



## Project Overview

- Exploring innovative methods to understand discharge from flexible intermediate bulk containers (FIBCs).
- Integrating experimental, theoretical, and numerical approaches to enhance comprehension of FIBC discharge phenomena.
- Investigating industry challenges such as arching, and ratholing to improve inefficiencies in material handling.



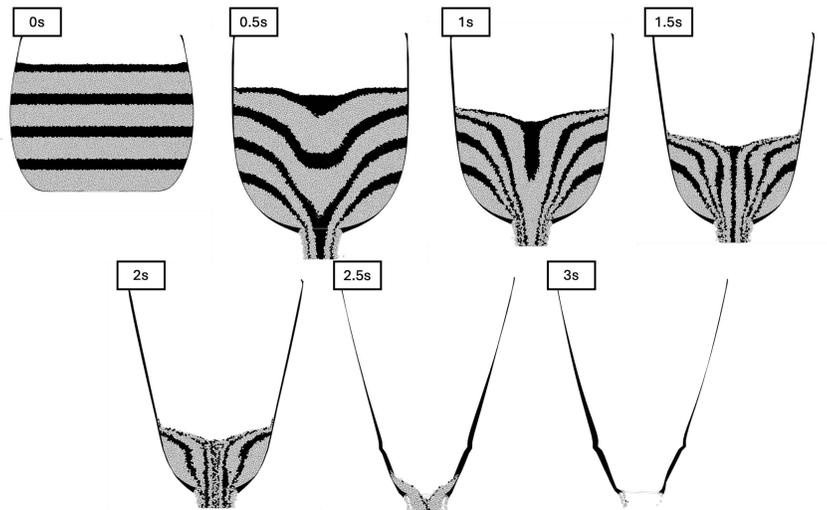
## Experimental Testing

- '2D' Rig designed, manufactured and commissioned.
- Testing on Plastic Beads – cohesionless.
- Testing on Sand – cohesive.
- Comparisons with a rigid bin (drawdown rig) were done.
- Results with cohesive material have shown, increase in consolidation stresses when compared with rigid.

Moisture Content	130 mm Opening		215 mm Opening	
	Flexible	Rigid	Flexible	Rigid
2.4 %				
7.2 %				
Outlet Size	50% Full	75% Full	100% Full	
165 mm				
190 mm				
215 mm				

## Numerical Modelling - DEM

- Bonded-particle models utilised to simulate the flexible walls of FIBC bags.
- Validation of simulations through comparison with experimental results.
- Calibrated simulations demonstrate strong agreement with observed flow behaviour.
- Calibration tests conducted:
  - Shear box testing – calibrating to residual mass and internal shear angle.
  - Drawdown tests – calibrating to residual mass, discharge rate, dynamic angle of repose, and drawdown angle.
- Ongoing investigation of contact models to accurately represent cohesive powder interactions.



## Next Steps

- Characterisation of selected bulk materials to determine key flow and handling properties.
- Calibration and simulation of cohesive powders, incorporating advanced contact models to improve accuracy.
- Final design and commissioning of a full-scale 3D experimental rig for testing flexible intermediate bulk containers (FIBCs).
- Investigation of analytical approaches, including Jenike's flow theory and related methodologies.

