

BARWON HEADS BRIDGE

REPORT OF THE ADVISORY COMMITTEE

JANUARY 2007

BARWON HEADS BRIDGE

ADVISORY COMMITTEE REPORT



LESTER TOWNSEND, CHAIR



MAGGIE BARON, MEMBER



HENRY TURNBULL, MEMBER

JANUARY 2007

Contents

1. SUMMARY	1
2. BACKGROUND	4
2.1 The Barwon Heads Bridge.....	4
2.2 A deteriorating asset	5
2.3 The proposal	6
2.4 The Advisory Committee	7
2.5 The conduct of the hearings and investigations.....	8
3. POLICY CONTEXT	9
3.1 The significance of the Bridge and its setting.....	9
3.2 Other heritage	12
3.3 Policy context for a second crossing	12
4. IDENTIFICATION OF ISSUES	18
4.1 Summary of issues.....	18
4.2 Approach of the Advisory Committee.....	19
4.3 Issues dealt with in this Report.....	19
5. WHAT NEEDS TO BE REPAIRED?	20
5.1 What is the issue?	20
5.2 Evidence and submissions	20
5.3 Discussion.....	22
5.4 Conclusion.....	27
6. DEFICIENCIES IN THE CURRENT BRIDGE.....	29
6.1 What are the issues?.....	29
6.2 Structural problems with the crossheads	29
6.3 Railings and Barriers	31
6.4 Traffic lanes and barrier clearance	33
6.5 Pedestrian and bike access.....	34
6.6 Coping with traffic growth	36
7. PRACTICAL ISSUES IN RETAINING THE BRIDGE.....	38
7.1 Maintaining traffic access.....	38
7.2 Rehabilitate or reconstruct?	40
7.3 Finding new wood	43
8. WHAT IF A SECOND BRIDGE IS NECESSARY?	46
8.1 Comparison of cost.....	46
8.2 Heritage	48
8.3 Visual amenity	49
8.4 Land acquisition	51
8.5 Social impact – Impact on sailing.....	51
8.6 Social impact – Impact on camping.....	52
8.7 Splitting the town.....	53
8.8 Impact on business.....	54
8.9 Indigenous heritage.....	56
8.10 Air quality.....	58
8.11 Flora and fauna	59
8.12 Traffic and traffic engineering.....	61
8.13 General conclusion on the suitability of Corridor 2	62

9. PREFERRED OPTION.....	63
9.1 What are the options?	63
9.2 What needs to be achieved?.....	63
9.3 The nature of the works	64
9.4 Adapting of the Bridge	66
9.5 Achieving the cross section	70
10. THE NEXT STEPS	71
10.1 Heritage Act.....	71
10.2 Greater Geelong Planning Scheme	72
10.3 Other approvals.....	74
11. SUMMARY OF CONCLUSIONS AND RECOMMENDATIONS	75

Appendices

A PARTIES TO THE HEARING	79
B PHOTOGRAPHS OF BRIDGE ELEMENTS	81

Tables

Table 1: Options for keeping the Bridge.....	7
Table 2: Comparison of remaining life estimates for piles provided by SW Consultants (Glynn Jones) between 2003 and 2006	23
Table 3: Cost advantage (-disadvantage) of rehabilitation over rebuilding	42
Table 4: Construction and Life Cycle Costs for Timber Bridge Options	47

Figures

Figure 1: Barwon Heads Bridge.....	4
Figure 2: Cross section of the Bridge.....	5

Photographs of elements

The Photographs are presented in Appendix B

Photograph 1:Condition of bridge piles	81
Photograph 2:Condition of crossheads.....	82
Photograph 3:Condition of bracing	82
Photograph 4:Condition of stringers, corbels and cross frames	83
Photograph 5:Condition of the deck.....	84

1. Summary

The problem

Barwon Heads Bridge ('the Bridge') needs significant remedial work and many of its elements are suffering from decay and need replacement. Having considered the evidence and submissions we concluded that:

The Barwon Heads Bridge is in need of significant repair and restoration and that requires the replacement of a number of the elements of the Bridge.

We do not think that this conclusion is a surprise to anyone who has reviewed the evidence. The question is not whether work on the Bridge is required – it is how should the work be carried out.

The Bridge is listed on the Victorian Heritage Register and cannot simply be demolished and replaced. The Minister for Planning has determined that the Bridge will be retained.

The options before us are:

- To retain and upgrade the Bridge.
- To retain the Bridge and build a new bridge beside it.
- To retain the Bridge and build a new bridge further upstream.

The recommended solution

Having heard the evidence and submissions and considered all matters we have reached the overall conclusion that if the Bridge can be adapted to provide more appropriately for pedestrians, cyclists and with adequate vehicle lanes while maintaining heritage values in accordance with the Burra Charter then this is clearly the superior option – provided the work can be carried out in a practical fashion. However, it is not clear whether this can be achieved.

Much will rest on the detailed design and specification of the necessary works and we think that these details are best resolved by intensive discussions between VicRoads and Heritage Victoria.

We are confident that a solution that retains and adapts the Bridge for road traffic is achievable and practical. However, there remain at this stage a number of unresolved issues and it may well be that a second bridge is required to cater adequately for pedestrian and cyclists.

If a second bridge *must* be built this report concludes that it should be placed next to the existing Bridge, not in a new corridor opposite the Geelong Road.

A second bridge in the Geelong Road corridor is more expensive than a new bridge adjacent to the existing Bridge and has a lower level of benefit to the community. There are no advantages for a bridge at the Geelong Road alignment, but there are a number of significant disadvantages.

Preferred option

Having considered:

- potential environmental, social, cultural (including Aboriginal cultural heritage) and economic effects of the options, and
 - relevant strategic planning and land use considerations,
- we recommend the following preferred option for the redevelopment of the Barwon Heads Bridge.

The existing Bridge be repaired and adapted as the road bridge at Barwon Heads.

The Bridge be restored using the following materials:

- **the piles be replaced in timber of same dimensions and similar species as original bridge,**
- **the walers and cross braces be reused where possible or replaced in timber of same dimensions and similar species as original bridge,**
- **the existing steel stringers be reused with relocation above piles, and the loadings on the cross heads recalculated in this revised configuration,**
- **if possible, following a reassessment of loadings on crossheads after the relocation of the stringers, the crossheads be replaced in timber of the same dimension as existing or in steel of the same dimension as the existing timber crossheads,**
- **the deck (including remnants of the original wooden deck) be replaced in concrete.**

That VicRoads work with Heritage Victoria to develop a refined option that delivers the best heritage outcome in Corridor 1 while providing:

- **traffic lanes no less than 3.5 metres,**
- **a speed limit of 50 km per hour for the Bridge and approach roads from Hitchcock Avenue to Surf Beach Road Ocean Grove,**
- **44 tonne (T44) capability for crossing,**
- **clearance between traffic lanes and bridge barriers or kerbs of 1.0 metre (with provision of a stand up kerb and not a barrier between any shared path or foot path and traffic lanes),**
- **code compliant barriers,**
- **a shared path of no less than 3.0 metres,**
- **fishing platforms,**
- **one way traffic access during construction.**

We believe that all these requirements can and should be met on the existing Bridge with a widening of the deck while maintaining its heritage values, but this is

ultimately a decision for Heritage Victoria. The critical issue in terms of deck width is whether the improved facilities for pedestrians and cyclists can be accommodated together with the adaptations required to meet vehicular traffic needs.

It is important to note that the heritage impact is not simply the increased deck width, but also the need to alter the alignment of the Bridge in order to provide one lane of traffic during construction. If a change in the alignment of the Bridge is not considered appropriate then either a closure of the Bridge or a new bridge will be required. We do not think that a temporary bridge is a feasible alternative.

If Heritage Victoria does not support adapting the Bridge to meet all the needs for the corridor, or does not accept the construction methodology that this implies, then we recommend:

If the existing Bridge cannot be adapted to meet all identified needs then a pedestrian and cycle bridge be constructed adjacent to the Bridge. The design, width and separation from the Bridge be determined primarily on heritage grounds in accordance with the requirements of the *Heritage Act*.

Where to from here

To implement the preferred solution we recommend:

That the normal process of seeking a permit under the *Heritage Act* apply.

That the normal process of seeking approval under the *Coastal Management Act* apply.

VicRoads work with the relevant section of DSE to facilitate approval by way of a planning scheme amendment once a permit has been obtained under the *Heritage Act*.

VicRoads liaise with the Department of Sustainability and Environment to resolve *Coastal Management Act*, Ramsar and land tenure issues.

To ensure that there is a long term source of suitable timber for maintenance of heritage bridge structures, suitable trees need to be planted. Such a plantation would ensure critical timber resources will be available for future repairs while providing environmental benefits such as carbon emission balancing through the generation of new forests. We recommend:

VicRoads work with the Department of Sustainability to put in place long term plans (80 to 100 year timeframe) for securing suitable bridge timbers for its heritage assets.

2. Background

2.1 The Barwon Heads Bridge

The Barwon Heads Bridge was completed in 1927. It is a timber-beam bridge spanning 308.5 metres in length, which crosses the Barwon River estuary at Barwon Heads. It is situated on the Barwon Heads – Ocean Grove Road (C121) and provides a link between the two seaside towns and the broader Great Ocean Road and Bellarine Peninsula localities.

The Barwon Heads Bridge is the only crossing of the Barwon River between Geelong and the river mouth at Barwon Heads. It services local residents as well as providing a link for regional travel and freight usage. The Bridge also provides cycling and pedestrian access and is used as a platform for anglers.

Adaptations over time

The existing Bridge was originally constructed in 1927, but has been adapted and repaired since that time. These adaptations include:

- fitting concrete jackets to the piles to guard against sand scour and teredo worm infestation,
- insertion of steel stringers, and removal of redundant wooden stringers,
- layering of a concrete deck above the wooden deck,
- construction of walking path, and
- fitting of guard rails.

The heritage value of the Bridge includes these adaptations over time.

The Bridge is suffering from deterioration and needs significant repair or reconstruction works. Even if all elements were in good condition the Bridge would still have a number of structural and functional deficiencies.



Figure 1: Barwon Heads Bridge

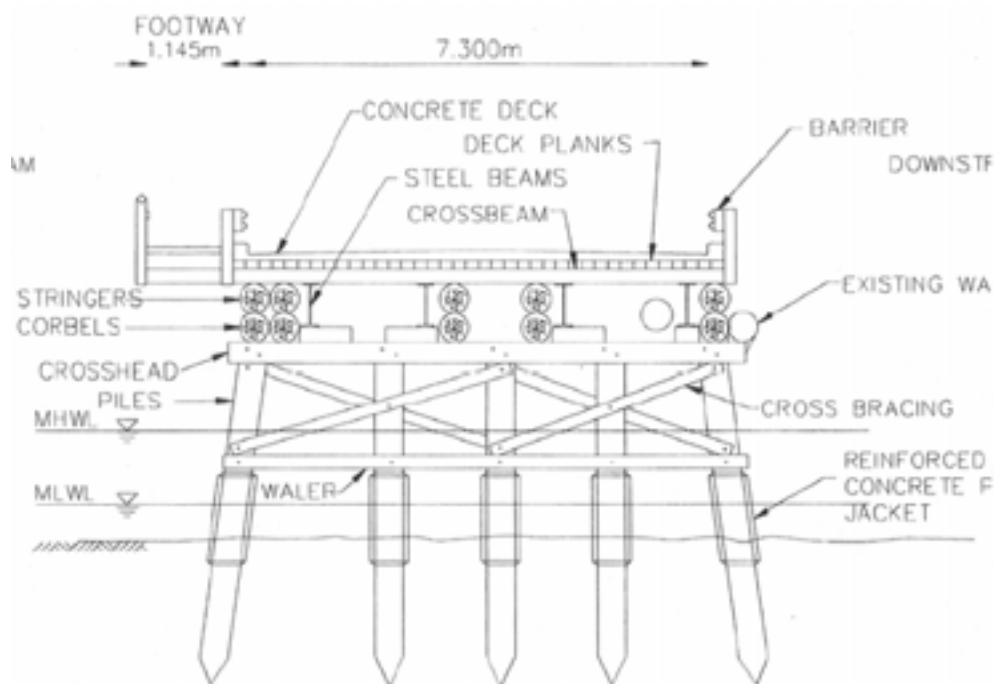


Figure 2: Cross section of the Bridge

Heritage

The Barwon Heads Bridge is listed on the Victorian Heritage Register (H1848) and subject to the Heritage Overlay of the Greater Geelong Planning Scheme. Under the *Heritage Act* 1995, a permit from Heritage Victoria is required to alter or demolish the Bridge.

2.2 A deteriorating asset

The Barwon Heads Bridge is owned and maintained by VicRoads. Over the last several years the costs associated with bridge maintenance have increased to the point where the long term financial viability of the Bridge has been brought into question. Furthermore, recent structural analysis of the Bridge suggested the Bridge has a residual life of 4 – 6 years unless significant rehabilitation works are undertaken to address structural deficiencies.

In response to safety considerations, the load limit on the Bridge has been downgraded from a 44 tonne limit (T44) - which accommodates all vehicles – to 16 tonnes, limiting tourist coaches and freight transport. The Bridge is also considered to be narrow and has:

- single lane access for vehicles,
- no effective clearance between traffic lanes and the Bridge rail,
- conflicts between pedestrian access, recreational cyclists and anglers, particularly during peak holiday periods, and
- limited access for disabled users.

VicRoads has commissioned condition reports on the Bridge for many years. More recently structural engineering reports outlined cost projections for the retention of the Bridge which VicRoads determined were not financially feasible.

2.3 The proposal

In March 2005 VicRoads initiated community consultation in relation to a 'safe and feasible' bridge crossing.

VicRoads investigated three crossing points for replacing the Bridge:

- Corridor 1 – constructing a new bridge along the alignment of the existing Bridge,
- Corridor 2 – building a new bridge along the extension of Geelong Road at its eastern end and linking with the Barwon Heads-Ocean Grove road roughly 500m upstream from the existing Bridge, or
- Corridor 3 – building a new bridge along the extension of Thacker Street in Ocean Grove to connect with Sheepwash or Barwon Heads Roads in Barwon Heads.

These three options were forwarded to the Minister for Planning for consideration. Corridor 3 was excluded from consideration due to the environmental impacts on the Connewarre State reserve.

VicRoads then prepared eight options for replacing the Bridge in Corridor 1 or Corridor 2. The options covered both locations, but also offered height variations to respond to the concerns of boating enthusiasts.

On 20 July 2006 Heritage Victoria, refused a permit application from VicRoads to demolish the Bridge. VicRoads did not appeal the Heritage Victoria decision and the Government decided to retain the Bridge.

Consequently a refined range of options required consideration. These options were:

- To retain and upgrade the historic bridge,
- To retain the old bridge and build a new bridge beside it, or
- To retain the old bridge and build a new bridge further upstream.

These options comprised a range of responses where the Bridge could accommodate vehicle traffic, cyclists and pedestrians or a subset of these groups with a new structure accommodating the other needs. Table 1 describes these options.

A1	Rebuild existing bridge at existing width
A2	Rebuild existing bridge widening to accommodate all users
B1	Rebuild existing bridge for cyclists and pedestrians and construct a new bridge for traffic in Corridor 1
B2	Rebuild existing bridge for traffic and construct a new bridge for cyclists and pedestrians in Corridor 1
B3	Rebuild existing bridge for one-way operation and construct a new bridge for all users also with one-way traffic operation in Corridor 1
C1	Rebuild existing bridge for road traffic and construct a new low bridge in Corridor 2 (Option 5a),
C2	Rebuild existing bridge for pedestrian and cyclists and construct a new low bridge in Corridor 2 (Option 5a) without bicycle lanes or footways
C3	Rebuild existing bridge for road traffic and construct a new high bridge in Corridor 2 (Option 5b),
C2	Rebuild existing bridge for pedestrian and cyclists and construct a high bridge in Corridor 2 (Option 5b) without bicycle lanes or footways.

Table 1: Options for keeping the Bridge

2.4 The Advisory Committee

This Advisory Committee was appointed under delegation on 21 April 2006 pursuant to Section 151 of the *Planning and Environment Act 1987* to hear and consider submissions in respect of the proposal.

The Advisory Committee consisted of:

- Chairperson: Lester Townsend
- Member: Maggie Baron
- Member: Henry Turnbull

Terms of Reference

We were provided with Terms of Reference. The Task for the Advisory Committee as set out in the Terms of Reference was to:

- Assess the overall merits of options for developing a new bridge within Corridors 1 and 2.
- Recommend a preferred option for the redevelopment of the Barwon Heads Bridge (which may warrant more detailed investigation subsequently) having particular regard to:
 - potential environmental, social, cultural (including Aboriginal cultural heritage) and economic effects of the options;
 - relevant strategic planning and land use considerations;
 - the appropriateness of demolishing the Bridge, should the Minister decide to consider the matter under the *Heritage Act 1995*.

Following a refusal of Heritage Victoria to permit the demolition of the Bridge we were given additional options to consider:

- To retain and upgrade the historic bridge.
- To retain the old bridge and build a new bridge beside it.
- To retain the old bridge and build a new bridge further upstream.

2.5 The conduct of the hearings and investigations

All hearings were held at the Thirteenth Beach Golf Links, Barwon Heads.

A Directions Hearing was held on 28 June 2006. At the Directions Hearing the Advisory Committee was notified that Heritage Victoria had received a permit application from VicRoads to demolish the Barwon Heads Bridge and that the application was under consideration.

