Construction of houses in a flood hazard area

P2.1.2

The Performance Requirements of the National Construction Code (NCC) can be met using either a Performance Solution, a Deemed-to-Satisfy (DTS) Solution or a combination of both solutions. The following demonstrates a performance-based design process, aligning with the ABCB's Performance Solution Process guidance document.

Scenario

A homeowner wishes to construct a new dwelling in a designated flood hazard area. Investigation has revealed that the flow velocity for the defined flood event (DFE) exceeds the limits for a DTS Solution using the ABCB's Standard "Construction of Buildings in Flood Hazard Areas". The design consultant has determined that the best approach is to develop a Performance Solution, in relation to the structural design only, based on an appropriate international standard.

Prepare a performance-based design brief

What are the design objectives?

The design objective is to ensure that the house does not collapse during the DFE. Investigation has shown that the flow velocity during the DFE exceeds the limits of the DTS Provisions outlined in the ABCB's Standard "Construction of Buildings in Flood Hazard Areas", meaning a Performance Solution is required.

Who should be consulted?

The building designer, the client, the structural design engineer, the builder and the appropriate authority are all stakeholders in this scenario. If reliable flood information covering flow velocity and depth of inundation for the subject site is not available, a specialised hydraulic consultant would most likely also need to be engaged to identify the flow velocities and depth of inundation during the DFE.

What is the basis of the Performance Solution?

The Performance Solution relating to structural adequacy needs to be developed by determining the appropriate flood design actions in accordance with an appropriate international standard. The ABCB's "Construction of Buildings in Flood Hazard Areas" Handbook references the American Society for Civil Engineers and the Structural Engineers Institute ASCE/SEI 7-05 "Minimum Design Loads for Buildings and Other Structures" as a useful source for flood load calculation.

What evidence is proposed?

A design report outlining the assumptions, procedure, design loads and design methodology used to determine the flood actions, as well as structural resistance to flood actions (structural resistance can be determined by the Australian Standards referenced in the DTS Provisions once flooding design loads have been determined).

Which DTS Provisions are applicable?

3.10.3 Flood hazard areas.

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Which Performance Requirement is applicable?

P2.1.2 Buildings in flood hazard areas

(a) A building in a *flood hazard area* must be designed and constructed, to the degree necessary, to resist flotation, collapse or significant permanent movement resulting from the action of hydrostatic, hydrodynamic, erosion and scour, wind and other actions during the *defined flood event*.

(b) The actions and requirements to be considered to satisfy (a) include but are not limited to—

(i) flood actions; and

(ii) elevation requirements; and

(iii) foundation and footing requirements; and

(iv) requirements for enclosures below the *flood hazard level*; and

(v) requirements for structural connections; and

(vi) material requirements; and

(vii) requirements for utilities; and

(viii) requirements for occupant egress.

Note: for brevity, the applicable Performance Requirements and DTS Provisions have been limited. When determining which Performance Requirements and DTS Provisions are applicable, consideration should be made to the latest edition of the NCC. This solution may also impact other Performance Requirements and DTS Provisions and must be considered in accordance with Part A2 of NCC 2019.

Carry out analysis

Which Assessment Methods are the most suitable and where can they be found?

Assessment Methods are listed in A2.2 of Part A2 in Section 1 of NCC Volume Two and state that any Assessment Method, or combination of them, may be used to determine that a solution complies with the Performance Requirements. In this scenario, Expert Judgement is used as the Assessment Method.

The structural engineering consultant develops an appropriate design incorporating the flood design load as determined by the procedure outlined in the international standard ASCE\SEI 7-05. This aligns with Evidence of Suitability in A5.0 of Part A5 in Section 1 of NCC Volume Two, as the engaged engineer is a registered professional engineer and will submit an appropriate report with design calculations for consideration by the appropriate authority.

Some of the points of consideration for the design engineer are:

- Hydrostatic flow design action;
- Hydrodynamic flow design action;
- Buoyancy design action;
- Overturning of the structure due to flow actions;
- Scour resistance of footing and other structural related items;
- Appropriate selection of materials; and
- Structural stability of individual members.

Evaluate results

The design engineer uses their design calculation to develop detailed documentation. Once developed, this documentation is issued to the building designer, client and appropriate authority, along with the design report and calculations supporting the Performance Solution.

Prepare a final report

What should be in the final submission?

The final design report contains:

- A summary of the Performance Solution, including:
  – Flood velocity and depth information from relevant source (authority or consultant);
  – A summary of design findings;
- Detailed calculations of structural design; and
- Design documentation.