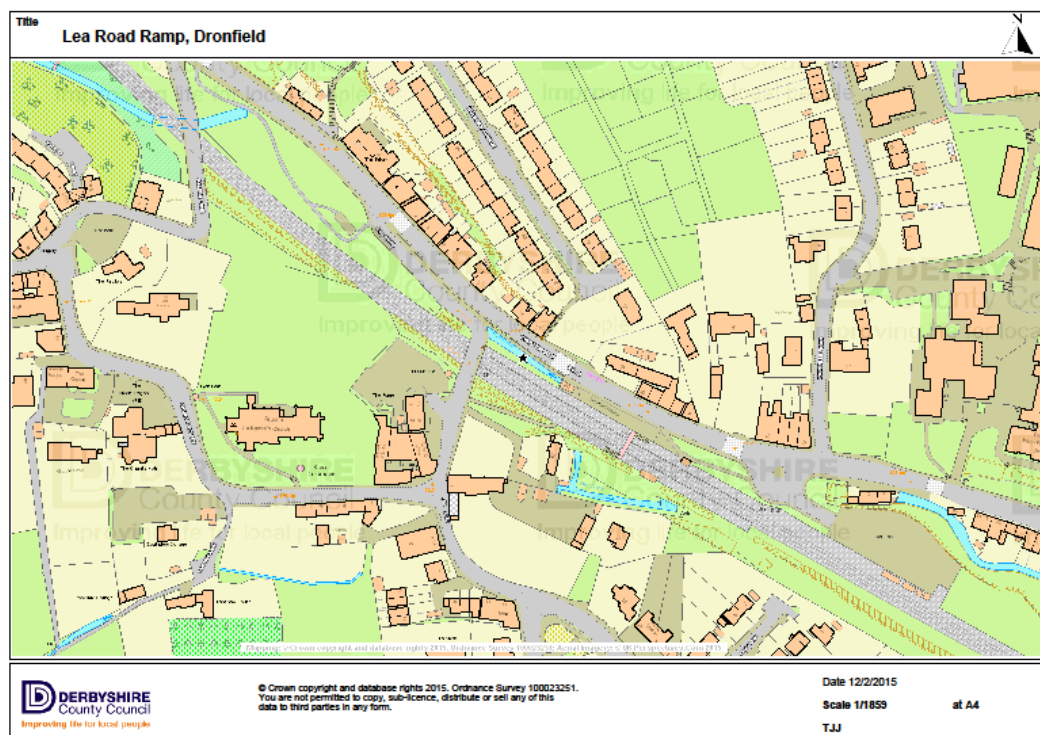


Figure 1 – Location of Lea Road Ramp

Historical development of Lea Road Ramp

Chesterfield Road appears to have developed from the pre-turnpike Road on the east side of the River Drone in Dronfield (Figure 2).



Figure 2 – Extract from Burdett's Map of Derbyshire 1791 – note the Duffield to Sheffield turnpike road passing through Coal Aston

This road was later incorporated into the Duffield to Sheffield turnpike road circa 1797. Shaw Lane was a continuation of Lea Road and is shown on the Dronfield Enclosure Map of 1846 running from higher ground to the east of Dronfield Church to meet Soaper Lane before crossing the River Drone by Dyer's Bridge which was near the north end of the present Lea Road Bridge.

