Queensland Railway Bridges – Past and Present

Presented by Arthur Robinson

The majority bridges described in this paper were erected when the Imperial measurement of the foot (ft) was standard in Australia, therefore this unit is used for pre 1974 bridges. Where dimensions are shown in feet a metric equivalent is show in brackets. eg: 50ft (15.2m). For bridges erected after 1974 only the metre (m) is used.

Historical Overview

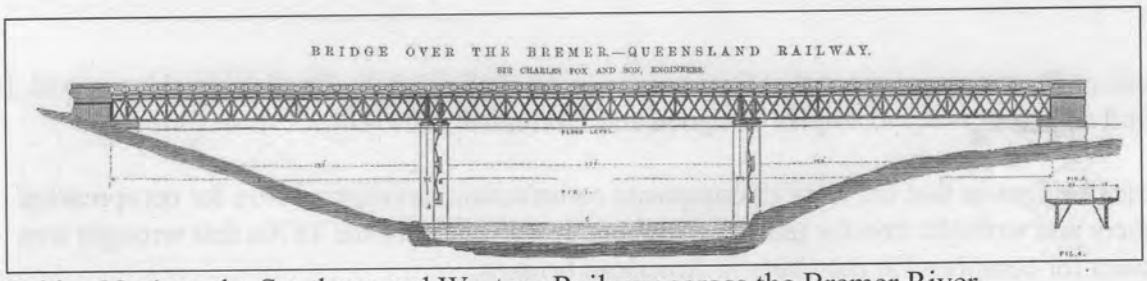
There approximately 6000 bridges at the greatest extent of the system. The majority were timber, but iron and later steel spans were used in the larger span bridges.

In 1945 there were 127 Miles (204km) of timber bridges. Subsequently many have been replacement by steel and later Pre Stressed Concrete spans. There is an ongoing timber bridge replacement strategy.

The first section of The Southern and Western Railway, between Ipswich and Grandchester, was opened on 31st July 1865.
Abraham Fitzgibbon was the engineer responsible for the initial design.

Before construction there was some consideration given to the line extending towards Brisbane but the line when constructed left the south bank of the Bremer River over a substantial bridge and then followed the north bank of the river crossing side streams, Wide Gully, Mihi Creek and Iron Pot Creek before [present day] Wulkuraka.[1]

There were 26 bridges, 7 designed as culverts and converted to bridges during construction.[1]



Bridge No.1 on the Southern and Western Railway across the Bremer River.

A combined rail and road bridge, it was an iron Lattice Truss consisting of three 150 foot (45.7m) spans on cast iron cylinder piers.
The trusses were unique in Australia, and indeed any British colony, in having cast iron top chords and bottom chords composed of pin jointed "eye-bar" links, both of these were common features in American bridges of this era.

Reference 2 has a description of this bridge.

Bridge No.2 Wide Gully

Bridges No.2 Wide Gully, No.3 Mihi Creek and No.4 Ironpot Creek on the Southern and Western Railway had three wrought iron Pratt truss spans on timber piers with timber approach spans. The iron spans were No.2 60ft (18.3m), Nos.3 and 4 50ft (15.2m).

Iron girders on timber piers for the spans of 50ft (15.2m) or more on timber piers and timber approach spans were a standard for some time. Some examples still exist on branch lines.

The use of Pratt trusses was at that time unique in Australia and the English speaking world. I can find only four other examples designed and fabricated in the UK.

America bridges in that era were of composite construction having cast iron for compression members and wrought iron for tension members. It was not until the 1870s that wrought iron was used for compression members in American bridges.

The Pratt truss later became the choice for medium span bridges in most countries.

The other 22 bridges between Ipswich and Grandchester were timber.

Bridges over Neerkol and Stewarts Creeks on The Great Northern Railway, now Central Line, had wrought iron Pratt Trusses on timber piers with timber approach spans to the same design as the Wide Gully Bridge.

Between Grandchester and Toowoomba three were about 40 bridges, 11 of which had iron spans on timber piers.
Some of the iron bridges had Pratt trusses and others Plate Girders for the main spans.

Fountains Bridge the longest bridge on the then S&WR at 555ft (169m).

Fountains Bridge had Pratt trusses for the longer 100ft (30.5m) spans and 50ft (15.2m) Plate Girder spans with timber for the shorter spans, 20ft (6.1m) and 25 ft(7.6m) spans

A feature of bridges designed by Fitzgibbon was the use of multiple rows of piles for piers. When the height exceeded 15ft (15.2m) two rows of piles were used and when the height exceeded 30ft (9m) three rows of piles were used.

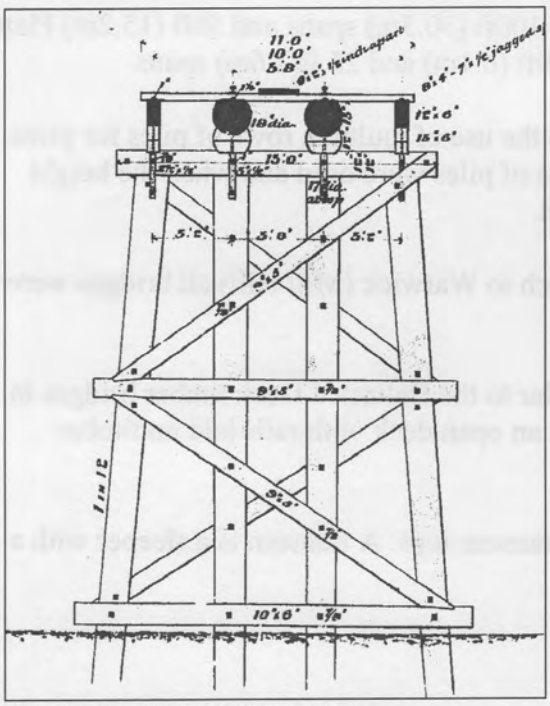
On the subsequent section to Dalby and the branch to Warwick (Mill Hill) all bridges were of timber construction.

The deck system on the timber bridges was similar to the Ballasted Deck timber bridges in NSW in that it consisted of four girders but with an open deck with rails laid on timber longitudinals.

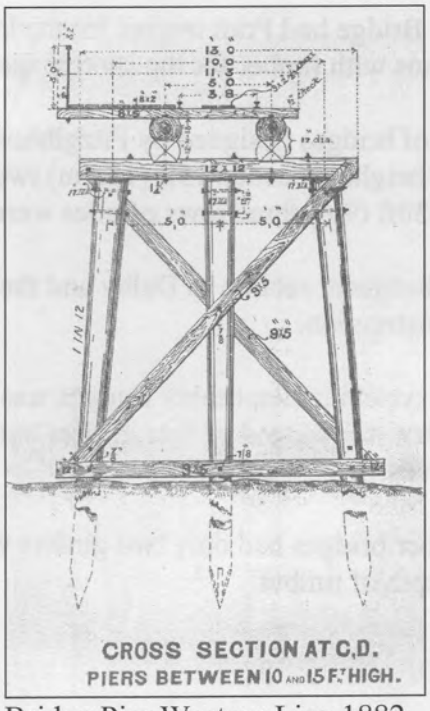
Later timber bridges had only two girders with transom tops. A transom is a sleeper with a greater depth of timber.

Gowrie Creek Bridge Western Line.
The photo shows the two rows of piles per pier and the later conversion to transom top.

Some timber bridges between Toowoomba and Warwick still have double rows of piles.



Bridge Pier 1867 Fitzgibbon



Bridge Pier Western Line 1882

Further railway construction under Chief Engineer Henry Stanley saw the construction of the Ipswich to Brisbane line, opened in 1875.

The timber bridges were of similar design with four girder construction, but only on the higher bridges were multiple rows of piles used. However some low bridges had only two girders with transoms.

Four bridges had iron spans of 50ft (15.2m), three with reused spans from MiHi Creek bridge at North Ipswich where a timber bridge on a deviation further from the Bremer River had been constructed to replace embankments undermined by floodwaters.

The Albert Bridge at Indooroopilly was a 160' Hog Back lattice truss with one 160ft (48.8m) span with six 80ft (24.4m) and one 40ft (1.2m) approach spans, some spans were washed away in 1893 flood.
The remaining spans were reused on Chillagoe Mining Company Railway.

