Old Public Works Department truss bridges

**Period of construction:** 1855 to 1882  
**Queen Post truss design**  
**Number built:** 147  
**Number remaining:** Two – both in RTA ownership

**Advantages of design**

All timber members were assembled from relatively smaller and shorter sizes, spliced at regular intervals for the top and bottom chords, laid parallel in pairs but held apart by spacer timber blocks. This allowed rainwater to fall through, gave easy access for painting and increased the buckling strengths of the compression members. Consequently, the 147 Old Public Works Department (Old PWD) truss bridges served their function well, with their average life being 54 years and twenty-six remained in service from 80 to 117 years.

The truss design was successively improved upon with better construction, load carrying and maintenance performance in successive re-designs with the succeeding four types of timber truss bridge.

**Defining features of Old Public Works Department truss design**

The technical benefits of the OLD Public Works Department (Old PWD) truss over the previous timber arch bridges were limited because there was little engineering science in their design and little practical input into cost-effective maintenance. Faults were soon recognised, the major ones being:

- The segmental arch components of the truss were all made from single large-sized timbers which were both hard to obtain and difficult to handle and install.

- It was extremely difficult to renew such members, particularly the lower inner piece of the top chord in long spans, because taking the defective member out immediately destroyed the structural integrity of the truss so it had to be temporarily supported or even taken out of service until the work was completed. This could impose great inconvenience to road traffic where the next available bridge was many miles away.

- The vertical iron rods connecting the top and bottom horizontal timbers were comprised of single rods installed through the middle of these timbers. Had the theory of structures been applied, it would have shown that loads applied to the rods are larger near the ends of each truss. It is not surprising then that there were frequent breakages of the single rods which seriously weakened the truss span and incurred unexpected and recurring repair costs.

- The bottom chords were made from four flitches or planks placed side by side on edge and cross bolted together. This was equivalent to vertical rather than the horizontal laminations applied at the earlier arch bridges. The same flaw existed for each arrangement of laminates, in that when the inner laminates deteriorated, it was extremely difficult to renew them and a completely new assembly of flitches was required.

- They were both expensive to build and maintain.
Old PWD trusses – number of spans (147 bridges built)

<table>
<thead>
<tr>
<th>Number of spans</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number built</td>
<td>67</td>
<td>40</td>
<td>23</td>
<td>12</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>2</td>
</tr>
</tbody>
</table>

Old PWD truss sub types

Sub-types measure variation in the design of Old PWD truss bridges. Two distinct sub types are discernible in the population of Old PWD truss bridges. There may be others but as there are few existing examples and documentation is incomplete, only the following sub-types have been identified.

- **Type 1 – Rylstone Bridge type**

  The Rylstone Bridge, built in 1861, featured a ‘pony’ or short truss design and demonstrated key elements that bear some similarity to the earlier Queen Post truss. The extent that these elements were utilised beyond the Rylstone Bridge have not been defined.

- **Type 2 – Quirindi Bridge type**

  The Quirindi Creek Bridge, built in 1875, featured a ‘pony’ or short truss design and other elements that suggest an evolutionary trend back towards the bow string arch from which the Old PWD truss form originated. The extent that these elements were utilised beyond the Quirindi Bridge have not been defined.

- **Type 3 – ‘Standard’ type**

  In the absence of evidence for further variation, all other Old PWD truss bridges are presumed to belong to the Standard sub-type. The scope for investigation into the Old PWD truss form variation is obviously limited by the presence of only two remaining examples, both of which therefore exhibit exceptional rarity. In a small number of locations archaeological evidence of former Old PWD truss bridges can be observed but this is limited to substructural material only.

No Old PWD trusses were used in unison with lift spans.
Old Public Work Department truss bridges and their future operability

<table>
<thead>
<tr>
<th>Bridge</th>
<th>Construction date</th>
<th>Number of trusses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clarence Town</td>
<td>1880</td>
<td>2</td>
</tr>
<tr>
<td>Monkerai</td>
<td>1882</td>
<td>3</td>
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</table>

Standard modifications required to bring Old PWD bridges up to a reasonable level of risk using the T44 Standard

Truss span
- Installation of a steel welded section as the centre flitch of the new timber bottom chord members.
- Installation of additional steel sway braces to provide lateral support for the truss at each panel point to prevent compression buckling of top chord member of the truss.
- Replacement of primary timber cross girders with steel cross girders where appropriate.
- Installation of weather protection barrier on top chord member of truss.

Approach spans
- Replacement of approach span decks with timber concrete composite decks.

Substructure
- Replacement of timber piles below ground with steel and/or reinforced concrete piles and pile caps forming the sill for the piers.
- Replacement of existing timber piers and abutments with modern heritage-sympathetic design and materials.

