Client: DIAMOND GRID

Attention: Ben Kirkup

Your Reference: Purchase Order COD

Date: 3 September 2015

REPORT NO: 42151157-REV0

DIAMOND GRID SYSTEM – COMPRESSIVE STRENGHT ASSESSMENT OF THE SUPPLIED CONCRETE FILLED SAMPLE

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1 INTRODUCTION

ALS was engaged by Ben Kirkup from Diamond Grid to undertake compressive strength testing on the supplied composite concrete and polypropylene surface stabiliser.

The trafficable composite area is used for various applications with various grid fill options. The supplied sample consists of an infill concrete matrix.

Various testing configurations were adopted during the testing process to understand the behaviour of the supplied material. The testing configurations consisted of the following:

- A single cell with polypropylene on each of the four sides, refer **Error! Reference source not found.**
- A sample with concrete exposed on all four sides, refer Figure 3
- Samples consisting of 4 cells with polypropylene on each of the four sides, refer Figure 4

This report shall detail the result from each of the compressive tests undertaken on the supplied sample.

The samples as supplied to ALS are provided below in Figure 1

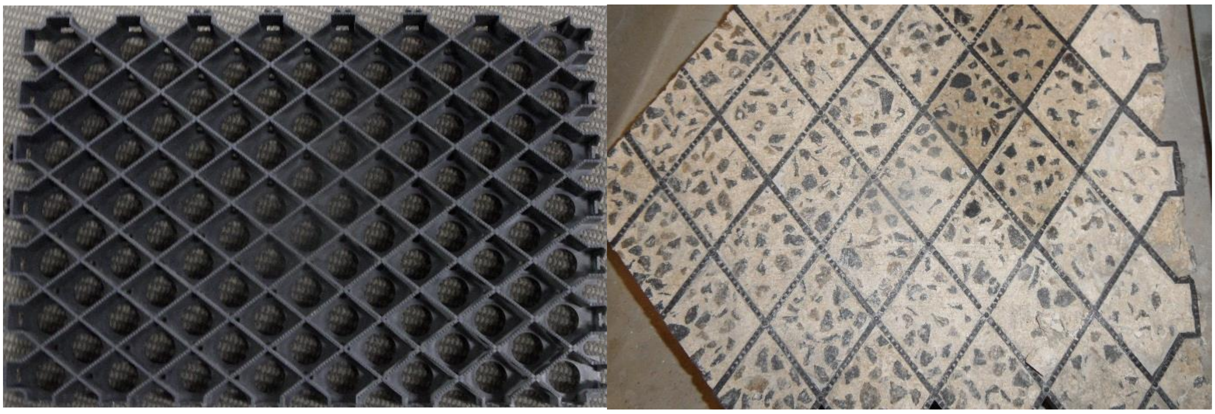

Figure 1: Sheeting before infill is applied. Sheeting after concrete infill is applied (as supplied to ALS)

2 CONCLUSIONS

A summary of the testing results is provided below

- SAMPLE GROUP B: In the situation where the sample was cut so that the polypropylene was removed from the exterior testing surface, an average strength of the 16.38 MPa was recorded. Refer Figure 3

- SAMPLE GROUP A: A single cell with the polypropylene on all four edges recorded an average strength of 19.84 MPa. Refer Figure 2

- SAMPLE GROUP C: A configuration of 4 cells with polypropylene on all four edges recorded an average strength of 24.23 MPa. Refer Figure 4

The tests indicate that the larger configuration of the product with the concrete infill yielded the highest compressive strength. This is sample group C as may be seen in Figure 4

It is held that the most realistic in-situ representation of the DIAMOND GRID system is sample C which yielded an average of 24.23MPa.

3 PROCEDURE

3.1 Compressive Strength Testing

Two samples were supplied to the ALS office in form of 2 sheets of 0.4m by 0.6m. These were in filled with concrete as may be seen in Figure 1 . The sheets were cut into sections to allow for compressive strength testing to be undertaken. Various configurations were tested during the process, these include:

- Single cell with polypropylene around the 4 edges – sample reference group A
- Multi-cell cut so concrete was exposed on the edges - sample reference group B
- Multi-cell (4) with polypropylene around the 4 edges - sample reference group C

A total of three samples of each configuration were prepared to gain a measure as to the consistency of performance of the material under the varying configurations.

The configurations were chosen as it was not practically possible to test a full panel. The most realistic in-situ configuration is taken as where 4 cells are tested as shown in Figure 4.