Later construction saw the evolution of timber to the simple two girder transom top as per the diagram above of Western Line Bridge 1882

Condamine River Warwick 100ft (30.5m) span Lattice Truss on timber piers.

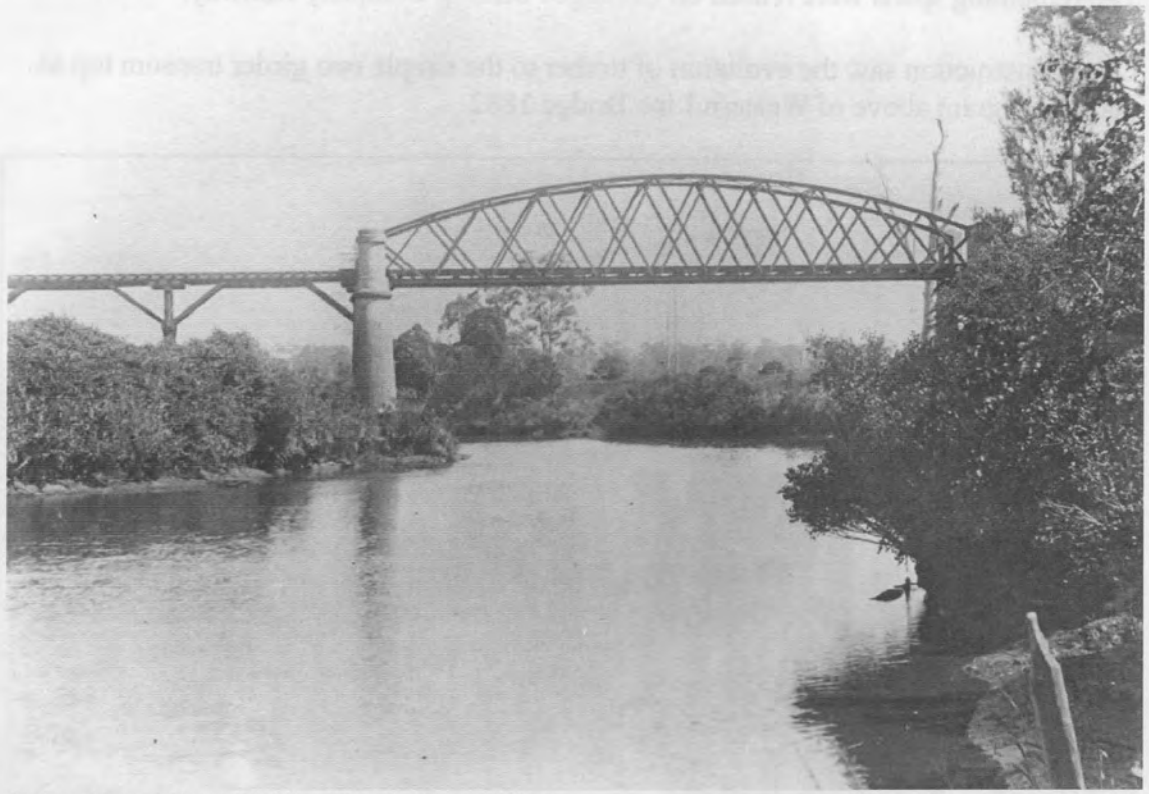
Henry Stanley adopted the Lattice Truss as standard for his long span bridges, initially on timber piers but later cast iron cylinder and later concrete piers became standard.

Lattice Trusses were used until 1893.

Channing Creek on the Western Line (previous page).

This was a typical bridge of Stanley era with multiple timber spans and steel spans across the main channel.

This bridge consisted of 78 spans of 20ft (6.1m) , 4 of 26ft (7.9m) in timber and a 50ft (15.2m)Plate Girder, the total length being 1714ft (522m).



Caboolture River Bridge North Coast Line

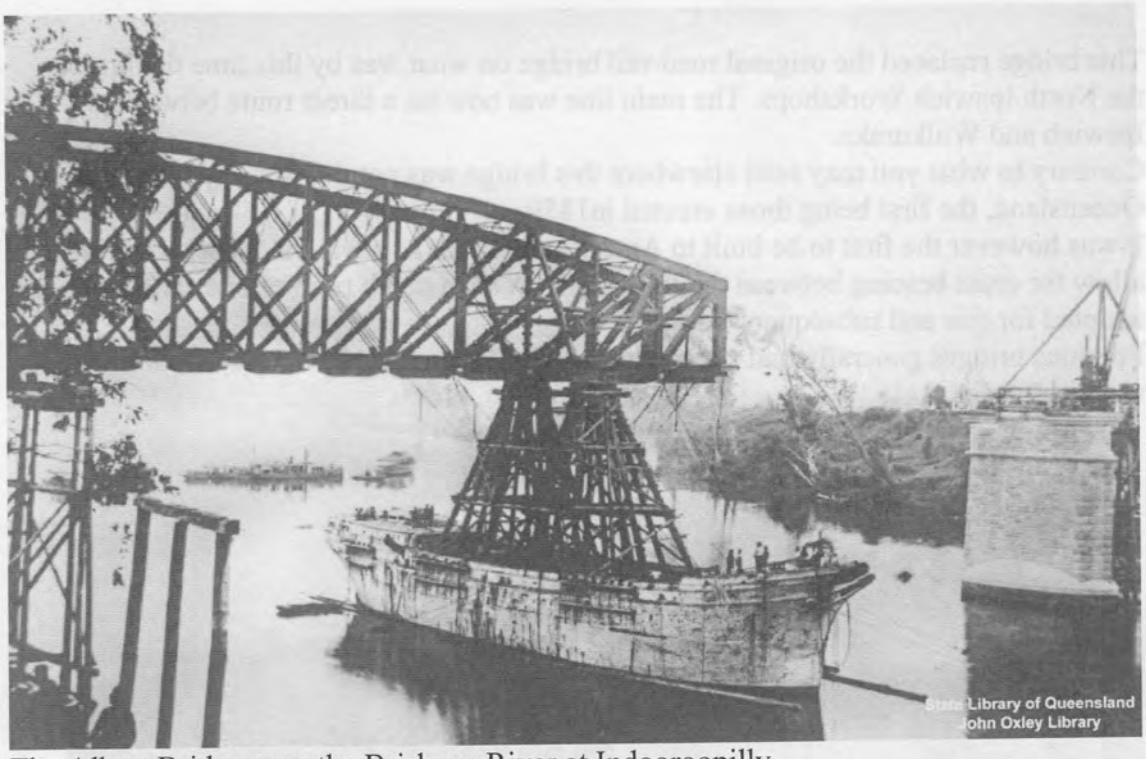
A hog back lattice truss of 120ft (36.6m) span. The timber approach spans are 36ft (11m) understrutted spans.

Understrutted spans of 36ft (11m) were used for longer spans on many bridges, particularly on the North Coast Line.

The greatest number of these spans was 25 in the approaches to the main steel spans of the South Pine River Bridge.

As 26ft (7.9m) was the largest simple timber span the use of these longer spans was a saving in timber but more maintenance was required.

In 1947 Queensland Rail commenced a long term strategy to eliminate all timber bridges. The high priority was give to replacement of the understrutted spans.



