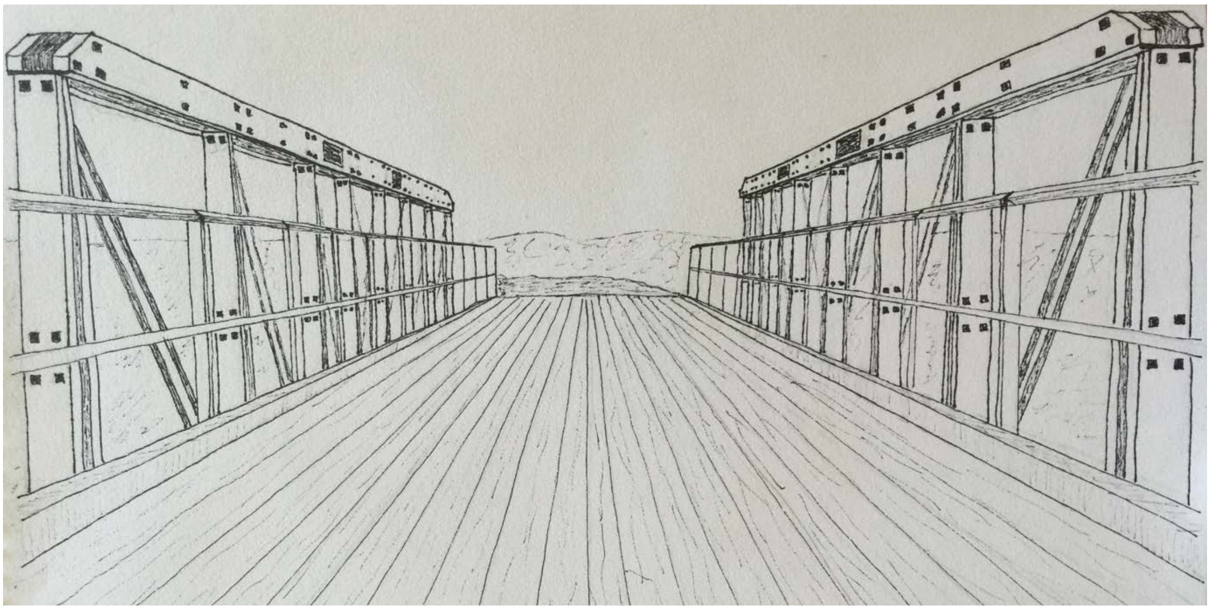
CONSERVATION MANAGEMENT PLAN



GILLIES BRIDGE OVER BLACK CREEK

Prepared for: Cessnock City Council – June 2017

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1. EXECUTIVE SUMMARY

Gillies Bridge is a de Burgh type timber truss bridge located approximately 50 km northwest of Newcastle on Wilderness Road over Black Creek near Rothbury. It was constructed by the Department of Public Works in 1901-02 and is under the care and control of Cessnock City Council.

Given the fact that Cessnock City Council has limited funds for bridge maintenance, and also that there are no drawings of the bridge as originally designed and constructed, Council has done an exceptional job of conserving the most significant elements of Gillies Bridge largely intact to date.

Gillies Bridge has been assessed to be of State significance. It is an early and intact example of a de Burgh type timber truss bridge, and is the only remaining example of the standard design for the 70’ (21.336 m) span, the shortest of the de Burgh truss designs. The bridge is locally esteemed and contributes to the community’s sense of identity. It has strong associations with Ernest Macartney de Burgh, then Assistant Engineer for Bridges, one of the ablest engineers in Australia, and the designer of this truss type. The design took advantage of the high quality NSW hardwoods and is an example of engineering excellence, using a wide range of materials each to their best effect.

On the basis of the assessed cultural significance, and after considering a variety of issues, constraints and opportunities, this report offers a number of conservation management policies for the bridge. The primary policy is that the bridge should be maintained in such a way which protects or enhances its cultural significance. In the short term, this is achieved primarily through regular inspection and maintenance, removal of harmful accretions (metal flashing on top chords and non-breathable paint on truss timber), and replacement of deteriorated truss timber with new timbers detailed to the original design in order to keep the bridge in use and preferably without a load limit. Drawings showing the original details of the truss span have been prepared to facilitate this work.

Some consideration has also been given to longer term conservation options, given that the current approach to repairing the abutments, piers, approach spans and deck is not sustainable, and that as traffic volumes grow, it is likely that the deck and rails will require upgrading to keep the bridge safe. Options for new works have therefore been considered, and appropriate polices given to ensure that the heritage significance of the bridge is protected or enhanced through any modifications made.

2. INTRODUCTION

2.1 Project Outline

Gillies Bridge is a timber truss bridge which has been assessed by a previous Conservation Management Plan as being of State Significance.[1] This updated Conservation Management Plan has been commissioned to reassess the significance of Gillies Bridge and to identify policies for the conservation of its heritage values with a view to developing a brief for its repair and refurbishment.

2.2 Study Area and Item

Gillies Bridge is located approximately 50km northwest of Newcastle on Wilderness Road over Black Creek near Rothbury in Cessnock City Council LGA, as shown in Figure 2.1. It was constructed by the Department of Public Works in 1901-02 and is under the care and control of Cessnock City Council.

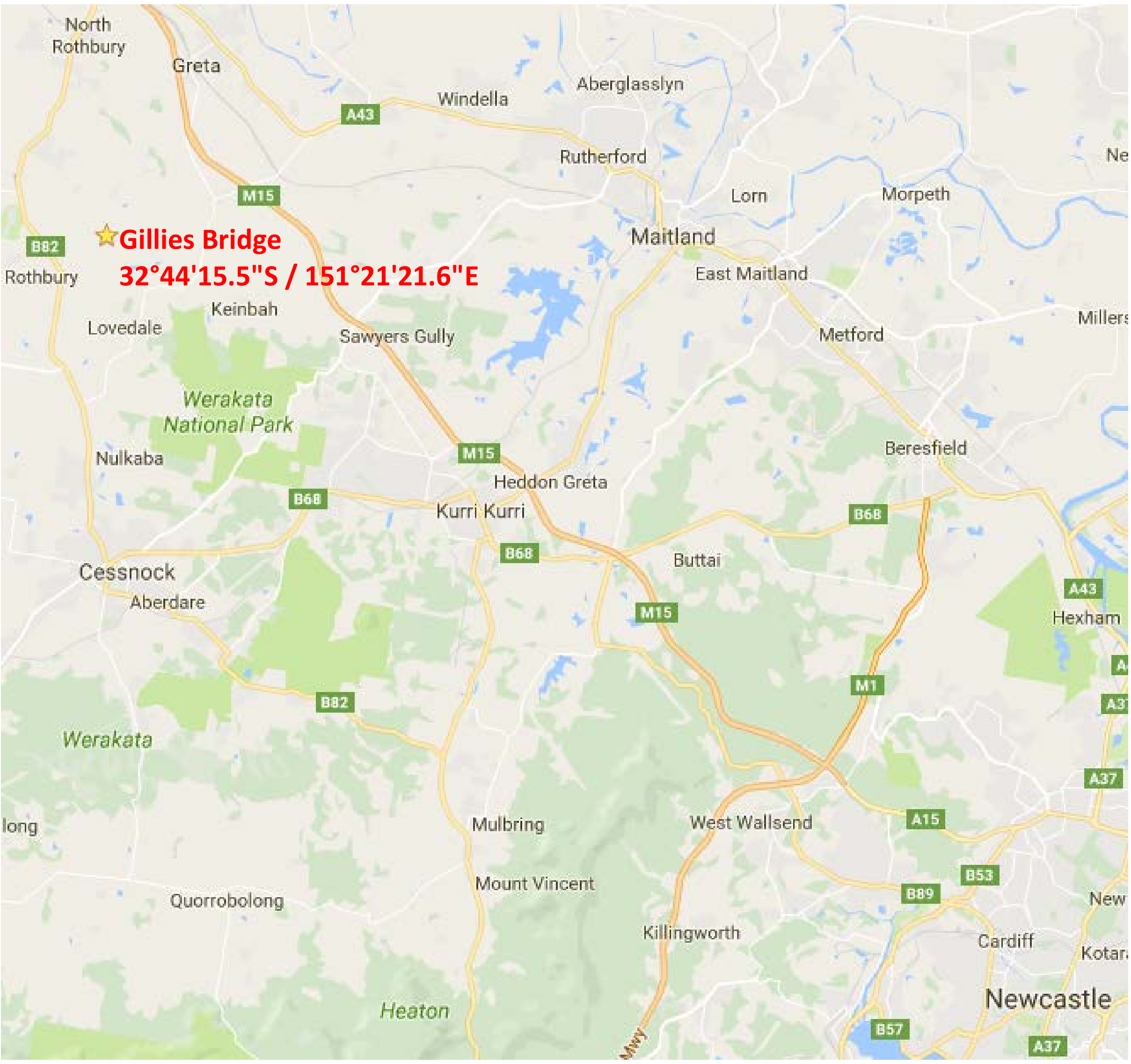

Figure 2.1: Map showing location of Gillies Bridge in relation to Newcastle, Cessnock and Rothbury

[1] Bill Jordan & Associates, *Gillies Bridge (de Burgh timber truss) Black Creek, Wilderness Road, Rothbury, Conservation Management Plan*, prepared for Cessnock City Council, October 2001.

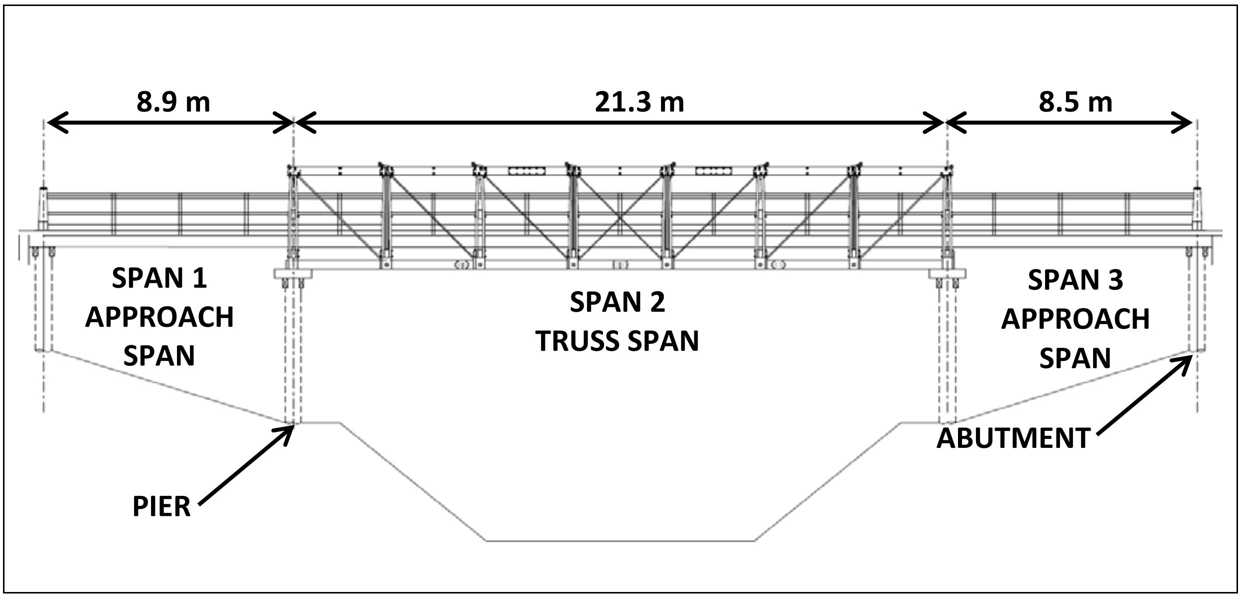

Figure 2.2 General Arrangement of Gillies Bridge (source: author)

As is indicated in Figure 2.2 above, the bridge is approximately 40m in length consisting of three spans. The main central span is a 70' (21m) de Burgh type timber truss span and the two approach spans are timber girder spans. The bridge has a total width of approximately 5.5m and carries a single lane of traffic. The three spans are supported on timber trestle piers and timber abutments.

Figure 2.3 Photograph of Gillies Bridge (source: author, August 2013)

2.3 Methodology

The purpose of this report is to present a detailed assessment of the cultural significance of Gillies Bridge and to propose management strategies to maintain that significance. Cultural significance is defined in the *Australia ICOMOS Burra Charter, 2013* as aesthetic, historic, scientific, social or spiritual value for past, present or future generations.[2] In order to manage the bridge in a way that will conserve cultural significance, it is necessary to understand why it is considered significant.

Identifying the heritage significance of an item relies on understanding and analysing documentary evidence, the context and historic themes that apply, the ways in which the item's existing features demonstrate its functions and associations, and its aesthetic qualities. This report has been prepared according to the methodology recommended by the Heritage Division of the New South Wales Office of Environment and Heritage (OEH) in *Assessing Heritage Significance*, and is consistent with the guidelines set out in the *Burra Charter* and in the *Conservation Plan*.[3]

The format and structure of this report follows the OEH suggested table of contents.[4]

2.4 Limitations

This Conservation Management Plan (CMP) has been prepared and the policy formulated based on information researched within the time frame allocated for preparing the report (3 months). Such searches are never exhaustive and it should be expected that further information may come to light in the future. It is therefore recommended that the CMP be updated after a period of ten years or as new evidence comes to light. Although a brief site inspection was undertaken on Friday 24 March 2017, no detailed inspection of the condition of the fabric was undertaken, but rather, this report has relied on the bridge Level 3 inspection undertaken by a consultant in March 2016. No real investigation has been undertaken to discover the archaeological potential or remains of previous crossings, and this report has relied on previous investigations to cover the local history.

2.5 Identification of Author

This Conservation Management Plan has been prepared by Amie Nicholas, Chartered Heritage and Conservation Engineer (Structural), BE, Grad Dip (PM), M.E., M.Herit.Cons., MIEAust, CPEng, NPER.

2.6 Acknowledgments

This report has been prepared with the support and assistance of Peter Davis of Cessnock City Council who provided valuable information held by Council and arranged for the site inspection.

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[2] *The Burra Charter: The Australia ICOMOS Charter for Places of Cultural Significance, 2013*, p 2.
[3] Assessing Heritage Significance, *NSW Heritage Manual*, NSW Heritage Office, 2001; *Burra Charter*, 2013; James Semple Kerr, *Conservation Plan*, 7th edition, National Trust of Australia (NSW), January 2013.
[4] *A Suggested Table of Contents for a Conservation Management Plan that can be Endorsed by the NSW Heritage Council*, Heritage Division of the New South Wales Office of Environment and Heritage, July 2002.

2.7 Definitions

The terminology in this report is consistent with the definitions given in the *Burra Charter* (copied in full in 2.7.1 below) with bridge specific terminology as defined in 2.7.2 as well as Figures 2.2 and 2.4.

2.7.1 Burra Charter Definitions:

Place means a geographically defined area. It may include elements, objects, spaces and views. Place may have tangible and intangible dimensions.

Cultural significance means aesthetic, historic, scientific, social or spiritual value for past, present or future generations. Cultural significance is embodied in the place itself, its fabric, setting, use, associations, meanings, records, related places and related objects. Places may have a range of values for different individuals or groups.

Fabric means all the physical material of the place including elements, fixtures, contents and objects.

Conservation means all the processes of looking after a place so as to retain its cultural significance.

Maintenance means the continuous protective care of a place, and its setting. Maintenance is to be distinguished from repair which involves restoration or reconstruction.

Preservation means maintaining a place in its existing state and retarding deterioration.

Restoration means returning a place to a known earlier state by removing accretions or by reassembling existing elements without the introduction of new material.

Reconstruction means returning a place to a known earlier state and is distinguished from restoration by the introduction of new material.

Adaptation means changing a place to suit the existing use or a proposed use.

Use means the functions of a place, including the activities and traditional and customary practices that may occur at the place or are dependent on the place.

Compatible use means a use which respects the cultural significance of a place. Such a use involves no, or minimal, impact on cultural significance.

Setting means the immediate and extended environment of a place that is part of or contributes to its cultural significance and distinctive character.

Related place means a place that contributes to the cultural significance of another place.

Related object means an object that contributes to the cultural significance of a place but is not at the place.

Associations mean the connections that exist between people and a place.

Meanings denote what a place signifies, indicates, evokes or expresses to people.

Interpretation means all the ways of presenting the cultural significance of a place.

2.7.2 Bridge Specific Definitions:

Anchor Block means the cast iron component which connects the top of the vertical timber members and diagonal metal members in a de Burgh truss to the timber top chord (Fig 2.4).

Bottom Chord means the lower horizontal member of the truss (Fig 2.4).

Cross Girder means a transverse bending member spanning between the upstream truss and the downstream truss which supports the deck system (Fig 2.4).

Deck means the components of the bridge which directly support vehicle and pedestrian loads.

Flitch means one of two elements bolted together with spacers to form a single member (Fig 2.4).

Laminated means three or more rows of parallel components are joined together (by glue, bolts or stressed strand) to form a single member which is longer than any of the individual components.

Panel means the area between the panel points (or main joints) in a truss (for example, the truss of Gillies Bridge shown in the diagram below consists of seven panels, each 10' or 3048 mm long).

Panel Point means the locations of the intersections of the main members in a truss.

Stringer means a member which spans between cross girders and supports the deck.

Sway Brace means a member located outside the truss extending between the top chord and the cross girder designed to resist sway of the truss or provide lateral support to the top chord.

Tension Rod means a diagonal metal bar connecting the top and bottom chords of a truss (Fig 2.4).

Top Chord means the upper horizontal member of a truss (Fig 2.4).

Truss means a special class of structure in which members are connected at joints in a manner that permits rotation so that the individual members can only carry either tension or compression.

Wind Bracing means the system of metal rods under the deck which connect the upstream bottom chord and the downstream bottom chord in such a way to provide lateral resistance to wind loads.

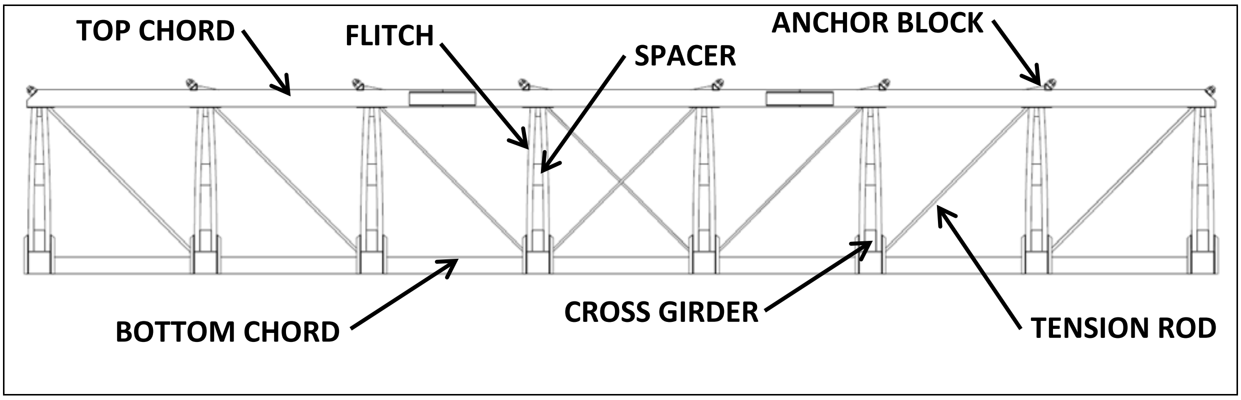

Figure 2.4 Diagram showing de Burgh truss terminology (source: author)

3. DOCUMENTARY EVIDENCE

3.1 Thematic History

The bridge is associated primarily with two State historical themes, these being “Technology” (Activities and processes associated with the knowledge or use of mechanical arts and applied sciences) and “Transport” (Activities associated with the moving of people and goods from one place to another, and systems for the provision of such movements). These two themes fall under the National historical theme of “Developing local, regional and national economies”.

3.2 History of the Area

The traditional custodians of the Hunter Valley Area were the Wonnaruah people.

This section (3.2) is taken directly from the 2001 Conservation Management Plan.[5]

3.2.1 Locality History Overview

Black Creek was so named, by explorer John Howe, for the colour of the water in the oak-lined creek at the time the watercourse was located by European explorers.[6]

Settlers, prior to 1825, took up land along Black Creek. Figure 3.1 indicates significant early land grants along Black Creek.[7] This area was favoured by its proximity to the early road from Windsor to Wollombi, thence to Wallis Plains or Patrick’s Plains.

Historically significant estates on Black Creek were Campbell’s *Cessnock* (coloured red), McDonald’s *Glenmore* (yellow) and Coulston’s estate of 3700 acres in five parts (green), which was located on both sides of Black Creek.

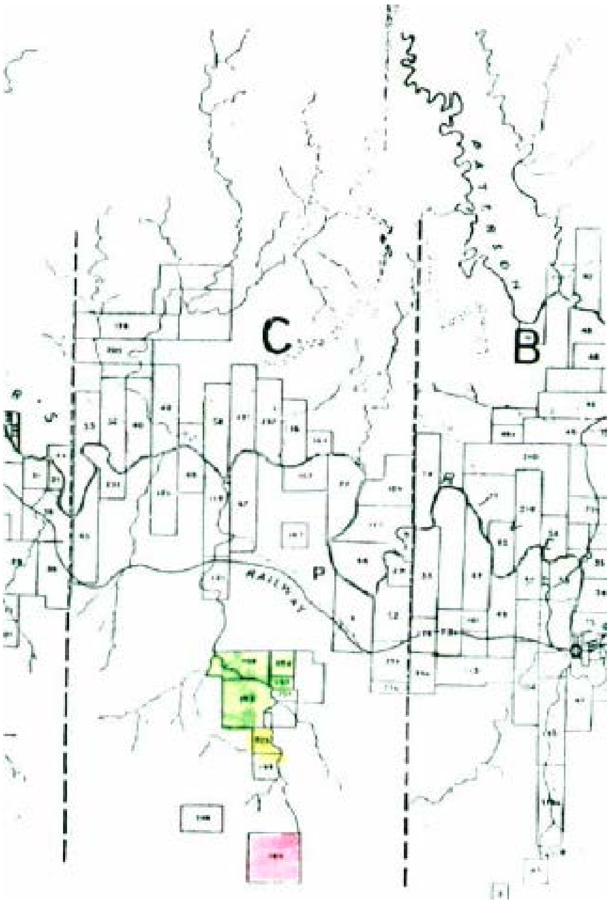

Figure 3.1 (Source: RAHS Journal, Vol 12, Part 2)

Early local roads were those from Wollombi to Rutherford, Wollombi to Cessnock and Branxton, and an east-west link from Bishops Bridge near the first mentioned road to Allandale then through the northern part of Coulston’s estate (*Belmont*) and on to the road to Patrick’s Plains.

[5] Bill Jordan & Associates, *Gillies Bridge Conservation Management Plan*, October 2001, with historical research and writing undertaken by Mrs Cynthia Hunter, pp 1-6.
[6] Interview, Cynthia Hunter with Jack Delaney
[7] James Jervis, ‘The Genesis of Rural Settlement on the Hunter’, RAHS Journal, Vol 12, Part 2 (seems to be incorrect citation – should be Vol 12 pt 2 (1926) J. F. Campbell, 'The genesis of rural settlement on the Hunter')

In 1831, a water mill was built on Black Creek in the *Belmont* part of Coulston's estate. Farmers grew much wheat.

In time, the 3700 acres became the farms of Timothy O'Sullivan Green, *Ballabourneen*, McDonald's *Weronga*, Blick's *Belmont* (later *Belbourie* vineyards of J H and J W Roberts), Holme's vinyards *The Wilderness* and *Caerphilly*, Campbell's *Daisy Hill*, St Paul's Church of England and cemetery, and the site of Rothbury Public School and Rothbury School of Arts.[8] Joseph Broadbent Holmes built his homestead 'The Wilderness' on the right bank of Black Creek near the site of the bridge.

With this division of the large estate, Wilderness Road joining Rothbury to Allandale became necessary for the farming community to more easily access their markets. From 1858/9 the Great Northern Railway provided carriage for goods. A rail station at Allandale was provided in the late 1860s.

The great number of smaller land holdings apparent in the accompanying part of the County of Northumberland map (Figure 3.2) indicates the taking up of small farms following the 1861 Land Acts, which accelerated rural settlement and agricultural productivity. The movement in the Rothbury area in the 1860s to open a public school and the provision of a post office in 1875 indicates this.

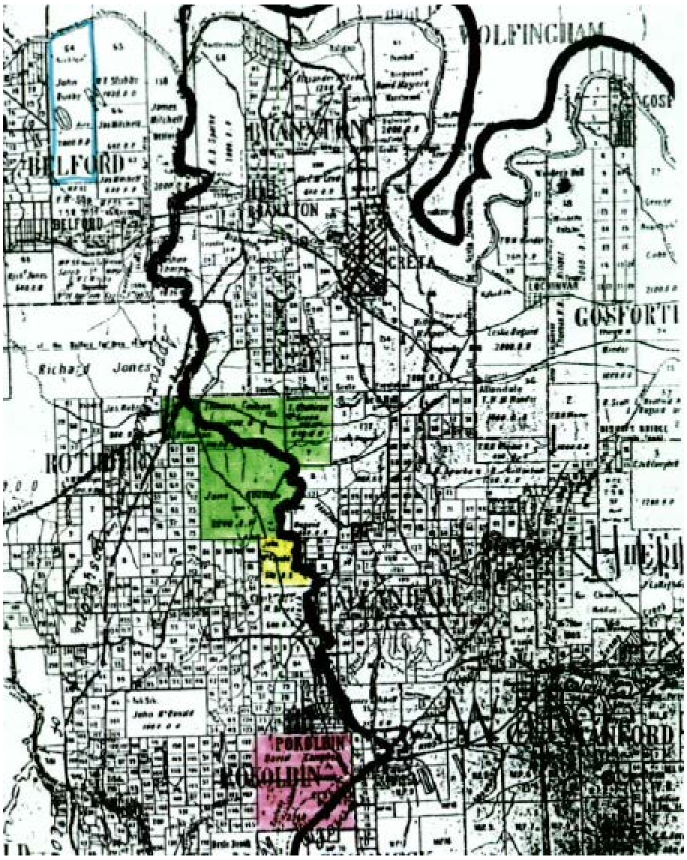

Figure 3.2 (Source: County of Northumberland map, 1896)

3.2.2 The Wine Industry

The development of vineyards in the Lower Hunter Valley began first on the Hunter River at Kirkton by Busby and Kelman (see Figure 3.2, blue) and then spread to the north side of the river, the valleys of the Paterson and Williams Rivers and east to Port Stephens. These early vineyards were the forerunners of the many that developed in the Cessnock area following the 1861 Land Acts about 30 years later. The area particularly favourable for vineyards was between the Hunter River and the Mount View range and about Pokolbin and Rothbury and towards Sawyers Gully. Members of some of the most famous wine making families in Australia are buried in St Paul's Rothbury Cemetery.

3.2.3 Farming and Timber Getting

Growing wheat and other crops, mixed farming, livestock production and timber getting were other important activities in the Rothbury-Allandale area. Building railways, providing poles for the overland telegraph lines both locally and for export, providing timber for the coal mining industry

[8] WS Parkes, Jim Comerford and Dr Max Lake, *Mines, Wines and People*, Part 1.

and for building coal wagons, and construction work generally, created an insatiable demand for timber, which this district provided.

3.2.4 Local Growth, Development and Change

The years between the late 1860s and 1900 were ones of population and economic growth. St Paul's Anglican Church (the 'Wilderness' Church) and cemetery served the needs of the Pokolbin and Rothbury communities after its opening in 1868. Public Schools opened at Cessnock in 1867 (after a brief attempt to establish a school in 1859), at Rothbury in 1868, Pokolbin in 1880 and Allandale in 1882. Rothbury secured a Post Office in 1875. The School of Arts opened in 1902, at the same time as the bridge was opened.

In 1901/2, Allandale was a very busy railway depot and export centre for the Rothbury and other surrounding areas. 'Allandale News' items from the *Maitland Mercury* 1901-1902 appended indicate the considerable traffic along Wilderness Road and the problems with 'Holmes Crossing' at Black Creek.[9] Also indicated is the fact that the community had sought a bridge here for many years.

Rothbury church, school, School of Arts and tennis courts all closed by the post-World War Two period, brought about in part by the decline in dairy farming. In recent years, grape growing and winemaking have enjoyed a revival and along with this the population and economy have also revived.

3.2.5 Local Government

Within the Cessnock area the Municipality of Greta was the first local government area to be formed. Greta took off as a settlement in 1868 when Farthing bought a large tract of land and began to develop a coal mine. This brought people and justified a railway station on the Great Northern Railway line in 1869, a post office in 1874, a school in 1878 and a municipal status in 1890.[10]

The Shire of Cessnock was constituted sixteen years later in 1906. This was in response to contemporary legislation that made incorporation of rural areas compulsory. Population growth had occurred in response to the mines opened along the outcrop of the Greta measures from Stanford Merthyr, Kurri, Weston, Aberdare, Cessnock, Abermain and Neath.

By 1924 the population of the town of Cessnock was 5,102 with 12,048 within a mile radius. This justified the creation of two separate local government areas – the Municipality of Cessnock covered the town itself and the Shire of Kearsley the rest of the former Shire of Cessnock, renamed in honour of William Kearsley, MLA 1910-1921.

While Cessnock prospered, coal mining in Greta declined. As its economy was based solely on coal, the town also declined – industry, shops and pubs closed and miners moved further south to the newer coalfields around Cessnock. In 1934 the Municipality was incorporated into the Shire of Kearsley. Ten years later portions of the Shire of Lower Hunter and Maitland Municipality were added to the Shire of Kearsley. In 1957 the Municipality of Cessnock amalgamated with the Shire of Kearsley to form the Municipality of Greater Cessnock. This was proclaimed the City of Greater Cessnock a year later and the title shortened to City of Cessnock in 1984.

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[9] 'appended' newspaper articles are illegible and are not included in this report, but are summarised in 3.7.1.
[10] City of Cessnock Heritage Study, Section 3.8.8

3.3 The Unique Hardwood Timbers of New South Wales

When Europeans first explored Australia, they were less than impressed by the Australian timbers. Captain James Cook said in 1770 that the trees were so "hard and ponderous" that they were pretty much useless. Surgeon John White reported in 1790 that, "I do not know any one purpose for which it (Australian timber) will answer except for firewood; and for that it is excellent; but in other respects it is the worst wood that any country or climate ever produced." [11]

Various newspaper articles of the late 1700s and very early 1800s describe the difficulties the convicts had in dealing with the Australian timbers due to their "monstrous bulk", hardness and incredible weight.[12] The trees in the immediate vicinity of the settlement at Sydney were too crooked, too hard to work, and too damaged by fire to be used as a structural material.

Soon, however, timbers were discovered in New South Wales which would rival any in the world. Australian Red Cedar (*Toona ciliata*) was discovered in the Hawkesbury Flats and gangs of convicts were immediately sent to cut them down. Sixty logs from the Hawkesbury were exported to India as early as 1795, followed by loads to England, China, South Africa and New Zealand.[13]

Between 1855 and 1886, there were international exhibitions of timber in Paris, Melbourne, London, Sydney and New Zealand. The judges sawed the samples, planed them, nailed them and tested them for strength. Australian timbers met high praise.[14] Experiments were made at the foundry of P.N. Russell & Co. in 1860 which showed how much tougher the ironbark is than Baltic or American timber. The conclusion made was that whatever span had been possible with timber in other countries could certainly be imitated, if not surpassed, in New South Wales. [15]

Figure 3.3 Left: Forest of young Black-Butt Trees in 1800s; Right: Tallow-wood Logs for Transport in 1800s
(Source: Hutchinson (ed) New South Wales: the Mother Colony of the Australias, Sydney: Govt. Printer, 1896)

[11] E.G. Trueman, *Timber Bridge Conservation in NSW*, Sydney: Hughes Trueman Ludlow, 1984, p 18.
[12] "Sydney", *Sydney Gazette and New South Wales Advertiser*, Sunday 7 August 1803, p 2.
[13] Eric Rolls, "A Land Changed Forever", *In the Living Forest: An Exploration of Australia's Forest Community: Industry, Science, Technology, Government, Tourism, Management, Conservation, Planning*, edited by John Keeney, 2005, pp 16-19.
[14] Eric Rolls, "A Land Changed Forever", 2005, p 16.
[15] *The Sydney Morning Herald*, Wednesday 16 May 1860, p 4.

