

3D Printing Technology

Application in Resilient Construction

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3D Printing Technology offers a promising pathway toward disaster-resilient housing, but its effectiveness depends on optimized wall geometries, reliable structural performance, and validated design strategies.

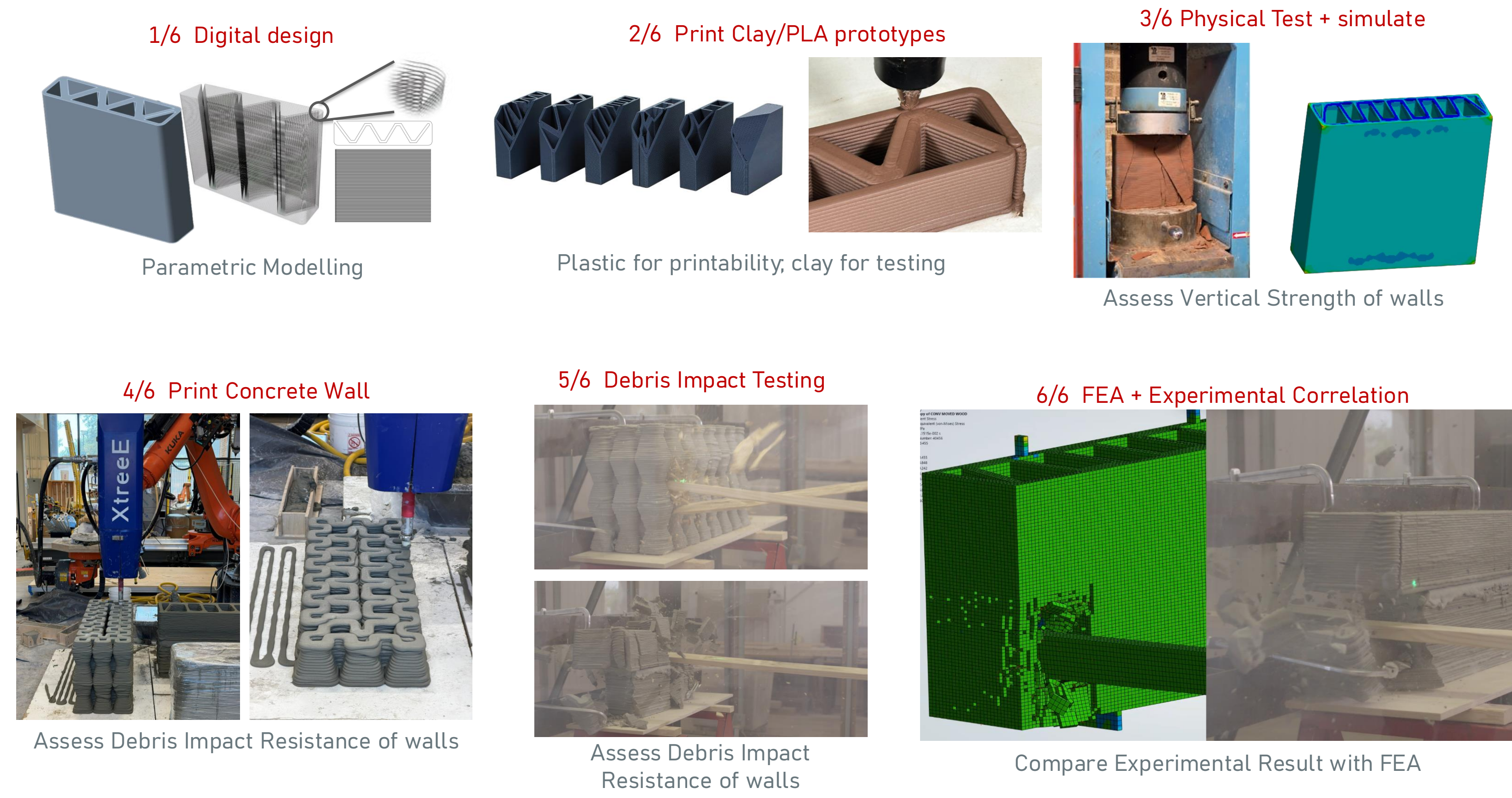


Introduction

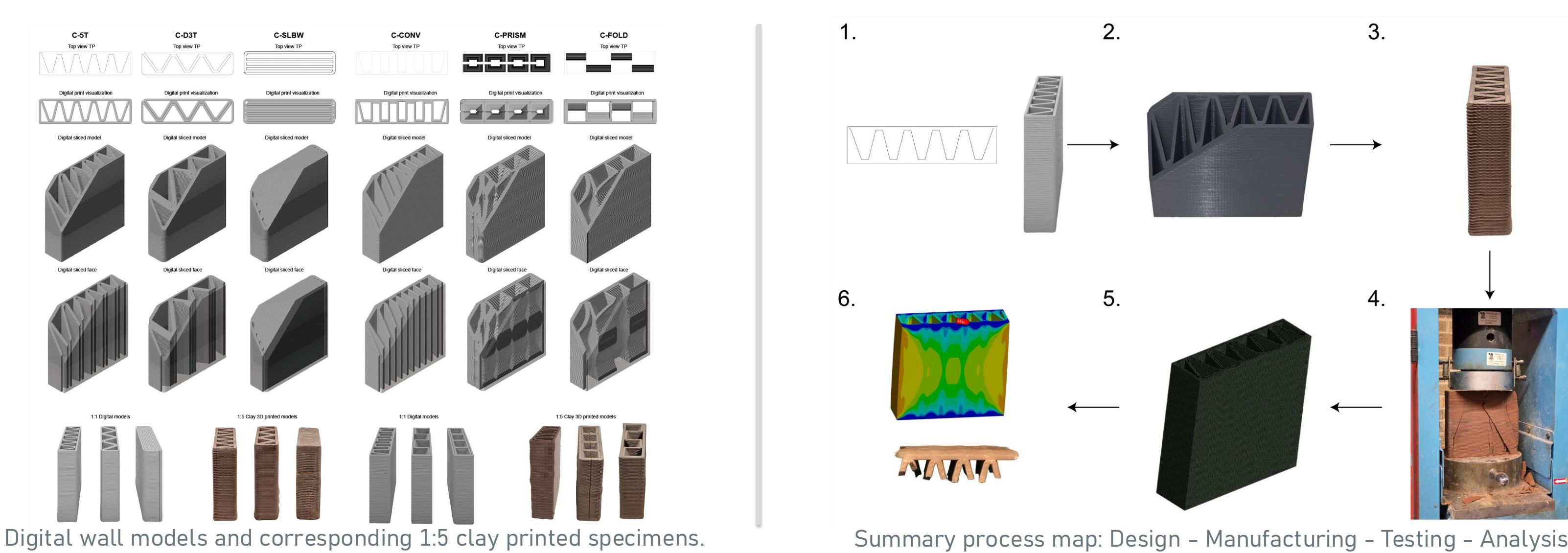
The increasing frequency and severity of natural disasters highlight the need for innovative construction methods that improve structural resilience, efficiency, and adaptability. Three-dimensional (3D) printing offers promising opportunities through automated fabrication, geometric flexibility, and efficient material utilization. However, its application to disaster-resilient construction remains insufficiently understood, particularly regarding the relationship between design, fabrication, and structural performance under extreme loading.

This research investigates the potential application of 3D printing technologies (3DPT) toward disaster-resilient construction by integrating various technologies, materials, and evaluation methods, including computational design, multi-material prototyping, experimental testing, and finite element analysis (FEA). Through this integrated approach, the study examines structural behavior, failure mechanisms, and debris-impact resistance to assess the opportunities, limitations, and potential contributions of 3DPT to disaster-resilient housing.