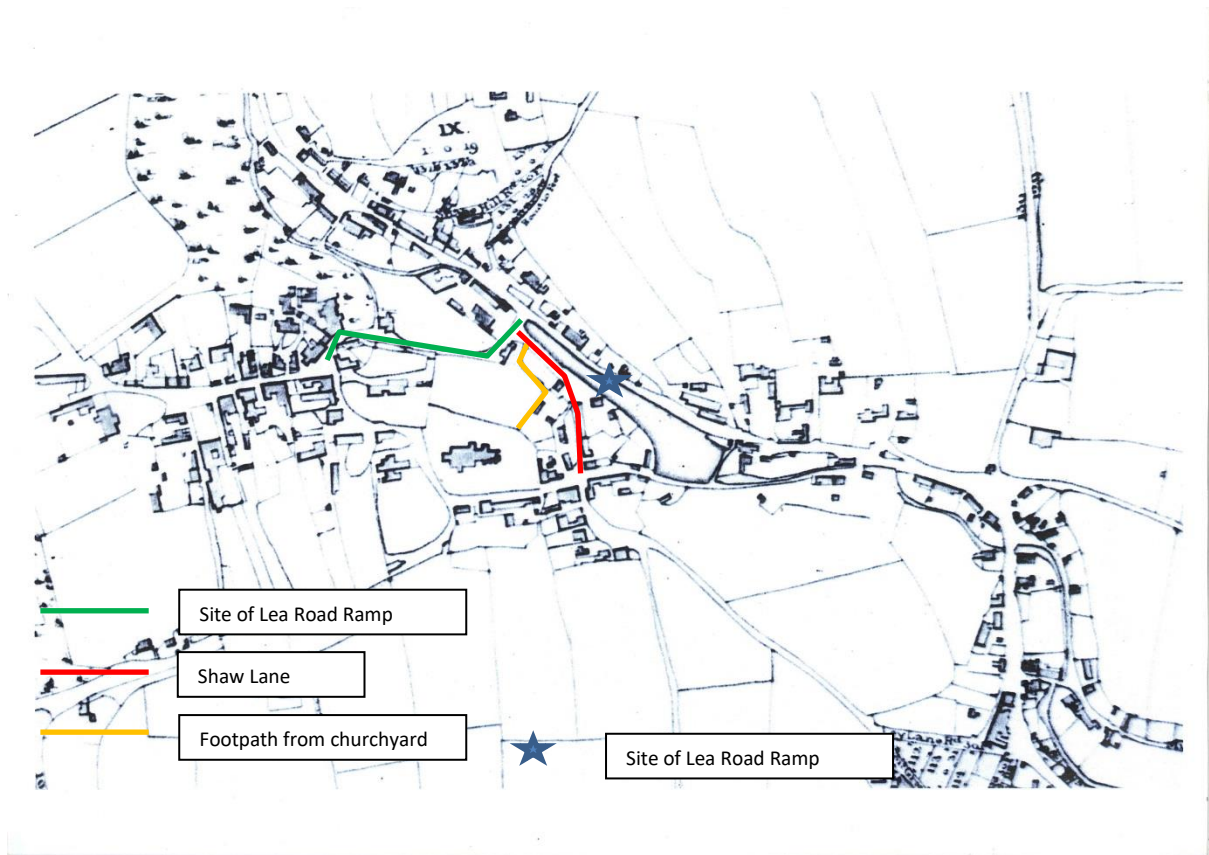


Figure 3 - Extract from Dronfield Enclosure Map of 1846 showing Dronfield Centre note the Turnpike Road running along Chesterfield Road

The Bridge Inn on Chesterfield Road was built opposite Dyer's Bridge and pre-dates the construction of Lea Road Bridge (Figure 4). South of Dyer's bridge, Chesterfield Road ran alongside the millpond of Upper Mill (Stroud, 2004).



Figure 4 – Bridge Inn showing Dyer's Bridge in the bottom left corner (pre 1870)

The Midland Railway Line from Sheffield to Chesterfield was constructed in 1870 (Salt, 2001). The railway followed the Drone Valley and its construction severed both Lea Road and Shaw Lane from Chesterfield Road.

Shaw Lane was diverted by an continuation of Lea Road which crossed the railway by a twin arch bridge (Figure 5) and then turned through a right angled bend and was carried on a further twin arch structure down towards Chesterfield road (Figure 6).



Figure 5 – twin arch spans of Lea Road Bridge over the railway



Figure 6 – twin arch spans of Lea Road Bridge and ramp carrying Lea Road along the line of the River Drone

A footpath leading from the north east of the churchyard (Figure 3) crossed the railway by a pedestrian crossing. This crossing was closed in the 20th century.

The retaining wall between Chesterfield Road and the millpond is likely to be preserved between the northern arches of the approach ramp of Lea Road Bridge and to the east of Lea Road Ramp. Bulging of the southern part of the latter wall is recorded on a drawing of 1922 and in the wall has been subsequently strengthened with a concrete buttress, as has the northern section.

Soaper Lane was diverted with an acute bend and crossed the railway via a skewed bridge before ramping down to Chesterfield Road near its junction with Snape Hill (Figure 7).



Figure 7 – Soaper Lane Railway Bridge

It is likely that the retaining wall to the west of Lea Road Bridge was constructed at this time to support the railway and act as a training wall for the River Drone. Slots which are still present in the wall are likely to be for props to provide lateral stability to Lea Road Ramp and may be original (Figure 10).



Figure 8 – Railway retaining wall on right hand side of photograph with culvert under Dronfield Station in the distance



Figure 9 – Training walls to River Drone underneath Lea Road Ramp



Figure 10 – Socket in railway retaining wall – probably representing a socket for prop opposite Pier C

Lea Road Ramp occupies its present location on the first edition Ordnance Survey map surveyed in 1875 (Figure 11). It is possible that ramp carrying Lea Road abutted Dyer's bridge which was retained under the junction with Lea Road. Alternatively Dyer's bridge may have been demolished and the culvert under the ramp carrying Lea Road over the River Drone was extended to occupy the position of Dyer's bridge.

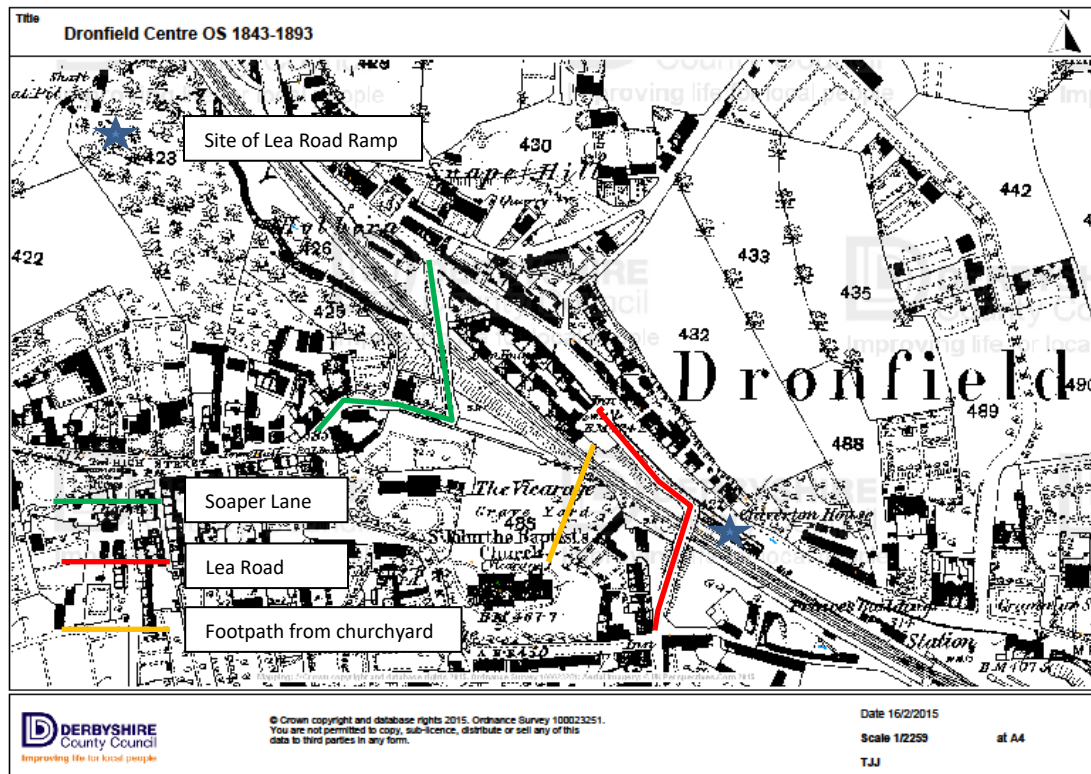


Figure 11 – Dronfield Centre – OS 1st Edition 1 to 2500 map 1879 (Surveyed 1875)