In 1896, J. J. C. Bradfield, famous for the design of the Sydney Harbour Bridge, reported on the comparative strength of ironbark and iron, and found that, for the same weight, ironbark is more than three times stronger than iron in tension, and almost twice as strong as iron in compression.[16]

In 1896, Botanist J.H. Maiden wrote that, "Ironbark stands alone as the embodiment of the combination of a number of qualities valued in timber, viz., hardness, strength, and durability… one of the main reasons why colonial timbers are not more used is because users are nervous through ignorance… I plead for a wider interest to be taken in our trees and our timbers, and that in place of the apathy which exists… it may be realised that study of them is not only full of interest, but, as a mental discipline alone, worthy of attention by the best intellects of the Colony." [17]

Figure 3.4 Australian Hardwood Sleepers and Girders being loaded at Darling Harbour for South Africa, 1903 (Source: NSW Legislative Assembly: Report of the Department of Public Works for Year Ended 30 June, 1903)

Around this time, the duty of inspecting exported timber fell to the Department of Public Works (PWD). It was thought that, whatever views may be held as to the advisableness of sending away large quantities of our best timbers, it was desirable that all such exports should be properly inspected and classed. By 1904, the rapid disappearance of hardwoods was increasing due to the recognition of its value by the commercial world of Europe, South Africa, and the East. In 1907 it was reported that excessive exports had greatly increased the price of timber, and that unless there be some check given to the trade, national works were likely to be seriously handicapped.[18]

[16] J.J.C. Bradfield, "Some Notes on Australian Timbers", read before the Sydney University Engineering Society on 28-05-1896

[17] J.H. Maiden, "Timbers of the Colony", *New South Wales: the Mother Colony of the Australias*, edited by F. Hutchinson, Sydney: Charles Potter, Government Printer, Phillip Street 1896, pp 168-180.

[18] NSW Legislative Assembly: *Reports of the Department of Public Works*, 1903 p 64; 1901 p 73; and 1899 p 12.

Percy Allan of the PWD rather discourteously described the difficulties in obtaining large long lengths of timber for timber truss bridges in 1895: "Again, some of the flitches are 53' 6" long and, having to be free of heart and sapwood, are difficult to obtain, and this oftentimes occasioned delay in the erection of the structures, the simple-minded sawmill proprietor supplying all the short and profitable sizes in the bridge, and then pleading inability to supply the more costly flitches." [19]

It would seem that saw-millers had something of a reputation, as seen by Henry Kendall's poem below. Thomas Henry Kendall (1839-1882) was born in Ulladulla, New South Wales, and was once regarded as Australia's finest poet, and is known for his distinctly Australian poetry. Not only was Kendall a poet, but he also worked for a time in the timber business in the Mid North Coast of NSW, and was, for the last 18 months of his life, appointed by Henry Parkes as inspector of forests, for which he was admirably fitted by his knowledge of native timbers.[20]

JIM THE SPLITTER, by Henry Kendall[21]

No party is Jim of the Pericles type —
He is modern right up from the toe to the pipe;
And being no reader or roamer,
He hasn't Euripides much in the head;
And let it be carefully, tenderly said,
He never has analysed Homer…

You mustn't, however, adjudge him in haste,
Because a red robber is more to his taste
Than Ruskin, Rossetti, or Dante!
You see, he was bred in a bangalow wood,
And bangalow pith was the principal food
His mother served out in her shanty.

His knowledge is this — he can tell in the dark
What timber will split by the feel of the bark;
And rough as his manner of speech is,
His wits to the fore he can readily bring
In passing off ash as the genuine thing
When scarce in the forest the beech is.

In girthing a tree that he sells "in the round,"
He assumes, as a rule, that the body is sound,
And measures, forgetting to bark it!
He may be a ninny, but still the old dog
Can plug to perfection the pipe of a log
And "palm it" away on the market.

He splits a fair shingle, but holds to the rule
Of his father's, and, haply, his grandfather's school;
Which means that he never has blundered,
When tying his shingles, by slinging in more
Than the recognized number of ninety and four
To the bundle he sells for a hundred!

When asked by the market for ironbark red,
It always occurs to the Wollombi head
To do a "mahogany" swindle.
In forests where never the ironbark grew,
When Jim is at work, it would flabbergast you
To see how the "ironbarks" dwindle…

He shines at his best at the tiller of saw,
On the top of the pit, where his whisper is law
To the gentleman working below him.
When the pair of them pause in a circle of dust,
Like a monarch he poses — exalted, august —
There's nothing this planet can show him!

… So much for our hero! A statuesque foot
Would suffer by wearing that heavy-nailed boot —
Its owner is hardly Achilles.
However, he's happy! He cuts a great "fig"
In the land where a coat is no part of the "rig" —
In the country of damper and "billies."

[19] Percy Allan, "Timber Bridge Construction in New South Wales", read before the Engineering Section of the Royal Society of NSW on 18 Sept 1895, *Journal and proceedings of the Royal Society of NSW*, Vol 29, 1895, p VI.
[20] T.T. Reed, Australian Dictionary of Biography, Volume 5, 1974, Kendall, Thomas Henry (1839 – 1882) http://adb.anu.edu.au/biography/kendall-thomas-henry-3941 (accessed 20/02/2017)
[21] The Poems of Henry Kendall, Sydney: Angus and Robertson, 1920.

3.4 History of Early Timber Bridges in New South Wales

The first bridge to be built in Australia was in 1788 when a gang of convicts were employed in rolling timber together to form a bridge over the Tank Stream in Sydney. This bridge lasted more than 15 years until it was replaced in 1804 by a "more permanent" stone arch bridge, which collapsed within twelve months and had to be rebuilt.[22] The stone bridge was again largely rebuilt in 1811 at a cost of '660 gallons of spirits'.[23] The idea that timber bridges are "temporary" structures has been pervasive throughout their history, despite many of them outlasting so called "more permanent" structures made of "modern" materials such as steel and concrete.

This is clearly indicated in the report to the Legislative Assembly of New South Wales of the Department of Public Works in 1897, which states, "With regard to the repairs and maintenance of bridges, which now demand a large and yearly-increasing expenditure, the Assistant Engineer suggests, as settlement advances in the Colony, replacing timber structures, so far as practicable, by bridges of a more permanent character, and thus reducing the annual cost of repairs and maintenance. He points out that, in consequence of the improvement effected of late years to the surface of the roads, and the cutting down of grades, the bridges are now required to bear the strain of much heavier loads than they were estimated to sustain at the time they were built." [24]

Percy Allan, the first Australian born engineer to be appointed Chief Bridge Engineer, challenged the popular idea that steel bridges were more economical in the long run than timber, arguing in 1924 that this idea was based on overseas experience with lesser quality timber. He said that, "In Australia, however, with timber bridges of modern design built of more durable hardwood, experience has shown that the popular idea has no solid foundation in fact." [25]

The early days of timber bridge building in Australia were largely experimental, and not always terribly successful. The first timber arch bridge was built in Maitland in 1852.[26] Timber arches were popular at first for both road and rail bridges but fabrication was difficult, and they were subject to deterioration and distortion, and so this type of bridge did not last very long, and none remain today. The main problem was the separation of the laminates, due to the large amount of shrinkage of the Australian hardwoods, and the consequent penetration of water into the joints. Once fungi or termites attacked the timber it was impossible to renew the laminates or portions of the arch. These bridges were costly to build, and as their short lives proved, they were not cost-effective.[27]

Despite the early difficulties with timber as a structural material in NSW, engineers continued to experiment, and the first timber truss bridge in NSW was built in Carcoar between Bathurst and Cowra in 1855 (opened 1856).[28] Although good work was done by the early colonial road-engineers, the real engineering history of NSW road bridges dates from the formation of the Public Works Department in 1858 shortly after the inauguration of responsible Government in the Colony.

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[22] E.G. Trueman, *Timber Bridge Conservation in New South Wales*, Sydney: Hughes Trueman Ludlow, 1984.
[23] Department of Main Roads, NSW, *The Roadmakers, A History of Main Roads in New South Wales*, Sydney: Department of Main Roads NSW 1976.
[24] Report of the Department of Public Works to the Legislative Assembly for the year ended June 1896, p 8.
[25] Percy Allan, "Highway Bridge Construction", *Industrial Australian and Mining Standard*, 14 Aug. 1924, p 243.
[26] Department of Main Roads NSW, *Timber Truss Bridge Maintenance Handbook*, February 1987, p 7.
[27] Department of Main Roads NSW, *Timber Truss Bridge Maintenance Handbook*, February 1987, pp 7-8.
[28] *The Sydney Morning Herald*, Monday 31 December 1855, p 4.

Figure 3.5 The laminated timber arch bridge over South Creek at Windsor in 1872
(Source: DMR, *The Roadmakers*, Sydney: Department of Main Roads, NSW, 1976, p 54.)

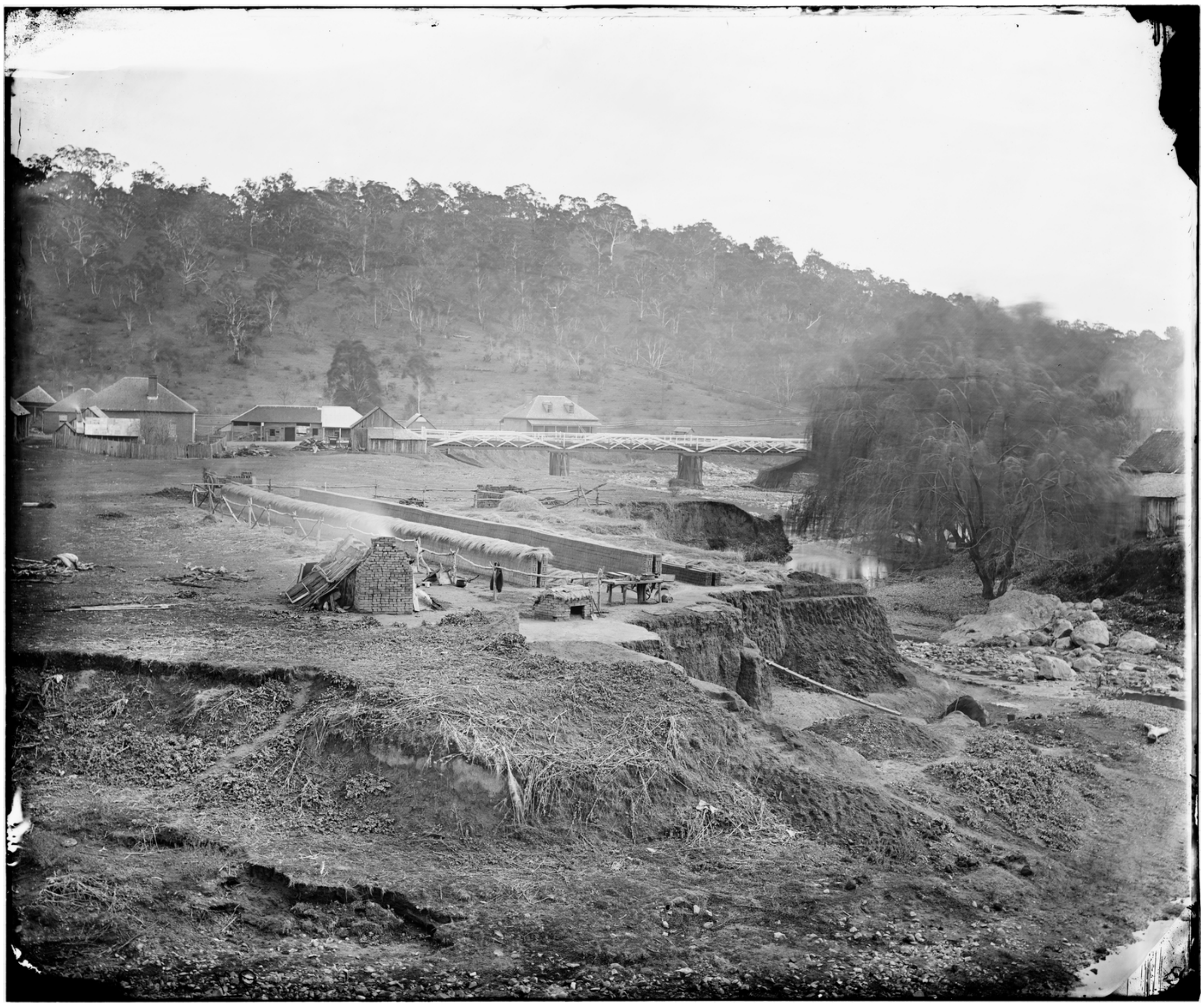


Figure 3.6 First Timber Truss Bridge in NSW constructed over the Belubula River at Carcoar in 1855/56
(Source: American & Australasian Photographic Company, Brick-making on the banks of the river at Carcoar, looking south, from the collections of the State Library of New South Wales, date of work approx. 1870 – 1875)

3.5 History of Timber Truss Bridge Design in New South Wales

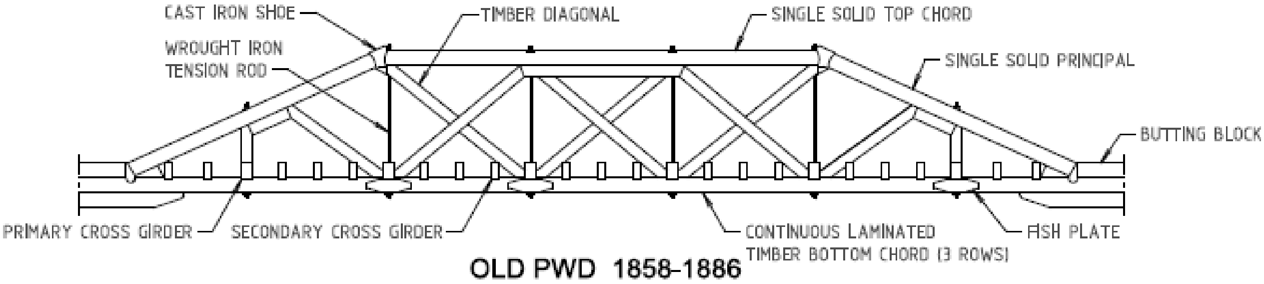
Truss principles were first utilised in the simple pitched roofs of ancient times, where the thrust of the rafters was provided for by the provision of a lower horizontal tie-beam. With the addition of inclined braces and a central king-post, such truss frames were used in Roman timber roofs.[29]

Development of the timber truss was slow. In the fifteenth century, Leonardo da Vinci analysed the forces in triangulated structures, and produced a design for a timber truss bridge.[30] A century later, Palladio published four books of architecture, in which two timber truss bridges were illustrated.[31] Until the 19th Century, design was purely intuitive or based on experience. Even Howe and Pratt, who introduced the most significant truss developments, could not make accurate calculations of their systems. The first rational discussion of the determination of stresses and proportioning truss members was made in 1847 by Squire Whipple in his *Work on Bridge Building*, and in 1858, W.M. Rankine published his *Applied Mechanics* which remains a classic work on the theory of structures.[32]

Between 1858 and 1936, over 400 timber truss road bridges were built in New South Wales, all of which were designed by engineers of the NSW Department of Public Works.[33] The vast majority of these bridges can be divided into five types (a small number of other types were also constructed)[34]: Old PWD (designed by William Christopher Bennett, 1824-1889); McDonald (designed by John Alexander McDonald, 1856-1930); Allan (designed by Percy Allan, 1861-1930); de Burgh (designed by Ernest Macartney de Burgh, 1863-1929); and Dare (designed by Henry Harvey Dare, 1867-1949). There is a clear evolution in design, with the later designs learning from the earlier designs as knowledge of NSW hardwoods grew, and availability and economy of materials changed.

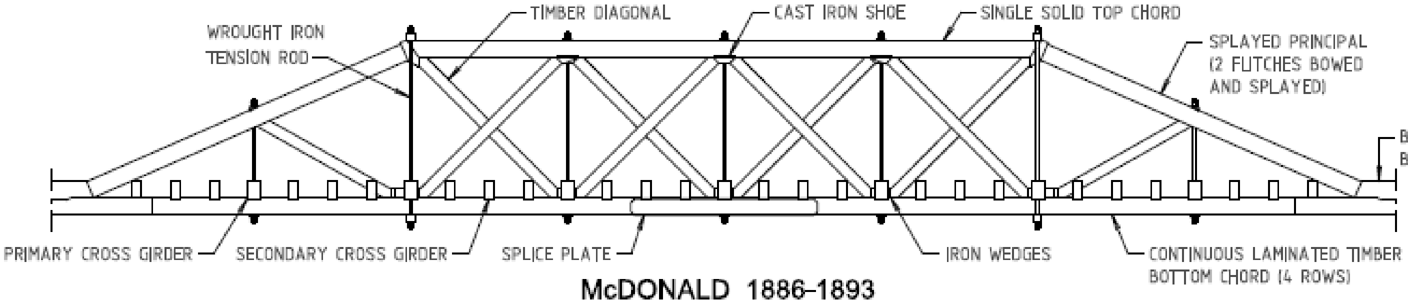
Figure 3.7 The Engineers
(source 1: MBK, "Study of Relative Heritage Significance of All Timber Truss Road Bridges in NSW", 1998, p 23)
(source 2: RTA Oral History Program, "Maintaining the Links: Maintenance of Historic Timber Bridges in NSW")
(source 3: "Mr Percy Allan, Noted Engineer's Death", *The Sydney Morning Herald*, Thursday 8 May 1930, p 12)
(source 4: MBK, "Study of Relative Heritage Significance of All Timber Truss Road Bridges in NSW", 1998, p 37)
(source 5: Engineering Heritage, Sydney http://www.engheritage-sydney.org.au/PDFs/Darlington.pm.pdf)

[29] Lynn Heather Mackay, *Timber Truss Bridges in New South Wales*, a thesis submitted in partial fulfilment of the requirements for the degree of Bachelor of Architecture at the University of Sydney, 1972, p 1.
[30] Lynn Heather Mackay, *Timber Truss Bridges in New South Wales*, 1972, p 1.
[31] Palladio, Andrea, *I Quattro Libri dell' Architettura*, [The Four Books of Architecture]: Venice, 1570.
[32] Lynn Heather Mackay, *Timber Truss Bridges in New South Wales*, 1972, pp 5-6.
[33] Don Fraser, Timber Truss Bridges NSW Database, unpublished, 1998.
[34] For example, an American style Howe truss was designed by Bennett for Vacy Bridge as early as 1858, two American style McCallum trusses were constructed, one at Cowra in 1870 and the other at Casino in 1876. Much later, in 1929 a 70' timber truss bridge was constructed over Mill Creek near Wisemans' Ferry (extant, but closed to traffic) which has more in common with Victorian timber truss bridge design than the NSW.



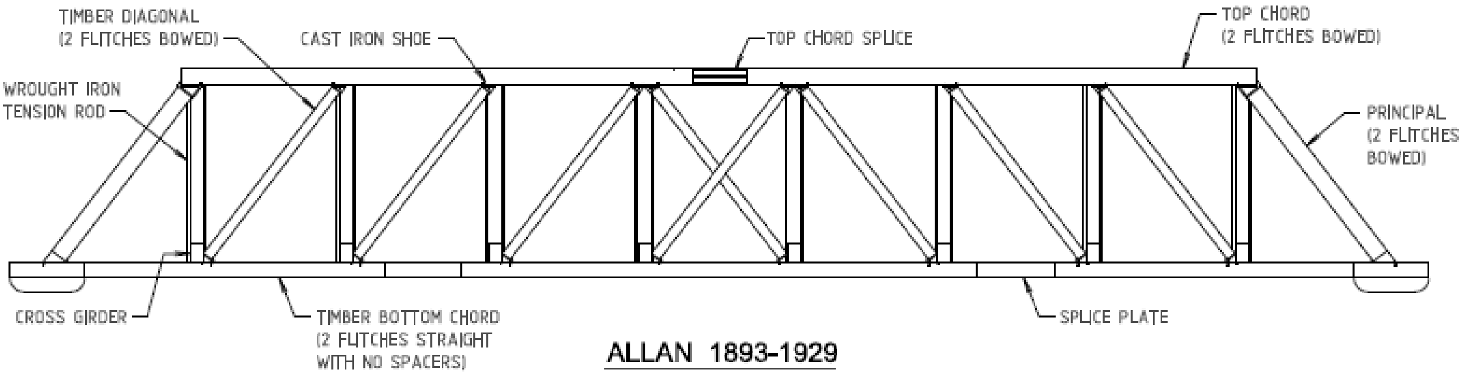
OLD PWD 1858-1886

(70' SHOWN, ALSO 100')



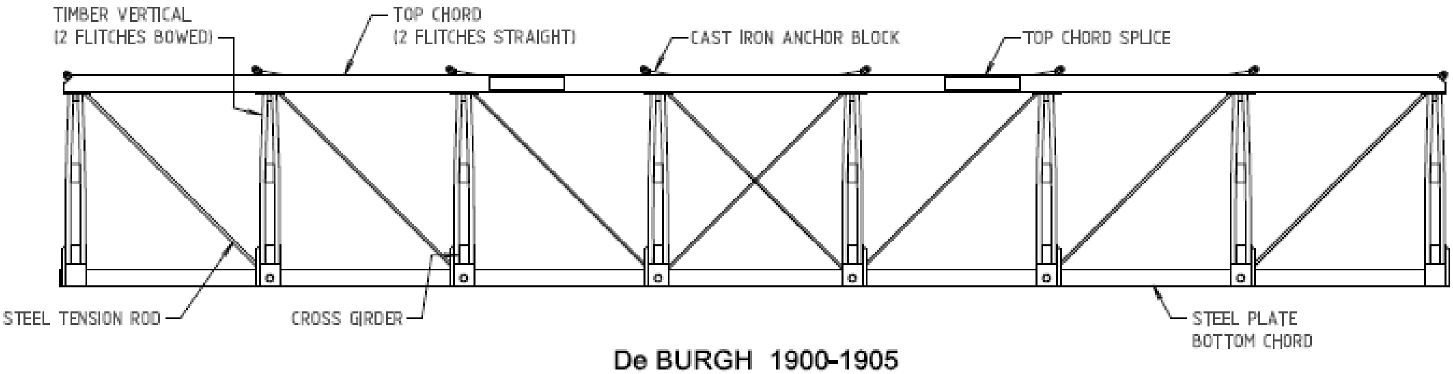
McDONALD 1886-1893

(90' SHOWN, ALSO 75' AND 65')



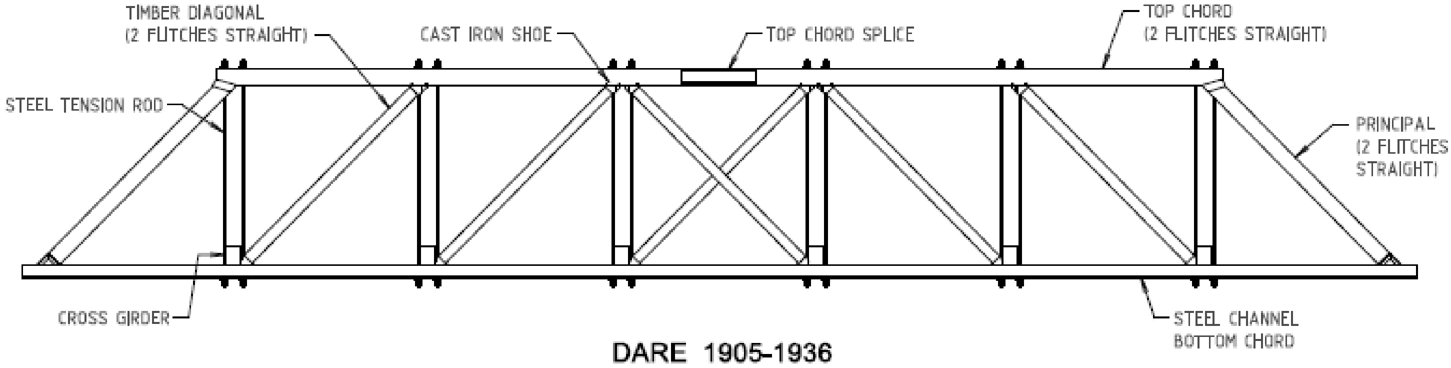
ALLAN 1893-1929

(90' SHOWN, ALSO 110' AND 70')



De BURGH 1900-1905

(91' SHOWN, ALSO 70', 104' AND 117')



DARE 1905-1936

(91' SHOWN, ALSO 70' AND 104')

3.5.1 Old PWD Trusses

Of approximately 150 Old PWD type timber truss bridges built in New South Wales between 1858 and 1886, two remain in 2017. Both are the responsibility of Roads and Maritime Services (RMS).

The historical context which drove the design of these bridges is primarily the plentiful high quality hardwood. The design is an example of innovative and practical engineering in a time when large and long section timbers were readily available and vast numbers of bridges were being built, but budgets were tight and skilled workmen were few.[35] These bridges were not designed as permanent structures due to the fact that, in the new Colony, the required routes were very likely to be diverted by circumstances impossible to anticipate, so it was not economical to provide permanent bridges.[36]

3.5.2 McDonald Trusses

Of approximately 90 McDonald type timber truss bridges built in New South Wales between 1886 and 1893, four remain in 2017 (see next page for details), and are all the responsibility of RMS.

The historical context which drove the design of these bridges is similar to the Old PWD in that large, long, quality hardwoods were still plentiful and permanent bridges were not considered economical. The changes in design stem from the growing knowledge of timber as a structural material due to extensive testing at the University of Sydney, and also the increasing loads requiring that bridges be designed for a minimum distributed live load of 4kPa and a traction engine weighing 16 tons.[37]

3.5.3 Allan Trusses

Of over 100 Allan type timber truss bridges built between 1893 and 1929, twenty remain in 2017. These are listed on the following page, and include 16 owned by RMS and four owned by others.

The historical context which drove the design of these bridges was the increasing difficulty in obtaining large section long timbers, and the need for durable and maintainable bridge designs.

3.5.4 De Burgh Trusses

Of approximately 20 de Burgh type timber truss bridges built between 1900 and 1905, eight remain in 2017. These are listed on the following page, and include seven owned by RMS and Gillies Bridge.

The historical context which drove the design of these bridges was the fact that materials other than timber (such as concrete and steel and other metals) had become increasingly economical.

3.5.5 Dare Trusses

Of approximately 40 Dare type timber truss bridges built between 1905 and 1936, 17 remain in 2017. These are listed in on the next page, and include 12 owned by RMS and five owned by others.

The historical context which drove the design of these bridges was a desire to combine the best aspects from the de Burgh and Allan trusses, while avoiding the primary problems with each.

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[35] Amie Nicholas, *Design and Assessment of NSW Timber Bridges*, RMS, DRAFT, January 2017, p 19.
[36] Percy Allan, "Timber Bridge Construction in New South Wales", read before the Engineering Section of the Royal Society of NSW, 18 Sept 1895, *Journal and proceedings of the Royal Society of NSW*, Vol 29, 1895, p XII.
[37] Percy Allan, "Timber Bridge Construction in New South Wales", p I.

Old PWD	built		De Burgh	built	
Clarence Town over Williams River	1880	✓	Gillies over Black Creek	1902	✓
Monkerai over Karuah River	1882	✓	Beckers over Webbers Creek[38]	1902	?
McDonald			Lansdowne over Mulwaree[39]	1902	×
Galston Gorge over Tunks Creek	1893	✓	Middle Falbrook over Glennies	1904	✓
Junction over Tumut River	1893	✓	Tabulam over Clarence River[40]	1902	×
Crankies Plains over Coolumbooka[41]	1893	?	Cobram over Murray River[42]	1902	?
McKanes over Cox's River	1893	✓	Barham over Murray River	1904	✓
Allan			St Albans over Macdonald River	1902	✓
Beryl over Wyaldra Creek	1927	✓	**Dare**		
Tooleybuc over Murray River[43]	1925	?	Warroo	1909	✓
Carrathool over Murrumbidgee	1922	✓	Junction over Rouchel Brook[44]	1930	?
Abercrombie near Tuena[45]	1919	?	Birrie River near Goodooga[46]	1929	?
Victoria Bridge at Picton	1897	✓	Bells over Hunter River[47]	1929	×
Wallaby Rocks near Sofala	1897	✓	Cooreei over Williams River[48]	1906	?
Hinton over Paterson River	1901	✓	Korns Crossing over Rous River[49]	1916	?
Vacy over Paterson River[50]	1898	?	Briner over Upper Coldstream	1908	✓
Barrington over Barrington River[51]	1918	?	Coonamit over Wakool River[52]	1929	?
Swan Hill over Murray River	1896	✓	Rawsonville over Macquarie	1916	✓
Payten's Bridge over Lachlan River	1926	✓	Gee Gee over Wakool[53]	1929	×
Charleyong over Mongarlowe[54]	1901	?	Scabbing Flat over Macquarie	1911	✓
Wee Jasper over Goodradigbee	1923	✓	New Buildings over Towamba	1921	✓
Rossi over Wollondilly River	1898	✓	Cameron over Rouchel Brook[55]	1930	?
Styx River near Jeogla[56]	1900	×	Bulga over Wollombi Brook[57]	1912	?
Foxlow over Molonglo[58]	1897	?	Colemans over Leycester Creek	1908	✓
Tharwa over Murrumbidgee	1895	✓	Sportsmans Creek at Lawrence[59]	1911	×
Morpeth over Hunter River	1898	✓	Bendemeer over Macdonald[60]	1905	?
Dunmore over Paterson River	1899	✓			
Pyrmont over Darling Harbour	1902	✓			

Table of remaining NSW timber truss road bridges with indications of future (✓ = good, ? = unsure, × = poor)

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[38] Included in the RMS Timber Truss Bridge Conservation Strategy (TTBCS) as a bridge to be replaced.
[39] Included in the RMS TTBCS as a bridge to be replaced, new bridge imminent.
[40] Included in the RMS TTBCS as a bridge to be replaced, new bridge imminent.
[41] Included in the RMS TTBCS as a bridge to be replaced.
[42] Included in the RMS TTBCS as a bridge to be retained, but has already been replaced with a concrete bridge with full pedestrian and cyclist facilities and the timber trusses and piers are in very poor condition.
[43] Included in the RMS TTBCS as a bridge to be replaced.
[44] Council owned bridge, well maintained and in reasonable condition, but with no heritage listings
[45] Included in the RMS TTBCS as a bridge to be replaced.
[46] Council owned bridge, in questionable condition with ad-hoc strengthening measures, no heritage listings
[47] Bridge has been replaced and only parts of damaged old truss remain, approaches and deck removed.
[48] Included in the RMS TTBCS as a bridge to be replaced.
[49] Included in the RMS TTBCS as a bridge to be replaced.
[50] Included in the RMS TTBCS as a bridge to be replaced.
[51] Included in the RMS TTBCS as a bridge to be replaced.
[52] Included in the RMS TTBCS as a bridge to be replaced.
[53] Included in the RMS TTBCS as a bridge to be replaced, new bridge imminent.
[54] Included in the RMS TTBCS as a bridge to be replaced.
[55] Council owned bridge, well maintained and in reasonable condition, but with no heritage listings
[56] Bridge has been replaced and damaged truss bridge is fenced off, no heritage listings
[57] Included in the RMS TTBCS as a bridge to be replaced.
[58] Council owned bridge in poor condition, no heritage listings
[59] Included in the RMS TTBCS as a bridge to be replaced, new bridge imminent.
[60] Council owned bridge open only to pedestrians, in poor condition, listed on Tamworth LEP

3.6 History of the de Burgh Truss

Ernest Macartney de Burgh was born at Sandymount County Dublin, Ireland on 18 January 1863. He was educated at Rathmines School and the Royal College of Science, Ireland. After graduating, he was engaged for a time on railway work in Ireland, and later came to New South Wales, joining the Public Works Department on survey and construction work in 1885. Within two years he was in charge of the construction of steel bridges across the Murrumbidgee and Snowy Rivers, and then designed and superintended the construction of many other bridges throughout the State.[61] His name ranked high beyond Australia, and he was twice awarded Telford Premiums for papers contributed to the Institution of Civil Engineers, London. De Burgh is probably best remembered for his design and construction of many great engineering works for water supply and conservation.[62]

Figure 3.8 Ernest Macartney de Burgh (Source: MBK, 1998)

In 1903 de Burgh became acting principal assistant engineer for rivers, water-supply and drainage and was a member of the Sydney Harbour Bridge Advisory Board. Confirmed in his position next year, he was sent to England and France to study dam construction and water-supply. On his return he was given special responsibility for the construction of Cataract Dam for the Sydney water-supply and served on the royal commission to report upon the project. In 1910-13 he represented the State government at engineers' conferences leading to the River Murray Waters Act. He was involved in the design and construction of Burrinjuck Dam and the Murrumbidgee Irrigation Scheme.[63]

In 1909 de Burgh became chief engineer for harbours and water-supply, and in 1911-13 was also a member of the committee of management of Cockatoo Island Dockyard. In 1913 he was appointed chief engineer for water-supply and sewerage, and was responsible for the design and construction of the Cordeaux, Avon and Nepean dams (Sydney water-supply), the Chichester scheme for Newcastle and the Umberumberka scheme for Broken Hill. In 1921-25 he was a member of the Federal Capital Advisory Committee and prepared the original plans for Canberra's water-supply.[64]

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[61] "Mr. E. M. de Burgh. Prominent Engineer's Death", *Sydney Morning Herald*, Friday 5 April 1929, p 17.
[62] "Mr. E. M. de Burgh. Distinguished Career", Sydney Morning Herald, Wednesday 14 September 1927, p 16.
[63] J. M. Antill, 'de Burgh, Ernest Macartney (1863–1929)', Australian Dictionary of Biography, National Centre of Biography, Australian National University, http://adb.anu.edu.au/biography/de-burgh-ernest-macartney-5937/text10121, published first in hardcopy 1981, accessed online 11 April 2017.
[64] J. M. Antill, 'de Burgh, Ernest Macartney (1863–1929)', Australian Dictionary of Biography, National Centre of Biography, Australian National University, http://adb.anu.edu.au/biography/de-burgh-ernest-macartney-5937/text10121, published first in hardcopy 1981, accessed online 11 April 2017.