The Albert Bridge over the Brisbane River at Indooroopilly

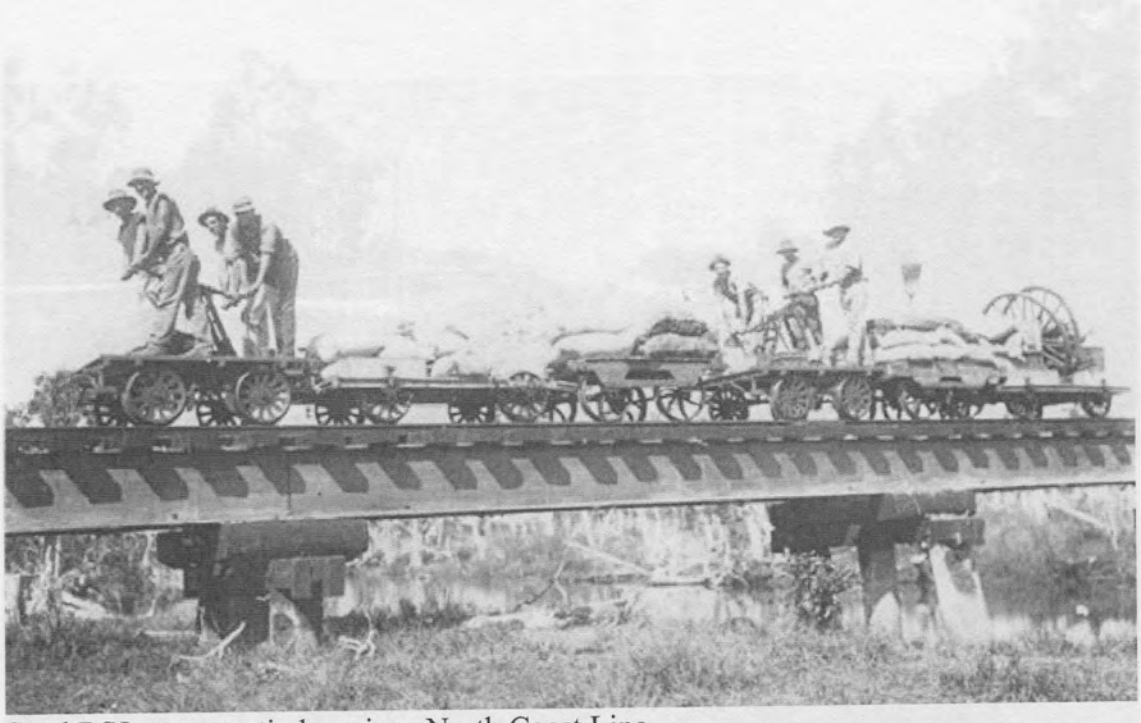
This bridge was the first of five Whipple Trusses built in the 1890s.
This type of truss was adopted for large spans.
The Albert Bridge has two 340ft (103.6m) spans. Three others, the Calliope River and the Fitzroy River on the North Coast Line and the Burdekin Bridge on the Great Northern Railway had main spans of 250ft (76.2m). The Bremer river Bridge west of Ipswich has two 150ft (45.7m) spans.

The 1897 bridge Over the Bremer River at Ipswich

This bridge replaced the original road-rail bridge on what was by this time the line to the North Ipswich Workshops. The main line was now on a direct route between Ipswich and Wulkuraka.
Contrary to what you may read elsewhere this bridge was not the first Pratt Truss in Queensland, the first being those erected in1859.
It was however the first to be built to American practice in having a deeper truss to allow for cross bracing between the top chords. A span depth ratio of one sixth was adopted for this and subsequent bridges.
Previous bridges generally had a span depth ration of one in 12 which was commonly used in Britain.

Raglan Creek Bridge North Coast Line
A typical Pratt truss of 110ft (33.5n) span with steel approach spans.

Saltwater Creek Bridge North Coast Line North of Townsville
A 60ft (18.3m) Half-through Pratt Truss of the early 1900-1920 era.



Steel RSJ spans on timber piers. North Coast Line

This bridge north of Mackay was one of a new standard adopted about 1915 as longer timber girders longer than 18ft (5.5m) were "becoming increasingly difficult to get".[3] The greatest use of these spans was on the North Coast Line between Rockhampton and Proserpine.

Nash's Gully Bridge North Coast Line

A high timber bridge replaced by steel girders on concrete rectangular piers ca 1927.

Moonie River Bridge South West Line.

A low level timber replaced by steel girders on concrete piers 1960.
Note the change in shape of the piers.

Six Mile Creek Elimbah North Coast line.

Understrutted spans replaced by steel girders on concrete piers 1967.
Note the changing pier shapes, in this instance circular columns with rectangular headstocks.

Petrie's Creek Bridge Nambour North Coast Line

From the left rectangular piers of 1969 and octagonal concrete twin piers of 1915.
An interesting feature for a model.

Gowrie Creek Bridge Western Line 1963

In 1963 the first prestressed concrete rail bridge in Queensland replaced the steel and timber bridge over Woogaroo Creek at Goodna on the Main Line.

The Gowrie Creek Bridge of four 50ft (15.2m) is typical of the first prestressed concrete bridges with two PSC I beam girders.

1966 prestressed concrete bridge of seven 50ft (15.2) spans on a curve.
Concrete pier of old steel span on the left of the photo.

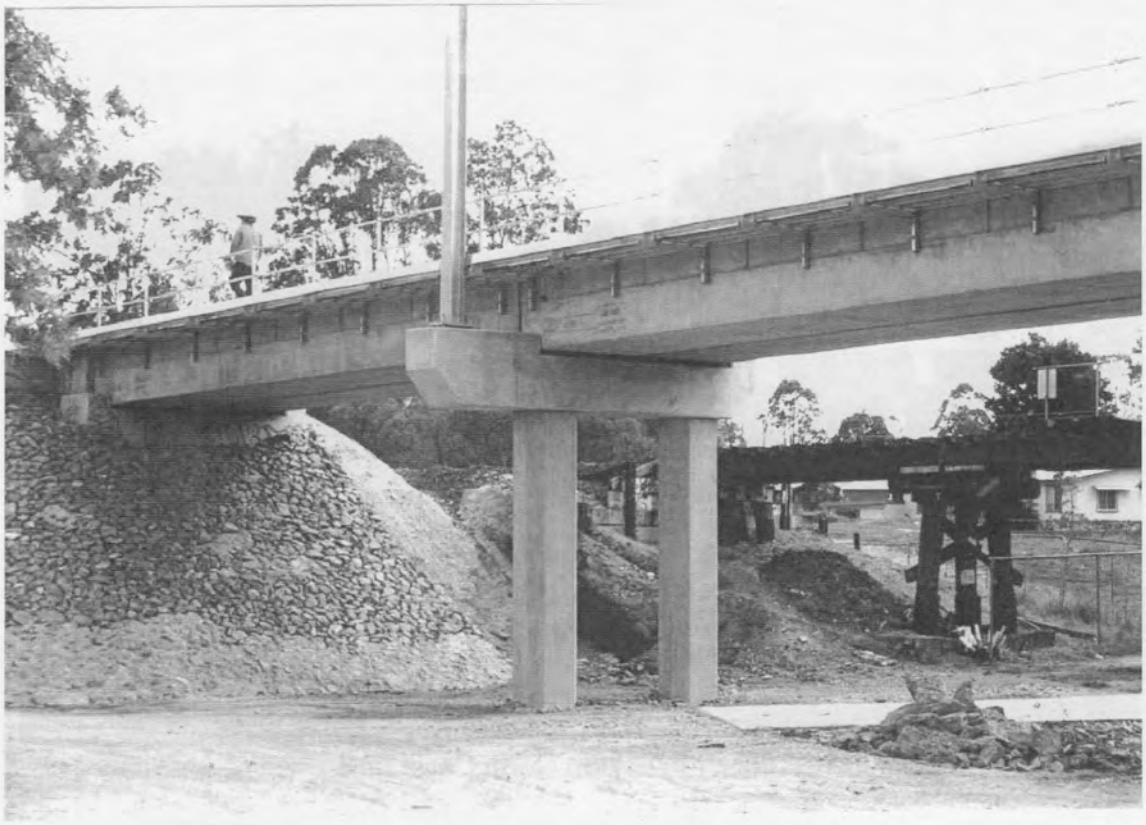
1997 prestressed concrete bridge of three 25m spans.
Note the increase in pier diameter at the base on the high piers.

Prestressed Concrete Box Girder 1362.12km North Coast Line

Four 7.3m spans. This bridge is typical of the design for spans up to 12.2m. Rectangular headstock on twin cylinder piers. This bridge was constructed on a deviation and the width of the piers is narrower than at bridges replaced on line.