To the south, Lea Road Ramp carries pedestrians towards the Railway Station. The foundations of the ramp lie within the River Drone which flows in a southerly direction after emerging from Lea Road Bridge. At the southern end of the ramp the River Drone enters a culvert which then runs under the railway (Figure 12).

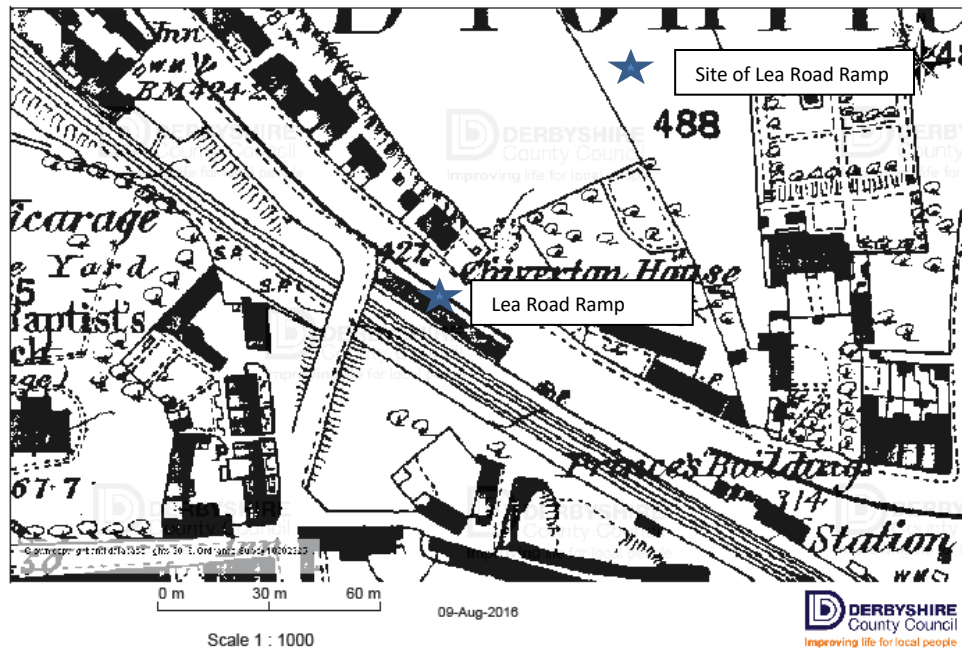


Figure 12 – Lea Road Ramp – OS 1st Edition 1 to 2500 map 1879 (Surveyed 1875)

The setting of the Lea Road Ramp since its construction has been changed by alterations to the railway infrastructure.

Access to the Sheffield Platform from Lea Road Bridge was provided by timber steps which are shown on a Midland Railway drawing of 1880 (Figure 13).

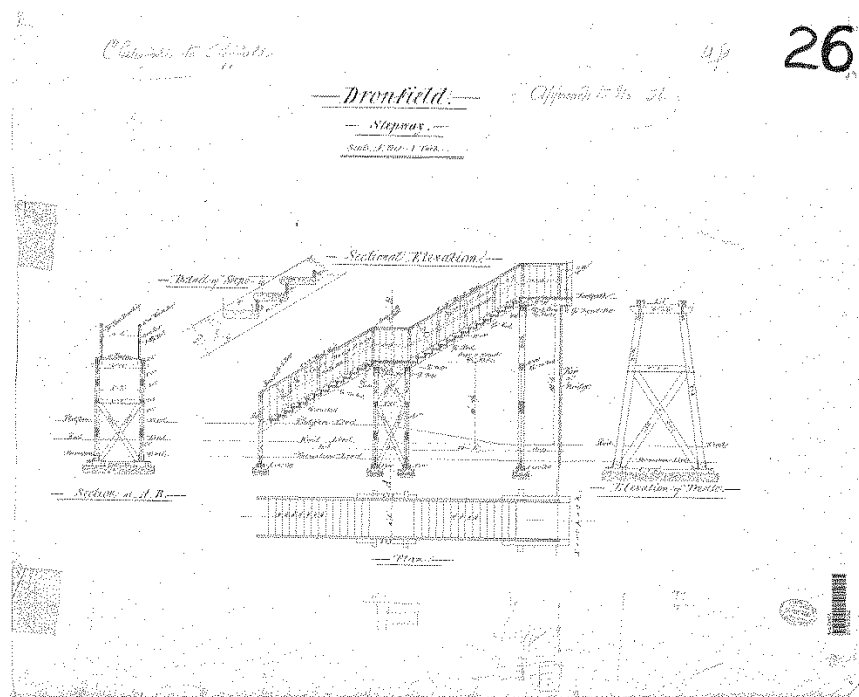


Figure 13 – Drawing of steps from Lea Road Bridge to the Sheffield Platform dated 1880

These steps are shown on Ordnance Survey maps based on a revised survey of 1897 (Figure 14). Also shown on these maps is a footbridge linking the two platforms.