That de Burgh made his mark in the country of his adoption is no wonder: his ability and his character rendered mediocrity impossible. A typical Irishman in many respects, de Burgh was a deservedly popular officer. In his dealings with the many men who come under him he had a way which won the goodwill of all; and which enabled him to quickly arrange any of those little difficulties which are apt to crop up where large numbers of men are engaged.[65] From his officers he got the best work by creating a feeling of companionship in all things. It was his breezy personality and ready wit that made an impression upon most people with whom he came in contact. Contractors knew that if they treated him fairly, he would give them also a fair deal; but woe betide the contractor or the officer either, who failed to please him. The edge of his tongue could then be very rough, however charming his manner when things were going satisfactorily.[66]

De Burgh was not alone in designing the de Burgh truss. As can be seen from Figure 3.9 below, de Burgh had worked in the Roads and Bridges Branch of the PWD with Bennett, Allan, McDonald and Dare for many years prior to his design of the truss which is named after him. De Burgh regarded Bennett as a friend as well as his chief, and as someone he looked to for technical advice as well as advice of a more personal nature.[67] Dare was also good friends with de Burgh and had significant involvement in the design of the de Burgh type timber truss bridges.[68] When he designed his truss, de Burgh had all the benefits of the testing which had been conducted from 1886 onwards by William Henry Warren and which both McDonald and Dare had been involved with.[69]

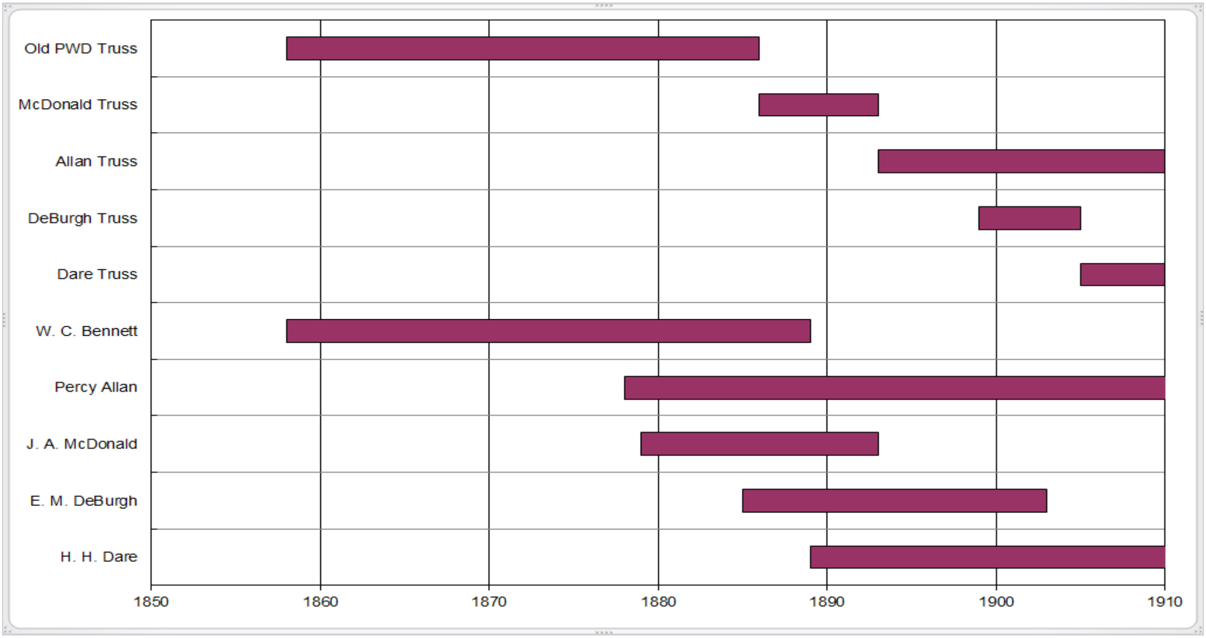

Figure 3.9 Years Employed by PWD Roads & Bridges Branch and Years of Construction (source: author)

[65] "About People", *Town and Country Journal*, 25 September 1907, p 26.
[66] "E. M. de Burgh An Appreciation", *Sydney Morning Herald*, Thursday 11 April 1929, p 10.
[67] William Christopher Bennett - Records, 1850 - 1889, UMS 333; Mitchell Library Manuscripts Collection.
[68] Henry Harvey Dare, *Tales of a Grandfather 1867-1941*, unpublished autobiography.
[69] William Henry Warren, *The Strength and Elasticity of Ironbark Timber as applied to Works of Construction*, read before the Royal Society of NSW 1-12-1886; Ian Bowie, "Australia's First Materials Testing Machine", *ASHET News, Australian Society for History of Engineering and Technology Newsletter*, Vol 3, No 4 Oct 2010, pp 4-6; Henry Harvey Dare, "Recent Road-Bridge Practice in NSW", *Proceedings of the Institution of Civil Engineers (London)*, Vol 115, 1903-04, pp 382-400.

Henry Harvey Dare had significant involvement in the design of the de Burgh type timber truss bridges, but he designed them acting under de Burgh with his assistance and advice, and Percy Allan attributed the introduction of the new design to de Burgh, so it is not inappropriate to call them de Burgh trusses. These bridges are a composite truss design based on the American Pratt type truss, in which the bottom chords and diagonals are of metal (usually steel) and the verticals and top chords of timber. The connection of diagonal tension rods with the bottom chord is effected with pins.[70]

The longest span timber truss bridge constructed in NSW was a de Burgh truss over the Lane Cove River which spanned 165' (50 m).[71] The bridge was opened on 20 December 1900 and officially named De Burgh Bridge on 23 February 1901. A much wider concrete bridge was constructed for the increased traffic volumes in 1967 and the original timber bridge was destroyed in the bushfires of January 1994, but the 1967 concrete bridge nearby is still named de Burghs Bridge.[72]

Figure 3.10 de Burgh Bridge Lane Cove River
(Source: NSW Legislative Assembly: Report of the Department of Public Works for Year Ended 30 June, 1901)

There were two primary reasons for the de Burgh truss design. By the very end of the 1800s, it had been found that, despite Allan's attention to detail and significant innovations introduced in his Allan truss, in almost every case the timber bottom chord had been the first member of the truss to fail, and being in tension, was difficult to replace. Another reason for the introduction of the composite truss, according to Dare, was the extensive timber export trade, which had made it increasingly expensive and difficult to obtain lower chord timbers, which had to be of the best quality ironbark.[73]

In addition to the introduction of a new truss type, de Burgh also brought innovations to the substructure design of timber truss bridges with his use of reinforced concrete Monier Pipes as both a pile covering (where timber piles were used), and in place of cast-iron for cylinder foundations.[74]

The de Burgh truss includes the greatest variety of materials found in any of the NSW timber truss bridges, including mass concrete and reinforced concrete (piers), rolled steel (bottom chords), cast steel (washer blocks), wrought iron (cross girders), cast iron (anchor blocks), brass (in bearings) and, of course, timber (top chords, verticals, stringers and decks). This indicates the increased variety of available materials and also excellence in design to use each material to its best advantage.

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[70] Percy Allan, "Highway Bridge Construction", *Industrial Australian and Mining Standard*, 4 Sept. 1924, p 357.
[71] Don Fraser, "Timber Bridges of New South Wales", *Transactions of Multi-Disciplinary Engineering*, Institution of Engineers Australia, Vol. GE9 No.2 1985, p 99.
[72] MBK, Study of Relative Heritage Significance of All Timber Truss Road Bridges in NSW, 1998, p 39.
[73] Henry Harvey Dare, "Recent Road-Bridge Practice in NSW", *Proceedings of the Institution of Civil Engineers (London)*, Vol 115, 1903-04, pp 382-400.
[74] Report of the Department of Public Works to the Legislative Assembly for the year ended 1899, p 72.

Henry Harvey Dare, who designed many of the de Burgh truss bridges gave an excellent description of the standard details and the design intent in 1904, describing the now demolished Wyong Bridge:

> The lower chords in Wyong Bridge are of the standard type adopted in this form of truss, viz., two steel plates 12 inches in depth, spaced 12 inches apart, laced together in the end bays, and connected at each apex with diaphragms and saddle-plates carrying the timber cross-girders. The vertical struts are of timber, each formed of two sawn pieces seated on the saddle-plates, and securely connected to the lower chords by extending the angle-bars of one of the diaphragms upwards, and bolting right through the verticals and cross-girder.[75] The top chords consist of two sawn timbers free of heart, with a space of 4 inches between.[76] They are connected at each apex by a casting recessed 1¼ inch into the inner side of each flitch, for the full depth, and bolted through. The notching takes the horizontal component of the stress in the diagonal-rods, and the castings, acting as rigid distance-pieces connected to the vertical struts, prevent any tendency to twist on the part of the timber flitches, and ensure that the chords shall keep a good line.
>
> Wind-bracing, consisting of diagonal-rods with turn-buckles, is provided between the lower chords, and the top chords are stiffened against vibration by side stiffeners of T-section, connecting the chord with the cross-girders, which are extended outwards for that purpose.[77] The diagonal-rods are of wrought iron, screwed at the upper end, and having an eye forged on the lower end, which is connected to the lower chord by a pin at each apex. The ends of the chords are seated on cast-iron bed-plates, a gun-metal or rolled-brass plate, ¼ inch in thickness, being interposed loosely between the wrought-iron bearing-plate on the under side of the chord and the bed-plate at the expansion-end of each span.[78]

Twenty de Burgh truss bridges were constructed in New South Wales between 1900 and 1905:[79]

- 1 / 165' (50.3 m) span de Burgh truss bridge which no longer exists.
- 1 / 117' (35.7 m) span de Burgh truss bridge at St Albans which does still exist today.
- 6 / 104' (31.7 m) span de Burgh truss bridges of which three remain today (Barham, Tabulam and Cobram, although Cobram is closed to traffic and a new concrete bridge has been built)
- 10 / 91' (27.7 m) span de Burgh truss bridges of which three remain today (Glennies Creek at Middle Falbrook, Beckers Bridge over Webbers Creek and Lansdowne Bridge at Goulburn)
- 2 / 70' (21.3 m) spans of which Gillies Bridge is the only one remaining (the other was constructed over Lake Macquarie at Fennell Bay in 1902 and was replaced in 1967)

No original design drawings have been found for the 70' de Burgh truss over Black Creek, but RMS holds scanned copies of the original design drawings for the other demolished 70' de Burgh truss.

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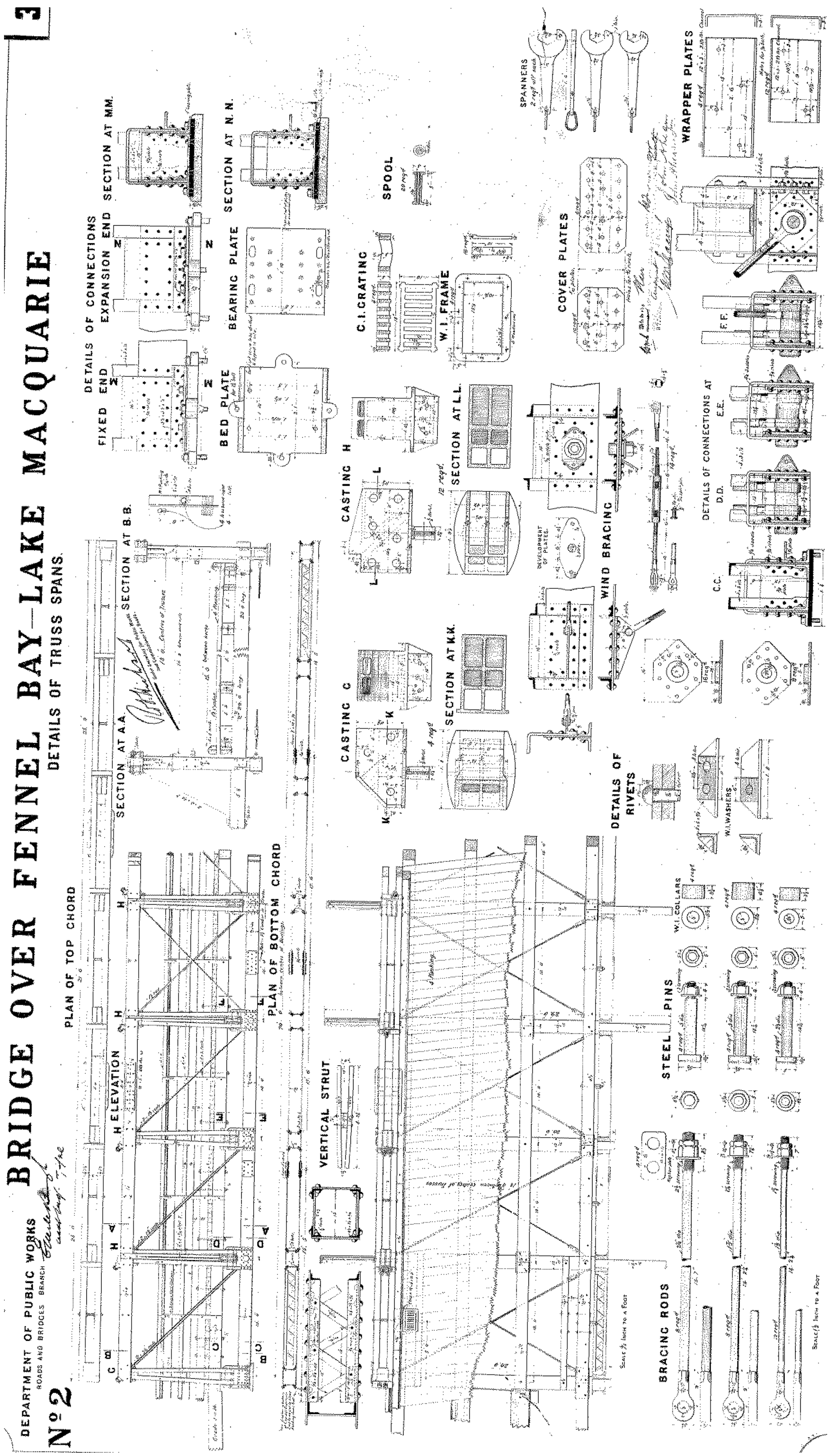
[75] It is interesting that Dare describes the standard design as having angles extended on only one side of the timber verticals, as most of the de Burgh type bridges constructed (including Gillies Bridge) had angles extended on both sides of the timber verticals. One examples of a de Burgh type bridge where angles extend on only one side is the bridge over Glennies Creek at Middle Falbrook, also located in the Hunter Region.
[76] There is an error in Dare's paper. The standard space between top chord timbers should be 8 inches.
[77] This confirms that sway bracing was not originally intended to provide lateral support to the top chord.
[78] Henry Harvey Dare, "Recent Road-Bridge Practice in NSW", *Proceedings of the Institution of Civil Engineers (London)*, Vol 115, 1903-04, p 389.
[79] Don Fraser, Timber Truss Bridges NSW Database, unpublished, 1998.


DEPARTMENT OF PUBLIC WORKS
ROADS AND BRIDGES BRANCH
No 2
BRIDGE OVER FENNEL BAY-LAKE MACQUARIE
DETAILS OF TRUSS SPANS
PLAN OF TOP CHORD
ELEVATION
PLAN OF BOTTOM CHORD
VERTICAL STRUT
SECTION AT A.A.
SECTION AT B.B.
DETAILS OF CONNECTIONS
FIXED END
EXPANSION END
SECTION AT MM.
SECTION AT N.N.
BED PLATE
BEARING PLATE
CASTING G
CASTING H
SECTION AT K.K.
SECTION AT L.L.
C.I. GRATING
W.I. FRAME
SPOOL
DETAILS OF RIVETS
WIND BRACING
DEVELOPMENT OF PLATES
COVER PLATES
SPANNERS
BRACING RODS
STEEL PINS
W.I. COLLARS
W.I. WASHERS
DETAILS OF CONNECTIONS AT
C.C.
D.D.
E.E.
F.F.
WRAPPER PLATES
SCALE ½ INCH TO A FOOT

3.7 History of Gillies Bridge

3.7.1 The Need for the Crossing

The following three newspaper reports from 1901 indicate that, prior to the construction of Gillies Bridge, there was a crossing by the name of Holmes Crossing which was inadequate for local needs.

> *Messrs. Bennett and Gillies are to be thanked for their tickling the dormant Minister, and the latter (Gillies) is receiving great praise from Rothbury and Pokolbin residents for the promise extracted, re Holmes Crossing – a crossing becoming more important every day. As several large dairies are the opposite side to the station in case of flood, a great detour has to be taken with the cream and again farmers with produce and pigs are placed hors de marche.*[80]

> *The tenders for the bridge at Holmes' crossing, Black Creek, are to be called for in three weeks, so that a nasty entrance and exit to this abominable watercourse will be erased from the list of local grievances.*[81]

> *To-day the tenders close for the Rothbury bridge, so we shall soon see a much-needed improvement completed. The get-in and get-out of this creek require testing to be fully appreciated; it is facilis est, going in from either side, but when half-way up, going out, the odds are in favour of your again reaching the bottom – especially after a shower.*[82]

3.7.2 The Construction of the Bridge

The following four newspaper reports from 1901 and 1902 indicate that Mr. W. F. Oakes won the contract for construction of the bridge at £1902 and that construction was complete after a matter of months, it seems, to everybody's satisfaction. Messrs. Gordon, Marr and Co. supplied the ironwork and Mr. Chapman of Ellalong the timber with the piles coming from the Manning River.

> *As predicted one of the lower tenders for the construction of the composite truss bridge over Black Creek, Rothbury, has been accepted. Viz: W. F. Oakes, Sydney, £1902, 36 weeks' time for completion. Everyone using the crossing is thankful that at last this delightful slippery spot is to become a relic of the past.*[83]

> *Messrs. Gordon, Marr and Co. supplied the ironwork, and Mr. Chapman of Ellalong, the timber. The piles came from the Manning River.*[84]

> *Mr. Oakes has completed Rothbury Bridge, and all hands give him credit for having carried out his contract to the letter. He has spared no pains in making a thorough good job, and one that will last for generations.*[85] *All speak well of the contractor, Mr. Oakes, and his employees, praising them for the work accomplished in such a satisfactory manner.*[86]

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[80] *The Maitland Daily Mercury*, Monday 29 April 1901, p 4.
[81] *The Maitland Daily Mercury*, Tuesday 25 June 1901, p 5.
[82] *The Maitland Daily Mercury*, Tuesday 16 July 1901, p 5.
[83] *The Maitland Daily Mercury*, Wednesday 28 August 1901, p 6.
[84] *The Maitland Daily Mercury*, Tuesday 20 May 1902, p 4.
[85] *The Maitland Daily Mercury*, Monday 5 May 1902, p 4.
[86] *The Maitland Daily Mercury*, Monday 12 May 1902, p 2.

W. F. Oakes (Walter Frank Oakes), in partnership with his brother, Percy, was a prominent and successful bridge builder in New South Wales during the first 25 years of the 20th Century. Walter Frank was a Whitworth Scholar, a prestigious UK award endowed by famed 19th Century Industrialist Sir Joseph Whitworth. The Oakes brothers specialised in heavy timber constructions, with family records showing in excess of 60 projects ranging from small timber beam structures for local Councils to a series of timber truss bridges and a large steel truss bridge for the PWD.[87]

Oakes wrote a letter to his cousin in England in 1908 which includes some interesting comments.

> The coasts are heavily timbered and very fertile as a rule; the interior in the wet seasons is extraordinarily fertile but the long periods of drought leave it quite dried up, and as bare as a board. The Australian hardwoods are I think the finest class of hardwoods in the world for durability and strength, and you are doubtless aware that large quantities are sent to England for special works, I am somewhat interested in the timber trade of this country but cannot help thinking it is a great mistake to be denuding our forest for export the way we are now with no thought of the future: the export trade runs into many millions of feet each year and there is no thought of replanting or afforestation of any kind.[88]

Oakes died in 1934 at the age of 62, and there was a short obituary in *The Sydney Morning Herald*:

> *DEATH OF MR. W. F. OAKES. Mr. Walter Frank Oakes, 62, died at his home in Lismore after a short illness. He was a civil engineer and one of the best known contractors on the North Coast. He had built scores of bridges, including the two main bridges which span the Richmond River at Lismore. He was born in New Zealand, and came to Australia with his father, also a civil engineer. When his father died he undertook civil engineering work in the Newcastle district. He built bridges at Casino and Goondiwindi, the pier at Tathra on the South Coast, and a lighthouse. In 1903 he left Australia for 12 months to lay railway lines in South Africa for the South African Government…. He is survived by a widow, three sons and a daughter.*[89]

Figure 3.11 W. F. Oakes (Source: Engineers Australia)

Other bridges constructed by Oakes include:
- Allan truss: Styx River, Jeogla, Kempsey to Armidale Road (closed to traffic)
- De Burgh truss: Beckers Bridge, Webbers Creek (planned for replacement)
- Dare truss: Coleman's Bridge in Lismore (listed on State Heritage Register, to be retained)

The 1908 Irving Bridge at Casino may be seen as his crowning achievement, and he received many work commendations beginning in 1895 with one from the eminent PWD engineer E. M. de Burgh.[90]

[87] Don Fraser, Nomination Report for the Bendemeer Bridge as an Historic Engineering Marker celebrating its centenary in 2005, prepared for Engineering Heritage Australia (Newcastle), September 2004, p 10.
[88] Personal Letter from W.F. Oakes, Civil Engineer and Contractor to his Cousin dated 14 May 1908, p 2.
[89] *The Sydney Morning Herald*, Tuesday 9 October 1934, p 12.
[90] Don Fraser, Nomination Report for the Bendemeer Bridge, p 10.

3.7.3 The Opening and Naming of the Bridge

Although Gillies bridge is not unique in this, it is certainly unusual that the bridge reportedly received two official openings with two separate christenings and two quite different names given (neither of which were 'Gillies Bridge'). The first opening was by the Contractor on Thursday 15 May 1902:

> *The bridge at Rothbury was formally opened on Thursday evening by the contractor, Mr. W. F. Oakes, and was to be handed over on Monday to Mr. Edgell, who was away, and could not put in an appearance. Mr Oakes had everything ready: red, white and blue ribbons tied across the bridge, and a bottle of wine, slung so as to strike a small rock in the centre of the bridge. The bottle was broken by Miss Bessie Nicholson, and ribbons broke by the first buggy. It was christened the Coronation bridge.*[91]

The second opening was a month later by the local member, Mr Gillies, on Wednesday 18 June:

> *Wednesday 18th of June, is the anniversary of Waterloo. It will be remembered for years to come as the anniversary of the opening of the bridge, the School of Arts, and one of the best entertainments given in the district. The bridge was gaily decorated with the flags of all nations, an evergreen arch being in the centre, from which was suspended the bottle of wine used for the christening…. Mr. Gillies…. Praised Rothbury to the skies, and, stating he would speak later, handed the bottle to Mrs. Gillies, who smashed it against a bolt, declaring the bridge open for traffic, and naming it the Rothbury Bridge. The vehicles were then driven to and fro across the bridge, breaking the usual ribbons.*[92]

It would seem that during construction, the bridge was called 'Rothbury Bridge'. At its first official opening it was named 'Coronation Bridge', until its second official opening where it resumed its original name of 'Rothbury Bridge'. By the 1930s, the bridge was known as 'Wilderness Bridge', as can be seen from the newspaper articles in the following section, and now it is 'Gillies Bridge'.

Interestingly, there are reports of other bridges in the area being named 'Gillies Bridge'. In 1894 (eight years prior to the opening of the bridge over Black Creek), it was reported that a new bridge connecting west Maitland with Campbell's Hill and the Great Northern Road was "to be called Gillies Bridge, as a mark of respect to the present member for the district".[93] Only two years later it was reported that a party of nearly 300 ladies and gentlemen assembled while two bridges in the locality were formally opened by, "Mrs Gillies, wife of Mr. John Gillies, M.L.A., that spanning Black Creek being christened the Lovedale Bridge and that over Deep Creek the Gillies Bridge".[94]

In 2001, it was decided by Cessnock City Council to signpost the bridge as "Gillies Bridge – Black Creek" because it had been discovered that the bridge was denoted "Gillies Bridge" on the Allandale Parish Map Editions three (1902) and four (1908).[95] It is possible that the naming on these maps was incorrect and later maps do not show the name. However, since the other Gillies Bridges in the region are no longer so named it is probably not inappropriate for this bridge to take that name.

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[91] *The Maitland Daily Mercury*, Tuesday 20 May 1902, p 4.
[92] *The Maitland Daily Mercury*, Thursday 19 June 1902, p 4.
[93] *Evening News*, Friday 18 May 1894, p 5.
[94] *The Sydney Morning Herald*, Monday 31 August 1896, p 5.
[95] Director Strategic & Community Services Report #218/2001, Cessnock City Council, Report December 12, 2001: De Burgh's Truss Bridge, Wilderness Road, Rothbury – proposed naming as "Gillies Bridge"

3.7.4 The Repair and Use of the Bridge

A number of modifications have been made to the bridge over its life in order to allow for its continuing use, and a number of changes have also been made to the kinds of vehicles that the bridge has been required to carry. While automobiles were in existence when the bridge was opened, still by 1908 there were estimated to be only 1,000 motor cars in New South Wales (with 600 chauffeurs employed).[96] Released in 1909, a Report of the Royal Commission for Improvement of the City of Sydney and its Suburbs did not include any strategies specifically geared towards the motor car because most people believed it had no future beyond its function as a recreational toy.[97]

As noted under 3.7.1, a number of dairies were required to use Holmes Crossing prior to the opening of the bridge, and the likely method of transportation is shown in Figure 3.12. The primary vehicle that NSW timber truss bridges were designed to carry was the 16 tonne traction engine (shown in Figure 3.13), which was able to carry about three times the load carried in wagons drawn by horses, bullocks or donkeys.[98] Clearly these vehicles are very different in size and weight and speed to the kinds of vehicles which use the bridge today.

Figure 3.12 Daily Deliveries of the Dairy Farmers
(Source: Broomham, Vital Connections, p 97)

Figure 3.13 Steam Traction Engine hauling sawn pine from Dorrigo along the Bellingen Road
(Source: Collections of the State Library of NSW, call number 'At Work and Play – 01688')

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96 Rosemary Broomham, *Vital Connections: a history of NSW roads from 1788*, Hale & Ironmonger in association with the Roads and Traffic Authority NSW: 2001, p 102.
97 Rosemary Broomham, *Vital Connections: a history of NSW roads from 1788*, pp 103-104.
98 Rosemary Broomham, *Vital Connections: a history of NSW roads from 1788*, p 99.

The following newspaper reports from the 1930s indicate the extent and method of the first set of substantial repair works that were undertaken on the bridge. The timber trestle piers had to be modified including the introduction of concrete less than 40 years after construction. This is typical of timber trestle piers, where the timber within the top metre below ground level tends to deteriorate due to rot or termite attack within approximately 30 years depending upon the local conditions. Adding concrete encasements (generally unreinforced) was a typical method used when splicing new timber piles to existing rotted piles in an attempt to provide some additional stiffness to the connection, which would otherwise be susceptible to rotation under lateral (flood) loading.

> *WILDERNESS BRIDGE. The Shire Engineer (Mr. J. F. Shine) submitted the following report concerning repairs required to Wilderness Bridge over Black Creek, on the Rothbury-Allandale road. "I reported on this bridge 3 years ago recommending at that time that early attention should be given to it, on account of rotten girders and capsills. It has now reached a stage when the work is urgent. Two of the girders are practically shells and another one is fast approaching the same condition. The traffic on the road at present is light which is the reason why some of these timbers have not collapsed. Three piles in one of the piers have rotten and are not carrying any weight whilst two strut piles, two wing piles and one capsill are also rotted completely. The bridge is a truss structure with one 75ft. truss span on iron lattice girders and two timber beam spans of 35ft. each. It will be necessary to put in concrete blocks set in rock to carry the rotted piles. The repairs are estimated to cost £110 of which £60 will be for material. In addition to this the structure is suffering badly for want of painting. The cost of the work would be about £30. I would recommend funds be provided viz. £140 to have the work carried out." The President Cr. Collins and the Engineer were appointed to interview the residents with a view to getting a donation of timber*.[99]
>
> *WILDERNESS BRIDGE. The engineer (Mr J. F. Shine) reported: …. An opportunity now has arisen before the year's programme commences of concentrating some of the permanent employees who are used to the work, and some timber can be obtained from Melville Ford and Hillsborough Bridges suitable for repairs*.[100]
>
> *The repairs to this bridge approved at last meeting will commence during the next fortnight, and it will be necessary to close the bridge to traffic for about three weeks, whilst the beam spans are being dismantled and girders, deck, etc., placed in position. Other work can be done after the bridge is re-opened to traffic*.[101]
>
> *The Shire Engineer reported that after several disappointing delays due to wet weather and transport of timber, the Wilderness bridge was now open for traffic. There still remained work to be done but this could be completed by closing one half of the width off at a time. It would be necessary for traffic to travel slowly across for several weeks*….[102]

Also interesting to note from the above is the use of recycled timber (from other bridges) in the repairs of Gillies Bridge, and the need for lengthy closures of the bridge during the repairs.

[99] *The Cessnock Eagle and South Maitland Recorder*, Friday 9 April 1937, p 2.
[100] *The Cessnock Eagle and South Maitland Recorder*, Friday 3 February 1939, p 10.
[101] *The Cessnock Eagle and South Maitland Recorder*, Friday 17 February 1939, p 9.
[102] *The Cessnock Eagle and South Maitland Recorder*, Friday 23 March 1939, p 3.

Further substantial repairs were undertaken in the mid-1940s, but no details are provided.[103] According to the 2001 CMP, Jack Delaney (a local historian) recalled that the Gillies Bridge underwent repair, possibly in the 1960s, and that prior to the repair the bridge was closed for some time.[104] It is probable that either the 1940s or the 1960s repairs (or both) included reconstruction and relocation of the abutments, which were then reconstructed again shortly prior to a 1993 assessment, and one of the abutments has since been reconstructed and relocated yet again.[105]

3.7.5 The Bridge Today

Wilderness Road was been identified by Cessnock City Council as a critical piece of infrastructure that supports existing land use, and will come under additional pressure from traffic generated from population growth projections.[106] Council is responsible for 74 vehicular bridges across the LGA, 42 of which are timber. Bridges are an integral part of the road transport network, connecting many pedestrian, bicycle and vehicle paths. Following extensive inspections and analysis of a number of bridges within the municipality, Council has implemented load limits on 14 bridges for the safety of residents and visitors. This includes a 15 tonne load limit on Gillies Bridge on Wilderness Road.[107]

Within the past ten years, Wilderness Road has been sealed (until recently it was a gravel road), and within the past 15 years, longitudinal timber sheeting has been added to the deck of Gillies Bridge. Both these factors mean that driving across Gillies Bridge today is a very different driving experience to what it would have been like in the past, and this may encourage increased use in the future.

3.8 Ability to Demonstrate

As noted in 3.1, the bridge is associated primarily with two State historical themes, these being “Technology” (Activities and processes associated with the knowledge or use of mechanical arts and applied sciences) and “Transport” (Activities associated with the moving of people and goods from one place to another, and systems for the provision of such movements). These two themes fall under the National historical theme of “Developing local, regional and national economies”.

Although extensive modifications have been made over the years to the substructure (piers and abutments) and to the approach spans (changes in lengths and details due to numerous relocations of abutments), the truss span remains very close to its original configuration and also retains its original colour scheme (timber was originally painted white and the ironwork painted black).[108] The bridge is therefore able to demonstrate the key technical advances and details of the de Burgh timber truss bridge design, and it therefore clearly demonstrates the historical theme of technology.

The bridge, which has been in use for 115 years (although at times has been closed to traffic due to deterioration or load limited) also has the ability to demonstrate the historical theme of transport.

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[103] *The Cessnock Eagle and South Maitland Recorder*, Friday 17 May 1946, p 8.
[104] CMP, 2001, p 5.
[105] CMP, 2001, Appendix 5, p4.
[106] Cessnock City Council, City Wide Settlement Strategy 2010, p 170 https://www.cessnock.nsw.gov.au/planning-and-development/publications/cwss2010, accessed 14/03/17.
[107] Council Website, https://www.cessnock.nsw.gov.au/community/roads/bridges, accessed 14/03/17.
[108] *The Maitland Daily Mercury*, Tuesday 20 May 1902, p 4.