West Hill Creek North Coast Line

On line replacement with pile boring clear of any train operation. The cylindrical columns were constructed on top of the piles and headstocks cast under the existing structure. Under track closure conditions the existing girders were removed and the new girders placed.
Where there is no need for a deviation to improver the alignment and where grading is satisfactory replacement bridges are constructed in this way.



Hindes Street Bridge Lota 2007.
Twin rectangular columns to piers.

Tooley Street footbridge, Maryborough.

The original Pratt trusses from Ironpot Creek from the original line via North Ipswich were reused on the Western Line and later reused for this footbridge in 1915.

One of the oldest if not the oldest Pratt truss in the world, but definitely the oldest of all wrought iron construction.

References:

1. J Knowles: Centenary of the Ipswich – Grandchester Railway, ARHS Bulletin No.333 Juky 1965

2. K McDonald: The First Bremer Bridge, Sunshine Express, January 2009.

3. W. J. Doak: Design of Timber Railway Bridges in Queensland", The Commonwealth Engineer. November 1, 1915

BRIDGE REPALCEMENT / UPGRADING

With the introduction of heavier locomotives it has been necessary to replace or upgrade bridges.

Accommodation Creek Bridge Southern Line 1902
Temporary timber piers pending the construction of the new bridge.

The original bridge could only support locomotives of 8 Tons axle load.
Temporary strengthening allowed for the operation of B17 class locomotive which had an axle load of 12 Tons.

The replacement bridge was constructed on a deviation.

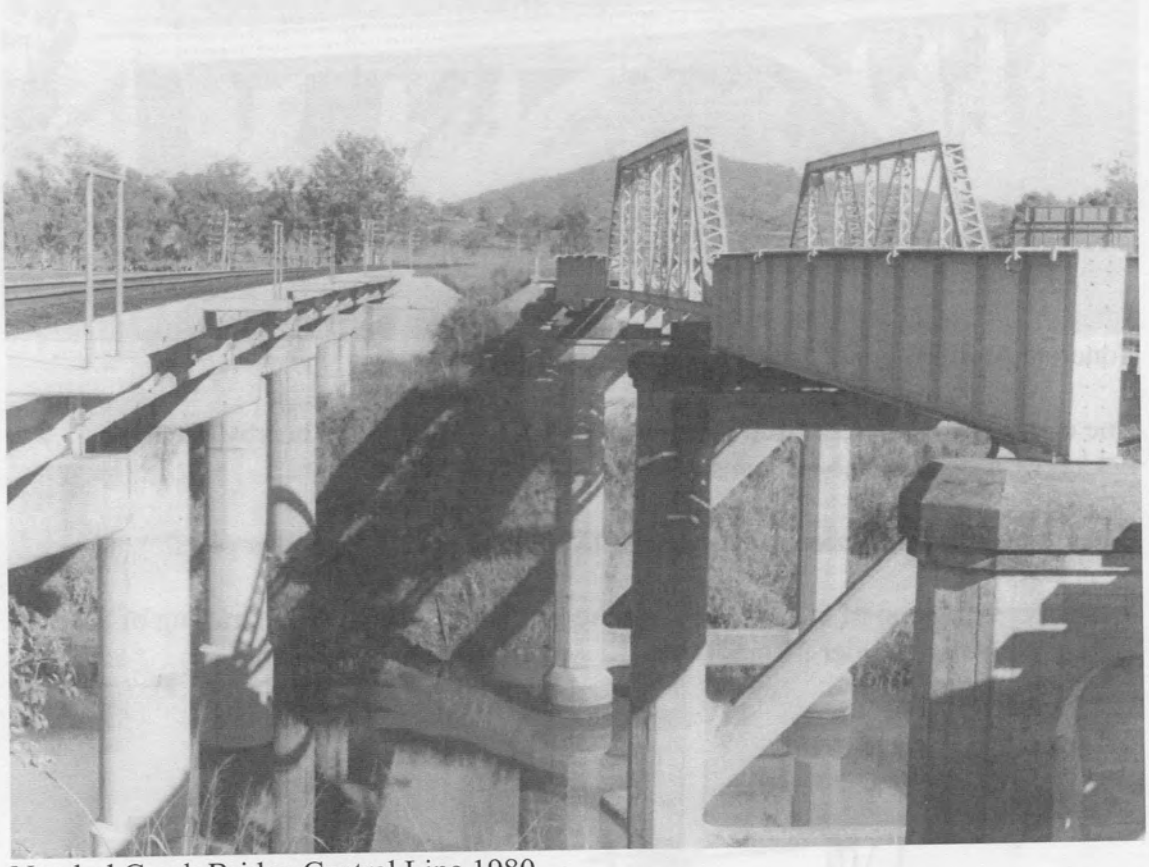
Temporary strengthening was done at many bridges in the Brisbane Suburban Area and on the Main and Southern lines to allow larger locomotives to operate.

In some places new girders were installed and at others new bridges were erected.

Neerkol Creek Bridge Great Northern Railway now Central Line ca 1910

Wrought iron Pratt Trusses 60ft (18.3m) span on timber piers with timber approach spans.

Timber falsework was erected to allow construction of the concrete piers. Then the new spans were placed.



Neerkol Creek Bridge Central Line 1980

On the right steel spans of the 1910 bridge and on the left the six 15m Prestressed Concrete spans of the 1980 replacement bridge.

I often wondered about the unusual use of one truss and two plate girders, both 60ft (18.3m) span.

The note from a QR file explains:

Walkers contract for supply material for Maronghi Creek and Emu Creek bridges - 132 weeks overdue, no penalty recommended.

On 20 Jan.1910 Minute 9369 approved transfer of 2 60ft open girder spans intended for Neerkol Creek Bridge to Maronghi Creek as no urgency with Neerkol Creek; will use plate girders intended for Maronghi Creek on Neerkol Creek Bridge. (Batch 17, A/8852, QSA)

Note: Maronghi Creek is now called Emu Creek.

Concrete Arch Bridge at 75M 25c Main Line 1902.

One of only six Concrete Arch bridges on QR. This one and the nearby one over Lockyer Creek were the last constructed.

Constructed on a deviation to replace the 1867 Plate Girder on timber piers.

A close examination of the photo shows the temporary timber understrutting of the iron span to allow for heavier locomotives.

Grahams Creek Bridge North Coast Line ca 1916, removing original truss

The truss was replaced on line 1916
The timber piers for the main span were replaced by concrete, a new truss was erected around the old one and the timber spans strengthened.

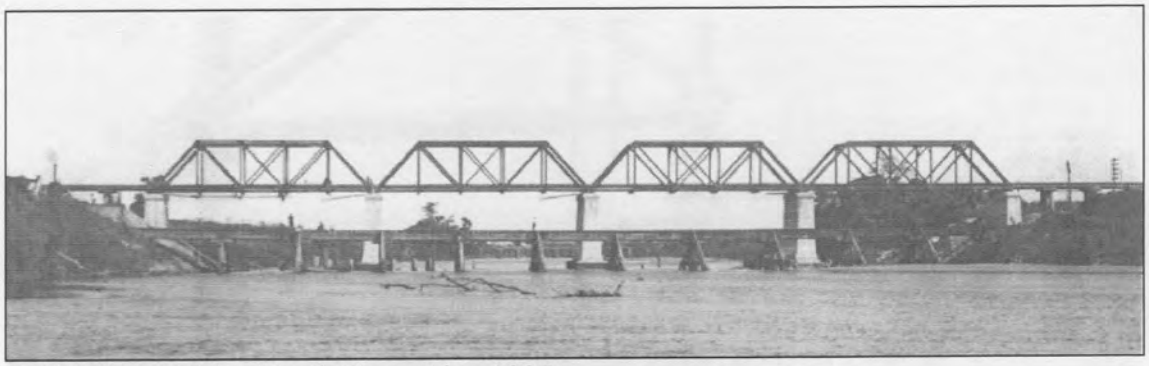
This allowed for construction without major interruption to traffic. The old truss was removed and the new truss raised into final position during a track closure.
The truss was designed for 15 Tons axle load which had been adopted for main bridge spans.

Yuleba Creek Western Line ca 1926.