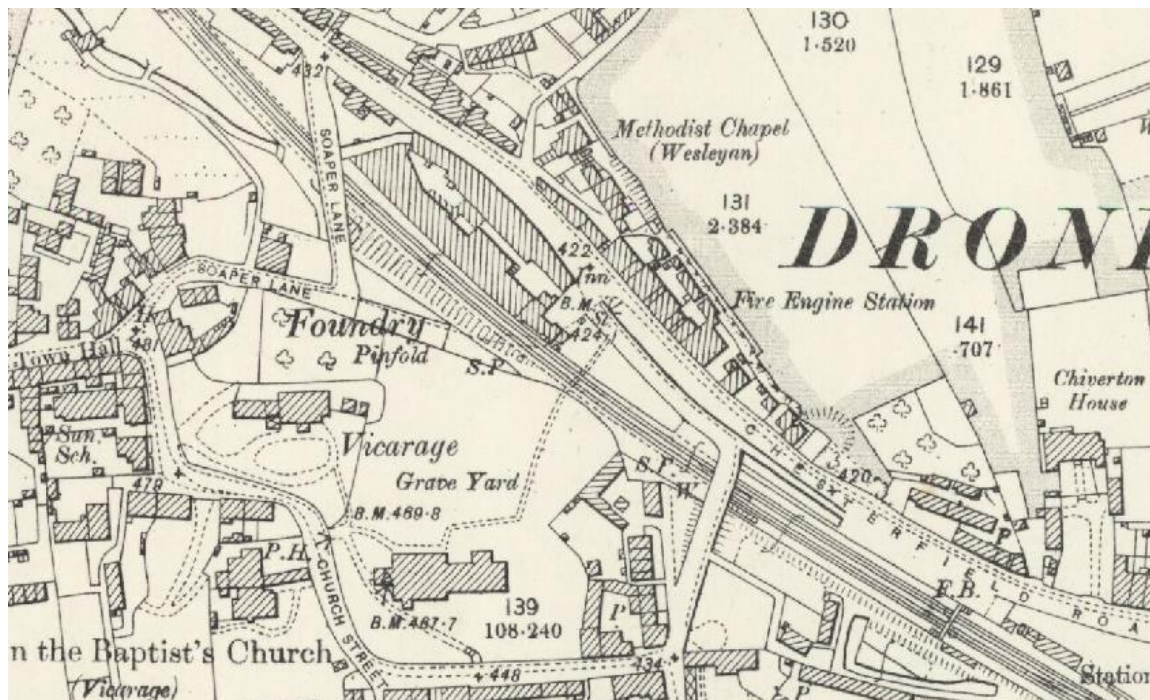


Figure 14 – Lea Road Ramp – OS 2nd Edition 1 to 2500 - Surveyed 1875 Revised 1897

Photographic evidence from circa 1910 shows that Lea Road Ramp was in its current form and also that the station footbridge was of a timber truss form with in span steps (Figure 15).



Figure 15 – view looking south down Chesterfield Road with Lea Road Ramp in its present polygonal arch form circa 1910

The third edition Ordnance Survey based on a revised survey of 1914-15 shows that the steps to the Sheffield Platform from Lea Road Bridge had been removed and replaced with the present earthen ramp from Lea Road (Figure 16). The pilaster at the end of the ramped structure carrying Lea Road is

now no longer present. This may represent a scheme to ease the gradient of Lea Road following complaints from road users (Salt, 2001).

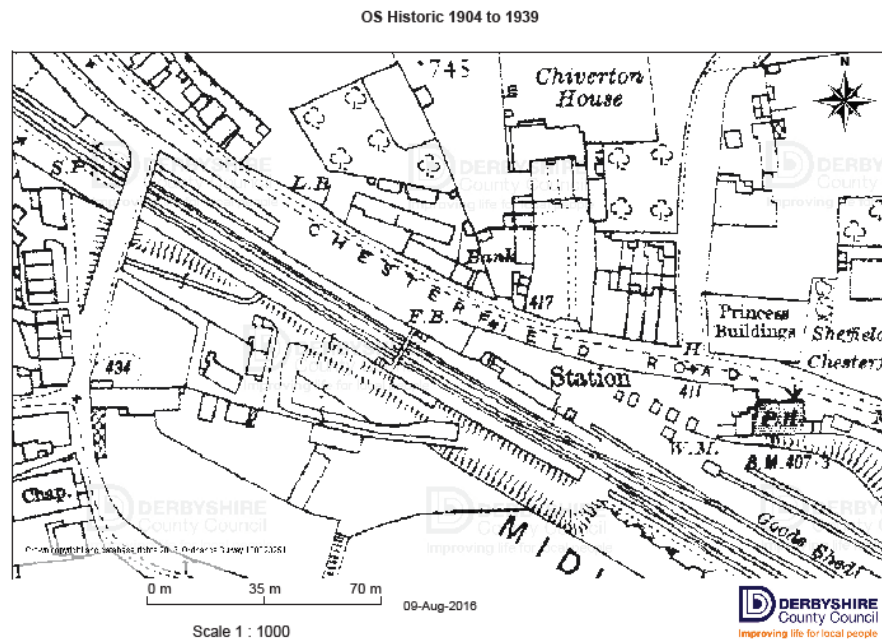


Figure 16 – OS Edition of 1918 1 to 2500 - Surveyed 1875 Revised 1914-15

Major repairs to Lea Road Ramp are recorded on a drawing of 1922 (Figure 17).

