HISTORIC BRIDGES
OF THE WELLINGTON REGION

for
Greater Wellington Regional Council
HISTORIC BRIDGES
OF THE WELLINGTON REGION

Survey for the
Freshwater Plan Review

Report Prepared by

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for

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Front cover photo:
Ruakokoputuna River Bridge, upstream view from the true left bank.

Back cover photo:
Pakuratahi Bridge from the northern end.
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1.0 INTRODUCTION

1.1 Commission

This survey of historic bridges of the Wellington region is the result of a commission (5 April 2010) from Laura Paynter, on behalf of Greater Wellington Regional Council. The reason for the survey is that the Wellington Region Freshwater Plan (1999) is currently being reviewed. Historic heritage is being identified for inclusion in the next regional plan.

The survey covers 13 selected bridges, with a physical description, present-day photographs, and an assessment of significance. Assessment criteria are based on those in policy 20 of the proposed Regional Policy Statement, with particular attention being paid to physical values; archaeological, tangata whenua and social values were not to be specifically addressed.

Two further bridges were to be assessed, but were found to be modern structures of no heritage value. The Karapoti Bridge (a timber truss bridge, built in the early 1930s) was damaged in a flood in 2007 and was replaced shortly afterwards with a modern concrete structure. Further up the valley of the Akatarawa River West, McGhie’s Bridge (a single under-strutted beam span, built in 1925) was also found to have been replaced with a modern structure, being steel beams supporting a concrete deck.

Research on the history of the bridges was carried out by Helen McCracken and Miranda Williamson. Material relating to the history of each bridge is now gathered into files held by the regional council, and can be consulted for further detailed information.

Survey work was carried out by Chris Cochran during May and June 2010. Additional photos of the Rimutaka Incline bridges were taken in August because of poor weather during the first site visit. Site notes have been added to the files mentioned above.

1.2 Acknowledgements

This report has been prepared with the assistance of several people. Acknowledgement is made to:

Laura Paynter, for briefing and information relating to the bridges. Scott Ihaka was the liaison person at the conclusion of the project.

Helen McCracken and Miranda Williamson for gathering material on the history of the bridges.

Research and documentation, and production of this report, was funded by the Greater Wellington Regional Council.
1.3 References

For a full list of references for each bridge, see the research files mentioned above. Some general references are listed below.

Published


New Zealand Government Railways, Inspection Manual Bridges and Structures, Publicity and Advertising Branch, New Zealand Railways, revised 1973; also ONTRACK hold information on railway bridges throughout the region.

New Zealand Historic Places Trust, Registration of Historic Places. Information is held on all bridges that are registered under the Historic Places Act 1993.


Thornton, Geoffrey, Bridging the Gap, Early Bridges in New Zealand 1830 - 1939, Reed Books, Auckland, 2001. (This is the best general survey of bridges in New Zealand, and includes information on a number of those included in this survey.)

Unpublished


2.0 INVENTORY

TIMBER TRUSS ROAD BRIDGES

Ngatiawa River Bridge, view from the north-east.

Ngatiawa River Bridge
Reikorangi
1913
1 Location

The Ngatiawa River Bridge spans the Ngatiawa River immediately above its junction with the Waikanae River. It is approximately one kilometre north-east of Reikorangi, and was on the Mangaone (or Mangaone South) Road that wound up the valley of the Waikanae River. Today the road bypasses the bridge, and crosses the Ngatiawa River 100 metres upstream where there is a modern concrete bridge.

The bridge is set in a quiet rural landscape, with open farmland to the east and steep bush-covered hills to the west.

2 Outline History

The Ngatiawa River Bridge was built in 1912/13, and was opened for use probably in June 1913; it was designed by the Public Works Department, and built by local sawmiller Norman Campbell.

The boundary between the Horowhenua and Hutt Counties at the time was the centre line of the Ngatiawa River, so that there was one abutment in each of the counties. There was a great deal of correspondence as to which body should be responsible for funding the bridge, with the finally agreed split being Horowhenua County £300, Hutt County £200, with the Government contributing £250.

The bridge and the Mangaone South Road served the timber milling industry of the valley (there was a large mill at the end of the road), and later farming. It was closed in about 1980 when the new bridge was constructed.

3 Physical Description

The bridge is made up of a single trussed span of 27 metres (88 feet). It is a conventional Howe truss (see Appendix I for a full description), made up of six bays, the two middle bays with counter struts. It was built for road traffic, but has been closed for many years, and today it is in very poor condition, with the upstream truss in particular distinctly out of plumb; it is unsafe even for foot traffic. Access at its eastern end is fenced off.

The main components are:

Structural Type
Howe truss, six bays, 27 metre span; no piers.

Eastern Abutment (true left bank)
In-situ concrete.
This abutment is on road reserve land.

Western Abutment (true right bank)
In-situ concrete.
This abutment is now on privately owned land.

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1 To be confirmed.
Main Materials
Australian hardwood, ironbark for the trusses and jarrah for the decking; steel tie rods and fixings.

4 Changes over Time
Repairs have been carried out, but there is no apparent deviation from the original form. It is therefore a very authentic structure, true to its original form and detail.

There is one quite unexplained matter that should be noted however: the original Public Works Department drawing shows trusses with eight bays, whereas the bridge was built with six bays.

5 Assessment of Significance
Criteria for this assessment of significance are taken from policy 20 of the proposed Regional Policy Statement.

Historic Values
These relate to the history of a place and how it demonstrates important historical themes, events, people or experiences.

The Ngatiawa Bridge has strong local historical value in that it served the timber milling industry and the farming community of the valley through much of the 20th century. It was built by Norman Campbell, a sawmiller and a person who played a significant role in the development of the valley.

There is also an interesting story in the financing, design and construction of the bridge that sheds light on the working relationship between local authorities and central government in the early decades of the 20th century. It is a fine example of the engineering excellence of the Public Works Department, which was very influential in setting engineering standards in New Zealand.

Architectural Values
The place is notable for its style, design, form, scale, materials, ornamentation, period, craftsmanship or other architectural values.

The structure has an engineering intelligence: all components are clear in their function, the materials are chosen for their strength and durability characteristics, and the whole is assembled in a logical and economical solution to an engineering problem. It therefore has high value for its formal design qualities.

Technological Values
The place provides evidence of the history of technological development or demonstrates innovation or important methods of construction or design.

The Ngatiawa Bridge is a very good example of Howe truss design, exhibiting all the characteristics of the type, and demonstrating a mastery of the art of heavy timber bridge construction. Since the design drawings exist, engineering technology of the time can be well understood by a study of the drawings and the structure itself.
There is evidence of the longevity of timber, including some members that have remained sound over the near 100 year life of the bridge (although it should be noted that the bridge is now, overall, in fragile condition).

**Integrity**
The significant physical values of the place have been largely unmodified.

The bridge is very little altered from its original form and detail. The early history of repair is presently unknown, but it is known that some timbers were replaced with matching material and the structure stabilised in the mid-1990s.

**Age**
The place is particularly old in the context of human occupation of the Wellington region.

The bridge is now almost 100 years old (built in 1913), so that it is an important surviving structure of the early years of development of the Reikorangi area.

**Group or Townscape Values**
The place is strongly associated with other natural or cultural features in the landscape or townscape, and/or contributes to the heritage values of a wider townscape or landscape setting, and/or it is a landmark.

The aesthetic value of the bridge is extremely high, since it is part of an area of high scenic value. The picturesque aging of the bridge timbers means that it blends well in the landscape, being seen from the Mangaone South Road (especially as one travels south) against a steep backdrop of bush with the two rivers – Ngatiawa and Waikanae - below.

**Surroundings**
The setting or context of the place contributes to an appreciation and understanding of its character, history and/or development.

The formation of the old road at either end of the bridge is more or less intact, so that the early road alignment can still be understood, noting however that the land on the far (western) end of the bridge is in private ownership and cannot be accessed.

**Rarity**
The place is unique or rare within the district or region.

While timber truss bridges were once a very common sight on the New Zealand road and rail systems, they are now rare. For the few comparable structures that remain, see Appendix I.

Of special note is the fact that the Ngatiawa Bridge has the longest span of any known timber truss road bridge in New Zealand.

**Representativeness**
The place is a good example of its type or era.

It is a very good representative road bridge of the Howe truss type, and of the era in which it was built. It was one of many hundreds built.
Registration
Registration under the Historic Places Act 1993
The Ngatiawa Bridge was registered Category II, registration number 7189, on 23 June 1994.

View of the Ngatiawa Bridge from the Mangone South Road, true left bank.
View from the eastern end of the bridge.

View of the upstream truss from the eastern end.
Akatarawa River Bridge, view from downstream.

Akatarawa River Bridge, B1/4
Akatarawa Road, Cloustonville
1922
1 Location
The Akatarawa River Bridge (known also as bridge B1/4) is a road bridge spanning the Akatarawa River on the road from Upper Hutt to Waikanae; it is at Cloustonville, some 13.5 kilometres from where the Akatarawa Road branches off State Highway 2 just north of Upper Hutt. This road is the northern-most link from the Hutt Valley to the west coast.

The bridge is set in a rural landscape, with open farmland to the east, some forestry on nearby hills, and steep bush-clad hills to the west.

2 Outline History
The bridge, with several others, was built in 1922 and opened the road link between the Hutt Valley and Waikanae. At this time demand for the bridge was strong, since timber milling was an important industry in the valley, but more particularly it opened up a direct route (though a very windy one) between Upper Hutt and Waikanae and the west coast. In recent years, it has served a mix of land uses, including farming. It remains in use today, although with major repairs and strengthening evident.