The Advisory Committee held two days of the hearing, on 24 and 26 July 2006.

On the 20 July 2006 the Executive Director, Heritage Victoria, refused a permit to demolish the Bridge. The State Government subsequently announced that VicRoads would not appeal the decision.

Consequently, the Advisory Committee adjourned the hearings to allow VicRoads and parties to the hearing to respond to the additional options under consideration.

A second Directions Hearing was conducted on 28 August 2006. The hearing recommenced on 11 September 2006 and was conducted on 11, 12, 19, 22, 25 and 26 September and 3, 4 and 10 October 2006.

Inspections

The Advisory Committee members conducted several inspections of the site and surrounding areas, including each side of the Barwon Heads River at both Corridors 1 and 2, the Bluff lookout, the Ocean Grove camping area and Barwon Heads shopping village.

Submissions

The Advisory Committee received over 220 written submissions. In addition to these submissions, the Advisory Committee received a number of postcards. Where the postcard contained only a signature and address the Advisory Committee determined the postcard was effectively part of a petition. These people were contacted by Planning Panels Victoria and advised of that determination. They were also invited to make an additional submission.

The Advisory Committee has considered all written and oral submissions and all material presented to it in connection with this matter.

Inquiries following the hearing

At the hearing we advised that we would discuss our report and recommendations with Heritage Victoria to ensure that our advice was consistent with the approval process that VicRoads would be required to undertake to make alterations to the Bridge. VicRoads advised that they supported this approach. Discussions were subsequently held with Heritage Victoria.

3. Policy context

This section of the report considers the policy context for the proposal and focuses on the strategic and policy issues. It addresses the heritage significance of the Bridge and the relevant objectives and strategies of the Planning Scheme.

3.1 The significance of the Bridge and its setting

The heritage issues relate to the ways the proposed options for the Barwon Heads Bridge affect the heritage values of:

- the Bridge, and
- other heritage places within each corridor.

The Barwon Heads Bridge is listed on the Victorian Heritage Register (H1848). The registration covers the Bridge and its abutments together with land five metres either side of the Bridge and its abutments.

Under the *Heritage Act* 1995, it is an offence to remove, demolish, alter, develop or excavate a registered heritage place without a permit.

The Bridge is also protected by a Heritage Overlay under the Greater Geelong Planning Scheme (HO1537). This covers the Bridge and land 10 metres either side of the Bridge.

Statement of Significance

The Bridge is significant because it is the only surviving large timber bridge associated with the Tourist Road program. At 308 metres it is the second longest timber-piered bridge in Victoria.

It is of scientific (technical) significance for its exceptional size, and as the best illustration of sympathetic modifications to a major timber bridge over time. The issue of modification over time is important for two reasons: it suggests that future modifications may be acceptable, and dispels concerns that the modifications have undermined the heritage value.

This last point is important because some submitters did not consider the Bridge to be significant:

After looking at the Bridge, I conclude that it is a misnomer to suggest that the Bridge is in fact a historical relic-it has been patched with concrete and additional timber over the years and is only the veneer that gives it the appearance of being the heritage structure.

The Statement of Significance for the Barwon Heads Bridge states:

What is Significant?

The Barwon Heads bridge is an exceptionally long timber beam road bridge of 34 spans built over the Barwon River estuary at Barwon Heads in 1927. Despite recent modifications such as the discreet addition of some steel beams and a 7.3 metre wide concrete and bitumen deck that better meets contemporary traffic needs, the Bridge retains much of its historical integrity. The sympathetic modifications have preserved the essential form and aesthetics of a traditional timber bridge with its original driven-pile timber piers, twin pairs of cross-bracing, round timber corbels, old timber stringers, timber crossheads, timber abutments, and timber side railings. A major consideration in choosing the site for this bridge was its proposed tourist function and the desire to provide scenic views of the ocean and broad Barwon River estuary. Set amongst attractive sand dune vegetation at its eastern end, it provides an impressive and aesthetically-appealing profile when viewed from the river banks and is an historic gateway to the town. The Bridge forms a link between major Victorian recreational and tourist districts.

How is it Significant?

It is of historical, aesthetic, and scientific (technical) significance to the State of Victoria.

Why is it Significant?

It is of historical significance for its association with the Country Roads Board Tourist Road's program, a State government-funded initiative that responded to increased motor car ownership and the growing popularity of motor touring during the 1920s. It was a major work in this program, which built some of Victoria's most famous coastal and alpine roads. The Bridge was originally planned as a link in a proposed extension of the Great Ocean Road. It is the only surviving large timber bridge associated with the Tourist Road's program. It is a rare surviving example of a historic timber bridge whose construction helped to shape a town's settlement.

It is of aesthetic significance as a rare historic timber bridge in an estuarine setting. This particularly long, and low, timber bridge is a significant and sympathetic historical component of an outstanding natural and cultural landscape, and provides memorable marine views. The only other comparable historical timber bridge in an estuarine setting, the Hopkins River Bridge at Warrnambool, is scheduled for replacement¹.

It is of scientific (technical) significance for its exceptional size, and as the best illustration of sympathetic modifications to a major timber bridge over time. At 308 metres, it is the second longest timber-piered bridge in Victoria and the longest bridge with timber stringers. The only other largely timber bridge of comparable length in Victoria, Kirwan's

¹ This bridge has subsequently been replaced.

Bridge at Nagambie (310 metres), has had its original timber stringers replaced with steel beams throughout². The durability of the original Barwon Heads Bridge owes much to research into Australian hardwoods at Sydney and Melbourne Universities during previous decades. The Bridge exemplifies the whole evolution of timber bridge construction practice from the 1920s until modern times. No other timber river bridge designed in an era still dominated by horse-drawn vehicles has survived so many modifications to meet changing traffic needs, and yet retains so much of its structural integrity and historic appearance. It is a monument both to the 1920s, and to CRB³ engineering ingenuity over many decades. It is one of very few CRB timber bridges from the 1920s still in operation.

Context and setting

Much of the focus of the consideration of options was of the existing Barwon Heads Bridge. It is also important to consider the setting of the Bridge and in particular the other heritage places within both Corridor 1 and Corridor 2.

The heritage citation includes the following:

In the context of its magnificent estuarine river setting, the Bridge makes both an impressive spectacle when viewed from the banks, and an excellent viewing platform for holiday makers and tourists.

A major consideration in choosing the site for this bridge was its proposed tourist function and the desire to provide scenic views of the ocean and broad Barwon River estuary. Set amongst attractive sand dune vegetation at its eastern end, it provides an impressive and aesthetically appealing profile when viewed from the river banks and is an historic gateway to the town.

It is of aesthetic significance as a rare historic timber bridge in an estuarine setting. This particularly long, and low, timber bridge is a significant and sympathetic historical component of an outstanding natural and cultural landscape, and provides memorable marine views.

The Barwon Heads Bridge is also a rare historic timber bridge in an estuarine setting.

Retaining the Bridge

The evidence presented to us shows that the Bridge requires significant work and repair. This report documents these issues in later sections.

How this work can be undertaken while maintaining the heritage values of the Bridge is a critical issue, and one that ultimately might rest on the detailed design decisions and material specifications.

² This has also occurred on the Barwon Heads Bridge

³ Country Roads Board

3.2 Other heritage

There are a number of other heritage assets potentially affected by this proposal:

- Corridor 1
 - HO 1649 Flinders Heritage Area,
 - HO 1660 bluestone retaining wall at 1 Ewing Blythe Drive,
 - HO 1661 Barwon Heads Park, and
 - HO 1668 1 Flinders Parade, Barwon Heads.
- Corridor 2
 - HO 1658 2 Carr Street (corner Geelong Road).

Under the Greater Geelong Planning Scheme a permit is required to change, alter or demolish a place listed in the schedule to the Heritage Overlay. This would include areas protected under the Heritage Overlay which extends 10 metres either side of the Bridge (that is beyond the Heritage Victoria registration).

3.3 Policy context for a second crossing

The work required to retain the Bridge is governed by the policies and requirements that apply to heritage places. Issues of a second crossing involve a broader range of considerations.

The 'Friends of the Barwon River' submitted that:

The local, municipal and state planning instruments speak with one voice as to the landscape, historic, scientific, habitat and cultural significance of the Barwon estuary and the need to enhance and protect these values.

We generally agree with this assessment of the policy framework that applies to the estuary. It is obvious from the planning policy of the Greater Geelong Planning Scheme that protection of the estuary is a clear objective of state and local policy.

This section provides a brief overview of this policy context. There can be no doubt that there is an overwhelming policy direction to protect the estuary. There is no corresponding or competing policy direction that directly lends support to a second crossing.

3.3.1 The significance of the wetland

The wetland area upstream of the Barwon Heads Bridge is of regional, state, national and international significance.

The site forms part of the Port Phillip Bay (Western Shoreline) and Bellarine Peninsula Ramsar Site and is listed under the Convention on Wetlands (Ramsar, Iran, 1971). These wetlands provide important habitat for migratory birds, waterfowl and endangered species and sustain significant proportions of the Australian populations of these species.

They are remnants of wetland types that were once much more extensive in the Geelong region and elsewhere in Victoria and contain a high diversity of plant and

animal species. The site is also habitat for species listed under an international agreement for the conservation of plants or animals, including the Japan-Australia Migratory Bird Agreement (JAMBA), the China-Australia Migratory Bird Agreement (CAMBA) and the Convention on the Conservation of Migratory Species of Wild Animals (the Bonn Convention).

3.3.2 State Planning Policy Framework

Transport routes

The State Planning Policy Framework (SPPF) clearly sets out that new transport routes are to achieve the greatest overall community benefit when considered against a broad range of factors – not simply transport efficiency.

18.01-2 General implementation

Transport routes should be located to achieve the greatest overall benefit to the community and with regard to making the best use of existing social, cultural and economic infrastructure, minimising impacts on the environment and optimising accessibility, safety, emergency access, service and amenity.

New transport routes and adjoining land uses should be located and designed to minimise disruption of residential communities and their amenity.

Protecting coasts

There is a clear policy direction to protect coastal areas.

15.08 Coastal Areas

15.08-1 Objective

To protect and enhance the natural ecosystems and landscapes of the coastal and marine environment.

To ensure sustainable use of natural coastal resources.

To achieve development that provides an environmental, social and economic balance.

To recognise and enhance the community's value of the coast.

15.08-2 Strategies – General

Land use and development planning should be coordinated with the requirements of the Coastal Management Act 1995 to:

- Provide clear direction for the future sustainable use of the coast, including the marine environment, for recreation, conservation, tourism, commerce and similar uses in appropriate areas.*
- Protect and maintain areas of environmental significance.*
- Identify suitable areas and opportunities for improved facilities.*

Decision-making by planning authorities and responsible authorities should be consistent with the hierarchy of principles for coastal planning and management as set out in the Victorian Coastal Strategy 2002, which are:

1. *Provide for the protection of significant environmental features.*
2. *Ensure the sustainable use of natural coastal resources.*
3. *Undertake integrated planning and provide direction for the future.*

When the above principles have been considered and addressed:

- 4 *Facilitate suitable development on the coast within existing modified and resilient environments where the demand for services is evident and requires management.*

Planning for coastal areas should:

...

Ensure development respects the character of coastal settlements.

Ensure development is sensitively sited and designed.

Protect identified visually significant landscapes, views and vistas in coastal areas.

...

Protect Aboriginal sites and places from inappropriate development.

An application of the SPPF requires us to consider:

- What is the character of Barwon Heads?
- What are the visually significant landscapes, views and vistas in coastal areas?

Section 8.3 deals in more detail with the evidence and submissions in relation to the visual qualities of Barwon Heads, but it is worth stating here that we think the Bridge is an essential part of the character of Barwon Heads, not just for its design or heritage values, but for its relationship to the other elements of the town and foreshore including:

- the main street,
- the hotel,
- the jetty and associated buildings,
- the land form – it crosses the estuary at the narrowest point, and
- the estuary beach on the Ocean Grove side of the river.

We also find visually significant views:

- in the way the Bridge connects to the town,
- upstream from the Bridge to the wide expanse of the estuary, and
- from the estuary beaches and public access points across the expanse of the estuary with the Bridge at the narrowest point.

Had we still been required to determine whether a bridge crossing should be retained in its current location we would have found overwhelming support for the retention

of a bridge crossing in its current location in the coastal planning policies of the SPPF.

3.3.3 Municipal Strategic Statement and Local Planning Policies

The Greater Geelong Municipal Strategic Statement (MSS) sets out a number of objectives and strategies for the protection of heritage assets. These of course all lend support to retention of the Bridge. The MSS explains:

The City takes pride in the wealth and range of its heritage, the retention of which provides a strong tool for interpretation and increased potential for cultural tourism and awareness. The City is working to ensure that the region's significant buildings and historic areas survive to be used and enjoyed by its residents and visitors today – and tomorrow.

The MSS contains a number of strategies related to transport issues. We have reviewed these and find that the only relevant transport considerations relate to bicycle and pedestrian provision – these are discussed in Section 8.12.

The MSS also contains the following relevant objective and strategies in Clause 21.13

Objective 2

To protect and maintain the visual qualities of the City's coastal areas.

Strategies

Protect and enhance viewscales and the characteristics of intervening coastal areas, particularly along major tourist routes.

Objective 3

To manage tourism pressures on the coast to ensure that the values that attract visitors are not compromised or diminished.

Strategies

Discourage the establishment or extension of car parks and roads in sensitive coastal locations.

Discourage the construction of additional structures on the foreshore except where substantial net benefits to the community and/or coastal environment are demonstrated.

Give priority for waterfront access to activities that are dependent on direct access to the marine environment.

Ensure that management and development decisions on the coast enhance the value and attributes of the coast as a public asset.

Clause 21.35 sets out four objectives and a number of strategies for Barwon Heads. These objectives and strategies provide limited guidance to the issue of the Bridge crossing, but importantly identify that growth in Barwon Heads will be limited. The Bridge will not have to cater for significant increases in traffic related to residential growth in Barwon Heads.

Clause 21.32 sets out objectives and strategies for Ocean Grove. Ocean Grove is the principal coastal township in the municipality.

The township has experienced considerable growth in recent years and when the MSS was prepared was expected to grow 15,000 persons by the year 2010.

Ocean Grove acts as a coastal dormitory town to Geelong, a resort town, and a service centre catering to the commercial, residential, recreational and local employment needs of the resident population, surrounding rural hinterland, nearby coastal towns, and visitors.

The resort role of the township is declining despite the provision of substantial visitor accommodation. However, its role as a service centre is expanding as the population increases.

3.3.4 Planning controls

The Barwon Estuary is zoned Public Conservation and Resource Zone together with the beachfront, the Barwon River and shore area and Lake Connewarre Game Reserve.

The purposes of the Public Conservation and Recreation Zone include:

To protect and conserve the natural environment and natural processes for their historic, scientific, landscape, habitat or cultural values.

The Barwon Estuary is covered by Schedule 2 of the Environmental Significance Overlay.

The environmental objectives of the ESO2 Overlay are:

To maintain the ecological character (the sum of the biological, physical and chemical components of the wetland ecosystem, and their interactions which maintain the wetland and its products, functions and attributes) of Ramsar wetlands.

To protect natural resources and maintain ecological processes and genetic diversity.

To protect and ensure the long-term future of terrestrial and aquatic habitat for native plants and animals, including shorebird feeding areas and roosts and species and communities listed under the Fauna and Flora Guarantee Act 1988.

To encourage ecological restoration, regeneration and revegetation with indigenous species within the site and in adjoining areas.

To maintain the function of the wetland or habitat area as part of the broader natural system, including maintenance of natural flows and flooding regimes.

To prevent further loss of wetland habitat.

To manage the site in order to maintain and/or improve its value as a conservation site for native plants and animals.

To protect water quality and prevent water pollution in watercourses, water bodies, wetlands and groundwater.

To protect cultural (including aboriginal and non-aboriginal heritage) values.

To protect visual amenity.

Any crossing of the wetlands upstream of the Corridor 2 would face significant hurdles in dealing with the ecological impact of a bridge structure on the wetlands.

4. Identification of issues

4.1 Summary of issues

Many of the issues raised in submissions were made before the Government's decision to retain the Bridge, and so deal with a range of issues that are no longer directly relevant.

Issues raised in submissions

From the submissions to the amendment, we identified a number of key issues that need to be addressed. These can be summarised as follows:

- engineering issues concerning the carrying capacity and lifespan of the Bridge,
- structural and geological conditions along the corridors,
- costs associated with each of the options under consideration, including maintenance and lifespan projections for 20, 50 and 100 year scenarios,
- traffic matters relating to transport routes, safety, impacts of local business and amenity,
- impacts on the heritage significance of the Barwon Heads Bridge and other heritage features in the locality of both proposed corridors with submissions emphasising its value or questioning its value,
- environmental significance impacts on the Barwon Heads River and estuary,
- issues relating to social impacts, including pedestrian and cycling to the Bridge and boating access to the river estuary,
- the impact of climate change on beach stability,
- the desirability and practicality of wooden bridge structure,
- the visual amenity of the estuary,
- the impact of land acquisition,
- the impact on sailing,
- the impact on camping and beach use,
- the way corridor two would 'split the town',
- the impact on business,
- indigenous heritage,
- air quality,
- flora and fauna issues,
- traffic growth and traffic volumes,
- traffic engineering and road safety,
- the form of an amendment and required changes to the Greater Geelong Planning Scheme, and
- drafting of the proposed planning scheme provisions.

