NUMERICAL INVESTIGATION INTO THE BEHAVIOUR OF FLOODWAYS DURING EXTREME FLOOD EVENTS

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Australian floodway design guidelines exclusively consider hydraulic principles. Comprehensive analysis of floodway failure mechanisms has exposed deficiencies demanding the need to investigate the structural adequacy of floodways to enhance resilience during extreme flood events.

RESEARCH INTEREST

The severity of flood events in the Lockyer Valley Region has become more prevalent in recent years causing catastrophic failure to floodway superstructures. A recent event which had devastating consequences on the built environment causing loss of life was the Lockyer Valley floods of January 2011.

RESEARCH AIMS

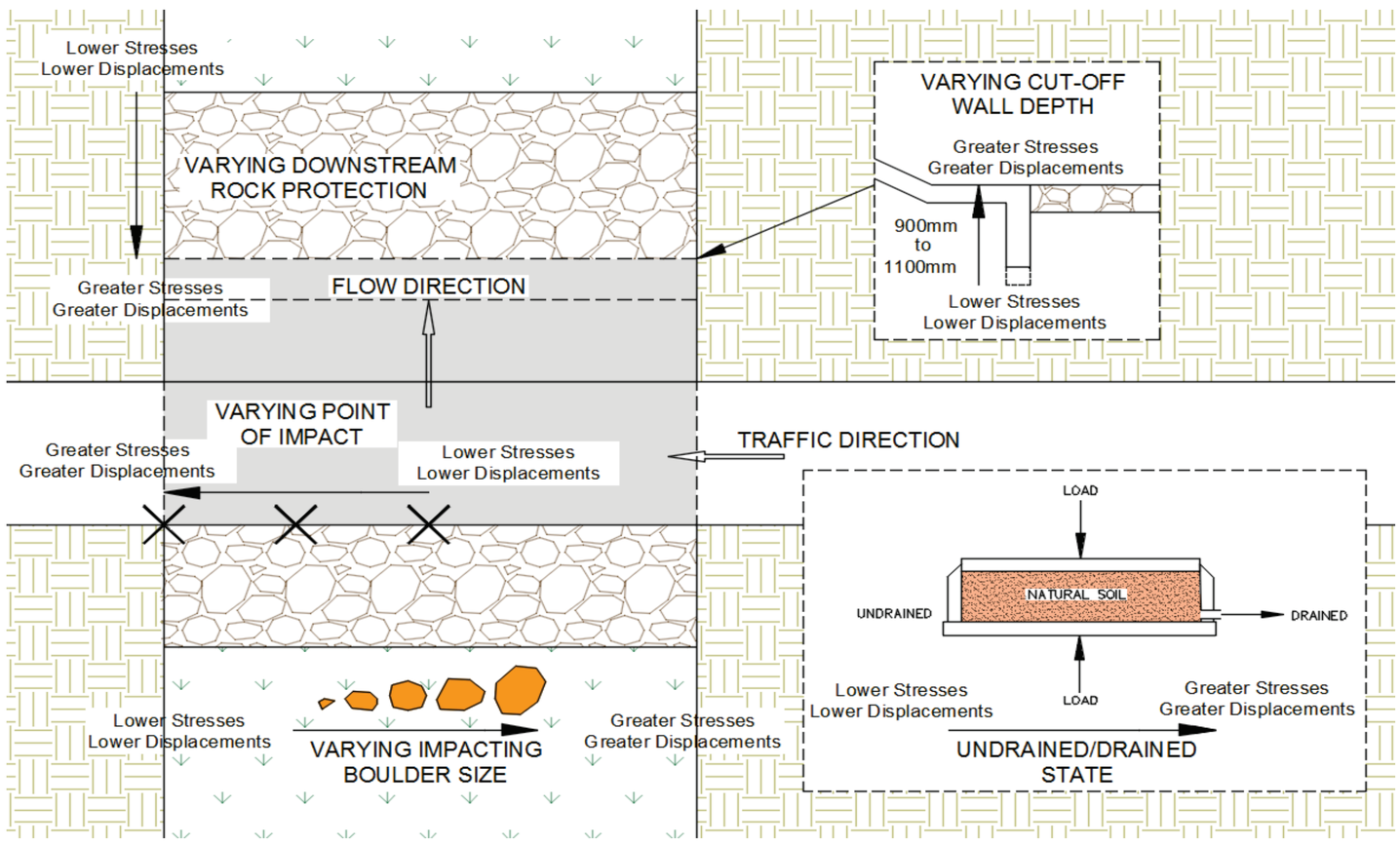
- Review the geometric and loading factors contributing to floodway failure.
- Develop a design process that satisfies strength and serviceability requirements for floodways under extreme flood loading.
- Integrate the proposed structural analysis outcomes into the current hydraulic design methods recommended by Australian design guidelines.