Old 60ft (18.3m) girder replaced by 90ft (27.4m) span.
The 90ft (27.4m) truss was fabricated from components of the 150ft (45.7m) truss from the Mary River Bridge at Antigua on the North Coast Line.

Blythes Creek Bridge Western Line

New plate girder and steel beam spans on concrete piers replaced the old steel girder on timber piers. Some the timber approach spans replaced by steel beam on concrete and the remainder strengthened.
Subsequently timber piers needing renewal have been replaced by concrete.



Tully River Bridge North Coast Line 1935.

High Level bridge on deviation erected in 1935.

The 80ft (24.4m) Trusses on concrete replaced the old low level timber bridge that was subject to inundation by floodwaters. Heavier locomotives were allowed on the new bridge.

Harpurs Creek Bridge North Coast Line

Originally a Lattice Truss main span on concrete piers and timber approach spans.

The Pratt Truss replaced the Lattice ca 1924 and the timber spans strengthened.

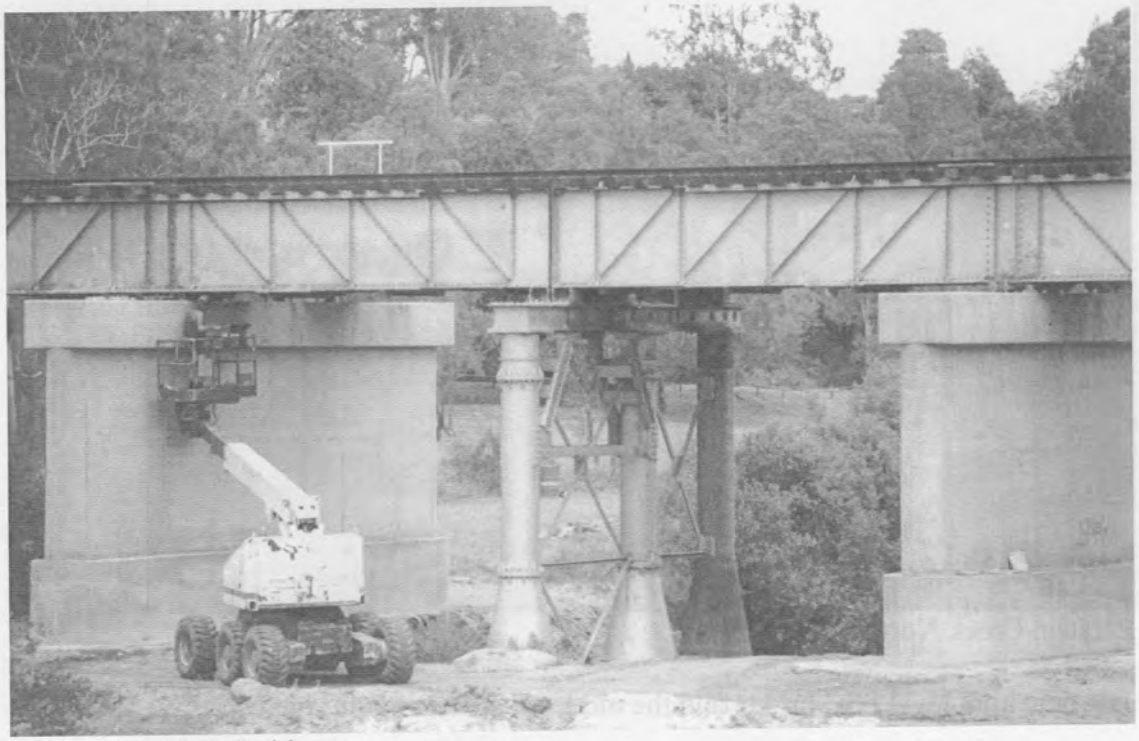
Later the timber spans were replaced by steel girders on concrete piers

.

The shorter span in the centre kept the new pier construction clear of the timber piers.

Isis River Bridge North Coast Line

Original truss bridge was strengthened to carry 12TAL locomotive ca 1917 by inserting a centre truss. The 36ft (11m) understrutted timber spans were converted to 18ft (5.5m) spasns.
A new Prestressed concrete replacement bridge was erected in the 1994 Main Line Upgrading Programme to allow for 20tonne axle loads.



North Pine River Bridge

New midspan concrete piers to halve the span and thus allow increased load capacity.

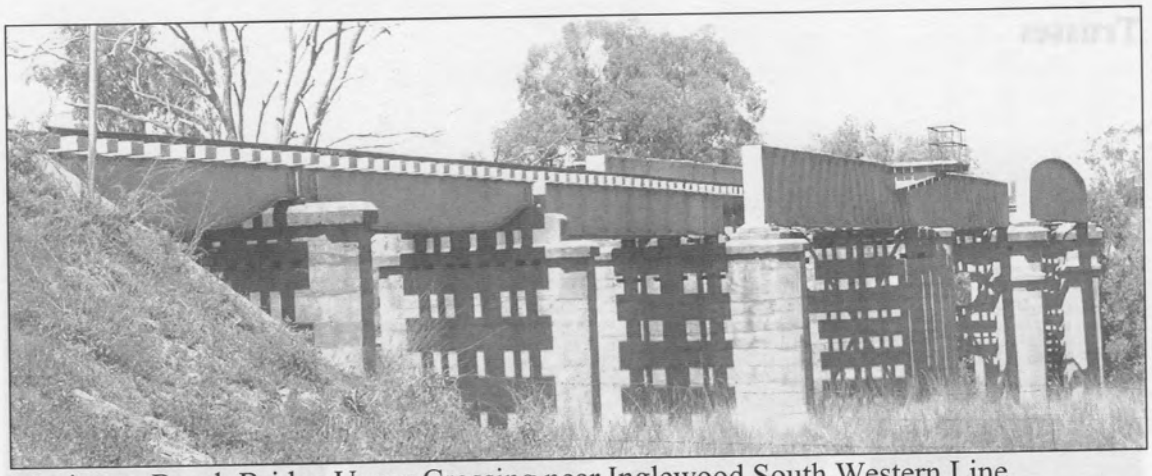
Unlike the 1902 temporary piers at Accommodation Creek the new piers at this bridge are designed to take the full load of new prestressed concrete spans.
When required the old spans can be lifted out and replacement PSC spans dropped into place.

Alligator Creek Bridge North Coast Line.

One of the few Warren Truss Bridges in Queensland.
The end spans of this bridge were RSJs on timber piers.
They were replaced with standard PSC spans in 1994 to allow for 20tonne axle loading.

Fursden Creek North Coast Line

The new high level PSC bridge and the old low level timber bridge.



Macintyre Brook Bridge Upper Crossing near Inglewood South Western Line

Whilst this bridge does not fit the category of "upgrading" the five different types of spans came from bridges that have been replaced.

2/26ft (7.9m) fish belly girders, cross girders from the 1885 Breakfast Creek Bridge.
34ft (10.4m(PWG girders from the 1885 Boundary Street Bridge.(now named Boomerang Street)
2/60ft (18.3m) PWG girders from an 1867 bridge on the Main Range.
72ft (22m) Hogback PWG from the 1880 Countess Street Bridge
50ft (15.2m) PWG from the 1885 Devils Gully and Woogaroo Creek Bridges.

So far in my research I have identified 65 instances of reused spans.