4.2 Approach of the Advisory Committee

The Bridge is to be retained. This project is essentially one of transport and heritage infrastructure renewal. It is not a tourism or urban development project for Barwon Heads. While some submitters thought that the project had opportunities to deliver a range of benefits in terms of improved tourism or nature conservation outcomes, such outcomes remain essentially untested against other similar possible projects in the region.

With the project viewed essentially as transport and heritage infrastructure renewal and with the decision that the Bridge will be retained we have considered the following issues:

What work is required to retain the Bridge? This includes:

- what repairs are necessary?
- what modifications are required to overcome existing or projected deficiencies?
- what are the practical issues with 'constructability'?

What is the most suitable option if a second bridge is required?

What is our recommended approach to resolving the many technical, heritage and practical details of this project?

4.3 Issues dealt with in this Report

We have considered all written submissions, as well as submissions presented to us during the Hearing. In addressing the issues raised in those submissions, we have been assisted by the information provided to us as well as our own observations from inspections of specific sites.

This report deals with the issues under the following issues:

- the condition and integrity of the Bridge,
- deficiencies in the Bridge,
- practical issues in retaining the Bridge,
- issues related to a second bridge,
- identification of a preferred option, and
- the next steps.

5. What needs to be repaired?

5.1 What is the issue?

The need to act

Many of the elements of the existing bridge have deteriorated and need to be repaired or replaced. The poor state of the Bridge is obvious even to a lay observer.

5.2 Evidence and submissions

Assessments undertaken

VicRoads took over responsibility for maintaining the Barwon Heads Bridge from the City of Greater Geelong in 2002, and since that time a number of bridge assessments have been undertaken.

There are three levels of bridge inspection:

- Level 1: Routine maintenance
- Level 2: Bridge condition inspection
- Level 3: Detailed structural engineering inspection

The most comprehensive suite of reports on the Bridge has been compiled by Glynn Jones of SW Engineering Consultants Pty Ltd. In March 2003, Mr Jones undertook a Level 3 (Detailed structural engineering) inspection of the Bridge to assess the condition and life expectancies of the Bridge's various elements and provide recommendations for future maintenance. The inspection was documented in *Report on Barwon Heads Bridge Inspection, March 2003*. This report was supplemented by two additional reports on the crossbeams and bridge deck, which were prepared in June and July 2003.

As a result of these and other reports, a bridge management regime was put in place.

Part of this regime involved monthly Level 2: (Bridge condition) inspections throughout 2005, which were also undertaken by Mr Jones.

In January 2006, Mr Jones produced a new report entitled *Barwon Heads Bridge Condition Report* which provided an update on the estimated remaining life of the Bridge and its elements as well as proposals and cost estimates for its rehabilitation.

This report represents an extension of Mr Jones's 2003 work, drawing on the monthly monitoring inspections he conducted throughout 2005, as well as a report on the condition of submerged sections of the Bridge piles, prepared by Elstone Diving Services in February 2003. This report was not available to Mr Jones during his 2003 assessment of above-water elements of the Bridge.

The experts

Evidence was called by VicRoads from five engineers:
Asset Management and Project Engineering.

- Glynn Jones – SW Engineering. Bridge Inspection, Construction and Maintenance of bridges including evaluation and prioritisation of works – particularly old historic and timber structures. Training of bridge engineers & field personnel in bridge asset management, inspection and maintenance options.
- Phil Vimpani – Maunsell. In June 2006, undertook a peer review of Glynn Jones' 2006 report with reference to a site visit and Mr Jones' 2003 report.
- Len Stevens – Emeritus Professor. Undertook a review of both Glynn Jones' and Phil Vimpani's reports.
- Joe Muccillo – Prepared a theoretical structural analysis of the Bridge.
- Mr Michael Verey – VicRoads' Principal Bridge Engineer. Mr Verey responsible for approving bridge load limits, and recommending maintenance, rehabilitation and upgrade requirements which inform funding applications to Government.

Reports

Documents that the various witnesses relied upon include:

- Barwon Heads Road, Bridge over Barwon River, Level 3 Bridge Inspection – VicRoads Design, June 2000.
- Bridge Load Assessment, Barwon Heads Bridge – Connell Wagner Pty Ltd, 5 July 2002.
- Inspection of Barwon River Bridge, Barwon Heads on Wednesday 5 February 2003 – Craig Elstone, Elstone Diving Services, 28 February 2003.
- *Report on Barwon Heads Bridge Inspection* – SW Engineering Consultants Pty Ltd, March 2003.
- Barwon River Bridge, Barwon Heads, Bridge Coating Condition Assessment – Geopave Materials Technology, May 2003.
- Bridge over Barwon River at Barwon Heads, Report on Structural Adequacy and Rehabilitation Requirements – VicRoads Design, July 2003.
- Barwon Heads Inspection and Report, Cross Beams Study – SW Engineering Consultants Pty Ltd, June 2005.
- *Barwon Heads Inspection and Report, Deck Study* – SW Engineering Consultants Pty Ltd, July 2005.
- Monthly Monitoring Inspections – SW Engineering Consultants, January – December 2005.
- Three-monthly Monitoring Inspections – SW Engineering Consultants, March and June 2006.
- Barwon Heads Bridge, Peer Review of SW Engineering Consultant's Structural Condition Report (Also includes Review of Papers by Peter Yttrup) – Maunsell/AECOM, June 2006.
- Barwon Heads Bridge, Structural Integrity of the Existing Bridge – Professor Emeritus Len K Stevens, 18 June 2006.

- Barwon Heads Bridge, Review of Additional Documents Relating to Inspections – Emeritus Professor Len K Stevens, 21 June 2006.
- Barwon Heads Bridge Condition Report, Comments on the Maunsell/AECOM Peer Review – SW Engineering Consultants, 12 July 2006.
- Barwon Heads Bridge, Theoretical Structural Analysis, Maunsell/AECOM, July 2006.
- Report on Structural Integrity of Barwon Heads Bridge (Addendum) - Professor Emeritus Len K Stevens, 25 July 2006.
- Barwon Heads Bridge, Report Implications following Review of Structural Assessment – Maunsell/AECOM, 26 July 2006.
- *Comments on Treatment Options* – SW Engineering, 15 August 2006.
- Cost Estimates for Barwon Heads Bridge – Maunsell Australia, 21 August 2006.

5.3 Discussion

5.3.1 Piles

Photographs of the condition of the bridge piles are shown in Appendix B.

In his 2006 report Mr Jones concluded that all piles have suffered extensive deterioration over the years due to general wear and tear, Teredo worm attack and sand scour. Teredo worm is a salt water worm that attacks wooden marine structures including ship's hulls – it requires aerobic conditions. Sound scour is the physical abrasion of the piers from sand shifted by the tides or currents.

Many piles have split and are reinforced with splints and/or bands which themselves show signs of significant deterioration and are in need of replacement. Some piles have been spliced; the deteriorated section of pile above the sea bed has been removed and a new section of pile fitted in its place.

Almost all piles have been provided with concrete jackets in order to overcome or protect against the effects of Teredo Worm attack and sand abrasion. These present difficulties in identifying maintenance requirements and undertaking maintenance. Concrete jackets around recently spliced piles hamper inspections of splice condition.

Table 2 provides a comparison of remaining life estimates for piles provided by SW Consultants between 2003 and 2006.

Mr Vimpani concluded that the 2003 survey that included detailed coring of timber elements provided a good indication as to the extent of deterioration of these elements:

This testing therefore provided a very good basis for the assessment of the integrity of these elements. Details of the condition/remaining life estimates for piles from this survey is included in [the]Table

As can be seen from this survey the assessed pile condition has changed significantly from this survey of three years ago. The percentage of piles assessed as being in a good condition (be it with a

slightly different proposed remaining life) has changed from 62% in 2003 to the estimated 3% in 2006. This extent of change is difficult to justify considering the absence of timber drilling that has occurred since the 2003 survey.

There is some debate about the residual life of the piles and Mr Vimpani concluded that Mr Jones' 2003 estimate of residual pile life may have been slightly optimistic whereas Mr Jones' 2006 estimate may be slightly pessimistic resulting in a higher than expected deterioration rate over the intervening period.

Element	Condition	Remaining life	Percentage
Life Estimate Based on Test Samples and Observed Defects 2003	Good	10-15 Years	62%
	Fair	6-10 Years	36%
	Poor	0-5 Years	2%
Life Estimate Based on Observed Defects 2006	Good	10-15 Years	3%
	Fair	6-10 Years	72%
	Poor	0-5 Years	25%
Life Estimate Based on Estimated Defects 2006	Good	10-15 Years	3%
	Fair	6-10 Years	50%
	Poor	0-5 Years	47%

Table 2: Comparison of remaining life estimates for piles provided by SW Consultants (Glynn Jones) between 2003 and 2006

While there may be some debate about the precise condition of the piles there is no doubt that the majority are in poor condition and need to be replaced. It is worth stressing that in the context of the existing piles 'good' covers a relatively short time span (10 – 15 years) there was no evidence that the Bridge piles had a longer life than this. This replacement could consist of a new pile or a sliced pile. Depending on the method chosen and the program of works adopted complete or staged replacement of the piles would be possible.

Len Stevens concluded that where piles show signs of significant deterioration or severe splitting, the risk and consequence of failure is considered moderate in the long term without replacement or reinstatement of the defective sections.

The piles are structurally adequate provided that they are in sound condition, but that a split pile would experience stresses exceeding acceptable limits for a T44 load. For pedestrian loadings, stresses to a split pile would be within acceptable limits.

It is important to note that pedestrian loading must cater for a fully loaded bridge (a New Years Eve crowd for example) and so in practice equate to approximately a 15 or 16 tonne vehicle limit.

Joe Muccillo considered prudent to replace split piles as such splits could lead to further deterioration mechanisms such as rotting within the centre of the pile.

Having considered this issue we conclude that:

The current condition of piles is poor due to many defects including splits and rot.

A clear majority of piles need to be replaced within 10 years if not sooner.

Whether the piles are replaced as part of a comprehensive program or more gradually, and whether they are re-driven or spliced depends on a range of considerations discussed elsewhere in this report. The starting point for these other considerations, however, is that all the piles need to be replaced if the Bridge is to be retained over the long term.

5.3.2 Crossheads

Photographs of the condition of crossheads are shown in Appendix B.

Glynn Jones (2006) concluded that the crossheads are generally in fair condition except on the downstream side where continual wetting from runoff from the large water main has caused rusting and swelling of the crosshead bolts resulting in vertical splitting of many crossheads. Some crossheads show minor deterioration under the steel beam stringers.

The crossheads should sit on rebates in the pile tops, but this is not always the case. For Michael Verey the crosshead to pile connections are the most concerning feature of the bridge. The crossheads do not sit properly on the piles because of the poor condition of the tops of piles, inadequate seating of crossheads and the condition of crosshead ends.

Having considered this issue we conclude that:

The current condition of the connection of the crossheads to the piles is poor. The seating of the crossheads on the piles need to be repaired, remediated or strengthened.

Another pertinent consideration is that the current size of the crossheads is insufficient to meet modern loads and the connections between the crossheads and the piles are deficient. This is discussed in the next chapter.

5.3.3 Pier Bracing and Walers

Photographs of the condition of bracing are shown in Appendix B.

Glynn Jones (2006) assessed the pier bracings as ranging from just satisfactory to good in condition.

Cross braces and lower waler members were found to have adequate structural strength when considering vertical loads on the Bridge. It is noted that cross braces and walers serve an important role in resisting the effects of horizontal loading such as flood, wind loading and vessel impact and these were not assessed in the theoretical analysis.

Having considered this issue we conclude that:

The current condition of the bracing and walers is satisfactory to good.

5.3.4 Stringers, Corbels and Cross Frames

Photographs of the condition of stringers, corbels and cross frames are shown in Appendix B.

The wooden stringers have deteriorated and most (or perhaps all) have been removed. The wooden stringers have not served a structural function since the steel stringers were introduced.

The steel stringers are still structurally sound, although the surface coating has deteriorated. All steel stringers could be cleaned and painted to lengthen their life.

The support for these beams is provided by timber packers which are subject to long term deterioration and crushing which could seriously reduce their capacity.

The effects of corrosion, on both the effective section and possible fatigue cracking, need to be considered, particularly around welds. The weld quality, with respect to fatigue details, is variable according to Mr Steven's (limited) observations with some in the poor category.

Having considered this issue we conclude that:

The wooden stringers serve no structural function.

The current condition of the steel stringers and cross frames is generally good.

5.3.5 The deck

Photographs of the condition of the deck are shown in Appendix B.

The original deck consisted traverse planks, but this was modified early in the Bridge's life to a system of traverse cross beams and longitudinal planks. In 1980 this modified deck structure was overlaid with concrete.

Glynn Jones (2006) stated:

Deterioration has occurred in the cross beams along the Bridge centreline due to the ingress of water through the longitudinal joint in the concrete overlay. This has resulted in the collapse of a few crossbeams and resultant loss of support for the longitudinal timber deck planks which are, in turn, supporting the concrete overlay. This exacerbates the tendency for cracking in the overlay. More crossbeams will collapse in the short term as water continues to permeate the deck cracks.

If the deck crossbeams fail in conjunction with decking failure, then the concrete overlay will crack resulting in a hole that would be dangerous to motorcyclists. Even so, the risk of this occurring was considered moderate only.

Phil Vimpani noted that:

- The Jones report has identified deck movement and the development of holes in the deck as a likely risk following the deterioration of these elements.
- Cracking would be a significant risk for a motorcyclist should it be allowed to develop further.
- The impact of loading on the long term integrity of the deck will require works to be undertaken.

Mr Vimpani concluded that the deck of this structure is relatively thin when compared to conventionally reinforced concrete bridges and most probably uses the strength of the original timber deck positioned under the overlay to provide local support to the deck structure. Local damage to the deck was observed under one section of the deck where failure of the supporting timber had occurred. Generally the deck is in a fair condition.

The concrete deck overlay limits access to the underlying timber deck planks for inspection and maintenance purposes.

Mr Verey reached the conclusion that:

It is my view that this limitation in access is partially responsible for the differences in opinion between Glynn Jones and Phil Vimpani on the extent of deterioration in the deck planks and therefore the difference in opinion in the maintenance requirements.

Mr Muccillo found the transverse timber deck members to have adequate strength to accommodate all the load cases considered when assumed to be in 'good' condition. Deterioration in these members was considered in the form of section loss, particularly under the longitudinal joint in the concrete overlay where water ingress has resulted in rotting in these timber members. Based on the assessed deterioration scenarios the stresses in these members were found to exceed acceptable limits for T44 loading but were acceptable for the 16 tonne vehicle.

As the timbers supporting the concrete overlay rot or soften, they fail to provide support to the concrete overlay which results in cracking. The risk of sudden failure is small, particularly if the current load limit is observed. However, the risk of deck cracking is a reality as cracking is currently occurring.

If planks are defective the concrete overlay acts to distribute the wheel loads to adjacent planks. This is effective for up to two adjacent defective planks but beyond this the concrete overlay will have insufficient flexural capacity to continue to act in this capacity and structural failure of both overlay and deck planks could occur with limited warning.

The risk of failure and its consequences are unacceptable in the long term without continual replacement and repair of the deck timbers. This replacement or repair is not practical where the timber underlies a concrete top. Repair or replacement means repair or replacement of the timber and concrete overlay.

Having considered this issue we conclude that:

The current condition of the deck timbers is poor. The deck needs significant repair or replacement.

5.3.6 Railings and Barriers

Glynn Jones (2006) concluded that the existing pedestrian railing should serve another 8 -10 yrs with routine maintenance. The existing lane side guardrails are corroded badly and holes are starting to appear. They have an estimated residual life of between 0 and 5 yrs. The guardrail does not meet Code requirements or that required for cyclists.

Phil Vimpani agreed that the railings and barriers need to be replaced.

Mike Verey Existing barriers do not satisfy current standards for traffic, pedestrians and cyclists and should be upgraded to AS5100 standards. He noted that replacement of the existing deck with a composite reinforced concrete deck will allow effective fixing of code-compliant barriers.

Having considered this issue we conclude that:

The current condition of the rails and barriers is poor and they do not meet relevant standards. The railings and barriers need replacement.

5.4 Conclusion

Conclusions on individual elements

In this section we have reached the following conclusions about work need for individual elements:

- A clear majority of piles need to be replaced within 10 years.
- The seating of the crossheads on the piles need to be repaired, remediated or strengthened.
- The deck needs significant repair or replacement.
- The railings and barriers need replacement.

Overall condition

Glynn Jones (2006) estimated residual life of the Bridge, without heavy maintenance, is 4-6 yrs, and concluded that the Bridge has reached its 'use by date'.

Despite some disagreement as to the extent of deterioration and condition of elements, Mr Vimpani largely agrees with the remaining life estimates provided by Mr Jones.

For options where no maintenance would be undertaken on the Bridge, Mr Vimpani agrees with the 4-6 year remaining life estimates proposed for existing loads or for the use of this bridge for pedestrian or cyclist use only.

Mr Vimpani (writing on behalf of his firm Maunsell) stated:

Despite some disagreement as to the extent of deterioration and condition of elements, Maunsell largely agrees with the remaining life estimates provided in SW 2006 report.

For options where no maintenance would be undertaken on the Bridge, Maunsell agrees with the 4-6 year remaining life estimates proposed for existing loads or for the use of this bridge for pedestrian/cyclist use only.

If the Bridge is to be regularly maintained, Maunsell is in agreement with element[s] ... that need work.

