SENIOR ENGINEER STRUCTURES CIRCULAR
SES 01/11
BRIDGE ACCESS WAYS

| No. Drawings Following | 7 | No. Appendix Sheets Following | 7 |

(i) **Background**

MRWA identified that there was a need to consider safe access to bridge sites throughout the State for its staff and consultants undertaking inspections, maintenance, design and asset management activities on these structures.

Subsequently Structures Engineering Branch has prepared ‘Design Guidelines for Access Requirements at Bridge Abutments’ and accompanying Drawing numbers 0730-0406 and 0407 for permanent bridge access ways and Drawing numbers 1030-1763 to 1766 and 1902 for transportable temporary stairs.

(ii) **Notes**

The guidelines were developed with a broad range of input and are considered to provide useful guidance on determining the appropriate level or standard access that should be provided. It is recommended that they are used at all sites to assess the need and level of intervention required to achieve safe access.

R F Scanlon  
Senior Engineer Structures  
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**DISTRIBUTION:**
All Asset/Project Managers Structures  
BDS Consultants
DESIGN GUIDELINES FOR ACCESS REQUIREMENTS AT BRIDGE ABUTMENTS

1.0 INTRODUCTION

These guidelines for access requirements originated from the identification by Main Roads Western Australia (MRWA) of a need to consider the safe access to bridge sites throughout the State for its staff and consultants engaged and working with MRWA, undertaking inspections, maintenance, design and asset management activities on these structures.

It has been identified that access via existing natural and man-made embankments could potentially pose a safety risk due to hazards associated with steep and slippery banks and/or loose materials. An identified and maintained access way also avoids additional hazards that might be hidden in natural grass such as fences, stakes, loose rocks, holes etc. In addition, condition inspections on larger structures will take time and there is the chance of inclement conditions adding to the difficulties in access.

The provision of safe bridge access incorporates the needs of timber bridge inspectors, carrying generators, drills etc. required to inspect all bridge timbers. Consultation with employees who undertake these tasks, as well as MRWA legal and occupational safety and health personnel has been undertaken to ensure both worker safety and public liability aspects are addressed.

These guidelines can be used at any bridge site to assess the need and level of intervention required to achieve safe access.

2.0 AUSTRALIAN STANDARD REQUIREMENTS

There is no Australian Standard that is directly and completely applicable to this situation of bridge access. From a detailed search, the two most relevant standards are:

AS 1657  Fixed platforms, walkways, stairs and ladders
AS 2156  Walking tracks – Part 1: Classification and signage
          Part 2: Infrastructure design

Although AS 1657 is applicable to "places normally used by operating, inspection, maintenance, and servicing personnel" the scope of this standard is for fixed walkways and fixed stairways and does not reflect the intermittent access requirements to the open bridge environments throughout the State. In addition, retrofitting access ways to existing bridges under this Standard would be prohibitively expensive and hence beyond the means of most maintenance budgets.

AS 2156 applies to outdoor areas and specifies requirements for the structural and geometrical design of walking track structures. The focus of this standard is for design of walking track structures for recreational activity as opposed to vocational but is also stated as being applicable to "providing a route or part of a route through ... natural areas".

The main difference in application of these standards to access requirements at bridge abutments is the addition of handrails to the edge of the access ways when adopting AS 1657. In accordance with clause 3.2 for fixed walkways, handrails are only provided for falls greater than 300 mm above "an adjacent platform or floor". There are obviously no adjacent platforms or floors in the open bridge environment and an approach assessing
barrier requirements based on effective fall height as per AS 2156.2 is deemed more appropriate. This rationale is supported by the bridge inspectors and regional bridge staff as discussed at a bridge access workshop.

AS 2156 requirements have been adopted as the most appropriate for access at bridge abutments. Thus bridge access ways will meet the standard's performance requirements of providing safe "access, with the appropriate degree of reliability, for human visitors to natural areas".

3.0 DETERMINATION OF NEED FOR IMPROVED ACCESS AND OPTIONS

3.1 Site Specific Need

Consideration shall be given to access provisions when any programmed works are to be constructed at the bridge site or more urgently if the existing access is identified as unsafe.

Each site needs to be assessed on an individual basis. A list of site specific factors that may influence the need for and the type of designed access to bridge abutments has been prepared (Appendix 1) as a checklist and a guide. Although the checklist is expected to cover nearly all situations, there may be additional factors that can be considered. Review of the factors in the list and an evaluation of their importance should provide sufficient guidance as to the need, type and level of access required at a particular bridge site (refer Appendix 2).

3.2 Access Options

Once consideration of all the site specific factors has been undertaken, various options to enable safe access to bridge abutments should be explored.