The designer of the bridge is not presently known, although it appears to have been based on Public Works Department standard designs.

3 Physical Description
The bridge is made up of a single trussed span of 19.8 metres, with two short spans of beams at either end. It is a conventional Howe truss (see Appendix I for a full description), made up of six bays, the two middle bays with counter struts. It was built for single-lane road traffic.

The main components are:

**Structural Type**
Howe truss, six bays, 19.8 metre span.
Simply supported beams at each end, 4.5 metres.

**Dimensions**
Length 28.8 metres
Width 4.9 metres

**Southern Pier and Abutment (true left bank)**
In-situ concrete.

**Northern Pier and Abutment (true right bank)**
In-situ concrete.

**Main Materials**
Australian hardwood, possibly ironbark for the trusses and jarrah for the decking; steel tie rods and fixings.
4 Changes over Time

Quite major repairs have been carried out to both trusses, with the insertion of galvanised steel saddle blocks, and purpose-made connectors, especially for one of the top chord/king strut connections. New timber windbraces have been built in on the upstream side, and there is now a modern pipe and mesh handrail on either side. However, there is little deviation from the original form and even where new steel has been inserted, the original timber has not been removed. It is therefore a reasonably authentic structure, although with the insertion of modern strengthening steel members.

During the 1980s and 90s the bridge stood out clearly in the landscape because it was painted white; today most of the paint has weathered off.

5 Assessment of Significance

Criteria for this assessment of significance are taken from policy 20 of the proposed Regional Policy Statement.

Historic Values

These relate to the history of a place and how it demonstrates important historical themes, events, people or experiences.

The Akatarawa River Bridge has strong local historical value in that it served the timber milling industry and the farming community of the valley through much of the 20th century. It is a good example of the engineering excellence of the Public Works Department, which was very influential in setting engineering standards in New Zealand.

Architectural Values

The place is notable for its style, design, form, scale, materials, ornamentation, period, craftsmanship or other architectural values.

The structure has an engineering intelligence: all components are clear in their function, the materials are chosen for their strength and durability characteristics, and the whole is assembled in a logical and economical solution to an engineering problem. It therefore has high value for its formal design qualities.

Technological Values

The place provides evidence of the history of technological development or demonstrates innovation or important methods of construction or design.

The Akatarawa River Bridge is a very good example of Howe truss design, exhibiting all the characteristics of the type, and demonstrating a mastery of the art of heavy timber bridge construction.

There is evidence of the longevity of timber, including some members that have remained sound over the near 90 year life of the bridge (although it should be noted that the bridge is now in heavily repaired condition).
Integrity
The significant physical values of the place have been largely unmodified.

The bridge has been altered from its original detail by modern strengthening work, although this has not altered its general form.

Age
The place is particularly old in the context of human occupation of the Wellington region.

The bridge is now almost 90 years old (built in 1922), so that it is an important surviving structure of the early years of development of the area and of the road link from the Hutt Valley through to the west coast.

Group or Townscape Values
The place is strongly associated with other natural or cultural features in the landscape or townscape, and/or contributes to the heritage values of a wider townscape or landscape setting, and/or it is a landmark.

The aesthetic value of the bridge is extremely high, since it is part of an area of high scenic value. The picturesque aging of the bridge timbers means that it blends well in the landscape, being seen in both approaches.

Surroundings
The setting or context of the place contributes to an appreciation and understanding of its character, history and/or development.

The formation of the Akatarawa Road at either end of the bridge follows the original line, so that the early road alignment can still be understood; indeed, over much of the road through to Reikorangi the original narrow and winding alignment is still intact.

Rarity
The place is unique or rare within the district or region.

While timber truss bridges were once a very common sight on the New Zealand road and rail systems, they are now rare. For the few comparable structures that remain, see Appendix I. This bridge is one of three on the Akatarawa Road still in use; there would not be such a concentration of timber truss bridges left anywhere else in New Zealand.

Representativeness
The place is a good example of its type or era.

It is a very good representative road bridge of the Howe truss type, and of the era in which it was built. It was one of many hundreds built.

Registration
Registration under the Historic Places Act 1993

The bridge is not registered.
View of bridge B1/4 from the northern end.

View from the southern end.
View from the north, upstream side.

Closer view of the downstream truss.
Underside of the bridge, and concrete pier at south end.
Akatarawa River Bridge, view from downstream.

Akatarawa River Bridge, B1/5
Akatarawa Road
1922
1 Location

The Akatarawa River Bridge (known also as bridge B1/5) is a road bridge spanning the Akatarawa River on the road from Upper Hutt to Waikanae; it is some 17.2 kilometres from where the Akatarawa Road branches off State Highway 2 just north of Upper Hutt. This road is the northern-most link from the Hutt Valley to the west coast.

The bridge is set in a steep sided valley, with bush-clad hills and some forestry nearby.

2 Outline History

The bridge, with several others, was built in 1922 and opened the road link between the Hutt Valley and Waikanae. At this time demand for the bridge was strong, since timber milling was an important industry in the valley, but more particularly it opened up a direct route (though a very windy one) between Upper Hutt and Waikanae and the west coast. In recent years, it has served a mix of land uses, including farming. It remains in use today, although with major repairs and strengthening evident.

The designer of the bridge is not presently known, although it appears to have been based on Public Works Department standard designs.

3 Physical Description

The bridge is made up of a single trussed span of 26.0 metres, with one short span of beams at the south end. It is a conventional Howe truss (see Appendix 1 for a full description), made up of six bays, the two middle bays with counter struts. It was built for single-lane road traffic.

The main components are:

- **Structural Type**
  Howe truss, six bays, 26.0 metre span.

- **Simply supported beams at south end, 4.5 metres.**

- **Dimensions**
  Length 30.5 metres
  Width 5.1 metres

- **Southern Pier and Abutment (true right bank)**
  In-situ concrete.

- **Northern Abutment (true left bank)**
  In-situ concrete.

- **Main Materials**
  Australian hardwood, possibly ironbark for the trusses and jarrah for the decking; steel tie rods and fixings.
4 Changes over Time

Quite major repairs have been carried out to both trusses, with the insertion of galvanised steel saddle blocks, and purpose-made connectors, especially for one of the top chord/king strut connections. New timber windbraces have been built in on the upstream side, and there is now a modern pipe and wire handrail on either side. However, there is little deviation from the original form and even where new steel has been inserted, the original timber has not been removed. It is therefore a reasonably authentic structure, although with the insertion of modern strengthening steel members.

During the 1980s and 90s the bridge stood out clearly in the landscape because it was painted white; today most of the paint has weathered off.

5 Assessment of Significance

Criteria for this assessment of significance are taken from policy 20 of the proposed Regional Policy Statement.

Historic Values
These relate to the history of a place and how it demonstrates important historical themes, events, people or experiences.

The Akatarawa River Bridge has strong local historical value in that it served the timber milling industry and the farming community of the valley through much of the 20th century. It is a good example of the engineering excellence of the Public Works Department, which was very influential in setting engineering standards in New Zealand.

Architectural Values
The place is notable for its style, design, form, scale, materials, ornamentation, period, craftsmanship or other architectural values.

The structure has an engineering intelligence: all components are clear in their function, the materials are chosen for their strength and durability characteristics, and the whole is assembled in a logical and economical solution to an engineering problem. It therefore has high value for its formal design qualities.

Technological Values
The place provides evidence of the history of technological development or demonstrates innovation or important methods of construction or design.

The Akatarawa River Bridge is a very good example of Howe truss design, exhibiting all the characteristics of the type, and demonstrating a mastery of the art of heavy timber bridge construction.

There is evidence of the longevity of timber, including some members that have remained sound over the near 90 year life of the bridge (although it should be noted that the bridge is now in heavily repaired condition).
Integrity
The significant physical values of the place have been largely unmodified.

The bridge has been altered from its original detail by modern strengthening work, although this has not altered its general form.

Age
The place is particularly old in the context of human occupation of the Wellington region.

The bridge is now almost 90 years old (built in 1922), so that it is an important surviving structure of the early years of development of the area and of the road link from the Hutt Valley through to the west coast.

Group or Townscape Values
The place is strongly associated with other natural or cultural features in the landscape or townscape, and/or contributes to the heritage values of a wider townscape or landscape setting, and/or it is a landmark.

The aesthetic value of the bridge is extremely high, since it is part of an area of high scenic value. The picturesque aging of the bridge timbers means that it blends well in the landscape, being seen in both approaches.

Surroundings
The setting or context of the place contributes to an appreciation and understanding of its character, history and/or development.

The formation of the Akatarawa Road at either end of the bridge follows the original line, so that the early road alignment can still be understood; indeed, over much of the road through to Reikorangi the original narrow and winding alignment is still intact.

Rarity
The place is unique or rare within the district or region.

While timber truss bridges were once a very common sight on the New Zealand road and rail systems, they are now rare. For the few comparable structures that remain, see Appendix I. This bridge is one of three on the Akatarawa Road still in use; there would not be such a concentration of timber truss bridges left anywhere else in New Zealand.

Representativeness
The place is a good example of its type or era.

It is a very good representative road bridge of the Howe truss type, and of the era in which it was built. It was one of many hundreds built.

Registration
Registration under the Historic Places Act 1993
The bridge is not registered.
View of Bridge 1/5 from the northern end.

View from the southern end.
View from the north, downstream truss.

Detail of top chord, downstream truss.
Underside of the bridge, and concrete pier at south end.
Underside of the deck, from the north end.
Bull Steam Bridge, view from downstream.