4. PHYSICAL EVIDENCE

4.1 Identification of Existing Fabric

4.1.1 The Bridge

As is indicated in Figure 2.2, the bridge is approximately 40m in length consisting of three spans. The main central span is a 70’ (21m) de Burgh type timber truss span and the two approach spans are timber girder spans. The bridge has a total width of approximately 5.5m and carries a single lane of traffic. The three spans are supported on timber trestle piers and timber abutments. While the truss span is largely original both in its configuration and its fabric, the piers, abutments, and approach spans have been modified in both configuration and fabric since original construction. A comprehensive investigation and identification of the existing fabric is given below in section 4.2.

4.1.2 Curtilage

The heritage curtilage is defined as the area of land surrounding an item of heritage significance which is essential for retaining and interpreting its heritage significance. A curtilage is used to establish the boundaries of a zone worthy of special protection, and should contain all elements contributing to the heritage significance, conservation and interpretation of a heritage item.[109]

The heritage curtilage of the timber truss bridges managed by RMS is set as a buffer of five metres from the outward side and termination of the road deck. The curtilage extends in space above and below the deck level. The same curtilage applies equally well to this bridge, and is shown below.

Figure 4.1: Map showing Heritage Curtilage boundaries with coordinates for Gillies Bridge

[109] Heritage Office, Dept. Urban Affairs and Planning, *Heritage Curtilages*, Harley & Jones, 1996, pp 1-5.

4.1.3 Visual Setting and Context

Gillies Bridge is in a rural setting, and the local context has changed from predominantly farming and timber-getting when the bridge was first constructed to wine-making and tourism today.

Due to the local topography, vegetation and relatively small scale of the bridge, the structure cannot easily be viewed from a distance, but is best viewed when crossing it, either in a vehicle or on foot. The retention of the original black and white colour scheme adds to the visual amenity of the bridge.

The bridge is somewhat remote from population centres, and while it visually enhances the rural landscape in this area, it does not make a prominent contribution to the local or regional landscape.

The photographs below highlight some of the changes to the visual setting over the past 25 years.

Figure 4.2 Left: Photo taken in 1993 (source: SHI listing); Right: Photo taken in 2017 (source: author)

Since 1993, much additional signage has been provided at and near the bridge. This includes width reduction markers in front of each timber end post immediately at each end of the bridge, as well as signs slightly further away from the bridge (still within approximately 10 m) giving the bridge and creek name as well as the bridge load limit. While these signs are important for the safe use of the bridge, they reduce the visual amenity, and partially obscure some views of the bridge.

Longitudinal timber decking was added to the bridge in 2004, which introduces a strong visual effect from the continuous longitudinal lines, and thereby draws some visual attention from the truss.

Within the past ten years, Wilderness Road has been widened and sealed. This accentuates the narrowness of the timber bridge due to the fact that the approach roads have been widened. It also makes the route seem somewhat less historical, and more like a normal modern rural road.

Also within the past ten years, overhead power lines have been installed across the creek and up the road very close to the bridge. With these overhead power lines came the associated tree removal.

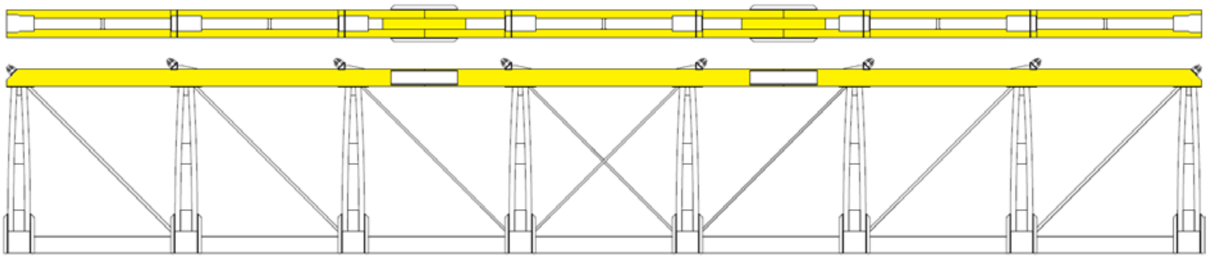
Guardrail has recently been added to the outside curve of the road which approaches the bridge when coming from Rothbury. The guardrail is connected directly to the timber end post. Again, the guardrail is important for the safe use of the bridge, especially due to the narrow bridge width, but it does detract from the visual amenity of the bridge, being very different in style and colour from the timber bridge. In addition to reducing the visual amenity, the guardrail is also not as effective as it should be because it is connected only to the timber end post which has negligible capacity.

4.2 Analysis of Existing Fabric

4.2.1 Truss Span

4.2.1.1 Timber Top Chords

The timber top chords are highlighted below and shown in both plan (top) and elevation.



The original dimensions of the top chord timbers were 12" x 6" (304.8 mm x 152.4 mm). The original lengths of the top chord timbers were 25'0" (7.62 m) for the end timbers and 21'6" (6.55 m) for the central timbers. The timber spacers at the top chord splice locations were 5'0" (1.52 m) long.

Each flitch of the timber top chord is carefully notched 1¼" (32 mm) around the central six cast iron anchor blocks, and is further notched and shaped to suit the end anchor blocks. Metal spools are provided midway between panel points to ensure consistent 8" (203 mm) spacing between flitches.

Each flitch of the timber top chord was originally notched ¼" (6 mm) on its top surface to accommodate wrought iron washer blocks, which consist of 5" x 5" x 5/8" (127 mm x 127 mm x 16 mm) angle sections with solid triangular metal blocks fitted within them to support the tension rods.

Metal splice plates, consisting of 10" x 3" x 20½ lbs channel sections 4'0" (1220 mm) long were originally located on both sides of the top chords at splice locations (in the 3rd and 5th truss panel).

The metal components of the top chord (excluding bolts, which are unlikely to be original fabric), which include the cast iron anchor blocks, the metal spools, the wrought iron washer blocks and the metal channel splice plates mostly appear to be original fabric. A foundry mark is visible on three of the splice plates which indicate that they came from Dorman Long in Middlesbrough, England. The metal components are in good condition for their age, though there is some corrosion present.

None of the timber in the top chord is original fabric, but it is NSW hardwood similar to the original. Although the dimensions of the top chord timbers in the top chord are not exactly as original, they are close to original, and still largely reflect the original design intent and original load paths.

The primary modification of the top chord, which does not reflect the original design intent, is the addition of an extra splice on one of the trusses. One of the original 7.62m lengths of timber has been replaced with two shorter lengths on the outer flitch. Rather than using channel sections like the original splices, flat metal plates painted white have been provided on both sides with timber packing between. The date of this additional splice is not known. The 6mm notches for the washer blocks have also been eliminated and the timbers replaced with slightly smaller timbers thereby leaving a space between the washer block and the timber rather than necessitating a notch. Metal flashing has been added along the entire length in an attempt to protect the timber from water.

Figure 4.3: Left: Original Splice Plate with Foundry Mark; Right: Introduced splice plate (source: author 2013)

Figure 4.4: Left: Original timber notching at anchor blocks; Right: Introduced flashing (source: author 2013)

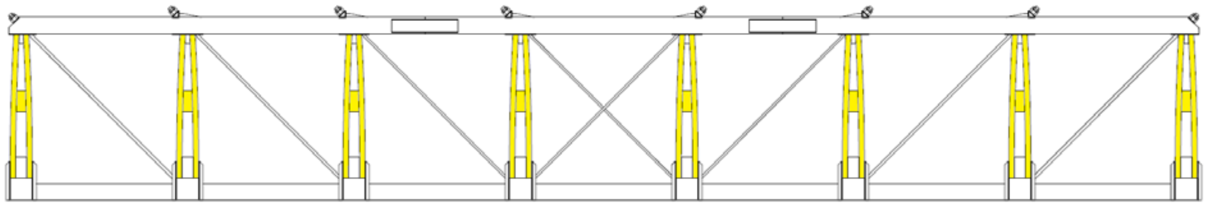
Figure 4.5: Left: Original metal spools; Right: no notching under washer blocks (source: author 2013)

According to the Level 3 Inspection conducted on 20 January 2016 by Royal HaskoningDHV, the top chords are in good condition with little or no deterioration.[110] However, there is evidence of deterioration at panel points on both trusses and significant active termite activity on the northern truss. It is likely that hidden deterioration would be occurring under the metal flashing as well as under the current non-breathable paint as these tend to cause moisture traps and accelerate rot.

[110] Royal HaskoningDHV, Wilderness Bridge Inspection Report Cessnock City Council, 22 March 2016, p 12.

4.2.1.2 Timber Verticals

The timber verticals (including timber spacers) are highlighted below.



The original dimensions of the flitches of the timber verticals were 4” x 12” (101.6 mm x 304.8 mm) and 8’7¼” (2.62 m) long. The central timber spacer was 15” high (381 mm along the grain) 12” wide (304.8 mm same width as timber flitches), and tapered to suit the tapered curved flitches. The flitches were spaced 8” (203.2 mm) at the base, being sandwiched between the timber cross girders and four metal angles being 3” x 3” x ½” (76.2 mm x 76.2 mm x 12.7 mm). The flitches were spaced 3” (76.2 mm) at the top, being connected to the cast iron anchor blocks. The flitches were curved with a bow of approximately 18mm, and bear directly against the cast iron anchor block at the top and the 5/8” (16 mm) thick by 16” (406.4 mm) wide metal saddle plate at the base.

None of the timber in the timber verticals is original fabric, but it is still NSW hardwood similar to the original, and the dimensions and configuration of the verticals remains very close to original design.

The bolting configuration for both the timber top chords and the timber verticals is very close to the original design (the only exception being additional bolts for the introduced top chord splice), although none of the bolts are likely to be original fabric. The use of square washers carefully arranged so that faces are vertical well reflects the original aesthetic, as does the use of white paint for the timber members and black paint for the metal elements including bolts and washers.

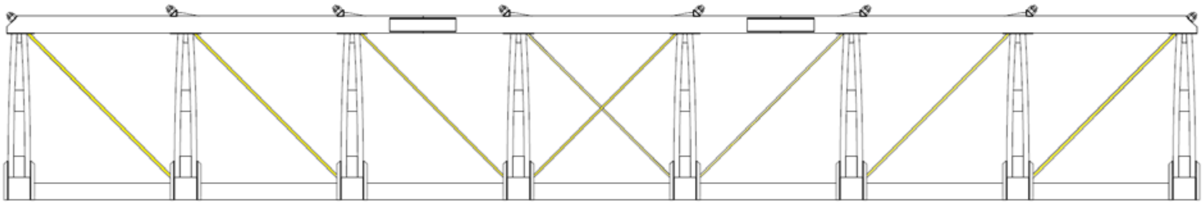
According to the Level 3 Inspection conducted on 20 January 2016 by Royal HaskoningDHV, the timber verticals are in good condition with little or no deterioration.[111] However, there is evidence of significant active termite activity on the northern truss, and it is likely that there would be further hidden deterioration at the bases, where water accumulates at the interface between the timber cross girder and the verticals and at the interface between the saddle plate and the verticals.

Figure 4.6: Left: Verticals viewed from bridge; Right: verticals viewed from off bridge (source: author 2013)

[111] Royal HaskoningDHV, Wilderness Bridge Inspection Report Cessnock City Council, 22 March 2016, p 12.

4.2.1.3 Metal Tension Rods

The metal tension rods are highlighted below.



Each panel of the truss contains two tension rods. The outer panels of the truss (1 & 7) have a pair of tension rods of 2¼" (57 mm) diameter. The next panels (2 & 6) have a pair of tension rods of 1⅞" (48 mm) diameter. The next panels (3 & 5) have a pair of tension rods of 1½" (38 mm) diameter. The central panel (4) has two single tension rods of 1½" (38 mm) diameter in opposing directions.

The tension rods in a de Burgh truss are significantly more complex than the tension rods in other timber truss bridge types due to the pinned connection at the base. The figure below shows the original design drawings for the 70' de Burgh truss tension rods. The bottom ends (shown on the left hand side) have been upsized by forging and have been provided with a hole of the same size as the bottom chord pins in order to create a strong and durable connection to the bottom chord. The top ends (shown on the right hand side) have also been upsized, but to a lesser degree by forging, and threaded ends have been provided so that a regular and a thin nut can be provided at the top.

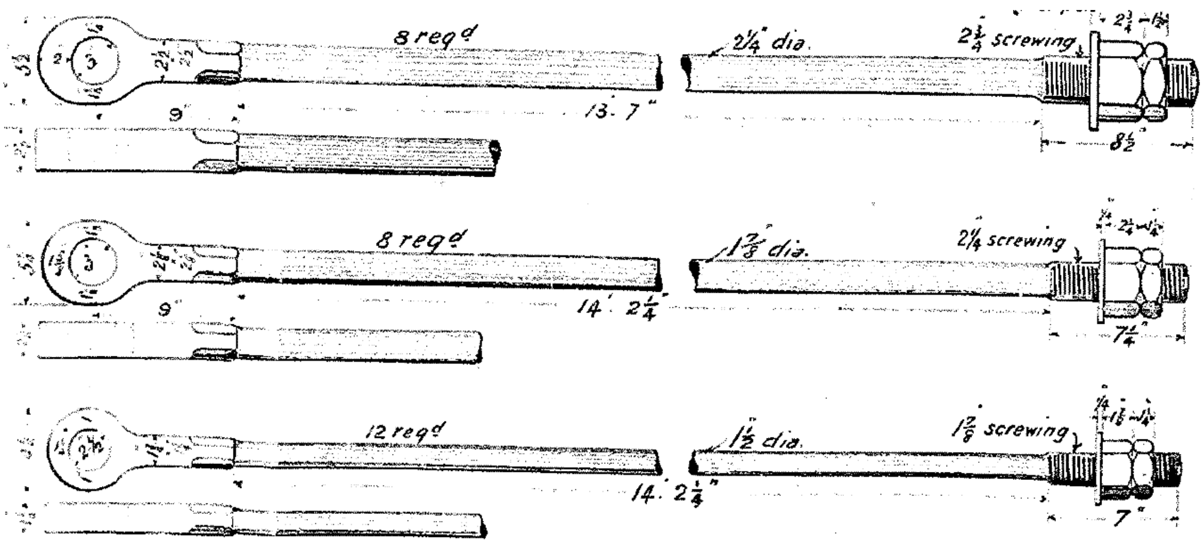


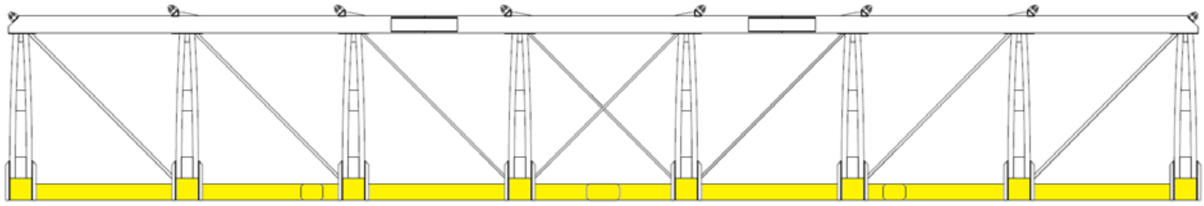
Figure 4.7: Original Drawings for Tension Rods for 70' de Burgh Truss over Lake Macquarie at Fennell Bay

All of the tension rods appear to be original fabric. According to the Level 3 Inspection conducted on 20 January 2016 by Royal HaskoningDHV, the metal tension rods are in good condition, although there is some surface corrosion and paint damage.[112] One of the tension rods in the southern truss is bent, perhaps indicating some previous damage. While the material of some of the elements of the bridge is unquestionable, the material for the tension rods varied between de Burgh trusses, sometimes being steel and sometimes being wrought iron. It is most likely wrought iron here.

[112] Royal HaskoningDHV, Wilderness Bridge Inspection Report Cessnock City Council, 22 March 2016, p 12.

4.2.1.4 Metal Bottom Chords

The metal bottom chord including three splice plates (small in panels 2 & 6 and large in the central panel (4)) and eight saddle plates (located at every panel point) is highlighted below.



The bottom chord consists of two flat metal plates 12” (304.8 mm) high with a 12” (304.8 mm) gap between them. Each plate consists of four plates riveted together. The outer two plates are ½” (12.7 mm) thick and the inner plates toward the centre of the span are ⅝” (15.9 mm) thick. The bottom chord plates are connected with 5/16” (8 mm) thick cover plates with an internal 1/8” (3 mm) liner provided at the outer splices (panels 2 & 6) where the plate thickness transitions.

While the bottom chord is primarily a tension member, the outer two panels can experience minor compressive stresses, and so at these panels (1 & 7) riveted angles and lacing have been provided between the two bottom chord steel plates in order to stiffen this section of the bottom chord.

The connections between the diagonal tension rods and the metal bottom chord are unique to the de Burgh truss and consist of a pined connection as shown in the figure below. A ⅝” saddle plate is bent into an upside-down U shape and riveted to the outside of both plates of the bottom chord. The cross girders and timber verticals sit directly on top of these saddle plates, and the saddle plate protects the bottom chord pinned connection from exposure to moisture or other damage.

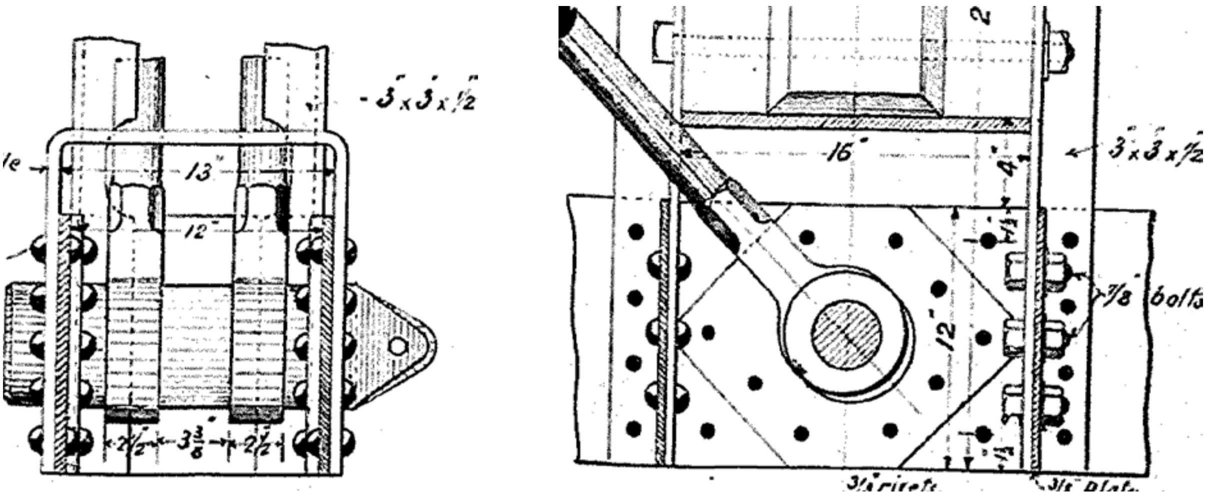


Figure 4.8: Original Drawings showing details for Bottom Chord Pins in 70’ de Burgh Truss at Fennell Bay

Between the two bottom chord plates there are castings riveted to both the saddle plate and the bottom chord plates in order to provide local strengthening to the bottom chord at the pin location. A steel pin of 2½” or 3” (64 mm or 76 mm) diameter is inserted through tightly fitting holes in the bottom chord plates, saddle plate and castings and the tension rods are threaded onto the pins spaced by wrought iron collars designed to ensure that the tension rods remain straight. The pin also connects a bracket to the inside of the bottom chord to connect the under-deck wind bracing.

Figure 4.9: Photograph showing various bottom chord details at panel point (source: author 2017)

The photograph above shows a typical pinned connection in the bottom chord, with the riveted saddle plate and angles extending vertically upwards from either side of the saddle plate. The under-deck wind bracing can be seen also extending from the pinned connection. On the right hand side, the outer panel is shown which has lacing connecting the two bottom chord steel plates.

The photograph below shows a typical riveted splice connection in the bottom chord, which is evidencing the beginnings of crevice corrosion due to breakdown of protective coating.

Figure 4.10: View looking down - bottom chord splice connection ½" to ⅝" steel plates (source: author 2017)

All of the bottom chord components appear to be original fabric. According to the Level 3 Inspection conducted on 20 January 2016 by Royal HaskoningDHV, the bottom chords are in mostly good condition, although there is some corrosion of the saddle plates and some paint damage.[113] Of particular concern is the evidence of crevice corrosion at the splice plate connections because once corrosion starts between the various metal plates it is very difficult to stop the corrosion.

[113] Royal HaskoningDHV, Wilderness Bridge Inspection Report Cessnock City Council, 22 March 2016, p 12.

4.2.1.5 Sway Braces and Wind Bracing

The metal sway braces and wind bracing are shown in the diagram below.

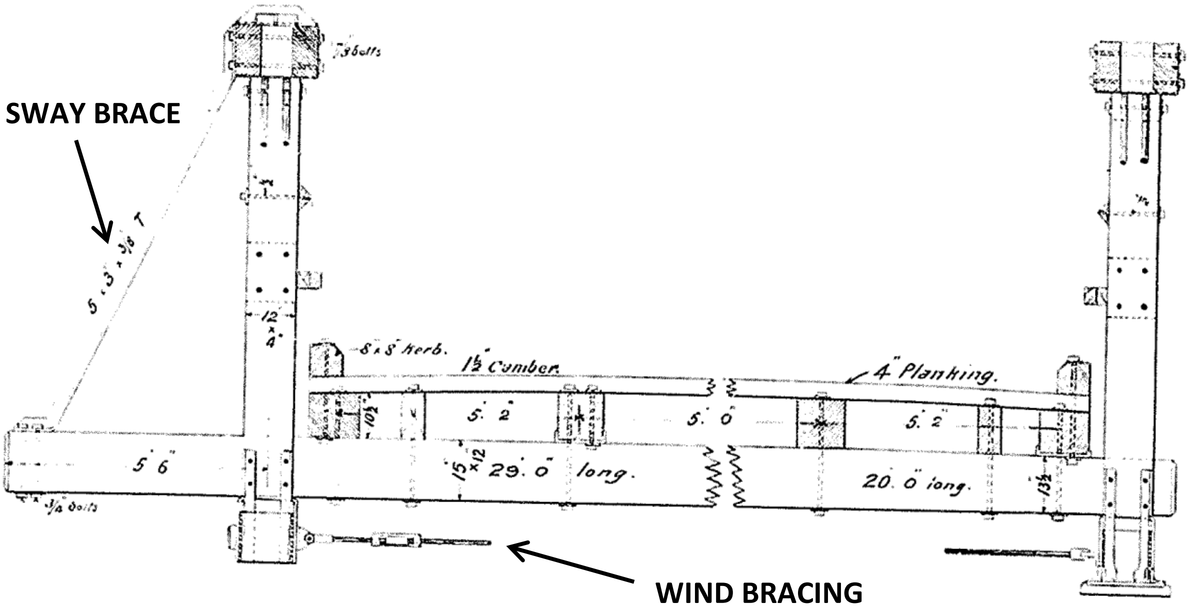


Figure 4.11: Original Drawings showing details for Sway Brace and Wind Bracing in 70' de Burgh Truss

The sway bracing, which consists of 5" x 3" x ⅜" (127 x 76.2 x 9.5 mm) T-sections is intended to prevent excessive vibration of the truss top chords. Four of the timber cross girders are extended beyond the truss bottom chord in order to support the sway braces. Both ends of the sway braces are connected with two bolts, with slotted holes provided at the top of the T-section.

The sway bracing at Gillies Bridge appears to be original fabric, and is located at the original locations (ie. no additional sway braces have been added, and sway braces have not been lengthened as has been attempted on other bridges).

Figure 4.12 Photograph of Sway Braces (Source: Author, 2013)

The under-deck wind bracing consists of sets of metal diagonal-rods, and two of these sets are provided between the lower chords in each truss panel and connected to the lower chords with clevis connections at panel points. Each wind brace consists of two rods, a short 1" (25.4 mm) diameter rod and a long ⅞" (22.2 mm) diameter rod connected with a turn-buckle. The wind bracing at Gillies Bridge appears to be original fabric located at original locations. Neither the sway bracing nor the wind bracing were covered in the Level 3 Inspection, but both appear to be in fair condition.

4.2.1.6 Cross Girders and Stringers

The timber cross girders and stringers are shown in the diagram below.

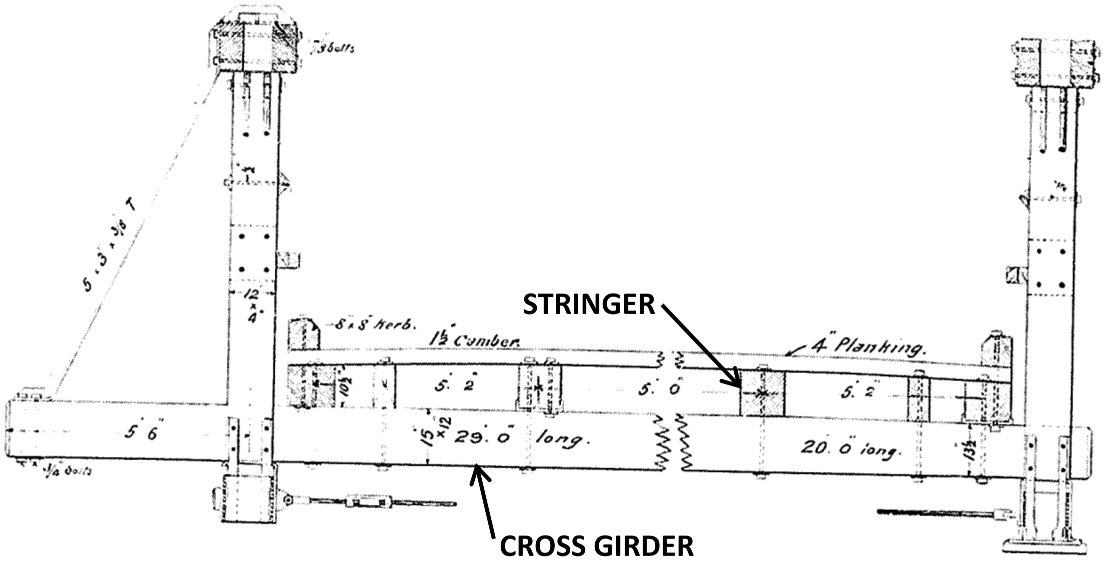


Figure 4.13: Original Drawings showing details for Cross Girders and Stringers in 70' de Burgh Truss

In the 70' de Burgh truss there are eight cross girders of which half are long and half are short. The central two cross girders are long, and they alternate between long and short from the centre. Originally, all cross girders consisted of hewn timber (either ironbark, tallow-wood or grey-box) 15" (381 mm) deep by 12" (304.8 mm) wide between the trusses, and reduced to 15" (381 mm) deep and 8" (203.2 mm) wide at the trusses and outside the trusses. The long cross girders were 29' (8.8 m) long and supported the metal sway braces, and the short ones were 20' (6.1 m) long.

None of the cross girders contain original fabric, but remain NSW hardwood similar to the original. As can be seen from Figure 4.12 on the previous page, the current cross girders reflect something of the original design intent, having the long and short timber cross girders in their correct locations. However, the long cross girders are significantly longer than the originals. This was probably done because the cross girders deteriorate from the ends, compromising the sway brace connections. The lengthened cross girders have an unfortunate visual impact and add to the weight of the bridge.

Originally there were four rows of hewn timber stringers 12" x 12" (304.8 x 304.8 mm), each 20' (6.1 m) long except for two at each of the end panels which were 10' (3.0 m) long seated at butt joints on staggered metal wrapper plates which consisted of 12" x 3" x 23½ lbs channel sections. The carefully staggered joints were intended to ensure a relatively even load distribution between the cross girders. The central two rows of stringers were originally notched locally over the wrapper plates to give a consistent height, and the outer two rows of stringers were originally notched an additional 1½" at cross girder locations in order to provide the deck with a 1½" two-way curved camber.

None of the stringers contain original fabric, and the current configuration does not reflect the original design intent. Most of the stringers have been replaced with round timbers which do not fit neatly into the wrapper plates and according to the Level 3 Inspection conducted on 20 January 2016 by Royal HaskoningDHV, many of the stringers require replacement due to deterioration.[114]

[114] Royal HaskoningDHV, Wilderness Bridge Inspection Report Cessnock City Council, 22 March 2016, p 12.

4.2.2 Approach Spans

Without the original drawings, there is some speculation required to determine what the original configuration of the approach spans and substructure were at this bridge. According to one of the early newspaper reports (1937, 35 years after construction), the timber girder approach spans were originally each 35' (10.7 m) long. This newspaper report is not terribly reliable because it wrongly states that the truss span is 75' rather than 70'. However, 35' was a relatively standard length for approach spans, so it is not unlikely that there were originally two 35' approach spans.

The standard configuration for 35' approach spans on de Burgh trusses was four rows of timber girders aligned with the four rows of truss span stringers. The inner two girders were round timbers 19" (482.6 mm) in diameter at the centre of the span and the outer timber girders were hewn to 12" (304.8 mm) wide and 14" (355.6 mm) deep. The difference in depth between the central and the outer girders meant that the 1½" deck camber on the truss span continued on the approach spans.

The outer girders being rectangular in shape, and painted white, allowed for a neat connection between the timber girders and the posts for the railings as well as a neat side view of the bridge. The photograph below indicates something of the visual effect of sawn white outer timber girders on the approach spans of a de Burgh truss (although many other details on this bridge are not original – for example, the metal elements as well as the timber elements are painted white).

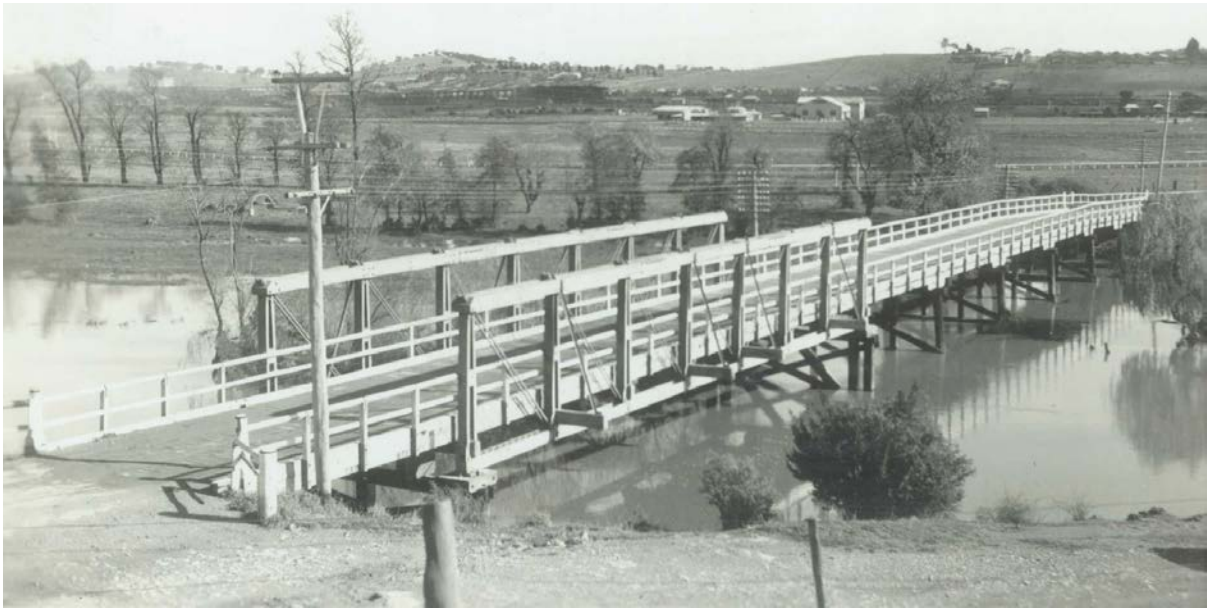


Figure 4.14: Photo of Lansdowne Bridge near Goulbourn taken 8th June 1950 (source: RMS file# 172.61)

The approach spans at Gillies Bridge do not contain any original fabric, and the current configuration does not reflect the original design intent. The span lengths have been significantly shortened in order to accommodate new abutments, and the outer girders have been replaced with round girders of varying diameters. The round outer girders have an unfortunate visual impact when viewing the bridge from the side. According to the Level 3 Inspection conducted on 20 January 2016 by Royal HaskoningDHV, all of the approach span timber girders appear to be in fair to good condition.[115]

[115] Royal HaskoningDHV, Wilderness Bridge Inspection Report Cessnock City Council, 22 March 2016, p 10.

4.2.3 Timber Deck

The original deck consisted of tarred 4" (101.6 mm) thick planking which was at a slight angle off transverse and was curved on the truss span and approach spans to provide a 1½" camber to ensure good drainage. Scuppers (for drainage) were provided at the four corners of the truss span, consisting of 10" x 18" (254 x 457 mm) cast iron gratings set into wrought iron frames and connected to the outer stringers and additional timber beams provided for that purpose. That the original designers even considered providing drainage for timber decks should alert us to the fact that leaky timber decks today are very different to the timber decks originally provided on timber truss bridges.

