

Mechanical Testing

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IN CONFIDENCE TO THE CLIENT

REPORT NO: 20-0682

COMPRESSIVE LOAD TESTING OF “ACE GREY FOAM PANELS”

CLIENT: **ACE POLYSTYRENE PRODUCTS PTY LTD**
2/44 HARLEY CRESCENT
CONDELL PARK NSW 2200

DATE OF TEST: JULY 8TH - JULY 9TH 2020

DATE OF REPORT: JULY 17TH 2020

TEST SYNOPSIS:

A consignment of polystyrene foam panels, designed for use as void forming systems in concrete construction, was delivered by the client to the MTS laboratory for testing (see Fig.1). At the request of the client, the panels were to be tested in compression for the determination of strength and stiffness performance attributes.

The panels were supplied in three (3) thickness variations: 60, 100 & 150 mm. For each thickness, five (5) repeat tests were performed on separate samples.

Compression tests were also conducted on 100 and 150 mm panels vertically stacked to form an assembled cell with an overall thickness of 210 mm. Two (2) repeat tests were performed on the single stacked configuration.



FIG.1
TEST ITEMS

TEST ITEMS:

Upon arrival at the laboratory, the following details and nominal dimensions were recorded:

Product I.D: *Ace Grey Foam Panels*
Material: *High Density Polystyrene (as specified by the client)*
Dimensions: *600 mm × 600 mm (Length × Width)*
Test Panel Thickness: *Panel Type (1) – 60 mm*
Panel Type (2) – 100 mm
Panel Type (3) – 150 mm
Stacked Configuration – 60 + 150 = 210 mm Overall Thickness

TEST PROCEDURE:

For each test, a polystyrene panel was installed centrally onto the flat steel baseplate of a universal testing machine (UTM). A rigid 610 × 610 mm compression platen was then positioned over the specimen in order to deliver force across the entire face of the void former (see Fig.2). Compressive load was applied at a constant rate up to a peak force of 40 kN (\approx 4077 kg). Compressive force and the UTM actuator displacement were recorded autographically throughout testing using a computerised data acquisition system.



FIG.2
INDIVIDUAL PANEL TEST SET-UP



FIG.3
210MM STACKED PANEL CONFIGURATION

TEST RESULTS:

The statistical results for the individual and stacked panel configurations are provided in Tables 1 to 4. A summary of the test results is presented in Table 5.

As per the results tables, the yield loads are coincident with the limit of proportionality (LOP), whereby this is the approximate point at which the load vs displacement curves depart from linearity.

Load versus Displacement Test curves are provided in Appendix A.

Pressure versus Displacement Test curves are shown in Appendix B.

TEST COMMENTS:

The ACE GREY FOAM PANELS were observed to exhibit similar load versus displacement behaviour. All specimens initially showed linear elastic response to an applied load in the range of 18–23 kN. A reduction in stiffness was then observed up to the peak applied force of 40 kN.

The 60 mm thick panels were recorded to be the stiffest under compressive loading. A general trend was observed, whereby the compressive stiffness of the panels decreased as the thickness of the sample under test increased.

Upon the completion of testing, a post-test visual examination of each sample was performed. No signs of splitting or rupture of the samples were observed.

Specimen I.D.	Compressive Stiffness (kN/mm)	Compressive Stiffness (kPa/mm)	Compressive Stiffness per Square Metre (kg/m²/mm)	Yield Load (kN)	Yield Load (kg)	Yield Load (t)	Yield Load per Square Metre (kg/m²)	Yield Pressure (kPa)
60 mm - #1	13.9	38.6	3936	21.9	2232	2.23	6201	60.8
60 mm - #2	13.8	38.3	3908	21.8	2222	2.22	6173	60.6
60 mm - #3	17.1	47.5	4842	22.8	2324	2.32	6456	63.3
60 mm - #4	14.6	40.6	4134	20.8	2120	2.12	5890	57.8
60 mm - #5	15.9	44.2	4502	23.0	2345	2.34	6513	63.9
Average	15.1	41.8	4264	22.1	2249	2.25	6246	61.3
Standard Deviation	1.4	3.9	401	0.9	90	0.09	250	2.5