Two publications about steel bridge upgradings on the North Coast Line and the Cairns Range can be found at:

http://www.onesteel.com/images/db_images/casestudies/bridgerail15cbp.pdf
http://www.onesteel.com/images/db_images/casestudies/bridgerail19ssp.pdf

Trusses

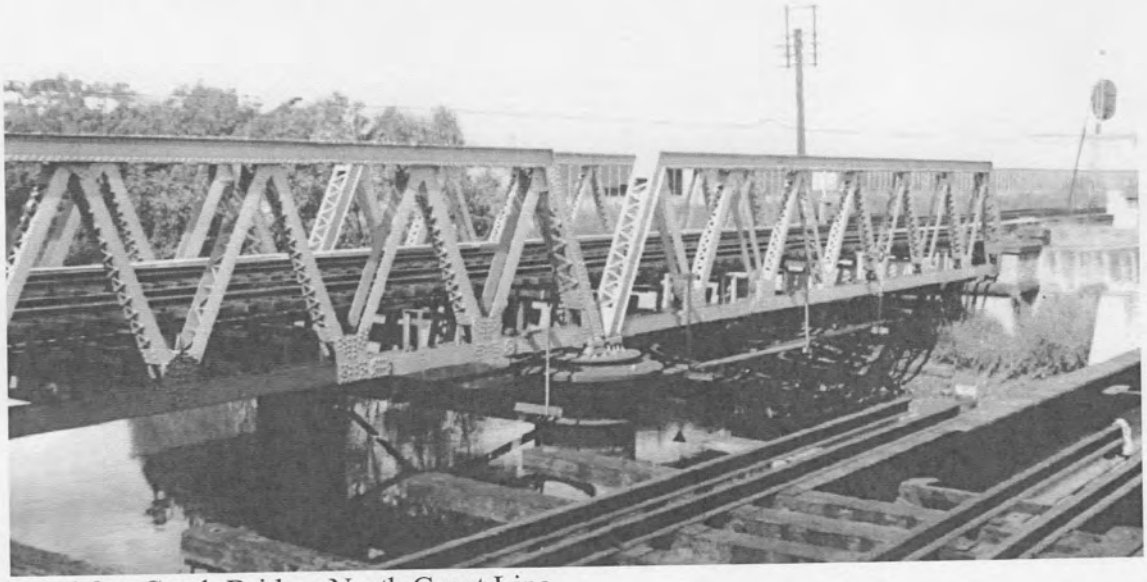
Spring Creek Bridge, Southern Line.

Deck Lattice trusses on Masonry Piers.
This bridge and the nearby Mineral Creek Bridge were the only bridges with masonry piers.
Both bridges have now been replaced by pipe culverts under embankments on deviations.

Maroochy River Bridge, North Coast Line
Half-through Lattice Truss on Cast Iron Cylinder piers.
Replaced by the bridge in the next photograph.

Maroochy River Bridge, North Coast Line.

The original bridge was replaced by a Pratt Truss when the track was upgraded to carry heavier locomotives.
The new bridge was built the duplication alignment with the truss on extensions of the original piers.
The 1994 Prestressed Concrete Bridge that replaced this bridge was built on a Deviation.



Breakfast Creek Bridge, North Coast Line.

Warren trusses were not common in Queensland.
The Alligator Creek Bridge pictured previously and the 1956 Indooroopilly Rail Bridge being two examples.
The Breakfast Creek Bridge is the only example of a half-through Warren Truss rail bridge in Queensland.

The Burdekin River Bridge, North Coast Line.

The High level road and rail bridge erected in 1956 and the old low level bridge that it replaced.

The bridge consists of ten 250ft (76.2m) Pratt Truss spans across the river channel with eight 45ft and three 60ft steel girder spans on each approach.

Due to the depth of the sand bed the main spans are supported on caissons were sunk into the river bed to a depth of about 100ft (30 metres). These caissons each weigh about 4,000 tons.

TIMBER BRIDGES

First a couple of examples of the not so common timber bridges.

Bridge No. 59 on the Gogango Range, Central Line.

Timber trusses were not as common in Queensland, even for road bridges, as they were in New South Wales and New Zealand.

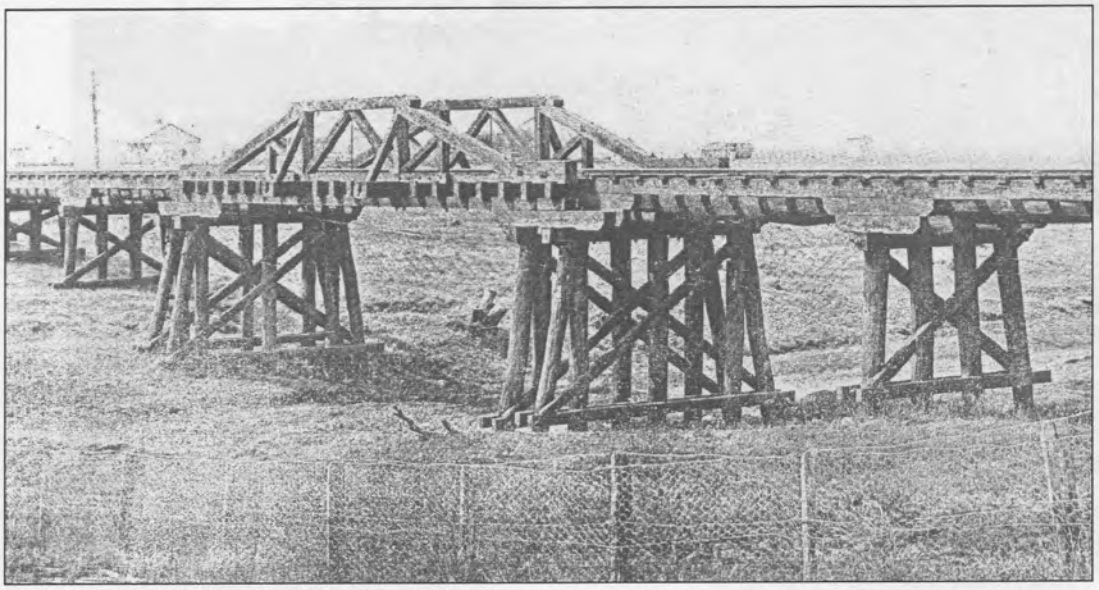
Robert Ballard introduced them on the then Great Northern Railway. This line was renamed the central Line when the present Great Northern railway was constructed west from Townsville.

This bridge of three 45ft (13.7m) spans was a Ballard timber truss bridge, one of two on the Gogango Range, they were replaced by embankments ca 1924 when the line was upgraded to allow heavier locomotives to operate.

The Dawson River combined road and rail bridge, Central line.

Built as a road bridge this bridge was used for rail traffic until the 1904 rail bridge was completed.

The bridge had two laminated timber bowstring arch spans. Although there were other bridges of this type in Queensland, this was the only one that carried rail traffic.



Jimbour Creek Bridge, Western Line.

This 50ft (15.2m) timber truss and the one at Cooranga Creek were erected in 1877. Replaced by new timber piers and simple 25ft (7.6m) spans. The wider timber piers that supported the trusses are still in evidence today.

Some typical timber bridges.

Splitters Creek Bridge, North Bundaberg, Mount Perry Branch.

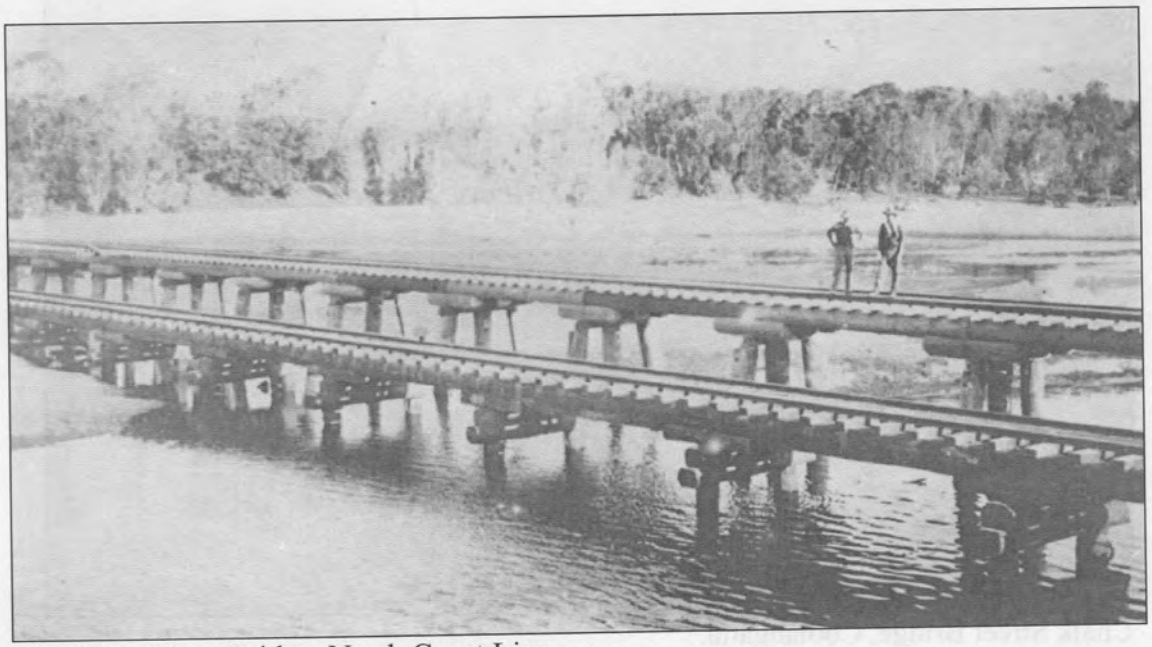
Built 1881, it is has steel Plate Girder spans on timber piers and understrutted timber approach spans, both features of many Queensland rail bridges in the 1880-1890s.