Following are excerpts from an original specification for the construction a timber truss bridge:

> *Timber employed to be…. Tallow-wood, white mahogany, grey gum, red gum, grey box, blackbutt, or brush box, at option of Contractor, for the planking and kerbs…. All to be of approved quality, sound, straight, free from sapwood, large or loose knots, wanes, shakes, gum-veins, cores, or other defects; to have clean sharp arrises, and to be of the full dimensions shown or specified…. Sawn timber to be absolutely free from heart, and to be so fixed that the surface which was farthest from the heart of the tree will be the outermost in the work other than planking, and uppermost in the planking…. The flooring planks, which laid, to receive on the upper surface between kerbs one coat, composed of 7 parts coal tar, 4 parts of Stockholm tar, and 1 part of pitch, thoroughly melted together, and applied hot; to be well sprinkled with a layer of clean sharp sand and lime…. All tarring to be completed before painting is commenced, and no tar is to be applied during or immediately after wet weather, or while surface of timber is wet…. Floor to consist of 4-in. sawn planking, from 6 in. to 10 in. wide, laid transversely, as shown. All planks to run the entire width of bridge in one length; to be laid flush and close, and secured to girders and stringers by ⅜-in. square spikes, 7 in. long, two spikes at each intersection; heads of spikes to be drifted down ¼ in., and surface of the floor left smooth, all inequalities being adzed down….* [116]

The primary function of the deck is to carry traffic. Originally a tarred surface was provided in order to minimise the slipperiness of the exposed timber deck so that vehicles and cattle could cross safely as well as to provide a protection against water to maximise the durability of the timber deck. As can be seen from the excerpts above, much care was taken to achieve a smooth safe deck surface. This means that the aesthetic of the original bridge was considerably less determined by the timber deck (which was smooth and dark and visually recessive) and considerably more focused on the truss with its white-painted timber and striking black metal fittings and black bolted connections.

None of the deck is original fabric, and the current configuration does not reflect the original design intent. The deck currently consists of spaced transverse timber decking (approximately 100 mm thick) with bolted longitudinal timber sheeting (approximately 70 mm thick). According to the Level 3 Inspection conducted on 20 January 2016 by Royal HaskoningDHV, most of the decking is in good condition, but some of the longitudinal sheeting has started to split and will require replacement.[117]

[116] Dept. of Public Works, NSW Harbours, Roads and Bridges Branch, Contract for construction of a composite truss bridge over Wakool River, at Gee-Gee Crossing, Swan Hill to Deniliquin Road, Specification, 1928.
[117] Royal HaskoningDHV, Wilderness Bridge Inspection Report Cessnock City Council, 22 March 2016, p 13.

Figure 4.15 Original Timber Deck on Timber Truss Bridge over Darling River at Wentworth in 1894
(Source: NSW Legislative Assembly: Report of the Department of Public Works for Year Ended 30 June, 1894)

The photograph above gives an indication of the original aesthetic of timber decks on timber truss bridges. The photograph was taken in 1894 and shows a new McDonald truss bridge. The smoothness of the deck as well as the dark colour of the deck indicates that a similar specification was used in 1894 as was used 35 years later when the specification mentioned above was written.

The fact that these timber deck details were used with very little modification (the earlier two designs had flat decks with diagonal planks, whereas the later three designs had cambered decks with transverse planks and generous scuppers) by all five timber truss designers indicates that the details worked well at the time in which they were used. This is a testament to the quality of the timber which they were using, as the timber available today does not achieve the same result.

4.2.4 Kerbs and Rails

The original timber railing had no real structural capacity and was not intended to be a traffic barrier for vehicles, but was intended to delineate the sides of the bridge for vehicles and to prevent horses, bullocks, sheep and cows (who were the most frequent bridge users) from falling off the bridge.

The original timber railing was a traditional timber ordnance fence which was typical of the railings on Allan, de Burgh and Dare truss bridges. Timber posts were 6” x 4” (152.4 x 101.6 mm) and were bolted to the outer girders (on approach spans) and stringers (on truss span) and to the kerbs. The posts were located at the centre of each truss panel on the truss spans. The railing was 4’0” (1.22 m) high from the top of the deck, and located immediately behind the 8” x 8” (203.2 x 203.2 mm) timber kerb. The rails consisted of a 4” x 4” (101.6 x 101.6 mm) timber top rail placed at a 45 degree angle, and a 4” x 3” (101.6 x 76.2 mm) timber mid rail centred 2’0” (0.61 m) above the deck.

Figure 4.16 Ordnance Fence on Prince Alfred Bridge 1929
(Source: RMS General Bridge File #178.146, vol 1)

Two lengths of 8 gauge (3 mm) wire were threaded through holes in the timber posts. The galvanised steel wires, which extended the length of the bridge, were located between the top and mid rail, and also between the mid rail and the kerb. The report below shows that travel was a dangerous business when timber truss bridges were being constructed, but also that the steel wires were, at least sometimes, for the non-motorised vehicles of the time, effective.

> *About 8 o’clock on Wednesday morning a serious accident occurred on the Prince Alfred Bridge, Gundagai. A team of horses with a load of corn weighing about 5½ tons, in charge of Charles Field, was crossing the bridge going in the direction of the railway station, when it came into collision with a horse and springcart driven by Thomas Slater, who was accompanied by a boy named Frederick Johnson. With a sudden impact the cart swung round, and Slater was thrown head first over the front board of the trap, falling with his horse between the wheels of the wagon. One of the wheels passed over the heel of Slater’s right boot, completely crushing it and seriously injuring the foot, and then passed over one of the fetlocks of his horse, severing the hoof from the leg. The scene was one of indescribable confusion. Slater was dragged from underneath the wagon, and it was then found that he had also sustained an injury to his left knee. The horse, limping, was conducted over the bridge and shot. Two railings of the bridge were broken, and it was only the wires that prevented the horse and cart from tumbling over. The boy Johnson managed to remain in the cart all the time, and he escaped without injury.*[118]

[118] *Evening News* (Sydney, NSW: 1869-1931), Monday 25 February 1895, p 7.

Figure 4.17 No notching of top rails around truss verticals (source: author)

The existing timber kerbs and rails reflect something of the original form, containing white timber posts and rails with black metal fixings. However, a number of modifications have been introduced. Firstly, the kerb has been raised in level so that it sits above the longitudinal sheeting rather than directly on the transverse decking, thereby modifying the geometry of the fence in relation to the truss. The original steel wires are entirely missing from the existing arrangement, and red and white reflectors have been added on a number of the timber posts to assist with delineation at night-time. The top rail has been moved in on the truss span, thereby slightly reducing the clear width between rails and eliminating the original notching in the top rail and connection at each truss span timber vertical. The connection details between the posts and the outer timber girders have been modified due to the use of round outer timber girders so that significant notches in the girders are introduced as well as an additional thickness of timber post to keep a straight alignment with the truss span. The geometry and detailing of the large timber end posts has been modified from the original. The timber rails were not covered in the Level 3 Inspection, but appear to be in fair condition.

4.2.5 Piers and Abutments

Without the original drawings, there is some speculation required to determine what the original configuration of the piers and abutments were at this bridge. While it can safely be assumed that the piers are in their original locations, even the location of the original abutments is uncertain.

The original piers would have consisted of driven timber piles which extended to the top of the pier without splices, connected by timber headstocks at the top as well as with timber braces and wales. The original timber piles in the piers would have been hewn to 14” x 14” (355.6 x 355.6 mm) square sections either for their entire lengths, or just for the length which protrudes above the ground.

Driven timber piles in bridges, as a general rule, rot just below ground level within 30 to 40 years. These rotted timber piles are impossible to replace “like for like” or to restore to the original design. This is because, before a new timber pile can be driven, the remains of the buried old timber pile would have to be removed, and this is generally physically impossible. For this reason, timber piers and abutments tend to undergo numerous and significant modifications throughout their life. At Gillies Bridge, the abutments have been completely reconstructed in different locations (allowing new piles to be driven clear of old piles) a number of times, with the current location probably approximately 2 m in front of the original abutments, thereby shortening the bridge by 4 m.

Figure 4.18 Photograph showing configuration of current piers and abutments (source: author)

Because the piers could not be relocated without changing the truss span, the piers have instead been modified by the introduction of hidden underground splices encased in concrete. The piers currently have round timbers above ground rather than square and the carpentry details are not original. According to the Level 3 Inspection conducted on 20 January 2016 by Royal HaskoningDHV, the elements of both timber piers and both timber abutments are in fair to good condition.[119]

[119] Royal HaskoningDHV, Wilderness Bridge Inspection Report Cessnock City Council, 22 March 2016, pp 11-12.

4.2.6 Summary of Physical Condition and Integrity

Element	Condition	Integrity (ie: ability to demonstrate original design)
Timber Top Chords	Variable	Fair: Timber is not original fabric, sizes of timber smaller than original, additional splice introduced, most metal components are original fabric and connections demonstrate original design intent. Four original metal spools are missing – two have been replaced with timber and two with metal tubes.
Timber Verticals	Variable	Good: Timber is not original fabric, sizes of timber smaller than original, other details all original.
Metal Tension Rods	Good	Excellent: Original fabric, no visible modifications.
Metal Bottom Chords	Good	Excellent: Original fabric, no visible modifications.
Sway Braces and Wind Bracing	Good	Excellent: Original fabric, no visible modifications.
Cross Girders and Stringers	Variable	Poor: No original fabric, lengths of cross girders modified, stringers are not original dimensions or shape and connection details do not suit.
Approach Spans	Variable	Poor: No original fabric, lengths of approach spans have been modified, shapes of outer timber girders has been modified as well as connection details.
Timber Deck	Variable	Poor: No original fabric, does not reflect the original detailing or aesthetic or demonstrate design intent.
Kerbs and Rails	Variable	Poor: No original fabric, does not reflect the original detailing or aesthetic or demonstrate design intent.
Piers and Abutments	Variable	Poor: No original fabric visible (original timber piles likely remain under-ground), abutments not in original location, detailing of piers modified both above and below ground, timber shapes changed.
Visual Setting and Context	Variable	Fair: Widening and sealing of the road as well as signage, powerlines, guardrails, sheeting and other additions detract somewhat from visual amenity.

4.3 Comparative Analysis

Twenty de Burgh truss bridges were constructed in New South Wales between 1900 and 1905, and each of these is compared in the table on page 52. The colours in the table indicate whether the bridge has been demolished (red), or conserved (green) or whether the future of the bridge is somewhat uncertain due to planned or past replacement with a concrete bridge (orange).

Of the eight de Burgh truss bridges that remain today, there are seven which are still in use (Cobram Bridge has been replaced with a concrete bridge and so no longer performs its original function).

The remaining de Burgh trusses include samples of all the original span lengths (70', 91', 104 & 117') except for the very longest timber truss bridge constructed in NSW (165') which was destroyed by fire in 1994. Gillies Bridge contains the shortest remaining span and St Albans contains the longest.

Two of the remaining de Burgh truss bridges (Lansdowne Bridge over Mulwaree River at Goulburn and Tabulam Bridge over the Clarence River at Tabulam) are currently in the process of being replaced by RMS with new concrete bridges and so their demolition is imminent. One more bridge (Beckers Bridge over Webbers Creek near Gresford) is included in the RMS Timber Truss Bridge Conservation Strategy as a bridge to be replaced, and is likely to be demolished within five years.

Two of the remaining de Burgh truss bridges (Barham Bridge over the Murray River and Glennies Creek Bridge at Middle Falbrook) are currently undergoing a capacity upgrade which involves replacement of all truss components with new components consistent with the original design. Therefore, although these bridges currently contain original fabric (bottom chords, tension rods etc), when the current projects are completed within the next couple of years, this original fabric will be replaced with new materials still reflecting the original construction and original design intent.

Of the eight remaining de Burgh truss bridges, all have had significant modifications done to deck, approach spans, piers and abutments somewhat similar to what has happened at Gillies Bridge. All of the remaining de Burgh truss bridges are able to demonstrate much of the original truss design detailing, although some modifications have been introduced on some bridges (eg, additional timber spacers added to timber verticals at St Albans and Tabulam, additional sway braces added to lengthened cross girders at Beckers, St Albans and Tabulam, and original colour scheme has been completely modified Lansdowne, Tabulam, Glennies and Barham, and slightly modified at Beckers).

Of the eight remaining de Burgh trusses, six (including Gillies Bridge) have four angles extending from the bottom chord connecting to each timber vertical and one (Glennies Creek) has only two angles connecting to each timber vertical. Only four bridges (Gillies, Beckers, Lansdowne, Cobram) have top chord spools. St Albans Bridge has a different arrangement due to the longer span.

It seems that there was something of a progression in design detail of the washer blocks which exist at the tops of the tension rods in de Burgh truss bridges. In the earlier bridges, these consisted of two separate elements, being an angle cut to size and a wrought iron block shaped to suit. Of the remaining de Burgh trusses, only four, including Gillies Bridge, have this early detail. The other bridges which display this detail are Lansdowne, Cobram and Beckers Bridges, all of which have somewhat uncertain futures, which increases the importance of this detail at Gillies Bridge. Gillies Bridge is a particularly good example because this detail is easier to see than on other bridges because the truss at Gillies Bridge is shorter than all of the other remaining de Burgh truss bridges.

Later de Burgh truss bridges gave two options for the washer blocks, being either cast steel washer blocks (with the same shape as the two piece wrought iron washer blocks, but cast as a single piece) or a wrought iron forging (which was a different simpler shape, being a large solid triangular prism). There are no remaining examples of wrought iron forging option (Crookwell Bridge, demolished in 2015, contained these unique washer blocks which are photographed below). Tabulam, Glennies and Barham Bridges have cast steel washer plates and St Albans has a different configuration.

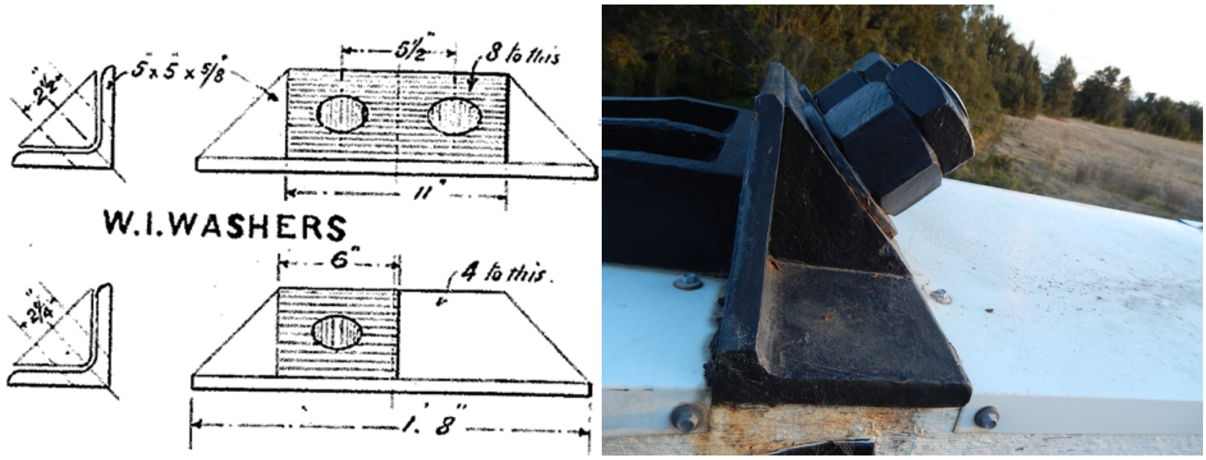


Figure 4.19 Design and Photograph of Wrought Iron Washer Block at Gillies Bridge (source: RMS, author)

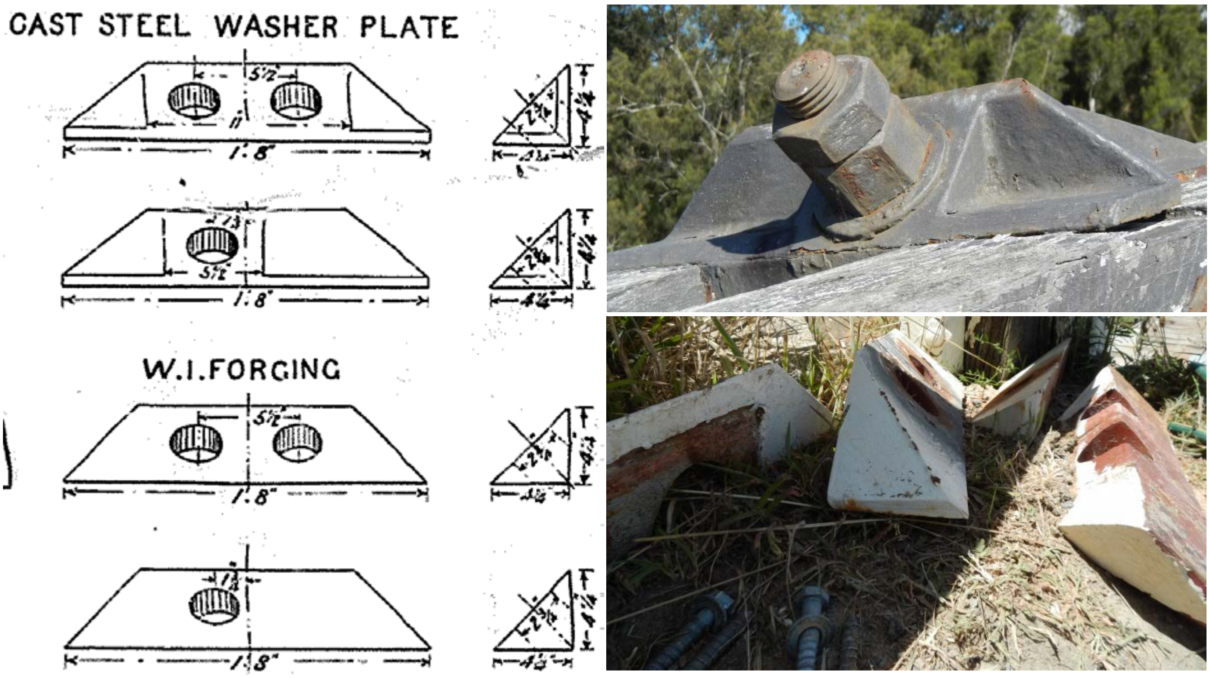


Figure 4.20 Design and Photographs of Washer Blocks at Glennies (top) Crookwell (bottom) (source: author)

Gillies Bridge is therefore rare as the only remaining example of a 70' de Burgh truss and also representative as a fine example of a de Burgh truss bridge, including all of the principal characteristics of the standard de Burgh truss design and outstanding due to its integrity to the original design of the truss members, containing much original fabric which is in relatively good condition and could be expected to last into the future with regular inspection and maintenance including repainting of metal components to mitigate against corrosion. The bridge displays the original colour scheme and performs the function for which it was designed (to carry traffic).

Bridge	Built	Span	Comments
Lane Cove River	1900	165’	Longest span timber truss bridge constructed in NSW, rare example of under-deck truss (Pyrmont remains)
Queanbeyan River	1900	91’	Three truss spans, sloping end principals (only two constructed and none remain), originally designed with metal cross girders
Belubula River, Canowindra	1901	91’	Single truss span, four angles supporting vertical struts, additional holes in cast iron anchor blocks, spools
MacIntyre River, Inverell	1901	91’	Two truss spans, sloping end principals (only two constructed and none remain), originally designed with metal cross girders
Beardy Waters, Yarrowford	1902	91’	Single truss span, four angles supporting vertical struts, additional holes in cast iron anchor blocks, spools
Black Creek, (Gillies Bridge)	1902	70’	Single truss span, shortest span remaining de Burgh truss, four angles supporting vertical struts, spools
Lower Coldstream River	1902	104’	Two truss spans, four angles supporting vertical struts, additional holes in cast iron anchor blocks, spools
Fennel Bay, Toronto	1902	70’	Single truss span, four angles supporting vertical struts, spools
Mulwarree River, Goulburn (Lansdowne)	1902	91’	Single truss span, Monier concrete / timber piers, four angles supporting vertical struts, bridge in poor condition (especially timber approach spans), new bridge imminent, spools
Murray River, Cobram	1902	104’	Two truss spans with central lift span, replaced with concrete bridge, no current use, partially demolished, originally designed with metal cross girders, four angles supporting vertical struts, design drawings show additional holes in anchor blocks, but anchor blocks were cast without the additional holes, spools
Webbers Creek, Gresford (Beckers)	1902	91’	Single truss span, anchor blocks with additional holes (only remaining example), four angles supporting vertical struts, included in RMS TTBCS as a bridge to be replaced, spools
Wyong River, Wyong Creek	1902	91’	Single truss span, Monier Concrete piers, compound timber girder approach spans, two angles supporting vertical struts
Clarence River, Tabulam	1903	104’	Five truss spans, most remaining truss spans in a de Burgh truss bridge, mass concrete piers, four angles supporting vertical struts, new bridge imminent, no spools
MacDonald River, St Albans	1903	117’	Two truss spans, longest span remaining de Burgh truss, some tension rods external to bottom chord plates which is unique to this span length, metal in truss is original fabric
Crookwell River	1903	91’	Single truss span, four angles supporting vertical struts, camber diagram included, components stored in field near Goulbourn
Glennies Creek, Middle Falbrook	1904	91’	Two truss spans, Monier concrete piers, two angles supporting vertical struts, camber diagram in original drawings, capacity upgrade underway including replacement of original fabric
Lachlan River, Gooloogong	1904	104’	Single truss span, mass concrete piers, two angles supporting vertical struts, camber diagram included, no spools
Macquarie River, Dubbo	1904	104’	Three truss spans, two angles supporting vertical struts, camber diagram in original drawings, external footway provided
Murray River, Barham	1904	104’	Two truss spans with central lift span, originally designed with metal cross girders, four angles supporting vertical struts, camber diagram included, capacity upgrade underway
Murrumbidgee, Darlington Point	1905	91’	Single truss span with bascule span, two angles supporting vertical struts, part of lift span has been reconstructed in a caravan park nearby, camber diagram in original drawings

5. ASSESSMENT OF CULTURAL SIGNIFICANCE

5.1 Criteria for Assessing Significance

Heritage assessment criteria, based upon the *Burra Charter* definitions of cultural significance, have been devised by OEH in order to allow consistency in assessment of heritage items across New South Wales.[120] This section of the CMP assesses Gillies Bridge for State significance against these criteria.

5.1.1 NSW Heritage Assessment Criterion (a): Historic Significance

An item is important in the course, or pattern, of NSW's cultural or natural history. Guidelines for INCLUSION • shows evidence of a significant human activity • is associated with a significant activity or historical phase • maintains or shows the continuity of a historical process or activity Guidelines for EXCLUSION • has incidental or unsubstantiated connections with historically important activities or processes • provides evidence of activities or processes that are of dubious historical importance • has been so altered that it can no longer provide evidence of a particular association.

Gillies Bridge provided an essential link for the reliable transport of produce in the Rothbury area to the most convenient rail access point at Allandale. It is historically significant through its association with the expansion of the New South Wales road network, and the contribution of that road system to settlement, development and economic activity throughout New South Wales.

Gillies Bridge was constructed with New South Wales hardwood. As noted by Dare, "The hardwood timbers of New South Wales are second to none in Australia, and indeed compare favourably, both for strength and durability, with any timbers in the world".[121] As a timber truss bridge, it is associated with the historical phase when quality hardwood timber (especially Ironbark) was available and was widely used in public works, both for road bridges and rail bridges and sleepers.

Gillies Bridge was designed and constructed at a time when high quality NSW hardwood was still available, but was becoming less economical as timber exports grew and metal imports became less expensive. The de Burgh truss is historically significant through its association with the transition from using almost entirely local materials (ie. timber and masonry) for the construction of timber truss bridges, to the importation of iron and steel and the beginnings of the use of concrete.

Gillies Bridge therefore meets this criterion at a State level.

[120] Assessing Heritage Significance, *NSW Heritage Manual*, NSW Heritage Office, 2001
[121] Henry Harvey Dare, "Recent Road-Bridge Practice in NSW", p 382.

5.1.2 NSW Heritage Assessment Criterion (b): Significance of Association

An item has strong or special association with the life or works of a person, or group of persons, of importance in NSW's cultural or natural history. Guidelines for INCLUSION • shows evidence of a significant human occupation • is associated with a significant event, person, or group of persons Guidelines for EXCLUSION • has incidental or unsubstantiated connections with historically important people or events • provides evidence of people or events that are of dubious historical importance • has been so altered that it can no longer provide evidence of a particular association.

The bridge, largely due to its renaming in 2001, is associated with Mr John Gillies MLA, who served as parliamentary representative for the seat of West Maitland from 1891 until his death in 1911. The bridge name recognises that Mr Gillies was highly respected in his electorate and was largely responsible for obtaining government funding for the construction of Gillies Bridge.

The bridge is also associated with W.F. Oakes, Civil Engineer and Contractor, who was a prominent and successful bridge builder in New South Wales during the first 25 years of the 20th Century.

Being a de Burgh truss, Gillies Bridge has strong associations with Ernest Macartney de Burgh, then Assistant Engineer for Bridges, who became recognised as one of the ablest engineers in Australia.

Gillies Bridge therefore meets this criterion at a State level.

5.1.3 NSW Heritage Assessment Criterion (c): Aesthetic Significance

An item is important in demonstrating aesthetic characteristics and/or a high degree of creative or technical achievement in NSW. Guidelines for INCLUSION • shows or is associated with, creative or technical innovation or achievement • is the inspiration for a creative or technical innovation or achievement • is aesthetically distinctive • has landmark qualities • exemplifies a particular taste, style or technology Guidelines for EXCLUSION • is not a major work by an important designer or artist • has lost its design or technical integrity • its positive visual or sensory appeal or landmark and scenic qualities have been more than temporarily degraded • has only a loose association with a creative or technical achievement.

Gillies Bridge fits neatly into the rural landscape, being aesthetically pleasing in scale, proportion and materials used. A sketch of the bridge has also been used as a logo for one of the local wineries.

The structural details of the bridge are clearly visible, which is assisted by the relatively small scale of the structure. Simply by walking over and under the bridge, excellent views can be obtained of almost all of the structural design details, which is much more difficult on bridges of a larger scale.

The de Burgh truss includes the greatest variety of materials found in any of the NSW timber truss bridges, including mass concrete and reinforced concrete (piers), rolled steel (bottom chords and top chord splices), cast steel (washer blocks), wrought iron (cross girders), cast iron (anchor blocks), brass (in bearings) and, of course, timber (top chords, verticals, stringers and decks). Although Gillies Bridge did not originally include any concrete, it is one of the earliest remaining examples of a de Burgh truss, and demonstrates excellence in engineering design and technical achievement, especially with respect to the variety of materials used, each material to its best advantage.

Gillies Bridge therefore meets this criterion at a State level.

5.1.4 NSW Heritage Assessment Criterion (d): Social Significance

An item has strong or special association with a particular community or cultural group in NSW for social, cultural or spiritual reasons. Guidelines for INCLUSION • is important for its associations with an identifiable group • is important to a community's sense of place Guidelines for EXCLUSION • is only important to the community for amenity reasons • is retained only in preference to a proposed alternative.

The bridge is esteemed by the local community not just for amenity reasons, but also because of its historical and aesthetic value which contributes to the local community's sense of identity. If the bridge were modified to such an extent that it damaged its historical and aesthetic value then it would cause the local community a sense of loss. Gillies Bridge meets this criterion at a local level.

5.1.5 NSW Heritage Assessment Criterion (e): Archaeological / Research Potential

An item has potential to yield information that will contribute to an understanding of NSW's cultural or natural history. Guidelines for INCLUSION • has the potential to yield new or further substantial scientific and/or archaeological information • is an important benchmark or reference site or type • provides evidence of past human cultures that is unavailable elsewhere Guidelines for EXCLUSION • the knowledge gained would be irrelevant to research on science, human history or culture • has little archaeological or research potential • only contains information that is readily available from other resources or archaeological sites.

It is possible that there may be archaeological remains of the previous Holmes Crossing (outside the curtilage of this study) and it is likely that there would be remains of original timber piles for the piers and abutments buried underground, which may also include some original metal driving shoes.

Considerable research potential exists into the pioneering use of structural steel and other metals by the NSW Public Works Department due to the fact that almost all of the original metal fabric of the truss remains at this bridge. The de Burgh truss has more complex metal fabrication required than any of the other timber truss bridge types (including forging of tension rods, very close construction tolerances on pinned connections and casting of cellular hollow anchor blocks). Foundry marks indicate that some of the metal was imported. Research potential exists into understanding the original design intent and the progression of design between the truss types due to the integrity of this bridge to the original design. Gillies Bridge therefore meets this criterion at a State level.

5.1.6 NSW Heritage Assessment Criterion (f): Rarity

An item possesses uncommon, rare or endangered aspects of NSW's cultural or natural history. Guidelines for INCLUSION • provides evidence of a defunct custom, way of life or process • demonstrates a process, custom or other human activity that is in danger of being lost • shows unusually accurate evidence of a significant human activity • is the only example of its type • demonstrates designs or techniques of exceptional interest • shows rare evidence of a significant human activity important to a community Guidelines for EXCLUSION • is not rare • is numerous but under threat.

Gillies Bridge is rare at the State level as the only remaining example of a 70' de Burgh truss.

5.1.7 NSW Heritage Assessment Criterion (g): Representativeness

An item is important in demonstrating the principal characteristics of a class of NSW's cultural or natural places; or cultural or natural environments. Guidelines for INCLUSION • is a fine example of its type • has the principal characteristics of an important class or group of items • has attributes typical of a particular way of life, philosophy, custom, significant process, design, technique or activity • is a significant variation to a class of items • is part of a group which collectively illustrates a representative type • is outstanding because of its setting, condition or size • is outstanding because of its integrity or the esteem in which it is held Guidelines for EXCLUSION • is a poor example of its type • does not include or has lost the range of characteristics of a type • does not represent well the characteristics that make up a significant variation of a type.

Gillies Bridge is representative at the State level as a fine example of a de Burgh truss bridge, including all of the principal characteristics of the de Burgh truss design and outstanding due to its integrity to the original truss design, containing much original fabric which is in relatively good condition and could be expected to last into the future with regular inspection and maintenance (including repainting of metal components to mitigate against corrosion). The bridge displays the original colour scheme and performs the function for which it was designed (to carry traffic).

5.2 Gradings of Significance

While Gillies Bridge as a whole has been assessed as fulfilling the criteria for listing on the State Heritage Register, the various elements that comprise the bridge are of varying levels of significance. While each of these elements contributes to the overall significance of the bridge, it is a useful management tool to separate the bridge into its components and examine the heritage significance of each. This process allows for more informed analysis of what constitutes significant form and fabric, or what fabric is of lesser significance, or intrusive. The table below outlines how the different features of Gillies Bridge make relative contributions to the heritage value of the item.

Feature	Significance[122]	Justification for Significance
Timber Top Chords	Exceptional (State)	Although the timber top chords do not contain original fabric, and some details have been modified, the original details can be largely restored when the timber is next replaced.
Timber Verticals	Exceptional (State)	Integrity to original design is good, and can be further improved when timber is next replaced.
Metal Tension Rods	Exceptional (State)	Original fabric in good condition, tension rod detailing is unique to the de Burgh truss.
Metal Bottom Chords	Exceptional (State)	Original fabric in good condition, bottom chord detailing is unique to the de Burgh truss.
Sway Braces and Wind Bracing	High (State)	Original fabric in good condition, bracing details are more common and do not directly contribute to the significance of the de Burgh truss.
Cross Girders and Stringers	Moderate (State)	Alterations of stringers (especially) but also cross girders detract from significance and would be difficult to restore to original details.
Approach Spans	Little (State)	Details common, and do not directly contribute to significance, have been substantially altered.
Timber Deck	Little (State)	Details common, and do not directly contribute to significance, have been substantially altered.
Kerbs and Rails	Little (State)	Details common, and do not directly contribute to significance, have been substantially altered.
Piers and Abutments	Little (State)	Details common, and do not directly contribute to significance, have been substantially altered.
Visual Setting and Context	Moderate (State)	The visual setting and context has been modified over the decades, but still contributes to overall significance and allows good views of the bridge.

Exceptional: Rare or outstanding element directly contributing to an item's local and State significance.
High: High degree of original fabric. Demonstrates a key element of the item's significance. Alterations do not detract from significance.
Moderate: Altered or modified elements. Elements with little heritage value, but which contribute to the overall significance of the item.
Little: Alterations detract from significance. Difficult to interpret.

[122] Assessing Heritage Significance, NSW Heritage Office, 2001, p 11, see notes below table for OEH definitions.