**TABLE 1
60MM PANELS: TEST DATA**

Specimen I.D.	Compressive Stiffness (kN/mm)	Compressive Stiffness (kPa/mm)	Compressive Stiffness per Square Metre (kg/m²/mm)	Yield Load (kN)	Yield Load (kg)	Yield Load (t)	Yield Load per Square Metre (kg/m²)	Yield Pressure (kPa)
100 mm - #1	13.1	36.4	3709	22.0	2243	2.24	6229	61.1
100 mm - #2	11.9	33.1	3370	21.3	2171	2.17	6031	59.2
100 mm - #3	14.7	40.8	4162	23.0	2345	2.34	6513	63.9
100 mm - #4	12.0	33.3	3398	22.9	2334	2.33	6484	63.6
100 mm - #5	14.4	40.0	4077	23.5	2396	2.40	6654	65.3
Average	13.2	36.7	3743	22.5	2298	2.30	6382	62.6
Standard Deviation	1.3	3.6	370	0.9	90	0.09	249	2.4

**TABLE 2
100MM PANELS: TEST DATA**

Specimen I.D.	Compressive Stiffness (kN/mm)	Compressive Stiffness (kPa/mm)	Compressive Stiffness per Square Metre (kg/m²/mm)	Yield Load (kN)	Yield Load (kg)	Yield Load (t)	Yield Load per Square Metre (kg/m²)	Yield Pressure (kPa)
150 mm - #1	10.3	28.6	2917	21.6	2202	2.20	6116	60.0
150 mm - #2	8.9	24.7	2520	20.2	2059	2.06	5720	56.1
150 mm - #3	8.5	23.6	2407	20.9	2130	2.13	5918	58.1
150 mm - #4	8.9	24.7	2520	21.8	2222	2.22	6173	60.6
150 mm - #5	11.1	30.8	3143	20.9	2130	2.13	5918	58.1
Average	9.5	26.5	2701	21.1	2149	2.15	5969	58.6
Standard Deviation	1.1	3.1	314	0.6	65	0.07	181	1.8

TABLE 3
150MM PANELS: TEST DATA

Specimen I.D.	Compressive Stiffness (kN/mm)	Compressive Stiffness (kPa/mm)	Compressive Stiffness per Square Metre (kg/m²/mm)	Yield Load (kN)	Yield Load (kg)	Yield Load (t)	Yield Load per Square Metre (kg/m²)	Yield Pressure (kPa)
210 mm - #1	6.4	17.8	1812	18.4	1876	1.88	5210	51.1
210 mm - #2	7.4	20.6	2095	18.6	1896	1.90	5267	51.7
Average	6.9	19.2	1954	18.5	1886	1.89	5238	51.4
Standard Deviation	0.7	2.0	200	0.1	14	0.01	40	0.4

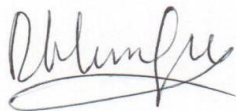
TABLE 4
210MM STACKED CONFIGURATION: TEST DATA

Specimen I.D.	Yield Load (kN)	Average Yield Load (kN)	Average Yield Load (kg)	Average Yield Load per Square Metre (kg/m ²)	Average Yield Pressure (kPa)
Individual Panel Test Configurations					
60 mm - #1	21.9	22.1	2249	6246	61.3
60 mm - #2	21.8				
60 mm - #3	22.8				
60 mm - #4	20.8				
60 mm - #5	23.0				
100 mm - #1	22.0	22.5	2298	6382	62.6
100 mm - #2	21.3				
100 mm - #3	23.0				
100 mm - #4	22.9				
100 mm - #5	23.5				
150 mm - #1	21.6	21.1	2149	5969	58.6
150 mm - #2	20.2				
150 mm - #3	20.9				
150 mm - #4	21.8				
150 mm - #5	20.9				
Multiple / Stacked Panel Test Configurations					
210 mm - #1	18.4	18.5	1886	5238	51.4
210 mm - #2	18.6				

**TABLE 5
TEST RESULTS**

Notes:

