

MiAS: Image Analysis to Improve Routine Monotonic BMD Testing

SEAUPG 2025
Wed Nov 19, 3:30 PM
Charleston

Andrew Cooper

MiAS

Contents

- Background on BMD tests
- IDEAL CT — *just because it is the test most people have an interest in Louay*
- Image analysis
- Videos, outputs and results
- Future work

MiAS

Simple tests



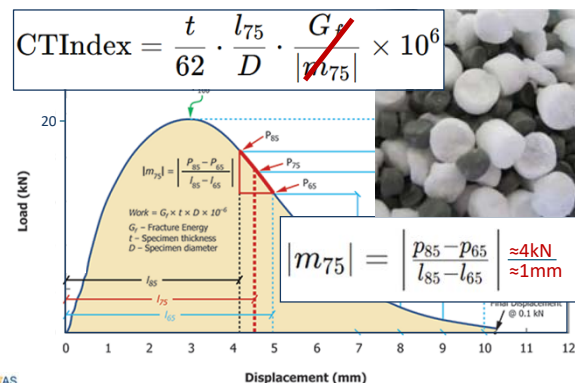
MiAS

BMD tests

Positive	Negative
Simple to run	High CoV
Fast	PMB performance
Reliable equipment	
Simple specimen prep	
Inexpensive equipment	
Index output	

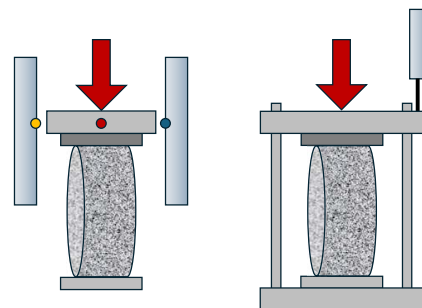
MiAS

CT Index

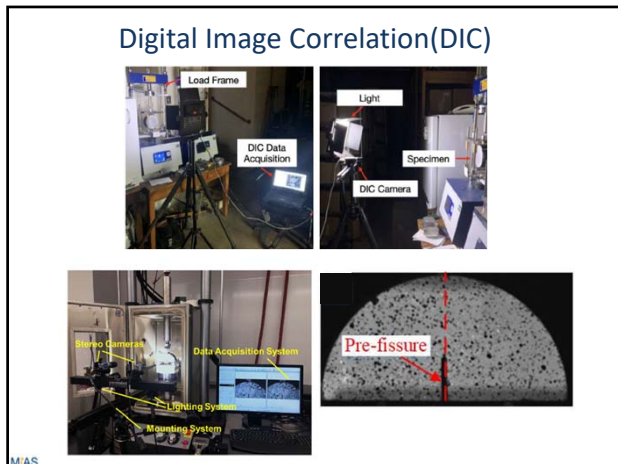
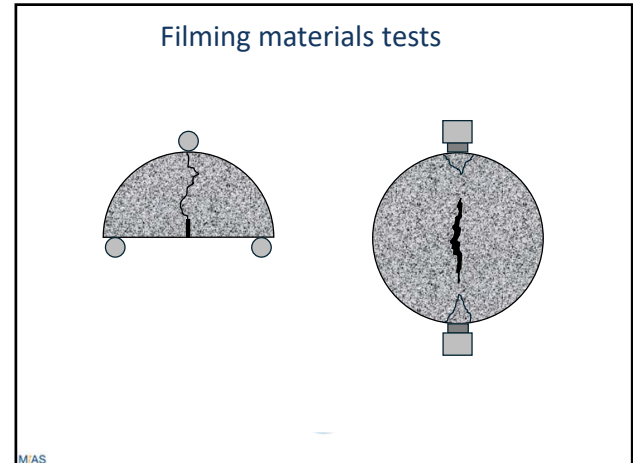
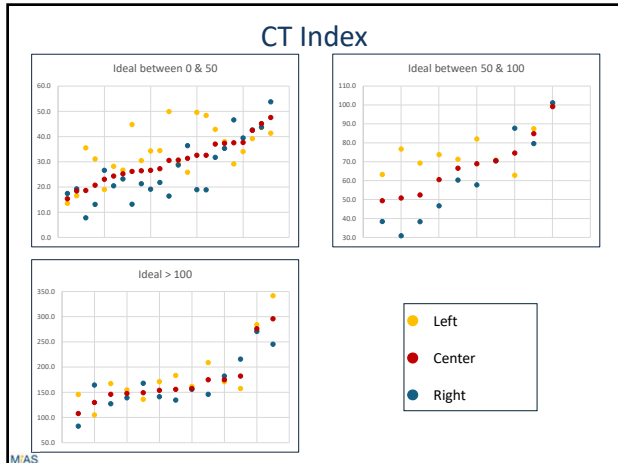


