SEISMIC ASSESSMENT OF NEW ZEALAND HIGHWAY BRIDGES: DEVELOPMENT AND TESTING OF PRELIMINARY SCREENING PROCEDURES

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AN IMPORTANT NOTE FOR THE READER

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ACKNOWLEDGMENTS

The recommended preliminary screening procedure is closely based on that developed and used by the State of California Department of Transportation (Caltrans). The agreement of Caltrans to the use of its work, and the assistance received from its staff during this project, are gratefully acknowledged.

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EXECUTIVE SUMMARY

1. Introduction

Bridges form vital links in highway networks. If the links are broken by a major earthquake, serious disruption to the flow of relief services and other essential highway traffic is likely.

Highway authorities in seismically active countries are paying increasing attention to the assessment of the vulnerability of important highways to earthquake damage, and to the associated costs of their disruption to both the road users and the communities served by the highways. Procedures have been introduced, notably in Japan and the United States of America, by which the risks and consequences of damage to highway bridges in earthquakes can be assessed. For feasible and economically justifiable cases retrofitting programmes have been implemented to reduce the risk of serious bridge damage to an acceptable level.

In New Zealand recent investigations indicate that there are enough vulnerable structures on the state highway network to warrant implementing a systematic seismic evaluation of all its bridges. Such evaluation requires a three step process, as follows:

a. Using a preliminary screening procedure, produce a list of bridges, in order of priority, that require detailed study to assess their seismic vulnerability and need for retrofitting.

b. Identify those bridges in that list which, by adequately detailed evaluation, show seismic retrofitting to be financially justifiable.

c. Design retrofit measures for the bridges identified in step b. for which implementation is to proceed.

No preliminary screening procedure has been published for application specifically to New Zealand's bridges, and the purpose of this project was to develop, test, review and recommend such a procedure. This report describes the results of an investigation of existing screening procedures which are in use in other countries, and sets out a *Proposed Preliminary Screening Procedure*, which was subsequently tested by application to 29 of the bridges on State Highway 1 between Bulls and Wellington. The results of the testing are reported, together with the modifications made to the Proposed Procedure as a consequence of the testing, and of reviewers' comments. An appendix to the report contains a *Recommended Preliminary Screening Procedure*, for possible adoption by Transit New Zealand in its future programme of assessment of the vulnerability of highway bridges to damage by earthquakes.

2. Project Objective

The objective of this study was to develop a recommended preliminary screening procedure, for use in deciding the priority order in which New Zealand highway bridges should be assessed for the risk of their sustaining seismic damage.

3. Review of Existing Procedures

A literature review was carried out along with a detailed examination of the Seismic Risk Identification and Prioritisation Procedures adopted in the United States of America and Japan. A literature search was performed on the topic of seismic screening, prioritisation and retrofitting procedures. Thirty relevant references were selected and reviewed.

Principal findings from the literature review were:

- Procedures to identify and prioritise bridges in need of retrofitting have been established, or were being considered, in many states in the United States of America; and in Japan a nationwide seismic inspection of highway bridges has been carried out, and a procedure established for prioritising bridge structures in need of seismic retrofitting.

- The Japan Ministry of Construction prioritisation procedure was largely a vulnerability assessment based on the extensive records of damage to Japanese highway bridges following earthquakes. The intensity of ground shaking and the importance of a bridge to the social or survival needs of a community serviced by the bridge were not specifically evaluated in the prioritisation process.

- The prioritisation procedures adopted by the United States highway authorities were similar to each other in that they required basic information to be obtained on:

  - The seismic hazard of the bridge and site;
  - The vulnerability of the bridge to earthquake damage; and
  - The importance of the bridge as a vital link in the transportation system.

  Each of these three major variables was numerically rated with an index. The indices were arithmetically combined to give an overall grade which was used to rank the bridges in order of priority for detailed evaluation for retrofitting.

- The preliminary screening and prioritisation procedure needed to be kept simple. Then the basic information required could be obtained and numerically rated by technical staff who were not experienced in evaluating the seismic response of bridges in earthquakes, damage assessment or retrofit design.

4. Development of the Proposed Preliminary Screening Procedure

The Procedure is based on the model developed by the State of California Department of Transportation (Caltrans). It has three main parts:

- Identification of bridges which have a low risk of catastrophic collapse during a severe earthquake, so that they can be excluded from the assessment. These are bridges designed to comply with bridge seismic design codes of 1972 or later; single span bridges with monolithic or otherwise secure abutment seats; or uniform bridges of limited pier heights with a length-to-width ratio of 8 or less and with some other required characteristics.

- Identification of bridges which lack positive connecting linkages between superstructure elements, so that they can be assessed as soon as possible for possible retrofit.

- The screening developed for bridges not in the above two categories to evaluate three main variables:

    - Hazard (seismicity at the bridge site and other hazards threatening the bridge);
    - Importance of the bridge; and
    - Vulnerability of the structural system.

  There are 18 recommended attributes within the above three variables, and criteria against which a numerical index can be chosen for each attribute. From these indices the final overall "Seismic Prioritisation Grade" (SPG) is calculated.

  The SPG = Hazard Index x [(0.6 x Importance Index) + (0.4 x Vulnerability Index)].

5. Testing the Proposed Preliminary Screening Procedure

5.1 Research Tasks

Of the 36 bridges on State Highway 1 between Bulls and Wellington, 29 were included in the project. This part of the project comprised three research tasks.

5.1.1 **Task 1:** Assemble information and undertake preliminary seismic screening

i Obtain details of structures and available site investigation results, details of traffic intensities using the bridges, and details of available detour routes.

ii Apply the trial procedure developed.

iii Summarise the results of applying the trial procedure.

5.1.2 **Task 2:** Detailed Assessment of Bridges

i. For all the bridges included in the assessment project, determine the critical points in each structure for stability, strength, ductility and displacement; the threshold response acceleration(s) above which significant damage is caused; and appropriate approximate response spectra. Take account (to the extent that available information held in the bridge records allows) of the effects that ground liquefaction or lateral spreading may have on the abutments and/or piers, if they are likely to be potential problems.

ii. Determine the probability of significant structural damage occurring within 50 years, and estimate both the direct and indirect costs of seismic damage.

iii. Compare the results of the seismic assessments undertaken in steps i and ii with those of the Proposed Preliminary Screening Procedure in Task 1, and determine whether the procedure identifies bridges that warrant more detailed assessment, and whether the procedure prioritises structures satisfactorily.

iv. Identify improvements which could be made to the Proposed Preliminary Screening Procedure and estimate the time and costs required to apply the screening procedure to the state highway system.

5.1.3 **Task 3:** Reporting

Prepare a report describing in detail the work undertaken, the results obtained and such conclusions and recommendations as may be appropriate.

5.1.4 Other Tasks:

Possible alternative ways of calculating the Seismic Performance Grading had been suggested during the discussions with the Project Review Committee, and the effects of these alternatives were also investigated.

5.2 Implementing the Tasks

5.2.1 Assemble Information and Undertake Preliminary Seismic Screening (Task 1)

Information was gathered on the structures, the traffic intensities and the available detours. This information formed the basic input for completion of the screening procedure.

The information on the structures was obtained from copies of the detailed drawings held by Works Consultancy Services Limited. Suitable information on ground conditions was not readily available, leading to difficulties in allocating ratings to the "ground conditions" part of the screening data sheets.

The information on traffic volumes was obtained from Transit New Zealand records. Lengths of detours were identified from topographical maps.

Each bridge site was visited to enable checks to be made that the record drawings being used did represent the structure in its current condition. The visits enabled the assessor to better gain a "feel" for the structure and to identify important characteristics which were not obvious from the drawings.

The Proposed Preliminary Screening Procedure, described in outline in 4. above, was applied to each bridge and was found to be easy and quick to use.

5.2.2 Detailed Assessment of Bridges (Task 2)

i and ii Risks, Damage Probability and Costs

The effectiveness of the proposed screening procedure was judged by comparing the prioritisation obtained from the procedure with an economic prioritisation obtained by estimating the future costs of bridge damage caused by earthquakes. The scope of the project made it necessary for the costs to be obtained by approximate means. Even with more detailed analyses the imprecise underlying assumptions would have led to only approximate results.

For each bridge the hierarchy of damage was identified by using approximate structural analysis methods. Analyses generally comprised use of a computer model based on assumed elastic behaviour of the structure to identify the initial and subsequent points of yielding or failure. Assessment of bridge member capacities took account of recent research rather than being based on "design code" values.

The costs and times required to repair bridges, and to provide temporary replacement crossings where needed, were all important factors in estimating the direct and indirect costs of damage. All these items were estimated for each bridge, and this information formed the basis of an economic analysis. The results were expressed as an expected annual cost of damage for each bridge, together with a breakdown into cost components. A feature of the analyses was the very high effect of disruption to traffic on the indirect cost of damage to bridges, and the consequential need for this to be given prominence in the screening procedure. A list of bridges in priority order was produced on the basis of the expected annual cost of damage.

iii Comparison of Results

Correlation between the prioritisations obtained by applying the screening procedure and by applying the economic analysis was poor. Better correlation was obtained when the values of some of the factors within the screening procedure were adjusted to take account of influential items identified from the economic analysis. But close correlation was not obtained.

But the poor correlation was not surprising, in view of the necessarily approximate base data on which the economic analyses were founded. Investigation of poor correlations showed that six of the 10 bridges producing poor correlations were small and would have been excluded from assessment by the screening procedure. The other four anomalies were more difficult to eliminate by modification of the screening procedure alone. The poor correlation highlighted that the prioritisation process should include a review of the results of the screening, as an integral part, to take account of specific factors identified for individual bridges. Such a review should be undertaken by experienced seismic engineers in conjunction with geotechnical engineers and input from economists.

iv Improvements to the Proposed Preliminary Screening Procedure and Costs of Implementation

Changes were made to the Proposed Preliminary Screening Procedure as a result of testing and reviewers' comments on the draft reports. The Recommended Preliminary Screening Procedure was the result. The changes resulted in some simplification, and an increased effect of the loss of use of a bridge by accentuating the influence of traffic volume, detour length, bridge length and soil conditions.

The cost to apply the screening procedure to the 3000 bridges on the State Highways network is estimated to be between NZ$1 million and NZ$1.5 million. Between 10 000 and 15 000 hours work is estimated, about half of which would be provided by engineers with seismic or geotechnical experience and economists. The other half would be provided by other technical and support staff.

6. Conclusions

- The Recommended Preliminary Screening Procedure will produce an acceptable screening of structures for more detailed assessment of their susceptibility to earthquake damage, albeit with some anomalies.

  An attractive feature of the procedure is its simplicity of application.

  To identify and rectify the anomalies an integral part of the procedure must be the review of the results by an experienced seismic engineer, with advice also from a geotechnical engineer and an economist.

- Site geotechnical information needed to assess the older bridges is likely to be scarce. The information is important as these bridges are of most interest in the review process for selecting appropriate site response spectra, and for assessing the probability of subsoil liquefaction.

7. Recommendations

It is recommended that the *Recommended Preliminary Screening Procedure* be adopted for use in identifying bridges on the state highway network for detailed assessment of their earthquake resistance.

It is desirable to screen all the bridge stock to obtain a prioritised ranking list before undertaking detailed seismic assessments. In practice it is likely that the prioritised lists will consist of closely graded groups of bridges, and it is important to begin assessments of those in the highest priority groupings before all bridges could be screened.

It is therefore recommended that the screening procedure be applied progressively within geographic areas selected on the basis of relative seismic hazard and traffic intensity. Convenient areas would be the Transit New Zealand regions. Within each geographic area the order of assessment of the bridges would be determined on the basis of factors which influence the screening prioritisation. These are the average daily traffic on the bridge, the bridge length, pier heights and number of spans, all of which are readily available from Transit New Zealand records. This would represent an imperfect but practical approach, which would enable the assessment effort to be applied to many, but not necessarily all, of the most appropriate bridges first.

A suggested list of regions, in decreasing order of priority, for application of the screening procedure is as follows (with the approximate number of state highway bridges in each region): 9 (81), 8 (189), 3 (236), 6 (73), 7 (99), 10 (158), 4 (139), 5 (75), 12 (286), 2 (182), 11 (262), 13 (200), 1 (164), 14 (222).

8. Other Issues

It would be useful to have the relative benefit/cost ratios at the same time as the results of the proposed preliminary screening procedure. It would be appropriate to derive these for the bridges identified as being in the highest priority for detailed assessment, as an additional indicator of the order in which assessment should be undertaken. Such a ratio could only be produced quickly if it were based on approximate methods, and would itself be approximate. For the individual bridges judgements would be required of the cost and probability of damage, the cost of repairs, the time required for repairs, the effect of detours on traffic demand, the likelihood and extent of damage to detours etc. Estimation of a benefit/cost ratio could be included in the procedure as part of the "expert" appraisal after the secondary screening, but would add a significant time element to the overall process.

The Recommended Screening Procedure does not include the bridge approaches. A methodology for screening and assessment of embankments, whether at bridge approaches or at other locations on the highways, would require different criteria, and consideration should be given to its development. However, the likelihood of long term disruption of bridge use by seismic damage to the approaches is much lower than that caused by damage to the structures they serve because temporary access to the bridge is likely to be achievable in a relatively short time.

ABSTRACT

A preliminary screening procedure for the prioritisation of New Zealand State Highway bridges is presented. The procedure is designed to identify bridges which justify detailed assessment of their earthquake resistance. The derivation of the procedure is described and the source material is listed. The results of a pilot application carried out in 1994 of a preliminary version of the screening procedure are presented. The pilot application considered 29 bridges on State Highway 1 between Bulls and Wellington, North Island. The results from the screening procedure were compared with those from an economic analysis which used base data from an approximate structural assessment. The comparison led to some modifications being made to the preliminary procedures to produce the final version. Results of the comparison and details of the modifications are presented.

1. INTRODUCTION

Bridges form vital links in highway networks. If the links are broken by a major earthquake, serious disruption to the flow of relief services and other essential highway traffic is likely. The 10 500 km of state highways in New Zealand include some 3000 bridges, which is equivalent to a bridge every 3½ km. This represents a very high incidence of bridges by international standards. It makes New Zealand's transportation system particularly vulnerable to disruption should significant bridge damage occur on a major route as a result of an earthquake.

Highway authorities in seismically active countries are paying increasing attention to the assessment of the vulnerability of important highways to earthquake damage, and to the associated costs of disruption to the road users and the communities served by the highways. Procedures have been introduced, notably in Japan and the United States of America, by which the risks and consequences of damage to highway bridges in earthquakes can be assessed. For feasible and economically justifiable cases retrofitting programmes have been implemented to reduce the risk of serious bridge damage to an acceptable level.

In New Zealand no comprehensive formal procedures exist for the assessment of the risk of seismic damage to the highway bridges. Although the highway network can be seriously disrupted by slumping or by landslides in an earthquake, this type of damage can usually be repaired quickly to allow essential traffic services to be reinstated. On the other hand, partial or total collapse of a bridge cannot usually be repaired quickly, causing many weeks or months of disruption to essential traffic. Seismic risk assessment of a highway should therefore focus initially on the bridges. While the general public may accept relatively minor disruption caused by slumping and landslip, they would probably not accept the possible loss of life or the major disruption of highway routes as a result of bridge damage.

Recent reports by Works Consultancy Services Limited (WCS 1990a, b, 1991a, b, 1992) have been prepared for Transit New Zealand to investigate the seismic vulnerability of typical and specific highway bridges. These reports represent the initial steps taken to assess the risk of disruption of the state highway network because of potential damage to its bridges. They indicate that there are enough vulnerable structures on the state highway network to warrant implementing systematic seismic evaluation of all Transit New Zealand bridges. Such evaluation requires a three step process.

i Using a preliminary screening procedure produce a list of bridges, in order of priority, that require detailed study to assess their seismic vulnerability and need for retrofitting.

ii Identify bridges in that list which by detailed evaluation show retrofitting to be financially justifiable.

iii Design retrofit measures for the bridges identified in step ii. for which implementation is to proceed.

Assessment of the risk of seismic damage to highway bridges usually requires a significant amount of detailed investigation and analysis, and should therefore only be applied to bridges which justify such effort. An initial step in an assessment programme is to use a preliminary screening procedure to help identify which bridges need not be studied in detail, and to decide the order of priority of those which should be studied.

No preliminary screening procedure has been published for application specifically to New Zealand's bridges, and the purpose of this project was to develop, test, review and recommend such a procedure. This report describes the results of an investigation of existing screening procedures which are in use in other countries, and sets out a *Proposed Preliminary Screening Procedure* which was subsequently tested on 29 bridges on State Highway 1 between Bulls and Wellington. The results of the testing are reported, together with the modifications made to the Proposed Procedure as a consequence of the testing, and of reviewers' comments. Appendix 5 contains a *Recommended Preliminary Screening Procedure* for possible adoption by Transit New Zealand in its future programme of assessment of the vulnerability of highway bridges to damage by earthquakes.

2. PROJECT OBJECTIVE

The objective of this study was to develop a recommended preliminary screening procedure for use in deciding the priority order in which New Zealand highway bridges should be assessed for the risk of sustaining seismic damage.

3. REVIEW OF PRELIMINARY SCREENING PROCEDURES

3.1 Literature Review

The project included undertaking a literature search, in 1993, on the topic of seismic screening, prioritisation and retrofitting procedures. Thirty relevant references were selected and reviewed (Section 10). They provide very good coverage of the preliminary screening and prioritisation procedures which had been implemented by highway authorities in the United States of America (USA) and Japan since the mid-1980s, and particularly those adopted by the State of California Department of Transportation (Caltrans) - a world leader in the field of seismic retrofitting of bridges. Caltrans first implemented a comprehensive programme of screening, prioritising and retrofitting vulnerable bridges following the 1971 San Fernando earthquake in California which caused major damage to some modern bridge structures. The screening and prioritisation procedures adopted by Caltrans have been reviewed and progressively refined by them since that earthquake. The last review was completed in 1992 but information on more recent developments was obtained by correspondence.

The principal findings from the literature review were:

1. Procedures to identify and prioritise bridges in need of retrofitting had been established in many states in the United States of America, including California, Washington, Missouri, Nevada and New York. A number of other states had procedures currently under consideration.

2. Guidelines for the seismic retrofitting for highway bridges, which include a preliminary screening and prioritisation procedure, have been published by the Applied Technology Council (ATC) with financial support from the United States Federal Highway Administration (FHWA).

3. The Ministry of Construction in Japan has carried out a nationwide seismic inspection of highway bridges and has established a procedure for prioritising bridge structures in need of seismic retrofitting.

4. The prioritisation procedures adopted by the highway authorities are all similar in that they require basic information to be obtained on:

    - The seismic hazard of the bridge and site;
    - The vulnerability of the bridge to earthquake damage; and
    - The importance of the bridge as a vital link in the transportation system.

    Each of these three major variables is numerically rated with an index. The indices are arithmetically combined to give an overall seismic prioritisation grade which is used to rank the bridges in order of priority for detailed evaluation for retrofitting.

5. The formulae used by the highway authorities to arithmetically combine the individual indices of the three major variables to give an overall seismic prioritisation grade differed considerably. The indices were usually added or multiplied. The consensus appeared to show a preference for the multiplicative or semi-multiplicative methods because they generally achieve a greater spread of final grades and fewer inconsistencies. Some highway authorities also applied different weightings to each of the three major variables.

6. Only one highway authority included the cost of retrofitting in their initial screening and prioritisation procedures, and none took other economic considerations directly into account.

7. A number of references stressed the need to keep the preliminary screening and prioritisation procedure simple. Then the basic information required could be obtained and numerically rated by technical staff who did not need to be experienced in evaluating the seismic response of bridges in earthquakes, damage assessment or retrofit design. It was considered that the initial stages of the screening procedures needed to be carried out by experienced general practitioners using clear straightforward guidelines for the numerical rating.

8. The broad consensus of opinion among bridge design experts was that the lack of adequate direct or indirect connections between superstructure components exposed a bridge to the greatest probability of span collapse in the event of a significant earthquake. Any retrofitting programme should therefore initially focus on correcting this serious structural deficiency.

9. The New York and Illinois procedures included consideration of both the soil amplification and soil liquefaction potential of the bridge site, whereas the post-1992 Caltrans procedure considered only soil amplification effects. The ATC, Washington, and pre-1992 Caltrans procedures did not consider either soil amplification or soil liquefaction potential. The Washington and New York procedures also took into account the remaining life of the bridge.

3.2 Risk Identification and Prioritisation Procedures adopted in the United States of America and Japan

3.2.1 United States of America Procedures

Preliminary screening and prioritisation procedures have been either implemented or proposed in the states of California, Washington, Illinois, Nevada and New York.

The first comprehensive study was performed by the ATC under contract to the FHWA, and published as a set of guidelines for seismic retrofit in 1983 (ATC 1983). The guidelines were national in scope and compatible with the seismic performance categories used in the ATC/FHWA design criteria for new bridges. (Since completion of the 1993 literature search, and the subsequent development of the Recommended

Preliminary Screening Procedure described in this report, a revision of the 1983 Guidelines has been developed (Buckle 1995).)

Before 1983 Caltrans was implementing Phase I of its retrofit programme which focused on inadequate span seat lengths and on the installation of restrainers at piers and intermediate in-span hinges to interlink spans. In 1990 Caltrans developed a rating system for prioritising Phase II of its programme (column and footing retrofit), which quantified some of the more subjective items in the ATC/FHWA Guidelines. Both the ATC and the 1990 Caltrans Phase II rating systems added the indices for the major variables to give an overall grade. The weighted factors affecting probability of failure were added to the weighted factors affecting the consequences of failure.

In 1992 Caltrans adopted a revised rating system for Phase II of its retrofit programme. They considered that the additive approach could produce inconsistent evaluations of risk. Thus, in the revised procedures they adopted a semi-multiplicative or hybrid approach.

Other states followed California's lead in this area and proposed alternative rating systems for the preliminary screening and prioritisation of their bridges for retrofitting. These included Washington (Babaei and Hawkins 1991), Illinois (Cooling 1990), New York (Buckle 1990), Nevada and Missouri. Buckle (1991) reported significant differences, although all used importance, seismicity and vulnerability to determine a rank or priority index. For example, both ATC/FHWA and the pre-1992 Caltrans procedures added the weighted factors together to obtain an overall index. Washington multiplied unweighted factors to give the final result. The Illinois procedure was a hybrid in that fragility curves and probability-of-exceedance curves were used to obtain structural and ground vulnerability factors. These were combined statistically to obtain a bridge vulnerability factor which was then multiplied by an importance factor to obtain the overall "bridge score". The post-1992 Caltrans procedure was also a hybrid in that the importance and vulnerability variations had different weighted factors which were added then multiplied by the seismicity variable.

Both the proposed New York and Illinois procedures included the "worth" of the bridge in the final overall index. They defined worth as:

worth = (retrofit cost / replacement cost) x average daily traffic volume.

In other schemes the average daily traffic volume was included in the importance factor (either directly or indirectly) but this was the only scheme that addressed the cost to retrofit a bridge as a function of the cost of a new structure.

3.2.2 Japanese Procedures

Kawashima et al. (1992) reported that nationwide inspections of highway bridges with lengths longer than 15m was made by the Japan Ministry of Construction in 1971, 1976, 1979 and 1986. The 1986 inspection identified 30% of bridges in service as requiring some form of retrofitting.

In contrast to the ATC approach in the United States of America, the 1986 Japan Ministry of Construction prioritisation for highway bridges was based on a multiplicative procedure. Two points are notable regarding the Japanese approach:

- The intensity of ground shaking was not specifically included in the prioritisation scheme. Past earthquakes in Japan had indicated that the threshold of ground motion causing unacceptable damage was around 0.25g. Consequently, structures located in regions where the expected ground acceleration was less than 0.25g were considered not to be a high risk, and excluded from the prioritisation process. Bridges designed since 1980 were also excluded.

- The importance of a bridge structure to the social or survival needs of a community serviced by the bridge was not specifically evaluated in the prioritisation process, but presumably would be considered when the allocation of funding for retrofit was made.

The Japan Ministry of Construction prioritisation procedure was largely a vulnerability assessment of the bridge structure, based on the extensive records of damage to Japanese highway bridges following earthquakes. The majority of past bridge failures in Japan in earthquakes were associated with:

- Inadequate restraint of the superstructure to the supporting piers;
- Inadequate seat-length for the deck structures;
- Liquefaction of foundation soil; and
- Brittle failures of piers in cases where most of the main reinforcement terminated near the mid-height of the pier.

Two vulnerability indices were computed in the Japan Ministry of Construction prioritisation scheme. The first vulnerability index was designed to reflect:

- Increased seismic risk associated with an increased number of spans;
- Inadequate restraint across movement joints;
- Unusual bridge geometry;
- Presence of liquefiable soil; and
- General deficiencies in old design guidelines.

The second vulnerability index was designed to emphasise the deficiencies of the substructure, and in particular:

- The potential for brittle failure which could occur in piers constructed with most of their longitudinal reinforcement terminated at mid-height of the pier; and
- Substructures supported on timber, brick or masonry piers.

Evaluated bridges were ranked in one of the three categories (A, highest risk; B, moderate risk; or C, lowest risk) depending on the values of the two vulnerability indices. A sub-index was used within one of the two, and reflected the potential for brittle failure in piers in which a large proportion of the main reinforcement was terminated at about the mid-height of the pier.

4 DEVELOPMENT OF THE PROPOSED PROCEDURE FOR PRELIMINARY SEISMIC SCREENING AND PRIORITISATION OF NEW ZEALAND BRIDGES[1]

4.1 Bridges Excluded by Preliminary Screening

Most of the established or proposed retrofit prioritisation procedures include preliminary screening to exclude bridges which have a low risk of catastrophic collapse during a severe earthquake. In New Zealand these include:

- Bridges designed to modern design codes (e.g. since the introduction in New Zealand of the Highway Bridge Design Brief in 1972 (MWD 1972));
- Single span bridges with monolithic abutments (4.4.2.3 vii.) or with spans well connected to sill-type abutments with adequate overlap rated zero in 4.4.2.3 iii.
- Multi-span bridges with *all* the following characteristics:
  - Three spans or fewer;
  - Structurally continuous spans, or spans interconnected with tight linkage bolts and with adequate overlap;
  - An overall bridge length-to-deck width ratio of 8 or less;
  - Less than 15 degrees skew;
  - Relatively balanced span arrangement with individual spans less than 30 metres in length;
  - Multi-column or slab-type piers less than 7 metres from the top of the foundation cap or footing to the underside of the superstructure;
  - Monolithic abutments or with spans which are well connected to sill-type abutments with adequate overlap; and
  - Foundations and abutments with little likelihood of failure through soil liquefaction or instability.

The Japanese initial screening procedures (3.2.2) exclude bridges which are unlikely to be exposed to peak ground accelerations larger than 0.25g. If these criteria were applied in New Zealand they would only exclude bridges in Northland and a small coastal area of Canterbury that were constructed at firm soil sites with relatively small seismic accelerations. Because of the small proportion of state highway bridges in Northland, many of which are on soft soils, and the small number of state highway bridges affected in Canterbury, it is recommended that no bridge in New Zealand should be excluded by preliminary screening based solely on the relative seismicity of the area.

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[1] Some details of the *Proposed* Procedure were subsequently modified, after the testing reported in Section 5. Modifications are noted in the following text, and the final *Recommended Preliminary Seismic Screening Procedure* is contained in Appendix 5.

4.2 Bridges without Connections between Superstructure Elements

The Californian experience has exposed a number of deficiencies in pre 1971 bridge designs, the most serious being the inadequate provision of connections between superstructure elements, and in particular at movement joints within spans. This has been overcome through retrofitting. Typical methods used were to add restraining cables or rods at piers and hinges and to add shear keys at abutments and bearings.

The number of state highway bridges in New Zealand which have no connections, direct or indirect, between superstructure elements are relatively few. This is primarily because a design requirement was introduced by the Public Works Department in 1933 (PWD 1933) following the 1931 Napier Earthquake. It stated "wherever possible the structures should be made monolithic, and where this is not possible all parts of the structure should be well tied together". In 1956 the Ministry of Works published the Bridge Manual (MOW 1956) which was largely based on the then current Standard Specification for Highway Bridges issued by the American Association of State Highway Officials (AASHO). Unfortunately, a specific requirement to provide connections between superstructure elements was not included in the Bridge Manual, even though it was considered good practice to do so at the time. Specific design requirements for connections between superstructure elements were again included in the 1972 issue of the Ministry of Works and Development (MWD) Design Brief (MWD 1972), and are retained in the Transit New Zealand Bridge Manual (hereafter referred to as "Bridge Manual") 1994.

Since the 1972 issue of the MWD Design Brief, bridge design engineers have recognised that bridges which have no connections between superstructure elements need to be retrofitted to reduce the risk of span collapse in an earthquake. Although the former National Roads Board (NRB) had no specific policy to retrofit bridges with inadequate connections, many bridges were in fact retrofitted during the 1970s and 1980s as part of the routine inspection and maintenance of state highway bridges carried out by the MWD. In 1991 Works Consultancy Services Limited examined state highway bridges in the zone of highest seismic risk, as defined in the Bridge Manual, with the purpose of identifying bridges which had no connections across intermediate superstructure hinges, or with existing connections which would require strengthening in order to comply with current code requirements (WCS 1991a). Eight bridges were identified in each of the above two categories. The report covered bridges only in the zone of highest seismic risk, with unconnected intermediate superstructure hinges, and did not include spans unconnected at piers.

The lack of connection between segments of a bridge superstructure is one deficiency which is readily improved by retrofitting. Interconnecting the segments of a bridge superstructure is usually inexpensive and has the advantage that it can partially alleviate the seriousness of other deficiencies. For example, bridges with single column piers are more vulnerable when structure segments are not connected.

4.2.1 Recommendation

It is recommended that bridges which have no connections between superstructure components (those with simply supported spans over intermediate piers, and across intermediate hinges within spans) should be identified as having first priority for consideration for retrofitting. They should be considered separately from bridges with other types of deficiencies, for the following reasons:

- The risk of span collapse in these bridges in even a modest earthquake is relatively high;
- The total number of such bridges is small; and
- The benefit of increased security of the bridges relative to the cost of retrofit.

On the basis that the number of bridges without connections is likely to be less than 100, it is recommended that simple prioritisation procedure be adopted, based on the annual average daily traffic count (AADT) and on the applicable seismic Zone Factor Z[2] specified in the Bridge Manual, with the following priority order:

1. Bridges with AADT exceeding 2500 vpd, with a seismic Zone Factor $Z = 0.8$

2. Bridges with AADT less than 2500 vpd, with a seismic Zone Factor $Z = 0.8$

3. Bridges with AADT exceeding 2500 vpd, with a seismic Zone Factor $Z < 0.8$

4. Bridges with AADT less than 2500 vpd, with a seismic Zone Factor $Z < 0.8$

4.3 Prioritisation of Bridges with other Structural Deficiencies

Well established procedures for the prioritisation of bridges for retrofitting are used in the United States of Amercia and Japan (Section 3.2). From those available, it is recommended that the procedure developed by Caltrans be selected and modified to suit New Zealand conditions, rather than developing an entirely new procedure from first principles. The Caltrans procedure is recommended for the following reasons:

- Caltrans has been implementing an active prioritisation and retrofit programme since 1972, and has developed and refined its procedures over a longer period than any other United States of America state highway authority.

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[2] The "earthquake resistant design" section of the Transit New Zealand Bridge Manual 1994 was revised in 1995. The revision includes changes to values of factors such as the Zone Factor Z (e.g. from 0.8 to 1.2 for the zone of highest seismic risk). While the original values of factor Z were used in the "Proposed Preliminary Screening Procedure", and in the testing of that procedure, the revised values have been adopted in the "Recommended Preliminary Screening Procedure" included as Appendix 5 to this report, and in other recommendations in this report, as appropriate.

- The standard designs for bridges developed by the New Zealand Public Works Department and the Ministry of Works are similar to the standard designs built in California prior to 1971.

- During the period 1943 to 1971 the New Zealand bridge design codes were based on the AASHO specifications. Consequently the structural proportions and details of non-standard New Zealand bridges built during this period tend to be similar to those of their contemporaries in the United States of America.

- Like New Zealand the relative seismicity of bridge sites throughout California ranges from very high to low.

- The 1994 Caltrans' formula for combining importance, seismicity and vulnerability factors forms a hybrid additive-multiplicative approach and overcomes some inconsistencies in prioritisation which arise when purely additive or multiplicative procedures are used. Buckle, 1991, reported that multiplication, instead of addition, gave more emphasis to extreme values of each parameter and that this could distort the ranking procedure. It also amplified the uncertainty inherent in each factor in such a way that the error in the overall index was significantly higher than would otherwise be the case if the same factors were added. In comparison, additive methods could be insensitive, leading to difficulty separating a large group of bridges with average scores. This is partially overcome by using unequal weighting factors, as was used in the additive elements of the Caltrans approach.

- The importance, seismicity and vulnerability factors in the Caltrans procedures can be readily evaluated by non-specialist bridge design or inspection engineers with the aid of comprehensive guidelines. Subsequent testing (Section 5) has shown it is important that an experienced seismic engineer reviews the results of the initial evaluation before final conclusions on the prioritisation are drawn.

The details of the Caltrans procedures and commentary on its development are described by Gilbert (1993) in a paper entitled "Developments in Seismic Prioritization of Bridges in California" (Appendix 1). Discussion with Gilbert indicates that the weightings included in the procedure - for example the 60% to 40% values for impact and vulnerability in the second level additive elements - were derived by canvassing the opinions of a cross section of well-informed specialists in the fields of seismic and bridge/structural engineering, rather than by statistical methods. It must be accepted that any prioritisation procedure of the type being discussed will depend on the subjective judgement of such specialists. For this reason using the Caltrans model as a starting point is advantageous as California has a larger pool of available specialists.

Adaptation for New Zealand conditions needed specialist local knowledge. The procedures being developed were reviewed by New Zealand specialists and were trialed on a limited section of state highway (Section 5). As a result of the trial application in

New Zealand changes were made to the Proposed Screening Procedures (Section 6) in developing the Recommended Preliminary Screening Procedures (Appendix 5).

Caltrans consider that the impact (importance) factor is more important than the vulnerability factor. The impact (importance) factor relates to the direct and consequent costs to the road user should the bridge become unserviceable after an earthquake, and the vulnerability factor indirectly relates to the degree of structural deficiency and hence to the financial cost of retrofitting to correct those deficiencies. This viewpoint has been supported in New Zealand by the results of the testing (Section 5), and the relative weighting factors have been adopted. Even so, subsequent adjustments can readily be made, if required, without compromising the overall procedure.

4.4 Proposed Preliminary Screening Procedure for New Zealand Bridges, based on Modified Caltrans Procedures

4.4.1 General

Prioritisation of seismically vulnerable bridges must be carried out efficiently and with a minimum of effort. The first step in the process is to document basic data about each bridge on the highway system. This information and the results of the seismic prioritisation grading should be concisely organised and incorporated into the bridge records. General engineering staff familiar with the structures within each Transit New Zealand region should undertake the compilation and most of the grading work to ensure consistency within each region. Standardisation of the procedure should achieve consistency nationally. A form for collecting and recording the information should be completed and added to the bridge records. The basic data, which will normally be available by accessing existing databases, should include details of the bridge recorded on the descriptive inventory; construction drawings; and inspection records.

If records are incomplete, the local knowledge of the staff involved should enable the work to be completed without a site visit. However, if the staff are not familiar with the structure, they should visit the site to ensure that the drawings include all post-construction modifications - for example foundation strengthening or span interconnections.

4.4.2 Seismic Prioritisation Grading System (SPGS) for New Zealand State Highways Bridges

Numerical ratings provide a systematic way of considering the major variables involved in a decision. The multi-attribute decision procedure used by Caltrans (Appendix 1) forms the basis of the proposed SPGS. A terminology has been proposed for the SPGS that is familiar to Transit New Zealand staff and its consultants. The terminology differs from that adopted by Caltrans (Table 4.1).

Table 4.1 Comparison of terminology used in SPGS for New Zealand bridges, and by Caltrans for Californian bridges.

SPGS		**Caltrans**	
Seismic Prioritisation Grade (SPG)		Prioritisation Rating	
Variable	Hazard Importance Vulnerability	Criteria	Seismic Activity, Hazard Impact Vulnerability
Variable Index		Criteria (rating)	
Attribute		Attribute	
Attribute Weight		Attribute Weight	
Attribute Rating		Global Utility Function Value	
Importance		Impact	

The SPGS terminology will be used in this report unless stated otherwise.

The seismic activity criterion used by Caltrans allows earthquake fault activity to be taken into account. This variable has been considered by Caltrans only since the recent availability of a fault activity map for California. As similarly detailed information will not be available for some time for New Zealand faults, the fault activity cannot be specifically considered in the SPGS for New Zealand.

The proposed preliminary screening procedure includes only three main variables:

- Hazard (seismicity at the bridge site and other hazards affecting the bridge structure);
- Importance of the bridge; and
- Vulnerability of the bridge structure.

In the proposed SPGS procedure each *variable* is assigned an index, which is the sum of the weighted values of *attribute* rating for that variable. The indices are then combined to give the *Seismic Prioritisation Grade* (SPG). Each attribute is assigned a relative weight based on the attribute's significance in determining the Index. A prioritisation grading sheet included in Figure 4.1 illustrates the structure of the procedure. For comparison, Figure 4.1 also includes a reproduction of Figure 2 from Gilbert (1993) (Appendix 1), and summarises the criteria and attribute details used in the Caltrans procedure.

Figure 4.1 Comparison of elements of Proposed SPGS with those used in Caltrans procedures

Proposed SPGS

PRIORITISATION GRADING SHEET (*Refer to Manual for derivation of Rating values)*

HIGHWAY ________
ROUTE POSITION ________
BRIDGE NAME ________

Hazard Index		Weighting	
Peak Ground Acceleration Rating	=	x 0.4	=
Remaining Service Life Rating	=	x 0.3	=
Soil Condition Rating	=	x 0.15	=
Risk of Liquefaction Rating	=	x 0.15	= ________
	∑ = **Hazard Index**		________

Importance Index			
AADT on Bridge Rating	=	x 0.25	=
AADT under Bridge Rating	=	x 0.15	=
Detour Length Rating	=	x 0.15	=
Facility Crossed Rating	=	x 0.2	=
Route Type on Bridge Rating	=	x 0.15	=
Critical Utility Rating	=	x 0.1	= ________
	∑ = **Importance Index**		________

Vulnerability Index			
Year Designed Rating	=	x 0.25	
Superstructure Hinges Rating	=	x 0.08	
Superstructure Overlap Rating	=	x 0.1	
Superstructure Length Rating	=	x 0.07	
Pier Type Rating	=	x 0.15	
Skew Rating	=	x 0.1	
Abutment Type Rating	=	x 0.1	
Other Feature Rating	=	x 0.15	= ________
	∑ = **Vulnerability Index**		________

Seismic = Hazard Index x [(0.6 x Importance Index) + (0.4 x Vulnerability Index)]
Prioritisation = x [(0.6 x) + (0.04 x)]
Grade = ________

Prepared by: ________ Date ________
Checked by: ________ Date ________

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Caltrans

GLOBAL UTILITY FUNCTION DEFINITIONS

ACTIVITY CRITERION	
Seismic Activity	1.00* (0.25 = low; 0.50 = moderate; 0.75 = active; 1.00 = high)
HAZARD CRITERION	
Soil Conditions	0.33* (1 = hgh risk zone; else 0)
Peak Rock Acceleration	0.38* (linear, normalised to 0.7g)
Seismic Duration	0.29* (0.5 = short; 0.75 = intermediate; 1 = long)
IMPACT CRITERION	
ADT on Structure	0.28*(parabola for a max ADT of 200000)
ADT Under/Over Structure	0.12* (see ADT above)
Detour Length	0.14*(linear, normalised to 100 miles)
Leased Air Space (Residential, Office)	0.15*(1=present; else 0)
Leased Air Space (Parking, Storage)	0.07*(1=present; else 0)
Rte Type on Bridge	0.07*(1.0=interstate; 0.8=US, ST rte, or stream; 0.7=RR; 0.5=fed funded Co rte or city str; 0.2=non fed funded Co rte of city str; 0.0=fed land, ST land, other)
Critical Utility	0.10*(1= present' else 0)
Facility Crossed	0.07*(see Rte Type on Bridge)
VULNERABILITY CRITERION	
Year Designed (Constructed)	0.25*(0.5=yr<1946; 1.0=1946 ≤yrs 1971; 0.25=1972 ≤ 1979; 0.0 = yr>1979)
Hinges (Drop Type Failure)	0.165* (0.0=no hinge; 0.5=1 hinge; 1.0=2 or more hinge)
Outriggers, Shared Column	0.22*(1=present; else 0)
Bent Redundancy	0.165*(0.0=no col; 0.25=pier walls; 0.5 multi-col bents; 1.0=single col bents)
Skew	0.12*(linear, normalised to 90)
Abutment Type	0.08*(0= monolithic; 1=nonmonolithic)

Figure 3

4.4.2.1 Hazard index

The *Hazard Index* reflects the seismicity and site risks for a particular bridge site and is based on the following attributes:

- *Peak Ground Acceleration*
- *Remaining Service Life*
- *Soil Condition*
- *Risk of Liquefaction*

The attributes adopted depart significantly from those used by Caltrans because of:

- The unavailability of detailed seismicity information in New Zealand;
- The desire to keep the procedure simple;
- The significance of the bridge structure's present age and likelihood of a damaging seismic event occurring in its remaining life;
- The potential for ground instability in the vicinity of the structure.

In view of this departure the index determination has so far only been used during the testing reported in Section 5.

Each of the attributes is discussed in detail below.

(i) Peak Ground Acceleration attribute

The *Peak Ground Acceleration* attribute has been adopted to reflect peak rock acceleration, seismic duration (because experience has shown that the duration of an earthquake event has a significant effect to the level of damage) and the frequency of seismic activity. Site-specific data on each of these characteristics are not presently available in New Zealand and are unlikely to be available for some time. The Zone Factor (Z), defined in the Bridge Manual (1994), was developed with consideration of all these characteristics, albeit in a qualitative manner. It is therefore efficient and appropriate to base this attribute on the Zone Factor which ranges from 0.4 to 0.8 (now 0.6 to 1.2)[3], to reflect the variation of seismic risk within New Zealand. For rating this attribute a linear relationship is proposed normalised to a Zone Factor of 0.8 (now 1.2),[3]

***Peak Ground Acceleration* rating is:**

$$= \mathbf{Z / 0.8} \quad (\text{now } Z / 1.2)^3$$

As the value of Z can range from 0.4 to 0.8 (now 0.6 to 1.2)[3] the *Peak Ground Acceleration* rating can range between 0.5 and 1.

[3] see footnote to Section 4.2.1

As this attribute is considered the most significant for this variable it has been assigned a 40% weighting. This differs significantly from the 67% weighting (Peak Rock Acceleration plus Seismic Duration) used by Caltrans, but reflects the fact that three extra attributes are included within the SPGS *Hazard* variable compared with those included in the Caltrans procedure (Figure 4.1).

(ii) *Remaining Service Life* attribute

The *Remaining Service Life* attribute has been adopted to reflect the likelihood of a damaging seismic event occurring within the remaining service life of a bridge. This attribute will ensure that appropriate consideration is given to effective use of Transit New Zealand's financial resources.

For rating this attribute a simple step function has been adopted. In assigning the rating value the Risk Factor, R, defined in the Bridge Manual (1994), was used, and is equivalent to the value for events with approximately a 25% probability of exceedance within the remaining service life of the structure.

***Remaining Service Life* rating is:**

= 1.0 greater than 50 years of remaining service life

= 0.7 remaining service life from 25 to 50 years

= 0.5 less than 25 years of remaining service life

As this attribute is considered significant for the Hazard variable it has been assigned a 30% weighting. The total weighting for this attribute plus the Peak Ground Acceleration attribute is 70%, and compares closely with the Caltrans value of 67% for the Peak Rock Acceleration plus Seismic Duration (Figure 4.1).

(iii) *Soil Condition* attribute

Experience has shown that the degree of flexibility of subsoils can have a significant effect on the level of damage that can occur in an earthquake. This was particularly evident in the Loma Prieta earthquake of October 1989. It is therefore appropriate to reflect this effect in the SPGS. To ensure consistency in interpretation of the soil type, the definitions of subsoil categories in the Bridge Manual (1994) have been adopted. For the Proposed Preliminary Screening Procedure two categories of subsoil flexibility applied, but since revision of the "Earthquake Resistant Design" section of the Bridge Manual, the three defined categories have been adopted and are included in Appendix 5.

It is recommended that Transit New Zealand should encourage those applying the SPGS to use the advice of a geotechnical engineer or geologist when completing this part of the procedure.

For rating this attribute a simple step function has been adopted. To assign the rating values, consideration was given to the availability of information (in California hazardous soil site maps are available), the skills of the staff completing the SPGS and the weighting of this attribute.

Soil Condition **rating is:**

= 1.0 Flexible soil or "Don't know"

= 0 Normal soil

This attribute has been assigned a 15% weighting. Although this weighting is significantly different from that used by Caltrans (33%), when combined with the risk of liquefaction attribute (of 15%), the total weighting of 30% compares closely.

(iv) *Risk of Liquefaction* attribute

Although several different types of ground instabilities might affect a bridge, liquefaction is the most significant. The effect of liquefaction has been well illustrated by past bridge failures during earthquakes overseas - for example in Alaska and Chile.

For rating this attribute a simple step function has been adopted. The attribute rating is based on a qualitative assessment of the risk of liquefaction, which will necessarily require subjective judgement where detailed site investigation results are not available. It is recommended that Transit New Zealand should encourage those undertaking the SPGS to use the advice of a geotechnical engineer or geologist when completing this part of the procedure. The following definitions for risk of liquefaction are proposed:

- High Risk of Liquefaction - soils which underlie abutment fills or footings, or provide lateral support to piles, and which generally comprise saturated medium-dense-to-loose sands, silty sands and non-plastic silts.

- Low Risk of Liquefaction - all other soil types

Risk of Liquefaction **rating is:**

= 1.0 High risk of Liquefaction or "Don't know"

= 0 Low risk of Liquefaction

This attribute has been assigned a 15% weighting.

Summary

The *Hazard Index* is the sum of:

Weighting		Attribute Rating		Weighted Rating
0.40	x	*Peak Ground Acceleration* rating	=	
0.30	x	*Remaining Service Life* rating	=	
0.15	x	*Soil Condition* rating	=	
0.15	x	*Risk of Liquefaction* rating	=	
		TOTAL	=	*Hazard Index*

4.4.2.2 Importance Index

The *Importance Index* utilises six attributes to assess and reflect the consequences of bridge damage including public safety, the recognition that bridges form a vital link, and the socioeconomic impacts and effects on road users. The attributes adopted include:

- *Annual Average Daily Traffic Count (AADT) on Bridge*
- *AADT under Bridge*
- *Detour Length*
- *Facility Crossed*
- *Route Type on Bridge*
- *Critical Utility*

The attributes adopted compare closely with those used by Caltrans but slight modifications have been made to more closely reflect the characteristics of New Zealand's transportation system and its usage, and the available information. Each of the attributes is discussed in detail below.

(i) *AADT on Bridge* attribute

The *AADT on Bridge* attribute has been adopted to reflect directly the traffic use and hence the traffic disruption, should damage occur. As this procedure is designed for state highway and motorway bridges, cycle and pedestrian use is usually low and traffic use is the appropriate indicator. The AADT is a measure of state highway use that is readily available and has been compiled in a consistent manner. The total AADT on the bridge is therefore an appropriate and convenient measure for use in the SPGS.

For rating this attribute a parabolic relationship is proposed based on a maximum AADT of 20 000.

***AADT on Bridge* rating is:**

$$= \sqrt{[(AADT)/20\,000]} \quad \leq 1$$

The maximum AADT is significantly less than that used by Caltrans but is considered appropriate for New Zealand.

This attribute has been assigned a 25% weighting, which is consistent with that used by Caltrans. (The rating and weighting have been changed for the Recommended Preliminary Screening Procedure by omitting the square root, relating to a base AADT of 30 000, combining with the Detour Length attribute, and assigning a 50% weighting.)

(ii) *AADT under Bridge* attribute

The *AADT under Bridge* attribute reflects the traffic disruption in the vicinity of the bridge should that bridge fail. The other traffic users may or may not be on a state highway or motorway and the total AADT affected is to be used.

For rating the attribute a parabolic relationship is proposed based on a maximum AADT of 20,000. (This was changed for the Recommended Preliminary Screening Procedure by omitting the square root and relating to a base AADT of 30 000.)

The *AADT under Bridge* rating is:

$$= \sqrt{[(AADT)/20\,000]} \quad \leq 1$$

$$= 1$$ **when a state highway or motorway bridge crosses a railway line.**

This attribute has been assigned a 15% weighting, which is consistent with that used by Caltrans. In adopting this weighting a comparison was made to reflect a sensible balance of risk between this attribute and that of (iv) *Facility Crossed* (below). (The weighting was changed to 10% for the Recommended Preliminary Screening Procedure.)

(iii) *Detour Length* attribute

The *Detour Length* attribute has been adopted to reflect the level of inconvenience caused by the loss of a bridge. The basis of this attribute is the "extra distance travelled" (EDT). To assess this, consideration will probably need to be given to the "origin" and "destination" of the traffic, the condition of the detour route and its ability to accommodate the traffic use, and the likelihood that the detour route itself to have survived the seismic event. Consideration of these items is necessarily subject to considerable qualitative judgement.

For rating this attribute a linear relationship normalised to 100 km is proposed.

The *Detour Length* rating is:

$$= (EDT)/100 \qquad \leq 1$$

This attribute has been assigned a 15% weighting which is consistent with that used by Caltrans. (The weighting has been changed for the Recommended Preliminary Screening Procedure by combining with the AADT on Bridge attribute, and assigning a 50% weighting.)

(iv) *Facility Crossed* attribute

The *Facility Crossed* attribute has been adopted to reflect the potential for loss of life beneath the bridge, property damage and individual or business financial losses. In assessing the width of the affected land, 2 x height of structure above the ground plus the width of the structure should be adopted. This attribute is equivalent to the combined Caltrans Leased Air Space attributes.

For rating this attribute a simple step function has been adopted.

***Facility Crossed* rating is:**

= 1.0 where residential, commercial or industrial facilities would be affected by collapse;

= 0.5 where parking, storage facilities or railway facilities would be affected by collapse;

= 0 other uses

This attribute has been assigned a 20% weighting which is consistent with that used by Caltrans. In adopting this weighting a comparison was made to reflect a sensible balance of risk between this attribute and that of (ii) *AADT under Bridge* (above). (The weighting was changed to 15% for the Recommended Preliminary Screening Procedure.)

(v) *Route Type on Bridge* attribute

The *Route Type on Bridge* attribute was adopted to directly reflect the importance of the route as a national traffic lifeline. To reflect Transit New Zealand's responsibilities it is appropriate to apply the national rather than local importance of the route. The categories of relative importance of highways, listed in Section 5 of the Bridge Manual (1994), have been adopted as the basis for this attribute.

For rating this attribute a simple step function has been adopted.

Route Type on Bridge **rating is:**

= **1.0 Bridges carrying more than 2500 vpd**
Bridges carrying motorways
Bridges on State Highways No: 1, 2, 3, 3A, 4, 5, 6, 8, 8A

= **0.8 Bridges carrying between 250 and 2500 vpd**
Bridges on State Highways not listed above

= **0.6 Bridges carrying less than 250 vpd**
Non-permanent bridges

The attribute has been assigned a 15% weighting. This weighting is higher than that used by Caltrans but reflects the low occurrence of a state highway (or motorway) bridge crossing another state highway (or motorway) in New Zealand; and the level of Transit New Zealand's responsibility for the transportation system.

(vi) *Critical Utility* attribute

The *Critical Utility* attribute has been adopted to reflect the importance of the other services that are carried on the bridge and would be disrupted should the bridge collapse. The services that are to be considered in rating this attribute include: water supply, sewerage, electricity, gas and telephone

(For the Recommended Preliminary Screening Procedure only water supply, sewerage and gas, in pipes of 150 mm or greater internal diameter, are considered for this attribute.)

Should any of these utilities be carried on a bridge then a high rating should be given. However, some state highway bridges may carry utilities that service only a small population. In these cases it may be appropriate to check with the utility authority whether temporary disruption to these would be critical or not, and rate the attribute accordingly.

For rating this attribute a simple step function has been adopted.

Critical Utility **rating is:**

= **1.0** **critical utility is carried on the bridge**

= **0** **critical utility is not carried on the bridge**

This attribute has been assigned a 10% weighting which is consistent with that used by Caltrans.

Summary

The *Importance Index* is the sum of:

Weighting		Attribute Rating		Weighted Rating
0.25	x	*AADT on Bridge* rating	=	
0.15	x	*AADT under Bridge* rating	=	
0.15	x	*Detour Length* rating	=	
0.20	x	*Facility Crossed* rating	=	
0.15	x	*Route Type on Bridge* rating	=	
0.10	x	*Critical Utility* rating	=	
		TOTAL	=	*Importance Index*

4.4.2.3 Vulnerability Index

The *Vulnerability Index* utilises eight attributes to define and reflect structural details which have a potential for damage. Hence the Index also reflects the potential cost of retrofitting a bridge. These attributes have been based on the experience gained from past performance of bridges in earthquakes and allows for the interaction of structural components. The attributes adopted in the SPGS include:

- *Year Designed*
- *Superstructure Hinges*
- *Superstructure Overlap on Supports*
- *Superstructure Length*
- *Pier Type*
- *Skew*
- *Abutment Type*
- *Other Feature*

The attributes adopted generally align with, but differ in some ways from, those used by Caltrans.

As the outrigger/shared column structural form has not been used in New Zealand this attribute, used by Caltrans, is not relevant to the SPGS and has essentially been replaced with the *Other Feature* attribute. The *Other Feature* attribute allows the assessor the discretion to identify the presence of a vulnerable feature, whether this is an abutment/approach instability (other than liquefaction), bearing details, diaphragms, inadequate linkages or the general bridge condition.

In the SPGS greater emphasis has been placed on the general "looseness" of the superstructure relative to its supports. This is reflected in the *Hinges, Overlap* and *Length* attributes for the superstructure, because a "loose" bridge allows greater relative movement during an earthquake and is therefore more likely to suffer a "drop" type failure.

Because bridge details have important effects on the performance of the structure during an earthquake the assessor will need to access the original structure drawings (preferably As-Built revisions) and to have a knowledge of the structural modifications that have been made since construction. The assessor will also need to have, or be able to call upon, an advisor with some experience of how structures will respond in an earthquake.

Each of the attributes adopted to determine this index is discussed in detail below.

(i) *Year Designed* Attribute

The *Year Designed* attribute reflects the main stages in the development of seismic design and detailing. Experience has shown that structure performance and hence the level of damage in a seismic event is strongly dependent on the overall design philosophy and on the design of individual elements. In New Zealand the main code changes occurred in 1933 (following the Napier earthquake), and in 1972 when the Highway Bridge Design Brief (MWD 1972) was issued. The distinction between year designed and year constructed must be recognised, so the year designed is to be used.

For rating this attribute a simple step function has been adopted.

***Year Designed* rating is:**

= 1.0 Bridge designed before 1933

= 0.5 Bridge designed in the years 1933-1972

= 0 Bridge designed after 1972

The 1956 Bridge Manual (MOW 1956) did not contain the requirement for linkages between superstructure elements that was included in the 1933 design instruction but this potential structural shortcoming is covered specifically by the initial bridge screening (see Section 4.2).

This attribute is considered the most significant for this variable and has been assigned a 25% weighting. This is consistent with that used by Caltrans.

(ii) *Superstructure Hinges* attribute

The *Superstructure Hinges* attribute refers specifically to in-span hinged or movement joints within the main longitudinal load-bearing structural members. It accounts for the potential "drop type" failure during earthquakes which experience has shown is a common potential problem with this detail.

This attribute excludes stepped seatings which commonly exist at piers or abutments, as these are specifically covered in the (iii) *Superstructure Overlap* attribute (below). It also excludes articulated deck slabs with continuous longitudinal reinforcing steel passing through the "hinges".

The number of hinges is the total for all spans of a bridge. For rating this attribute a simple step function has been adopted.

Superstructure Hinges **rating is:**

= 1.0 if there are 2 hinges or more within a bridge superstructure

= 0.5 if only one superstructure hinge is present

= 0 if no superstructure hinges are present

This attribute has been assigned an 8% weighting. Comparison with the Caltrans value suggests this weighting is low, but when combined with the *Superstructure Overlap* and *Superstructure Length* attributes weightings, the "drop type" failure can be seen to have been emphasised.

(iii) ***Superstructure Overlap on Supports*** **attribute**

The *Superstructure Overlap on Supports* attribute has been adopted to reflect the potential "drop type" failure at piers or abutments, which experience has shown to be a potential problem during earthquakes. The attribute rating is based on the Minimum Overlap Requirements for the span/support overlap specified in the Bridge Manual (1994). The bearing overlap, also specified in the Bridge Manual, is not considered critical for the purposes of the SPGS.

As inter-span linkages are considered to provide low-cost insurance against loss of span support, it is appropriate to adopt a conservative approach to rating this attribute. The Bridge Manual overlap requirements are based on the assumption that the linkages have been designed to meet the requirements applicable to them, as also set out in the Bridge Manual. Such an assumption cannot be justified for an existing structure. For the situations where the linkage capacity is clearly undersized, significantly deteriorated or has an inadequate load path (e.g. if a holding-down bolt has inadequate lateral support from pier cap concrete), then a "no linkage" situation should be assumed and also a high rating should be given for the *Other Feature* attribute. In extreme circumstances the assessor has the discretion to withdraw the structure from the SPGS and prioritise it under the initial screening procedures (Section 4.2). For the situations where the linkage capacity is marginally inadequate then the choice of whether a linkage system is present or not will be at the assessor's discretion.

An intermediate category of linkage by "holding-down bolts in shear" has been adopted to recognise the lesser ductility available in this form of span/support linkage.

For rating this attribute a simple step function has been adopted. As a bridge may have different details, with different rating values, for different locations, the highest rating value should be used.

Superstructure Overlap on Supports **rating is:**

No linkage system or loose linkage system present:
= 1.0 overlap less than 400 mm
= 0 overlap 400 mm or more

Linkage comprising holding-down bolts in shear:
= 1.0 overlap less than 300 mm
= 0 overlap 300 mm or more

Tight tension linkage system present
= 1.0 overlap less than 200 mm
= 0 overlap 200 mm or more

This attribute has been assigned a 10% weighting. This weighting is slightly higher than that for the *Superstructure Hinge* attribute because hinges in bridges in the most seismically active areas of New Zealand have been identified and at least some have been retrofitted to make them more secure. For comments in comparison with the Caltrans procedure refer to the (ii) *Superstructure Hinges* attribute (above).

(iv) *Superstructure Length* attribute

The *Superstructure Length* attribute reflects:

- The higher risks of differential seismic responses with the longer structures;
- The diminished damping effect provided by the approach fills in the transverse direction with increased bridge length; and
- The greater potential for a "drop type" failure because longitudinal displacements of multiple simply supported spans may accumulate, possibly resulting in overlap provisions being exceeded.

For rating this attribute a simple step function has been adopted.

Superstructure Length **rating is:**

=	**1.0**	**bridge length exceeding 100 m**
=	**0.5**	**bridge length from 50 m to 100 m**
=	**0**	**bridge length less than 50 m**

The attribute has been assigned a 7% weighting. For comments in comparison with the Caltrans procedure refer to the (ii) *Superstructure Hinges* attribute (above).

(For the Recommended Preliminary Screening Procedure 5 categories of superstructure length and a weighting of 12% have been adopted to reflect the results of testing reported in Section 5.)

(v) *Pier Type* attribute

The *Pier Type* attribute has been adopted to reflect the different seismic responses and the different degrees of reserve against sudden failure which are inherent in the typical structural forms used. Past performance of bridges during earthquakes has shown pier type to be a significant attribute and it is appropriate to include it in the SPGS.

For rating this attribute a simple step function has been adopted.

Pier Type **rating is:**

=	**1.0**	**single column**
=	**0.5**	**multi column, or slab pier on pile foundation**
=	**0.25**	**slab pier on spread footing foundation**

The attribute has been assigned a 15% weighting and relates closely to that used by Caltrans (in which the term "Bent" is used instead of "Pier").

(vi) *Skew* attribute

The *Skew* attribute has been adopted to reflect the likely accumulation of eccentricity and torsional effects which may not have been fully allowed for in the original design. Past performance of bridges in seismic events has shown that bridge skews tend to be increased during strong earthquake shaking, and it is appropriate to include this attribute in the SPGS.

For rating this attribute a linear relationship is proposed normalised to 90°.

***Skew* rating is:**

$$= \theta / 90 \leq 1$$

θ = the angle in degrees between the perpendicular to the centreline of the roadway at each abutment, and the line of the backface of the abutment. If θ at each abutment differs, the greater value shall be used.

The attribute has been assigned a 10% weighting and this relates closely to that used by Caltrans. (The weighting was changed to 5% for the Recommended Preliminary Screening Procedure reported in Section 5.)

(vii) *Abutment Type* attribute

The *Abutment Type* attribute has been adopted to reflect that bridges with monolithic abutments perform very well in earthquakes, whereas those without them are more susceptible to damage. In this context a monolithic abutment is defined as one to which the superstructure is tightly linked, so that significant independent horizontal movement of the superstructure relative to the abutment during earthquake shaking is unlikely. To be considered as monolithic the abutment backwall must be in intimate contact with the approach fills over a depth at least equal to the depth of the superstructure, and over the full width of the main longitudinal members.

***Abutment Type* rating is:**

= 1.0 non-monolithic abutments

= 0 monolithic abutments

The attribute has been assigned a 10% weighting, which relates closely to that used by Caltrans.

(viii) *Other Feature* attribute

The *Other Feature* attribute has been adopted to allow the assessor the discretion to reflect any other feature which is likely to make the bridge vulnerable to damage. It is expected that these other features will be different from the attributes used in the SPGS, except for linkages (refer iii *Superstructure Overlap* attribute (above)). At least the following features should be considered:

- Linkages (capacity, condition, ductile capability)
- Diaphragms (adequacy for second order effects)
- Bearings (susceptibility to damage)
- Standard of important details
- The overall general condition of the bridge

- Approach stability (e.g. landslides that may be activated by a seismic event). Note that liquefaction is covered separately and should not be included in this attribute.

For rating this attribute, a value between 1.0 and 0 has been adopted based on the judged importance of the feature(s) identified.

Other Feature **rating is:**

=	**1.0 (maximum)**	**if a vulnerable feature or features are present**
=	**0**	**if a vulnerable feature is not present**

This attribute has been assigned a 15% weighting.

Summary

The *Vulnerability Index* is the sum of:

Weighting		Attribute Rating		Weighted Rating
0.25	x	*Year Designed* rating	=	
0.08	x	*Superstructure Hinges* rating	=	
0.10	x	*Superstructure Overlap* rating	=	
0.07	x	*Superstructure Length* rating	=	
0.15	x	*Pier Type* rating	=	
0.10	x	*Skew* rating	=	
0.10	x	*Abutment Type* rating	=	
0.15	x	*Other Feature* rating	=	
		TOTAL	=	*Vulnerability Index*

4.4.2.4 Seismic Prioritisation Grade (SPG)

To determine the *Seismic Prioritisation Grade* the weightings from the Caltrans procedure have been adopted for the Proposed Preliminary Screening Procedure.

Seismic Prioritisation Grade **is:**

SPG = *Hazard Index* x [0.6 x (*Importance Index*) + 0.4 x (*Vulnerability Index*)]

As noted in Section 4.3 the relative weighting between the *Importance Index* and the *Vulnerability Index* can be readily amended. The testing reported in Section 5 presented an opportunity to investigate the sensitivity of the SPG to the relative weightings.

4.4.3 Bridge Ranking

The Seismic Prioritisation Grading System (SPGS) will provide for each bridge a Seismic Prioritisation Grade (SPG). The purpose of the SPG is to produce a preliminary ranking list of bridges which justify more detailed seismic assessments. This ranking will indicate the relative assessed risk of highway disruption and its consequences caused by seismic damage of the bridges surveyed.

The preliminary screening process outlined in Section 4.2 is intended to be used to identify the first priority bridges. These bridges would be afforded the highest overall ranking and, possibly, the highest priority for retrofit. It must be emphasised that before any decisions are made regarding the justification of physical retrofit works, more detailed seismic assessment of higher ranked structures on an individual basis will be necessary to more closely determine the feasibility and benefit/cost ratio of any retrofit work which may be identified as appropriate.

Transit New Zealand funding limitations and level of acceptable risk of highway disruption will determine the retrofitting programme. The vulnerability of bridge approaches is not addressed by this ranking procedure. The potential for the formation of a hazard to vehicles if the approach fill settles to expose the vertical face of the abutment backwall is also not addressed. The presence or absence on bridge drawings of approach settlement slabs should be noted when extracting structure details from the records. A decision on whether slabs should be installed may also then be appropriate as part of the retrofit decision at a later stage.

4.5 Summary and Implementation of the Proposed Preliminary Screening Procedure for New Zealand Bridges

The Proposed Preliminary Screening Procedure is summarised in Table 4.2.

Three forms were produced for use in implementing the Proposed Preliminary Screening Procedure. The forms are included as Appendix 4 to this report. As a result of the subsequent testing, reported in Section 5, the forms were modified. The modified versions are included in Appendix 5 to this report, as part of the Draft Manual for Implementing the Recommended Preliminary Screening Procedure.

Table 4.2 Summary of Proposed Preliminary Screening Procedure

1 Exclude:

- Designed post-1972
- Single spans with integral abutments or well connected/overlapped abutments (overlap rating = 0)
- Multi spans with all of:
  - Three spans or fewer
  - Continuous, or spans interconnected with tight linkage bolts
  - Overall bridge length-to-deck width ratio 8 or less
  - Skew angle less than 15 degrees
  - Span arrangement reasonably balanced, with no span exceeding 30 metres
  - All the piers of multi-column or slab form
  - All the piers of less than 7 metres high from the top of the foundation to the soffit of the superstructure
  - Bridge superstructure with monolithic abutments or a superstructure overlap rating of 0 when rated to the seismic screening procedures
  - Foundations and abutments founded with little likelihood of failure due to soil liquefaction or instability
- Primarily timber superstructure

2 First priority for assessment:

Bridges without connections between superstructure elements, in the following priority order:

- Bridges with AADT exceeding 2500 vpd in seismic Zone Factor $Z = 0.8$
- Bridges with AADT less than 2500 vpd in seismic Zone Factor $Z = 0.8$
- Bridges with AADT exceeding 2500 vpd with a seismic Zone Factor $Z < 0.8$
- Bridges with AADT less than 2500 vpd with a seismic Zone Factor $Z < 0.8$

3 Prioritisation of remaining bridge stock by deriving the Seismic Prioritisation Grading (SPG):

• **Hazard**	**Hazard Index = sum of:**	
Peak ground acceleration	[Z/0.8]	x 0.4
Remaining service life	[<25 yrs 25-50yrs >50yrs] 0.5 0.7 1.0	x 0.3
Soil condition	[flexible or "don't know"; normal] 1.0 0	x 0.15
Risk of liquefaction	[high risk or "don't know"; low risk] 1.0 0	x 0.15

Table 4.2 (Continued)

• **Importance**	**Importance Index = sum of:**	
AADT count on bridge	$[(\sqrt{AADT}/20\,000) \le 1]$	x 0.25
AADT count under bridge	$[(\sqrt{AADT}/20\,000) \le 1$, but = 1 if over r'way]	x 0.15
Detour length	[extra distance travelled/100 ≤1]	x 0.15
Facility crossed	[resid, commerc, indust, 1.0] [parking, storage, railway 0.5] [other uses 0]	x 0.2
Route type on bridge	[AADT > 2500 vpd, m/ways, main SH's 1.0] [AADT 250-2500 vpd, secondary SH's 0.8] [AADT < 250 vpd, non-perm bridges 0.6]	x 0.15
Critical utility	[utility carried 1.0] [utility not carried 0]	x 0.1
• **Vulnerability**	**Vulnerability Index = sum of:**	
Year designed	[pre-1933 1933-1972 post-1972] 1.0 0.5 0	x 0.25
Superstructure hinges in spans	[>2 1 none] 1.0 0.5 0	x 0.08
Superstructure o'lap at supports	[no link or loose link: o'lap < 400 1.0] o'lap ≥ 400 0] [HD bolts in shear: o'lap < 300 1.0] o'lap ≥ 300 0] [tight tension linkage: o'lap < 200 1.0] o'lap ≥ 200 0]	x 0.1
Superstructure length	[>100m 50-100m <50m] 1.0 0.5 0	x 0.07
Pier type	[single column 1.0] [multi col, or slab pier on piles 0.5] [slab pier on spread footing 0.25]	x 0.15
Skew	[skew angle/90]	x 0.1
Abutment type	[non-monolithic monolithic] 1.0 0 	x 0.1
Other feature	[feature present not present] 1.0 0	x 0.15

SPG = Hazard Index x [0.6 x Importance Index + 0.4 x Vulnerability Index]

5. TESTING OF PROPOSED PRELIMINARY SCREENING PROCEDURE

5.1 Project Tasks

The bridge inventory for SH 1 between Bulls and Wellington lists 36 road bridges. Initially all listed bridges were to be included in the pilot study but the Ngauranga interchange structures are of recent design and the Thorndon overbridge is a special case which would not be appropriate for a screening procedure such as this. These bridges were omitted. Since the structures north of the Ngauranga interchange bridges are most representative of the bridges on the state highway network, it was decided the detailed appraisal should include 31 bridges comprising all the structures from Bulls to the Johnsonville access structures. Details of two small bridges south of Bulls were unavailable and were omitted resulting in 29 bridges being appraised in the project.

The research fell into four task areas.

Task 1 Assemble Information and Undertake Preliminary Seismic Screening

Task 1.1: Obtain details of structures, site investigations, traffic intensities and detour routes.

Task 1.2: Apply the Proposed Preliminary Screening Procedure described in Section 4.

Task 1.3: Summarise the results of applying the Proposed Procedure.

Task 2 Detailed Assessment of Bridges

Task 2.1: For all the bridges included in the pilot assessment determine the critical points in each structure for stability, strength, ductility and displacement. Determine the threshold response acceleration(s) above which significant damage would be caused and appropriate approximate response spectra. Take account (to the extent that available information held in the bridge records allows) of the effects of ground liquefaction or lateral spreading on the abutments and/or piers and assess if they are likely to be potential problems.

Task 2.2: Determine the probability of significant structural damage occurring within a time span of 50 years and estimate both the direct and indirect costs of seismic damage.

Task 2.3: Compare the results of the seismic assessments undertaken in Task 2.1 and Task 2.2 with those of the Proposed Preliminary Screening Procedure in Task 1, and determine whether:

- The procedure identifies bridges that warrant more detailed assessment; and
- The procedure prioritises structures satisfactorily?

Task 2.4: Identify improvements which could be made to the Proposed Preliminary Screening Procedure and estimate the time and costs required to apply the screening procedure to the state highway system.

Task 3 Reporting

Prepare a report describing in detail the work undertaken, the results obtained and such conclusions and recommendations as may be appropriate.

Other Tasks

Investigate the effects of alternative ways of calculating the Seismic Performance Grading as suggested during discussions on the development of the screening procedure with the Project Review Committee.

5.2 Procedures

5.2.1 **Task 1** – Assemble Information and Undertake Preliminary Seismic Screening

5.2.1.1 Structural information (Task 1.1)

Information on each bridge was assembled by obtaining copies of the detailed structural drawings held in the offices of Works Consultancy Services Limited. Drawings could not be obtained for the two bridges at Route Positions 850/5.67 and 5.68, both identified as Makowai No.2 and with spans of 6 m. Their omission from the appraisal is not considered significant.

It was intended to obtain site information from bores to better evaluate the *Soil Condition* and *Liquefaction Risk* attributes but available site information was generally limited to what was included on the drawings. As a result the survey recorded "Don't Know" for the majority of the structures for these attributes. For bridges south of Porirua there is more confidence in the quality of the foundation subsoils because the bridges are grade separating structures rather than stream crossings.

Each bridge site was visited to ensure that the drawings held represented the current structures. This was a valuable exercise and should always be a part of the assessment process. The benefit from such a visit is illustrated, for example, by the discovery that the drawings initially obtained for the Rangitikei River bridge at Bulls did not show the underpinning of the piers and the retrofit of the in-span hinges that had been carried out 25 years after the bridge was built. Further searching located more drawings under a separate records number. More generally, a site visit allows the assessor to develop a better feel for the structure when selecting values for some of the more subjective attributes of the screening procedure, such as *Other Features*, and to identify important characteristics which may not be obvious from the drawings.

5.2.1.2 Information on traffic volumes (Task 1.1)

Traffic information was obtained from Transit New Zealand records, and comprised the values of Average Annual Daily Traffic (AADT) counts for reference stations along the route. The values adopted were used for the AADT attribute ratings in the screening procedure, and for calculating the economic impacts of loss of use of the bridges after possible seismic damage. AADT values had to be estimated for structures located between reference stations and intersections that may influence traffic volumes. A summary of the traffic data used is included in Table 5.4.

5.2.1.3 Information on available detours (Task 1.1)

Available detours for each bridge were identified from topographic maps, and the shortest additional route length was tabulated (Table 5.4). In some cases loss of use of a bridge would result in a very long detour and those in excess of 100 km were tabulated as a maximum of 100 km.

5.2.2 Trial Application of the Proposed Preliminary Screening Procedure (Task 1.2)

The Proposed Preliminary Screening Procedure described in Section 4 and summarised in Table 4.2 was applied and the results are summarised in Table 5.1. The table also includes comparison with ranking from the economic analysis discussed later.

5.2.3 Tasks 2.1 and 2.2

5.2.3.1 Assessment of the bridge structures (see Tables 5.2 and 5.3)

For each bridge the hierarchy of damage was identified by approximate analysis. It assumed incremental horizontal loading in the calculations to determine the load resistance of various parts of the structure and the equivalent return periods of shaking at which they would progressively reach their strength limits. For the scope of this project, analyses were necessarily approximate and generally based on a computer model which assumed elastic behaviour of the structure. The following assumptions were made:

- Material properties were assumed to be the specified minimum values where shown on the drawings, or otherwise as advised in the Bridge Manual (1994). Member strengths were taken as "ideal" values i.e. assuming a strength reduction factor of 1.

- Member shear strengths were assessed on the basis of the methods set out in "Design Guidelines for Assessment, Retrofit and Repair of Bridges for Seismic Performance" (Priestley 1992). Member shear strengths associated with member ductility values of $\mu = 2$ were used. The shear force acting on a section failing in flexure was derived by applying a factor of 1.15 to the force causing the member to reach its flexural strength, to allow for strain hardening effects.

- For structures where the limiting member would be acting in flexure the threshold of significant damage was assumed to have been reached when the structure attained a displacement ductility factor of $\mu = 2$. In many instances this is probably conservative, but is considered reasonable for members of structures of the age of those being assessed.

- The return period at which various thresholds would be reached was calculated on the following basis:

  - Estimate the structure period from the flexibility indicated by the computer model.

  - Calculate the response force and equivalent seismic coefficient C_μ' at which a threshold strength would develop in the structure. For non-ductile behaviour this value was noted. For ductile behaviour assumed to reach a threshold at $\mu = 2$, and on the basis of the equal displacement theory for periods exceeding 0.7 seconds (which applied to all significant structures) a value of 2 x C_μ' was noted.

  - Read off, from Figure 5.2 of the Bridge Manual (1994), the elastic response coefficient C_μ for the structure period.

  - Calculate the ratio of C_μ' (or 2 x C_μ' as appropriate) to C_μ which represents the value of the risk factor R shown on Figure 5.5 of the Bridge Manual (1994). Read off the value of return period equivalent to the value of R for the threshold being investigated. The probability of exceedance of the threshold within a period of 50 years was then estimated on the basis of the equation in Section 5.2.3 of the Bridge Manual (1994).

    (Note:Since the testing the Bridge Manual seismic loading requirements have been revised to reflect the seismic hazard specified in the New Zealand Loadings code (SNZ 1992). The proposed revisions indicate a reduction of loading for a given return period, and hence the probabilities of damage used in this project are conservatively greater than likely in reality. However, for the purposes of developing a list of bridges ranked in relative order of estimated annual damage costs, it is unlikely to be of serious consequence.)

- Many of the assessed bridges are of a type similar to the Whirokino Trestle at Route Position (RP) 872/13.04, with similar column details. Tests at the University of Canterbury on models of piers of this type have shown that good ductile behaviour can be attained under numerous loading cycles but that the bar anchorages fail prematurely. The tests also showed that the sloping bars which extend into the lower lengths of the columns from the haunches of the piers contribute significantly to the strength. These effects were taken into account in the assessments for this project, although a structure ductility of $\mu = 2$ was used as a threshold value for damage. In higher columns with similar haunching, hinging may form in the column above the point where the sloping bars enhance the column strength, and this should not be overlooked.

Table 5.1 Results of applying the Proposed Preliminary Screening Procedure

PILOT APPRAISAL OF SEISMIC SCREENING PROCEDURES
STATE HIGHWAY 1 BRIDGES BETWEEN RP 844/1.27 AND 979/4.61

Sorted by Route Position Order

SH1 RP	Bridge Name	Excluded from Prioritisation By Screening Procedure	Seismic Prioritisation Grade (SPG)	Hazard Index	Importance Index	Vulnerability Index	Hazard Index Factors: Peak Ground Accn.	Remaining Service Life	Soil Condition	Liquefaction Risk	Importance Index Factors: AADT On Bridge	AADT Under Bridge	Detour Length	Facility Crossed	Route Type	Critical Utility	Vulnerability Index Factors: Year Designed	Super-structure Hinges	Super-structure Overlap	Super-structure Length	Pier Type	Bridge Skew	Abutment Type	Other Feature	Route Position Order	Economic Analysis Ranking	Difference Econ-SPG Rankings
844/1.27	Rangitikei River Bridge at Bulls	no	0.39	0.76	0.45	0.60	1.00	0.70	0.00	1.00	0.70	0.00	0.18	0.00	1.00	1.00	0.50	1.00	0.00	1.00	0.50	0.00	1.00	1.00	1	3	-11
845/2.38	Makowai Stream Bridge	yes	0.23	0.76	0.42	0.13	1.00	0.70	0.00	1.00	0.69	0.00	0.01	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.09	0.00	0.00	2	27	-2
845/3.82	Pukakuku Stream Bridge	yes	0.28	0.91	0.42	0.13	1.00	0.70	1.00	1.00	0.69	0.00	0.00	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.09	0.00	0.00	3	29	5
850/4.35	Makahikaroa Stream Bridge	yes	0.27	0.91	0.41	0.13	1.00	0.70	1.00	1.00	0.63	0.00	0.03	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4	26	1
850/5.67	Makowai No 2 Bridge	No Drawings Available		Could Not Be Assessed																					5		
850/5.68	Makowai No 2 Bridge	No Drawings Available		Could Not Be Assessed																					6		
872/12.41	North Whirokino Trestle	yes	0.31	0.91	0.43	0.20	1.00	0.70	1.00	1.00	0.63	0.00	0.17	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.50	0.00	0.00	0.00	7	17	-3
872/13.04	Whirokino Trestle	no	0.33	0.91	0.43	0.27	1.00	0.70	1.00	1.00	0.63	0.00	0.17	0.00	1.00	1.00	0.50	0.00	0.00	1.00	0.50	0.00	0.00	0.00	8	7	-11
872/14.30	Manawatu River (Whirokino) Bridge	no	0.48	0.91	0.47	0.62	1.00	0.70	1.00	1.00	0.63	0.00	0.40	0.00	1.00	1.00	0.50	1.00	0.00	1.00	0.50	0.22	1.00	1.00	9	6	-1
900/6.77	Ohau River Bridge	no	0.48	1.00	0.59	0.31	1.00	1.00	1.00	1.00	0.75	0.00	1.00	0.00	1.00	1.00	0.50	0.50	0.00	1.00	0.50	0.00	0.00	0.00	10	1	-7
900/7.04	Ohau Overbridge	yes	0.58	1.00	0.84	0.19	1.00	1.00	1.00	1.00	0.75	1.00	1.00	0.50	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.61	0.00	0.00	11	10	8
900/8.16	Kuku Stream Bridge	no	0.42	0.91	0.59	0.28	1.00	0.70	1.00	1.00	0.76	0.00	1.00	0.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.33	0.00	0.00	12	22	10
900/10.35	Waikawa River Bridge	no	0.44	0.91	0.59	0.33	1.00	0.70	1.00	1.00	0.76	0.00	1.00	0.00	1.00	1.00	1.00	0.00	0.00	0.00	0.50	0.00	0.00	0.00	13	5	-6
900/10.87	Manakau North Overbridge	no	0.54	0.91	0.84	0.24	1.00	0.70	1.00	1.00	0.76	1.00	1.00	0.50	1.00	1.00	0.50	0.00	0.00	0.50	0.50	0.00	0.00	0.00	14	9	5
900/13.90	Waiauti Stream (Manakau) Bridge	yes	0.41	0.91	0.59	0.25	1.00	0.70	1.00	1.00	0.76	0.00	1.00	0.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	15	23	10
915/0.00	Pukehou (Manakau South) Overbridge	no	0.59	1.00	0.71	0.41	1.00	1.00	1.00	1.00	0.76	1.00	0.16	0.50	1.00	1.00	0.50	0.00	0.00	0.50	1.00	0.00	1.00	0.00	16	12	11
915/4.04	Waitohu Stream Bridge	no	0.33	0.91	0.46	0.20	1.00	0.70	1.00	1.00	0.76	0.00	0.16	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.50	0.00	0.00	0.00	17	14	-5
915/4.86	Otaki Overbridge	no	0.46	0.91	0.70	0.20	1.00	0.70	1.00	1.00	0.77	1.00	0.07	0.50	1.00	1.00	0.50	0.00	0.00	0.00	0.50	0.00	0.00	0.00	18	15	6
915/6.81	Otaki River Bridge	no	0.45	0.91	0.60	0.35	1.00	0.70	1.00	1.00	0.79	0.00	1.00	0.00	1.00	1.00	0.50	1.00	0.00	1.00	0.50	0.00	0.00	0.00	19	11	1
915/10.53	Mangaone Stream Bridge	yes	0.30	0.91	0.47	0.13	1.00	0.70	1.00	1.00	0.85	0.00	0.06	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	20	28	7
931/5.19	Waikanae River Bridge	no	0.56	1.00	0.61	0.49	1.00	1.00	1.00	1.00	0.85	0.00	1.00	0.00	1.00	1.00	0.50	0.00	0.00	0.50	0.50	0.00	1.00	1.00	21	4	1
942/0.00	Paraparaumu Overbridge	no	0.39	0.76	0.71	0.20	1.00	0.70	1.00	0.00	0.85	1.00	0.00	0.50	1.00	1.00	0.50	0.00	0.00	0.00	0.50	0.00	0.00	0.00	22	16	1
953/0.00	Paekakariki Overbridge	no	0.48	0.91	0.73	0.24	1.00	0.70	1.00	1.00	0.92	1.00	0.01	0.50	1.00	1.00	0.50	0.00	0.00	0.50	0.50	0.00	0.00	0.00	23	13	7
953/7.70	Pukerua Bay Overbridge	no	0.50	0.91	0.75	0.25	1.00	0.70	1.00	1.00	0.93	1.00	0.08	0.50	1.00	1.00	0.50	0.00	0.00	0.00	0.50	0.53	0.00	0.00	24	8	3
953/15.41	Paremata Harbour Bridge	no	0.38	0.91	0.52	0.27	1.00	0.70	1.00	1.00	1.00	0.00	0.11	0.00	1.00	1.00	0.50	0.00	0.00	1.00	0.50	0.00	0.00	0.00	25	2	-14
969/4.40	Kenepuru Stream Bridge	yes	0.35	1.00	0.50	0.12	1.00	1.00	1.00	1.00	1.00	0.00	0.01	0.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.17	1.00	0.00	26	20	3
969/7.15	Collins Avenue East Bridge	no	0.28	0.70	0.45	0.33	1.00	1.00	0.00	0.00	1.00	0.35	0.01	0.00	1.00	0.00	0.50	0.00	0.00	0.00	0.50	0.27	1.00	0.00	27	18	-4
969/7.15	Collins Avenue West Bridge	no	0.28	0.70	0.45	0.33	1.00	1.00	0.00	0.00	1.00	0.35	0.01	0.00	1.00	0.00	0.50	0.00	0.00	0.00	0.50	0.27	1.00	0.00	28	19	-4
979/0.00	Takapu Road Overbridge	yes	0.24	0.70	0.48	0.13	1.00	1.00	0.00	0.02	1.00	0.50	0.01	0.00	1.00	0.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	29	21	-7
979/4.27	Johnsonville North Overpass	yes	0.24	0.70	0.47	0.16	1.00	1.00	0.00	0.00	1.00	0.48	0.01	0.00	1.00	0.00	0.50	0.00	0.00	0.00	0.00	0.33	0.00	0.00	30	25	-2
979/4.61	Johnsonville South Overpass	yes	0.25	0.70	0.47	0.18	1.00	1.00	0.00	0.00	1.00	0.48	0.00	0.00	1.00	0.00	0.50	0.00	0.00	0.00	0.00	0.50	0.00	0.00	31	24	-2
	FACTORS - THIS TRIAL:			1.00	0.60	0.40	0.40	0.30	0.15	0.15	0.25	0.15	0.15	0.20	0.15	0.10	0.25	0.08	0.10	0.07	0.15	0.10	0.10	0.15			
	FACTORS IN REPORT:			1.00	0.60	0.40	0.40	0.30	0.15	0.15	0.25	0.15	0.15	0.20	0.15	0.10	0.25	0.08	0.10	0.07	0.15	0.10	0.10	0.15			

Sorted by Seismic Priority Grade

SH1 RP	Bridge Name	Excluded from Prioritisation By Screening Procedure	Seismic Prioritisation Grade (SPG)	Hazard Index	Importance Index	Vulnerability Index	Hazard Index Factors: Peak Ground Accn.	Remaining Service Life	Soil Condition	Liquefaction Risk	Importance Index Factors: AADT On Bridge	AADT Under Bridge	Detour Length	Facility Crossed	Route Type	Critical Utility	Vulnerability Index Factors: Year Designed	Super-structure Hinges	Super-structure Overlap	Super-structure Length	Pier Type	Bridge Skew	Abutment Type	Other Feature	Route Position Order	Economic Analysis Ranking	SPG Ranking	Difference Econ-SPG Rankings
915/0.00	Pukehou (Manakau South) Overbridge	no	0.59	1.00	0.71	0.41	1.00	1.00	1.00	1.00	0.76	1.00	0.16	0.50	1.00	1.00	0.50	0.00	0.00	0.50	1.00	0.00	1.00	0.00	16	12	1	11
900/7.04	Ohau Overbridge	yes	0.58	1.00	0.84	0.19	1.00	1.00	1.00	1.00	0.75	1.00	1.00	0.50	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.61	0.00	0.00	11	10	2	8
931/5.19	Waikanae River Bridge	no	0.56	1.00	0.61	0.49	1.00	1.00	1.00	1.00	0.85	0.00	1.00	0.00	1.00	1.00	0.50	0.00	0.00	0.50	0.50	0.00	1.00	1.00	21	4	3	1
900/10.87	Manakau North Overbridge	no	0.54	0.91	0.84	0.24	1.00	0.70	1.00	1.00	0.76	1.00	1.00	0.50	1.00	1.00	0.50	0.00	0.00	0.50	0.50	0.00	0.00	0.00	14	9	4	5
953/7.70	Pukerua Bay Overbridge	no	0.50	0.91	0.75	0.25	1.00	0.70	1.00	1.00	0.93	1.00	0.08	0.50	1.00	1.00	0.50	0.00	0.00	0.00	0.50	0.53	0.00	0.00	24	8	5	3
953/0.00	Paekakariki Overbridge	no	0.48	0.91	0.73	0.24	1.00	0.70	1.00	1.00	0.92	1.00	0.01	0.50	1.00	1.00	0.50	0.00	0.00	0.50	0.50	0.00	0.00	0.00	23	13	6	7
872/14.30	Manawatu River (Whirokino) Bridge	no	0.48	0.91	0.47	0.62	1.00	0.70	1.00	1.00	0.63	0.00	0.40	0.00	1.00	1.00	0.50	1.00	0.00	1.00	0.50	0.22	1.00	1.00	9	6	7	-1
900/6.77	Ohau River Bridge	no	0.48	1.00	0.59	0.31	1.00	1.00	1.00	1.00	0.75	0.00	1.00	0.00	1.00	1.00	0.50	0.50	0.00	1.00	0.50	0.00	0.00	0.00	10	1	8	-7
915/4.86	Otaki Overbridge	no	0.46	0.91	0.70	0.20	1.00	0.70	1.00	1.00	0.77	1.00	0.07	0.50	1.00	1.00	0.50	0.00	0.00	0.00	0.50	0.00	0.00	0.00	18	15	9	6
915/6.81	Otaki River Bridge	no	0.45	0.91	0.60	0.35	1.00	0.70	1.00	1.00	0.79	0.00	1.00	0.00	1.00	1.00	0.50	1.00	0.00	1.00	0.50	0.00	0.00	0.00	19	11	10	1
900/10.35	Waikawa River Bridge	no	0.44	0.91	0.59	0.33	1.00	0.70	1.00	1.00	0.76	0.00	1.00	0.00	1.00	1.00	1.00	0.00	0.00	0.00	0.50	0.00	0.00	0.00	13	5	11	-6
900/8.16	Kuku Stream Bridge	no	0.42	0.91	0.59	0.28	1.00	0.70	1.00	1.00	0.76	0.00	1.00	0.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.33	0.00	0.00	12	22	12	10
900/13.90	Waiauti Stream (Manakau) Bridge	yes	0.41	0.91	0.59	0.25	1.00	0.70	1.00	1.00	0.76	0.00	1.00	0.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	15	23	13	10
844/1.27	Rangitikei River Bridge at Bulls	no	0.39	0.76	0.45	0.60	1.00	0.70	0.00	1.00	0.70	0.00	0.18	0.00	1.00	1.00	0.50	1.00	0.00	1.00	0.50	0.00	1.00	1.00	1	3	14	-11
942/0.00	Paraparaumu Overbridge	no	0.39	0.76	0.71	0.20	1.00	0.70	1.00	0.00	0.85	1.00	0.00	0.50	1.00	1.00	0.50	0.00	0.00	0.00	0.50	0.00	0.00	0.00	22	16	15	1
953/15.41	Paremata Harbour Bridge	no	0.38	0.91	0.52	0.27	1.00	0.70	1.00	1.00	1.00	0.00	0.11	0.00	1.00	1.00	0.50	0.00	0.00	1.00	0.50	0.00	0.00	0.00	25	2	16	-14
969/4.40	Kenepuru Stream Bridge	yes	0.35	1.00	0.50	0.12	1.00	1.00	1.00	1.00	1.00	0.00	0.01	0.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.17	1.00	0.00	26	20	17	3
872/13.04	Whirokino Trestle	no	0.33	0.91	0.43	0.27	1.00	0.70	1.00	1.00	0.63	0.00	0.17	0.00	1.00	1.00	0.50	0.00	0.00	1.00	0.50	0.00	0.00	0.00	8	7	18	-11
915/4.04	Waitohu Stream Bridge	no	0.33	0.91	0.46	0.20	1.00	0.70	1.00	1.00	0.76	0.00	0.16	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.50	0.00	0.00	0.00	17	14	19	-5
872/12.41	North Whirokino Trestle	yes	0.31	0.91	0.43	0.20	1.00	0.70	1.00	1.00	0.63	0.00	0.17	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.50	0.00	0.00	0.00	7	17	20	-3
915/10.53	Mangaone Stream Bridge	yes	0.30	0.91	0.47	0.13	1.00	0.70	1.00	1.00	0.85	0.00	0.06	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	20	28	21	7
969/7.15	Collins Avenue East Bridge	no	0.28	0.70	0.45	0.33	1.00	1.00	0.00	0.00	1.00	0.35	0.01	0.00	1.00	0.00	0.50	0.00	0.00	0.00	0.50	0.27	1.00	0.00	27	18	22	-4
969/7.15	Collins Avenue West Bridge	no	0.28	0.70	0.45	0.33	1.00	1.00	0.00	0.00	1.00	0.35	0.01	0.00	1.00	0.00	0.50	0.00	0.00	0.00	0.50	0.27	1.00	0.00	28	19	23	-4
845/3.82	Pukakuku Stream Bridge	yes	0.28	0.91	0.42	0.13	1.00	0.70	1.00	1.00	0.69	0.00	0.00	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.09	0.00	0.00	3	29	24	5
850/4.35	Makahikaroa Stream Bridge	yes	0.27	0.91	0.41	0.13	1.00	0.70	1.00	1.00	0.63	0.00	0.03	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4	26	25	1
979/4.61	Johnsonville South Overpass	yes	0.25	0.70	0.47	0.18	1.00	1.00	0.00	0.00	1.00	0.48	0.00	0.00	1.00	0.00	0.50	0.00	0.00	0.00	0.00	0.50	0.00	0.00	31	24	26	-2
979/4.27	Johnsonville North Overpass	yes	0.24	0.70	0.47	0.16	1.00	1.00	0.00	0.00	1.00	0.48	0.01	0.00	1.00	0.00	0.50	0.00	0.00	0.00	0.00	0.33	0.00	0.00	30	25	27	-2
979/0.00	Takapu Road Overbridge	yes	0.24	0.70	0.48	0.13	1.00	1.00	0.00	0.00	1.00	0.50	0.01	0.00	1.00	0.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	29	21	28	-7
845/2.38	Makowai Stream Bridge	yes	0.23	0.76	0.42	0.13	1.00	0.70	0.00	1.00	0.69	0.00	0.01	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.09	0.00	0.00	2	27	29	-2
850/5.67	Makowai No 2 Bridge	No Drawings Available		Could Not Be Assessed																					5			
850/5.68	Makowai No 2 Bridge	No Drawings Available		Could Not Be Assessed																					6			

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- Most of the shorter structures resist transverse seismic loads by a combination of resistance at the abutments and at individual piers, with the deck acting as a diaphragm. The proportional contributions of the systems are indeterminate. For shorter structures computer simulations were made of each case to calculate the upper and lower bound forces which might develop at each support point. For the assessment the pier and abutment loads were assumed to be the average of the upper and lower bound values.

5.2.3.2 Assessment of cost and time to repair bridge damage

Estimation of the cost to repair the damage expected from the earthquakes of various estimated return periods (Section 5.2.3.1) was based generally on assuming a percentage of the new cost for the item damaged, taking into account the added difficulties of working on an existing structure. The costs to repair less significant items of damage were estimated from an itemised breakdown of activities where possible. Estimation of times for repair were based on consideration of the activities involved.