- Melbourne Testing Services (MTS) Pty Ltd shall not be liable for loss, cost, damages or expenses incurred by the client or any other person or company, resulting from the use of any information or interpretation given in this report. In no case shall MTS be liable for consequential damages including, but not limited to, lost profit, damages for failure to meet deadlines and lost production arising from this report. This document shall not be reproduced except in full and relates only to the items tested.
- It remains the responsibility of the client to ensure that the samples tested are representative of the entire product batch.
- MTS shall take no responsibility for the procurement and authenticity of the test product as described herein.
- This report is specific to the test items in their state at the time of testing. It should not be taken as a statement that all products in all states of repair, would also perform in the same manner.
- MTS shall take no responsibility for the interpretation or misinterpretation of the procedures or calculation methods as provided herein or for the appropriateness or validity of the test procedures for the test items described and reported herein.
- The tests as reported herein are considered Experimental Type Tests and therefore do not validate or certify the products with any Australian or International standards that may apply
- MTS shall take no responsibility for any reduction in load capacity of the void forming panels where they are subjected to loading in a manner other than as reported herein. This includes but is not limited to variations in loading direction and support materials/ conditions.
- The results for the limited number of tests reported herein are not necessarily statistically significant. It remains the responsibility of the reader to conduct rigorous statistical analyses and apply appropriate load reduction safety factors as required. MTS shall take no responsibility for the misinterpretation of the test data as being representative of a broad population when a limited sample size has been tested.



DANIEL HUMFREY
Test Engineer

APPENDIX A:

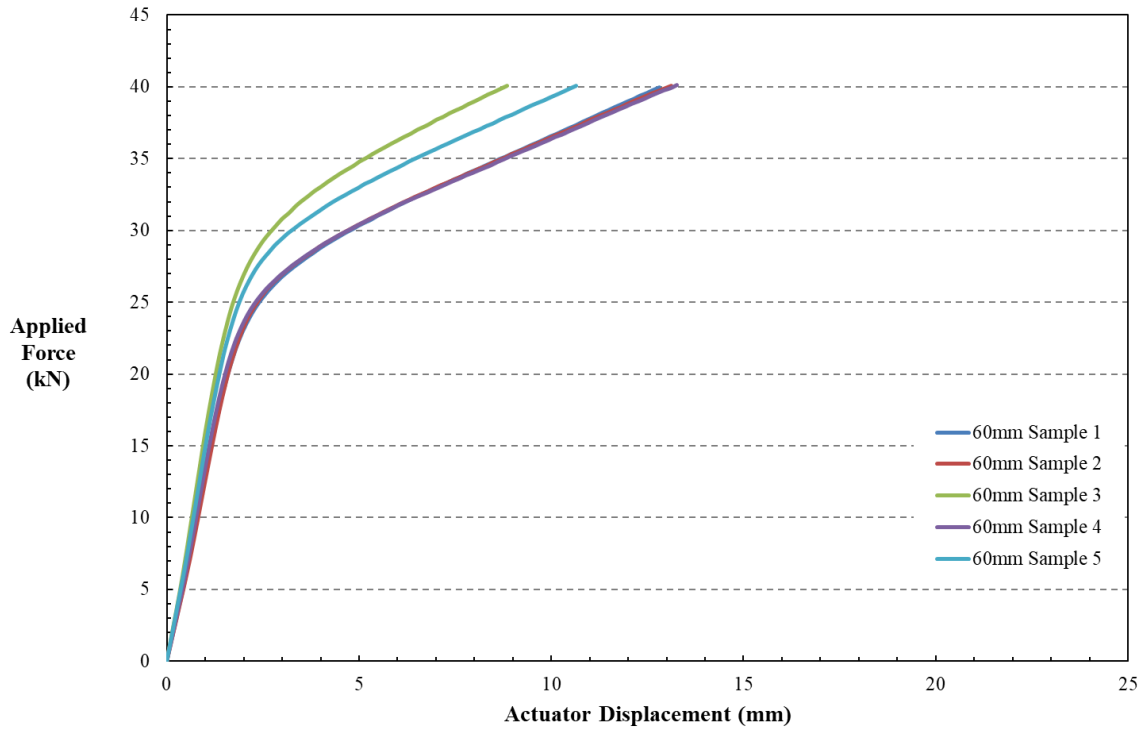


FIG.A1
60 MM PANELS: FORCE VS DISPLACEMENT TEST CURVES

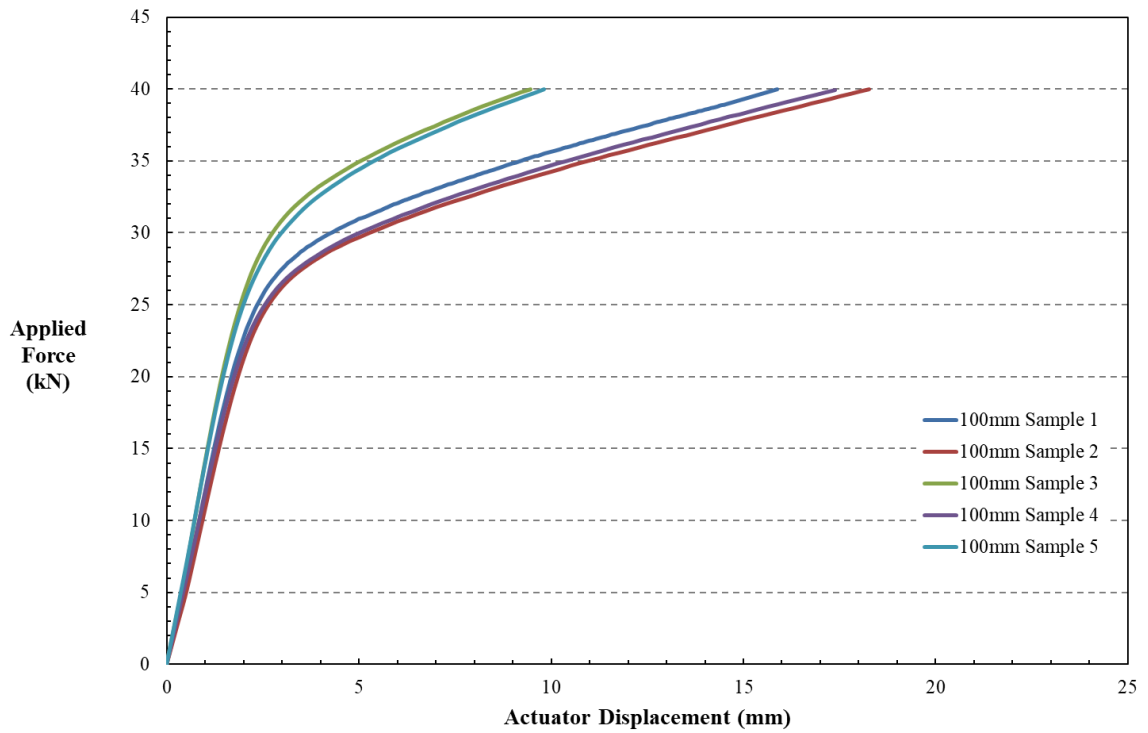


FIG.A2
100 MM PANELS: FORCE VS DISPLACEMENT TEST CURVES

APPENDIX A (CONT.):