The three sample configurations are shown below in **Error! Reference source not found.** to Figure 4

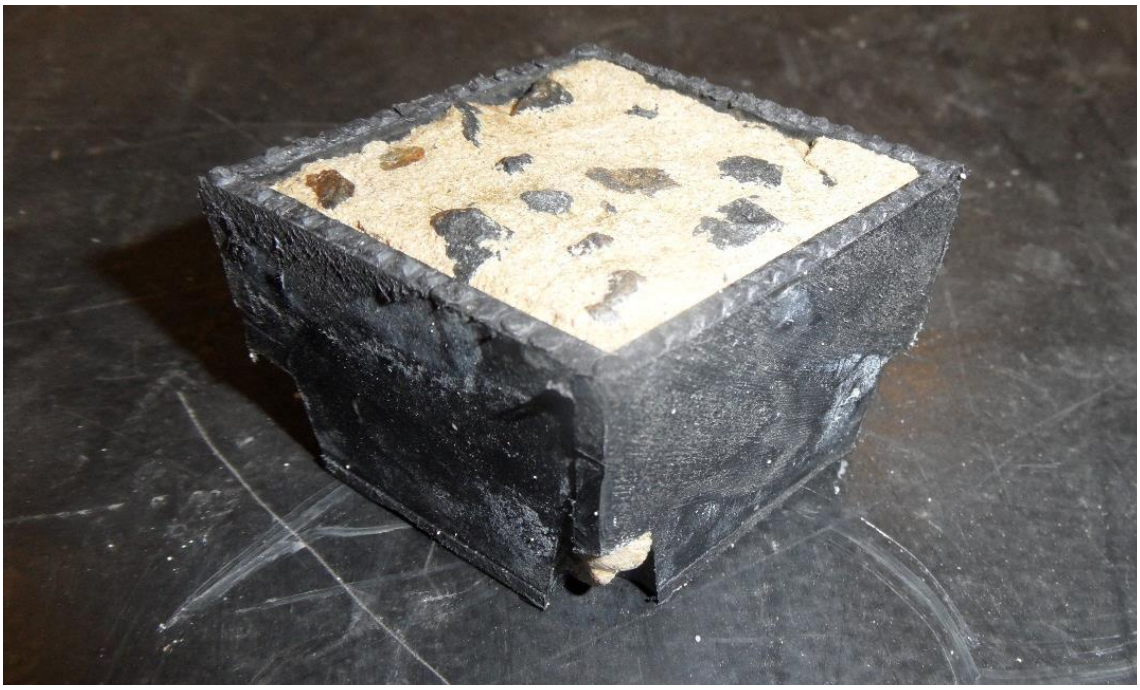

Figure 2: Testing configuration A – a single cell of the grid was extracted and the compression stress of the unit assessed.

Figure 3: Testing configuration B – The compression of an alternate configuration was cut from the sheet to encompass four cells not constrained about the perimeter.

Figure 4: Testing configuration c – The compression of an alternate configuration was cut from the sheet to encompass four cells that are constrained about the perimeter.

The samples were capped with sulphur to allow for uniform compression during crushing as shown in Figure 5 below.

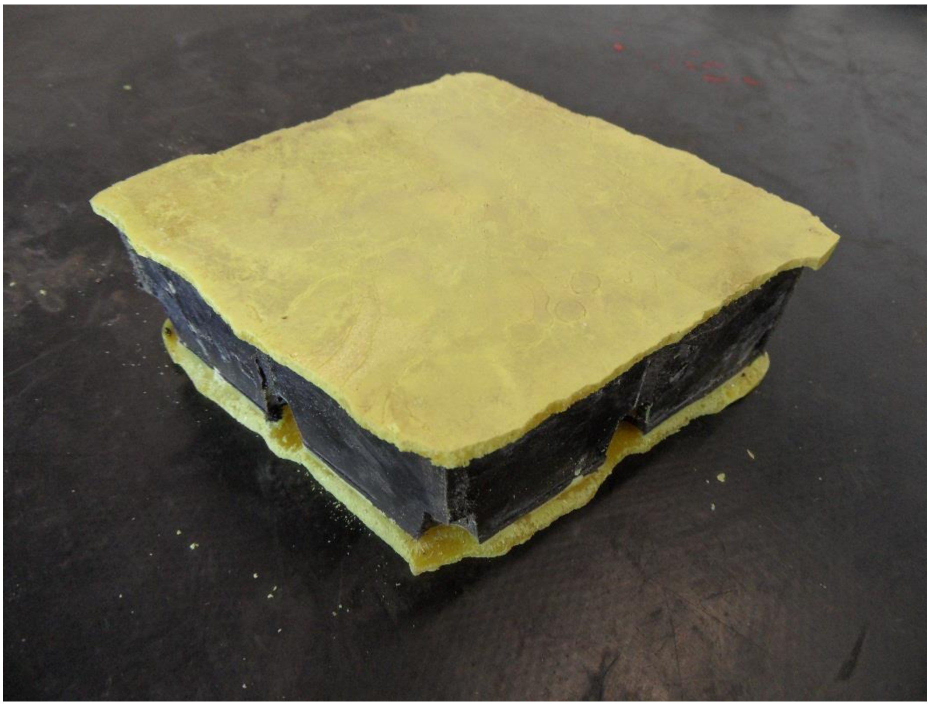

Figure 5: Sulphur capped sample

The samples are then crushed in accordance with procedure as laid down AS1012.9:2014 to point of fracture with their fracture strength recorded. AS the samples were not to the dimensions and geometry as required in the standard, these should be read as nonstandard tests. The fracture point is converted into a compressive strength for the each of the specific samples. The results are presented within the results section of this report.