5.3 Statement of Significance

Gillies Bridge is of State significance primarily due to its technical significance. It is an early and intact example of a de Burgh type timber truss road bridge, and is the only remaining example of the standard design for the 70’ (21.336 m) span, which was the shortest of the de Burgh truss designs. The bridge is locally esteemed and contributes to the local community’s sense of identity.

As a timber truss road bridge, it has strong associations with the expansion of the road network and economic activity throughout NSW, and with Ernest Macartney de Burgh, then Assistant Engineer for Bridges, one of the ablest engineers in Australia, and the designer of this truss type. De Burgh trusses were the fourth in the five-stage development of NSW timber truss road bridges. The trusses took advantage of the high quality NSW hardwoods and also steel, which had become increasingly economical. The design is an example of engineering excellence, using a wide range of materials each to their best effect. The evolution in design shows the increasing difficulty in obtaining quality hardwood timbers, as well as problems with the previous timber bottom chords.

6. CONSTRAINTS AND OPPORTUNITIES

6.1 Constraints and Opportunities arising from the Statement of Significance

According to the New South Wales Heritage Division, the Statement of Significance is to be the basis for policies and management structures that will affect the item's future.

6.1.1 NSW Heritage Assessment Criterion (a): Historic Significance

The historical context of this bridge is the availability of high quality (strong and durable) New South Wales hardwood and so its conservation should continue the use of NSW hardwood timbers. The availability of high-quality hardwood timber required for heritage timber truss bridges is a substantial concern. It is an increasingly scarce resource, and is valuable as part of our natural heritage, as well as for its usefulness in carrying heavy vehicles over heritage timber truss bridges.

The key timbers required have to be derived from 80 to 200 year old trees in order to achieve the necessary strength, durability and dimensions. The major structural elements require species from old-growth forests that are often rare outside national parks. These bridges need species such as Grey Box, Ironbark, Tallowwood and Grey Gum, as used in the original designs. Lesser timbers have less strength and deteriorate at a faster rate, thus requiring more frequent replacement.

Although at least two pieces of heart-free sap-free bridge timber should be able to be recovered from a single log, in practice (on average) less than a single piece per log meets the requirements for use in most heritage timber truss bridges.[123] This increases the responsibility of designers to ensure that designs maximise the durability of timber in order to minimise the need to cut down old growth forests, which are part of the valuable natural heritage of this country.[124] Careful consideration should also be given to replacing timber with modern materials where the heritage significance of the fabric of the particular element is little or moderate, and where the introduction of modern materials would not substantially affect the heritage significance of the bridge as a whole.

Timber truss bridges have strong associations with the expansion of the road network and economic activity throughout NSW. Therefore, the conservation of this bridge should retain its use as a vital part of the NSW road infrastructure, which may necessitate some elements being strengthening.

6.1.2 NSW Heritage Assessment Criterion (b): Significance of Association

De Burgh truss bridges have strong associations with Ernest Macartney de Burgh, and have the opportunity to demonstrate the engineered design details. Although some of the details have changed throughout the life of the bridge and although there are no original drawings or photographs for this particular bridge, there is sufficient evidence of the original design in the standard drawing of the 70' de Burgh truss to allow restoration and reconstruction within the bounds of Articles 19 and 20 of the Burra Charter. The conservation of this bridge should seek to apply engineering excellence so as not to obscure the work of one of Australia's ablest engineers.

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[123] J. Bowden, 'A Bridge Too Far: major shortage of big section hardwoods', *inwood magazine*, Issue 78, p 28.

[124] There are 19 listed World Heritage Places in Australia, 16 of which are natural heritage such as rainforests, wilderness areas and national parks. A large proportion of places on the National Heritage List consist of natural rather than built heritage. This indicates the importance of conservation of natural heritage as well.

6.1.3 NSW Heritage Assessment Criterion (c): Aesthetic Significance

As a timber truss bridge, Gillies Bridge is aesthetically distinctive and has some landmark qualities. However, it is the engineering excellence which is particularly notable. Therefore, the conservation of this bridge should not obscure the original details and use of materials. There are opportunities to improve the views of the bridge by regular removal of excessive vegetation growth in the area.

Article 22.1 of the Burra Charter states that, "New work such as additions or other changes to the place may be acceptable where it respects and does not distort or obscure the cultural significance of the place, or detract from its interpretation and appreciation." New work may include such things as installation of new traffic barriers and modifications to approach spans and substructure. As well as considering how and from what angles the bridge and its various elements will be viewed, consideration must be given to the overall form, bulk, scale and fabric of the rehabilitated bridge. Care must be taken before introducing new fabric or changing the sizes of elements (even elements of lower significance) to ensure that this does not negatively impact the views to and from the bridge. For elements of lower cultural significance (eg, piers) it may be most appropriate to change the fabric in order to retain the simplicity of form rather than increasing the bulk or complexity of design by retaining timber. Similarly, while it is important to retain a rhythm in the barrier posts, it may be preferable to increase the post spacing when post sizes are increased so that the change in bulk of the upgraded barrier posts is minimised, and so that views are not unnecessarily obscured.

6.1.4 NSW Heritage Assessment Criterion (d): Social Significance

The bridge is locally esteemed and contributes to the local community's sense of identity. The best way to conserve a heritage structure is to ensure that the local community continues to value it. A bridge that looks like it is the result of Band-Aid solutions or poor workmanship, left to deteriorate until traffic restrictions are put in place to carry out repairs is less likely to be valued by the community. A community is more likely to value a bridge if it has an element of beauty or elegance to it. It is also more likely to value a structure if convenience is maximised and inconvenience minimised. Community sentiment can be assisted by education, so providing information regarding the history and the ingenuity of the original design and its place in NSW may assist.

Any modifications to the bridge should aim to increase its social significance by community focused design. A community focused design will include, but not be limited to, the following:

- **Elegance in Design**: The bridge, and any additions to it, should be in keeping with the elegance and simplicity of the original, with any additions designed to be visually recessive;
- **Road Safety**: The Bridge should be safe for vehicles and for pedestrians where appropriate. This may require sensitively upgraded barrier rails, alignments and approach treatments;
- **Transparency in Design**: Design should enable the inquisitive to determine the original details, fabric and form where possible by not obscuring this by changes and additions;
- **Durability in Design**: The design should be detailed to maximise service life so that community impact of traffic diversions due to bridge closures is minimised;
- **Strength for Modern Vehicles**: The bridge should be strengthened to carry today's vehicles so that inconvenient load restrictions are minimised, and community benefit maximised;
- **Interpretation**: Information on the bridge and its history should be made readily available, and where appropriate, included in the vicinity of the bridge.

6.1.5 NSW Heritage Assessment Criterion (e): Archaeological / Research Potential

The presence of original metal fabric as well as the integrity to the original design at Gillies Bridge provides significant research potential. Article 3.2 of the Burra Charter states that, "Changes to a place should not distort the physical or other evidence it provides, nor be based on conjecture." Similarly, the ICOMOS Principles for Historic Timber Structures emphasise the importance of authenticity and load-bearing function.[125] While discretion and sensitivity are critical when modern additions are provided, any strengthening works should be able to be interpreted as such, and the original design intent should not be obscured in the process. Where possible, the retention of original fabric should be maximised. If original fabric must be removed from the bridge for some reason (eg, structural failure, excessive deterioration or modifications) then the fabric should be examined (eg, metallurgical examination) and recorded and samples retained for future research.

6.1.6 NSW Heritage Assessment Criterion (f): Rarity

Gillies Bridge is the only remaining example of a 70' de Burgh truss and so should be conserved.

6.1.7 NSW Heritage Assessment Criterion (g): Representativeness

Gillies Bridge is representative as a fine example of a de Burgh truss bridge, including all of the principal characteristics of the de Burgh truss design and outstanding due to its integrity to the original truss design, containing much original fabric and displaying the original colour scheme.

The representativeness could be enhanced by restoring some of the original details which have been modified, especially the dimensions and detailing of timbers in top chords when these timbers next require replacement. Care should be taken to preserve the remaining original (metal) fabric by regular detailed inspection and maintenance which would include regular repainting of metal components to mitigate against corrosion, especially at connections (eg splices) and interfaces with timber (eg where the timber verticals and cross girders bear on the metal saddle plates).

6.2 Constraints and Opportunities arising from Statutory and non-Statutory Obligations

6.2.1 Summary and Assessment of Current Listings

Gillies Bridge is listed only on the schedule of heritage items in the Cessnock City Council Local Environmental Plan (LEP).[126] The NSW Heritage Council developed seven criteria gazetted under section 4A (3) of the *Heritage Act 1977* to help guide decisions about whether an item is of State heritage significance. Gillies Bridge has been assessed against these criteria above and six of the seven criteria are satisfied at a State level. Section 33 (3) of the *Heritage Act 1977* states that, in general, two or more criteria need to be satisfied for the Heritage Council to recommend State listing. It is clear that Gillies Bridge meets the criteria for listing on the State Heritage Register as an item of State heritage significance in addition to its current listing on the Cessnock City Council LEP.

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[125] ICOMOS (International Council on Monuments and Sites), Principles for the Preservation of Historic Timber Structures (1999), adopted by ICOMOS at the 12th General Assembly in Mexico, October 1999, p 2.

[126] Cessnock Local Environmental Plan 2011 (www.legislation.nsw.gov.au) accessed 13/03/17

Places of National heritage significance, Commonwealth Heritage Places or World Heritage are protected under the *Environmental Protection and Biodiversity Conservation Act 1999*. This Act allows places which are thought to be of outstanding heritage value to the Nation to be listed, managed and protected. Section 324D of the *Environmental Protection and Biodiversity Conservation Act 1999* states: “A place has a National Heritage value if and only if the place meets one of the criteria prescribed by the regulations for the purposes of this section.” Clause 10.01A (2) of the *Environmental Protection and Biodiversity Conservation Regulations 2000* give the criteria:

The National Heritage criteria for a place are any or all of the following:
(a) the place has outstanding heritage value to the nation because of the place’s importance in the course, or pattern, of Australia’s natural or cultural history; (b) the place has outstanding heritage value to the nation because of the place’s possession of uncommon, rare or endangered aspects of Australia’s natural or cultural history; (c) the place has outstanding heritage value to the nation because of the place’s potential to yield information that will contribute to an understanding of Australia’s natural or cultural history; (d) the place has outstanding heritage value to the nation because of the place’s importance in demonstrating the principal characteristics of: (i) a class of Australia’s natural or cultural places; or (ii) a class of Australia’s natural or cultural environments; (e) the place has outstanding heritage value to the nation because of the place’s importance in exhibiting particular aesthetic characteristics valued by a community or cultural group; (f) the place has outstanding heritage value to the nation because of the place’s importance in demonstrating a high degree of creative or technical achievement at a particular period; (g) the place has outstanding heritage value to the nation because of the place’s strong or special association with a particular community or cultural group for social, cultural or spiritual reasons; (h) the place has outstanding heritage value to the nation because of the place’s special association with the life or works of a person, or group of persons, of importance in Australia’s natural or cultural history; (i) the place has outstanding heritage value to the nation because of the place’s importance as part of indigenous tradition.

Gillies Bridge does not meet the criteria for National heritage significance, and is not an item of World Heritage. Therefore, Commonwealth legislation does not apply. A summary of the different statutory and non-statutory lists is provided in the table below, along with a summary of whether or not Gillies Bridge meets the criteria for listing, and whether or not the bridge is currently listed:

Register / List	Brief Explanation	Meets Criteria	Listed
World Heritage List	Properties forming part of the cultural and natural heritage which the World Heritage Committee considers as having outstanding value.	✘	✘
National Heritage List	Places of outstanding heritage significance to Australia, including natural, historic and indigenous places of outstanding value.	✘	✘
Commonwealth Heritage List	A list of natural, indigenous and historic heritage places owned or controlled by the Australian Government.	✘	✘
State Heritage Register	A list of places and objects of particular importance to the people of New South Wales, including items in both private and public ownership.	✓	✘
LEP Heritage Schedule	List with maps in principal legal document for controlling development and guiding Council’s planning decisions.	✓	✓
Register of National Trust	Non-Statutory register identifies historic places of national and local significance through expert committees.	✓	✘

6.2.2 Statutory Obligations

	Explanation	Constraints	Opportunities
NSW Heritage Act (1977)[127]	NSW Heritage Act 1977 is to conserve the cultural heritage in NSW. Section 31 of the Act states that the items assessed to be of state heritage significance are to be listed in the State Heritage Register. Section 118 states the minimum standards of maintenance and repair to an item listed in the State Heritage Register (SHR).	The bridge should be listed in the State Heritage Register. The bridge and the setting should be maintained at an acceptable level. Maintain records for repairs, maintenance and other activities related to the bridge.	Additional listing will further ensure that the cultural significance of the item is conserved. Technical assistance from the Heritage Council may be available. Opportunity for future research and studies of archival records.
Environmental Planning & Assessment Act (1979)[128]	This Act gives local governments the power to protect places of heritage significance through local environmental plans (LEP), which include provisions for development controls and identify any incentives that council may offer.	The bridge is listed in the LEP, and any development within the heritage curtilage should be assessed by Part 4 of the Act.[129]	Not Applicable
Work Health and Safety Act (2011) & Regulation (2011)[130]	This legislation is administered by SafeWork NSW, and aims to secure the health and safety of workers and workplaces, which includes construction or maintenance people working on bridges.	Any design, maintenance or construction work must be planned in order to manage safety risks for workers as well as maintainers, operators and users.	There may be opportunities to improve the safety of the bridge by modifications to the deck and to the rails.
Disability Discrimination Act (1992)[131]	The Act relates to discrimination on the grounds of disability. Section 23 of the Act requires that public premises must be accessible to persons with disability.	Disabled access to the item is not required by this Act, but access to places from which the bridge can be viewed must remain.	Not Applicable

[127] The NSW Heritage Act 1977, http://www.legislation.nsw.gov.au/inforcepdf/1977-136.pdf?id=d14bd599-ae30-6b78-ff54-b9e2c358f4e0 (accessed 29/03/2017).
[128] Environmental Planning and Assessment Act 1979, http://www.legislation.nsw.gov.au/maintop/view/inforce/act+203+1979+cd+0+N (accessed 29/03/2017).
[129] Cessnock LEP 2011, http://www.legislation.nsw.gov.au/#/view/EPI/2011/702 (29/03/2017).
[130] Work Health and Safety Act http://www.legislation.nsw.gov.au/#/view/act/2011/10 and Regulation http://www.legislation.nsw.gov.au/#/view/regulation/2011/674 (accessed 29/03/2017).
[131] Disability Discrimination Act 1992, https://www.legislation.gov.au/Details/C2016C00763 (29/03/2017).

6.2.3 Non-Statutory Obligations

	Explanation	Constraints	Opportunities
National Trust of Australia (NSW)	The National Trust of Australia is a community-based, non-government organisation, committed to promoting and conserving Australia's indigenous, natural and historic heritage through its advocacy work and its custodianship of heritage places and objects.[132]	Not applicable	If Gillies Bridge were to be listed on the Register of the National Trust this would increase awareness of the bridge, and perhaps encourage more tourists to the region.
Australia ICOMOS Burra Charter (1999)[133]	Australia ICOMOS is a national committee of the International Council on Monuments and Sites, which is a non-government professional organisation concerned with the philosophy, terminology, methodology and techniques of conservation. The Burra Charter provides guidelines for the conservation and management of places of cultural significance.	Articles 14-25 guide the extent of change, maintenance, preservation and restoration. Articles 26-34 guide the development of conservation policy for the heritage item.	Conservation and management of the bridge's fabric and setting to best practice.
Australian Standards	Australian Standards establish specifications, procedures and guidelines to ensure products, services and systems are safe, reliable and consistent. The relevant Australian Standard is AS 5100 Bridge Design.[134]	Relevant parts of AS 5100 should be considered to ensure that Gillies Bridge remains safe and serviceable for use.	Opportunities may exist to increase the capacity, safety and serviceability of the bridge by heritage sympathetic (visually recessive) introduction of new work.
Austroads Documentation	Austroads is the association of Australasian road transport and traffic agencies. Austroads provides expert technical input into national road and transport policy and publishes guides to promote a nationally consistent approach to the design, maintenance and operation of road networks.[135]	Relevant guides to Bridge Technology, Road Design and Road Safety should be considered to ensure that Gillies Bridge remains safe and serviceable for use.	Opportunities may exist to increase the safety of the bridge by appropriate road safety or road design measures taken outside of the curtilage of the structure.

[132] National Trusts of Australia, http://www.nationaltrust.org.au/?pageid=2 (accessed 10 June 2011).
[133] Australia ICOMOS, http://australia.icomos.org/about-us/ (accessed 10 June 2011).
[134] Standards Australia http://www.standards.org.au/Pages/default.aspx (accessed 29/03/2017)
[135] Austroads Guides http://www.austroads.com.au/about-austroads/austroads-guides (accessed 29/03/2017)

6.3 Constraints and Opportunities arising from Original Use and Compatible Use

There is an unfortunate history in New South Wales of building new concrete bridges next to existing timber truss bridges, and then demolishing the timber bridge when it becomes too hard to maintain. Efforts have been made in the past to find adaptive reuse for such bridges. In 1990, a single span of the unique bowstring timber truss over the Lachlan River at Cowra was reconstructed in an adjacent riverside park as a landmark of engineering heritage.[136] Although this project was originally heralded as a great success, within ten years, the reconstructed bridge had been so damaged by termites that it had to be demolished due to safety concerns. A bridge that had lasted almost a century under traffic including heavy loads did not last even one decade without traffic.

Another adaptive reuse that has been tried is using a bridge to carry utilities. This was the case for de Burgh's bridge over the Lane Cove River. Built in 1900, it was the longest de Burgh truss built. A new concrete bridge was constructed for traffic in 1967, and ownership of the bridge was transferred to the Sydney Water Board because the bridge was being used to carry a water-main.[137] However, the water-main was decommissioned and the bridge burned down in a bushfire in 1994.

There is often an idea that timber bridges could be adaptively reused to take pedestrians and cyclists. Although this may be suitable for other bridge types, the timber decking typical of timber truss bridges causes hazards for cyclists, and so in reality the adaptive reuse would have to be limited to pedestrians, or the decking upgraded.[138] Again, this has been attempted unsuccessfully a number of times, the worst example being an Allan truss in Glebe (Fig 6.1).[139] Timber bridges need to be regularly inspected and maintained to protect against rot and termite attack, and pedestrian bridges do not receive sufficient use or funding, which means they deteriorate very quickly.

Figure 6.1 Johnston's Creek Bridge, Glebe (source: J. McPhail)

Since experience has shown that these structures are very rarely successfully preserved by removing vehicular traffic and adaptive reuse, it is imperative that the bridge remain open to traffic. This may necessitate new work to ensure that the bridge is strong enough for the heavy vehicles which will use the route in the future (eg, replacement of timber cross girders and stringers with steel), it may require upgrades to the deck and rails to provide adequate safety and slip resistance, and it may require modifications to the approach spans and substructures in order to minimise bridge closures for repairs and in order to maximise the sustainability of the timber so it is available for the truss.

[136] D.J. Fraser, Cowra Bridge – Preservation of a Unique Structure, Sixth National Conference on Engineering Heritage 1992, Hobart 5 – 7 October 1992, p 1.
[137] R. Mackay, Conservation and Industrial Archaeology: Recent Work by the National Trust (NSW), Australian Historical Archaeology, Vol 4, 1986, p 15.
[138] For example, Sydney Morning Herald article on 14 July 2013, "Bridge fall highlights maintenance crisis".
[139] J. McPhail, Timber/Concrete Composite Module, Testing and Performance, Australian Small Bridges Conference, October 2005, p 6.

6.4 Constraints and Opportunities arising from Operational and Management Requirements

6.4.1 Capacity for Heavy Vehicles

There are operational constraints which arise from Gillies Bridge being a functioning part of the NSW road network, meaning that Council must ensure that the bridge operates in a safe manner and fulfils traffic requirements. Although the bridge is not located on a main road, the route is used by heavy vehicles such as semi-trailers (even despite the current 15 tonne load limit), and so it is essential that the bridge be able to meet current legal load requirements so that load limits need not be applied to the bridge, and so that the bridge is not at risk of structural failure under such loads.

6.4.2 Safety for Light Vehicles

In the NAASRA (National Association of Australian State Road Authorities) Highway Bridge Design Specification of 1965, there are design requirements for roadway railings on bridges, for footway railings on bridges, and for “crash resisting railings” on bridges. Even in 1965, barriers were only designed to actually resist impact loads from vehicles on, “bridge structures carrying traffic over busy thoroughfares”, otherwise design loads were approximately 2 kN/m. In 1992, the AUSTROADS Bridge Design Code came into effect, and barrier loads increased to 90kN. In 2004 a new Australian Standard for Bridge Design, AS 5100 introduced a design load up to 500kN to resist heavy vehicles.

Timber rails do not have any ability to prevent a vehicle from falling off the bridge. On the contrary, timber rails are a spearing risk to errant vehicles and their passengers. There have been a number of instances of vehicles driving off the sides of timber truss bridges in NSW, with some fatalities. Photographs below are typical of what happens when a car loses control at a timber truss bridge. The likelihood of accidents on timber bridges is accentuated by the slippery timber decks. It is therefore likely that a traffic barrier and new deck may be required at Gillies Bridge in the future.

Figure 6.2 Photographs of vehicle recovery after crash on a de Burgh truss in Hunter Region (source: RMS)

6.4.3 Safety for Workers

Work Health and Safety legislation in New South Wales emphasises the need for employers to provide a safe working environment for their employees or contractors. The safety risks of maintenance at Gillies Bridge are significant, including working at heights, working near traffic, working near overhead powerlines, working over water, working with hazardous materials (timber preservatives, termite treatments and possibly lead paint) and manual handling. In order to meet legislative safety requirements, sometimes traditional methods of construction and repair are not feasible, and so changes must be introduced in order to facilitate safe maintenance of the bridge.

6.5 Constraints and Opportunities arising from the Condition and Integrity of the Fabric

Element	Constraints	Opportunities
Timber Top Chords	Timber is not original fabric and cannot be returned to original fabric. Four of the original metal spools are missing. Termites and rot necessitates replacement of timber, flashing and paint are damaging timber.	When timber is replaced with new timber, the original dimensions and detailing can be restored which has been somewhat lost with progressive replacements. Flashing and paint should be removed and breathable white paint applied.
Timber Verticals	Timber is not original fabric and cannot be returned to original fabric. Termite and rot damage to timber necessitates replacement of timber. Existing paint system damaging timber.	When timber is replaced with new timber, the original dimensions and detailing can be restored. Existing paint should be removed and breathable white paint applied.
Metal Tension Rods	Fabric is original but is suffering some damage due to proximity of timber rails and timber deck at some locations.	Preserve tension rods by rearranging timber rail and cutting deck flush with kerb and repainting tension rods black.
Metal Bottom Chords	Fabric is original but is suffering some damage due to breakdown of protective coating at some locations.	Preserve bottom chord by removal of corrosion product and restoration of protective coating (black paint).
Sway Braces and Wind Bracing	Fabric is original but is suffering some damage due to breakdown of protective coating at some locations.	Preserve metal by removal of corrosion product and restoration of protective coating (black paint).
Cross Girders and Stringers	Timber is not original fabric or form and cannot be returned to original fabric. Stringers tend to deteriorate quickly, and some are in poor condition.	Design heritage sympathetic replacement for existing cross girders and stringers which are more durable and less visually incompatible than existing.
Approach Spans	Form and fabric are not original and cannot be restored due to physical constraints.	As per cross girders & stringers.
Timber Deck	Form and fabric are not original and cannot be restored due to material and capacity problems.	As per cross girders & stringers.
Kerbs and Rails	Form and fabric are not original, unsafe for today's vehicles.	Design heritage sympathetic replacement for rails to provide required safety for vehicles.
Piers and Abutments	Form, fabric and location not original and cannot be restored due to physical constraints.	As per cross girders & stringers.

7. DEVELOPMENT OF CONSERVATION POLICY

7.1 Current Management Context

Given the fact that Cessnock City Council has limited funds for bridge maintenance, and also that there are no drawings of the bridge as originally designed and constructed, Council has done an exceptional job of conserving the most significant elements of Gillies Bridge largely intact.

The fact that the current truss timber sizes are less than the original sizes, and that some of the carpentry details have been modified is probably due to the lack of drawings, so that measurements have to be taken from existing timber which tends to shrink, meaning that timber dimensions would get smaller and smaller with every replacement. Drawings showing the original detailing of Gillies Bridge have been prepared as part of the development of this Conservation Management Plan so that planned and emergency works can be done according to the original design. Drawings focus on the timber elements which will soon require replacement, and are shown on the following pages.

While the most significant elements of the bridge have been conserved in relatively good condition and largely intact, the less significant and less visually prominent elements (substructure, approach spans and stringers) bear little resemblance to the original design and detract somewhat from the significance of the bridge as a whole as the work of "one of the ablest engineers in Australia". Parts which particularly detract from the significance are the relocation of the abutments (the bridge is currently a little too short for the waterway, which is not a sign of a good design), the use of round outer girders with excessive notching and irregular decking (detracts from the aesthetics of the bridge as a whole, which the original designer paid very close attention to), the modifications to the piers with the introduction of concrete and irregular shapes and sizes (lacks robustness and symmetry), and the current configuration of stringers which does not suit the truss span design. All of these modifications (and also modifications to the deck) are fairly typical of bridges throughout the State, and demonstrate the difficulties of maintaining timber bridges with scarce resources.

The other difficulty faced by Council is keeping up with the required bridge maintenance so that the bridge can remain open to traffic and without load limits. The bridge currently has a posted 15 tonne load limit due primarily to deteriorated stringers. This is an inconvenience to the local community, and heavier vehicles such as semi-trailers continue to use the bridge despite the load limit, which puts both the drivers and the bridge at risk. It is notoriously difficult to enforce load limits without introducing visually obtrusive portal structures such as has been done for the Allan trusses on Victoria Bridge at Picton (note the two portals, one large and one small, which are located at both ends of the bridge). The load limit at Gillies Bridge also detracts from the heritage significance of the bridge because it is not possible for a load limited bridge to adequately demonstrate the strength of the NSW hardwoods from which it is constructed, and the excellence of engineering design which is adequate to carry today's heavy vehicles if the timber is maintained in good condition.

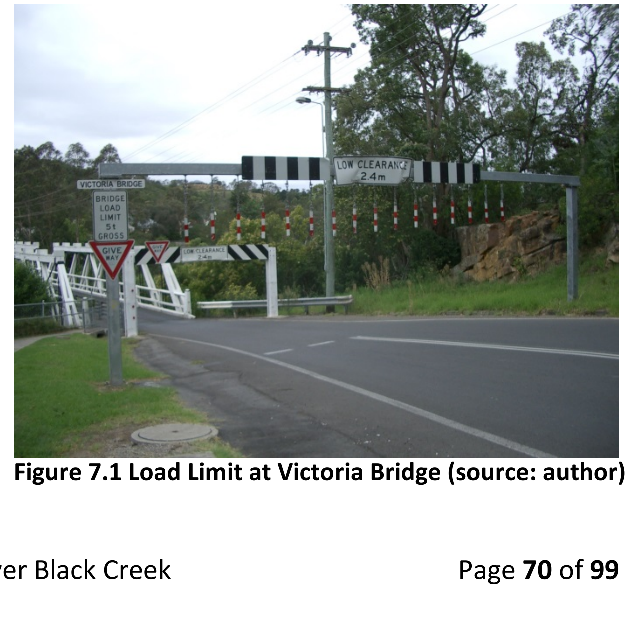
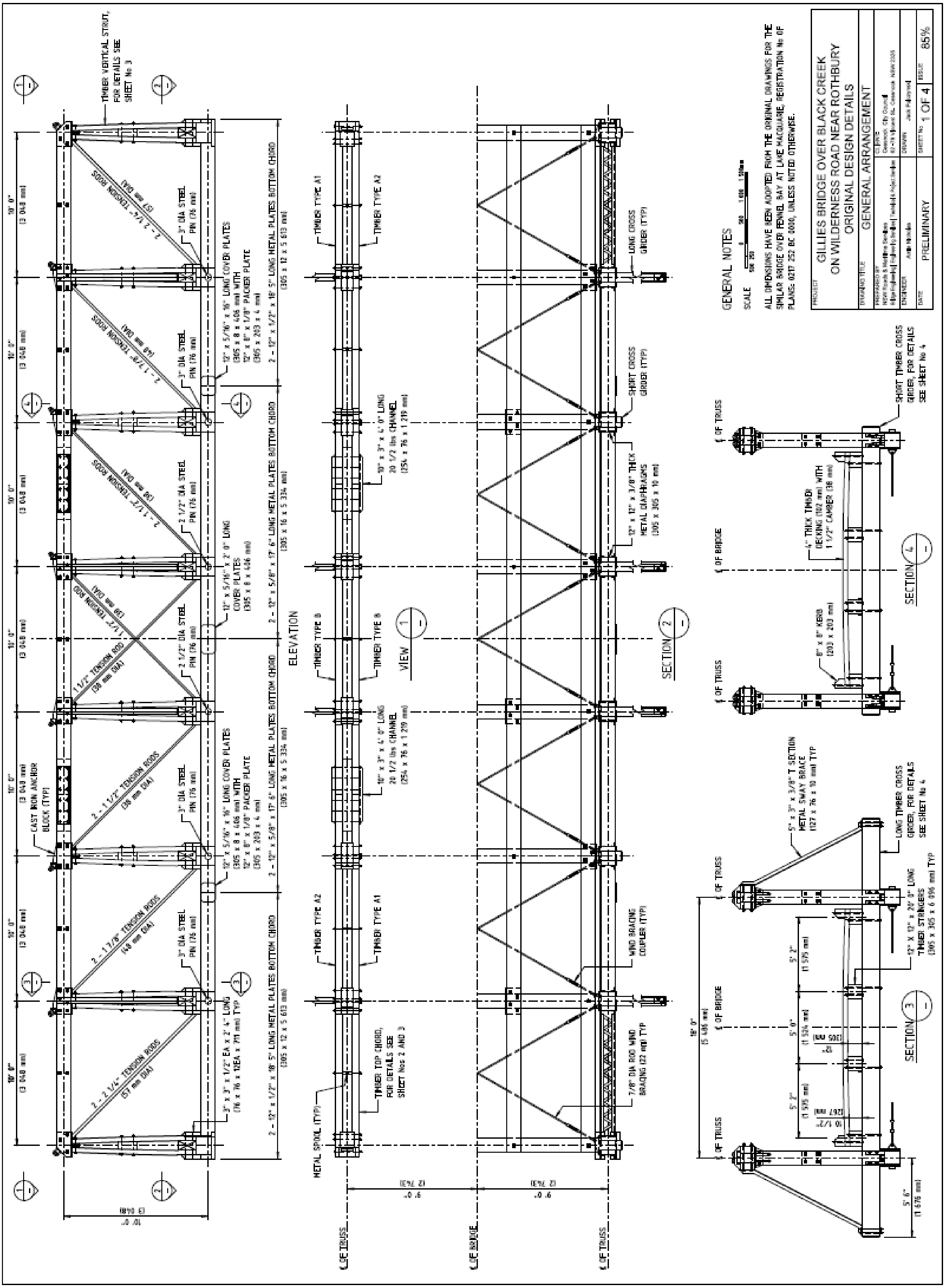
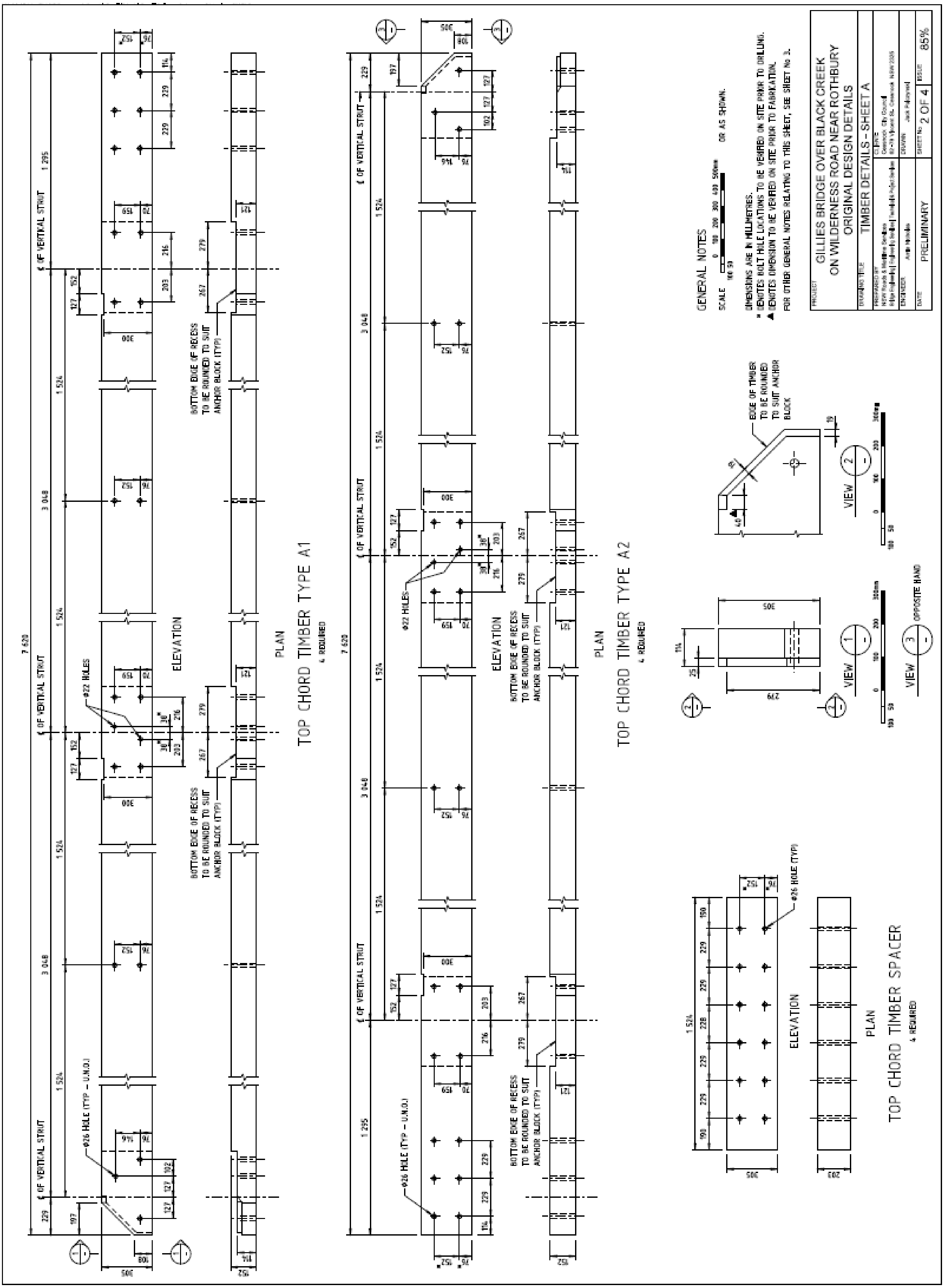
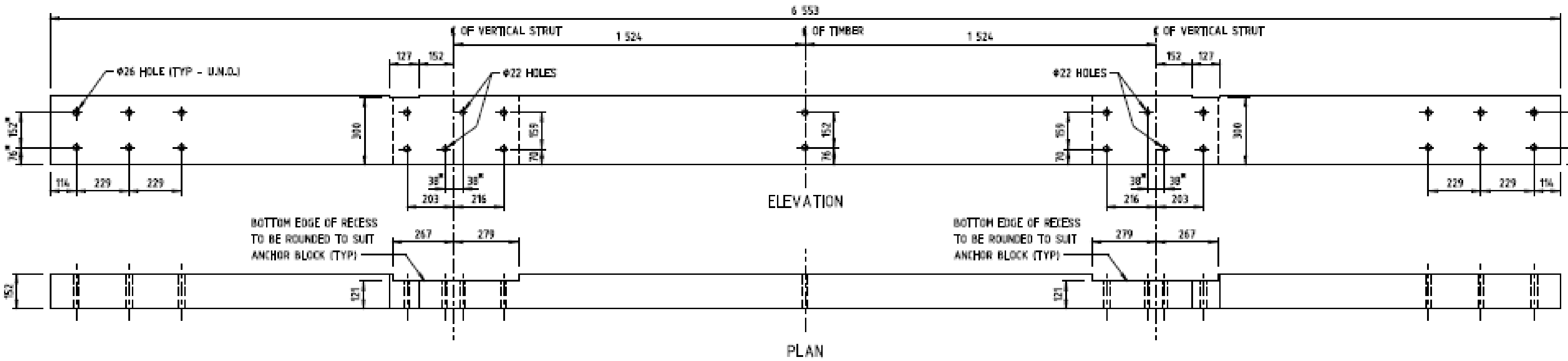