We heard a great deal of evidence about the condition of the Bridge and all evidence is in general agreement on the current condition of the Bridge. It would be wishful thinking to attempt to preserve the Barwon Heads Bridge by simply patching or replacing elements as they fail. We think that such an approach would not be a sustainable management regime for this important heritage asset. We think that it is important to act now to properly restore this valuable Victorian heritage asset.

Having considered this issue we reach the overall conclusions that:

The Barwon Heads Bridge is in need of significant repair and restoration and that requires the replacement of a number of the elements of the Bridge.

6. Deficiencies in the current Bridge

6.1 What are the issues?

In the course of the various investigations carried out it has become clear that the Bridge has a number of deficiencies.

The theoretical analysis undertaken by Joe Muccillo of Maunsell AECOM concluded that if the poor materials in the Barwon Heads Bridge were replaced like for like but not upgraded the following deficiencies would still exist:

- Crossheads would not be of sufficient strength to enable the Bridge to carry all legal vehicles.
- Pedestrian railings and roadside barriers would not comply with Code requirements.

The Bridge also fails to cater properly for pedestrians and cyclists, and the Bridge or its approach roads may not cater adequately for future traffic growth.

6.2 Structural problems with the crossheads

6.2.1 Evidence and submissions

Size of crossheads

The Theoretical Analysis undertaken by Joe Muccillo indicates that the existing timber crossheads are not large enough to support a 44 tonne limit (T44) on the Bridge even when in good condition.

The bending and shear stresses in the pier crossheads were found to be well in excess of the requirements of the relevant Australian Standard for the case of T44 loading and marginally over when considering 16 tonne vehicle and pedestrian loading on the walkway.

If the concrete deck overlay were to be removed, then the crossbeams would be adequate for pedestrian loadings.

For the Bridge to cater for all legal vehicles with the stringers in their current location the crossheads need to be upgraded.

Phil Vimpani advised that a timber crossbeam would need to have dimensions of at least 425 mm deep and 200 mm wide to cater for the Bridge to cater for T44 loadings (compared with the existing crossheads that are 300 mm by 150 mm). It is not clear whether timber crossheads of this size are readily available.

Location of stringers

Part of the problem with the loading on the crossheads is that the steel stringers do not sit directly above the Bridge piers. A design where the stringers were closer to the piers would reduce the loading on the crossheads.

Connection with piers

Bearing stresses in the crosshead at its connection to the pile were found to exceed the requirements of the relevant Australian Standard under most loading conditions considered even connections were assumed to be in good condition. For the purposes of this assessment the crossheads were assumed to bear on a 50 mm rebate cut into the side faces of the piles. Observations by the experts of actual conditions indicate that bearing stresses could be even higher than determined in this analysis.

In Len Stevens' view a loss of support of the cross head to the pile – say from the failure by bearing over-stress or local rotting in the cross head or pile top – would result in very a large over-stress and resultant very high risk of failure.

6.2.2 Discussion

The critical issue is how T44 loading might be catered for at Barwon Heads. There are three options:

- there is no crossing that caters for T44 loadings,
- the restored Bridge caters for T44 loadings, or
- the restored Bridge caters for T16 (pedestrian) loadings and a parallel crossing caters for T44 loadings.

These options invite a number of questions.

Does the crossing need to cater for T44 loadings?

Given the length of the alternative route we think that it is important that the crossing cater for a T44 loading, either on the Bridge or a parallel bridge. If the Bridge only catered for T16 then a truck or bus operator with a higher mass vehicle who needed to cross the Bridge would be faced to choose between an illegal crossing of the Bridge or a detour of over 40 kilometres. We are not confident that all operators will choose to bypass the Bridge and this raises serious safety concerns over the life of the Bridge.

What changes are required for T44 loading on the Bridge?

Any repairs of the Bridge to achieve T44 loadings need to address the issue of the structural integrity of the crossheads and their connection to the piers.

Mr Vimpani recommended that steel crossheads be used and Mr Verey agreed with this recommendation. Replacing the timber crossheads with steel crossheads would enable the T44 loading to be achieved with a similar sized element to the existing wooden crosshead. Further, some bracing or bracketing of the connection of the crossheads to the piers may be needed.

Part of the problem with the size of the crosshead is that the steel stringers do not sit directly above the piers. Relocating the stringers might mean that a wooden crosshead of the current dimensions could be used.

Ultimately a judgement needs to be made whether the changes needed to achieve a T44 loading are acceptable on heritage grounds. If one accepts the view that a T44 loading is needed, then ultimately a choice might need to be made between steel crossheads and a complete new bridge. In this case we think the obvious choice is steel crossheads.

6.2.3 Conclusions

Having considered this issue we recommend:

The crossing cater for T44 loading.

Having considered this issue we conclude:

Adapting the Bridge to cater for T44 loadings would involve:

- **relocating the existing steel stringers above piles, and recalculating the loadings on the crossheads in this revised configuration.**
- **replacing the crossheads in timber of the same dimension as existing or in steel of the same dimension as the existing timber crossheads following a reassessment of loadings on crossheads following the relocation of the stringers.**
- **redesigning the connection of the crossheads to the piers be to cater for the projected loadings.**

6.3 Railings and Barriers

6.3.1 Evidence and submissions

The railing does not meet current requirements of 1.1m minimum height, and there are no vertical balustrades (required at 130 mm centres) to prevent small children from falling through the railing into the river. A new railing is required to overcome these obvious deficiencies.

Less obvious is that the railing does not meet strength requirements. Mr Verey stated:

Given that the existing bridge is to be retained and, rehabilitation or reconstruction options are being developed for long term use of the Bridge, it is essential, in my view, that the rehabilitation or reconstruction include replacement of the existing railings and barriers with ones that comply with AS 5100 requirements in order to provide adequate safety for road users as well as inspection and maintenance workers. The need to provide such protection for road workers is also mandated by Section 28 of the Occupational Health and Safety Act, 2004.

6.3.2 Discussion

The existing bridge deck, which comprises a thin concrete overlay on top of timber planks and timber cross beams cannot provide adequate support for barriers installed to Code standard. Alternative fixing methods or a replacement deck need to be considered.

In relation to alternative fixing methods Mr Verey advised that there were two alternatives that retained the existing deck:

- the barriers could be attached to the steel stringers via brackets. An upgrading of the steel crossframes (the bracing between the steel stringers) would be required to enable the stringers to resist moments that would be generated if a vehicle hits the barriers, or
- the barriers could be fixed through the Bridge deck to new steel crossbeams installed at 1.5 to 2.0 metre centres. The provision of additional crossbeams at such frequencies would severely reduce the ability to identify deterioration in the timber deck planks and undertake maintenance works.

Both these fixing methods introduce a significant amount of additional steel to the Bridge, which will require frequent and continuous maintenance due to the marine environment.

An alternative is to remove the existing concrete overlay, timber planks and timber crossbeams and replace them by a new composite concrete deck which would provide good support for code-compliant barriers without the need for additional steel elements.

Such a new deck would remove the heritage fabric on the crossbeams and planks. These are only now visible from underneath the Bridge.

6.3.3 Conclusions

Having considered this issue we conclude:

Adapting the Bridge to provide for code compliant rails on the Bridge would require the deck (including remnants of the original wooden deck) to be replaced in concrete.

6.4 Traffic lanes and barrier clearance

6.4.1 What is the issue?

There are minimum standards set for the width of traffic lanes and the clearance from roadside barriers. The existing Bridge does not meet these minimums and is too narrow according to the standards.

6.4.2 Evidence and submissions

AS5100–2004 is the Australian Standard for Bridge Design – AS5100.1–2004 deals with scope and general principles including geometrics and durability while AS5100.2–2004 deals with design loads.

To provide adequately for the potential traffic on the Bridge, including busses, a lane width of 3.5 meters is appropriate.

Section 9 of AS5100.1-2004 specifies geometric requirements for bridges. Table 9.5 specifies that the clearance between roadside barriers and traffic lanes should be 1.2 metres although VicRoads has accepted that this may be reduced to 1.0 metres for the new two-way bridges.

6.4.3 Discussion

To meet requirements for 3.5 m wide traffic lanes with 1.0 m clearance to barriers a minimum distance of 9 metres would be required – this is an increase of 0.6 metres on the current width (slightly more than the width of a footpath). It may be possible to dispense with the railing between the footpath and the traffic lane – after all this is the condition on most roads; this would reduce the need for increased width to address road geometry issues.

6.4.4 Conclusion

Having considered this issue we conclude:

Adapting the Bridge to provide adequate clearances to barriers would involve providing 3.5 metre wide traffic lanes with 1 metre clearances to barriers.

Having considered this issue we recommend:

The crossing provide:

- **traffic lanes of no less than 3.5 metres, and**
- **clearance between traffic lanes and bridge barriers or kerbs of 1.0 metre (with provision of a stand up kerb and not a barrier between any shared path or foot path and traffic lanes).**

6.5 Pedestrian and bike access

6.5.1 What is the issue?

The Bridge currently provides for a 1.145 metre wide pedestrian path along the north (upstream) side. This is generally inadequate to cater for pedestrians and recreational cyclists.

6.5.2 Evidence and submissions

Clause 21.26 of the Greater Geelong Planning Scheme states:

Planning for travel by bicycle and for pedestrians is an important consideration in the preparation of local township structure plans and outline development plans for new growth areas. To maintain and foster further bicycle and pedestrian movements across the City future 'outline' planning needs to ensure that new facilities are provided and adequately link new areas into existing networks. These networks form key components of Council's open space system.

This clause sets out the objective (Objective 4):

To develop a comprehensive network of cycling routes and infrastructure linking city, coast and country, that identifies cycling as a legitimate form of transport for commuter, recreational and personal travel.

Strategies under this objective include:

Link the bicycle network to the open space network with the continuing shared use of pedestrian/cycling pathways.

Ensure that the bicycle network is planned through outline development plans, structure plans and subdivision proposals.

The objectives and strategies for Ocean Grove (Clause 21.32) include:

Objective 7

To provide a safe and efficient transport network within the township.

Strategies

Provide pedestrian and cycle paths to link schools, community facilities, recreation areas and nearby townships.

The objectives and strategies for Barwon heads (Clause 21.35) include:

Objective 4

To create a walking and cycling loop around Barwon Heads linking all major open spaces and to maintain these open space assets.

Strategies

Encourage the establishment of pedestrian and cycling linkages between significant public open space assets and community and commercial facilities.

In addition to concerns relating to the narrowness of the Bridge, Ms Davies, who provided social planning evidence, noted that the condition of the Bridge presents a number of concerns in relation to pedestrian users:

- the timbers on the walkway are rotted resulting in timber lifting and presenting a tripping hazard,
- fastening nails work loose and present a hazard, and
- there are gaps in the boards and the existing guardrail between the walkway and road is below current safety standards in relation to strength and height.

6.5.3 Discussion

Shared paths are typically provided at 2.5 metres width, or 3 metres in more heavily trafficked areas.

We think that the crossing should cater adequately for pedestrian and cyclists and see strong support for this contention in the Greater Geelong Planning Scheme.

Many of the cyclists who will potentially use the Bridge will be younger people on holiday, or recreational cyclists. In this regard provision of a shared bike path is likely to be more suitable than an on road facility. Provision of a three metre wide shared path on the Bridge would represent the minimum level of infrastructure to cater safely for cyclists. We expect that in summer months at periods of high use cyclists may need to dismount, but during the off season or when riding to the shops early in the morning in summer for a newspaper or milk a cyclist would have a reasonably unobstructed path on a three metre wide shared path.

6.5.4 Conclusion

Having considered this issue we conclude:

Adapting the Bridge to cater for an acceptable minimal level for pedestrians and cyclists would involve providing a three metre wide pedestrian and cycling path along the upstream side in addition to fishing platforms.

Having considered this issue we recommend:

The crossing provide better for pedestrians and bicyclists by providing a shared path at least 3.0 metres wide.

6.6 Coping with traffic growth

6.6.1 What is the issue?

Traffic studies were undertaken to determine project traffic growth and impact on Barwon Heads. These studies included projections of traffic volumes as well as traffic origin–destination surveys and traffic modelling.

In terms of traffic projections a potential issue is whether the crossing will need to cater for significantly more traffic in the future.

6.6.2 Evidence and submissions

VicRoads called Stephen Pelosi of Maunsell who had made projections for future traffic demand between Barwon Heads and Ocean Grove.

At the hearing Mr Pelosi explained that the study had been a desk-top study and he had not constrained his predictions based on the environmental capacity of the approach roads, particularly along the Ocean Grove spit.

6.6.3 Discussion

We had great difficulty understanding the logic behind the traffic growth predictions which seemed to take no account of the environmental capacity of the surrounding road network and hence the real likelihood that the projected volumes would ever emerge. It makes no sense in this situation to project traffic volumes on the assumption that the road network is unconstrained, and then to use these figures as input to traffic distribution models based on the constraints of the network.

Traffic modelling can be used for a number of purposes. Two of the most common are: determining capacity requirements to cater for growth, and projecting the impact of new development on the road network.

When using traffic modelling to determine capacity requirements to cater for growth the aim of the exercise is to determine the network requirements to achieve a certain level of service. In this approach certain land use assumptions are made and trip generation rates are assumed. The traffic modelling is used to answer the question ‘what network capacity is required to cater for this urban growth?’

When traffic modelling is used to assess the impact of development a different question is asked: ‘what will be the effect of this growth on the existing network?’ Of course, at times both questions are asked.

In the evidence presented to us the question seemed to be: ‘how much more traffic will be there be if we project growth trends?’ We are unconvinced that this question makes any sense.

There are obvious traffic capacity constraints in the approach roads to any crossing of the Barwon River estuary, and in busy times much of the traffic is leisure and

recreation traffic and hence more easily able to take alternative routes or choose alternative destinations. In this situation traffic projections in the absence of a proper assessment of the broader context makes little sense.

6.6.4 Conclusion

Having considered this issue we conclude:

Two traffic lanes are adequate to meet future vehicular traffic demand.

7. Practical issues in retaining the Bridge

7.1 Maintaining traffic access

7.1.1 What is the issue?

Traffic flow needs to be maintained across the estuary during construction. This means:

- the works on the Bridge are carried out in a way that provides for traffic access,
- a temporary bridge is constructed, or
- a new bridge is needed.

7.1.2 Evidence and submissions

Using the Bridge during repair

If alternating one-way traffic flow is considered acceptable throughout the construction period, then a variation on construction methodology as suggested by Phil Vimpani could be used to retain traffic access.

For a rebuilding of the Bridge (Option A1) Phil Vimpani's construction methodology involves:

1. Relocate existing footway to the downstream side of the Bridge,
2. Demolish 3.5 metre wide upstream section of the Bridge,
3. Rebuild 5 metre upstream section of bridge and metre footway,
4. Demolish relocated footway on downstream side of bridge,
5. Demolish 4.65 metre downstream section of existing bridge,
6. Rebuild 3.16 metre downstream section of bridge.

The end result of this bridge construction methodology is that the rebuilt bridge will be on an alignment approximately 1.5 metres upstream of its current location.

We note that Mr Lovell supported this approach in principle, but we acknowledge that any adaptation and repairs will require approval under the *Heritage Act*.

For a rebuilding of the Bridge with significant widening (Option A2) Phil Vimpani's construction methodology involves:

1. Construct new 6 metre wide section of bridge, including footway, on downstream side of existing bridge,
2. Rebuild existing bridge.

The end result of this bridge construction methodology is that the existing alignment of the upstream side of the Bridge is maintained with the widening occurring entirely on the downstream side.

Temporary bridge

A temporary bridge would add in the order of 30 to 40 per cent to project costs – about \$7 million for a single lane crossing. Finding temporary bridge elements may not be straight forward.

VicRoads' inventory of temporary bridge elements within Victoria is not sufficient to provide a full single lane crossing of the Barwon River 7. The shortfall may be able to be sourced from interstate but further investigations would be required.

There would also be a significant cost penalty and possible time delay as temporary bridge elements are sourced.

New bridge

Building a new road bridge substantially removes issues of constructability. A new pedestrian bridge could be designed to serve as a temporary crossing provided it was designed with sufficient strength and width in the deck.

We note that the option proposed by VicRoads for a parallel pedestrian bridge required such a bridge to be over 5 metres wide and designed to cater for T44 traffic. We think that a T44 standard is excessive and the emphasis for a pedestrian bridge should be on a light weight design. A pedestrian bridge would still require a T16 load capacity. However, if the bridge is to serve traffic needs during works to the existing Bridge and provide for emergency access in case of a breakdown or accident a width in the order of 5 metres will also be required.

If needs be the new bridge could be designed with a temporary road function and then completed to its final pedestrian configuration.

7.1.3 Discussion

There is a clear need to maintain some road access during construction though there will clearly be significant disruption. It would only be practicable to maintain two way traffic if a new road bridge is constructed.

The heritage impact of repair works on the Bridge is not simply any increased deck width or change in material and design detail. It potentially includes a change to the alignment of the bridge so that works can be undertaken due to the treatment of the piles while also allowing a lane of traffic to be accommodated during construction.

7.1.4 Conclusion

Having considered this issue we recommend:

One way traffic be maintained during reconstruction.

Having considered this issue we conclude:

The use of a temporary bridge would add significantly to the cost of the project.

A slight change in alignment of the Bridge may be required if the Bridge is to provide for continued access during reconstruction.

A new pedestrian bridge adjacent to the existing Bridge could be designed to act as a temporary one way road crossing.

7.2 Rehabilitate or reconstruct?

7.2.1 What is the issue?

There is a choice between rehabilitating and repairing the Bridge in a more gradual manner, or in reconstructing the Bridge. This choice is critical in two elements:

- whether the deck is repaired or replaced, and
- whether the piles are repaired by splicing or new piles are driven.