Bungil Creek Bridge, Western Line.

An example of a long low timber bridge ca 1880.

This bridge with one steel span and a number of timber spans was a feature of early construction on the Western Line. Note the two pile piers.

Other long low timber bridges were across the Yeppen Flood plain on the Central Line across near Rockhampton, 1845ft (560m) and 1980ft (600m) and near Curra on the North Coast Line, 1120ft (340m)and 1470ft (450m). All now have been replaced by shorter bridges.



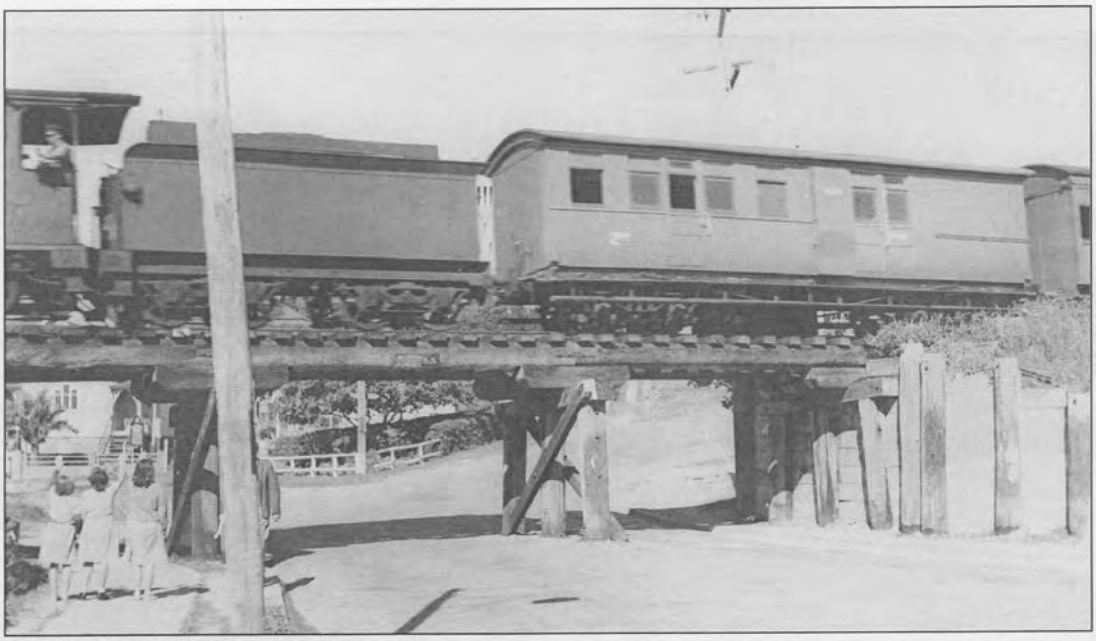
Haughton River Bridge, North Coast Line.

The original bridge with two pile piers and the new 1926 higher bridge with three pile piers.

A timber bridge with solid headstocks ca 2000.

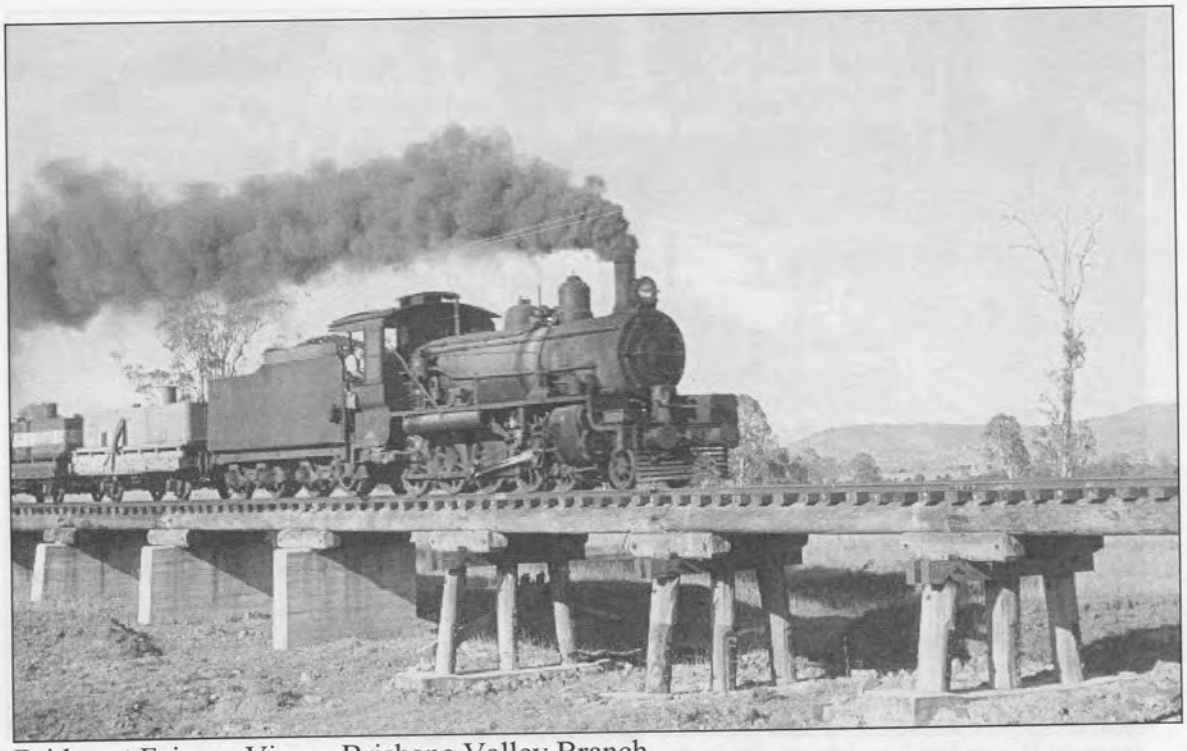
The first timber bridges were first built with solid headstocks.
When upgraded to 12 Ton Axle Load some were modified to have split headstocks. Split headstocks were standard in later bridges. Replacement was simplified as no temporary supports were required when renewing headstocks. One headstock could be replaced as the other remained to support the girders.
The bridge pictured is an example of those that retained solid headstocks.

Some variations of timber bridges.



Chalk Street Bridge, Coolangatta.

Concrete walls supporting the embankments allowing addition space for roadway and footpath.



Bridge at Fairney View - Brisbane Valley Branch.

Some timber piers cut off above ground level and supported on concrete bases. The others replaced fully in concrete.

Examples could be found of bridges having all concrete piers and others with various combinations of standard timber piers and both of the types illustrated.

Bridge at Blackbutt - Brisbane Valley Branch.