Bull Steam Bridge, B₁/6
Akatarawa Road
1922
1 Location

The Bull Stream Bridge (known also as bridge B1/6) is a road bridge spanning Bull Stream just 30 metres upstream from where it runs into the Akatarawa River. It is on the road from Upper Hutt to Waikanae, some 17.5 kilometres from where the Akatarawa Road branches off State Highway 2 just north of Upper Hutt (just 300 metres beyond bridge B1/5). This road is the northern-most link from the Hutt Valley to the west coast.

The bridge is set in a steep sided valley, closely enclosed with bush-clad hills.

2 Outline History

The bridge, with several others, was built in 1922 and opened the road link between the Hutt Valley and Waikanae. At this time demand for the bridge was strong, since timber milling was an important industry in the valley, but more particularly it opened up a direct route (though a very windy one) between Upper Hutt and Waikanae and the west coast. In recent years, it has served a mix of land uses, including farming. It remains in use today, although with major repairs and strengthening evident.

The designer of the bridge is not presently known, although it appears to have been based on Public Works Department standard designs.

3 Physical Description

The bridge is made up of a single trussed span of 19.8 metres, with one short span of beams at the north end. It is a conventional Howe truss (see Appendix I for a full description), made up of six bays, the two middle bays with counter struts. It was built for single-lane road traffic.

The main components are:

**Structural Type**
Howe truss, six bays, 19.8 metre span.

**Simply supported beams at snorth end, 4.5 metres.**

**Dimensions**
Length 24.3 metres
Width 5.0 metres

**Southern Abutment (true left bank)**
In-situ concrete.

**Northern Pier and Abutment (true right bank)**
In-situ concrete.

**Main Materials**
Australian hardwood, possibly ironbark for the trusses and jarrah for the decking; steel tie rods and fixings.
4 Changes over Time

Quite major repairs have been carried out to both trusses, with the insertion of galvanised steel saddle blocks, steel channels alongside some floor beams, and purpose-made connectors, especially for one of the top chord/king strut connections. New timber windbraces have been built in on the upstream side, and there is now a modern pipe and mesh handrail on either side. However, there is little deviation from the original form and even where new steel has been inserted, the original timber has not been removed. It is therefore a reasonably authentic structure, although with the insertion of modern strengthening steel members.

During the 1980s and 90s the bridge stood out clearly in the landscape because it was painted white; today most of the paint has weathered off.

5 Assessment of Significance

Criteria for this assessment of significance are taken from policy 20 of the proposed Regional Policy Statement.

Historic Values

These relate to the history of a place and how it demonstrates important historical themes, events, people or experiences.

The Bull Stream Bridge has strong local historical value in that it served the timber milling industry and the farming community of the valley through much of the 20th century. It is a good example of the engineering excellence of the Public Works Department, which was very influential in setting engineering standards in New Zealand.

Architectural Values

The place is notable for its style, design, form, scale, materials, ornamentation, period, craftsmanship or other architectural values.

The structure has an engineering intelligence: all components are clear in their function, the materials are chosen for their strength and durability characteristics, and the whole is assembled in a logical and economical solution to an engineering problem. It therefore has high value for its formal design qualities.

Technological Values

The place provides evidence of the history of technological development or demonstrates innovation or important methods of construction or design.

The Bull Stream Bridge is a very good example of Howe truss design, exhibiting all the characteristics of the type, and demonstrating a mastery of the art of heavy timber bridge construction.

There is evidence of the longevity of timber, including some members that have remained sound over the near 90 year life of the bridge (although it should be noted that the bridge is now in heavily repaired condition).
**Integrity**

The significant physical values of the place have been largely unmodified.

The bridge has been altered from its original detail by modern strengthening work, although this has not altered its general form.

**Age**

The place is particularly old in the context of human occupation of the Wellington region.

The bridge is now almost 90 years old (built in 1922), so that it is an important surviving structure of the early years of development of the area and of the road link from the Hutt Valley through to the west coast.

**Group or Townscape Values**

The place is strongly associated with other natural or cultural features in the landscape or townscape, and/or contributes to the heritage values of a wider townscape or landscape setting, and/or it is a landmark.

The aesthetic value of the bridge is extremely high, since it is part of an area of high scenic value. The picturesque aging of the bridge timbers means that it blends well in the landscape, being seen in both approaches.

**Surroundings**

The setting or context of the place contributes to an appreciation and understanding of its character, history and/or development.

The formation of the Akatarawa Road at either end of the bridge follows the original line, so that the early road alignment can still be understood; indeed, over much of the road through to Reikorangi the original narrow and winding alignment is still intact.

**Rarity**

The place is unique or rare within the district or region.

While timber truss bridges were once a very common sight on the New Zealand road and rail systems, they are now rare. For the few comparable structures that remain, see Appendix I. This bridge is one of three on the Akatarawa Road still in use; there would not be such a concentration of timber truss bridges left anywhere else in New Zealand.

**Representativeness**

The place is a good example of its type or era.

It is a very good representative road bridge of the Howe truss type, and of the era in which it was built. It was one of many hundreds built.

**Registration**

Registration under the Historic Places Act 1993

The bridge is not registered.
View of Bridge B1/6 from the northern end.

View from the southern end.
View from the northern end, upstream truss.

Guard rail at the southern end of the bridge.
Detail of the strengthened top chord/king strut junction, upstream truss.

Detail of the top chord, upstream truss.
View from upstream, true right bank.
Underside of the deck, from the north end.
TIMBER TRUSS RAIL BRIDGE

Pakuratahi Bridge, view from southern end, true left bank.

Pakuratahi Bridge
Rimutaka Incline
1876/1910
1 Location

The Pakuratahi Bridge is a rail bridge spanning the Pakuratahi River on the western side of the rail line known as the Rimutaka Incline which joined Wellington and the Wairarapa.

The bridge is set in the steep sided valley of the Pakuratahi River, now of regenerating bush and forestry plantations.

2 Outline History

The bridge was designed by the Public Works Department and built in 1876 as part of the Rimutaka Incline. This was an extremely important rail link for the growing country, joining the capital city with the vast hinterland of the Wairarapa. It was also an extremely challenging engineering enterprise, since it involved a number of tunnels and bridges, and the steepest section of main trunk railway (up to 1 in 14) ever laid in New Zealand, that up the eastern side of the Rimutaka Range, the part known as the Incline.

The bridge was built in 1876, while the rail line itself opened in 1878. Around 1910 the bridge was badly damaged by fire and it appears to have been largely (if not completely) rebuilt at that time; the abutments however were retained.

The line continued in active use until 1955, when the present Rimutaka Tunnel, 8.8 kilometres long, was opened, making the whole of the incline redundant. Today the route is much used for recreation and the Pakuratahi Bridge serves a useful purpose as a safe crossing for walkers and mountain bikers of a mountainous river, albeit carrying much lighter loads than it did in its heyday. It was upgraded by the Regional Council in 2001, engineering by Kingston Morrison Ltd, and is today in sound condition.

3 Physical Description

The bridge is made up of a single trussed span of 22.0 metres. It is a conventional Howe truss (see Appendix I for a full description), made up (unusually) of seven bays, all but the outer bays with counter struts. As is common for the heavier loads on rail bridges, the bottom chords of the trusses are twin steel plates rather than timber.

The main components are:

- **Structural Type**
  Howe truss, seven bays, 24.4 metre span; 20.65 metres between abutments.

- **Dimensions**
  - Length 22.0 metres
  - Width 4.4 metres outside/outside

- **Western Abutment (true left bank)**
  In-situ concrete.

- **Eastern Abutment (true right bank)**
  In-situ concrete.

- **Main Materials**
  Australian hardwood, possibly ironbark for the trusses and jarrah for the decking; steel tie rods and fixings.
4 Changes over Time

An early photo of the bridge (pre-1910) shows a trussed structure with perhaps 12 floor beams. Since the present bridge is fundamentally different, with six floor beams, it is presumed that the structure was largely rebuilt after the fire of 1910. While repairs have been carried out to the structure, they are quite unobtrusive and small in scale. A handrail has been added, and new mesh fixed to the decking, but the structure remains an extremely authentic one.

5 Assessment of Significance

Criteria for this assessment of significance are taken from policy 20 of the proposed Regional Policy Statement.

Historic Values

These relate to the history of a place and how it demonstrates important historical themes, events, people or experiences.

The Pakuratahi Bridge has very strong regional and national historical value in that it was part of the first rail link between Wellington and the Wairarapa, remaining in active rail use until the closing of the line in 1955. It is a good example of the engineering excellence of the Public Works Department, which was very influential in setting engineering standards in New Zealand.

Architectural Values

The place is notable for its style, design, form, scale, materials, ornamentation, period, craftsmanship or other architectural values.

The structure has an engineering intelligence: all components are clear in their function, the materials are chosen for their strength and durability characteristics, and the whole is assembled in a logical and economical solution to an engineering problem. It therefore has high value for its formal design qualities.

Technological Values

The place provides evidence of the history of technological development or demonstrates innovation or important methods of construction or design.

The Pakuratahi Bridge is a very good example of Howe truss design, exhibiting all the characteristics of the type, and demonstrating a mastery of the art of heavy timber bridge construction. Its original design for the heavy loadings of rail is seen in the large cross section of the timbers and in the twin plate bottom chords of the trusses.

There is evidence of the longevity of timber, including some members that have remained sound over the 100 year life of the bridge.

Integrity

The significant physical values of the place have been largely unmodified.

The bridge is largely unmodified, and has a very high level of authenticity.
Age
The place is particularly old in the context of human occupation of the Wellington region.