MiAS

Test frames

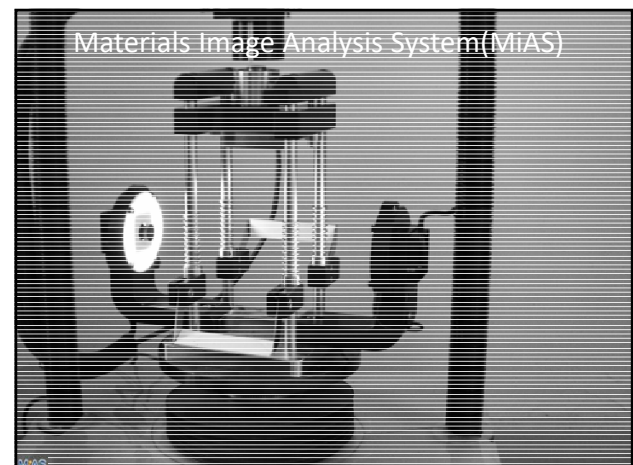
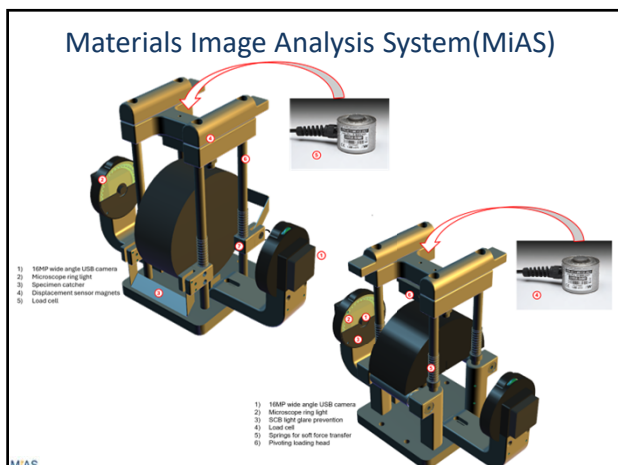


MiAS



Digital Image Correlation(DIC)

Positive	Negative
Full-field strain	Complicated setup
Non-contact	Speckling
High accuracy	Expensive
Virtual gauges	Scale
High speed cameras	Only one side filmed