Overall Methodology



Initial Geometry Performance Evaluation (3D Ceramic Printing)



Conclusions

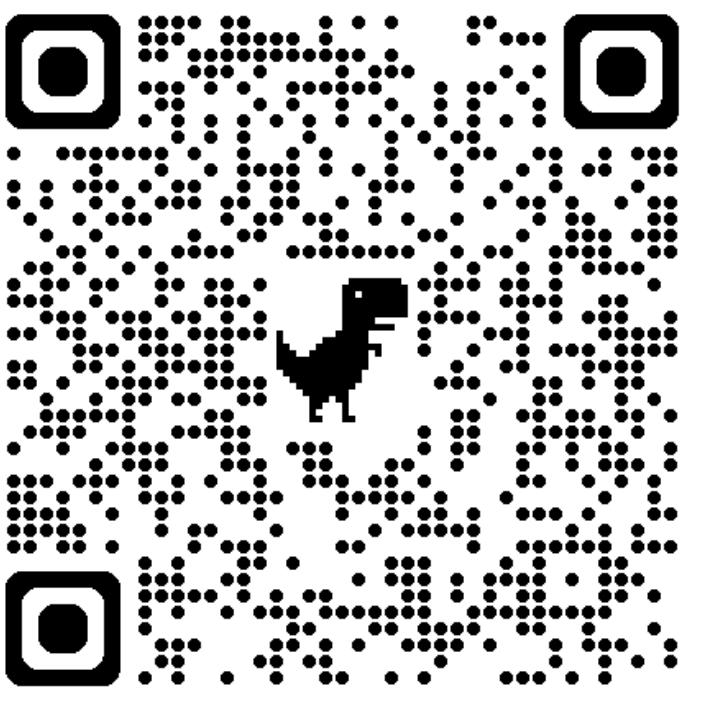
- PLA and ceramic prototyping enable effective screening of wall geometries before concrete fabrication.
- Combining interconnected internal geometries with nonplanar surfaces offers potential for improved structural resilience.
- This research establishes a systematic framework for developing and evaluating disaster-resilient 3D-printed wall systems.

Further Reading

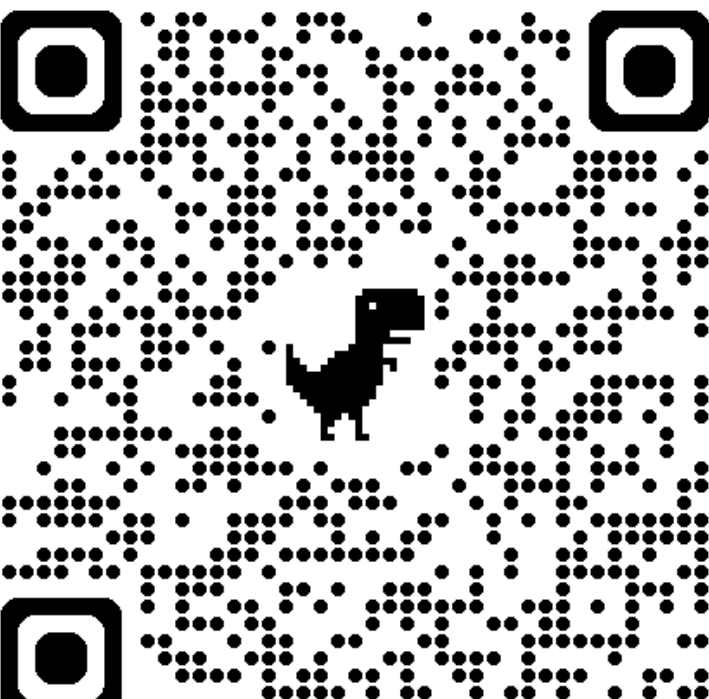
Advancing sustainable and disaster-resilient housing through 3D printing technology: A systematic review



Early Performance Evaluation of 3D Printed Concrete Walls Using Scaled Prototypes Simulation



Debris Impact Resistance of High-Performance 3D-Printed Concrete Wall Systems



References

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- Totsawat Daungwilailuk, Phoosak Pheinsusom, and Withit Pansuk. 2021. Uniaxial load testing of large-scale 3D-printed concrete wall and finite-element model analysis. Construction and Building Materials 275, (March 2021), 122039. <https://doi.org/https://doi.org/10.1016/j.conbuildmat.2020.122039>

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