Execution of this project task highlighted the approximation inherent in the assessment of the cost and time for repairing. Similar approximation, in the form of widely scattered values is evident in other published results of exercises in estimating damage costs as a percentage of replacement costs. While averaging such estimates to obtain overall damage costs for a large number of structures in an affected area may provide acceptable accuracy, the estimation of damage cost and repair time for each of a number of structures for the purpose of ranking the structures in terms of an economic analysis is much more difficult. For example, the repair time would be dependent on accessibility to the site and availability of resources.

For this project it was decided that the "best estimate" of damage cost and repair time for each structure would be used, rather than a possible range of data for each of the structures. A summary of the data adopted for the economic analyses is included in Table 5.3.

5.2.3.3 Assessment of cost and time to provide temporary bridging

At locations where damage was considered likely to close a bridge to traffic the cost and time required for installing a Bailey bridge or constructing a local bypass were estimated on the basis of experience with past similar projects. A critical aspect in providing a temporary bridge is the feasibility of installing a single span against the need for intermediate piers. A maximum of 43 metres (140 feet) was assumed for a single span. A summary of the costs and times assumed for the provision of temporary crossings is included in Table 5.3.

Table 5.2 Summary of SPGs and hierarchies of bridge damage derived from structural assessments

SUMMARY OF STRUCTURAL ASSESSMENT, AND SPG FROM SCREENING PROCEDURE (refer to notes for interpretation)

SH1 RP	Bridge Name	SPG	Comments from Structural Assessment	
844/1.27	Rangitikei River Bridge at Bulls	0.39	*Sway bracing between beams:* *Pier piles (transverse load):* *Span restraints at piers and joints:*	Yield/buckling – high probability – moderately serious consequences. Plastic hinging causing spalling & shear failure – low probability – serious consequences. Shear damage to holding bolts – low probability – not serious consequences.
845/2.38	Makowai Stream Bridge	0.23		6m span monolithic with abutment walls on footings – not analysed.
845/3.82	Piakatutu Stream Bridge	0.28		6m span monolithic with abutment walls on footings – not analysed.
850/4.35	Makahikaroa Stream Bridge	0.27		7m span monolithic with abutment walls on piles– not analysed.
850/5.67	Makowai Nº 2 Bridge	–		No information available – not analysed.
850/5.68	Makowai Nº 2 Bridge	–		No information available – not analysed.
872/12.41	North Whirokino Trestle	0.31		Structural details same as Whirokino Trestle below; bridge 3 x 12m spans long. Due to deck diaphragm action it is judged structure has very low probability of pier yielding or column bar pull-out – not analysed.
872/13.04	Whirokino Trestle	0.33	*Pier columns:* *Column bar anchorage slippage:*	Plastic hinging with spalling – low probability – moderately serious consequences. High probability this will occur before columns yield in flexure, causing structure to "soften".
872/14.30	Manawatu River (Whirokino) Bridge	0.48	*Sway bracing between beams (Piers B, C, G, F):* *Pier D, E piles (transverse load):* *Span restraints at piers and joints:*	Yield/buckling – high probability – moderately serious consequences. Plastic hinging causing spalling & flexure/shear failure – medium probability – serious consequences. Yielding – low probability – not serious consequences.
900/6.77	Ohau River Bridge	0.48	*Piles under piers:* *Shear thrust blocks at mid-length deck joint:*	Shear failure – low probability – serious consequences. Shear failure could cause damage to joint hangers – strength is equivalent to pier pile strength – low probability of failure judged.
900/7.04	Ohau Overbridge	0.58	*Abutment walls at base:*	Possible shear damage under dynamic earth pressure – low probability but judged less than this, taking into account usual behaviour of such items – moderately serious.
900/8.16	Kuku Stream Bridge	0.42		11m span monolithic with abutment walls on footings – not analysed

Table 5.2 (continued)

SH1 RP	Bridge Name	SPG	Comments from Structural Assessment	
900/10.35	Waikawa River Bridge	0.44	*Piles under piers:*	Shear failure – low probability – serious consequences
900/10.67	Manakau North Overbridge	0.54	*Piers C, G:* *Piers D, E, F:* *Piers B, H:*	Slab piers on footings – very robust. Plastic hinging with spalling – low probability – moderately serious consequences. Tie beams likely to flexure damage – medium probability – little significance in short term. Plastic hinging with spalling – low probability – moderately serious consequences.
900/13.90	Waiauti Stream (Manakau) Bridge	0.41		12m span monolithic with abutment walls – not analysed.
915/0.00	Pukehou (Manakau South) Overbridge	0.59	*Abutment E raked piles, and shear key at Pier D:* *Connections at pier bottom/tops (dowelled hinges) and at Abutment A (concrete rocker):*	Shear failure under longitudinal loading – high probability – very serious consequences. These connections theoretically have good resistance to shear (low probability of failure) but their form is unconventional and warrants detailed assessment to determine if there is sufficient reserve in the system.
915/4.04	Waitohu Stream Bridge	0.33	*Piles under piers:*	Shear failure – low probability – serious consequences.
915/4.86	Otaki Overbridge	0.46	*Columns carrying abutments:* *Columns of main piers:*	Plastic hinging with spalling – high probability – moderately serious consequences. Plastic hinging with spalling – low probability – serious consequences.
915/6.81	Otaki River Bridge	0.45	*Piles under river piers (with significant free length):*	Plastic hinging causing spalling & flexure/shear failure – medium probability – serious consequences.
915/10.53	Mangaone Stream Bridge	0.30		6m span monolithic with abutment walls on footings – not analysed.
931/5.19	Waikanae Overbridge	0.56	*Link beams at piers:* *Abutment piles:* *Pier stems and piles:*	Shear damage – high probability – moderately serious consequences. Flexural yield – high probability – not serious consequences. Flexural or shear damage – low probability – serious consequences.
942/0.00	Paraparaumu Overbridge	0.39	*Columns carrying abutments:*	Plastic hinging with spalling – low probability – moderately serious consequences.
953/0.00	Paekakariki Overbridge	0.48	*Piers C, G:* *Piers D, F:* *Pier E:* *Piers B, H:*	Plastic hinging/shear failure in piles – medium probability – serious consequences. Plastic hinging in columns causing flexural damage to hinge – low probability – serious; high probability of damage to ground tie beam – moderately serious. Plastic hinging in columns causing flexural damage to hinge – low probability – serious; high probability of damage to ground tie beam – moderately serious. Plastic hinging in columns causing flexural damage to hinge – low probability – serious.
953/7.70	Pukerua Bay Overbridge	0.50	*Pier columns*	Subject to flexural damage from rotation of deck in plan if skewed abutments move in. Assessed risk – low.

SH1 RP	Bridge Name	SPG	Comments from Structural Assessment	
953/15.41	Paremata Harbour Bridge	0.38	*Piles under piers:* *South abutment:* *North abutment:*	Pile flexural hinging with buckling (spalling) – medium to high probability – serious consequences. Residual rotation under longitudinal loading – high probability – moderately serious consequences. Subject to possible distortion due to liquefaction of surrounding soils – medium probability – moderately serious.
969/4.40	Kenepuru Stream Bridge	0.35		12m span on piles – designed 1987 – not analysed.
969/7.15	Collins Avenue East Bridge	0.28	*Columns carrying abutments:*	Plastic hinging with spalling – judged low probability – serious consequences.
	Collins Avenue West Bridge	0.28		
979/0.00	Takapu Road Overbridge	0.24		11m span monolithic with abutment walls on footings – not analysed.
979/4.27	Johnsonville North Overpass	0.24		9m span monolithic with abutment walls on footings – not analysed.
979/4.61	Johnsonville South Overpass	0.25		

NOTES:

1. The shaded SPG cells indicate that the screening procedure would exclude these bridges from assessment – the SPG was calculated to investigate what score would result, as part of evaluation of the screening procedures.

2. The stated probabilities relate to a 50 year period and are for comparative purposes only for evaluating the screening procedures. The analyses undertaken which resulted in the stated probabilities were based on simplified analytical methods using assumed material properties and non-specific site data. Because of the approximations and judgements used for the analyses, probabilities have been stated in bands, representing the following ranges:
   Very low <10% Low 10% - 30% Medium 30% - 60% High > 60%

3. The consequences of occurrence of the failures listed should be read in conjunction with the probability – ie although an occurrence may be stated as having serious consequences, it may be that there is only a low probability of the failure occurring.

Table 5.3 Data obtained from the bridge assessment, used for the economic analysis

STATE HIGHWAY 1 BRIDGES BETWEEN RP 844/1.27 AND 979/4.61 – IN ORDER OF ROUTE POSITION														
SH1 RP	Bridge Name	Return Period (Years)	Probability of Exceedance in 50 yrs	Cost to repair damage ($)	Time crossing out of service (days)	Bailey and approaches required?		Install/remove bailey		Build temporary bypass		Estimated bridge replacement cost ($) ± 20%	Length of Detour km (local traffic in brackets)	Annual average daily traffic count (AADT) 1992
						Req'd?	Days in use	Time (days)	Cost ($)	Req'd?	Cost ($)			
844/1.27	Rangitikei River Bridge at Bulls	20	.92	400,000	60	no	–	–	–	no	–	8,000,000	10 (≤18)	9,910
		165	.26	1,400,000	300	no	–	–	–	no	–			
845/2.38	Makowai Stream Bridge	?150	.28	5,000	0	no	–	–	–	no	–	50,000	0.5	9,500
845/3.82	Piakatutu Stream Bridge	?150	.28	5,000	0	no	–	–	–	no	–	50,000	0	9,500
850/4.35	Makahikaroa Stream Bridge	?150	.28	5,000	0	no	–	–	–	no	–	60,000	3	–
850/5.67	Makowai Nº 2 Bridge	No details of these bridges held – 6.8 and 10 metres long respectively. Effect of seismic damage to these bridges is judged to be insignificant unless liquefaction causes settlement.										60,000	–	–
850/5.68	Makowai Nº 2 Bridge											90,000	–	–
872/12.41	North Whirokino Trestle	200	.22	120,000	0	no	–	–	–	no	–	400,000	17	7,900
872/13.04	Whirokino Trestle	200	.22	270,000	1	no	–	–	–	no	–	12,000,000	17	7,900
		3000	.02	1,000,000	28	no	–	–	–	no	–			
872/14.30	Manawatu River (Whirokino) Bridge	20	.92	80,000	5	no	–	–	–	no	–	2,500,000	25 (≤40)	7,900
		90	.43	380,000	21	yes	180	21	290,000	no	–			
900/6.77	Ohau River Bridge	200	.22	770,000	21	yes	300	21	290,000	no	–	1,700,000	>100	11,300
900/7.04	Ohau Overbridge	170	.26	50,000	1	no	–	–	–	no	–	200,000	>100	11,300
900/8.16	Kuku Stream Bridge	?150	.28	5,000	0	no	–	–	–	no	–	100,000	>100	11,400
900/10.35	Waikawa River Bridge	150	.28	100,000	3	yes	21	3	29,000	no	–	350,000	>100	11,400

Table 5.3 (continued)

STATE HIGHWAY 1 BRIDGES BETWEEN RP 844/1.27 AND 979/4.61 – IN ORDER OF ROUTE POSITION

SH1 RP	Bridge Name	Return Period (Years)	Probability of Exceedance in 50 yrs	Cost to repair damage ($)	Time crossing out of service (days)	Bailey and approaches required?		Install/remove bailey		Build temporary bypass		Estimated bridge replacement cost ($) ± 20%	Length of Detour km (local traffic in brackets)	Annual average daily traffic count (AADT) 1992
						Req'd?	Days in use	Time (days)	Cost ($)	Req'd?	Cost ($)			
900/10.67	Manakau North Overbridge	65	.54	75,000	3	no	–	–	–	yes	50,000	1,000,000	>100	11,400
		450	.11	300,000	3	no	–	–	–					
900/13.90	Waiauti Stream (Manakau) Bridge	?150	.28	5,000	0	no	–	–	–	no	–	125,000	>100	11,400
915/0.00	Pukehou (Manakau South) Overbridge	50	.63	130,000	3	yes	21	3	9,000	no	–	1,100,000	3 (≤13)	11,400
915/4.04	Waitohu Stream Bridge	185	.24	130,000	3	yes	28	3	29,000	no	–	260,000	3 (≤13)	11,500
915/4.86	Otaki Overbridge	45	.67	80,000	0	no	–	–	–	yes (exists)	–	450,000	1	11,800
		185	.24	180,000	28	no	–	–	–		–			
915/6.81	Otaki River Bridge	100	.39	120,000	4	yes	28	4	26,000	no	–	3,000,000	>100	12,400
915/10.53	Mangaone Stream Bridge	?150	.28	5,000	0	no	–	–	–	no	–	50,000	6	14,600
931/5.19	Waikanae Overbridge	20	.92	25,000	1	no	–	–	–	no	–	1,200,000	>100	14,600
		38	.74	80,000	3	yes	21	3	9,000	no	–			
942/0.00	Paraparaumu Overbridge	200	.22	120,000	0	no	–	–	–	yes (exists)	–	500,000	0	14,600
953/0.00	Paekakariki Overbridge	20	.92	75,000	0	no	–	–	–	yes (exists)	–	1,200,000	0.5	16,900
		140	.30	460,000	2	no	–	–	–					
953/7.70	Pukerua Bay Overbridge	200	.22	30,000	4	yes	28	4	29,000	no	–	450,000	8 (≤36)	17,400

Table 5.3 (continued)

STATE HIGHWAY 1 BRIDGES BETWEEN RP 844/1.27 AND 979/4.61 – IN ORDER OF ROUTE POSITION														
SH1 RP	Bridge Name	Return Period (Years)	Probability of Exceedance in 50 yrs	Cost to repair damage ($)	Time crossing out of service (days)	Bailey and approaches required?		Install/remove bailey		Build temporary bypass		Estimated bridge replacement cost ($) ± 20%	Length of Detour km (local traffic in brackets)	Annual average daily traffic count (AADT) 1992
						Req'd?	Days in use	Time (days)	Cost ($)	Req'd?	Cost ($)			
953/15.41	Paremata Harbour Bridge	50	.63	260,000	115 85	maybe	115	85	270,000	no	–	2,500,000	11	25,300
		70	.51	460,000	155	maybe	155							
		90	.43	550,000	170	maybe	170							
969/4.40	Kenepuru Stream Bridge	?150	.28	5,000	0	no	–	–	–	no	–	110,000	0.5	34,400
969/7.15	Collins Avenue East Bridge	?150	.28	10,000 (total, two bridges)	0	no	–	–	–	no	–	540,000 (total, two bridges)	1	32,400 (Total)
969/7.15	Collins Avenue West Bridge													
979/0.00	Takapu Road Overbridge	?150	.28	5,000	0	no	–	–	–	no	–	110,000	1	39,500
979/4.27	Johnsonville North Overpass	?150	.28	10,000 (total two bridges)	0	no	–	–	–	no	–	160,000 (total, two bridges)	0.5	30,100 (Total)
979/4.61	Johnsonville South Overpass													

5.2.3.4 Economic analysis

A. Methodology

The "Seismic hazard" relating to a bridge denotes the potential for adverse consequences associated with bridge failure in a seismic event. The hazard is ranked according to the magnitude of potential adverse consequences or cost, i.e. the vulnerability of the bridge.

The cost of damage will probably be high for any bridge which has been subjected to a very large seismic event. However in considering the economic risk to society, account must also be taken of the likelihood of occurrence of the event causing damage to the bridge, i.e. the product of hazard and risk.

Accordingly the appropriate measure of economic risk is the expected annual damage cost, which makes allowance for all possible damaging events in any year and sums the costs of these, modified or weighted by their probability of occurrence. Figure 5.1 shows the relationship between the probabilities of exceedance for seismic events of various intensities and the resultant cost of damage. This is for the full range of seismic events between those of very large magnitude, high damage and low probability to those of high probability at which damage first commences. The expected annual damage cost is the sum of all costs multiplied by probability, i.e. the area under the curve.

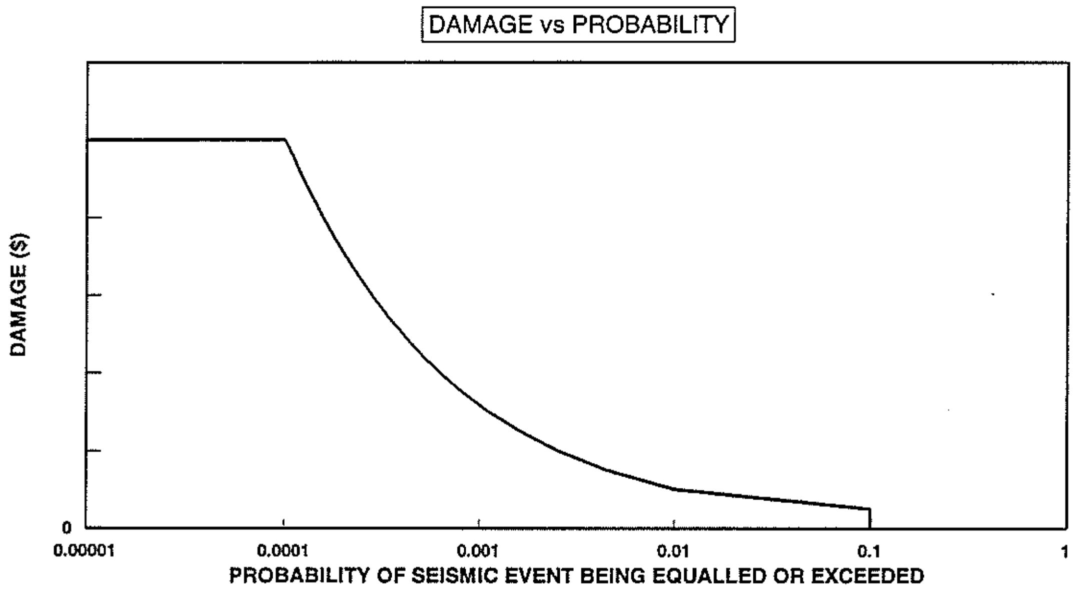

Figure 5.1 Relationship between probability of exceedance for seismic events and resultant cost of damage

These curves can be developed for each bridge by detailed analysis with a number of seismic events of differing intensities. However for the purpose of appraising the Proposed Preliminary Screening Procedure a rough order method at a lesser level of detail was used. In this project use was made of the data for the one, two or three events applied to each bridge, for which damage costs were estimated. The obvious difficulty was to synthesise a curve through a single point when the cost of damage for only one event was estimated.

To assist in the evaluation an analysis was made of damage related to seismic events from existing data to look for trends. Figure 5.2 shows the relationship between earthquake return period (plotted on a log scale) and damage (expressed as a percentage of bridge replacement cost). Data from three sources has been used:

- The analysis carried out in this study where two or three events per bridge have been analysed.
- Information from the Applied Technology Council publication ATC-13 "Earthquake Damage Evaluation Data for California", 1985, (ATC 1985) which presents the results of a survey of expert opinion on the relationship between a seismic event and damage for a range of infrastructure, including simple-span and continuous bridges.
- The draft Retrofit Concepts Report for Thorndon Overbridge, by Beca Carter Hollings and Ferner Ltd (BCHF 1994).

The latter report gives expected damage to the Thorndon Overbridge for a number of seismic events associated with (i) the Wellington faultline only and (ii) all faultlines except the Wellington faultline.

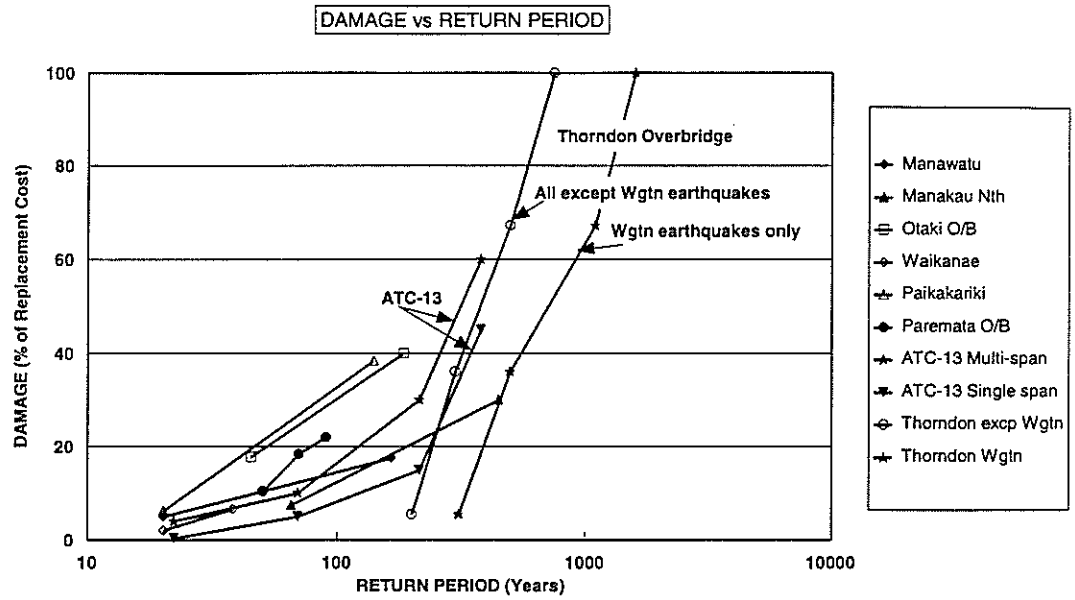

Figure 5.2 Relationship between earthquake return period and cost of damage.

The graph in Figure 5.2 indicates a trend for flatter slopes at the onset of damage, and steeper slopes with more damaging events. For synthesising a continuous curve for each bridge, the curve is assumed to consist of two straight line sections. The following method has been used to construct the curves for each bridge:

- The change in line slope has been assumed to occur at the damage cost level of 40% of replacement cost.

- No damage has been assumed to occur in earthquakes of return period less than 20 years.

- Where two points have been obtained from estimates of damage for a bridge a straight line has been drawn between these extending to the level of 40% damage. Beyond the 40% level the curve continues in a straight line at the slope given by the Thorndon Overbridge results.

- Where three points have been obtained from estimates of damage only the extreme two have been used in the above process.

- Where a single point only has been obtained from estimates of damage a straight line has been drawn from a point given by 4% damage and a 20 year return period event through the single point, and extending to the 40% damage level. The line has been continued as a straight line beyond the 40% level at the slope given by the results from the report on the Thorndon Overbridge.

- Where a single point only has been obtained from estimates of damage, and which has a damage percentage of less than or equal to 4%, the line below the 40% level has been assumed to start at a point given by zero damage and a 20 year return period event.

B. Costs

Bridge damage costs and related seismic events have been taken from the data presented in Table 5.3.

The costs associated with any seismic event include those of traffic disruption and the construction of temporary bridging and detours.

The costs of traffic disruption have been evaluated by determining the length of detour required and calculating additional travel costs (for vehicle operation, time and accidents) using the parameter costs given by the Transit New Zealand Project Evaluation Manual (Transit New Zealand 1991). Table 5.4 shows the assumptions made on detour length for each bridge, traffic volumes and resulting daily total disruption cost. Traffic detour costs in the table have been evaluated for the full volume of daily traffic. However some portion of the normal number of tripmakers will be discouraged by the additional detour costs (the value or benefit of the trip is less than the new high cost). Hence the cost of traffic disruption is equal to the additional or detour cost imposed on those who continue to travel, plus the loss of benefit to those who cease to make the trip. The total is less than the costs noted in the table by up to 50%. In the absence of detailed analysis of the traffic demand curves (which would form a major study) a factor of 0.75 has been applied to the costs shown in Table 5.4. This factor was based on the results of a more detailed verification analysis carried out on the Paremata Harbour bridge (Section 5.2.3.4.(C)).

Other costs associated with the installation of a Bailey bridge or construction of a temporary bypass have also been included.

The analysis makes allowance for the number of days that traffic would be disrupted, an estimate of which is given in Table 5.3, and queueing delay costs while temporary bridging is in operation (Section 5.2.3.4.(C)). Assumptions are set out in Table 5.5.

The impact of loss of life on total costs was tested in an evaluation which assumed that it was only at the higher percentages of bridge damage that risk to life is significant. While the costs of loss of life were in some cases high, the low probabilities of the associated events reduced the impact on final costs. The largest increase found was in the order of 4% of expected annual damage cost. This did not alter the ranking of the bridges.

C. Verification of Detour Costs

A more detailed analysis was undertaken for the costs incurred from seismic damage to the Paremata Harbour bridge. Estimates were made of the number of travellers switching to alternative modes (e.g. rail), and of trip suppression, to calculate the likely traffic volumes using the Grays Road detour route. Accident records for the last 13 years were used to assess the existing accident rate. The cost of additional accidents was assessed for the detour traffic using this route. Allowance was also made for the consumer surplus loss (lost benefits net of saved travel costs) of those discouraged from tripmaking. Total costs were calculated to be in the order of $150,000 per day compared with the figure of $190,000 per day using the cruder (full detour cost) method. Consequently a factor of 0.75 on full detour cost was chosen for the analysis.

Delay costs caused by reduced flow capacity on temporary bridging were also evaluated for the Paremata Harbour bridge. Assuming the deck is sealed and the approach road alignment is good, the initial capacity is assessed at 1200 vehicles per hour (vph) rising to 1400 vph. An analysis of queueing time (taking into account the variation and duration of traffic flow) produced an average estimated daily delay cost of $25,000. This figure was used in the analysis, and scaled amounts (depending on AADT) were chosen for the other bridges which would have temporary bridging.

Table 5.4 Detour lengths, traffic volumes, and calculated consequential daily total costs of traffic disruption for traffic using the detours.

Bridge	Detour (km)	AADT	Detour Cost ($/day)
Rangitikei River		9 910	42,836
local traffic	18		
non-local SH1-SH1	3		
non-local SH1-SH3	10		
Makowai Stream	0.5	9 500	3,081
Piakatutu Stream	0	9 500	0
Makahikaroa Stream	0		0
Makowai No 2			
North Whirokino Trestle	17	7 900	79,512
Whirokino Trestle	17	7 900	79,512
Manawatu River Whirokino		7 900	79,512
local traffic	40		
non-local traffic	25		
Ohau River	100	11 300	624,760
Ohau Overbridge	100	11 300	624,760
Kuku Stream	100	11 400	630,288
Waikawa River	100	11 400	630,288
Manakau North Overbridge	100	11 400	630,288
Waiatuti Stream	100	11 400	28,405
Pukehou Overbridge		11 400	28,158
local traffic	13		
non-local traffic	3		
Waitohu Stream		11 500	28,405
local traffic	13		
non-local traffic	3		
Otaki Overbridge	7	11 800	51,006
Otaki River	7	12 400	53,382
Mangaone Stream	6	14 600	53,874
Waikanae River	100	14 600	803,562
Paraparaumu Overbridge	0	14 600	0
Paekakariki Overbridge	0.5	19 600	5,460
Pukerua Bay Overbridge		17 400	86,190
local traffic	36		
non-local traffic	8		
Paremata Harbour	11	25 300	190,636
Kenepuru Stream	0.5	34 400	11,782
Collins Avenue East	1	32 400	19,926
Collins Avenue West	1	23 400	19,391
Takapu Road Overbridge	1	39 500	24,293
Johnsonville North Overpass	0.5	30 100	9,724
Johnsonville South Overpass	0	30 100	0

Table 5.5 Estimated costs of traffic disruption.

Bridge	AADT	Days	Daily Cost ($)	Total Cost ($)
Manawatu River Whirokino	7 900	180	5,000	900,000
Ohau River	11 300	300	5,000	1,500,000
Waikawa River	11 400	21	5,000	105,000
Pukehou Overbridge	11 400	21	5,000	105,000
Waitohu Stream	11 500	28	5,000	140,000
Otaki River	12 400	28	5,000	140,000
Waikanae River	14 600	21	10,000	210,000
Pukerua Bay Overbridge	17 400	28	10,000	280,000
Paremata-Seismic return period	25 300			
50 years		115	25,000	2,875,000
70 years		155	25,000	3,875,000
90 years		170	25,000	4,250,000

D. Calculated annual damage costs for bridges in the study.

The annual damage costs for bridges in the study have been calculated using a spreadsheet analysis. The details for each bridge are included in Appendix 2.

The spreadsheet synthesises the curve of damage *v* seismic event for each bridge and evaluates return periods for a given set of damage percentages. This enables each curve to be sketched and a calculation to be made of the area under the curve.

The results are expressed as an expected annual cost of damage for each bridge, with a breakdown into cost components. Expected annual costs of damage are set out in Table 5.6 along with a cost ranking of the bridges.

E. Comments

All costs have a rough order of accuracy. In particular the traffic disruption costs are dependent on assumptions made for detour length, extent of discouragement of tripmaking and time over which the traffic is disrupted. These assumptions may be subject to considerable variation. However, the methods used are adequate to give a broad ranking of the bridges with the impacts of high traffic levels, long detours and lengthy detour periods being enough to clearly weigh against particular bridges.

In many cases the cost of detours far exceeds the cost of bridge damage. The detour costs make no allowance for secondary impacts such as loss of regional production or business output. These would increase the total costs assumed, but their inclusion would require detailed consideration of impacts along with consideration of combined bridge effects (more than one bridge failing during the one event). In one study the cost of secondary impacts has been estimated as being equal to twice the total direct costs. However, assuming that the factor quoted applies to all direct costs (bridge plus detour costs) the ranking order of the bridges would not be affected.

Inclusion of the costs from probable loss of life did not significantly alter expected annual damage costs or affect the ranking. The value of life was taken from the Transit New Zealand Project Evaluation Manual parameters. It made no allowance for any risk-averse attitude of Transit New Zealand to loss of life, which would increase the benefit ascribed to preventing loss of life.

5.2.4 Task 2.3

5.2.4.1 Comparison of Results

Task 2.3 requires a comparison of the results of Tasks 2.1 and 2.2 with those of Task 1, and a determination of the effectiveness of the trial seismic screening procedure. This has been achieved by comparing the expected annual cost of seismic damage to the bridges, listed in Table 5.6, with the results of applying the trial procedure for preliminary seismic screening, listed in Table 5.1. Section 5.3 contains a discussion of the comparison.

5.2.5 Task 2.4

5.2.5.1 Identify improvements to the trial screening procedure

To identify improvements to the trial screening procedure 14 additional applications were made that incorporated changes to the attribute rating values, the weighting factors, or both. From each application the bridges were ranked in order of decreasing value of seismic priority grade, and the ranking list was compared with the listing of expected annual cost of damage (Table 5.6). The comparisons were summarised in tabular form and are presented in Section 5.3.

A comparison of the results of applying the different screening procedure options was made with a list of the bridges ranked in order of priority for seismic assessment. This ranking was based on judgement, examination of the drawings and on the results of the structural assessment presented in Table 5.3. The list was drawn up to contain three bands of priority rather than attempting to identify a specific order. The results of this comparison are discussed in Section 5.3.

Table 5.6 Expected annual costs of damage to bridges, in order of route position and in order of annual damage cost.

No	SH1 RP	Bridge Name in order of Route Position	Annual Damage Cost ($)	Bridges in order of Annual Damage Cost	Annual Damage Cost ($)
1	844/1.27	Rangitikei River	192,769	Ohau River	602,578
2	845/2.38	Makowai Stream	197	Paremata Harbour	341,312
3	845/3.82	Piakatutu Stream	197	Rangitikei River	192,769
4	850/4.35	Makahikaroa Stream	237	Waikanae River	83,633
	850/5.67	Makowai No 2		Waikawa River	80,717
	850/5.68	Makowai No 2		Manawatu River Whirokino	74,113
5	872/12.41	North Whirokino Trestle	3,324	Whirokino Trestle	33,598
6	872/13.04	Whirokino Trestle	33,598	Pukerua Bay Overbridge	29,961
7	872/14.30	Manawatu River (Whirokino)	74,113	Manakau North Overbridge	25,803
8	900/6.77	Ohau River	602,578	Ohau Overbridge	24,907
9	900/7.04	Ohau Overbridge	24,907	Otaki River	24,029
10	900/8.16	Kuku Stream	350	Pukehou (Manakau South) Overbridge	16,150
11	900/10.35	Waikawa River	80,717	Paekakariki Overbridge	15,485
12	900/10.67	Manakau North Overbridge	25,803	Waitohu Stream	15,269
13	900/13.90	Waiauti Stream (Manakau)	316	Otaki Overbridge	11,269
14	915/0.00	Pukehou (Manakau South) Overbridge	16,150	Paraparaumu Overbridge	3,361
15	915/4.04	Waitohu Stream	15,269	North Whirokino Trestle	3,324
16	915/4.86	Otaki Overbridge	11,269	Collins Ave East	675
17	915/6.81	Otaki River	24,029	Collins Ave West	675
18	915/10.53	Mangaone Stream	197	Kenepuru Stream	385
19	931/5.19	Waikanae River	83,633	Takapu Road O'Bridge	385
20	942/0.00	Paraparaumu Overbridge	3,361	Kuku Stream	350
21	953/0.00	Paekakariki Overbridge	15,485	Waiauti Stream (Manakau)	316
22	953/7.70	Pukerua Bay Overbridge	29,961	Johnsonville South U'pass	280
23	953/15.41	Paremata Harbour	341,312	Johnsonville North U'pass	280
24	969/4.40	Kenepuru Stream	385	Makahikaroa Stream	237
25	969/7.15	Collins Ave East	675	Makowai Stream	197
26	969/7.15	Collins Ave West	675	Mangaone Stream	197
27	979/0.00	Takapu Road Overbridge	385	Piakatutu Stream	197
28	979/4.27	Johnsonville North U'pass	280	Makowai No 2	
29	979/4.61	Johnsonville South U'pass	280	Makowai No 2	

Table 5.7 Comparison of the ranking orders derived from the trial screening procedure and the economic analysis.

PILOT APPRAISAL OF SEISMIC SCREENING PROCEDURES
STATE HIGHWAY 1 BRIDGES BETWEEN RP 844/1.27 AND 979/4.61

Sorted by Route Position Order

SH1 RP	Bridge Name	Bridges with Difference > 5	Excluded from Prioritisation By Screening Procedure	SUMMARY - DIFFERENCE IN RANKINGS : (ECONOMIC ANALYSIS - SEISMIC PERFORMANCE GRADE)															
				RANKING	RANKING1	RANKING2	RANKING3	RANKING4	RANKING5	RANKING6	RANKING7	RANKING8	RANKING9	RANKING10	RANKING12	RANKING14	AVERAGE	RANKING11	RANKING13
844/1.27	Rangitikei River Bridge at Bulls	*	no	-11	-1	-10	-11	-12	-7	-1	-10	-9	-4	-5	-6	-8	-7.3	-4	-5
845/2.38	Makowai Stream Bridge		yes	-2	-1	-2	-1	1	-2	-1	-2	-1	-1	-1	1	-1	-1.0		
845/3.82	Piakatutu Stream Bridge	*	yes	5	3	5	7	7	5	3	5	7	7	5	5	7	5.5		
850/4.35	Makahikaroa Stream Bridge		yes	1	-1	1	1	3	1	-1	1	1	1	1	1	3	1.0		
850/5.67	Makowai No 2 Bridge				No drawings available - not assessed														
850/5.68	Makowai No 2 Bridge				No drawings available - not assessed														
872/12.41	North Whirokino Trestle		yes	-3	-4	-3	-2	-2	-3	-4	-3	-2	-2	-2	-2	-3	-2.7		
872/13.04	Whirokino Trestle	*	no	-11	-10	-10	-10	-10	-9	-8	-9	-9	-9	-9	-9	-10	-9.5	-7	-7
872/14.30	Manawatu River (Whirokino) Bridge		no	-1	3	2	1	3	4	4	2	2	2	1	-2	-2	1.5	1	-1
900/6.77	Ohau River Bridge		no	-7	-5	-4	-1	-4	-2	-5	-2	-1	-1	-1	-1	-1	-2.7	-1	-1
900/7.04	Ohau Overbridge		yes	8	-1	7	7	6	2	-2	5	4	4	4	4	7	4.2		
900/8.16	Kuku Stream Bridge	*	no	10	10	13	13	13	15	14	13	13	12	12	12	13	12.5	9	9
900/10.35	Waikawa River Bridge		no	-6	-3	-3	-3	-3	0	-2	-3	-3	-4	-4	-2	-2	-2.9	-3	-1
900/10.67	Manakau North Overbridge		no	5	2	3	2	3	-2	0	2	2	1	2	5	5	2.3	3	5
900/13.90	Waiauti Stream (Manakau) Bridge	*	yes	10	10	12	13	12	14	12	13	13	12	12	12	13	12.2		
915/0.00	Pukehou (Manakau South) Overbridge	*	no	11	10	10	8	10	6	9	10	9	9	9	7	6	8.8	8	6
915/4.04	Waitohu Stream Bridge		no	-5	-6	-4	-4	-4	-3	-6	-4	-4	-4	-4	-4	-4	-4.3	-2	-2
915/4.86	Otaki Overbridge		no	6	1	0	0	1	-4	-3	0	0	0	0	0	0	0.1	1	1
915/6.81	Otaki River Bridge	*	no	1	6	4	5	4	7	6	5	6	6	7	8	6	5.5	6	7
915/10.53	Mangaone Stream Bridge	*	yes	7	4	7	8	8	7	4	7	8	8	7	8	9	7.1		
931/5.19	Waikanae River Bridge		no	1	3	3	3	3	3	3	3	3	3	3	3	3	2.8	3	3
942/0.00	Paraparaumu Overbridge		no	1	0	-3	-5	-5	-2	-3	-3	-5	-5	-4	-5	-5	-3.4	-1	-1
953/0.00	Paekakariki Overbridge		no	7	3	1	1	1	-2	-1	2	0	0	0	-1	0	0.8	1	0
953/7.70	Pukerua Bay Overbridge		no	3	-1	-2	-3	-2	-5	-2	-4	-6	-6	-4	-4	-4	-3.1	-2	-2
953/15.41	Paremata Harbour Bridge	*	no	-14	-13	-12	-11	-11	-10	-11	-12	-9	-10	-12	-11	-12	-11.4	-10	-9
969/4.40	Kenepuru Stream Bridge		yes	3	-2	4	4	4	6	-2	3	3	3	3	3	4	2.8		
969/7.15	Collins Avenue East Bridge		no	-4	0	-4	-5	-6	-4	2	-4	-5	-5	-4	-4	-6	-3.8	-1	-1
969/7.15	Collins Avenue West Bridge		no	-4	0	-4	-5	-6	-4	2	-4	-5	-5	-4	-4	-6	-3.8	-1	-1
979/0.00	Takapu Road Overbridge	*	yes	-7	-8	-7	-8	-8	-7	-8	-7	-8	-8	-8	-8	-8	-7.7		
979/4.27	Johnsonville North Overpass		yes	-2	0	-2	-2	-3	-2	0	-2	-2	-2	-2	-3	-2	-1.8		
979/4.61	Johnsonville South Overpass		yes	-2	1	-2	-2	-3	-2	1	-2	-2	-2	-2	-3	-2	-1.7		
			Sum of all	158	112	144	146	158	140	120	142	142	136	132	138	152		64.0	62.0
			Sum of all but *	71	37	54	52	63	53	44	51	51	51	46	52	60		20.0	19.0

SUMMARY OF CHANGES TO FACTORS EXPLORED:

RANKING. Basic screening data and SPG to draft report
RANKING1. As "RANKING." but SPG = Hazard x Importance x Vulnerability
RANKING2. As "RANKING." but AADT = 0 for bridges over railways
RANKING3. As "RANKING2." but Importance factors adjusted
RANKING4. As "RANKING2." but Hazard factors adjusted
RANKING5. As "RANKING2." but soils liquefaction values = 0 for bridges over railways
RANKING6. As "RANKING2." but SPG = Hazard x Importance x Vulnerability
RANKING7. As "RANKING2." but Vulnerability adjusted
RANKING8. As "RANKING2." but Importance and Vulnerability adjusted
RANKING9. As "RANKING8." but Soil Condition = 1 for Rangitikei River Bridge
RANKING10. As "RANKING9." but with more gradations of superstructure length attribute
RANKING11. As RANKING10 but with "excluded" bridges omitted from ranking
RANKING12. As RANKING10, but with Importance & Vulnerability adjusted further than in RANKING8, 9 & 10
RANKING13. As RANKING12 but with "excluded" bridges omitted from ranking
RANKING14. As RANKING10 but with weighting factors for Importance & Vulnerability indices altered

NOTES:

* Sum of values ignore negative signs, to indicate total variation from exact match of rankings

* A negative difference value indicates the screening procedure ranks the bridge lower than ranked by the economic analysis

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5.2.5.2 Assessment of time required to apply the Preliminary Screening Procedure to the state highway system

An assessment of the time required to apply the Preliminary Screening Procedure to the New Zealand state highway system is very difficult to make on the basis of the small sample of structures included in this project. The estimate has been based on an assessment of the average time per bridge required for acquiring the drawings, visiting the site, completing the bridge data and screening procedure, entering the data into a spreadsheet, reviewing the results and considering anomalies. The results are discussed in Section 7.

5.3 Results and Discussion

5.3.1 Comparison of the Results of Application of the Proposed Preliminary Screening Procedure with the Results of the Economic Analysis

5.3.1.1 General

Comparison of the ranking orders derived from the trial screening procedure and the economic analysis is presented in Table 5.7. The bridges were listed in priority order 1 to 29 for the two procedures (1 is equivalent to the bridge with the largest SPG or the greatest annual damage cost (Tables 5.1, Appendix 3 and Table 5.6). The difference in their ranking numbers was calculated as: economic rank value minus seismic performance grade (SPG) rank. A positive value for a bridge indicates the economic analysis ranks the bridge as a lower priority than does the trial screening procedure. An ideal match of the priorities from the two procedures would produce a value of zero for each bridge and a total of values for all bridges of zero. The value of the total for all bridges, with the minus signs ignored, therefore indicates the magnitude of the overall discrepancy between the results from the two procedures. This total is listed below the summary of results for each trial. For a procedure such as this, a correlation within five places is considered reasonable in view of the considerable approximations in the base data for the economic analysis and the closeness in the values of some of the seismic priority gradings. The reasons for discrepancies exceeding five were investigated.

Table 5.7 also contains the results for all the calculation runs carried out. Each run involved ranking the bridges by application of the screening procedure using a particular set of factors (as described in the summary on Table 5.7) followed by a comparison with the ranking order from the economic analysis.

This project has not evaluated some aspects of the Preliminary Screening Procedure directly, because some attributes show no variation in the bridges on the length of highway considered - in particular those included in the Hazard Index. This deficiency was recognised and discussed when the project brief was set up, and the decision was made to investigate bridges on a length of highway rather than to select bridges from various areas. This is discussed in more detail later.

5.3.1.2 Results using the Proposed Preliminary Screening Procedure

The results of the comparison using the proposed trial screening procedure are listed under RANKING in Table 5.7. The correlation of individual bridges is poor, and the average correlation is poor.

5.3.1.3 Results using Variations of the Proposed Preliminary Screening Procedure

The results of comparisons made by incorporating changes to the attribute rating values, to the weighting factors, or to both, of the trial screening procedure are listed under RANKING1 to RANKING14 of Table 5.7. Details of the changes made for each trial are summarised in Table 5.7 and are highlighted on the results sheet for each, included in Appendix 3.

5.3.2 Discussion of Results

5.3.2.1 General

Although the economic analysis was unavoidably based on approximate data (summarised in Table 5.3), it showed the strong influence of the costs of interruption of use of the bridges. The breakdown of the expected annual costs of damage are summarised in Table 5.8, which shows that the cost of traffic having to detour is a major proportion of the high costs.

While the above conclusion is considered reasonable, the approximation of the cost values must be noted and becomes more understandable with examination of the data in Table 5.3 on which the costs are based. Apart from the approximations made in execution of the economic analysis, and discussed in Section 5.2, key items of the base data for the analysis are:

- The extent of seismic damage to each bridge and the cost and time needed for repairs, particularly with the uncertain availability of resources.

- The intensities of shaking to cause the different identified levels of seismic damage, and their probabilities of occurrence.

- The extent to which seismic damage is likely to render each bridge unserviceable to either light or heavy vehicles, or both.

- The likelihood for the need to install a temporary bridge and the cost and time required for its installation.

Table 5.8 Expected annual costs of seismic damage to bridges.

PILOT APPRAISAL OF SEISMIC SCREENING PROCEDURES
STATE HIGHWAY 1 BRIDGES BETWEEN RP 844/1.27 AND 979/4.61

Sorted by Route Position Order

SH1 RP	Bridge Name	Excluded from Prioritisation By Screening Procedure	Economic Analysis Ranking	Expected Annual Damage Costs ($/yr)				
				Bridge Damage	Detour	Bailey Bridge	Bypass	Total
844/1.27	Rangitikei River Bridge at Bulls	no	3	45,433	147,335	0	0	192,768
845/2.38	Makowai Stream Bridge	yes	27	197	0	0	0	197
845/3.82	Piakatutu Stream Bridge	yes	29	197	0	0	0	197
850/4.35	Makahikaroa Stream Bridge	yes	26	237	0	0	0	237
850/5.67	Makowai No 2 Bridge			No Drawings Available - Not Assessed				
850/5.68	Makowai No 2 Bridge			No Drawings Available - Not Assessed				
872/12.41	North Whirokino Trestle	yes	17	3,324	0	0	0	3,324
872/13.04	Whirokino Trestle	no	7	31,081	2,517	0	0	33,598
872/14.30	Manawatu River (Whirokino) Bridge	no	6	14,827	44,786	14,500	0	74,113
900/6.77	Ohau River Bridge	no	1	21,079	566,999	14,500	0	602,578
900/7.04	Ohau Overbridge	yes	10	1,479	23,429	0	0	24,908
900/8.16	Kuku Stream Bridge	no	22	350	0	0	0	350
900/10.35	Waikawa River Bridge	no	5	3,110	76,157	1,450	0	80,717
900/10.67	Manakau North Overbridge	no	9	3,216	21,818	0	769	25,803
900/13.90	Waiauti Stream (Manakau) Bridge	yes	23	316	0	0	0	316
915/0.00	Pukehou (Manakau South) Overbridge	no	12	7,283	8,417	450	0	16,150
915/4.04	Waitohu Stream Bridge	no	14	3,624	10,195	1,450	0	15,269
915/4.86	Otaki Overbridge	no	15	3,793	6,874	602	0	11,269
915/6.81	Otaki River Bridge	no	11	7,722	15,007	1,300	0	24,029
915/10.53	Mangaone Stream Bridge	yes	28	197	0	0	0	197
931/5.19	Waikanae River Bridge	no	4	5,976	77,207	450	0	83,633
942/0.00	Paraparaumu Overbridge	no	16	3,361	0	0	0	3,361
953/0.00	Paekakariki Overbridge	no	13	15,397	88	0	0	15,485
953/7.70	Pukerua Bay Overbridge	no	8	1,582	26,929	1,450	0	29,961
953/15.41	Paremata Harbour Bridge	no	2	17,187	318,725	5,400	0	341,312
969/4.40	Kenepuru Stream Bridge	yes	20	385	0	0	0	385
969/7.15	Collins Avenue East Bridge	no	18	675	0	0	0	675
969/7.15	Collins Avenue West Bridge	no	19	675	0	0	0	675
979/0.00	Takapu Road Overbridge	yes	21	385	0	0	0	385
979/4.27	Johnsonville North Overpass	yes	25	280	0	0	0	280
979/4.61	Johnsonville South Overpass	yes	24	280	0	0	0	280

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Table 5.9 Summary of the ranking orders derived on the basis of SPG calculated using the Proposed Preliminary Screening Procedure and variations.

PILOT APPRAISAL OF SEISMIC SCREENING PROCEDURES
STATE HIGHWAY 1 BRIDGES BETWEEN RP 844/1.27 AND 979/4.61

Sorted by Route Position Order

SH1 RP	Bridge Name	Excluded from Prioritisation By Screening Procedure	SUMMARY - RANKING BY SEISMIC PRIORITY GRADE															
			RANKING	RANKING1	RANKING2	RANKING3	RANKING4	RANKING5	RANKING6	RANKING7	RANKING8	RANKING9	RANKING10	RANKING12	RANKING14	AVERAGE	RANKING11	RANKING13
844/1.27	Rangitikei River Bridge at Bulls	no	14	14	13	14	15	10	4	13	12	7	8	9	11	11.1	7	8
845/2.38	Makowai Stream Bridge	yes	29	29	29	28	26	29	28	29	28	28	28	26	28	28.1	0	0
845/3.82	Piakatutu Stream Bridge	yes	24	24	24	22	22	24	26	24	22	22	24	24	22	23.4	0	0
850/4.35	Makahikaroa Stream Bridge	yes	25	25	25	25	23	25	27	25	25	25	25	25	23	24.8	0	0
850/5.67	Makowai No 2 Bridge		No drawings available - not assessed															
850/5.68	Makowai No 2 Bridge		No drawings available - not assessed															
872/12.41	North Whirokino Trestle	yes	20	20	20	19	19	20	21	20	19	19	19	19	20	19.6	0	0
872/13.04	Whirokino Trestle	no	18	18	17	17	17	16	15	16	16	16	16	16	17	16.5	14	14
872/14.30	Manawatu River (Whirokino) Bridge	no	7	7	4	5	3	2	2	4	4	4	5	8	8	4.8	5	7
900/6.77	Ohau River Bridge	no	8	8	5	2	5	3	6	3	2	2	2	2	2	3.8	2	2
900/7.04	Ohau Overbridge	yes	2	2	3	3	4	8	12	5	6	6	6	6	3	5.1	0	0
900/8.16	Kuku Stream Bridge	no	12	12	9	9	9	7	8	9	9	10	10	10	9	9.5	9	9
900/10.35	Waikawa River Bridge	no	11	11	8	8	8	5	7	8	8	9	9	7	7	8.2	8	6
900/10.67	Manakau North Overbridge	no	4	4	6	7	6	11	9	7	7	8	7	4	4	6.5	6	4
900/13.90	Waiauti Stream (Manakau) Bridge	yes	13	13	11	10	11	9	11	10	10	11	11	11	10	10.8	0	0
915/0.00	Pukehou (Manakau South) Overbridge	no	1	1	2	4	2	6	3	2	3	3	3	5	6	3.2	3	5
915/4.04	Waitohu Stream Bridge	no	19	19	18	18	18	17	20	18	18	18	18	18	18	18.2	15	15
915/4.86	Otaki Overbridge	no	9	9	15	15	14	19	18	15	15	15	15	15	15	14.5	13	13
915/6.81	Otaki River Bridge	no	10	10	7	6	7	4	5	6	5	5	4	3	5	5.9	4	3
915/10.53	Mangaone Stream Bridge	yes	21	21	21	20	20	21	24	21	20	20	21	20	19	20.7	0	0
931/5.19	Waikanae River Bridge	no	3	3	1	1	1	1	1	1	1	1	1	1	1	1.3	1	1
942/0.00	Paraparaumu Overbridge	no	15	15	19	21	21	18	19	19	21	21	20	21	21	19.3	16	16
953/0.00	Paekakariki Overbridge	no	6	6	12	12	12	15	14	11	13	13	13	14	13	11.8	11	12
953/7.70	Pukerua Bay Overbridge	no	5	5	10	11	10	13	10	12	14	14	12	12	12	10.8	10	10
953/15.41	Paremata Harbour Bridge	no	16	16	14	13	13	12	13	14	11	12	14	13	14	13.5	12	11
969/4.40	Kenepuru Stream Bridge	yes	17	17	16	16	16	14	22	17	17	17	17	17	16	16.8	0	0
969/7.15	Collins Avenue East Bridge	no	22	22	22	23	24	22	16	22	23	23	22	22	24	22.1	17	17
969/7.15	Collins Avenue West Bridge	no	23	23	23	24	25	23	17	23	24	24	23	23	25	23.1	18	18
979/0.00	Takapu Road Overbridge	yes	28	28	28	29	29	28	29	28	29	29	29	29	29	28.6	0	0
979/4.27	Johnsonville North Overpass	yes	27	27	27	27	28	27	25	27	27	27	27	28	27	27.0	0	0
979/4.61	Johnsonville South Overpass	yes	26	26	26	26	27	26	23	26	26	26	26	27	26	25.9	0	0

SUMMARY OF CHANGES TO FACTORS EXPLORED:

RANKING. Basic screening data and SPG to draft report
RANKING1. As "RANKING." but SPG = Hazard x Importance x Vulnerability
RANKING2.. As "RANKING." but AADT = 0 for bridges over railways
RANKING3. As "RANKING2." but Importance factors adjusted
RANKING4. As "RANKING2." but Hazard factors adjusted
RANKING5. As "RANKING2." but soils liquefaction values = 0 for bridges over railways
RANKING6. As "RANKING2." but SPG = Hazard x Importance x Vulnerability
RANKING7. As "RANKING2." but Vulnerability adjusted
RANKING8. As "RANKING2." but Importance and Vulnerability adjusted
RANKING9. As "RANKING8." but Soil Condition = 1 for Rangitikei River Bridge
RANKING10. As "RANKING8." but with more gradations of superstructure length attribute
RANKING11. As RANKING10 but with "excluded" bridges omitted from ranking
RANKING12. As RANKING10. but with Importance & Vulnerability adjusted further than in RANKING8, 9 & 10
RANKING13. As RANKING12 but with "excluded" bridges omitted from ranking
RANKING14. As RANKING10 but with weighting factors for Importance & Vulnerability indices altered

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- The dependability of the detour route in the event that the state highway bridge becomes unserviceable. The economic analysis is based on the assumption that the shortest detour remains available but clearly this may not be the case if strong shaking affects the area.

When the above factors are taken into account it is understandable that correlation with a specific set of ranking values from another source is poor. Different judgement of each of the values of base data could change the ranking from the economic analysis significantly. Similarly the ranking order from the results of the screening procedure are quite sensitive to the factors built in to the procedure. However, the exercise is valuable in highlighting the influence of the detour costs, and hence the need to concentrate on the security of bridges which are either:

- Key items with no short detour nearby, or

- Difficult to temporarily replace with a demountable bridge or with a ford or other bypass.

5.3.2.2 Comparison of the results of the calculation runs

The results of the testing are summarised in Tables 5.7 and 5.9. Table 5.9 lists, for each calculation run, the ranking number of each bridge on the basis of the seismic priority grade (SPG) calculated in that run. A high SPG value means a high priority for assessment with an associated smaller priority ranking number.

Several changes were made to the original factors in the Proposed Preliminary Screening Procedure and summarised in Table 5.9 for each calculation run. The changes were based on the following considerations:

- The effect of the application of a high value factor (AADT under = 1) for bridges crossing a railway.

  While the importance of the security of these bridges is not doubted, some of the discrepancy of ranking could possibly arise because the economic analysis took no account of this high value factor. RANKING2 with *AADT Under* = 0 showed a small reduction of discrepancy compared with RANKING. However, for all other trials the value of 0 was used for *AADT Under*. The conclusion was that for the screening procedure the same rating should be used for the attribute, but that the weighting factor for the attribute should be reduced from 0.15 to 0.10.

- The importance of the cost to road users of loss of use of the bridge.

  The economic analysis showed strongly that the length of detour, the duration of the detour and the traffic volumes using the bridge all had a big influence on the cost of disruption. For this reason the SPG was also calculated using increased weighting factors for the *AADT on Bridge*, *Detour Length* and *Superstructure Length* attributes (increased variously by 0.05 or 0.1), with corresponding decreases in the values for *AADT under Bridge*, *Facility Crossed*, *Bridge Skew* and *Other Feature*.

To further strengthen the influence of the cost of a detour, RANKING12 included five subdivisions of the *Superstructure length* attribute factor - namely 0, 0.2, 0.6, 0.8 and 1.0 for lengths 0-20, 20-40, 40-100, 100-200 and >200 metres respectively. The increased interval from 0.2 to 0.6 for bridge lengths over 40 metres was selected because 40 metres is the maximum span that can be conveniently provided with a temporary structure without intermediate piers. If intermediate piers are required, the length of time a detour is needed is likely to be extended.

The discrepancy values for RANKING10 and RANKING12 were lower than the results of other equivalent trials. As a result the adjustment of the attribute weighting values is considered appropriate, using the values adopted for RANKING10, but also applying a total weighting factor of 0.5 to the product of the *AADT on bridge* and the *Detour length* ratings. The product concept was introduced to further emphasize the influence of these two attributes.

-	*AADT under bridge*	0.10 instead of 0.15
-	*Facility crossed*	0.15 instead of 0.20
-	*Superstructure length*	0.12 instead of 0.07
-	*Bridge skew*	0.05 instead of 0.10

- SPG was calculated as:

  Hazard Index x Importance Index x Vulnerability Index

  instead of the original formula:

  Hazard Index x (0.6 x Importance Index + 0.4 x Vulnerability Index)

  RANKING1 and RANKING6 included calculation of the SPG on the above basis. The discrepancy values for both of these calculation runs were significantly less than those for all others, which might suggest that adoption of the fully multiplicative approach should be adopted. This approach has been discouraged by others in the past (Section 4.3), on the grounds that extreme values gain emphasis and errors are amplified. Although the discrepancies were reduced there was no change in ranking order in RANKING1 compared to RANKING, but there were some changes in RANKING6 compared with RANKING2. From this project sufficient evidence is not considered to have been generated to warrant changing the formula for the calculation of the SPG.

- Use of different weighting factors for calculating the Hazard Index.

  RANKING4 included values of 0.35 (0.40), 0.25 (0.30), 0.20 (0.15) and 0.20 (0.15) for the weighting factors applied to *Peak Ground Acceleration*, *Remaining Service Life*, *Soil Condition* and *Liquefaction Risk* respectively. The values originally included in the Proposed Preliminary Screening Procedure, and used in all other calculation runs, are shown in parentheses.

  Compared with RANKING2 results, the ranking orders in Table 5.9 show very little difference, while the discrepancy values in Table 5.7 are higher for "RANKING4". In view of the similarity of the attribute values for the hazard index for the bridges, little change could be expected to occur in the ranking. As a result of the uniformity of values the Hazard Index content of the procedure was not subject to testing in this project. The recommendation is that the originally proposed values of weighting factors for the Hazard Index should not be changed.

- Use of different factors in the SPG calculation in RANKING14 using 0.7 x Importance Index and 0.3 x Vulnerability Index instead of 0.6 and 0.4 respectively.

  Using different factors would give more emphasis to the importance of the bridges, as indicated by the economic analysis. The overall discrepancy was the second highest of all calculation runs, and the rankings did not alter significantly.

5.3.2.3 Comparison of the ranking results for specific bridges

A. Comparison of SPGR and EAR

Because the correlation between the rankings from the economic assessment and the screening procedure was inconsistent, the results of the screening procedure were examined from other viewpoints as well.

Table 5.7 includes a column in which the average values of the difference in rankings for each of the bridges are listed. These show a number of bridges to have consistently large differences (say exceeding 5) of SPG rankings (SPGR) compared with the economic analysis rankings (EAR) (either consistently more or less). Contributory factors in each case clarify the reasons.

(i) *Bridges in which SPG ranking exceeds, on average, the economic assessment ranking by 5 or more*:

Piakatutu Stream bridge

Bridge is 5.4 metres long. SPGR exceeds EAR by 5.5.
All annual cost is incurred from damage but is small anyway ($197).
Screening procedure excludes this bridge in the initial stage.

Kuku Stream bridge

Bridge is 11 metres long. SPGR exceeds EAR by 12.5.
All annual cost is in damage but is small anyway ($350).
Screening procedure does not exclude this bridge in the initial stage, but only because it has a skew of 30 degrees.

Waiauti Stream bridge

Bridge is 13.7 metres long. SPGR exceeds EAR by 12.2.
All annual cost is in damage but is small anyway ($316).
Screening procedure excludes this bridge in the initial stage.

Pukehou (Manakau South) overbridge

Bridge is 82 metres long. SPGR exceeds EAR by 8.8.
Shares of annual damage and detour costs are 45% and 52% respectively of the total of $16,150.

This is a significant bridge across the railway and, intuitively, it should rank higher than the 12th ranking from the EAR, particularly when some of its details are considered.

Otaki River bridge

Bridge is 208 metres long. SPGR exceeds EAR by 5.5.
Shares of annual damage and detour costs is 32% and 62% respectively of the total of $24,029.

This is a significant river bridge but is of robust construction provided the lengths of exposed piles are not excessive. Intuitively the SPGR seems higher than appropriate but the bridge should be in an "intermediate" ranking category, as is the case with its EAR of 15.

Mangaone Stream bridge

Bridge is 5.9 metres long. SPGR exceeds EAR by 7.1.

All annual cost is incurred from damage but is small anyway ($197).
Screening procedure excludes this bridge in the initial stage.

(ii) *Bridges in which SPG ranking is less than, on average, the economic assessment ranking by 5 or more:*

Rangitikei River bridge at Bulls

Bridge is 496 metres long. SPGR is 7.3 less than the EAR.
Shares of annual damage and detour costs are 24% and 76% respectively of the total of $192,768.

This is a significant river bridge with some bracing details which warrant closer study. Intuitively the SPGR seems lower than it should be and the EAR of 3 is nearer to what might be appropriate.

Whirokino Trestle

Bridge is 1097 metres long. SPGR is 9.5 less than the EAR.
Shares of annual damage and detour costs are 93% and 7% respectively of the total of $33,598, but only because it is expected that the structure will not become unserviceable except in low probability strong shaking. The detour is very long and is included as such in the SPGR. Nevertheless, the EAR is significantly higher than the SPGR.

This is a long and important bridge with no close detour. Intuitively it should be assessed with medium/high priority because of its length, with a priority ranking between the EAR of 7 and the SPGR of 14.

Paremata Harbour bridge

Bridge is 136 metres long. SPGR is 11.4 less than the EAR.
Shares of annual damage and detour costs are 5% and 94% respectively of the total of $341,312. The SPGR of this bridge is the most anomalous of the group since this bridge is a vital link with heavy traffic volumes and has been assessed to have poor seismic resistance because of its pile details. Intuitively the ranking should be much closer to the EAR value of 2 than to the SPGR of 12.

Takapu Road overbridge

Bridge is 11 metres long. SPGR is 7.7 less than the EAR.
All annual cost is in damage but is small anyway ($385).
Screening procedure excludes this bridge in the initial stage.

(iii) *Discussion*

From the above points the reasons for the differences between the values of the SPGRs and the EARs generally can be identified. In 5 of the 10 cases the bridges in question are short and, by application of the screening procedure, would be excluded from further consideration unless liquefaction of the foundation materials was a consideration. A sixth bridge (Kuku Stream) would also be excluded on inspection as its 30 degree skew is unlikely to warrant detailed assessment of the structure.

Of the other 4 structures the SPGR for Pukehou overbridge appears to be justified. Of more concern are the low SPGRs for Rangitikei River bridge, Whirokino Trestle and Paremata bridge. While it may be possible to modify the factors in the screening procedure to more closely account for all conditions, it seems unlikely that such a scheme could be more than a stage 1 screening process, as has always been the intention. The question is whether the procedure should be refined more than is proposed in this report, provided that the prioritisation process includes a review of the results of the screening that takes account of specific factors identifiable for individual bridges. Such a review must be undertaken by engineers experienced in earthquake engineering and bridge design, in conjunction with geotechnical engineers and economists.

B. Intuitive assessment of bridges

For this part of the review the bridges were subjected to an intuitive assessment, based on the information shown on the drawings and gained from the site visit, to allocate them to a priority category for more detailed assessment. Categories 1, 2 and 3 indicate the order of priority for assessment. No further priority order within each group was established for this report, although it could be in practice. Table 5.10 presents a summary of the rankings, including the categories from the intuitive assessment.

C. Miscellaneous observations

During application of the trial screening procedure it became evident that site investigation information is unlikely to be readily available for many of the bridges, and in particular for the older bridges which are generally those of most interest for assessment. The screening procedure, or a subsequent seismic assessment process, must consider the ground conditions to determine the likely seismic spectra and the probability of liquefaction or instability. This requirement could be a significant item of cost in the determination of priorities for seismic retrofit.

During application of the Proposed Preliminary Screening Procedure inclusion of cables in the *Critical Utilities* attribute (Section 4.4.2.2 (vi)) was considered inappropriate. The recommendation is that the criterion be amended to relate only to services in pipes with an internal diameter of 150 mm or more.

Table 5.10 Summary of priorities for detailed seismic assessment, based on the average SPG rankings from Table 5.7

PILOT APPRAISAL OF SEISMIC SCREENING PROCEDURES
STATE HIGHWAY 1 BRIDGES BETWEEN RP 844/1.27 AND 979/4.61

Sorted by Ranking of Average Seismic Priority Grading. (excluding Rankings 11 and 13) | Sorted by Ranking of Average Seismic Priority Grading. (Rankings 11 and 13 only)

SH1 RP	Bridge Name	Excluded from Prioritisation By Screening Procedure	Economic Assessment Ranking	SPG Ranking	Economic Assessment Ranking	SH1 RP	Bridge Name	Excluded from Prioritisation By Screening Procedure	Priority Category from Intuitive Assessment
931/5.19	Waikanae River Bridge	no	4	1	4	931/5.19	Waikanae River Bridge	no	1
915/0.00	Pukehou (Manakau South) Overbridge	no	12	2	1	900/6.77	Ohau River Bridge	no	2
900/6.77	Ohau River Bridge	no	1	3	11	915/6.81	Otaki River Bridge	no	2
872/14.30	Manawatu River (Whirokino) Bridge	no	6	4	12	915/0.00	Pukehou (Manakau South) Overbridge	no	1
900/7.04	Ohau Overbridge	yes	10	5	9	900/10.67	Manakau North Overbridge	no	2
915/6.81	Otaki River Bridge	no	11	6	6	872/14.30	Manawatu River (Whirokino) Bridge	no	1
900/10.67	Manakau North Overbridge	no	9	7	5	900/10.35	Waikawa River Bridge	no	2
900/10.35	Waikawa River Bridge	no	5	8	3	844/1.27	Rangitikei River Bridge at Bulls	no	1
900/8.16	Kuku Stream Bridge	no	22	9	22	900/8.16	Kuku Stream Bridge	no	3
953/7.70	Pukerua Bay Overbridge	no	8	10	8	953/7.70	Pukerua Bay Overbridge	no	2
900/13.90	Waiauti Stream (Manakau) Bridge	yes	23	11	13	953/0.00	Paekakariki Overbridge	no	2
844/1.27	Rangitikei River Bridge at Bulls	no	3	12	2	953/15.41	Paremata Harbour Bridge	no	1
953/0.00	Paekakariki Overbridge	no	13	13	15	915/4.86	Otaki Overbridge	no	1
953/15.41	Paremata Harbour Bridge	no	2	14	7	872/13.04	Whirokino Trestle	no	1-2
915/4.86	Otaki Overbridge	no	15	15	14	915/4.04	Waitohu Stream Bridge	no	2
872/13.04	Whirokino Trestle	no	7	16	16	942/0.00	Paraparaumu Overbridge	no	2
969/4.40	Kenepuru Stream Bridge	yes	20	17	18	969/7.15	Collins Avenue East Bridge	no	2
915/4.04	Waitohu Stream Bridge	no	14	18	19	969/7.15	Collins Avenue West Bridge	no	2
942/0.00	Paraparaumu Overbridge	no	16	19		845/2.38	Makowai Stream Bridge	yes	3
872/12.41	North Whirokino Trestle	yes	17	20		845/3.82	Piakatutu Stream Bridge	yes	3
915/10.53	Mangaone Stream Bridge	yes	28	21		850/4.35	Makahikaroa Stream Bridge	yes	3
969/7.15	Collins Avenue East Bridge	no	18	22		872/12.41	North Whirokino Trestle	yes	3
969/7.15	Collins Avenue West Bridge	no	19	23		900/13.90	Waiauti Stream (Manakau) Bridge	yes	3
845/3.82	Piakatutu Stream Bridge	yes	29	24		900/7.04	Ohau Overbridge	yes	3
850/4.35	Makahikaroa Stream Bridge	yes	26	25		915/10.53	Mangaone Stream Bridge	yes	3
979/4.61	Johnsonville South Overpass	yes	24	26		969/4.40	Kenepuru Stream Bridge	yes	3
979/4.27	Johnsonville North Overpass	yes	25	27		979/0.00	Takapu Road Overbridge	yes	3
845/2.38	Makowai Stream Bridge	yes	27	28		979/4.27	Johnsonville North Overpass	yes	3
979/0.00	Takapu Road Overbridge	yes	21	29		979/4.61	Johnsonville South Overpass	yes	3
850/5.67	Makowai No 2 Bridge	No Drawings Available -	Not Assessed			850/5.67	Makowai No 2 Bridge		
850/5.68	Makowai No 2 Bridge	No Drawings Available -	Not Assessed			850/5.68	Makowai No 2 Bridge		

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6. CHANGES TO PROPOSED PRELIMINARY SCREENING PROCEDURE RESULTING FROM REVIEWERS' COMMENTS AND FROM TESTING

6.1 Background

The testing in Section 5 identified elements of the Proposed Preliminary Screening Procedure that needed modification to improve the results of the screening.

The draft reports containing the research results were reviewed by specialists appointed by Transit New Zealand who suggested detail and major changes to the Procedure.

6.2 Reviewer's Proposal for Major Changes

6.2.1 Reviewer's Proposed Procedure

One of the reviewers doubted the accuracy of the Caltrans procedure and questioned the validity of the basis on which it was structured. He believed that it was preferable for Transit New Zealand to adopt a newly-developed method rather than to use a modified Caltrans procedure. He had developed such a method during post-graduate work at the University of Canterbury (Maffei and Park 1995) ("M and P"). It has been examined but not tested by the authors of this report while developing the Proposed Preliminary Screening Procedure.

6.2.2 Discussion

The "M and P" approach was designed to provide a basic screening procedure (flow-chart) coupled with a secondary screening (visual/schematic assessment). This is equivalent to the approach discussed in this report which uses the Proposed Preliminary Screening Procedure and a subsequent review by an experienced seismic engineer. The "M and P" approach, however, claims to use a minimum of data but to analyse it as accurately as possible with the basic and secondary screenings based on approximate benefit/cost analyses.

An examination of the "M and P" method raised doubts over whether it would result in more "accurate" orders of ranking. There was doubt whether it could use basic records in its first stage screening, and whether the results of the benefit/cost analyses would be reliable as a means of differentiating between the bridges in a group being screened. Reasons for these doubts include the following:

- There were unavoidable approximations incorporated in the curves used in the procedure (e.g. the Damage *v* intensity, "fragility", curves for different seismic vulnerability ratings). The derivation of these curves for individual bridges or groups of bridges would be time consuming if they were to be sufficiently "accurate" for inter-relating the damage inflicted on individual bridges. Even so, it was questionable if "accuracy" could be attained. It seemed that the curves were to be derived by using specialist knowledge of the behaviour of various types of structure, or by observing typical levels of damage in past earthquakes, yet the database of damage records was small and did not cover the range of structural types for which information would be required.

- The data on which it was proposed to base the benefit/cost calculations appeared to depend on averaged values, such as percentage damage information from other general studies. This approach may be suitable when considering damage to a group of structures, but appeared to defeat the object of differentiating between the performance of individual structures, because of the large scatter of data which applied between individual cases.

In summary, the "M and P" method represents a logical approach to the problem of prioritising structures for seismic assessment, but it requires accurate input data to produce accurate output information. It is not appropriate to apply averaged data when differentiating between structures because neglecting the scatter of actual data for individual structures is likely to cause significant errors in the results, which would possess an illusory accuracy caused by the apparent sophistication of the methodology. Production of "accurate" input data, if attainable, would be very time consuming, and would need to be customised to each structure or group of similar structures.

Although the results of the testing in Section 5 show poor correlation between the ranking orders of bridges using the SPGS and the economic analysis, the overall ranking obtained when combined with a secondary screening will be realistic for practical purposes. It will enable the bridges to be prioritised for more detailed assessment of seismic resistance. A significant advantage of the Proposed Screening Procedure is that it is easy and quick to apply.

It would be very useful to have a measure of the relative benefit/cost ratios of retrofitting the bridges at the same time as the results of the screening procedure. It would be appropriate to derive these for the bridges identified as being in the highest priority for detailed assessment as an additional indicator of the order in which the assessments should be undertaken. Such a ratio could only be produced quickly if it were based on approximate methods, and hence itself would be approximate. Judgements for the individual bridges would be required of the cost and probability of damage, the cost of repairs, the time required for repairs, the effect of detours on traffic demand and costs, the likelihood and extent of damage to detours etc. Estimation of a benefit/cost ratio could be included in the procedure as part of the "expert" appraisal after the secondary screening, but would add a significant time delay to the overall process.

A recent paper (Buckle et al, 1995) describes the 1995 improved screening procedures for seismic retrofitting of highway bridges produced for the United States of America Federal Highway Authority. The procedure recognises that not all issues can be reduced to a numerical factor, and includes a critical review of the results of the numerical ranking to take account of factors such as redundancy and economic aspects, before the final prioritised list of bridges for detailed seismic assessment is produced.

6.3 Changes to the Proposed Preliminary Screening Procedure to produce the Recommended Preliminary Screening Procedure

Changes have been made to the Proposed Preliminary Screening Procedure outlined in Section 4, as a result of the testing in Section 5 the Reviewers' comments on the draft reports. The Recommended Preliminary Screening Procedure is set out in Appendix 5. Changes made are as follows:

4.4.2.1 Hazard index:

(iii) *Soil Condition* rating is:

= 1.0 Flexible or deep soil or "Don't know"

= 0.5 Intermediate soii

= 0 Rock or very stiff soil

The definition of subsoil types contained in the Bridge Manual 1994 (1995 Amendment), which is the same as that in NZS 4203 : 1992, is adopted.

Reason: It is logical to use readily available classifications, and the use of 3 rating values reduces the effect of the "step" function.

4.4.2.2 Importance index:

(i) AADT on bridge rating is:

= AADT/30,000 ≤ 1

(ii) AADT under bridge rating is:

= AADT/30,000 ≤ 1

= 1 when a state highway or motorway bridge crosses a railway line.

(vi) *Critical Utility* attribute has been modified to exclude electricity and telephone cables and include only piped services in pipes of 150 mm diameter or larger.

Reason: The presence of cables is likely to represent a minor factor relative to traffic disruption costs, and their elimination from the procedure is a worthwhile simplification.

The *Importance Index* is the sum of:

Weighting		Attribute Rating		Weighted Rating
0.50	x	*AADT on Bridge* rating x *Detour Length* rating	=	
0.10	x	*AADT under Bridge* rating	=	
0.15	x	*Facility Crossed* rating	=	
0.15	x	*Route Type on Bridge* rating	=	
0.10	x	*Critical Utility* rating	=	
		TOTAL	=	*Importance Index*

Reason: The testing in Section 5 showed the traffic volume and length of detour represent a large component of the consequential costs of a bridge closure. Adjustment of the basis of the *AADT on bridge* rating and multiplying it by the *Detour Length* rating emphasise the effect of these factors.

4.4.2.3 Vulnerability index:

(iv) *Superstructure Length* rating is:

= 1.0 bridge length exceeding 200 m
= 0.8 bridge length from 100 m to 200 m
= 0.6 bridge length from 40 m to less than 100 m
= 0.2 bridge length from 20 m to less than 40 m
= 0 bridge length less than 20 m

Reason: The testing in Section 5 showed the length of time taken to reopen a bridge has a significant influence on the consequent cost of traffic interruption. The time taken to place a temporary bridge is affected by a need to construct temporary pier(s), which is likely for bridges more than 40 m long, and is also related to the length of the bridge. The scope of the *Superstructure Length* attribute has therefore been expanded and its weighting increased from 0.07 to 0.12.

(vi) *Skew rating:*

The weighting of this attribute has been reduced to 0.05 to cater for the increase in the weighting of the *Superstructure Length* attribute.

4.5 (Table 4.2):

Reference to "Bridges with primarily timber superstructure" is deleted from the list of bridges excluded from further seismic assessment.

Reason: There is no structural reason why bridges with a timber superstructure should be excluded on the grounds of the material from which the superstructure is made. In practice, the majority of the small remaining number of timber bridges are likely to be in one of the categories which qualify for exclusion.

7. ASSESSMENT OF COST AND TIME REQUIRED TO APPLY THE PRELIMINARY SCREENING PROCEDURE

The total number of bridges on state highways in New Zealand is variously reported as 2524 on the Bridge Inventory and 3272 in Transit New Zealand Roading Statistics 1994. Some of this difference may arise from reporting bridges on dual carriageways collectively or individually, but it is also likely that some of the difference arises from the definition of a bridge at the small end of the range. For this reason, for the purposes of assessing the cost of applying the preliminary screening procedure to all the bridges on state highways, a figure of 3000 has been assumed.

From the Bridge Inventory, approximately 20% of bridges were designed after 1972. In the Recommended Preliminary Screening Procedure these bridges can be excluded from the prioritisation procedure. A decision will need to be made on the extent to which their details are assembled during screening of a length of highway. It is recommended that their details be retrieved, recorded and made available for brief review with all others, even though the detailed screening would not be required. The estimates of cost and time have been calculated based on this assumption.

On the basis of the times taken to screen the relatively small sample (29) which forms the subject of this report, it is estimated that the cost to apply the Recommended Preliminary Screening Procedure to the assumed 3000 bridges on the state highways network would be NZ$1 - 1½ million. A time input of 10 000 to 15 000 hours is estimated, about half of which would be provided by engineers experienced in seismic engineering.

8. SUMMARY AND CONCLUSIONS

8.1 Summary Points

- The trial screening procedure is quick and easy to apply although completion of some items are subject to judgement. A visit to the site by one of the assessment team is essential before the screening is carried out to confirm details and ensure that the drawings held truly represent the existing structure.

- Correlation was not consistent between the two sets of priority rankings for seismic assessment, first using the trial screening procedure and second using approximate structural assessment and an economic analysis. This was caused by unavoidable approximations in the base data calculated for the economic analysis and by limitations in the scope (with consequent simplification) of the screening procedure.

- Examination of the reasons for the discrepancies in correlation showed that many, but not all, applied to small bridges that would be eliminated from assessment in the preliminary stage by the screening procedure.

- The economic analysis highlighted the significant cost to traffic in the event of a bridge becoming unserviceable. For this reason trials were run with alternative factors applied to the traffic numbers, bridge length and detour length attributes. Alternative values of factors were selected for recommended use.

- Insufficient evidence was obtained to justify calculating the seismic performance grade using a fully multiplicative formula rather than the combined multiplicative/additive formula recommended. The hazard index values relating to seismic zone, remaining service life and foundation conditions varied only slightly between bridges.

- Intuitive assessment of the bridges was carried out to sort them into three priority groups for more detailed assessment. The three groups matched reasonably closely the priority order from the screening procedure.

8.2 Conclusions

- The Recommended Preliminary Screening Procedure will produce an acceptable screening of structures for more detailed assessment of their susceptibility to earthquake damage, albeit with some anomalies.

To identify and rectify the anomalies an integral part of the procedure must be the review of the results by an experienced seismic engineer with advice from a geotechnical engineer and an economist.

An attractive feature of the procedure is its simplicity of application.

- Site geotechnical information needed to assess the older bridges is likely to be scarce. The information is important as these bridges are of most interest in the review process for selecting appropriate site response spectra, and for assessing the probability of subsoil liquefaction.

9. RECOMMENDATIONS

9.1 General Recommendation

It is proposed that the *Recommended Preliminary Screening Procedure* as set out in Appendix 5, be adopted for use in identifying bridges on the state highway network which justify detailed assessment of their earthquake resistance.

9.2 Implementation

9.2.1 Background

There are approximately 3000 bridges on the state highway network. As discussed in Section 7, the total cost of applying the screening procedure to these bridges is estimated to be NZ$1 - 1½ million, with a time input of 10 000 to 15 000 hours.

Ideally it is desirable to screen all the bridge stock and to obtain a prioritised ranking list, before undertaking any detailed seismic assessments. In practice it is likely that the prioritised lists will consist of closely graded groups of bridges, and it is important to begin assessments of those in the highest priority groupings before all bridges could be screened. It is therefore recommended that the screening procedure be applied progressively within geographic areas selected on the basis of relative seismic hazard and traffic intensity. It is suggested that convenient units of area for the purpose would be the Transit New Zealand regions. Within each geographic area the order of assessment of the bridges would be determined on the basis of factors which influence the screening prioritisation. These are namely the average daily traffic on the bridge, the bridge length, pier heights and number of spans. They are readily available from Transit New Zealand records. This would represent an imperfect but practical approach which would enable the assessment effort to be applied to many, but not all, of the most appropriate bridges first.

9.2.3 Proposed Procedure

The proposed procedure for implementation would be:

- List the Transit New Zealand regions in order of priority and work on the bridges within one or more regions at one time depending on budget or other constraints.

- Decide the order in which routes, or parts of routes, within the region would be screened by using the Average Annual Daily Traffic (AADT) count.

- Sort the bridges on each route into descending order of importance for screening, based on age, number of spans, AADT and pier heights, in that order.

- Obtain drawings for the bridges.

- Review all the bridges in order of importance and note special features. Using judgement and the summary of Seismic Prioritisation Grading (Table 4.2) decide the final "best guess" priority list of bridges for screening within the region. A bridge/seismic design specialist may need to be consulted in some cases at this stage.

- Consult personnel familiar with the bridges in the local area, to confirm the proposed "best guess" list of priority for applying the assessment procedure.

- Apply the screening procedure to all the bridges in the order of priority determined. As noted in Section 8.2 (Conclusions) an integral part of the screening procedure must be the review of the results by an experienced seismic engineer, with advice from a geotechnical engineer and an economist. The resulting Seismic Priority Grading values will facilitate the production of a preliminary ranking list of bridges, within the Transit New Zealand region, which justify more detailed seismic assessment. More importantly, bridges will have been examined by a seismic design specialist and any inherent vulnerabilities noted, thus giving an opportunity for early action if considered necessary.

9.2.4 Suggested Order of Implementation

Figure 9.1 shows the relationship between the Transit New Zealand regions and the seismic zone factors, which reflect seismic hazard. On this basis, and taking traffic volumes into account, a suggested list of regions, in decreasing order of priority, for application of the screening procedure is as follows. The approximate number of state highway bridges within each region is also noted in brackets :

9 (81), 8 (189), 3 (236), 6 (73), 7 (99), 10 (158), 4 (139), 5 (75), 12 (286), 2 (182), 11 (262), 13 (200), 1 (164), 14 (222).

9.3 Other Issues

The Recommended Preliminary Screening Procedure does not include the bridge approaches. A methodology for screening and assessing embankments at bridge approaches or at other locations on the highways would require different criteria. Consideration should be given to its development. However, the likelihood of long term disruption of bridge use being caused by seismic damage to bridge approaches is considered much lower than damage to the structures they serve, because temporary access to the bridge is likely to be achievable in a relatively short time.

Figure 9.1(a) Relationship between the Transit New Zealand regions (numbers ringed, boundaries dashed), the state highways, and the seismic zone factors (numbers not ringed) - North Island.

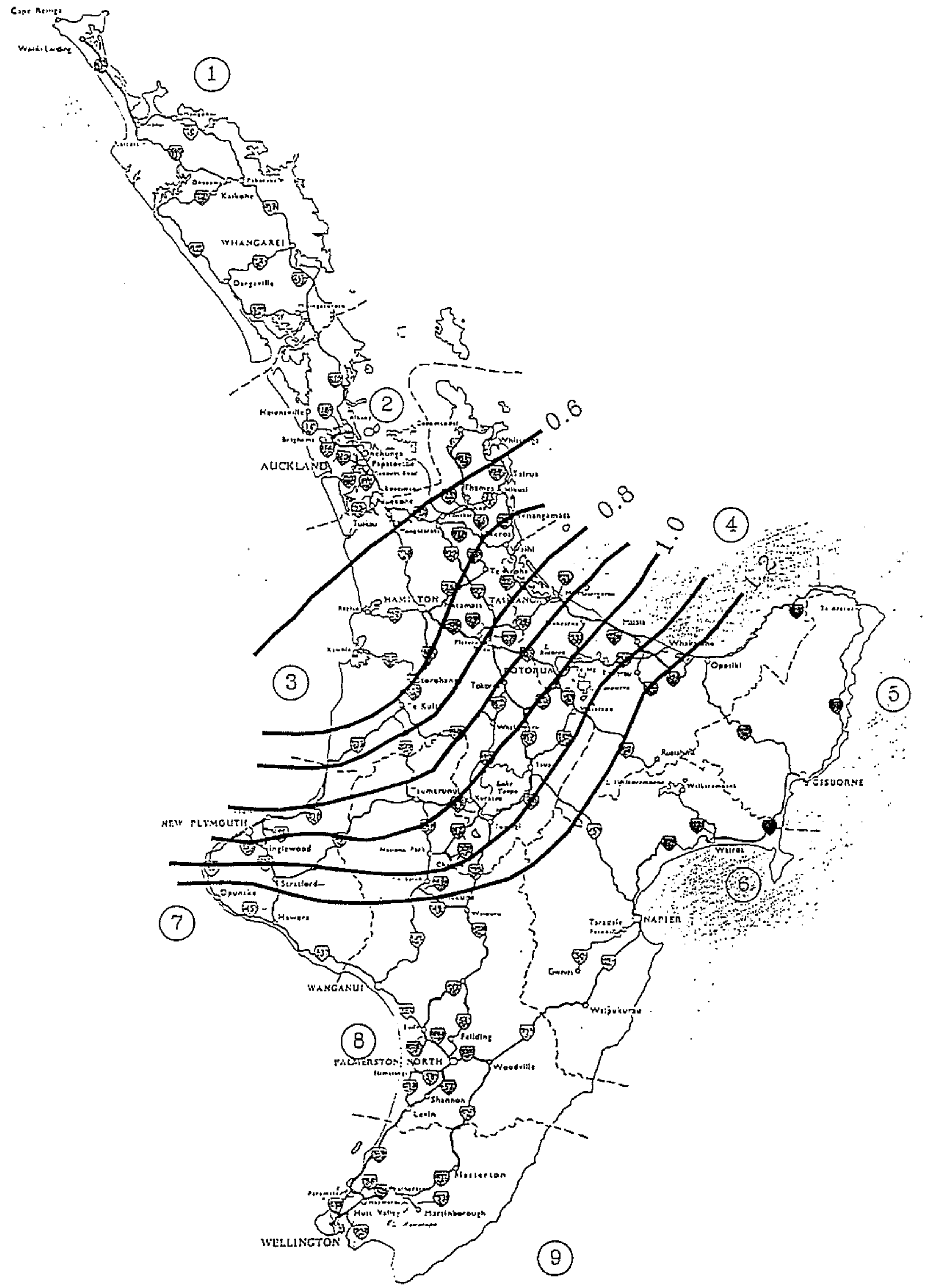
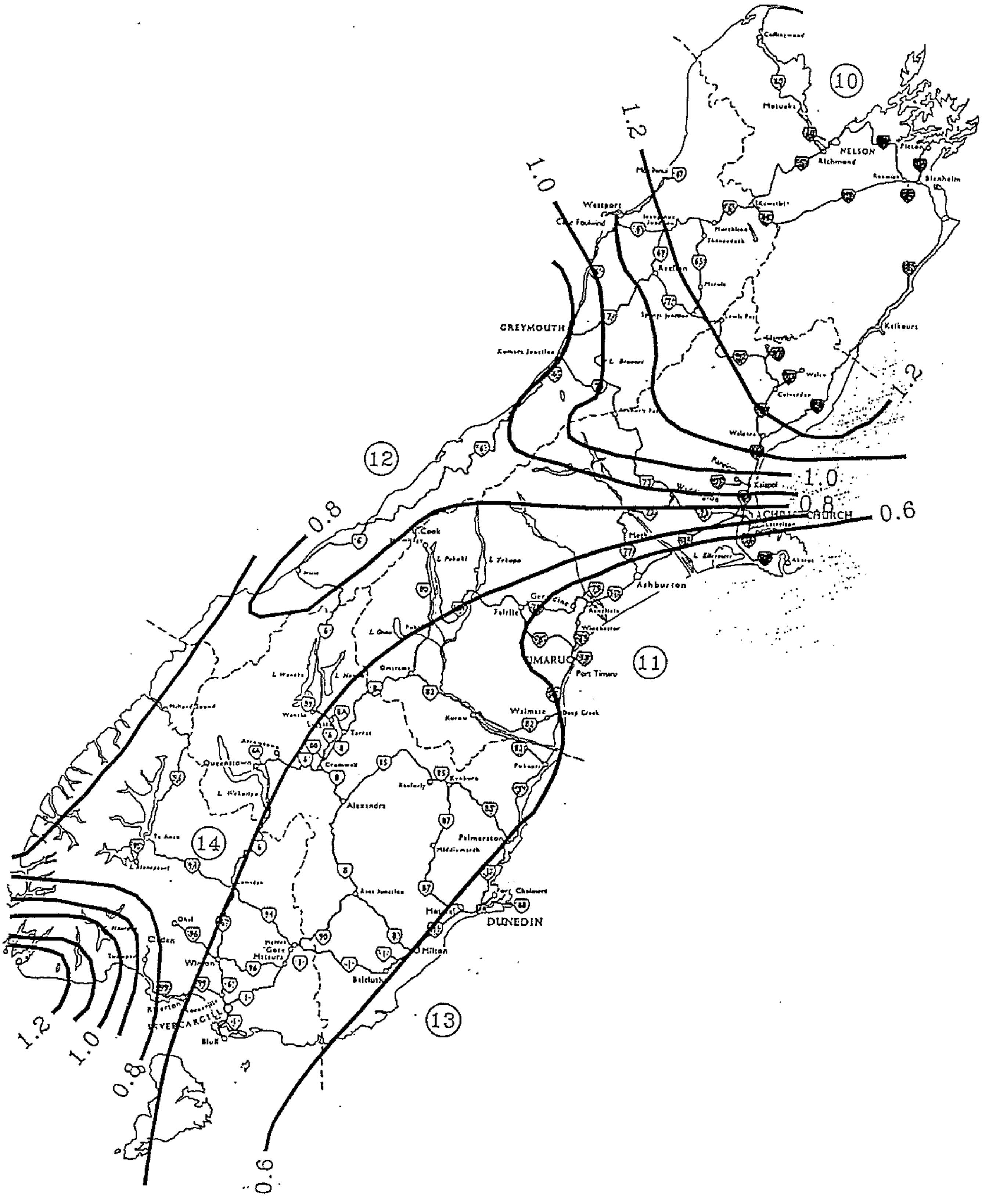


Figure 9.1(b) Relationship between the Transit New Zealand regions (numbers ringed, boundaries dashed), the state highways, and the seismic zone factors (numbers not ringed) - South Island.



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APPENDIX 1

DEVELOPMENTS IN SEISMIC PRIORITISATION OF BRIDGES IN CALIFORNIA

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DEVELOPMENTS IN SEISMIC PRIORITIZATION OF BRIDGES IN CALIFORNIA

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ABSTRACT

Proposed is a risk based methodology to systematically prioritize bridges in California according to their need for seismic retrofit. The proposed procedure is based on the multi-attribute decision theory. Objectives of the prioritization program and procedural details are discussed.

INTRODUCTION

A highway system is a complex network of vulnerable links. Bridge structures are by far the most critical links because of their vulnerability to damage when subjected to earthquake loads. It is crucial that transportation agencies in seismic regions evaluate bridges for potential deficiencies. The California Department of Transportation has an ongoing program to develop risk based methodologies for prioritizing existing bridges according to their need for seismic retrofit. Upgrading efforts to reduce seismic risk have continued at an unprecedented rate since the Loma Prieta Earthquake. A logical procedure to systematically rank all bridges according to their need for seismic hazard mitigation has been an essential tool.

California poses a unique atmosphere with special demands on any prioritization procedure. The California highway system contains over 12,000 bridge structures with a wide variance in the seismic loads and hazards applied to each bridge. Extreme demands are placed on the highway system with usage over 20,000 vehicles per day. Furthermore, bridge types, configurations, and details are inconsistent throughout the state. Engineers must remain cognizant of these challenging issues when developing a seismic prioritization procedure.

This paper presents an overview of the latest developments in the seismic prioritization of bridge structures in California. The recent advances have been significant and will be discussed in terms of overall objectives.

RECENT ACHIEVEMENTS

The seismic retrofit prioritization scheme utilized by Caltrans prior to 1992 employed a simplified judgment based risk assessment. In this scheme, each bridge received an overall score computed as the weighted sum of 12 factors. The real merits of this system was its simplicity and the speed of computation.

This ranking scheme employed an additive approach where the weighted factors affecting the probability of failure were added to the weighted factors affecting the consequences of failure. The overall ranking score as previously computed may produce inconsistent evaluations of relative risk.

Risk is properly evaluated by multiplying the probability of failure by the consequences of that failure. Recent investigations to revise the prioritization scheme has lead to some significant advances. The development work in this area has meant a redefinition of goals and accompanying limitations. Some cognizant and deliberate trade off decisions were necessary in an effort to make measurable progress and improvements in short periods of time. A conventional seismic risk evaluation for all 12,000 bridges in the 15,000 miles of California state highways, although ideal, would be extremely detailed and time-consuming. It has always been imperative that the screening procedure to prioritize for seismic retrofit be efficient and capable of rapidly assessing a large number of bridges. Thus, it was decided that the merits of the previous scheme in terms of its simplicity and speed of computation should not be compromised for an enhanced methodology.

The objective was to develop a logical framework to systematically combine those factors which evaluate relative risk for ranking purposes. It became essential to migrate toward the proper multiplicative definition of risk as the product of the probability of failure multiplied by the consequences of that failure. These goals have been achieved by the employment of the multi-attribute decision theory [1].

PROCEDURAL DETAILS

The development of a prioritization scheme based on the multi-attribute decision theory has resulted in many positive outcomes. This procedure utilizes a risk-based methodology and therefore provides a rational criteria for evaluating the relative priorities of existing bridges. This procedure does not assess absolute risk but only determines relative risk. It remains simplistic in nature and serves only to produce a preliminary ranking. The resultant ranking provides a framework for selecting bridges to undergo a detailed seismic evaluation and retrofit design. Perhaps the single most important achievement in this prioritization scheme is that it incorporates the advantages of previously developed methodologies while employing a multiplicative formulation. The multi-attribute decision procedure provides a systematic method for treating preferences and values in the prioritization process. The hierarchical nature of this procedure has the distinct advantages discussed below.

The multi-attribute decision procedure assigns a priority rating to each bridge in order to determine those structures which are more vulnerable to seismic activity in their current conditions. The prioritization is based on a two-level approach which separates the seismic hazard from the impact and structural vulnerability criteria. The severity of seismic exposure is considered independently from the vulnerability and importance. The prioritization risk rating estimates the seismic hazard to a bridge from various sources and then subsequently assesses the impact and structural vulnerability resulting from those hazards. The details of this formulation allows a bridge with low seismic hazard to receive a lower overall risk rating than a similar structure with higher seismic hazards. This effect was not as achievable with previous prioritization methods which rely on a point-score summation procedure.

Figure 1 presents an overview of the multi-attribute decision procedure. A priority risk rating is computed for each bridge in the California highway network. It is a two level approach with the first level assessing the seismic exposures to a bridge and the second level assessing the impact and structural vulnerability criteria.