Figure 7.1 Load Limit at Victoria Bridge (source: author)


GILLIES BRIDGE OVER BLACK CREEK
ON WILDERNESS ROAD NEAR ROTHBURY
ORIGINAL DESIGN DETAILS
GENERAL ARRANGEMENT
PRELIMINARY
1 OF 4
85%
GENERAL NOTES
ALL DIMENSIONS HAVE BEEN ADOPTED FROM THE ORIGINAL DRAWINGS FOR THE SIMILAR BRIDGE OVER FENNEL BAY AT LAKE MACQUARIE, REGISTRATION No OF PLANS: 0217 252 BC 0000, UNLESS NOTED OTHERWISE.
ELEVATION
VIEW 1
SECTION 2
SECTION 3
SECTION 4

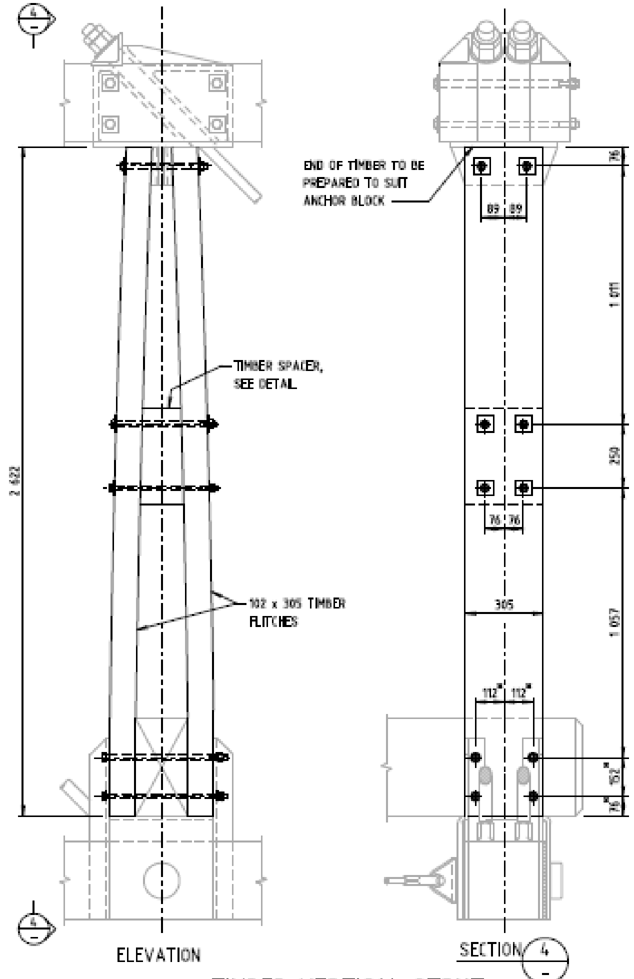

TOP CHORD TIMBER TYPE A1
4 REQUIRED
ELEVATION
PLAN
℄ OF VERTICAL STRUT
Φ26 HOLE (TYP – U.N.O.)
Φ22 HOLES
BOTTOM EDGE OF RECESS TO BE ROUNDED TO SUIT ANCHOR BLOCK (TYP)
TOP CHORD TIMBER TYPE A2
4 REQUIRED
TOP CHORD TIMBER SPACER
4 REQUIRED
Φ26 HOLE (TYP)
VIEW 1
VIEW 2
VIEW 3 OPPOSITE HAND
EDGE OF TIMBER TO BE ROUNDED TO SUIT ANCHOR BLOCK
GENERAL NOTES
SCALE OR AS SHOWN.
DIMENSIONS ARE IN MILLIMETRES.
* DENOTES BOLT HOLE LOCATIONS TO BE VERIFIED ON SITE PRIOR TO DRILLING.
▲ DENOTES DIMENSION TO BE VERIFIED ON SITE PRIOR TO FABRICATION.
FOR OTHER GENERAL NOTES RELATING TO THIS SHEET, SEE SHEET No 3.
PROJECT
GILLIES BRIDGE OVER BLACK CREEK
ON WILDERNESS ROAD NEAR ROTHBURY
ORIGINAL DESIGN DETAILS
DRAWING TITLE
TIMBER DETAILS – SHEET A
ENGINEER
DRAWN
DATE
PRELIMINARY
SHEET No 2 OF 4
ISSUE 85%



TOP CHORD TIMBER TYPE B

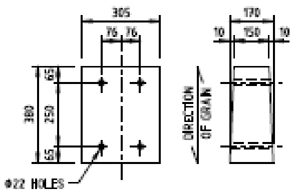
4 REQUIRED

NOTE: BOLT HOLES FOR STRINGERS NOT SHOWN (TO BE DETERMINED ON SITE).



TIMBER VERTICAL STRUT

4 REQUIRED



VERTICAL STRUT TIMBER SPACER

16 REQUIRED

TABLE 1 – BOLTING ASSEMBLY DETAILS

BOLTING CATEGORY 4.6/S, MINIMUM 75mm THREAD LENGTH

BOLT LOCATION	SIZE	LENGTH	NUMBER OF WASHERS REQUIRED: PLAIN ROUND NORMAL SERIES	NUMBER OF WASHERS REQUIRED: FABRICATED SQUARE 65 x 65 x 5 mm	TOTAL NUMBER OF ASSEMBLIES REQUIRED
TOP CHORD ANCHOR BLOCK CONNECTIONS	M24	550	–	2	60
TOP CHORD SPLICE CONNECTIONS	M24	570	1	–	48
TOP CHORD METAL SPOOL CONNECTIONS	M24	550	–	2	20
TOP CHORD SWAY BRACE CONNECTIONS	M20	560	1	1	16
VERTICAL STRUT BASE CONNECTIONS	M20	475	1	–	64
VERTICAL STRUT TO TIMBER SPACER LOWER BOLTS	M20	410	–	2	32
VERTICAL STRUT TO TIMBER SPACER UPPER BOLTS	M20	395	–	2	32
VERTICAL STRUT ANCHOR BLOCK CONNECTIONS	M20	325	–	2	32
CROSS GIRDER TO SWAY BRACE CONNECTIONS	M20	430	–	1	16

GENERAL NOTES

SCALE 0 100 200 300 400 500mm OR AS SHOWN.

DIMENSIONS ARE IN MILLIMETRES.

* DENOTES BOLT HOLE LOCATIONS TO BE VERIFIED ON SITE PRIOR TO DRILLING.

▲ DENOTES DIMENSION TO BE VERIFIED ON SITE PRIOR TO FABRICATION.

TOP CHORD ORIGINALLY HAD 7/8" BOLTS THROUGHOUT EXCEPT FOR 1" BOLTS AT SPLICE LOCATIONS. THESE DRAWINGS HAVE ASSUMED THAT IMPERIAL BOLTS WILL BE REPLACED WITH METRIC (M20 AND M24 AS APPROPRIATE).

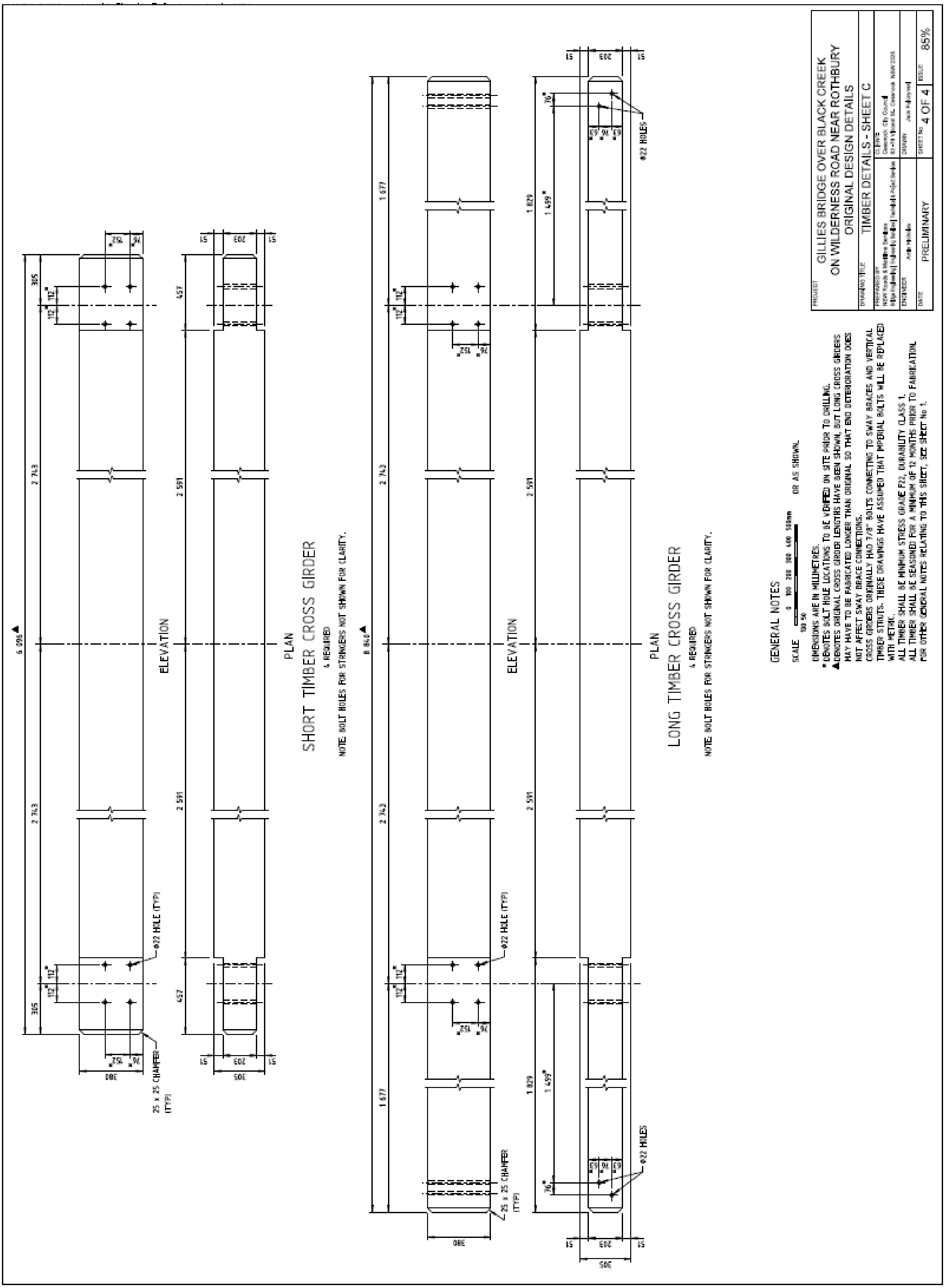
ALL TIMBER SHALL BE MINIMUM STRESS GRADE F22, DURABILITY CLASS 1, FREE OF HEART.

ALL TIMBER SHALL BE SEASONED FOR A MINIMUM OF 12 MONTHS PRIOR TO FABRICATION.

THE HEART SIDE OF TIMBERS SHALL FACE INWARDS ON TOP CHORDS AND VERTICAL STRUTS.

FOR OTHER GENERAL NOTES RELATING TO THIS SHEET, SEE SHEET No 1.

PROJECT	GILLIES BRIDGE OVER BLACK CREEK ON WILDERNESS ROAD NEAR ROTHBURY ORIGINAL DESIGN DETAILS
DRAWING TITLE	TIMBER DETAILS – SHEET B
PREPARED BY	NSW Roads & Maritime Services, Bridge Engineering, Engineering Services, Technical & Project Services
CLIENT	Cessnock City Council, 62-78 Vincent St, Cessnock NSW 2325
ENGINEER	Amie Nicholas
DRAWN	Jack Palczynski
DATE	PRELIMINARY
SHEET No	3 OF 4
ISSUE	85%


6 096
305
2 743
2 743
305
112
380
152
76
25 x 25 CHAMFER (TYP)
Φ22 HOLE (TYP)
ELEVATION
457
2 591
2 591
457
51
203
305
PLAN
SHORT TIMBER CROSS GIRDER
4 REQUIRED
NOTE: BOLT HOLES FOR STRINGERS NOT SHOWN FOR CLARITY.
8 840
1 677
2 743
2 743
1 677
ELEVATION
1 829
2 591
2 591
1 829
1 499
63
Φ22 HOLES
PLAN
LONG TIMBER CROSS GIRDER
4 REQUIRED
NOTE: BOLT HOLES FOR STRINGERS NOT SHOWN FOR CLARITY.
GENERAL NOTES
SCALE 0 100 200 300 400 500mm OR AS SHOWN.
DIMENSIONS ARE IN MILLIMETRES.
* DENOTES BOLT HOLE LOCATIONS TO BE VERIFIED ON SITE PRIOR TO DRILLING.
▲ DENOTES ORIGINAL CROSS GIRDER LENGTHS HAVE BEEN SHOWN, BUT LONG CROSS GIRDERS MAY HAVE TO BE FABRICATED LONGER THAN ORIGINAL SO THAT END DETERIORATION DOES NOT AFFECT SWAY BRACE CONNECTIONS.
CROSS GIRDERS ORIGINALLY HAD 7/8" BOLTS CONNECTING TO SWAY BRACES AND VERTICAL TIMBER STRUTS. THESE DRAWINGS HAVE ASSUMED THAT IMPERIAL BOLTS WILL BE REPLACED WITH METRIC.
ALL TIMBER SHALL BE MINIMUM STRESS GRADE F22, DURABILITY CLASS 1.
ALL TIMBER SHALL BE SEASONED FOR A MINIMUM OF 12 MONTHS PRIOR TO FABRICATION.
FOR OTHER GENERAL NOTES RELATING TO THIS SHEET, SEE SHEET No 1.
PROJECT
GILLIES BRIDGE OVER BLACK CREEK
ON WILDERNESS ROAD NEAR ROTHBURY
ORIGINAL DESIGN DETAILS
DRAWING TITLE
TIMBER DETAILS - SHEET C
PREPARED BY
NSW Roads & Maritime Services
CLIENT
Cessnock City Council
ENGINEER
Amie Nicholas
DRAWN
Jack Pakoyne
DATE
PRELIMINARY
SHEET No 4 OF 4
ISSUE 85%

7.2 Routine Repair Works

Before discussing routine works, there are some relatively urgent maintenance and repair works which are necessary in the short term to prevent serious and irreparable damage and deterioration.

- The connection between an anchor block and top chord has failed due to timber deterioration, which means that a primary load path is largely missing. Failure is indicated by a gap opening between the anchor block and the top chord on the far side (away from the tension rod) and by crushing and splitting of the top chord timber on the tension rod side. These two top chord timbers require replacement as a matter of some urgency.

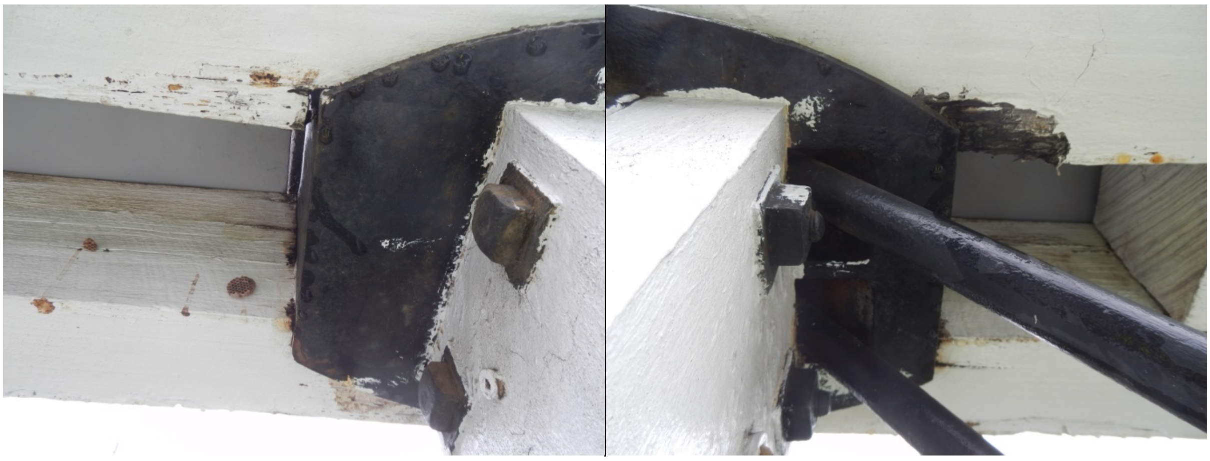


Figure 7.2 Photographs of failed top chord at anchor block location (source: Author, March 2017)

- The metal flashing on the top of the top chords should be removed because, although it was originally installed to protect the timber, it is likely to be doing more harm than good. Flashing has been a popular experimental treatment for top chords of timber truss bridges, and RMS has developed a number of different types of flashing which attempt to mitigate against the problems of moisture trapping and loss of air flow. However, it has become clear that flashing usually causes more problems than it solves (provides unwanted habitat for termites, wasps and micro bats, is an obstacle to regular inspections, funnels water to gaps in flashing causing accelerated local deterioration and detracts from the bridge aesthetics). Appropriate treatment to connector holes will be required after removal.

Figure 7.3 Photographs of metal flashing and attachments to top chord timber (source: Author, August 2013)

- The current non-breathable paint on the timber top chords and verticals is exacerbating rot and termite attack, and should be removed and replaced with a breathable white paint.

Figure 7.4 Photographs of damage due to non-breathable paint in top chords (source: Author, March 2017)

- The timber top chords and verticals should be closely inspected and treated for termites as well as any other creatures which may have taken up residence on or in the truss timbers.

Figure 7.5 Photographs of termites and wasps in top chords and verticals (source: Author, March 2017)

- The transverse decking on the truss span should be cut flush with the outside edge of the kerb along the length of the truss span to ensure no clashes with tension rods, and one section of timber handrail is detailed differently to the other sections and is too close to the tension rod, causing deterioration. This section should be moved 50 mm clear of tension rods and any existing damage to tension rods due to either the decking or the handrail or any other clash should be cleaned and patch painted to prevent further deterioration.

Figure 7.6 Photographs of damage to tension rods from decking and railing (source: Author, March 2017)

Other non-routine works, which are less urgent than those listed above, but which should be considered for completion within the next five to ten years, are as follows:

- Apply a rubberised spray seal to timber deck to reduce risk of vehicles slipping and crashing. The original timber deck had a tar seal sprinkled with sand to avoid slipperiness. Although there is no recent history of accidents on the bridge, the unsealed timber deck is susceptible to slipperiness, especially after rain, and the relatively recent sealing of the road approaches does increase the risk of vehicles travelling at some speed and slipping on the timber deck.
- The 2001 CMP included as an appendix (7) a "report of an investigation into the presence of lead in surface coatings on the bridge across Black Creek, Wilderness Road, Rothbury" written in July 2001 which found that all the surface coatings that were tested on the bridge contained unacceptable concentrations of lead and were designated hazardous substances. The lead paint on the timber is relatively simple to remove when the timber is replaced, but the removal and replacement of the lead paint on the metal components is more complex and will require substantial planning and funds to complete safely and appropriately.
- Replace non-original spools with either new spools machined from steel to the original design or spools salvaged from demolished de Burgh type timber truss bridges (Lansdowne Bridge and Beckers Bridge are planned for demolition within the next five years by RMS).
- Replace the top chord timbers which are shorter than the originals with new top chord timbers of the original dimensions, retaining only original splices (and restoring lost spools).

Figure 7.7 Photographs non-original details including splice on left and spools on right (source: Author)

Routine repair and maintenance works as would generally be required on a timber truss bridge are included in the tables on the following pages. Regular inspections, tightening of bolts, reapplications of preservative treatments, termite treatments and upkeep of good quality protective paint systems are essential for the long term conservation of the bridge. Timely replacement of deteriorated timber elements is also necessary in order to keep the bridge in a safe and serviceable condition.

The primary natural agencies causing the deterioration of timbers include rot, termites and fire.

Rotting occurs in trusses most frequently where water accumulates. In the de Burgh truss, the tops of the top chords and the bases of the vertical timbers are particularly susceptible to rot and inspections should focus on this area. The best prevention of rot is use of NSW hardwood timbers with the highest levels of natural durability and to apply frequent and careful painting.

Termites are major destroyers of timber. It can take three to five years for a new colony of termites to become established enough to damage bridges, but termite colonies are extremely difficult to locate at this early stage. In order for termites to establish a colony, they require food (decaying timber), shelter and moisture, and so moist timber or timbers in moist ground are favoured nesting areas for new termite colonies. Large bridge timbers containing heart (such as truss span cross girders or approach span girders) that have deteriorated are excellent sites for termite nest establishment, especially those that have formed large checks in the top surfaces causing them to become water reservoirs. It is practically impossible to eliminate all termites from a timber bridge, so the aim is to contain termite activity to a level considered economically acceptable by:

Figure 7.8 Termites (source: Ricky Forrester, presentation at RMS Timber Bridge School)

- Annual inspections of the bridge for active termites conducted between October and December, and including treatment of any active termites found in the timber members.
- Follow-up inspections before April of the following year focusing on those members treated to ascertain the success of that treatment and to apply additional treatment where required.
- All inspections and treatment of termites conducted by a suitably experienced and qualified person who is familiar with the tell-tale signs of active termite activity and the likely locations for such activity, who can distinguish between destructive and harmless termite species, who can correctly and appropriately install and monitor termite monitoring dowels and termite baits, who can correctly and appropriately apply termite dust, and who can accurately and clearly record and report on termite activity, locations and treatments.

Fire damage is relatively rare on timber truss bridges, and the hardwoods generally used are slow to burn so that only very few timber truss bridges have been lost due to fire. However, many have been damaged due to fire, requiring temporary closures and significance maintenance work, and the risk of this can be reduced by vegetation control in the vicinity of the Bridge to form a fire break.

	Every Year	Every Three Years (in addition to every year)	Additional works (as required or specified)
Site & General	Remove any debris and rubbish from the site		
	Clear any vegetation in area that contributes to a fire hazard or obstructs views		
	Inspect all timber and treat any active termites in October to December with follow-up inspections before the end of April the following year		
Truss timber top chords and verticals (not containing heart)	Check for paint damage, clean & patch paint as necessary	Treat bolt holes with copper naphthenate emulsion	When truss is supported for major works, loosen all joints and coat with copper naphthenate emulsion
	Tighten all bolts		When timber requires replacement due to deterioration (approx. 30 to 50 years), replace with new timber sized in accordance with the original design
	Remove any accumulations of dirt		
Truss timber cross girders and stringers (containing heart)	Check for paint damage, clean & patch paint as necessary	Treat joints with copper naphthenate emulsion	When timber requires replacement due to deterioration (approx. 20 to 30 years), replace with new timber sized in accordance with the original design with length as necessary
	Tighten all bolts	Treat bolt holes with copper naphthenate emulsion	
	Remove any accumulations of dirt		
	Check and replenish any previously treated holes with solid diffusing preservative rods		When truss is supported for major works, loosen all joints and coat with copper naphthenate emulsion
Truss span metal components (bottom chords, tension rods, anchor blocks, washer blocks, spools etc)	Check for paint damage, clean & patch paint as necessary		If damage occurs to original metal fabric then new metal components should be fabricated to precisely match the original dimensions, which should be taken from the original design drawings for the 70' truss over Fennell Bay
	Check for other damage (some metal components are susceptible to brittle fracture, and components can also be damaged by floods or vehicular incidents)		

	Every Year	Every Three Years (in addition to every year)	Additional works (as required or specified)
Approach span timber girders (containing heart and sapwood)	Tighten all bolts	Treat joints with copper naphthenate emulsion	When timber requires replacement due to deterioration (approx. 20 to 30 years), replace with new timber
	Remove any accumulations of dirt	Treat bolt holes with copper naphthenate emulsion	
	Check and replenish any previously treated holes with solid diffusing preservative rods		
Timber transverse decking and longitudinal sheeting	Tighten all bolts		When timber requires replacement due to deterioration (approx. 7 to 15 years), replace with new timber
	Remove any accumulations of dirt		
Timber kerbs with posts and handrails	Tighten all bolts	Treat joints with copper naphthenate emulsion	When timber requires replacement due to deterioration (approx. 10 to 15 years), replace with new timber
	Remove any accumulations of dirt		
	Check reflectors and check for paint damage or fading, clean or patch paint as necessary to ensure good delineation is maintained		
	Check for incident damage and repair as necessary, report any incident damage to assist future risk assessments for need for traffic barrier		
Timber piles in piers and abutments (containing heart)	Tighten all bolts	Treat joints with copper naphthenate emulsion	When timber requires replacement due to deterioration (approx. 20 to 30 years), then a suitably qualified and experienced structural engineer should be engaged to design a new substructure to ensure ongoing safety
	Remove any accumulations of dirt, vegetation or debris and check for scour and for any lack of verticality		
	Check and replenish any previously treated holes with solid diffusing preservative rods	Treat bolt holes with copper naphthenate emulsion	
Timber headstocks, capwales, wales, bracing, wingwalls and sheathing	Tighten all bolts	Treat joints with copper naphthenate emulsion	When timber requires replacement due to deterioration (approx. 10 to 15 years), replace with new timber
	Remove any accumulations of dirt	Treat bolt holes with copper naphthenate emulsion	
	Check and replenish any previously treated holes with solid diffusing preservative rods		

7.3 New Work

Clause 22.1 of the Burra Charter states that, "New work such as additions or other changes to the place may be acceptable where it respects and does not distort or obscure the cultural significance of the place, or detract from its interpretation and appreciation" and notes that new work should respect the significance of a place through consideration of its siting, bulk, form, scale, character, colour, texture and material. Clause 22.2 states that, "New work should be readily identifiable as such, but must respect and have minimal impact on the cultural significance of the place."

7.3.1 Truss Span

The cultural significance of the bridge is found primarily in the truss span, and so it is critical that any new work on the bridge does not detract from the interpretation or appreciation of the de Burgh truss. However, timber truss bridges are unable to adequately demonstrate the strength and durability of the materials or the design without remaining a vital part of the NSW road infrastructure, which may necessitate some elements being strengthened as vehicular loads increase. There are some elements which are essential to the interpretation and appreciation of the de Burgh truss and there are other elements which are less critical and may be modified.

The material and shape and size and detailing of the timber top chords and verticals cannot be modified without impacting the cultural significance. The use of NSW hardwood in these members is essential to the design and demonstrates the historic significance of the bridge. The shapes and sizes and detailing of the timber in accordance with the original design is essential to demonstrate the typical details of the de Burgh truss, and to differentiate it from other truss types.

The metal tension rods, anchor blocks and bottom chords are also of exceptional significance. Being original fabric, these elements are irreplaceable today due to the changes in available technology. The metal tension rods were made of forged wrought iron, and while there are a very limited number of Australian manufacturers who can still make forged items of this scale, they are exceedingly expensive and are forged from modern steels rather than from wrought iron. Similarly, the anchor blocks were grey cast iron made with relatively complex shapes which are difficult to achieve with the facilities available today. The metal bottom chords were assembled by riveted connections which again is a technology commonly used in the past, but not used today for structural purposes primarily due to the health and safety risks associated with hot riveting.

For these reasons, the ideal would be for the original metal components of the de Burgh truss to be preserved. However, there is always a risk that these original metal components may fail either due to material defects, heavy loads, flood or impact damage or deterioration (photographs showing examples of structural failure or damage to original de Burgh truss metal components are shown on the next page), and so there may come a time when the original fabric must be replaced. There is currently one tension rod at Gillies Bridge which is bent, probably evidencing some previous impact damage. Some tension rods have suffered corrosion, especially where timber rails or decks have been located too close to the tension rods. The bottom chord steel is showing signs of corrosion especially at splice locations and also at saddle plates where timber bears on the steel. If metal elements require replacement, then the replacement should be designed with reference to the original drawings, with shapes and sizes as close as possible to the original. For bottom chords, riveted connection would have to be replaced with high strength friction grip bolted connections.

Figure 7.9 Photographs of broken anchor blocks and washer blocks on other de Burgh trusses (source: RMS)

Figure 7.10 Photographs of deterioration of tension rods at Gillies Bridge due to clashes (source: author)

The sway braces and wind bracing are of less cultural significance than the other metal elements of the truss span because they are relatively common features and are not primary structural elements of the truss, but secondary elements added to limit deflections and vibrations rather than take loads. These elements are also not essential to the de Burgh truss because detailing varied somewhat between bridges (the wind bracing was configured quite differently at Tabulam Bridge, for example, and the sway braces were shaped quite differently on trusses with external footways provided.

Figure 7.11 Overhead portal bracing (source: RMS)

Timber top chords of timber truss bridges have a tendency to buckle laterally under repeated heavy loading. Modifications to sway bracing can be designed to provide lateral restraint without the need for visually intrusive overhead portal bracing or modifications to the timber top chords which are of exceptional cultural significance. Being original fabric, the ideal would be for the original metal sway braces and wind bracing of the de Burgh truss to be preserved. However, these elements have suffered from corrosion in the past and may require replacement or modification. When they require replacement, the replacement should be designed with reference to the original drawings, with shapes and sizes as close as possible to the original.

The timber cross girders and stringers are of less cultural significance than the other timber elements of the truss span (ie. the top chords and verticals) because they are very common features and are not primary structural elements of the truss, but secondary elements to carry the deck. These elements are also not essential to the de Burgh truss because detailing varied considerably between bridges, with timber cross girders used sometimes, and sometimes metal cross girders.