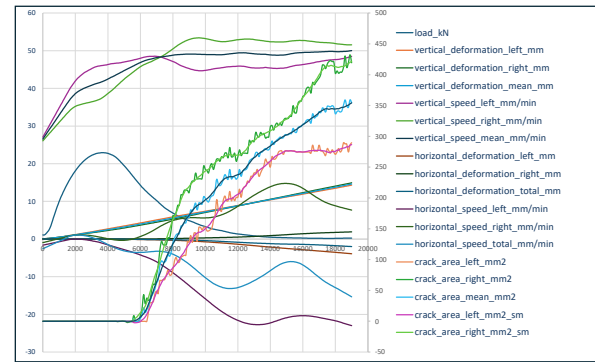


Standard dot pattern



MAS

Standard output



MAS

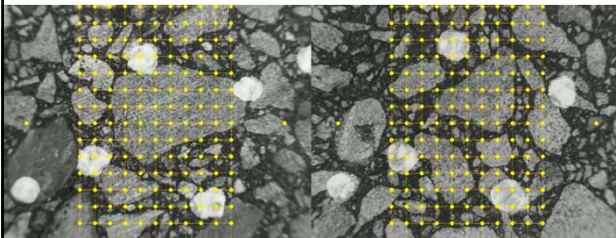


SCB dots



MAS

20 x 26mm grid

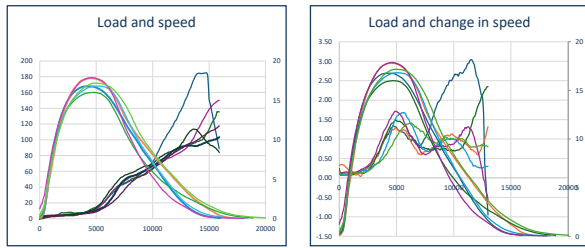


MAS



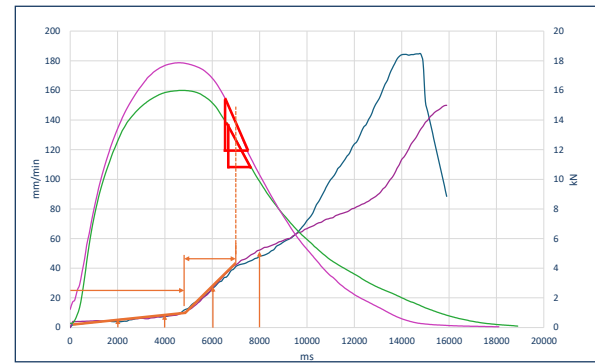
MAS

Possible metrics



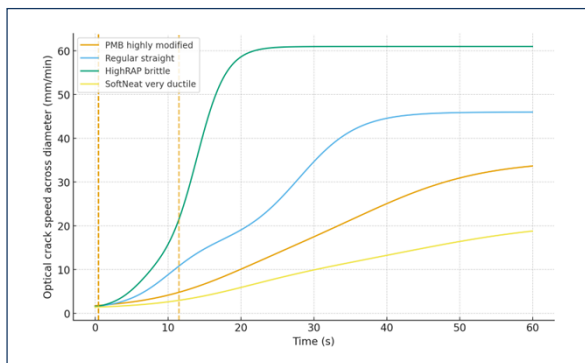
MAS

Metrics



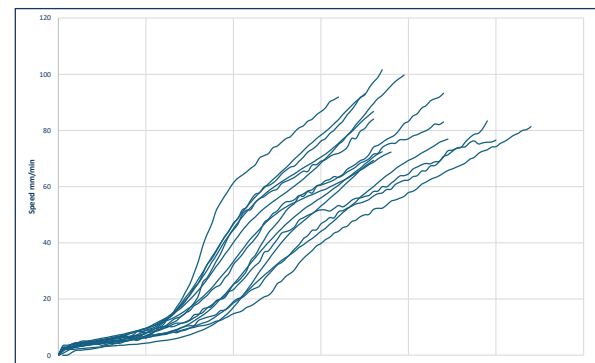
MAS

Speed curves



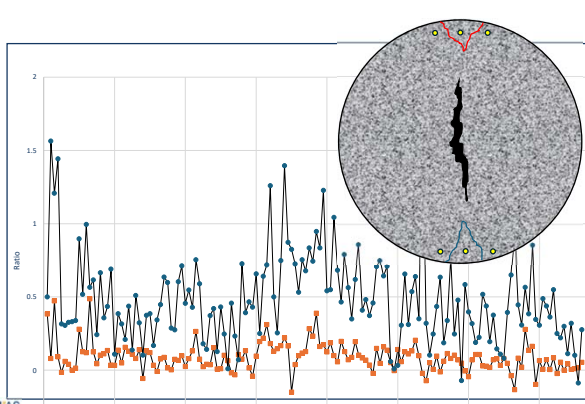
MAS

Speed curves



MAS

Indentation at loading strips



MAS

The near future



MAS

Summary

- **BMD is perfect for image analysis** – current indices *infer* cracking from load; we can now measure the actual crack on both sides.
- **Horizontal speed curves could be key** – they separate densification, micro-crack and macro-crack phases and could link to fatigue / field performance.
- **Scale is a massive advantage** – thousands of routine BMD tests per year can feed image-based models; DIC can't run at that throughput.
- **Assess crack paths in SCB tests** – relating the crack path to aggregate structure and binder can explain why “similar” mixes behave differently.
- **Just filming the tests reduces CoV** – video helps flag bad tests, machine issues and the cause of outliers.

MEASURE ACTUAL CRACKING IN CRACKING TESTS

ONE SIDE OF THE SPECIMEN DOES NOT TELL THE STORY

MIAS

Thanks to

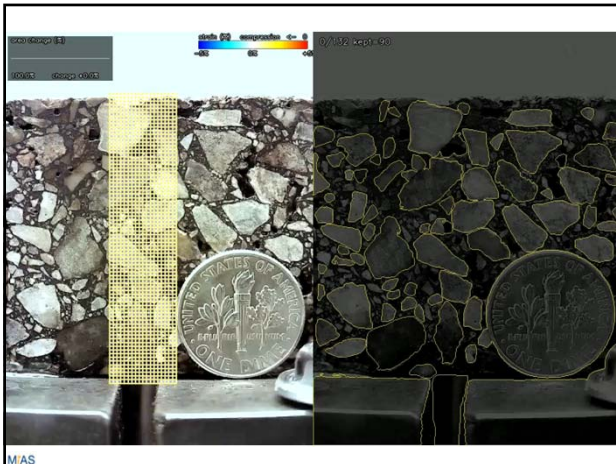


**Jill Baumgardner
Brian O'Toole**



MIAS

MIAS@AndrewBcooper.com



MIAS