Some of these differences in opinion relate to different life expectations of the repaired or rehabilitated bridge.

Costings were presented for a rehabilitation option that spread works over a more extended time period and a 'reconstruction' option where the works were carried out over a shorter period.

7.2.2 Evidence and submissions

Repairing or replacing the deck

The deck consists of a concrete overlay on wooden planks and crossbeams. As the wooden crossbeams and planks have deteriorated the deck has cracked. The choice is between replacing the deck (with a new concrete deck) and continuing to patch it.

Splicing or re-driving the piles

As concluded earlier, all of the piles will require replacement in the short to medium term. Mr Jones originally recommended the complete replacement of piles by driving new piles. In its peer review of Mr Jones recommendations Maunsells advised that piles could be sliced rather than replaced.

Piles are spliced by cutting out the existing pile from just below the level of the sea-bed and joining a new section of pile to the section that remain in the ground. This involves construction crews working underwater. A number of the piles on the Bridge have already been replaced by spliced piles.

Mr Jones (while considering Maunsells review to be fair) provided this comment on splicing:

... I disagree with the proposal to splice the piles particularly in such an aggressive environment where teredo worm is present and constant wetting and drying occurs. Maunsells have now defined the splice level as being at sea-bed level, and a system using a 2 metre steel shell, and filling any voids with epoxy adhesive.

In making these recommendation Maunsells accepted that spliced piles provided a lower quality of finish:

We have also proposed alternatives to replacing members (eg splicing of piles rather than replacing piles ...). These options are considered to be lower cost alternatives but do not provide the same quality of finish.

Heritage implications

Mr Lovell stated that conventional heritage conservation would not generally support ‘wholesale’ replacement (reconstruction) of the Bridge, but you may decide to do so at a point in time, effectively undertaking 20 years of repairs within a shortened timeline. He stated that the Burra Charter would support this approach as a practice. This point is raised in his written statement:

This aspect of the history of the Bridge – the fact that the structure does not necessarily have a high degree of intactness to its original form and materials – is acknowledged in the Heritage Victoria citation, and moreover is seen as contributing to the significance of the Bridge, as the following extracts from the citation indicate:

The Bridge exemplifies the whole evolution of timber bridge construction practice from the 1920s until modern times. No other timber river bridge designed in an era still dominated by horse-drawn vehicles has survived so many modifications to meet changing traffic needs, and yet retains so much of its structural integrity and historic appearance. It is a monument both to the 1920s, and to CRB engineering ingenuity over many decades.

It is one of very few CRB timber bridges from the 1920s still in operation.

...The sympathetic modifications [to the Bridge] have preserved the essential form and aesthetics of a traditional timber bridge with its original driven-pile timber piers, twin pairs of cross-bracing, round timber corbels, old timber stringers, timber crossheads, timber abutments, and timber side railings.

He also commented on the impact of rebuilding the Bridge with new material. He noted that the new material would have no intrinsic value but that reconstructing the Barwon Heads Bridge in a precise manner would support the heritage values. He referred to the case of the recently rebuilt kiosk on St Kilda pier.

He further elaborated that the reconstruction could re-use structurally suitable elements such as the cross-bracing, stringers and corbels.

Costs

In determining the most appropriate rehabilitation or reconstruction option, consideration needs to be given to both the initial construction cost and the ongoing maintenance costs that will be influenced by the initial standard of construction.

Mr Vimpani produced construction and long term maintenance cost estimates for:

- A total rebuild of the Bridge to suit future use requirements;

- A partial rebuild of the Bridge to suit future use requirements.

Each construction option would lead to different ongoing maintenance requirements. For each of the options, a summary of the initial construction costs and 100 year life cycle costs is tabulated below.

Table 3 shows the cost difference between rehabilitation and reconstruction. The table shows that the cost differences are not significant.

Option	Cost advantage (-disadvantage) of rehabilitation over rebuilding			
	20 year timeframe		100 year timeframe	
	Total cost \$Ms	NPV ¹ \$Ms	Total cost \$Ms	NPV ¹ \$Ms
A1	1.26	1.89	-17.06	-0.97
A2	-1.75	-1.25	-16.11	-3.23
B1	7.03	6.93	6.79	5.32
B2	-0.05	0.65	-19.66	-2.4
B3	-0.23	0.47	-20.02	-2.57
C1	2.25	2.84	-11.95	0.42
C2	2.26	2.85	-11.95	0.43
C3	2.26	2.84	-11.95	0.42
C4	2.26	2.84	-11.95	0.42

Note 1 Net Present Value at 6 per cent discount rate

Table 3: Cost advantage (-disadvantage) of rehabilitation over rebuilding

Mr Verey concluded:

For options where the existing bridge is to be rehabilitated or reconstructed to accommodate vehicular traffic (all options except Option B1), there is a clear 100 year life cycle cost advantage in undertaking a total rebuild initially. For options where the existing bridge is to be only used by pedestrians or cyclists (Option B1 and, potentially, Options C1-C4 which would cost the same as Option B1 if light vehicles were not to be permitted), the 100 yr life cycle cost advantage is not as significant and it might be more appropriate to undertake a partial rebuild initially if cost alone is considered.

7.2.3 Discussion

The wooden elements of the Bridge need to be replaced and whether this happen over a short time period or an extended period (but still a short period in the life of the Bridge) is a matter of cost, constructability and heritage implications.

The two critical differences between reconstruction and rehabilitation relate to the deck and the piles. There is no escaping the fact that the piles and deck need to be replaced in the relative short term.

We think that there is a strong case for complete replacement of the deck (as opposed to gradual patching) because:

- the timber elements of the deck are in poor condition and not readily inspected or maintained,
- the replacement of the deck would not be readily visible except from underneath the bridge,
- replacement of the deck facilitates the fitting of code compliant barriers, and
- the adaptations required to the Bridge could not be carried out without reconstruction.

With respect to the piles, while a replacement program over a period of time might be seen to be more sensitive to heritage values than reconstruction, both options ultimately result in new piles above the water line. It is not clear whether spliced piles have the same longevity as new piles because the splicing introduces a potential point of decay or structural weakness.

While the deck is being replaced there is an opportunity to replace all the piles with ready access to the crossheads and pile tops. We have already noted the poor seating of the crossheads on the piles and the structural problems this introduces. If a more gradual program of pile replacement is adopted it will be more difficult to rectify the structural deficiencies of the Bridge.

7.2.4 Conclusions

Having considered this issue we conclude:

Spliced piles may not be as long lasting as re-driven piles.

Overcoming identified deficiencies in relation to the seating of the crossheads on the piles is likely to be far easier if all the piles are replaced when the deck is replaced.

Having considered this issue we recommend:

The piles be replaced at the same time that the deck is replaced.

7.3 Finding new wood

7.3.1 What is the issue?

There was some speculation in the hearing about whether or not suitable wood was, or would be available.

7.3.2 Evidence and submissions

It was submitted that regal timbers are no longer routinely identified as part of timber harvesting and that the industry has been 'dumbed down' so that all hardwood is treated in the same way. This poses a particular difficulty for sourcing high quality structural timbers for use in heritage structures.

Historically the piles were constructed from turpentine gums which have a natural resin which fully impregnates the timber trunks. Modern attempts to replicate this system involve the use of arsenic impregnation of pine which only reaches about 20% of the exterior portion of the poles.

It was clear from photographs presented at the hearing that where existing piles had been spliced the visual quality of the outcome (at least in some cases) was quite different to the existing piles. It was also easy to mistake photographs of new wooden piles for steel piles.

It was submitted that suitable timber may need to be sourced from outside of Australia.

7.3.3 Discussion

This is not a new issue and it is disappointing that no processes exist to ensure regal timbers are preserved and stockpiled, and that no plantations have been established.

Part of the heritage of the Bridge is that it is a timber bridge. If suitable pile timbers can be found we can expect them to have a life span of about eighty years. A concrete structure in a marine environment might be expected to have a life span of 100 years.

Using less suitable timbers will result in a lower life span, at some point a decision needs to be made balancing the heritage advantages of using a particular timber against the engineering advantages of using modern materials.

We note that this decision needs to bear in mind the full lifetime of the Bridge which could be several hundred years. It is clear that if high grade bridge timbers can be found then the Bridge should be reconstructed in timber (these timbers have an expected life of 80 years).

It cannot be assumed that suitable timbers can be located (or located from a sustainable source), and until they are there will be some unanswered questions on how the Bridge can best be retained. Because splicing piles uses less timber, timber availability may be a determining factor on whether new piles are driven or existing piles repaired.

The search for timber will almost certainly involve identifying supplies in other states. Securing these supplies is likely to require negotiations with forest and conservation bodies in those states.

We think that it is important that the bridge is repaired using timber of the same characteristics as the original Bridge. Using a modern treated wood is, in effect, using a different material. Use of modern treated woods (particularly if they do not have the lifespan of the original timbers) is likely to be confusing the heritage value of the Bridge and be misleading as to the durability of wooden bridges. Further, we believe that plantation pine is an unsustainable timber and that arsenic impregnation is not environmentally suitable.

Securing a future supply

If the Barwon Heads Bridge is worth saving today, then we presume it will be worth saving in 80 years time when it will again need significant repairs. The timber that will be required in 80 years time needs to start growing now. Somebody needs to plant it, and we think that VicRoads should act to secure a long term supply of bridge timbers. We note that the Barwon Heads Bridge is not the only timber structure in Victoria that will require high grade replacement timbers (regal timbers).

There is a story recounted by urban designers of a 300 year old dining hall in Oxford where woodworm finally destroyed some incredibly long oak roof beams. In distress the college fathers called their forestry department to ask for advice in sourcing oaks of such length in this day and age. A few days later a forester from the college's estate called the don and explained that one of his roles was to look after a number of old oaks which had been planted centuries previously in a corner known as the 'dining hall plantation' to allow for replacement of the dining hall beams when the time would come.

Establishing a sustainable source of regal timbers for wooden bridges is important and urgent – even if this urgency is on a timescale we are unused to thinking about.

7.3.4 Conclusions

Having considered this issue we conclude:

VicRoads may need to search nationally to secure a supply of suitable timber. Suitable timbers may not be available to reconstruct or repair the bridge in timber.

Having considered this issue we recommend:

VicRoads work with the Department of Sustainability to put in place long term plans (80 to 100 year timeframe) for securing suitable bridge timbers for its heritage assets.

8. What if a second bridge is necessary?

Previous sections have addressed issues with the retention of the Bridge. This section examines the relative impacts of the location of a second bridge in the estuary.

A great deal of evidence and submissions addressed the issues of construction of a second bridge upstream of the existing Bridge.

8.1 Comparison of cost

8.1.1 What is the issue?

How important is cost?

The State Planning Policy Framework does not provide a policy framework in relation to the cost of new transport works.

The closest the SPPF comes to addressing cost is the statement:

Transport routes should be located to achieve the greatest overall benefit to the community and with regard to making the best use of existing social, cultural and economic infrastructure, minimising impacts on the environment and optimising accessibility, safety, emergency access, service and amenity.

The *Road Management Act 2004* is more explicit:

20. Principal object and management principles

- (1) The principal object of road management is to ensure that a safe and efficient network of roads is provided primarily for travel and transport and that road reserves are available for other appropriate uses.*
- (2) The following principles apply in respect of the management of works and infrastructure under this Act—*
 - (a) – (e) ...*
 - (f) the efficient use of resources of road authorities and infrastructure managers and the **minimisation of cost to the community of infrastructure and services.** (our emphasis)*

While cost is not an overriding factor in determining the most appropriate location for a second crossing it cannot be ignored.

How should cost be assessed?

All bridges require maintenance over their life span and it is important to consider maintenance costs as part of the total cost of the Bridge.

When totals are spread over a period of time it is appropriate to compare 'discounted' costs – that is costs that have been adjusted to take account of the time into the future that the costs are incurred.

8.1.2 Evidence and submissions

Table 4 presents the total costs for the various options over a 100 year time period. As might be expected the discounted costs are considerably less than the undiscounted costs. A significant portion of the estimated cost of maintaining the Bridge is incurred many years into the future and these future costs are heavily discounted (reduced) and so have a relatively small present value.

Option	100 year Net Present Value costs			100 year undiscounted costs
	Work on existing bridge \$Ms	Estimate for new bridge \$Ms	Total \$Ms	Total \$Ms
A1	21.26	0	21.26	67.33
A2	26.85	0	26.85	87.21
B1	18.62	16.82	35.44	95.02
B2	20.14	11.57	31.71	90.59
B3	20.14	16.81	36.95	103.88
C1	19.58	27.04	46.61	127.15
C2	19.65	23.23	42.87	119.21
C3	19.58	32.13	51.71	137.51
C4	19.58	28.55	48.13	130.31

Note: Cost discounted at 6 percent in accordance with Victorian Treasury Guidelines

Table 4: Construction and Life Cycle Costs for Timber Bridge Options

Mr Verey based his decision on the best option in part on the costs to VicRoads rather than the cost to the government as a whole:

On the expectation that non-arterial bridges would be the responsibility of another authority, it is only the maintenance costs associated with the arterial bridges that contribute towards my ranking of options.

While VicRoads as a Road Authority might choose to rank the options based on the financial costs to VicRoads this is hardly a helpful approach when trying to decide the overall best option from a community point of view.

Some concerns were raised in submissions that the foundation conditions in Corridor 2 were substantially different to the findings of the geotechnical report commissioned

by VicRoads. The effect of poor foundation conditions would be to further increase the costs associated with Corridor 2. This cost increase was estimated by VicRoads to be relatively minor even considering the worst case scenario for poor foundations.

8.1.3 Discussions

The cost of a new bridge in Corridor 2 (the upstream corridor shown as the C options) is considerably more than the cost of a new bridge adjacent to the existing Bridge.

8.1.4 Conclusion

Having considered this issue we conclude:

Building a new bridge adjacent to the Bridge is preferable to a new bridge on Corridor 2 on cost grounds.

8.2 Heritage

8.2.1 What is the issue?

The choice of bridge corridor has a number of heritage implications.

8.2.2 Evidence and submissions

In his written submissions Mr Lovell originally ranked the 'C' options (Corridor 2 options) ahead of the "B" options, that is he preferred a new bridge in Corridor 2, rather than a new element adjacent to the Bridge.

However in his comments to the Advisory Committee, Mr Lovell outlined that he had further refined his understanding of the setting of the Barwon Heads Bridge and that he accepted the place clearly includes the setting of the river estuary and viewlines north through to the Connewarre Reserve. He clarified that having consolidated his views on the setting, he subsequently preferred the "B" suite of options to any new structure in Corridor 2. This refined position was attributed to several factors which he outlined as follows:

- The estuary has value in aesthetic heritage sense.
- Utilising C options will result in two bridges and impact on the broad value of the Barwon Heads Bridge as a singular object.
- Another strong element in the vista has the potential to draw away from the heritage significance of the Barwon Heads Bridge.

Introducing new element of increased height

The Statement of Significance for the Barwon Heads Bridge includes reference to it being a long and low structure. Mr Lovell confirms this point and notes that introducing a new element of increased height in close proximity to the Barwon Heads Bridge would detract from the heritage significance.

8.2.3 Discussion

The heritage value of the Bridge can be distinguished from the heritage value of the crossing. That is there is a heritage value that attaches to the wider estuary and a crossing at the point of the existing bridge that is distinct from the heritage value of the structure of the Barwon Heads Bridge itself.

Building another bridge upstream would result in two bridges and this would impact on the value of the crossing as a singular point. Another strong element in the vista would also draw away from the heritage significance of the Barwon Heads Bridge as a structure. We do not think that the upstream location is sufficiently removed from the Bridge to mitigate its adverse heritage impact.

8.2.4 Conclusion

Having considered this issue we conclude:

Building a new bridge adjacent to the Bridge is preferable to a new bridge on Corridor 2 on heritage grounds.

8.3 Visual amenity

8.3.1 What is the issue?

The issue is the impact of an additional crossing on the visual amenity of the Barwon River estuary and surrounds and whether one particular corridor would be preferable to another.

8.3.2 Evidence and submissions

Chris Razzell of Aspect Studios provided evidence for the proponent VicRoads. He identified landscape opportunities and constraints for each of the corridor options. He highlighted a series of landscape heritage principles:

- Maintain the bridges relationship to the landscape i.e. long and low with views of the surrounding landscape visible above the bridge deck;
- Column spacing and relationship to the landscape to develop an appropriate “rhythm” for the substructure and associated elements that responds to the maritime landscape setting;
- The sense of proportion of the bridge deck thickness and carriageway width;
- It is a utilitarian bridge, that retains a sense of its place and is not dominating in the landscape; and
- Should retain all existing uses of the bridge including vehicle, pedestrian and fishing.

He further elaborated the main landscape and heritage considerations of the existing Barwon Heads Bridge are:

- Any bridge at the Barwon Heads foreshore should be considered memorable and an iconic element in the landscape, due to the landscape character and the use of the foreshore landscape;
- There is a difference between a replica structure and a sympathetic design that “references” its form or elements that contribute to its overall appearance; and
- Proximity to the water in that the existing bridge is more like a causeway structure than a typical elevated bridge.

He also noted that any new element should not mirror or replicate the existing design elements of the Barwon Heads Bridge.

In his summary of the impacts on the visual amenity he noted that the upgrade of the existing bridge or the construction of a new bridge adjacent to the Barwon Heads Bridge had the least impact on the visual amenity of the Barwon River estuary.