The bridge is now 100 years old (built in 1910), with some components dating back nearly 135 years to the original structure of 1876. It is therefore a very early structure not just in the construction of a rail network in Wellington but also nationally.

Group or Townscape Values
The place is strongly associated with other natural or cultural features in the landscape or townscape, and/or contributes to the heritage values of a wider townscape or landscape setting, and/or it is a landmark.

The aesthetic value of the bridge is extremely high, since it is part of an area of high scenic value, for the bush-covered hills and the wild unmodified nature of the river. The picturesque aging of the bridge timbers means that it blends well in the landscape, being seen in the open approach from the west, and through the narrow curved and fern-lined cutting from the east.

Surroundings
The setting or context of the place contributes to an appreciation and understanding of its character, history and/or development.

The formation of the Rimutaka Incline is still largely intact, so that the early alignment of sweeping curves and easy gradients (those of the Incline itself excepted) can be readily understood.

Rarity
The place is unique or rare within the district or region.

While timber truss bridges were once a very common sight on the New Zealand road and rail systems, they are now rare. For the few comparable structures that remain, see Appendix I.

Representativeness
The place is a good example of its type or era.

It is a very good representative road bridge of the Howe truss type, and of the era in which it was built. It was one of many hundreds built.

Registration
Registration under the Historic Places Act 1993

The bridge is part of an historic area, the Rimutaka Incline, which is registered under the Historic Places Act.
View of the Pakuratahi Bridge from the northern end, through the cutting.
Upstream truss, top chord, bays 1/2.

Upstream truss, top chord, bays 2/3.
Upstream truss, top chord, bays 5/6.

Upstream truss, top chord, bays 6/7.
Upstream truss, view from the southern end of the bridge.

Downstream truss, view from the northern end.
Windbraces on the downstream side of the bridge.
Northern abutment, true right bank of the Pakuratahi River.
Abbott’s Creek Bridge
Featherston
c.1920

Abbott’s Creek Bridge, upstream view from the true left bank.
1 Location

The Abbott’s Creek Bridge spans Abbott’s Creek on State Highway 2 at the foot of the Rimutaka Hill; it is approximately two kilometres west of Featherston. The highway bypasses the bridge, which is some 50 metres upstream from the modern bridge; one catches just a glimpse of the old bridge from the highway as mature willows and other trees have largely hidden it from view.

The bridge is set in a landscape of quite rugged bush-clad hills of the Rimutakas to the west, with regenerating bush nearby, just where the valley of Abbott’s Creek opens out to farmland around Featherston; Lake Wairarapa soon appears in distant views to the south-east as one travels towards Featherston.

2 Outline History

The designer of the Abbott’s Creek Bridge is presently unknown; it was built sometime between 1910 and 1920, by Jack Davis.

(Given some very close design parallels with the Ruakokoputuna Bridge, it seems likely that the engineers were Toogood, Jones and Holmes; see inventory entry for this bridge. It might even be that the design was a ‘standard’ one, used for both bridges, so closely matching are some of the details.)

The bridge was an integral part of the main road, now State Highway 2, between Wellington and the Wairarapa. It remained in use until the construction of the present two-lane bridge in 1956. Its relatively short life may be attributed to the fact that it was single lane, a restriction on what became a busy state highway.

3 Physical Description

The bridge is made up of two parallel concrete arches spanning 15.8 metres; it has a total length of 26.8 metres and width of 4.5 metres, hence it is single-lane. The whole of the structure is reinforced concrete, including the handrail posts; these support two galvanised iron pipe rails and three runs of no 8 wire.

There is walking access to each end of the bridge, on the alignment of the old road, that at the western end in particular being still clear. Access today is restricted by large concrete blocks placed across the approach at either end.

The bridge today is in good condition, especially since it has been out of use for over 50 years. The river bank on the true right has been scoured out behind the abutment, although there is no damage to bridge itself.

The main components are:

**Structural Type**

Two parallel concrete arches, bank to bank, 18.8 metre span; no piers.

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2 Date and builder taken from Thornton; no records of the designer have been found by the researchers. The span is also taken from Thornton.
Dimensions
Length 26.8 metres
Width 4.5 metres

Eastern Abutment (true left bank)
In-situ concrete.

Western Abutment (true right bank)
In-situ concrete.

Main Materials
Whole structure is reinforced in-situ concrete.

4 Changes over Time
Minor repairs have been carried out, but there is no apparent deviation from the original form. It is therefore a very authentic structure, true to its original form and detail.

5 Assessment of Significance
Criteria for this assessment of significance are taken from policy 20 of the proposed Regional Policy Statement.

Historic Values
These relate to the history of a place and how it demonstrates important historical themes, events, people or experiences.

The Abbott’s Creek Bridge has historical value in that it was part of the important Wellington to Wairarapa road link for some 40 years. This road, which began as a track in the 1840s, has played a crucial role in the development of the Wairarapa from the time of European settlement since the region had no port of its own.

Architectural Values
The place is notable for its style, design, form, scale, materials, ornamentation, period, craftsmanship or other architectural values.

The bridge has a lightness and elegance, the main structural component of the arch making an effortless leap across the rough gulley of the stream. The concrete columns and beams are well-scaled and neatly finished with chamfered corners. Although modest in scale, it is an intelligent engineering design, an excellent example of the structural type.

Technological Values
The place provides evidence of the history of technological development or demonstrates innovation or important methods of construction or design.

The Abbott’s Creek Bridge is a very good example of a concrete arch bridge, exhibiting all the characteristics of the type. It approaches the age of 100 years still in very sound condition (with some minor concrete spalling; the only significant threat to its stability is the scouring of the riverbank).
**Integrity**
The significant physical values of the place have been largely unmodified.
The bridge is very little altered from its original form and detail.

**Age**
The place is particularly old in the context of human occupation of the Wellington region.
The bridge is now almost 100 years old (built in the decade 1910 to 1920), so that it is an important surviving structure of the early Wellington to Wairarapa road link which began as a track in the 1840s.

**Group or Townscape Values**
The place is strongly associated with other natural or cultural features in the landscape or townscape, and/or contributes to the heritage values of a wider townscape or landscape setting, and/or it is a landmark.
The aesthetic value of the bridge is potentially high, but it is almost impossible to appreciate this today because of the mature trees between it and the main road; a view from upstream is also difficult as the stream bed is full of blackberry. It is nevertheless in a picturesque setting, and its graceful form is a man-made compliment to the natural landscape of rugged hills.

**Surroundings**
The setting or context of the place contributes to an appreciation and understanding of its character, history and/or development.
The formation of the old road at either end of the bridge, especially at the western end, is intact, so that the early road alignment can still be understood. Needless to say, the modern alignment to the new bridge takes a straighter line than the curves approaching the old bridge.

**Rarity**
The place is unique or rare within the district or region.
Concrete arch bridges are not numerous, but nor could they be categorised as rare. Locally, the Ruakokoputuna Bridge is a comparable example, while the Grafton Road Bridge in Auckland is a nationally known structure of the same type.

**Representativeness**
The place is a good example of its type or era.
It is a very good representative example of a concrete arch road bridge, and of the era in which it was built.

**Registration**
Registration under the Historic Places Act 1993
The bridge is not registered.
Abbott’s Creek Bridge from the east, true left bank, showing the curved alignment of the road at each end; State Highway 2 shows at the extreme left, and the main range of the Rimutakas in the distance.
Closer view from the eastern end.

View from the western end.
Detail of a handrail post, with galvanised iron rails and no. 8 wire; there are eleven equally spaced posts on either side of the bridge.
Ruakokoputuna Bridge, upstream view from the true left bank.

Ruakokoputuna Bridge
Ruakokoputuna
1921
1 Location

The Ruakokoputuna Bridge spans the Ruakokoputuna Stream on the road that winds up the valley to the Haurangi State Forest Park; it is approximately 8.3 kilometres from the turn-off on the Martinborough to Tora Road. The metalled road winds down to a narrow ravine which is spanned by the concrete arch bridge, and the arched form can be seen when approaching from this direction.

The bridge is set in a mixed landscape of farming, forestry and regenerating bush, with some mature bush in clumps, especially just downstream of the bridge. There are no buildings in sight.

2 Outline History

The construction of the Ruakokoputuna Bridge was undertaken by the Featherston County Council, and was estimated to cost £1,700. It was subsidised £1 for £1 by the government.

A specification for the work exists, and these state that the drawings for the bridge (which have not been found) were signed by H F Toogood CE and were dated 29 November 1920. The drawings and the specification were forwarded for approval to the Public Works Department District Office in Wellington by Messrs Toogood, Jones and Holmes, Engineers.

The bridge, built in 1921, was part of a rural road, servicing the farming community in the Ruakokoputuna valley. It has remained in use to the present day, a life of some 90 years.

3 Physical Description

The bridge is made up of two parallel concrete arches spanning 18.2 metres; it has a total length of 28.5 metres and width of 4.5 metres, hence it is single-lane. The whole of the structure is reinforced concrete, including the handrail posts; these support two galvanised iron pipe rails and three runs of no 8 wire.

The bridge today is in good condition, with damage restricted to broken handrails posts and bent rails. Some large trees have blown down near the right abutment, but have not caused any damage.

The main components are:

<table>
<thead>
<tr>
<th>Structural Type</th>
<th>Two parallel concrete arches, bank to bank, 18.2 metre span; no piers.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dimensions</td>
<td>Length 28.5 metres</td>
</tr>
<tr>
<td></td>
<td>Width 4.5 metres</td>
</tr>
</tbody>
</table>

Northern Abutment (true left bank)
Stone walling.

