

Predicting Powder Flow from Containers with Flexible Walls

Annual General Meeting 2024

Centre for Bulk Solids and Particulate Technologies (CBSPT)
In association with TUNRA Bulk Solids (TBS)
The University of Newcastle, Australia

Project Overview



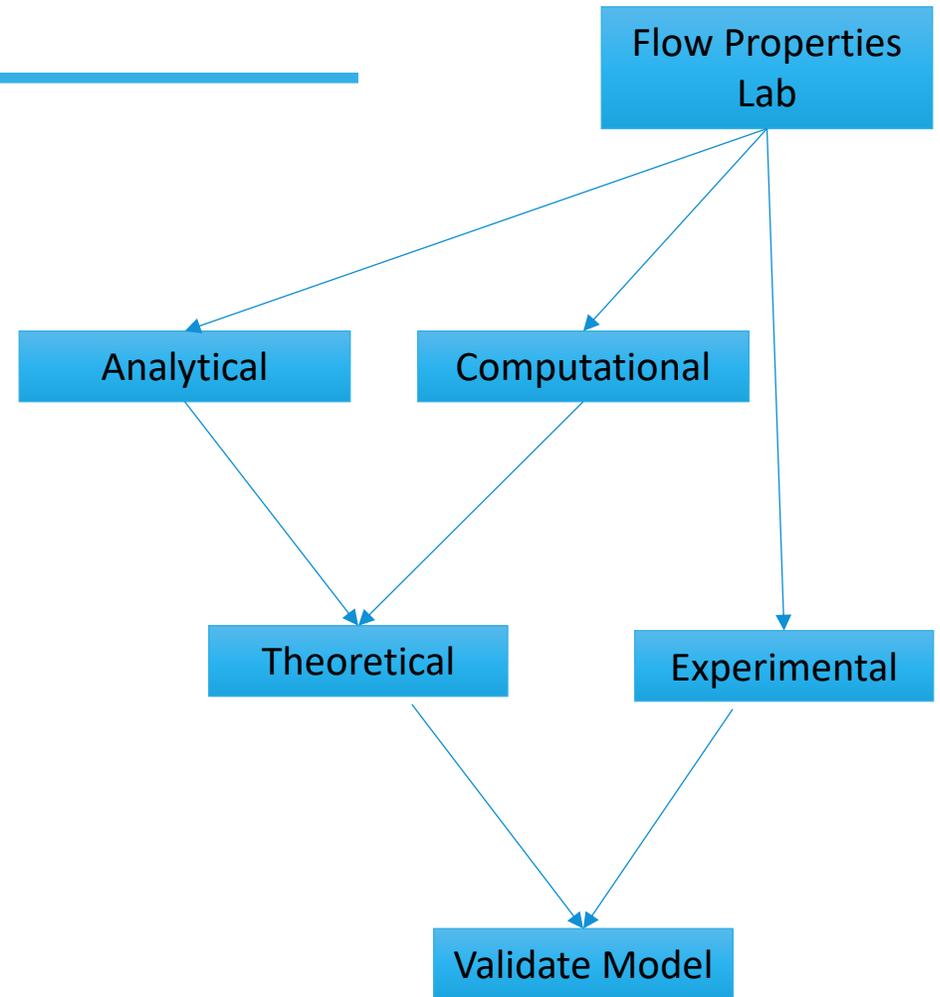
First Annual Meeting



Project commenced in February upon enrolment of the PhD student



Ambitious Plan



Survey Results



Initial survey distributed amongst members



Project Survey, AGM involvement requested



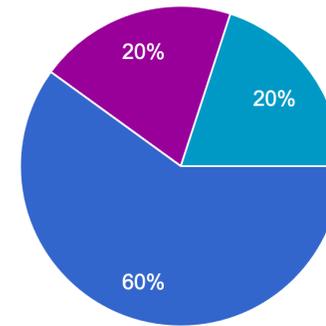
Nothing we didn't expect, but gave us valuable insight into some of the issues



Common issues, cohesive arching, ratholing, time consolidation

Question 10: What does your company use to discharge FIBC?

5 responses



- Gravity
- Screw
- Conveyor
- Full Dump
- Gravity and screw
- big bag discharge stations with massaging / punching system

Literature Review

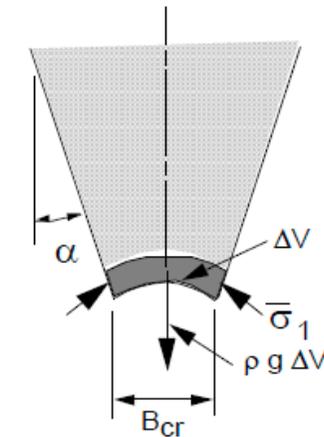
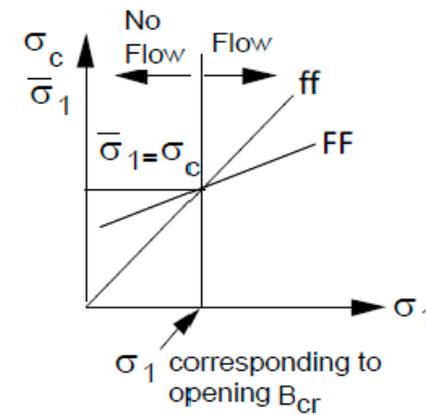


AS 3774 Supp1—1997

AS 3774 Supplement 1—1997

Loads on bulk solids containers—
Commentary

(Supplement 1 to AS 3774—1996)



$$\psi = 1 - \alpha$$

$$\alpha = \frac{E_s R}{E_w t}$$

Preliminary Observations of Discharge

Early experimental trials, have been conducted.