The Friends of the Barwon River (FOBR) commissioned Dr Wulff to provide an opinion on the impact of an additional estuary crossing. Dr Wulff concluded that the impact of an additional bridge in Corridor 1 was intrinsically less detrimental on the visual amenity of the estuary than a bridge in Corridor 2.

8.3.3 Discussion

In considering the impacts of a new bridge crossing in the Barwon River estuary we note that each corridor has certain advantages and disadvantages in terms of the views it provides, and how a bridge sits in the landscape.

Based on the impact of landscape values alone, we do not think there is necessarily a clear difference between Corridor 1 and Corridor 2. For instance, if in 1927 the bridge had been built along the Corridor 2 we do not think the community would have spent the last 80 years thinking that, on aesthetic grounds alone, it should be moved to Corridor 1.

The issue is not comparing the impact of a bridge in Corridor 2 with the impact of a bridge in Corridor 1, but comparing the impact of two crossings of the estuary with one crossing. We think it is clear that one crossing better meets the established planning policies than two crossings.

8.3.4 Conclusion

Having considered this issue we conclude:

Building a new bridge adjacent to the Bridge is preferable to a new bridge on Corridor 2 on visual amenity grounds.

8.4 Land acquisition

VicRoads outlined in their submissions that if a bridge is built in Corridor 2, Geelong Road would need widening at the western end. This would have significant impacts on a number of properties and requires the acquisition of a residence in Geelong Road.

It is clearly desirable to avoid the acquisition of residential properties where this is possible.

Having considered this issue we conclude:

Building a new bridge adjacent to the Bridge is preferable to a new bridge on Corridor 2 on land acquisition grounds.

8.5 Social impact – Impact on sailing

8.5.1 What is the issue?

The issue is whether an additional estuary crossing would have an impact on sailing, camping and the town generally.

8.5.2 Evidence and submissions

The Barwon Heads Sailing Association (BHSA) outlined that sailing has been conducted on the estuary since at least the turn of the century, including competitive small boat racing on the Barwon River estuary for about 50 years.

The Bridge provides a barrier between the entrance to the river at the heads and the open water of the estuary which creates:

... a relatively shallow lake like area that provides a comparatively safe haven for sailing and other water-recreational activities, particularly for the club, but also for general users of the river estuary, including many families with children.

Submissions and evidence were presented that a low level bridge at Corridor 2 would mean that sailing competition on the estuary would no longer be practical. Estuary sailing is quite different to open water sailing and there are no nearby opportunities for this type of sailing with the next nearest estuarine environment being Warrnambool.

8.5.3 Discussion

What is relevant here is the impact of a second crossing on the social fabric of Barwon Heads – not so much the impact on the range of sailing opportunities on the Bellarine Peninsula or in southern Victoria.

We are satisfied on the basis of the evidence and submissions that a low level bridge in Corridor 2 would have an adverse social impact to the degree that it would render impossible small boat racing as it is now conducted on the Barwon River. This is a social activity that brings together a diverse range of people and complements the other beach related activities at Barwon Heads.

A high level bridge may not make sailing impossible, but the need to sail around the bridge piles and deal with wind eddies created by the bridge would significantly undermine competition sailing. It would also be an additional risk for novice sailors who are not well skilled at charting a course around obstacles (bridge piles).

8.5.4 Conclusion

We acknowledge that the small boat activities situated in the Barwon River estuary are an important element of recreation at Barwon Heads. This site provides a unique situation which allows for training and skills acquisition, as well as racing carnivals during the summer season.

Having considered this issue we conclude:

Building a new bridge adjacent to the Bridge is preferable to a new bridge on Corridor 2 on social impact grounds related to sailing.

8.6 Social impact – Impact on camping

8.6.1 Evidence and submissions

Camping facilities are provided on the western bank of the Barwon River estuary. Construction of a new bridge in Corridor 2 would affect the public camping area and require the reconstruction of an amenities block. To provide amenities for campers on both sides of the new access road two replacement amenity blocks would be needed.

Additionally the new bridge would create a visual barrier and local residents believe that users of the beach would have restricted sightlines of their children's activities, thus making the area more hazardous for young beach users.

8.6.2 Discussion

The camping area provides an important form of accommodation for visitors to Barwon Heads and Ocean Grove. A new bridge in Corridor 2 would severely impact this public camping. No alternative camping area was suggested as being available to rectify any imbalance created by a new Corridor 2 bridge.

A new bridge at Corridor 2 would introduce a disruptive element into the quiet section of estuary beach that makes the area attractive for campers.

8.6.3 Conclusion

Having considered this issue we conclude:

Building a new bridge adjacent to the Bridge is preferable to a new bridge on Corridor 2 on social impact grounds in relation to camping.

8.7 Splitting the town

8.7.1 What is the issue?

The issue is the impact a new bridge crossing would have on the township of Barwon Heads.

8.7.2 Evidence and submissions

Ms Ruth Davies of Maunsell AECOM provided expert testimony about the social impacts of the two corridor options. In her evidence she noted that the Barwon Heads community valued the village nature of the town and that Barwon Heads and Ocean Grove have strong community networks. Within this dynamic, Ocean Grove provides the key retail and service provision while Barwon Heads has a key focus on recreation and leisure.

Additionally, the community appreciate the ability to walk or cycle across the Barwon Heads Bridge and enjoy the Barwon River estuary amenity and views.

Numerous submissions from residents and visitors to Barwon Heads addressed the impact of a new bridge corridor at the end of Geelong Road (Corridor 2). Submissions were either in favour of the traffic being taken out of the Barwon Heads township, or opposed to traffic diversions away from the township hub.

The range of issues raised can be summarised as follows:

Those in support of Corridor 1

- Reduced impact on the camping facilities and beach access on the west side of the river.
- Need to manage the traffic – not build a new bridge.
- Retaining traffic through the township provides better business and tourism product opportunities.
- All road networks through Barwon Heads have some management challenges, but they can be managed.
- Increasing traffic through Corridor 2 will result in more traffic past the Barwon Heads Village recreation space.
- The Barwon Heads Bridge provides an important pedestrian linkage to the spit and the beach.

Those in support of Corridor 2

- It would be better to take the traffic which is constantly growing out of the town.
- The Barwon Heads township would have greater amenity if less traffic.
- Traffic flows in peak season cause safety hazards for pedestrians and these would be reduced in the town area.
- Corridor 2 would take traffic away from the primary school and library thus improving pedestrian access for children and the elderly.

8.7.3 Discussion

In considering the impacts of an additional bridge across the Barwon River, we note that social linkages are pivotal to maintaining a cohesive community. If a second bridge were built at Corridor 2 some traffic flows would be redirected along the Geelong Road.

The town has expanded over recent times with development in the northern sections which were undeveloped when the Bridge was first constructed. The relocation of the main traffic routes to Corridor 2 would result in increased traffic along the Geelong Road. The traffic modelling presented also shows that it is doubtful a bridge in Corridor 2 would remove traffic from the retail area.

It is clear that a bridge at Corridor 2 is not obviously superior in minimising the adverse impacts of traffic on Barwon heads compared to a bridge in Corridor 1 (in fact it may not be superior at all).

8.7.4 Conclusion

Having considered this issue we conclude:

There is no significant advantage to building a new element in either the Corridor 1 or Corridor 2 alignments when considering the impact of splitting the town.

8.8 Impact on business

8.8.1 What is the issue?

Numerous submissions raised concerns about the negative impact of increased traffic flows on business and tourism in Corridor 1.

8.8.2 Evidence and submissions

VicRoads commissioned Mr Bill Unkles to assess the potential impacts to business and tourism for each of the corridor options. Mr Unkles provided both written testimony and appeared before the Advisory Committee.

Mr Unkles relied primarily on information from retail traders to estimate the likely impacts of either corridor option on business and tourism in Barwon Heads.

Based on this work Mr Unkles determined that Corridor 1 was the preferred option as an improved bridge crossing in Corridor 1 is perceived to bring additional visitors and ultimately boost the economy.

Corridor 2 was determined as less desirable as potential visitors are expected to bypass the township and take trade away from Barwon Heads.

Submissions were also received by residents and visitors, much of which has been addressed in the section on 'splitting the town'.

Numerous submissions raised concerns about the negative impact of increased traffic flows on business and tourism in Corridor 1.

Mr Eastmure from the Barwon Heads hotel raised a concern that diverting traffic through Corridor 2 would reduce traffic flows past the hotel and consequently patronage would drop off, ultimately reducing employment opportunities in Barwon Heads.

8.8.3 Discussion

Would a bridge in Corridor 2 remove traffic from the retail area? This question is confused with the similar questions 'Is it desirable to remove traffic from the town?' Our conclusion based on the traffic modelling presented is that it is doubtful a bridge in Corridor 2 would remove traffic from the retail area.

We think that the quality of data relating to the impacts on business and tourism gathered by Mr Unkles to be somewhat limited to the perceptions of the traders themselves. Nonetheless, the impacts are not clearly aligned to one particular corridor over another: removing traffic from the town hub (if a bridge in Corridor 2 actually achieved this) might lead to improved amenity, while taking some trade away from Barwon Heads. Yet congestion and increased traffic within the town may reduce the amenity to such a degree that people will avoid the township.

8.8.4 Conclusion

Having considered this issue we conclude:

No evidence was provided to suggest the Corridor 1 would support business and tourism objectives better than Corridor 2. As such no preference is given to either corridor in relation to this issue.

8.9 Indigenous heritage

8.9.1 What is the issue?

To what extent would an additional river crossing impact Indigenous heritage values?

8.9.2 Evidence and submissions

Policy context of the issue

Indigenous heritage sites are protected under both Federal and State legislation. The legislation provides for the protection of Aboriginal cultural property and provides a framework for consultation. The state legislation protects physical evidence of past Indigenous activities, whereas the federal legislation provides wider protection, including protection of places of cultural heritage significance to Indigenous communities.

Barwon Heads and Ocean Grove are in the area of the Wathaurong Indigenous community. The Wathaurong Co-operative is the statutory authority charged with provision of approvals for Indigenous heritage impacts in the region.

Evidence

VicRoads commissioned TerraCulture heritage consultants to conduct an archaeological investigation of Barwon Heads River in the locality of the (then) proposed three corridors.

Indigenous heritage sites were recorded in Corridor 2 and Corridor 3. Corridor 3 has been dismissed for consideration; however the potential impact of a bridge in Corridor 2 needs to be considered.

The studies comprised terrestrial field surveys and did not extend into the river.

Aboriginal midden material was identified and recorded at:

- AAV 7821 – TBA a newly recorded site located on the Ocean Grove spit in the seasonal camping area near Corridor 2.

Non-Indigenous archaeological sites were not identified within either Corridor 1 or Corridor 2; however their report notes that the footings of the Barwon Heads Bridge have an archaeological component which is integral to the Bridge itself.

In their written report, a series of recommendations are made:

Recommendation 2

For the study area selected to accommodate an alignment for a new bridge and prior to the construction of any bridge, the Aboriginal archaeological investigation should be extended to the subsurface testing of locations within or close to the construction footprint. The testing

should aim to ascertain the presence and distribution of any subsurface archaeological deposits.

Recommendation 3

Under circumstances where the proposed construction of any bridge will disturb or destroy any subsurface archaeological deposits, these deposits should be salvaged and their contents subject to detailed analysis including radiocarbon dating.

Recommendation 4

Under circumstances where the proposed construction of any bridge will disturb or destroy any known (registered) archaeological sites, these sites should be subject to further investigation in the form of subsurface testing and detailed analysis of the excavated material including radiocarbon dating.

The report also provides recommendations in relation to consultation with the Wathaurong Aboriginal community.

8.9.3 Discussion

An Aboriginal midden was located in the camping ground in the location of the proposed alignment for Corridor 2. The presence of surface midden material is often accompanied by sub-surface archaeological evidence. If a new river crossing was required, further investigation would be required if a bridge were to be built in Corridor 2.

We support the recommendations outlined above but note that the appropriate approvals process requires consultation with the Wathaurong community and Aboriginal Affairs Victoria.

No Indigenous heritage sites were located in Corridor 1, and there are no native title claims in the study area.

8.9.4 Conclusion

Having considered this issue we conclude:

Building a new bridge adjacent to the Bridge is preferable to a new bridge on Corridor 2 on Indigenous heritage grounds.

8.10 Air quality

8.10.1 What is the issue?

To what extent would a new river crossing effect air quality?

8.10.2 Evidence and submissions

Air quality is managed by the Environment protection Authority using a State Environment Protection Policy (SEPP) and the National Environment Protection Measure (NEPM).

Submissions were made raising concerns about the air quality data used by VicRoads and about the impact on school children of additional traffic if the Corridor 2 option was pursued.

In the written response, Mr Wallis for VicRoads outlined that both the SEPP and the NEPM specify the limit of particles on the basis of mass per unit volume (ug/m^3). Mr Wallis further outlined that the data used for his considerations was not collected specifically at Barwon Heads but that he used EPA data collected for the South Geelong region as the baseline data set.

Based on this data he concluded that the highest predicted level of particles less than 2.5 micron is $8 \text{ ug}/\text{m}^3$ and that is well below the intervention level of $36 \text{ ug}/\text{m}^3$.

Mr Wallis also calculated the projected contaminant concentrations caused by vehicles over a 16 year period to 2021. The figures were extrapolated to 25,000 vehicles per day, well in excess of current VicRoads projections for that period. These projections revealed that none of the currently monitored substances would trigger an air quality intervention requirement.

8.10.3 Discussion

During the course of the directions hearings, Mr Wallace-Smith raised concerns that the air quality expert was not to be called by VicRoads.

We formed the view that the written evidence was sufficient for our purposes, based on the submissions and other data presented. We noted that in the event a submission raised issues not addressed in the written testimony of Mr Wallis, we would be free to call Mr Wallis to respond to those matters. This did not eventuate.

8.10.4 Conclusions

In considering the issues raised about air quality, we have determined that the current and projected levels of particulate matters covered by the SEPP and the NEPM will not exceed the level which would trigger an intervention requirement. Consequently air quality matters do not influence our deliberations in relation to the Bridge options under consideration.

8.11 Flora and fauna

8.11.1 What is the issue?

Flora and fauna management within the affected two corridors are impacted by numerous pieces of legislation, including the Commonwealth *Environment Protection and Biodiversity Conservation Act* (1999), the State *Flora and Fauna Guarantee Act* (1988), the Victorian *Coastal Management Act* (1995). Further, any removal of native vegetation is managed in accordance with Victoria's Native Vegetation Management: A Framework for Action.

8.11.2 Evidence and submissions

VicRoads commissioned ERM to prepare a flora and fauna assessment of the three proposed corridors. Paul Kelly of ERM appeared at the hearing.

The key findings detailed in his report were that overall the environmental significance of the proposed sites was reasonably low. Corridor 1 was rated as having low to medium conservation significance and contains four habitat zones of EVC 1 (Ecological Vegetation Class 1) which would require 42.6 habitat hectares of Net Gain offsets if all that vegetation was removed.

Corridor 2 contains only one habitat zone of EVC 1. It has a higher conservation significance rating but would require only 28.7 habitat hectares of offset if Corridor 2 was selected.

The Barwon River estuary upstream of the existing Barwon Heads Bridge forms part of the Lake Connewarre RAMSAR site for its role in supporting international migratory water birds. The proposal was referred to the Commonwealth Department of Environment and Heritage which determined it was not a controlled action.

In both the Corridor 1 and Corridor 2 options, the vegetation quality is deemed low and offsets can be readily achieved.

In addition to the evidence provided by ERM, the Friends of the Barwon River commissioned Dr Jeff Yugovic of Biosis Research to review the flora and fauna work of ERM. Dr Yugovic's area of study was limited to Corridor 1 and Corridor 2.

Dr Yugovic formed the view that the ERM work was flawed due to an incorrect area of assessment and mistakes with the area calculations leading to a higher conservation significance assessment for Corridor 2. He concurs with the general ranking of impacts however, Corridor 1, Corridor 2 and then Corridor 3 being the order of least to greatest impact; but believes the habitat hectare offsets for Corridor 1 and Corridor 2 are very similar.

He also drew attention to another element of flora impact for Corridor 2 which is the requirement for road widening along Geelong Road if Corridor 2 were used. This would result in the loss of Coastal Moonah Woodland trees being removed which are protected under the *Flora and Fauna Guarantee Act* 1988.

Mr Stephan Gabbas of GHD presented evidence on the potential impacts to seagrass communities. He determined that both corridor 1 and corridor 2 have low ecological significance, with corridor 2 having one patch of slightly higher quality seagrass.

The height of a new bridge could have an impact in respect of shadowing, but as the seagrass colonies are of low quality, neither corridor was deemed preferable. If the new bridge was built in corridor 2 however any subsequent dredging to enable sailing would disturb those colonies.

Analysis of hydrocarbon, metal or other sediments showed very low level of contamination, again with no preference between the two options.

8.11.3 Discussion

The Department of Environment and Heritage determined that the proposal was not a controlled action under the *EPBC Act*.

Both Corridor 1 and Corridor 2 have degraded environmental values due to decades of settlement and development. Nonetheless, constructing a new estuary crossing in either corridor would require planting regimes to address the State Native Vegetation Management policy requirements and offset loss of native vegetation. The evidence presented by Mr Kelly and Dr Yugovic differed somewhat, but only to the extent of habitat hectare offsets required which are generally considered to be low.

Mr Kelly did not address the impacts of road widening on the Coastal Moonah Woodland trees, this would increase the overall impacts for corridor 2.

