May 2010 Newsletter

Footbridge Special Issue: *Why Are Unsuitable Bridges Being Installed?*

Contents

Unsuitable bridge needed bracing back to existing road bridge

Unsuitable gauge steel damaged by mower

Vibration and Load Requirements

The images above are a cause for concern. These pedestrian bridges were purchased on the basis of lowest price and, while the structure may have appeared satisfactory at the time of purchase, in our opinion they are not up to an acceptable standard. We urge purchasers to exercise extreme caution when specifying bridges to ensure that all tenderers meet minimum performance and safety standards. Three times in the last month we have had to deal with bridges specified as 3 kPa from potential purchasers. This practice has prompted this newsletter.

Ideally you should just be able call up AS5100 (Bridge Code) but we feel it is necessary that attention is drawn to the following performance requirements and specific reference is made to the following when calling footbridge quotations. Not many have access to the Code as a hardcopy costs over $700.

Vibration:

Get the vibration characteristics right and then basically everything else falls into place. The bridge must be designed so that the natural frequency is outside the problem vibration range which can be an annoyance in long span pedestrian bridges. You should specify at least 5 Hertz so it is far removed from a typical pedestrian walking speed. We find many specifiers are accepting of high vibration as they mistakenly think that it is normal, perhaps even acceptable. In addition, the stiffness of the decking influences the confidence a user has in such a structure. We confine decking movement to less than 1.7mm under a 100kg concentrated (foot) load which was a criterion from the original AS 1684 (Timber Framing Code).

Steel thickness:
While you can design a strong bridge with thin sections, it may not be sufficiently robust in service. While no minimum thickness is specified in the current Bridge Code, the 1976 NAASRA Bridge Code specified 6mm for sealed sections (no vent holes) and 4mm if effectively sealed. A thicker steel serves several purposes in facilitating a good weld and increasing zinc deposition on hot dipped elements. The nature of the hot dip galvanizing process is that a thicker metal attracts more zinc and that means a longer time to first maintenance. Steel greater than 5mm typically would be covered with 30% more sacrificial zinc that a section less than 5mm thickness. A thicker section also gives further leeway before maintenance of the coating as, many a time, rust starts at some less visible portion of the steelwork. Then thin sections can often rust-through very quickly by a process known as crevice corrosion.

Applied Loads:
There is NO allowance under AS 5100 for any reduction of the distributed load of 5 kPa until the element being designed is supporting an area greater than 85 m2.

Then typically it only reduces to 4 kPa for girders of 40m span bridges or longer. A lower load is only permitted for the footpath attached to a normal vehicular bridge and, in that situation, the footway area has to support a 4 tonne axle load anyhow, and that would tend to govern the design.

When a tractor has to cross the pedestrian bridge it has to be designed for it and that requires a wider bridge generally and a much heavier deck.


Unsuitable gauge steel needed additional plate to take the load as well as climbing toe holds on handrail

If an alternative maintenance vehicle crossing can be found or a load limitation posted or bollards to restrict vehicle access, then there is no guidance from that Code so we have to resort to AS 1170.1 (Loading Code) where a 4.5kN concentrated load is specified. This allows our bridges to carry a golf car or similar vehicle with no fuss.

Load Factor:
Most structural codes in Australia now have Limit State approaches to design, so loads have to be multiplied by a Load Factor. AS 5100 requires a load Factor of 1.8 but will permit 1.5 for bridges NOT over public roads or railways.

Design Methods:
Like the British Standard, AS 5100 specifies that a 'Through' bridge must have the compression element designed for restraint by the 'U Frame' method.Many designers are not aware that this significantly increases the 'effective length' of the top chord - typically double the nodal distance. [A 'Through' bridge is where the deck is at the bottom of the girder or truss. Almost all truss bridges are 'Through Bridges'.]