This drawing shows that the following work was carried out:-

- One column received a spliced repair.
- Six out of the sixteen rakers were replaced
- One straining piece out of eight was replaced
- Six corbels out of ten were replaced
- New bracings were added to rakers
- Five sills out of six were replaced
- All the longitudinal beams were replaced with new bigger beams
- The bottom third of the deck planks were replaced

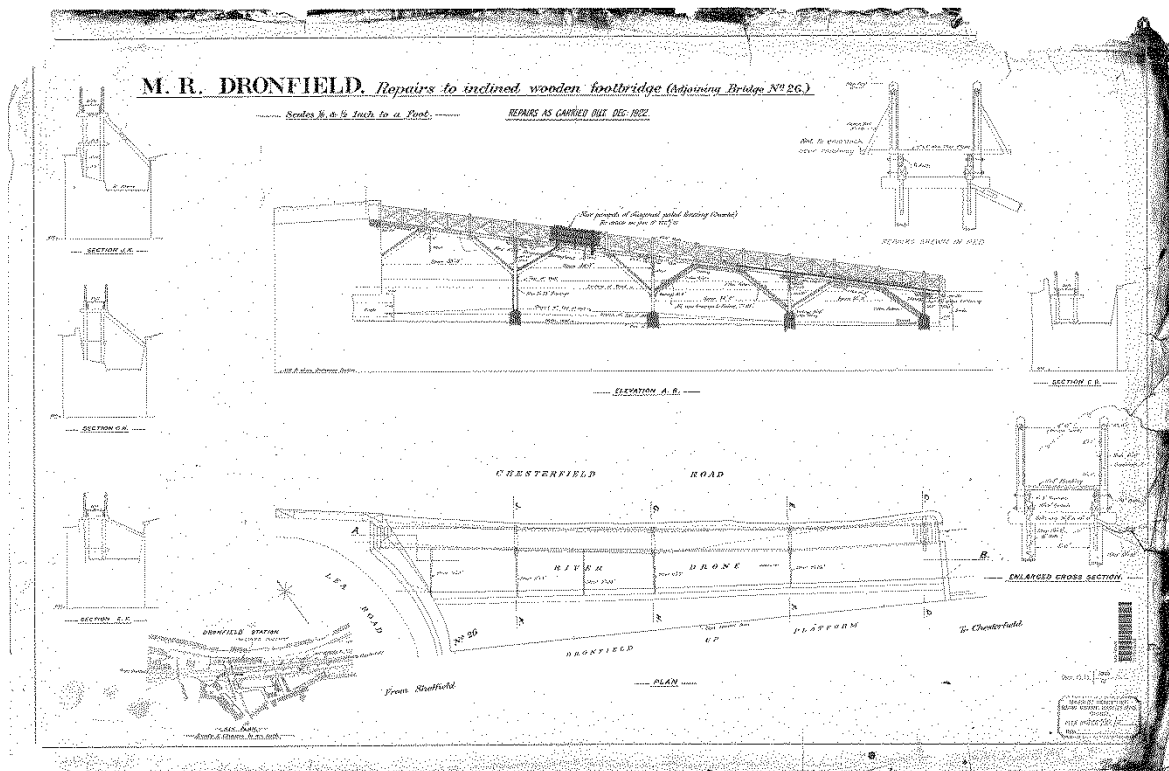


Figure 17 – repair scheme to timber ramp carried out December 1922

The parapet was totally replaced with a new system with a 9'0" module which included diagonal creosoted pales (Figure 18). This meant that the parapet post modules did not fit the span modules as had previously been the case when there were three parapet modules per span. This drawing may represent part of the scheme carried out in 1922.

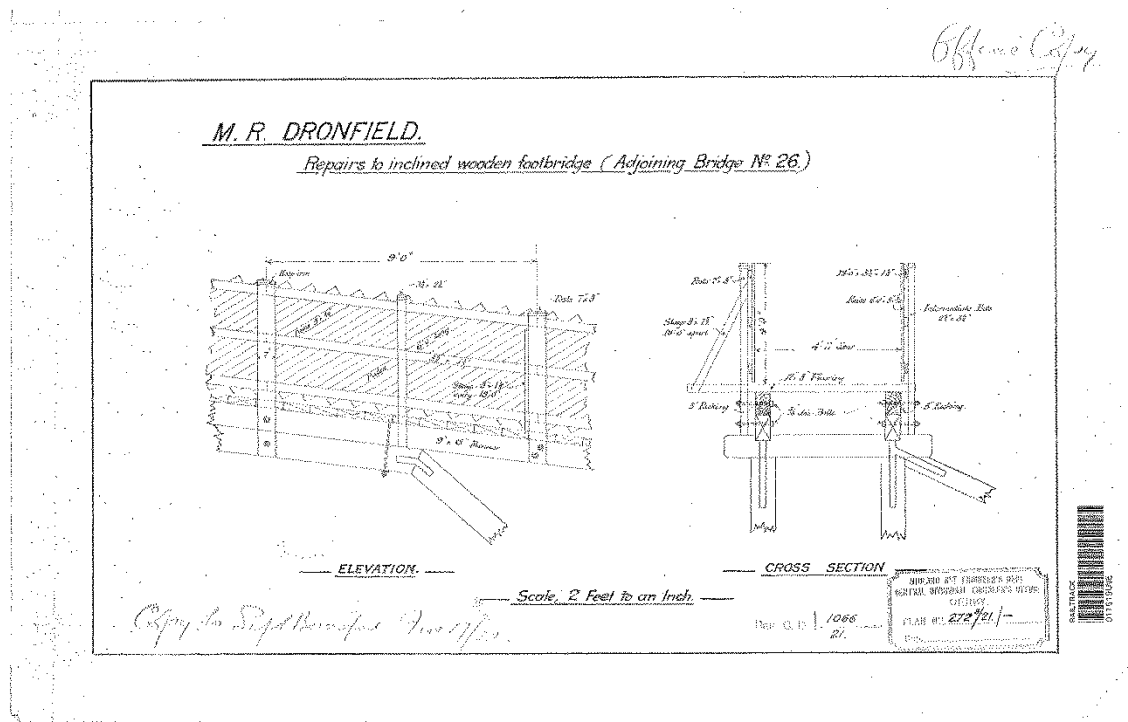


Figure 18 – 1921 scheme for replacement parapet and decking

Also carried out in 1922 was a scheme to replace the timber footbridge (Figure 19) connecting the platforms with the present structure (Salt, 2001).