The first level criteria directly assess the seismic activity and hazard to each bridge. The second level criteria jointly define the performance of each bridge and potential losses of a bridge. Each of the following four criteria ($c_1, c_2, \ldots, c_i$): seismic activity, hazard, impact, and vulnerability depend on a set of attributes ($a_1, a_2, \ldots, a_{mk}$). A set of weights ($w_1, w_2, \ldots, w_i$) are assigned to each criterion at every level to reflect their relative importance. Attribute weights ($x_1, x_2, \ldots, x_{mk}$) are also assigned to each attribute to define their relative importance within each criterion [1]. The details are illustrated in Figure 2. The criteria weights and attribute weights are based on a 1991 expert opinion survey work of engineers and managers within Caltrans [2].

A global utility function, $g(a_{mk})$, was created for each attribute. They are essentially weight functions defined between 0 and 1 in Figures 3 through 9. These global utility functions are the same as those used in previous algorithm work.

A prioritization rating, $\mathcal{R}_n$, is thus computed for each bridge such that:

$$\mathcal{R}_1 \geq \mathcal{R}_2 \geq \mathcal{R}_3 \geq \ldots \geq \mathcal{R}_n.$$

The prioritization rating is computed by multiplying the global utility functions with the weights of the attributes. That is:

$$\mathcal{R}_n = \sum_{\text{all } c_i} w_i(c_i) \sum_{j=1}^{mk} x_j(a_j) g(a_j)$$

where,

c_1 = seismic activity $\quad w(c_1) = w_1 = 1.0$
c_2 = hazard criterion $\quad w(c_2) = w_2 = 1.0$
c_3 = impact criterion $\quad w(c_3) = w_3 = 0.6$
c_4 = vulnerability criterion $\quad w(c_4) = w_4 = 0.4.$

The seismic activity criterion is based on some preliminary assessments and a recently developed activity map by L. Mualchin, Seismologist with the Division of Structures. Fault activity has only recently been incorporated into the prioritization and stems from the recognition that the sources of maximum credible earthquakes [3] have different seismic activities. Since absolute seismic activity is quite difficult to ascertain, relative differences of fault seismic activity were determined utilizing slip rate, seismicity, and recency of movements. The ground shaking effects from each fault were captured by delineating a distance to 0.2g acceleration. The entire state of California was divided into areas affected by high active, active, moderate active, and low active faults. However, only three activity zones resulted because the effects from moderate faults were practically overshadowed by the active and high active faults [4].

The seismic hazard criterion includes three principle components: soil site conditions, peak rock acceleration, and duration of strong ground shaking. The peak rock acceleration is presumed to be produced by maximum credible earthquakes. Duration is a newly considered component and is currently divided into three groups: long (bracketed duration greater than 25 seconds), intermediate (bracketed duration of 15 to 25 seconds), and short (bracketed duration less than 15 seconds). Bracketed duration was employed as the approximate function of magnitude and source distance [4].

The impact criterion utilizes eight attributes to assess the consequences of bridge damage on public safety. The importance of bridge structures as vital lifeline links is determined in terms of socioeconomic impacts and the effects on the users of the transportation system. In addition to considerations for traffic capacities on and under the structure, potential property damage and loss of life beneath the structure is accounted for by including the residential leased air space and storage leased air space attributes. The importance of each bridge as part of an overall transportation system is evaluated in this criterion.

The final criterion is structural vulnerability. It is defined by six attributes which examine structural details and components to define potential damage. The six attributes generally remain unchanged from previous prioritization procedures [5].

It is useful to compare the ranking which results from the multi-attribute decision procedure with the ranking produced by the previous additive procedure. Figure 10 presents the different ratings for a sample of 100 representative bridge structures. It represents approximately a 30% variation in rank ordering. It is believed that this 30% change produces a more consistent and accurate ranking.

FUTURE OBJECTIVES

There are several areas to address when considering potential enhancement issues. Some efforts are currently underway and others are only potential long term goals. Any refinements which can be achieved have merits in optimizing the allocation of retrofit funds and serve to enhance the prioritization tools which need to be in place in the event of a major earthquake.

Each enhanced prioritization method which has been adopted over the past several years has continually brought Caltrans closer to a methodology based on structural reliability theory. This is a very important concept and provides a defensible and theoretically sound approach to prioritization. Consideration is being given to the application of rigorous structural reliability principles to specific critical bridges with the eventual extension to all structures. A key component will be the development of empirical fragility curves. The ATC-13 [6] structural classifications currently available are inadequate. Work needs to be done in the area of extrapolating extremely limited damage data and correlating it with ground acceleration.

The California highway system is a complex network of critical and potentially vulnerable bridges. It is increasingly important to evaluate the seismic reliability of the lifeline from a network systems point of view. Each critical element, or bridge, must be considered as part of a global system. Some modest attempts have been made to address this concept in the current work. However, additional work is needed.

Further refinements of the current method may eventually include subdividing each attribute into sub-attributes. Possible correlation and interrelationships between attributes must also be addressed. A few of the global utility functions need to be reevaluated, modified, and subjected to a sensitivity analysis. Also, an investigation is needed to evaluate the possibility of saturation of several of the global utility functions. Seismic duration is a complex function of soil conditions, characteristics of sources, and propagation paths. The necessity of improving duration assessments has already been recognized but needs to be implemented.

Improvements in the seismic hazard definitions including refinement of the soil condition attribute and seismic activity maps need to be addressed. Likewise, continued emphasis should be placed on data development efforts. This includes further documentation of leased air space sites and other collocation issues.

Finally, an additional level of sophistication should incorporate a cost-benefit analysis. In this way, the overall highway system vulnerability can be reduced by optimally allocating limited resources. Consideration needs to be given to the fact that a sequentially ordered prioritization list provides an imperfect framework in which to optimally select retrofit projects. The selection of alternatives and optimization exercises must be formalized.

CONCLUSION

Relative seismic risk computations for bridge structures are currently based on a large number of assumptions and judgment. The origin of much of this is the uncertainty and randomness of the earthquake process, as well as, the absence of defensible fragility curves. Yet, the current multi-attribute decision procedure has proven to be a successful tool for prioritization. The heavy reliance on empirical experience through past seismic damage of highway bridges coupled with a logical decision process has served Caltrans well in meeting its current challenges. With research efforts already in place empirical experience can be combined with statistical data to advance towards state-of-the-art structural reliability procedures.

ACKNOWLEDGEMENTS

The author wishes to acknowledge the continued support and contributions from James H. Gates, California Department of Transportation, Divison of Structures. His commitment and recognition of the merits of risk based prioritization procedures have made the recent advances possible in California.

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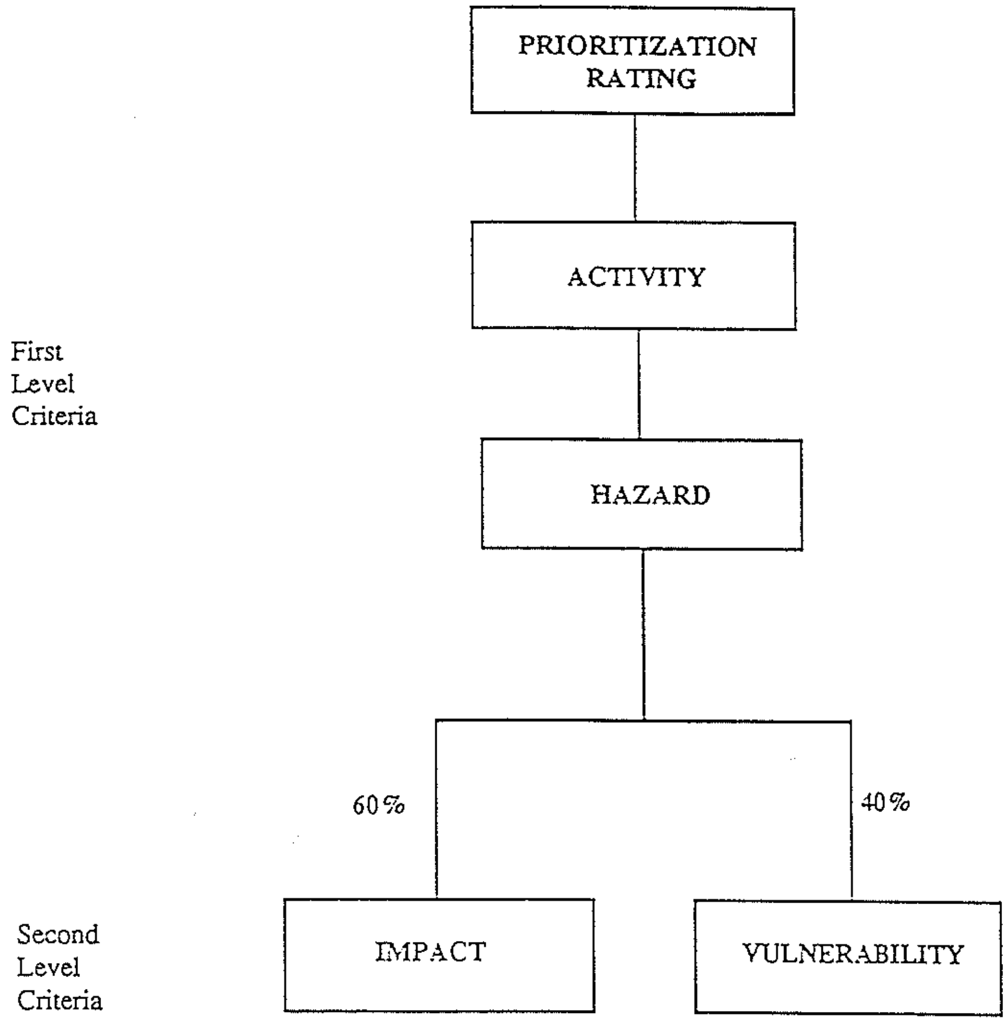
MULTI-ATTRIBUTE DECISION PROCEDURE



Prioritization Rating = (Activity)(Hazard) [(0.60)(Impact) + (0.40)(Vulnerability)]

Where,

Activity = (Global Utility Function Value)

Hazard = $\sum$ (Attribute Weight)(Global Utility Function Value)

Impact = $\sum$ (Attribute Weight)(Global Utility Function Value)

Vulnerability = $\sum$ (Attribute Weight)(Global Utility Function Value)

Figure 1

CRITERIA AND ATTRIBUTE DETAILS

c_1 = ACTIVITY CRITERION:

Activity Attributes	Activity Weights
a_{11} = Seismic Activity	x_{11} = 100%

c_2 = HAZARD CRITERION:

Hazard Attributes	Hazard Weights
a_{21} = Soil Conditions	x_{21} = 33%
a_{22} = Peak Rock Acceleration	x_{22} = 38%
a_{23} = Seismic Duration	x_{23} = 29%

c_3 = IMPACT CRITERION:

Impact Attributes	Impact Weights
a_{31} = ADT on Structure	x_{31} = 28%
a_{32} = ADT Under/Over Structure	x_{32} = 12%
a_{33} = Detour Length	x_{33} = 14%
a_{34} = Leased Air Space (Residential, Office)	x_{34} = 15%
a_{35} = Leased Air Space (Parking, Storage)	x_{35} = 07%
a_{36} = Rte Type on Bridge	x_{36} = 07%
a_{37} = Critical Utility	x_{37} = 10%
a_{38} = Facility Crossed	x_{38} = 07%

c_4 = VULNERABILTY CRITERION:

a_{41} = Year Designed (Constructed)	x_{41} = 25%
a_{42} = Hinges (Drop Type Failure)	x_{42} = 16.5%
a_{43} = Outriggers, Shared Column	x_{43} = 22%
a_{44} = Bent Redundancy	x_{44} = 16.5%
a_{45} = Skew	x_{45} = 12%
a_{46} = Abutment Type	x_{46} = 08%

Figure 2

GLOBAL UTILITY FUNCTION DEFINITIONS

ACTIVITY CRITERION

Seismic Activity	1.00*(0.25=low;0.50=moderate;0.75=active; 1.00=high)

HAZARD CRITERION

Soil Conditions	0.33*(1=high risk zone; else 0)
Peak Rock Acceleration	0.38*(linear, normalized to 0.7g)
Seismic Duration	0.29*(0.5=short;0.75=intermediate;1=long)

IMPACT CRITERION

ADT on Structure	0.28*(parabola for a max ADT of 200000)
ADT Under/Over Structure	0.12*(see ADT above)
Detour Length	0.14*(linear, normalized to 100 miles)
Leased Air Space (Residential, Office)	0.15*(1=present; else 0)
Leased Air Space (Parking, Storage)	0.07*(1=present; else 0)
Rte Type on Bridge	0.07*(1.0=interstate; 0.8=US , ST rte, or stream; 0.7=RR; 0.5=fed funded Co rte or city str; 0.2=nonfed funded Co rte of city str; 0.0=fed land, ST land, other)
Critical Utility	0.10*(1=present; else 0)
Facility Crossed	0.07*(see Rte Type on Bridge)

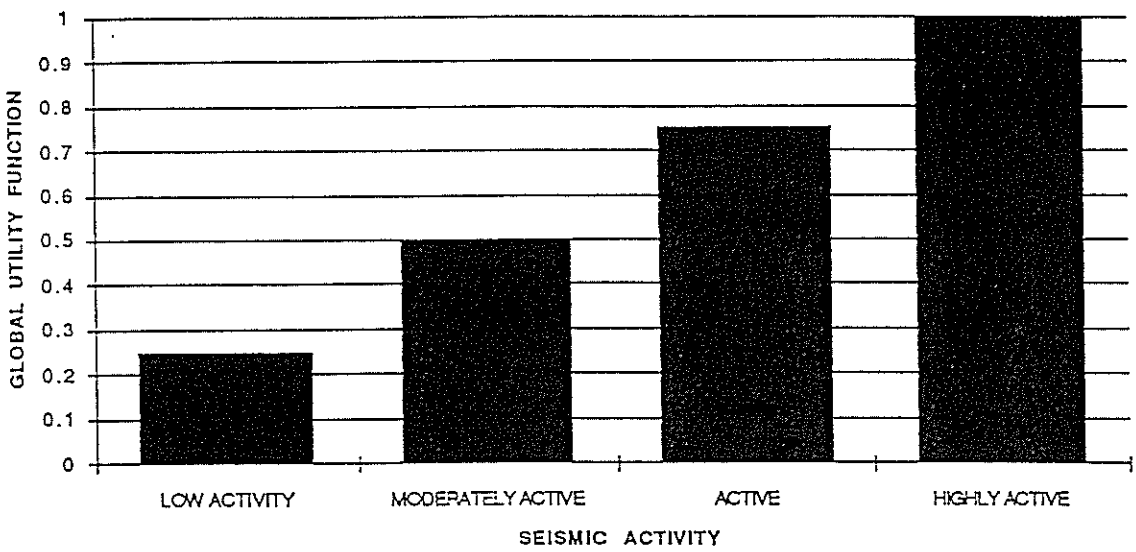
VULNERABILITY CRITERION

Year Designed (Constructed)	0.25*(0.5=yr<1946; 1.0=1946≤yr≤1971; 0.25=1972≤yr≤1979; 0.0=yr>1979)
Hinges (Drop Type Failure)	0.165*(0.0=no hinge; 0.5=1 hinge; 1.0=2 or more hinges)
Outriggers, Shared Column	0.22*(1=present; else 0)
Bent Redundancy	0.165*(0.0=no col.;0.25=pier walls;0.5 multi-col bents;1.0=single col bents)
Skew	0.12*(linear, normalized to 90)
Abutment Type	0.08*(0=monolithic;1=nonmonolithic)

Figure 3

GLOBAL UTILITY FUNCTIONS

SEISMIC ACTIVITY



PEAK ROCK ACCELERATION

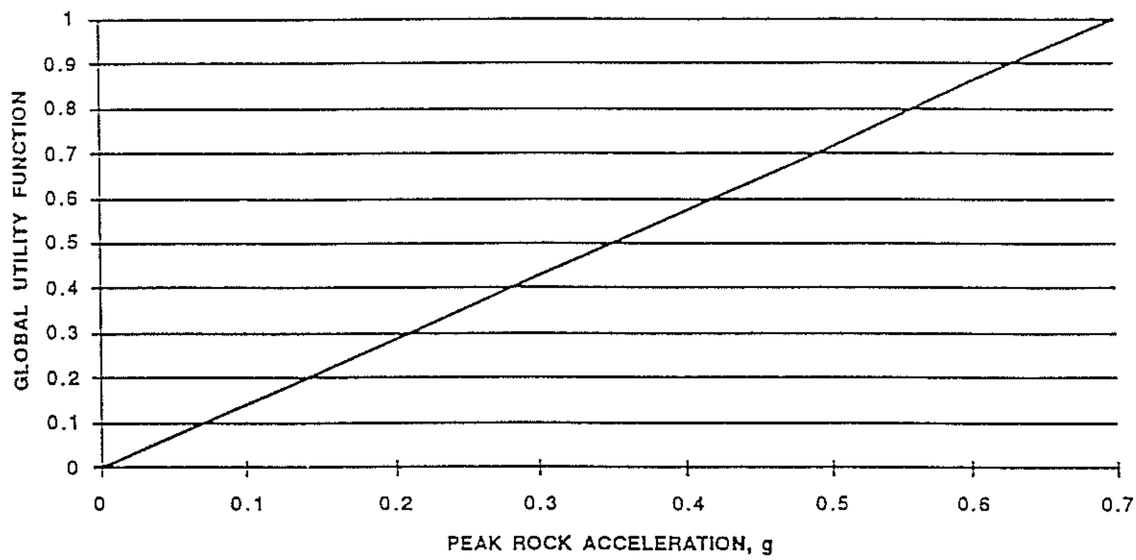
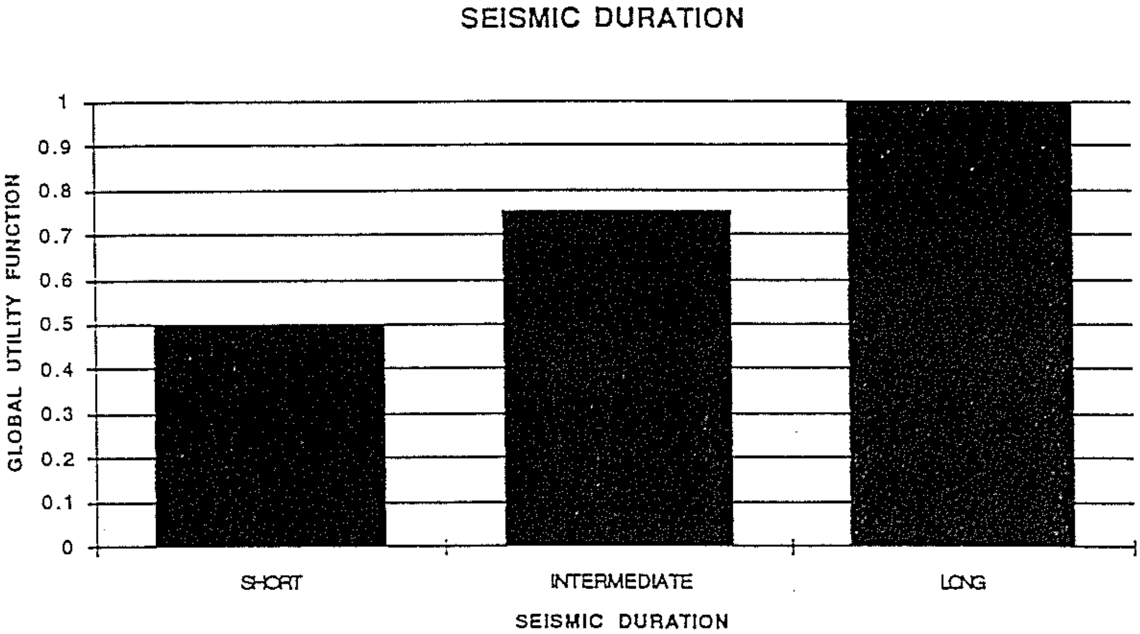


Figure 4

GLOBAL UTILITY FUNCTIONS



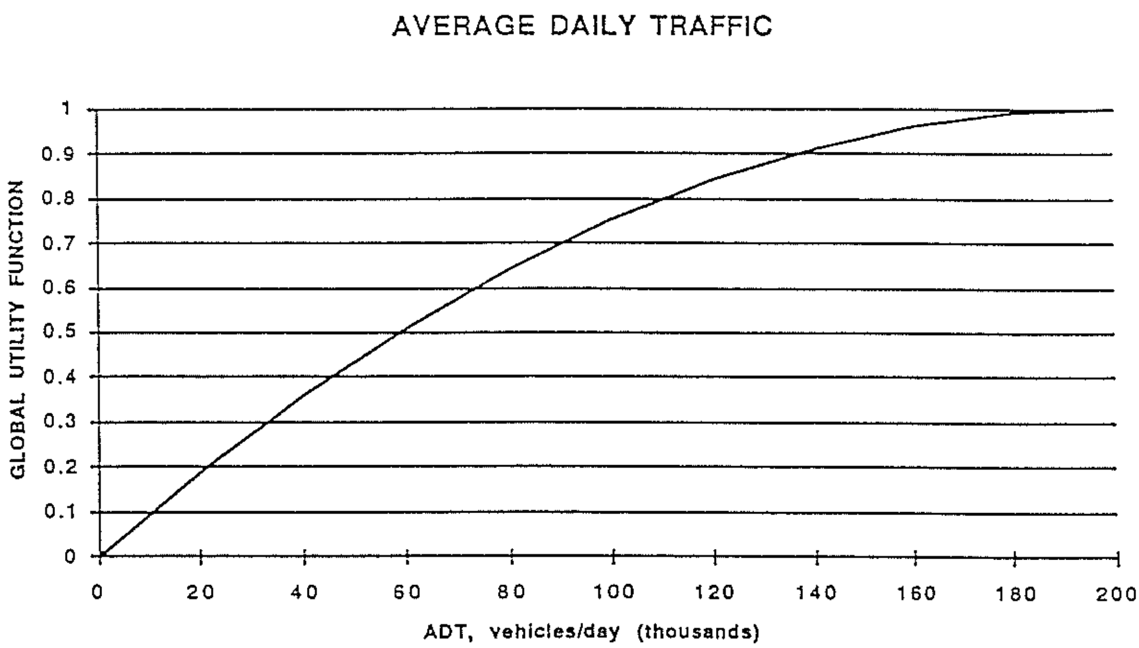
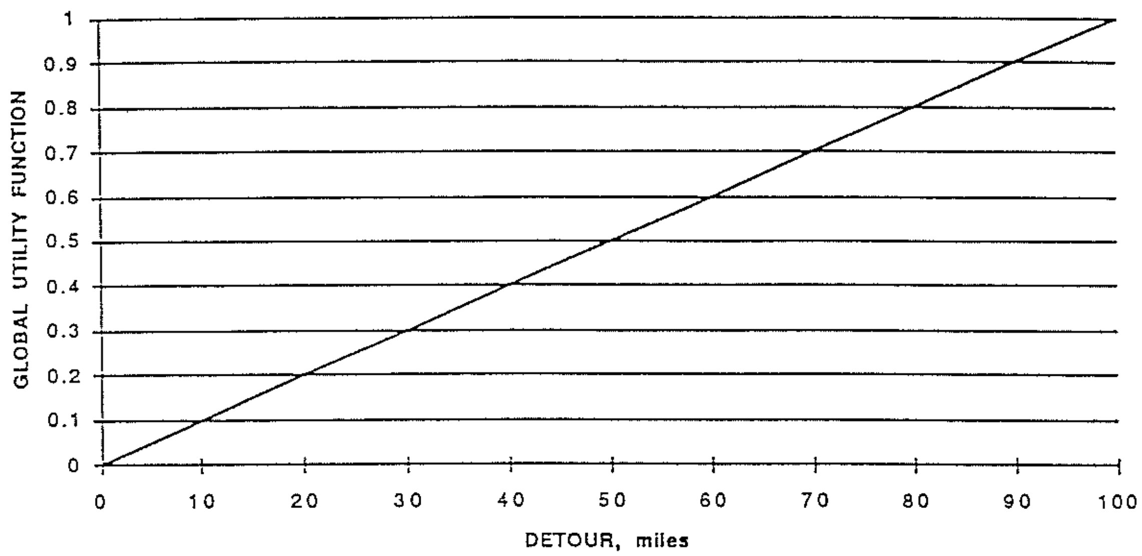


Figure 5

GLOBAL UTILITY FUNCTIONS

DETOUR



ROUTE TYPE

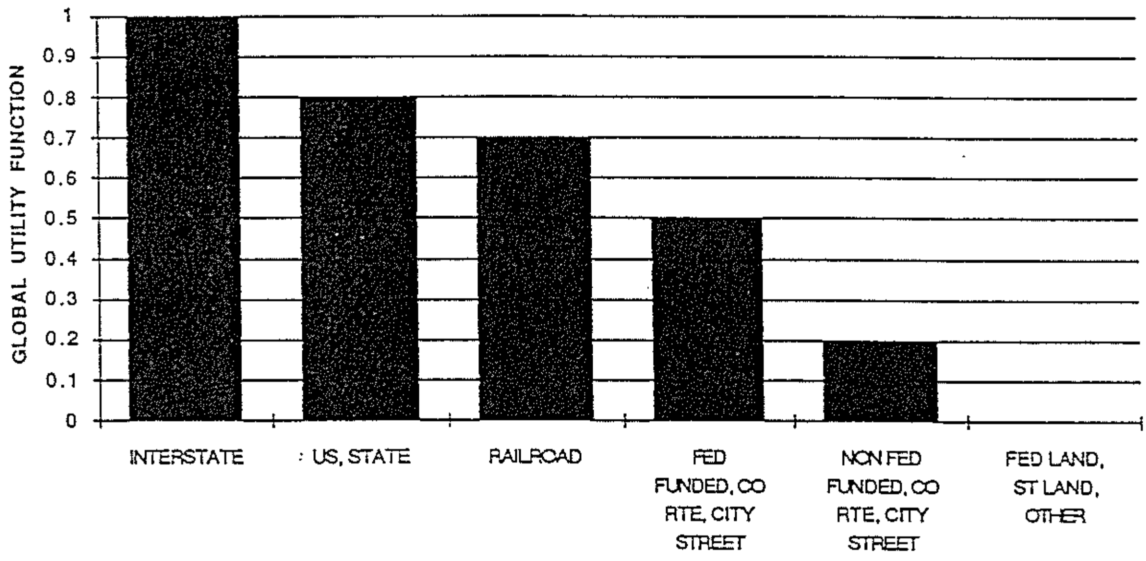
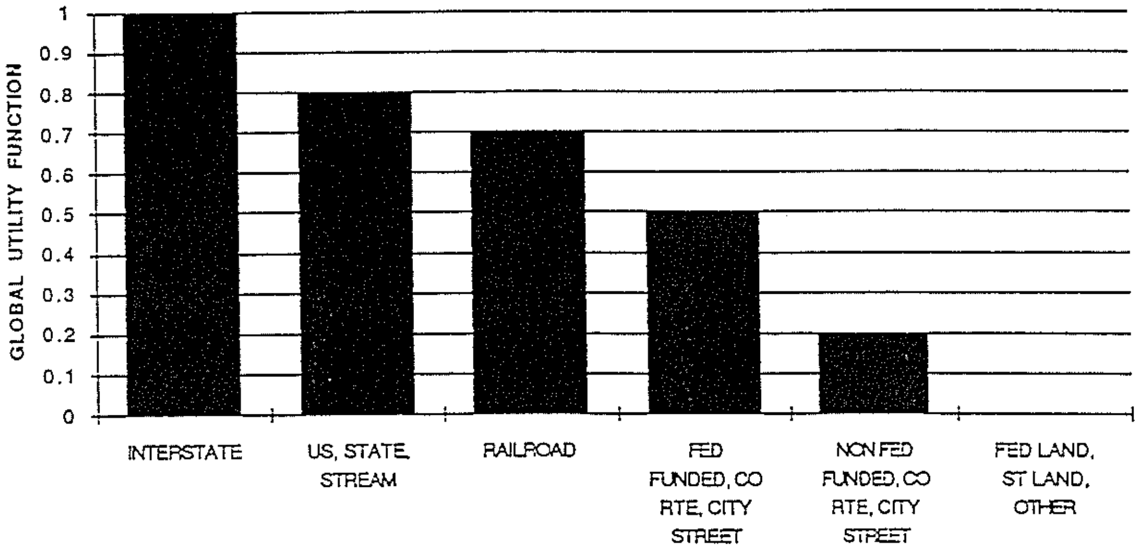


Figure 6

GLOBAL UTILITY FUNCTIONS

FACILITY CROSSED



YEAR CONSTRUCTED

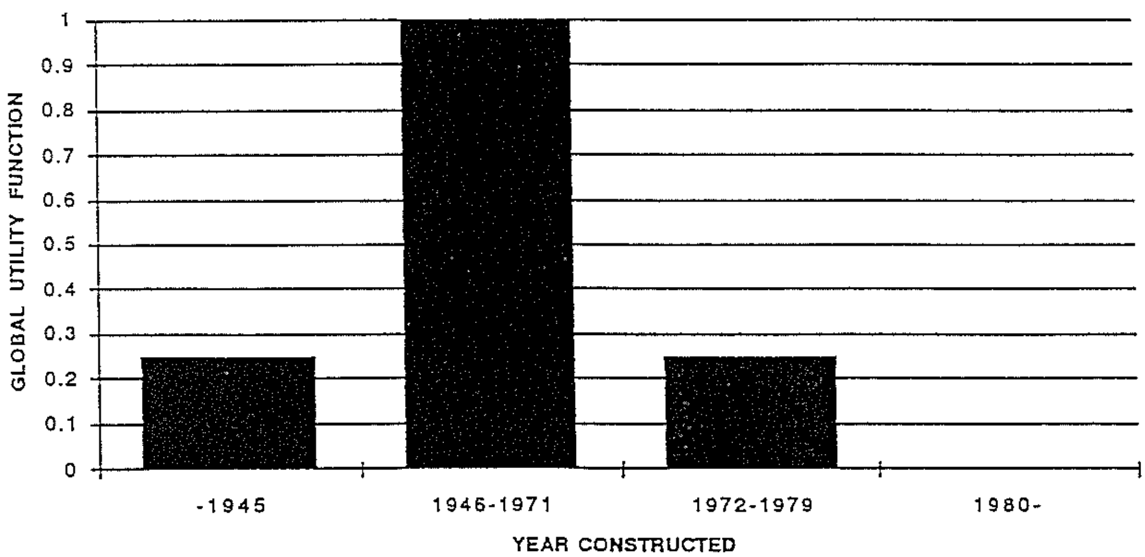
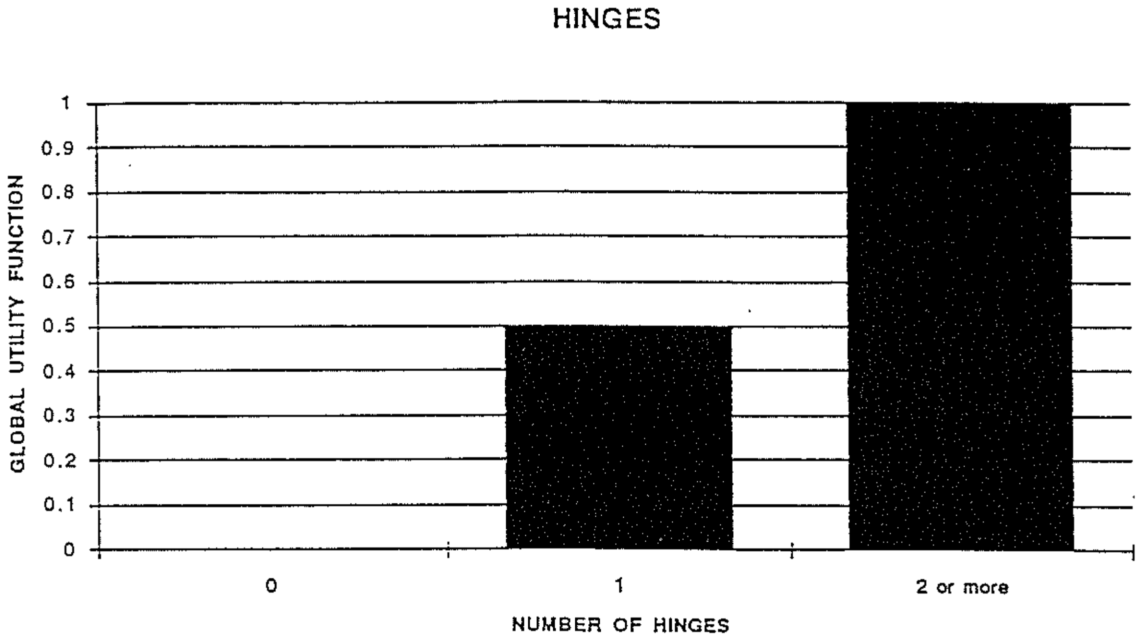


Figure 7

GLOBAL UTILITY FUNCTIONS



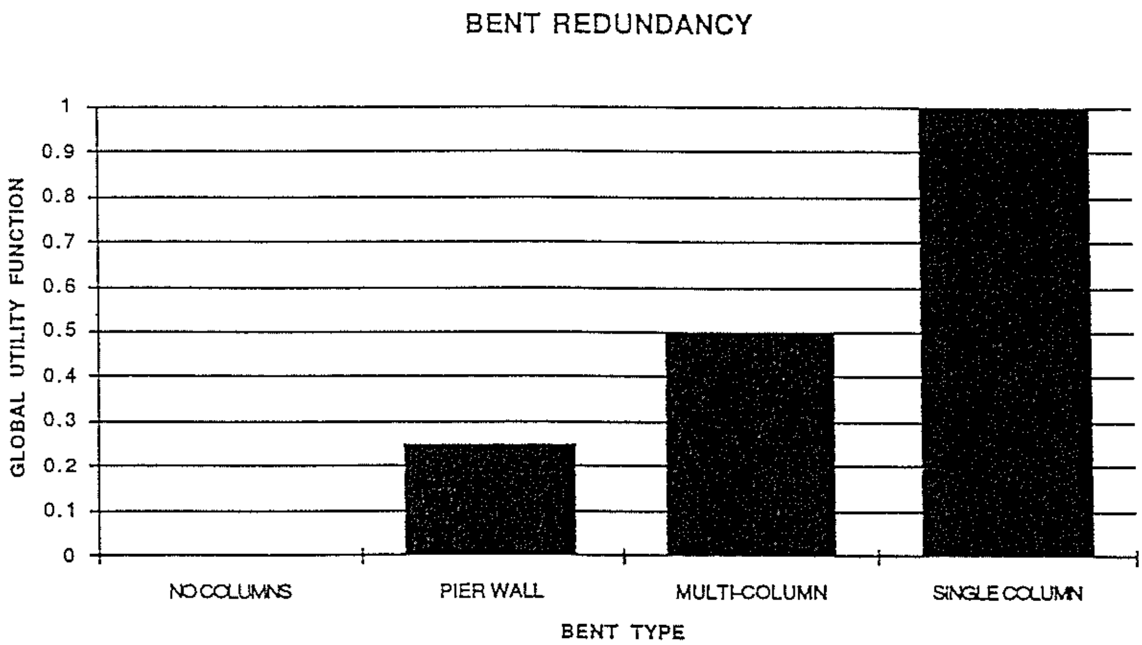


Figure 8

GLOBAL UTILITY FUNCTIONS

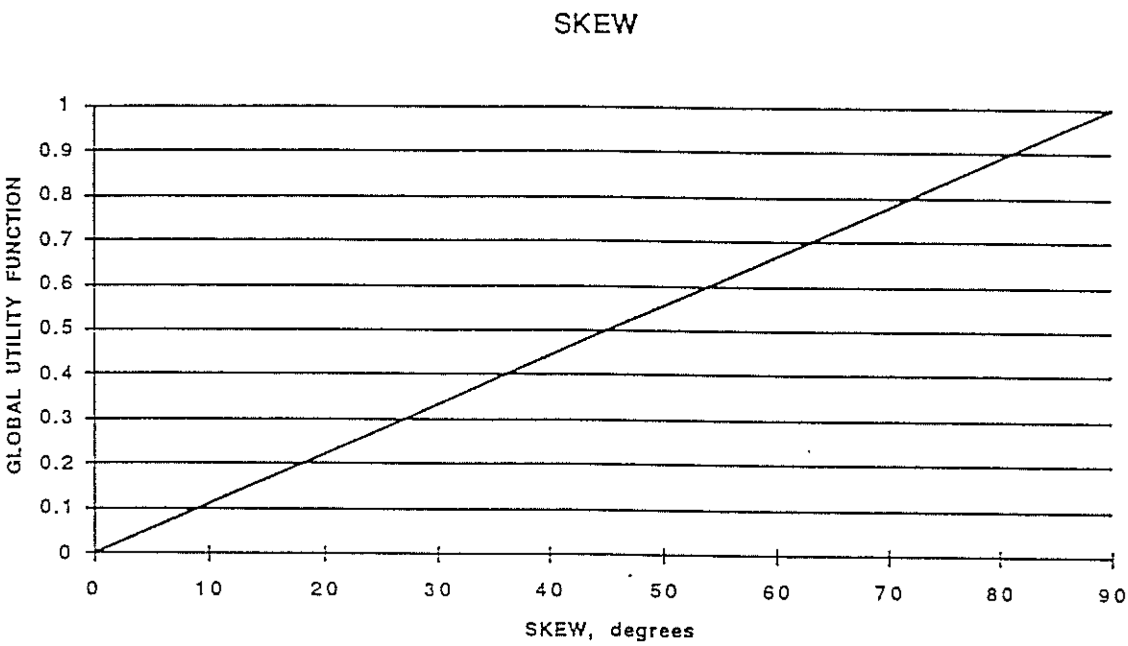


Figure 9

Multi-Attribute Decision Theory

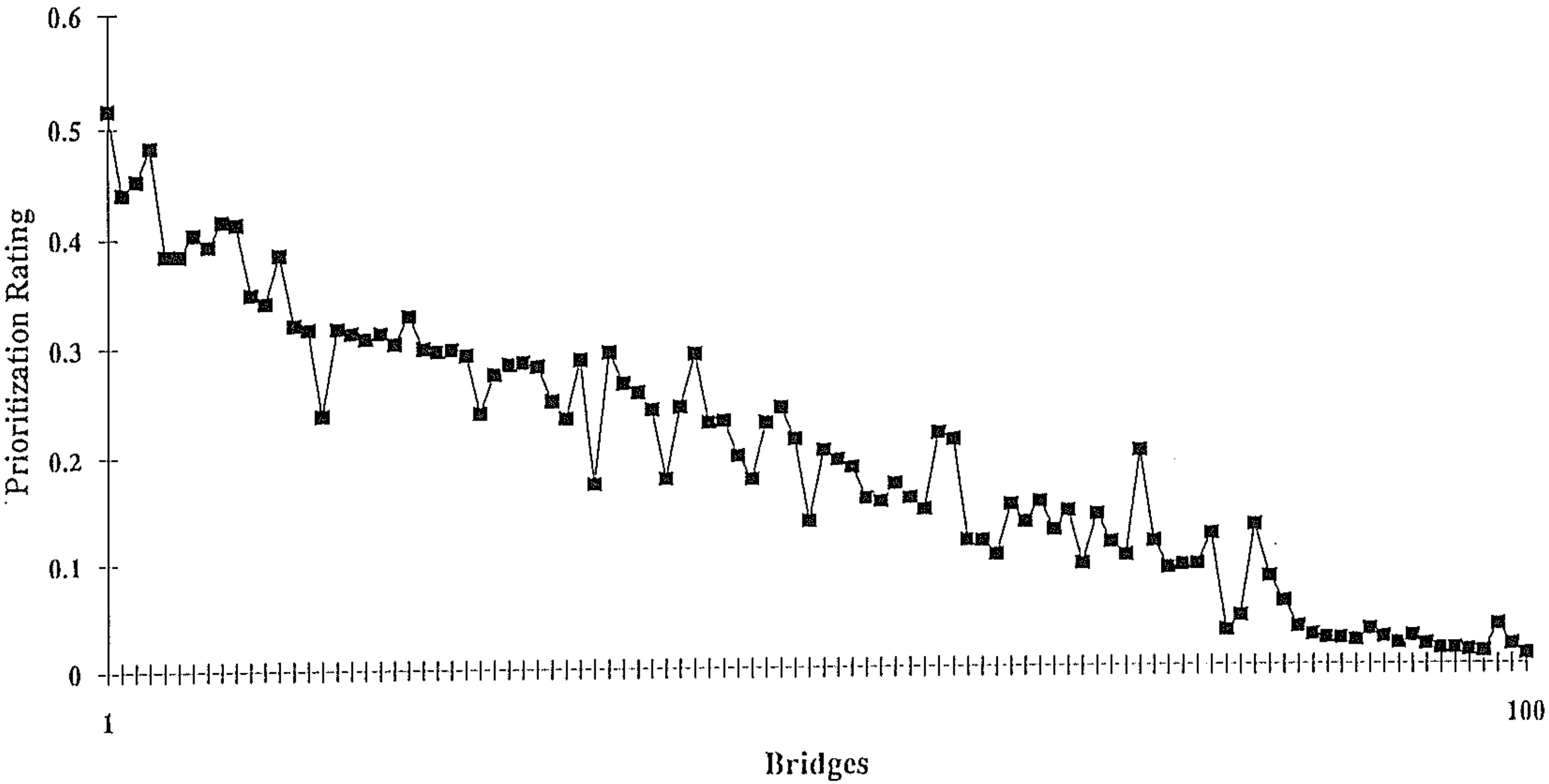


Figure 10

APPENDIX 2

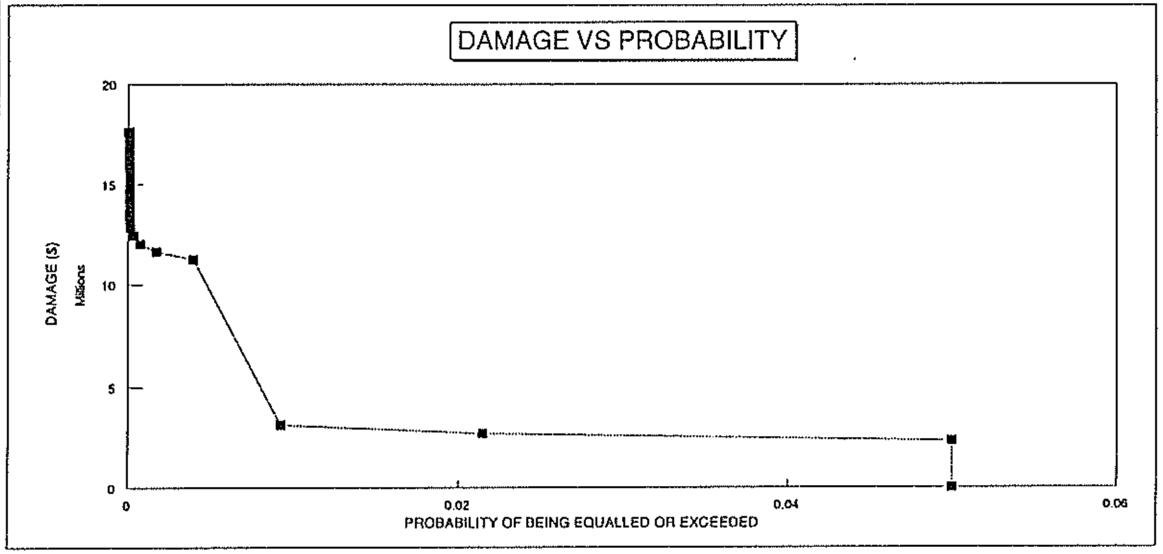
ECONOMIC ANALYSIS - DETAILED SHEETS FOR EACH BRIDGE

BRIDGE :	Rangitikei River (1)
REPLACEMENT COST ($):	8000000
DETOUR COST ($/day) :	42836

POINT 1		POINT 2	
Return Period (yrs)	Damage %	Return Period (yrs)	Damage %
20	5	165	17.5

RETURN PERIOD	LN(RP)	DAMAGE %	DAMAGE ($)	DETOUR ($/d)	x FACTOR	OUTAGE (d)	DETOUR ($)	BAILEY COST	BYPASS COST	TOT COST($)	PROB EQ/ EXCEED	(diff)	(damage)	(product)
		0.0	0	42836	32127	0	0	0	0	0	0.05			
20	2.995732	5.0	400000	42836	32127	60	1927620	0	0	2327620	0.05	0	1163810	0
47	3.839818	10.0	800000	42836	32127	60	1927620	0	0	2727620	0.021498	0.028502	2527620	72043
108	4.683903	15.0	1200000	42836	32127	60	1927620	0	0	3127620	0.009243	0.012255	2927620	35877
252	5.527988	20.0	1600000	42836	32127	300	9638100	0	0	11238100	0.003974	0.005269	7182860	37846
585	6.372073	25.0	2000000	42836	32127	300	9638100	0	0	11638100	0.001709	0.002265	11438100	25911
1361	7.216159	30	2400000	42836	32127	300	9638100	0	0	12038100	0.000735	0.000974	11838100	11530
3166	8.060244	35.0	2800000	42836	32127	300	9638100	0	0	12438100	0.000316	0.000419	12238100	5125
7364	8.904329	40.0	3200000	42836	32127	300	9638100	0	0	12838100	0.000136	0.00018	12638100	2275
7986	8.985413	45.0	3600000	42836	32127	300	9638100	0	0	13238100	0.000125	0.000011	13038100	138
8660	9.066497	50.0	4000000	42836	32127	300	9638100	0	0	13638100	0.000115	9.8E-06	13438100	131
9392	9.14758	55.0	4400000	42836	32127	300	9638100	0	0	14038100	0.000106	9.0E-06	13838100	124
10185	9.228664	60.0	4800000	42836	32127	300	9638100	0	0	14438100	0.000098	8.3E-06	14238100	118
11045	9.309748	65.0	5200000	42836	32127	300	9638100	0	0	14838100	0.000091	7.6E-06	14638100	112
11978	9.390831	70.0	5600000	42836	32127	300	9638100	0	0	15238100	0.000083	7.1E-06	15038100	106
12990	9.471915	75.0	6000000	42836	32127	300	9638100	0	0	15638100	0.000077	6.5E-06	15438100	100
14087	9.552999	80.0	6400000	42836	32127	300	9638100	0	0	16038100	0.000071	6.0E-06	15838100	95
15277	9.634082	85.0	6800000	42836	32127	300	9638100	0	0	16438100	0.000065	5.5E-06	16238100	90
16567	9.715166	90.0	7200000	42836	32127	300	9638100	0	0	16838100	0.00006	5.1E-06	16638100	85
17966	9.79625	95.0	7600000	42836	32127	300	9638100	0	0	17238100	0.000056	4.7E-06	17038100	80
19484	9.877334	100.0	8000000	42836	32127	300	9638100	0	0	17638100	0.000051	4.3E-06	17438100	76
		100.0	8000000	42836	32127	300	9638100	0	0	17638100	0	0.000051	17638100	905

EXPECTED ANNUAL DAMAGE COST ($/YR) 192769



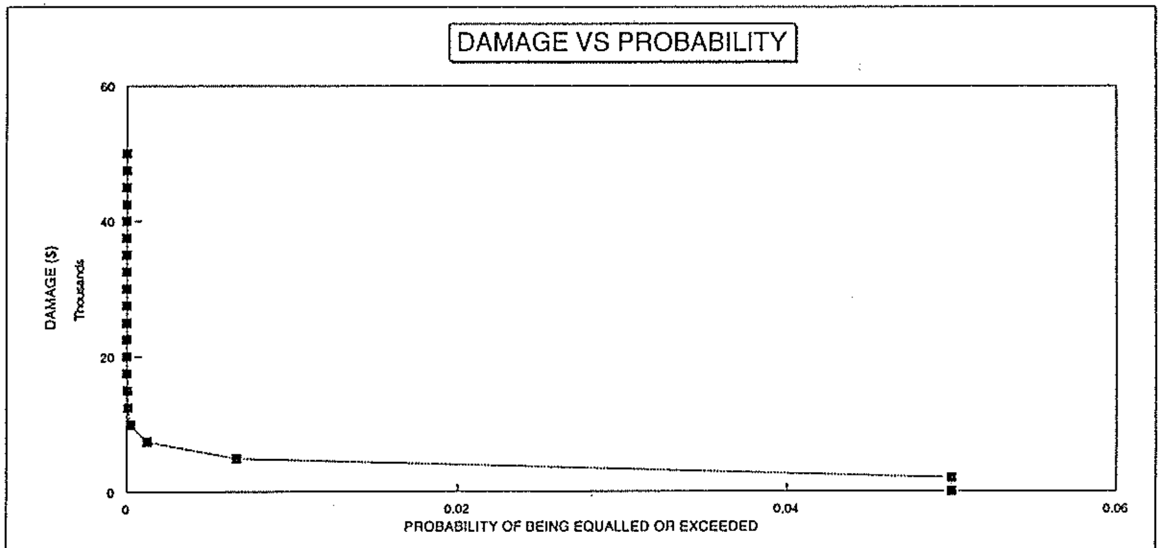
COST BREAKDOWN			
Bridge Damage	Detour	Bailey Bridge	Bypass
$45,433	$147,335	$0	$0

BRIDGE :	Makowal Stream (2)
REPLACEMENT COST ($):	50000
DETOUR COST ($/day) :	3081

POINT 1		POINT 2	
Return Period (yrs)	Damage %	Return Period (yrs)	Damage %
20	4	150	10

RETURN PERIOD	LN(RP)	DAMAGE %	DAMAGE ($)	DETOUR ($/d)	x FACTOR	OUTAGE (d)	DETOUR ($)	BAILEY COST	BYPASS COST	TOT COST($)	PROB EQ/ EXCEED	(diff)	(damage)	(product)
		0.0	0	3081	2310.75	0	0	0	0	0	0.05			
20	2.995732	4.0	2000	3081	2310.75	0	0	0	0	2000	0.05	0	1000	0
150	5.010635	10.0	5000	3081	2310.75	0	0	0	0	5000	0.006667	0.043333	3500	152
804	6.689721	15.0	7500	3081	2310.75	0	0	0	0	7500	0.001244	0.005423	6250	34
4310	8.368807	20.0	10000	3081	2310.75	0	0	0	0	10000	0.000232	0.001012	8750	9
23107	10.04789	25.0	12500	3081	2310.75	0	0	0	0	12500	0.000043	0.000189	11250	2
123869	11.72698	30	15000	3081	2310.75	0	0	0	0	15000	8.1E-06	0.000035	13750	0
664018	13.40606	35.0	17500	3081	2310.75	0	0	0	0	17500	1.5E-06	6.6E-06	16250	0
3559570	15.08515	40.0	20000	3081	2310.75	0	0	0	0	20000	2.8E-07	1.2E-06	18750	0
3860218	15.16623	45.0	22500	3081	2310.75	0	0	0	0	22500	2.6E-07	2.2E-08	21250	0
4186258	15.24732	50.0	25000	3081	2310.75	0	0	0	0	25000	2.4E-07	2.0E-08	23750	0
4539836	15.3284	55.0	27500	3081	2310.75	0	0	0	0	27500	2.2E-07	1.9E-08	26250	0
4923278	15.40949	60.0	30000	3081	2310.75	0	0	0	0	30000	2.0E-07	1.7E-08	28750	0
5339106	15.49057	65.0	32500	3081	2310.75	0	0	0	0	32500	1.9E-07	1.6E-08	31250	0
5790056	15.57165	70.0	35000	3081	2310.75	0	0	0	0	35000	1.7E-07	1.5E-08	33750	0
6279094	15.65274	75.0	37500	3081	2310.75	0	0	0	0	37500	1.6E-07	1.3E-08	36250	0
6809437	15.73382	80.0	40000	3081	2310.75	0	0	0	0	40000	1.5E-07	1.2E-08	38750	0
7384573	15.8149	85.0	42500	3081	2310.75	0	0	0	0	42500	1.4E-07	1.1E-08	41250	0
8008286	15.89599	90.0	45000	3081	2310.75	0	0	0	0	45000	1.2E-07	1.1E-08	43750	0
8684679	15.97707	95.0	47500	3081	2310.75	0	0	0	0	47500	1.2E-07	9.7E-09	46250	0
9418202	16.05815	100.0	50000	3081	2310.75	0	0	0	0	50000	1.1E-07	9.0E-09	48750	0
		100.0	50000	3081	2310.75	0	0	0	0	50000	0	1.1E-07	50000	0

EXPECTED ANNUAL DAMAGE COST ($/YR) 197



COST BREAKDOWN			
Bridge Damage	Detour	Bailey Bridge	Bypass
$197	$0	$0	$0

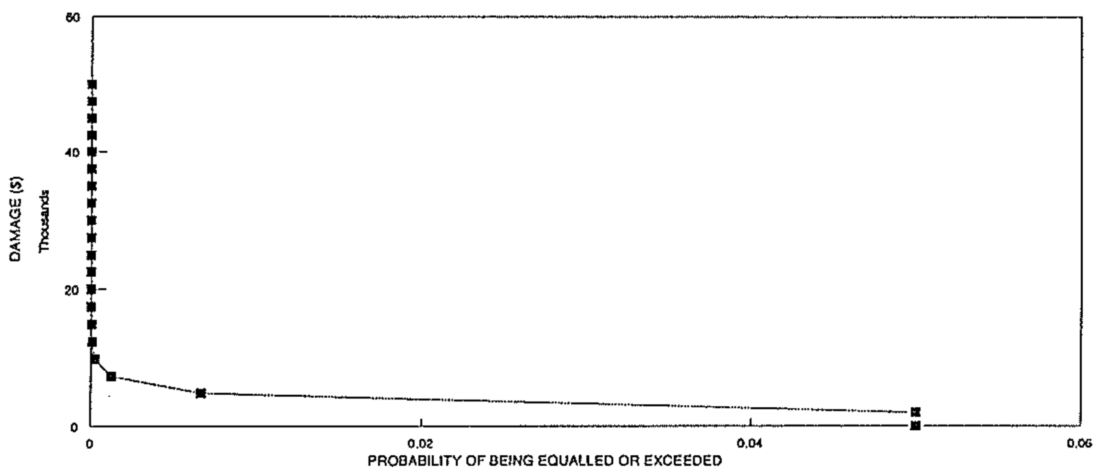
BRIDGE :	Piakatutu Stream (3)
REPLACEMENT COST ($):	50000
DETOUR COST ($/day) :	3081

POINT 1		POINT 2	
Return Period (yrs)	Damage %	Return Period (yrs)	Damage %
20	4	150	10

RETURN PERIOD	LN(RP)	DAMAGE %	DAMAGE ($)	DETOUR ($/d)	x FACTOR	OUTAGE (d)	DETOUR ($)	BAILEY COST	BYPASS COST	TOT COST($)	PROB EQ/ EXCEED	(diff)	(damage)	(product)
		0.0	0	3081	2310.75	0	0	0	0	0	0.05			
20	2.995732	4.0	2000	3081	2310.75	0	0	0	0	2000	0.05	0	1000	0
150	5.010635	10.0	5000	3081	2310.75	0	0	0	0	5000	0.006667	0.043333	3500	152
804	6.689721	15.0	7500	3081	2310.75	0	0	0	0	7500	0.001244	0.005423	6250	34
4310	8.368807	20.0	10000	3081	2310.75	0	0	0	0	10000	0.000232	0.001012	8750	9
23107	10.04789	25.0	12500	3081	2310.75	0	0	0	0	12500	0.000043	0.000189	11250	2
123869	11.72698	30	15000	3081	2310.75	0	0	0	0	15000	8.1E-06	0.000035	13750	0
664018	13.40606	35.0	17500	3081	2310.75	0	0	0	0	17500	1.5E-06	6.6E-06	16250	0
3559570	15.08515	40.0	20000	3081	2310.75	0	0	0	0	20000	2.8E-07	1.2E-06	18750	0
3860218	15.16623	45.0	22500	3081	2310.75	0	0	0	0	22500	2.6E-07	2.2E-08	21250	0
4186258	15.24732	50.0	25000	3081	2310.75	0	0	0	0	25000	2.4E-07	2.0E-08	23750	0
4539836	15.3284	55.0	27500	3081	2310.75	0	0	0	0	27500	2.2E-07	1.9E-08	26250	0
4923278	15.40949	60.0	30000	3081	2310.75	0	0	0	0	30000	2.0E-07	1.7E-08	28750	0
5339106	15.49057	65.0	32500	3081	2310.75	0	0	0	0	32500	1.9E-07	1.6E-08	31250	0
5790056	15.57165	70.0	35000	3081	2310.75	0	0	0	0	35000	1.7E-07	1.5E-08	33750	0
6279094	15.65274	75.0	37500	3081	2310.75	0	0	0	0	37500	1.6E-07	1.3E-08	36250	0
6809437	15.73382	80.0	40000	3081	2310.75	0	0	0	0	40000	1.5E-07	1.2E-08	38750	0
7384573	15.8149	85.0	42500	3081	2310.75	0	0	0	0	42500	1.4E-07	1.1E-08	41250	0
8008286	15.89599	90.0	45000	3081	2310.75	0	0	0	0	45000	1.2E-07	1.1E-08	43750	0
8684679	15.97707	95.0	47500	3081	2310.75	0	0	0	0	47500	1.2E-07	9.7E-09	46250	0
9418202	16.05815	100.0	50000	3081	2310.75	0	0	0	0	50000	1.1E-07	9.0E-09	48750	0
		100.0	50000	3081	2310.75	0	0	0	0	50000	0	1.1E-07	50000	0

EXPECTED ANNUAL DAMAGE COST ($/YR) 197

DAMAGE VS PROBABILITY



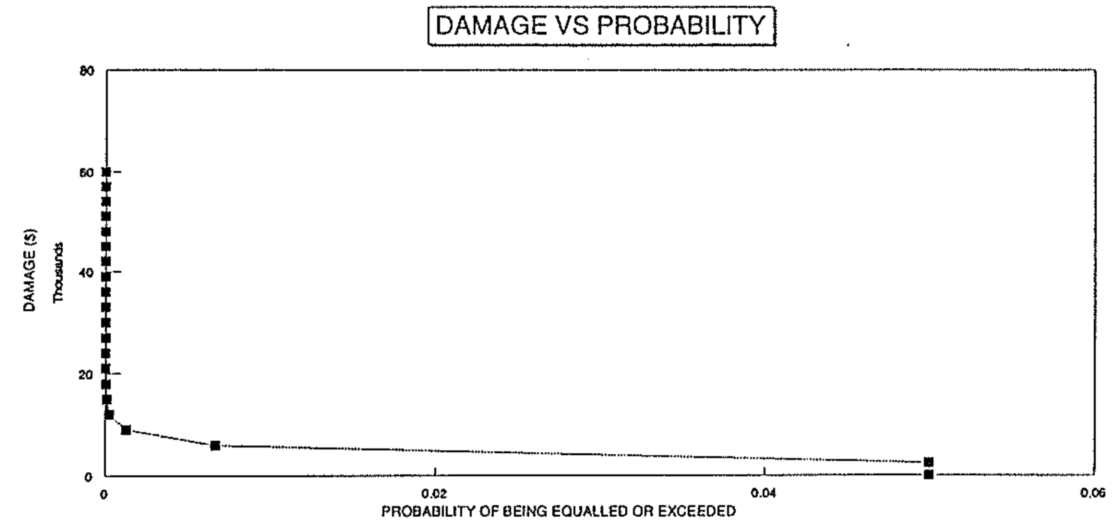
COST BREAKDOWN			
Bridge Damage	Detour	Bailey Bridge	Bypass
$197	$0	$0	$0

BRIDGE :	Makahikaroa Stream (4)			
REPLACEMENT COST ($):	60000			
DETOUR COST ($/day) :	0			

POINT 1		POINT 2	
Return Period (yrs)	Damage %	Return Period (yrs)	Damage %
20	4	150	10

RETURN PERIOD	LN(RP)	DAMAGE %	DAMAGE ($)	DETOUR ($/d)	x FACTOR	OUTAGE (d)	DETOUR ($)	BAILEY COST	BYPASS COST	TOT COST($)	PROB EQ/ EXCEED	(diff)	(damage)	(product)
		0.0	0	0	0	0	0	0	0	0	0.05			
20	2.995732	4.0	2400	0	0	0	0	0	0	2400	0.05	0	1200	0
150	5.010635	10.0	6000	0	0	0	0	0	0	6000	0.006667	0.043333	4200	182
804	6.689721	15.0	9000	0	0	0	0	0	0	9000	0.001244	0.005423	7500	41
4310	8.368807	20.0	12000	0	0	0	0	0	0	12000	0.000232	0.001012	10500	11
23107	10.04789	25.0	15000	0	0	0	0	0	0	15000	0.000043	0.000189	13500	3
123869	11.72698	30	18000	0	0	0	0	0	0	18000	8.1E-06	0.000035	16500	1
664018	13.40606	35.0	21000	0	0	0	0	0	0	21000	1.5E-06	6.6E-06	19500	0
3559570	15.08515	40.0	24000	0	0	0	0	0	0	24000	2.8E-07	1.2E-06	22500	0
3860218	15.16623	45.0	27000	0	0	0	0	0	0	27000	2.6E-07	2.2E-08	25500	0
4186258	15.24732	50.0	30000	0	0	0	0	0	0	30000	2.4E-07	2.0E-08	28500	0
4539836	15.3284	55.0	33000	0	0	0	0	0	0	33000	2.2E-07	1.9E-08	31500	0
4923278	15.40949	60.0	36000	0	0	0	0	0	0	36000	2.0E-07	1.7E-08	34500	0
5339106	15.49057	65.0	39000	0	0	0	0	0	0	39000	1.9E-07	1.6E-08	37500	0
5790056	15.57165	70.0	42000	0	0	0	0	0	0	42000	1.7E-07	1.5E-08	40500	0
6279094	15.65274	75.0	45000	0	0	0	0	0	0	45000	1.6E-07	1.3E-08	43500	0
6809437	15.73382	80.0	48000	0	0	0	0	0	0	48000	1.5E-07	1.2E-08	46500	0
7384573	15.8149	85.0	51000	0	0	0	0	0	0	51000	1.4E-07	1.1E-08	49500	0
8008286	15.89599	90.0	54000	0	0	0	0	0	0	54000	1.2E-07	1.1E-08	52500	0
8684679	15.97707	95.0	57000	0	0	0	0	0	0	57000	1.2E-07	9.7E-09	55500	0
9418202	16.05815	100.0	60000	0	0	0	0	0	0	60000	1.1E-07	9.0E-09	58500	0
		100.0	60000	0	0	0	0	0	0	60000	0	1.1E-07	60000	0

EXPECTED ANNUAL DAMAGE COST ($/YR) 237



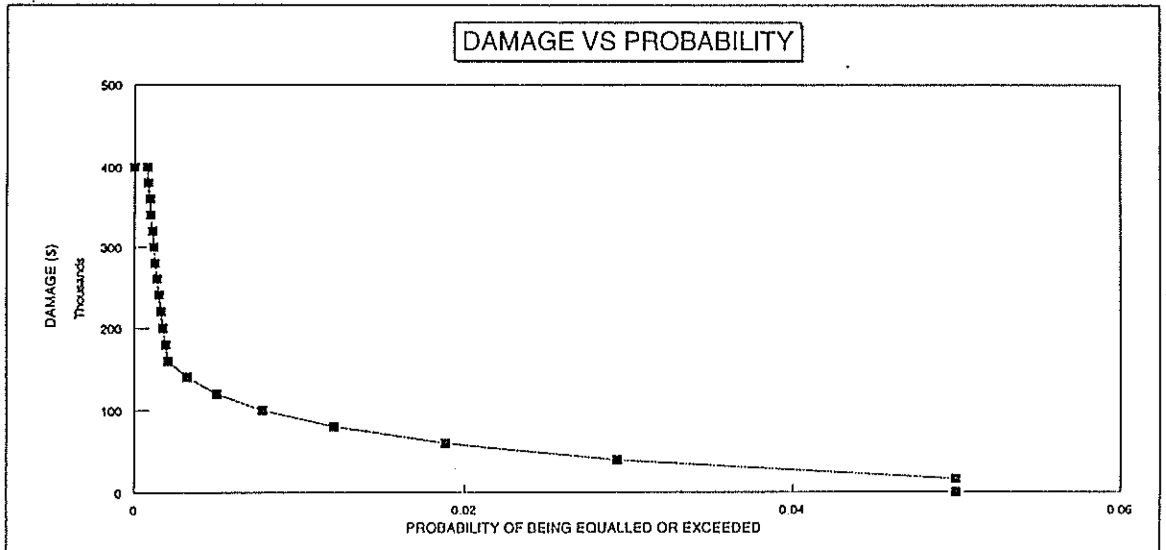
COST BREAKDOWN			
Bridge Damage	Detour	Bailey Bridge	Bypass
$237	$0	$0	$0

BRIDGE :	North Whirokino Trestle (5)
REPLACEMENT COST ($):	400000
DETOUR COST ($/day) :	79512

POINT 1		POINT 2	
Return Period (yrs)	Damage %	Return Period (yrs)	Damage %
20	4	200	30

RETURN PERIOD	LN(RP)	DAMAGE %	DAMAGE ($)	DETOUR ($/d)	x FACTOR	OUTAGE (d)	DETOUR ($)	BAILEY COST	BYPASS COST	TOT COST($)	PROB EQ/ EXCEED	(diff)	(damage)	(product)
		0.0	0	79512	59634	0	0	0	0	0	0.05			
20	2.995732	4.0	16000	79512	59634	0	0	0	0	16000	0.05	0	8000	0
34	3.527098	10.0	40000	79512	59634	0	0	0	0	40000	0.02939	0.02061	28000	577
53	3.969903	15.0	60000	79512	59634	0	0	0	0	60000	0.018875	0.010515	50000	526
82	4.412708	20.0	80000	79512	59634	0	0	0	0	80000	0.012122	0.006753	70000	473
128	4.855513	25.0	100000	79512	59634	0	0	0	0	100000	0.007785	0.004337	90000	390
200	5.298317	30	120000	79512	59634	0	0	0	0	120000	0.005	0.002785	110000	306
311	5.741122	35.0	140000	79512	59634	0	0	0	0	140000	0.003211	0.001789	130000	233
485	6.183927	40.0	160000	79512	59634	0	0	0	0	160000	0.002062	0.001149	150000	172
526	6.265011	45.0	180000	79512	59634	0	0	0	0	180000	0.001902	0.000161	170000	27
570	6.346094	50.0	200000	79512	59634	0	0	0	0	200000	0.001754	0.000148	190000	28
618	6.427178	55.0	220000	79512	59634	0	0	0	0	220000	0.001617	0.000137	210000	29
671	6.508262	60.0	240000	79512	59634	0	0	0	0	240000	0.001491	0.000126	230000	29
727	6.589345	65.0	260000	79512	59634	0	0	0	0	260000	0.001375	0.000116	250000	29
789	6.670429	70.0	280000	79512	59634	0	0	0	0	280000	0.001268	0.000107	270000	29
855	6.751513	75.0	300000	79512	59634	0	0	0	0	300000	0.001169	0.000099	290000	29
928	6.832597	80.0	320000	79512	59634	0	0	0	0	320000	0.001078	0.000091	310000	28
1006	6.91368	85.0	340000	79512	59634	0	0	0	0	340000	0.000994	0.000084	330000	28
1091	6.994764	90.0	360000	79512	59634	0	0	0	0	360000	0.000917	0.000077	350000	27
1183	7.075848	95.0	380000	79512	59634	0	0	0	0	380000	0.000845	0.000071	370000	26
1283	7.156931	100.0	400000	79512	59634	0	0	0	0	400000	0.000779	0.000066	390000	26
		100.0	400000	79512	59634	0	0	0	0	400000	0	0.000779	400000	312

EXPECTED ANNUAL DAMAGE COST ($/YR) **3324**



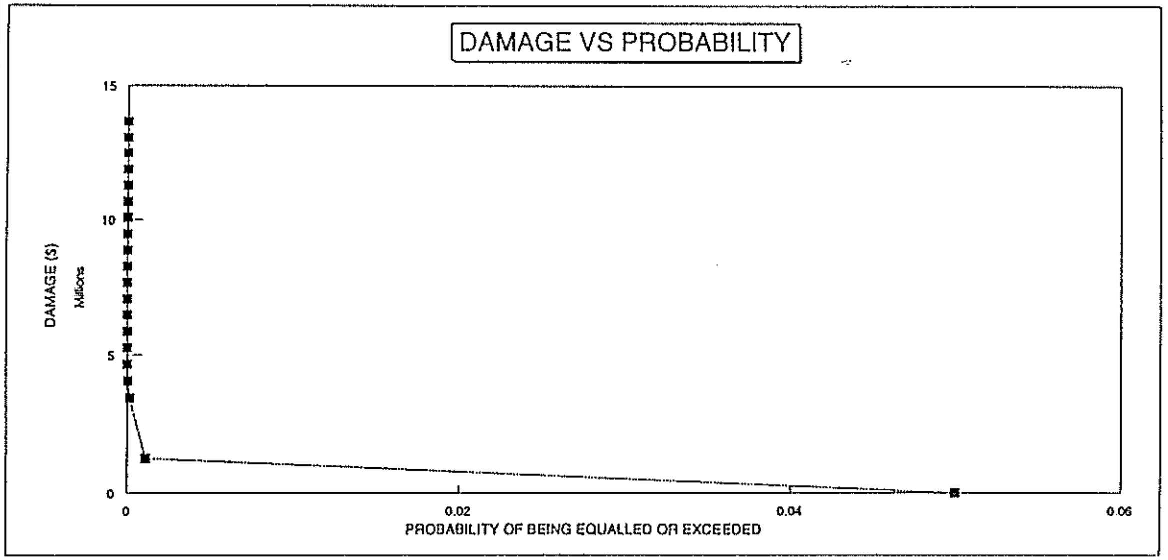
COST BREAKDOWN			
Bridge Damage	Detour	Bailey Bridge	Bypass
$3,324	$0	$0	$0

BRIDGE :	Whirokino Trestle (6)
REPLACEMENT COST ($):	12000000
DETOUR COST ($/day) :	79512

POINT 1		POINT 2	
Return Period (yrs)	Damage %	Return Period (yrs)	Damage %
20	0	200	6

RETURN PERIOD	LN(RP)	DAMAGE %	DAMAGE ($)	DETOUR ($/d)	x FACTOR	OUTAGE (d)	DETOUR ($)	BAILEY COST	BYPASS COST	TOT COST($)	PROB EQ/ EXCEED	(diff)	(damage)	(product)
		0.0	0	79512	59634	0	0	0	0	0	0.05			
20	2.995732	0.0	0	79512	59634	0	0	0	0	0	0.05	0	0	0
928	6.833374	10.0	1200000	79512	59634	1	59634	0	0	1259634	0.001077	0.048923	629817	30812
6325	8.752195	15.0	1800000	79512	59634	28	1669752	0	0	3469752	0.000158	0.000919	2364693	2173
43089	10.67102	20.0	2400000	79512	59634	28	1669752	0	0	4069752	0.000023	0.000135	3769752	509
293560	12.58984	25.0	3000000	79512	59634	28	1669752	0	0	4669752	3.4E-06	0.00002	4369752	87
2000000	14.50866	30	3600000	79512	59634	28	1669752	0	0	5269752	5.0E-07	2.9E-06	4969752	14
13625841	16.42748	35.0	4200000	79512	59634	28	1669752	0	0	5869752	7.3E-08	4.3E-07	5569752	2
92831777	18.3463	40.0	4800000	79512	59634	28	1669752	0	0	6469752	1.1E-08	6.3E-08	6169752	0
1.0E+08	18.42738	45.0	5400000	79512	59634	28	1669752	0	0	7069752	9.9E-09	8.4E-10	6769752	0
1.1E+08	18.50847	50.0	6000000	79512	59634	28	1669752	0	0	7669752	9.2E-09	7.7E-10	7369752	0
1.2E+08	18.58955	55.0	6600000	79512	59634	28	1669752	0	0	8269752	8.4E-09	7.1E-10	7969752	0
1.3E+08	18.67063	60.0	7200000	79512	59634	28	1669752	0	0	8869752	7.8E-09	6.6E-10	8569752	0
1.4E+08	18.75172	65.0	7800000	79512	59634	28	1669752	0	0	9469752	7.2E-09	6.1E-10	9169752	0
1.5E+08	18.8328	70.0	8400000	79512	59634	28	1669752	0	0	10069752	6.6E-09	5.6E-10	9769752	0
1.6E+08	18.91389	75.0	9000000	79512	59634	28	1669752	0	0	10669752	6.1E-09	5.2E-10	10369752	0
1.8E+08	18.99497	80.0	9600000	79512	59634	28	1669752	0	0	11269752	5.6E-09	4.8E-10	10969752	0
1.9E+08	19.07605	85.0	10200000	79512	59634	28	1669752	0	0	11869752	5.2E-09	4.4E-10	11569752	0
2.1E+08	19.15714	90.0	10800000	79512	59634	28	1669752	0	0	12469752	4.8E-09	4.0E-10	12169752	0
2.3E+08	19.23822	95.0	11400000	79512	59634	28	1669752	0	0	13069752	4.4E-09	3.7E-10	12769752	0
2.5E+08	19.3193	100.0	12000000	79512	59634	28	1669752	0	0	13669752	4.1E-09	3.4E-10	13369752	0
		100.0	12000000	79512	59634	28	1669752	0	0	13669752	0	4.1E-09	13669752	0

EXPECTED ANNUAL DAMAGE COST ($/YR) 33598



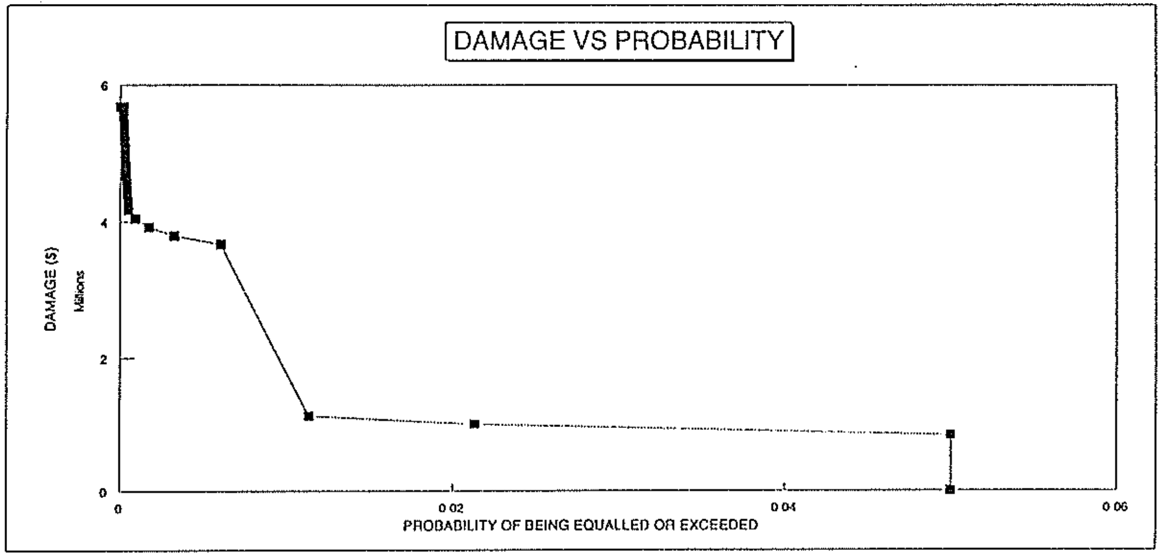
COST BREAKDOWN			
Bridge Damage	Detour	Bailey Bridge	Bypass
$31,081	$2,517	$0	$0

BRIDGE :	Manawatu River (7)
REPLACEMENT COST ($):	2500000
DETOUR COST ($/day) :	126268

POINT 1		POINT 2	
Return Period (yrs)	Damage %	Return Period (yrs)	Damage %
20	3.2	90	15.2

RETURN PERIOD	LN(RP)	DAMAGE %	DAMAGE ($)	DETOUR ($/d)	x FACTOR	OUTAGE (d)	DETOUR ($)	BAILEY COST	BYPASS COST	TOT COST($)	PROB EQ/ EXCEED	(diff)	(damage)	(product)
		0.0	0	126268	94701	0	0	0	0	0	0.05			
20	2.995732	3.2	80000	126268	94701	5	473505	290000	0	843505	0.05	0	421753	0
47	3.848043	10.0	250000	126268	94701	5	473505	290000	0	1013505	0.021321	0.028679	928505	26628
88	4.474742	15.0	375000	126268	94701	5	473505	290000	0	1138505	0.011393	0.009928	1076005	10683
164	5.101441	20.0	500000	126268	94701	21	1988721	290000	0	3678721	0.006088	0.005305	2408613	12778
307	5.72814	25.0	625000	126268	94701	21	1988721	290000	0	3803721	0.003253	0.002835	3741221	10606
575	6.354838	30	750000	126268	94701	21	1988721	290000	0	3928721	0.001738	0.001515	3866221	5857
1077	6.981537	35.0	875000	126268	94701	21	1988721	290000	0	4053721	0.000929	0.000809	3991221	3231
2015	7.608236	40.0	1000000	126268	94701	21	1988721	290000	0	4178721	0.000496	0.000433	4116221	1780
2184.888	7.68932	45.0	1125000	126268	94701	21	1988721	290000	0	4303721	0.000458	0.000039	4241221	164
2369.428	7.770404	50.0	1250000	126268	94701	21	1988721	290000	0	4428721	0.000422	0.000036	4366221	156
2569.553	7.851487	55.0	1375000	126268	94701	21	1988721	290000	0	4553721	0.000389	0.000033	4491221	148
2786.582	7.932571	60.0	1500000	126268	94701	21	1988721	290000	0	4678721	0.000359	0.00003	4616221	140
3021.941	8.013655	65.0	1625000	126268	94701	21	1988721	290000	0	4803721	0.000331	0.000028	4741221	133
3277.18	8.094738	70.0	1750000	126268	94701	21	1988721	290000	0	4928721	0.000305	0.000026	4866221	125
3553.976	8.175822	75.0	1875000	126268	94701	21	1988721	290000	0	5053721	0.000281	0.000024	4991221	119
3854.15	8.256906	80.0	2000000	126268	94701	21	1988721	290000	0	5178721	0.000259	0.000022	5116221	112
4179.678	8.33799	85.0	2125000	126268	94701	21	1988721	290000	0	5303721	0.000239	0.00002	5241221	106
4532.701	8.419073	90.0	2250000	126268	94701	21	1988721	290000	0	5428721	0.000221	0.000019	5366221	100
4915.54	8.500157	95.0	2375000	126268	94701	21	1988721	290000	0	5553721	0.000203	0.000017	5491221	94
5330.715	8.581241	100.0	2500000	126268	94701	21	1988721	290000	0	5678721	0.000188	0.000016	5616221	89
		100.0	2500000	126268	94701	21	1988721	290000	0	5678721	0	0.000188	5678721	1065

EXPECTED ANNUAL DAMAGE COST ($/YR) 74113



COST BREAKDOWN			
Bridge Damage	Detour	Bailey Bridge	Bypass
$14,827	$44,786	$14,500	$0

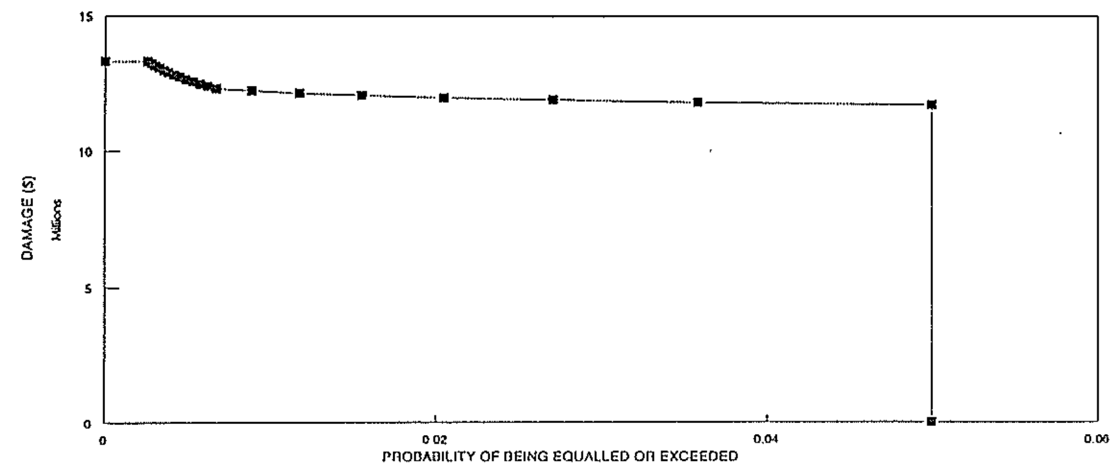
BRIDGE :	Ohau River (8)
REPLACEMENT COST ($):	1700000
DETOUR COST ($/day) :	624760

POINT 1		POINT 2	
Return Period (yrs)	Damage %	Return Period (yrs)	Damage %
20	4	200	45.3

RETURN PERIOD	LN(RP)	DAMAGE %	DAMAGE ($)	DETOUR ($/d)	x FACTOR	OUTAGE (d)	DETOUR ($)	BAILEY COST	BYPASS COST	TOT COST($)	PROB EQ/ EXCEED	(diff)	(damage)	(product)
		0.0	0	624760	468570	0	0	0	0	0	0.05			
20	2.995732	4.0	68000	624760	468570	21	9839970	290000	0	11697970	0.05	0	5848985	0
28	3.330248	10.0	170000	624760	468570	21	9839970	290000	0	11799970	0.035784	0.014216	11748970	167021
37	3.609012	15.0	255000	624760	468570	21	9839970	290000	0	11884970	0.027079	0.008706	11842470	103096
49	3.887775	20.0	340000	624760	468570	21	9839970	290000	0	11969970	0.020491	0.006588	11927470	78575
64	4.166538	25.0	425000	624760	468570	21	9839970	290000	0	12054970	0.015506	0.004985	12012470	59883
85	4.445302	30	510000	624760	468570	21	9839970	290000	0	12139970	0.011734	0.003772	12097470	45635
113	4.724065	35.0	595000	624760	468570	21	9839970	290000	0	12224970	0.008879	0.002855	12182470	34776
149	5.002828	40.0	680000	624760	468570	21	9839970	290000	0	12309970	0.006719	0.00216	12267470	26499
161.4042	5.083912	45.0	765000	624760	468570	21	9839970	290000	0	12394970	0.006196	0.000523	12352470	6464
175.0367	5.164996	50.0	850000	624760	468570	21	9839970	290000	0	12479970	0.005713	0.000483	12437470	6002
189.8206	5.246079	55.0	935000	624760	468570	21	9839970	290000	0	12564970	0.005268	0.000445	12522470	5572
205.8531	5.327163	60.0	1020000	624760	468570	21	9839970	290000	0	12649970	0.004858	0.00041	12607470	5173
223.2398	5.408247	65.0	1105000	624760	468570	21	9839970	290000	0	12734970	0.004479	0.000378	12692470	4802
242.095	5.48933	70.0	1190000	624760	468570	21	9839970	290000	0	12819970	0.004131	0.000349	12777470	4458
262.5428	5.570414	75.0	1275000	624760	468570	21	9839970	290000	0	12904970	0.003809	0.000322	12862470	4138
284.7176	5.651498	80.0	1360000	624760	468570	21	9839970	290000	0	12989970	0.003512	0.000297	12947470	3841
308.7653	5.732581	85.0	1445000	624760	468570	21	9839970	290000	0	13074970	0.003239	0.000274	13032470	3565
334.8441	5.813665	90.0	1530000	624760	468570	21	9839970	290000	0	13159970	0.002986	0.000252	13117470	3309
363.1256	5.894749	95.0	1615000	624760	468570	21	9839970	290000	0	13244970	0.002754	0.000233	13202470	3071
393.7958	5.975833	100.0	1700000	624760	468570	21	9839970	290000	0	13329970	0.002539	0.000214	13287470	2850
		100.0	1700000	624760	468570	21	9839970	290000	0	13329970	0	0.002539	13329970	33850

EXPECTED ANNUAL DAMAGE COST ($/YR) 602577

DAMAGE VS PROBABILITY



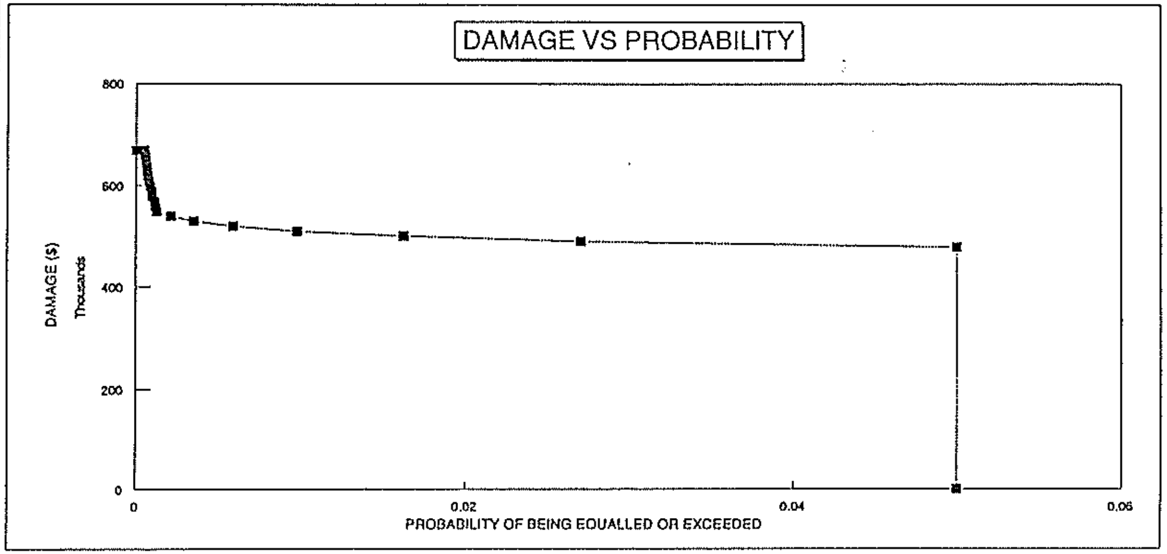
COST BREAKDOWN			
Bridge Damage	Detour	Bailey Bridge	Bypass
$21,079	$566,999	$14,500	$0

BRIDGE :	Ohau Overbridge (0)
REPLACEMENT COST ($):	200000
DETOUR COST ($/day) :	624760

POINT 1		POINT 2	
Return Period (yrs)	Damage %	Return Period (yrs)	Damage %
20	4	170	25

RETURN PERIOD	LN(RP)	DAMAGE %	DAMAGE ($)	DETOUR ($/d)	x FACTOR	OUTAGE (d)	DETOUR ($)	BAILEY COST	BYPASS COST	TOT COST($)	PROB EQ/ EXCEED	(diff)	(damage)	(product)
		0.0	0	624760	468570	0	0	0	0	0	0.05			
20	2.995732	4.0	8000	624760	468570	1	468570	0	0	476570	0.05	0	238285	0
37	3.60718	10.0	20000	624760	468570	1	468570	0	0	488570	0.027128	0.022872	482570	11037
61	4.116719	15.0	30000	624760	468570	1	468570	0	0	498570	0.016298	0.01083	493570	5346
102	4.626259	20.0	40000	624760	468570	1	468570	0	0	508570	0.009791	0.006507	503570	3277
170	5.135798	25.0	50000	624760	468570	1	468570	0	0	518570	0.005882	0.003909	513570	2008
283	5.645338	30	60000	624760	468570	1	468570	0	0	528570	0.003534	0.002348	523570	1230
471	6.154878	35.0	70000	624760	468570	1	468570	0	0	538570	0.002123	0.001411	533570	753
784	6.664417	40.0	80000	624760	468570	1	468570	0	0	548570	0.001275	0.000848	543570	461
850.2248	6.745501	45.0	90000	624760	468570	1	468570	0	0	558570	0.001176	0.000099	553570	55
922.0362	6.826585	50.0	100000	624760	468570	1	468570	0	0	568570	0.001085	0.000092	563570	52
999.9129	6.907668	55.0	110000	624760	468570	1	468570	0	0	578570	0.001	0.000084	573570	48
1084.367	6.988752	60.0	120000	624760	468570	1	468570	0	0	588570	0.000922	0.000078	583570	45
1175.955	7.069836	65.0	130000	624760	468570	1	468570	0	0	598570	0.00085	0.000072	593570	43
1275.278	7.150919	70.0	140000	624760	468570	1	468570	0	0	608570	0.000784	0.000066	603570	40
1382.99	7.232003	75.0	150000	624760	468570	1	468570	0	0	618570	0.000723	0.000061	613570	37
1499.799	7.313087	80.0	160000	624760	468570	1	468570	0	0	628570	0.000667	0.000056	623570	35
1626.475	7.39417	85.0	170000	624760	468570	1	468570	0	0	638570	0.000615	0.000052	633570	33
1763.85	7.475254	90.0	180000	624760	468570	1	468570	0	0	648570	0.000567	0.000048	643570	31
1912.827	7.556338	95.0	190000	624760	468570	1	468570	0	0	658570	0.000523	0.000044	653570	29
2074.388	7.637421	100.0	200000	624760	468570	1	468570	0	0	668570	0.000482	0.000041	663570	27
		100.0	200000	624760	468570	1	468570	0	0	668570	0	0.000482	668570	322

EXPECTED ANNUAL DAMAGE COST ($/YR) 24907

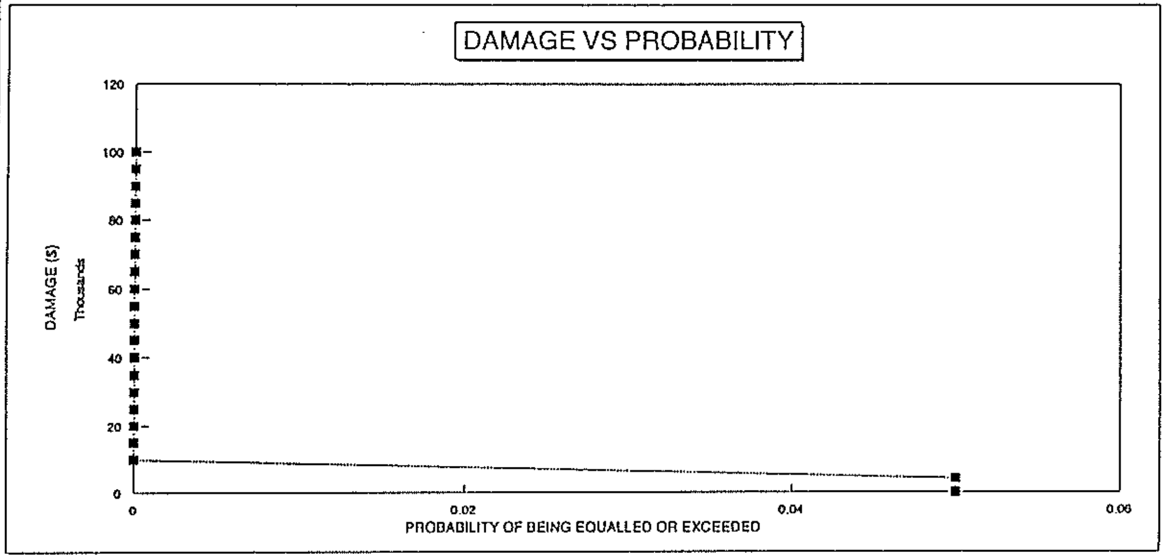


COST BREAKDOWN			
Bridge Damage	Detour	Bailey Bridge	Bypass
$1,479	$23,429	$0	$0

BRIDGE :	Kuku Stream (10)		POINT 1		POINT 2	
REPLACEMENT COST ($):	100000		Return Period (yrs)	Damage %	Return Period (yrs)	Damage %
DETOUR COST ($/day) :	630288		20	4	150	5

RETURN PERIOD	LN(RP)	DAMAGE %	DAMAGE ($)	DETOUR ($/d)	x FACTOR	OUTAGE (d)	DETOUR ($)	BAILEY COST	BYPASS COST	TOT COST($)	PROB EQ/ EXCEED	(diff)	(damage)	(product)
		0.0	0	630288	472716	0	0	0	0	0	0.05			
20	2.995732	4.0	4000	630288	472716	0	0	0	0	4000	0.05	0	2000	0
3559570	15.08515	10.0	10000	630288	472716	0	0	0	0	10000	2.8E-07	0.05	7000	350
8.4E+10	25.15967	15.0	15000	630288	472716	0	0	0	0	15000	1.2E-11	2.8E-07	12500	0
2.0E+15	35.23418	20.0	20000	630288	472716	0	0	0	0	20000	5.0E-16	1.2E-11	17500	0
4.8E+19	45.3087	25.0	25000	630288	472716	0	0	0	0	25000	2.1E-20	5.0E-16	22500	0
1.1E+24	55.38321	30	30000	630288	472716	0	0	0	0	30000	8.9E-25	2.1E-20	27500	0
2.7E+28	65.45773	35.0	35000	630288	472716	0	0	0	0	35000	3.7E-29	8.9E-25	32500	0
6.4E+32	75.53224	40.0	40000	630288	472716	0	0	0	0	40000	1.6E-33	3.7E-29	37500	0
6.9E+32	75.61332	45.0	45000	630288	472716	0	0	0	0	45000	1.5E-33	1.2E-34	42500	0
7.5E+32	75.69441	50.0	50000	630288	472716	0	0	0	0	50000	1.3E-33	1.1E-34	47500	0
8.1E+32	75.77549	55.0	55000	630288	472716	0	0	0	0	55000	1.2E-33	1.0E-34	52500	0
8.8E+32	75.85658	60.0	60000	630288	472716	0	0	0	0	60000	1.1E-33	9.6E-35	57500	0
9.5E+32	75.93766	65.0	65000	630288	472716	0	0	0	0	65000	1.0E-33	8.9E-35	62500	0
1.0E+33	76.01874	70.0	70000	630288	472716	0	0	0	0	70000	9.7E-34	8.2E-35	67500	0
1.1E+33	76.09983	75.0	75000	630288	472716	0	0	0	0	75000	8.9E-34	7.5E-35	72500	0
1.2E+33	76.18091	80.0	80000	630288	472716	0	0	0	0	80000	8.2E-34	6.9E-35	77500	0
1.3E+33	76.26199	85.0	85000	630288	472716	0	0	0	0	85000	7.6E-34	6.4E-35	82500	0
1.4E+33	76.34308	90.0	90000	630288	472716	0	0	0	0	90000	7.0E-34	5.9E-35	87500	0
1.6E+33	76.42416	95.0	95000	630288	472716	0	0	0	0	95000	6.4E-34	5.4E-35	92500	0
1.7E+33	76.50525	100.0	100000	630288	472716	0	0	0	0	100000	5.9E-34	5.0E-35	97500	0
		100.0	100000	630288	472716	0	0	0	0	100000	0	5.9E-34	100000	0