3 PW/WDO No 1883, 50438.
Southern Abutment (true right bank)
Stone walling.

Main Materials
Whole structure is reinforced in-situ concrete.

4  Changes over Time
Minor repairs have been carried out, but there is no apparent deviation from the original form. It is therefore a very authentic structure, true to its original form and detail.

5  Assessment of Significance
Criteria for this assessment of significance are taken from policy 20 of the proposed Regional Policy Statement.

Historic Values
These relate to the history of a place and how it demonstrates important historical themes, events, people or experiences.

The Ruakokoputuna Bridge has historical value in that it has been part of the local infrastructure of a remote farming valley of the Wairarapa for nearly 90 years.

Architectural Values
The place is notable for its style, design, form, scale, materials, ornamentation, period, craftsmanship or other architectural values.

The bridge has a lightness and elegance, the main structural component of the arch making an effortless leap across the rough gulley of the stream. The concrete columns and beams are well-scaled and neatly finished with chamfered corners. Although modest in scale, it is an intelligent engineering design, an excellent example of the structural type.

Technological Values
The place provides evidence of the history of technological development or demonstrates innovation or important methods of construction or design.

The Ruakokoputuna Bridge is a very good example of a concrete arch bridge, exhibiting all the characteristics of the type. It is in very good condition for its 90 years of life.

Integrity
The significant physical values of the place have been largely unmodified.

The bridge is very little altered from its original form and detail.

Age
The place is particularly old in the context of human occupation of the Wellington region.

The bridge is now almost 90 years old (built in 1921), so that it is an important surviving structure from the time of development of a remote farming valley.
Group or Townscape Values
The place is strongly associated with other natural or cultural features in the landscape or townscape, and/or contributes to the heritage values of a wider townscape or landscape setting, and/or it is a landmark.

The aesthetic value of the bridge is high, not from road level but certainly in views from below, especially from the upstream side. It has a very picturesque setting, and its graceful form is a man-made compliment to the natural landscape of hills, bush covered and farmed.

Surroundings
The setting or context of the place contributes to an appreciation and understanding of its character, history and/or development.

The context of the bridge, the approaches, follow the original alignment, so that the whole place is strongly evocative of its age.

Rarity
The place is unique or rare within the district or region.

Concrete arch bridges are not numerous, but nor could they be categorised as rare. Locally, the Abbott’s Creek Bridge is a comparable example, while the Grafton Road Bridge in Auckland is a nationally known structure of the same type. For some other comparable structures that remain, see Appendix II.

Representativeness
The place is a good example of its type or era.

It is a very good representative example of a concrete arch road bridge, and of the era in which it was built.

Registration
Registration under the Historic Places Act 1993
The bridge is not registered.
Approach to the Ruakokoputuna Bridge from the north, from the Tora Road, on the true left bank.

Approach from the south.
View from the bridge, looking upstream.

View from the bridge looking downstream.
Detail of the handrail; this is precisely the same design as that for the Abbott’s Creek Bridge.
Parawhaiti Stream Bridge, upstream view from the true right bank.

Parawhaiti Stream Bridge
Stronvar Road
1935
1 Location

The Parawhaiti Stream Bridge spans the stream on the Masterton to Stronvar Road; it is approximately 6 kilometres from the turn-off on the Masterton – Castlepoint Road, and 12 kilometres from Masterton itself. It is in level to undulating country, and the arched form of the bridge can be seen when approaching from the Stronvar direction.

The landscape is open farming country, with scattered farm buildings (at some distance) forming part of the setting.

2 Outline History

The bridge was built for the Masterton County Council; it was designed by Seaton, Sladden and Pavitt, Engineers of Wellington, and constructed by the Fletcher Construction Company. The drawings are dated 11 July 1934, and according to the plaque, the bridge was built in 1935.

It has remained in use to the present day, a life of some 75 years.

3 Physical Description

The bridge is an unusual arch design for two reasons: it is technically a squinch arch bridge, where the outer edges of the arch are off-set to allow the the bridge to pass over the stream bed at an angle; and the spandrel panels are solid, with the void behind filled with earth.

The arch spans 23.8 metres; the total length is 30.1 metres and width 7.1 metres. The whole of the structure is reinforced concrete, including the balustrade which is pierced with narrow round-headed openings.

The bridge today is in good condition, and in regular use on a rural road serving a large farming area.

The main components are:

- **Structural Type**
  Squinch arches, in concrete, with earth filled spandrels, 23.9 metre (78’ 5”) span; no piers.

- **Dimensions**
  Length 30.1 metres
  Width 7.1 metres

- **Eastern Abutment (true left bank)**
  Concrete.

- **Western Abutment (true right bank)**
  Concrete.

- **Main Materials**
  Whole structure is reinforced in-situ concrete.
4  Changes over Time

There is no apparent alteration from the original form. It is therefore a very authentic structure, true to its original form and detail.

5  Assessment of Significance

Criteria for this assessment of significance are taken from policy 20 of the proposed Regional Policy Statement.

Historic Values

These relate to the history of a place and how it demonstrates important historical themes, events, people or experiences.

The Parawhaiti Stream Bridge has historical value in that it has been part of the local infrastructure of a prosperous farming area of the Wairarapa for some 75 years.

Architectural Values

The place is notable for its style, design, form, scale, materials, ornamentation, period, craftsmanship or other architectural values.

The bridge has a simplicity in the spring of the arch, the solidness of the spandrel panels, and the patterned perforations of the balustrade, all executed in a well considered manner in raw off-the-boxing concrete. It is an intelligent engineering design, an excellent example of the structural type.

Technological Values

The place provides evidence of the history of technological development or demonstrates innovation or important methods of construction or design.

This is a very good example of a concrete arch bridge, exhibiting the basic characteristics of the type but with two features that make it of particular interest – its squinch arch design, and the solid spandrels with the filled void behind. It is in very good condition for its 75 years of life.

Integrity

The significant physical values of the place have been largely unmodified.

The bridge is very little altered from its original form and detail.

Age

The place is particularly old in the context of human occupation of the Wellington region.

The bridge is now almost 75 years old (built in 1935), so that it is not old in the context of farming in the area which dates back to the 1850s.
Group or Townscape Values

The place is strongly associated with other natural or cultural features in the landscape or townscape, and/or contributes to the heritage values of a wider townscape or landscape setting, and/or it is a landmark.

The aesthetic value of the bridge is high, not from road level (where it is a modest feature in the landscape) but certainly in views from below, especially from the upstream side. It has a pleasant rural setting, with no particular distinguishing features, and although an integral part of the road, the bridge is otherwise unrelated to other built features.

Surroundings

The setting or context of the place contributes to an appreciation and understanding of its character, history and/or development.

The context of the bridge, the approaches, follow the re-alignment of the road that occurred at the time the bridge was built, so that the whole place is evocative of its age.

Rarity

The place is unique or rare within the district or region.

Concrete arch bridges are not numerous, but nor could they be categorised as rare. However, the distinguishing features of this bridge – the squinch arch design and the solid spandrels with the filled void behind – make it very unusual, and rare. No other examples of arch bridges with these features is presently known. See Appendix II.

Representativeness

The place is a good example of its type or era.

It is a very good representative example of a concrete arch road bridge, and of the era in which it was built.

Registration

Registration under the Historic Places Act 1993

The bridge is not registered.
Approach to the Parawhāiti Stream Bridge from the west, from Masterton, on the true right bank.

Upstream view from the true right bank.
Upstream view from the true left bank.

Downstream view from the true right bank.
Solid balustrade at west end.

Detail of plaque at west end, showing in the photo at top of page.
CONCRETE PIER AND GIRDER BRIDGES

Tauweru Bridge, downstream view from the true right bank.

Tauweru Bridge
Tauweru
1922
1  Location

The Tauweru Bridge spans the Tauweru River on the Masterton to Castlepoint Road; it is approximately 400 metres east of the town.

The bridge is set in an undulating farming landscape. There are scattered buildings nearby, some old macrocarpas, and grass covered paddocks and hills.

2  Outline History

The engineers for the Tauweru Bridge were Sladden, Pavitt and Dyett; one drawing (PWD 51007) exists at National Archives, although there would have been others in the set. It was built for the Masterton County Council, with the aid of a £1 for £2 subsidy from the Government; a total of £2,000 was paid. In approving the subsidy, the Public Works Department required some unspecified amendments to the design, and the plans were approved in October 1920. The contract price was £5,847, excluding the steel and cement which was supplied by the Council. The bridge was opened in 1922.

It suffered damage during the 1942 Wairarapa earthquake which necessitated (amongst other repairs) the replacement of the true right abutment; a contemporary photograph shows extensive slumping and cracking of the ground in this area.

The bridge is an integral part of the Masterton to Castlepoint Road, servicing a large area of the north Wairarapa hinterland. It has remained in use from 1922 to the present day.

3  Physical Description

The bridge is made up of one main span of 9.1 metres across the stream, with six haunched beam spans of 9.1 metres, two at the northern end and four at the southern; the total length is 73.5 metres. Each span is made up of three beams, and this is neatly reflected in the solid piers which are thickened to form three supporting columns.

There is a full length concrete balustrade on both sides of the deck which is pierced with narrow round-headed openings.

The bridge today is in good condition, with some local damage to the balustrade.

The main components are:

   Structural Type
   Concrete girders, 18.3 and 9.1 metre spans

   Dimensions
   Length 73.5 metres
   Width 5.9 metres

   Northern Abutment (true left bank)
   In-situ concrete.

   Southern Abutment (true right bank)
   In-situ concrete.