The stringers in the bridge currently bear almost no resemblance to the original design, and have been one of the most common reasons for load limits and bridge closures due to deterioration. The cross girders display much of the original detailing, but are considerably longer than the original cross girders due to the original sway bracing connection being located right at the end of the cross girder so that when the cross girder deteriorates from the end grain, the sway braces become loose. The longer cross girders and the non-original stringers detract from the aesthetic of the bridge.

The cross girders and stringers are generally the first mode of failure for a timber truss bridge, and are the first elements which require strengthening in order to accommodate heavier vehicles. The cross girders were originally constructed from Ironbark, Tallowwood or Grey-box (ie. the strongest of the NSW hardwoods) of very long and large cross sectional dimensions (approx. 380 x 300 mm and almost 9 m long). These timbers are increasingly difficult to obtain, and therefore these members are a good example of when careful consideration should be given to replacing timber with modern materials (eg, steel hollow box section) in order to conserve the valuable natural timber resource for use in the timber elements of higher significance (ie, the tops chords and verticals).

When timber cross girders are replaced with steel cross girders, an additional benefit is that the steel cross girders provide a connection point for an upgraded traffic barrier if required (it is not possible to effectively connect a traffic barrier to timber cross girders). A fabricated steel box section can be designed to reflect the original cross sectional dimensions and lengths of the timber cross girders, and can be painted white to reflect the original colour scheme of the timber cross girders. This would restore the original aesthetic of the bridge, and could also reduce the rate of deterioration of the metal bottom chord saddle plates at the interface locations, thereby assisting in the preservation of the original metal fabric. Furthermore, the replacement of the timber cross girders with steel cross girders strengthens the bolted connection between the sway braces and the cross girder, which could be used to assist providing lateral restraint to the timber top chord.

The timber deck, kerbs and rails are of little significance with alterations detracting from significance and making the bridge as a whole more difficult to interpret. It is impractical to restore the original deck details because of the lack of quality timber, the use of materials no longer used due to health and safety issues (ie, tar) and the inability to carry some of the heavier loads on the roads today. A stress laminated timber (SLT) deck with a rubberised spray seal could be used to replace both the existing deck and stringers and would restore something of the original aesthetic of the bridge. An SLT deck would also improve the safety of the deck, making it less slippery in wet weather.

It is also impractical to restore the original timber kerbs and rails because they do not meet current minimum safety requirements, as legislated in the 2011 Work Health and Safety Act and Regulation. When major refurbishment is due to be done to the bridge, consideration should be given to replacing the existing timber kerbs and rails with a visually recessive steel traffic barrier designed to ensure safety for passenger vehicles (ie, cars and utes up to 2 tonnes) crossing the bridge, complying with the 1996 Austroads Bridge Design Code (since compliance with current AS 5100 is impossible).

7.3.2 Approach Spans

The timber approach spans with deck, kerbs and rails are of little significance with alterations detracting from significance and making the bridge as a whole more difficult to interpret. None of the fabric is original, and even the span lengths are shorter than the original span lengths. The decking is substantially different from the original, is less safe than the original (due to slipperiness of exposed timber), and detracts from the aesthetic significance of the truss by introducing strong longitudinal lines which inevitably occur between the longitudinal sheeting. The transverse decking has not been sawn neatly to the correct lengths and therefore protrudes rather messily off the side of the deck on all three spans. The outer timber girders were originally sawn and painted white flush with the kerb to give a neat straight edge, but these have been replaced with round timber girders which have been notched at various locations to accommodate vertical timber posts for the rails, with some notches no longer used and therefore looking rather unsightly. Due to the fact that the girders are located outside of the deck line rather than under the kerb, an additional short post has been provided, which again detracts from the neat, clean and simple aesthetic of the original design.

Figure 7.12 Photograph of current approach span configuration (source: author, March 2017)

It is impractical to restore the original timber approach spans with deck, kerbs and rails because of the relocation of the abutments, the difficulties in obtaining the long timber girders, especially the sawn outer girders, as well as the same difficulties as the truss span with regards to the deck, kerbs and rails. The approach span girders are another example of when careful consideration should be given to replacing timber with modern materials to conserve the valuable timber for use in the elements of higher significance. The most appropriate treatment would probably consist of simple steel I beam girders with steel cross girders supporting a stress laminated timber deck and steel traffic barrier matching the deck and barrier used on the truss span. This would restore the neat aesthetic of the original bridge and would allow the truss to again take visual prominence.

7.3.3 Piers and Abutments

Historically, the most common cause of structural failure (collapse) of timber truss bridges has been flood damage to the substructure (ie, piers and abutments). Although there are some rare instances where overloaded vehicles have caused timber truss bridges to collapse, there have been many timber truss bridges that have lost whole spans due to flood damage. Bridges with timber trestle piers are particularly susceptible to flood damage due to the prevalence of hidden deterioration in the timber piles and limited capacity in bolted timber connections. It is critical for the conservation of Gillies Bridge that the substructure be kept sufficiently strong to resist likely future flood loads.

The timber piers and abutments are of little cultural significance with alterations detracting from significance and making the bridge as a whole more difficult to interpret. None of the fabric is original, and the current timber abutments are in a different location to the original abutments. It would be physically impossible to restore the original configuration of piers and abutments.

The excerpt from a recent flood study shown in the figure below indicates that the deck of Gillies Bridge is completely inundated in the 1 in 100 year flood event, and that the probable maximum flood is at a higher level still. This means that Gillies Bridge is at relatively high risk of damage due to floods, and special attention must be paid to the piers and abutments to manage this risk.

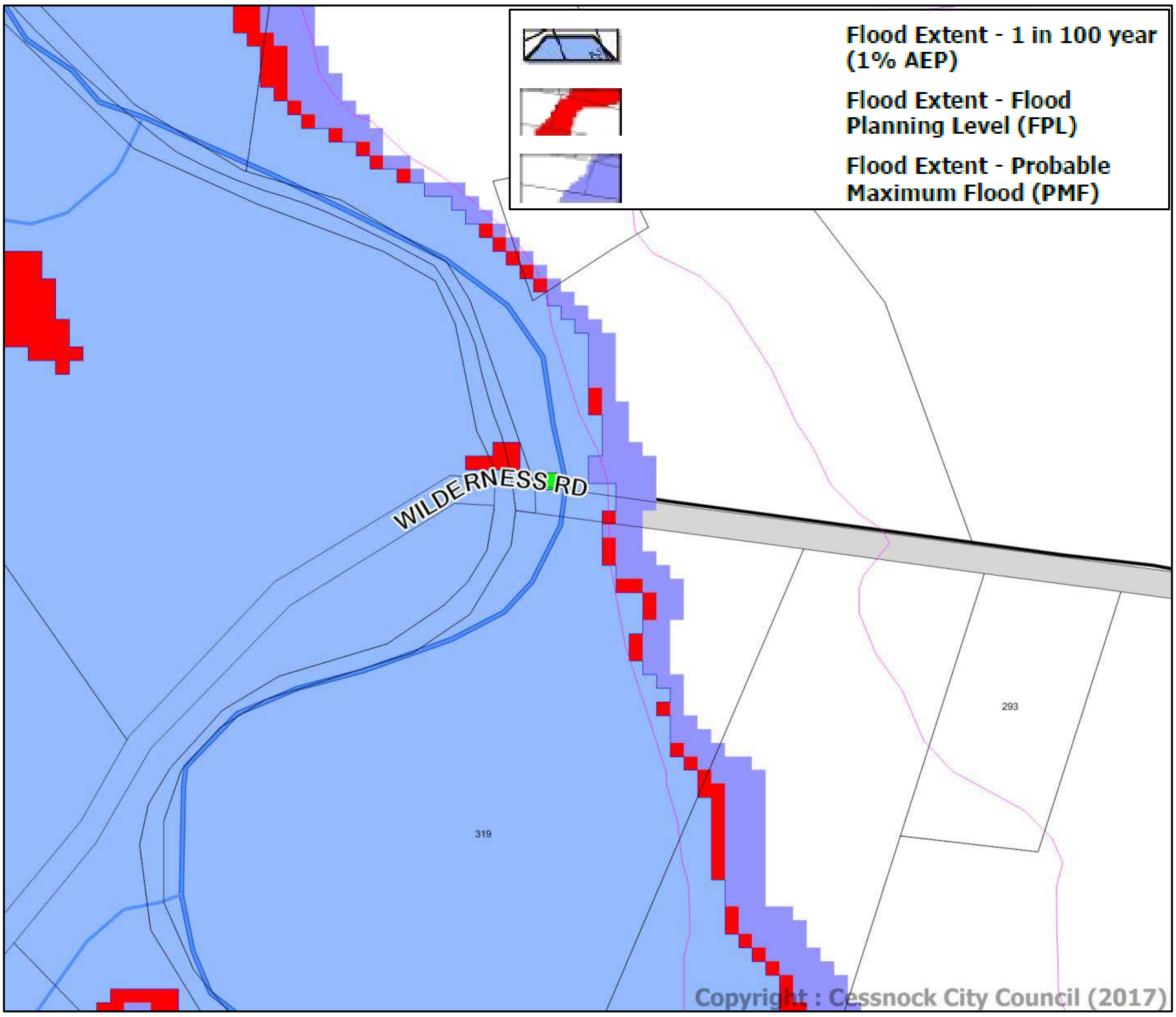


Figure 7.13 Map showing 1 in 100 year and Maximum Probable Flood (source: Cessnock City Council)

Although it is generally stated that there is no "original fabric" when it comes to timber in bridges, this only applies to visible and accessible fabric. The timber piles well below ground level are almost certainly the original timber piles driven there in the very early 1900s. The current timber piles in the piers seen above ground level would be spliced to those original piles by an underground connection. Unfortunately, these timber to timber buried splices do not have anywhere near the original capacity or durability and therefore pose a significant risk to the bridge. Timber piles rot below ground level and are impossible to replace as a "like for like" replacement or as a restoration of the original. This is because, before a new timber pile can be driven, the old timber pile would have to be removed, and this is generally not possible. Similarly, the abutments have been reconstructed a number of times in different locations, and it is likely that partial remains of the original timber piles of the abutments would remain buried deep below ground level.

Of all the details of the bridge, the original details of the piers and abutments are the least certain because we have neither old photographs nor original drawings for the substructure as constructed. Article 20.1 of the Burra Charter states that, "Reconstruction is appropriate only where a place is incomplete through damage or alteration, and only where there is sufficient evidence to reproduce an earlier state of the fabric." Although the substructure at Gillies Bridge meets the first part of the criteria for reconstruction (ie, the substructure has been altered), it does not meet the second part because there is not sufficient evidence (ie, no photos or drawings) to reproduce the original.

Options considered for the substructure at Gillies Bridge include:

- Restore original design (discounted due to impossibility as outlined above).
- Do nothing but keep the current configuration of piers and abutments and continue like for like maintenance approach (discounted because the abutments will probably have to be relocated again within 30 years due to deterioration, thereby shortening the bridge again, and the piers as currently constructed leave the bridge at risk of serious flood damage).
- Relocate the bridge (and therefore the piers and abutments) in order to allow new timber trestle piers and abutments to be constructed as per the most likely original design (discounted because there is a significant heritage impact by moving the bridge from its original and existing location, and this solution was not sustainable so the bridge would have to be relocated again and again approximately every 25 years due to deterioration).
- Retain bridge in current location and restore the original length of bridge and capacity of substructure by replacement with new materials. This may involve replacing single trestle timber piers with new single trestle steel piers on underground concrete foundations and replacing the existing timber abutments with new concrete abutments closer to the original locations, thereby restoring the most likely original approach spans lengths of 35' (10.67 m).

The last option (replace piers with steel piers and abutments with concrete abutments) is preferred. Steel piers can be very neatly detailed to closely reflect the original aesthetic when viewed from a distance while providing the robustness and durability required preventing collapse in a flood. Concrete abutments have the advantage of termite resistance. By introducing concrete abutments at the original abutment locations, the original bridge length can be restored (which is good for heritage and is also good for maximising waterway area, reducing flood velocities), and an effective termite barrier is introduced so that termites are less easily able to access the timbers of the truss span. Concrete abutments can be designed to be visually recessive primarily by limiting their size.

7.3.4 Summary of Heritage Implications of New Work

Natural Heritage Principles is a document prepared by OEH in recognition of the fact that the environmental heritage of NSW includes natural as well as cultural heritage, and that the recognition of the value in conserving our remaining natural heritage is vital in order to kerb the accelerating rates of extinctions of plants and animals, and of modifications to the natural environment.[140]

Although Gillies Bridge is not in a natural heritage area, it was originally constructed with timber obtained from old growth hardwood forests in NSW, which were even then becoming endangered. The timbers originally used would have been derived from 80 to 200 year old trees in order to achieve the necessary strength, durability and dimensions. Unfortunately, the timber in the bridges does not last as long as it takes to grow a new tree of the appropriate species and age. On average:

- Truss timber (top chords and verticals) can last up to 50 years in a timber truss bridge if regular termite treatments are undertaken and if a suitable protective paint is maintained.
- Timbers which contain heart (cross girders, stringers, approach span girders and piles) can last up to 30 years in a bridge if regular termite treatments are undertaken.
- Single layer timber decking can last up to 15 years on a timber bridge if well maintained and kept tight, but double layer timber decking (transverse decking and longitudinal sheeting) increases the rate of deterioration and generally the sheeting lasts less than ten years.

There are some very clever modern engineered wood products available today which provide substantial strength and durability using imported sustainably grown preservative treated softwoods combined with glass-aramid or carbon-aramid fibres glued together with modern epoxies. However, these are not as strong or as durable as the original ironbark timbers used, and their use would detract substantially from the heritage value of the timber truss bridge, a large part of which is the incredible NSW hardwoods which are the very reason for the timber truss bridges being constructed.

Timber girders, cross girders, stringers and substructures (piers and abutments) have been used in bridges all around the world making use of many different species (both hardwoods and softwoods) which are considerably less strong and less durable than the NSW hardwoods. These elements are therefore not able to demonstrate the unique strength and durability of the NSW hardwoods, and do not contribute substantially to the cultural significance of a timber truss bridge. The elements which do demonstrate the unique strength and durability of the NSW hardwoods are the primary load bearing truss elements, which in a de Burgh truss are the timber top chords and verticals. In order to achieve a balanced approach to conserving both natural and cultural heritage, and to maximise future stocks of NSW hardwoods available for maintaining timber truss bridges, it is appropriate to consider replacing timbers of little heritage value with other materials such as steel.

The tables on the next two pages summarise the heritage implications of the new works discussed in this section. Only elements which may require new work are discussed, so elements which contain original fabric to be conserved, or elements of exceptional significance to be restored to their original detailing are not included. The first table shows the heritage implications of elements in their current configuration, given that a number of changes have already been introduced, and the second table shows the heritage implications of the same elements if the new works are completed.

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[140] Natural Heritage Principals, *Heritage Information Series*, NSW Heritage Office, 2000

	Cross Girders	Stringers & Deck	Approach Spans	Kerbs & Rails	Substructure
Historical	Demonstrates historical abundance of timber, but fabric and dimensions are not original	Modified such that they bear little resemblance to the original and detract from the original design and workmanship	Modified such that they bear little resemblance to the original and detract from the original design and workmanship	Very common historical rail	Modified such that they bear little resemblance to the original and detract from the original design and workmanship
Associational	Detailing of cross girders through centre of timber verticals is associated with de Burgh and unique to his design	Very common original detail not associated with de Burgh, modified such that they now misrepresent de Burgh	Very common original detail not associated with de Burgh, modified such that they now misrepresent de Burgh	Very common, and not associated with de Burgh	Very common original detail not associated with de Burgh, modified such that they now misrepresent de Burgh
Aesthetic	The current cross girders are longer than the original design and detract from the aesthetics of the bridge as a whole	Stringers and deck detract from the aesthetics of the bridge due to the messy stringers and the strong deck lines	Approach spans detract from the aesthetics of the bridge due to irregular “rustic” look rather than original look	The kerbs and rails reflect something of the original aesthetic, which is recessive with respect to the truss	Piers and abutments detract from the aesthetics of the bridge due to irregular “rustic” look, not original
Social	N/A	Current deck requires regular closures for maintenance and makes noise when loose, detracting from social value	Current approach spans are not in keeping with the aesthetics of the truss spans, and so detract from the social value	Current kerbs and rails are not safe in the event of an errant vehicle, and this detracts from the social value	N/A
Research	Cross girders (timber or metal) were connected to timber verticals which added strength and stability to truss	Common, no research, cannot learn about original design from current configuration due to modifications	Common, no research, cannot learn about original design from current configuration due to modifications	Common, no research, cannot learn about original design from current configuration due to modifications	There are probably still original timber piles buried below and behind the current substructure
Rarity	Cross girders (timber or metal) are common to any truss and are not rare	Stringers and deck are common to many trusses (not only timber trusses) and are not rare	Common, not rare	Very common both on and off bridges, not rare	Common, not rare
Representative	Timber cross girders are not representative of all de Burgh trusses as some were originally metal, common	Timber decks were very widely used, and stringers also, not representative	Very common, widely used, not representative	Very common, widely used, not representative	Very common, widely used, not representative

Table summarising cultural significance of current configuration of bridge (GOOD, NEUTRAL, POOR)

	Cross Girders	Stringers & Deck	Approach Spans	Kerbs & Rails	Substructure
Historical	Replacement with steel cross girders restores original dimensions and painted white to demonstrate original material	Removal of stringers and introduction of SLT deck is more in keeping with design intent and original aesthetic	Replacement of approach spans with steel girders and SLT deck is more in keeping with original tidy aesthetic	New steel traffic barriers would be readily identifiable as new work, not part of the historical design	Replacement with steel piers and concrete abutments more in keeping with original design intent & aesthetic
Associational	Detailing of cross girders through centre of timber verticals is associated with de Burgh and unique to his design	SLT deck keeps timber as primary decking material but "engineered" rather than "rustic" restores original aesthetic	New steel & SLT approach spans would be readily identifiable as new work, not associated with de Burgh, as original spans were not	New steel traffic barriers would be readily identifiable as new work, not associated with de Burgh, as original rails were not	New substructure would be readily identifiable as new work, not associated with de Burgh, as original abutments and piers were not
Aesthetic	Restores original aesthetic with regard to length, and painted white to indicate timber	Restores original aesthetic of deck, removes visually intrusive stringers which cannot be restored to original detailing	Restores original neat and straight aesthetic of spans, removes visually intrusive girders which cannot be restored to original detailing	New steel traffic barriers would be readily identifiable as new work, but visually recessive so that trusses retain visual prominence	Restores original aesthetic with regard to length of bridge & approach spans and neat slender symmetrical piers
Social	N/A	SLT deck and stringer removal minimises load limits and closures increasing social value and use	New steel & SLT approach spans restore visual prominence of truss & increases social significance of the truss span	New steel traffic barrier increases safety for the public, encouraging increased use and appreciation	N/A
Research	Cross girders (timber or metal) were connected to timber verticals which added strength and stability to truss	Common, no research, cannot learn much about original design from current or new configuration	Common, no research, cannot learn much about original design from current or new configuration	Common, no research, cannot learn much about original design from current or new configuration	There are probably still original timber piles buried below and behind the current substructure
Rarity	Common, not rare	Common, not rare	Common, not rare	Common, not rare	Common, not rare
Representative	Very common, widely used, not representative	Very common, widely used, not representative	Very common, widely used, not representative	Very common, widely used, not representative	Very common, widely used, not representative

Table summarising cultural significance of bridge after possible future new work (GOOD, NEUTRAL, POOR)

8. CONSERVATION POLICIES AND GUIDELINES

The purpose of the conservation policies in this section is to provide a guide to the care of Gillies Bridge, enabling the quality and significance to be retained and, in some cases, enhanced.

8.1 Primary Conservation Policies

8.1.1 Conservation of Cultural Significance

Gillies Bridge should be maintained and conserved in such a way which protects or enhances the cultural significance of the bridge. Cessnock City Council should ensure that the cultural significance of the bridge and its curtilage guide future decisions that affect the area and the route.

8.1.2 Approach to Conservation

The future conservation of the bridge should be carried out in accordance with the principles of the Australia ICOMOS Charter for the Conservation of Places of Cultural Significance (Burra Charter).

8.1.3 Heritage Listings

Gillies Bridge should be included on:

- Cessnock City Council Local Environmental Plan (currently listed); and
- State Heritage Register (not currently listed, nomination form should be filled in based on information in this CMP and lodged with the New South Wales Heritage Division).

8.2 Policies related to Management and Ownership

8.2.1 Ownership of the Bridge

The bridge is public property under the ownership, care and control of Cessnock City Council. Should Cessnock City Council cease to be responsible for the care and control of the bridge, ownership should be transferred to another public authority, preferably RMS in the first instance.

8.2.2 Use of the Bridge

Gillies Bridge should continue to be used for vehicular traffic. The continued usage of this bridge as functioning road bridge is integral to its significance as a heritage item. Unacceptable uses of Gillies Bridge include any uses or activities that may cause or accelerate physical damage to the fabric or views to and from the bridge (for example, attaching utilities to the bridge is unacceptable).

8.2.3 Integrity and Safety Checks

The bridge is located on a public road and should be maintained in a manner that does not create a public safety hazard. The bridge should be regularly inspected by specialists for the integrity of the structure. A separate specialist should be engaged twice a year to inspect for and treat any active termites. Any issues affecting public safety, if found, shall be addressed by appropriate methods.

8.2.4 Management of Prepared Drawings

Since the original design drawings for Gillies Bridge have not been found, some drawings have been prepared so that both planned and emergency works can be done according to the original detailing for the timber components with heritage significance. These drawings should be included in Council's document management system such that they are always readily available when required.

8.2.5 Implementation of Repair Works

Repair works should be carried out by suitably skilled workers with reference to the information and policies provided in this CMP and with reference to drawings that show the original design details.

8.2.6 Implementation of New Work

Any new works planned for the bridge should have the heritage significance of the structure as a primary consideration as well as considering other necessary issues such as safety and serviceability. Proposals to undertake changes to the bridge should be assessed by a Statement of Heritage Impact.

New works should be designed to enhance, and not impinge on, the functioning of the bridge. New works should not detract visually from the bridge or its setting. New works should not hasten the deterioration of surviving original fabric or result in irreversible alteration to significant fabric.

Applications and methods used should be proven and should not be carried out as experiments.

8.2.7 Archival and Photographic Recording

Immediately before and after any works being undertaken, an inspection should be completed, detailing and photographing the condition and defects of all elements. All methods and materials used during any work done to the bridge should be fully documented with written information and appropriate photographs. Records, reports and photographs of any work carried out on the bridge should be placed in a permanent archive to enable retrieval of information afterwards.

8.3 Policies related to the Fabric

Policies related to fabric use words specifically defined in the Burra Charter as follows:

Fabric means all the physical material of the place including elements, fixtures, contents and objects.

Conservation means all the processes of looking after a place so as to retain its cultural significance.

Preservation means maintaining a place in its existing state and retarding deterioration.

Restoration means returning a place to a known earlier state by removing accretions or by reassembling existing elements without the introduction of new material.

Reconstruction means returning a place to a known earlier state and is distinguished from restoration by the introduction of new material.

Adaptation means changing a place to suit the existing use or a proposed use.

Interpretation means all the ways of presenting the cultural significance of a place.

8.3.1 Timber Top Chords

Conservation: NSW Hardwoods are essential to the cultural significance of the truss, and so NSW hardwoods should be used for the timber in the top chords as per the original design. The presence of original metal fabric (splice plates, anchor blocks and spools) in relatively good condition contributes to the cultural significance of the item and should be preserved for as long as is practical. The retention of the original colour scheme (white for all timber elements and black for all metal elements including bolts and square washers which are carefully positioned so that faces are parallel with top chord) also contributes to the cultural significance of the bridge and should be preserved.

Restoration: The introduced metal flashing and non-breathable white paint should be removed.

Preservation: The timber of the top chord should be preserved for as long as is practical by ensuring that a protective coating (breathable white paint) is applied and reapplied as necessary and that termite inspections and treatments are undertaken regularly (twice a year). A waterproof white paint (Sikafloor 400N Elastic) should be applied to the top surface only of the top chord. The metal components (splice plates, anchor blocks and spools) should also be preserved by ensuring that the protective coating (black paint) is reapplied as necessary before the onset of corrosion.

Reconstruction: The timber fabric is not original and is subject to deterioration from rot and termite attack. It should be replaced before the level of deterioration affects the safety or serviceability of the bridge. Timber supplied for use in top chords should conform to RMS Specification B2380, and the dimensions and detailing of the timber should conform to the original design. The four missing spools should be replaced either with original spools from other de Burgh trusses intended for demolition by RMS (Beckers or Lansdowne), or by steel spools machined to match the original design. Records should be kept to ensure that introduced fabric can be readily identified as such.

Interpretation: The foundry marks on the splice plates should be arranged so that they remain clearly visible (when top chord timbers are replaced, locate top chord splices with foundry marks on the inside of truss rather than the outside and with text of foundry marks the right way around).

8.3.2 Timber Verticals

Conservation: NSW Hardwoods are essential to the cultural significance of the truss, and so NSW hardwoods should be used for the timber verticals including spacers as per the original design. The retention of the original colour scheme (white timber and black bolts with black square washers orientated parallel) also contributes to the cultural significance and should be preserved.

Restoration: The non-breathable white paint should be removed.

Preservation: The timber should be preserved for as long as is practical by ensuring that a protective coating (breathable white paint) is applied and reapplied as necessary and that termite inspections and treatments are undertaken regularly (twice a year).

Reconstruction: The timber fabric is not original and is subject to deterioration from rot and termite attack. It should be replaced before the level of deterioration affects the safety or serviceability of the bridge. Timber supplied for use in top chords should conform to RMS Specification B2380, and the dimensions and detailing of the timber should conform to the original design.

8.3.3 Metal Tension Rods

Conservation: The detailing of the metal tension rods with an upsized threaded end at the top and with the bottom forged into a shape to accommodate a pinned connection is unique to the de Burgh truss and essential to the cultural significance of the item. The presence of original fabric (all tension rods in Gillies Bridge appear to be original fabric) in relatively good condition contributes to the cultural significance of the item and so these items should be preserved for as long as is practical. The detailing of the washer blocks at the top of the tension rods is representative of the earlier de Burgh truss bridges and is an important contribution to the cultural significance of the item.

Restoration: Transverse decking which has not been cut flush with the kerb and which is within 50 mm of the tensions rods should be cut flush with the kerb to avoid accelerated deterioration of the tension rods due to contact with timber. Similarly, the top timber handrail at one location on the bridge is leaning against a tension rod and causing corrosion, so the handrail should be relocated similar to all the other handrails on the bridge to avoid accelerated deterioration of the tension rods.

Preservation: The metal of the tension rods, nuts and washer blocks should be preserved by ensuring that the protective coating (black paint) is reapplied as necessary before the onset of corrosion. Care should be taken that nothing is placed in contact with the tension rods along their length (for example, decking, rails, or excessively long bolts from timber verticals or posts or rails).

8.3.4 Metal Bottom Chords

Conservation: The detailing of the metal bottom chords consisting of two different thicknesses of flat metal plates (thicker towards the centre of the span) laced together in the end panels and with saddle plates and pinned connections at panel points is unique to the de Burgh truss and essential to the cultural significance of the item. The presence of original fabric (all bottom chord components at Gillies Bridge appear to be original fabric) in relatively good condition contributes to the cultural significance of the item and so these items should be preserved for as long as is practical.

Preservation: The metal should be preserved by ensuring that the protective coating (black paint) is reapplied as necessary before the onset of corrosion, with special attention paid to interface details.

8.3.5 Sway Braces and Wind Bracing

Conservation: The detailing of the wind bracing and especially the sway braces are relatively common (wind bracing typical of all de Burgh and Dare trusses as well as longer span Allan trusses, sway bracing typical of McDonald, Allan, de Burgh and Dare trusses) and do not contribute directly to the significance of the item. However, the presence of original fabric (sway braces and wind bracing at Gillies Bridge appear to be original fabric) contributes to the cultural significance of the item and so these items should be preserved for as long as is practical (the condition of the fabric does not appear to be as good as the other primary structural metal components).

Preservation: The metal should be preserved by ensuring that the protective coating (black paint) is reapplied as necessary before the onset of corrosion, with special attention paid to interface details.

Adaptation: The sway braces may by sympathetically modified to provide lateral restraint to the top chords, as may the wind bracing to provide lateral load paths for barrier impact loads if necessary.

8.3.6 Cross Girders and Stingers

Conservation: The cross girders and stringers do not contribute directly to the significance of the item except as they connect to and support the vertical timbers (the general configuration is otherwise common, neither the current detailing nor the fabric is original). The current stringers detract from significance of the truss. The current configuration of cross girders is similar to the original except for the additional length of the long cross girders which detract from the aesthetics of the bridge, but the original lengths would be impractical to reinstate in timber (possible in steel).

Adaptation: The cross girders may be sympathetically modified (including changing material from timber to steel) to provide additional strength and durability and to provide connections for a traffic barrier if necessary. The stringers may be removed if a suitable alternative decking system is used.

8.3.7 Approach Spans

Conservation: The approach spans do not contribute directly to the significance of the item (the general configuration is common, neither the current detailing nor the fabric is original). The current configuration of round outer girders notched for timber posts detracts from aesthetic of the truss.

Adaptation: The approach spans may be substantially modified to provide increased strength and durability and to provide connections for a traffic barrier if necessary. Any modifications to the approach spans should be done is such a way that the truss span remains visually dominant.

8.3.8 Timber Deck

Conservation: The deck does not contribute directly to the significance of the item (the general configuration is common, neither the current detailing nor the fabric nor the aesthetic is original).

Adaptation: The deck may be substantially modified to provide increased safety and serviceability.

8.3.9 Kerbs and Rails

Conservation: The kerbs and rails do not contribute directly to the significance of the item (the general configuration is common, neither the current detailing nor the fabric is original).

Adaptation: The kerbs and rails may be replaced with a metal traffic barrier if required. The design of the traffic barrier should be done is such a way that the truss remains visually dominant.

8.3.10 Piers and Abutments

Conservation: The piers and abutments do not contribute directly to the significance of the item (the general configuration is common, neither the current detailing nor the fabric is original, the locations of the abutments are not original, and it is not physically possible to reconstruct the original).

Adaptation: The piers and abutments may be substantially modified to provide increased structural robustness and durability. The abutments may be replaced with concrete abutments, preferably located closer to the original abutments than the current abutments to restore the original length of the bridge, and designed to be visually recessive. The piers may be replaced with steel piers with a similar slenderness, simplicity and form to the original piers, designed to be visually recessive.

8.4 Policies related to Interpretation

8.4.1 Interpretation Strategy for Gillies Bridge

An Interpretation Strategy for Gillies Bridge should be prepared based on the historical themes and historical analyses documented in this report. Interpretation should remain low-key at the bridge and should conform to the Heritage Division's *Interpreting Heritage Places and Items Guidelines*.[141]

A suitably designed, non-obtrusive sign or plaque could be placed within 30 m of the Bridge to provide interested visitors with relevant information, although the placement of any sign or plaque should be carefully considered to avoid creating a hazard to either road users or bridge visitors.

8.4.2 Protection of the Visual Setting

The curtilage does not cover the land adjacent to the Bridge or the creek. Any development proposed for the land adjacent to the Bridge outside the curtilage should be considered carefully to ensure that it does not have an unacceptable visual impact which could cause a reduction in the aesthetic significance of the Bridge. Signage at the bridge should be minimised to what is necessary for safety and identification so that it does not create visual clutter and block views.

Vegetation in the vicinity of the Bridge should be kept to a minimum. Weeds should be removed from within the curtilage. Vegetation clearance should be taken with a view to improving the visual setting, and to reduce the risk of fire by creating a cleared area that acts as a fire break.

8.5 Policies related to this Conservation Management Plan

8.5.1 Adoption and Implementation of the Conservation Management Plan

This Conservation Management Plan should be adopted and implemented by Cessnock City Council as a guide for the future management of the bridge and its curtilage. The effectiveness of any CMP relies on its being implemented during both future project planning and during any works to the structure, including routine repairs. All works will need to be undertaken in accordance with the conservation policies contained within this document. It is essential that Council formally adopt the policies contained within this CMP and make resources available for ensuring that the document is available for, and understood by, staff coordinating and undertaking the management of the bridge.

8.5.2 Accessibility of the Conservation Management Plan

The Conservation Management Plan should be a publicly accessible document. A copy of this Conservation Management Plan should be made available on the Cessnock City Council website.

8.5.3 Review of the Conservation Management Plan

This Conservation Management Plan should be reviewed and updated after a period of ten years. Furthermore, this Conservation Management Plan should be updated in the event of significant changes to applicable legislation, route requirements, or if new historical evidence comes to light.

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[141] NSW Heritage Office, Heritage Information Series, *Interpreting Heritage Places and Items Guidelines*, 2005.

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