3.2.1 Status Quo

Alternative access may be readily available at a location a short distance from the bridge abutments, for example an old road alignment, floodway crossing or local picnic spot.

Additionally, the bridge may already have safe access incorporated as either part of the design or previous construction works.

3.2.2 Transportable Temporary Stairs

Transportable temporary stairs may be an access option for short (typically < 3 m slope length) embankments or as a connection to a more permanent designed access way. Refer Section 4.0.

3.2.3 Permanent Access Way Design

Permanent bridge access ways designed to AS 2156. Refer Section 5.0.
4.0 TRANSPORTABLE TEMPORARY STAIRS

Transportable temporary stairs may be an access option in their own right or may provide a suitable start for connection to a more permanent system. No proprietary transportable stair system was available worldwide so MRWA scoped and arranged for design and manufacture of fully adjustable, lightweight and durable stairs to suit various terrain situations.

The design brief proposed to meet the following requirements:

- Live Loading – 2.5 kPa or point load of 1.0 kN whichever is worst
- Handrail Loading – 330 N/m or point load of 550 N whichever is worst
- Width – 0.6 m clear
- Handrail – One side only required
- Design Slope – 1:8 to 1:1.5, adjustable to suit individual bridge sites
- Lightweight – less than 25 kg per segment
- Step Dimensions – Maximum going of 300 mm and minimum rise of 100 mm
- Stabilisation – A system to stabilise the temporary stairs
- Fast setup
- Easy to transport and stackable segments

The transportable temporary stairs are of aluminium design with special stair unit connectors, removable handrails, incline screw mechanism, landings and incline locking device. Each unit has been designed to stack on top of each other for ease of transportation and storage. Consultation with employees who undertake these tasks, as well as MRWA occupational safety and health personnel was undertaken to ensure worker safety. As there was very limited practical information available to start with, the development included some trial and amendment. There were three iterations before the final design and specification of the stairs was deemed acceptable to trial in practice.

Although installation of these new transportable temporary stairs requires personnel to stand on the bridge embankment, this is only for short periods of time and under controlled conditions. Much of the installation can be undertaken from the stable top landing and subsequent stair segments. The units easily connect together to form the stairs and are capable of accommodating varied and changed embankment slopes. The screw mechanism is readily adjustable to fit each slope so the stair treads can be made horizontal and the segments can be easily locked into place. The handrails easily install into the in-built sockets and lock into place.

The MRWA transportable temporary stairs provide safe access to bridge abutments and incorporate the needs of inspectors carrying heavy and dangerous equipment such as generators and drills. MRWA has manufactured three sets (including landings and two stair segments) of transportable temporary stairs with storage in Perth (Welshpool), Bunbury and Narrogin to provide convenient access for bridge inspections.

Refer Drawings 1030-1763 to 1766 and 1902 for details.

5.0 PERMANENT ACCESS WAY DESIGN

Permanent bridge access ways have been designed in accordance with the minimum requirements of AS 2156.2 given the assessed walking track classification as outlined in AS 2156.1. The classification system gives the designer a comprehensive description for six elements (track conditions, gradient, signage, infrastructure, terrain and weather) which help
to provide a consistent standard and ensures management considerations match intended use. Bridge access ways are classified as Class 4 with limited use and a generally distinct track without major modification to the ground.

Provision of barriers is assessed quantitatively in accordance with AS 2156.2 to reduce the risk of falling from a walking track structure. Bridge access ways are formed into the embankment, either by the provision of a cleated walkway or steps, and as such have a zero actual fall height. However, the 'impact surface value' contributes to the effective fall height and must be assessed for each site.

Most embankment material such as loose gravel, sand and grass are given as 'favourable' surface types and are assessed as providing no additional harm with impact of fall. However, on terrain whose slope exceeds 35 degrees, there is the likelihood of serious harm arising from rolling or sliding following initial impact. In these cases the effective fall height shall be 3.0 m.

It can therefore be concluded from Table 2 of AS 2156.2 that bridge access ways require no barriers for slopes less than or equal to 35 degrees. For the steeper slopes, barrier type C (post and rail type) is required but need only be provided on one side of the track.

Legal and Commercial Services (LCS) branch of MRWA expressed concern regarding the use of bridge access ways by the public. As such, if the permanent access way is readily visible from the road or the site is regularly visited by the public, consideration shall be given to constructing the permanent way starting below the top of the embankment and using transportable temporary stairs from the road to connect to the permanent access way. Each site needs to be considered individually. In addition, where barriers are required, LCS required two barriers and a locked gate at the entrance of the permanent access way to prevent public access. This level of deterrent is supported by the Regional bridge staff to minimise vandalism and antisocial behaviour at the bridge sites.