   Main Materials
   Whole structure is reinforced in-situ concrete.
4 Changes over Time

Minor repairs have been carried out, but there is no apparent deviation from the original form. It is therefore a very authentic structure, true to its original form and detail.

5 Assessment of Significance

Criteria for this assessment of significance are taken from policy 20 of the proposed Regional Policy Statement.

Historic Values
These relate to the history of a place and how it demonstrates important historical themes, events, people or experiences.

The Tauweru Bridge has historical value in that it is part of the roading infrastructure of the northern Wairarapa, giving access to a large farming hinterland as well as to the coast, for nearly 90 years.

Architectural Values
The place is notable for its style, design, form, scale, materials, ornamentation, period, craftsmanship or other architectural values.

The bridge is of a straightforward and logical pier and beam type; structural function is neatly reflected in the shapes of the elements, and in particular in the greater depth of the girders that span the stream. All components are well finished with chamfered corners, and textures are appropriately raw off-the-boxing concrete. It is an intelligent engineering design, an excellent example of the structural type.

Technological Values
The place provides evidence of the history of technological development or demonstrates innovation or important methods of construction or design.

The Tauweru Bridge is a very good example of a concrete pier and girder bridge, exhibiting all the characteristics of the type. It is in very sound condition for its age, a tribute to its good design and construction.

Integrity
The significant physical values of the place have been largely unmodified.

The bridge is very little altered from its original form and detail.

Age
The place is particularly old in the context of human occupation of the Wellington region.

The bridge is now nearly 90 years old (built in 1922), so that it is not old in the context of farming in the area which dates back to the 1850s.
Group or Townscape Values
The place is strongly associated with other natural or cultural features in the landscape or townscape, and/or contributes to the heritage values of a wider townscape or landscape setting, and/or it is a landmark.

The aesthetic value of the bridge is high, not from road level (where it is a modest feature in the landscape) but in views from below. It has a pleasant rural setting, with no particular distinguishing features, and although an integral part of the road, with scattered houses and farm buildings within the visual catchment of the bridge, it is not otherwise especially related to other built features.

Surroundings
The setting or context of the place contributes to an appreciation and understanding of its character, history and/or development.

The context of the bridge, the approaches, follow the slight re-alignment of the road that occurred at the time the bridge was built, so that the whole place is evocative of its age.

Rarity
The place is unique or rare within the district or region.

This bridge is a very good example of a common bridge type, and has no claim to rarity.

Representativeness
The place is a good example of its type or era.

It is a very good representative example of a concrete pier and girder concrete road bridge, and of the era in which it was built.

Registration
Registration under the Historic Places Act 1993

The bridge is not registered.
Looking east across the Tauweru Bridge from the town end.

The upstream setting of the bridge.
The face of a pier; the boxing and day-pouring lines are clearly evident.
Tauveru Bridge from downstream, true right bank, showing the deeper girders of the long (18.3 metre) span.
Upstream view from the true right bank.

Detail of haunched beams and the top of a typical pier.
Waihenga Bridge, upstream view from the true left bank.

Waihenga Bridge
Martinborough
1912
1 Location

The Waihenga Bridge spans the Ruamahanga River on State Highway 53 between Featherston and Martinborough; it is approximately 2.8 kilometres from the Martinborough Square.

The bridge is set in a flat farming landscape, with the willow-lined banks and wide sweeps of shingle of the Ruamahanga the main feature of the area. There are a few scattered buildings in the vicinity.

2 Outline History

The designer of the Waihenga Bridge was G Laing-Meason, Civil Engineer of Wellington. The 17 page specification (PWD 28115) exists at National Archives, signed by the engineer on 21 October 1910, with tenders closing a month later. The accompanying two drawings are numbered PWD 28499.

It was built for the Featherston County Council, and was opened by the Prime Minister Sir Joseph Ward in January 1912. It was to be tested by running two 14 ton traction engines over it ‘in such manner as the Engineer may direct’, and there is a contemporary photograph to show that this was actually done.

The bridge is an integral part of State Highway 53 providing just the second crossing of the Ruamahanga up from its mouth; it therefore services the huge hinterland of the South Wairarapa and is on the main access route out to the east coast. It has remained in use from its construction to the present day.

3 Physical Description

The bridge is made up of 14 spans of 12.2 metres; eight approach spans of six metres at the eastern end have now been filled in. The piers are each founded on eight reinforced concrete piles driven into the river bed, and they support three deep (925 x 400) haunched beams to each span. The total length is approximately 170 metres.

There is a full length concrete upstand on either side of the deck; the original concrete handrail has been replaced with galvanised steel, splayed out to get greater clearance.

The bridge today is in good condition.

The main components are:

- **Structural Type**
  Concrete girders, 12.2 metre spans

- **Dimensions**
  - Length 170 metres
  - Width 6.2 metres

- **Eastern Abutment (true left bank)**
  In-situ concrete.

- **Western Abutment (true right bank)**
  In-situ concrete.
Main Materials
Whole structure is reinforced in-situ concrete.

4 Changes over Time
The main structure is unaltered, although the original balustrade has been replaced with a galvanised steel handrail. It is therefore an authentic structure, true to its original form but not detail.

5 Assessment of Significance
Criteria for this assessment of significance are taken from policy 20 of the proposed Regional Policy Statement.

Historic Values
These relate to the history of a place and how it demonstrates important historical themes, events, people or experiences.

The Waihenga Bridge has historical value in that it is part of the roading infrastructure of the southern Wairarapa, giving access to a large farming hinterland as well as to the coast, for nearly 100 years. It is very close to the site of an older timber truss bridge.

Architectural Values
The place is notable for its style, design, form, scale, materials, ornamentation, period, craftsmanship or other architectural values.

The bridge is of a straightforward and logical pier and beam type; structural function is reflected in the shapes of the elements, which are appropriately sized for their loadings. All components are well finished with chamfered corners, and textures are appropriately raw off-the-boxing concrete. It is an intelligent engineering design, an excellent example of the structural type.

Technological Values
The place provides evidence of the history of technological development or demonstrates innovation or important methods of construction or design.

The Waihenga Bridge is a very good example of a concrete pier and girder bridge, exhibiting all the characteristics of the type. It is in very sound condition for its age, a tribute to its good design and construction.

Integrity
The significant physical values of the place have been largely unmodified.

The form of the bridge is very little altered from the time of its construction, although the balustrade has been replaced.
Age
The place is particularly old in the context of human occupation of the Wellington region.

The bridge is now nearly 100 years old (opened in 1912), so that it is not old in the context of farming in the area which dates back to the 1850s.

Group or Townscape Values
The place is strongly associated with other natural or cultural features in the landscape or townscape, and/or contributes to the heritage values of a wider townscape or landscape setting, and/or it is a landmark.

The aesthetic value of the bridge is high, not from road level (where it is a modest feature in the landscape) but in views from below. Here it is a strong feature in the wide open bed of this part of the Ruamahanga, a regular, straightforward and well-proportioned man-made structure. It is not especially related to other built features.

Surroundings
The setting or context of the place contributes to an appreciation and understanding of its character, history and/or development.

The context of the bridge, the approaches, follow a curved alignment at each end, aiding the integration of the structure into the surroundings.

Rarity
The place is unique or rare within the district or region.

This bridge is a good example of a common bridge type, and has no claim to rarity.

Representativeness
The place is a good example of its type or era.

It is a very good representative example of a concrete pier and girder concrete road bridge, and of the era in which it was built.

Registration
Registration under the Historic Places Act 1993

The bridge is not registered.
Looking east towards the Waihenga Bridge, from the Featherston end.

Looking west, from the Martinborough end of the bridge.
Downstream view from the true left bank.

Detail of the underside of the structure, where haunched beams meet the pier.
From upstream, showing one of the two expansion joints in the bridge.
Kokotau Bridge, upstream view from the true left bank, looking west towards Carterton.

Kokotau Bridge
Kokotau
1930
1 Location

The Kokotau Bridge spans the Ruamahanga River on the Ponatahi Road joining Carterton and Martinborough; it is approximately 19 kilometres from the Martinborough Square.

The bridge is set in an undulating farming landscape, with the willow-lined banks and wide sweeps of shingle of the Ruamahanga the main feature of the area. There are cliffs nearby downstream of the bridge, and distant views of the Tararua ranges to the west.

2 Outline History

The designers of the Kokotau Bridge were the engineers Seaton, Sladden and Pavitt, and the contractor who built it was W D McCalmont. The estimated cost was £9,750.

The cost of the bridge was shared by the Wairarapa South County Council, the Featherston County Council and the Government; of the contribution of the two counties, Wairarapa South paid by far the larger proportion (92.5%). It was opened in 1930.

The bridge is an integral part of the network of rural roads in the Wairarapa, and is well used since it provides the only crossing of the Ruamahanga River between Gladstone and Martinborough. Its original traffic was anticipated as ‘traction engines, motors, stock and general vehicular traffic’. It has remained in use from the time of its construction to the present day.

3 Physical Description

The bridge is made up of nine equal spans of 15.2 metres, comprising three deep girders to each span. The piers are 5.6 metres long, 600 mm wide, with pointed ends facing into the current; they are founded on reinforced concrete piles driven into the river bed. The total length of the bridge is approximately 135 metres.

There is a concrete balustrade with splayed ends on either side of the deck; this is pierced with narrow round-headed openings.

The bridge today is in good condition.

The main components are:

- **Structural Type**
  - Concrete girders, three per bay, 15.2 metre spans

- **Dimensions**
  - Length 135 metres
  - Width 6.3 metres

- **Eastern Abutment (true left bank)**
  - In-situ concrete.