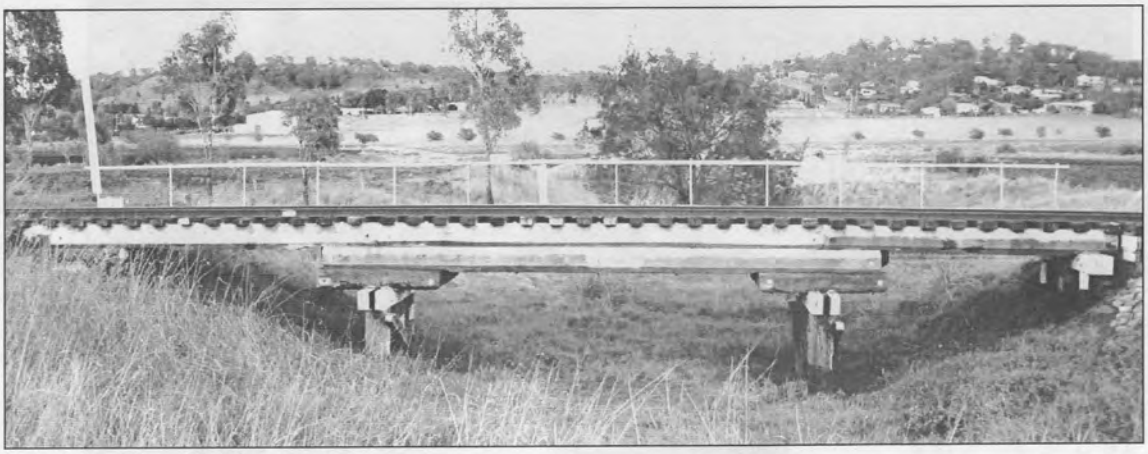
Another example of a roadway under the bridge.

To provide more headroom for road traffic the ground level has been lowered and concrete retaining walls provided. These walls also support the timber piers.

Burnett River Bridge, Monto Branch

A low level bridge designed to be overtopped by floodwaters.

To resist flood forces inclined struts were added to piers at some bridges. At other locations upstream ones called fenders were provided to help turn floating timber to pass between the piers. Some bridges had both.



Western Line Bridge.

At this bridge corbels are provided at the junction of single and double girder spans.

There are bridges where these corbels are omitted and the extended lower girder acts as a corbel. Bridges without these corbels would be in the minority.

Again on the Western Line this is a simple single span bridge with concrete ballast boards.

Timber bridge replacement by concrete culvert. In this case a large box culvert to provide access under the track.

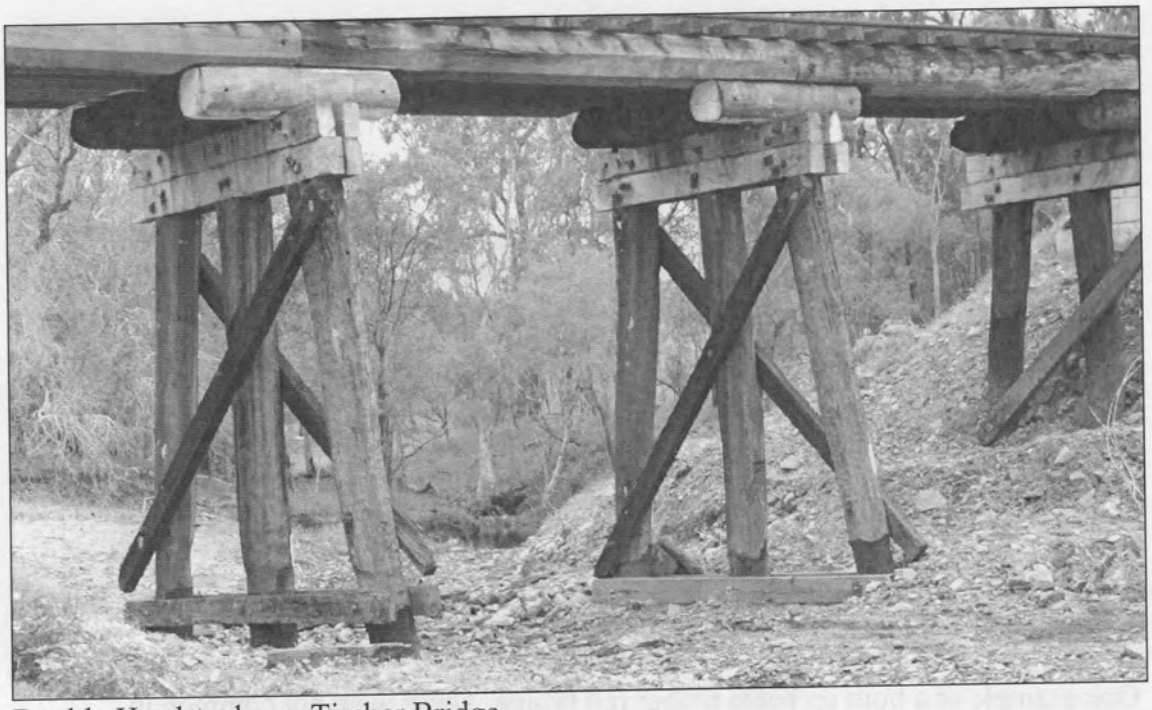
Some large bridges have been replaced by culverts under embankments.

Replacement pier in steel.

TIMBER BRIDGES UPGRADED to 20tal

Three Mile Creek Bridge near Bororen, North Coast Line

Upgraded for 20 tonne axle load by insertion of intermediate concrete piers to halve the span.

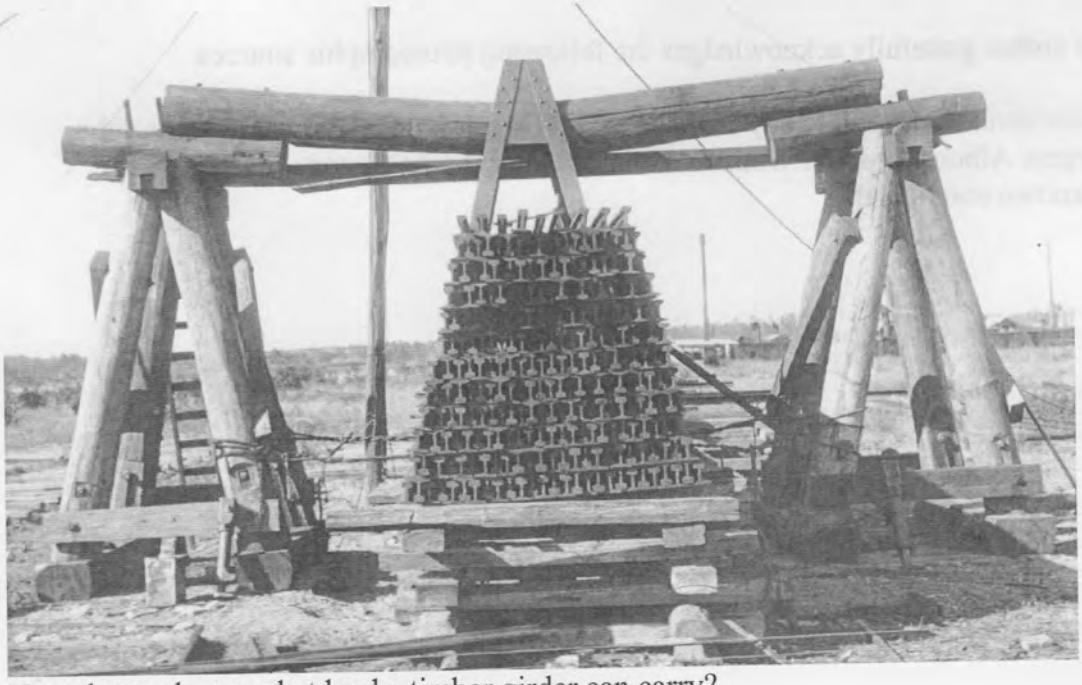


Double Headstocks on Timber Bridge

This bridge has been upgraded to the 20 tonne axle load by provision of double headstocks. Depending on the span a third or fourth girder would have been inserted.

If you are operating 2800 or 4000 class locomotives on your layout any timber bridges must have been upgrade to the 20 tonne axle load standard.

TESTING TIMBER GIRDERS



How do you know what load a timber girder can carry?
You test it.

The original Haughton River Bridge, Great Northern Railway.

One example of a built up beam timber rail bridge. These were not common in Queensland .

The original built up beam spans have been strengthened by understrutting to carry 9 Ton Axle Load steam locomotives.

The photo was taken prior to replacement with Plate Girder spans to allow 12 Ton Axle Load steam locomotives.

Replaced in 1963 by a Prestressed Concrete bridge.

Photo credits.

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