Figure 19 – Dronfield Station and timber footbridge circa 1900 – note Lea Road Ramp in background

The setting has become less industrialised recently. Notably there has been closure in 1971 and demolition in 1972-3 of Lucas's Works to the northeast of Lea Road Bridge (Figure 20). This area was converted into a community centre.



Figure 20 – Lucas's Works from Lea Road Bridge

Butler's Foundry to the northwest of Lea Road Bridge closed in 1990 and was later converted into The Forge shopping centre in 2004 (Figure 21).



Figure 21 – Butler's Foundry at western end of Lea Road Bridge

Public Conveniences were constructed at the foot of Lea Road Ramp in the post-war period. These were shut and are now used as a store by the Friends of Dronfield Station.

Dronfield Station was closed in 1966. The ramp was the subject of a licence agreement between The British Railways Board and The Dronfield Urban District Council dated 24th October 1968. The description of the licence is "To retain a timber ramp footway on the Board's land between Lea Road Bridge and Chesterfield Road". The station buildings were demolished in 1973 (Figure 22).



Figure 22 – Demolition of timber station buildings in 1973

The main cast iron girders spanning Soaper Lane were replaced by the present bridge in 1977.

The licence agreement was amended by a memorandum dated 9th February 1978 to reflect Derbyshire County Council becoming entitled to the interest of Dronfield Urban District Council.

Further repairs to the ramp were carried out in 1983 and included repairs at the foot of the southernmost two bases, addition of a timber strut at a third of the way along the ramp from the bottom and unquantified repairs to the deck timbers and parapets.

A complete reconstruction of the deck and parapets was carried out in 1991.

Since 2000 residential developments have seen flats and town houses built adjacent to Lea Road Ramp on the east side of Chesterfield Road at The Priory in 2006 and Chiverton Mews in 2015/16.

Dronfield Railway Station was re-opened in 2008.

The lower sections of the northernmost pair of columns were replaced with structural steel shoes in 2010.

The bottom section of parapets was replaced in 2015.

Summary of the main developments affecting Lea Road Ramp

Pre-1791	Development along road on east side of the river Drone
Pre-1791	Construction of dam for Dronfield Over Mill (later Upper Mill) necessitating construction of retaining wall to road on east side of river.
1797	Road on east side of river upgraded to turnpike
1870	Railway constructed through valley – Lea Road Bridge, Lea Road Ramp, Soaper Lane bridge and footpath crossing all constructed. Dronfield Upper Mill, dam and millpond all demolished or partly demolished.
After 1870	Northern end of Lea Road bridge altered to ease gradient.
1875-1897	Timber footbridge constructed to link platforms
1880	Timber steps added to Sheffield Platform from Lea Road Bridge
1897-1915	Timber steps demolished and replaced with earthen ramp
1922	Timber Footbridge demolished and replaced with present Station Footbridge,
1922	Lea Road Ramp heavily repaired
After 1945	Span of Soaper Lane Bridge over railway replaced
After 1945	Concrete buttress added to Chesterfield Road retaining wall encasing part of Lea Road Ramp substructure
1968	Butler's Foundry closed and later redeveloped as the Forge shopping centre
1971	Lucas Works closed and later demolished and park created
1983	Extensive Repairs to Lea Road Ramp
1991	New decking and parapets to Lea Road Ramp
2010	Bottom of northernmost timber trestle legs on Lea Road Ramp replaced with steel sections
2015	Parapets on southernmost span of Lea Road Bridge replaced
2015-16	Town houses built on Sheffield Road to east of Lea Road Ramp
2017	Propping added to ends and centre of ramp

Description of the extant structure

The existing structure is a timber structure, approximately 45m long and slopes down from Lea Road Bridge at the north end to Chesterfield Road (formerly Station Road) at a gradient of approximately 1 in 8.

Lea Road Bridge appears to have been built to accommodate a ramp at its southeast corner. Map regression shows that a ramp was in place in 1875 and photographic evidence shows that the ramp was in its current polygonal arch form circa 1910.

The structure has four main spans of a polygonal arch form and a small cantilever span at the south end. The polygonal arch comprises a pair of raking members from the supports which butt against a straining piece. Supporting the deck is a pair of longitudinal beams, which span between supports and gain support over their central third from the polygonal arch members (Figure 26).

The deck of the ramp has two lateral timber props at approximately third points along its length which are anchored in the bank above a retaining wall on the west bank of the River Drone. Sockets in the railway retaining wall and drawing evidence from the 1922 strengthening scheme indicate that the ramp was originally propped at 5 locations and that the railway retaining wall and the ramp are contemporaneous. The likely date of construction is 1870.



Figure 23 – View looking north towards Pier B



Figure 24 – view looking south towards Span AB



Figure 25 – View looking west of Span DE and Lea Road Bridge abutment

The overall appearance of the ramp and Lea Road Bridge has changed little since their construction (compare with Figure 27 with Figure 28). The deteriorating condition of the ramp meant that props were added at the ends and centre of the ramp in February 2017.