- **Western Abutment (true right bank)**
  - In-situ concrete.

- **Main Materials**
  - Whole structure is reinforced in-situ concrete.
4 Changes over Time

The structure is unaltered, so that it is today an authentic structure, true to its original form and detail.

5 Assessment of Significance

Criteria for this assessment of significance are taken from policy 20 of the proposed Regional Policy Statement.

Historic Values
These relate to the history of a place and how it demonstrates important historical themes, events, people or experiences.

The Kokotau Bridge has historical value in that has been part of the roading infrastructure of the Wairarapa for some 80 years. It is very close to the site of an older timber truss bridge.

Architectural Values
The place is notable for its style, design, form, scale, materials, ornamentation, period, craftsmanship or other architectural values.

The bridge is of a straightforward and logical pier and beam type; structural function is reflected in the shapes of the elements, which are appropriately sized for their loadings. All components are well finished with chamfered corners, and textures are appropriately raw off-the-boxing concrete. It is an intelligent engineering design, an excellent example of the structural type.

Technological Values
The place provides evidence of the history of technological development or demonstrates innovation or important methods of construction or design.

The Kokotau Bridge is a very good example of a concrete pier and girder bridge, exhibiting all the characteristics of the type. It is in very sound condition for its age, a tribute to its good design and construction.

Integrity
The significant physical values of the place have been largely unmodified.

The form of the bridge is unaltered from the time of its construction, making it a very authentic structure.

Age
The place is particularly old in the context of human occupation of the Wellington region.

The bridge is now nearly 80 years old (opened in 1930), so that it is not old in the context of farming in the area which dates back to the 1850s.
Group or Townscape Values

The place is strongly associated with other natural or cultural features in the landscape or townscape, and/or contributes to the heritage values of a wider townscape or landscape setting, and/or it is a landmark.

The aesthetic value of the bridge is high, not from road level (where it is a modest feature in the landscape) but in views from below. Here it is a strong feature in the open bed of this part of the Ruamahanga, a regular, straightforward and well-proportioned man-made structure. It is well seen from below, since just upstream of the bridge is the popular picnic area of the Kokotau Public Reserve. The bridge is not especially related to other built features.

Surroundings

The setting or context of the place contributes to an appreciation and understanding of its character, history and/or development.

The bridge is well integrated into its surroundings, at its eastern end the road emerging from a high bank onto the bridge, and running out in a long straight at its western end.

Rarity

The place is unique or rare within the district or region.

This bridge is a good example of a common bridge type, and has no special claim to rarity.

Representativeness

The place is a good example of its type or era.

It is a very good representative example of a concrete pier and girder concrete road bridge, and of the era in which it was built.

Registration

Registration under the Historic Places Act 1993

The bridge is not registered.
Upstream view of the Kokotau Bridge from the true right bank.

Seen through the trees of the Kokotau Public Reserve.
Downstream view from the true right bank.

Detail of the underside of the structure, where the triple beams meet the pier.
Looking east, from the Carterton end of the bridge.

Detail of the plaque, showing on the left in the photo at the top of the page.
Looking downstream from the middle of the bridge.
Swingbridge, Queen Elizabeth Park
Masterton
1939
1 Location

The Swingbridge, as it is colloquially known, spans the Waipoua River as it runs along the northern side of Queen Elizabeth Park in Masterton. It provides a walking route between the park and the Masterton CBD, through to the suburb of Landsborough and the Masterton Hospital. The engineering drawing for the structure actually calls it the 'Hospital Suspension Bridge'.

It is somewhat hidden by the willow-lined banks of the river, but it provides lovely views of the river both upstream and downstream.

2 Outline History

The swingbridge was constructed in 1939 as part of major flood protection works carried out on the Waipoua River. This was in response to several serious flooding events in the mid-1930s. The bridge spans between stopbanks that were built on either side of the river as part of the flood control work. Although the design drawing exists (held by the Masterton District Council) it is unsigned; the designer may have been the county engineer.

The bridge is still today a useful pedestrian link over the Waipoua River, providing an alternative to the State Highway 2 bridge further upstream.

3 Physical Description

The bridge is a suspension bridge, the cables supported by two concrete towers. It is stiffened by the truss action of diagonal ties between the handrail and the deck.

The main components are:

- **Structural Type**
  Suspension bridge, 64 metre spans with two end spans of 13.4 metres (south) and 13.1 metres (north)

- **Dimensions**
  Length 90.5 metres
  Width 1.0 metre at deck level

- **Main Materials**
  Towers, reinforced in-situ concrete.
  Cables and tie rods, steel
  Deck, handrail and some fixings, timber

4 Changes over Time

The structure appears to be unaltered, so that it is today an authentic structure, true to its original form and detail.
5 Assessment of Significance

Criteria for this assessment of significance are taken from policy 20 of the proposed Regional Policy Statement.

Historic Values
These relate to the history of a place and how it demonstrates important historical themes, events, people or experiences.

The Swingbridge has historical value for its origins in the major flood control work carried out on the Waipoua River in the late 1930s. It has been much used by the people of Masterton for some 70 years.

Architectural Values
The place is notable for its style, design, form, scale, materials, ornamentation, period, craftsmanship or other architectural values.

The bridge is notable for its lightness and elegance, a graceful structure that seemingly floats through the trees and over the river. It is an intelligent engineering design, an excellent example of the structural type.

Technological Values
The place provides evidence of the history of technological development or demonstrates innovation or important methods of construction or design.

The Swingbridge is a very good example of a suspension bridge, exhibiting all the characteristics of the type. It demonstrates clearly the physical characteristics of the materials – concrete in compression for the towers, steel in tension for the cables, and timber in bending for transoms and decking.

Integrity
The significant physical values of the place have been largely unmodified.

The form of the bridge is apparently unaltered from the time of its construction, making it a very authentic structure.

Age
The place is particularly old in the context of human occupation of the Wellington region.

The bridge is now 70 years old (opened in 1939), so that it is not particularly old in the context of the growth of Masterton.
Group or Townscape Values
The place is strongly associated with other natural or cultural features in the landscape or townscape, and/or contributes to the heritage values of a wider townscape or landscape setting, and/or it is a landmark.

The aesthetic value of the bridge is high, in the glimpses one catches of it between the willows, from the State Highway 2 bridge upstream, and from the river bed. It is seen in a distinctly rural setting, since the buildings of Masterton, although relatively close, are largely hidden by the trees.

Surroundings
The setting or context of the place contributes to an appreciation and understanding of its character, history and/or development.

The bridge is well integrated into its surroundings, the towers standing strong amongst the dense willow trees on either bank, and the deck of the bridge landing neatly on the stopbank on either side. At its southern end a path leads directly into Queen Elizabeth Park, and at the northern end to a walkway along the stopbank, playing fields and the road to the hospital; the bridge thus connects an important array of public open spaces and facilities. It is partnered by the remains of an earlier bridge, although the two structures are not visually related.

Rarity
The place is unique or rare within the district or region.

This bridge is a good example of a common bridge type, although one that is rare within the region.

Representativeness
The place is a good example of its type or era.

It is a very good representative example of a suspension bridge, and of the era in which it was built.

Registration
Registration under the Historic Places Act 1993

The bridge is not registered.
Swingbridge, upstream view from the true left bank.
Looking south, towards Queen Elizabeth Park.
Looking north from mid-span.
Detail of the connection between the droppers and cables.
Ladle Bend Bridge, view from upstream, true right bank of the Pakuratahi River.

Ladle Bend Bridge
Rimutaka Incline
1876
1 Location

The Ladle Bend Bridge is a rail bridge spanning the small Ladle Bend Creek that runs into the Pakuratahi River just a few metres below the bridge. It is on the western side of the rail line known as the Rimutaka Incline which joined Wellington and the Wairarapa, and a little over one kilometre from the Pakuratahi Bridge heading towards the summit.

The bridge is set in an open part of the upper valley of the Pakuratahi River, now of regenerating bush and forestry plantations.

2 Outline History

The bridge was designed by the Public Works Department and built in 1876 as part of the Rimutaka Incline. This was an extremely important rail link for the growing country, joining the capital city with the vast hinterland of the Wairarapa. It was also an extremely challenging engineering enterprise, since it involved a number of tunnels and bridges, and the steepest section of main trunk railway (up to 1 in 14) ever laid in New Zealand, that up the eastern side of the Rimutaka Range.

The bridge was built two years before the rail line itself opened in 1878. The line continued in active use until 1955, when the present Rimutaka Tunnel, 8.8 kilometres long, was opened, making the whole of the incline redundant. Today the route is much used for recreation and the bridge serves a useful purpose as a crossing for walkers and mountain bikers, albeit carrying much lighter loads than it did in its heyday. It was upgraded by the Regional Council in 2001, engineering by Kingston Morrison Ltd, and is today in sound condition. (Its infrastructure number is RI 1-102-03.)

3 Physical Description

The bridge is built on a curve as the rail alignment sweeps around a bend on the true right bank of the Pakuratahi River, spanning the Ladle Bend Creek. It is an unusual design, made up of two timber spans; these comprise three main beams, each spanning between stone abutments and a central stone pier, and supported by raking timber props.

The stone abutments at either end, stone-faced embankments and the substantial masonry monolith of the central pier, tapered upwards, make this more a bridge of stone construction than of timber, and the combination of materials and the geometry of the timber beams and raking props give the bridge a picturesque quality.

The bridge is however, difficult to appreciate because of the topography, and growth has hidden much of the stone embankment work.

The main components are:

**Structural Type**
Timber beams (three per span) between stone abutments and central stone pier, with raking timber props. Spans 8.53 (western span) and 8.76 metres (eastern span), at a slight angle to each other.

