

**ABN 31 105 704 078**

13 Brock Street, Thomastown

Victoria 3074

(P) +61 3 9464 4617



# **LEVEL 1 INSPECTION & TESTING LUCAS ESTATE - STAGE K3**

Prepared for Bild Group

**Report Reference: GS6240.2 AA**

**Date: 8 September 2022**

**ABN 31 105 704 078**

13 Brock Street, Thomastown

Victoria 3074

(P) +61 3 9464 4617



## PROJECT DETAILS

Project Reference	GS6240.2	Rev	AA
Project Title	Lucas Estate Stage K3		
Project Location	Lucas	State	VIC
Date	8 September 2022		

## CLIENT DETAILS

Prepared For (Client)	Bild Group
Client Address	133 Metrolink Circuit, Campbellfield VIC 3061

## DISTRIBUTION

Original Held By	Ground Science Pty Ltd
One (1) Electronic Copy	Bild Group

This document presents the results of the Level 1 Inspection and Testing performed by Ground Science for the aforementioned project, as the nominated project Geotechnical Inspection & Testing Authority (GITA). This report is detailed for the sole use of the intended recipient(s). Should you have any questions related to this report please do not hesitate to contact the undersigned.

**AUTHOR:**

**Anton Manoj**  
Geotechnical Engineer

**REVIEWED:**

**Gee Singh, RPEng**  
Senior Geotechnical Engineer

# Table of Contents

---

- 1. INTRODUCTION ..... 1
- 2. PROJECT BACKGROUND ..... 1
- 3. SCOPE OF WORK..... 1
  - 3.1 AREAS OF WORK..... 1
  - 3.2 PLACEMENT METHODOLOGY ..... 1
- 4. INSPECTION AND TESTING ..... 2
  - 4.1 SUBGRADE PREPARATION..... 2
  - 4.2 CONSTRUCTION MATERIALS ..... 2
  - 4.3 FILL CONSTRUCTION ..... 2
  - 4.4 RESULTS OF COMPACTION CONTROL TESTING ..... 2
  - 4.5 FINAL SURFACE LEVELS ..... 3
- 5. COMPLIANCE ..... 3
- 6. LIMITATIONS..... 4
- 7. REFERENCES ..... 5

**APPENDICES**

- APPENDIX A    FIELD DENSITY TEST SUMMARY SHEETS AND TEST LOCATIONS
- APPENDIX B    FIELD DENSITY TEST REPORT SHEETS
- APPENDIX C    SITE PHOTOGRAPHS



## 1. INTRODUCTION

This report presents the results of the inspection activities, compaction control and laboratory testing services performed by Ground Science Pty Ltd for the development at Lucas Estate Stage K3, Lucas, Victoria (the site).

## 2. PROJECT BACKGROUND

It is understood that the project involves the construction of fill platforms for residential allotments. Ground Science was engaged to provide Level 1 Inspection and Testing services for these components of the project. Authorisation to proceed was provided by Bild Group (the 'Client').

Level 1 Inspection & Testing, as defined in AS3798 (2007) 'Guidelines on Earthworks for Commercial and Residential Developments' provides for full-time inspection of the construction of controlled fill and compaction testing in accordance with AS1289 'Methods of Testing Soils for Engineering Purposes'. The primary objective of Level 1 Inspection & Testing, according to AS3798 (2007), is for the geotechnical inspection and testing authority (GITA) to be able to express an opinion on the compliance of the work.

Ground Science performed the role of the project GITA. The testing services described in this report were undertaken by an experienced GITA site representative.

## 3. SCOPE OF WORK

### 3.1 AREAS OF WORK

The areas requiring Level 1 Inspection & Testing are shown in **Appendix A**, which is based on plans prepared by Integra (LUK3-CD-701 REV 1). This report details the Level 1 earthworks process which commenced on 02 June 2022 and was completed on 29 July 2022, including 2 days of filling operations.

### 3.2 PLACEMENT METHODOLOGY

It is understood that the following methodology was adopted:

- preparing the base by stripping all loose surficial fill, topsoil, soft material, vegetation, and materials containing significant organic matter to expose the natural soil subgrade
- sorting and mixing the fill materials to eliminate oversize particles greater than 20 % by volume, no particles coarser than 37.5 mm, and no particle over 200 mm in any dimension
- placing approved fill material in loose horizontal layers not exceeding 250 mm in thickness
- compacting the controlled fill materials to achieve a target dry density ratio of not less than 95 % Standard Compaction (AS 1289: 5.1.1, 5.4.1 or 5.7.1)
- moisture-conditioning the fill to within 85 % – 115 % of the standard optimum moisture content (SOMC)
- completing field density testing at a frequency for large scale developments (Type 1 AS3798) which nominates a frequency of not less than:
  - one test per layer or 200 mm per 2500 m<sup>2</sup>
  - one test per 500 m<sup>3</sup> distributed reasonably evenly throughout the full depth and area, or
  - three tests per site visit; whichever requires the most tests.

## 4. INSPECTION AND TESTING

### 4.1 SUBGRADE PREPARATION

Site stripping was carried out prior to the attendance of on-site GITA. Trial pads were conducted at the request of this office to assess the subgrade which appeared to be suitable. Typically, the subgrade material comprised silty CLAY (CI- CH), medium to high plasticity, and brown.

### 4.2 CONSTRUCTION MATERIALS

The fill material used in this project was nominated by the on-site contractor and advised to be sourced from on-site excavations.

Ground Science assessed the fill source to identify the following material characteristics:

- material suitability as an engineering property
- cohesiveness
- free from building debris and vegetative matter
- oversize rock particles.