EXPECTED ANNUAL DAMAGE COST ($/YR) 350



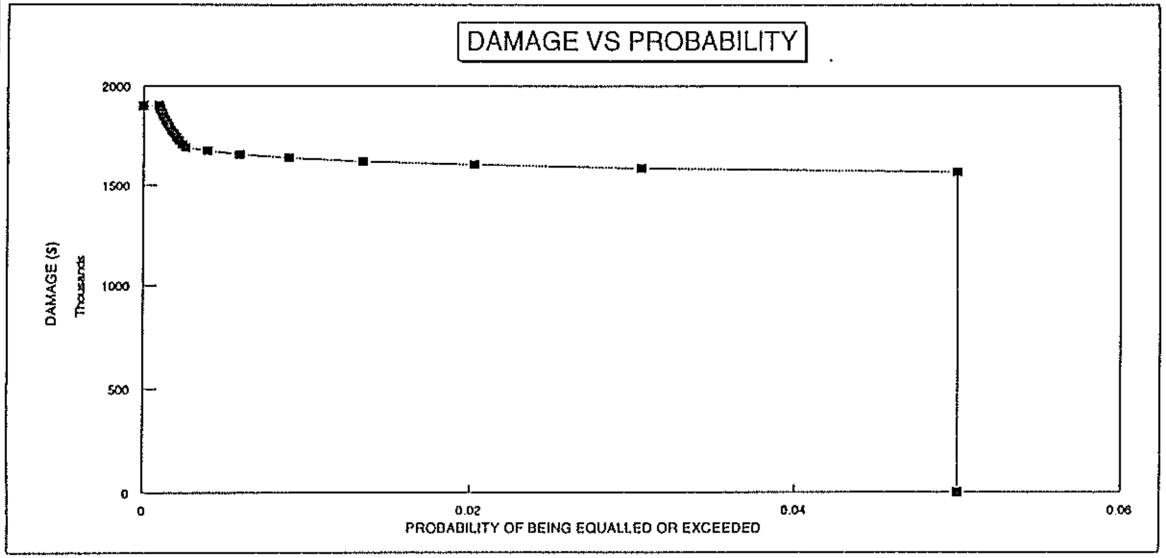
COST BREAKDOWN			
Bridge Damage	Detour	Bailey Bridge	Bypass
$350	$0	$0	$0

BRIDGE :	Waikawa River (11)
REPLACEMENT COST ($):	350000
DETOUR COST ($/day) :	630288

POINT 1		POINT 2	
Return Period (yrs)	Damage %	Return Period (yrs)	Damage %
20	4	150	28.6

RETURN PERIOD	LN(RP)	DAMAGE %	DAMAGE ($)	DETOUR ($/d)	x FACTOR	OUTAGE (d)	DETOUR ($)	BAILEY COST	BYPASS COST	TOT COST($)	PROB EQ/ EXCEED	(diff)	(damage)	(product)
		0.0	0	630288	472716	0	0	0	0	0	0.05			
20	2.995732	4.0	14000	630288	472716	3	1418148	29000	0	1566148	0.05	0	783074	0
33	3.487172	10.0	35000	630288	472716	3	1418148	29000	0	1587148	0.030587	0.019413	1576648	30607
49.23994	3.896705	15.0	52500	630288	472716	3	1418148	29000	0	1604648	0.020309	0.010279	1595898	16403
74.16099	4.306238	20.0	70000	630288	472716	3	1418148	29000	0	1622148	0.013484	0.006825	1613398	11011
111.6949	4.715771	25.0	87500	630288	472716	3	1418148	29000	0	1639648	0.008953	0.004531	1630898	7390
168.2254	5.125305	30	105000	630288	472716	3	1418148	29000	0	1657148	0.005944	0.003009	1648398	4959
253.3667	5.534838	35.0	122500	630288	472716	3	1418148	29000	0	1674648	0.003947	0.001998	1665898	3328
381.5992	5.944371	40.0	140000	630288	472716	3	1418148	29000	0	1692148	0.002621	0.001326	1683398	2233
413.8297	6.025455	45.0	157500	630288	472716	3	1418148	29000	0	1709648	0.002416	0.000204	1700898	347
448.7824	6.106538	50.0	175000	630288	472716	3	1418148	29000	0	1727148	0.002228	0.000188	1718398	323
486.6873	6.187622	55.0	192500	630288	472716	3	1418148	29000	0	1744648	0.002055	0.000174	1735898	301
527.7938	6.268706	60.0	210000	630288	472716	3	1418148	29000	0	1762148	0.001895	0.00016	1753398	281
572.3721	6.349789	65.0	227500	630288	472716	3	1418148	29000	0	1779648	0.001747	0.000148	1770898	261
620.7156	6.430873	70.0	245000	630288	472716	3	1418148	29000	0	1797148	0.001611	0.000136	1788398	243
673.1423	6.511957	75.0	262500	630288	472716	3	1418148	29000	0	1814648	0.001486	0.000125	1805898	227
729.997	6.59304	80.0	280000	630288	472716	3	1418148	29000	0	1832148	0.00137	0.000116	1823398	211
791.6537	6.674124	85.0	297500	630288	472716	3	1418148	29000	0	1849648	0.001263	0.000107	1840898	196
858.5181	6.755208	90.0	315000	630288	472716	3	1418148	29000	0	1867148	0.001165	0.000098	1858398	183
931.03	6.836291	95.0	332500	630288	472716	3	1418148	29000	0	1884648	0.001074	0.000091	1875898	170
1009.666	6.917375	100.0	350000	630288	472716	3	1418148	29000	0	1902148	0.00099	0.000084	1893398	158
		100.0	350000	630288	472716	3	1418148	29000	0	1902148	0	0.00099	1902148	1884

EXPECTED ANNUAL DAMAGE COST ($/YR) 80717



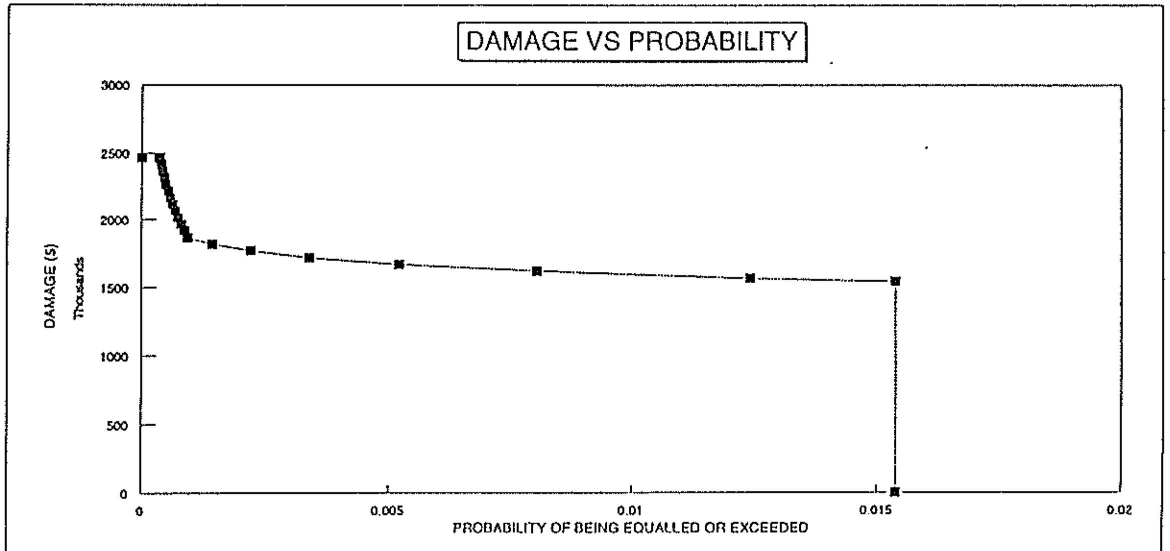
COST BREAKDOWN			
Bridge Damage	Detour	Bailey Bridge	Bypass
$3,110	$76,157	$1,450	$0

BRIDGE :	Manakau Nth O/bridge (12)
REPLACEMENT COST ($):	1000000
DETOUR COST ($/day) :	630288

POINT 1		POINT 2	
Return Period (yrs)	Damage %	Return Period (yrs)	Damage %
65	7.5	450	30

RETURN PERIOD	LN(RP)	DAMAGE %	DAMAGE ($)	DETOUR ($/d)	x FACTOR	OUTAGE (d)	DETOUR ($)	BAILEY COST	BYPASS COST	TOT COST($)	PROB EQ/ EXCEED	(diff)	(damage)	(product)
		0.0	0	630288	472716	0	0	0	0	0	0.015385			
65	4.174387	7.5	75000	630288	472716	3	1418148	0	50000	1543148	0.015385	0	771574	0
81	4.389372	10.0	100000	630288	472716	3	1418148	0	50000	1568148	0.012409	0.002976	1555648	4630
123.8834	4.819341	15.0	150000	630288	472716	3	1418148	0	50000	1618148	0.008072	0.004336	1593148	6909
190.4348	5.24931	20.0	200000	630288	472716	3	1418148	0	50000	1668148	0.005251	0.002821	1643148	4635
292.7382	5.679279	25.0	250000	630288	472716	3	1418148	0	50000	1718148	0.003416	0.001835	1693148	3107
450	6.109248	30	300000	630288	472716	3	1418148	0	50000	1768148	0.002222	0.001194	1743148	2081
691.7444	6.539217	35.0	350000	630288	472716	3	1418148	0	50000	1818148	0.001446	0.000777	1793148	1393
1063.356	6.969185	40.0	400000	630288	472716	3	1418148	0	50000	1868148	0.00094	0.000505	1843148	931
1153.169	7.050269	45.0	450000	630288	472716	3	1418148	0	50000	1918148	0.000867	0.000073	1893148	139
1250.568	7.131353	50.0	500000	630288	472716	3	1418148	0	50000	1968148	0.0008	0.000068	1943148	131
1356.193	7.212437	55.0	550000	630288	472716	3	1418148	0	50000	2018148	0.000737	0.000062	1993148	124
1470.739	7.29352	60.0	600000	630288	472716	3	1418148	0	50000	2068148	0.00068	0.000057	2043148	117
1594.96	7.374604	65.0	650000	630288	472716	3	1418148	0	50000	2118148	0.000627	0.000053	2093148	111
1729.673	7.455688	70.0	700000	630288	472716	3	1418148	0	50000	2168148	0.000578	0.000049	2143148	105
1875.764	7.536771	75.0	750000	630288	472716	3	1418148	0	50000	2218148	0.000533	0.000045	2193148	99
2034.194	7.617855	80.0	800000	630288	472716	3	1418148	0	50000	2268148	0.000492	0.000042	2243148	93
2206.006	7.698939	85.0	850000	630288	472716	3	1418148	0	50000	2318148	0.000453	0.000038	2293148	88
2392.328	7.780022	90.0	900000	630288	472716	3	1418148	0	50000	2368148	0.000418	0.000035	2343148	83
2594.389	7.861106	95.0	950000	630288	472716	3	1418148	0	50000	2418148	0.000385	0.000033	2393148	78
2813.515	7.94219	100.0	1000000	630288	472716	3	1418148	0	50000	2468148	0.000355	0.00003	2443148	73
		100.0	1000000	630288	472716	3	1418148	0	50000	2468148	0	0.000355	2468148	877

EXPECTED ANNUAL DAMAGE COST ($/YR) 25803



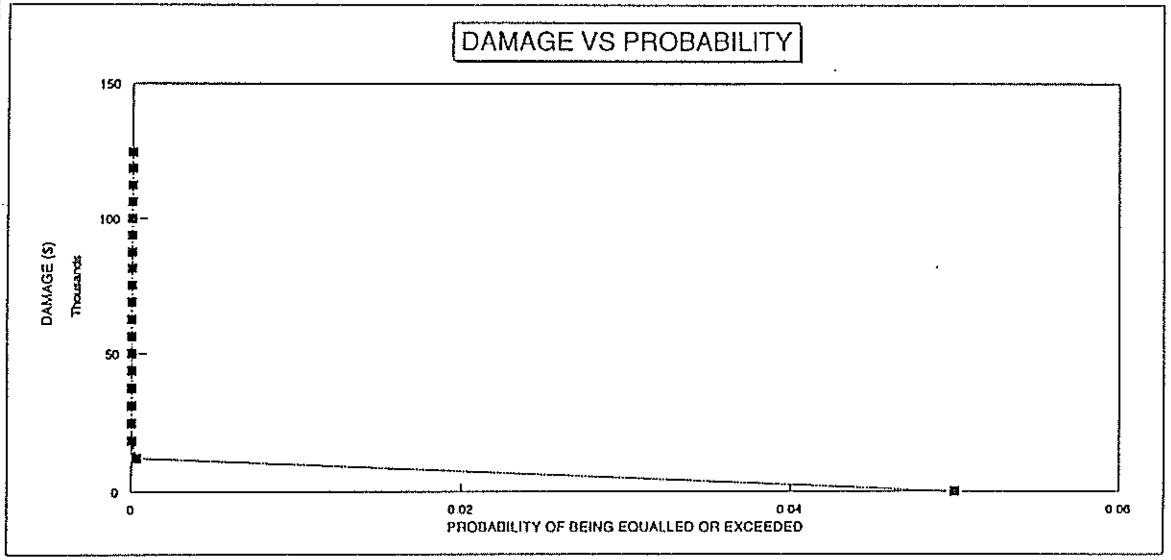
COST BREAKDOWN			
Bridge Damage	Detour	Bailey Bridge	Bypass
$3,216	$21,818	$0	$769

BRIDGE :	Waiauli Stream (13)
REPLACEMENT COST ($):	125000
DETOUR COST ($/day) :	28405

POINT 1		POINT 2	
Return Period (yrs)	Damage %	Return Period (yrs)	Damage %
20	0	150	4

RETURN PERIOD	LN(RP)	DAMAGE %	DAMAGE ($)	DETOUR ($/d)	x FACTOR	OUTAGE (d)	DETOUR ($)	BAILEY COST	BYPASS COST	TOT COST($)	PROB EQ/ EXCEED	(diff)	(damage)	(product)
		0.0	0	28405	21303.75	0	0	0	0	0	0.05			
20	2.995732	0.0	0	28405	21303.75	0	0	0	0	0	0.05	0	0	0
3081	8.03299	10.0	12500	28405	21303.75	0	0	0	0	12500	0.000325	0.049675	6250	310
38239.28	10.55162	15.0	18750	28405	21303.75	0	0	0	0	18750	0.000026	0.000298	15625	5
474609.4	13.07025	20.0	25000	28405	21303.75	0	0	0	0	25000	2.1E-06	0.000024	21875	1
5890646	15.58888	25.0	31250	28405	21303.75	0	0	0	0	31250	1.7E-07	1.9E-06	28125	0
73112136	18.1075	30	37500	28405	21303.75	0	0	0	0	37500	1.4E-08	1.6E-07	34375	0
9.1E+08	20.62613	35.0	43750	28405	21303.75	0	0	0	0	43750	1.1E-09	1.3E-08	40625	0
1.1E+10	23.14476	40.0	50000	28405	21303.75	0	0	0	0	50000	8.9E-11	1.0E-09	46875	0
1.2E+10	23.22585	45.0	56250	28405	21303.75	0	0	0	0	56250	8.2E-11	6.9E-12	53125	0
1.3E+10	23.30693	50.0	62500	28405	21303.75	0	0	0	0	62500	7.5E-11	6.4E-12	59375	0
1.4E+10	23.38801	55.0	68750	28405	21303.75	0	0	0	0	68750	7.0E-11	5.9E-12	65625	0
1.6E+10	23.4691	60.0	75000	28405	21303.75	0	0	0	0	75000	6.4E-11	5.4E-12	71875	0
1.7E+10	23.55018	65.0	81250	28405	21303.75	0	0	0	0	81250	5.9E-11	5.0E-12	78125	0
1.8E+10	23.63126	70.0	87500	28405	21303.75	0	0	0	0	87500	5.5E-11	4.6E-12	84375	0
2.0E+10	23.71235	75.0	93750	28405	21303.75	0	0	0	0	93750	5.0E-11	4.3E-12	90625	0
2.2E+10	23.79343	80.0	100000	28405	21303.75	0	0	0	0	100000	4.6E-11	3.9E-12	96875	0
2.3E+10	23.87452	85.0	106250	28405	21303.75	0	0	0	0	106250	4.3E-11	3.6E-12	103125	0
2.5E+10	23.9556	90.0	112500	28405	21303.75	0	0	0	0	112500	3.9E-11	3.3E-12	109375	0
2.7E+10	24.03668	95.0	118750	28405	21303.75	0	0	0	0	118750	3.6E-11	3.1E-12	115625	0
3.0E+10	24.11777	100.0	125000	28405	21303.75	0	0	0	0	125000	3.4E-11	2.8E-12	121875	0
		100.0	125000	28405	21303.75	0	0	0	0	125000	0	3.4E-11	125000	0

EXPECTED ANNUAL DAMAGE COST ($/YR) **316**



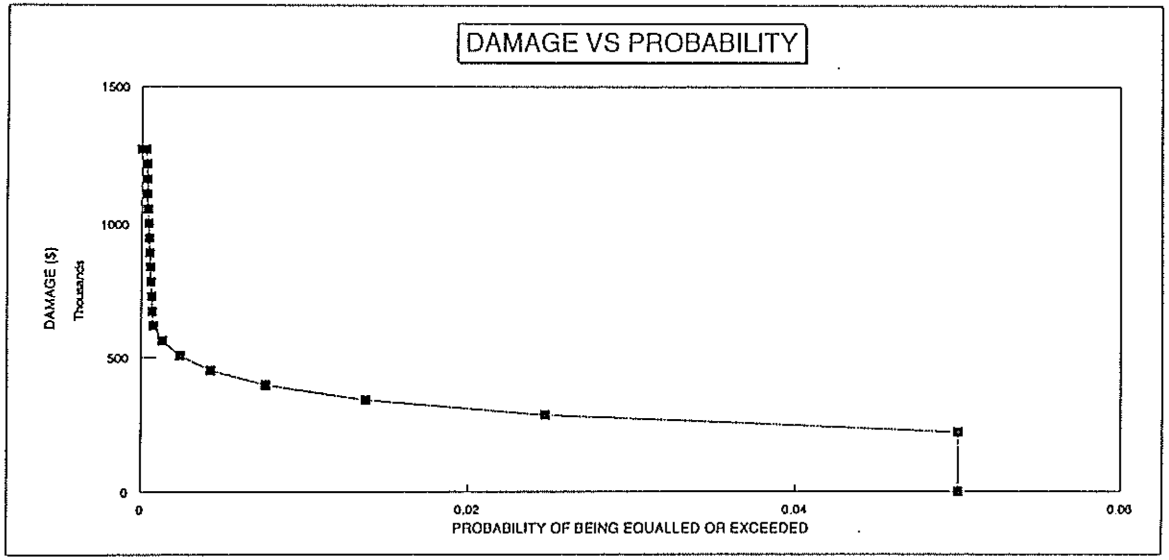
COST BREAKDOWN			
Bridge Damage	Detour	Bailey Bridge	Bypass
$316	$0	$0	$0

BRIDGE :	Pukehou O/bridge (14)		
REPLACEMENT COST ($):	1100000		
DETOUR COST ($/day) :	28158		

POINT 1		POINT 2	
Return Period (yrs)	Damage %	Return Period (yrs)	Damage %
20	4	50	11.8

RETURN PERIOD	LN(RP)	DAMAGE %	DAMAGE ($)	DETOUR ($/d)	x FACTOR	OUTAGE (d)	DETOUR ($)	BAILEY COST	BYPASS COST	TOT COST($)	PROB EQ/ EXCEED	(diff)	(damage)	(product)
		0.0	0	28158	21118.5	0	0	0	0	0	0.05			
20	2.995732	4.0	44000	28158	21118.5	3	63356	9000	0	221356	0.05	0	110678	0
40	3.700571	10.0	110000	28158	21118.5	3	63356	9000	0	287356	0.024709	0.025291	254356	6433
72.8161	4.287937	15.0	165000	28158	21118.5	3	63356	9000	0	342356	0.013733	0.010976	314856	3456
131.0138	4.875303	20.0	220000	28158	21118.5	3	63356	9000	0	397356	0.007633	0.0061	369856	2256
235.7257	5.462669	25.0	275000	28158	21118.5	3	63356	9000	0	452356	0.004242	0.003391	424856	1440
424.1278	6.050035	30	330000	28158	21118.5	3	63356	9000	0	507356	0.002358	0.001884	479856	904
763.1088	6.637401	35.0	385000	28158	21118.5	3	63356	9000	0	562356	0.00131	0.001047	534856	560
1373.018	7.224766	40.0	440000	28158	21118.5	3	63356	9000	0	617356	0.000728	0.000582	589856	343
1488.985	7.30585	45.0	495000	28158	21118.5	3	63356	9000	0	672356	0.000672	0.000057	644856	37
1614.747	7.386934	50.0	550000	28158	21118.5	3	63356	9000	0	727356	0.000619	0.000052	699856	37
1751.132	7.468018	55.0	605000	28158	21118.5	3	63356	9000	0	782356	0.000571	0.000048	754856	36
1899.035	7.549101	60.0	660000	28158	21118.5	3	63356	9000	0	837356	0.000527	0.000044	809856	36
2059.431	7.630185	65.0	715000	28158	21118.5	3	63356	9000	0	892356	0.000486	0.000041	864856	35
2233.374	7.711269	70.0	770000	28158	21118.5	3	63356	9000	0	947356	0.000448	0.000038	919856	35
2422.008	7.792352	75.0	825000	28158	21118.5	3	63356	9000	0	1002356	0.000413	0.000035	974856	34
2626.575	7.873436	80.0	880000	28158	21118.5	3	63356	9000	0	1057356	0.000381	0.000032	1029856	33
2848.42	7.95452	85.0	935000	28158	21118.5	3	63356	9000	0	1112356	0.000351	0.00003	1084856	32
3089.002	8.035603	90.0	990000	28158	21118.5	3	63356	9000	0	1167356	0.000324	0.000027	1139856	31
3349.904	8.116687	95.0	1045000	28158	21118.5	3	63356	9000	0	1222356	0.000299	0.000025	1194856	30
3632.843	8.197771	100.0	1100000	28158	21118.5	3	63356	9000	0	1277356	0.000275	0.000023	1249856	29
		100.0	1100000	28158	21118.5	3	63356	9000	0	1277356	0	0.000275	1277356	352

EXPECTED ANNUAL DAMAGE COST ($/YR) 16150



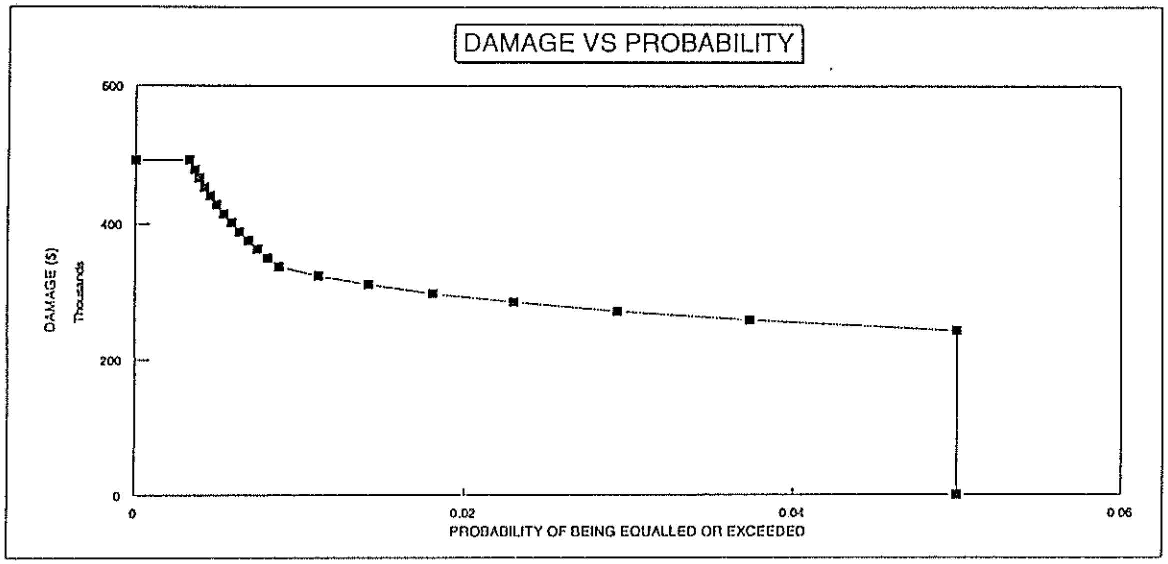
COST BREAKDOWN			
Bridge Damage	Detour	Bailey Bridge	Bypass
$7,283	$8,418	$450	$0

BRIDGE :	Waitohu Stream (15)
REPLACEMENT COST ($):	260000
DETOUR COST ($/day) :	28405

POINT 1		POINT 2	
Return Period (yrs)	Damage %	Return Period (yrs)	Damage %
20	4	185	50

RETURN PERIOD	LN(RP)	DAMAGE %	DAMAGE ($)	DETOUR ($/d)	x FACTOR	OUTAGE (d)	DETOUR ($)	BAILEY COST	BYPASS COST	TOT COST($)	PROB EQ/ EXCEED	(diff)	(damage)	(product)
		0.0	0	28405	21303.75	0	0	0	0	0	0.05			
20	2.995732	4.0	10400	28405	21303.75	3	63911	29000	0	243311	0.05	0	121656	0
27	3.285901	10.0	26000	28405	21303.75	3	63911	29000	0	258911	0.037407	0.012593	251111	3162
34.04583	3.527707	15.0	39000	28405	21303.75	3	63911	29000	0	271911	0.029372	0.008035	265411	2133
43.359	3.769514	20.0	52000	28405	21303.75	3	63911	29000	0	284911	0.023063	0.006309	278411	1756
55.21978	4.011321	25.0	65000	28405	21303.75	3	63911	29000	0	297911	0.018109	0.004954	291411	1444
70.32506	4.253128	30	78000	28405	21303.75	3	63911	29000	0	310911	0.01422	0.00389	304411	1184
89.56236	4.494935	35.0	91000	28405	21303.75	3	63911	29000	0	323911	0.011165	0.003054	317411	969
114.062	4.736742	40.0	104000	28405	21303.75	3	63911	29000	0	336911	0.008767	0.002398	330411	792
123.6958	4.817826	45.0	117000	28405	21303.75	3	63911	29000	0	349911	0.008084	0.000683	343411	234
134.1434	4.898909	50.0	130000	28405	21303.75	3	63911	29000	0	362911	0.007455	0.00063	356411	224
145.4734	4.979993	55.0	143000	28405	21303.75	3	63911	29000	0	375911	0.006874	0.000581	369411	214
157.7603	5.061077	60.0	156000	28405	21303.75	3	63911	29000	0	388911	0.006339	0.000535	382411	205
171.085	5.14216	65.0	169000	28405	21303.75	3	63911	29000	0	401911	0.005845	0.000494	395411	195
185.5351	5.223244	70.0	182000	28405	21303.75	3	63911	29000	0	414911	0.00539	0.000455	408411	186
201.2057	5.304328	75.0	195000	28405	21303.75	3	63911	29000	0	427911	0.00497	0.00042	421411	177
218.1999	5.385412	80.0	208000	28405	21303.75	3	63911	29000	0	440911	0.004583	0.000387	434411	168
236.6294	5.466495	85.0	221000	28405	21303.75	3	63911	29000	0	453911	0.004226	0.000357	447411	160
256.6155	5.547579	90.0	234000	28405	21303.75	3	63911	29000	0	466911	0.003897	0.000329	460411	152
278.2897	5.628663	95.0	247000	28405	21303.75	3	63911	29000	0	479911	0.003593	0.000304	473411	144
301.7945	5.709746	100.0	260000	28405	21303.75	3	63911	29000	0	492911	0.003314	0.00028	486411	136
		100.0	260000	28405	21303.75	3	63911	29000	0	492911	0	0.003314	492911	1633

EXPECTED ANNUAL DAMAGE COST ($/YR) 15269



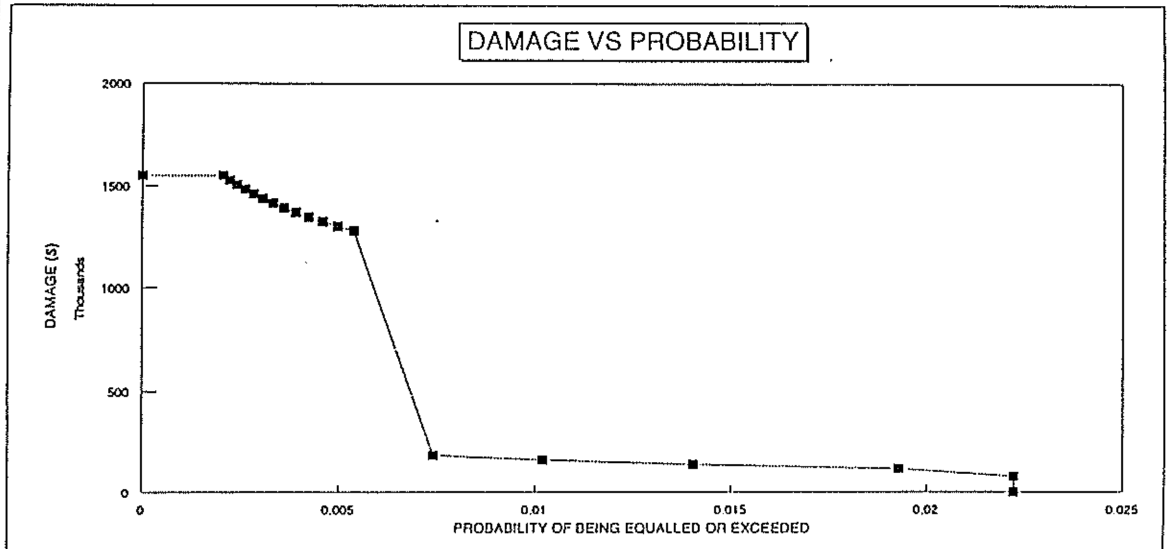
COST BREAKDOWN			
Bridge Damage	Detour	Bailey Bridge	Bypass
$3,624	$10,196	$1,450	$0

BRIDGE :	Olaki O/bidge (16)
REPLACEMENT COST ($):	450000
DETOUR COST ($/day) :	51006

POINT 1		POINT 2	
Return Period (yrs)	Damage %	Return Period (yrs)	Damage %
45	17.78	185	40

RETURN PERIOD	LN(RP)	DAMAGE %	DAMAGE ($)	DETOUR ($/d)	x FACTOR	OUTAGE (d)	DETOUR ($)	BAILEY COST	BYPASS COST	TOT COST($)	PROB EQ/ EXCEED	(diff)	(damage)	(product)
		0.0	0	51006	38254.5	0	0	0	0	0	0			
0	0	0.0	0	51006	38254.5	0	0	0	0	0	0		0	0
0	0	0.0	0	51006	38254.5	0	0	0	0	0	0.022222		0	0
45	3.806662	17.8	80010	51006	38254.5	0	0	0	0	80010	0.022222	0	40005	0
51.82665	3.947905	20.0	90000	51006	38254.5	0	0	29000	0	119000	0.019295	0.002927	59500	174
71.23736	4.266017	25.0	112500	51006	38254.5	0	0	29000	0	141500	0.014038	0.005258	130250	685
97.91798	4.58413	30	135000	51006	38254.5	0	0	29000	0	164000	0.010213	0.003825	152750	584
134.5913	4.902243	35.0	157500	51006	38254.5	0	0	29000	0	186500	0.00743	0.002783	175250	488
185	5.220356	40.0	180000	51006	38254.5	28	1071126	29000	0	1280126	0.005405	0.002024	733313	1485
200.6254	5.30144	45.0	202500	51006	38254.5	28	1071126	29000	0	1302626	0.004984	0.000421	1291376	544
217.5706	5.382523	50.0	225000	51006	38254.5	28	1071126	29000	0	1325126	0.004596	0.000388	1313876	510
235.9469	5.463607	55.0	247500	51006	38254.5	28	1071126	29000	0	1347626	0.004238	0.000358	1336376	478
255.8754	5.544691	60.0	270000	51006	38254.5	28	1071126	29000	0	1370126	0.003908	0.00033	1358876	449
277.4871	5.625774	65.0	292500	51006	38254.5	28	1071126	29000	0	1392626	0.003604	0.000304	1381376	420
300.9241	5.706858	70.0	315000	51006	38254.5	28	1071126	29000	0	1415126	0.003323	0.000281	1403876	394
326.3406	5.787942	75.0	337500	51006	38254.5	28	1071126	29000	0	1437626	0.003064	0.000259	1426376	369
353.9039	5.869025	80.0	360000	51006	38254.5	28	1071126	29000	0	1460126	0.002826	0.000239	1448876	346
383.7952	5.950109	85.0	382500	51006	38254.5	28	1071126	29000	0	1482626	0.002606	0.00022	1471376	324
416.2112	6.031193	90.0	405000	51006	38254.5	28	1071126	29000	0	1505126	0.002403	0.000203	1493876	303
451.3651	6.112276	95.0	427500	51006	38254.5	28	1071126	29000	0	1527626	0.002216	0.000187	1516376	284
489.4881	6.19336	100.0	450000	51006	38254.5	28	1071126	29000	0	1550126	0.002043	0.000173	1538876	266
		100.0	450000	51006	38254.5	28	1071126	29000	0	1550126	0	0.002043	1550126	3167

EXPECTED ANNUAL DAMAGE COST ($/YR) 11269



COST BREAKDOWN			
Bridge Damage	Detour	Bailey Bridge	Bypass
$3,793	$6,874	$602	$0

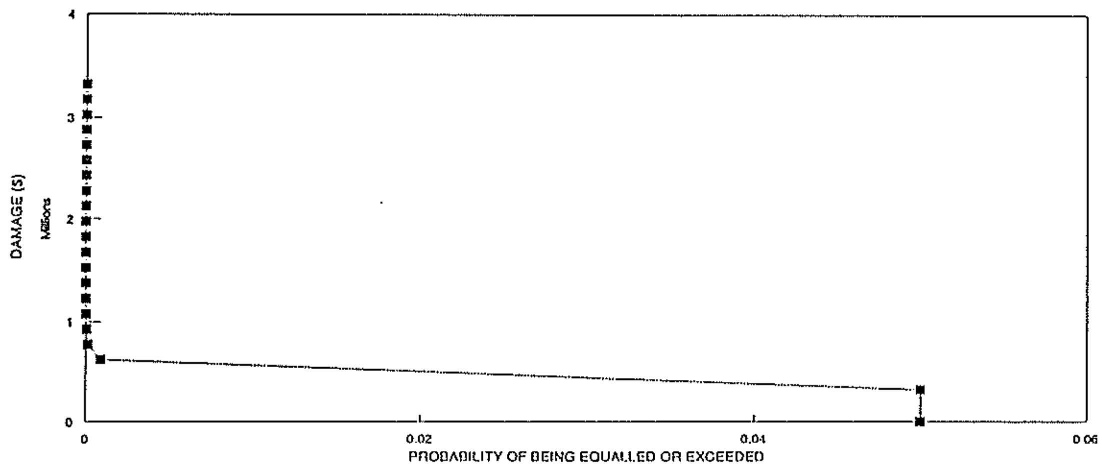
BRIDGE :	Olaki River (17)
REPLACEMENT COST ($):	3000000
DETOUR COST ($/day) :	53382

POINT 1		POINT 2	
Return Period (yrs)	Damage %	Return Period (yrs)	Damage %
20	0	100	4

RETURN PERIOD	LN(RP)	DAMAGE %	DAMAGE ($)	DETOUR ($/d)	x FACTOR	OUTAGE (d)	DETOUR ($)	BAILEY COST	BYPASS COST	TOT COST($)	PROB EQ/ EXCEED	(diff)	(damage)	(product)
		0.0	0	53382	40036.5	0	0	0	0	0	0.05			
20	2.995732	0.0	0	53382	40036.5	4	160146	26000	0	326146	0.05	0	163073	0
1118	7.019327	10.0	300000	53382	40036.5	4	160146	26000	0	626146	0.000894	0.049106	476146	23381
8359.254	9.031124	15.0	450000	53382	40036.5	4	160146	26000	0	776146	0.00012	0.000775	701146	543
62500	11.04292	20.0	600000	53382	40036.5	4	160146	26000	0	926146	0.000016	0.000104	851146	88
467296.5	13.05472	25.0	750000	53382	40036.5	4	160146	26000	0	1076146	2.1E-06	0.000014	1001146	14
3493856	15.06652	30	900000	53382	40036.5	4	160146	26000	0	1226146	2.9E-07	1.9E-06	1151146	2
26122660	17.07831	35.0	1050000	53382	40036.5	4	160146	26000	0	1376146	3.8E-08	2.5E-07	1301146	0
2.0E+08	19.09011	40.0	1200000	53382	40036.5	4	160146	26000	0	1526146	5.1E-09	3.3E-08	1451146	0
2.1E+08	19.1712	45.0	1350000	53382	40036.5	4	160146	26000	0	1676146	4.7E-09	4.0E-10	1601146	0
2.3E+08	19.25228	50.0	1500000	53382	40036.5	4	160146	26000	0	1826146	4.4E-09	3.7E-10	1751146	0
2.5E+08	19.33336	55.0	1650000	53382	40036.5	4	160146	26000	0	1976146	4.0E-09	3.4E-10	1901146	0
2.7E+08	19.41445	60.0	1800000	53382	40036.5	4	160146	26000	0	2126146	3.7E-09	3.1E-10	2051146	0
2.9E+08	19.49553	65.0	1950000	53382	40036.5	4	160146	26000	0	2276146	3.4E-09	2.9E-10	2201146	0
3.2E+08	19.57661	70.0	2100000	53382	40036.5	4	160146	26000	0	2426146	3.1E-09	2.7E-10	2351146	0
3.4E+08	19.6577	75.0	2250000	53382	40036.5	4	160146	26000	0	2576146	2.9E-09	2.5E-10	2501146	0
3.7E+08	19.73878	80.0	2400000	53382	40036.5	4	160146	26000	0	2726146	2.7E-09	2.3E-10	2651146	0
4.1E+08	19.81986	85.0	2550000	53382	40036.5	4	160146	26000	0	2876146	2.5E-09	2.1E-10	2801146	0
4.4E+08	19.90095	90.0	2700000	53382	40036.5	4	160146	26000	0	3026146	2.3E-09	1.9E-10	2951146	0
4.8E+08	19.98203	95.0	2850000	53382	40036.5	4	160146	26000	0	3176146	2.1E-09	1.8E-10	3101146	0
5.2E+08	20.06312	100.0	3000000	53382	40036.5	4	160146	26000	0	3326146	1.9E-09	1.6E-10	3251146	0
		100.0	3000000	53382	40036.5	4	160146	26000	0	3326146	0	1.9E-09	3326146	0

EXPECTED ANNUAL DAMAGE COST ($/YR) 24029

DAMAGE VS PROBABILITY



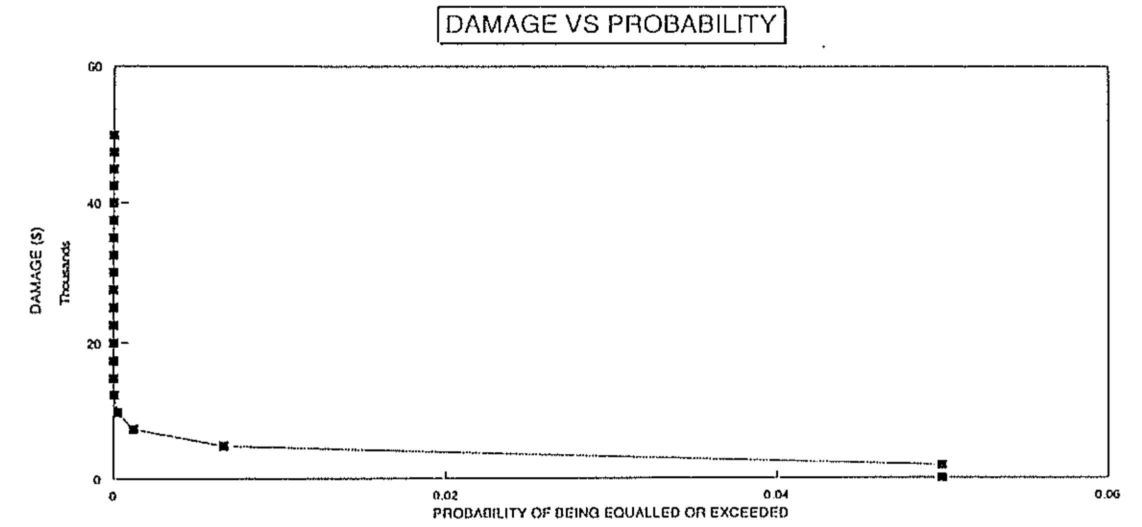
COST BREAKDOWN			
Bridge Damage	Detour	Bailey Bridge	Bypass
$7,722	$15,007	$1,300	$0

BRIDGE :	Mangaone Stream (18)
REPLACEMENT COST ($):	50000
DETOUR COST ($/day) :	53874

POINT 1		POINT 2	
Return Period (yrs)	Damage %	Return Period (yrs)	Damage %
20	4	150	10

RETURN PERIOD	LN(RP)	DAMAGE %	DAMAGE ($)	DETOUR ($/d)	x FACTOR	OUTAGE (d)	DETOUR ($)	BAILEY COST	BYPASS COST	TOT COST($)	PROB EQ/ EXCEED	(diff)	(damage)	(product)
		0.0	0	53874	40405.5	0	0	0	0	0	0.05			
20	2.995732	4.0	2000	53874	40405.5	0	0	0	0	2000	0.05	0	1000	0
150	5.010635	10.0	5000	53874	40405.5	0	0	0	0	5000	0.006667	0.043333	3500	152
804.098	6.689721	15.0	7500	53874	40405.5	0	0	0	0	7500	0.001244	0.005423	6250	34
4310.491	8.368807	20.0	10000	53874	40405.5	0	0	0	0	10000	0.000232	0.001012	8750	9
23107.05	10.04789	25.0	12500	53874	40405.5	0	0	0	0	12500	0.000043	0.000189	11250	2
123868.9	11.72698	30	15000	53874	40405.5	0	0	0	0	15000	8.1E-06	0.000035	13750	0
664018	13.40606	35.0	17500	53874	40405.5	0	0	0	0	17500	1.5E-06	6.6E-06	16250	0
3559570	15.08515	40.0	20000	53874	40405.5	0	0	0	0	20000	2.8E-07	1.2E-06	18750	0
3860218	15.16623	45.0	22500	53874	40405.5	0	0	0	0	22500	2.6E-07	2.2E-08	21250	0
4186258	15.24732	50.0	25000	53874	40405.5	0	0	0	0	25000	2.4E-07	2.0E-08	23750	0
4539836	15.3284	55.0	27500	53874	40405.5	0	0	0	0	27500	2.2E-07	1.9E-08	26250	0
4923278	15.40949	60.0	30000	53874	40405.5	0	0	0	0	30000	2.0E-07	1.7E-08	28750	0
5339106	15.49057	65.0	32500	53874	40405.5	0	0	0	0	32500	1.9E-07	1.6E-08	31250	0
5790056	15.57165	70.0	35000	53874	40405.5	0	0	0	0	35000	1.7E-07	1.5E-08	33750	0
6279094	15.65274	75.0	37500	53874	40405.5	0	0	0	0	37500	1.6E-07	1.3E-08	36250	0
6809437	15.73382	80.0	40000	53874	40405.5	0	0	0	0	40000	1.5E-07	1.2E-08	38750	0
7384573	15.8149	85.0	42500	53874	40405.5	0	0	0	0	42500	1.4E-07	1.1E-08	41250	0
8008286	15.89599	90.0	45000	53874	40405.5	0	0	0	0	45000	1.2E-07	1.1E-08	43750	0
8684679	15.97707	95.0	47500	53874	40405.5	0	0	0	0	47500	1.2E-07	9.7E-09	46250	0
9418202	16.05815	100.0	50000	53874	40405.5	0	0	0	0	50000	1.1E-07	9.0E-09	48750	0
		100.0	50000	53874	40405.5	0	0	0	0	50000	0	1.1E-07	50000	0

EXPECTED ANNUAL DAMAGE COST ($/YR) 197



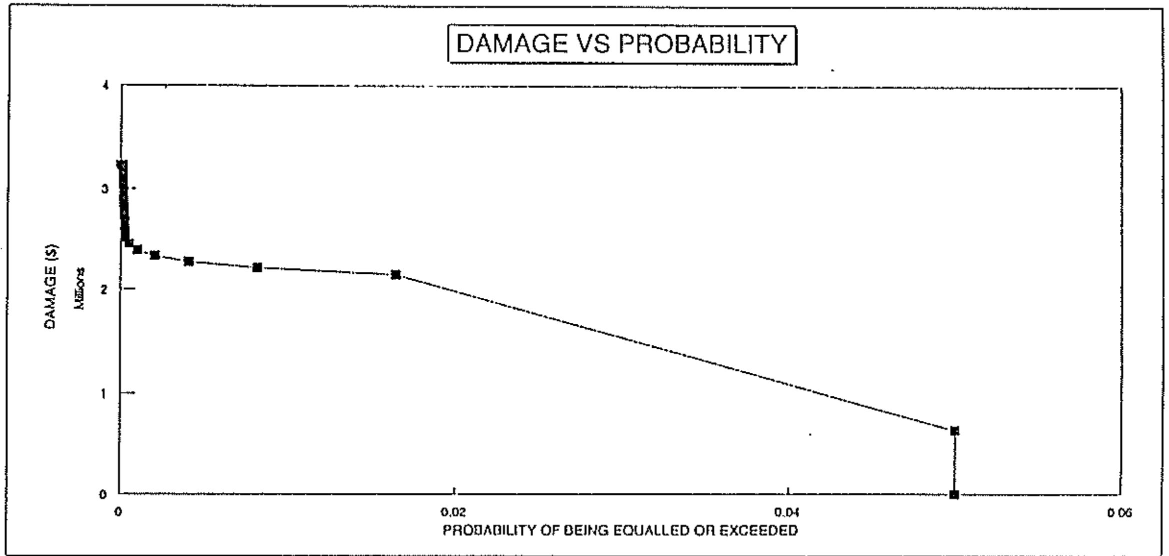
COST BREAKDOWN			
Bridge Damage	Detour	Bailey Bridge	Bypass
$197	$0	$0	$0

BRIDGE :	Waikanae River (19)		
REPLACEMENT COST ($):	1200000		
DETOUR COST ($/day) :	803562		

POINT 1		POINT 2	
Return Period (yrs)	Damage %	Return Period (yrs)	Damage %
20	2.08	38	6.67

RETURN PERIOD	LN(RP)	DAMAGE %	DAMAGE ($)	DETOUR ($/d)	x FACTOR	OUTAGE (d)	DETOUR ($)	BAILEY COST	BYPASS COST	TOT COST($)	PROB EQ/ EXCEED	(diff)	(damage)	(product)
		0.0	0	803562	602671.5	0	0	0	0	0	0.05			
20	2.995732	2.1	24960	803562	602671.5	1	602672	9000	0	636632	0.05	0	318316	0
61	4.103245	10.0	120000	803562	602671.5	3	1808015	9000	0	2147015	0.016519	0.033481	1391823	46600
121.8063	4.802432	15.0	180000	803562	602671.5	3	1808015	9000	0	2207015	0.00821	0.008309	2177015	18089
245.0885	5.501619	20.0	240000	803562	602671.5	3	1808015	9000	0	2267015	0.00408	0.00413	2237015	9238
493.1466	6.200807	25.0	300000	803562	602671.5	3	1808015	9000	0	2327015	0.002028	0.002052	2297015	4714
992.2686	6.899994	30	360000	803562	602671.5	3	1808015	9000	0	2387015	0.001008	0.00102	2357015	2404
1996.56	7.599181	35.0	420000	803562	602671.5	3	1808015	9000	0	2447015	0.000501	0.000507	2417015	1225
4017.312	8.298368	40.0	480000	803562	602671.5	3	1808015	9000	0	2507015	0.000249	0.000252	2477015	624
4356.621	8.379452	45.0	540000	803562	602671.5	3	1808015	9000	0	2567015	0.00023	0.000019	2537015	49
4724.588	8.460536	50.0	600000	803562	602671.5	3	1808015	9000	0	2627015	0.000212	0.000018	2597015	46
5123.635	8.541619	55.0	660000	803562	602671.5	3	1808015	9000	0	2687015	0.000195	0.000016	2657015	44
5556.385	8.622703	60.0	720000	803562	602671.5	3	1808015	9000	0	2747015	0.00018	0.000015	2717015	41
6025.687	8.703787	65.0	780000	803562	602671.5	3	1808015	9000	0	2807015	0.000166	0.000014	2777015	39
6534.626	8.78487	70.0	840000	803562	602671.5	3	1808015	9000	0	2867015	0.000153	0.000013	2837015	37
7086.552	8.865954	75.0	900000	803562	602671.5	3	1808015	9000	0	2927015	0.000141	0.000012	2897015	35
7685.094	8.947038	80.0	960000	803562	602671.5	3	1808015	9000	0	2987015	0.00013	0.000011	2957015	32
8334.189	9.028122	85.0	1020000	803562	602671.5	3	1808015	9000	0	3047015	0.00012	0.00001	3017015	31
9038.109	9.109205	90.0	1080000	803562	602671.5	3	1808015	9000	0	3107015	0.000111	9.3E-06	3077015	29
9801.482	9.190289	95.0	1140000	803562	602671.5	3	1808015	9000	0	3167015	0.000102	8.6E-06	3137015	27
10629.33	9.271373	100.0	1200000	803562	602671.5	3	1808015	9000	0	3227015	0.000094	7.9E-06	3197015	25
		100.0	1200000	803562	602671.5	3	1808015	9000	0	3227015	0	0.000094	3227015	304

EXPECTED ANNUAL DAMAGE COST ($/YR) 83633



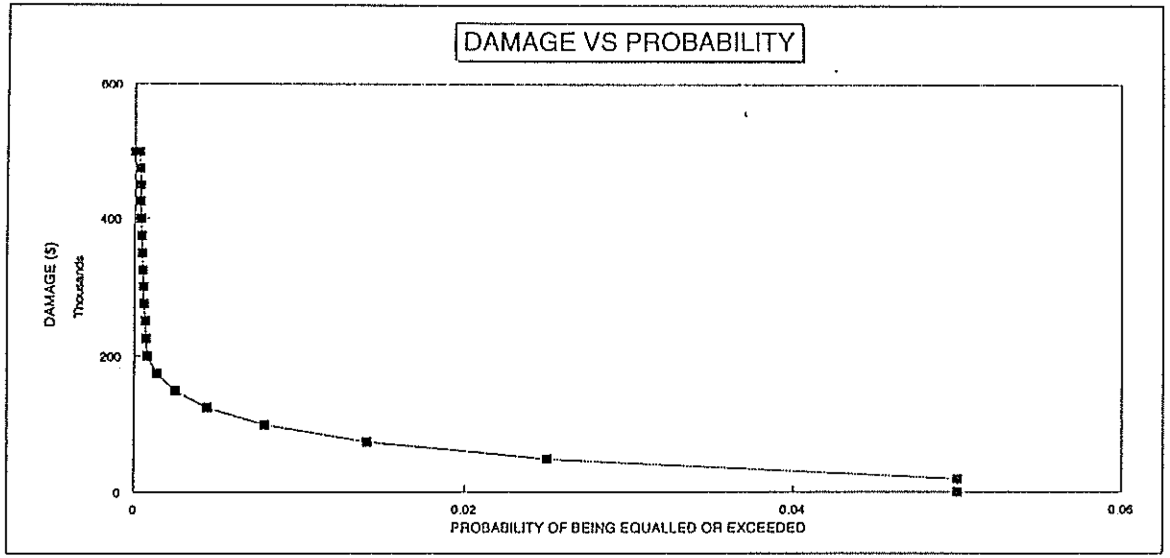
COST BREAKDOWN			
Bridge Damage	Detour	Bailey Bridge	Bypass
$5,976	$77,207	$450	$0

BRIDGE :	Paraparaumu O/bridge (20)
REPLACEMENT COST ($):	500000
DETOUR COST ($/day) :	0

POINT 1		POINT 2	
Return Period (yrs)	Damage %	Return Period (yrs)	Damage %
20	4	200	24

RETURN PERIOD	LN(RP)	DAMAGE %	DAMAGE ($)	DETOUR ($/d)	x FACTOR	OUTAGE (d)	DETOUR ($)	BAILEY COST	BYPASS COST	TOT COST($)	PROB EQ/ EXCEED	(diff)	(damage)	(product)
		0.0	0	0	0	0	0	0	0	0	0.05			
20	2.995732	4.0	20000	0	0	1	0	0	0	20000	0.05	0	10000	0
40	3.686508	10.0	50000	0	0	3	0	0	0	50000	0.025059	0.024941	35000	873
70.96268	4.262154	15.0	75000	0	0	3	0	0	0	75000	0.014092	0.010967	62500	685
126.1915	4.8378	20.0	100000	0	0	3	0	0	0	100000	0.007924	0.006167	87500	540
224.4037	5.413447	25.0	125000	0	0	3	0	0	0	125000	0.004456	0.003468	112500	390
399.0525	5.989093	30	150000	0	0	3	0	0	0	150000	0.002506	0.00195	137500	268
709.6268	6.564739	35.0	175000	0	0	3	0	0	0	175000	0.001409	0.001097	162500	178
1261.915	7.140385	40.0	200000	0	0	3	0	0	0	200000	0.000792	0.000617	187500	116
1368.498	7.221469	45.0	225000	0	0	3	0	0	0	225000	0.000731	0.000062	212500	13
1484.084	7.302553	50.0	250000	0	0	3	0	0	0	250000	0.000674	0.000057	237500	14
1609.432	7.383637	55.0	275000	0	0	3	0	0	0	275000	0.000621	0.000052	262500	14
1745.367	7.46472	60.0	300000	0	0	3	0	0	0	300000	0.000573	0.000048	287500	14
1892.784	7.545804	65.0	325000	0	0	3	0	0	0	325000	0.000528	0.000045	312500	14
2052.651	7.626888	70.0	350000	0	0	3	0	0	0	350000	0.000487	0.000041	337500	14
2226.022	7.707971	75.0	375000	0	0	3	0	0	0	375000	0.000449	0.000038	362500	14
2414.035	7.789055	80.0	400000	0	0	3	0	0	0	400000	0.000414	0.000035	387500	14
2617.929	7.870139	85.0	425000	0	0	3	0	0	0	425000	0.000382	0.000032	412500	13
2839.043	7.951222	90.0	450000	0	0	3	0	0	0	450000	0.000352	0.00003	437500	13
3078.833	8.032306	95.0	475000	0	0	3	0	0	0	475000	0.000325	0.000027	462500	13
3338.877	8.11339	100.0	500000	0	0	3	0	0	0	500000	0.0003	0.000025	487500	12
		100.0	500000	0	0	3	0	0	0	500000	0	0.0003	500000	150

EXPECTED ANNUAL DAMAGE COST ($/YR) 3361



COST BREAKDOWN			
Bridge Damage	Detour	Bailey Bridge	Bypass
$3,361	$0	$0	$0

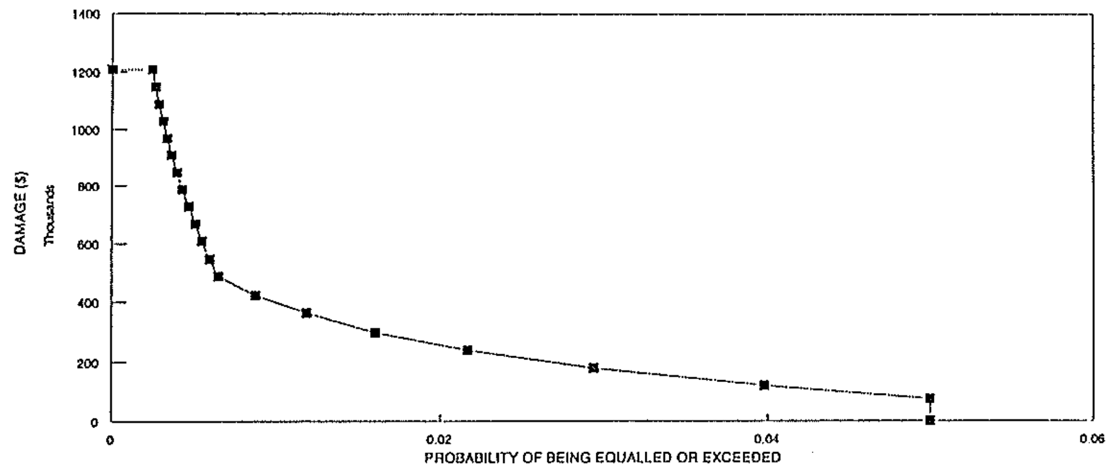
BRIDGE :	Paekakariki O/bridge (21)
REPLACEMENT COST ($):	1200000
DETOUR COST ($/day) :	5460

POINT 1		POINT 2	
Return Period (yrs)	Damage %	Return Period (yrs)	Damage %
20	6.25	140	38.33

RETURN PERIOD	LN(RP)	DAMAGE %	DAMAGE ($)	DETOUR ($/d)	x FACTOR	OUTAGE (d)	DETOUR ($)	BAILEY COST	BYPASS COST	TOT COST($)	PROB EQ/ EXCEED	(diff)	(damage)	(product)
		0.0	0	5460	4095	0	0	0	0	0	0.05			
20	2.995732	6.3	75000	5460	4095	0	0	0	0	75000	0.05	0	37500	0
25	3.2232	10.0	120000	5460	4095	0	0	0	0	120000	0.039827	0.010173	97500	992
34.00441	3.52649	15.0	180000	5460	4095	0	0	0	0	180000	0.029408	0.010419	150000	1563
46.05242	3.82978	20.0	240000	5460	4095	0	0	0	0	240000	0.021714	0.007694	210000	1616
62.36914	4.133071	25.0	300000	5460	4095	0	0	0	0	300000	0.016034	0.005681	270000	1534
84.467	4.436361	30	360000	5460	4095	1	4095	0	0	364095	0.011839	0.004195	332048	1393
114.3943	4.739651	35.0	420000	5460	4095	1	4095	0	0	424095	0.008742	0.003097	394095	1221
154.925	5.042941	40.0	480000	5460	4095	2	8190	0	0	488190	0.006455	0.002287	456143	1043
168.0103	5.124025	45.0	540000	5460	4095	2	8190	0	0	548190	0.005952	0.000503	518190	261
182.2007	5.205109	50.0	600000	5460	4095	2	8190	0	0	608190	0.005488	0.000464	578190	268
197.5897	5.286192	55.0	660000	5460	4095	2	8190	0	0	668190	0.005061	0.000427	638190	273
214.2784	5.367276	60.0	720000	5460	4095	2	8190	0	0	728190	0.004667	0.000394	698190	275
232.3767	5.44836	65.0	780000	5460	4095	2	8190	0	0	788190	0.004303	0.000363	758190	276
252.0036	5.529444	70.0	840000	5460	4095	2	8190	0	0	848190	0.003968	0.000335	818190	274
273.2883	5.610527	75.0	900000	5460	4095	2	8190	0	0	908190	0.003659	0.000309	878190	271
296.3707	5.691611	80.0	960000	5460	4095	2	8190	0	0	968190	0.003374	0.000285	938190	267
321.4026	5.772695	85.0	1020000	5460	4095	2	8190	0	0	1028190	0.003111	0.000263	998190	262
348.5488	5.853778	90.0	1080000	5460	4095	2	8190	0	0	1088190	0.002869	0.000242	1058190	256
377.9878	5.934862	95.0	1140000	5460	4095	2	8190	0	0	1148190	0.002646	0.000223	1118190	250
409.9133	6.015946	100.0	1200000	5460	4095	2	8190	0	0	1208190	0.00244	0.000206	1178190	243
		100.0	1200000	5460	4095	2	8190	0	0	1208190	0	0.00244	1208190	2947

EXPECTED ANNUAL DAMAGE COST ($/YR) 15485

DAMAGE VS PROBABILITY



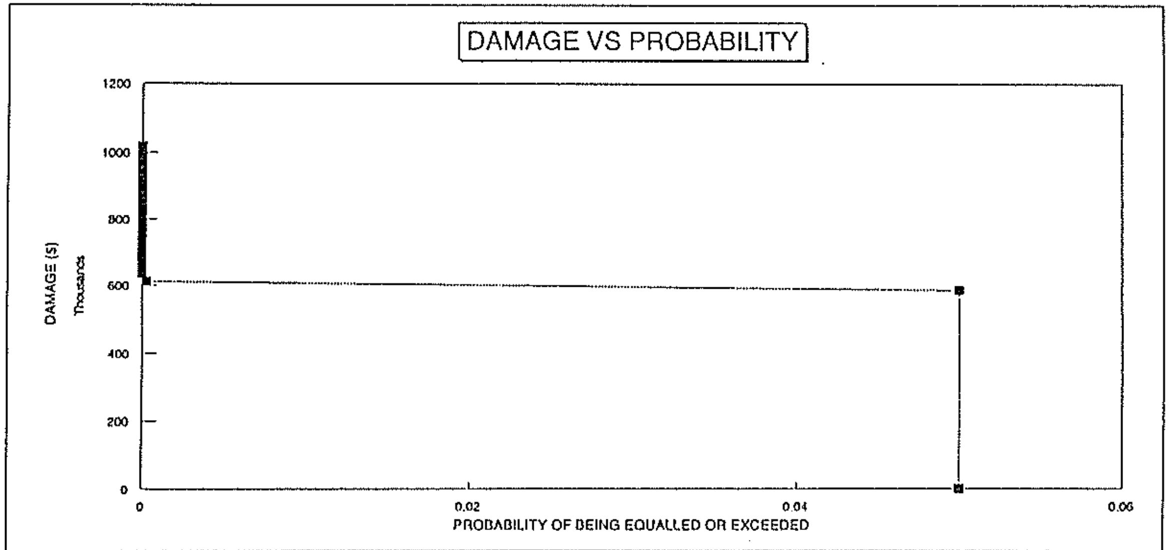
COST BREAKDOWN			
Bridge Damage	Detour	Bailey Bridge	Bypass
$15,397	$88	$0	$0

BRIDGE :	Pukerua Bay O/bridge (22)
REPLACEMENT COST ($):	450000
DETOUR COST ($/day) :	86190

POINT 1		POINT 2	
Return Period (yrs)	Damage %	Return Period (yrs)	Damage %
20	4	200	6.67

RETURN PERIOD	LN(RP)	DAMAGE %	DAMAGE ($)	DETOUR ($/d)	x FACTOR	OUTAGE (d)	DETOUR ($)	BAILEY COST	BYPASS COST	TOT COST($)	PROB EQ/ EXCEED	(diff)	(damage)	(product)
		0.0	0	86190	64642.5	0	0	0	0	0	0.05			
20	2.995732	4.0	18000	86190	64642.5	4	258570	29000	0	585570	0.05	0	292785	0
3534	8.170081	10.0	45000	86190	64642.5	4	258570	29000	0	612570	0.000283	0.049717	599070	29784
263560.4	12.48204	15.0	67500	86190	64642.5	4	258570	29000	0	635070	3.8E-06	0.000279	623820	174
19658001	16.794	20.0	90000	86190	64642.5	4	258570	29000	0	657570	5.1E-08	3.7E-06	646320	2
1.5E+09	21.10595	25.0	112500	86190	64642.5	4	258570	29000	0	680070	6.8E-10	5.0E-08	668820	0
1.1E+11	25.41791	30	135000	86190	64642.5	4	258570	29000	0	702570	9.1E-12	6.7E-10	691320	0
8.2E+12	29.72987	35.0	157500	86190	64642.5	4	258570	29000	0	725070	1.2E-13	9.0E-12	713820	0
6.1E+14	34.04182	40.0	180000	86190	64642.5	4	258570	29000	0	747570	1.6E-15	1.2E-13	736320	0
6.6E+14	34.12291	45.0	202500	86190	64642.5	4	258570	29000	0	770070	1.5E-15	1.3E-16	758820	0
7.2E+14	34.20399	50.0	225000	86190	64642.5	4	258570	29000	0	792570	1.4E-15	1.2E-16	781320	0
7.8E+14	34.28507	55.0	247500	86190	64642.5	4	258570	29000	0	815070	1.3E-15	1.1E-16	803820	0
8.4E+14	34.36616	60.0	270000	86190	64642.5	4	258570	29000	0	837570	1.2E-15	1.0E-16	826320	0
9.1E+14	34.44724	65.0	292500	86190	64642.5	4	258570	29000	0	860070	1.1E-15	9.3E-17	848820	0
9.9E+14	34.52833	70.0	315000	86190	64642.5	4	258570	29000	0	882570	1.0E-15	8.5E-17	871320	0
1.1E+15	34.60941	75.0	337500	86190	64642.5	4	258570	29000	0	905070	9.3E-16	7.9E-17	893820	0
1.2E+15	34.69049	80.0	360000	86190	64642.5	4	258570	29000	0	927570	8.6E-16	7.3E-17	916320	0
1.3E+15	34.77158	85.0	382500	86190	64642.5	4	258570	29000	0	950070	7.9E-16	6.7E-17	938820	0
1.4E+15	34.85266	90.0	405000	86190	64642.5	4	258570	29000	0	972570	7.3E-16	6.2E-17	961320	0
1.5E+15	34.93374	95.0	427500	86190	64642.5	4	258570	29000	0	995070	6.7E-16	5.7E-17	983820	0
1.6E+15	35.01483	100.0	450000	86190	64642.5	4	258570	29000	0	1017570	6.2E-16	5.2E-17	1006320	0
		100.0	450000	86190	64642.5	4	258570	29000	0	1017570	0	6.2E-16	1017570	0

EXPECTED ANNUAL DAMAGE COST ($/YR) 29961



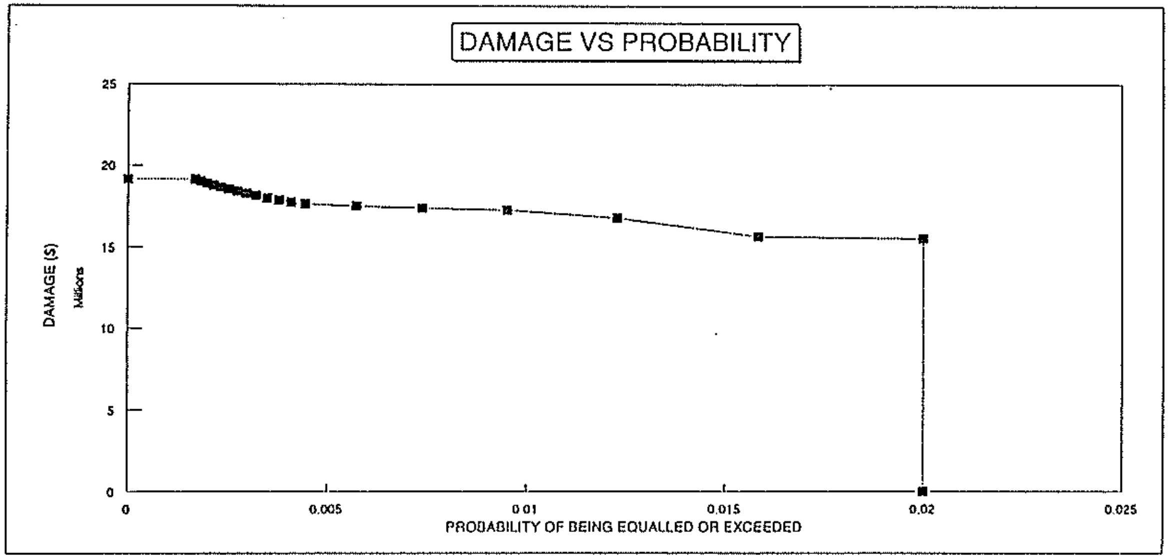
COST BREAKDOWN			
Bridge Damage	Detour	Bailey Bridge	Bypass
$1,582	$26,929	$1,450	$0

BRIDGE :	Paremata Harbour (23)
REPLACEMENT COST ($):	2500000
DETOUR COST ($/day) :	190636

POINT 1		POINT 2	
Return Period (yrs)	Damage %	Return Period (yrs)	Damage %
50	10.4	90	22

RETURN PERIOD	LN(RP)	DAMAGE %	DAMAGE ($)	DETOUR ($/d)	x FACTOR	OUTAGE (d)	DETOUR ($)	BAILEY COST	BYPASS COST	TOT COST($)	PROB EQ/ EXCEED	(diff)	(damage)	(product)
		0.0	0	190636	142977	0	0	0	0	0	0.02			
50	3.912023	10.4	260000	190636	142977	85	12153045	270000	0	15558045	0.02	0	7779023	0
63.12462	4.145111	15.0	375000	190636	142977	85	12153045	270000	0	15673045	0.015842	0.004158	15615545	64934
81.32611	4.398467	20.0	500000	190636	142977	85	12153045	270000	0	16798045	0.012296	0.003546	16235545	57563
104.7759	4.651823	25.0	625000	190636	142977	85	12153045	270000	0	17298045	0.009544	0.002752	17048045	46916
134.9872	4.90518	30	750000	190636	142977	85	12153045	270000	0	17423045	0.007408	0.002136	17360545	37083
173.9097	5.158536	35.0	875000	190636	142977	85	12153045	270000	0	17548045	0.00575	0.001658	17485545	28991
224.0552	5.411892	40.0	1000000	190636	142977	85	12153045	270000	0	17673045	0.004463	0.001287	17610545	22663
242.9793	5.492976	45.0	1125000	190636	142977	85	12153045	270000	0	17798045	0.004116	0.000348	17735545	6165
263.5017	5.57406	50.0	1250000	190636	142977	85	12153045	270000	0	17923045	0.003795	0.000321	17860545	5725
285.7575	5.655144	55.0	1375000	190636	142977	85	12153045	270000	0	18048045	0.003499	0.000296	17985545	5316
309.893	5.736227	60.0	1500000	190636	142977	85	12153045	270000	0	18173045	0.003227	0.000273	18110545	4936
336.0671	5.817311	65.0	1625000	190636	142977	85	12153045	270000	0	18298045	0.002976	0.000251	18235545	4583
364.4519	5.898395	70.0	1750000	190636	142977	85	12153045	270000	0	18423045	0.002744	0.000232	18360545	4255
395.2341	5.979478	75.0	1875000	190636	142977	85	12153045	270000	0	18548045	0.00253	0.000214	18485545	3950
428.6162	6.060562	80.0	2000000	190636	142977	85	12153045	270000	0	18673045	0.002333	0.000197	18610545	3667
464.8179	6.141646	85.0	2125000	190636	142977	85	12153045	270000	0	18798045	0.002151	0.000182	18735545	3404
504.0772	6.222729	90.0	2250000	190636	142977	85	12153045	270000	0	18923045	0.001984	0.000168	18860545	3160
546.6524	6.303813	95.0	2375000	190636	142977	85	12153045	270000	0	19048045	0.001829	0.000155	18985545	2933
592.8235	6.384897	100.0	2500000	190636	142977	85	12153045	270000	0	19173045	0.001687	0.000142	19110545	2723
		100.0	2500000	190636	142977	85	12153045	270000	0	19173045	0	0.001687	19173045	32342

EXPECTED ANNUAL DAMAGE COST ($/YR) **341312**



COST BREAKDOWN			
Bridge Damage	Detour	Bailey Bridge	Bypass
$17,187	$318,725	$5,400	$0

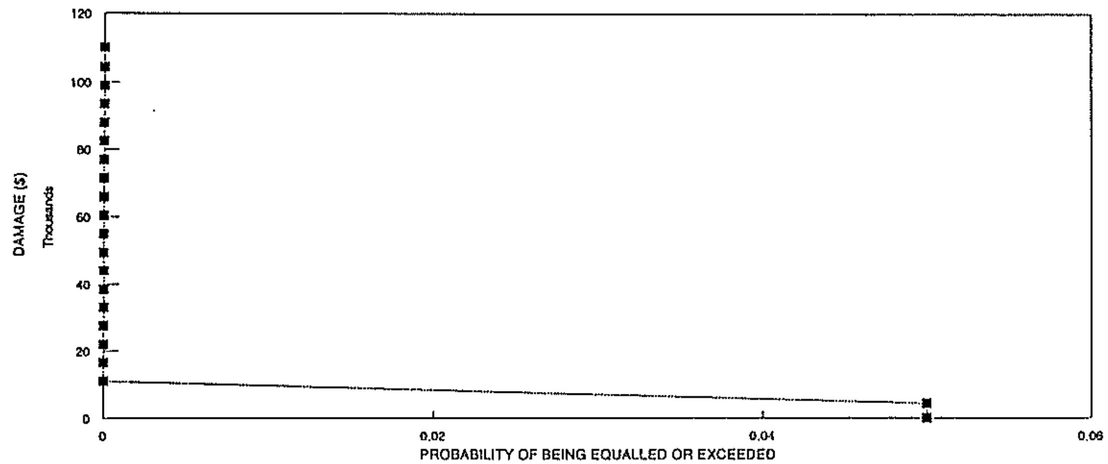
BRIDGE :	Kenepuru Stream (24)
REPLACEMENT COST ($):	110000
DETOUR COST ($/day) :	11782

POINT 1		POINT 2	
Return Period (yrs)	Damage %	Return Period (yrs)	Damage %
20	4	150	4.55

RETURN PERIOD	LN(RP)	DAMAGE %	DAMAGE ($)	DETOUR ($/d)	x FACTOR	OUTAGE (d)	DETOUR ($)	BAILEY COST	BYPASS COST	TOT COST($)	PROB EQ/ EXCEED	(diff)	(damage)	(product)
		0.0	0	11782	8836.5	0	0	0	0	0	0.05			
20	2.995732	4.0	4400	11782	8836.5	0	0	0	0	4400	0.05	0	2200	0
7.03E+10	24.97649	10.0	11000	11782	8836.5	0	0	0	0	11000	1.4E-11	0.05	7700	385
6.3E+18	43.29379	15.0	16500	11782	8836.5	0	0	0	0	16500	1.6E-19	1.4E-11	13750	0
5.7E+26	61.61109	20.0	22000	11782	8836.5	0	0	0	0	22000	1.7E-27	1.6E-19	19250	0
5.2E+34	79.92839	25.0	27500	11782	8836.5	0	0	0	0	27500	1.9E-35	1.7E-27	24750	0
4.7E+42	98.24569	30	33000	11782	8836.5	0	0	0	0	33000	2.1E-43	1.9E-35	30250	0
4.2E+50	116.563	35.0	38500	11782	8836.5	0	0	0	0	38500	2.4E-51	2.1E-43	35750	0
3.8E+58	134.8803	40.0	44000	11782	8836.5	0	0	0	0	44000	2.6E-59	2.4E-51	41250	0
4.1E+58	134.9614	45.0	49500	11782	8836.5	0	0	0	0	49500	2.4E-59	2.1E-60	46750	0
4.4E+58	135.0425	50.0	55000	11782	8836.5	0	0	0	0	55000	2.2E-59	1.9E-60	52250	0
4.8E+58	135.1235	55.0	60500	11782	8836.5	0	0	0	0	60500	2.1E-59	1.8E-60	57750	0
5.2E+58	135.2046	60.0	66000	11782	8836.5	0	0	0	0	66000	1.9E-59	1.6E-60	63250	0
5.7E+58	135.2857	65.0	71500	11782	8836.5	0	0	0	0	71500	1.8E-59	1.5E-60	68750	0
6.2E+58	135.3668	70.0	77000	11782	8836.5	0	0	0	0	77000	1.6E-59	1.4E-60	74250	0
6.7E+58	135.4479	75.0	82500	11782	8836.5	0	0	0	0	82500	1.5E-59	1.3E-60	79750	0
7.2E+58	135.529	80.0	88000	11782	8836.5	0	0	0	0	88000	1.4E-59	1.2E-60	85250	0
7.8E+58	135.61	85.0	93500	11782	8836.5	0	0	0	0	93500	1.3E-59	1.1E-60	90750	0
8.5E+58	135.6911	90.0	99000	11782	8836.5	0	0	0	0	99000	1.2E-59	9.9E-61	96250	0
9.2E+58	135.7722	95.0	104500	11782	8836.5	0	0	0	0	104500	1.1E-59	9.2E-61	101750	0
1.0E+59	135.8533	100.0	110000	11782	8836.5	0	0	0	0	110000	1.0E-59	8.4E-61	107250	0
		100.0	110000	11782	8836.5	0	0	0	0	110000	0	1.0E-59	110000	0

EXPECTED ANNUAL DAMAGE COST ($/YR) 385

DAMAGE VS PROBABILITY



COST BREAKDOWN			
Bridge Damage	Detour	Bailey Bridge	Bypass
$385	$0	$0	$0

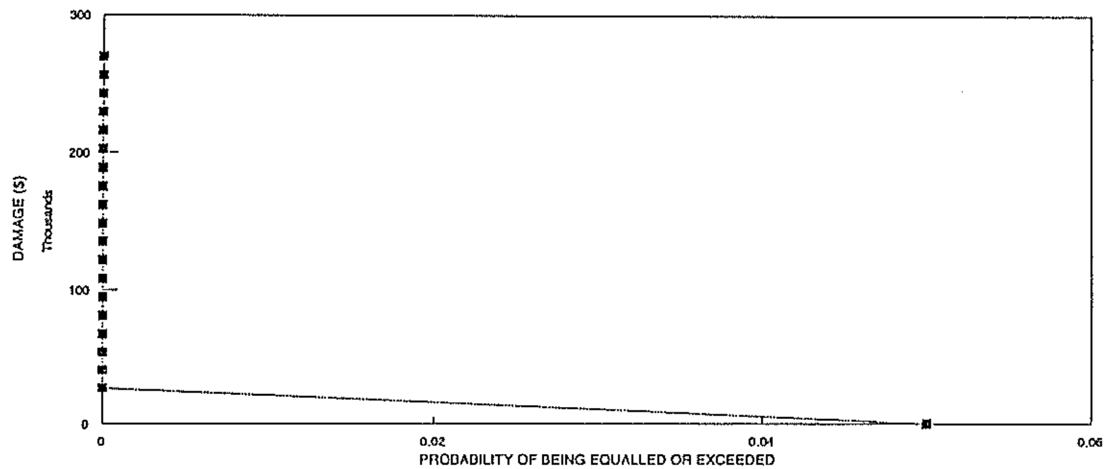
BRIDGE :	Collins Ave East (25)
REPLACEMENT COST ($):	270000
DETOUR COST ($/day) :	19926

POINT 1		POINT 2	
Return Period (yrs)	Damage %	Return Period (yrs)	Damage %
20	0	150	19

RETURN PERIOD	LN(RP)	DAMAGE %	DAMAGE ($)	DETOUR ($/d)	x FACTOR	OUTAGE (d)	DETOUR ($)	BAILEY COST	BYPASS COST	TOT COST($)	PROB EQ/ EXCEED	(diff)	(damage)	(product)
		0.0	0	19926	14944.5	0	0	0	0	0	0.05			
20	2.995732	0.0	0	19926	14944.5	0	0	0	0	0	0.05	0	0	0
8.07E+05	13.60049	10.0	27000	19926	14944.5	0	0	0	0	27000	1.2E-06	0.049999	13500	675
1.6E+08	18.90286	15.0	40500	19926	14944.5	0	0	0	0	40500	6.2E-09	1.2E-06	33750	0
3.3E+10	24.20524	20.0	54000	19926	14944.5	0	0	0	0	54000	3.1E-11	6.1E-09	47250	0
6.5E+12	29.50761	25.0	67500	19926	14944.5	0	0	0	0	67500	1.5E-13	3.1E-11	60750	0
1.3E+15	34.80999	30	81000	19926	14944.5	0	0	0	0	81000	7.6E-16	1.5E-13	74250	0
2.6E+17	40.11237	35.0	94500	19926	14944.5	0	0	0	0	94500	3.8E-18	7.6E-16	87750	0
5.3E+19	45.41474	40.0	108000	19926	14944.5	0	0	0	0	108000	1.9E-20	3.8E-18	101250	0
5.7E+19	45.49583	45.0	121500	19926	14944.5	0	0	0	0	121500	1.7E-20	1.5E-21	114750	0
6.2E+19	45.57691	50.0	135000	19926	14944.5	0	0	0	0	135000	1.6E-20	1.4E-21	128250	0
6.7E+19	45.65799	55.0	148500	19926	14944.5	0	0	0	0	148500	1.5E-20	1.3E-21	141750	0
7.3E+19	45.73908	60.0	162000	19926	14944.5	0	0	0	0	162000	1.4E-20	1.2E-21	155250	0
7.9E+19	45.82016	65.0	175500	19926	14944.5	0	0	0	0	175500	1.3E-20	1.1E-21	168750	0
8.6E+19	45.90125	70.0	189000	19926	14944.5	0	0	0	0	189000	1.2E-20	9.8E-22	182250	0
9.3E+19	45.98233	75.0	202500	19926	14944.5	0	0	0	0	202500	1.1E-20	9.1E-22	195750	0
1.0E+20	46.06341	80.0	216000	19926	14944.5	0	0	0	0	216000	9.9E-21	8.3E-22	209250	0
1.1E+20	46.1445	85.0	229500	19926	14944.5	0	0	0	0	229500	9.1E-21	7.7E-22	222750	0
1.2E+20	46.22558	90.0	243000	19926	14944.5	0	0	0	0	243000	8.4E-21	7.1E-22	236250	0
1.3E+20	46.30666	95.0	256500	19926	14944.5	0	0	0	0	256500	7.7E-21	6.5E-22	249750	0
1.4E+20	46.38775	100.0	270000	19926	14944.5	0	0	0	0	270000	7.1E-21	6.0E-22	263250	0
		100.0	270000	19926	14944.5	0	0	0	0	270000	0	7.1E-21	270000	0

EXPECTED ANNUAL DAMAGE COST ($/YR) 675

DAMAGE VS PROBABILITY



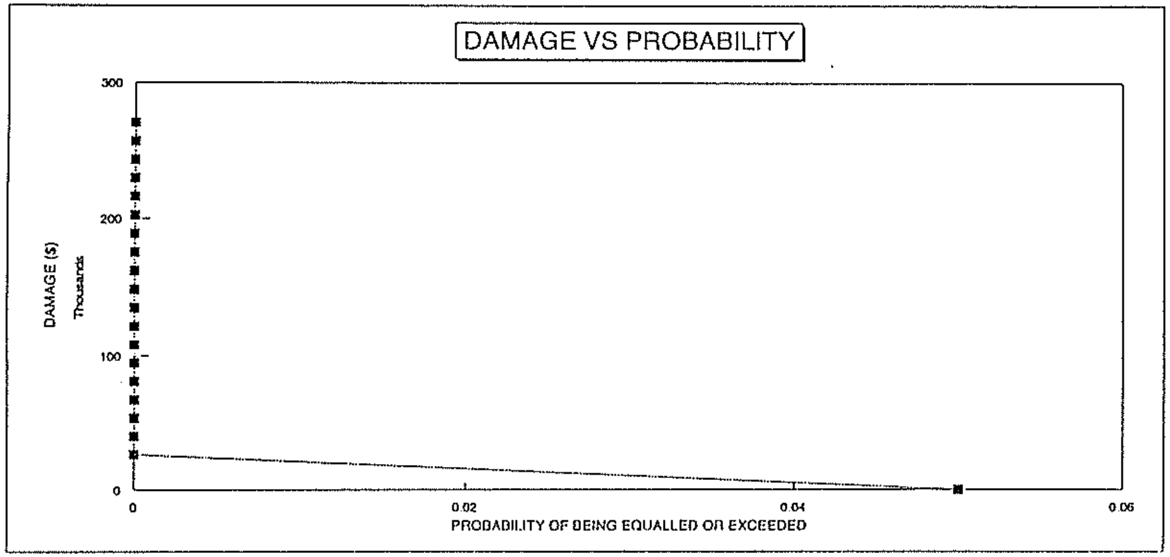
COST BREAKDOWN			
Bridge Damage	Detour	Bailey Bridge	Bypass
$675	$0	$0	$0

BRIDGE :	Collins Ave West (26)
REPLACEMENT COST ($):	270000
DETOUR COST ($/day) :	14391

POINT 1		POINT 2	
Return Period (yrs)	Damage %	Return Period (yrs)	Damage %
20	0	150	1.9

RETURN PERIOD	LN(RP)	DAMAGE %	DAMAGE ($)	DETOUR ($/d)	x FACTOR	OUTAGE (d)	DETOUR ($)	BAILEY COST	BYPASS COST	TOT COST($)	PROB EQ/ EXCEED	(diff)	(damage)	(product)
		0.0	0	14391	10793.25	0	0	0	0	0	0.05			
20	2.995732	0.0	0	14391	10793.25	0	0	0	0	0	0.05	0	0	0
8.07E+05	13.60049	10.0	27000	14391	10793.25	0	0	0	0	27000	1.2E-06	0.049999	13500	675
1.6E+08	18.90286	15.0	40500	14391	10793.25	0	0	0	0	40500	6.2E-09	1.2E-06	33750	0
3.3E+10	24.20524	20.0	54000	14391	10793.25	0	0	0	0	54000	3.1E-11	6.1E-09	47250	0
6.5E+12	29.50761	25.0	67500	14391	10793.25	0	0	0	0	67500	1.5E-13	3.1E-11	60750	0
1.3E+15	34.80999	30	81000	14391	10793.25	0	0	0	0	81000	7.6E-16	1.5E-13	74250	0
2.6E+17	40.11237	35.0	94500	14391	10793.25	0	0	0	0	94500	3.8E-18	7.6E-16	87750	0
5.3E+19	45.41474	40.0	108000	14391	10793.25	0	0	0	0	108000	1.9E-20	3.8E-18	101250	0
5.7E+19	45.49583	45.0	121500	14391	10793.25	0	0	0	0	121500	1.7E-20	1.5E-21	114750	0
6.2E+19	45.57691	50.0	135000	14391	10793.25	0	0	0	0	135000	1.6E-20	1.4E-21	128250	0
6.7E+19	45.65799	55.0	148500	14391	10793.25	0	0	0	0	148500	1.5E-20	1.3E-21	141750	0
7.3E+19	45.73908	60.0	162000	14391	10793.25	0	0	0	0	162000	1.4E-20	1.2E-21	155250	0
7.9E+19	45.82016	65.0	175500	14391	10793.25	0	0	0	0	175500	1.3E-20	1.1E-21	168750	0
8.6E+19	45.90125	70.0	189000	14391	10793.25	0	0	0	0	189000	1.2E-20	9.8E-22	182250	0
9.3E+19	45.98233	75.0	202500	14391	10793.25	0	0	0	0	202500	1.1E-20	9.1E-22	195750	0
1.0E+20	46.06341	80.0	216000	14391	10793.25	0	0	0	0	216000	9.9E-21	8.3E-22	209250	0
1.1E+20	46.1445	85.0	229500	14391	10793.25	0	0	0	0	229500	9.1E-21	7.7E-22	222750	0
1.2E+20	46.22558	90.0	243000	14391	10793.25	0	0	0	0	243000	8.4E-21	7.1E-22	236250	0
1.3E+20	46.30666	95.0	256500	14391	10793.25	0	0	0	0	256500	7.7E-21	6.5E-22	249750	0
1.4E+20	46.38775	100.0	270000	14391	10793.25	0	0	0	0	270000	7.1E-21	6.0E-22	263250	0
		100.0	270000	14391	10793.25	0	0	0	0	270000	0	7.1E-21	270000	0

EXPECTED ANNUAL DAMAGE COST ($/YR) 675



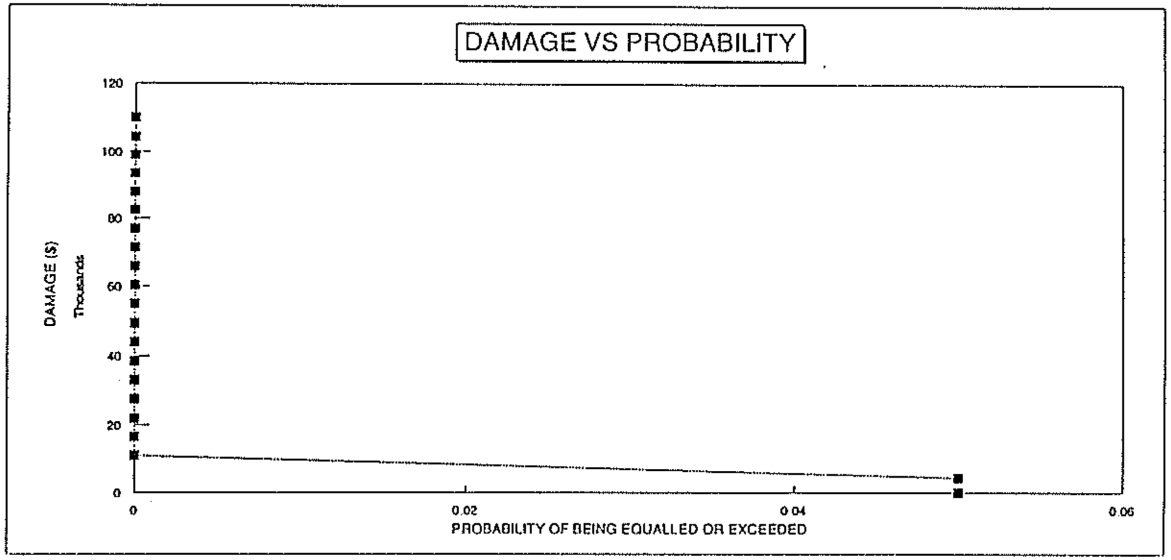
COST BREAKDOWN			
Bridge Damage	Detour	Bailey Bridge	Bypass
$675	$0	$0	$0

BRIDGE :	Takapu Rd O/bridge (27)
REPLACEMENT COST ($):	110000
DETOUR COST ($/day) :	24293

POINT 1		POINT 2	
Return Period (yrs)	Damage %	Return Period (yrs)	Damage %
20	4	300	4.55

RETURN PERIOD	LN(RP)	DAMAGE %	DAMAGE ($)	DETOUR ($/d)	x FACTOR	OUTAGE (d)	DETOUR ($)	BAILEY COST	BYPASS COST	TOT COST($)	PROB EQ/ EXCEED	(diff)	(damage)	(product)
		0.0	0	24293	18219.75	0	0	0	0	0	0.05			
20	2.995732	4.0	4400	24293	18219.75	0	0	0	0	4400	0.05	0	2200	0
1.35E+14	32.5381	10.0	11000	24293	18219.75	0	0	0	0	11000	7.4E-15	0.05	7700	385
6.7E+24	57.15674	15.0	16500	24293	18219.75	0	0	0	0	16500	1.5E-25	7.4E-15	13750	0
3.3E+35	81.77537	20.0	22000	24293	18219.75	0	0	0	0	22000	3.1E-36	1.5E-25	19250	0
1.6E+46	106.394	25.0	27500	24293	18219.75	0	0	0	0	27500	6.2E-47	3.1E-36	24750	0
7.9E+56	131.0127	30	33000	24293	18219.75	0	0	0	0	33000	1.3E-57	6.2E-47	30250	0
3.9E+67	155.6313	35.0	38500	24293	18219.75	0	0	0	0	38500	2.6E-68	1.3E-57	35750	0
1.9E+78	180.2499	40.0	44000	24293	18219.75	0	0	0	0	44000	5.2E-79	2.6E-68	41250	0
2.1E+78	180.331	45.0	49500	24293	18219.75	0	0	0	0	49500	4.8E-79	4.1E-80	46750	0
2.2E+78	180.4121	50.0	55000	24293	18219.75	0	0	0	0	55000	4.4E-79	3.8E-80	52250	0
2.4E+78	180.4932	55.0	60500	24293	18219.75	0	0	0	0	60500	4.1E-79	3.5E-80	57750	0
2.6E+78	180.5743	60.0	66000	24293	18219.75	0	0	0	0	66000	3.8E-79	3.2E-80	63250	0
2.9E+78	180.6553	65.0	71500	24293	18219.75	0	0	0	0	71500	3.5E-79	2.9E-80	68750	0
3.1E+78	180.7364	70.0	77000	24293	18219.75	0	0	0	0	77000	3.2E-79	2.7E-80	74250	0
3.4E+78	180.8175	75.0	82500	24293	18219.75	0	0	0	0	82500	3.0E-79	2.5E-80	79750	0
3.7E+78	180.8986	80.0	88000	24293	18219.75	0	0	0	0	88000	2.7E-79	2.3E-80	85250	0
4.0E+78	180.9797	85.0	93500	24293	18219.75	0	0	0	0	93500	2.5E-79	2.1E-80	90750	0
4.3E+78	181.0608	90.0	99000	24293	18219.75	0	0	0	0	99000	2.3E-79	2.0E-80	96250	0
4.7E+78	181.1418	95.0	104500	24293	18219.75	0	0	0	0	104500	2.1E-79	1.8E-80	101750	0
5.1E+78	181.2229	100.0	110000	24293	18219.75	0	0	0	0	110000	2.0E-79	1.7E-80	107250	0
		100.0	110000	24293	18219.75	0	0	0	0	110000	0	2.0E-79	110000	0

EXPECTED ANNUAL DAMAGE COST ($/YR) 385



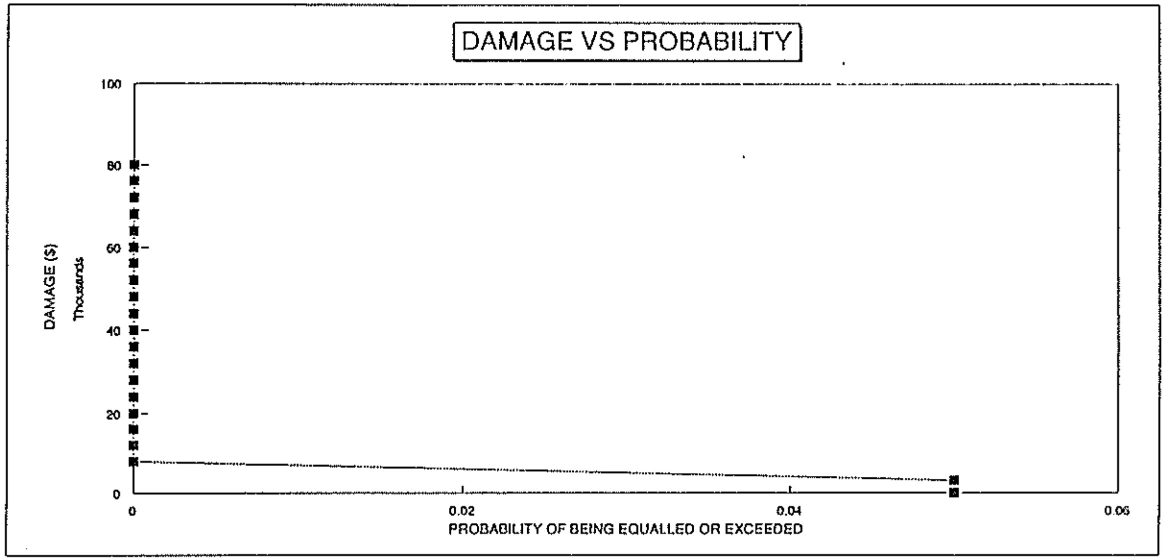
COST BREAKDOWN			
Bridge Damage	Detour	Bailey Bridge	Bypass
$385	$0	$0	$0