Overall Mr Kelly and Dr Yugovic concurred that the introduction of a new crossing would have less impact of Corridor 1 than Corridor 2.

8.11.4 Conclusions

Having considered this issue we conclude:

Building a new bridge adjacent to the Bridge is preferable to a new bridge on Corridor 2 on flora and fauna grounds.

8.12 Traffic and traffic engineering

8.12.1 What is the issue?

To what extent would a new location for the river crossing provide a better outcome for traffic flows in Barwon Heads.

8.12.2 Evidence and submissions

While we see merit in the position put forward by Mr Nuttal that both Ocean Grove and Barwon Heads should be bypassed by a new river crossing route, we understand that environmental considerations rule out a more northerly crossing at this time.

Mr Walsh from Grogan Richards (called by the Barwon Heads Sailing Club) noted that the adoption of Corridor 2 did not significantly remove traffic from Hitchcock Avenue (the town centre) as there were strong continuing traffic demands from the commercial activities as well as to the Bluff Road tourist route.

Many residents were concerned that the Corridor 2 route would lead to traffic infiltration of minor residential streets leading to the town centre from the Geelong Road. We agree that changes to the main traffic flows would change the current situation and create 'winners' and 'losers'.

There was also much discussion about the impact of the corridor choice would have on the Barwon Heads Primary School, and to a lesser extent the library. We were told that the school community was divided in opinion as to the preferred route.

8.12.3 Discussion

While the extension of the Geelong Road appears to give a benefit in providing a more direct link to Ocean Grove which reduces traffic impacts on the spit and allows Ocean Grove–Geelong traffic to miss the Barwon Heads town centre, the traffic modelling suggests that flows through the town centre would still be high.

Significantly, retention of the Bridge means traffic on the spit will not be removed, although two crossings would allow its reduction.

The main traffic argument was whether traffic past the school was appropriate or safe.

On inspection we found that we strongly favoured the route between Geelong Road and the Bridge via Golf Links Road–Bridge Road rather than by Hitchcock Avenue–Bridge Road. The bustling town centre of Barwon Heads is not conducive to operate as an arterial route. It is a high volume pedestrian shopping precinct with significant informal 'holiday' crossing activity.

On the other hand the route past the primary school has a supervised crossing and is not distinctly different to many situations both within metropolitan Melbourne and

regional centres. We believe that once a supervised crossing is provided the level of traffic is not particularly relevant from a crossing point of view.

It was also pointed out by a number of submitters that the school is closed during the busy holiday traffic peaks.

8.12.4 Conclusions

Having considered this issue we conclude:

The traffic engineering advantages which could flow from the Geelong Road extension at Corridor 2 are negligible if the current bridge is retained for road traffic.

Having considered these issues we recommend:

The route for the Barwon Heads–Ocean Grove Road through Barwon Heads should be Golf Links Road–Bridge Road.

8.13 General conclusion on the suitability of Corridor 2

In this section of the report we have explored a range of issues and the effects of the location of a second river crossing.

Considering all the issues related to Corridor 2 we conclude that:

Building a new bridge adjacent to the Bridge is overwhelmingly preferable to a new bridge on Corridor 2.

9. Preferred option

9.1 What are the options?

Our revised terms of reference asked us to consider three options:

- To retain and upgrade the existing Bridge,
- To retain the existing Bridge and build a new bridge beside it, or
- To retain the existing Bridge and build a new bridge further upstream.

We reached the conclusion in the preceding chapter that a new bridge beside the existing bridge was preferable to a new bridge upstream. The choice is between retaining and upgrading the existing Bridge or duplicating it.

The critical issues revolve around how much upgrading is necessary or desirable to the existing bridge, and what sort of new Bridge might be constructed beside it.

9.2 What needs to be achieved?

What the crossing should achieve

We have reached a number of conclusions about what needs to be achieved in the estuary crossing (without determining whether this is best achieved by adapting the Bridge or constructing a new bridge).

We have concluded that at a minimum the crossing should provide:

- T44 loading,
- two 3.5 metre wide traffic lanes with 1 metre clearances to barriers,
- a 50 kph travel speed, and
- a 3 metre wide shared path for pedestrians and cyclists.

To this we should add the current important social function:

- facilities for anglers.

It is clear that simply repairing the Bridge without further adaptation will not achieve these identified outcomes.

We have considered the potential impact on heritage values that might arise from improving the level of service of the estuary crossing at Barwon Heads as outlined above. We believe the improvements provided will have a net community benefit and overcome some serious deficiencies in the existing crossing and can be achieved while conserving the heritage values of the crossing and the existing Bridge.

What repair and adaptation should achieve

It is clear from the evidence, planning policy and the decision of Heritage Victoria that the works should conserve the heritage values of the existing bridge and its setting.

Article 1.1 of the Burra Charter outlines that the place should be understood in its broadest sense and that it may include components such as space or views. Article 1.12 of the Charter further refines the term 'setting':

Setting means the area around a place, which may include the visual catchment.

This conservation of heritage values needs to be sustainable, and needs to ensure that the Bridge is a lasting asset.

9.3 The nature of the works

The extent of works required on the Bridge to maintain its structural integrity will have a bearing on how much adaptation is feasible, so it is best to consider these issues before the issues of adaptation.

What is new fabric?

Replacing degraded timbers in wooden bridges with timber of the same dimension and species should not be viewed as introducing new fabric. It is an accepted method of heritage conservation.

Wooden bridge structures need renewal and if we are to keep wooden bridges then it will be by a process of replacing the timbers over time either continually or as part of periodic renewal.

If timber of the same species and a suitable grade cannot be located, then the use of substitute materials – alternative timbers, or modern materials – will need to be negotiated with Heritage Victoria. In considering alternative materials consideration should be given to:

- longevity – the material should have a similar durability to the original material,
- dimensions – the new material should be the same size as the element it replaces, and
- visual character – the material should maintain the visual character of the Bridge.

Simply replacing timber elements with a different sort of timber is a simplistic approach that can lead to poor outcomes, as evidenced by some of the recent replacement piles on the Bridge.

Any replacement with modern material may form part of an interim solution to the overall conservation management of the Bridge. We note that there is a draft Conservation Management Plan for the Bridge and that this will need to be updated following repair of the Bridge.

Piles

Engineering evidence was provided concerning the state of the support piles. Many of the piles have been repaired over time and yet still suffer damage from both Teredo worm and abrasion. Some piles have been jacketed and others supported with vertical braces.

Addressing the piles is critical to ensuring the structural integrity of the Barwon Heads Bridge. The condition of many piles is such that they need to be completely replaced.

Two methods are possible:

- splicing the existing piles with new timbers, and
- re-driving replacement piles.

Splicing of the existing piles would only provide a short-term solution unless high quality native eucalypt timber was employed.

Re-driving piles is considered the most effective and efficient means of renewing the sub-structural supports and it is important that again, high quality eucalypt is used. Whether or not the piles can be re-driven depends on what is done with the deck.

The deck

If the deck were in good condition with heritage fabric viewable to the motorist and pedestrian then keeping the deck would make sense. But this is not the case. The original fabric is hidden by the concrete overlay. It is not practical to replace this fabric with new timber.

Nor is it practical from a safety, level of service, structural or maintenance point of view to fully reinstate a wooden deck.

Preferred solution

Having considered these issues we recommend:

The Bridge be restored using the following materials:

- **the piles be replaced in timber of same dimensions and similar species as original bridge,**
- **the walers and cross braces be reused where possible or replaced in timber of same dimensions and similar species as original bridge,**
- **the existing steel stringers be reused with relocation above piles, and the loadings on the cross heads recalculated in this revised configuration,**
- **if possible, following a reassessment of loadings on crossheads after the relocation of the stringers, the crossheads be replaced in timber of the same dimension as existing or in steel of the same dimension as the existing timber crossheads,**
- **the deck (including remnants of the original wooden deck) be replaced in concrete.**

9.4 Adapting of the Bridge

Section 6 of this report identified the adaptations that would be required for the existing bridge to meet the requirements we have identified. These were as follows:

- Adapting the Bridge to cater for T44 loadings would involve:
 - relocating the existing steel stringers above piles, and recalculating the loadings on the crossheads in this revised configuration.
 - replacing the crossheads in timber of the same dimension as existing or in steel of the same dimension as the existing timber crossheads following a reassessment of loadings on crossheads following the relocation of the stringers.
 - redesigning the connection of the crossheads to the piers be to cater for the projected loadings.
- Adapting the Bridge to provide for code compliant rails on the Bridge would require the deck (including remnants of the original wooden deck) be replaced in concrete.
- Adapting the Bridge to provide adequate clearances to barriers would involve providing 3.5 meter wide traffic lanes with 1 metre clearances to barriers.
- Adapting the Bridge to cater at an acceptable minimal level for pedestrians and cyclists would involve providing a three metre wide pedestrian and cycling path along the upstream side in addition to fishing platforms.

Can the bridge be further adapted?

The statement of significance of the Bridge makes reference to the evolution of the Bridge and its continued adaptation over a series of modifications to accommodate increased traffic and other needs.

The critical issue is this: ‘can the existing Bridge be further adapted to meet the identified requirements while conserving its heritage values?’

If the answer to this question is ‘no’, then a judgement will need to be made whether the adverse impacts of the proposed adaptations better or worse than the adverse impacts of a new bridge.

Mr Lovell provided evidence in relation to duplication of the Bridge and its affect on the Barwon Heads Bridge.

The duplication of bridges in the past, whereby an historic bridge is retained but superseded by a new adjacent structure, has been a not uncommon occurrence for historic road bridges.

The impact from a heritage perspective is highly variable dependant upon a range of factors including the physical proximity of the Bridges, the scale and form of the new bridge, the importance of the existing bridge setting and the future use and conservation program for the retained bridge. In many cases, where the original bridge is retained it is done so in a manner which addresses the Bridge as a heritage object, without context, rather than considering the broader issues of setting which can contribute fundamentally to the Bridge’s significance.

In this case an added factor would be that in both the upstream or downstream location within Corridor 1 the works would intrude into areas covered by heritage overlay controls.

In both locations the works would impact on the bluestone retaining wall located on either side of the existing bridge (HO1660) and in the case of the upstream solution possibly on the individually listed shop (HO1668) at 1 Flinders Parade.

Duplication in Corridor 1 is not a preferred outcome from a heritage perspective. Should it be pursued the preference would be for the downstream location which impacts less on nearby heritage places and would maintain the ability to view the stringer and corbel detail on the upstream side of the existing bridge.

Mr Lovell outlined in his submission that modifying the Bridge to allow for the full complement of traffic options, including the widening of the Bridge, was the most desirable option, provided that the modifications were in accordance with the principles of heritage conservation.

In his written evidence he stated:

... a modified reconstruction which utilised timber piled piers and incorporated those elements which generated the 'timber-look' of the existing bridge would largely address the aesthetic and social values of the Bridge and in this regard deliver a structure which responded to aspects of the popular appreciation of the Bridge as an historic structure

In questions to Mr Lovell we explored a range of broad issues in order to understand his views on the ways in which modifications and changes to the Bridge could be approached. The following points summarise the key issues raised and the position of Mr Lovell:

- The heritage significance of the Barwon Heads Bridge will be retained through the retention of the Bridge.
- Timber structures always need elements replaced and the Barwon Heads Bridge has undergone continuous repairs and modifications since first built.
- It is important to retain the historic use of a heritage place where possible: the Bridge has always been used by vehicles.
- Modifications to the Bridge would be consistent with the history of the Bridge and the ongoing changes required for its operations and are described in the Statement of Significance.
- The Bridge is the only Victorian timber bridge adapted from use by horse drawn to modern vehicles whilst retaining its timber integrity.
- Replicating this bridge with modern materials would compromise the heritage significance of the Bridge.
- Two proximate structures could deliver a good outcome.
- A wider structure would impact the Flinders Heritage Area.

Additionally he commented that retaining a concrete deck was consistent with the current fabrication, but that additional support timber underneath the decking should be discouraged.

In summary, Mr Lovell supported retaining the Bridge in its present configuration, but that if it needed to be widened he supported a modification of the Bridge where the Bridge is widened slightly, but not to the extent suggested in the option A2 presented by VicRoads.

Why Option A2 is unsuitable

Option A2 comprises the rebuilding of the five piled existing bridge, then adding an additional three piles to extend the Bridge downstream.

This approach would severely compromise the heritage significance of the Barwon Heads Bridge for the following reasons:

- It confuses modern fabric and design with the historic bridge through the use of pseudo replication. An untrained eye may think the Bridge was always an eight piled bridge. This is in conflict with Article 1.3 of the Burra Charter.
- The cultural significance of the place (the Bridge) would be compromised through the extent of change. This includes adding a significant element in the form of three extra piles and changing the overall dimensions. This is in conflict with Article 2.2 of the Burra Charter and should be avoided.

Mr Lovell supported the use of contemporary modifications and suggested that the Bridge deck could be widened somewhat to accommodate increased traffic lanes. However the wholesale replication or expansion as a replica segment was not supported. He believed a contemporary element adjacent would be a better outcome.

Preferred cross section

The most successful way of maintaining the heritage significance of the Bridge is to keep the Bridge as an operational bridge and not construct a new element.

Clearly the more the Bridge is widened the less likely it is that its heritage values will be conserved. We have considered whether the required outcomes for the crossing could be achieved on the existing Bridge while maintaining its heritage values.

The minimum adaptation required would produce a bridge with:

- two traffic lanes of 3.5 metres,
- T44 capability for crossing,
- clearance between traffic lanes and bridge barriers or kerbs of 1.0 metres (with provision of a stand up kerb and not a barrier between any shared path or foot path and traffic lanes),
- code compliant barriers,
- a shared path of no less than 3 metres, and
- fishing platforms.

The Barwon Heads Bridge has undergone widening and other adaptation over its 80 years of operational life. The Statement of Significance for the Barwon Heads Bridge recognises these changes and the heritage evidence supports further modifications in order to maintain a bridge of sufficient integrity to service the community. It is considered preferable to manage changes to the Bridge rather than to decommission the structure.

The Barwon Heads Bridge differs from most heritage places in that it has a history of change and adaptation. The Burra Charter where adaptation is set out in Article 1.9:

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

We believe that all these requirements may be able to be met on the existing Bridge with a widening of the deck while maintaining its heritage values, but we are conscious of two things:

- we have not seen detailed plans that present this option and so it remains somewhat untested, and
- such modification would require a permit from Heritage Victoria.

It is important to note that the heritage impact is not simply the increased deck width, but also the need to alter the alignment of the bridge so that a lane of traffic can be accommodated during construction. We note this adjustment to the alignment is small, less than 1.5 m and would occur within the extent of the heritage registration.

Furthermore, the total increase in deck width would be from 8.4 metres to 11 metres where the shared pathway provides for the one metre of clearance between the traffic lane and barrier.

Considering all these issues we recommend:

That VicRoads work with Heritage Victoria to develop a refined option that delivers the best heritage outcome in Corridor 1 while providing:

- **traffic lanes no less than 3.5 metres,**
- **a speed limit of 50 km per hour for the Bridge and approach roads from Hitchcock Avenue to Surf Beach Road Ocean Grove,**
- **T44 capability for crossing,**
- **clearance between traffic lanes and bridge barriers or kerbs of 1.0 metres (with provision of a stand up kerb and not a barrier between any shared path or foot path and traffic lanes),**
- **code compliant barriers,**
- **a shared path of no less than 3 metres,**
- **fishing platforms,**
- **continued access (one way traffic) during construction.**

Barwon Heads Bridge approach

The proposed approach route to the bridge involves the construction of a large roundabout to cater for future traffic flows at the intersection of Bridge Road with Flinders Parade and Ewing Blyth Drive.

The roundabout would require land from the current car park area significantly reducing the number of spaces available.

During the hearing we asked that as an alternative a signalised treatment of the Bridge Road/Flinders Parade/Ewing Blyth Drive intersection be considered. While

no formal proposal was prepared, this alternative has significant advantages over the roundabout proposal, namely:

- both Finders Parade and Ewing Blyth Drive could be signalised avoiding the need to divert one leg to make a cross-intersection,
- less land would be required from the foreshore car park,
- the treatment would provide good pedestrian access to the bridge,
- there would no longer be a need for a separate pedestrian signal crossing of Bridge Road midway between the Bridge and Hitchcock Avenue,
- the signals would work well with, and be compatible to ultimate signalisation of the Bridge Road/Hitchcock Avenue intersection.

Having considered these issues we recommend:

The Bridge Road/Flinders Parade/Ewing Blyth Drive intersection be signalised.

9.5 Achieving the cross section

We believe that the road traffic requirements can certainly be met with a widening of the deck of the Bridge consistent with maintaining its heritage values. We recommend:

The existing Bridge be repaired and adapted as the road bridge at Barwon Heads.

It is less clear whether the pedestrian and cycle function could also be achieved on an adapted Bridge and this will require further detailed investigation and ultimately a decision from Heritage Victoria.

Any second crossing should be a contemporary light-weight high-quality design not just a standard bridge. Design of the new element should incorporate architectural, artistic and heritage expertise. This will be easier to achieve on a new pedestrian bridge than a new road bridge.

In the event that the Bridge cannot be adapted to the satisfaction of Heritage Victoria we recommend:

If the existing Bridge cannot be adapted to meet all identified needs then a pedestrian and cycle bridge be constructed adjacent to the Bridge. The design, width and separation from the Bridge be determined primarily on heritage grounds in accordance with the requirements of the *Heritage Act*.