**Dimensions**
Length approximately 18.0 metres
Width 3.3 metres inside/inside
Eastern Abutment (true left bank)
Masonry, hidden by embankment construction and growth.

Western Abutment (true right bank)
Masonry.

Main Materials
Stone masonry, timber beams and props.

4 Changes over Time
Apart from handrails and decking which are modern, the structure of the Ladle Bend Bridge is remarkably authentic. The repair work of 2001 saw some structural timbers replaced with matching material.

5 Assessment of Significance
Criteria for this assessment of significance are taken from policy 20 of the proposed Regional Policy Statement.

Historic Values
These relate to the history of a place and how it demonstrates important historical themes, events, people or experiences.

The Ladle Bend Bridge has very strong regional and national historical value in that it was part of the first rail link between Wellington and the Wairarapa, remaining in active rail use until the closing of the line in 1955. It is a good example of the engineering excellence of the Public Works Department, which was very influential in setting engineering standards in New Zealand.

Architectural Values
The place is notable for its style, design, form, scale, materials, ornamentation, period, craftsmanship or other architectural values.

The structure has an engineering simplicity of robust masonry abutments and pier and timber beams: all components are clear in their function, the materials are chosen for their strength and durability characteristics, and the whole is assembled in an economical solution to an engineering problem. It therefore has high value for its formal design qualities.

Technological Values
The place provides evidence of the history of technological development or demonstrates innovation or important methods of construction or design.

The bridge is of unusual design because of the mixture of materials, is robust and functional. It has stood the test of time remarkably well, testimony to the suitability of the design.
**Integrity**
The significant physical values of the place have been largely unmodified.

The bridge is largely unmodified, and has a very high level of authenticity. The repair work of 2001 was carefully done with matching material and details.

**Age**
The place is particularly old in the context of human occupation of the Wellington region.

The bridge is now 135 years old (built in 1976). It is therefore a very early structure not just in the construction of a rail network in Wellington but also nationally.

**Group or Townscape Values**
The place is strongly associated with other natural or cultural features in the landscape or townscape, and/or contributes to the heritage values of a wider townscape or landscape setting, and/or it is a landmark.

The aesthetic value of the bridge is modest from the approaches, since it is largely hidden, although when viewed from below (although difficult of access) it has a strong affinity with its natural surroundings. The tapered shapes of the masonry and the robustness of the form means that it integrates well in the environment. It is part of an area of high scenic value, for the bush-covered hills and the wild unmodified nature of the Pakuratahi River.

**Surroundings**
The setting or context of the place contributes to an appreciation and understanding of its character, history and/or development.

The formation of the Rimutaka Incline is still largely intact, so that the early alignment can be readily understood, and the bridge follows the gentle curve of the rail alignment, helping it integrate in to the surroundings.

**Rarity**
The place is unique or rare within the district or region.

This is a rare rail bridge, for its age and design.

**Representativeness**
The place is a good example of its type or era.

Because of its unusual design, the bridge does not have significant representative value.

**Registration**
Registration under the Historic Places Act 1993

The bridge is part of an historic area, the Rimutaka Incline, which is registered under the Historic Places Act.
Distant view of the Ladle Bend Bridge from the south, Pakuratahi River on the right.

Closer view, looking east, towards the summit.
View from the north east, Pakuratahi River on the left; the stone embankment in the foreground is now grown over.
View of the central stone pier, from the western end, true right bank of the Ladle Bend Creek.
APPENDIX I

General Description of the Howe Truss Bridge

The design of the Howe-type truss is based on patents taken out by an American engineer William Howe in 1840. Howe (1803 – 1852) made significant improvements in truss design of the time, and during the later years of the 19th century and the early years of the 20th, very many Howe-type truss bridges were built in New Zealand, both for road and rail.

Howe trusses have compression members in timber (large section Australian hardwood) and tension members in steel – these include rods joining the top chords to the bottom chords and transoms. For lightly loaded road bridges of the Howe type, bottom chords were commonly in timber, but for heavier rail loadings steel was common. Transoms (or floor beams) spanning between the trusses are timber.

Bridges are made up of two trusses; they are ‘through’ trusses, with the road or rail deck level with the bottom chords of the trusses.

The trusses are divided into ‘bays’ each with diagonal struts in one or both directions. While the struts are single lengths of timber, the top chord is sometimes doubled in flitches, and lengths are joined with bolted steel plates. The transoms span between the bottom chords of the trusses and support major longitudinal beams, which in turn support the deck planking or sleepers and rails. The transoms extend beyond the line of the trusses where timber or steel wind braces are fitted to stabilise the top chords of the trusses.

Members are sized carefully and economically for the loads they carry, so that (for example) timber members vary in cross-section and the vertical tension rods of the trusses vary from the outside where they have the greatest diameter to the central bays where they have the least.

Timbers

Australian ironbark was the preferred timber for bridge construction, although it was commonly allowed that greygum, greybox and tallowwood could be used ‘as they have similar properties’.4

Replacement of Members and Strengthening

One of the advantages of the Howe truss was the ability to replace whole members without support from below. There are examples in the Wellington bridges of all timber members – top chords, struts, thrust blocks and braces – being replaced over time and coded (see below). Sometimes top chords of the trusses were doubled and the timbers were not the full length of the chord, so that sections of the top chord, known as flitches, could be replaced as necessary.

For the rail bridges, New Zealand Railways had a rigorous system for inspection and maintenance. Methods were set out in the Inspection Manual, Bridges and Structures, and the revised edition of 1973 includes sections on timbers used in bridging, surface

examinations, boring of timber, and defects and their interpretation. A methodology for preparing reports and carrying out repairs was set out.

An important part of the inspection process was the drilling of timber members at critical locations, often at bearing points. Holes of around 6mm diameter were drilled to locate internal cavities caused by rot, and were plugged with timber dowels. Clusters of these holes are evident in (for example) the Pakuratahi Bridge. Cavities of a size sufficient to significantly weaken the structure resulted in members being replaced.

**Code Markings**

The history of repair is sometimes evident in code markings on the bridge itself. New Zealand Railways developed a system of marking new timbers that were built into bridges, and such markings appear in one of the Wellington bridges documented here.

The code included letters and numbers. For example, the marking ’38 SH’ seen on the upstream top chord of the Pakuratahi Bridge indicates that the timber was fitted in 1938 and was second hand at that time.

**Howe Truss Bridges Throughout New Zealand**

Examples of Howe truss railway bridges in New Zealand include:

- **Mahinapua Bridge, West Coast, 1905, Category I**
  Hokitika – Ross line.
  One trussed span, 27.6 metres.

- **Waimea Creek Bridge, West Coast, c.1905**
  Greymouth – Hokitika line.
  Three trussed spans, in use.

- **Taramakau River Bridge, West Coast**
  Greymouth – Hokitika line, in use.

- **New River Bridge, West Coast**
  Greymouth – Hokitika line.
  Three trussed spans, in use.

- **Ford Creek Bridge, West Coast**
  (date and span not known)

- **Totara River Bridge, West Coast**
  (date and span not known)

Two very good comparative examples of Howe truss railway bridges are the remaining spans of the Rapahoe Bridge, now on display on the left bank of the Grey River at Greymouth, and of the Arahura Bridge, also on display, on the left bank of the Arahura. For information on these bridges, see reports referred to in Section 1.3 References.
Examples of Howe truss road bridges in New Zealand include:

**Ngatiawa River Bridge, Reikorangi, 1913**  
Single trussed span of 27 metres; poor condition, not in use.

**Airlie Road Road Bridge, Porirua**  
Date and span not known; in use.

**Akatarawa Road Bridges, 1922**  
Each of three bridges on the Akatarawa Road have single trussed spans (19.4, 24.4 and 24.6 metres); all are in use.

**Manganuku Bridge, Waioeka Gorge, 1928**  
Single trussed span of 24.8 metres; in pedestrian use.

These bridges are all good examples of Howe truss design, although the Ngatiawa Bridge is in very poor condition.

**Glossary of Terms**

Following are the meanings of some words used in this report.

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
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<tbody>
<tr>
<td>Abutment</td>
<td>The end pier of the bridge.</td>
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<tr>
<td>Arch</td>
<td>Curved structural member which takes a vertical load in compression.</td>
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<tr>
<td>Bay</td>
<td>The interval in the truss between the pier and first floor beam, or between any two floor beams.</td>
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<tr>
<td>Bottom chord</td>
<td>The horizontal tension member forming the bottom of the truss.</td>
</tr>
<tr>
<td>Top chord</td>
<td>The top chord is the horizontal compression member forming the top of the truss.</td>
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<tr>
<td>Floor beam (or transom)</td>
<td>The major beams forming the ‘floor’ of the Howe truss and supporting the longitudinal beams.</td>
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<td>Girder</td>
<td>A concrete beam of large cross section.</td>
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<td>Haunched girder</td>
<td>The deepening of a girder as it meets a pier.</td>
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<tr>
<td>Span</td>
<td>The horizontal portion of the structure which supports the deck and track between the piers.</td>
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<tr>
<td>Spandrel</td>
<td>The ‘triangular’ area above the arch and below the horizontal deck of an arch bridge.</td>
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<tr>
<td>Top chord</td>
<td>The horizontal compression member forming the top of a truss.</td>
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<tr>
<td>True right bank and true left bank</td>
<td>The side of the river, right or left, when facing downstream.</td>
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<tr>
<td>Windbrace</td>
<td>Bracing that gives lateral support to the top chord of the truss from the extended ends of the floor beams.</td>
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