BRIDGE :	Johnsonville Nth O/pass (28)
REPLACEMENT COST ($):	80000
DETOUR COST ($/day) :	9724

POINT 1		POINT 2	
Return Period (yrs)	Damage %	Return Period (yrs)	Damage %
20	4	300	6.25

RETURN PERIOD	LN(RP)	DAMAGE %	DAMAGE ($)	DETOUR ($/d)	x FACTOR	OUTAGE (d)	DETOUR ($)	BAILEY COST	BYPASS COST	TOT COST($)	PROB EQ/ EXCEED	(diff)	(damage)	(product)
		0.0	0	9724	7293	0	0	0	0	0	0.05			
20	2.995732	4.0	3200	9724	7293	0	0	0	0	3200	0.05	0	1600	0
2.74E+04	10.2172	10.0	8000	9724	7293	0	0	0	0	8000	0.000037	0.049963	5600	280
11241117	16.23509	15.0	12000	9724	7293	0	0	0	0	12000	8.9E-08	0.000036	10000	0
4.6E+09	22.25298	20.0	16000	9724	7293	0	0	0	0	16000	2.2E-10	8.9E-08	14000	0
1.9E+12	28.27087	25.0	20000	9724	7293	0	0	0	0	20000	5.3E-13	2.2E-10	18000	0
7.8E+14	34.28876	30	24000	9724	7293	0	0	0	0	24000	1.3E-15	5.3E-13	22000	0
3.2E+17	40.30665	35.0	28000	9724	7293	0	0	0	0	28000	3.1E-18	1.3E-15	26000	0
1.3E+20	46.32454	40.0	32000	9724	7293	0	0	0	0	32000	7.6E-21	3.1E-18	30000	0
1.4E+20	46.40562	45.0	36000	9724	7293	0	0	0	0	36000	7.0E-21	5.9E-22	34000	0
1.5E+20	46.4867	50.0	40000	9724	7293	0	0	0	0	40000	6.5E-21	5.5E-22	38000	0
1.7E+20	46.56779	55.0	44000	9724	7293	0	0	0	0	44000	6.0E-21	5.0E-22	42000	0
1.8E+20	46.64887	60.0	48000	9724	7293	0	0	0	0	48000	5.5E-21	4.6E-22	46000	0
2.0E+20	46.72995	65.0	52000	9724	7293	0	0	0	0	52000	5.1E-21	4.3E-22	50000	0
2.1E+20	46.81104	70.0	56000	9724	7293	0	0	0	0	56000	4.7E-21	4.0E-22	54000	0
2.3E+20	46.89212	75.0	60000	9724	7293	0	0	0	0	60000	4.3E-21	3.6E-22	58000	0
2.5E+20	46.97321	80.0	64000	9724	7293	0	0	0	0	64000	4.0E-21	3.4E-22	62000	0
2.7E+20	47.05429	85.0	68000	9724	7293	0	0	0	0	68000	3.7E-21	3.1E-22	66000	0
3.0E+20	47.13537	90.0	72000	9724	7293	0	0	0	0	72000	3.4E-21	2.9E-22	70000	0
3.2E+20	47.21646	95.0	76000	9724	7293	0	0	0	0	76000	3.1E-21	2.6E-22	74000	0
3.5E+20	47.29754	100.0	80000	9724	7293	0	0	0	0	80000	2.9E-21	2.4E-22	78000	0
		100.0	80000	9724	7293	0	0	0	0	80000	0	2.9E-21	80000	0

EXPECTED ANNUAL DAMAGE COST ($/YR) 280



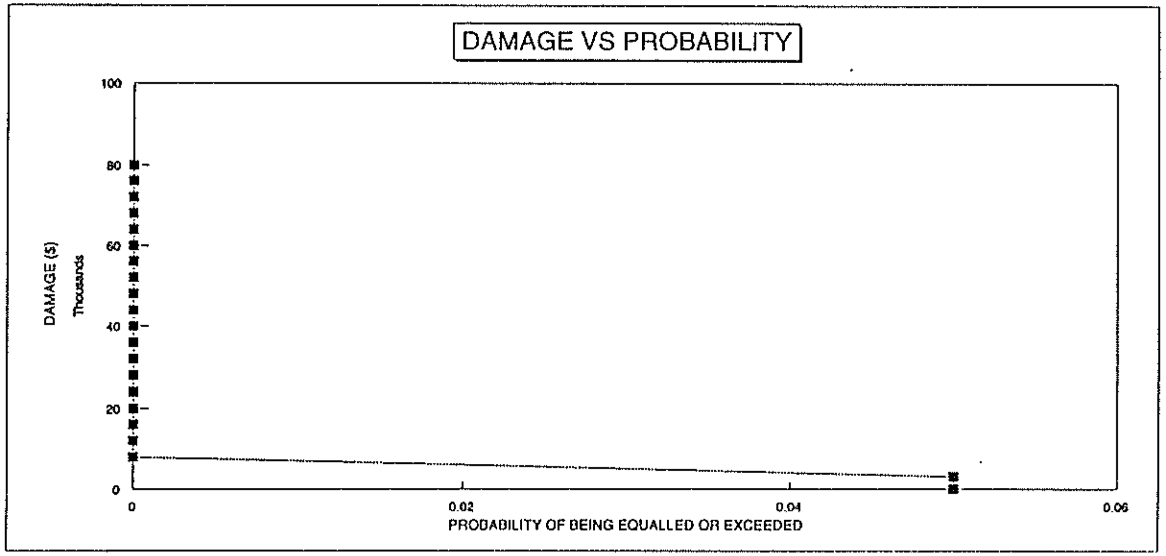
COST BREAKDOWN			
Bridge Damage	Detour	Bailey Bridge	Bypass
$280	$0	$0	$0

BRIDGE :	Johnsonville Sth O/pass (29)
REPLACEMENT COST ($):	80000
DETOUR COST ($/day) :	0

POINT 1		POINT 2	
Return Period (yrs)	Damage %	Return Period (yrs)	Damage %
20	4	300	6.25

RETURN PERIOD	LN(RP)	DAMAGE %	DAMAGE ($)	DETOUR ($/d)	x FACTOR	OUTAGE (d)	DETOUR ($)	BAILEY COST	BYPASS COST	TOT COST($)	PROB EQ/ EXCEED	(diff)	(damage)	(product)
		0.0	0	0	0	0	0	0	0	0	0.05			
20	2.995732	4.0	3200	0	0	0	0	0	0	3200	0.05	0	1600	0
2.74E+04	10.2172	10.0	8000	0	0	0	0	0	0	8000	0.000037	0.049963	5600	280
11241117	16.23509	15.0	12000	0	0	0	0	0	0	12000	8.9E-08	0.000036	10000	0
4.6E+09	22.25298	20.0	16000	0	0	0	0	0	0	16000	2.2E-10	8.9E-08	14000	0
1.9E+12	28.27087	25.0	20000	0	0	0	0	0	0	20000	5.3E-13	2.2E-10	18000	0
7.8E+14	34.28876	30	24000	0	0	0	0	0	0	24000	1.3E-15	5.3E-13	22000	0
3.2E+17	40.30665	35.0	28000	0	0	0	0	0	0	28000	3.1E-18	1.3E-15	26000	0
1.3E+20	46.32454	40.0	32000	0	0	0	0	0	0	32000	7.6E-21	3.1E-18	30000	0
1.4E+20	46.40562	45.0	36000	0	0	0	0	0	0	36000	7.0E-21	5.9E-22	34000	0
1.5E+20	46.4867	50.0	40000	0	0	0	0	0	0	40000	6.5E-21	5.5E-22	38000	0
1.7E+20	46.56779	55.0	44000	0	0	0	0	0	0	44000	6.0E-21	5.0E-22	42000	0
1.8E+20	46.64887	60.0	48000	0	0	0	0	0	0	48000	5.5E-21	4.6E-22	46000	0
2.0E+20	46.72995	65.0	52000	0	0	0	0	0	0	52000	5.1E-21	4.3E-22	50000	0
2.1E+20	46.81104	70.0	56000	0	0	0	0	0	0	56000	4.7E-21	4.0E-22	54000	0
2.3E+20	46.89212	75.0	60000	0	0	0	0	0	0	60000	4.3E-21	3.6E-22	58000	0
2.5E+20	46.97321	80.0	64000	0	0	0	0	0	0	64000	4.0E-21	3.4E-22	62000	0
2.7E+20	47.05429	85.0	68000	0	0	0	0	0	0	68000	3.7E-21	3.1E-22	66000	0
3.0E+20	47.13537	90.0	72000	0	0	0	0	0	0	72000	3.4E-21	2.9E-22	70000	0
3.2E+20	47.21646	95.0	76000	0	0	0	0	0	0	76000	3.1E-21	2.6E-22	74000	0
3.5E+20	47.29754	100.0	80000	0	0	0	0	0	0	80000	2.9E-21	2.4E-22	78000	0
		100.0	80000	0	0	0	0	0	0	80000	0	2.9E-21	80000	0

EXPECTED ANNUAL DAMAGE COST ($/YR) 280



COST BREAKDOWN			
Bridge Damage	Detour	Bailey Bridge	Bypass
$280	$0	$0	$0

APPENDIX 3

SUMMARIES OF RESULTS OF SCREENING USING VARIOUS ATTRIBUTE FACTORS

PILOT APPRAISAL OF SEISMIC SCREENING PROCEDURES
STATE HIGHWAY 1 BRIDGES BETWEEN RP 844/1.27 AND 979/4.61

Sorted by Route Position Order

SH1 RP	Bridge Name	Excluded from Prioritisation By Screening Procedure	Seismic Prioritisation Grade (SPG)	Hazard Index	Importance Index	Vulnerability Index	Hazard Index Factors: Peak Ground Accln.	Remaining Service Life	Soil Condition	Liquefaction Risk	Importance Index Factors: AADT On Bridge	AADT Under Bridge	Detour Length	Facility Crossed	Route Type	Critical Utility	Vulnerability Index Factors: Year Designed	Super-structure Hinges	Super-structure Overlap	Super-structure Length	Pier Type	Bridge Skew	Abutment Type	Other Feature	Route Position Order	Economic Analysis Ranking	Difference Econ-SPG Rankings
844/1.27	Rangitikei River Bridge at Bulls	no	0.39	0.76	0.45	0.60	1.00	0.70	0.00	1.00	0.70	0.00	0.18	0.00	1.00	1.00	0.50	1.00	0.00	1.00	0.50	0.00	1.00	1.00	1	3	-11
845/2.38	Makowai Stream Bridge	yes	0.23	0.76	0.42	0.13	1.00	0.70	0.00	1.00	0.69	0.00	0.01	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.09	0.00	0.00	2	27	-2
845/3.82	Piakatutu Stream Bridge	yes	0.28	0.91	0.42	0.13	1.00	0.70	1.00	1.00	0.69	0.00	0.00	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.09	0.00	0.00	3	29	5
850/4.35	Makahakaroa Stream Bridge	yes	0.27	0.91	0.41	0.13	1.00	0.70	1.00	1.00	0.63	0.00	0.03	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4	26	1
850/5.67	Makowai No 2 Bridge	No Drawings Available		Could Not Be Assessed																					5		
850/5.68	Makowai No 2 Bridge	No Drawings Available		Could Not Be Assessed																					6		
872/12.41	North Whirokino Trestle	yes	0.31	0.91	0.43	0.20	1.00	0.70	1.00	1.00	0.63	0.00	0.17	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.50	0.00	0.00	0.00	7	17	-3
872/13.04	Whirokino Trestle	no	0.33	0.91	0.43	0.27	1.00	0.70	1.00	1.00	0.63	0.00	0.17	0.00	1.00	1.00	0.50	0.00	0.00	1.00	0.50	0.00	0.00	0.00	8	7	-11
872/14.30	Manawatu River (Whirokino) Bridge	no	0.48	0.91	0.47	0.62	1.00	0.70	1.00	1.00	0.63	0.00	0.40	0.00	1.00	1.00	0.50	1.00	0.00	1.00	0.50	0.22	1.00	1.00	9	6	-1
900/6.77	Ohau River Bridge	no	0.48	1.00	0.59	0.31	1.00	1.00	1.00	1.00	0.75	0.00	1.00	0.00	1.00	1.00	0.50	0.50	0.00	1.00	0.50	0.00	0.00	0.00	10	1	-7
900/7.04	Ohau Overbridge	yes	0.58	1.00	0.84	0.19	1.00	1.00	1.00	1.00	0.75	1.00	1.00	0.50	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.61	0.00	0.00	11	10	8
900/8.16	Kuku Stream Bridge	no	0.42	0.91	0.59	0.28	1.00	0.70	1.00	1.00	0.76	0.00	1.00	0.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.33	0.00	0.00	12	22	10
900/10.35	Waikawa River Bridge	no	0.44	0.91	0.59	0.33	1.00	0.70	1.00	1.00	0.76	0.00	1.00	0.00	1.00	1.00	1.00	0.00	0.00	0.00	0.50	0.00	0.00	0.00	13	5	-6
900/10.67	Manakau North Overbridge	no	0.54	0.91	0.84	0.24	1.00	0.70	1.00	1.00	0.76	1.00	1.00	0.50	1.00	1.00	0.50	0.00	0.00	0.50	0.50	0.00	0.00	0.00	14	9	5
900/13.90	Waiauti Stream (Manakau) Bridge	yes	0.41	0.91	0.59	0.25	1.00	0.70	1.00	1.00	0.76	0.00	1.00	0.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	15	23	10
915/0.00	Pukehou (Manakau South) Overbridge	no	0.59	1.00	0.71	0.41	1.00	1.00	1.00	1.00	0.76	1.00	0.16	0.50	1.00	1.00	0.50	0.00	0.00	0.50	1.00	0.00	1.00	0.00	16	12	11
915/4.04	Waitohu Stream Bridge	no	0.33	0.91	0.46	0.20	1.00	0.70	1.00	1.00	0.76	0.00	0.16	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.50	0.00	0.00	0.00	17	14	-5
915/4.86	Otaki Overbridge	no	0.46	0.91	0.70	0.20	1.00	0.70	1.00	1.00	0.77	1.00	0.07	0.50	1.00	1.00	0.50	0.00	0.00	0.00	0.50	0.00	0.00	0.00	18	15	6
915/6.81	Otaki River Bridge	no	0.45	0.91	0.60	0.35	1.00	0.70	1.00	1.00	0.79	0.00	1.00	0.00	1.00	1.00	0.50	1.00	0.00	1.00	0.50	0.00	0.00	0.00	19	11	1
915/10.53	Mangaone Stream Bridge	yes	0.30	0.91	0.47	0.13	1.00	0.70	1.00	1.00	0.85	0.00	0.06	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	20	28	7
931/5.19	Waikanae River Bridge	no	0.56	1.00	0.81	0.49	1.00	1.00	1.00	1.00	0.85	0.00	1.00	0.00	1.00	1.00	0.50	0.00	0.00	0.50	0.50	0.00	1.00	1.00	21	4	1
942/0.00	Paraparaumu Overbridge	no	0.39	0.76	0.71	0.20	1.00	0.70	1.00	0.00	0.85	1.00	0.00	0.50	1.00	1.00	0.50	0.00	0.00	0.00	0.50	0.00	0.00	0.00	22	16	1
953/0.00	Paekakariki Overbridge	no	0.48	0.91	0.73	0.24	1.00	0.70	1.00	1.00	0.92	1.00	0.01	0.50	1.00	1.00	0.50	0.00	0.00	0.50	0.50	0.00	0.00	0.00	23	13	7
953/7.70	Pukerua Bay Overbridge	no	0.50	0.91	0.75	0.25	1.00	0.70	1.00	1.00	0.93	1.00	0.08	0.50	1.00	1.00	0.50	0.00	0.00	0.00	0.50	0.53	0.00	0.00	24	8	3
953/15.41	Paremata Harbour Bridge	no	0.38	0.91	0.52	0.27	1.00	0.70	1.00	1.00	1.00	0.00	0.11	0.00	1.00	1.00	0.50	0.00	0.00	1.00	0.50	0.00	0.00	0.00	25	2	-14
969/4.40	Kenepuru Stream Bridge	yes	0.35	1.00	0.50	0.12	1.00	1.00	1.00	1.00	1.00	0.00	0.01	0.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.17	1.00	0.00	26	20	3
969/7.15	Collins Avenue East Bridge	no	0.28	0.70	0.45	0.33	1.00	1.00	0.00	0.00	1.00	0.35	0.01	0.00	1.00	0.00	0.50	0.00	0.00	0.00	0.50	0.27	1.00	0.00	27	18	-4
969/7.15	Collins Avenue West Bridge	no	0.28	0.70	0.45	0.33	1.00	1.00	0.00	0.00	1.00	0.35	0.01	0.00	1.00	0.00	0.50	0.00	0.00	0.00	0.50	0.27	1.00	0.00	28	19	-4
979/0.00	Takapu Road Overbridge	yes	0.24	0.70	0.48	0.13	1.00	1.00	0.00	0.00	1.00	0.50	0.01	0.00	1.00	0.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	29	21	-7
979/4.27	Johnsonville North Overpass	yes	0.24	0.70	0.47	0.16	1.00	1.00	0.00	0.00	1.00	0.48	0.01	0.00	1.00	0.00	0.50	0.00	0.00	0.00	0.00	0.33	0.00	0.00	30	25	-2
979/4.61	Johnsonville South Overpass	yes	0.25	0.70	0.47	0.18	1.00	1.00	0.00	0.00	1.00	0.48	0.00	0.00	1.00	0.00	0.50	0.00	0.00	0.00	0.00	0.50	0.00	0.00	31	24	-2
		FACTORS - THIS TRIAL:		1.00	0.60	0.40	0.40	0.30	0.15	0.15	0.25	0.15	0.15	0.20	0.15	0.10	0.25	0.06	0.10	0.07	0.15	0.10	0.10	0.15			
		FACTORS IN REPORT:		1.00	0.60	0.40	0.40	0.30	0.15	0.15	0.25	0.15	0.15	0.20	0.15	0.10	0.25	0.06	0.10	0.07	0.15	0.10	0.10	0.15			

Sorted by Seismic Priority Grade

SH1 RP	Bridge Name	Excluded from Prioritisation By Screening Procedure	Seismic Prioritisation Grade (SPG)	Hazard Index	Importance Index	Vulnerability Index	Hazard Index Factors: Peak Ground Accln.	Remaining Service Life	Soil Condition	Liquefaction Risk	Importance Index Factors: AADT On Bridge	AADT Under Bridge	Detour Length	Facility Crossed	Route Type	Critical Utility	Vulnerability Index Factors: Year Designed	Super-structure Hinges	Super-structure Overlap	Super-structure Length	Pier Type	Bridge Skew	Abutment Type	Other Feature	Route Position Order	Economic Analysis Ranking	SPG	Difference Econ SPG Rankings
915/0.00	Pukehou (Manakau South) Overbridge	no	0.59	1.00	0.71	0.41	1.00	1.00	1.00	1.00	0.76	1.00	0.16	0.50	1.00	1.00	0.50	0.00	0.00	0.50	1.00	0.00	1.00	0.00	16	12	1	11
900/7.04	Ohau Overbridge	yes	0.58	1.00	0.84	0.19	1.00	1.00	1.00	1.00	0.75	1.00	1.00	0.50	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.61	0.00	0.00	11	10	2	8
931/5.19	Waikanae River Bridge	no	0.56	1.00	0.81	0.49	1.00	1.00	1.00	1.00	0.85	0.00	1.00	0.00	1.00	1.00	0.50	0.00	0.00	0.50	0.50	0.00	1.00	1.00	21	4	3	1
900/10.67	Manakau North Overbridge	no	0.54	0.91	0.84	0.24	1.00	0.70	1.00	1.00	0.76	1.00	1.00	0.50	1.00	1.00	0.50	0.00	0.00	0.50	0.50	0.00	0.00	0.00	14	9	4	5
953/7.70	Pukerua Bay Overbridge	no	0.50	0.91	0.75	0.25	1.00	0.70	1.00	1.00	0.93	1.00	0.08	0.50	1.00	1.00	0.50	0.00	0.00	0.00	0.50	0.53	0.00	0.00	24	8	5	3
953/0.00	Paekakariki Overbridge	no	0.48	0.91	0.73	0.24	1.00	0.70	1.00	1.00	0.92	1.00	0.01	0.50	1.00	1.00	0.50	0.00	0.00	0.50	0.50	0.00	0.00	0.00	23	13	6	7
872/14.30	Manawatu River (Whirokino) Bridge	no	0.48	0.91	0.47	0.62	1.00	0.70	1.00	1.00	0.63	0.00	0.40	0.00	1.00	1.00	0.50	1.00	0.00	1.00	0.50	0.22	1.00	1.00	9	6	7	-1
900/6.77	Ohau River Bridge	no	0.48	1.00	0.59	0.31	1.00	1.00	1.00	1.00	0.75	0.00	1.00	0.00	1.00	1.00	0.50	0.50	0.00	1.00	0.50	0.00	0.00	0.00	10	1	8	-7
915/4.86	Otaki Overbridge	no	0.46	0.91	0.70	0.20	1.00	0.70	1.00	1.00	0.77	1.00	0.07	0.50	1.00	1.00	0.50	0.00	0.00	0.00	0.50	0.00	0.00	0.00	18	15	9	6
915/6.81	Otaki River Bridge	no	0.45	0.91	0.60	0.35	1.00	0.70	1.00	1.00	0.79	0.00	1.00	0.00	1.00	1.00	0.50	1.00	0.00	1.00	0.50	0.00	0.00	0.00	19	11	10	1
900/10.35	Waikawa River Bridge	no	0.44	0.91	0.59	0.33	1.00	0.70	1.00	1.00	0.76	0.00	1.00	0.00	1.00	1.00	1.00	0.00	0.00	0.00	0.50	0.00	0.00	0.00	13	5	11	-6
900/8.16	Kuku Stream Bridge	no	0.42	0.91	0.59	0.28	1.00	0.70	1.00	1.00	0.76	0.00	1.00	0.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.33	0.00	0.00	12	22	12	10
900/13.90	Waiauti Stream (Manakau) Bridge	yes	0.41	0.91	0.59	0.25	1.00	0.70	1.00	1.00	0.76	0.00	1.00	0.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	15	23	13	10
844/1.27	Rangitikei River Bridge at Bulls	no	0.39	0.76	0.45	0.60	1.00	0.70	0.00	1.00	0.70	0.00	0.18	0.00	1.00	1.00	0.50	1.00	0.00	1.00	0.50	0.00	1.00	1.00	1	3	14	-11
942/0.00	Paraparaumu Overbridge	no	0.39	0.76	0.71	0.20	1.00	0.70	1.00	0.00	0.85	1.00	0.00	0.50	1.00	1.00	0.50	0.00	0.00	0.00	0.50	0.00	0.00	0.00	22	16	15	1
953/15.41	Paremata Harbour Bridge	no	0.38	0.91	0.52	0.27	1.00	0.70	1.00	1.00	1.00	0.00	0.11	0.00	1.00	1.00	0.50	0.00	0.00	1.00	0.50	0.00	0.00	0.00	25	2	16	-14
969/4.40	Kenepuru Stream Bridge	yes	0.35	1.00	0.50	0.12	1.00	1.00	1.00	1.00	1.00	0.00	0.01	0.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.17	1.00	0.00	26	20	17	3
872/13.04	Whirokino Trestle	no	0.33	0.91	0.43	0.27	1.00	0.70	1.00	1.00	0.63	0.00	0.17	0.00	1.00	1.00	0.50	0.00	0.00	1.00	0.50	0.00	0.00	0.00	8	7	18	-11
915/4.04	Waitohu Stream Bridge	no	0.33	0.91	0.46	0.20	1.00	0.70	1.00	1.00	0.76	0.00	0.16	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.50	0.00	0.00	0.00	17	14	19	-5
872/12.41	North Whirokino Trestle	yes	0.31	0.91	0.43	0.20	1.00	0.70	1.00	1.00	0.63	0.00	0.17	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.50	0.00	0.00	0.00	7	17	20	-3
915/10.53	Mangaone Stream Bridge	yes	0.30	0.91	0.47	0.13	1.00	0.70	1.00	1.00	0.85	0.00	0.06	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	20	28	21	7
969/7.15	Collins Avenue East Bridge	no	0.28	0.70	0.45	0.33	1.00	1.00	0.00	0.00	1.00	0.35	0.01	0.00	1.00	0.00	0.50	0.00	0.00	0.00	0.50	0.27	1.00	0.00	27	18	22	-4
969/7.15	Collins Avenue West Bridge	no	0.28	0.70	0.45	0.33	1.00	1.00	0.00	0.00	1.00	0.35	0.01	0.00	1.00	0.00	0.50	0.00	0.00	0.00	0.50	0.27	1.00	0.00	28	19	23	-4
845/3.82	Piakatutu Stream Bridge	yes	0.28	0.91	0.42	0.13	1.00	0.70	1.00	1.00	0.69	0.00	0.00	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.09	0.00	0.00	3	29	24	5
850/4.35	Makahakaroa Stream Bridge	yes	0.27	0.91	0.41	0.13	1.00	0.70	1.00	1.00	0.63	0.00	0.03	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4	26	25	1
979/4.61	Johnsonville South Overpass	yes	0.25	0.70	0.47	0.18	1.00	1.00	0.00	0.00	1.00	0.48	0.00	0.00	1.00	0.00	0.50	0.00	0.00	0.00	0.00	0.50	0.00	0.00	31	24	26	-2
979/4.27	Johnsonville North Overpass	yes	0.24	0.70	0.47	0.16	1.00	1.00	0.00	0.00	1.00	0.48	0.01	0.00	1.00	0.00	0.50	0.00	0.00	0.00	0.00	0.33	0.00	0.00	30	25	27	-2
979/0.00	Takapu Road Overbridge	yes	0.24	0.70	0.48	0.13	1.00	1.00	0.00	0.00	1.00	0.50	0.01	0.00	1.00	0.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	29	21	28	-7
845/2.38	Makowai Stream Bridge	yes	0.23	0.76	0.42	0.13	1.00	0.70	0.00	1.00	0.69	0.00	0.01	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.09	0.00	0.00	2	27	29	-2
850/5.67	Makowai No 2 Bridge	No Drawings Available		Could Not Be Assessed																					5			
850/5.68	Makowai No 2 Bridge	No Drawings Available		Could Not Be Assessed																					6			

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PILOT APPRAISAL OF SEISMIC SCREENING PROCEDURES
STATE HIGHWAY 1 BRIDGES BETWEEN RP 844/1.27 AND 979/4.61

Sorted by Route Position Order

SH1 RP	Bridge Name	Excluded from Prioritisation By Screening Procedure	Seismic Prioritisation Grade (SPG)	Hazard Index	Importance Index	Vulnerability Index	Hazard Index Factors: Peak Ground Accln.	Hazard Index Factors: Remaining Service Life	Hazard Index Factors: Soil Condition	Hazard Index Factors: Liquefaction Risk	Importance Index Factors: AADT On Bridge	Importance Index Factors: AADT Under Bridge	Importance Index Factors: Detour Length	Importance Index Factors: Facility Crossed	Importance Index Factors: Route Type	Importance Index Factors: Critical Utility	Vulnerability Index Factors: Year Designed	Vulnerability Index Factors: Super-structure Hinges	Vulnerability Index Factors: Super-structure Overlap	Vulnerability Index Factors: Super-structure Length	Vulnerability Index Factors: Pier Type	Vulnerability Index Factors: Bridge Skew	Vulnerability Index Factors: Abutment Type	Vulnerability Index Factors: Other Feature	Route Position Order	Economic Analysis Ranking	Difference Econ SPG Rankings
844/1.27	Rangitikei River Bridge at Bulls	no	0.21	0.76	0.45	0.60	1.00	0.70	0.00	1.00	0.70	0.00	0.18	0.00	1.00	1.00	0.50	1.00	0.00	1.00	0.50	0.00	1.00	1.00	1	3	-1
845/2.58	Makowai Stream Bridge	yes	0.04	0.76	0.42	0.13	1.00	0.70	0.00	1.00	0.69	0.00	0.01	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.09	0.00	0.00	2	27	-1
845/3.82	Piakatutu Stream Bridge	yes	0.05	0.91	0.42	0.13	1.00	0.70	1.00	1.00	0.69	0.00	0.00	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.09	0.00	0.00	3	29	3
850/4.35	Makahikatoa Stream Bridge	yes	0.05	0.91	0.41	0.13	1.00	0.70	1.00	1.00	0.63	0.00	0.03	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4	26	-1
850/5.67	Makowai No 2 Bridge	No Drawings Available		Could Not Be Assessed																					5		
850/5.68	Makowai No 2 Bridge	No Drawings Available		Could Not Be Assessed																					6		
872/12.41	North Whirokino Trestle	yes	0.08	0.91	0.43	0.20	1.00	0.70	1.00	1.00	0.63	0.00	0.17	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.50	0.00	0.00	0.00	7	17	-4
872/13.04	Whirokino Trestle	no	0.11	0.91	0.43	0.27	1.00	0.70	1.00	1.00	0.63	0.00	0.17	0.00	1.00	1.00	0.50	0.00	0.00	1.00	0.50	0.00	0.00	0.00	8	7	-10
872/14.30	Manawatu River (Whirokino) Bridge	no	0.26	0.91	0.47	0.62	1.00	0.70	1.00	1.00	0.63	0.00	0.40	0.00	1.00	1.00	0.50	1.00	0.00	1.00	0.50	0.22	1.00	1.00	9	6	3
900/6.77	Ohau River Bridge	no	0.18	1.00	0.59	0.31	1.00	1.00	1.00	1.00	0.75	0.00	1.00	0.00	1.00	1.00	0.50	0.50	0.00	1.00	0.50	0.00	0.00	0.00	10	1	-5
900/7.04	Ohau Overbridge	yes	0.16	1.00	0.84	0.19	1.00	1.00	1.00	1.00	0.75	1.00	1.00	0.50	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.61	0.00	0.00	11	10	-1
900/8.16	Kuku Stream Bridge	no	0.15	0.91	0.59	0.28	1.00	0.70	1.00	1.00	0.76	0.00	1.00	0.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.33	0.00	0.00	12	22	10
900/10.35	Waikawa River Bridge	no	0.17	0.91	0.59	0.33	1.00	0.70	1.00	1.00	0.76	0.00	1.00	0.00	1.00	1.00	1.00	0.00	0.00	0.00	0.50	0.00	0.00	0.00	13	5	-3
900/10.67	Manakau North Overbridge	no	0.18	0.91	0.84	0.24	1.00	0.70	1.00	1.00	0.76	1.00	1.00	0.50	1.00	1.00	0.50	0.00	0.00	0.50	0.50	0.00	0.00	0.00	14	9	2
900/13.90	Waiauti Stream (Manakau) Bridge	yes	0.13	0.91	0.59	0.25	1.00	0.70	1.00	1.00	0.78	0.00	1.00	0.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	15	23	10
915/0.00	Pukehou (Manakau South) Overbridge	no	0.29	1.00	0.71	0.41	1.00	1.00	1.00	1.00	0.76	1.00	0.16	0.50	1.00	1.00	0.50	0.00	0.00	0.50	1.00	0.00	1.00	0.00	16	12	10
915/4.04	Waitohu Stream Bridge	no	0.08	0.91	0.48	0.20	1.00	0.70	1.00	1.00	0.76	0.00	0.16	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.50	0.00	0.00	0.00	17	14	-6
915/4.86	Otaki Overbridge	no	0.13	0.91	0.70	0.20	1.00	0.70	1.00	1.00	0.77	1.00	0.07	0.50	1.00	1.00	0.50	0.00	0.00	0.00	0.50	0.00	0.00	0.00	18	15	1
915/6.81	Otaki River Bridge	no	0.19	0.91	0.60	0.35	1.00	0.70	1.00	1.00	0.79	0.00	1.00	0.00	1.00	1.00	0.50	1.00	0.00	1.00	0.50	0.00	0.00	0.00	19	11	6
915/10.53	Mangaone Stream Bridge	yes	0.05	0.91	0.47	0.13	1.00	0.70	1.00	1.00	0.85	0.00	0.06	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	20	28	4
931/5.19	Waikanae River Bridge	no	0.30	1.00	0.61	0.49	1.00	1.00	1.00	1.00	0.85	0.00	1.00	0.00	1.00	1.00	0.50	0.00	0.00	0.50	0.50	0.00	1.00	1.00	21	4	3
942/0.00	Paraparaumu Overbridge	no	0.11	0.76	0.71	0.20	1.00	0.70	1.00	0.00	0.85	1.00	0.00	0.50	1.00	1.00	0.50	0.00	0.00	0.00	0.50	0.00	0.00	0.00	22	16	0
953/0.00	Paekakariki Overbridge	no	0.16	0.91	0.73	0.24	1.00	0.70	1.00	1.00	0.92	1.00	0.01	0.50	1.00	1.00	0.50	0.00	0.00	0.50	0.50	0.00	0.00	0.00	23	13	3
953/7.70	Pukerua Bay Overbridge	no	0.17	0.91	0.75	0.25	1.00	0.70	1.00	1.00	0.93	1.00	0.08	0.50	1.00	1.00	0.50	0.00	0.00	0.00	0.50	0.53	0.00	0.00	24	8	-1
953/15.41	Paremata Harbour Bridge	no	0.13	0.91	0.52	0.27	1.00	0.70	1.00	1.00	1.00	0.00	0.11	0.00	1.00	1.00	0.50	0.00	0.00	1.00	0.50	0.00	0.00	0.00	25	2	-13
969/4.40	Kenepuru Stream Bridge	yes	0.06	1.00	0.50	0.12	1.00	1.00	1.00	1.00	1.00	0.00	0.01	0.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.17	1.00	0.00	26	20	-2
969/7.15	Collins Avenue East Bridge	no	0.10	0.70	0.45	0.33	1.00	1.00	0.00	0.00	1.00	0.35	0.01	0.00	1.00	0.00	0.50	0.00	0.00	0.00	0.50	0.27	1.00	0.00	27	18	0
969/7.15	Collins Avenue West Bridge	no	0.10	0.70	0.45	0.33	1.00	1.00	0.00	0.00	1.00	0.35	0.01	0.00	1.00	0.00	0.50	0.00	0.00	0.00	0.50	0.27	1.00	0.00	28	19	0
979/0.00	Takapu Road Overbridge	yes	0.04	0.70	0.48	0.13	1.00	1.00	0.00	0.00	1.00	0.50	0.01	0.00	1.00	0.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	29	21	-8
979/4.27	Johnsonville North Overpass	yes	0.05	0.70	0.47	0.16	1.00	1.00	0.00	0.00	1.00	0.48	0.01	0.00	1.00	0.00	0.50	0.00	0.00	0.00	0.00	0.33	0.00	0.00	30	25	0
979/4.61	Johnsonville South Overpass	yes	0.06	0.70	0.47	0.18	1.00	1.00	0.00	0.00	1.00	0.48	0.00	0.00	1.00	0.00	0.50	0.00	0.00	0.00	0.00	0.50	0.00	0.00	31	24	1
		FACTORS - THIS TRIAL:		1.00	1.00	1.00	0.40	0.30	0.15	0.15	0.15	0.15	0.15	0.20	0.15	0.10	0.25	0.04	0.10	0.07	0.15	0.10	0.10	0.15			
		FACTORS IN REPORT:		1.00	0.80	0.40	0.40	0.30	0.15	0.15	0.25	0.15	0.15	0.20	0.15	0.10	0.25	0.04	0.10	0.07	0.15	0.10	0.10	0.15			

Sorted by Seismic Priority Grade

SH1 RP	Bridge Name	Excluded from Prioritisation By Screening Procedure	Seismic Prioritisation Grade (SPG)	Hazard Index	Importance Index	Vulnerability Index	Hazard Index Factors: Peak Ground Accln.	Hazard Index Factors: Remaining Service Life	Hazard Index Factors: Soil Condition	Hazard Index Factors: Liquefaction Risk	Importance Index Factors: AADT On Bridge	Importance Index Factors: AADT Under Bridge	Importance Index Factors: Detour Length	Importance Index Factors: Facility Crossed	Importance Index Factors: Route Type	Importance Index Factors: Critical Utility	Vulnerability Index Factors: Year Designed	Vulnerability Index Factors: Super-structure Hinges	Vulnerability Index Factors: Super-structure Overlap	Vulnerability Index Factors: Super-structure Length	Vulnerability Index Factors: Pier Type	Vulnerability Index Factors: Bridge Skew	Vulnerability Index Factors: Abutment Type	Vulnerability Index Factors: Other Feature	Route Position Order	Economic Analysis Ranking	SPG	Difference Econ SPG Rankings
931/5.19	Waikanae River Bridge	no	0.30	1.00	0.61	0.49	1.00	1.00	1.00	1.00	0.85	0.00	1.00	0.00	1.00	1.00	0.50	0.00	0.00	0.50	0.50	0.00	1.00	1.00	21	4	1	3
915/0.00	Pukehou (Manakau South) Overbridge	no	0.29	1.00	0.71	0.41	1.00	1.00	1.00	1.00	0.76	1.00	0.16	0.50	1.00	1.00	0.50	0.00	0.00	0.50	1.00	0.00	1.00	0.00	16	12	2	10
872/14.30	Manawatu River (Whirokino) Bridge	no	0.26	0.91	0.47	0.62	1.00	0.70	1.00	1.00	0.63	0.00	0.40	0.00	1.00	1.00	0.50	1.00	0.00	1.00	0.50	0.22	1.00	1.00	9	6	3	3
844/1.27	Rangitikei River Bridge at Bulls	no	0.21	0.76	0.45	0.60	1.00	0.70	0.00	1.00	0.70	0.00	0.18	0.00	1.00	1.00	0.50	1.00	0.00	1.00	0.50	0.00	1.00	1.00	1	3	4	-1
915/6.81	Otaki River Bridge	no	0.19	0.91	0.60	0.35	1.00	0.70	1.00	1.00	0.79	0.00	1.00	0.00	1.00	1.00	0.50	1.00	0.00	1.00	0.50	0.00	0.00	0.00	19	11	5	6
900/6.77	Ohau River Bridge	no	0.18	1.00	0.59	0.31	1.00	1.00	1.00	1.00	0.75	0.00	1.00	0.00	1.00	1.00	0.50	0.50	0.00	1.00	0.50	0.00	0.00	0.00	10	1	6	-5
900/10.67	Manakau North Overbridge	no	0.18	0.91	0.84	0.24	1.00	0.70	1.00	1.00	0.76	1.00	1.00	0.50	1.00	1.00	0.50	0.00	0.00	0.50	0.50	0.00	0.00	0.00	14	9	7	2
900/10.35	Waikawa River Bridge	no	0.17	0.91	0.59	0.33	1.00	0.70	1.00	1.00	0.76	0.00	1.00	0.00	1.00	1.00	1.00	0.00	0.00	0.00	0.50	0.00	0.00	0.00	13	5	8	-3
953/7.70	Pukerua Bay Overbridge	no	0.17	0.91	0.75	0.25	1.00	0.70	1.00	1.00	0.93	1.00	0.08	0.50	1.00	1.00	0.50	0.00	0.00	0.00	0.50	0.53	0.00	0.00	24	8	9	-1
953/0.00	Paekakariki Overbridge	no	0.16	0.91	0.73	0.24	1.00	0.70	1.00	1.00	0.92	1.00	0.01	0.50	1.00	1.00	0.50	0.00	0.00	0.50	0.50	0.00	0.00	0.00	23	13	10	3
900/7.04	Ohau Overbridge	yes	0.16	1.00	0.84	0.19	1.00	1.00	1.00	1.00	0.75	1.00	1.00	0.50	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.61	0.00	0.00	11	10	11	-1
900/8.16	Kuku Stream Bridge	no	0.15	0.91	0.59	0.28	1.00	0.70	1.00	1.00	0.76	0.00	1.00	0.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.33	0.00	0.00	12	22	12	10
900/13.90	Waiauti Stream (Manakau) Bridge	yes	0.13	0.91	0.59	0.25	1.00	0.70	1.00	1.00	0.78	0.00	1.00	0.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	15	23	13	10
915/4.86	Otaki Overbridge	no	0.13	0.91	0.70	0.20	1.00	0.70	1.00	1.00	0.77	1.00	0.07	0.50	1.00	1.00	0.50	0.00	0.00	0.00	0.50	0.00	0.00	0.00	18	15	14	1
953/15.41	Paremata Harbour Bridge	no	0.13	0.91	0.52	0.27	1.00	0.70	1.00	1.00	1.00	0.00	0.11	0.00	1.00	1.00	0.50	0.00	0.00	1.00	0.50	0.00	0.00	0.00	25	2	15	-13
942/0.00	Paraparaumu Overbridge	no	0.11	0.76	0.71	0.20	1.00	0.70	1.00	0.00	0.85	1.00	0.00	0.50	1.00	1.00	0.50	0.00	0.00	0.00	0.50	0.00	0.00	0.00	22	16	16	0
872/13.04	Whirokino Trestle	no	0.11	0.91	0.43	0.27	1.00	0.70	1.00	1.00	0.63	0.00	0.17	0.00	1.00	1.00	0.50	0.00	0.00	1.00	0.50	0.00	0.00	0.00	8	7	17	-10
969/7.15	Collins Avenue East Bridge	no	0.10	0.70	0.45	0.33	1.00	1.00	0.00	0.00	1.00	0.35	0.01	0.00	1.00	0.00	0.50	0.00	0.00	0.00	0.50	0.27	1.00	0.00	27	18	18	0
969/7.15	Collins Avenue West Bridge	no	0.10	0.70	0.45	0.33	1.00	1.00	0.00	0.00	1.00	0.35	0.01	0.00	1.00	0.00	0.50	0.00	0.00	0.00	0.50	0.27	1.00	0.00	28	19	19	0
915/4.04	Waitohu Stream Bridge	no	0.08	0.91	0.48	0.20	1.00	0.70	1.00	1.00	0.76	0.00	0.16	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.50	0.00	0.00	0.00	17	14	20	-6
872/12.41	North Whirokino Trestle	yes	0.08	0.91	0.43	0.20	1.00	0.70	1.00	1.00	0.63	0.00	0.17	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.50	0.00	0.00	0.00	7	17	21	-4
969/4.40	Kenepuru Stream Bridge	yes	0.06	1.00	0.50	0.12	1.00	1.00	1.00	1.00	1.00	0.00	0.01	0.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.17	1.00	0.00	26	20	22	-2
979/4.61	Johnsonville South Overpass	yes	0.06	0.70	0.47	0.18	1.00	1.00	0.00	0.00	1.00	0.48	0.00	0.00	1.00	0.00	0.50	0.00	0.00	0.00	0.00	0.50	0.00	0.00	31	24	23	1
915/10.53	Mangaone Stream Bridge	yes	0.05	0.91	0.47	0.13	1.00	0.70	1.00	1.00	0.85	0.00	0.06	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	20	28	24	4
979/4.27	Johnsonville North Overpass	yes	0.05	0.70	0.47	0.16	1.00	1.00	0.00	0.00	1.00	0.48	0.01	0.00	1.00	0.00	0.50	0.00	0.00	0.00	0.00	0.33	0.00	0.00	30	25	25	0
845/3.82	Piakatutu Stream Bridge	yes	0.05	0.91	0.42	0.13	1.00	0.70	1.00	1.00	0.69	0.00	0.00	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.09	0.00	0.00	3	29	26	3
850/4.35	Makahikatoa Stream Bridge	yes	0.05	0.91	0.41	0.13	1.00	0.70	1.00	1.00	0.63	0.00	0.03	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4	26	27	-1
845/2.58	Makowai Stream Bridge	yes	0.04	0.76	0.42	0.13	1.00	0.70	0.00	1.00	0.69	0.00	0.01	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.09	0.00	0.00	2	27	28	-1
979/0.00	Takapu Road Overbridge	yes	0.04	0.70	0.48	0.13	1.00	1.00	0.00	0.00	1.00	0.50	0.01	0.00	1.00	0.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	29	21	29	-8
850/5.67	Makowai No 2 Bridge	No Drawings Available		Could Not Be Assessed																					5			
850/5.68	Makowai No 2 Bridge	No Drawings Available		Could Not Be Assessed																					6			

File RANKING1 WK1 - 15:10 - 22 April 1995 - As RANKING WK1 but SPG = Hazard*Importance*Vulnerabil.

PILOT APPRAISAL OF SEISMIC SCREENING PROCEDURES
STATE HIGHWAY 1 BRIDGES BETWEEN RP 844/1.27 AND 979/4.61

Sorted by Route Position Order

SH1 RP	Bridge Name	Excluded from Prioritisation By Screening Procedure	Seismic Prioritisation Grade (SPG)	Hazard Index	Importance Index	Vulnerability Index	Hazard Index Factors: Peak Ground Accln.	Remaining Service Life	Soil Condition	Liquefaction Risk
844/1.27	Rangitikei River Bridge at Bulls	no	0.39	0.76	0.45	0.60	1.00	0.70	0.00	1.00
845/2.38	Makowai Stream Bridge	yes	0.23	0.76	0.42	0.13	1.00	0.70	0.00	1.00
845/3.82	Piakatutu Stream Bridge	yes	0.28	0.91	0.42	0.13	1.00	0.70	1.00	1.00
850/4.35	Makahikaroa Stream Bridge	yes	0.27	0.91	0.41	0.13	1.00	0.70	1.00	1.00
850/5.67	Makowai No 2 Bridge	No Drawings Available		Could Not Be Assessed						
850/5.68	Makowai No 2 Bridge	No Drawings Available		Could Not Be Assessed						
872/12.41	North Whirokino Trestle	yes	0.31	0.91	0.43	0.20	1.00	0.70	1.00	1.00
872/13.04	Whirokino Trestle	no	0.33	0.91	0.43	0.27	1.00	0.70	1.00	1.00
872/14.30	Manawatu River (Whirokino) Bridge	no	0.48	0.91	0.47	0.62	1.00	0.70	1.00	1.00
900/6.77	Ohau River Bridge	no	0.48	1.00	0.59	0.31	1.00	1.00	1.00	1.00
900/7.04	Ohau Overbridge	yes	0.49	1.00	0.69	0.19	1.00	1.00	1.00	1.00
900/8.16	Kuku Stream Bridge	no	0.42	0.91	0.69	0.28	1.00	0.70	1.00	1.00
900/10.35	Waikawa River Bridge	no	0.44	0.91	0.59	0.33	1.00	0.70	1.00	1.00
900/10.67	Manakau North Overbridge	no	0.46	0.91	0.69	0.24	1.00	0.70	1.00	1.00
900/13.90	Waiauti Stream (Manakau) Bridge	yes	0.41	0.91	0.59	0.25	1.00	0.70	1.00	1.00
915/0.00	Pukehou (Manakau South) Overbridge	no	0.50	1.00	0.56	0.41	1.00	1.00	1.00	1.00
915/4.04	Waitohu Stream Bridge	no	0.33	0.91	0.46	0.20	1.00	0.70	1.00	1.00
915/4.86	Otaki Overbridge	no	0.37	0.91	0.55	0.20	1.00	0.70	1.00	1.00
915/6.81	Otaki River Bridge	no	0.45	0.91	0.60	0.35	1.00	0.70	1.00	1.00
915/10.53	Mangaone Stream Bridge	yes	0.30	0.91	0.47	0.13	1.00	0.70	1.00	1.00
931/5.19	Waikanae River Bridge	no	0.56	1.00	0.61	0.49	1.00	1.00	1.00	1.00
942/0.00	Paraparaumu Overbridge	no	0.32	0.76	0.56	0.20	1.00	0.70	1.00	0.00
953/0.00	Paekakariki Overbridge	no	0.40	0.91	0.58	0.24	1.00	0.70	1.00	1.00
953/7.70	Pukerua Bay Overbridge	no	0.42	0.91	0.60	0.25	1.00	0.70	1.00	1.00
953/15.41	Paremata Harbour Bridge	no	0.38	0.91	0.52	0.27	1.00	0.70	1.00	1.00
969/4.40	Kenepuru Stream Bridge	yes	0.35	1.00	0.50	0.12	1.00	1.00	1.00	1.00
969/7.15	Collins Avenue East Bridge	no	0.28	0.70	0.45	0.33	1.00	1.00	0.00	0.00
969/7.15	Collins Avenue West Bridge	no	0.28	0.70	0.45	0.33	1.00	1.00	0.00	0.00
979/0.00	Takapu Road Overbridge	yes	0.24	0.70	0.48	0.13	1.00	1.00	0.00	0.00
979/4.27	Johnsonville North Overpass	yes	0.24	0.70	0.47	0.16	1.00	1.00	0.00	0.00
979/4.61	Johnsonville South Overpass	yes	0.25	0.70	0.47	0.18	1.00	1.00	0.00	0.00
	FACTORS - THIS TRIAL:			1.00	0.60	0.40	0.40	0.30	0.15	0.15
	FACTORS IN REPORT:			1.00	0.60	0.40	0.40	0.30	0.15	0.15

SH1 RP	Importance Index Factors: AADT On Bridge	AADT Under Bridge	Detour Length	Facility Crossed	Route Type	Critical Utility	Vulnerability Index Factors: Year Designed	Super-structure Hinges	Super-structure Overlap	Super-structure Length	Pier Type	Bridge Skew	Abutment Type	Other Feature	Route Position Order	Economic Analysis Ranking	Difference Econ-SPG Rankings
844/1.27	0.70	0.00	0.18	0.00	1.00	1.00	0.50	1.00	0.00	1.00	0.50	0.00	1.00	1.00	1	3	-10
845/2.38	0.63	0.00	0.01	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.09	0.00	0.00	2	27	-2
845/3.82	0.69	0.00	0.00	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.09	0.00	0.00	3	29	5
850/4.35	0.63	0.00	0.03	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4	26	1
850/5.67															5		
850/5.68															6		
872/12.41	0.63	0.00	0.17	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.50	0.00	0.00	0.00	7	17	-3
872/13.04	0.63	0.00	0.17	0.00	1.00	1.00	0.50	0.00	0.00	1.00	0.50	0.00	0.00	0.00	8	7	-10
872/14.30	0.63	0.00	0.40	0.00	1.00	1.00	0.50	1.00	0.00	1.00	0.50	0.22	1.00	1.00	9	6	2
900/6.77	0.75	0.00	1.00	0.00	1.00	1.00	0.50	0.50	0.00	1.00	0.50	0.00	0.00	0.00	10	1	-4
900/7.04	0.75	0.00	1.00	0.50	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.41	0.00	0.00	11	10	7
900/8.16	0.76	0.00	1.00	0.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.33	0.00	0.00	12	22	13
900/10.35	0.76	0.00	1.00	0.00	1.00	1.00	1.00	0.00	0.00	0.00	0.50	0.00	0.00	0.00	13	5	-3
900/10.67	0.76	0.00	1.00	0.50	1.00	1.00	0.50	0.00	0.00	0.50	0.50	0.00	0.00	0.00	14	8	3
900/13.90	0.76	0.00	1.00	0.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	15	23	12
915/0.00	0.76	0.00	0.16	0.50	1.00	1.00	0.50	0.00	0.00	0.50	1.00	0.00	1.00	0.00	16	12	10
915/4.04	0.76	0.00	0.16	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.50	0.00	0.00	0.00	17	14	-4
915/4.86	0.77	0.00	0.07	0.50	1.00	1.00	0.50	0.00	0.00	0.00	0.50	0.00	0.00	0.00	18	15	0
915/6.81	0.79	0.00	1.00	0.00	1.00	1.00	0.50	1.00	0.00	1.00	0.50	0.00	0.00	0.00	19	11	4
915/10.53	0.85	0.00	0.06	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	20	28	7
931/5.19	0.85	0.00	1.00	0.00	1.00	1.00	0.50	0.00	0.00	0.50	0.50	0.00	1.00	1.00	21	4	3
942/0.00	0.85	0.00	0.00	0.50	1.00	1.00	0.50	0.00	0.00	0.00	0.50	0.00	0.00	0.00	22	18	-3
953/0.00	0.92	0.00	0.01	0.50	1.00	1.00	0.50	0.00	0.00	0.50	0.50	0.00	0.00	0.00	23	13	1
953/7.70	0.93	0.00	0.08	0.50	1.00	1.00	0.50	0.00	0.00	0.00	0.50	0.53	0.00	0.00	24	8	-2
953/15.41	1.00	0.00	0.11	0.00	1.00	1.00	0.50	0.00	0.00	1.00	0.50	0.00	0.00	0.00	25	2	-12
969/4.40	1.00	0.00	0.01	0.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.17	1.00	0.00	26	20	4
969/7.15	1.00	0.35	0.01	0.00	1.00	0.00	0.50	0.00	0.00	0.00	0.50	0.27	1.00	0.00	27	18	-4
969/7.15	1.00	0.35	0.01	0.00	1.00	0.00	0.50	0.00	0.00	0.00	0.50	0.27	1.00	0.00	28	19	-4
979/0.00	1.00	0.50	0.01	0.00	1.00	0.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	29	21	-7
979/4.27	1.00	0.48	0.01	0.00	1.00	0.00	0.50	0.00	0.00	0.00	0.00	0.33	0.00	0.00	30	25	-2
979/4.61	1.00	0.48	0.00	0.00	1.00	0.00	0.50	0.00	0.00	0.00	0.00	0.50	0.00	0.00	31	24	-2
FACTORS - THIS TRIAL:	0.25	0.15	0.16	0.20	0.14	0.10	0.25	0.04	0.10	0.07	0.15	0.10	0.10	0.15			
FACTORS IN REPORT:	0.25	0.15	0.16	0.20	0.15	0.10	0.25	0.04	0.10	0.07	0.15	0.10	0.10	0.15			

Sorted by Seismic Priority Grade

SH1 RP	Bridge Name	Excluded from Prioritisation By Screening Procedure	Seismic Prioritisation Grade (SPG)	Hazard Index	Importance Index	Vulnerability Index	Hazard Index Factors: Peak Ground Accln.	Remaining Service Life	Soil Condition	Liquefaction Risk
931/5.19	Waikanae River Bridge	no	0.56	1.00	0.61	0.49	1.00	1.00	1.00	1.00
915/0.00	Pukehou (Manakau South) Overbridge	no	0.50	1.00	0.56	0.41	1.00	1.00	1.00	1.00
900/7.04	Ohau Overbridge	yes	0.49	1.00	0.69	0.19	1.00	1.00	1.00	1.00
872/14.30	Manawatu River (Whirokino) Bridge	no	0.48	0.91	0.47	0.62	1.00	0.70	1.00	1.00
900/6.77	Ohau River Bridge	no	0.48	1.00	0.59	0.31	1.00	1.00	1.00	1.00
900/10.67	Manakau North Overbridge	no	0.46	0.91	0.69	0.24	1.00	0.70	1.00	1.00
915/6.81	Otaki River Bridge	no	0.45	0.91	0.60	0.35	1.00	0.70	1.00	1.00
900/10.35	Waikawa River Bridge	no	0.44	0.91	0.59	0.33	1.00	0.70	1.00	1.00
900/8.16	Kuku Stream Bridge	no	0.42	0.91	0.69	0.28	1.00	0.70	1.00	1.00
953/7.70	Pukerua Bay Overbridge	no	0.42	0.91	0.60	0.25	1.00	0.70	1.00	1.00
900/13.90	Waiauti Stream (Manakau) Bridge	yes	0.41	0.91	0.59	0.25	1.00	0.70	1.00	1.00
953/0.00	Paekakariki Overbridge	no	0.40	0.91	0.58	0.24	1.00	0.70	1.00	1.00
844/1.27	Rangitikei River Bridge at Bulls	no	0.39	0.76	0.45	0.60	1.00	0.70	0.00	1.00
953/15.41	Paremata Harbour Bridge	no	0.38	0.91	0.52	0.27	1.00	0.70	1.00	1.00
915/4.86	Otaki Overbridge	no	0.37	0.91	0.55	0.20	1.00	0.70	1.00	1.00
969/4.40	Kenepuru Stream Bridge	yes	0.35	1.00	0.50	0.12	1.00	1.00	1.00	1.00
872/13.04	Whirokino Trestle	no	0.33	0.91	0.43	0.27	1.00	0.70	1.00	1.00
915/4.04	Waitohu Stream Bridge	no	0.33	0.91	0.46	0.20	1.00	0.70	1.00	1.00
942/0.00	Paraparaumu Overbridge	no	0.32	0.76	0.56	0.20	1.00	0.70	1.00	0.00
872/12.41	North Whirokino Trestle	yes	0.31	0.91	0.43	0.20	1.00	0.70	1.00	1.00
915/10.53	Mangaone Stream Bridge	yes	0.30	0.91	0.47	0.13	1.00	0.70	1.00	1.00
969/7.15	Collins Avenue East Bridge	no	0.28	0.70	0.45	0.33	1.00	1.00	0.00	0.00
969/7.15	Collins Avenue West Bridge	no	0.28	0.70	0.45	0.33	1.00	1.00	0.00	0.00
845/3.82	Piakatutu Stream Bridge	yes	0.28	0.91	0.42	0.13	1.00	0.70	1.00	1.00
850/4.35	Makahikaroa Stream Bridge	yes	0.27	0.91	0.41	0.13	1.00	0.70	1.00	1.00
979/4.61	Johnsonville South Overpass	yes	0.25	0.70	0.47	0.18	1.00	1.00	0.00	0.00
979/4.27	Johnsonville North Overpass	yes	0.24	0.70	0.47	0.16	1.00	1.00	0.00	0.00
979/0.00	Takapu Road Overbridge	yes	0.24	0.70	0.48	0.13	1.00	1.00	0.00	0.00
845/2.38	Makowai Stream Bridge	yes	0.23	0.76	0.42	0.13	1.00	0.70	0.00	1.00
850/5.67	Makowai No 2 Bridge	No Drawings Available		Could Not Be Assessed						
850/5.68	Makowai No 2 Bridge	No Drawings Available		Could Not Be Assessed						

SH1 RP	Importance Index Factors: AADT On Bridge	AADT Under Bridge	Detour Length	Facility Crossed	Route Type	Critical Utility	Vulnerability Index Factors: Year Designed	Super-structure Hinges	Super-structure Overlap	Super-structure Length	Pier Type	Bridge Skew	Abutment Type	Other Feature	Route Position Order	Economic Analysis Ranking	SPG	Difference Econ SPG Rankings
931/5.19	0.85	0.00	1.00	0.00	1.00	1.00	0.50	0.00	0.00	0.50	0.50	0.00	1.00	1.00	21	4	1	3
915/0.00	0.76	0.00	0.16	0.50	1.00	1.00	0.50	0.00	0.00	0.50	1.00	0.00	1.00	0.00	16	12	2	10
900/7.04	0.75	0.00	1.00	0.50	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.41	0.00	0.00	11	10	3	7
872/14.30	0.63	0.00	0.40	0.00	1.00	1.00	0.50	1.00	0.00	1.00	0.50	0.22	1.00	1.00	9	6	4	2
900/6.77	0.75	0.00	1.00	0.00	1.00	1.00	0.50	0.50	0.00	1.00	0.50	0.00	0.00	0.00	10	1	5	-4
900/10.67	0.76	0.00	1.00	0.50	1.00	1.00	0.50	0.00	0.00	0.50	0.50	0.00	0.00	0.00	14	8	6	3
915/6.81	0.79	0.00	1.00	0.00	1.00	1.00	0.50	1.00	0.00	1.00	0.50	0.00	0.00	0.00	19	11	7	4
900/10.35	0.76	0.00	1.00	0.00	1.00	1.00	1.00	0.00	0.00	0.00	0.50	0.00	0.00	0.00	13	5	8	-3
900/8.16	0.76	0.00	1.00	0.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.33	0.00	0.00	12	22	9	13
953/7.70	0.93	0.00	0.08	0.50	1.00	1.00	0.50	0.00	0.00	0.00	0.50	0.53	0.00	0.00	24	8	10	-2
900/13.90	0.76	0.00	1.00	0.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	15	23	11	12
953/0.00	0.92	0.00	0.01	0.50	1.00	1.00	0.50	0.00	0.00	0.50	0.50	0.00	0.00	0.00	23	13	12	1
844/1.27	0.70	0.00	0.18	0.00	1.00	1.00	0.50	1.00	0.00	1.00	0.50	0.00	1.00	1.00	1	3	13	-10
953/15.41	1.00	0.00	0.11	0.00	1.00	1.00	0.50	0.00	0.00	1.00	0.50	0.00	0.00	0.00	25	2	14	-12
915/4.86	0.77	0.00	0.07	0.50	1.00	1.00	0.50	0.00	0.00	0.00	0.50	0.00	0.00	0.00	18	15	15	0
969/4.40	1.00	0.00	0.01	0.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.17	1.00	0.00	26	20	16	4
872/13.04	0.63	0.00	0.17	0.00	1.00	1.00	0.50	0.00	0.00	1.00	0.50	0.00	0.00	0.00	8	7	17	-10
915/4.04	0.76	0.00	0.16	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.50	0.00	0.00	0.00	17	14	18	-4
942/0.00	0.85	0.00	0.00	0.50	1.00	1.00	0.50	0.00	0.00	0.00	0.50	0.00	0.00	0.00	22	18	19	-3
872/12.41	0.63	0.00	0.17	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.50	0.00	0.00	0.00	7	17	20	-3
915/10.53	0.85	0.00	0.06	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	20	28	21	7
969/7.15	1.00	0.35	0.01	0.00	1.00	0.00	0.50	0.00	0.00	0.00	0.50	0.27	1.00	0.00	27	18	22	-4
969/7.15	1.00	0.35	0.01	0.00	1.00	0.00	0.50	0.00	0.00	0.00	0.50	0.27	1.00	0.00	28	19	23	-4
845/3.82	0.69	0.00	0.00	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.09	0.00	0.00	3	29	24	5
850/4.35	0.63	0.00	0.03	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4	26	25	1
979/4.61	1.00	0.48	0.00	0.00	1.00	0.00	0.50	0.00	0.00	0.00	0.00	0.50	0.00	0.00	31	24	26	-2
979/4.27	1.00	0.48	0.01	0.00	1.00	0.00	0.50	0.00	0.00	0.00	0.00	0.33	0.00	0.00	30	25	27	-2
979/0.00	1.00	0.50	0.01	0.00	1.00	0.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	29	21	28	-7
845/2.38	0.69	0.00	0.01	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.09	0.00	0.00	2	27	29	-2
850/5.67															5			
850/5.68															6			

PILOT APPRAISAL OF SEISMIC SCREENING PROCEDURES
STATE HIGHWAY 1 BRIDGES BETWEEN RP 844/1.27 AND 979/4.81

Sorted by Route Position Order

SH1 RP	Bridge Name	Excluded from Prioritisation By Screening Procedure	Seismic Prioritisation Grade (SPG)	Hazard Index	Importance Index	Vulnerability Index	Hazard Index Factors: Peak Ground Accln	Remaining Service Life	Soil Condition	Liquefaction Risk	Importance Index Factors: AADT On Bridge	AADT Under Bridge	Detour Length	Facility Crossed	Route Type	Critical Utility	Vulnerability Index Factors: Year Designed	Super-structure Hinges	Super-structure Overlap	Super-structure Length	Pier Type	Bridge Skew	Abutment Type	Other Feature	Route Position Order	Economic Analysis Ranking	Difference Econ-SPG Rankings
844/1.27	Rangitikei River Bridge at Bulls	no	0.41	0.76	0.50	0.60	1.00	0.70	0.00	1.00	0.70	0.00	0.18	0.00	1.00	1.00	0.50	1.00	0.00	1.00	0.50	0.00	1.00	1.00	1	3	-11
845/2.38	Makowai Stream Bridge	yes	0.25	0.76	0.46	0.13	1.00	0.70	0.00	1.00	0.69	0.00	0.01	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.09	0.00	0.00	2	27	-1
845/3.82	Piakatutu Stream Bridge	yes	0.30	0.91	0.46	0.13	1.00	0.70	1.00	1.00	0.69	0.00	0.00	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.09	0.00	0.00	3	29	7
850/4.35	Makahikatoa Stream Bridge	yes	0.29	0.91	0.45	0.13	1.00	0.70	1.00	1.00	0.63	0.00	0.03	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4	26	1
850/5.47	Makowai No 2 Bridge	No Drawings Available		Could Not Be Assessed																					5		
850/5.68	Makowai No 2 Bridge	No Drawings Available		Could Not Be Assessed																					6		
872/12.41	North Whirokino Trestle	yes	0.33	0.91	0.47	0.20	1.00	0.70	1.00	1.00	0.63	0.00	0.17	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.50	0.00	0.00	0.00	7	17	-2
872/13.04	Whirokino Trestle	no	0.36	0.91	0.47	0.27	1.00	0.70	1.00	1.00	0.63	0.00	0.17	0.00	1.00	1.00	0.50	0.00	0.00	1.00	0.50	0.00	0.00	0.00	8	7	-10
872/14.30	Manawatu River (Whirokino) Bridge	no	0.51	0.91	0.52	0.62	1.00	0.70	1.00	1.00	0.63	0.00	0.40	0.00	1.00	1.00	0.50	1.00	0.00	1.00	0.50	0.22	1.00	1.00	9	6	1
900/6.77	Ohau River Bridge	no	0.53	1.00	0.68	0.31	1.00	1.00	1.00	1.00	0.75	0.00	1.00	0.00	1.00	1.00	0.50	0.50	0.00	1.00	0.50	0.00	0.00	0.00	10	1	-1
900/7.04	Ohau Overbridge	yes	0.52	1.00	0.75	0.19	1.00	1.00	1.00	1.00	0.75	0.00	1.00	0.50	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.61	0.00	0.00	11	10	7
900/8.16	Kuku Stream Bridge	no	0.47	0.91	0.68	0.28	1.00	0.70	1.00	1.00	0.76	0.00	1.00	0.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.33	0.00	0.00	12	22	13
900/10.35	Waikawa River Bridge	no	0.49	0.91	0.68	0.33	1.00	0.70	1.00	1.00	0.76	0.00	1.00	0.00	1.00	1.00	1.00	0.00	0.00	0.00	0.50	0.00	0.00	0.00	13	5	-3
900/10.67	Manakau North Overbridge	no	0.50	0.91	0.75	0.24	1.00	0.70	1.00	1.00	0.74	0.00	1.00	0.50	1.00	1.00	0.50	0.00	0.00	0.50	0.50	0.00	0.00	0.00	14	9	2
900/13.90	Waiauti Stream (Manakau) Bridge	yes	0.46	0.91	0.68	0.25	1.00	0.70	1.00	1.00	0.74	0.00	1.00	0.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	15	23	13
915/0.00	Pukehou (Manakau South) Overbridge	no	0.51	1.00	0.58	0.41	1.00	1.00	1.00	1.00	0.76	0.00	0.16	0.50	1.00	1.00	0.50	0.00	0.00	0.50	1.00	0.00	1.00	0.00	16	12	8
915/4.04	Waitohu Stream Bridge	no	0.35	0.91	0.51	0.20	1.00	0.70	1.00	1.00	0.76	0.00	0.16	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.50	0.00	0.00	0.00	17	14	-4
915/4.86	Otaki Overbridge	no	0.38	0.91	0.57	0.20	1.00	0.70	1.00	1.00	0.77	0.00	0.07	0.50	1.00	1.00	0.50	0.00	0.00	0.00	0.50	0.00	0.00	0.00	18	15	0
915/6.81	Otaki River Bridge	no	0.50	0.91	0.69	0.35	1.00	0.70	1.00	1.00	0.79	0.00	1.00	0.00	1.00	1.00	0.50	1.00	0.00	1.00	0.50	0.00	0.00	0.00	19	11	5
915/10.53	Mangaone Stream Bridge	yes	0.33	0.91	0.52	0.13	1.00	0.70	1.00	1.00	0.85	0.00	0.06	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	20	28	8
931/5.18	Waikanae River Bridge	no	0.62	1.00	0.71	0.49	1.00	1.00	1.00	1.00	0.85	0.00	1.00	0.00	1.00	1.00	0.50	0.00	0.00	0.50	0.50	0.00	1.00	1.00	21	4	3
942/0.00	Paraparaumu Overbridge	no	0.33	0.76	0.58	0.20	1.00	0.70	1.00	0.00	0.85	0.00	0.00	0.50	1.00	1.00	0.50	0.00	0.00	0.00	0.50	0.00	0.00	0.00	22	16	-6
953/0.00	Paekakariki Overbridge	no	0.41	0.91	0.60	0.24	1.00	0.70	1.00	1.00	0.92	0.00	0.01	0.50	1.00	1.00	0.50	0.00	0.00	0.50	0.50	0.00	0.00	0.00	23	13	1
953/7.70	Pukerua Bay Overbridge	no	0.43	0.91	0.62	0.25	1.00	0.70	1.00	1.00	0.93	0.00	0.04	0.50	1.00	1.00	0.50	0.00	0.00	0.00	0.50	0.53	0.00	0.00	24	8	-3
953/15.41	Paremata Harbour Bridge	no	0.41	0.91	0.57	0.27	1.00	0.70	1.00	1.00	1.00	0.00	0.11	0.00	1.00	1.00	0.50	0.00	0.00	1.00	0.50	0.00	0.00	0.00	25	2	-11
969/4.40	Kenepuru Stream Bridge	yes	0.38	1.00	0.65	0.12	1.00	1.00	1.00	1.00	1.00	0.00	0.01	0.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.17	1.00	0.00	26	20	4
969/7.15	Collins Avenue East Bridge	no	0.30	0.70	0.49	0.33	1.00	1.00	0.00	0.00	1.00	0.35	0.01	0.00	1.00	0.00	0.50	0.00	0.00	0.00	0.50	0.27	1.00	0.00	27	18	-5
969/7.15	Collins Avenue West Bridge	no	0.30	0.70	0.49	0.33	1.00	1.00	0.00	0.00	1.00	0.35	0.01	0.00	1.00	0.00	0.50	0.00	0.00	0.00	0.50	0.27	1.00	0.00	28	19	-5
979/0.00	Takapu Road Overbridge	yes	0.25	0.70	0.50	0.13	1.00	1.00	0.00	0.00	1.00	0.50	0.01	0.00	1.00	0.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	29	21	-4
979/4.27	Johnsonville North Overpass	yes	0.25	0.70	0.50	0.16	1.00	1.00	0.00	0.00	1.00	0.48	0.01	0.00	1.00	0.00	0.50	0.00	0.00	0.00	0.00	0.33	0.00	0.00	30	25	-2
979/4.81	Johnsonville South Overpass	yes	0.26	0.70	0.50	0.16	1.00	1.00	0.00	0.00	1.00	0.48	0.00	0.00	1.00	0.00	0.50	0.00	0.00	0.00	0.00	0.50	0.00	0.00	31	24	-2
	FACTORS - THIS TRIAL:			1.00	0.60	0.40	0.40	0.30	0.15	0.15	0.30	0.10	0.20	0.15	0.15	0.10	0.28	0.04	0.10	0.07	0.15	0.10	0.10	0.15			
	FACTORS IN REPORT:			1.00	0.60	0.40	0.40	0.30	0.15	0.15	0.25	0.15	0.15	0.20	0.15	0.10	0.25	0.04	0.10	0.07	0.15	0.10	0.10	0.15			

Sorted by Seismic Priority Grade

SH1 RP	Bridge Name	Excluded from Prioritisation By Screening Procedure	Seismic Prioritisation Grade (SPG)	Hazard Index	Importance Index	Vulnerability Index	Hazard Index Factors: Peak Ground Accln	Remaining Service Life	Soil Condition	Liquefaction Risk	Importance Index Factors: AADT On Bridge	AADT Under Bridge	Detour Length	Facility Crossed	Route Type	Critical Utility	Vulnerability Index Factors: Year Designed	Super-structure Hinges	Super-structure Overlap	Super-structure Length	Pier Type	Bridge Skew	Abutment Type	Other Feature	Route Position Order	Economic Analysis Ranking	SPG	Difference Econ SPG Rankings
931/5.18	Waikanae River Bridge	no	0.62	1.00	0.71	0.49	1.00	1.00	1.00	1.00	0.85	0.00	1.00	0.00	1.00	1.00	0.50	0.00	0.00	0.50	0.50	0.00	1.00	1.00	21	4	1	3
900/6.77	Ohau River Bridge	no	0.53	1.00	0.68	0.31	1.00	1.00	1.00	1.00	0.75	0.00	1.00	0.00	1.00	1.00	0.50	0.50	0.00	1.00	0.50	0.00	0.00	0.00	10	1	2	-1
900/7.04	Ohau Overbridge	yes	0.52	1.00	0.75	0.19	1.00	1.00	1.00	1.00	0.75	0.00	1.00	0.50	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.61	0.00	0.00	11	10	3	7
915/0.00	Pukehou (Manakau South) Overbridge	no	0.51	1.00	0.58	0.41	1.00	1.00	1.00	1.00	0.76	0.00	0.16	0.50	1.00	1.00	0.50	0.00	0.00	0.50	1.00	0.00	1.00	0.00	16	12	4	8
872/14.30	Manawatu River (Whirokino) Bridge	no	0.51	0.91	0.62	0.62	1.00	0.70	1.00	1.00	0.63	0.00	0.40	0.00	1.00	1.00	0.50	1.00	0.00	1.00	0.50	0.22	1.00	1.00	9	6	5	1
915/6.81	Otaki River Bridge	no	0.50	0.91	0.69	0.35	1.00	0.70	1.00	1.00	0.79	0.00	1.00	0.00	1.00	1.00	0.50	1.00	0.00	1.00	0.50	0.00	0.00	0.00	19	11	6	5
900/10.67	Manakau North Overbridge	no	0.50	0.91	0.76	0.24	1.00	0.70	1.00	1.00	0.74	0.00	1.00	0.50	1.00	1.00	0.50	0.00	0.00	0.50	0.50	0.00	0.00	0.00	14	9	7	2
900/10.35	Waikawa River Bridge	no	0.49	0.91	0.68	0.33	1.00	0.70	1.00	1.00	0.76	0.00	1.00	0.00	1.00	1.00	1.00	0.00	0.00	0.00	0.50	0.00	0.00	0.00	13	5	8	-3
900/8.16	Kuku Stream Bridge	no	0.47	0.91	0.68	0.28	1.00	0.70	1.00	1.00	0.76	0.00	1.00	0.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.33	0.00	0.00	12	22	9	13
900/13.90	Waiauti Stream (Manakau) Bridge	yes	0.46	0.91	0.68	0.25	1.00	0.70	1.00	1.00	0.74	0.00	1.00	0.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	15	23	10	13
953/7.70	Pukerua Bay Overbridge	no	0.43	0.91	0.62	0.25	1.00	0.70	1.00	1.00	0.93	0.00	0.08	0.50	1.00	1.00	0.50	0.00	0.00	0.00	0.50	0.53	0.00	0.00	24	8	11	-3
953/0.00	Paekakariki Overbridge	no	0.41	0.91	0.60	0.24	1.00	0.70	1.00	1.00	0.92	0.00	0.01	0.50	1.00	1.00	0.50	0.00	0.00	0.50	0.50	0.00	0.00	0.00	23	13	12	1
953/15.41	Paremata Harbour Bridge	no	0.41	0.91	0.57	0.27	1.00	0.70	1.00	1.00	1.00	0.00	0.11	0.00	1.00	1.00	0.50	0.00	0.00	1.00	0.50	0.00	0.00	0.00	25	2	13	-11
844/1.27	Rangitikei River Bridge at Bulls	no	0.41	0.76	0.50	0.60	1.00	0.70	0.00	1.00	0.70	0.00	0.18	0.00	1.00	1.00	0.50	1.00	0.00	1.00	0.50	0.00	1.00	1.00	1	3	14	-11
915/4.86	Otaki Overbridge	no	0.38	0.91	0.57	0.20	1.00	0.70	1.00	1.00	0.77	0.00	0.07	0.50	1.00	1.00	0.50	0.00	0.00	0.00	0.50	0.00	0.00	0.00	18	15	15	0
969/4.40	Kenepuru Stream Bridge	yes	0.38	1.00	0.65	0.12	1.00	1.00	1.00	1.00	1.00	0.00	0.01	0.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.17	1.00	0.00	26	20	16	4
872/13.04	Whirokino Trestle	no	0.36	0.91	0.47	0.27	1.00	0.70	1.00	1.00	0.63	0.00	0.17	0.00	1.00	1.00	0.50	0.00	0.00	1.00	0.50	0.00	0.00	0.00	8	7	17	-10
915/4.04	Waitohu Stream Bridge	no	0.35	0.91	0.51	0.20	1.00	0.70	1.00	1.00	0.76	0.00	0.16	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.50	0.00	0.00	0.00	17	14	18	-4
872/12.41	North Whirokino Trestle	yes	0.33	0.91	0.47	0.20	1.00	0.70	1.00	1.00	0.63	0.00	0.17	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.50	0.00	0.00	0.00	7	17	19	-2
915/10.53	Mangaone Stream Bridge	yes	0.33	0.91	0.52	0.13	1.00	0.70	1.00	1.00	0.85	0.00	0.06	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	20	28	20	8
942/0.00	Paraparaumu Overbridge	no	0.33	0.76	0.58	0.20	1.00	0.70	1.00	0.00	0.85	0.00	0.00	0.50	1.00	1.00	0.50	0.00	0.00	0.00	0.50	0.00	0.00	0.00	22	16	21	-5
845/3.82	Piakatutu Stream Bridge	yes	0.30	0.91	0.46	0.13	1.00	0.70	1.00	1.00	0.69	0.00	0.00	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.09	0.00	0.00	3	29	22	7
969/7.15	Collins Avenue East Bridge	no	0.30	0.70	0.49	0.33	1.00	1.00	0.00	0.00	1.00	0.35	0.01	0.00	1.00	0.00	0.50	0.00	0.00	0.00	0.50	0.27	1.00	0.00	27	18	23	-5
969/7.15	Collins Avenue West Bridge	no	0.30	0.70	0.49	0.33	1.00	1.00	0.00	0.00	1.00	0.35	0.01	0.00	1.00	0.00	0.50	0.00	0.00	0.00	0.50	0.27	1.00	0.00	28	19	24	-5
850/4.35	Makahikatoa Stream Bridge	yes	0.29	0.91	0.45	0.13	1.00	0.70	1.00	1.00	0.63	0.00	0.03	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4	26	25	1
979/4.81	Johnsonville South Overpass	yes	0.26	0.70	0.50	0.18	1.00	1.00	0.00	0.00	1.00	0.48	0.00	0.00	1.00	0.00	0.50	0.00	0.00	0.00	0.00	0.50	0.00	0.00	31	24	26	-2
979/4.27	Johnsonville North Overpass	yes	0.25	0.70	0.50	0.16	1.00	1.00	0.00	0.00	1.00	0.48	0.01	0.00	1.00	0.00	0.50	0.00	0.00	0.00	0.00	0.33	0.00	0.00	30	25	27	-2
845/2.38	Makowai Stream Bridge	yes	0.25	0.76	0.46	0.13	1.00	0.70	0.00	1.00	0.69	0.00	0.01	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.09	0.00	0.00	2	27	28	-1
979/0.00	Takapu Road Overbridge	yes	0.25	0.70	0.50	0.13	1.00	1.00	0.00	0.00	1.00	0.50	0.01	0.00	1.00	0.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	29	21	29	-8
850/5.47	Makowai No 2 Bridge	No Drawings Available		Could Not Be Assessed																					5			
850/5.68	Makowai No 2 Bridge	No Drawings Available		Could Not Be Assessed																					6			

PILOT APPRAISAL OF SEISMIC SCREENING PROCEDURES
STATE HIGHWAY 1 BRIDGES BETWEEN RP 844/1.27 AND 979/4.61

Sorted by Route Position Order

SH1 RP	Bridge Name	Excluded from Prioritisation By Screening Procedure	Seismic Prioritisation Grade (SPG)	Hazard Index	Importance Index	Vulnerability Index	Hazard Index Factors: Peak Ground Accln.	Remaining Service Life	Soil Condition	Liquefaction Risk	Importance Index Factors: AADT On Bridge	AADT Under Bridge	Detour Length	Facility Crossed	Route Type	Critical Utility	Vulnerability Index Factors: Year Designed	Super-structure Hinges	Super-structure Overlap	Super-structure Length	Pier Type	Bridge Skew	Abutment Type	Other Feature	Route Position Order	Economic Analysis Ranking	Difference Econ-SPG Rankings
844/1.27	Rangitikei River Bridge at Bulls	no	0.37	0.73	0.45	0.60	1.00	0.70	0.00	1.00	0.70	0.00	0.18	0.00	1.00	1.00	0.50	1.00	0.00	1.00	0.50	0.00	1.00	1.00	1	3	-12
845/2.38	Makowai Stream Bridge	yes	0.22	0.73	0.42	0.13	1.00	0.70	0.00	1.00	0.69	0.00	0.01	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.09	0.00	0.00	2	27	1
845/3.82	Piakatutu Stream Bridge	yes	0.28	0.93	0.42	0.13	1.00	0.70	1.00	1.00	0.69	0.00	0.00	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.09	0.00	0.00	3	29	7
850/4.35	Makahikatoa Stream Bridge	yes	0.27	0.93	0.41	0.13	1.00	0.70	1.00	1.00	0.63	0.00	0.03	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4	26	3
850/5.67	Makowai No 2 Bridge	No Drawings Available		Could Not Be Assessed																					5		
850/5.68	Makowai No 2 Bridge	No Drawings Available		Could Not Be Assessed																					6		
872/12.41	North Whirokino Trestle	yes	0.31	0.93	0.43	0.20	1.00	0.70	1.00	1.00	0.63	0.00	0.17	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.50	0.00	0.00	0.00	7	17	-2
872/13.04	Whirokino Trestle	no	0.34	0.93	0.43	0.27	1.00	0.70	1.00	1.00	0.63	0.00	0.17	0.00	1.00	1.00	0.50	0.00	0.00	1.00	0.50	0.00	0.00	0.00	8	7	-10
872/14.30	Manawatu River (Whirokino) Bridge	no	0.49	0.93	0.47	0.62	1.00	0.70	1.00	1.00	0.63	0.00	0.40	0.00	1.00	1.00	0.50	1.00	0.00	1.00	0.50	0.22	1.00	1.00	9	6	3
900/6.77	Ohau River Bridge	no	0.48	1.00	0.59	0.31	1.00	1.00	1.00	1.00	0.75	0.00	1.00	0.00	1.00	1.00	0.50	0.50	0.00	1.00	0.50	0.00	0.00	0.00	10	1	-4
900/7.04	Ohau Overbridge	yes	0.49	1.00	0.69	0.19	1.00	1.00	1.00	1.00	0.75	0.00	1.00	0.50	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.61	0.00	0.00	11	10	6
900/8.16	Kuku Stream Bridge	no	0.43	0.93	0.59	0.28	1.00	0.70	1.00	1.00	0.76	0.00	1.00	0.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.33	0.00	0.00	12	22	13
900/10.35	Waikawa River Bridge	no	0.45	0.93	0.59	0.33	1.00	0.70	1.00	1.00	0.76	0.00	1.00	0.00	1.00	1.00	1.00	0.00	0.00	0.00	0.50	0.00	0.00	0.00	13	5	-3
900/10.67	Manakau North Overbridge	no	0.47	0.93	0.69	0.24	1.00	0.70	1.00	1.00	0.76	0.00	1.00	0.50	1.00	1.00	0.50	0.00	0.00	0.50	0.50	0.00	0.00	0.00	14	9	3
900/13.90	Waiauti Stream (Manakau) Bridge	yes	0.42	0.93	0.59	0.25	1.00	0.70	1.00	1.00	0.76	0.00	1.00	0.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	15	23	12
915/0.00	Pukehou (Manakau South) Overbridge	no	0.50	1.00	0.56	0.41	1.00	1.00	1.00	1.00	0.76	0.00	0.16	0.50	1.00	1.00	0.50	0.00	0.00	0.50	1.00	0.00	1.00	0.00	16	12	10
915/4.04	Waitohu Stream Bridge	no	0.33	0.93	0.46	0.20	1.00	0.70	1.00	1.00	0.76	0.00	0.16	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.50	0.00	0.00	0.00	17	14	-4
915/4.86	Otaki Overbridge	no	0.38	0.93	0.55	0.20	1.00	0.70	1.00	1.00	0.77	0.00	0.07	0.50	1.00	1.00	0.60	0.00	0.00	0.00	0.50	0.00	0.00	0.00	18	15	1
915/6.81	Otaki River Bridge	no	0.46	0.93	0.60	0.35	1.00	0.70	1.00	1.00	0.79	0.00	1.00	0.00	1.00	1.00	0.50	1.00	0.00	1.00	0.50	0.00	0.00	0.00	19	11	4
915/10.53	Mangaone Stream Bridge	yes	0.31	0.93	0.47	0.13	1.00	0.70	1.00	1.00	0.85	0.00	0.06	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	20	28	8
931/5.19	Waikanae River Bridge	no	0.56	1.00	0.61	0.49	1.00	1.00	1.00	1.00	0.85	0.00	1.00	0.00	1.00	1.00	0.50	0.00	0.00	0.50	0.50	0.00	1.00	1.00	21	4	3
942/0.00	Paraparaumu Overbridge	no	0.30	0.73	0.56	0.20	1.00	0.70	1.00	0.00	0.85	0.00	0.00	0.50	1.00	1.00	0.50	0.00	0.00	0.00	0.50	0.00	0.00	0.00	22	16	-5
953/0.00	Paekakariki Overbridge	no	0.41	0.93	0.58	0.24	1.00	0.70	1.00	1.00	0.92	0.00	0.01	0.50	1.00	1.00	0.50	0.00	0.00	0.50	0.50	0.00	0.00	0.00	23	13	1
953/7.70	Pukerua Bay Overbridge	no	0.42	0.93	0.60	0.25	1.00	0.70	1.00	1.00	0.93	0.00	0.08	0.50	1.00	1.00	0.50	0.00	0.00	0.00	0.50	0.53	0.00	0.00	24	8	-2
953/15.41	Paremata Harbour Bridge	no	0.39	0.93	0.52	0.27	1.00	0.70	1.00	1.00	1.00	0.00	0.11	0.00	1.00	1.00	0.50	0.00	0.00	1.00	0.50	0.00	0.00	0.00	25	2	-11
969/4.40	Kenepuru Stream Bridge	yes	0.35	1.00	0.50	0.12	1.00	1.00	1.00	1.00	1.00	0.00	0.01	0.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.17	1.00	0.00	26	20	4
969/7.15	Collins Avenue East Bridge	no	0.24	0.60	0.45	0.33	1.00	1.00	0.00	0.00	1.00	0.35	0.01	0.00	1.00	0.00	0.50	0.00	0.00	0.00	0.50	0.27	1.00	0.00	27	18	-6
969/7.15	Collins Avenue West Bridge	no	0.24	0.60	0.45	0.33	1.00	1.00	0.00	0.00	1.00	0.35	0.01	0.00	1.00	0.00	0.50	0.00	0.00	0.00	0.50	0.27	1.00	0.00	28	19	-6
979/0.00	Takapu Road Overbridge	yes	0.20	0.60	0.48	0.13	1.00	1.00	0.00	0.00	1.00	0.50	0.01	0.00	1.00	0.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	29	21	-8
979/4.27	Johnsonville North Overpass	yes	0.21	0.60	0.47	0.16	1.00	1.00	0.00	0.00	1.00	0.48	0.01	0.00	1.00	0.00	0.50	0.00	0.00	0.00	0.00	0.33	0.00	0.00	30	25	-3
979/4.61	Johnsonville South Overpass	yes	0.21	0.60	0.47	0.18	1.00	1.00	0.00	0.00	1.00	0.48	0.00	0.00	1.00	0.00	0.50	0.00	0.00	0.00	0.00	0.50	0.00	0.00	31	24	-3
		FACTORS - THIS TRIAL:		1.00	0.60	0.40	0.35	0.25	0.20	0.20	0.26	0.16	0.15	0.20	0.15	0.10	0.25	0.06	0.10	0.07	0.15	0.10	0.10	0.15			
		FACTORS #1 REPORT:		1.00	0.60	0.40	0.40	0.30	0.15	0.15	0.25	0.15	0.15	0.20	0.15	0.10	0.25	0.08	0.10	0.07	0.15	0.10	0.10	0.15			

Sorted by Seismic Priority Grade

SH1 RP	Bridge Name	Excluded from Prioritisation By Screening Procedure	Seismic Prioritisation Grade (SPG)	Hazard Index	Importance Index	Vulnerability Index	Hazard Index Factors: Peak Ground Accln.	Remaining Service Life	Soil Condition	Liquefaction Risk	Importance Index Factors: AADT On Bridge	AADT Under Bridge	Detour Length	Facility Crossed	Route Type	Critical Utility	Vulnerability Index Factors: Year Designed	Super-structure Hinges	Super-structure Overlap	Super-structure Length	Pier Type	Bridge Skew	Abutment Type	Other Feature	Route Position Order	Economic Analysis Ranking	SPG	Difference Econ SPG Rankings
931/5.19	Waikanae River Bridge	no	0.56	1.00	0.61	0.49	1.00	1.00	1.00	1.00	0.85	0.00	1.00	0.00	1.00	1.00	0.50	0.00	0.00	0.50	0.50	0.00	1.00	1.00	21	4	1	3
915/0.00	Pukehou (Manakau South) Overbridge	no	0.50	1.00	0.56	0.41	1.00	1.00	1.00	1.00	0.76	0.00	0.16	0.50	1.00	1.00	0.50	0.00	0.00	0.50	1.00	0.00	1.00	0.00	16	12	2	10
872/14.30	Manawatu River (Whirokino) Bridge	no	0.49	0.93	0.47	0.62	1.00	0.70	1.00	1.00	0.63	0.00	0.40	0.00	1.00	1.00	0.50	1.00	0.00	1.00	0.50	0.22	1.00	1.00	9	6	3	3
900/7.04	Ohau Overbridge	yes	0.49	1.00	0.69	0.19	1.00	1.00	1.00	1.00	0.75	0.00	1.00	0.50	1.00	1.00	0.60	0.00	0.00	0.00	0.00	0.61	0.00	0.00	11	10	4	6
900/6.77	Ohau River Bridge	no	0.48	1.00	0.59	0.31	1.00	1.00	1.00	1.00	0.75	0.00	1.00	0.00	1.00	1.00	0.50	0.50	0.00	1.00	0.50	0.00	0.00	0.00	10	1	5	-4
900/10.67	Manakau North Overbridge	no	0.47	0.93	0.69	0.24	1.00	0.70	1.00	1.00	0.76	0.00	1.00	0.50	1.00	1.00	0.50	0.00	0.00	0.50	0.50	0.00	0.00	0.00	14	9	6	3
915/6.81	Otaki River Bridge	no	0.46	0.93	0.60	0.35	1.00	0.70	1.00	1.00	0.79	0.00	1.00	0.00	1.00	1.00	0.50	1.00	0.00	1.00	0.50	0.00	0.00	0.00	19	11	7	4
900/10.35	Waikawa River Bridge	no	0.45	0.93	0.59	0.33	1.00	0.70	1.00	1.00	0.76	0.00	1.00	0.00	1.00	1.00	1.00	0.00	0.00	0.00	0.50	0.00	0.00	0.00	13	5	8	-3
900/8.16	Kuku Stream Bridge	no	0.43	0.93	0.59	0.28	1.00	0.70	1.00	1.00	0.76	0.00	1.00	0.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.33	0.00	0.00	12	22	9	13
953/7.70	Pukerua Bay Overbridge	no	0.42	0.93	0.60	0.25	1.00	0.70	1.00	1.00	0.93	0.00	0.08	0.50	1.00	1.00	0.50	0.00	0.00	0.00	0.50	0.53	0.00	0.00	24	8	10	-2
900/13.90	Waiauti Stream (Manakau) Bridge	yes	0.42	0.93	0.59	0.25	1.00	0.70	1.00	1.00	0.76	0.00	1.00	0.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	15	23	11	12
953/0.00	Paekakariki Overbridge	no	0.41	0.93	0.58	0.24	1.00	0.70	1.00	1.00	0.92	0.00	0.01	0.50	1.00	1.00	0.50	0.00	0.00	0.50	0.50	0.00	0.00	0.00	23	13	12	1
953/15.41	Paremata Harbour Bridge	no	0.39	0.93	0.52	0.27	1.00	0.70	1.00	1.00	1.00	0.00	0.11	0.00	1.00	1.00	0.50	0.00	0.00	1.00	0.50	0.00	0.00	0.00	25	2	13	-11
915/4.86	Otaki Overbridge	no	0.38	0.93	0.55	0.20	1.00	0.70	1.00	1.00	0.77	0.00	0.07	0.50	1.00	1.00	0.60	0.00	0.00	0.00	0.50	0.00	0.00	0.00	18	15	14	1
844/1.27	Rangitikei River Bridge at Bulls	no	0.37	0.73	0.45	0.60	1.00	0.70	0.00	1.00	0.70	0.00	0.18	0.00	1.00	1.00	0.50	1.00	0.00	1.00	0.50	0.00	1.00	1.00	1	3	15	-12
969/4.40	Kenepuru Stream Bridge	yes	0.35	1.00	0.50	0.12	1.00	1.00	1.00	1.00	1.00	0.00	0.01	0.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.17	1.00	0.00	26	20	16	4
872/13.04	Whirokino Trestle	no	0.34	0.93	0.43	0.27	1.00	0.70	1.00	1.00	0.63	0.00	0.17	0.00	1.00	1.00	0.50	0.00	0.00	1.00	0.50	0.00	0.00	0.00	8	7	17	-10
915/4.04	Waitohu Stream Bridge	no	0.33	0.93	0.46	0.20	1.00	0.70	1.00	1.00	0.76	0.00	0.16	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.50	0.00	0.00	0.00	17	14	18	-4
872/12.41	North Whirokino Trestle	yes	0.31	0.93	0.43	0.20	1.00	0.70	1.00	1.00	0.63	0.00	0.17	0.00	1.00	1.00	0.60	0.00	0.00	0.00	0.50	0.00	0.00	0.00	7	17	19	-2
915/10.53	Mangaone Stream Bridge	yes	0.31	0.93	0.47	0.13	1.00	0.70	1.00	1.00	0.85	0.00	0.06	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	20	28	20	8
942/0.00	Paraparaumu Overbridge	no	0.30	0.73	0.56	0.20	1.00	0.70	1.00	0.00	0.85	0.00	0.00	0.50	1.00	1.00	0.50	0.00	0.00	0.00	0.50	0.00	0.00	0.00	22	16	21	-5
845/3.82	Piakatutu Stream Bridge	yes	0.28	0.93	0.42	0.13	1.00	0.70	1.00	1.00	0.69	0.00	0.00	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.09	0.00	0.00	3	29	22	7
850/4.35	Makahikatoa Stream Bridge	yes	0.27	0.93	0.41	0.13	1.00	0.70	1.00	1.00	0.63	0.00	0.03	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4	26	23	3
969/7.15	Collins Avenue East Bridge	no	0.24	0.60	0.45	0.33	1.00	1.00	0.00	0.00	1.00	0.35	0.01	0.00	1.00	0.00	0.50	0.00	0.00	0.00	0.50	0.27	1.00	0.00	27	18	24	-6
969/7.15	Collins Avenue West Bridge	no	0.24	0.60	0.45	0.33	1.00	1.00	0.00	0.00	1.00	0.35	0.01	0.00	1.00	0.00	0.50	0.00	0.00	0.00	0.50	0.27	1.00	0.00	28	19	25	-6
845/2.38	Makowai Stream Bridge	yes	0.22	0.73	0.42	0.13	1.00	0.70	0.00	1.00	0.69	0.00	0.01	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.09	0.00	0.00	2	27	26	1
979/4.61	Johnsonville South Overpass	yes	0.21	0.60	0.47	0.18	1.00	1.00	0.00	0.00	1.00	0.48	0.00	0.00	1.00	0.00	0.50	0.00	0.00	0.00	0.00	0.50	0.00	0.00	31	24	27	-3
979/4.27	Johnsonville North Overpass	yes	0.21	0.60	0.47	0.16	1.00	1.00	0.00	0.00	1.00	0.48	0.01	0.00	1.00	0.00	0.50	0.00	0.00	0.00	0.00	0.33	0.00	0.00	30	25	28	-3
979/0.00	Takapu Road Overbridge	yes	0.20	0.60	0.48	0.13	1.00	1.00	0.00	0.00	1.00	0.50	0.01	0.00	1.00	0.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	29	21	29	-8
850/5.67	Makowai No 2 Bridge	No Drawings Available		Could Not Be Assessed																					5			
850/5.68	Makowai No 2 Bridge	No Drawings Available		Could Not Be Assessed																					6			