Barrier:
A normal bridge rail should be able to withstand 0.75 kN/m laterally and vertically (not crowd loading which increases to 3 kN/m). The stiffness specified is span (between posts) /800 which is difficult to achieve, especially with aluminium [low E value]. The barrier often becomes the most contentious part of a design. It needs to be higher and offset for cyclists and the Bridge Code requires it to be non-climbable. Some local authorities, recognising that typical fall heights of most pedestrian/cycle bridges are less than 4m, adopt the view that a railing comparable to the building code would suffice. That component then is not included in the Bridge Code certification.

Walking Track Structures:
If a bridge can be classsified as a Walking Track Structure (AS 2156.2), then the design load could be reduced to 4kPa but it would not comply with AS 5100. It would also have to support a concentrated load of 4.5kN. For non-urban locations with infrequent walkers (refer to AS 2156.1) as in remote sections of National Parks, a Class 3 track is possible. Such a structure requires a 3 kPa loading and a 1.4 kN (140kg) concentrated load provided it is not likely to be used as a viewing platform. The concentrated load is very similar to the 1.35kN load from the British Code, being a walker with a full backpack. Outdoor Structures Australia makes two types of bridges for Class 3 tracks - a segmental bridge that can be carried by a quad bike and assembled on site and a robust tube bridge that is designed to be carried fully complete by helicopter. Both of these can carry a quad bike with ease.

Flood Loads:
To reduce span and/or cost, many of our bridges have to be placed so low that a flood with inundate them. Most times flood forces are significant but the barriers can be modified to reduce both the load on the bridge and to minimize the increase in flood level upstream. Obviously catching debris is a problem for the daming effect and for the clean-up afterwards. Truss and suspension bridges are not appropriate in these situations.

Of course it goes without saying that these criteria and more are all addressed in an OSA footbridge making it the most robust on the market. These comments are directed to public/commercial bridges. A domestic bridge would simply have to comply with AS 1170.1 (loads) and its barriers comply with the BCA.

Timber Links

An outstanding bridge project by OSA
http://www.outdoorstructures.com.au/gallery.php?gid=95&SID=2

A selection of bridge projects by OSA
http://www.outdoorstructures.com.au/gallery.php?SID=2

Just a reminder of why you must get it right
http://en.wikipedia.org/wiki/Maccabiah_bridge_collapse

Use of Nailplates in Footbridges

Years ago we investigated how we might offer a lower priced footbridge. We thought this could easily be achieved by nailplating a truss together, just like a rooftruss.

We soon found a major problem; our nailplate supplier would not certify his product when used in that application and with good reason.

We resisted the temptation to offer a risky (but inexpensive) bridge and removed any nailplates from our own product.

The link below directs you to the advice we received at the time. Read what it says and then ponder the image above. The bridge, possibly a 3Kpa design when new, is down to half its design capacity!!

Nailplated bridge links

Letter from Pryda

http://www.outdoorstructures.com.au/pdf/nailplates_in_external_environment.pdf

Arched Footbridges

Bridges with curved girders give enhanced aesthetics but cause major problems when it comes to code compliance.

In today's society you simply cannot put a set of stairs where disabled access is needed. We have recently added a page to our website with a discussion of "arched" footbridges.

It contains information on when they can be used and how much arch can be achieved and still be code compliant. Follow the links below.

Arched Links

Arched Bridges
http://www.outdoorstructures.com.au/pdf/curved_bridges.pdf

Arched bridge projects
http://www.outdoorstructures.com.au/gallery.php?gid=23&SID=2

Ted Stubbersfield

Director OUTDOOR STRUCTURES AUSTRALIA

Phone 07 5462 4255

OUTDOOR STRUCTURES AUSTRALIA

E-Mail: ted@outdoorstuctures.com.au

Web:www.outdoorstructures.com.au

Phone: (07) 5462 4255

Fax (07) 5462 4077

Old College Road Gatton, Australia

PO Box 517

Gatton Q 4343

Australia

ABN 29 713 463 351