Railing
- Replacement with structurally and dimensionally appropriate heritage-sympathetic design and materials for the entire length of the bridge.
Clarence Town Bridge over the Williams River

Description

<table>
<thead>
<tr>
<th>Truss type</th>
<th>Old PWD</th>
<th>Road</th>
<th>MR 567</th>
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<tbody>
<tr>
<td>Number of spans</td>
<td>2</td>
<td>Location</td>
<td>Clarencetown</td>
</tr>
<tr>
<td>Sub-type</td>
<td>Standard</td>
<td>RTA region</td>
<td>Hunter</td>
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<tr>
<td>Built</td>
<td>1880</td>
<td>RTA bridge number</td>
<td>1752</td>
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<tr>
<td>Assessed significance(MBK)</td>
<td>State</td>
<td>Local government</td>
<td>Dungog Shire</td>
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<td>SHR listed</td>
<td>SHR 01462</td>
<td>Daily traffic [AADT]</td>
<td>905</td>
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Clarence Town Bridge is a two-span Old PWD truss bridge on the Limeburners Road (Main Road 567), crossing the Williams River. It is the oldest surviving Old PWD truss bridge in NSW. The bridge is situated on a relatively quiet road with limited heavy freight movements. It is located two kilometres from Clarence Town in an accessible setting.

Analysis of heritage and operational factors

Service requirements: The bridge is required to meet the current regulatory limits for general access trucks (ie a reasonable level of risk using the T44 Standard which is the design standard for bridges carrying a 42.5 tonne semi-trailer or equivalent).

The current bridge therefore needs to be upgraded in order to meet the operability standard for long-term network requirements. A Section 60 approval has been received for the upgrading of Clarence Town Bridge to meet a reasonable level of risk using the T44 Standards. Work commenced in 2010.

Clarence Town Bridge is listed on the State Heritage Register. It was ranked 5th overall in the 1998 MBK timber truss bridge study and this is recognised in the timber truss bridge conservation strategy sensitivity test.
Conservation strategy – Clarence Town bridge

Clarence Town Bridge can be upgraded to meet operability requirements, given its location on the road network. Future strengthening and modification will be required to maintain this operability standard as the bridge ages.

Proposed future conservation works

- Routine and periodic maintenance using existing forms of fabric.
- Interpretation of the bridge.

Truss span
- Installation of a steel welded section as the centre flitch of the new timber bottom chord members.
- Installation of additional steel sway braces to provide lateral support for the truss at each panel point to prevent compression buckling of top chord member of the truss.
- Replacement of primary timber cross girders with steel cross girders.
- Installation of weather protection barrier on top chord member of truss.

Approach spans
- Replacement of approach span decks with timber concrete composite decks.

Substructure
- Replacement of timber piles below ground with steel and/or reinforced concrete piles and pile caps forming the sill for the piers.
- Replacement of existing timber piers and abutments with modern heritage-sympathetic design and materials.

Railing
- Replacement with structurally and dimensionally appropriate heritage-sympathetic design and materials for the entire length of the bridge.

Conservation outcomes

The retention of this structure would ensure that the oldest surviving example of an Old PWD truss bridge in NSW is conserved. Conservation would be achieved by maintenance and necessary upgrades to the structure to offset inherent lack of design capability. Clarence Town Bridge is one of two Old PWD truss bridges, and the only two-span Old PWD truss bridge in the operable RTA timber truss bridge portfolio. As a multi-span bridge, it is not the most commonly built form of this type of bridge.
Monkerai Bridge over the Karuah River

Monkerai Bridge is a three-span Old PWD truss bridge on a little used unsealed road (RR101). It is located over 30 kilometres from populated areas. Monkerai Bridge is closed to traffic pending upgrading works and a detour is available.

### Analysis of heritage and operational factors

#### Service requirements:
The bridge is required to meet the current regulatory limits for general access trucks (ie a reasonable level of risk using the T44 Standard which is the design standard for bridges carrying a 42.5 tonne semi-trailer or equivalent).

The current bridge therefore needs to be upgraded in order to meet the operability standard for long-term network requirements. A Section 60 approval has been received for the upgrading of Monkerai Bridge to meet a reasonable level of risk using the T44 Standard. Work commenced in 2010/11.

Monkerai Bridge is listed on the State Heritage Register. It was ranked 3rd overall in the 1998 MBK timber truss bridge study and this is recognised in the timber truss bridge conservation strategy sensitivity test.
Conservation strategy – Monkerai Bridge

Monkerai Bridge can be upgraded to meet operability requirements, given its location on the road network. Future strengthening and modification will be required to maintain this operability standard as the bridge ages.

Proposed future conservation works

- Routine and periodic maintenance using existing forms of fabric.
- Interpretation of the bridge.

Truss span
- Installation of a steel welded section as the centre flitch of the new timber bottom chord members.
- Installation of additional steel sway braces to provide lateral support for the truss at each panel point to prevent compression buckling of top chord member of the truss.
- Replacement of primary timber cross girders with steel cross girders.
- Installation of weather protection barrier on top chord member of truss.

Approach spans
- Replacement of approach span decks with timber concrete composite decks.

Substructure
- Replacement of timber piles below ground with steel and/or reinforced concrete piles and pile caps forming the sill for the piers.
- Replacement of existing timber piers and abutments with modern heritage-sympathetic design and materials.

Railing
- Replacement with structurally and dimensionally appropriate heritage-sympathetic design and materials for the entire length of the bridge.

Conservation outcomes

The retention of this structure would ensure that both remaining Old PWD truss bridges in NSW are conserved. Conservation would be achieved by maintenance and necessary upgrades to the structure to offset inherent lack of design capability. Monkerai Bridge is one of two Old PWD truss bridges, and the only three-span Old PWD truss bridge in the operable RTA timber truss bridge portfolio. As a multi-span bridge, it is not the most commonly built form of this type of bridge.