4 RESULTS

4.1 Compressive Strength Testing

The compressive strength test results have been provided in Table 1

Table 1: Determined compressive strengths (MPa)

Sample Reference	Sample description	Compressive strength (MPa)
A1	Single cell	17.03
A2	Single cell	17.62
A3	Single cell	24.88
B1	Sample without plastic on edges	18.87
B2	Sample without plastic on edges	15.17
B3	Sample without plastic on edges	15.10
C1	4 cells with plastic on edges	26.87
C2	4 cells with plastic on edges	24.10
C3	4 cells with plastic on edges	19.71
C4	4 cells with plastic on edges	26.24

5 DISCUSSION

The above results demonstrate a variable result based on the testing configuration.

In the testing scenario where the sample was cut so that the polypropylene was removed from the exterior testing surface (sample group B), an average strength of the 16.38 MPa was recorded.

A single cell with the polypropylene on all four edges (sample A) recorded an average strength of 19.84 MPa

A configuration of 4 cells with polypropylene on all four edges (sample C) recorded an average strength of 24.23 MPa.

The results indicate that it would be likely that an increased strength would be obtained if more cells were tested in a single configuration. It also indicates that when the polypropylene plastic remained about the perimeter of the sample as would be the case in-situ, the resultant strength increased.

Testing scenario B involved the removal of the polypropylene so that the concrete surfaces were exposed. This testing scenario is not realistic of the in-situ conditions for which the product would be used. This test allows for the developed understanding of the stress-strain relationship between the concrete and polypropylene interaction. The edges of the plastic confine the concrete allowing for a greater strength to be achieved than when the edges are unrestrained from movement. This tests also allows for the exclusion of the strength occurring simply from the concrete as this particular test group resulted in the lowest average compressive strength.

CONCRETE TEST CERTIFICATE (4215-1157-001UCS)

UCS - Unconfined Compression Strength Test

Client :
Diamond Grid
PO Box 34
Beaudesert QLD 4285

Notes:
1. *Density to AS 1012.12.1*
2. *Cap type key:*
   R-rubber / G-grind / P-plaster / S-sulphur
3. *Compressive strength to AS 1012.9*
4. *Correction factor to AS 1012.14*
5. *Comment by exception*
6. NATA test undertaken for ALS by Cement Australia

ALS Industrial
7 Brisbane Road, Riverview, QLD, 4303
P.O.Box 6062, Riverview, QLD, 4303
Telephone : (07) 3816 5500
Fax: (07) 3282 0118

Details; of the samples supplied to the ALS offices on the : 4/09/2015
Sample Identification : Supplied Diamond Gı
Date sampled : unknown
Client purchase order: COD
Preconditioning : none
Project description : Diamond Grid pavement wearing course

Test Results

Sample Identification	Length (mm)	Breadth (mm)	Height (mm)	Diameter (mm)	Density kg/m^3	Condition Time days	Cap Type (note 2)	Test Date	Age days	Uncorrected Strength MPa (note3)	Correction Factor (note 4)	Corrected Strength MPa (note4)	Comments
		Dimensions											
A1	48.7	48.7	43.9	n/a	n/a	n/a	S	2/09/2015	n/a	n/a	n/a	17.03	
A2	48.7	48.5	44.3	n/a	n/a	n/a	S	2/09/2015	n/a	n/a	n/a	17.62	
A3	48.8	49.4	45.1	n/a	n/a	n/a	S	2/09/2015	n/a	n/a	n/a	24.88	
B1	77.1	58.0	44.8	n/a	n/a	n/a	S	2/09/2015	n/a	n/a	n/a	18.87	
B2	58.8	73.7	46.7	n/a	n/a	n/a	S	2/09/2015	n/a	n/a	n/a	15.17	
B3	74.5	55.6	46.5	n/a	n/a	n/a	S	2/09/2015	n/a	n/a	n/a	15.10	
C1	94.9	94.7	45.9	n/a	n/a	n/a	S	2/09/2015	n/a	n/a	n/a	26.87	
C2	94.2	94.4	46.5	n/a	n/a	n/a	S	2/09/2015	n/a	n/a	n/a	24.10	
C3	94.5	94.5	46.3	n/a	n/a	n/a	S	2/09/2015	n/a	n/a	n/a	19.71	
C4	94.6	84.3	46.4	n/a	n/a	n/a	S	2/09/2015	n/a	n/a	n/a	26.24	

Signed on behalf of ALS Industrial by:

Robert Bell (Principal civil engineer & team leader)