PILOT APPRAISAL OF SEISMIC SCREENING PROCEDURES
STATE HIGHWAY 1 BRIDGES BETWEEN RP 844/1.27 AND 979/4.61

Sorted by Route Position Order

SH1 RP	Bridge Name	Excluded from Prioritisation By Screening Procedure	Seismic Prioritisation Grade (SPG)	Hazard Index	Importance Index	Vulnerability Index	Hazard Index Factors				Importance Index Factors						Vulnerability Index Factors								Route Position Order	Economic Analysis Ranking	Difference Econ-SPG Rankings
							Peak Ground Accln.	Remaining Service Life	Soil Condition	Liquefaction Risk	AADT On Bridge	AADT Under Bridge	Detour Length	Facility Crossed	Route Type	Critical Utility	Year Designed	Super-structure Hinges	Super-structure Overlap	Super-structure Length	Pier Type	Bridge Skew	Abutment Type	Other Feature			
844/1.27	Rangitikei River Bridge at Bulls	no	0.39	0.76	0.45	0.60	1.00	0.70	0.00	1.00	0.70	0.00	0.18	0.00	1.00	1.00	0.50	1.00	0.00	1.00	0.50	0.00	1.00	1.00	1	3	-7
845/2.38	Makowai Stream Bridge	yes	0.23	0.76	0.42	0.13	1.00	0.70	0.00	1.00	0.69	0.00	0.01	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.09	0.00	0.00	2	27	-2
845/3.82	Piakatutu Stream Bridge	yes	0.28	0.91	0.42	0.13	1.00	0.70	1.00	1.00	0.69	0.00	0.00	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.09	0.00	0.00	3	29	5
850/4.35	Makahikatoa Stream Bridge	yes	0.27	0.91	0.41	0.13	1.00	0.70	1.00	1.00	0.63	0.00	0.03	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4	26	1
850/5.67	Makowai No 2 Bridge	No Drawings Available		Could Not Be Assessed																					5		
850/5.68	Makowai No 2 Bridge	No Drawings Available		Could Not Be Assessed																					6		
872/12.41	North Whirokino Trestle	yes	0.31	0.91	0.43	0.20	1.00	0.70	1.00	1.00	0.63	0.00	0.17	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.50	0.00	0.00	0.00	7	17	-3
872/13.04	Whirokino Trestle	no	0.33	0.91	0.43	0.27	1.00	0.70	1.00	1.00	0.63	0.00	0.17	0.00	1.00	1.00	0.50	0.00	0.00	1.00	0.50	0.00	0.00	0.00	8	7	-9
872/14.30	Manawatu River (Whirokino) Bridge	no	0.48	0.91	0.47	0.62	1.00	0.70	1.00	1.00	0.63	0.00	0.40	0.00	1.00	1.00	0.50	1.00	0.00	1.00	0.50	0.22	1.00	1.00	9	6	4
900/6.77	Ohau River Bridge	no	0.48	1.00	0.59	0.31	1.00	1.00	1.00	1.00	0.75	0.00	1.00	0.00	1.00	1.00	0.50	0.50	0.00	1.00	0.50	0.00	0.00	0.00	10	1	-2
900/7.04	Ohau Overbridge	yes	0.41	0.85	0.69	0.19	1.00	1.00	1.00	0.00	0.75	0.00	1.00	0.50	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.61	0.00	0.00	11	10	2
900/8.16	Kuku Stream Bridge	no	0.42	0.91	0.59	0.28	1.00	0.70	1.00	1.00	0.76	0.00	1.00	0.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.33	0.00	0.00	12	22	15
900/10.35	Waikawa River Bridge	no	0.44	0.91	0.59	0.33	1.00	0.70	1.00	1.00	0.76	0.00	1.00	0.00	1.00	1.00	1.00	0.00	0.00	0.00	0.50	0.00	0.00	0.00	13	5	0
900/10.67	Manakau North Overbridge	no	0.39	0.76	0.69	0.24	1.00	0.70	1.00	0.00	0.76	0.00	1.00	0.50	1.00	1.00	0.50	0.00	0.00	0.50	0.50	0.00	0.00	0.00	14	9	-2
900/13.90	Waiauti Stream (Manakau) Bridge	yes	0.41	0.91	0.59	0.25	1.00	0.70	1.00	1.00	0.76	0.00	1.00	0.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	15	23	14
915/0.00	Pukehou (Manakau South) Overbridge	no	0.43	0.85	0.56	0.41	1.00	1.00	1.00	0.00	0.76	0.00	0.16	0.50	1.00	1.00	0.50	0.00	0.00	0.50	1.00	0.00	1.00	0.00	16	12	6
915/4.04	Waitohu Stream Bridge	no	0.33	0.91	0.46	0.20	1.00	0.70	1.00	1.00	0.76	0.00	0.16	0.00	1.00	1.00	0.60	0.00	0.00	0.00	0.50	0.00	0.00	0.00	17	14	-3
915/4.86	Otaki Overbridge	no	0.31	0.76	0.55	0.20	1.00	0.70	1.00	0.00	0.77	0.00	0.07	0.50	1.00	1.00	0.50	0.00	0.00	0.00	0.50	0.00	0.00	0.00	18	15	-4
915/5.81	Otaki River Bridge	no	0.45	0.91	0.60	0.35	1.00	0.70	1.00	1.00	0.79	0.00	1.00	0.00	1.00	1.00	0.50	1.00	0.00	1.00	0.50	0.00	0.00	0.00	19	11	7
915/10.53	Mangaone Stream Bridge	yes	0.30	0.91	0.47	0.13	1.00	0.70	1.00	1.00	0.85	0.00	0.06	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	20	28	7
931/5.19	Waikanae River Bridge	no	0.56	1.00	0.61	0.49	1.00	1.00	1.00	1.00	0.85	0.00	1.00	0.00	1.00	1.00	0.50	0.00	0.00	0.50	0.50	0.00	1.00	1.00	21	4	3
942/0.00	Paraparaumu Overbridge	no	0.32	0.76	0.56	0.20	1.00	0.70	1.00	0.00	0.85	0.00	0.00	0.50	1.00	1.00	0.60	0.00	0.00	0.00	0.50	0.00	0.00	0.00	22	16	-2
953/0.00	Paekakariki Overbridge	no	0.34	0.76	0.58	0.24	1.00	0.70	1.00	0.00	0.92	0.00	0.03	0.50	1.00	1.00	0.50	0.00	0.00	0.50	0.50	0.00	0.00	0.00	23	13	-2
953/7.70	Pukerua Bay Overbridge	no	0.35	0.76	0.60	0.25	1.00	0.70	1.00	0.00	0.93	0.00	0.04	0.50	1.00	1.00	0.50	0.00	0.00	0.00	0.50	0.53	0.00	0.00	24	8	-5
953/15.41	Paremata Harbour Bridge	no	0.38	0.91	0.52	0.27	1.00	0.70	1.00	1.00	1.00	0.00	0.11	0.00	1.00	1.00	0.50	0.00	0.00	1.00	0.50	0.00	0.00	0.00	25	2	-10
969/4.43	Kenepuru Stream Bridge	yes	0.35	1.00	0.50	0.12	1.00	1.00	1.00	1.00	1.00	0.00	0.01	0.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.17	1.00	0.00	26	20	6
969/7.15	Collins Avenue East Bridge	no	0.28	0.70	0.45	0.33	1.00	1.00	0.00	0.00	1.00	0.35	0.01	0.00	1.00	0.00	0.50	0.00	0.00	0.00	0.50	0.27	1.00	0.00	27	18	-4
969/7.15	Collins Avenue West Bridge	no	0.28	0.70	0.45	0.33	1.00	1.00	0.00	0.00	1.00	0.35	0.01	0.00	1.00	0.00	0.50	0.00	0.00	0.00	0.50	0.27	1.00	0.00	28	19	-4
979/0.00	Takapu Road Overbridge	yes	0.24	0.70	0.48	0.13	1.00	1.00	0.00	0.00	1.00	0.50	0.01	0.00	1.00	0.00	0.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	29	21	-7
979/4.27	Johnsonville North Overpass	yes	0.24	0.70	0.47	0.16	1.00	1.00	0.00	0.00	1.00	0.48	0.01	0.00	1.00	0.00	0.50	0.00	0.00	0.00	0.00	0.33	0.00	0.00	30	25	-2
979/4.61	Johnsonville South Overpass	yes	0.25	0.70	0.47	0.18	1.00	1.00	0.00	0.00	1.00	0.48	0.00	0.00	1.00	0.00	0.50	0.00	0.00	0.00	0.00	0.50	0.00	0.00	31	24	-2
		FACTORS - THIS TRIAL:		1.00	0.60	0.40	0.40	0.30	0.16	0.14	0.25	0.16	0.15	0.20	0.15	0.10	0.25	0.06	0.10	0.07	0.18	0.10	0.10	0.15			
		FACTORS IN REPORT:		1.00	0.60	0.40	0.40	0.30	0.15	0.15	0.25	0.15	0.15	0.20	0.15	0.10	0.25	0.06	0.10	0.07	0.15	0.10	0.10	0.15			

Sorted by Seismic Priority Grade

SH1 RP	Bridge Name	Excluded from Prioritisation By Screening Procedure	Seismic Prioritisation Grade (SPG)	Hazard Index	Importance Index	Vulnerability Index	Hazard Index Factors				Importance Index Factors						Vulnerability Index Factors								Route Position Order	Economic Analysis Ranking	SPG	Difference Econ-SPG Rankings
							Peak Ground Accln.	Remaining Service Life	Soil Condition	Liquefaction Risk	AADT On Bridge	AADT Under Bridge	Detour Length	Facility Crossed	Route Type	Critical Utility	Year Designed	Super-structure Hinges	Super-structure Overlap	Super-structure Length	Pier Type	Bridge Skew	Abutment Type	Other Feature				
931/5.19	Waikanae River Bridge	no	0.56	1.00	0.61	0.49	1.00	1.00	1.00	1.00	0.85	0.00	1.00	0.00	1.00	1.00	0.50	0.00	0.00	0.50	0.50	0.00	1.00	1.00	21	4	1	3
872/14.30	Manawatu River (Whirokino) Bridge	no	0.48	0.91	0.47	0.62	1.00	0.70	1.00	1.00	0.63	0.00	0.40	0.00	1.00	1.00	0.50	1.00	0.00	1.00	0.50	0.22	1.00	1.00	9	6	2	4
900/6.77	Ohau River Bridge	no	0.48	1.00	0.59	0.31	1.00	1.00	1.00	1.00	0.75	0.00	1.00	0.00	1.00	1.00	0.50	0.50	0.00	1.00	0.50	0.00	0.00	0.00	10	1	3	-2
915/5.81	Otaki River Bridge	no	0.45	0.91	0.60	0.35	1.00	0.70	1.00	1.00	0.79	0.00	1.00	0.00	1.00	1.00	0.50	1.00	0.00	1.00	0.50	0.00	0.00	0.00	19	11	4	7
900/10.35	Waikawa River Bridge	no	0.44	0.91	0.59	0.33	1.00	0.70	1.00	1.00	0.76	0.00	1.00	0.00	1.00	1.00	1.00	0.00	0.00	0.00	0.50	0.00	0.00	0.00	13	5	5	0
915/0.00	Pukehou (Manakau South) Overbridge	no	0.43	0.85	0.56	0.41	1.00	1.00	1.00	0.00	0.76	0.00	0.16	0.50	1.00	1.00	0.50	0.00	0.00	0.50	1.00	0.00	1.00	0.00	16	12	6	6
900/8.16	Kuku Stream Bridge	no	0.42	0.91	0.59	0.26	1.00	0.70	1.00	1.00	0.76	0.00	1.00	0.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.33	0.00	0.00	12	22	7	15
900/7.04	Ohau Overbridge	yes	0.41	0.85	0.69	0.19	1.00	1.00	1.00	0.00	0.75	0.00	1.00	0.50	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.41	0.00	0.00	11	10	8	2
900/13.90	Waiauti Stream (Manakau) Bridge	yes	0.41	0.91	0.59	0.25	1.00	0.70	1.00	1.00	0.76	0.00	1.00	0.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	15	23	9	14
844/1.27	Rangitikei River Bridge at Bulls	no	0.39	0.76	0.45	0.60	1.00	0.70	0.00	1.00	0.70	0.00	0.18	0.00	1.00	1.00	0.50	1.00	0.00	1.00	0.50	0.00	1.00	1.00	1	3	10	-7
900/10.67	Manakau North Overbridge	no	0.39	0.76	0.69	0.24	1.00	0.70	1.00	0.00	0.76	0.00	1.00	0.50	1.00	1.00	0.50	0.00	0.00	0.50	0.50	0.00	0.00	0.00	14	9	11	-2
953/15.41	Paremata Harbour Bridge	no	0.38	0.91	0.52	0.27	1.00	0.70	1.00	1.00	1.00	0.00	0.11	0.00	1.00	1.00	0.50	0.00	0.00	1.00	0.50	0.00	0.00	0.00	25	2	12	-10
953/7.70	Pukerua Bay Overbridge	no	0.35	0.76	0.60	0.25	1.00	0.70	1.00	0.00	0.93	0.00	0.04	0.50	1.00	1.00	0.60	0.00	0.00	0.00	0.50	0.63	0.00	0.00	24	8	13	-5
969/4.40	Kenepuru Stream Bridge	yes	0.35	1.00	0.50	0.12	1.00	1.00	1.00	1.00	1.00	0.00	0.01	0.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.17	1.00	0.00	26	20	14	6
953/0.00	Paekakariki Overbridge	no	0.34	0.76	0.58	0.24	1.00	0.70	1.00	0.00	0.92	0.00	0.01	0.60	1.00	1.00	0.60	0.00	0.00	0.50	0.50	0.00	0.00	0.00	23	13	15	-2
872/13.04	Whirokino Trestle	no	0.33	0.91	0.43	0.27	1.00	0.70	1.00	1.00	0.63	0.00	0.17	0.00	1.00	1.00	0.50	0.00	0.00	1.00	0.50	0.00	0.00	0.00	8	7	16	-9
915/4.04	Waitohu Stream Bridge	no	0.33	0.91	0.46	0.20	1.00	0.70	1.00	1.00	0.76	0.00	0.18	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.60	0.00	0.00	0.00	17	14	17	-3
942/0.00	Paraparaumu Overbridge	no	0.32	0.76	0.54	0.20	1.00	0.70	1.00	0.00	0.85	0.00	0.00	0.60	1.00	1.00	0.50	0.00	0.00	0.00	0.50	0.00	0.00	0.00	22	16	18	-2
915/4.86	Otaki Overbridge	no	0.31	0.76	0.55	0.20	1.00	0.70	1.00	0.00	0.77	0.00	0.07	0.50	1.00	1.00	0.50	0.00	0.00	0.00	0.50	0.00	0.00	0.00	18	15	19	-4
872/12.41	North Whirokino Trestle	yes	0.31	0.91	0.43	0.20	1.00	0.70	1.00	1.00	0.63	0.00	0.17	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.50	0.00	0.00	0.00	7	17	20	-3
915/10.53	Mangaone Stream Bridge	yes	0.30	0.91	0.47	0.13	1.00	0.70	1.00	1.00	0.85	0.00	0.06	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	20	28	21	7
969/7.15	Collins Avenue East Bridge	no	0.28	0.70	0.45	0.33	1.00	1.00	0.00	0.00	1.00	0.35	0.01	0.00	1.00	0.00	0.50	0.00	0.00	0.00	0.50	0.27	1.00	0.00	27	18	22	-4
969/7.15	Collins Avenue West Bridge	no	0.28	0.70	0.45	0.33	1.00	1.00	0.00	0.00	1.00	0.35	0.01	0.00	1.00	0.00	0.50	0.00	0.00	0.00	0.50	0.27	1.00	0.00	28	19	23	-4
845/3.82	Piakatutu Stream Bridge	yes	0.28	0.91	0.42	0.13	1.00	0.70	1.00	1.00	0.69	0.00	0.00	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.09	0.00	0.00	3	29	24	5
850/4.35	Makahikatoa Stream Bridge	yes	0.27	0.91	0.41	0.13	1.00	0.70	1.00	1.00	0.63	0.00	0.03	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4	26	25	1
979/4.61	Johnsonville South Overpass	yes	0.25	0.70	0.47	0.18	1.00	1.00	0.00	0.00	1.00	0.48	0.00	0.00	1.00	0.00	0.50	0.00	0.00	0.00	0.00	0.50	0.00	0.00	31	24	26	-2
979/4.27	Johnsonville North Overpass	yes	0.24	0.70	0.47	0.16	1.00	1.00	0.00	0.00	1.00	0.48	0.01	0.00	1.00	0.00	0.50	0.00	0.00	0.00	0.00	0.33	0.00	0.00	30	25	27	-2
979/0.00	Takapu Road Overbridge	yes	0.24	0.70	0.48	0.13	1.00	1.00	0.00	0.00	1.00	0.50	0.01	0.00	1.00	0.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	29	21	28	-7
845/2.38	Makowai Stream Bridge	yes	0.23	0.76	0.42	0.13	1.00	0.70	0.00	1.00	0.69	0.00	0.01	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.09	0.00	0.00	2	27	29	-2
850/5.67	Makowai No 2 Bridge	No Drawings Available		Could Not Be Assessed																					5			
850/5.68	Makowai No 2 Bridge	No Drawings Available		Could Not Be Assessed																					6			

file RANKINGS.WK1 - 15:55 - 22 April 1995 - As RANKING2.WK1 but liquefaction index factors altered

PILOT APPRAISAL OF SEISMIC SCREENING PROCEDURES
STATE HIGHWAY 1 BRIDGES BETWEEN RP 844/1.27 AND 979/4.61

Sorted by Route Position Order

SH1 RP	Bridge Name	Excluded from Prioritisation By Screening Procedure	Seismic Prioritisation Grade (SPG)	Hazard Index	Importance Index	Vulnerability Index	Hazard Index Factors				Importance Index Factors						Vulnerability Index Factors								Route Position Order	Economic Analysis Ranking	Difference Econ SPG Rankings
							Peak Ground Accln.	Remaining Service Life	Soil Condition	Liquefaction Risk	AADT On Bridge	AADT Under Bridge	Detour Length	Facility Crossed	Route Type	Critical Utility	Year Designed	Superstructure Hinges	Superstructure Overlap	Superstructure Length	Pier Type	Bridge Skew	Abutment Type	Other Feature			
844/1.27	Rangitikei River Bridge at Bulls	no	0.21	0.76	0.45	0.60	1.00	0.70	0.00	1.00	0.70	0.00	0.18	0.00	1.00	1.00	0.50	1.00	0.00	1.00	0.50	0.00	1.00	1.00	1	3	-1
845/2.38	Makowai Stream Bridge	yes	0.04	0.76	0.42	0.13	1.00	0.70	0.00	1.00	0.69	0.00	0.01	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.09	0.00	0.00	2	27	-1
845/3.82	Pukahutu Stream Bridge	yes	0.05	0.91	0.42	0.13	1.00	0.70	1.00	1.00	0.69	0.00	0.00	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.09	0.00	0.00	3	29	3
850/4.35	Makahikaroa Stream Bridge	yes	0.05	0.91	0.41	0.13	1.00	0.70	1.00	1.00	0.63	0.00	0.03	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4	26	-1
850/5.67	Makowai No 2 Bridge	No Drawings Available		Could Not Be Assessed																					5		
850/5.68	Makowai No 2 Bridge	No Drawings Available		Could Not Be Assessed																					6		
872/12.41	North Whirokino Trestle	yes	0.08	0.91	0.43	0.20	1.00	0.70	1.00	1.00	0.63	0.00	0.17	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.50	0.00	0.00	0.00	7	17	-4
872/13.04	Whirokino Trestle	no	0.11	0.91	0.43	0.27	1.00	0.70	1.00	1.00	0.63	0.00	0.17	0.00	1.00	1.00	0.50	0.00	0.00	1.00	0.50	0.00	0.00	0.00	8	7	-8
872/14.30	Manawatu River (Whirokino) Bridge	no	0.26	0.91	0.47	0.62	1.00	0.70	1.00	1.00	0.63	0.00	0.40	0.00	1.00	1.00	0.50	1.00	0.00	1.00	0.50	0.22	1.00	1.00	9	6	4
900/6.77	Ohau River Bridge	no	0.18	1.00	0.59	0.31	1.00	1.00	1.00	1.00	0.75	0.00	1.00	0.00	1.00	1.00	0.50	0.50	0.00	1.00	0.50	0.00	0.00	0.00	10	1	-5
900/7.04	Ohau Overbridge	yes	0.13	1.00	0.69	0.19	1.00	1.00	1.00	1.00	0.75	0.00	1.00	0.50	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.61	0.00	0.00	11	10	-2
900/8.16	Kuku Stream Bridge	no	0.15	0.91	0.59	0.28	1.00	0.70	1.00	1.00	0.76	0.00	1.00	0.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.33	0.00	0.00	12	22	14
900/10.35	Waikawa River Bridge	no	0.17	0.91	0.59	0.33	1.00	0.70	1.00	1.00	0.76	0.00	1.00	0.00	1.00	1.00	1.00	0.00	0.00	0.00	0.50	0.00	0.00	0.00	13	5	-2
900/10.87	Manakau North Overbridge	no	0.15	0.91	0.69	0.24	1.00	0.70	1.00	1.00	0.76	0.00	1.00	0.50	1.00	1.00	0.50	0.00	0.00	0.50	0.50	0.00	0.00	0.00	14	9	0
900/13.90	Waiauti Stream (Manakau) Bridge	yes	0.13	0.91	0.59	0.25	1.00	0.70	1.00	1.00	0.76	0.00	1.00	0.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	15	23	12
915/9.00	Pukehou (Manakau South) Overbridge	no	0.23	1.00	0.56	0.41	1.00	1.00	1.00	1.00	0.76	0.00	0.16	0.50	1.00	1.00	0.50	0.00	0.00	0.50	1.00	0.00	1.00	0.00	16	12	9
915/4.04	Waitohu Stream Bridge	no	0.08	0.91	0.46	0.20	1.00	0.70	1.00	1.00	0.76	0.00	0.16	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.50	0.00	0.00	0.00	17	14	-6
915/4.86	Otaki Overbridge	no	0.10	0.91	0.55	0.20	1.00	0.70	1.00	1.00	0.77	0.00	0.07	0.50	1.00	1.00	0.50	0.00	0.00	0.00	0.50	0.00	0.00	0.00	18	15	-3
915/6.81	Otaki River Bridge	no	0.19	0.91	0.60	0.35	1.00	0.70	1.00	1.00	0.79	0.00	1.00	0.00	1.00	1.00	0.50	1.00	0.00	1.00	0.50	0.00	0.00	0.00	19	11	6
915/10.53	Mangaone Stream Bridge	yes	0.05	0.91	0.47	0.13	1.00	0.70	1.00	1.00	0.85	0.00	0.06	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	20	28	4
931/5.19	Waikanae River Bridge	no	0.30	1.00	0.61	0.49	1.00	1.00	1.00	1.00	0.85	0.00	1.00	0.00	1.00	1.00	0.50	0.00	0.00	0.50	0.50	0.00	1.00	1.00	21	4	3
942/9.00	Paraparaumu Overbridge	no	0.09	0.76	0.56	0.20	1.00	0.70	1.00	0.00	0.85	0.00	0.00	0.50	1.00	1.00	0.50	0.00	0.00	0.00	0.50	0.00	0.00	0.00	22	16	-3
953/9.00	Paekakariki Overbridge	no	0.12	0.91	0.58	0.24	1.00	0.70	1.00	1.00	0.92	0.00	0.01	0.50	1.00	1.00	0.50	0.00	0.00	0.50	0.50	0.00	0.00	0.00	23	13	-1
953/7.70	Pukerua Bay Overbridge	no	0.14	0.91	0.60	0.25	1.00	0.70	1.00	1.00	0.93	0.00	0.06	0.50	1.00	1.00	0.50	0.00	0.00	0.00	0.50	0.53	0.00	0.00	24	8	-2
953/15.41	Paremata Harbour Bridge	no	0.13	0.91	0.52	0.27	1.00	0.70	1.00	1.00	1.00	0.00	0.11	0.00	1.00	1.00	0.50	0.00	0.00	1.00	0.50	0.00	0.00	0.00	25	2	-11
969/4.40	Kenepuru Stream Bridge	yes	0.06	1.00	0.60	0.12	1.00	1.00	1.00	1.00	1.00	0.00	0.01	0.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.17	1.00	0.00	26	20	-2
969/7.15	Collins Avenue East Bridge	no	0.10	0.70	0.45	0.33	1.00	1.00	0.00	0.00	1.00	0.35	0.01	0.00	1.00	0.00	0.50	0.00	0.00	0.00	0.50	0.27	1.00	0.00	27	18	2
969/7.15	Collins Avenue West Bridge	no	0.10	0.70	0.45	0.33	1.00	1.00	0.00	0.00	1.00	0.35	0.01	0.00	1.00	0.00	0.50	0.00	0.00	0.00	0.50	0.27	1.00	0.00	28	19	2
979/0.00	Takapu Road Overbridge	yes	0.04	0.70	0.48	0.13	1.00	1.00	0.00	0.00	1.00	0.50	0.01	0.00	1.00	0.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	29	21	-8
979/4.27	Johnsonville North Overpass	yes	0.05	0.70	0.47	0.16	1.00	1.00	0.00	0.00	1.00	0.48	0.01	0.00	1.00	0.00	0.50	0.00	0.00	0.00	0.00	0.33	0.00	0.00	30	25	0
979/4.61	Johnsonville South Overpass	yes	0.06	0.70	0.47	0.18	1.00	1.00	0.00	0.00	1.00	0.48	0.00	0.00	1.00	0.00	0.50	0.00	0.00	0.00	0.00	0.50	0.00	0.00	31	24	1
	FACTORS - THIS TRIAL:			1.00	1.00	1.00	0.40	0.30	0.15	0.15	0.25	0.15	0.15	0.20	0.15	0.10	0.25	0.04	0.10	0.07	0.15	0.10	0.10	0.15			
	FACTORS IN REPORT:			1.00	0.60	0.40	0.40	0.30	0.15	0.15	0.25	0.15	0.15	0.20	0.15	0.10	0.25	0.04	0.10	0.07	0.15	0.10	0.10	0.15			

Sorted by Seismic Priority Grade

SH1 RP	Bridge Name	Excluded from Prioritisation By Screening Procedure	Seismic Prioritisation Grade (SPG)	Hazard Index	Importance Index	Vulnerability Index	Hazard Index Factors				Importance Index Factors						Vulnerability Index Factors								Route Position Order	Economic Analysis Ranking	SPG	Difference Econ SPG Rankings
							Peak Ground Accln.	Remaining Service Life	Soil Condition	Liquefaction Risk	AADT On Bridge	AADT Under Bridge	Detour Length	Facility Crossed	Route Type	Critical Utility	Year Designed	Superstructure Hinges	Superstructure Overlap	Superstructure Length	Pier Type	Bridge Skew	Abutment Type	Other Feature				
931/5.19	Waikanae River Bridge	no	0.30	1.00	0.61	0.49	1.00	1.00	1.00	1.00	0.85	0.00	1.00	0.00	1.00	1.00	0.50	0.00	0.00	0.50	0.50	0.00	1.00	1.00	21	4	1	3
872/14.30	Manawatu River (Whirokino) Bridge	no	0.26	0.91	0.47	0.62	1.00	0.70	1.00	1.00	0.63	0.00	0.40	0.00	1.00	1.00	0.50	1.00	0.00	1.00	0.50	0.22	1.00	1.00	9	6	2	4
915/9.00	Pukehou (Manakau South) Overbridge	no	0.23	1.00	0.56	0.41	1.00	1.00	1.00	1.00	0.76	0.00	0.16	0.50	1.00	1.00	0.50	0.00	0.00	0.50	1.00	0.00	1.00	0.00	16	12	3	9
844/1.27	Rangitikei River Bridge at Bulls	no	0.21	0.76	0.45	0.60	1.00	0.70	0.00	1.00	0.70	0.00	0.18	0.00	1.00	1.00	0.50	1.00	0.00	1.00	0.50	0.00	1.00	1.00	1	3	4	-1
915/6.81	Otaki River Bridge	no	0.19	0.91	0.60	0.35	1.00	0.70	1.00	1.00	0.79	0.00	1.00	0.00	1.00	1.00	0.50	1.00	0.00	1.00	0.50	0.00	0.00	0.00	19	11	5	6
900/6.77	Ohau River Bridge	no	0.18	1.00	0.59	0.31	1.00	1.00	1.00	1.00	0.75	0.00	1.00	0.00	1.00	1.00	0.50	0.50	0.00	1.00	0.50	0.00	0.00	0.00	10	1	6	-5
900/10.35	Waikawa River Bridge	no	0.17	0.91	0.59	0.33	1.00	0.70	1.00	1.00	0.76	0.00	1.00	0.00	1.00	1.00	1.00	0.00	0.00	0.00	0.50	0.00	0.00	0.00	13	5	7	-2
900/8.16	Kuku Stream Bridge	no	0.15	0.91	0.59	0.28	1.00	0.70	1.00	1.00	0.76	0.00	1.00	0.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.33	0.00	0.00	12	22	8	14
900/10.87	Manakau North Overbridge	no	0.15	0.91	0.69	0.24	1.00	0.70	1.00	1.00	0.76	0.00	1.00	0.50	1.00	1.00	0.50	0.00	0.00	0.50	0.50	0.00	0.00	0.00	14	9	9	0
953/7.70	Pukerua Bay Overbridge	no	0.14	0.91	0.60	0.25	1.00	0.70	1.00	1.00	0.93	0.00	0.06	0.50	1.00	1.00	0.50	0.00	0.00	0.00	0.50	0.53	0.00	0.00	24	8	10	-2
900/13.90	Waiauti Stream (Manakau) Bridge	yes	0.13	0.91	0.59	0.25	1.00	0.70	1.00	1.00	0.76	0.00	1.00	0.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	15	23	11	12
900/7.04	Ohau Overbridge	yes	0.13	1.00	0.69	0.19	1.00	1.00	1.00	1.00	0.75	0.00	1.00	0.50	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.61	0.00	0.00	11	10	12	-2
953/15.41	Paremata Harbour Bridge	no	0.13	0.91	0.52	0.27	1.00	0.70	1.00	1.00	1.00	0.00	0.11	0.00	1.00	1.00	0.50	0.00	0.00	1.00	0.50	0.00	0.00	0.00	25	2	13	-11
953/9.00	Paekakariki Overbridge	no	0.12	0.91	0.58	0.24	1.00	0.70	1.00	1.00	0.92	0.00	0.01	0.50	1.00	1.00	0.50	0.00	0.00	0.50	0.50	0.00	0.00	0.00	23	13	14	-1
872/13.04	Whirokino Trestle	no	0.11	0.91	0.43	0.27	1.00	0.70	1.00	1.00	0.63	0.00	0.17	0.00	1.00	1.00	0.50	0.00	0.00	1.00	0.50	0.00	0.00	0.00	8	7	15	-8
969/7.15	Collins Avenue East Bridge	no	0.10	0.70	0.45	0.33	1.00	1.00	0.00	0.00	1.00	0.35	0.01	0.00	1.00	0.00	0.50	0.00	0.00	0.00	0.50	0.27	1.00	0.00	27	18	16	2
969/7.15	Collins Avenue West Bridge	no	0.10	0.70	0.45	0.33	1.00	1.00	0.00	0.00	1.00	0.35	0.01	0.00	1.00	0.00	0.50	0.00	0.00	0.00	0.50	0.27	1.00	0.00	28	19	17	2
915/4.86	Otaki Overbridge	no	0.10	0.91	0.55	0.20	1.00	0.70	1.00	1.00	0.77	0.00	0.07	0.50	1.00	1.00	0.50	0.00	0.00	0.00	0.50	0.00	0.00	0.00	18	15	18	-3
942/9.00	Paraparaumu Overbridge	no	0.09	0.76	0.56	0.20	1.00	0.70	1.00	0.00	0.85	0.00	0.00	0.50	1.00	1.00	0.50	0.00	0.00	0.00	0.50	0.00	0.00	0.00	22	16	19	-3
915/4.04	Waitohu Stream Bridge	no	0.08	0.91	0.46	0.20	1.00	0.70	1.00	1.00	0.76	0.00	0.16	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.50	0.00	0.00	0.00	17	14	20	-6
872/12.41	North Whirokino Trestle	yes	0.08	0.91	0.43	0.20	1.00	0.70	1.00	1.00	0.63	0.00	0.17	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.50	0.00	0.00	0.00	7	17	21	-4
969/4.40	Kenepuru Stream Bridge	yes	0.06	1.00	0.60	0.12	1.00	1.00	1.00	1.00	1.00	0.00	0.01	0.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.17	1.00	0.00	26	20	22	-2
979/4.61	Johnsonville South Overpass	yes	0.06	0.70	0.47	0.18	1.00	1.00	0.00	0.00	1.00	0.48	0.00	0.00	1.00	0.00	0.50	0.00	0.00	0.00	0.00	0.50	0.00	0.00	31	24	23	1
915/10.53	Mangaone Stream Bridge	yes	0.05	0.91	0.47	0.13	1.00	0.70	1.00	1.00	0.85	0.00	0.06	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	20	28	24	4
979/4.27	Johnsonville North Overpass	yes	0.05	0.70	0.47	0.16	1.00	1.00	0.00	0.00	1.00	0.48	0.01	0.00	1.00	0.00	0.50	0.00	0.00	0.00	0.00	0.33	0.00	0.00	30	25	25	0
845/3.82	Pukahutu Stream Bridge	yes	0.05	0.91	0.42	0.13	1.00	0.70	1.00	1.00	0.69	0.00	0.00	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.09	0.00	0.00	3	29	26	3
850/4.35	Makahikaroa Stream Bridge	yes	0.05	0.91	0.41	0.13	1.00	0.70	1.00	1.00	0.63	0.00	0.03	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4	26	27	-1
845/2.38	Makowai Stream Bridge	yes	0.04	0.76	0.42	0.13	1.00	0.70	0.00	1.00	0.69	0.00	0.01	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.09	0.00	0.00	2	27	28	-1
979/0.00	Takapu Road Overbridge	yes	0.04	0.70	0.48	0.13	1.00	1.00	0.00	0.00	1.00	0.50	0.01	0.00	1.00	0.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	29	21	29	-8
850/5.67	Makowai No 2 Bridge	No Drawings Available		Could Not Be Assessed																					5			
850/5.68	Makowai No 2 Bridge	No Drawings Available		Could Not Be Assessed																					6			

file RANKING6.WK1 - 15:55 - 22 April 1995 - As RANKING2.WK1 but SPG = Hazard*Importance*Vulnerabil.

PILOT APPRAISAL OF SEISMIC SCREENING PROCEDURES
STATE HIGHWAY 1 BRIDGES BETWEEN RP 844/1.27 AND 979/4.61

Sorted by Route Position Order

SH1 RP	Bridge Name	Excluded from Prioritisation By Screening Procedure	Seismic Prioritisation Grade (SPG)	Hazard Index	Importance Index	Vulnerability Index	Hazard Index Factors: Peak Ground Accln.	Remaining Service Life	Soil Condition	Liquefaction Risk	Importance Index Factors: AADT On Bridge	AADT Under Bridge	Detour Length	Facility Crossed	Route Type	Critical Utility	Vulnerability Index Factors: Year Designed	Super-structure Hinges	Super-structure Overlap	Super-structure Length	Pier Type	Bridge Skew	Abutment Type	Other Feature	Route Position Order	Economic Analysis Ranking	Difference Econ-SPG Rankings
844/1.27	Rangitikei River Bridge at Bulls	no	0.40	0.76	0.45	0.65	1.00	0.70	0.00	1.00	0.70	0.00	0.18	0.00	1.00	1.00	0.50	1.00	0.00	1.00	0.50	0.00	1.00	1.00	1	3	-10
845/2.38	Makowai Stream Bridge	yes	0.23	0.76	0.42	0.13	1.00	0.70	0.00	1.00	0.69	0.00	0.01	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.09	0.00	0.00	2	27	-2
845/3.82	Piakatutu Stream Bridge	yes	0.28	0.91	0.42	0.13	1.00	0.70	1.00	1.00	0.69	0.00	0.00	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.09	0.00	0.00	3	29	5
850/4.35	Makahikaroa Stream Bridge	yes	0.27	0.91	0.41	0.13	1.00	0.70	1.00	1.00	0.63	0.00	0.03	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4	26	1
850/5.67	Makowai No 2 Bridge	No Drawings Available		Could Not Be Assessed																					5		
850/5.68	Makowai No 2 Bridge	No Drawings Available		Could Not Be Assessed																					6		
872/12.41	North Whirokino Trestle	yes	0.31	0.91	0.43	0.20	1.00	0.70	1.00	1.00	0.63	0.00	0.17	0.00	1.00	1.00	0.50	0.00	0.00	0.10	0.50	0.00	0.00	0.00	7	17	-3
872/13.04	Whirokino Trestle	no	0.35	0.91	0.43	0.32	1.00	0.70	1.00	1.00	0.63	0.00	0.17	0.00	1.00	1.00	0.50	0.00	0.00	1.00	0.60	0.00	0.00	0.00	8	7	-9
872/14.30	Manawatu River (Whirokino) Bridge	no	0.50	0.91	0.47	0.66	1.00	0.70	1.00	1.00	0.63	0.00	0.40	0.00	1.00	1.00	0.50	1.00	0.00	1.00	0.50	0.22	1.00	1.00	9	6	2
900/6.77	Ohau River Bridge	no	0.50	1.00	0.59	0.36	1.00	1.00	1.00	1.00	0.75	0.00	1.00	0.00	1.00	1.00	0.50	0.50	0.00	1.00	0.50	0.00	0.00	0.00	10	1	-2
900/7.04	Ohau Overbridge	yes	0.47	1.00	0.69	0.16	1.00	1.00	1.00	1.00	0.75	0.00	1.00	0.50	1.00	1.00	0.60	0.00	0.00	0.00	0.00	0.61	0.00	0.00	11	10	5
900/8.16	Kuku Stream Bridge	no	0.42	0.91	0.59	0.27	1.00	0.70	1.00	1.00	0.76	0.00	1.00	0.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.33	0.00	0.00	12	22	13
900/10.35	Waikawa River Bridge	no	0.44	0.91	0.59	0.33	1.00	0.70	1.00	1.00	0.76	0.00	1.00	0.00	1.00	1.00	1.00	0.00	0.00	0.00	0.60	0.00	0.00	0.00	13	5	-3
900/10.67	Manakau North Overbridge	no	0.47	0.91	0.69	0.26	1.00	0.70	1.00	1.00	0.76	0.00	1.00	0.50	1.00	1.00	0.50	0.00	0.00	0.50	0.60	0.00	0.00	0.00	14	9	2
900/13.90	Waiauti Stream (Manakau) Bridge	yes	0.41	0.91	0.59	0.25	1.00	0.70	1.00	1.00	0.76	0.00	1.00	0.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	15	23	13
915/0.00	Pukehou (Manakau South) Overbridge	no	0.51	1.00	0.56	0.44	1.00	1.00	1.00	1.00	0.76	0.00	0.16	0.50	1.00	1.00	0.50	0.00	0.00	0.50	1.00	0.00	1.00	0.00	16	12	10
915/4.04	Waitohu Stream Bridge	no	0.33	0.91	0.46	0.20	1.00	0.70	1.00	1.00	0.76	0.00	0.16	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.50	0.00	0.00	0.00	17	14	-4
915/4.86	Otaki Overbridge	no	0.37	0.91	0.55	0.20	1.00	0.70	1.00	1.00	0.77	0.00	0.07	0.50	1.00	1.00	0.50	0.00	0.00	0.00	0.50	0.00	0.00	0.00	18	15	0
915/6.81	Otaki River Bridge	no	0.47	0.91	0.60	0.40	1.00	0.70	1.00	1.00	0.79	0.00	1.00	0.00	1.00	1.00	0.50	1.00	0.00	1.00	0.50	0.00	0.00	0.00	19	11	5
915/10.53	Mangaone Stream Bridge	yes	0.30	0.91	0.47	0.13	1.00	0.70	1.00	1.00	0.85	0.00	0.06	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	20	28	7
931/5.19	Waikanae River Bridge	no	0.57	1.00	0.61	0.51	1.00	1.00	1.00	1.00	0.85	0.00	1.00	0.00	1.00	1.00	0.50	0.00	0.00	0.50	0.50	0.00	1.00	1.00	21	4	3
942/0.00	Paraparaumu Overbridge	no	0.32	0.76	0.56	0.20	1.00	0.70	1.00	0.00	0.85	0.00	0.00	0.50	1.00	1.00	0.50	0.00	0.00	0.00	0.50	0.00	0.00	0.00	22	16	-3
953/0.00	Paekakariki Overbridge	no	0.41	0.91	0.58	0.26	1.00	0.70	1.00	1.00	0.92	0.00	0.01	0.50	1.00	1.00	0.60	0.00	0.00	0.50	0.50	0.00	0.00	0.00	23	13	2
953/7.70	Pukerua Bay Overbridge	no	0.41	0.91	0.60	0.23	1.00	0.70	1.00	1.00	0.93	0.00	0.08	0.50	1.00	1.00	0.50	0.00	0.00	0.00	0.50	0.53	0.00	0.00	24	8	-4
953/15.41	Paremata Harbour Bridge	no	0.40	0.91	0.52	0.32	1.00	0.70	1.00	1.00	1.00	0.00	0.11	0.00	1.00	1.00	0.60	0.00	0.00	1.00	0.50	0.00	0.00	0.00	25	2	-12
969/4.40	Kenepuru Stream Bridge	yes	0.34	1.00	0.50	0.11	1.00	1.00	1.00	1.00	1.00	0.00	0.01	0.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.17	1.00	0.00	26	20	3
969/7.15	Collins Avenue East Bridge	no	0.28	0.70	0.45	0.31	1.00	1.00	0.00	0.00	1.00	0.35	0.01	0.00	1.00	0.00	0.50	0.00	0.00	0.00	0.50	0.27	1.00	0.00	27	18	-4
969/7.15	Collins Avenue West Bridge	no	0.28	0.70	0.45	0.31	1.00	1.00	0.00	0.00	1.00	0.35	0.01	0.00	1.00	0.00	0.50	0.00	0.00	0.00	0.50	0.27	1.00	0.00	28	19	-4
979/0.00	Takapu Road Overbridge	yes	0.24	0.70	0.48	0.13	1.00	1.00	0.00	0.00	1.00	0.50	0.01	0.00	1.00	0.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	29	21	-7
979/4.27	Johnsonville North Overpass	yes	0.24	0.70	0.47	0.14	1.00	1.00	0.00	0.00	1.00	0.48	0.01	0.00	1.00	0.00	0.50	0.00	0.00	0.00	0.00	0.33	0.00	0.00	30	25	-2
979/4.61	Johnsonville South Overpass	yes	0.24	0.70	0.47	0.15	1.00	1.00	0.00	0.00	1.00	0.48	0.00	0.00	1.00	0.00	0.50	0.00	0.00	0.00	0.00	0.50	0.00	0.00	31	24	-2
	FACTORS - THIS TRIAL:			1.00	0.60	0.40	0.40	0.30	0.15	0.15	0.06	0.15	0.16	0.20	0.18	0.10	0.28	0.04	0.10	0.12	0.16	0.05	0.10	0.15			
	FACTORS IN REPORT:			1.00	0.60	0.40	0.40	0.30	0.15	0.15	0.25	0.15	0.16	0.20	0.16	0.10	0.25	0.08	0.10	0.07	0.15	0.10	0.10	0.15			

Sorted by Seismic Priority Grade

SH1 RP	Bridge Name	Excluded from Prioritisation By Screening Procedure	Seismic Prioritisation Grade (SPG)	Hazard Index	Importance Index	Vulnerability Index	Hazard Index Factors: Peak Ground Accln.	Remaining Service Life	Soil Condition	Liquefaction Risk	Importance Index Factors: AADT On Bridge	AADT Under Bridge	Detour Length	Facility Crossed	Route Type	Critical Utility	Vulnerability Index Factors: Year Designed	Super-structure Hinges	Super-structure Overlap	Super-structure Length	Pier Type	Bridge Skew	Abutment Type	Other Feature	Route Position Order	Economic Analysis Ranking	SPG	Difference Econ-SPG Rankings
931/5.19	Waikanae River Bridge	no	0.57	1.00	0.61	0.51	1.00	1.00	1.00	1.00	0.85	0.00	1.00	0.00	1.00	1.00	0.50	0.00	0.00	0.50	0.50	0.00	1.00	1.00	21	4	1	3
915/0.00	Pukehou (Manakau South) Overbridge	no	0.51	1.00	0.56	0.44	1.00	1.00	1.00	1.00	0.76	0.00	0.16	0.50	1.00	1.00	0.50	0.00	0.00	0.50	1.00	0.00	1.00	0.00	16	12	2	10
900/6.77	Ohau River Bridge	no	0.50	1.00	0.59	0.36	1.00	1.00	1.00	1.00	0.75	0.00	1.00	0.00	1.00	1.00	0.50	0.50	0.00	1.00	0.50	0.00	0.00	0.00	10	1	3	-2
872/14.30	Manawatu River (Whirokino) Bridge	no	0.50	0.91	0.47	0.66	1.00	0.70	1.00	1.00	0.63	0.00	0.40	0.00	1.00	1.00	0.50	1.00	0.00	1.00	0.50	0.22	1.00	1.00	9	6	4	2
900/7.04	Ohau Overbridge	yes	0.47	1.00	0.69	0.16	1.00	1.00	1.00	1.00	0.75	0.00	1.00	0.50	1.00	1.00	0.60	0.00	0.00	0.00	0.00	0.61	0.00	0.00	11	10	5	5
915/6.81	Otaki River Bridge	no	0.47	0.91	0.60	0.40	1.00	0.70	1.00	1.00	0.79	0.00	1.00	0.00	1.00	1.00	0.50	1.00	0.00	1.00	0.50	0.00	0.00	0.00	19	11	6	5
900/10.67	Manakau North Overbridge	no	0.47	0.91	0.69	0.26	1.00	0.70	1.00	1.00	0.76	0.00	1.00	0.50	1.00	1.00	0.50	0.00	0.00	0.50	0.60	0.00	0.00	0.00	14	9	7	2
900/10.35	Waikawa River Bridge	no	0.44	0.91	0.59	0.33	1.00	0.70	1.00	1.00	0.76	0.00	1.00	0.00	1.00	1.00	1.00	0.00	0.00	0.00	0.60	0.00	0.00	0.00	13	5	8	-3
900/8.16	Kuku Stream Bridge	no	0.42	0.91	0.59	0.27	1.00	0.70	1.00	1.00	0.76	0.00	1.00	0.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.33	0.00	0.00	12	22	9	13
900/13.90	Waiauti Stream (Manakau) Bridge	yes	0.41	0.91	0.59	0.25	1.00	0.70	1.00	1.00	0.76	0.00	1.00	0.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	15	23	10	13
953/0.00	Paekakariki Overbridge	no	0.41	0.91	0.58	0.26	1.00	0.70	1.00	1.00	0.92	0.00	0.01	0.50	1.00	1.00	0.60	0.00	0.00	0.50	0.50	0.00	0.00	0.00	23	13	11	2
953/7.70	Pukerua Bay Overbridge	no	0.41	0.91	0.60	0.23	1.00	0.70	1.00	1.00	0.93	0.00	0.08	0.50	1.00	1.00	0.50	0.00	0.00	0.00	0.50	0.53	0.00	0.00	24	8	12	-4
844/1.27	Rangitikei River Bridge at Bulls	no	0.40	0.76	0.45	0.65	1.00	0.70	0.00	1.00	0.70	0.00	0.18	0.00	1.00	1.00	0.50	1.00	0.00	1.00	0.50	0.00	1.00	1.00	1	3	13	-10
953/15.41	Paremata Harbour Bridge	no	0.40	0.91	0.52	0.32	1.00	0.70	1.00	1.00	1.00	0.00	0.11	0.00	1.00	1.00	0.60	0.00	0.00	1.00	0.50	0.00	0.00	0.00	25	2	14	-12
915/4.86	Otaki Overbridge	no	0.37	0.91	0.55	0.20	1.00	0.70	1.00	1.00	0.77	0.00	0.07	0.50	1.00	1.00	0.50	0.00	0.00	0.00	0.50	0.00	0.00	0.00	18	15	15	0
872/13.04	Whirokino Trestle	no	0.35	0.91	0.43	0.32	1.00	0.70	1.00	1.00	0.63	0.00	0.17	0.00	1.00	1.00	0.50	0.00	0.00	1.00	0.60	0.00	0.00	0.00	8	7	16	-9
969/4.40	Kenepuru Stream Bridge	yes	0.34	1.00	0.50	0.11	1.00	1.00	1.00	1.00	1.00	0.00	0.01	0.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.17	1.00	0.00	26	20	17	3
915/4.04	Waitohu Stream Bridge	no	0.33	0.91	0.46	0.20	1.00	0.70	1.00	1.00	0.76	0.00	0.16	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.50	0.00	0.00	0.00	17	14	18	-4
942/0.00	Paraparaumu Overbridge	no	0.32	0.76	0.56	0.20	1.00	0.70	1.00	0.00	0.85	0.00	0.00	0.50	1.00	1.00	0.50	0.00	0.00	0.00	0.50	0.00	0.00	0.00	22	16	19	-3
872/12.41	North Whirokino Trestle	yes	0.31	0.91	0.43	0.20	1.00	0.70	1.00	1.00	0.63	0.00	0.17	0.00	1.00	1.00	0.50	0.00	0.00	0.10	0.50	0.00	0.00	0.00	7	17	20	-3
915/10.53	Mangaone Stream Bridge	yes	0.30	0.91	0.47	0.13	1.00	0.70	1.00	1.00	0.85	0.00	0.06	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	20	28	21	7
969/7.15	Collins Avenue East Bridge	no	0.28	0.70	0.45	0.31	1.00	1.00	0.00	0.00	1.00	0.35	0.01	0.00	1.00	0.00	0.50	0.00	0.00	0.00	0.50	0.27	1.00	0.00	27	18	22	-4
969/7.15	Collins Avenue West Bridge	no	0.28	0.70	0.45	0.31	1.00	1.00	0.00	0.00	1.00	0.35	0.01	0.00	1.00	0.00	0.50	0.00	0.00	0.00	0.50	0.27	1.00	0.00	28	19	23	-4
845/3.82	Piakatutu Stream Bridge	yes	0.28	0.91	0.42	0.13	1.00	0.70	1.00	1.00	0.69	0.00	0.00	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.09	0.00	0.00	3	29	24	5
850/4.35	Makahikaroa Stream Bridge	yes	0.27	0.91	0.41	0.13	1.00	0.70	1.00	1.00	0.63	0.00	0.03	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4	26	25	1
979/4.61	Johnsonville South Overpass	yes	0.24	0.70	0.47	0.15	1.00	1.00	0.00	0.00	1.00	0.48	0.00	0.00	1.00	0.00	0.50	0.00	0.00	0.00	0.00	0.50	0.00	0.00	31	24	26	-2
979/4.27	Johnsonville North Overpass	yes	0.24	0.70	0.47	0.14	1.00	1.00	0.00	0.00	1.00	0.48	0.01	0.00	1.00	0.00	0.50	0.00	0.00	0.00	0.00	0.33	0.00	0.00	30	25	27	-2
979/0.00	Takapu Road Overbridge	yes	0.24	0.70	0.48	0.13	1.00	1.00	0.00	0.00	1.00	0.50	0.01	0.00	1.00	0.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	29	21	28	-7
845/2.38	Makowai Stream Bridge	yes	0.23	0.76	0.42	0.13	1.00	0.70	0.00	1.00	0.69	0.00	0.01	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.09	0.00	0.00	2	27	29	-2
850/5.67	Makowai No 2 Bridge	No Drawings Available		Could Not Be Assessed																					5			
850/5.68	Makowai No 2 Bridge	No Drawings Available		Could Not Be Assessed																					6			

file RANKING7.WK1 - 16.10 - 22 April 1995 - As RANKING2.WK1 but with vulnerability factors altered

PILOT APPRAISAL OF SEISMIC SCREENING PROCEDURES
STATE HIGHWAY 1 BRIDGES BETWEEN RP 844/1.27 AND 979/4.81

Sorted by Route Position Order

SH1 RP	Bridge Name	Excluded from Prioritisation By Screening Procedure	Seismic Prioritisation Grade (SPG)	Hazard Index	Importance Index	Vulnerability Index	Hazard Index Factors: Peak Ground Accn.	Remaining Service Life	Soil Condition	Liquefaction Risk	Importance Index Factors: AADT On Bridge	AADT Under Bridge	Detour Length	Facility Crossed	Route Type	Critical Utility	Vulnerability Index Factors: Year Designed	Super-structure Hinges	Super-structure Overlap	Super-structure Length	Pier Type	Bridge Skew	Abutment Type	Other Feature	Route Position Order	Economic Analysis Ranking	Difference Econ-SPG Rankings
844/1.27	Rangitikei River Bridge at Bulls	no	0.42	0.76	0.50	0.65	1.00	0.70	0.00	1.00	0.70	0.00	0.18	0.00	1.00	1.00	0.50	1.00	0.00	1.00	0.50	0.00	1.00	1.00	1	3	-9
845/2.38	Makowai Stream Bridge	yes	0.25	0.76	0.48	0.13	1.00	0.70	0.00	1.00	0.69	0.00	0.03	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.09	0.00	0.00	2	27	-1
845/3.82	Plakatutu Stream Bridge	yes	0.30	0.91	0.46	0.13	1.00	0.70	1.00	1.00	0.69	0.00	0.00	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.09	0.00	0.00	3	29	7
850/4.35	Makahikarea Stream Bridge	yes	0.29	0.91	0.45	0.13	1.00	0.70	1.00	1.00	0.63	0.00	0.03	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4	26	1
850/5.67	Makowai No 2 Bridge	No Drawings Available		Could Not Be Assessed																					5		
850/5.68	Makowai No 2 Bridge	No Drawings Available		Could Not Be Assessed																					6		
872/12.41	North Whirokino Trestle	yes	0.33	0.91	0.47	0.20	1.00	0.70	1.00	1.00	0.63	0.00	0.17	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.50	0.00	0.00	0.00	7	17	-2
872/13.04	Whirokino Trestle	no	0.37	0.91	0.47	0.32	1.00	0.70	1.00	1.00	0.63	0.00	0.17	0.00	1.00	1.00	0.50	0.00	0.00	1.00	0.50	0.00	0.00	0.00	8	7	9
872/14.30	Manawatu River (Whirokino) Bridge	no	0.52	0.91	0.52	0.64	1.00	0.70	1.00	1.00	0.63	0.00	0.40	0.00	1.00	1.00	0.50	1.00	0.00	1.00	0.50	0.22	1.00	1.00	9	6	2
900/6.77	Ohau River Bridge	no	0.55	1.00	0.68	0.36	1.00	1.00	1.00	1.00	0.75	0.00	1.00	0.00	1.00	1.00	0.50	0.50	0.00	1.00	0.50	0.00	0.00	0.00	10	1	-1
900/7.04	Ohau Overbridge	yes	0.51	1.00	0.75	0.16	1.00	1.00	1.00	1.00	0.75	0.00	1.00	0.50	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.61	0.00	0.00	11	10	4
900/8.16	Kuku Stream Bridge	no	0.47	0.91	0.68	0.27	1.00	0.70	1.00	1.00	0.76	0.00	1.00	0.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.33	0.00	0.00	12	22	13
900/10.35	Waikawa River Bridge	no	0.49	0.91	0.68	0.33	1.00	0.70	1.00	1.00	0.76	0.00	1.00	0.00	1.00	1.00	1.00	0.00	0.00	0.00	0.50	0.00	0.00	0.00	13	5	-3
900/10.67	Manakau North Overbridge	no	0.50	0.91	0.75	0.26	1.00	0.70	1.00	1.00	0.76	0.00	1.00	0.50	1.00	1.00	0.50	0.00	0.00	0.50	0.50	0.00	0.00	0.00	14	9	2
900/13.90	Waiauti Stream (Manakau) Bridge	yes	0.46	0.91	0.68	0.25	1.00	0.70	1.00	1.00	0.76	0.00	1.00	0.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	15	23	13
915/0.00	Pukehou (Manakau South) Overbridge	no	0.52	1.00	0.58	0.44	1.00	1.00	1.00	1.00	0.76	0.00	0.16	0.50	1.00	1.00	0.50	0.00	0.00	0.50	1.00	0.00	1.00	0.00	16	12	9
915/4.04	Waitohu Stream Bridge	no	0.35	0.91	0.51	0.20	1.00	0.70	1.00	1.00	0.76	0.00	0.16	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.50	0.00	0.00	0.00	17	14	-4
915/4.86	Otaki Overbridge	no	0.38	0.91	0.57	0.20	1.00	0.70	1.00	1.00	0.77	0.00	0.07	0.50	1.00	1.00	0.50	0.00	0.00	0.00	0.50	0.00	0.00	0.00	18	15	0
915/6.81	Otaki River Bridge	no	0.52	0.91	0.69	0.40	1.00	0.70	1.00	1.00	0.79	0.00	1.00	0.00	1.00	1.00	0.50	1.00	0.00	1.00	0.50	0.00	0.00	0.00	19	11	6
915/10.53	Mangaone Stream Bridge	yes	0.33	0.91	0.62	0.13	1.00	0.70	1.00	1.00	0.85	0.00	0.06	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	20	28	8
931/5.19	Waikanae River Bridge	no	0.63	1.00	0.71	0.51	1.00	1.00	1.00	1.00	0.85	0.00	1.00	0.00	1.00	1.00	0.50	0.00	0.00	0.50	0.50	0.00	1.00	1.00	21	4	3
942/0.00	Paraparaumu Overbridge	no	0.33	0.78	0.58	0.20	1.00	0.70	1.00	0.00	0.85	0.00	0.00	0.50	1.00	1.00	0.50	0.00	0.00	0.00	0.50	0.00	0.00	0.00	22	16	-5
953/0.00	Paekakariki Overbridge	no	0.42	0.91	0.60	0.26	1.00	0.70	1.00	1.00	0.92	0.00	0.01	0.50	1.00	1.00	0.50	0.00	0.00	0.50	0.50	0.00	0.00	0.00	23	13	0
953/7.70	Pukerua Bay Overbridge	no	0.42	0.91	0.62	0.23	1.00	0.70	1.00	1.00	0.93	0.00	0.08	0.50	1.00	1.00	0.50	0.00	0.00	0.00	0.50	0.53	0.00	0.00	24	8	-4
953/15.41	Paremata Harbour Bridge	no	0.43	0.91	0.57	0.32	1.00	0.70	1.00	1.00	1.00	0.00	0.11	0.00	1.00	1.00	0.50	0.00	0.00	1.00	0.50	0.00	0.00	0.00	25	2	-9
969/4.40	Kenepuru Stream Bridge	yes	0.37	1.00	0.55	0.11	1.00	1.00	1.00	1.00	1.00	0.00	0.01	0.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.17	1.00	0.00	26	20	3
969/7.15	Collins Avenue East Bridge	no	0.29	0.70	0.49	0.31	1.00	1.00	0.00	0.00	1.00	0.35	0.01	0.00	1.00	0.00	0.50	0.00	0.00	0.00	0.50	0.27	1.00	0.00	27	18	-5
969/7.15	Collins Avenue West Bridge	no	0.29	0.70	0.49	0.31	1.00	1.00	0.00	0.00	1.00	0.35	0.01	0.00	1.00	0.00	0.50	0.00	0.00	0.00	0.50	0.27	1.00	0.00	28	19	-5
979/0.00	Takapu Road Overbridge	yes	0.25	0.70	0.50	0.13	1.00	1.00	0.00	0.00	1.00	0.50	0.01	0.00	1.00	0.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	29	21	-8
979/4.27	Johnsonville North Overpass	yes	0.25	0.70	0.50	0.14	1.00	1.00	0.00	0.00	1.00	0.48	0.01	0.00	1.00	0.00	0.50	0.00	0.00	0.00	0.00	0.33	0.00	0.00	30	25	-2
979/4.81	Johnsonville South Overpass	yes	0.25	0.70	0.50	0.15	1.00	1.00	0.00	0.00	1.00	0.48	0.00	0.00	1.00	0.00	0.50	0.00	0.00	0.00	0.00	0.50	0.00	0.00	31	24	-2
		FACTORS - THIS TRIAL:		1.00	0.60	0.40	0.40	0.30	0.15	0.15	0.30	0.10	0.20	0.15	0.15	0.10	0.25	0.08	0.10	0.12	0.15	0.05	0.10	0.15			
		FACTORS IN REPORT:		1.00	0.60	0.40	0.40	0.30	0.15	0.15	0.25	0.15	0.15	0.20	0.15	0.10	0.25	0.08	0.10	0.07	0.15	0.10	0.10	0.15			

Sorted by Seismic Priority Grade

SH1 RP	Bridge Name	Excluded from Prioritisation By Screening Procedure	Seismic Prioritisation Grade (SPG)	Hazard Index	Importance Index	Vulnerability Index	Hazard Index Factors: Peak Ground Accn.	Remaining Service Life	Soil Condition	Liquefaction Risk	Importance Index Factors: AADT On Bridge	AADT Under Bridge	Detour Length	Facility Crossed	Route Type	Critical Utility	Vulnerability Index Factors: Year Designed	Super-structure Hinges	Super-structure Overlap	Super-structure Length	Pier Type	Bridge Skew	Abutment Type	Other Feature	Route Position Order	Economic Analysis Ranking	SPG	Difference Econ SPG Rankings
931/5.19	Waikanae River Bridge	no	0.63	1.00	0.71	0.51	1.00	1.00	1.00	1.00	0.85	0.00	1.00	0.00	1.00	1.00	0.50	0.00	0.00	0.50	0.50	0.00	1.00	1.00	21	4	1	3
900/6.77	Ohau River Bridge	no	0.55	1.00	0.68	0.36	1.00	1.00	1.00	1.00	0.75	0.00	1.00	0.00	1.00	1.00	0.50	0.50	0.00	1.00	0.50	0.00	0.00	0.00	10	1	2	-1
915/0.00	Pukehou (Manakau South) Overbridge	no	0.52	1.00	0.58	0.44	1.00	1.00	1.00	1.00	0.76	0.00	0.16	0.50	1.00	1.00	0.50	0.00	0.00	0.50	1.00	0.00	1.00	0.00	16	12	3	9
872/14.30	Manawatu River (Whirokino) Bridge	no	0.52	0.91	0.52	0.64	1.00	0.70	1.00	1.00	0.63	0.00	0.40	0.00	1.00	1.00	0.50	1.00	0.00	1.00	0.50	0.22	1.00	1.00	9	6	4	2
915/6.81	Otaki River Bridge	no	0.52	0.91	0.69	0.40	1.00	0.70	1.00	1.00	0.79	0.00	1.00	0.00	1.00	1.00	0.50	1.00	0.00	1.00	0.50	0.00	0.00	0.00	19	11	5	6
900/7.04	Ohau Overbridge	yes	0.51	1.00	0.75	0.16	1.00	1.00	1.00	1.00	0.75	0.00	1.00	0.50	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.61	0.00	0.00	11	10	6	4
900/10.67	Manakau North Overbridge	no	0.50	0.91	0.75	0.26	1.00	0.70	1.00	1.00	0.76	0.00	1.00	0.50	1.00	1.00	0.50	0.00	0.00	0.50	0.50	0.00	0.00	0.00	14	9	7	2
900/10.35	Waikawa River Bridge	no	0.49	0.91	0.68	0.33	1.00	0.70	1.00	1.00	0.76	0.00	1.00	0.00	1.00	1.00	1.00	0.00	0.00	0.00	0.50	0.00	0.00	0.00	13	5	8	-3
900/8.16	Kuku Stream Bridge	no	0.47	0.91	0.68	0.27	1.00	0.70	1.00	1.00	0.76	0.00	1.00	0.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.33	0.00	0.00	12	22	9	13
900/13.90	Waiauti Stream (Manakau) Bridge	yes	0.46	0.91	0.68	0.25	1.00	0.70	1.00	1.00	0.76	0.00	1.00	0.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	15	23	10	13
953/15.41	Paremata Harbour Bridge	no	0.43	0.91	0.67	0.32	1.00	0.70	1.00	1.00	1.00	0.00	0.11	0.00	1.00	1.00	0.50	0.00	0.00	1.00	0.50	0.00	0.00	0.00	25	2	11	-9
844/1.27	Rangitikei River Bridge at Bulls	no	0.42	0.76	0.50	0.65	1.00	0.70	0.00	1.00	0.70	0.00	0.18	0.00	1.00	1.00	0.50	1.00	0.00	1.00	0.50	0.00	1.00	1.00	1	3	12	-9
953/0.00	Paekakariki Overbridge	no	0.42	0.91	0.60	0.26	1.00	0.70	1.00	1.00	0.92	0.00	0.01	0.50	1.00	1.00	0.50	0.00	0.00	0.50	0.50	0.00	0.00	0.00	23	13	13	0
953/7.70	Pukerua Bay Overbridge	no	0.42	0.91	0.62	0.23	1.00	0.70	1.00	1.00	0.93	0.00	0.08	0.50	1.00	1.00	0.50	0.00	0.00	0.00	0.50	0.53	0.00	0.00	24	8	14	-4
915/4.86	Otaki Overbridge	no	0.38	0.91	0.57	0.20	1.00	0.70	1.00	1.00	0.77	0.00	0.07	0.50	1.00	1.00	0.50	0.00	0.00	0.00	0.50	0.00	0.00	0.00	18	15	15	0
872/13.04	Whirokino Trestle	no	0.37	0.91	0.47	0.32	1.00	0.70	1.00	1.00	0.63	0.00	0.17	0.00	1.00	1.00	0.50	0.00	0.00	1.00	0.50	0.00	0.00	0.00	8	7	16	-9
969/4.40	Kenepuru Stream Bridge	yes	0.37	1.00	0.65	0.11	1.00	1.00	1.00	1.00	1.00	0.00	0.01	0.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.17	1.00	0.00	26	20	17	3
916/4.04	Waitohu Stream Bridge	no	0.35	0.91	0.61	0.20	1.00	0.70	1.00	1.00	0.78	0.00	0.14	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.50	0.00	0.00	0.00	17	14	18	-4
872/12.41	North Whirokino Trestle	yes	0.33	0.91	0.47	0.20	1.00	0.70	1.00	1.00	0.63	0.00	0.17	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.50	0.00	0.00	0.00	7	17	19	-2
915/10.53	Mangaone Stream Bridge	yes	0.33	0.91	0.52	0.13	1.00	0.70	1.00	1.00	0.85	0.00	0.06	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	20	28	20	8
942/0.00	Paraparaumu Overbridge	no	0.33	0.78	0.58	0.20	1.00	0.70	1.00	0.00	0.85	0.00	0.00	0.50	1.00	1.00	0.50	0.00	0.00	0.00	0.50	0.00	0.00	0.00	22	16	21	-5
845/3.82	Plakatutu Stream Bridge	yes	0.30	0.91	0.46	0.13	1.00	0.70	1.00	1.00	0.69	0.00	0.00	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.09	0.00	0.00	3	29	22	7
969/7.15	Collins Avenue East Bridge	no	0.29	0.70	0.49	0.31	1.00	1.00	0.00	0.00	1.00	0.35	0.01	0.00	1.00	0.00	0.50	0.00	0.00	0.00	0.50	0.27	1.00	0.00	27	18	23	-5
969/7.15	Collins Avenue West Bridge	no	0.29	0.70	0.49	0.31	1.00	1.00	0.00	0.00	1.00	0.35	0.01	0.00	1.00	0.00	0.50	0.00	0.00	0.00	0.50	0.27	1.00	0.00	28	19	24	-5
850/4.35	Makahikarea Stream Bridge	yes	0.29	0.91	0.45	0.13	1.00	0.70	1.00	1.00	0.63	0.00	0.03	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4	26	25	1
979/4.81	Johnsonville South Overpass	yes	0.25	0.70	0.50	0.15	1.00	1.00	0.00	0.00	1.00	0.48	0.00	0.00	1.00	0.00	0.50	0.00	0.00	0.00	0.00	0.50	0.00	0.00	31	24	26	-2
979/4.27	Johnsonville North Overpass	yes	0.25	0.70	0.50	0.14	1.00	1.00	0.00	0.00	1.00	0.48	0.01	0.00	1.00	0.00	0.50	0.00	0.00	0.00	0.00	0.33	0.00	0.00	30	25	27	-2
845/2.38	Makowai Stream Bridge	yes	0.25	0.76	0.46	0.13	1.00	0.70	0.00	1.00	0.69	0.00	0.01	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.09	0.00	0.00	2	27	28	-1
979/0.00	Takapu Road Overbridge	yes	0.25	0.70	0.50	0.13	1.00	1.00	0.00	0.00	1.00	0.50	0.01	0.00	1.00	0.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	29	21	29	-8
850/5.67	Makowai No 2 Bridge	No Drawings Available		Could Not Be Assessed																					5			
850/5.68	Makowai No 2 Bridge	No Drawings Available		Could Not Be Assessed																					6			

PILOT APPRAISAL OF SEISMIC SCREENING PROCEDURES
STATE HIGHWAY 1 BRIDGES BETWEEN RP 844/1.27 AND 979/4.61

Sorted by Route Position Order

SH1 RP	Bridge Name	Excluded from Prioritisation By Screening Procedure	Seismic Prioritisation Grade (SPG)	Hazard Index	Importance Index	Vulnerability Index	Hazard Index Factors: Peak Ground Accln.	Remaining Service Life	Soil Condition	Liquefaction Risk	Importance Index Factors: AADT On Bridge	AADT Under Bridge	Detour Length	Facility Crossed	Route Type	Critical Utility	Vulnerability Index Factors: Year Designed	Superstructure Hinges	Superstructure Overlap	Superstructure Length	Pier Type	Bridge Skew	Abutment Type	Other Feature	Route Position Order	Economic Analysis Ranking	Difference Econ-SPG Rankings
844/1.27	Rangitikei River Bridge at Bulls	no	0.51	0.91	0.50	0.65	1.00	0.70	1.00	1.00	0.70	0.00	0.18	0.00	1.00	1.00	0.50	1.00	0.00	1.00	0.50	0.00	1.00	1.00	1	3	-4
845/2.38	Makowai Stream Bridge	yes	0.25	0.76	0.46	0.13	1.00	0.70	0.00	1.00	0.69	0.00	0.01	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.09	0.00	0.00	2	27	-1
845/3.82	Piakatutu Stream Bridge	yes	0.30	0.91	0.46	0.13	1.00	0.70	1.00	1.00	0.69	0.00	0.00	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.09	0.00	0.00	3	29	7
850/4.35	Makahikaroa Stream Bridge	yes	0.29	0.91	0.45	0.13	1.00	0.70	1.00	1.00	0.63	0.00	0.03	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4	26	1
850/5.67	Makowai No 2 Bridge	No Drawings Available		Could Not Be Assessed																					5		
850/5.68	Makowai No 2 Bridge	No Drawings Available		Could Not Be Assessed																					6		
872/12.41	North Whirokino Trestle	yes	0.33	0.91	0.47	0.20	1.00	0.70	1.00	1.00	0.63	0.00	0.17	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.50	0.00	0.00	0.00	7	17	-2
872/13.04	Whirokino Trestle	no	0.37	0.91	0.47	0.32	1.00	0.70	1.00	1.00	0.63	0.00	0.17	0.00	1.00	1.00	0.50	0.00	0.00	1.00	0.50	0.09	0.00	0.00	8	7	-9
872/14.30	Manawatu River (Whirokino) Bridge	no	0.52	0.91	0.52	0.66	1.00	0.70	1.00	1.00	0.63	0.00	0.40	0.00	1.00	1.00	0.50	1.00	0.00	1.00	0.50	0.22	1.00	1.00	9	6	2
900/6.77	Ohau River Bridge	no	0.55	1.00	0.68	0.36	1.00	1.00	1.00	1.00	0.75	0.00	1.00	0.00	1.00	1.00	0.50	0.50	0.00	1.00	0.50	0.00	0.00	0.00	10	1	-1
900/7.04	Ohau Overbridge	yes	0.51	1.00	0.75	0.16	1.00	1.00	1.00	1.00	0.75	0.00	1.00	0.50	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.61	0.00	0.00	11	10	4
900/8.16	Kuku Stream Bridge	no	0.47	0.91	0.68	0.27	1.00	0.70	1.00	1.00	0.76	0.00	1.00	0.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.33	0.00	0.00	12	22	12
900/10.35	Waikawa River Bridge	no	0.49	0.91	0.68	0.33	1.00	0.70	1.00	1.00	0.76	0.00	1.00	0.00	1.00	1.00	1.00	0.00	0.00	0.00	0.50	0.00	0.00	0.00	13	5	-4
900/10.67	Manakau North Overbridge	no	0.50	0.91	0.75	0.26	1.00	0.70	1.00	1.00	0.76	0.00	1.00	0.50	1.00	1.00	0.50	0.00	0.00	0.50	0.50	0.00	0.00	0.00	14	9	1
900/13.90	Waiauti Stream (Manakau) Bridge	yes	0.46	0.91	0.68	0.25	1.00	0.70	1.00	1.00	0.76	0.00	1.00	0.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	15	23	12
915/0.00	Pukehou (Manakau South) Overbridge	no	0.52	1.00	0.58	0.44	1.00	1.00	1.00	1.00	0.76	0.00	0.16	0.50	1.00	1.00	0.50	0.00	0.00	0.50	1.00	0.00	1.00	0.00	16	12	9
915/4.04	Waitohu Stream Bridge	no	0.35	0.91	0.51	0.20	1.00	0.70	1.00	1.00	0.76	0.00	0.16	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.50	0.00	0.00	0.00	17	14	-4
915/4.86	Otaki Overbridge	no	0.38	0.91	0.57	0.20	1.00	0.70	1.00	1.00	0.77	0.00	0.07	0.50	1.00	1.00	0.50	0.00	0.00	0.00	0.50	0.00	0.00	0.00	18	15	0
915/6.81	Otaki River Bridge	no	0.52	0.91	0.69	0.40	1.00	0.70	1.00	1.00	0.79	0.00	1.00	0.00	1.00	1.00	0.50	1.00	0.00	1.00	0.50	0.00	0.00	0.00	19	11	6
915/10.53	Mangaone Stream Bridge	yes	0.33	0.91	0.52	0.13	1.00	0.70	1.00	1.00	0.85	0.00	0.06	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	20	28	8
931/5.19	Waikanae River Bridge	no	0.63	1.00	0.71	0.51	1.00	1.00	1.00	1.00	0.85	0.00	1.00	0.00	1.00	1.00	0.50	0.00	0.00	0.50	0.50	0.00	1.00	1.00	21	4	3
942/0.00	Paraparaumu Overbridge	no	0.33	0.76	0.58	0.20	1.00	0.70	1.00	0.00	0.85	0.00	0.00	0.50	1.00	1.00	0.50	0.00	0.00	0.00	0.50	0.00	0.00	0.00	22	16	-5
953/0.00	Paekakariki Overbridge	no	0.42	0.91	0.60	0.26	1.00	0.70	1.00	1.00	0.92	0.00	0.01	0.50	1.00	1.00	0.50	0.00	0.00	0.50	0.50	0.00	0.00	0.00	23	13	0
953/7.70	Pukerua Bay Overbridge	no	0.42	0.91	0.62	0.23	1.00	0.70	1.00	1.00	0.93	0.00	0.08	0.50	1.00	1.00	0.50	0.00	0.00	0.00	0.50	0.53	0.00	0.00	24	8	-6
953/15.41	Paremata Harbour Bridge	no	0.43	0.91	0.57	0.32	1.00	0.70	1.00	1.00	1.00	0.00	0.11	0.00	1.00	1.00	0.50	0.00	0.00	1.00	0.50	0.00	0.00	0.00	25	2	-10
969/4.40	Kenepuru Stream Bridge	yes	0.37	1.00	0.55	0.11	1.00	1.00	1.00	1.00	1.00	0.00	0.01	0.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.17	1.00	0.00	26	20	3
969/7.15	Collins Avenue East Bridge	no	0.29	0.70	0.49	0.31	1.00	1.00	0.00	0.00	1.00	0.35	0.01	0.00	1.00	0.00	0.50	0.00	0.00	0.00	0.50	0.27	1.00	0.00	27	18	-5
969/7.15	Collins Avenue West Bridge	no	0.29	0.70	0.49	0.31	1.00	1.00	0.00	0.00	1.00	0.35	0.01	0.00	1.00	0.00	0.50	0.00	0.00	0.00	0.50	0.27	1.00	0.00	28	19	-5
979/0.00	Takapu Road Overbridge	yes	0.25	0.70	0.50	0.13	1.00	1.00	0.00	0.00	1.00	0.50	0.01	0.00	1.00	0.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	29	21	-8
979/4.27	Johnsonville North Overpass	yes	0.25	0.70	0.50	0.14	1.00	1.00	0.00	0.00	1.00	0.48	0.01	0.00	1.00	0.00	0.50	0.00	0.00	0.00	0.00	0.33	0.00	0.00	30	25	-2
979/4.61	Johnsonville South Overpass	yes	0.25	0.70	0.50	0.15	1.00	1.00	0.00	0.00	1.00	0.48	0.00	0.00	1.00	0.00	0.50	0.00	0.00	0.00	0.00	0.50	0.00	0.00	31	24	-2
		FACTORS - THIS TRIAL:		1.00	0.40	0.60	0.40	0.30	0.15	0.15	0.30	0.10	0.20	0.15	0.18	0.10	0.28	0.04	0.10	0.12	0.16	0.06	0.10	0.15			
		FACTORS IN REPORT:		1.00	0.60	0.40	0.40	0.30	0.15	0.15	0.25	0.15	0.16	0.20	0.16	0.10	0.25	0.04	0.10	0.07	0.16	0.10	0.10	0.15			

Sorted by Seismic Priority Grade

SH1 RP	Bridge Name	Excluded from Prioritisation By Screening Procedure	Seismic Prioritisation Grade (SPG)	Hazard Index	Importance Index	Vulnerability Index	Hazard Index Factors: Peak Ground Accln.	Remaining Service Life	Soil Condition	Liquefaction Risk	Importance Index Factors: AADT On Bridge	AADT Under Bridge	Detour Length	Facility Crossed	Route Type	Critical Utility	Vulnerability Index Factors: Year Designed	Superstructure Hinges	Superstructure Overlap	Superstructure Length	Pier Type	Bridge Skew	Abutment Type	Other Feature	Route Position Order	Economic Analysis Ranking	SPG	Difference Econ SPG Rankings
931/5.19	Waikanae River Bridge	no	0.63	1.00	0.71	0.51	1.00	1.00	1.00	1.00	0.85	0.00	1.00	0.00	1.00	1.00	0.50	0.00	0.00	0.50	0.50	0.00	1.00	1.00	21	4	1	3
900/6.77	Ohau River Bridge	no	0.55	1.00	0.68	0.36	1.00	1.00	1.00	1.00	0.75	0.00	1.00	0.00	1.00	1.00	0.50	0.50	0.00	1.00	0.50	0.00	0.00	0.00	10	1	2	-1
915/0.00	Pukehou (Manakau South) Overbridge	no	0.52	1.00	0.58	0.44	1.00	1.00	1.00	1.00	0.76	0.00	0.16	0.50	1.00	1.00	0.50	0.00	0.00	0.50	1.00	0.00	1.00	0.00	16	12	3	9
872/14.30	Manawatu River (Whirokino) Bridge	no	0.52	0.91	0.52	0.66	1.00	0.70	1.00	1.00	0.63	0.00	0.40	0.00	1.00	1.00	0.50	1.00	0.00	1.00	0.50	0.22	1.00	1.00	9	6	4	2
915/6.81	Otaki River Bridge	no	0.52	0.91	0.69	0.40	1.00	0.70	1.00	1.00	0.79	0.00	1.00	0.00	1.00	1.00	0.50	1.00	0.00	1.00	0.50	0.00	0.00	0.00	19	11	5	6
900/7.04	Ohau Overbridge	yes	0.51	1.00	0.75	0.16	1.00	1.00	1.00	1.00	0.75	0.00	1.00	0.50	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.61	0.00	0.00	11	10	6	4
844/1.27	Rangitikei River Bridge at Bulls	no	0.51	0.91	0.50	0.65	1.00	0.70	1.00	1.00	0.70	0.00	0.18	0.00	1.00	1.00	0.50	1.00	0.00	1.00	0.50	0.00	1.00	1.00	1	3	7	-4
900/10.67	Manakau North Overbridge	no	0.50	0.91	0.75	0.26	1.00	0.70	1.00	1.00	0.76	0.00	1.00	0.50	1.00	1.00	0.50	0.00	0.00	0.50	0.50	0.00	0.00	0.00	14	9	8	1
900/10.35	Waikawa River Bridge	no	0.49	0.91	0.68	0.33	1.00	0.70	1.00	1.00	0.76	0.00	1.00	0.00	1.00	1.00	1.00	0.00	0.00	0.00	0.50	0.00	0.00	0.00	13	5	9	-4
900/8.16	Kuku Stream Bridge	no	0.47	0.91	0.68	0.27	1.00	0.70	1.00	1.00	0.76	0.00	1.00	0.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.33	0.00	0.00	12	22	10	12
900/13.90	Waiauti Stream (Manakau) Bridge	yes	0.46	0.91	0.68	0.25	1.00	0.70	1.00	1.00	0.76	0.00	1.00	0.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	15	23	11	12
953/15.41	Paremata Harbour Bridge	no	0.43	0.91	0.57	0.32	1.00	0.70	1.00	1.00	1.00	0.00	0.11	0.00	1.00	1.00	0.50	0.00	0.00	1.00	0.50	0.00	0.00	0.00	25	2	12	-10
953/0.00	Paekakariki Overbridge	no	0.42	0.91	0.60	0.26	1.00	0.70	1.00	1.00	0.92	0.00	0.01	0.50	1.00	1.00	0.50	0.00	0.00	0.50	0.50	0.00	0.00	0.00	23	13	13	0
953/7.70	Pukerua Bay Overbridge	no	0.42	0.91	0.62	0.23	1.00	0.70	1.00	1.00	0.93	0.00	0.08	0.50	1.00	1.00	0.50	0.00	0.00	0.00	0.50	0.53	0.00	0.00	24	8	14	-6
915/4.86	Otaki Overbridge	no	0.38	0.91	0.57	0.20	1.00	0.70	1.00	1.00	0.77	0.00	0.07	0.50	1.00	1.00	0.50	0.00	0.00	0.00	0.50	0.00	0.00	0.00	18	15	15	0
872/13.04	Whirokino Trestle	no	0.37	0.91	0.47	0.32	1.00	0.70	1.00	1.00	0.63	0.00	0.17	0.00	1.00	1.00	0.50	0.00	0.00	1.00	0.50	0.00	0.00	0.00	8	7	16	-9
969/4.40	Kenepuru Stream Bridge	yes	0.37	1.00	0.55	0.11	1.00	1.00	1.00	1.00	1.00	0.00	0.01	0.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.17	1.00	0.00	26	20	17	3
915/4.04	Waitohu Stream Bridge	no	0.35	0.91	0.51	0.20	1.00	0.70	1.00	1.00	0.76	0.00	0.14	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.50	0.00	0.00	0.00	17	14	18	-4
872/12.41	North Whirokino Trestle	yes	0.33	0.91	0.47	0.20	1.00	0.70	1.00	1.00	0.63	0.00	0.17	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.50	0.00	0.00	0.00	7	17	19	-2
915/10.53	Mangaone Stream Bridge	yes	0.33	0.91	0.52	0.13	1.00	0.70	1.00	1.00	0.85	0.00	0.06	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	20	28	20	8
942/0.00	Paraparaumu Overbridge	no	0.33	0.76	0.58	0.20	1.00	0.70	1.00	0.00	0.85	0.00	0.00	0.50	1.00	1.00	0.50	0.00	0.00	0.00	0.50	0.00	0.00	0.00	22	16	21	-5
845/3.82	Piakatutu Stream Bridge	yes	0.30	0.91	0.46	0.13	1.00	0.70	1.00	1.00	0.69	0.00	0.00	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.09	0.00	0.00	3	29	22	7
969/7.15	Collins Avenue East Bridge	no	0.29	0.70	0.49	0.31	1.00	1.00	0.00	0.00	1.00	0.35	0.01	0.00	1.00	0.00	0.50	0.00	0.00	0.00	0.50	0.27	1.00	0.00	27	18	23	-5
969/7.15	Collins Avenue West Bridge	no	0.29	0.70	0.49	0.31	1.00	1.00	0.00	0.00	1.00	0.35	0.01	0.00	1.00	0.00	0.50	0.00	0.00	0.00	0.50	0.27	1.00	0.00	28	19	24	-5
850/4.35	Makahikaroa Stream Bridge	yes	0.29	0.91	0.45	0.13	1.00	0.70	1.00	1.00	0.63	0.00	0.03	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4	26	25	1
979/4.61	Johnsonville South Overpass	yes	0.25	0.70	0.50	0.15	1.00	1.00	0.00	0.00	1.00	0.48	0.00	0.00	1.00	0.00	0.50	0.00	0.00	0.00	0.00	0.50	0.00	0.00	31	24	26	-2
979/4.27	Johnsonville North Overpass	yes	0.25	0.70	0.50	0.14	1.00	1.00	0.00	0.00	1.00	0.48	0.01	0.00	1.00	0.00	0.50	0.00	0.00	0.00	0.00	0.33	0.00	0.00	30	25	27	-2
845/2.38	Makowai Stream Bridge	yes	0.25	0.76	0.46	0.13	1.00	0.70	0.00	1.00	0.69	0.00	0.01	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.09	0.00	0.00	2	27	28	-1
979/0.00	Takapu Road Overbridge	yes	0.25	0.70	0.50	0.13	1.00	1.00	0.00	0.00	1.00	0.50	0.01	0.00	1.00	0.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	29	21	29	-8
850/5.67	Makowai No 2 Bridge	No Drawings Available		Could Not Be Assessed																					5			
850/5.68	Makowai No 2 Bridge	No Drawings Available		Could Not Be Assessed																					6			

PILOT APPRAISAL OF SEISMIC SCREENING PROCEDURES
STATE HIGHWAY 1 BRIDGES BETWEEN RP 844/1.27 AND 979/4.61

Sorted by Route Position Order

SH1 RP	Bridge Name	Excluded from Prioritisation By Screening Procedure	Seismic Prioritisation Grade (SPG)	Hazard Index	Importance Index	Vulnerability Index	Hazard Index Factors: Peak Ground Accln.	Hazard Index Factors: Remaining Service Life	Hazard Index Factors: Soil Condition	Hazard Index Factors: Liquefaction Risk	Importance Index Factors: AADT On Bridge	Importance Index Factors: AADT Under Bridge	Importance Index Factors: Detour Length	Importance Index Factors: Facility Crossed	Importance Index Factors: Route Type	Importance Index Factors: Critical Utility	Vulnerability Index Factors: Year Designed	Vulnerability Index Factors: Super-structure Hinges	Vulnerability Index Factors: Super-structure Overlap	Vulnerability Index Factors: Super-structure Length	Vulnerability Index Factors: Pier Type	Vulnerability Index Factors: Bridge Skew	Vulnerability Index Factors: Abutment Type	Vulnerability Index Factors: Other Feature	Route Position Order	Economic Analysis Ranking	Difference Econ-SPG Rankings
844/1 27	Rangitikei River Bridge at Bulls	no	0.51	0.91	0.50	0.65	1.00	0.70	1.00	1.00	0.70	0.00	0.18	0.00	1.00	1.00	0.50	1.00	0.00	1.00	0.50	0.00	1.00	1.00	1	3	-5
845/2 38	Makowai Stream Bridge	yes	0.25	0.76	0.46	0.13	1.00	0.70	0.00	1.00	0.69	0.00	0.01	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.09	0.00	0.00	2	27	-1
845/3 82	Piakatutu Stream Bridge	yes	0.30	0.91	0.46	0.13	1.00	0.70	1.00	1.00	0.69	0.00	0.00	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.09	0.00	0.00	3	29	5
850/4 35	Makahikaroa Stream Bridge	yes	0.29	0.91	0.45	0.13	1.00	0.70	1.00	1.00	0.63	0.00	0.03	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4	26	1
850/5 67	Makowai No 2 Bridge	No Drawings Available		Could Not Be Assessed																					5		
850/5 68	Makowai No 2 Bridge	No Drawings Available		Could Not Be Assessed																					6		
872/12 41	North Whirokino Trestle	yes	0.34	0.91	0.47	0.22	1.00	0.70	1.00	1.00	0.63	0.00	0.17	0.00	1.00	1.00	0.50	0.00	0.00	0.20	0.50	0.00	0.00	0.00	7	17	-2
872/13 04	Whirokino Trestle	no	0.37	0.91	0.47	0.32	1.00	0.70	1.00	1.00	0.63	0.00	0.17	0.00	1.00	1.00	0.50	0.00	0.00	1.00	0.50	0.00	0.00	0.00	8	7	-9
872/14 30	Manawatu River (Whirokino) Bridge	no	0.52	0.91	0.52	0.64	1.00	0.70	1.00	1.00	0.63	0.00	0.40	0.00	1.00	1.00	0.50	1.00	0.00	0.80	0.50	0.22	1.00	1.00	9	6	1
900/6 77	Ohau River Bridge	no	0.54	1.00	0.68	0.34	1.00	1.00	1.00	1.00	0.75	0.00	1.00	0.00	1.00	1.00	0.50	0.50	0.00	0.80	0.50	0.00	0.00	0.00	10	1	-1
900/7 04	Ohau Overbridge	yes	0.51	1.00	0.75	0.16	1.00	1.00	1.00	1.00	0.75	0.00	1.00	0.50	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.61	0.00	0.00	11	10	4
900/8 16	Kuku Stream Bridge	no	0.47	0.91	0.68	0.27	1.00	0.70	1.00	1.00	0.76	0.00	1.00	0.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.33	0.00	0.00	12	22	12
900/10 35	Waikawa River Bridge	no	0.50	0.91	0.68	0.35	1.00	0.70	1.00	1.00	0.76	0.00	1.00	0.00	1.00	1.00	1.00	0.00	0.00	0.20	0.50	0.00	0.00	0.00	13	5	-4
900/10 67	Manakau North Overbridge	no	0.51	0.91	0.76	0.27	1.00	0.70	1.00	1.00	0.74	0.00	1.00	0.50	1.00	1.00	0.50	0.00	0.00	0.60	0.50	0.00	0.00	0.00	14	9	2
900/13 90	Waiauti Stream (Manakau) Bridge	yes	0.46	0.91	0.68	0.25	1.00	0.70	1.00	1.00	0.76	0.00	1.00	0.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	15	23	12
915/0 00	Pukehou (Manakau South) Overbridge	no	0.53	1.00	0.58	0.45	1.00	1.00	1.00	1.00	0.76	0.00	0.16	0.50	1.00	1.00	0.50	0.00	0.00	0.60	1.00	0.00	1.00	0.00	16	12	9
915/4 04	Waitohu Stream Bridge	no	0.36	0.91	0.51	0.22	1.00	0.70	1.00	1.00	0.76	0.00	0.16	0.00	1.00	1.00	0.50	0.00	0.00	0.20	0.50	0.00	0.00	0.00	17	14	-4
915/4 86	Otaki Overbridge	no	0.41	0.91	0.57	0.27	1.00	0.70	1.00	1.00	0.77	0.00	0.07	0.50	1.00	1.00	0.50	0.00	0.00	0.60	0.50	0.00	0.00	0.00	18	15	0
915/5 81	Otaki River Bridge	no	0.52	0.91	0.69	0.40	1.00	0.70	1.00	1.00	0.79	0.00	1.00	0.00	1.00	1.00	0.50	1.00	0.00	1.00	0.50	0.00	0.00	0.00	19	11	7
915/10 53	Mangaone Stream Bridge	yes	0.33	0.91	0.52	0.13	1.00	0.70	1.00	1.00	0.85	0.00	0.06	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	20	28	7
931/5 19	Waikanae River Bridge	no	0.63	1.00	0.71	0.52	1.00	1.00	1.00	1.00	0.85	0.00	1.00	0.00	1.00	1.00	0.50	0.00	0.00	0.60	0.50	0.00	1.00	1.00	21	4	3
942/0 00	Paraparaumu Overbridge	no	0.33	0.76	0.58	0.22	1.00	0.70	1.00	0.00	0.85	0.00	0.00	0.50	1.00	1.00	0.50	0.00	0.00	0.20	0.50	0.00	0.00	0.00	22	16	-4
953/0 00	Paekakariki Overbridge	no	0.43	0.91	0.60	0.27	1.00	0.70	1.00	1.00	0.92	0.00	0.05	0.50	1.00	1.00	0.50	0.00	0.00	0.60	0.50	0.00	0.00	0.00	23	13	0
953/7 70	Pukerua Bay Overbridge	no	0.45	0.91	0.62	0.30	1.00	0.70	1.00	1.00	0.93	0.00	0.08	0.50	1.00	1.00	0.50	0.00	0.00	0.60	0.50	0.53	0.00	0.00	24	8	-4
953/15 41	Paremata Harbour Bridge	no	0.42	0.91	0.57	0.30	1.00	0.70	1.00	1.00	1.00	0.00	0.11	0.00	1.00	1.00	0.50	0.00	0.00	0.80	0.50	0.00	0.00	0.00	25	2	-12
969/4 40	Kenepuru Stream Bridge	yes	0.37	1.00	0.65	0.11	1.00	1.00	1.00	1.00	1.00	0.00	0.01	0.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.17	1.00	0.00	26	20	3
969/7 15	Collins Avenue East Bridge	no	0.30	0.70	0.49	0.34	1.00	1.00	0.00	0.00	1.00	0.35	0.01	0.00	1.00	0.00	0.50	0.00	0.00	0.20	0.50	0.27	1.00	0.00	27	18	-4
969/7 15	Collins Avenue West Bridge	no	0.30	0.70	0.49	0.34	1.00	1.00	0.00	0.00	1.00	0.35	0.01	0.00	1.00	0.00	0.50	0.00	0.00	0.20	0.50	0.27	1.00	0.00	28	19	-4
979/0 00	Takapu Road Overbridge	yes	0.25	0.70	0.50	0.13	1.00	1.00	0.00	0.00	1.00	0.50	0.01	0.00	1.00	0.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	29	21	-8
979/4 27	Johnsonville North Overpass	yes	0.25	0.70	0.50	0.14	1.00	1.00	0.00	0.00	1.00	0.48	0.01	0.00	1.00	0.00	0.50	0.00	0.00	0.00	0.00	0.33	0.00	0.00	30	25	-2
979/4 61	Johnsonville South Overpass	yes	0.25	0.70	0.50	0.16	1.00	1.00	0.00	0.00	1.00	0.48	0.00	0.00	1.00	0.00	0.50	0.00	0.00	0.00	0.00	0.50	0.00	0.00	31	24	-2
		FACTORS - THIS TRIAL:		1.00	0.60	0.40	0.40	0.30	0.15	0.15	0.30	0.10	0.20	0.15	0.15	0.10	0.28	0.04	0.10	0.12	0.15	0.05	0.10	0.14			
		FACTORS IN REPORT:		1.00	0.60	0.40	0.40	0.30	0.15	0.15	0.25	0.15	0.15	0.20	0.15	0.10	0.26	0.06	0.10	0.07	0.15	0.10	0.10	0.15			