Using Figure 4.1 of AS 2156.2 the following levels of access way have been developed for various site conditions:

- **Low Level Walkways** – For slopes ≤ 1:3 - cleated path and no handrail. There must be a good surface for steadiness underfoot but there is no limit on the number of cleats and thus the length of walkway.
- **Moderate Level Stairways** – For slopes ≤ 1:1.5 - steps and no handrail. The number of risers shall be limited to 36 between landings.
- **High Level Stairways** – For slopes ≤ 1:1 - steps, two handrails with a lockable entrance. Sites that might warrant this level of access are with slopes of up to 1:1 or otherwise requiring limited access and/or a high probability of regular public visitation. Public visitation in this context is intended to cover situations where there may be unsupervised activities of children or where the access way presents a markedly different pedestrian environment to the public.

A flowchart (Appendix 2) is provided for further guidance.

In those instances where the access way will not include handrails or a lockable entrance, the access way should be designed and situated to minimise visibility to the casual observer. Transportable temporary stairs that connect to the permanent access ways at a lower level may be an option to increase security and to minimise visibility.

Refer Drawings 0730-0406 and 0407 for details.
6.0 INCORPORATING ACCESS INTO NEW BRIDGE DESIGN

In accordance with AS 5100.1, Clause 15 new bridge design "shall include provision for inspection and maintenance". MRWA has further acknowledged that the finished bridge becomes a workplace for various in-house and consultant personnel and requires new bridge design to consider discreetly located access/steps to the substructure/underside of the bridge to assist in safe future inspection and maintenance by experienced personnel.

Given the variability in site conditions it is not feasible to develop a standard that will be suitable for all bridge locations and engineering judgement will be required to select the appropriate level of access. Structures Engineering has incorporated permanent access into a new bridge design for a teeroff structure located in the Kimberley Region as shown below.

![Diagram of new bridge design](image)

7.0 MANAGEMENT GUIDELINES

AS 2156.1 gives guidance for managers to assist in operation and maintenance activities for various classes of walking tracks. These recommendations have been adopted as the basis for bridge access inspection and maintenance to ensure acceptable risks and to maintain safety.

Inspection of permanent bridge access ways has been included as a part of the annual visual inspection of each bridge. In addition, bridge inspectors now inspect and make good any deterioration of the walkway prior to conducting a detailed inspection. The current method of access to each bridge abutment is also recorded in the detailed inspection process and programmed for maintenance works with associated priority rating, if required.

The bridge owner is responsible for all management activities related to bridge access ways.

8.0 CONCLUSION

These guidelines for access requirements at bridge abutments shall be used for all sites to assess the need and level of intervention required to achieve safe access for inspections, maintenance and design/asset management visits.

Consideration shall be given to access provisions when any programmed works are to be constructed at the bridge site or more urgently if access is identified as unsafe.
APPENDIX 1

Site Specific Factors influencing the need for and the type of designed access to bridge abutments

1. Bridge environment – e.g. freeway, urban general, rural town, or rural remote. The potential or probability for random public proximity and usage.

2. Likelihood of public visitation. Such factors include remoteness, permanent water, parking or pull-off facilities, identifiable stopping and pull-off opportunity, open and straight geometry and scenic attraction.

3. Other alternative access points. The site may have steep and high embankments at the abutments, however, the approach embankments may be short and so safe access is available albeit on a longer track.

4. Embankment geometry – the height (length of slope) and the slope of the embankment become important factors in the type of access to be provided if there is no alternative access way.

5. The ground type or 'footing' is important. Loose or rounded material will require different consideration than heavier and more stable footing. Minor modifications to existing ground may be required.

6. Access ways require a minimum vertical clearance of 2 m, hence the track needs to be located with that constraint in mind.
APPENDIX 2
Design Flowchart

Consider Site Specific Factors

Is Access Way Required?

Y

Determine Slope of Access Way

Low Level Walkway
- Cleated path
- No handrail

Is Slope Steeper 1:3?

N

Moderate Level Stairway
- Steps
- No handrail

Is Slope Steeper 1:1.5?

Y

High Level Stairway
- Steps
- 2 post/rail handrails
- Lockable entrance

Is Slope Steeper 1:1?

N

Unsafe!! Alternative access required

N

Use Alternative Access Methods

Note 1: An access way should be designed to minimise visibility to the casual observer.
Note 2: Transportable temporary stairs that connect to permanent access ways may be an option to increase security and to minimise visibility.