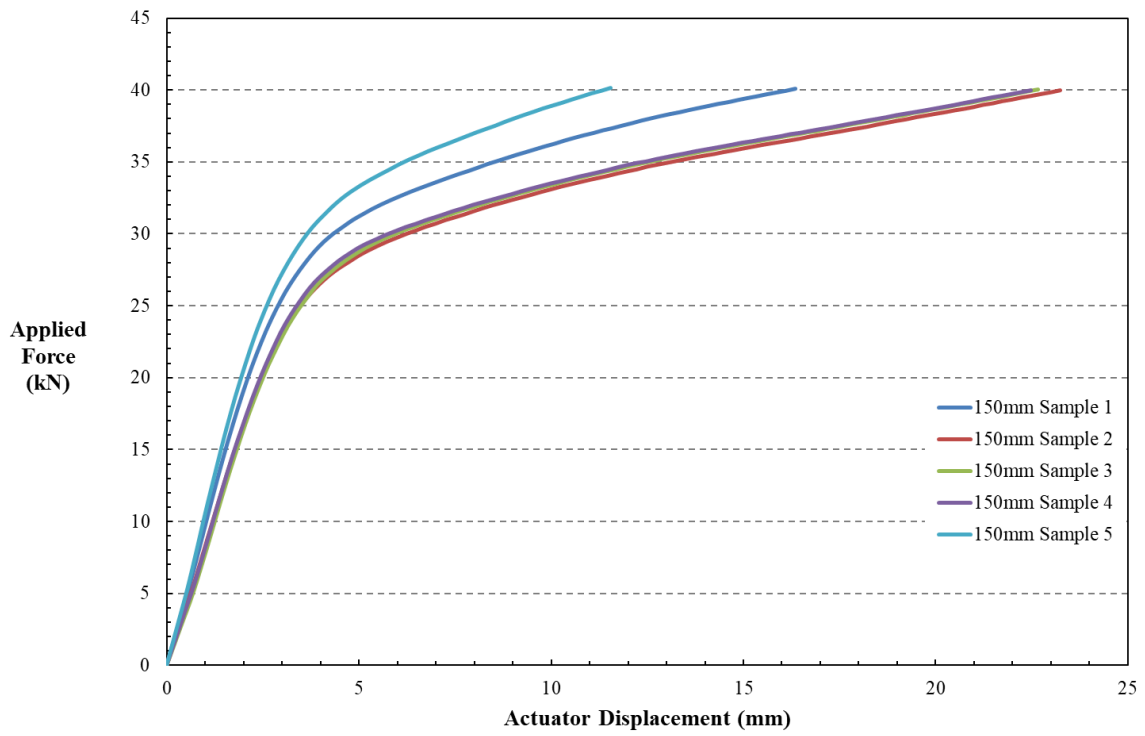


FIG.A3
150 MM PANELS: FORCE VS DISPLACEMENT TEST CURVES