Sorted by Seismic Priority Grade

SH1 RP	Bridge Name	Excluded from Prioritisation By Screening Procedure	Seismic Prioritisation Grade (SPG)	Hazard Index	Importance Index	Vulnerability Index	Hazard Index Factors: Peak Ground Accln.	Hazard Index Factors: Remaining Service Life	Hazard Index Factors: Soil Condition	Hazard Index Factors: Liquefaction Risk	Importance Index Factors: AADT On Bridge	Importance Index Factors: AADT Under Bridge	Importance Index Factors: Detour Length	Importance Index Factors: Facility Crossed	Importance Index Factors: Route Type	Importance Index Factors: Critical Utility	Vulnerability Index Factors: Year Designed	Vulnerability Index Factors: Super-structure Hinges	Vulnerability Index Factors: Super-structure Overlap	Vulnerability Index Factors: Super-structure Length	Vulnerability Index Factors: Pier Type	Vulnerability Index Factors: Bridge Skew	Vulnerability Index Factors: Abutment Type	Vulnerability Index Factors: Other Feature	Route Position Order	Economic Analysis Ranking	SPG	Difference Econ-SPG Rankings
931/5 19	Waikanae River Bridge	no	0.63	1.00	0.71	0.52	1.00	1.00	1.00	1.00	0.85	0.00	1.00	0.00	1.00	1.00	0.50	0.00	0.00	0.60	0.50	0.00	1.00	1.00	21	4	1	3
900/6 77	Ohau River Bridge	no	0.54	1.00	0.68	0.34	1.00	1.00	1.00	1.00	0.75	0.00	1.00	0.00	1.00	1.00	0.50	0.50	0.00	0.80	0.50	0.00	0.00	0.00	10	1	2	-1
915/0 00	Pukehou (Manakau South) Overbridge	no	0.53	1.00	0.58	0.45	1.00	1.00	1.00	1.00	0.76	0.00	0.16	0.50	1.00	1.00	0.50	0.00	0.00	0.60	1.00	0.00	1.00	0.00	16	12	3	9
915/5 81	Otaki River Bridge	no	0.52	0.91	0.69	0.40	1.00	0.70	1.00	1.00	0.79	0.00	1.00	0.00	1.00	1.00	0.50	1.00	0.00	1.00	0.50	0.00	0.00	0.00	19	11	4	7
872/14 30	Manawatu River (Whirokino) Bridge	no	0.52	0.91	0.52	0.64	1.00	0.70	1.00	1.00	0.63	0.00	0.40	0.00	1.00	1.00	0.50	1.00	0.00	0.80	0.50	0.22	1.00	1.00	9	6	5	1
900/7 04	Ohau Overbridge	yes	0.51	1.00	0.75	0.16	1.00	1.00	1.00	1.00	0.75	0.00	1.00	0.50	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.61	0.00	0.00	11	10	6	4
900/10 67	Manakau North Overbridge	no	0.51	0.91	0.76	0.27	1.00	0.70	1.00	1.00	0.74	0.00	1.00	0.50	1.00	1.00	0.50	0.00	0.00	0.60	0.50	0.00	0.00	0.00	14	9	7	2
844/1 27	Rangitikei River Bridge at Bulls	no	0.51	0.91	0.50	0.65	1.00	0.70	1.00	1.00	0.70	0.00	0.18	0.00	1.00	1.00	0.50	1.00	0.00	1.00	0.50	0.00	1.00	1.00	1	3	8	-5
900/10 35	Waikawa River Bridge	no	0.50	0.91	0.68	0.35	1.00	0.70	1.00	1.00	0.76	0.00	1.00	0.00	1.00	1.00	1.00	0.00	0.00	0.20	0.50	0.00	0.00	0.00	13	5	9	-4
900/8 16	Kuku Stream Bridge	no	0.47	0.91	0.68	0.27	1.00	0.70	1.00	1.00	0.76	0.00	1.00	0.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.33	0.00	0.00	12	22	10	12
900/13 90	Waiauti Stream (Manakau) Bridge	yes	0.46	0.91	0.68	0.25	1.00	0.70	1.00	1.00	0.76	0.00	1.00	0.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	15	23	11	12
953/7 70	Pukerua Bay Overbridge	no	0.45	0.91	0.62	0.30	1.00	0.70	1.00	1.00	0.93	0.00	0.08	0.50	1.00	1.00	0.50	0.00	0.00	0.60	0.50	0.53	0.00	0.00	24	8	12	-4
953/0 00	Paekakariki Overbridge	no	0.43	0.91	0.60	0.27	1.00	0.70	1.00	1.00	0.92	0.00	0.05	0.50	1.00	1.00	0.50	0.00	0.00	0.60	0.50	0.00	0.00	0.00	23	13	13	0
953/15 41	Paremata Harbour Bridge	no	0.42	0.91	0.57	0.30	1.00	0.70	1.00	1.00	1.00	0.00	0.11	0.00	1.00	1.00	0.50	0.00	0.00	0.80	0.50	0.00	0.00	0.00	25	2	14	-12
915/4 86	Otaki Overbridge	no	0.41	0.91	0.57	0.27	1.00	0.70	1.00	1.00	0.77	0.00	0.07	0.50	1.00	1.00	0.50	0.00	0.00	0.60	0.50	0.00	0.00	0.00	18	15	15	0
872/13 04	Whirokino Trestle	no	0.37	0.91	0.47	0.32	1.00	0.70	1.00	1.00	0.63	0.00	0.17	0.00	1.00	1.00	0.50	0.00	0.00	1.00	0.50	0.00	0.00	0.00	8	7	16	-9
969/4 40	Kenepuru Stream Bridge	yes	0.37	1.00	0.65	0.11	1.00	1.00	1.00	1.00	1.00	0.00	0.01	0.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.17	1.00	0.00	26	20	17	3
915/4 04	Waitohu Stream Bridge	no	0.36	0.91	0.51	0.22	1.00	0.70	1.00	1.00	0.76	0.00	0.16	0.00	1.00	1.00	0.50	0.00	0.00	0.20	0.50	0.00	0.00	0.00	17	14	18	-4
872/12 41	North Whirokino Trestle	yes	0.34	0.91	0.47	0.22	1.00	0.70	1.00	1.00	0.63	0.00	0.17	0.00	1.00	1.00	0.50	0.00	0.00	0.20	0.50	0.00	0.00	0.00	7	17	19	-2
942/0 00	Paraparaumu Overbridge	no	0.33	0.76	0.58	0.22	1.00	0.70	1.00	0.00	0.85	0.00	0.00	0.50	1.00	1.00	0.50	0.00	0.00	0.20	0.50	0.00	0.00	0.00	22	16	20	-4
915/10 53	Mangaone Stream Bridge	yes	0.33	0.91	0.52	0.13	1.00	0.70	1.00	1.00	0.85	0.00	0.06	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	20	28	21	7
969/7 15	Collins Avenue East Bridge	no	0.30	0.70	0.49	0.34	1.00	1.00	0.00	0.00	1.00	0.35	0.01	0.00	1.00	0.00	0.50	0.00	0.00	0.20	0.50	0.27	1.00	0.00	27	18	22	-4
969/7 15	Collins Avenue West Bridge	no	0.30	0.70	0.49	0.34	1.00	1.00	0.00	0.00	1.00	0.35	0.01	0.00	1.00	0.00	0.50	0.00	0.00	0.20	0.50	0.27	1.00	0.00	28	19	23	-4
845/3 82	Piakatutu Stream Bridge	yes	0.30	0.91	0.46	0.13	1.00	0.70	1.00	1.00	0.69	0.00	0.00	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.09	0.00	0.00	3	29	24	5
850/4 35	Makahikaroa Stream Bridge	yes	0.29	0.91	0.45	0.13	1.00	0.70	1.00	1.00	0.63	0.00	0.03	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4	26	25	1
979/4 61	Johnsonville South Overpass	yes	0.25	0.70	0.50	0.15	1.00	1.00	0.00	0.00	1.00	0.48	0.00	0.00	1.00	0.00	0.50	0.00	0.00	0.00	0.00	0.50	0.00	0.00	31	24	26	-2
979/4 27	Johnsonville North Overpass	yes	0.25	0.70	0.50	0.14	1.00	1.00	0.00	0.00	1.00	0.48	0.01	0.00	1.00	0.00	0.50	0.00	0.00	0.00	0.00	0.33	0.00	0.00	30	25	27	-2
845/2 38	Makowai Stream Bridge	yes	0.25	0.76	0.46	0.13	1.00	0.70	0.00	1.00	0.69	0.00	0.01	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.09	0.00	0.00	2	27	28	-1
979/0 00	Takapu Road Overbridge	yes	0.25	0.70	0.50	0.13	1.00	1.00	0.00	0.00	1.00	0.50	0.01	0.00	1.00	0.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	29	21	29	-8
850/5 67	Makowai No 2 Bridge	No Drawings Available		Could Not Be Assessed																					5			
850/5 68	Makowai No 2 Bridge	No Drawings Available		Could Not Be Assessed																					6			

PILOT APPRAISAL OF SEISMIC SCREENING PROCEDURES
STATE HIGHWAY 1 BRIDGES BETWEEN RP 844/1.27 AND 979/4.61

Sorted by Route Position Order

SH1 RP	Bridge Name	Excluded from Prioritisation By Screening Procedure	Seismic Prioritisation Grade (SPG)	Hazard Index	Importance Index	Vulnerability Index	Hazard Index Factors: Peak Ground Accn.	Remaining Service Life	Soil Condition	Liquefaction Risk	Importance Index Factors: AADT On Bridge	AADT Under Bridge	Detour Length	Facility Crossed	Route Type	Critical Utility	Vulnerability Index Factors: Year Designed	Super-structure Hinges	Super-structure Overlap	Super-structure Length	Pier Type	Bridge Skew	Abutment Type	Other Feature	Route Position Order	Economic Analysis Ranking	Difference Econ-SPG Rankings
844/1.27	Rangitikei River Bridge at Bulls	no	0.51	0.91	0.50	0.65	1.00	0.70	1.00	1.00	0.70	0.00	0.18	0.00	1.00	1.00	0.50	1.00	0.00	1.00	0.50	0.00	1.00	1.00	1	3	-4
845/2.38	Makowai Stream Bridge	yes	0.00	0.76	0.46	0.13	1.00	0.70	0.00	1.00	0.69	0.00	0.01	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.09	0.00	0.00	2	0	0
845/3.82	Piakatutu Stream Bridge	yes	0.00	0.91	0.46	0.13	1.00	0.70	1.00	1.00	0.69	0.00	0.00	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.09	0.00	0.00	3	0	0
850/4.35	Makahikaroa Stream Bridge	yes	0.00	0.91	0.45	0.13	1.00	0.70	1.00	1.00	0.63	0.00	0.03	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4	0	0
850/5.67	Makowai No 2 Bridge	No Drawings Available		Could Not Be Assessed																					5		
850/5.68	Makowai No 2 Bridge	No Drawings Available		Could Not Be Assessed																					6		
872/12.41	North Whirokino Trestle	yes	0.00	0.91	0.47	0.22	1.00	0.70	1.00	1.00	0.63	0.00	0.17	0.00	1.00	1.00	0.50	0.00	0.00	0.20	0.50	0.00	0.00	0.00	7	0	0
872/13.04	Whirokino Trestle	no	0.37	0.91	0.47	0.32	1.00	0.70	1.00	1.00	0.63	0.00	0.17	0.00	1.00	1.00	0.50	0.00	0.00	1.00	0.50	0.00	0.00	0.00	8	7	-7
872/14.30	Manawatu River (Whirokino) Bridge	no	0.52	0.91	0.52	0.64	1.00	0.70	1.00	1.00	0.63	0.00	0.40	0.00	1.00	1.00	0.50	1.00	0.00	0.80	0.50	0.22	1.00	1.00	9	6	1
900/6.77	Ohau River Bridge	no	0.54	1.00	0.68	0.34	1.00	1.00	1.00	1.00	0.75	0.00	1.00	0.00	1.00	1.00	0.50	0.50	0.00	0.80	0.50	0.00	0.00	0.00	10	1	-1
900/7.04	Ohau Overbridge	yes	0.00	1.00	0.75	0.16	1.00	1.00	1.00	1.00	0.75	0.00	1.00	0.50	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.81	0.00	0.00	11	0	0
900/8.16	Kuku Stream Bridge	no	0.47	0.91	0.68	0.27	1.00	0.70	1.00	1.00	0.76	0.00	1.00	0.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.33	0.00	0.00	12	18	9
900/10.35	Waikawa River Bridge	no	0.50	0.91	0.68	0.35	1.00	0.70	1.00	1.00	0.76	0.00	1.00	0.00	1.00	1.00	1.00	0.00	0.00	0.20	0.50	0.00	0.00	0.00	13	5	-3
900/10.67	Manakau North Overbridge	no	0.51	0.91	0.75	0.27	1.00	0.70	1.00	1.00	0.76	0.00	1.00	0.50	1.00	1.00	0.50	0.00	0.00	0.80	0.50	0.00	0.00	0.00	14	9	3
900/13.90	Waiaua Stream (Manakau) Bridge	yes	0.00	0.91	0.66	0.25	1.00	0.70	1.00	1.00	0.76	0.00	1.00	0.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	15	0	0
915/0.00	Pukehou (Manakau South) Overbridge	no	0.53	1.00	0.58	0.45	1.00	1.00	1.00	1.00	0.76	0.00	0.16	0.50	1.00	1.00	0.50	0.00	0.00	0.60	1.00	0.00	1.00	0.00	16	11	8
915/4.04	Waitohu Stream Bridge	no	0.36	0.91	0.51	0.22	1.00	0.70	1.00	1.00	0.78	0.00	0.16	0.00	1.00	1.00	0.50	0.00	0.00	0.20	0.50	0.00	0.00	0.00	17	13	-2
915/4.86	Otaki Overbridge	no	0.41	0.91	0.57	0.27	1.00	0.70	1.00	1.00	0.77	0.00	0.07	0.50	1.00	1.00	0.50	0.00	0.00	0.60	0.50	0.00	0.00	0.00	18	14	1
915/8.81	Otaki River Bridge	no	0.52	0.91	0.69	0.40	1.00	0.70	1.00	1.00	0.79	0.00	1.00	0.00	1.00	1.00	0.50	1.00	0.00	1.00	0.50	0.00	0.00	0.00	19	10	6
915/10.53	Mangaone Stream Bridge	yes	0.00	0.91	0.52	0.13	1.00	0.70	1.00	1.00	0.85	0.00	0.06	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	20	0	0
931/5.19	Waikanae River Bridge	no	0.63	1.00	0.71	0.52	1.00	1.00	1.00	1.00	0.85	0.00	1.00	0.00	1.00	1.00	0.50	0.00	0.00	0.60	0.50	0.00	1.00	1.00	21	4	3
942/0.00	Paraparaumu Overbridge	no	0.33	0.76	0.58	0.22	1.00	0.70	1.00	0.00	0.85	0.00	0.00	0.50	1.00	1.00	0.50	0.00	0.00	0.20	0.50	0.00	0.00	0.00	22	15	-1
953/0.00	Paekakariki Overbridge	no	0.43	0.91	0.60	0.27	1.00	0.70	1.00	1.00	0.92	0.00	0.01	0.50	1.00	1.00	0.50	0.00	0.00	0.60	0.50	0.00	0.00	0.00	23	12	1
953/7.70	Pukerua Bay Overbridge	no	0.45	0.91	0.62	0.30	1.00	0.70	1.00	1.00	0.93	0.00	0.04	0.50	1.00	1.00	0.50	0.00	0.00	0.60	0.50	0.53	0.00	0.00	24	8	-2
953/15.41	Paremata Harbour Bridge	no	0.42	0.91	0.57	0.30	1.00	0.70	1.00	1.00	1.00	0.00	0.11	0.00	1.00	1.00	0.50	0.00	0.00	0.80	0.50	0.00	0.00	0.00	25	2	-10
969/4.40	Kenepuru Stream Bridge	yes	0.00	1.00	0.55	0.11	1.00	1.00	1.00	1.00	1.00	0.00	0.01	0.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.17	1.00	0.00	26	0	0
969/7.15	Collins Avenue East Bridge	no	0.30	0.70	0.49	0.34	1.00	1.00	0.00	0.00	1.00	0.35	0.01	0.00	1.00	0.00	0.50	0.00	0.00	0.20	0.50	0.27	1.00	0.00	27	16	-1
969/7.15	Collins Avenue West Bridge	no	0.30	0.70	0.49	0.34	1.00	1.00	0.00	0.00	1.00	0.35	0.01	0.00	1.00	0.00	0.50	0.00	0.00	0.20	0.50	0.27	1.00	0.00	28	17	-1
979/0.00	Takapu Road Overbridge	yes	0.00	0.70	0.60	0.13	1.00	1.00	0.00	0.00	1.00	0.50	0.01	0.00	1.00	0.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	29	0	0
979/4.27	Johnsonville North Overpass	yes	0.00	0.70	0.60	0.14	1.00	1.00	0.00	0.00	1.00	0.48	0.01	0.00	1.00	0.00	0.50	0.00	0.00	0.00	0.00	0.33	0.00	0.00	30	0	0
979/4.61	Johnsonville South Overpass	yes	0.00	0.70	0.50	0.16	1.00	1.00	0.00	0.00	1.00	0.48	0.00	0.00	1.00	0.00	0.50	0.00	0.00	0.00	0.00	0.50	0.00	0.00	31	0	0
		FACTORS - THIS TRIAL:		1.00	0.60	0.40	0.40	0.30	0.15	0.15	0.30	0.10	0.20	0.15	0.15	0.10	0.25	0.04	0.15	0.12	0.15	0.06	0.10	0.15			
		FACTORS IN REPORT:		1.00	0.60	0.40	0.40	0.30	0.15	0.15	0.25	0.15	0.15	0.20	0.15	0.10	0.25	0.04	0.10	0.07	0.15	0.16	0.10	0.15			

Sorted by Seismic Priority Grade

SH1 RP	Bridge Name	Excluded from Prioritisation By Screening Procedure	Seismic Prioritisation Grade (SPG)	Hazard Index	Importance Index	Vulnerability Index	Hazard Index Factors: Peak Ground Accn.	Remaining Service Life	Soil Condition	Liquefaction Risk	Importance Index Factors: AADT On Bridge	AADT Under Bridge	Detour Length	Facility Crossed	Route Type	Critical Utility	Vulnerability Index Factors: Year Designed	Super-structure Hinges	Super-structure Overlap	Super-structure Length	Pier Type	Bridge Skew	Abutment Type	Other Feature	Route Position Order	Economic Analysis Ranking	SPG	Difference Econ-SPG Rankings
931/5.19	Waikanae River Bridge	no	0.63	1.00	0.71	0.52	1.00	1.00	1.00	1.00	0.85	0.00	1.00	0.00	1.00	1.00	0.50	0.00	0.00	0.60	0.50	0.00	1.00	1.00	21	4	1	3
900/6.77	Ohau River Bridge	no	0.54	1.00	0.68	0.34	1.00	1.00	1.00	1.00	0.75	0.00	1.00	0.00	1.00	1.00	0.50	0.50	0.00	0.60	0.50	0.00	0.00	0.00	10	1	2	-1
915/0.00	Pukehou (Manakau South) Overbridge	no	0.53	1.00	0.58	0.45	1.00	1.00	1.00	1.00	0.76	0.00	0.16	0.50	1.00	1.00	0.50	0.00	0.00	0.60	1.00	0.00	1.00	0.00	16	11	3	8
915/8.81	Otaki River Bridge	no	0.52	0.91	0.69	0.40	1.00	0.70	1.00	1.00	0.79	0.00	1.00	0.00	1.00	1.00	0.50	1.00	0.00	1.00	0.50	0.00	0.00	0.00	19	10	4	6
872/14.30	Manawatu River (Whirokino) Bridge	no	0.52	0.91	0.52	0.64	1.00	0.70	1.00	1.00	0.63	0.00	0.40	0.00	1.00	1.00	0.50	1.00	0.00	0.80	0.50	0.22	1.00	1.00	9	6	5	1
900/10.67	Manakau North Overbridge	no	0.51	0.91	0.75	0.27	1.00	0.70	1.00	1.00	0.76	0.00	1.00	0.50	1.00	1.00	0.50	0.00	0.00	0.60	0.50	0.00	0.00	0.00	14	9	6	3
844/1.27	Rangitikei River Bridge at Bulls	no	0.51	0.91	0.50	0.65	1.00	0.70	1.00	1.00	0.70	0.00	0.18	0.00	1.00	1.00	0.50	1.00	0.00	1.00	0.50	0.00	1.00	1.00	1	3	7	-4
900/10.35	Waikawa River Bridge	no	0.50	0.91	0.68	0.35	1.00	0.70	1.00	1.00	0.76	0.00	1.00	0.00	1.00	1.00	1.00	0.00	0.00	0.20	0.50	0.00	0.00	0.00	13	5	8	-3
900/8.16	Kuku Stream Bridge	no	0.47	0.91	0.68	0.27	1.00	0.70	1.00	1.00	0.76	0.00	1.00	0.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.33	0.00	0.00	12	18	9	9
953/7.70	Pukerua Bay Overbridge	no	0.45	0.91	0.62	0.30	1.00	0.70	1.00	1.00	0.93	0.00	0.04	0.50	1.00	1.00	0.50	0.00	0.00	0.80	0.50	0.53	0.00	0.00	24	8	10	-2
953/0.00	Paekakariki Overbridge	no	0.43	0.91	0.60	0.27	1.00	0.70	1.00	1.00	0.92	0.00	0.01	0.50	1.00	1.00	0.50	0.00	0.00	0.60	0.50	0.00	0.00	0.00	23	12	11	1
953/15.41	Paremata Harbour Bridge	no	0.42	0.91	0.57	0.30	1.00	0.70	1.00	1.00	1.00	0.00	0.11	0.00	1.00	1.00	0.50	0.00	0.00	0.80	0.50	0.00	0.00	0.00	25	2	12	-10
915/4.86	Otaki Overbridge	no	0.41	0.91	0.57	0.27	1.00	0.70	1.00	1.00	0.77	0.00	0.07	0.50	1.00	1.00	0.50	0.00	0.00	0.60	0.50	0.00	0.00	0.00	18	14	13	1
872/13.04	Whirokino Trestle	no	0.37	0.91	0.47	0.32	1.00	0.70	1.00	1.00	0.63	0.00	0.17	0.00	1.00	1.00	0.50	0.00	0.00	1.00	0.50	0.00	0.00	0.00	8	7	14	-7
915/4.04	Waitohu Stream Bridge	no	0.36	0.91	0.51	0.22	1.00	0.70	1.00	1.00	0.78	0.00	0.16	0.00	1.00	1.00	0.50	0.00	0.00	0.20	0.50	0.00	0.00	0.00	17	13	15	-2
942/0.00	Paraparaumu Overbridge	no	0.33	0.76	0.58	0.22	1.00	0.70	1.00	0.00	0.85	0.00	0.00	0.50	1.00	1.00	0.50	0.00	0.00	0.20	0.50	0.00	0.00	0.00	22	15	16	-1
969/7.15	Collins Avenue East Bridge	no	0.30	0.70	0.49	0.34	1.00	1.00	0.00	0.00	1.00	0.35	0.01	0.00	1.00	0.00	0.50	0.00	0.00	0.20	0.50	0.27	1.00	0.00	27	16	17	-1
969/7.15	Collins Avenue West Bridge	no	0.30	0.70	0.49	0.34	1.00	1.00	0.00	0.00	1.00	0.35	0.01	0.00	1.00	0.00	0.50	0.00	0.00	0.20	0.50	0.27	1.00	0.00	28	17	18	-1
845/2.38	Makowai Stream Bridge	yes	0.00	0.76	0.46	0.13	1.00	0.70	0.00	1.00	0.69	0.00	0.01	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.09	0.00	0.00	2	0	0	0
845/3.82	Piakatutu Stream Bridge	yes	0.00	0.91	0.46	0.13	1.00	0.70	1.00	1.00	0.69	0.00	0.00	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.09	0.00	0.00	3	0	0	0
850/4.35	Makahikaroa Stream Bridge	yes	0.00	0.91	0.45	0.13	1.00	0.70	1.00	1.00	0.63	0.00	0.03	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4	0	0	0
872/12.41	North Whirokino Trestle	yes	0.00	0.91	0.47	0.22	1.00	0.70	1.00	1.00	0.63	0.00	0.17	0.00	1.00	1.00	0.50	0.00	0.00	0.20	0.50	0.00	0.00	0.00	7	0	0	0
900/7.04	Ohau Overbridge	yes	0.00	1.00	0.75	0.16	1.00	1.00	1.00	1.00	0.75	0.00	1.00	0.50	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.81	0.00	0.00	11	0	0	0
900/13.90	Waiaua Stream (Manakau) Bridge	yes	0.00	0.91	0.66	0.25	1.00	0.70	1.00	1.00	0.76	0.00	1.00	0.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	15	0	0	0
915/10.53	Mangaone Stream Bridge	yes	0.00	0.91	0.52	0.13	1.00	0.70	1.00	1.00	0.85	0.00	0.06	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	20	0	0	0
969/4.40	Kenepuru Stream Bridge	yes	0.00	1.00	0.55	0.11	1.00	1.00	1.00	1.00	1.00	0.00	0.01	0.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.17	1.00	0.00	26	0	0	0
979/0.00	Takapu Road Overbridge	yes	0.00	0.70	0.60	0.13	1.00	1.00	0.00	0.00	1.00	0.50	0.01	0.00	1.00	0.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	29	0	0	0
979/4.27	Johnsonville North Overpass	yes	0.00	0.70	0.60	0.14	1.00	1.00	0.00	0.00	1.00	0.48	0.01	0.00	1.00	0.00	0.50	0.00	0.00	0.00	0.00	0.33	0.00	0.00	30	0	0	0
979/4.61	Johnsonville South Overpass	yes	0.00	0.70	0.50	0.16	1.00	1.00	0.00	0.00	1.00	0.48	0.00	0.00	1.00	0.00	0.50	0.00	0.00	0.00	0.00	0.50	0.00	0.00	31	0	0	0
850/5.67	Makowai No 2 Bridge	No Drawings Available		Could Not Be Assessed																					5			
850/5.68	Makowai No 2 Bridge	No Drawings Available		Could Not Be Assessed																					6			

PILOT APPRAISAL OF SEISMIC SCREENING PROCEDURES
STATE HIGHWAY 1 BRIDGES BETWEEN RP 844/1.27 AND 979/4.61

Sorted by Route Position Order

SH1 RP	Bridge Name	Excluded from Prioritisation By Screening Procedure	Seismic Prioritisation Grade (SPG)	Hazard Index	Importance Index	Vulnerability Index	Hazard Index Factors: Peak Ground Accln	Hazard Index Factors: Remaining Service Life	Hazard Index Factors: Soil Condition	Hazard Index Factors: Liquefaction Risk	Importance Index Factors: AADT On Bridge	Importance Index Factors: AADT Under Bridge	Importance Index Factors: Detour Length	Importance Index Factors: Facility Crossed	Importance Index Factors: Route Type	Importance Index Factors: Critical Utility	Vulnerability Index Factors: Year Designed	Vulnerability Index Factors: Super-structure Hinges	Vulnerability Index Factors: Super-structure Overlap	Vulnerability Index Factors: Super-structure Length	Vulnerability Index Factors: Pier Type	Vulnerability Index Factors: Bridge Skew	Vulnerability Index Factors: Abutment Type	Vulnerability Index Factors: Other Feature	Route Position Order	Economic Analysis Ranking	Difference Econ-SPG Rankings
844/1.27	Rangitikei River Bridge at Bulls	no	0.53	0.91	0.54	0.65	1.00	0.70	1.00	1.00	0.70	0.00	0.18	0.00	1.00	1.00	0.50	1.00	0.00	1.00	0.50	0.00	1.00	1.00	1	3	-6
845/2.38	Makowai Stream Bridge	yes	0.26	0.76	0.49	0.13	1.00	0.70	0.00	1.00	0.69	0.00	0.01	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.09	0.00	0.00	2	27	1
845/3.82	Piakatutu Stream Bridge	yes	0.32	0.91	0.49	0.13	1.00	0.70	1.00	1.00	0.69	0.00	0.00	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.09	0.00	0.00	3	29	5
850/4.35	Makahikaroa Stream Bridge	yes	0.31	0.91	0.48	0.13	1.00	0.70	1.00	1.00	0.63	0.00	0.03	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4	26	1
850/5.67	Makowai No 2 Bridge	No Drawings Available		Could Not Be Assessed																					5		
850/5.68	Makowai No 2 Bridge	No Drawings Available		Could Not Be Assessed																					6		
872/12.41	North Whirokino Trestle	yes	0.37	0.91	0.51	0.23	1.00	0.70	1.00	1.00	0.63	0.00	0.17	0.00	1.00	1.00	0.50	0.00	0.00	0.20	0.50	0.00	0.00	0.00	7	17	-2
872/13.04	Whirokino Trestle	no	0.41	0.91	0.51	0.37	1.00	0.70	1.00	1.00	0.63	0.00	0.17	0.00	1.00	1.00	0.50	0.00	0.00	1.00	0.50	0.00	0.00	0.00	8	7	-9
872/14.30	Manawatu River (Whirokino) Bridge	no	0.54	0.91	0.57	0.63	1.00	0.70	1.00	1.00	0.63	0.00	0.40	0.00	1.00	1.00	0.50	1.00	0.00	0.80	0.50	0.22	1.00	1.00	9	8	-2
900/6.77	Ohau River Bridge	no	0.61	1.00	0.76	0.38	1.00	1.00	1.00	1.00	0.75	0.00	1.00	0.00	1.00	1.00	0.50	0.50	0.00	0.80	0.50	0.00	0.00	0.00	10	1	-1
900/7.04	Ohau Overbridge	yes	0.55	1.00	0.81	0.18	1.00	1.00	1.00	1.00	0.75	0.00	1.00	0.50	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.61	0.00	0.00	11	10	4
900/8.16	Kuku Stream Bridge	no	0.51	0.91	0.76	0.27	1.00	0.70	1.00	1.00	0.76	0.00	1.00	0.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.33	0.00	0.00	12	22	12
900/10.35	Waikawa River Bridge	no	0.55	0.91	0.78	0.36	1.00	0.70	1.00	1.00	0.76	0.00	1.00	0.00	1.00	1.00	1.00	0.00	0.00	0.20	0.50	0.00	0.00	0.00	13	5	-2
900/10.87	Manakau North Overbridge	no	0.55	0.91	0.81	0.30	1.00	0.70	1.00	1.00	0.76	0.00	1.00	0.50	1.00	1.00	0.50	0.00	0.00	0.80	0.50	0.00	0.00	0.00	14	9	5
900/13.90	Waiauti Stream (Manakau) Bridge	yes	0.51	0.91	0.77	0.25	1.00	0.70	1.00	1.00	0.76	0.00	1.00	0.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	15	23	12
915/0.00	Pukehou (Manakau South) Overbridge	no	0.55	1.00	0.60	0.48	1.00	1.00	1.00	1.00	0.76	0.00	0.16	0.50	1.00	1.00	0.50	0.00	0.00	0.60	1.00	0.00	1.00	0.00	16	12	7
915/4.04	Waitohu Stream Bridge	no	0.39	0.91	0.56	0.23	1.00	0.70	1.00	1.00	0.76	0.00	0.16	0.00	1.00	1.00	0.50	0.00	0.00	0.20	0.50	0.00	0.00	0.00	17	14	-4
915/4.86	Otaki Overbridge	no	0.43	0.91	0.59	0.30	1.00	0.70	1.00	1.00	0.77	0.00	0.07	0.50	1.00	1.00	0.50	0.00	0.00	0.60	0.50	0.00	0.00	0.00	18	15	0
915/6.81	Otaki River Bridge	no	0.59	0.91	0.78	0.45	1.00	0.70	1.00	1.00	0.79	0.00	1.00	0.00	1.00	1.00	0.50	1.00	0.00	1.00	0.50	0.00	0.00	0.00	19	11	8
915/10.53	Mangaone Stream Bridge	yes	0.35	0.91	0.56	0.13	1.00	0.70	1.00	1.00	0.85	0.00	0.06	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	20	28	8
931/5.19	Waikanae River Bridge	no	0.68	1.00	0.80	0.50	1.00	1.00	1.00	1.00	0.85	0.00	1.00	0.00	1.00	1.00	0.50	0.00	0.00	0.60	0.50	0.00	1.00	1.00	21	4	3
942/0.00	Paraparaumu Overbridge	no	0.34	0.76	0.60	0.23	1.00	0.70	1.00	0.00	0.85	0.00	0.00	0.50	1.00	1.00	0.50	0.00	0.00	0.20	0.50	0.00	0.00	0.00	22	18	-5
953/0.00	Paekakariki Overbridge	no	0.45	0.91	0.62	0.30	1.00	0.70	1.00	1.00	0.92	0.00	0.01	0.50	1.00	1.00	0.50	0.00	0.00	0.60	0.50	0.00	0.00	0.00	23	13	-1
953/7.70	Pukerua Bay Overbridge	no	0.47	0.91	0.65	0.33	1.00	0.70	1.00	1.00	0.93	0.00	0.06	0.50	1.00	1.00	0.50	0.00	0.00	0.60	0.50	0.53	0.00	0.00	24	8	-4
953/15.41	Paremata Harbour Bridge	no	0.46	0.91	0.63	0.34	1.00	0.70	1.00	1.00	1.00	0.00	0.11	0.00	1.00	1.00	0.50	0.00	0.00	0.80	0.50	0.00	0.00	0.00	25	2	-11
969/4.40	Kenepuru Stream Bridge	yes	0.40	1.00	0.60	0.11	1.00	1.00	1.00	1.00	1.00	0.00	0.01	0.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.17	1.00	0.00	26	20	3
969/7.15	Collins Avenue East Bridge	no	0.32	0.70	0.52	0.35	1.00	1.00	0.00	0.00	1.00	0.35	0.01	0.00	1.00	0.00	0.50	0.00	0.00	0.20	0.50	0.27	1.00	0.00	27	18	-4
969/7.15	Collins Avenue West Bridge	no	0.32	0.70	0.52	0.35	1.00	1.00	0.00	0.00	1.00	0.35	0.01	0.00	1.00	0.00	0.50	0.00	0.00	0.20	0.50	0.27	1.00	0.00	28	19	-4
979/0.00	Takapu Road Overbridge	yes	0.26	0.70	0.53	0.13	1.00	1.00	0.00	0.00	1.00	0.50	0.01	0.00	1.00	0.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	29	21	-8
979/4.27	Johnsonville North Overpass	yes	0.26	0.70	0.53	0.14	1.00	1.00	0.00	0.00	1.00	0.48	0.01	0.00	1.00	0.00	0.60	0.00	0.00	0.00	0.00	0.33	0.00	0.00	30	25	-3
979/4.61	Johnsonville South Overpass	yes	0.26	0.70	0.52	0.16	1.00	1.00	0.00	0.00	1.00	0.48	0.00	0.00	1.00	0.00	0.60	0.00	0.00	0.00	0.00	0.50	0.00	0.00	31	24	-3
		FACTORS - THIS TRIAL:		1.00	0.60	0.40	0.40	0.35	0.15	0.15	0.35	0.05	0.25	0.10	0.18	0.10	0.25	0.04	0.10	0.17	0.15	0.05	0.10	0.10			
		FACTORS IN REPORT:		1.00	0.60	0.40	0.40	0.30	0.15	0.15	0.25	0.15	0.16	0.20	0.16	0.10	0.25	0.06	0.10	0.07	0.15	0.10	0.10	0.15			

Sorted by Seismic Priority Grade

SH1 RP	Bridge Name	Excluded from Prioritisation By Screening Procedure	Seismic Prioritisation Grade (SPG)	Hazard Index	Importance Index	Vulnerability Index	Hazard Index Factors: Peak Ground Accln	Hazard Index Factors: Remaining Service Life	Hazard Index Factors: Soil Condition	Hazard Index Factors: Liquefaction Risk	Importance Index Factors: AADT On Bridge	Importance Index Factors: AADT Under Bridge	Importance Index Factors: Detour Length	Importance Index Factors: Facility Crossed	Importance Index Factors: Route Type	Importance Index Factors: Critical Utility	Vulnerability Index Factors: Year Designed	Vulnerability Index Factors: Super-structure Hinges	Vulnerability Index Factors: Super-structure Overlap	Vulnerability Index Factors: Super-structure Length	Vulnerability Index Factors: Pier Type	Vulnerability Index Factors: Bridge Skew	Vulnerability Index Factors: Abutment Type	Vulnerability Index Factors: Other Feature	Route Position Order	Economic Analysis Ranking	SPG	Difference Econ-SPG Rankings
931/5.19	Waikanae River Bridge	no	0.68	1.00	0.80	0.50	1.00	1.00	1.00	1.00	0.85	0.00	1.00	0.00	1.00	1.00	0.50	0.00	0.00	0.60	0.50	0.00	1.00	1.00	21	4	1	3
900/6.77	Ohau River Bridge	no	0.61	1.00	0.76	0.38	1.00	1.00	1.00	1.00	0.75	0.00	1.00	0.00	1.00	1.00	0.50	0.50	0.00	0.80	0.50	0.00	0.00	0.00	10	1	2	-1
915/6.81	Otaki River Bridge	no	0.59	0.91	0.78	0.45	1.00	0.70	1.00	1.00	0.79	0.00	1.00	0.00	1.00	1.00	0.50	1.00	0.00	1.00	0.50	0.00	0.00	0.00	19	11	3	8
900/10.87	Manakau North Overbridge	no	0.55	0.91	0.81	0.30	1.00	0.70	1.00	1.00	0.76	0.00	1.00	0.50	1.00	1.00	0.50	0.00	0.00	0.60	0.50	0.00	0.00	0.00	14	9	4	5
915/0.00	Pukehou (Manakau South) Overbridge	no	0.55	1.00	0.60	0.48	1.00	1.00	1.00	1.00	0.78	0.00	0.16	0.50	1.00	1.00	0.50	0.00	0.00	0.60	1.00	0.00	1.00	0.00	16	12	5	7
900/7.04	Ohau Overbridge	yes	0.55	1.00	0.81	0.18	1.00	1.00	1.00	1.00	0.75	0.00	1.00	0.50	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.61	0.00	0.00	11	10	6	4
900/10.35	Waikawa River Bridge	no	0.55	0.91	0.78	0.36	1.00	0.70	1.00	1.00	0.76	0.00	1.00	0.00	1.00	1.00	1.00	0.00	0.00	0.20	0.50	0.00	0.00	0.00	13	5	7	-2
872/14.30	Manawatu River (Whirokino) Bridge	no	0.54	0.91	0.57	0.63	1.00	0.70	1.00	1.00	0.63	0.00	0.40	0.00	1.00	1.00	0.50	1.00	0.00	0.80	0.50	0.22	1.00	1.00	9	8	8	-2
844/1.27	Rangitikei River Bridge at Bulls	no	0.53	0.91	0.54	0.65	1.00	0.70	1.00	1.00	0.70	0.00	0.18	0.00	1.00	1.00	0.50	1.00	0.00	1.00	0.50	0.00	1.00	1.00	1	3	9	-6
900/8.16	Kuku Stream Bridge	no	0.51	0.91	0.76	0.27	1.00	0.70	1.00	1.00	0.76	0.00	1.00	0.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.33	0.00	0.00	12	22	10	12
900/13.90	Waiauti Stream (Manakau) Bridge	yes	0.51	0.91	0.77	0.25	1.00	0.70	1.00	1.00	0.76	0.00	1.00	0.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	15	23	11	12
953/7.70	Pukerua Bay Overbridge	no	0.47	0.91	0.65	0.33	1.00	0.70	1.00	1.00	0.93	0.00	0.06	0.50	1.00	1.00	0.50	0.00	0.00	0.60	0.50	0.53	0.00	0.00	24	8	12	-4
953/15.41	Paremata Harbour Bridge	no	0.46	0.91	0.63	0.34	1.00	0.70	1.00	1.00	1.00	0.00	0.11	0.00	1.00	1.00	0.50	0.00	0.00	0.80	0.50	0.00	0.00	0.00	25	2	13	-11
953/0.00	Paekakariki Overbridge	no	0.45	0.91	0.62	0.30	1.00	0.70	1.00	1.00	0.92	0.00	0.01	0.50	1.00	1.00	0.50	0.00	0.00	0.60	0.50	0.00	0.00	0.00	23	13	14	-1
915/4.86	Otaki Overbridge	no	0.43	0.91	0.59	0.30	1.00	0.70	1.00	1.00	0.77	0.00	0.07	0.50	1.00	1.00	0.50	0.00	0.00	0.60	0.50	0.00	0.00	0.00	18	15	15	0
872/13.04	Whirokino Trestle	no	0.41	0.91	0.51	0.37	1.00	0.70	1.00	1.00	0.63	0.00	0.17	0.00	1.00	1.00	0.50	0.00	0.00	1.00	0.50	0.00	0.00	0.00	8	7	16	-9
969/4.40	Kenepuru Stream Bridge	yes	0.40	1.00	0.60	0.11	1.00	1.00	1.00	1.00	1.00	0.00	0.01	0.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.17	1.00	0.00	26	20	17	3
915/4.04	Waitohu Stream Bridge	no	0.39	0.91	0.56	0.23	1.00	0.70	1.00	1.00	0.76	0.00	0.16	0.00	1.00	1.00	0.50	0.00	0.00	0.20	0.50	0.00	0.00	0.00	17	14	18	-4
872/12.41	North Whirokino Trestle	yes	0.37	0.91	0.51	0.23	1.00	0.70	1.00	1.00	0.63	0.00	0.17	0.00	1.00	1.00	0.50	0.00	0.00	0.20	0.50	0.00	0.00	0.00	7	17	19	-2
915/10.53	Mangaone Stream Bridge	yes	0.35	0.91	0.56	0.13	1.00	0.70	1.00	1.00	0.85	0.00	0.06	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	20	28	20	8
942/0.00	Paraparaumu Overbridge	no	0.34	0.76	0.60	0.23	1.00	0.70	1.00	0.00	0.85	0.00	0.00	0.50	1.00	1.00	0.50	0.00	0.00	0.20	0.50	0.00	0.00	0.00	22	18	21	-5
969/7.15	Collins Avenue East Bridge	no	0.32	0.70	0.52	0.35	1.00	1.00	0.00	0.00	1.00	0.35	0.01	0.00	1.00	0.00	0.50	0.00	0.00	0.20	0.50	0.27	1.00	0.00	27	18	22	-4
969/7.15	Collins Avenue West Bridge	no	0.32	0.70	0.52	0.35	1.00	1.00	0.00	0.00	1.00	0.35	0.01	0.00	1.00	0.00	0.50	0.00	0.00	0.20	0.50	0.27	1.00	0.00	28	19	23	-4
845/3.82	Piakatutu Stream Bridge	yes	0.32	0.91	0.49	0.13	1.00	0.70	1.00	1.00	0.69	0.00	0.00	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.09	0.00	0.00	3	29	24	5
850/4.35	Makahikaroa Stream Bridge	yes	0.31	0.91	0.48	0.13	1.00	0.70	1.00	1.00	0.63	0.00	0.03	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4	26	25	1
845/2.38	Makowai Stream Bridge	yes	0.26	0.76	0.49	0.13	1.00	0.70	0.00	1.00	0.69	0.00	0.01	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.09	0.00	0.00	2	27	26	1
979/4.61	Johnsonville South Overpass	yes	0.26	0.70	0.52	0.16	1.00	1.00	0.00	0.00	1.00	0.48	0.00	0.00	1.00	0.00	0.60	0.00	0.00	0.00	0.00	0.50	0.00	0.00	31	24	27	-3
979/4.27	Johnsonville North Overpass	yes	0.26	0.70	0.53	0.14	1.00	1.00	0.00	0.00	1.00	0.48	0.01	0.00	1.00	0.00	0.60	0.00	0.00	0.00	0.00	0.33	0.00	0.00	30	25	28	-3
979/0.00	Takapu Road Overbridge	yes	0.26	0.70	0.53	0.13	1.00	1.00	0.00	0.00	1.00	0.50	0.01	0.00	1.00	0.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	29	21	29	-8
850/5.67	Makowai No 2 Bridge	No Drawings Available		Could Not Be Assessed																					5			
850/5.68	Makowai No 2 Bridge	No Drawings Available		Could Not Be Assessed																					6			

PILOT APPRAISAL OF SEISMIC SCREENING PROCEDURES
STATE HIGHWAY 1 BRIDGES BETWEEN RP 844/1.27 AND 979/4.61

Sorted by Route Position Order

SH1 RP	Bridge Name	Excluded from Prioritisation By Screening Procedure	Seismic Prioritisation Grade (SPG)	Hazard Index	Importance Index	Vulnerability Index	Hazard Index Factors: Peak Ground Accln.	Remaining Service Life	Soil Condition	Liquefaction Risk	Importance Index Factors: AADT On Bridge	AADT Under Bridge	Detour Length	Facility Crossed	Route Type	Critical Utility	Vulnerability Index Factors: Year Designed	Super-structure Hinges	Super-structure Overlap	Super-structure Length	Pier Type	Bridge Skew	Abutment Type	Other Feature	Route Position Order	Economic Analysis Ranking	Difference Econ-SPG Rankings
844/1.27	Rangitikei River Bridge at Bulls	no	0.53	0.91	0.54	0.65	1.00	0.70	1.00	1.00	0.70	0.00	0.18	0.00	1.00	1.00	0.50	1.00	0.00	1.00	0.50	0.00	1.00	1.00	1	3	-5
845/2.38	Makowai Stream Bridge	yes	0.00	0.76	0.49	0.13	1.00	0.70	0.00	1.00	0.69	0.00	0.01	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.09	0.00	0.00	2	0	0
845/3.82	Piakatutu Stream Bridge	yes	0.00	0.91	0.49	0.13	1.00	0.70	1.00	1.00	0.69	0.00	0.00	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.09	0.00	0.00	3	0	0
850/4.35	Makahikaroa Stream Bridge	yes	0.00	0.91	0.48	0.13	1.00	0.70	1.00	1.00	0.63	0.00	0.03	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4	0	0
850/5.87	Makowai No 2 Bridge	No Drawings Available		Could Not Be Assessed																					5		
850/5.44	Makowai No 2 Bridge	No Drawings Available		Could Not Be Assessed																					6		
872/12.41	North Whirokino Trestle	yes	0.00	0.91	0.51	0.23	1.00	0.70	1.00	1.00	0.63	0.00	0.17	0.00	1.00	1.00	0.50	0.00	0.00	0.20	0.50	0.00	0.00	0.00	7	0	0
872/13.04	Whirokino Trestle	no	0.41	0.91	0.51	0.37	1.00	0.70	1.00	1.00	0.63	0.00	0.17	0.00	1.00	1.00	0.50	0.00	0.00	1.00	0.50	0.00	0.00	0.00	8	7	-7
872/14.30	Manawatu River (Whirokino) Bridge	no	0.54	0.91	0.57	0.63	1.00	0.70	1.00	1.00	0.63	0.00	0.40	0.00	1.00	1.00	0.50	1.00	0.00	0.80	0.50	0.22	1.00	1.00	9	6	-1
900/6.77	Ohau River Bridge	no	0.61	1.00	0.76	0.34	1.00	1.00	1.00	1.00	0.75	0.00	1.00	0.00	1.00	1.00	0.50	0.50	0.00	0.80	0.50	0.00	0.00	0.00	10	1	-1
900/7.04	Ohau Overbridge	yes	0.00	1.00	0.81	0.18	1.00	1.00	1.00	1.00	0.75	0.00	1.00	0.50	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.81	0.00	0.00	11	0	0
900/8.16	Kuku Stream Bridge	no	0.51	0.91	0.74	0.27	1.00	0.70	1.00	1.00	0.76	0.00	1.00	0.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.33	0.00	0.00	12	18	9
900/10.35	Waikawa River Bridge	no	0.55	0.91	0.76	0.36	1.00	0.70	1.00	1.00	0.76	0.00	1.00	0.00	1.00	1.00	1.00	0.00	0.00	0.20	0.50	0.00	0.00	0.00	13	5	-1
900/10.87	Manakau North Overbridge	no	0.55	0.91	0.81	0.30	1.00	0.70	1.00	1.00	0.76	0.00	1.00	0.50	1.00	1.00	0.50	0.00	0.00	0.60	0.50	0.00	0.00	0.00	14	9	5
900/13.90	Waiauti Stream (Manakau) Bridge	yes	0.00	0.91	0.77	0.25	1.00	0.70	1.00	1.00	0.76	0.00	1.00	0.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	15	0	0
915/0.00	Pukehou (Manakau South) Overbridge	no	0.55	1.00	0.60	0.48	1.00	1.00	1.00	1.00	0.76	0.00	0.16	0.50	1.00	1.00	0.50	0.00	0.00	0.60	1.00	0.00	1.00	0.00	16	11	6
915/4.04	Waitohu Stream Bridge	no	0.39	0.91	0.58	0.23	1.00	0.70	1.00	1.00	0.76	0.00	0.18	0.00	1.00	1.00	0.50	0.00	0.00	0.20	0.50	0.00	0.00	0.00	17	13	-2
915/4.86	Otaki Overbridge	no	0.43	0.91	0.59	0.30	1.00	0.70	1.00	1.00	0.77	0.00	0.07	0.50	1.00	1.00	0.50	0.00	0.00	0.60	0.50	0.00	0.00	0.00	18	14	1
915/6.81	Otaki River Bridge	no	0.59	0.91	0.78	0.45	1.00	0.70	1.00	1.00	0.79	0.00	1.00	0.00	1.00	1.00	0.50	1.00	0.00	1.00	0.50	0.00	0.00	0.00	19	10	7
915/10.53	Mangaone Stream Bridge	yes	0.00	0.91	0.56	0.13	1.00	0.70	1.00	1.00	0.85	0.00	0.06	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	20	0	0
931/5.19	Waikanae River Bridge	no	0.68	1.00	0.80	0.50	1.00	1.00	1.00	1.00	0.85	0.00	1.00	0.00	1.00	1.00	0.50	0.00	0.00	0.60	0.50	0.00	1.00	1.00	21	4	3
942/0.00	Paraparaumu Overbridge	no	0.34	0.76	0.60	0.23	1.00	0.70	1.00	0.00	0.85	0.00	0.00	0.50	1.00	1.00	0.50	0.00	0.00	0.20	0.50	0.00	0.00	0.00	22	15	-1
953/0.00	Paekakariki Overbridge	no	0.45	0.91	0.62	0.30	1.00	0.70	1.00	1.00	0.92	0.00	0.01	0.50	1.00	1.00	0.50	0.00	0.00	0.60	0.50	0.00	0.00	0.00	23	12	0
953/7.70	Pukerua Bay Overbridge	no	0.47	0.91	0.65	0.33	1.00	0.70	1.00	1.00	0.93	0.00	0.08	0.50	1.00	1.00	0.50	0.00	0.00	0.60	0.50	0.53	0.00	0.00	24	8	-2
953/15.41	Paremata Harbour Bridge	no	0.46	0.91	0.63	0.34	1.00	0.70	1.00	1.00	1.00	0.00	0.11	0.00	1.00	1.00	0.50	0.00	0.00	0.80	0.50	0.00	0.00	0.00	25	2	-9
963/4.40	Kenepuru Stream Bridge	yes	0.00	1.00	0.60	0.11	1.00	1.00	1.00	1.00	1.00	0.00	0.01	0.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.17	1.00	0.00	26	0	0
963/7.15	Collins Avenue East Bridge	no	0.32	0.70	0.52	0.35	1.00	1.00	0.00	0.00	1.00	0.35	0.01	0.00	1.00	0.00	0.50	0.00	0.00	0.20	0.50	0.27	1.00	0.00	27	16	-1
963/7.15	Collins Avenue West Bridge	no	0.32	0.70	0.52	0.35	1.00	1.00	0.00	0.00	1.00	0.35	0.01	0.00	1.00	0.00	0.50	0.00	0.00	0.20	0.50	0.27	1.00	0.00	28	17	-1
979/0.00	Takapu Road Overbridge	yes	0.00	0.70	0.53	0.13	1.00	1.00	0.00	0.00	1.00	0.50	0.01	0.00	1.00	0.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	29	0	0
979/4.27	Johnsonville North Overpass	yes	0.00	0.70	0.53	0.14	1.00	1.00	0.00	0.00	1.00	0.48	0.01	0.00	1.00	0.00	0.50	0.00	0.00	0.00	0.00	0.33	0.00	0.00	30	0	0
979/4.61	Johnsonville South Overpass	yes	0.00	0.70	0.52	0.15	1.00	1.00	0.00	0.00	1.00	0.48	0.00	0.00	1.00	0.00	0.50	0.00	0.00	0.00	0.00	0.50	0.00	0.00	31	0	0
		FACTORS - THIS TRIAL:		1.00	0.60	0.40	0.40	0.30	0.15	0.15	0.36	0.06	0.25	0.10	0.18	0.10	0.28	0.04	0.10	0.17	0.18	0.06	0.10	0.10			
		FACTORS IN REPORT:		1.00	0.60	0.40	0.40	0.30	0.15	0.15	0.25	0.15	0.15	0.20	0.15	0.10	0.25	0.04	0.10	0.07	0.15	0.10	0.10	0.15			

Sorted by Seismic Priority Grade

SH1 RP	Bridge Name	Excluded from Prioritisation By Screening Procedure	Seismic Prioritisation Grade (SPG)	Hazard Index	Importance Index	Vulnerability Index	Hazard Index Factors: Peak Ground Accln.	Remaining Service Life	Soil Condition	Liquefaction Risk	Importance Index Factors: AADT On Bridge	AADT Under Bridge	Detour Length	Facility Crossed	Route Type	Critical Utility	Vulnerability Index Factors: Year Designed	Super-structure Hinges	Super-structure Overlap	Super-structure Length	Pier Type	Bridge Skew	Abutment Type	Other Feature	Route Position Order	Economic Analysis Ranking	SPG	Difference Econ-SPG Rankings
931/5.19	Waikanae River Bridge	no	0.68	1.00	0.80	0.50	1.00	1.00	1.00	1.00	0.85	0.00	1.00	0.00	1.00	1.00	0.50	0.00	0.00	0.60	0.50	0.00	1.00	1.00	21	4	1	3
900/6.77	Ohau River Bridge	no	0.61	1.00	0.76	0.34	1.00	1.00	1.00	1.00	0.75	0.00	1.00	0.00	1.00	1.00	0.50	0.50	0.00	0.80	0.50	0.00	0.00	0.00	10	1	2	-1
915/6.81	Otaki River Bridge	no	0.59	0.91	0.78	0.45	1.00	0.70	1.00	1.00	0.79	0.00	1.00	0.00	1.00	1.00	0.50	1.00	0.00	1.00	0.50	0.00	0.00	0.00	19	10	3	7
900/10.87	Manakau North Overbridge	no	0.55	0.91	0.81	0.30	1.00	0.70	1.00	1.00	0.76	0.00	1.00	0.50	1.00	1.00	0.50	0.00	0.00	0.60	0.50	0.00	0.00	0.00	14	9	4	5
915/0.00	Pukehou (Manakau South) Overbridge	no	0.55	1.00	0.60	0.48	1.00	1.00	1.00	1.00	0.76	0.00	0.16	0.50	1.00	1.00	0.50	0.00	0.00	0.60	1.00	0.00	1.00	0.00	16	11	5	6
900/10.35	Waikawa River Bridge	no	0.55	0.91	0.76	0.36	1.00	0.70	1.00	1.00	0.76	0.00	1.00	0.00	1.00	1.00	1.00	0.00	0.00	0.20	0.50	0.00	0.00	0.00	13	5	6	-1
872/14.30	Manawatu River (Whirokino) Bridge	no	0.54	0.91	0.57	0.63	1.00	0.70	1.00	1.00	0.63	0.00	0.40	0.00	1.00	1.00	0.50	1.00	0.00	0.80	0.50	0.22	1.00	1.00	9	6	7	-1
844/1.27	Rangitikei River Bridge at Bulls	no	0.53	0.91	0.54	0.65	1.00	0.70	1.00	1.00	0.70	0.00	0.18	0.00	1.00	1.00	0.50	1.00	0.00	1.00	0.50	0.00	1.00	1.00	1	3	8	-5
900/8.16	Kuku Stream Bridge	no	0.51	0.91	0.74	0.27	1.00	0.70	1.00	1.00	0.76	0.00	1.00	0.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.33	0.00	0.00	12	18	9	9
953/7.70	Pukerua Bay Overbridge	no	0.47	0.91	0.65	0.33	1.00	0.70	1.00	1.00	0.93	0.00	0.08	0.50	1.00	1.00	0.50	0.00	0.00	0.60	0.50	0.53	0.00	0.00	24	8	10	-2
953/15.41	Paremata Harbour Bridge	no	0.46	0.91	0.63	0.34	1.00	0.70	1.00	1.00	1.00	0.00	0.11	0.00	1.00	1.00	0.50	0.00	0.00	0.80	0.50	0.00	0.00	0.00	25	2	11	-9
953/0.00	Paekakariki Overbridge	no	0.45	0.91	0.62	0.30	1.00	0.70	1.00	1.00	0.92	0.00	0.01	0.50	1.00	1.00	0.50	0.00	0.00	0.60	0.50	0.00	0.00	0.00	23	12	12	0
915/4.86	Otaki Overbridge	no	0.43	0.91	0.59	0.30	1.00	0.70	1.00	1.00	0.77	0.00	0.07	0.50	1.00	1.00	0.50	0.00	0.00	0.60	0.50	0.00	0.00	0.00	18	14	13	1
872/13.04	Whirokino Trestle	no	0.41	0.91	0.51	0.37	1.00	0.70	1.00	1.00	0.63	0.00	0.17	0.00	1.00	1.00	0.50	0.00	0.00	1.00	0.50	0.00	0.00	0.00	8	7	14	-7
915/4.04	Waitohu Stream Bridge	no	0.39	0.91	0.58	0.23	1.00	0.70	1.00	1.00	0.76	0.00	0.18	0.00	1.00	1.00	0.50	0.00	0.00	0.20	0.50	0.00	0.00	0.00	17	13	15	-2
942/0.00	Paraparaumu Overbridge	no	0.34	0.76	0.60	0.23	1.00	0.70	1.00	0.00	0.85	0.00	0.00	0.50	1.00	1.00	0.50	0.00	0.00	0.20	0.50	0.00	0.00	0.00	22	15	16	-1
963/7.15	Collins Avenue East Bridge	no	0.32	0.70	0.52	0.35	1.00	1.00	0.00	0.00	1.00	0.35	0.01	0.00	1.00	0.00	0.50	0.00	0.00	0.20	0.50	0.27	1.00	0.00	27	16	17	-1
963/7.15	Collins Avenue West Bridge	no	0.32	0.70	0.52	0.35	1.00	1.00	0.00	0.00	1.00	0.35	0.01	0.00	1.00	0.00	0.50	0.00	0.00	0.20	0.50	0.27	1.00	0.00	28	17	18	-1
845/2.38	Makowai Stream Bridge	yes	0.00	0.76	0.49	0.13	1.00	0.70	0.00	1.00	0.69	0.00	0.01	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.09	0.00	0.00	2	0	0	0
845/3.82	Piakatutu Stream Bridge	yes	0.00	0.91	0.49	0.13	1.00	0.70	1.00	1.00	0.69	0.00	0.00	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.09	0.00	0.00	3	0	0	0
850/4.35	Makahikaroa Stream Bridge	yes	0.00	0.91	0.48	0.13	1.00	0.70	1.00	1.00	0.63	0.00	0.03	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4	0	0	0
872/12.41	North Whirokino Trestle	yes	0.00	0.91	0.51	0.23	1.00	0.70	1.00	1.00	0.63	0.00	0.17	0.00	1.00	1.00	0.50	0.00	0.00	0.20	0.50	0.00	0.00	0.00	7	0	0	0
900/7.04	Ohau Overbridge	yes	0.00	1.00	0.81	0.18	1.00	1.00	1.00	1.00	0.75	0.00	1.00	0.50	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.81	0.00	0.00	11	0	0	0
900/13.90	Waiauti Stream (Manakau) Bridge	yes	0.00	0.91	0.77	0.25	1.00	0.70	1.00	1.00	0.76	0.00	1.00	0.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	15	0	0	0
915/10.53	Mangaone Stream Bridge	yes	0.00	0.91	0.56	0.13	1.00	0.70	1.00	1.00	0.85	0.00	0.06	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	20	0	0	0
963/4.40	Kenepuru Stream Bridge	yes	0.00	1.00	0.60	0.11	1.00	1.00	1.00	1.00	1.00	0.00	0.01	0.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.17	1.00	0.00	26	0	0	0
979/0.00	Takapu Road Overbridge	yes	0.00	0.70	0.53	0.13	1.00	1.00	0.00	0.00	1.00	0.50	0.01	0.00	1.00	0.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	29	0	0	0
979/4.27	Johnsonville North Overpass	yes	0.00	0.70	0.53	0.14	1.00	1.00	0.00	0.00	1.00	0.48	0.01	0.00	1.00	0.00	0.50	0.00	0.00	0.00	0.00	0.33	0.00	0.00	30	0	0	0
979/4.61	Johnsonville South Overpass	yes	0.00	0.70	0.52	0.15	1.00	1.00	0.00	0.00	1.00	0.48	0.00	0.00	1.00	0.00	0.50	0.00	0.00	0.00	0.00	0.50	0.00	0.00	31	0	0	0
850/5.87	Makowai No 2 Bridge	No Drawings Available		Could Not Be Assessed																					5			
850/5.44	Makowai No 2 Bridge	No Drawings Available		Could Not Be Assessed																					6			

PILOT APPRAISAL OF SEISMIC SCREENING PROCEDURES
STATE HIGHWAY 1 BRIDGES BETWEEN RP 844/1.27 AND 979/4.61

Sorted by Route Position Order

SH1 RP	Bridge Name	Excluded from Prioritisation By Screening Procedure	Seismic Prioritisation Grade (SPG)	Hazard Index	Importance Index	Vulnerability Index	Hazard Index Factors: Peak Ground Accln.	Remaining Service Life	Soil Condition	Liquefaction Risk	Importance Index Factors: AADT On Bridge	AADT Under Bridge	Detour Length	Facility Crossed	Route Type	Critical Utility	Vulnerability Index Factors: Year Designed	Super-structure Hinges	Super-structure Overlap	Super-structure Length	Pier Type	Bridge Skew	Abutment Type	Other Feature	Route Position Order	Economic Analysis Ranking	Difference Econ-SPG Rankings
844/1.27	Rangitikei River Bridge at Bulls	no	0.49	0.91	0.50	0.65	1.00	0.70	1.00	1.00	0.70	0.00	0.18	0.00	1.00	1.00	0.50	1.00	0.00	1.00	0.50	0.00	1.00	1.00	1	3	-8
845/2.38	Makowai Stream Bridge	yes	0.27	0.76	0.46	0.13	1.00	0.70	0.00	1.00	0.69	0.00	0.01	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.09	0.00	0.00	2	27	-1
845/3.82	Pukatutu Stream Bridge	yes	0.33	0.91	0.46	0.13	1.00	0.70	1.00	1.00	0.69	0.00	0.00	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.09	0.00	0.00	3	29	7
850/4.35	Makahikaroa Stream Bridge	yes	0.32	0.91	0.45	0.13	1.00	0.70	1.00	1.00	0.63	0.00	0.03	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4	26	3
850/5.67	Makowai No 2 Bridge	No Drawings Available		Could Not Be Assessed																					5		
850/5.84	Makowai No 2 Bridge	No Drawings Available		Could Not Be Assessed																					6		
872/12.41	North Whirokino Trestle	yes	0.36	0.91	0.47	0.22	1.00	0.70	1.00	1.00	0.63	0.00	0.17	0.00	1.00	1.00	0.50	0.00	0.00	0.20	0.50	0.00	0.00	0.00	7	17	-3
872/13.04	Whirokino Trestle	no	0.39	0.91	0.47	0.32	1.00	0.70	1.00	1.00	0.63	0.00	0.17	0.00	1.00	1.00	0.50	0.00	0.00	1.00	0.50	0.00	0.00	0.00	8	7	-10
872/14.30	Manawatu River (Whirokino) Bridge	no	0.50	0.91	0.52	0.64	1.00	0.70	1.00	1.00	0.63	0.00	0.40	0.00	1.00	1.00	0.50	1.00	0.00	0.80	0.50	0.22	1.00	1.00	9	6	-2
900/6.77	Ohau River Bridge	no	0.57	1.00	0.68	0.34	1.00	1.00	1.00	1.00	0.75	0.00	1.00	0.00	1.00	1.00	0.50	0.50	0.00	0.80	0.50	0.00	0.00	0.00	10	1	-1
900/7.04	Ohau Overbridge	yes	0.57	1.00	0.75	0.16	1.00	1.00	1.00	1.00	0.75	0.00	1.00	0.50	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.61	0.00	0.00	11	10	7
900/8.16	Kuku Stream Bridge	no	0.50	0.91	0.68	0.27	1.00	0.70	1.00	1.00	0.76	0.00	1.00	0.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.33	0.00	0.00	12	22	13
900/10.35	Waikawa River Bridge	no	0.53	0.91	0.68	0.35	1.00	0.70	1.00	1.00	0.76	0.00	1.00	0.00	1.00	1.00	1.00	0.00	0.00	0.20	0.50	0.00	0.00	0.00	13	5	-2
900/10.87	Manakau North Overbridge	no	0.55	0.91	0.75	0.27	1.00	0.70	1.00	1.00	0.76	0.00	1.00	0.50	1.00	1.00	0.50	0.00	0.00	0.60	0.50	0.00	0.00	0.00	14	9	5
900/13.90	Waiauti Stream (Manakau) Bridge	yes	0.50	0.91	0.68	0.25	1.00	0.70	1.00	1.00	0.76	0.00	1.00	0.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	15	23	13
915/0.00	Pukehou (Manakau South) Overbridge	no	0.54	1.00	0.58	0.45	1.00	1.00	1.00	1.00	0.76	0.00	0.16	0.50	1.00	1.00	0.50	0.00	0.00	0.60	1.00	0.00	1.00	0.00	16	12	6
915/4.04	Waitohu Stream Bridge	no	0.39	0.91	0.51	0.22	1.00	0.70	1.00	1.00	0.76	0.00	0.16	0.00	1.00	1.00	0.50	0.00	0.00	0.20	0.50	0.00	0.00	0.00	17	14	-4
915/4.86	Otaki Overbridge	no	0.44	0.91	0.57	0.27	1.00	0.70	1.00	1.00	0.77	0.00	0.07	0.50	1.00	1.00	0.50	0.00	0.00	0.60	0.50	0.00	0.00	0.00	18	15	0
915/6.81	Otaki River Bridge	no	0.55	0.91	0.69	0.40	1.00	0.70	1.00	1.00	0.79	0.00	1.00	0.00	1.00	1.00	0.50	1.00	0.00	1.00	0.50	0.00	0.00	0.00	19	11	6
915/10.53	Mangaone Stream Bridge	yes	0.36	0.91	0.52	0.13	1.00	0.70	1.00	1.00	0.85	0.00	0.06	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	20	28	9
931/5.19	Waikanae River Bridge	no	0.65	1.00	0.71	0.52	1.00	1.00	1.00	1.00	0.85	0.00	1.00	0.00	1.00	1.00	0.50	0.00	0.00	0.60	0.50	0.00	1.00	1.00	21	4	3
942/0.00	Paraparaumu Overbridge	no	0.36	0.76	0.58	0.22	1.00	0.70	1.00	0.00	0.85	0.00	0.00	0.50	1.00	1.00	0.50	0.00	0.00	0.20	0.50	0.00	0.00	0.00	22	16	-5
953/0.00	Paekakariki Overbridge	no	0.48	0.91	0.60	0.27	1.00	0.70	1.00	1.00	0.92	0.00	0.01	0.50	1.00	1.00	0.50	0.00	0.00	0.60	0.50	0.00	0.00	0.00	23	13	0
953/7.70	Pukerua Bay Overbridge	no	0.48	0.91	0.62	0.30	1.00	0.70	1.00	1.00	0.93	0.00	0.08	0.50	1.00	1.00	0.50	0.00	0.00	0.60	0.50	0.53	0.00	0.00	24	8	-4
953/15.41	Paremata Harbour Bridge	no	0.45	0.91	0.57	0.30	1.00	0.70	1.00	1.00	1.00	0.00	0.11	0.00	1.00	1.00	0.50	0.00	0.00	0.80	0.50	0.00	0.00	0.00	25	2	-12
969/4.40	Kenepuru Stream Bridge	yes	0.42	1.00	0.55	0.11	1.00	1.00	1.00	1.00	1.00	0.00	0.01	0.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.17	1.00	0.00	26	20	4
969/7.15	Collins Avenue East Bridge	no	0.31	0.70	0.49	0.34	1.00	1.00	0.00	0.00	1.00	0.35	0.01	0.00	1.00	0.00	0.60	0.00	0.00	0.20	0.50	0.27	1.00	0.00	27	18	-6
969/7.15	Collins Avenue West Bridge	no	0.31	0.70	0.49	0.34	1.00	1.00	0.00	0.00	1.00	0.35	0.01	0.00	1.00	0.00	0.60	0.00	0.00	0.20	0.60	0.27	1.00	0.00	28	19	-6
979/0.00	Takapu Road Overbridge	yes	0.27	0.70	0.60	0.13	1.00	1.00	0.00	0.00	1.00	0.50	0.01	0.00	1.00	0.00	0.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	29	21	-8
979/4.27	Johnsonville North Overpass	yes	0.27	0.70	0.50	0.14	1.00	1.00	0.00	0.00	1.00	0.48	0.01	0.00	1.00	0.00	0.60	0.00	0.00	0.00	0.00	0.33	0.00	0.00	30	25	-2
979/4.61	Johnsonville South Overpass	yes	0.28	0.70	0.60	0.15	1.00	1.00	0.00	0.00	1.00	0.48	0.00	0.00	1.00	0.00	0.60	0.00	0.00	0.00	0.00	0.50	0.00	0.00	31	24	-2
		FACTORS - THIS TRIAL:		1.00	0.70	0.30	0.40	0.30	0.15	0.15	0.30	0.10	0.20	0.15	0.15	0.10	0.25	0.08	0.10	0.12	0.15	0.05	0.10	0.15			
		FACTORS IN REPORT:		1.00	0.60	0.40	0.40	0.30	0.15	0.15	0.25	0.15	0.15	0.20	0.15	0.10	0.25	0.08	0.10	0.07	0.15	0.10	0.10	0.15			

Sorted by Seismic Priority Grade

SH1 RP	Bridge Name	Excluded from Prioritisation By Screening Procedure	Seismic Prioritisation Grade (SPG)	Hazard Index	Importance Index	Vulnerability Index	Hazard Index Factors: Peak Ground Accln.	Remaining Service Life	Soil Condition	Liquefaction Risk	Importance Index Factors: AADT On Bridge	AADT Under Bridge	Detour Length	Facility Crossed	Route Type	Critical Utility	Vulnerability Index Factors: Year Designed	Super-structure Hinges	Super-structure Overlap	Super-structure Length	Pier Type	Bridge Skew	Abutment Type	Other Feature	Route Position Order	Economic Analysis Ranking	SPG	Difference Econ-SPG Rankings
931/5.19	Waikanae River Bridge	no	0.65	1.00	0.71	0.52	1.00	1.00	1.00	1.00	0.85	0.00	1.00	0.00	1.00	1.00	0.50	0.00	0.00	0.60	0.50	0.00	1.00	1.00	21	4	1	3
900/6.77	Ohau River Bridge	no	0.57	1.00	0.68	0.34	1.00	1.00	1.00	1.00	0.75	0.00	1.00	0.00	1.00	1.00	0.50	0.50	0.00	0.80	0.50	0.00	0.00	0.00	10	1	2	-1
900/7.04	Ohau Overbridge	yes	0.57	1.00	0.75	0.16	1.00	1.00	1.00	1.00	0.75	0.00	1.00	0.50	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.61	0.00	0.00	11	10	3	7
900/10.87	Manakau North Overbridge	no	0.55	0.91	0.75	0.27	1.00	0.70	1.00	1.00	0.76	0.00	1.00	0.50	1.00	1.00	0.50	0.00	0.00	0.60	0.50	0.00	0.00	0.00	14	9	4	5
915/6.81	Otaki River Bridge	no	0.55	0.91	0.69	0.40	1.00	0.70	1.00	1.00	0.79	0.00	1.00	0.00	1.00	1.00	0.50	1.00	0.00	1.00	0.50	0.00	0.00	0.00	19	11	5	6
915/0.00	Pukehou (Manakau South) Overbridge	no	0.54	1.00	0.58	0.45	1.00	1.00	1.00	1.00	0.76	0.00	0.16	0.50	1.00	1.00	0.50	0.00	0.00	0.60	1.00	0.00	1.00	0.00	16	12	6	6
900/10.35	Waikawa River Bridge	no	0.53	0.91	0.68	0.35	1.00	0.70	1.00	1.00	0.76	0.00	1.00	0.00	1.00	1.00	1.00	0.00	0.00	0.20	0.50	0.00	0.00	0.00	13	5	7	-2
872/14.30	Manawatu River (Whirokino) Bridge	no	0.50	0.91	0.52	0.64	1.00	0.70	1.00	1.00	0.63	0.00	0.40	0.00	1.00	1.00	0.50	1.00	0.00	0.80	0.50	0.22	1.00	1.00	9	6	8	-2
900/8.16	Kuku Stream Bridge	no	0.50	0.91	0.68	0.27	1.00	0.70	1.00	1.00	0.76	0.00	1.00	0.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.33	0.00	0.00	12	22	9	13
900/13.90	Waiauti Stream (Manakau) Bridge	yes	0.50	0.91	0.68	0.25	1.00	0.70	1.00	1.00	0.76	0.00	1.00	0.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	15	23	10	13
844/1.27	Rangitikei River Bridge at Bulls	no	0.49	0.91	0.50	0.65	1.00	0.70	1.00	1.00	0.70	0.00	0.18	0.00	1.00	1.00	0.50	1.00	0.00	1.00	0.50	0.00	1.00	1.00	1	3	11	-8
953/7.70	Pukerua Bay Overbridge	no	0.48	0.91	0.62	0.30	1.00	0.70	1.00	1.00	0.93	0.00	0.08	0.50	1.00	1.00	0.50	0.00	0.00	0.60	0.50	0.53	0.00	0.00	24	8	12	-4
953/0.00	Paekakariki Overbridge	no	0.48	0.91	0.60	0.27	1.00	0.70	1.00	1.00	0.92	0.00	0.01	0.50	1.00	1.00	0.50	0.00	0.00	0.60	0.50	0.00	0.00	0.00	23	13	13	0
953/15.41	Paremata Harbour Bridge	no	0.45	0.91	0.57	0.30	1.00	0.70	1.00	1.00	1.00	0.00	0.11	0.00	1.00	1.00	0.50	0.00	0.00	0.80	0.50	0.00	0.00	0.00	25	2	14	-12
915/4.86	Otaki Overbridge	no	0.44	0.91	0.57	0.27	1.00	0.70	1.00	1.00	0.77	0.00	0.07	0.50	1.00	1.00	0.50	0.00	0.00	0.60	0.50	0.00	0.00	0.00	18	15	15	0
969/4.40	Kenepuru Stream Bridge	yes	0.42	1.00	0.55	0.11	1.00	1.00	1.00	1.00	1.00	0.00	0.01	0.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.17	1.00	0.00	26	20	16	4
872/13.04	Whirokino Trestle	no	0.39	0.91	0.47	0.32	1.00	0.70	1.00	1.00	0.63	0.00	0.17	0.00	1.00	1.00	0.50	0.00	0.00	1.00	0.50	0.00	0.00	0.00	8	7	17	-10
915/4.04	Waitohu Stream Bridge	no	0.39	0.91	0.51	0.22	1.00	0.70	1.00	1.00	0.76	0.00	0.16	0.00	1.00	1.00	0.50	0.00	0.00	0.20	0.50	0.00	0.00	0.00	17	14	18	-4
915/10.53	Mangaone Stream Bridge	yes	0.36	0.91	0.52	0.13	1.00	0.70	1.00	1.00	0.85	0.00	0.06	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	20	28	19	9
872/12.41	North Whirokino Trestle	yes	0.36	0.91	0.47	0.22	1.00	0.70	1.00	1.00	0.63	0.00	0.17	0.00	1.00	1.00	0.50	0.00	0.00	0.20	0.50	0.00	0.00	0.00	7	17	20	-3
942/0.00	Paraparaumu Overbridge	no	0.36	0.76	0.58	0.22	1.00	0.70	1.00	0.00	0.85	0.00	0.00	0.50	1.00	1.00	0.50	0.00	0.00	0.20	0.50	0.00	0.00	0.00	22	16	21	-5
845/3.82	Pukatutu Stream Bridge	yes	0.33	0.91	0.46	0.13	1.00	0.70	1.00	1.00	0.69	0.00	0.00	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.09	0.00	0.00	3	29	22	7
850/4.35	Makahikaroa Stream Bridge	yes	0.32	0.91	0.45	0.13	1.00	0.70	1.00	1.00	0.63	0.00	0.03	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4	26	23	3
969/7.15	Collins Avenue East Bridge	no	0.31	0.70	0.49	0.34	1.00	1.00	0.00	0.00	1.00	0.35	0.01	0.00	1.00	0.00	0.60	0.00	0.00	0.20	0.50	0.27	1.00	0.00	27	18	24	-6
969/7.15	Collins Avenue West Bridge	no	0.31	0.70	0.49	0.34	1.00	1.00	0.00	0.00	1.00	0.35	0.01	0.00	1.00	0.00	0.60	0.00	0.00	0.20	0.60	0.27	1.00	0.00	28	19	25	-6
979/4.61	Johnsonville South Overpass	yes	0.28	0.70	0.60	0.15	1.00	1.00	0.00	0.00	1.00	0.48	0.00	0.00	1.00	0.00	0.60	0.00	0.00	0.00	0.00	0.50	0.00	0.00	31	24	26	-2
979/4.27	Johnsonville North Overpass	yes	0.27	0.70	0.50	0.14	1.00	1.00	0.00	0.00	1.00	0.48	0.01	0.00	1.00	0.00	0.60	0.00	0.00	0.00	0.00	0.33	0.00	0.00	30	25	27	-2
845/2.38	Makowai Stream Bridge	yes	0.27	0.76	0.46	0.13	1.00	0.70	0.00	1.00	0.69	0.00	0.01	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.09	0.00	0.00	2	27	28	-1
979/0.00	Takapu Road Overbridge	yes	0.27	0.70	0.60	0.13	1.00	1.00	0.00	0.00	1.00	0.50	0.01	0.00	1.00	0.00	0.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	29	21	29	-8
850/5.67	Makowai No 2 Bridge	No Drawings Available		Could Not Be Assessed																					5			
850/5.84	Makowai No 2 Bridge	No Drawings Available		Could Not Be Assessed																					6			

PILOT APPRAISAL OF SEISMIC SCREENING PROCEDURES
STATE HIGHWAY 1 BRIDGES BETWEEN RP 844/1.27 AND 979/4.61

Sorted by Route Position Order

SH1 RP	Bridge Name	Excluded from Prioritisation By Screening Procedure	Seismic Prioritisation Grade (SPG)	Hazard Index	Importance Index	Vulnerability Index	Hazard Index Factors: Peak Ground Accln.	Hazard Index Factors: Remaining Service Life	Hazard Index Factors: Soil Condition	Hazard Index Factors: Liquefaction Risk	Importance Index Factors: AADT On Bridge	Importance Index Factors: AADT Under Bridge	Importance Index Factors: Detour Length	Importance Index Factors: Facility Crossed	Importance Index Factors: Route Type	Importance Index Factors: Critical Utility	Vulnerability Index Factors: Year Designed	Vulnerability Index Factors: Superstructure Hinges	Vulnerability Index Factors: Superstructure Overlap	Vulnerability Index Factors: Superstructure Length	Vulnerability Index Factors: Pier Type	Vulnerability Index Factors: Bridge Skew	Vulnerability Index Factors: Abutment Type	Vulnerability Index Factors: Other Feature	Route Position Order	Economic Analysis Ranking	Difference Econ-SPG Rankings
844/1.27	Rangitikei River Bridge at Bulls	no	0.47	0.91	0.50	0.65	1.00	0.70	1.00	1.00	0.70	0.00	0.18	0.00	1.00	1.00	0.50	1.00	0.00	1.00	0.50	0.00	1.00	1.00	1	5	-13
845/2.38	Makowai Stream Bridge	yes	0.32	0.76	0.46	0.13	1.00	0.70	0.00	1.00	0.69	0.00	0.01	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.09	0.00	0.00	2	27	-2
845/3.82	Piakatutu Stream Bridge	yes	0.39	0.91	0.46	0.13	1.00	0.70	1.00	1.00	0.69	0.00	0.00	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.09	0.00	0.00	3	29	7
850/4.35	Makahikaroa Stream Bridge	yes	0.38	0.91	0.45	0.13	1.00	0.70	1.00	1.00	0.63	0.00	0.03	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4	26	3
850/5.67	Makowai No 2 Bridge	No Drawings Available		Could Not Be Assessed																					5		
850/5.88	Makowai No 2 Bridge	No Drawings Available		Could Not Be Assessed																					6		
872/12.41	North Whirokino Trestle	yes	0.41	0.91	0.47	0.22	1.00	0.70	1.00	1.00	0.63	0.00	0.17	0.00	1.00	1.00	0.50	0.00	0.00	0.20	0.50	0.00	0.00	0.00	7	17	-4
872/13.04	Whirokino Trestle	no	0.42	0.91	0.47	0.32	1.00	0.70	1.00	1.00	0.63	0.00	0.17	0.00	1.00	1.00	0.50	0.00	0.00	1.00	0.50	0.00	0.00	0.00	8	7	-12
872/14.30	Manawatu River (Whirokino) Bridge	no	0.48	0.91	0.62	0.64	1.00	0.70	1.00	1.00	0.63	0.00	0.40	0.00	1.00	1.00	0.50	1.00	0.00	0.80	0.50	0.22	1.00	1.00	9	6	-9
900/6.77	Ohau River Bridge	no	0.64	1.00	0.68	0.34	1.00	1.00	1.00	1.00	0.75	0.00	1.00	0.00	1.00	1.00	0.50	0.50	0.00	0.80	0.50	0.00	0.00	0.00	10	1	-2
900/7.04	Ohau Overbridge	yes	0.69	1.00	0.75	0.16	1.00	1.00	1.00	1.00	0.75	0.00	1.00	0.50	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.61	0.00	0.00	11	10	9
900/8.16	Kuku Stream Bridge	no	0.58	0.91	0.64	0.27	1.00	0.70	1.00	1.00	0.76	0.00	1.00	0.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.33	0.00	0.00	12	22	15
900/10.35	Waikawa River Bridge	no	0.59	0.91	0.64	0.35	1.00	0.70	1.00	1.00	0.74	0.00	1.00	0.00	1.00	1.00	1.00	0.00	0.00	0.20	0.50	0.00	0.00	0.00	13	5	-1
900/10.67	Manakau North Overbridge	no	0.64	0.91	0.75	0.27	1.00	0.70	1.00	1.00	0.76	0.00	1.00	0.50	1.00	1.00	0.50	0.00	0.00	0.60	0.50	0.00	0.00	0.00	14	9	5
900/13.90	Waiauti Stream (Manakau) Bridge	yes	0.58	0.91	0.68	0.25	1.00	0.70	1.00	1.00	0.74	0.00	1.00	0.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	15	23	15
915/0.00	Pukehou (Manakau South) Overbridge	no	0.57	1.00	0.58	0.45	1.00	1.00	1.00	1.00	0.76	0.00	0.16	0.50	1.00	1.00	0.50	0.00	0.00	0.60	1.00	0.00	1.00	0.00	16	12	3
915/4.04	Waitohu Stream Bridge	no	0.44	0.91	0.51	0.22	1.00	0.70	1.00	1.00	0.76	0.00	0.16	0.00	1.00	1.00	0.50	0.00	0.00	0.20	0.50	0.00	0.00	0.00	17	14	-3
915/4.86	Otaki Overbridge	no	0.49	0.91	0.57	0.27	1.00	0.70	1.00	1.00	0.77	0.00	0.07	0.50	1.00	1.00	0.50	0.00	0.00	0.60	0.60	0.00	0.00	0.00	18	16	1
915/6.81	Otaki River Bridge	no	0.60	0.91	0.69	0.40	1.00	0.70	1.00	1.00	0.79	0.00	1.00	0.00	1.00	1.00	0.50	1.00	0.00	1.00	0.50	0.00	0.00	0.00	19	11	8
915/10.53	Mangaone Stream Bridge	yes	0.44	0.91	0.52	0.13	1.00	0.70	1.00	1.00	0.85	0.00	0.06	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	20	28	10
931/5.19	Waikanae River Bridge	no	0.69	1.00	0.71	0.52	1.00	1.00	1.00	1.00	0.85	0.00	1.00	0.00	1.00	1.00	0.50	0.00	0.00	0.60	0.50	0.00	1.00	1.00	21	4	2
942/0.00	Paraparaumu Overbridge	no	0.41	0.76	0.58	0.22	1.00	0.70	1.00	0.00	0.85	0.00	0.00	0.50	1.00	1.00	0.50	0.00	0.00	0.20	0.50	0.00	0.00	0.00	22	16	-4
953/0.00	Paekakariki Overbridge	no	0.52	0.91	0.60	0.27	1.00	0.70	1.00	1.00	0.92	0.00	0.01	0.50	1.00	1.00	0.50	0.00	0.00	0.60	0.50	0.00	0.00	0.00	23	13	2
953/7.70	Pukerua Bay Overbridge	no	0.54	0.91	0.62	0.30	1.00	0.70	1.00	1.00	0.93	0.00	0.08	0.50	1.00	1.00	0.60	0.00	0.00	0.60	0.50	0.63	0.00	0.00	24	8	-2
953/15.41	Paremata Harbour Bridge	no	0.50	0.91	0.57	0.30	1.00	0.70	1.00	1.00	1.00	0.00	0.11	0.00	1.00	1.00	0.60	0.00	0.00	0.80	0.60	0.00	0.00	0.00	25	2	-11
969/4.40	Kenepuru Stream Bridge	yes	0.51	1.00	0.65	0.11	1.00	1.00	1.00	1.00	1.00	0.00	0.01	0.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.17	1.00	0.00	26	20	8
969/7.15	Collins Avenue East Bridge	no	0.33	0.70	0.49	0.34	1.00	1.00	0.00	0.00	1.00	0.35	0.01	0.00	1.00	0.00	0.60	0.00	0.00	0.20	0.60	0.27	1.00	0.00	27	16	-8
969/7.15	Collins Avenue West Bridge	no	0.33	0.70	0.49	0.34	1.00	1.00	0.00	0.00	1.00	0.35	0.01	0.00	1.00	0.00	0.50	0.00	0.00	0.20	0.50	0.27	1.00	0.00	28	18	-8
979/0.00	Takapu Road Overbridge	yes	0.33	0.70	0.50	0.13	1.00	1.00	0.00	0.00	1.00	0.50	0.01	0.00	1.00	0.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	29	21	-5
979/4.27	Johnsonville North Overpass	yes	0.32	0.70	0.50	0.14	1.00	1.00	0.00	0.00	1.00	0.48	0.01	0.00	1.00	0.00	0.50	0.00	0.00	0.00	0.00	0.33	0.00	0.00	30	25	-2
979/4.61	Johnsonville South Overpass	yes	0.32	0.70	0.50	0.15	1.00	1.00	0.00	0.00	1.00	0.48	0.00	0.00	1.00	0.00	0.50	0.00	0.00	0.00	0.00	0.50	0.00	0.00	31	24	-4
		FACTORS - THIS TRIAL:		1.00	0.90	0.10	0.40	0.30	0.15	0.15	0.30	0.10	0.20	0.15	0.18	0.10	0.35	0.04	0.10	0.12	0.15	0.05	0.10	0.15			
		FACTORS IN REPORT:		1.00	0.60	0.40	0.40	0.30	0.15	0.15	0.25	0.15	0.15	0.20	0.15	0.10	0.75	0.08	0.10	0.07	0.15	0.10	0.10	0.15			

Sorted by Seismic Priority Grade

SH1 RP	Bridge Name	Excluded from Prioritisation By Screening Procedure	Seismic Prioritisation Grade (SPG)	Hazard Index	Importance Index	Vulnerability Index	Hazard Index Factors: Peak Ground Accln.	Hazard Index Factors: Remaining Service Life	Hazard Index Factors: Soil Condition	Hazard Index Factors: Liquefaction Risk	Importance Index Factors: AADT On Bridge	Importance Index Factors: AADT Under Bridge	Importance Index Factors: Detour Length	Importance Index Factors: Facility Crossed	Importance Index Factors: Route Type	Importance Index Factors: Critical Utility	Vulnerability Index Factors: Year Designed	Vulnerability Index Factors: Superstructure Hinges	Vulnerability Index Factors: Superstructure Overlap	Vulnerability Index Factors: Superstructure Length	Vulnerability Index Factors: Pier Type	Vulnerability Index Factors: Bridge Skew	Vulnerability Index Factors: Abutment Type	Vulnerability Index Factors: Other Feature	Route Position Order	Economic Analysis Ranking	SPG	Difference Econ-SPG Rankings
844/1.27	Rangitikei River Bridge at Bulls	yes	0.69	1.00	0.75	0.15	1.00	1.00	1.00	1.00	0.75	0.00	1.00	0.50	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.61	0.00	0.00	11	10	1	9
942/0.00	Paraparaumu Overbridge	no	0.69	1.00	0.71	0.52	1.00	1.00	1.00	1.00	0.85	0.00	1.00	0.00	1.00	1.00	0.50	0.00	0.00	0.60	0.50	0.00	1.00	1.00	21	4	2	2
900/13.90	Waiauti Stream (Manakau) Bridge	no	0.64	1.00	0.68	0.34	1.00	1.00	1.00	1.00	0.75	0.00	1.00	0.00	1.00	1.00	0.50	0.50	0.00	0.80	0.50	0.00	0.00	0.00	10	1	3	-2
953/15.41	Paremata Harbour Bridge	no	0.64	0.91	0.75	0.27	1.00	0.70	1.00	1.00	0.76	0.00	1.00	0.50	1.00	1.00	0.50	0.00	0.00	0.60	0.50	0.00	0.00	0.00	14	9	4	5
915/10.53	Mangaone Stream Bridge	no	0.60	0.91	0.69	0.40	1.00	0.70	1.00	1.00	0.79	0.00	1.00	0.00	1.00	1.00	0.50	1.00	0.00	1.00	0.50	0.00	0.00	0.00	19	11	5	6
953/0.00	Paekakariki Overbridge	no	0.59	0.91	0.68	0.35	1.00	0.70	1.00	1.00	0.76	0.00	1.00	0.00	1.00	1.00	1.00	0.00	0.00	0.20	0.50	0.00	0.00	0.00	13	5	6	-1
953/7.70	Pukerua Bay Overbridge	no	0.58	0.91	0.68	0.27	1.00	0.70	1.00	1.00	0.76	0.00	1.00	0.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.33	0.00	0.00	12	22	7	15
915/4.86	Otaki Overbridge	yes	0.58	0.91	0.68	0.25	1.00	0.70	1.00	1.00	0.76	0.00	1.00	0.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	15	23	8	15
969/4.40	Kenepuru Stream Bridge	no	0.57	1.00	0.68	0.45	1.00	1.00	1.00	1.00	0.76	0.00	0.16	0.50	1.00	1.00	0.60	0.00	0.00	0.60	1.00	0.00	1.00	0.00	16	12	9	3
969/7.15	Collins Avenue East Bridge	no	0.54	0.91	0.62	0.30	1.00	0.70	1.00	1.00	0.93	0.00	0.08	0.50	1.00	1.00	0.60	0.00	0.00	0.60	0.50	0.63	0.00	0.00	24	8	10	-2
850/4.35	Makahikaroa Stream Bridge	no	0.52	0.91	0.60	0.27	1.00	0.70	1.00	1.00	0.92	0.00	0.01	0.50	1.00	1.00	0.50	0.00	0.00	0.60	0.50	0.00	0.00	0.00	23	13	11	2
979/4.61	Johnsonville South Overpass	yes	0.51	1.00	0.55	0.11	1.00	1.00	1.00	1.00	1.00	0.00	0.01	0.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.17	1.00	0.00	26	20	12	8
969/7.15	Collins Avenue West Bridge	no	0.50	0.91	0.57	0.30	1.00	0.70	1.00	1.00	1.00	0.00	0.11	0.00	1.00	1.00	0.50	0.00	0.00	0.80	0.50	0.00	0.00	0.00	25	2	13	-11
915/4.04	Waitohu Stream Bridge	no	0.49	0.91	0.57	0.27	1.00	0.70	1.00	1.00	0.77	0.00	0.07	0.50	1.00	1.00	0.50	0.00	0.00	0.60	0.50	0.00	0.00	0.00	18	15	14	1
900/8.16	Kuku Stream Bridge	no	0.48	0.91	0.52	0.64	1.00	0.70	1.00	1.00	0.63	0.00	0.40	0.00	1.00	1.00	0.50	1.00	0.00	0.80	0.50	0.22	1.00	1.00	9	6	15	-9
931/5.19	Waikanae River Bridge	no	0.47	0.91	0.50	0.65	1.00	0.70	1.00	1.00	0.70	0.00	0.18	0.00	1.00	1.00	0.50	1.00	0.00	1.00	0.50	0.00	1.00	1.00	1	3	16	-13
872/13.04	Whirokino Trestle	no	0.44	0.91	0.51	0.22	1.00	0.70	1.00	1.00	0.76	0.00	0.16	0.00	1.00	1.00	0.50	0.00	0.00	0.20	0.50	0.00	0.00	0.00	17	14	17	-3
872/12.41	North Whirokino Trestle	yes	0.44	0.91	0.52	0.13	1.00	0.70	1.00	1.00	0.85	0.00	0.06	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	20	28	18	10
872/14.30	Manawatu River (Whirokino) Bridge	no	0.42	0.91	0.47	0.32	1.00	0.70	1.00	1.00	0.63	0.00	0.17	0.00	1.00	1.00	0.50	0.00	0.00	1.00	0.50	0.00	0.00	0.00	8	7	19	-12
845/3.82	Piakatutu Stream Bridge	no	0.41	0.76	0.58	0.22	1.00	0.70	1.00	0.00	0.85	0.00	0.00	0.50	1.00	1.00	0.50	0.00	0.00	0.20	0.50	0.00	0.00	0.00	22	18	20	-4
900/10.35	Waikawa River Bridge	yes	0.41	0.91	0.47	0.22	1.00	0.70	1.00	1.00	0.63	0.00	0.17	0.00	1.00	1.00	0.50	0.00	0.00	0.20	0.50	0.00	0.00	0.00	7	17	21	-4
900/7.04	Ohau Overbridge	yes	0.39	0.91	0.46	0.13	1.00	0.70	1.00	1.00	0.69	0.00	0.00	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.09	0.00	0.00	3	29	22	7
900/10.67	Manakau North Overbridge	yes	0.38	0.91	0.45	0.13	1.00	0.70	1.00	1.00	0.63	0.00	0.03	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4	26	23	3
979/4.27	Johnsonville North Overpass	no	0.33	0.70	0.49	0.34	1.00	1.00	0.00	0.00	1.00	0.35	0.01	0.00	1.00	0.00	0.50	0.00	0.00	0.20	0.50	0.27	1.00	0.00	27	18	24	-8
845/2.38	Makowai Stream Bridge	no	0.33	0.70	0.49	0.34	1.00	1.00	0.00	0.00	1.00	0.35	0.01	0.00	1.00	0.00	0.60	0.00	0.00	0.20	0.50	0.27	1.00	0.00	28	18	25	-8
979/0.00	Takapu Road Overbridge	yes	0.33	0.70	0.60	0.13	1.00	1.00	0.00	0.00	1.00	0.60	0.01	0.00	1.00	0.00	0.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	29	21	26	-5
850/5.67	Makowai No 2 Bridge	yes	0.32	0.70	0.50	0.14	1.00	1.00	0.00	0.00	1.00	0.48	0.01	0.00	1.00	0.00	0.60	0.00	0.00	0.00	0.00	0.33	0.00	0.00	30	25	27	-2
850/5.88	Makowai No 2 Bridge	yes	0.32	0.70	0.50	0.15	1.00	1.00	0.00	0.00	1.00	0.48	0.00	0.00	1.00	0.00	0.50	0.00	0.00	0.00	0.00	0.50	0.00	0.00	31	24	28	-4
900/6.77	Ohau River Bridge	yes	0.32	0.76	0.46	0.13	1.00	0.70	0.00	1.00	0.69	0.00	0.01	0.00	1.00	1.00	0.60	0.00	0.00	0.00	0.00	0.09	0.00	0.00	2	27	29	-2
915/6.81	Otaki River Bridge	No Drawings Available		Could Not Be Assessed																					5			
915/0.00	Pukehou (Manakau South) Overbridge	No Drawings Available		Could Not Be Assessed																					6			

file RANKING15.WK1 - 12:03 - 27 April 1995 - As RANKING14.WK1 but factors for impor. & vuln. diff.