Figure 27 - View from Chesterfield Road looking back towards the ramp circa 1910



Figure 28 – View from Chesterfield Road looking back towards the ramp 2015

Statutory Designation

The ramp is within the Dronfield Conservation Area. Lea Road Bridge is a Grade II Listed Building and was listed building on 11th February 2014, however the list description states:-

‘Pursuant to s.1 (5A) of the Planning (Listed Buildings and Conservation Areas) Act 1990 (‘the Act’) it is declared that the C20 timber footbridge leading to Dronfield Station is not of special architectural or historic interest’

Advice from Derbyshire County Council’s Conservation and Design section is that the “design is likely to be relatively unchanged since it was constructed”.

The C20 date for the timber footbridge also appears in a report of August 2014 on behalf of Network Rail in which the history and significance of the structures on the Midland Main Line are assessed (Alan Baxter and Associates, 2014). This document was used as part of the Midland Main Line Designation Consultation which was carried out by English Heritage.

Derbyshire County Council entered into correspondence with Dronfield Civic Society who expressed a view that the Structure should be put forward for listing. Given the additional historic data which Derbyshire County council had obtained, Derbyshire County Council took the view this information should be made available to Historic England who would then make a recommendation to the Secretary of State for Culture, Media and Sport whether or not the structure was worthy of listing. On 11th April 2016 Historic England advised Derbyshire County Council that the Secretary of State for Department of Culture, Media and Sport had certified that it was not his intention to list the structure. The effect of the certificate is to preclude the Secretary of State from listing Lea Road Ramp, Dronfield for a period of five years from 11th April 2016, and to preclude the local planning authority from serving a Building Preservation Notice (BPN) on the building during that period.

Assessment of historical significance of Lea Road Ramp

The form of the timber ramp is that of a polygonal arch (Booth & Booth, 1996). This is one of the standard forms of timber structures that were developed in the boom in railway construction in the period 1835-1855 (Bill, 2014). Timber structures continued to be built elsewhere as the network was further extended after the initial boom. Extant timber railway bridges are rare in the United Kingdom as their average service life varied tended to be less than 50 years (Bill, 2014).

Table 1 – Extant or recently demolished timber railway bridges in Great Britain

Bridge Name	Bridge Type	Construction Date	Location	Statutory Status
Ogilvie Halt Footbridge East	Beam carrying footway	1868 partially reconstructed 1924-6, restored 2011	Caerphilly	Grade II
Ogilvie Halt Footbridge West	Polygonal arch carrying footway	1871-1900, restored 2011	Caerphilly	Grade II
Leri Viaduct	7 span beam carrying railway	Circa 1864	Ceredigion	Not listed
Clettwr Viaduct	7 span beam carrying railway	Circa 1864	Ceredigion	Not listed
Dyfi Viaduct	5 span +12 span carrying railway	Circa 1867	Gwynedd	Not Listed
Barmouth Viaduct	113 span beam carrying railway and footway	Circa 1867	Gwynedd	Grade II*
Pensarn Viaduct	16 span beam carrying railway	Circa 1867	Gwynedd	Not listed
Pont Briwet, Penrhyndeudraeth	16 span beam carrying road and railway	Circa 1867 Demolished 2014	Gwynedd	Grade II
Traeth Mawr Viaduct	16 span beam carrying railway	Circa 1867	Gwynedd	Not listed
Loughor railway viaduct	17 span plate girders on wooden trestles and piles carrying railway	1880 Demolished 2013, elements re-erected on NR land	Carmarthen	Grade II
Wickham Bishops Viaduct	Beam/Propped beam/Polygonal arch? Carrying railway	Circa 1848 Restored 1995	Essex	Scheduled Monument
Aultnaslanach Viaduct, Moy	Five span polygonal arch carrying railway	Circa 1897 Load bearing structure inserted around timber structure 2002	Highland	Category A
Barony Junction, Auchinleck	Three span polygonal arch carrying accommodation road	Circa 1907	East Ayrshire	Not listed

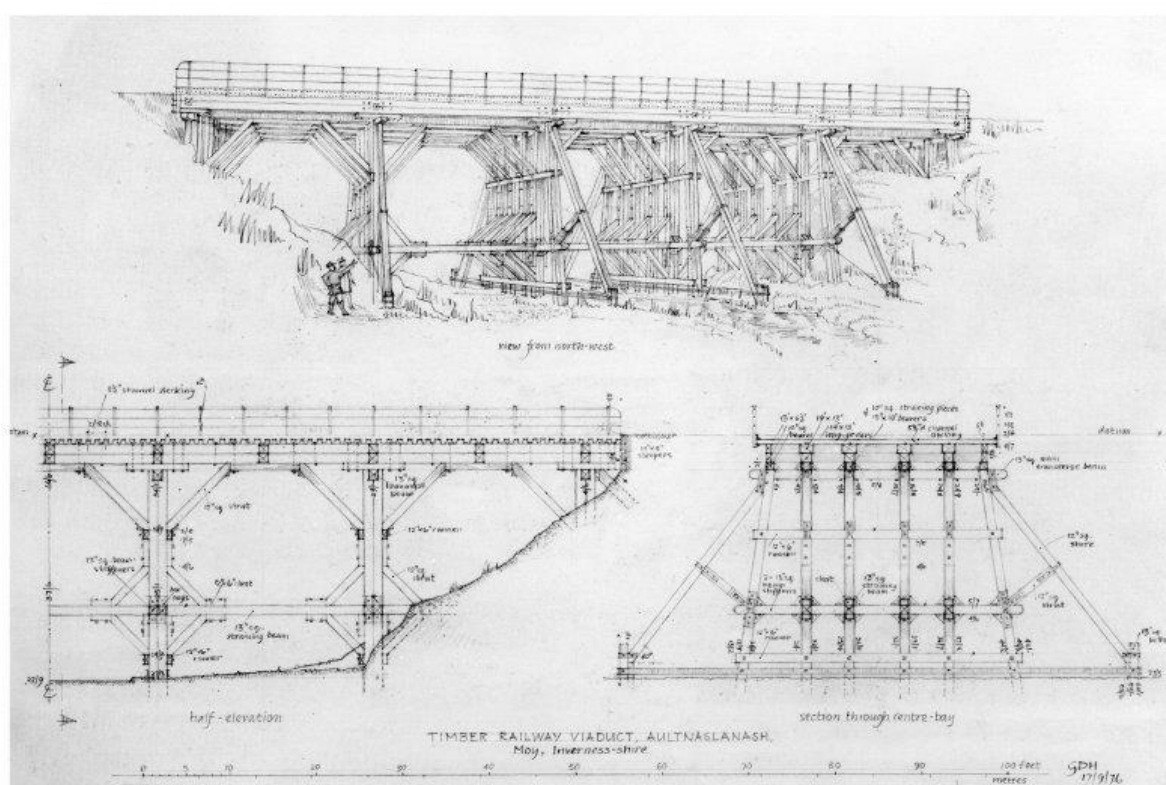
The nearest parallel to Lea Road Ramp is the Eastern timber footbridge at Ogilvie Halt (Figure 29). The reason for listing is given as “an exceptionally rare example of a formerly common type of bridge”.