10. The next steps

Approvals are needed under the:

- *Heritage Act* 1995,
- Greater Geelong Planning Scheme,
- *Coastal Management Act* 1995,
- RAMSAR convention.

Issues related to land tenure of various parcels also need to be addressed.

10.1 Heritage Act

A permit is required under the Victorian *Heritage Act* (1995).

The decision whether or not to grant a permit is made by the Executive Director of Heritage Victoria (or the Heritage Council if the Council so determines). An applicant can appeal to the Council in relation to a refusal by the Executive Director (or VCAT in relation to a refusal by the Council). The Minister for Planning has the power to 'call in' any appeal and decide the matter.

We are not able to provide advice about a new application that has yet to be made. We can provide advice as to what would be appropriate as an application, but we have no role in advising Heritage Victoria on how to discharge their legislative obligations.

We have held discussions with the Executive Director of Heritage Victoria to ensure that the recommendations of this report are complementary to the process under the *Heritage Act*, and to ensure, as far as is practicable that our recommendations are consistent with the considerations that the Executive Director will apply.

We note that the expert material provided to us is publicly available and hence available to Heritage Victoria.

We note that the Conservation Management Plan for the bridge will need to be updated, and we think that it would be desirable to have consistency between the extent of the Heritage Victoria listing and the Greater Geelong Planning Scheme heritage overlay.

Having considered this issue we recommend:

That the normal process of seeking a permit under the *Heritage Act* apply.

The Conservation Management Plan be revised to bring current issues into consideration.

Heritage Victoria review the extent of registration to achieve consistency with that protected in the Schedule to the Heritage Overlay for the Greater Geelong Planning Scheme.

That the Executive Director of Heritage Victoria be provided with a copy of this report.

10.2 Greater Geelong Planning Scheme

Extent of the Heritage Overlay

One issue that emerged during the course of the hearing was that the Heritage Victoria extent of registration differs from the area protected within the Heritage Overlay to the Greater Geelong Planning Scheme.

Orderly planning would suggest that the extent of area managed under heritage controls should reflect the threshold of heritage significance for that area.

Mr Lovell indicated that he felt that the area of heritage significance for the Barwon Heads Bridge should be increased to include a buffer of 20 metres either side of the Bridge and its abutments. He also suggested that Council should consider the application of a Significant Landscape Overlay or Environmental Significance Overlay for the entire estuarine region.

City of Greater Geelong also supported the rationalisation of the extent of heritage protection for the Bridge.

The following heritage places in Corridor 1 are also protected in the provisions of the Greater Geelong Planning Scheme:

- HO 1649 Heritage Precinct - Flinders Heritage Area,
- HO 1660 Bluestone retaining wall, 1 Ewing Blythe Drive,
- HO 1661 Barwon Heads Park, and
- HO 1668 1 Flinders Parade, Barwon Heads.

In accordance with the controls in the Greater Geelong Planning Scheme, a permit is required to change, alter or demolish a place listed in the schedule to the Heritage Overlay.

In evidence, Mr Lovell outlined that whilst some level of widening to the Bridge could be accommodated it is important to note that this would impact the abutments where the Bridge intersects the Flinders Heritage Area.

Planning approval

Mr Ward provide planning evidence that the most appropriate way of obtaining planning approval was by way of a site specific plan incorporated under Clause 52.03.

This clause provides for land identified in a schedule to the clause may be used or developed in accordance with the specific controls contained in an incorporated document corresponding to that land.

The specific controls may:

- allow the land to be used or developed in a manner that would otherwise be prohibited or restricted;
- exclude any other control in this scheme.

Using Clause 52.03 is an appropriate mechanism for a proposal of this type given the public process to date and the requirements under the *Heritage Act*. A schedule to Clause 52.03 would be introduced by a planning scheme amendment. The appropriate time to do this would be once a permit has been obtained under the *Heritage Act*.

Amendment

Section 20 (4) of the *Planning and Environment Act* allows the Minister for Planning to amend planning schemes without public notice or submissions. The use of these powers is governed by the Ministerial Powers of Intervention in Planning and Heritage Matters Practice Note.

The Practice Note requires the Minister for Planning to meet certain criteria in the exercise of Ministerial powers of intervention. As an overriding consideration, Ministerial powers will only be exercised having regard to and within the confines of, the legislative provision in question.

We have considered the criteria set out in the Practice note, and support a Ministerial Amendment under section 20(4) of the *Planning and Environment Act*. Specifically we advise that:

The Advisory Committee is satisfied that the circumstances for Ministerial intervention and the nature of the recommended amendment satisfy the relevant criteria in the Ministerial Powers of Intervention in Planning and Heritage Matters Practice Note on the following basis:

- **Criterion 1 – The matter is one of genuine State significance as it raises a major issue of State public interest.**
- **Criterion 2 – The matter will give effect to an outcome where the issues have been reasonably considered and the views of affected parties are known.**
- **Criterion 4 – The matter will raise issues of fairness of public interest, where there is a need for urgency and the public interest would be served by immediate action and the matter is unlikely to be reasonably resolved by the processes normally available.**
- **Criterion 5 – The matter requires the co-ordination to facilitate decision making by more than one agency.**

Having considered this issue we recommend:

VicRoads work with the relevant section of DSE to facilitate approval by way of a planning scheme amendment once a permit has been obtained under the *Heritage Act*.

10.3 Other approvals

Coastal Management Act

Approvals are also required under the *Coastal Management Act 1995*.

Section 37 of the Act provides:

A person must not use or develop coastal Crown land unless the written consent of the Minister has first been obtained.

A referral of a permit application under the *Planning and Environment Act 1987* is deemed to be an application under the *Coastal Management Act*. If the proposal is approved by way of a planning scheme amendment that removes the need for a permit then an application under the *Coastal Management Act* will be necessary.

The Minister must make a decision within 28 days of receiving an application. If the Minister fails to make a decision within this time, the Minister is deemed to have refused to consent to the use or development.

Having considered this issue we recommend:

That the normal process of seeking approval under the *Coastal Management Act* apply.

Ramsar

We understand that the Ramsar wetland is defined as being upstream of Barwon Heads Bridge. No doubt this was viewed as a convenient boundary, however it means that if the Bridge is reconstructed slightly upstream it will intrude in to the Ramsar area. This will trigger a number of approval processes.

Land tenure

Development may require the revocation of permanent Crown land – this requires legislation to be passed by Parliament. Such legislation to revoke a reservation (a miscellaneous land act) is not uncommon.

Conclusion

As we understand the requirements that with respect to these other approvals, and as was submitted to us at the hearing, none present any overwhelming difficulty, but rather go to matters of detail.

VicRoads liaise with the Department of Sustainability and Environment to resolve *Coastal Management Act*, Ramsar and land tenure issues.

11. Summary of conclusions and recommendations

Conclusions on considerations

In relation to the state of the Bridge we have concluded:

1.0 The Barwon Heads Bridge is in need of significant repair and restoration and that requires the replacement of a number of the elements of the Bridge.

- 1.1 The current condition of piles is poor due to many defects including splits and rot. A clear majority of piles need to be replaced within 10 years if not sooner.
- 1.2 The current condition of the connection of the crossheads to the piles is poor. The seating of the crossheads on the piles need to be repaired, remediated or strengthened.
- 1.3 The current condition of the bracing and walers is satisfactory to good.
- 1.4 The wooden stringers serve no structural function.
- 1.5 The current condition of the steel stringers and cross frames is generally good.
- 1.6 The current condition of the deck timbers is poor. The deck needs significant repair or replacement.
- 1.7 The current condition of the rails and barriers is poor and they do not meet relevant standards. The railings and barriers need replacement.

In relation to works required on the Bridge to overcome identified deficiencies in the crossing we have concluded:

- 2.1 Adapting the Bridge to cater for T44 loadings would involve:
 - relocating the existing steel stringers above piles, and recalculating the loadings on the crossheads in this revised configuration.
 - replacing the crossheads in timber of the same dimension as existing or in steel of the same dimension as the existing timber crossheads following a reassessment of loadings on crossheads following the relocation of the stringers.
 - redesigning the connection of the crossheads to the piers be to cater for the projected loadings.
- 2.2 Adapting the Bridge to provide for code compliant rails on the Bridge would require the deck (including remnants of the original wooden deck) be replaced in concrete.
- 2.3 Adapting the Bridge to provide adequate clearances to barriers would involve providing 3.5 metre wide traffic lanes with 1 metre clearances to barriers.
- 2.4 Adapting the Bridge to cater at an acceptable minimal level for pedestrians and cyclists would involve providing a three metre wide pedestrian and cycling path along the upstream side in addition to fishing platforms.
- 2.5 Two traffic lanes are adequate to meet future vehicular traffic demand.

In relation to the practical issues in reconstruction we have concluded:

- 3.1 The use of a temporary bridge would add significantly to the cost of the project.
- 3.2 A slight change in alignment of the Bridge may be required to allow for continued access during reconstruction.
- 3.3 Spliced piles may not be as long lasting as re-driven piles.
- 3.4 Overcoming identified deficiencies in relation to the seating of the crossheads on the piles is likely to be far easier if all the piles are replaced when the deck is replaced.
- 3.5 VicRoads may need to search nationally to secure a supply of suitable timber.
- 3.6 Suitable timbers may not be available to reconstruct or repair the bridge in timber.

In relation to whether a new bridge should be constructed adjacent to the existing bridge or upstream on the Geelong Road alignment we have concluded:

4.0 Building a new bridge adjacent to the Bridge is overwhelmingly preferable to a new bridge on Corridor 2.

- 4.1 Building a new bridge adjacent to the Bridge is preferable to a new bridge on Corridor 2 on:
 - cost grounds,
 - heritage grounds,
 - visual amenity grounds,
 - land acquisition grounds,
 - social impact grounds related to sailing,
 - social impact grounds in relation to camping,
 - ecological, and
 - Indigenous heritage grounds.
- 4.2 The traffic engineering advantages which could flow from the Geelong Road extension at Corridor 2 are negligible if the current bridge is retained for road traffic.
- 4.3 There is no significant advantage to building a new element in either the Corridor 1 or Corridor 2 alignments when considering the impact of splitting the town.
- 4.4 No evidence was provided to suggest that Corridor 1 would support business and tourism objectives better than Corridor 2. As such no preference is given to either corridor in relation to this issue.

Preferred option

In relation to the level of service to be provided by a crossing at Barwon Heads we recommend:

- 5.1 The crossing cater for T44 loading.
- 5.2 The crossing provide for 3.5 metre wide traffic lanes with 1 metre clearances to barriers.
- 5.3 The crossing provide better for pedestrians and bicyclists by providing a shared path at least 3.0 metres wide.

5.4 One way traffic be maintained during reconstruction.

In relation to the material and construction we recommend:

6.0 The existing Bridge be repaired and adapted as the road bridge at Barwon Heads.

6.1 The Bridge be restored using the following materials:

- the piles be replaced in timber of same dimensions and similar species as original bridge,
- the walers and cross braces be reused where possible or replaced in timber of same dimensions and similar species as original bridge,
- the existing steel stringers be reused with relocation above piles, and the loadings on the cross heads recalculated in this revised configuration,
- if possible, following a reassessment of loadings on crossheads after the relocation of the stringers, the crossheads be replaced in timber of the same dimension as existing or in steel of the same dimension as the existing timber crossheads,
- the deck (including remnants of the original wooden deck) be replaced in concrete.

6.2 The piles be replaced or spliced at the same time that the deck is replaced.

6.3 That VicRoads work with Heritage Victoria to develop a refined option that delivers the best heritage outcome in Corridor 1 while providing:

- traffic lanes no less than 3.5 metres,
- a speed limit of 50 km per hour for the Bridge and approach roads from Hitchcock Avenue to Surf Beach Road Ocean Grove,
- 44 tonne (T44) capability for crossing,
- clearance between traffic lanes and bridge barriers or kerbs of 1.0 metres (with provision of a stand up kerb and not a barrier between any shared path or foot path and traffic lanes),
- code compliant barriers,
- a shared path of no less than 3 metres,
- fishing platforms,
- continued access (one way traffic) during construction.

6.4 If the existing Bridge cannot be adapted to meet all identified needs then a pedestrian and cycle bridge be constructed adjacent to the Bridge. The design, width and separation from the Bridge be determined primarily on heritage grounds in accordance with the requirements of the *Heritage Act*.

6.5 The route for the Barwon Heads–Ocean Grove Road through Barwon Heads should be Golf Links Road–Bridge Road.

6.6 The Bridge Road/Flinders Parade/Ewing Blyth Drive intersection be signalised.

In relation to further action we recommend:

- 7.1 VicRoads work with the Department of Sustainability to put in place long term plans (80 to 100 year timeframe) for securing suitable bridge timbers for its heritage assets.
- 7.2 That the normal process of seeking a permit under the *Heritage Act* apply.
- 7.3 The Conservation Management Plan be revised to bring current issues into consideration.
- 7.4 Heritage Victoria review the extent of registration to achieve consistency with that protected in the Schedule to the Heritage Overlay for the Greater Geelong Planning Scheme.
- 7.5 That the Executive Director of Heritage Victoria be provided with a copy of this report.
- 7.6 VicRoads work with the relevant section of DSE to facilitate approval by way of a planning scheme amendment once a permit has been obtained under the *Heritage Act*.
- 7.7 That the normal process of seeking approval under the *Coastal Management Act* apply.
- 7.8 VicRoads liaise with the Department of Sustainability and Environment to resolve *Coastal Management Act*, Ramsar and land tenure issues.

In relation to a possible planning scheme amendment using Ministerial powers under Section 20(4) of the *Planning and Environment Act* we conclude:

- 8.0 The Advisory Committee is satisfied that the circumstances for Ministerial intervention and the nature of the recommended amendment satisfy the relevant criteria in the Ministerial Powers of Intervention in Planning and Heritage Matters Practice Note on the following basis:
 - Criterion 1 – The matter is one of genuine State significance as it raises a major issue of State public interest.
 - Criterion 2 – The matter will give effect to an outcome where the issues have been reasonably considered and the views of affected parties are known.
 - Criterion 4 – The matter will raise issues of fairness of public interest, where there is a need for urgency and the public interest would be served by immediate action and the matter is unlikely to be reasonably resolved by the processes normally available.
 - Criterion 5 – The matter requires the co-ordination to facilitate decision making by more than one agency.

A Parties to the hearing

The Advisory Committee heard the parties listed in Table below.

Table 1

Submittor	Represented By
Department of Sustainability and Environment	Kirsten Kilpatrick Senior Planner SW Region
VicRoads	Mr Michael Freeman Planning Studies Manager VicRoads
	Mr Mark Bartley and Ms Louise Hicks of the firm Philips Fox who called the following witnesses: <ul style="list-style-type: none"> - Sandy Russo, Traffic - David Shrimpton, Traffic - Stephen Pelosi, Traffic - Ruth Davies, Social Planner, - Bill Unkles, - Ian Wallis, Air Quality engineer (written submission only) - Peter Lovell, Heritage
National Trust of Australia (Vic)	David Moloney
Barwon Coast Committee of Management	Bob Jordan
Barwon Heads Association	Dr Robert Gibson
Barwon Heads Sailing Association	Mark Derham who called: <ul style="list-style-type: none"> - Gregory Martin, Club Captain
Friends of the Barwon Bridge	Bernard Naphine
Friends of the Barwon River	Peter Vickery who called: <ul style="list-style-type: none"> - Dr Wulff, Visual Amenity - Dr Jeff Yugovic, Flora and Fauna - Jason Walsh, Traffic
Barwon River Keepers	
Barwon Estuary Boat Hire	

Submittor	Represented By
Norma Leslie	
Annabel McFarlane	
Justin Teague	
James Fidge	
Judith Brooks	
Simon Dawe	
G H Wallace Smith	
Dorothy Leslie	
Heather McCarthy	
Carol Richardson	
Barry Pollard	
Ben and Sharon Lo	
Margaret Austin	
Jennifer Baker	
Jan Testro	
John Taylor	
David (John) Freeman	
Roger Bodey	

B Photographs of Bridge elements

		
<p>Evidence of Marine Bores</p>	<p>Piles repaired with cleats/splints</p>	<p>Piles repaired with bands</p>
		
<p>Previous repair to pile using concrete and timber splints along the full above-water length of pile</p>	<p>Band on piles</p>	<p>Rot and borer holes as well as cracking on pile. Repair attempted by installation of steel band.</p>

Photograph 1: Condition of bridge piles








Photograph 2: Condition of crossheads



Photograph 3: Condition of bracing

		
Crushing of bearing pads under steel beams	Typical rot of corbels beneath drainage points	No bracing between central corbels
		
Deterioration of corbel	Corbel with a large hole through centre	Major split in corbel.
		
Stringer showing evidence of borer infestation	Typical rust formation on through bolts on corbels	Deflection of stringer and corrosion of soffit of light post
		
Heavy oxidation on bracing due to salt splash	Total collapse of beam above corbell	

Photograph 4: Condition of stringers, corbels and cross frames

		
<p>Cracking of bituminous deck and hole in central section of the bridge</p>	<p>Timber rot and deterioration as a result of moisture collection. Source of moisture is from an above deck hole.</p>	<p>Central deck planks earmarked for replacement. New angle brackets are proposed to re-establish support under deteriorated ends of longitudinal planks.</p>
		
<p>Steel brackets connected to timber crossbeams used to support ends of timber decking that has significant rot.</p>	<p>Fire damage under walkway has not been repaired</p>	<p>Unprotected lighting conduit and cabling</p>

Photograph 5: Condition of the deck