Composite Fibre Technologies (CFT)

DEMYSTIFYING THE AUSTRALIAN PEDESTRIAN DESIGN CODES

ANSWERS TO THE TOP 10 MOST FREQUENTLY ASKED QUESTIONS

1. Is the Australian Bridge Design Code AS 5100 necessary in all locations for FRP pedestrian boardwalks and bridges?
Generally speaking, no, AS 5100 has been designed with the approach for a one set of rules that fits all methods, in both material requirement and usage requirement. So, using this code you would require the same requirements whether your structure was in a very built-up area, that would expect to get crowded, (for example in the central business district of a capital city), compared with a structure in a park in an area not built up as much or in a national park where the number of users is expected to be a lot lower.

In using the approach to specify AS 5100 it should be considered whether this approach is required, for example is the pedestrian structure adjacent to major infrastructure roads and highways or is it realistic to believe that the structure could expect these loads over its lifetime. If this seems unlikely for the structure to see loads like this, it might be a better approach to have the design based on AS2156 and AS1170 instead.

2. What walking track class do I require for my FRP pedestrian boardwalk or bridge?
As AS2156.1 Walking track classification is quite ambiguous it can be very difficult to determine what track class is required for a structure as it requires some interpretation.

The key note to remember is that AS2156.1 codes reference minimum requirements, not absolute rules. As such, a Walking Track Class 3, (which has requirements of grades no greater than 1:10, plus generally less than 1.2m wide), can actually be designed to incorporate DDA Compliance, over-crowding, and vehicle access. The structure just needs to meet the conditions of a Track Class 3 as the bare essential. Where this system can get tricky, is when a structure needs to have DDA Compliance, or the alignment dictates that the width is over 1.2m wide. While these are minimum requirements for the structure itself, they don't actually mean that the structure is a higher Walking Track Classification (Class 1 for example). As these items are still meeting the minimum requirement for a lower track class, the classification can be reduced to help with the asset owner's needs or intended usage. The final Walking Track Class for a structure can be defined by the asset owner, as long as the final design does meet the minimum requirements of that Track Classification.

3. Do all DDA Compliant Structures need to be Walking Track Class 1?
Simple answer, no. All structures no matter what classification they fall into, can be designed for DDA compliance. Instead only Track class 1 structures must be designed for DDA compliance, whereas all other classifications should be investigated on a case-by-case basis for their suitability to cater to those people with a disability or mobility issues. If the track on either side of the structure is not suitable for egress of someone with a disability or mobility issues, then DDA compliance is deemed negligible, without a full upgrade of the approach paths. Examples of this would be structures with stairs in the approach that do not have an accessible ramp, or structures in difficult terrain such as beach accesses. Asset owners should ensure that DDA Compliance is achieved where practical, and where existing infrastructure can allow it, not just on Walking Track Class 1 structures.

4. Is Australian Standard 2156.2 still relevant to be used in the design of FRP pedestrian boardwalks and bridges despite being withdrawn?
Although AS2156.2 has now been classified as "Withdrawn" this "does not affect the impact of the document's availability, or public's ability to use the document" as quoted from the standards Australia website.

The website also goes on to clarify that "*It is still possible for a withdrawn standard to be used within an industry or reference by a government if they choose to do so. One reason for this may be because there are no replacement technical documents readily available.*"

And the example noted is a correct analysis when it comes to classifying the handrail types to be used, because although AS/NZS 1170.1 notes the loads as per AS2156 in appendix B of AS/NZS 1170.1. Handrail loads and determination of handrail types has not been noted anywhere else and this in one way that this code, AS2156.2, can still be used in design of structures.

5. Which code governs handrail compliance for FRP pedestrian boardwalks and bridges?

Essentially all applicable codes need to correlate equally, for example if you have a shared path the minimum requirement needs to be compatible with AS2156.2 and Austroads Guide for Cycling 6A, but if AS5100 needs to be considered both AS5100 and Austroads Guide for Cycling 6A should be considered. If the structure has not been designed for cyclists, then it only needs to consider AS2156.2.

6. What level of geotech is generally acceptable in the foundation design of your FRP pedestrian boardwalks and bridges?

An acceptable level of geotechnical information for bridge/boardwalk design is to have a proper soil profile to a reasonable depth where good/natural soil is found, along with the foundation design parameters such as bearing capacity and shaft adhesion for shallow and deep foundation where applicable. In case high lateral loads are predicted, and the structure is expected to be a few metres high above the ground/surface, the lateral soil stiffness will be required as well to help with the piles lateral design.

7. According to the codes when should you consider wave and flood modelling for your FRP pedestrian boardwalk or bridge?

Water forces should be considered on every structure that lies within the wave/flood zone of influence. This is generally assessed based on the historical data of previous wave/flood events and comparing the water levels with respect to the proposed level of the new structure.

It is critical to consider water loads in the structural design of a project as it can be the governing design force. In some cases the structure might look over-designed but it is generally due to considering a wave/flood event that is predicted to happen once in 500 years, yet in any year!

8. Do FRP structures need to comply with AS5100 requirements?

While FRP can be designed to incorporate AS5100 Design Criteria, typically lower specifications, such as a combination of AS1170 and SA2156 are used. This is due to the higher deflection criteria placed on AS5100 structures.

Allowable deflections are required for two main reasons, the first is comfortability of the user walking or cycling over the structure and the second is for long term lifespan of the material. As noted earlier AS 5100 has been designed to be a code with only one set of requirements to fit all structures and materials, and it is this design of the code that makes it more restrictive for materials like Fibre Reinforced Polymer (FRP). FRP can handle quite high loads and is generally designed for deflection first rather than strength like other materials. So, when you take a code like AS 5100 with its one case fits all method where it chooses to restrict deflections based on brittle materials that require lots of stiffness to ensure a long life span of 100 years as required by AS 5100, you end up with over designed members according to their strength requirement for materials that are more flexible and elastic like FRP.

Generally, most FRP structures are designed to AS1170 deflection limits even when designing as per AS5100 noted above the deflection limits are not so applicable to the material.

9. Is the 200kN lateral restraint within AS5100 applicable to FRP pedestrian boardwalks and bridges?

The minimum restraint load of AS 5100 clause 10 where it states that pedestrian bridges shall be capable of 200kN or 5% of the superstructure dead load whichever is greater of lateral support at the piles and abutments, is in a way a safety factor load generally applied only when there is no agreement of flood loads to be applied onto the structure. So, when imposed flood loads are known or there is an agreement on a flood load to be applied to a bridge this clause is not necessary.

If this clause needs to be applied generally it has additional cost implications due to the lightweight nature of the glass fibre material and the height of this load is generally much higher than most known flood forces.

10. How do these three codes apply to Queensland Main Roads and Queensland Transport projects?

Transport and Main Roads of Queensland (TMR) currently is using a similar approach to that of AS 5100 where they have chosen for a one set of rules for all approach. This approach is only necessary for structures that will become TMR assets or are assets that are even partially funded by TMR. TMR specifications can be found in the "TMR Technical Guideline for Designers of Pedestrian and Cyclist Bridges to Achieve Value for Money (2018)".