METHODOLOGY

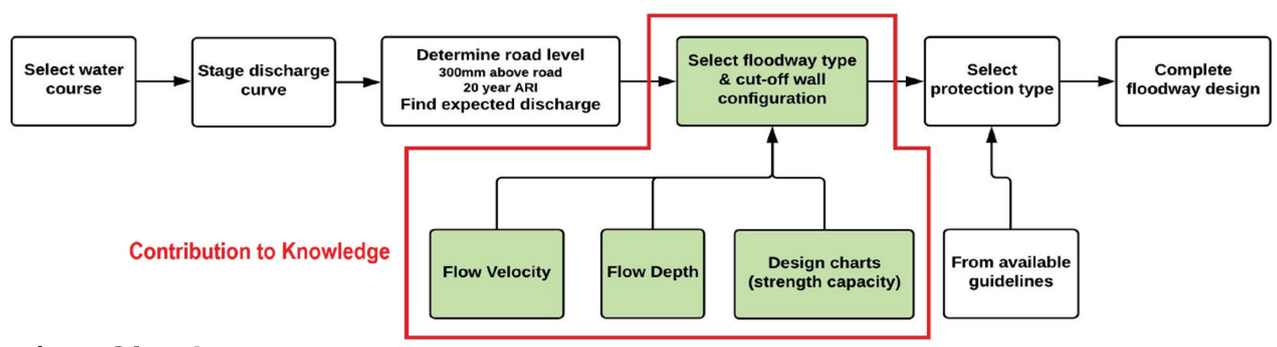
1. Select a range of standard engineering floodway types.
2. Construct detailed 3-dimensional finite element models of the floodway types.
3. Perform parametric finite element analysis to determine loading combination and geometric factors that cause the floodway types to be most susceptible to damage.
4. Develop design charts for design bending moment (M*) and design shear force (V*).

RESEARCH FINDINGS & OUTCOMES

Impact loading applied in reference to AS 5100.2:2017 consistently yielded the highest stress and displacement results for all loading cases.

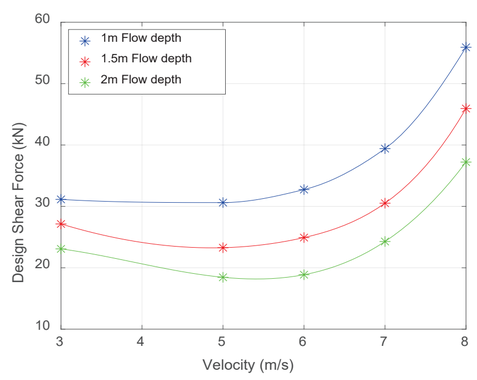


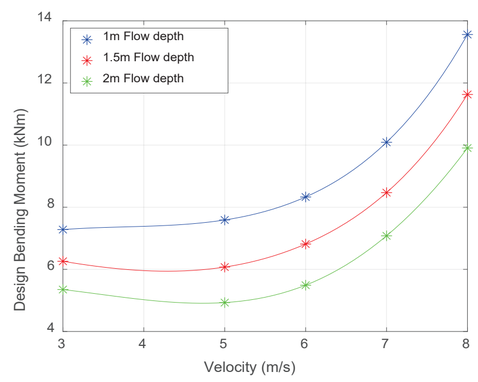
Integrated Design Procedure



Design Charts

Strength capacity charts assembled based on the worst case loading combination. M* and V* values can be referenced for different soil types, flow velocities and depths enabling accurate design of structural elements in reference to AS 3600.





CONCLUSION

Current floodway design presents structural vulnerability for a number of AS 5100.2:2017 flood loadings. This research, which remains ongoing seeks to present a finite element modelling approach to improve floodway resilience through a simplified structural design method and provide a procedure to integrate structural analysis outcomes into current hydraulic design processes.

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