Numerical Approaches

Assessing the feasibility of numerical approaches for visualization, validation, verification, and prediction:

Finite Element Analysis (FEA):

Accurately predicts stress distribution and deformation.

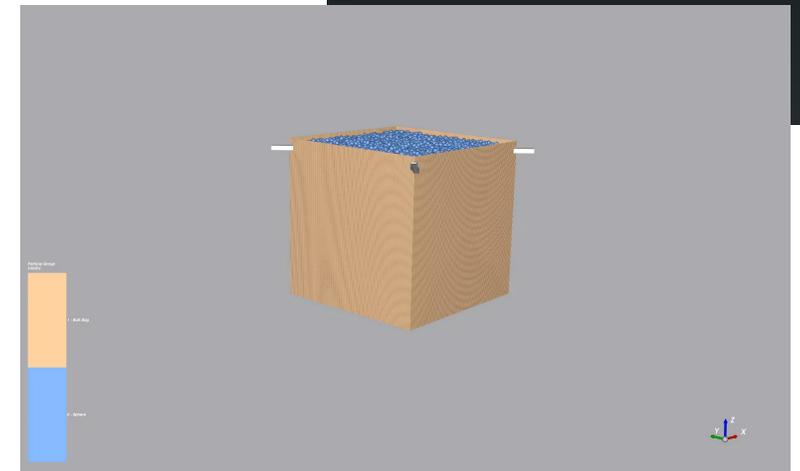
Simplifies analysis by modelling bulk material as a continuum, focusing on macroscopic properties.

Discrete Element Method (DEM):

Modelling individual particles.

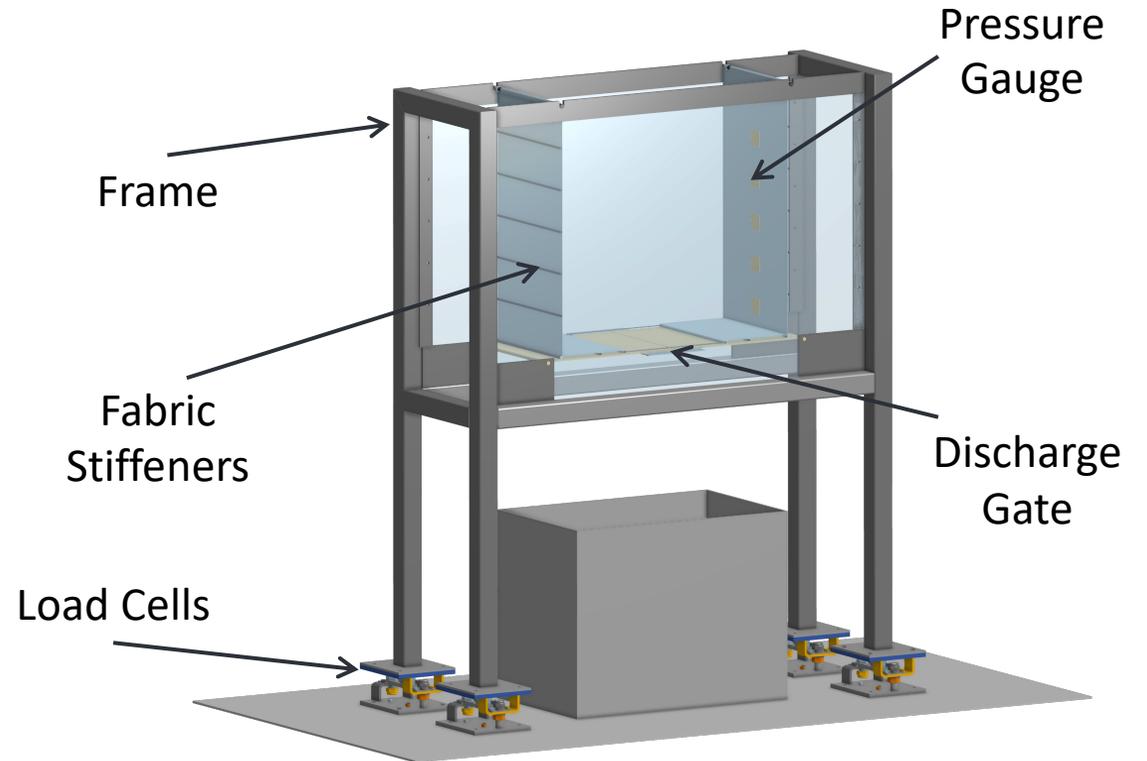
Captures collisions, friction, and cohesion effects comprehensively.

Modelling FIBC as a "Particle Shell" or Boundary.



Experimental Approach

- Early preliminary testing has underscored the necessity of constructing a scaled model.
 - 2D Visualization of flow regimes
 - Quicker repeat testing
 - Testing both fill and discharge scenarios, providing a flexible test bed
 - Understanding our needs prior to Phase 2 rig design and construction
- Commissioning of the framework is in progress
- Welcoming feedback to refine experimental aspects
- Testing slated to begin later this year



Next Steps