PILOT APPRAISAL OF SEISMIC SCREENING PROCEDURES
STATE HIGHWAY 1 BRIDGES BETWEEN RP 844/1.27 AND 979/4.61

Sorted by Route Position Order

SH1 RP	Bridge Name	Excluded from Prioritisation By Screening Procedure	Seismic Prioritisation Grade (SPG)	Hazard Index	Importance Index	Vulnerability Index	Hazard Index Factors: Peak Ground Accln	Remaining Service Life	Soil Condition	Liquefaction Risk	Importance Index Factors: AADT On Bridge	AADT Under Bridge	Detour Length	Facility Crossed	Route Type	Critical Utility	Vulnerability Index Factors: Year Designed	Super-structure Hinges	Super-structure Overlap	Super-structure Length	Pier Type	Bridge Skew	Abutment Type	Other Feature	Route Position Order	Economic Analysis Ranking	Difference Econ-SPG Rankings
844/1.27	Rangitikei River Bridge at Bulls	no	0.41	0.91	0.31	0.65	1.00	0.70	1.00	1.00	0.70	0.00	0.18	0.00	1.00	1.00	0.50	1.00	0.00	1.00	0.50	0.00	1.00	1.00	1	3	-8
845/2.38	Makowai Stream Bridge	yes	0.15	0.76	0.25	0.13	1.00	0.70	0.00	1.00	0.69	0.00	0.01	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.09	0.00	0.00	2	27	1
845/3.82	Pukalulu Stream Bridge	yes	0.18	0.91	0.25	0.13	1.00	0.70	1.00	1.00	0.69	0.00	0.00	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.09	0.00	0.00	3	29	6
850/4.35	Makahikaroa Stream Bridge	yes	0.19	0.91	0.26	0.13	1.00	0.70	1.00	1.00	0.63	0.00	0.03	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4	26	4
850/5.67	Makowai No 2 Bridge	No Drawings Available		Could Not Be Assessed																					5		
850/5.68	Makowai No 2 Bridge	No Drawings Available		Could Not Be Assessed																					6		
872/12.41	North Whirokino Trestle	yes	0.25	0.91	0.30	0.22	1.00	0.70	1.00	1.00	0.63	0.00	0.17	0.00	1.00	1.00	0.50	0.00	0.00	0.20	0.50	0.00	0.00	0.00	7	17	-1
872/13.04	Whirokino Trestle	no	0.28	0.91	0.30	0.32	1.00	0.70	1.00	1.00	0.63	0.00	0.17	0.00	1.00	1.00	0.50	0.00	0.00	1.00	0.50	0.00	0.00	0.00	8	7	-7
872/14.30	Manawatu River (Whirokino) Bridge	no	0.44	0.91	0.38	0.64	1.00	0.70	1.00	1.00	0.63	0.00	0.40	0.00	1.00	1.00	0.50	1.00	0.00	0.80	0.50	0.22	1.00	1.00	9	6	-2
900/6.77	Ohau River Bridge	no	0.51	1.00	0.63	0.34	1.00	1.00	1.00	1.00	0.75	0.00	1.00	0.00	1.00	1.00	0.50	0.50	0.00	0.80	0.50	0.00	0.00	0.00	10	1	-1
900/7.04	Ohau Overbridge	yes	0.48	1.00	0.70	0.16	1.00	1.00	1.00	1.00	0.75	0.00	1.00	0.50	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.61	0.00	0.00	11	10	5
900/8.16	Kuku Stream Bridge	no	0.44	0.91	0.63	0.27	1.00	0.70	1.00	1.00	0.76	0.00	1.00	0.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.33	0.00	0.00	12	22	15
900/10.35	Waikawa River Bridge	no	0.47	0.91	0.63	0.35	1.00	0.70	1.00	1.00	0.76	0.00	1.00	0.00	1.00	1.00	1.00	0.00	0.00	0.20	0.50	0.00	0.00	0.00	13	5	-1
900/10.67	Manakau North Overbridge	no	0.48	0.91	0.70	0.27	1.00	0.70	1.00	1.00	0.76	0.00	1.00	0.50	1.00	1.00	0.50	0.00	0.00	0.60	0.50	0.00	0.00	0.00	14	9	5
900/13.90	Waiauti Stream (Manakau) Bridge	yes	0.43	0.91	0.63	0.25	1.00	0.70	1.00	1.00	0.76	0.00	1.00	0.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	15	23	14
915/0.00	Pukehou (Manakau South) Overbridge	no	0.41	1.00	0.39	0.45	1.00	1.00	1.00	1.00	0.76	0.00	0.16	0.50	1.00	1.00	0.50	0.00	0.00	0.60	1.00	0.00	1.00	0.00	16	12	2
915/4.04	Waitohu Stream Bridge	no	0.25	0.91	0.31	0.22	1.00	0.70	1.00	1.00	0.76	0.00	0.16	0.00	1.00	1.00	0.50	0.00	0.00	0.20	0.50	0.00	0.00	0.00	17	14	-3
915/4.86	Otaki Overbridge	no	0.29	0.91	0.35	0.27	1.00	0.70	1.00	1.00	0.77	0.00	0.07	0.50	1.00	1.00	0.50	0.00	0.00	0.60	0.50	0.00	0.00	0.00	18	15	2
915/6.81	Otaki River Bridge	no	0.50	0.91	0.64	0.40	1.00	0.70	1.00	1.00	0.79	0.00	1.00	0.00	1.00	1.00	0.50	1.00	0.00	1.00	0.50	0.00	0.00	0.00	19	11	8
915/10.53	Mangaone Stream Bridge	yes	0.20	0.91	0.28	0.13	1.00	0.70	1.00	1.00	0.85	0.00	0.06	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	20	28	8
931/5.19	Waikanae River Bridge	no	0.62	1.00	0.68	0.52	1.00	1.00	1.00	1.00	0.85	0.00	1.00	0.00	1.00	1.00	0.50	0.00	0.00	0.60	0.50	0.00	1.00	1.00	21	4	3
942/0.00	Paraparaumu Overbridge	no	0.22	0.76	0.33	0.22	1.00	0.70	1.00	0.00	0.85	0.00	0.00	0.50	1.00	1.00	0.50	0.00	0.00	0.20	0.50	0.00	0.00	0.00	22	16	-3
953/0.00	Paekakariki Overbridge	no	0.28	0.91	0.33	0.27	1.00	0.70	1.00	1.00	0.92	0.00	0.01	0.50	1.00	1.00	0.50	0.00	0.00	0.60	0.50	0.00	0.00	0.00	23	13	-2
953/7.70	Pukerua Bay Overbridge	no	0.31	0.91	0.36	0.30	1.00	0.70	1.00	1.00	0.93	0.00	0.08	0.50	1.00	1.00	0.50	0.00	0.00	0.60	0.50	0.53	0.00	0.00	24	8	-4
953/15.41	Paremata Harbour Bridge	no	0.27	0.91	0.31	0.30	1.00	0.70	1.00	1.00	1.00	0.00	0.11	0.00	1.00	1.00	0.50	0.00	0.00	0.80	0.50	0.00	0.00	0.00	25	2	-14
969/4.40	Kenepuru Stream Bridge	yes	0.19	1.00	0.25	0.11	1.00	1.00	1.00	1.00	1.00	0.00	0.01	0.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.17	1.00	0.00	26	20	-1
969/7.15	Collins Avenue East Bridge	no	0.17	0.70	0.19	0.34	1.00	1.00	0.00	0.00	1.00	0.35	0.01	0.00	1.00	0.00	0.50	0.00	0.00	0.20	0.50	0.27	1.00	0.00	27	18	-7
969/7.15	Collins Avenue West Bridge	no	0.17	0.70	0.19	0.34	1.00	1.00	0.00	0.00	1.00	0.35	0.01	0.00	1.00	0.00	0.50	0.00	0.00	0.20	0.50	0.27	1.00	0.00	28	19	-5
979/0.00	Takapu Road Overbridge	yes	0.12	0.70	0.21	0.13	1.00	1.00	0.00	0.00	1.00	0.50	0.01	0.00	1.00	0.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	29	21	-8
979/4.27	Johnsonville North Overpass	yes	0.12	0.70	0.20	0.14	1.00	1.00	0.00	0.00	1.00	0.48	0.01	0.00	1.00	0.00	0.50	0.00	0.00	0.00	0.00	0.33	0.00	0.00	30	25	-3
979/4.61	Johnsonville South Overpass	yes	0.13	0.70	0.20	0.15	1.00	1.00	0.00	0.00	1.00	0.48	0.00	0.00	1.00	0.00	0.50	0.00	0.00	0.00	0.00	0.50	0.00	0.00	31	24	-3
		FACTORS - THIS TRIAL		1.00	0.60	0.40	0.40	0.30	0.15	0.15	0.5(wk+det)	0.10	0.5(wk+det)	0.15	0.15	0.10	0.26	0.04	0.10	0.12	0.15	0.05	0.10	0.15			
		FACTORS IN REPORT		1.00	0.60	0.40	0.40	0.30	0.15	0.15	0.25	0.15	0.15	0.20	0.15	0.10	0.25	0.08	0.10	0.07	0.16	0.10	0.10	0.15			

Sorted by Seismic Priority Grade

SH1 RP	Bridge Name	Excluded from Prioritisation By Screening Procedure	Seismic Prioritisation Grade (SPG)	Hazard Index	Importance Index	Vulnerability Index	Hazard Index Factors: Peak Ground Accln	Remaining Service Life	Soil Condition	Liquefaction Risk	Importance Index Factors: AADT On Bridge	AADT Under Bridge	Detour Length	Facility Crossed	Route Type	Critical Utility	Vulnerability Index Factors: Year Designed	Super-structure Hinges	Super-structure Overlap	Super-structure Length	Pier Type	Bridge Skew	Abutment Type	Other Feature	Route Position Order	Economic Analysis Ranking	SPG	Difference Econ SPG Rankings
931/5.19	Waikanae River Bridge	no	0.62	1.00	0.68	0.52	1.00	1.00	1.00	1.00	0.85	0.00	1.00	0.00	1.00	1.00	0.50	0.00	0.00	0.60	0.50	0.00	1.00	1.00	21	4	1	3
900/6.77	Ohau River Bridge	no	0.51	1.00	0.63	0.34	1.00	1.00	1.00	1.00	0.75	0.00	1.00	0.00	1.00	1.00	0.50	0.50	0.00	0.80	0.50	0.00	0.00	0.00	10	1	2	-1
915/6.81	Otaki River Bridge	no	0.50	0.91	0.64	0.40	1.00	0.70	1.00	1.00	0.79	0.00	1.00	0.00	1.00	1.00	0.50	1.00	0.00	1.00	0.50	0.00	0.00	0.00	19	11	3	8
900/10.67	Manakau North Overbridge	no	0.48	0.91	0.70	0.27	1.00	0.70	1.00	1.00	0.76	0.00	1.00	0.50	1.00	1.00	0.50	0.00	0.00	0.60	0.50	0.00	0.00	0.00	14	9	4	5
900/7.04	Ohau Overbridge	yes	0.48	1.00	0.70	0.16	1.00	1.00	1.00	1.00	0.75	0.00	1.00	0.50	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.61	0.00	0.00	11	10	5	5
900/10.35	Waikawa River Bridge	no	0.47	0.91	0.63	0.35	1.00	0.70	1.00	1.00	0.76	0.00	1.00	0.00	1.00	1.00	1.00	0.00	0.00	0.20	0.50	0.00	0.00	0.00	13	5	6	-1
900/8.16	Kuku Stream Bridge	no	0.44	0.91	0.63	0.27	1.00	0.70	1.00	1.00	0.76	0.00	1.00	0.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.33	0.00	0.00	12	22	7	15
872/14.30	Manawatu River (Whirokino) Bridge	no	0.44	0.91	0.38	0.64	1.00	0.70	1.00	1.00	0.63	0.00	0.40	0.00	1.00	1.00	0.50	1.00	0.00	0.80	0.50	0.22	1.00	1.00	9	6	8	-2
900/13.90	Waiauti Stream (Manakau) Bridge	yes	0.43	0.91	0.63	0.25	1.00	0.70	1.00	1.00	0.76	0.00	1.00	0.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	15	23	9	14
915/0.00	Pukehou (Manakau South) Overbridge	no	0.41	1.00	0.39	0.45	1.00	1.00	1.00	1.00	0.76	0.00	0.16	0.50	1.00	1.00	0.50	0.00	0.00	0.60	1.00	0.00	1.00	0.00	16	12	10	2
844/1.27	Rangitikei River Bridge at Bulls	no	0.41	0.91	0.31	0.65	1.00	0.70	1.00	1.00	0.70	0.00	0.18	0.00	1.00	1.00	0.50	1.00	0.00	1.00	0.50	0.00	1.00	1.00	1	3	11	-8
953/7.70	Pukerua Bay Overbridge	no	0.31	0.91	0.36	0.30	1.00	0.70	1.00	1.00	0.93	0.00	0.08	0.50	1.00	1.00	0.50	0.00	0.00	0.60	0.50	0.53	0.00	0.00	24	8	12	-4
915/4.86	Otaki Overbridge	no	0.29	0.91	0.35	0.27	1.00	0.70	1.00	1.00	0.77	0.00	0.07	0.50	1.00	1.00	0.50	0.00	0.00	0.60	0.50	0.00	0.00	0.00	18	15	13	2
872/13.04	Whirokino Trestle	no	0.28	0.91	0.30	0.32	1.00	0.70	1.00	1.00	0.63	0.00	0.17	0.00	1.00	1.00	0.50	0.00	0.00	1.00	0.50	0.00	0.00	0.00	8	7	14	-7
953/0.00	Paekakariki Overbridge	no	0.28	0.91	0.33	0.27	1.00	0.70	1.00	1.00	0.92	0.00	0.01	0.50	1.00	1.00	0.50	0.00	0.00	0.60	0.50	0.00	0.00	0.00	23	13	15	-2
953/15.41	Paremata Harbour Bridge	no	0.27	0.91	0.31	0.30	1.00	0.70	1.00	1.00	1.00	0.00	0.11	0.00	1.00	1.00	0.50	0.00	0.00	0.80	0.50	0.00	0.00	0.00	25	2	16	-14
915/4.04	Waitohu Stream Bridge	no	0.25	0.91	0.31	0.22	1.00	0.70	1.00	1.00	0.76	0.00	0.16	0.00	1.00	1.00	0.50	0.00	0.00	0.20	0.50	0.00	0.00	0.00	17	14	17	-3
872/12.41	North Whirokino Trestle	yes	0.25	0.91	0.30	0.22	1.00	0.70	1.00	1.00	0.63	0.00	0.17	0.00	1.00	1.00	0.50	0.00	0.00	0.20	0.50	0.00	0.00	0.00	7	17	18	-1
942/0.00	Paraparaumu Overbridge	no	0.22	0.76	0.33	0.22	1.00	0.70	1.00	0.00	0.85	0.00	0.00	0.50	1.00	1.00	0.50	0.00	0.00	0.20	0.50	0.00	0.00	0.00	22	16	19	-3
915/10.53	Mangaone Stream Bridge	yes	0.20	0.91	0.28	0.13	1.00	0.70	1.00	1.00	0.85	0.00	0.06	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	20	28	20	8
969/4.40	Kenepuru Stream Bridge	yes	0.19	1.00	0.25	0.11	1.00	1.00	1.00	1.00	1.00	0.00	0.01	0.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.17	1.00	0.00	26	20	21	-1
850/4.35	Makahikaroa Stream Bridge	yes	0.19	0.91	0.26	0.13	1.00	0.70	1.00	1.00	0.63	0.00	0.03	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4	26	22	4
845/3.82	Pukalulu Stream Bridge	yes	0.18	0.91	0.25	0.13	1.00	0.70	1.00	1.00	0.69	0.00	0.00	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.09	0.00	0.00	3	29	23	6
969/7.15	Collins Avenue West Bridge	no	0.17	0.70	0.19	0.34	1.00	1.00	0.00	0.00	1.00	0.35	0.01	0.00	1.00	0.00	0.50	0.00	0.00	0.20	0.50	0.27	1.00	0.00	28	19	24	5
969/7.15	Collins Avenue East Bridge	no	0.17	0.70	0.18	0.34	1.00	1.00	0.00	0.00	1.00	0.35	0.01	0.00	1.00	0.00	0.50	0.00	0.00	0.20	0.50	0.27	1.00	0.00	27	18	25	-7
845/2.38	Makowai Stream Bridge	yes	0.15	0.76	0.25	0.13	1.00	0.70	0.00	1.00	0.69	0.00	0.01	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.09	0.00	0.00	2	27	26	1
979/4.61	Johnsonville South Overpass	yes	0.13	0.70	0.20	0.15	1.00	1.00	0.00	0.00	1.00	0.48	0.00	0.00	1.00	0.00	0.50	0.00	0.00	0.00	0.00	0.50	0.00	0.00	31	24	27	3
979/4.27	Johnsonville North Overpass	yes	0.12	0.70	0.20	0.14	1.00	1.00	0.00	0.00	1.00	0.48	0.01	0.00	1.00	0.00	0.50	0.00	0.00	0.00	0.00	0.33	0.00	0.00	30	25	28	-3
979/0.00	Takapu Road Overbridge	yes	0.12	0.70	0.21	0.13	1.00	1.00	0.00	0.00	1.00	0.50	0.01	0.00	1.00	0.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	29	21	29	-8
850/5.67	Makowai No 2 Bridge	No Drawings	Available	Could Not Be	Assessed																				5			
850/5.68	Makowai No 2 Bridge	No Drawings	Available	Could Not Be	Assessed																				6			

PILOT APPRAISAL OF SEISMIC SCREENING PROCEDURES
STATE HIGHWAY 1 BRIDGES BETWEEN RP 844/1.27 AND 979/4.61

Sorted by Route Position Order

SH1 RP	Bridge Name	Excluded from Prioritisation By Screening Procedure	Seismic Prioritisation Grade (SPG)	Hazard Index	Importance Index	Vulnerability Index	Hazard Index Factors: Peak Ground Accln.	Remaining Service Life	Soil Condition	Liquefaction Risk	Importance Index Factors: AADT On Bridge	AADT Under Bridge	Detour Length	Facility Crossed	Route Type	Critical Utility	Vulnerability Index Factors: Year Designed	Super-structure Hinges	Super-structure Overlap	Super-structure Length	Pier Type	Bridge Skew	Abutment Type	Other Feature	Route Position Order	Economic Analysis Ranking	Difference Econ-SPG Rankings
844/1 27	Rangitikei River Bridge at Bulls	no	0.45	0.91	0.40	0.65	1.00	0.70	1.00	1.00	0.70	0.00	0.42	0.00	1.00	1.00	0.50	1.00	0.00	1.00	0.50	0.00	1.00	1.00	1	3	-6
845/2 38	Makowai Stream Bridge	yes	0.17	0.76	0.28	0.13	1.00	0.70	0.00	1.00	0.69	0.00	0.10	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.09	0.00	0.00	2	27	1
845/3 82	Piakatutu Stream Bridge	yes	0.18	0.91	0.25	0.13	1.00	0.70	1.00	1.00	0.69	0.00	0.00	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.09	0.00	0.00	3	29	4
850/4 35	Makahakaroa Stream Bridge	yes	0.21	0.91	0.30	0.13	1.00	0.70	1.00	1.00	0.63	0.00	0.17	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4	26	4
850/5 67	Makowai No 2 Bridge	No Drawings Available		Could Not Be Assessed																					5		
850/5 68	Makowai No 2 Bridge	No Drawings Available		Could Not Be Assessed																					6		
872/12 41	North Whirokino Trestle	yes	0.29	0.91	0.38	0.22	1.00	0.70	1.00	1.00	0.63	0.00	0.41	0.00	1.00	1.00	0.50	0.00	0.00	0.20	0.50	0.00	0.00	0.00	7	17	-1
872/13 04	Whirokino Trestle	no	0.32	0.91	0.38	0.32	1.00	0.70	1.00	1.00	0.63	0.00	0.41	0.00	1.00	1.00	0.50	0.00	0.00	1.00	0.50	0.00	0.00	0.00	8	7	-8
872/14 30	Manawatu River (Whirokino) Bridge	no	0.48	0.91	0.45	0.64	1.00	0.70	1.00	1.00	0.63	0.00	0.63	0.00	1.00	1.00	0.50	1.00	0.00	0.80	0.50	0.22	1.00	1.00	9	6	0
900/6 77	Ohau River Bridge	no	0.51	1.00	0.63	0.34	1.00	1.00	1.00	1.00	0.75	0.00	1.00	0.00	1.00	1.00	0.50	0.50	0.00	0.80	0.50	0.00	0.00	0.00	10	1	-1
900/7 04	Ohau Overbridge	yes	0.48	1.00	0.70	0.16	1.00	1.00	1.00	1.00	0.76	0.00	1.00	0.50	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.81	0.00	0.00	11	10	5
900/8 16	Kuku Stream Bridge	no	0.44	0.91	0.63	0.27	1.00	0.70	1.00	1.00	0.76	0.00	1.00	0.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.33	0.00	0.00	12	22	12
900/10 35	Waikawa River Bridge	no	0.47	0.91	0.63	0.35	1.00	0.70	1.00	1.00	0.76	0.00	1.00	0.00	1.00	1.00	1.00	0.00	0.00	0.20	0.50	0.00	0.00	0.00	13	5	-2
900/10 67	Manakau North Overbridge	no	0.48	0.91	0.70	0.27	1.00	0.70	1.00	1.00	0.76	0.00	1.00	0.50	1.00	1.00	0.50	0.00	0.00	0.80	0.50	0.00	0.00	0.00	14	9	5
900/13 90	Waiauti Stream (Manakau) Bridge	yes	0.43	0.91	0.63	0.25	1.00	0.70	1.00	1.00	0.76	0.00	1.00	0.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	15	23	12
915/0 00	Pukehou (Manakau South) Overbridge	no	0.46	1.00	0.48	0.45	1.00	1.00	1.00	1.00	0.76	0.00	0.40	0.50	1.00	1.00	0.50	0.00	0.00	0.60	1.00	0.00	1.00	0.00	16	12	4
915/4 04	Waitohu Stream Bridge	no	0.30	0.91	0.40	0.22	1.00	0.70	1.00	1.00	0.76	0.00	0.40	0.00	1.00	1.00	0.50	0.00	0.00	0.20	0.50	0.00	0.00	0.00	17	14	-3
915/4 86	Otaki Overbridge	no	0.33	0.91	0.42	0.27	1.00	0.70	1.00	1.00	0.77	0.00	0.26	0.50	1.00	1.00	0.50	0.00	0.00	0.60	0.50	0.00	0.00	0.00	18	15	1
915/6 81	Otaki River Bridge	no	0.50	0.91	0.64	0.40	1.00	0.70	1.00	1.00	0.79	0.00	1.00	0.00	1.00	1.00	0.50	1.00	0.00	1.00	0.50	0.00	0.00	0.00	19	11	8
915/10 53	Mangaone Stream Bridge	yes	0.24	0.91	0.35	0.13	1.00	0.70	1.00	1.00	0.85	0.00	0.24	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	20	28	9
931/5 19	Waikanae River Bridge	no	0.62	1.00	0.68	0.52	1.00	1.00	1.00	1.00	0.85	0.00	1.00	0.00	1.00	1.00	0.50	0.00	0.00	0.60	0.50	0.00	1.00	1.00	21	4	3
942/0 00	Paraparaumu Overbridge	no	0.22	0.76	0.33	0.22	1.00	0.70	1.00	0.00	0.85	0.00	0.00	0.50	1.00	1.00	0.50	0.00	0.00	0.20	0.50	0.00	0.00	0.00	22	16	-5
953/0 00	Paekakariki Overbridge	no	0.30	0.91	0.37	0.27	1.00	0.70	1.00	1.00	0.92	0.00	0.10	0.50	1.00	1.00	0.50	0.00	0.00	0.60	0.50	0.00	0.00	0.00	23	13	-3
953/7 70	Pukerua Bay Overbridge	no	0.36	0.91	0.46	0.30	1.00	0.70	1.00	1.00	0.93	0.00	0.28	0.50	1.00	1.00	0.50	0.00	0.00	0.60	0.50	0.53	0.00	0.00	24	8	-4
953/15.41	Paremata Harbour Bridge	no	0.33	0.91	0.42	0.30	1.00	0.70	1.00	1.00	1.00	0.00	0.33	0.00	1.00	1.00	0.50	0.00	0.00	0.80	0.50	0.00	0.00	0.00	25	2	-11
969/4 40	Kenepuru Stream Bridge	yes	0.22	1.00	0.30	0.11	1.00	1.00	1.00	1.00	1.00	0.00	0.10	0.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.17	1.00	0.00	26	20	0
969/7.15	Collins Avenue East Bridge	no	0.19	0.70	0.24	0.34	1.00	1.00	0.00	0.00	1.00	0.35	0.10	0.00	1.00	0.00	0.50	0.00	0.00	0.20	0.50	0.27	1.00	0.00	27	18	-5
969/7.15	Collins Avenue West Bridge	no	0.19	0.70	0.24	0.34	1.00	1.00	0.00	0.00	1.00	0.35	0.10	0.00	1.00	0.00	0.50	0.00	0.00	0.20	0.50	0.27	1.00	0.00	28	19	-5
979/0 00	Takapu Road Overbridge	yes	0.14	0.70	0.25	0.13	1.00	1.00	0.00	0.00	1.00	0.50	0.10	0.00	1.00	0.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	29	21	-7
979/4 27	Johnsonville North Overpass	yes	0.14	0.70	0.25	0.14	1.00	1.00	0.00	0.00	1.00	0.48	0.10	0.00	1.00	0.00	0.50	0.00	0.00	0.00	0.00	0.33	0.00	0.00	30	25	-2
979/4 61	Johnsonville South Overpass	yes	0.13	0.70	0.20	0.15	1.00	1.00	0.00	0.00	1.00	0.48	0.00	0.00	1.00	0.00	0.50	0.00	0.00	0.00	0.00	0.50	0.00	0.00	31	24	-5
		FACTORS - THIS TRIAL:		1.00	0.60	0.40	0.40	0.30	0.15	0.15	0.5(ant+del)	0.10	0.5(ant+del)	0.15	0.18	0.10	0.25	0.14	0.10	0.12	0.15	0.05	0.10	0.15			
		FACTORS IN REPORT		1.00	0.60	0.40	0.40	0.30	0.15	0.16	0.25	0.15	0.15	0.20	0.16	0.10	0.25	0.08	0.10	0.07	0.15	0.10	0.10	0.15			

Sorted by Seismic Priority Grade

SH1 RP	Bridge Name	Excluded from Prioritisation By Screening Procedure	Seismic Prioritisation Grade (SPG)	Hazard Index	Importance Index	Vulnerability Index	Hazard Index Factors: Peak Ground Accln.	Remaining Service Life	Soil Condition	Liquefaction Risk	Importance Index Factors: AADT On Bridge	AADT Under Bridge	Detour Length	Facility Crossed	Route Type	Critical Utility	Vulnerability Index Factors: Year Designed	Super-structure Hinges	Super-structure Overlap	Super-structure Length	Pier Type	Bridge Skew	Abutment Type	Other Feature	Route Position Order	Economic Analysis Ranking	SPG	Difference Econ SPG Rankings
931/5 19	Waikanae River Bridge	no	0.62	1.00	0.68	0.52	1.00	1.00	1.00	1.00	0.85	0.00	1.00	0.00	1.00	1.00	0.50	0.00	0.00	0.60	0.50	0.00	1.00	1.00	21	4	1	3
900/6 77	Ohau River Bridge	no	0.51	1.00	0.63	0.34	1.00	1.00	1.00	1.00	0.75	0.00	1.00	0.00	1.00	1.00	0.50	0.50	0.00	0.80	0.50	0.00	0.00	0.00	10	1	2	-1
915/6 81	Otaki River Bridge	no	0.50	0.91	0.64	0.40	1.00	0.70	1.00	1.00	0.79	0.00	1.00	0.00	1.00	1.00	0.50	1.00	0.00	1.00	0.50	0.00	0.00	0.00	19	11	3	8
900/10 67	Manakau North Overbridge	no	0.48	0.91	0.70	0.27	1.00	0.70	1.00	1.00	0.76	0.00	1.00	0.50	1.00	1.00	0.50	0.00	0.00	0.80	0.50	0.00	0.00	0.00	14	9	4	5
900/7 04	Ohau Overbridge	yes	0.48	1.00	0.70	0.16	1.00	1.00	1.00	1.00	0.76	0.00	1.00	0.50	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.81	0.00	0.00	11	10	5	5
872/14 30	Manawatu River (Whirokino) Bridge	no	0.48	0.91	0.45	0.64	1.00	0.70	1.00	1.00	0.63	0.00	0.63	0.00	1.00	1.00	0.50	1.00	0.00	0.80	0.50	0.22	1.00	1.00	9	6	6	0
900/10 35	Waikawa River Bridge	no	0.47	0.91	0.63	0.35	1.00	0.70	1.00	1.00	0.76	0.00	1.00	0.00	1.00	1.00	1.00	0.00	0.00	0.20	0.50	0.00	0.00	0.00	13	5	7	-2
915/0 00	Pukehou (Manakau South) Overbridge	no	0.46	1.00	0.48	0.45	1.00	1.00	1.00	1.00	0.76	0.00	0.40	0.50	1.00	1.00	0.50	0.00	0.00	0.60	1.00	0.00	1.00	0.00	16	12	8	4
844/1 27	Rangitikei River Bridge at Bulls	no	0.45	0.91	0.40	0.65	1.00	0.70	1.00	1.00	0.70	0.00	0.42	0.00	1.00	1.00	0.50	1.00	0.00	1.00	0.50	0.00	1.00	1.00	1	3	9	-6
900/8 16	Kuku Stream Bridge	no	0.44	0.91	0.63	0.27	1.00	0.70	1.00	1.00	0.76	0.00	1.00	0.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.33	0.00	0.00	12	22	10	12
900/13 90	Waiauti Stream (Manakau) Bridge	yes	0.43	0.91	0.63	0.25	1.00	0.70	1.00	1.00	0.76	0.00	1.00	0.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	15	23	11	12
953/7 70	Pukerua Bay Overbridge	no	0.36	0.91	0.46	0.30	1.00	0.70	1.00	1.00	0.93	0.00	0.28	0.50	1.00	1.00	0.50	0.00	0.00	0.60	0.50	0.53	0.00	0.00	24	8	12	-4
953/15.41	Paremata Harbour Bridge	no	0.33	0.91	0.42	0.30	1.00	0.70	1.00	1.00	1.00	0.00	0.33	0.00	1.00	1.00	0.50	0.00	0.00	0.80	0.50	0.00	0.00	0.00	25	2	13	-11
915/4 86	Otaki Overbridge	no	0.33	0.91	0.42	0.27	1.00	0.70	1.00	1.00	0.77	0.00	0.26	0.50	1.00	1.00	0.50	0.00	0.00	0.60	0.50	0.00	0.00	0.00	18	15	14	1
872/13 04	Whirokino Trestle	no	0.32	0.91	0.38	0.32	1.00	0.70	1.00	1.00	0.63	0.00	0.41	0.00	1.00	1.00	0.50	0.00	0.00	1.00	0.50	0.00	0.00	0.00	8	7	15	-8
953/0 00	Paekakariki Overbridge	no	0.30	0.91	0.37	0.27	1.00	0.70	1.00	1.00	0.92	0.00	0.10	0.50	1.00	1.00	0.50	0.00	0.00	0.60	0.50	0.00	0.00	0.00	23	13	16	-3
915/4 04	Waitohu Stream Bridge	no	0.30	0.91	0.40	0.22	1.00	0.70	1.00	1.00	0.76	0.00	0.40	0.00	1.00	1.00	0.50	0.00	0.00	0.20	0.50	0.00	0.00	0.00	17	14	17	-3
872/12 41	North Whirokino Trestle	yes	0.29	0.91	0.38	0.22	1.00	0.70	1.00	1.00	0.63	0.00	0.41	0.00	1.00	1.00	0.50	0.00	0.00	0.20	0.50	0.00	0.00	0.00	7	17	18	-1
915/10 53	Mangaone Stream Bridge	yes	0.24	0.91	0.35	0.13	1.00	0.70	1.00	1.00	0.85	0.00	0.24	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	20	28	19	9
969/4 40	Kenepuru Stream Bridge	yes	0.22	1.00	0.30	0.11	1.00	1.00	1.00	1.00	1.00	0.00	0.10	0.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.17	1.00	0.00	26	20	20	0
942/0 00	Paraparaumu Overbridge	no	0.22	0.76	0.33	0.22	1.00	0.70	1.00	0.00	0.85	0.00	0.00	0.50	1.00	1.00	0.50	0.00	0.00	0.20	0.50	0.00	0.00	0.00	22	16	21	-5
850/4 35	Makahakaroa Stream Bridge	yes	0.21	0.91	0.30	0.13	1.00	0.70	1.00	1.00	0.63	0.00	0.17	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4	26	22	4
969/7 15	Collins Avenue East Bridge	no	0.19	0.70	0.24	0.34	1.00	1.00	0.00	0.00	1.00	0.35	0.10	0.00	1.00	0.00	0.50	0.00	0.00	0.20	0.50	0.27	1.00	0.00	27	18	23	-5
969/7 15	Collins Avenue West Bridge	no	0.19	0.70	0.24	0.34	1.00	1.00	0.00	0.00	1.00	0.35	0.10	0.00	1.00	0.00	0.50	0.00	0.00	0.20	0.50	0.27	1.00	0.00	28	19	24	-5
845/3 82	Piakatutu Stream Bridge	yes	0.18	0.91	0.25	0.13	1.00	0.70	1.00	1.00	0.69	0.00	0.00	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.09	0.00	0.00	3	29	25	4
845/2 38	Makowai Stream Bridge	yes	0.17	0.76	0.28	0.13	1.00	0.70	0.00	1.00	0.69	0.00	0.10	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.09	0.00	0.00	2	27	26	1
979/4 27	Johnsonville North Overpass	yes	0.14	0.70	0.25	0.14	1.00	1.00	0.00	0.00	1.00	0.48	0.10	0.00	1.00	0.00	0.50	0.00	0.00	0.00	0.00	0.33	0.00	0.00	30	25	27	-2
979/0 00	Takapu Road Overbridge	yes	0.14	0.70	0.25	0.13	1.00	1.00	0.00	0.00	1.00	0.50	0.10	0.00	1.00	0.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	29	21	28	-7
979/4 61	Johnsonville South Overpass	yes	0.13	0.70	0.20	0.15	1.00	1.00	0.00	0.00	1.00	0.48	0.00	0.00	1.00	0.00	0.50	0.00	0.00	0.00	0.00	0.50	0.00	0.00	31	24	29	-5
850/5 67	Makowai No 2 Bridge	No Drawings Available		Could Not Be Assessed																					5			
850/5 68	Makowai No 2 Bridge	No Drawings Available		Could Not Be Assessed																					6			

PILOT APPRAISAL OF SEISMIC SCREENING PROCEDURES
STATE HIGHWAY 1 BRIDGES BETWEEN RP 844/1.27 AND 979/4.61

Sorted by Route Position Order

SH1 RP	Bridge Name	Excluded from Prioritisation By Screening Procedure	Seismic Prioritisation Grade (SPG)	Hazard Index	Importance Index	Vulnerability Index	Hazard Index Factors				Importance Index Factors						Vulnerability Index Factors									Route Position Order	Economic Analysis Ranking	Difference Econ-SPG Rankings
							Peak Ground Accln.	Remaining Service Life	Soil Condition	Liquefaction Risk	AADT On Bridge	AADT Under Bridge	Detour Length	Facility Crossed	Route Type	Critical Utility	Year Designed	Super-structure Hinges	Super-structure Overlap	Super-structure Length	Pier Type	Bridge Skew	Abutment Type	Other Feature			
844/1.27	Rangitikei River Bridge at Bulls	no	0.39	0.91	0.28	0.65	1.00	0.70	1.00	1.00	0.33	0.00	0.18	0.00	1.00	1.00	0.50	1.00	0.00	1.00	0.50	0.00	1.00	1.00	1	3	-3
845/2.38	Makowai Stream Bridge	yes	0.15	0.76	0.25	0.13	1.00	0.70	0.00	1.00	0.32	0.00	0.01	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.09	0.00	0.00	2	27	1
845/3.82	Piakatutu Stream Bridge	yes	0.18	0.91	0.25	0.13	1.00	0.70	1.00	1.00	0.32	0.00	0.00	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.09	0.00	0.00	3	29	6
850/4.35	Makahikaroa Stream Bridge	yes	0.18	0.91	0.25	0.13	1.00	0.70	1.00	1.00	0.26	0.00	0.03	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4	26	4
850/5.67	Makowai No 2 Bridge	No Drawings Available		Could Not Be Assessed																					5		
850/5.68	Makowai No 2 Bridge	No Drawings Available		Could Not Be Assessed																					6		
872/12.41	North Whirokino Trestle	yes	0.23	0.91	0.27	0.22	1.00	0.70	1.00	1.00	0.26	0.00	0.17	0.00	1.00	1.00	0.50	0.00	0.00	0.20	0.50	0.00	0.00	0.00	7	17	-1
872/13.04	Whirokino Trestle	no	0.27	0.91	0.27	0.32	1.00	0.70	1.00	1.00	0.25	0.00	0.17	0.00	1.00	1.00	0.50	0.00	0.00	1.00	0.50	0.00	0.00	0.00	8	7	-9
872/14.30	Manawatu River (Whirokino) Bridge	no	0.40	0.91	0.30	0.64	1.00	0.70	1.00	1.00	0.26	0.00	0.40	0.00	1.00	1.00	0.50	1.00	0.00	0.80	0.50	0.22	1.00	1.00	9	6	3
900/6.77	Ohau River Bridge	no	0.40	1.00	0.44	0.34	1.00	1.00	1.00	1.00	0.38	0.00	1.00	0.00	1.00	1.00	0.50	0.50	0.00	0.80	0.50	0.00	0.00	0.00	10	1	-1
900/7.04	Ohau Overbridge	yes	0.37	1.00	0.52	0.16	1.00	1.00	1.00	1.00	0.38	0.00	1.00	0.50	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.61	0.00	0.00	11	10	2
900/8.16	Kuku Stream Bridge	no	0.34	0.91	0.44	0.27	1.00	0.70	1.00	1.00	0.38	0.00	1.00	0.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.33	0.00	0.00	12	22	12
900/10.35	Waikawa River Bridge	no	0.37	0.91	0.44	0.35	1.00	0.70	1.00	1.00	0.38	0.00	1.00	0.00	1.00	1.00	1.00	0.00	0.00	0.20	0.50	0.00	0.00	0.00	13	5	-4
900/10.67	Manakau North Overbridge	no	0.38	0.91	0.52	0.27	1.00	0.70	1.00	1.00	0.38	0.00	1.00	0.50	1.00	1.00	0.50	0.00	0.00	0.60	0.50	0.00	0.00	0.00	14	9	2
900/13.90	Waiauti Stream (Manakau) Bridge	yes	0.33	0.91	0.44	0.25	1.00	0.70	1.00	1.00	0.38	0.00	1.00	0.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	15	23	12
915/0.00	Pukehou (Manakau South) Overbridge	no	0.39	1.00	0.36	0.45	1.00	1.00	1.00	1.00	0.38	0.00	0.16	0.50	1.00	1.00	0.50	0.00	0.00	0.60	1.00	0.00	1.00	0.00	16	12	7
915/4.04	Waitohu Stream Bridge	no	0.23	0.91	0.28	0.22	1.00	0.70	1.00	1.00	0.38	0.00	0.16	0.00	1.00	1.00	0.50	0.00	0.00	0.20	0.50	0.00	0.00	0.00	17	14	3
915/4.86	Otaki Overbridge	no	0.28	0.91	0.34	0.27	1.00	0.70	1.00	1.00	0.39	0.00	0.07	0.50	1.00	1.00	0.50	0.00	0.00	0.60	0.50	0.00	0.00	0.00	18	15	2
915/6.81	Otaki River Bridge	no	0.39	0.91	0.46	0.40	1.00	0.70	1.00	1.00	0.41	0.00	1.00	0.00	1.00	1.00	0.50	1.00	0.00	1.00	0.50	0.00	0.00	0.00	19	11	7
915/10.53	Mangaone Stream Bridge	yes	0.19	0.91	0.26	0.13	1.00	0.70	1.00	1.00	0.49	0.00	0.06	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	20	28	7
931/5.19	Waikanae River Bridge	no	0.51	1.00	0.50	0.52	1.00	1.00	1.00	1.00	0.49	0.00	1.00	0.00	1.00	1.00	0.50	0.00	0.00	0.60	0.50	0.00	1.00	1.00	21	4	3
942/0.00	Paraparaumu Overbridge	no	0.22	0.76	0.33	0.22	1.00	0.70	1.00	0.00	0.49	0.00	0.00	0.50	1.00	1.00	0.50	0.00	0.00	0.20	0.50	0.00	0.00	0.00	22	16	-3
953/0.00	Paekakariki Overbridge	no	0.28	0.91	0.33	0.27	1.00	0.70	1.00	1.00	0.56	0.00	0.01	0.50	1.00	1.00	0.50	0.00	0.00	0.60	0.50	0.00	0.00	0.00	23	13	1
953/7.70	Pukerua Bay Overbridge	no	0.30	0.91	0.35	0.30	1.00	0.70	1.00	1.00	0.58	0.00	0.08	0.50	1.00	1.00	0.50	0.00	0.00	0.60	0.50	0.53	0.00	0.00	24	8	-4
953/15.41	Paremata Harbour Bridge	no	0.27	0.91	0.30	0.30	1.00	0.70	1.00	1.00	0.84	0.00	0.11	0.00	1.00	1.00	0.50	0.00	0.00	0.80	0.50	0.00	0.00	0.00	25	2	13
969/4.40	Kenepuru Stream Bridge	yes	0.19	1.00	0.25	0.11	1.00	1.00	1.00	1.00	1.00	0.00	0.01	0.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.17	1.00	0.00	26	20	0
969/7.15	Collins Avenue East Bridge	no	0.17	0.70	0.19	0.34	1.00	1.00	0.00	0.00	1.00	0.35	0.01	0.00	1.00	0.00	0.50	0.00	0.00	0.20	0.50	0.27	1.00	0.00	27	18	-7
969/7.15	Collins Avenue West Bridge	no	0.17	0.70	0.19	0.34	1.00	1.00	0.00	0.00	1.00	0.35	0.01	0.00	1.00	0.00	0.50	0.00	0.00	0.20	0.50	0.27	1.00	0.00	28	19	-5
979/0.00	Takapu Road Overbridge	yes	0.12	0.70	0.21	0.13	1.00	1.00	0.00	0.00	1.00	0.50	0.01	0.00	1.00	0.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	29	21	-8
979/4.27	Johnsonville North Overpass	yes	0.12	0.70	0.20	0.14	1.00	1.00	0.00	0.00	1.00	0.48	0.01	0.00	1.00	0.00	0.50	0.00	0.00	0.00	0.00	0.33	0.00	0.00	30	25	-3
979/4.61	Johnsonville South Overpass	yes	0.13	0.70	0.20	0.15	1.00	1.00	0.00	0.00	1.00	0.48	0.00	0.00	1.00	0.00	0.50	0.00	0.00	0.00	0.00	0.50	0.00	0.00	31	24	-3
		FACTORS - THIS TRIAL:		1.00	0.60	0.40	0.40	0.30	0.15	0.15	0.5(adt+det)	0.10	0.5(adt+det)	0.15	0.15	0.10	0.25	0.08	0.10	0.12	0.15	0.05	0.10	0.15			
		FACTORS IN REPORT:		1.00	0.60	0.40	0.40	0.30	0.15	0.15	0.25	0.15	0.15	0.20	0.15	0.10	0.25	0.08	0.10	0.07	0.15	0.10	0.10	0.15			

Sorted by Seismic Priority Grade

SH1 RP	Bridge Name	Excluded from Prioritisation By Screening Procedure	Seismic Prioritisation Grade (SPG)	Hazard Index	Importance Index	Vulnerability Index	Hazard Index Factors				Importance Index Factors						Vulnerability Index Factors									Route Position Order	Economic Analysis Ranking	SPG	Difference Econ-SPG Rankings
							Peak Ground Accln.	Remaining Service Life	Soil Condition	Liquefaction Risk	AADT On Bridge	AADT Under Bridge	Detour Length	Facility Crossed	Route Type	Critical Utility	Year Designed	Super-structure Hinges	Super-structure Overlap	Super-structure Length	Pier Type	Bridge Skew	Abutment Type	Other Feature				
931/5.19	Waikanae River Bridge	no	0.51	1.00	0.50	0.52	1.00	1.00	1.00	1.00	0.49	0.00	1.00	0.00	1.00	1.00	0.50	0.00	0.00	0.60	0.50	0.00	1.00	1.00	21	4	1	3
900/6.77	Ohau River Bridge	no	0.40	1.00	0.44	0.34	1.00	1.00	1.00	1.00	0.38	0.00	1.00	0.00	1.00	1.00	0.50	0.50	0.00	0.80	0.50	0.00	0.00	0.00	10	1	2	-1
872/14.30	Manawatu River (Whirokino) Bridge	no	0.40	0.91	0.30	0.64	1.00	0.70	1.00	1.00	0.26	0.00	0.40	0.00	1.00	1.00	0.50	1.00	0.00	0.80	0.50	0.22	1.00	1.00	9	6	3	3
915/6.81	Otaki River Bridge	no	0.39	0.91	0.45	0.40	1.00	0.70	1.00	1.00	0.41	0.00	1.00	0.00	1.00	1.00	0.50	1.00	0.00	1.00	0.50	0.00	0.00	0.00	19	11	4	7
915/0.00	Pukehou (Manakau South) Overbridge	no	0.39	1.00	0.36	0.45	1.00	1.00	1.00	1.00	0.38	0.00	0.16	0.50	1.00	1.00	0.50	0.00	0.00	0.60	1.00	0.00	1.00	0.00	16	12	5	7
844/1.27	Rangitikei River Bridge at Bulls	no	0.39	0.91	0.28	0.65	1.00	0.70	1.00	1.00	0.33	0.00	0.18	0.00	1.00	1.00	0.50	1.00	0.00	1.00	0.50	0.00	1.00	1.00	1	3	6	3
900/10.67	Manakau North Overbridge	no	0.38	0.91	0.52	0.27	1.00	0.70	1.00	1.00	0.38	0.00	1.00	0.50	1.00	1.00	0.50	0.00	0.00	0.60	0.50	0.00	0.00	0.00	14	9	7	2
900/7.04	Ohau Overbridge	yes	0.37	1.00	0.52	0.16	1.00	1.00	1.00	1.00	0.38	0.00	1.00	0.50	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.61	0.00	0.00	11	10	8	2
900/10.35	Waikawa River Bridge	no	0.37	0.91	0.44	0.35	1.00	0.70	1.00	1.00	0.38	0.00	1.00	0.00	1.00	1.00	1.00	0.00	0.00	0.20	0.50	0.00	0.00	0.00	13	5	9	-4
900/8.16	Kuku Stream Bridge	no	0.34	0.91	0.44	0.27	1.00	0.70	1.00	1.00	0.38	0.00	1.00	0.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.33	0.00	0.00	12	22	10	12
900/13.90	Waiauti Stream (Manakau) Bridge	yes	0.33	0.91	0.44	0.25	1.00	0.70	1.00	1.00	0.38	0.00	1.00	0.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	15	23	11	12
953/7.70	Pukerua Bay Overbridge	no	0.30	0.91	0.35	0.30	1.00	0.70	1.00	1.00	0.56	0.00	0.08	0.50	1.00	1.00	0.50	0.00	0.00	0.60	0.50	0.53	0.00	0.00	24	8	12	-4
915/4.86	Otaki Overbridge	no	0.28	0.91	0.34	0.27	1.00	0.70	1.00	1.00	0.39	0.00	0.07	0.50	1.00	1.00	0.50	0.00	0.00	0.60	0.50	0.00	0.00	0.00	18	15	13	2
953/0.00	Paekakariki Overbridge	no	0.28	0.91	0.33	0.27	1.00	0.70	1.00	1.00	0.56	0.00	0.01	0.50	1.00	1.00	0.50	0.00	0.00	0.60	0.50	0.00	0.00	0.00	23	13	14	-1
953/15.41	Paremata Harbour Bridge	no	0.27	0.91	0.30	0.30	1.00	0.70	1.00	1.00	0.84	0.00	0.11	0.00	1.00	1.00	0.50	0.00	0.00	0.80	0.50	0.00	0.00	0.00	25	2	15	-13
872/13.04	Whirokino Trestle	no	0.27	0.91	0.27	0.32	1.00	0.70	1.00	1.00	0.25	0.00	0.17	0.00	1.00	1.00	0.50	0.00	0.00	1.00	0.50	0.00	0.00	0.00	8	7	16	-9
915/4.04	Waitohu Stream Bridge	no	0.23	0.91	0.28	0.22	1.00	0.70	1.00	1.00	0.38	0.00	0.16	0.00	1.00	1.00	0.50	0.00	0.00	0.20	0.50	0.00	0.00	0.00	17	14	17	-3
872/12.41	North Whirokino Trestle	yes	0.23	0.91	0.27	0.22	1.00	0.70	1.00	1.00	0.26	0.00	0.17	0.00	1.00	1.00	0.50	0.00	0.00	0.20	0.50	0.00	0.00	0.00	7	17	18	-1
942/0.00	Paraparaumu Overbridge	no	0.22	0.76	0.33	0.22	1.00	0.70	1.00	0.00	0.49	0.00	0.00	0.50	1.00	1.00	0.50	0.00	0.00	0.20	0.50	0.00	0.00	0.00	22	16	19	-3
969/4.40	Kenepuru Stream Bridge	yes	0.19	1.00	0.25	0.11	1.00	1.00	1.00	1.00	1.00	0.00	0.01	0.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.17	1.00	0.00	26	20	20	0
915/10.53	Mangaone Stream Bridge	yes	0.19	0.91	0.26	0.13	1.00	0.70	1.00	1.00	0.49	0.00	0.06	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	20	28	21	7
850/4.35	Makahikaroa Stream Bridge	yes	0.18	0.91	0.25	0.13	1.00	0.70	1.00	1.00	0.26	0.00	0.03	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4	26	22	4
845/3.82	Piakatutu Stream Bridge	yes	0.18	0.91	0.25	0.13	1.00	0.70	1.00	1.00	0.32	0.00	0.00	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.09	0.00	0.00	3	29	23	6
969/7.15	Collins Avenue West Bridge	no	0.17	0.70	0.19	0.34	1.00	1.00	0.00	0.00	1.00	0.35	0.01	0.00	1.00	0.00	0.50	0.00	0.00	0.20	0.50	0.27	1.00	0.00	28	19	24	-5
969/7.15	Collins Avenue East Bridge	no	0.17	0.70	0.19	0.34	1.00	1.00	0.00	0.00	1.00	0.35	0.01	0.00	1.00	0.00	0.50	0.00	0.00	0.20	0.50	0.27	1.00	0.00	27	18	25	-7
845/2.38	Makowai Stream Bridge	yes	0.15	0.76	0.25	0.13	1.00	0.70	0.00	1.00	0.32	0.00	0.01	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.09	0.00	0.00	2	27	26	1
979/4.61	Johnsonville South Overpass	yes	0.13	0.70	0.20	0.15	1.00	1.00	0.00	0.00	1.00	0.48	0.00	0.00	1.00	0.00	0.50	0.00	0.00	0.00	0.00	0.50	0.00	0.00	31	24	27	-3
979/4.27	Johnsonville North Overpass	yes	0.12	0.70	0.20	0.14	1.00	1.00	0.00	0.00	1.00	0.48	0.01	0.00	1.00	0.00	0.50	0.00	0.00	0.00	0.00	0.33	0.00	0.00	30	25	28	-3
979/0.00	Takapu Road Overbridge	yes	0.12	0.70	0.21	0.13	1.00	1.00	0.00	0.00	1.00	0.50	0.01	0.00	1.00	0.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	29	21	29	-8
850/5.67	Makowai No 2 Bridge	No Drawings Available		Could Not Be Assessed																					5			
850/5.68	Makowai No 2 Bridge	No Drawings Available		Could Not Be Assessed																					6			

APPENDIX 4

FORMS USED FOR TESTING THE *PROPOSED PRELIMINARY SCREENING PROCEDURE*

PRIORITISATION OF BRIDGES FOR SEISMIC ASSESSMENT

BRIDGE DATA

BRIDGE AUTHORITY/REGION ....

HIGHWAY .... ROUTE POSITION ....

BRIDGE NAME ....

Source of information (file/drawing numbers) ....

Year designed			....
Number of spans			....
Span lengths (metres)			....
Total length of spans (metres)			....
Is superstructure primary material timber?		(Yes/No)	....
Are all spans continuous or interconnected?		(Yes/No)	....
How many *in-span* movement joints in deck?			....
For tightly interlinked simply supported superstructure, is end overlap at any support less than 200mm?		(Yes/No/NA)	....
For simply supported superstructure end secured only with holding down bolts, is end overlap less than 300mm?		(Yes/No/NA)	....
For non-tightly interlinked simply supported superstructure, is end overlap at any support less than 400mm?		(Yes/No/NA)	....
Overall width of structural deck slab (metres)			....
Skew angle (degrees) at each abutment		....	....
Maximum pier height (top of foundation to soffit of superstructure) (metres)			....
Pier type	- slab on spread footing?	(Yes/No)	....
	- multicolumn, or slab on piles?	(Yes/No)	....
	- single column?	(Yes/No)	....
Abutment type (see 6.2.3 vii)	- monolithic/tightly connected?	(Yes/No)	....
Soil condition (see 6.2.1 iii)		(Flexible/Normal/Don't know)	....
Are foundations subject to liquefaction?		(High risk/Low risk/Don't know)	....
Annual average daily traffic count using bridge		(v.p.d.)	....
Annual average daily traffic count under bridge		(v.p.d.)	....
Detour length (km)			....
Route type (note State Highway number if applicable; state if motorway)			....
Facility crossed:	residential/commercial/industrial?	(Yes/No)	....
	parking/storage?	(Yes/No)	....
	other?	(Yes/No)	....
Does bridge carry:	water, sewerage, electricity gas or telephone utilities?	(Yes/No)	....
Remaining service life?	(<25 yrs; 25-50 yrs; >50yrs)		....
Seismic zone factor for site (Z)			....
Do drawings show approach settlement/relieving slabs?		(Yes/No)	....

Prepared by: .... Date ....

Checked by : .... Date ....

CAN BRIDGE BE EXCLUDED FROM PRIORITISATION PROCEDURE?

(Refer to Seismic Screening Manual for Bridges for definition of terminology)

HIGHWAY ....

ROUTE POSITION ....

BRIDGE NAME ....

- Was bridge designed after 1972?

  If so, exclude from prioritisation procedure (Yes/No) ....

- Is bridge a single span with either monolithic abutments or a superstructure overlap rating of 0 when rated to the seismic screening procedures?

  If so, exclude from prioritisation procedure (Yes/No) ....

- Is bridge of multi spans with "yes" as an answer to *all* the following questions: (Tick item if "Yes")

  - is bridge of three spans or fewer? ....
  - are spans structurally continuous or interconnected with tight linkage bolts? ....
  - is overall bridge length-to-deck width ratio 8 or less? ....
  - is the skew angle less than 15 degrees? ....
  - is the span arrangement reasonably balanced, with no span exceeding 30 metres? ....
  - are all the piers of multi-column or slab form? ....
  - are all the piers of less than 7 metres high from the top of the foundation to the soffit of the superstructure? ....
  - does bridge superstructure have monolithic abutments or a superstructure overlap rating of 0 when rated to the seismic screening procedures? ....
  - are foundations and abutments founded with little likelihood of failure due to soil liquefaction or instability? ....

  If so, exclude from prioritisation procedure (Yes/No) ....

- Is bridge superstructure primary material timber?

  If so, exclude from prioritisation procedure (Yes/No) ....

CONCLUSION: Can bridge be excluded from prioritisation procedure? (Yes/No) ....

Prepared by: .... Date ....

Checked by : .... Date ....

PRIORITISATION GRADING SHEET *(Refer to Manual for derivation of Rating values)*

HIGHWAY ....
ROUTE POSITION ....
BRIDGE NAME ....

Hazard Index		Weighting		
Peak Ground Acceleration Rating	=	x 0.4	=	
Remaining Service Life Rating	=	x 0.3	=	
Soil Condition Rating	=	x 0.15	=	
Risk of Liquefaction Rating	=	x 0.15	=	
				....
Σ = Hazard Index				....

Importance Index				
AADT on Bridge Rating	=	x 0.25	=	
AADT under Bridge Rating	=	x 0.15	=	
Detour Length Rating	=	x 0.15	=	
Facility Crossed Rating	=	x 0.2	=	
Route Type on Bridge Rating	=	x 0.15	=	
Critical Utility Rating	=	x 0.1	=	
				....
Σ = Importance Index				....

Vulnerability Index				
Year Designed Rating	=	x 0.25	=	
Superstructure Hinges Rating	=	x 0.08	=	
Superstructure Overlap Rating	=	x 0.1	=	
Superstructure Length Rating	=	x 0.07	=	
Pier Type Rating	=	x 0.15	=	
Skew Rating	=	x 0.1	=	
Abutment Type Rating	=	x 0.1	=	
Other Feature Rating	=	x 0.15	=	
				....
Σ = Vulnerability index				....

Seismic Prioritisation Grade = Hazard Index x [(0.6 x Importance Index) + (0.4 x Vulnerability Index)]

= x [(0.6 x) + (0.4 x)]

= ....

Prepared by: .... Date ....

Checked by : .... Date ....

APPENDIX 5

DRAFT MANUAL FOR IMPLEMENTING THE *RECOMMENDED PRELIMINARY SCREENING PROCEDURE*

NOTE ON CONTENTS OF APPENDIX 5:

The following pages contain the *Recommended Preliminary Screening Procedure,* which incorporates the changes made to the *Proposed Preliminary Screening Procedure.* The changes are summarised in Section 6 of this report.

The text is set out in the form of a manual for implementing the Screening Procedure, but further review and editing will be needed for a stand-alone document. The development of a manual was outside the scope of this project, and the main purpose of the text in this appendix is to provide a complete, revised summary of the Preliminary Screening Procedure recommended for implementation.

SEISMIC SCREENING MANUAL FOR BRIDGES

1. INTRODUCTION

This document sets out the steps to be taken in applying the Seismic Prioritisation Grading System (SPGS) to a bridge or group of bridges. The purpose of the SPGS is to identify and prioritise bridges which justify detailed assessment of their earthquake resistance.

Prioritisation of seismically vulnerable bridges must be carried out efficiently and with a minimum of effort. The first step in the process is to document basic data about each applicable bridge on the highway system. This information and the results of the seismic prioritisation grading should be concisely organised and incorporated into the bridge records.

General engineering staff familiar with the structures within each Transit New Zealand region should undertake the compilation and most of the grading work to ensure consistency within each region. Standardisation of the procedure should achieve consistency.

The set of forms in Section 7 of this manual are to be used for collecting and recording the information. The completed forms should be added to the bridge records.

The basic data, which will normally be available by accessing existing databases, should include:

- Details of the bridge recorded on the bridge descriptive inventory;
- Bridge construction drawings;
- Bridge inspection records; and
- Annual average daily traffic count (AADT) for the bridge.

If records are incomplete, the local knowledge of staff should enable the work to be completed without a site visit. If the staff are not familiar with the structure they should visit the site to ensure that the drawings include all post-construction modifications – for example foundation strengthening or span interconnections.

The vulnerability of bridge approaches is not addressed by this ranking procedure. The potential for the formation of hazard to vehicles if a bridge approach settles and exposes the abutment backwall is also not addressed. The presence or absence on bridge drawings of approach settlement slabs shall be noted when structure details are extracted from the records. A decision on whether slabs should be installed may then be appropriate as part of the retrofit decision at a later stage.

The SPGS includes three main variables:

- Hazard (seismicity at the bridge site and other hazards affecting the bridge structure);
- Importance of the bridge; and
- Vulnerability of the bridge structure

In the SPGS procedure each *variable* is assigned an *index*, which is the sum of the weighted *attribute* rating values for that variable. The indices are then combined to give the *Seismic Prioritisation Grade* (SPG). Each attribute is assigned a relative weight based on the attribute's significance in determining the Index. The prioritisation grading sheet in Figure 1 illustrates the structure of the procedure.

Reference to the Bridge Manual in this document should be interpreted as the Transit New Zealand Bridge Manual (1994) and subsequent amendments.

Figure 1 Prioritisation Grading Sheet

PRIORITISATION GRADING SHEET *(Refer to Seismic Screening Manual for Bridges for derivation of Rating values)*

HIGHWAY ____________
ROUTE POSITION ____________
BRIDGE NAME ____

Hazard Index	Rating	Weighting		Weighted Rating
Peak Ground Acceleration Rating	________	x 0.4	=	
Remaining Service Life Rating	________	x 0.3	=	
Soil Condition Rating	________	x 0.15	=	
Risk of Liquefaction Rating	________	x 0.15	=	
				________
∑ = **Hazard Index**		=		________
Importance Index				
AADT on Bridge Rating x *Detour Length* Rating	________	x 0.5	=	
AADT under Bridge Rating	________	x 0.10	=	
Facility Crossed Rating	________	x 0.15	=	
Route Type on Bridge Rating	________	x 0.15	=	
Critical Utility Rating	________	x 0.1	=	
				________
∑ = **Importance Index**		=		________
Vulnerability Index				
Year Designed Rating	________	x 0.25	=	
Superstructure Hinges Rating	________	x 0.08	=	
Superstructure Overlap Rating	________	x 0.1	=	
Superstructure Length Rating	________	x 0.12	=	
Pier Type Rating	________	x 0.15	=	
Skew Rating	________	x 0.05	=	
Abutment Type Rating	________	x 0.1	=	
Other Feature Rating	________	x 0.15	=	
				________
∑ = **Vulnerability Index**		=		________

Seismic Prioritisation Grade = Hazard Index x [(0.6 x Importance Index) + (0.4 x Vulnerability Index)]

= x [(0.6 x) + (0.04 x)]

= ________

2. BRIDGES EXCLUDED BY PRELIMINARY SCREENING

Form 2 in section 7, entitled "Can Bridge be Excluded from Prioritisation Procedure?", sets out the conditions and properties required for a bridge to be excluded from further screening and prioritisation. Nevertheless, the detailed records and drawings of the bridge must be assembled for perusal before the decision is made that the bridge should be excluded.

3. BRIDGES WITHOUT CONNECTIONS BETWEEN SUPERSTRUCTURE ELEMENTS

The lack of connection between segments of a bridge superstructure is one deficiency which is readily improved by retrofitting. The interconnection of bridge superstructure segments is usually inexpensive and has the advantage that it can also partially alleviate the seriousness of other deficiencies.

Bridges with no connections between superstructure components (those with simply supported spans over intermediate piers, and across intermediate hinges within spans) shall be identified separately from bridges with other types of deficiencies for the following reasons:

- The risk of span collapse in these bridges in a modest earthquake is relatively high;
- The total number of such bridges is small; and
- The benefit of increased security relative to the cost of retrofit is usually high

The following simple prioritisation procedure should be adopted, based on the annual average daily traffic count (AADT) and on the seismic Zone Factor Z applicable to the bridge site, as defined in the Bridge Manual:

1. Bridges with AADT exceeding 2500 vpd, with a seismic Zone Factor $Z = 1.2$
2. Bridges with AADT less than 2500 vpd, with a seismic Zone Factor $Z = 1.2$
3. Bridges with AADT exceeding 2500 vpd, with a seismic Zone Factor $Z < 1.2$
4. Bridges with AADT less than 2500 vpd, with a seismic Zone Factor $Z < 1.2$

4. RATING ATTRIBUTES AND CALCULATING INDICES FOR THE VARIABLES

4.1 Hazard Index

The *Hazard Index* reflects the seismicity and site risks for a particular bridge site and utilises four attributes:

- *Peak Ground Acceleration*
- *Remaining Service Life*
- *Soil Condition*
- *Risk of Liquefaction*

Each of the attributes is discussed in detail below.

4.1.1 *Peak Ground Acceleration* attribute

The *Peak Ground Acceleration* attribute reflects peak rock acceleration, seismic duration and the frequency of seismic activity. The Zone Factor (Z), defined in the Bridge Manual, considers all these characteristics in a qualitative manner. The *Peak Ground Acceleration* attribute is based on a Zone Factor ranging from 0.6 to 1.2 to reflect the variation of seismic risk within New Zealand. For rating this attribute a linear relationship is used normalised to a Zone Factor of 1.2.

***Peak Ground Acceleration* rating is:**

$$= Z / 1.2$$

As the value of Z can range from 0.6 to 1.2, *Peak Ground Acceleration* rating can range between 0.5 and 1.0.

The attribute **weighting** is **40%**.

4.1.2 *Remaining Service Life* attribute

The *Remaining Service Life* attribute reflects the likelihood of a damaging seismic event occurring within the remaining service life of a bridge. This attribute helps to ensure that appropriate consideration is given to effective use of Transit New Zealand's financial resources.

For rating this attribute a simple step function is used. In assigning the rating value the Risk Factor (R), defined in the Bridge Manual, was used and is equivalent to the value of R for events with a 25% probability of exceedance within the remaining service life of the structure.

***Remaining Service Life* rating is:**

= 1.0 Greater than 50 years of remaining service life

= 0.7 Remaining service life from 25 to 50 years

= 0.5 Less than 25 years of remaining service life

The attribute **weighting** is **30%**.

4.1.3 *Soil Condition* attribute

Experience has shown that the degree of flexibility of subsoils can have a significant effect on the level of damage that can occur in an earthquake. This effect is reflected in the SPGS. To ensure consistency in interpretation of soil type the definitions of subsoil categories in the Bridge Manual are used.

The advice of a geotechnical engineer or geologist should be obtained when completing this part of the procedure.

For rating this attribute a simple step function is used.

***Soil Condition* rating is:**

= **1.0 Flexible or deep soil site, or "Don't know"**

= **0.5 Intermediate soil site**

= **0 Rock or very stiff soil site**

The attribute **weighting** is **15%**.

4.1.4 *Risk of Liquefaction* attribute

Liquefaction is the most significant of several types of ground instability that can affect a bridge.

For rating this attribute a simple step function is used. The rating is based on a qualitative assessment of the risk of liquefaction, which will require subjective judgement where detailed site investigation results are not available. The advice of a geotechnical engineer or geologist should be used when completing this part of the procedure. The following definitions for risk of liquefaction are:

- High Risk of Liquefaction – Soils which underlie abutment fills or footings, or provide lateral support to piles, and which generally comprise saturated medium-dense to loose sands, silty sands and non-plastic silts.

- Low Risk of Liquefaction – All other soil types

***Risk of Liquefaction* rating is:**

= **1.0 High risk of Liquefaction or "Don't know"**

= **0 Low risk of Liquefaction**

The attribute **weighting** is **15%.**

4.1.5 Hazard Index Summary

The *Hazard Index* is the sum of:

Weighting		Attribute Rating		Weighted Rating
0.40	x	*Peak Ground Acceleration* rating	=	
0.30	x	*Remaining Service Life* rating	=	
0.15	x	*Soil Condition* rating	=	
0.15	x	*Risk of Liquefaction* rating	=	
		TOTAL	=	*Hazard Index*

4.2 Importance Index

The *Importance Index* utilises six attributes to assess and reflect the consequences of bridge damage including public safety, the recognition that bridges form a vital link, and the socioeconomic impacts and effects on road users. The attributes are:

- *Annual Average Daily Traffic Count (AADT) on Bridge*
- *Detour Length*
- *AADT under Bridge*
- *Facility Crossed*
- *Route Type on Bridge*
- *Critical Utility*

The AADT and the Detour attributes are combined for weighting purposes.

Each of the attributes is discussed in detail below.

4.2.1 *AADT on Bridge* attribute

The *AADT on Bridge* attribute directly reflects the traffic use and hence the traffic disruption should damage occur. Traffic use is the appropriate indicator for state highway and motorway bridges which have low cycle and pedestrian use. The AADT is a measure of state highway use that is readily available, and so total AADT on a bridge is an appropriate and convenient measure for use in the SPGS.

For rating this attribute a linear relationship is used based on a maximum AADT of 30 000.

***AADT on Bridge* rating is:**

= (AADT)/30 000 ≤ 1

The **weighting** of *(AADT on Bridge* rating x *Detour Length* rating) is **50%**.

4.2.2 *Detour Length* attribute

The *Detour Length* attribute reflects the level of inconvenience caused by the loss of a bridge. The basis of this attribute is the "extra distance travelled" (EDT). To assess this, consideration will need to be given to the origin and destination of the traffic, the condition of the detour route and its ability to accommodate the traffic use, and the likelihood that the detour route itself will have survived the seismic event. Consideration of these items is subject to considerable qualitative judgement.

For rating this attribute a linear relationship normalised to 100 km is used.

The *Detour Length* rating is:

= (EDT)/100 ≤ 1

The **weighting** of *(AADT on Bridge* rating x *Detour Length* rating) is **50%**.

4.2.3 *AADT under Bridge* attribute

The *AADT under Bridge* attribute reflects the traffic disruption in the vicinity of the bridge should that bridge fail. The other traffic users may or may not be on a state highway or motorway and the total AADT affected is to be used.

For rating the attribute a linear relationship is used based on a maximum AADT of 30 000.

The *AADT under Bridge* rating is:

= (AADT)/30 000 ≤ 1

= 1 when a state highway or motorway bridge crosses a railway line.

The attribute **weighting** is **10%**.

4.2.4 *Facility Crossed* attribute

The *Facility Crossed* attribute reflects the potential for loss of life beneath the bridge, property damage, and individual or business financial losses. In assessing the width of the affected land, 2 x height of structure above the ground plus the width of the structure should be adopted.

For rating this attribute a simple step function is used.

***Facility Crossed* rating is:**

= 1.0 Where residential, commercial or industrial facilities would be affected by collapse;

= 0.5 Where parking, storage facilities or railway facilities would be affected by collapse;

= 0 Other uses

The attribute **weighting** is **15%**.

4.2.5 *Route Type on Bridge* attribute

The *Route Type on Bridge* attribute directly reflects the importance of the route as a national traffic lifeline. To reflect Transit New Zealand's responsibilities it is appropriate to apply the national rather than local importance of the route. The categories of relative importance of highways listed in Section 5 of the Bridge Manual are used as the basis for this attribute.

For rating this attribute a simple step function is used.

***Route Type on Bridge* rating is:**

= 1.0 Bridges carrying more than 2500 vpd
Bridges carrying motorways
Bridges on State Highways No: 1, 2, 3, 3A, 4, 5, 6, 8, 8A

= **0.8** **Bridges carrying between 250 and 2500 vpd**
Bridges on State Highways not listed above

= **0.6** **Bridges carrying less than 250 vpd**
Non-permanent bridges

The attribute **weighting** is **15%**.

4.2.6 *Critical Utility* attribute

The *Critical Utility* attribute reflects the importance of the other lifelines that are carried on the bridge and would be disrupted should the bridge collapse. The lifelines that are to be considered in rating this attribute include:

- water supply
- sewerage
- gas

Only utilities in pipes with an internal diameter of 150 mm or more are considered in rating this attribute.

Should any of these utilities be carried on a bridge then a high rating should be given. However, some state highway bridges may carry utilities that service only a small population. In these cases it may be appropriate to check with the utility authority whether temporary disruption would be critical or not and rate the attribute accordingly.

For rating this attribute a simple step function is used.

***Critical Utility* rating is:**

= **1.0** **Critical utility is carried on the bridge**

= **0** **Critical utility is not carried on the bridge**

The attribute **weighting** is **10%**.

4.2.7 Importance Index Summary

The *Importance Index* is the sum of:

Weighting		Attribute Rating		Weighted Rating
0.50	x	*AADT on Bridge* rating x *Detour Length* rating	=	
0.10	x	*AADT under Bridge* rating	=	
0.15	x	*Facility Crossed* rating	=	
0.15	x	*Route Type on Bridge* rating	=	
0.10	x	*Critical Utility* rating	=	
		TOTAL	=	*Importance Index*

4.3 *Vulnerability Index*

The *Vulnerability Index* utilises eight attributes to define and reflect structural details which have a potential for damage. The index also reflects the potential cost of retrofitting a bridge. These attributes are based on the experience gained from the performance of bridges in earthquakes, and allow for the interaction of structural components. The attributes used are:

- *Year Designed*
- *Superstructure Hinges*
- *Superstructure Overlap on Supports*
- *Superstructure Length*
- *Pier Type*
- *Skew*
- *Abutment Type*
- *Other Feature*

The *Other Feature* attribute allows the assessor the discretion to identify the presence of a vulnerable feature, whether this is an abutment/approach instability (other than liquefaction), bearing details, diaphragms, inadequate linkages or the general bridge condition.

In the SPGS emphasis has been placed on the general "looseness" of the superstructure relative to its supports. This is reflected in the *Hinges, Overlap* and *Length* attributes because a "loose" bridge allows a greater relative movement during an earthquake and is more likely to suffer a "drop" type failure.

The assessor must inspect the original structure drawings (preferably as-built revisions) because bridge details have important effects on the performance of the structure during an earthquake. A knowledge of any structural modifications made since construction is required. The assessor will also need to have access to an advisor with experience of how structures respond in an earthquake.

Each of the attributes is discussed in detail below.

4.3.1 *Year Designed* Attribute

The *Year Designed* attribute reflects the main stages in the development of seismic design and detailing. Experience has shown that structure performance and hence the level of damage in a seismic event is strongly dependent on the overall design philosophy and on the design of individual elements. In New Zealand the main code changes occurred in 1933, following the Napier earthquake, and in 1972 when the Highway Bridge Design Brief (MWD 1972) was issued. The distinction between year designed and year constructed must be recognised, so the year designed is to be used.

The 1956 Bridge Manual did not contain the requirement for linkages between superstructure elements that was included in the 1933 design instruction, but this structural feature is checked during the initial bridge screening.

For rating this attribute a simple step function is used.

***Year Designed* rating is:**

= 1.0 Bridge designed before 1933

= **0.5** **Bridge designed in the years 1933-1972**

= **0** **Bridge designed after 1972**

The attribute **weighting** is **25%**.

4.3.2 *Superstructure Hinges* attribute

The *Superstructure Hinges* attribute refers specifically to in-span hinged or movement joints within the main longitudinal load-bearing structural members. It accounts for the"drop type" failure which can be a problem with this detail during earthquakes.

This attribute excludes stepped seatings which commonly exist at piers or abutments, as these are specifically covered in the *Superstructure Overlap* attribute. It also excludes articulated deck slabs with continuous longitudinal reinforcing steel passing through the "hinges".

The number of hinges is the total for all spans of a bridge. For rating this attribute a simple step function is used.

***Superstructure Hinges* rating is:**

= **1.0** **If there are 2 hinges or more within a bridge superstructure**

= **0.5** **If only one superstructure hinge is present**

= **0** **If no superstructure hinges are present**

The attribute **weighting** is **8%**.

4.3.3 *Superstructure Overlap on Supports* attribute

The *Superstructure Overlap on Supports* attribute reflects the potential "drop type" failure at piers or abutments which can be a problem during earthquakes. The attribute rating is based on the Minimum Overlap Requirements for the span/support overlap specified in the Bridge Manual. The bearing overlap, also specified in the Bridge Manual, is not considered critical for the purposes of the SPGS.

Inter-span linkages are a low-cost insurance against loss of span support, and it is appropriate to adopt a conservative approach to rating this attribute. The strength of linkages and span overlaps in older bridges do not necessarily meet current specification as set out in the Bridge Manual. A "no linkage" situation should be assumed and a high rating given for the *Other Feature* attribute where the linkage capacity is clearly undersized, significantly deteriorated or has an inadequate load path (e.g. if a holding-down bolt has inadequate lateral support from pier cap concrete). In extreme circumstances the assessor has the discretion to withdraw the structure from the SPGS and prioritise it under the initial screening procedures. For the situations where the linkage capacity is marginally inadequate the choice of whether a linkage system is acknowledged or not is at the assessor's discretion.

For rating this attribute a simple step function is used. As a bridge may have different details, with different rating values, for different locations, the highest rating value should be used.

***Superstructure Overlap on Supports* rating is:**

No linkage system or loose linkage system present:

= 1.0 Overlap less than 400 mm
= 0 Overlap 400 mm or more

Linkage comprising holding-down bolts in shear:
= 1.0 Overlap less than 300 mm
= 0 Overlap 300 mm or more

Tight tension linkage system present
= 1.0 Overlap less than 200 mm
= 0 Overlap 200 mm or more

The attribute **weighting** is **10%**.

4.3.4 *Superstructure Length* attribute

The *Superstructure Length* attribute reflects:

- The risk of differential seismic response increasing with the length;
- The diminished transverse damping provided by the approach fills as bridge length increases;
- The greater potential for a "drop type" failure because of the accumulation of longitudinal displacements of multiple simply-supported spans, possibly resulting in overlap provisions being exceeded.

For rating this attribute a simple step function is used.

***Superstructure Length* rating is:**

= 1.0 Bridge length exceeding 200 m

= 0.8 Bridge length from 100 m to 200 m

= 0.6 Bridge length from 40 m to less than 100 m

= 0.2 Bridge length from 20 m to less than 40 m

= 0 Bridge length less than 20 m

The attribute **weighting** is **12%**.

4.3.5 *Pier Type* attribute

The *Pier Type* attribute reflects the different seismic responses and the different degrees of reserve against sudden failure which are inherent in the typical structural forms used.

For rating this attribute a simple step function is used.

***Pier Type* rating is:**

= **1.0** **Single column**

= **0.5** **Multi column, or slab pier on pile foundation**

= **0.25** **Slab pier on spread footing foundation**

The attribute **weighting** is **15%**.

4.3.6 *Skew* attribute

The *Skew* attribute reflects the likely accumulation of eccentricity and torsional effects which may not have been fully allowed for in the original design. Bridge skews tend to be increased during strong earthquake shaking.

For rating this attribute a linear relationship is used, normalised to 90°.

***Skew* rating is:**

$$= \theta / 90 \leq 1$$

θ = the angle in degrees between the perpendicular to the centreline of the roadway at each abutment, and the line of the backface of the abutment. If θ at each abutment differs, the greater value shall be used.

The attribute **weighting** is **5%**.

4.3.7 *Abutment Type* attribute

The *Abutment Type* attribute reflects that bridges with monolithic abutments perform well in earthquakes whereas those without them are more susceptible to damage. In this context a monolithic abutment is defined as one to which the superstructure is tightly linked, so that significant independent horizontal movement of the superstructure relative to the abutment during earthquake shaking is unlikely. To be considered as monolithic the abutment backwall must be in intimate contact with the approach fills over the full depth or more of the superstructure, and the full width of the main longitudinal members.

***Abutment Type* rating is:**

= **1.0** **Non-monolithic abutments**

= **0** **Monolithic abutments**

The attribute **weighting** is **10%**.

4.3.8 *Other Feature* attribute

The *Other Feature* attribute allows the assessor the discretion to reflect any other feature which is likely to make the bridge vulnerable to damage. It is expected that these will be different from the attributes used in the SPGS, except for linkages (refer *Superstructure Overlap* attribute). At least the following features should be considered:

- Linkages (capacity, condition, ductile capability).
- Diaphragms (adequacy for second order effects).
- Bearings (susceptibility to damage).
- Standard of important details.
- The overall general condition of the bridge.
- Approach stability (e.g. landslides that may be activated by a seismic event). Note that liquefaction is covered separately and should not be included in this attribute.

For this attribute a rating value between 1.0 and 0 is assigned using judgement based on the importance of the feature or features identified.

***Other Feature* rating is:**

= **1.0 (maximum) If vulnerable features are present**

= **0 If a vulnerable feature is not present**

The attribute **weighting** is **15%**.

4.3.9 Vulnerability Index Summary

Weighting		**Attribute Rating**		**Weighted Rating**
0.25	x	*Year Designed* rating	=	
0.08	x	*Superstructure Hinges* rating	=	
0.10	x	*Superstructure Overlap* rating	=	
0.12	x	*Superstructure Length* rating	=	
0.15	x	*Pier Type* rating	=	
0.05	x	*Skew* rating	=	
0.10	x	*Abutment Type* rating	=	
0.15	x	*Other Feature* rating	=	
		TOTAL	=	*VulnerabilityIndex*

5. CALCULATING THE *SEISMIC PRIORITISATION GRADE (SPG)*

Seismic Prioritisation Grade **is:**

= ***Hazard Index*** **x [0.6 x (*Importance Index*) + 0.4 x (*Vulnerability Index*)]**

6. BRIDGE RANKING

The Seismic Prioritisation Grading System (SPGS) provides a Seismic Prioritisation Grade (SPG) for each bridge. The SPG is used to rank the bridges for more detailed seismic assessments. The ranking indicates the relative risk of highway disruption and its consequences from seismic damage to the bridges.

To identify and rectify the anomalies *an integral part of the procedure is the review of the results by an experienced seismic engineer, with advice from a geotechnical engineer and an economist.*

The screening process set out in Section 3 identifies the first priority bridges with the highest overall ranking.

Before any decisions are made regarding the justification of physical retrofit works more detailed seismic assessment of the higher ranked structures on an individual basis are necessary. This is to determine the feasibility and benefit/cost ratio of any retrofit work identified.

7. SUMMARY OF THE SPGS PRELIMINARY SCREENING PROCEDURE, AND FORMS FOR ITS IMPLEMENTATION

Table 7.1 summarises the SPGS Preliminary Screening Procedure with data from the three forms following it.

1 Excluded from further assessment:

- Bridges designed post-1972
- Single span bridges with integral abutments or well connected/overlapped abutments (overlap rating = 0)
- Multi span bridges with all of:
  - Three spans or fewer;
  - Spans that are structurally continuous or interconnected with tight linkage bolts;
  - Overall bridge length-to-deck width ratio 8 or less;
  - Skew angle less than 15 degrees;
  - Span arrangement reasonably balanced, with no span exceeding 30 metres;
  - All the piers of multi-column or slab form;
  - All the piers of less than 7 metres from the top of the foundation to the soffit of the superstructure;
  - Monolithic abutments or a superstructure overlap rating of 0 under the seismic screening procedures; and
  - Foundations and abutments founded with little likelihood of failure due to soil liquefaction or instability.

2 First priority for assessment

Bridges without connections between superstructure elements, in the following priority order:

- Bridges with AADT exceeding 2500 vpd in seismic Zone Factor $Z = 1.2$
- Bridges with AADT less than 2500 vpd in seismic Zone Factor $Z = 1.2$
- Bridges with AADT exceeding 2500 vpd with a seismic Zone Factor $Z < 1.2$
- Bridges with AADT less than 2500 vpd with a seismic Zone Factor $Z < 1.2$

3 Prioritisation of remaining bridge stock by deriving the Seismic Prioritisation Grading (SPG):

• **Hazard**	**Hazard Index = sum of:**			
Peak ground acceleration	[Z/1.2]			x 0.4
Remaining service life	[<25 yrs 0.5	25yrs-50yrs 0.7	>50yrs] 1.0	x 0.3
Soil condition	[flexible or "don't know"] 1.0	[intermediate] 0.5	[Rock or very stiff] 0	x 0.15
Risk of liquefaction	[high risk or "don't know"] 1.0		[low risk] 0	x 0.15

Table 7.1 (continued)

• **Importance**	**Importance Index = sum of:**	
AADT count on bridge	[AADT/30 000)≤ 1]) Product of) Rating	
Detour length	[extra distance travelled/100 ≤1]) Values	x 0.50
AADT count under bridge	[AADT/30 000 ≤ 1, but = 1 if over r'way]	x 0.10
Facility crossed	[residential, commercial, industrial, 1.0] [parking, storage, railway 0.5] [other uses 0]	x 0.15
Route type on bridge	[AADT > 2500 vpd, m/ways, main SH's 1.0] [AADT 250-2500 vpd, secondary SH's 0.8] [AADT < 250 vpd, non-perm bridges 0.6]	x 0.15
Critical utility	[utility carried 1.0] [utility not carried 0]	x 0.1
• **Vulnerability**	**Vulnerability Index = sum of:**	
Year designed	[pre-1933] [1933-1972] [post-1972] 1.0 0.5 0	x 0.25
Superstructure hinges in spans	[2 or more] [1] [none] 1.0 0.5 0	x 0.08
Superstructure o'lap at supports	[(no link or loose link: o'lap < 400) 1.0] o'lap ≥ 400) 0] [(HD bolts in shear: o'lap < 300) 1.0] o'lap ≥ 300) 0] [(tight tension linkage: o'lap < 200) 1.0] o'lap ≥ 200) 0]	x 0.1
Superstructure length	[>200m] [100-200m] [40-100m] [20-<40m][<20m] 1.0 0.8 0.6 0.2	x 0.12
Pier type	[single column 1.0] [multi col, or slab pier on piles 0.5] [slab pier on spread footing 0.25]	x 0.15
Skew	[skew angle/90] ≤ 0.1	x 0.05
Abutment type	[non-monolithic] [monolithic] 1.0 0	x 0.1
Other feature	[feature present] [not present] 1.0 0 (or intermediate value subject to judgement)	x 0.15

SPG = Hazard Index x [0.6 x Importance Index + 0.4 x Vulnerability Index]

PRIORITISATION OF BRIDGES FOR SEISMIC ASSESSMENT

BRIDGE DATA

BRIDGE AUTHORITY/REGION ....

HIGHWAY .... ROUTE POSITION ....

BRIDGE NAME ....

Source of information (file/drawing numbers) ....

Year designed			....
Number of spans			....
Span lengths (metres)			
Total length of spans (metres)			....
Are all spans continuous or interconnected?		(Yes/No)	....
How many *in-span* movement joints in deck?			....
For tightly interlinked simply supported superstructure, is end overlap at any support less than 200mm?		(Yes/No/NA)	....
For simply supported superstructure end secured only with holding down bolts, is end overlap less than 300mm?		(Yes/No/NA)	....
For non-tightly interlinked simply supported superstructure, is end overlap at any support less than 400mm?		(Yes/No/NA)	....
Overall width of structural deck slab (metres)			....
Skew angle (degrees) at each abutment		....	....
Maximum pier height (top of foundation to soffit of superstructure) (metres)			....
Pier type	- slab on spread footing?	(Yes/No)	....
	- multicolumn, or slab on piles?	(Yes/No)	....
	- single column?	(Yes/No)	....
Abutment type (see 4.3.7)	- monolithic/tightly connected?	(Yes/No)	....
Soil condition (see 4.1.3)		(Flexible/Normal/Don't know)	....
Are foundations subject to liquefaction?		(High risk/Low risk/Don't know)	....
Annual average daily traffic count using bridge		(v.p.d.)	....
Annual average daily traffic count under bridge		(v.p.d.)	....
Detour length (km)			....
Route type (note State Highway number if applicable; state if motorway)		....	
Facility crossed:	residential/commercial/industrial?	(Yes/No)	....
	parking/storage?	(Yes/No)	....
	other?	(Yes/No)	....
Does bridge carry:	water, sewage, or gas in pipes of 150 mm diameter or more	(Yes/No)	....
Remaining service life?	(<25 yrs; 25-50 yrs; >50yrs)		....
Seismic zone factor for site (Z)			....
Do drawings show approach settlement/relieving slabs?		(Yes/No)	....

Prepared by: .... Date ....

Checked by : .... Date ....

CAN BRIDGE BE EXCLUDED FROM PRIORITISATION PROCEDURE?

(Refer to Seismic Screening Manual for Bridges for definition of terminology)

HIGHWAY ....
ROUTE POSITION ....
BRIDGE NAME ....

- Was bridge designed after 1972?
  If so, exclude from prioritisation procedure (Yes/No) ....

- Is bridge a single span with either monolithic abutments or a superstructure overlap rating of 0 when rated to the seismic screening procedures?

  If so, exclude from prioritisation procedure (Yes/No) ....

- Is bridge of multi spans with "yes" as an answer to *all* the following questions:
  (Tick item if "Yes")
  - is bridge of three spans or fewer? ....
  - are spans structurally continuous or interconnected with tight linkage bolts? ....
  - is overall bridge length-to-deck width ratio 8 or less? ....
  - is the skew angle less than 15 degrees? ....
  - is the span arrangement reasonably balanced, with no span exceeding 30 metres? ....
  - are all the piers of multi-column or slab form? ....
  - are all the piers of less than 7 metres high from the top of the foundation to the soffit of the superstructure? ....
  - does bridge superstructure have monolithic abutments or a superstructure overlap rating of 0 when rated to the seismic screening procedures? ....
  - are foundations and abutments founded with little likelihood of failure due to soil liquefaction or instability? ....

  If so, exclude from prioritisation procedure (Yes/No) ....

CONCLUSION: Can bridge be excluded from prioritisation procedure? (Yes/No) ....

Prepared by: .... Date ....

Checked by : .... Date ....

PRIORITISATION GRADING SHEET

(Refer to Seismic Screening Manual for Bridges for derivation of Rating values)

HIGHWAY ____________

ROUTE POSITION ____________

BRIDGE NAME ____

Hazard Index	Rating		Weighting		Weighted Rating
Peak Ground Acceleration Rating	________	=	x 0.4	=	
Remaining Service Life Rating	________	=	x 0.3	=	
Soil Condition Rating	________	=	x 0.15	=	
Risk of Liquefaction Rating	________	=	x 0.15	=	
					________
∑ = Hazard Index					________

Importance Index	Rating		Weighting		Weighted Rating
AADT on Bridge Rating x *Detour Length* Rating	________	=	x 0.5	=	
AADT under Bridge Rating	________	=	x 0.1	=	
Facility Crossed Rating	________	=	x 0.15	=	
Route Type on Bridge Rating	________	=	x 0.15	=	
Critical Utility Rating	________	=	x 0.1	=	
					________
∑ = Importance Index					________

Vulnerability Index	Rating		Weighting		Weighted Rating
Year Designed Rating	________	=	x 0.25	=	
Superstructure Hinges Rating	________	=	x 0.08	=	
Superstructure Overlap Rating	________	=	x 0.1	=	
Superstructure Length Rating	________	=	x 0.12	=	
Pier Type Rating	________	=	x 0.15	=	
Skew Rating	________	=	x 0.05	=	
Abutment Type Rating	________	=	x 0.1	=	
Other Feature Rating	________	=	x 0.15	=	
					________
∑ = Vulnerability Index					________

Seismic Prioritisation Grade = Hazard Index x [(0.6 x Importance Index) + (0.4 x Vulnerability Index)]

= x [(0.6 x) + (0.4 x)]

= ________

Prepared by: .... Date ....

Checked by : .... Date ....