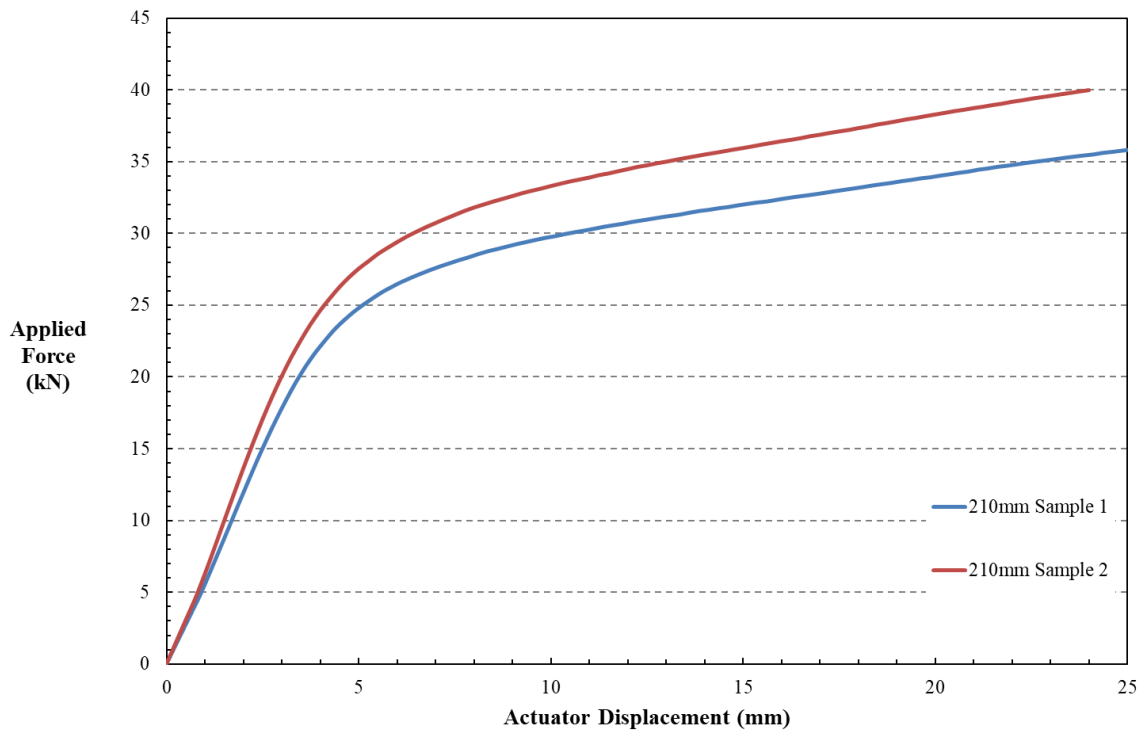


FIG.A4
210 MM STACKED CONFIGURATION: FORCE VS DISPLACEMENT TEST CURVES

APPENDIX B:

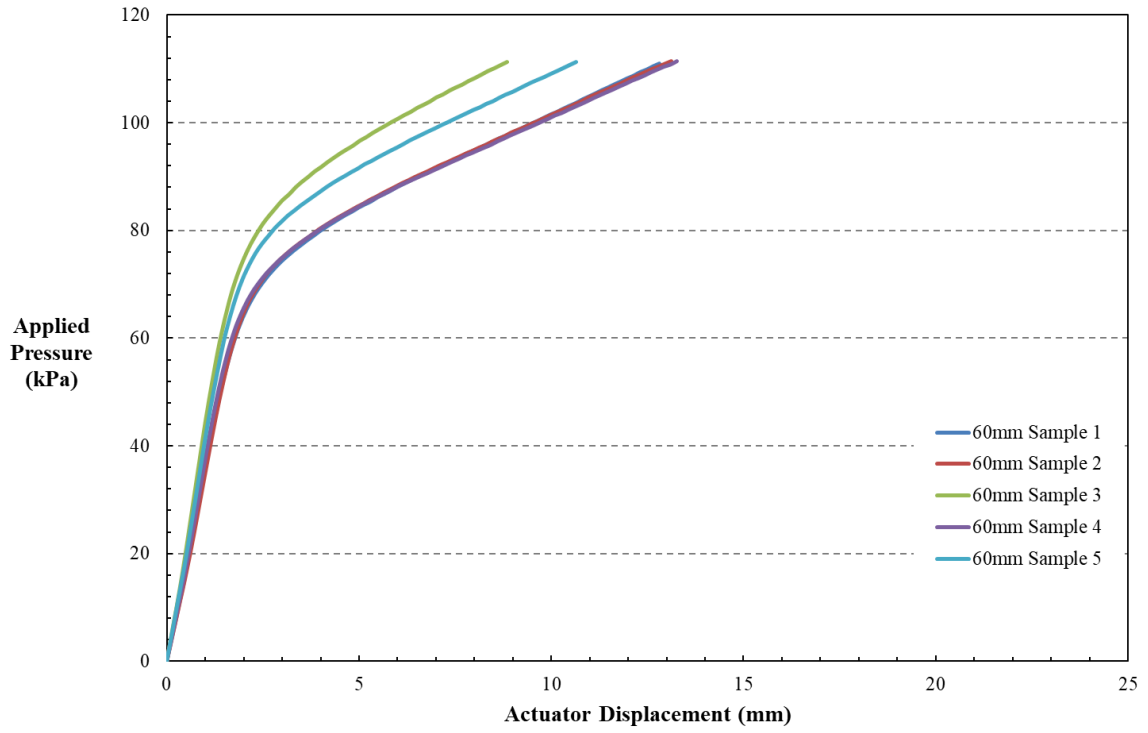


FIG.B1
60 MM PANELS: PRESSURE VS DISPLACEMENT CURVES

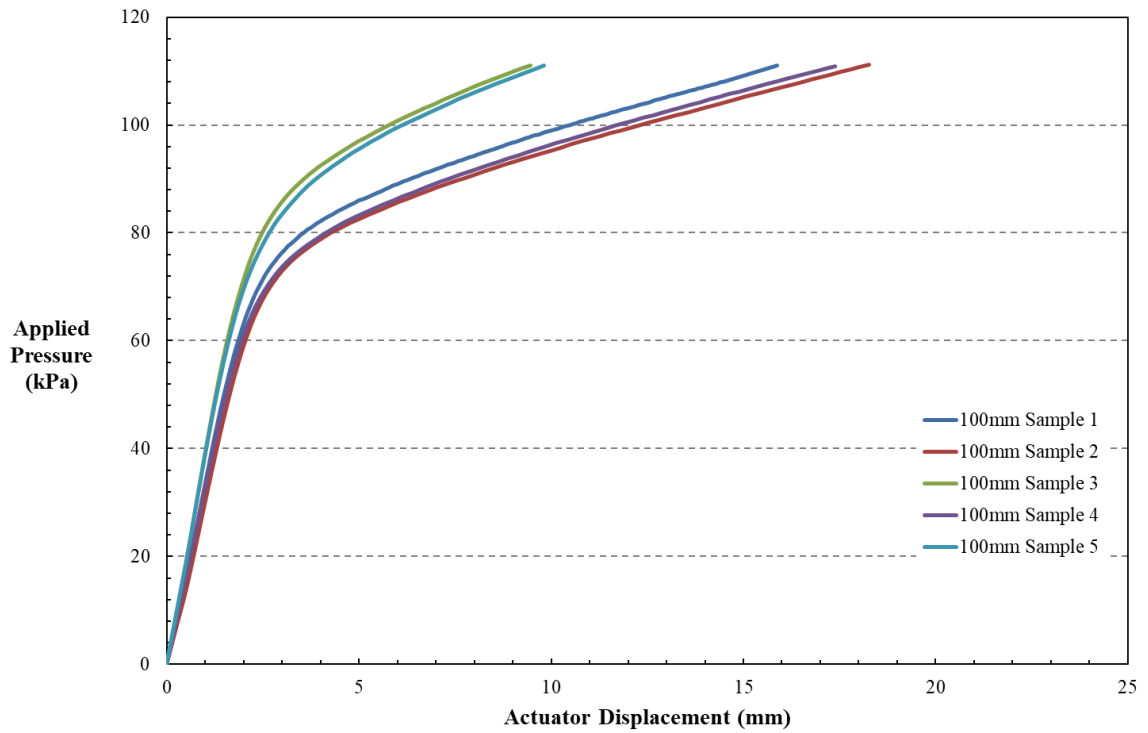


FIG.B2
100 MM PANELS: PRESSURE VS DISPLACEMENT CURVES

APPENDIX B (CONT.):