Table 2 – Other notable extant or recently demolished timber bridges in Great Britain

Bridge Name	Bridge Type	Construction Date	Location	Statutory Status
Ladies' Bridge, Cruden Bay	Propped Beam footbridge	1922, Demolished and replaced 2015 with Ekki Hardwood timber bridge £220k 52.5m long	Aberdeenshire	Not listed
Penmaenpool	Nineteen (eighteen) span Beam, carrying road	1879	Gwynedd	Grade II
Whitney on Wye Toll Bridge	Three span polygonal arch, carrying road	Originally 1802, refurbished 1992-3 £300k	South Herefordshire	Grade II
Mathematical Bridge	Tangential and radial truss footbridge	Originally 1749, Reconstructed 1906	Cambridge	Grade II
Shoreham Toll Bridge	Twenty seven span beam	Originally 1781, rebuilt 1916 then Restored 2008 for £500k- used as a footpath	West Sussex	Grade II*
Broomhill, Inverness-shire	Ten span beam and five span truss on timber trestle	1894	Highland	Category A



Figure 29 - Ogilvie Halt Footbridges (West left, East right)



<https://canmore.org.uk/collection/367674>

© Copyright RCAHMS

Figure 30 - Aultnaslanach Viaduct (before load bearing structure inserted)

Recommendations

Lea Road Ramp is an exceptionally rare example of a formerly common type of bridge. The bridge is part of the railway infrastructure that is a significant feature of the Drone Valley within the Dronfield conservation area. The bridge is likely to have preserved its original polygonal arch form. It has been extensively repaired and it is possible that parts of the original structure survive.

The poor condition of the timbers in the bridge is such that it is not considered feasible to repair the bridge. It is therefore proposed that a scheme to demolish the bridge and replace it with a modern steel structure which celebrates the polygonal arch form of the original structure and retains the characteristic sloping ramp of the original bridge. It is considered that a modern structure would avoid any misinterpretation of authenticity of the new structure against the grade II listed Lea Road Bridge. The retention of the polygonal arch form of structure would mean that minor alterations are required to attach the raking members of the polygonal arch.

The new structure would be self-supporting in terms of lateral stability and the none-authentic props would be removed from their position above the railway retaining wall.

It is proposed that some protection of the new structure from accidental vehicle impact would be afforded by introducing a second kerb which would enable the existing masonry parapet to be retained. It is considered that introducing a second kerb would be less visually intrusive in the Conservation Area than the alternative solutions of introducing a high containment kerb or raising the existing parapet.

To prevent unauthorised access to the top boom of the trusses it is proposed that a steeple coping is added which would have a minor effect on the appearance of the trusses. In elevation this would have the effect of the top boom matching the depth of the bottom boom more closely which is considered to be visually acceptable.

It is proposed that the following records are made of the existing structure:-

- A record of the bridge is made prior to demolition.
- Representative sample of the earliest timbers (up to and including 1922 repairs) of the ramp are sent for species identification and recorded.
- Castings that form the connections between the polygonal arch members should be retained from the demolition and recorded in detail.
- The concrete bases should be demolished in such a way to allow extraction of the timber piles and any pile shoes or shaping of the piles recorded.
- A copy of the final analytical record is placed in the Derbyshire Historical Environment Record.

Bibliography

1st edition OS Map, 25" Sheet XVIII.1. (1882).

2nd edition OS Map, 25" Sheet XVIII.1 . (1898).

3rd edition OS Map, 25" Sheet XVIII.1. (1919).

Alan Baxter and Associates. (2014). *Midland Main Line: Statement of History and Significance: Consultation Version*.

Bill, N. A. (2014). Design and construction deficiencies of timber railway bridges. *ICE proceedings: Engineering History and Heritage*, 167(EH4), 182-195.

Booth, L. G., & Booth, V. (1996). Timber railway bridges in England in the period 1835-1860: Their structural forms and contemporary lithographic illustrations. *Journal of the Institute of Wood Science*, 14(1), 48-61.

Derbyshire County Council. (2016). *Planning Statement, Lea Road Ramp*.

Parliamentary Enclosure Map. (1846). Derbyshire Record Office Q/RI 38.

Salt, D. (2001). Early Days at Dronfield Station. *Dronfield Miscellany No.2*.

Stroud, G. (2004). Derbyshire Extensive Urban Survey Archaeological Assessment Report.

The Highways Agency. (2004). *BD 29/04 Design Criteria for Footbridges*.