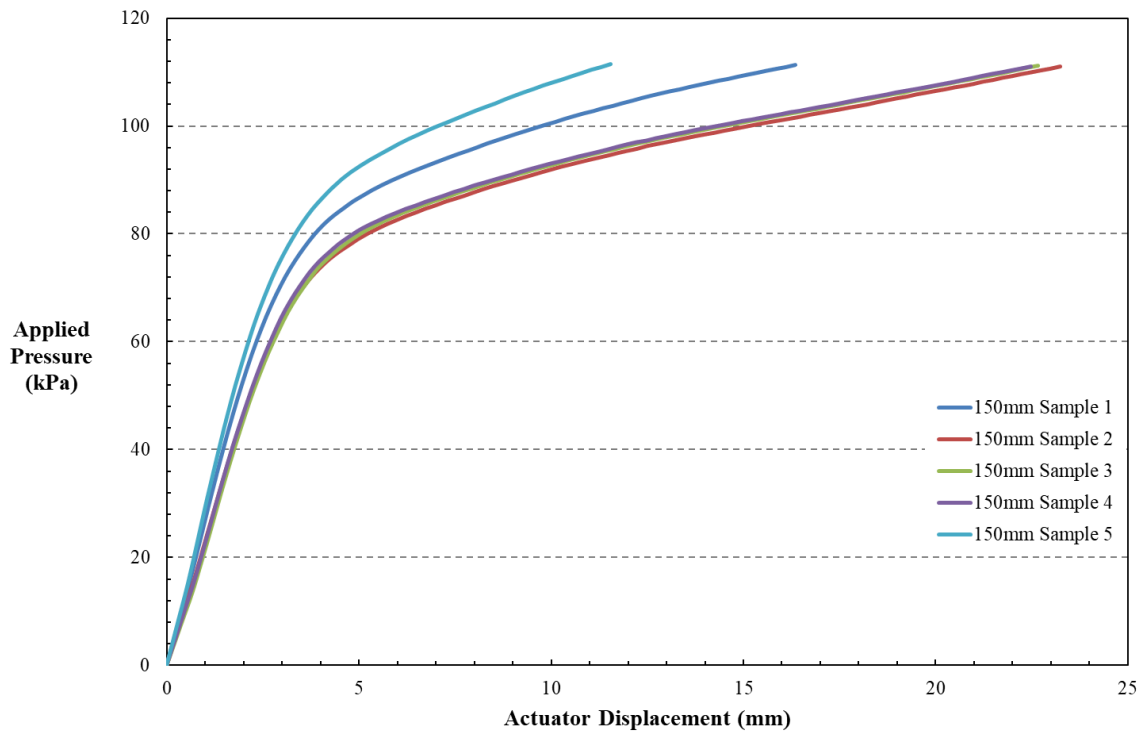


FIG.B3
150 MM PANELS: PRESSURE VS DISPLACEMENT CURVES

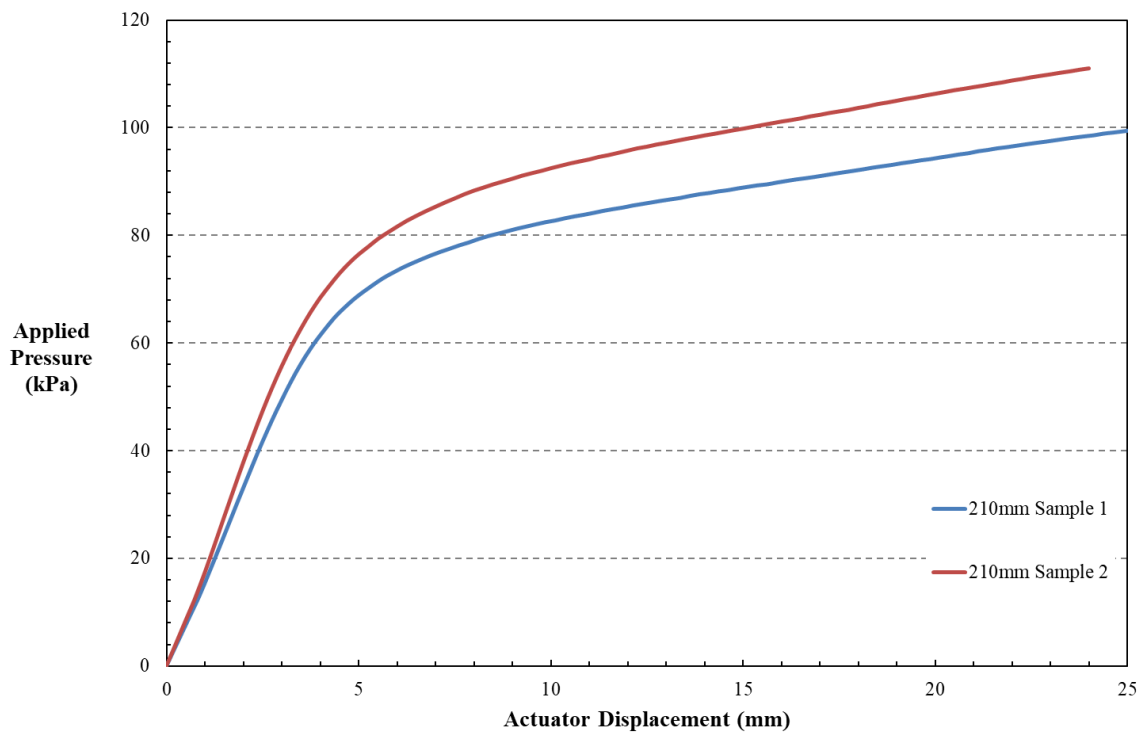


FIG.B4
210 MM STACKED CONFIGURATION: PRESSURE VS DISPLACEMENT CURVES