Visual assessments on the above-mentioned properties were conducted on-site and the fill material used was considered acceptable for use on this project. The nominated fill products were visually assessed to comprise silty CLAY(CI-CH), medium to high plasticity, and brown.

Ground Science did not perform any chemical or environmental analysis of the above fill sources.

### 4.3 FILL CONSTRUCTION

Fill placement occurred without the presence of the Ground Science GITA. Information on the civil drawings and discussions with Bild Group indicated that approximately two layers of fill were placed and compacted, up to three in the deepest zone (Lot 2069).

The onsite GITA carried out trial pads to inspect the condition of the fill at several positions. Field density testing was then carried out on the previously placed layers of fill.

It is considered that a 100 mm to 150 mm thick layer of topsoil may be spread at the completion of all works, which does not form part of the Level 1 process. Any fill placed as part of newly constructed drainage, sewer works, or similar does not form part of this Level 1 report.

### 4.4 RESULTS OF COMPACTION CONTROL TESTING

Testing comprised a total of 14 in-situ density tests using a nuclear moisture-density gauge in accordance with Australian Standard (AS1289.5.8.1) with 14 "Rapid HILF" Compaction tests (AS1289.5.7.1) including the tests that failed to achieve the required 95% standard compaction.

The moisture condition of the fill materials was compliant and within the recommended range of -3 % to +3 % of OMC.

A summary of the field density tests and re-tests performed for the project is presented in **Appendix A**. Field density and compaction control testing report sheets are presented in **Appendix B**.



#### 4.5 FINAL SURFACE LEVELS

The site foreman confirmed that finished levels were achieved. It should be noted that the overall fill depths are estimated using onsite visual tactile methods and may not be a true representation of fill depths given that conditions onsite may change over time. True fill depths should be obtained from the contractor's survey data.

#### 5. COMPLIANCE

Based on observations made by Ground Science staff and the results of the trial pads, moisture, and density tests, we consider that the controlled fill placed has been constructed in general accordance with the guidelines provided by AS3798 (2007).

It should be noted that Ground Science was not present during the site stripping stage and initial fill placement, as such, this report covers the areas where field density testing and trial pads were carried out.

It should be noted that the final fill layers may be subjected to adverse weather conditions resulting in either surface softening or drying and cracking over time; regardless of the compactive efforts and moisture conditioning applied during the works. The integrity of the top 300mm to 400mm of the fill will deteriorate with time and should be taken into account by the foundation engineer prior to the construction of dwellings or buildings. The levels nominated in this report are a guide to the amounts of fill placed and do not necessarily reflect an accurate survey of the fill levels.



## 6. LIMITATIONS

This type of investigation (as per our commission) is not designed or capable of locating all soil conditions, (which can vary even over short distances). The advice given in this report is based on the assumption that the test results are representative of the overall soil conditions. However, it should be noted that actual conditions in some parts of the Site might differ from those found. If further sampling reveals soil conditions significantly different from those shown in our findings, Ground Science must be consulted. Maintenance and upkeep of finished fill placement must be regularly monitored as exposure to extended weather periods/other elements may cause surface drying which may lead to cracking. Conversely, excessive exposure to moisture may cause heaving/softening in the soils.

It is recognised that the passage of time affects the information and assessment provided in this document. Ground Science's assessment is based on information that existed at the time of the preparation of this document. It is understood that the services provided allowed Ground Science to form no more than an opinion of the actual site conditions observed during sampling and observations of the site visit and cannot be used to assess the effects of any subsequent changes in the quality of the site, or its surroundings, or any laws or regulations.

The scope and the period of Ground Science services are described in the proposal and are subject to restrictions and limitations. Ground Science did not perform a complete assessment of all possible conditions or circumstances that may exist at the Site. If a service is not expressly indicated, do not assume it has been provided. If a matter is not addressed, do not assume that any determination has been made by Ground Science in regards to it.

Where data has been supplied by the client or a third party, it is assumed that the information is correct unless otherwise stated. No responsibility is accepted by Ground Science for incomplete or inaccurate data supplied by others.

Any drawings or figures presented in this report should be considered only as pictorial evidence of our work. Therefore, unless otherwise stated, any dimensions should not be used for accurate calculations or dimensioning.

This document is COPYRIGHT- all rights reserved. No part of this document may be reproduced or copied in any form or by means without written permission by Ground Science Pty Ltd. All other property in this submission shall not pass until all fees for preparation have been settled. This submission is for the use only of the party to whom it is addressed and for no other purpose. No responsibility is accepted to any third party who may use or rely on the whole or any part of the content of this submission. No responsibility will be taken for this report if it is altered in any way, or not reproduced in full. This document remains the property of Ground Science Pty Ltd until all fees and monies have been paid in full.



## 7. REFERENCES

- AS3798 (2007) Guidelines on Earthworks for Residential and Commercial Developments.
- AS1289 Methods of Testing Soils for Engineering Purposes.
- AS1726 (2017): Geotechnical Site Investigations



## **APPENDIX A**

Field Density Test Summary and Test Locations

# Project Summary Report



**Report Date:** 06/09/2022  
**Client:** BildGroup  
 7 Metrolink Circuit, Campbellfield, Melbourne VIC 3061  
**Contact:** Jamie Lancaster  
**Project Number:** GS6240/2  
**Project Name:** Lucas Estate - Stage K3 (Level 1)  
**Project Location:** Ballarat  
**Specification:** 95% Standard Compaction & +/- 3% Moisture Variation  
**Test Methods:** AS 1289 5.7.1 STD & 5.8.1 & 2.1.1

Ground Science Pty Ltd  
 Ground Science Laboratory  
 13 Brock Street Thomastown Victoria 3074  
 Phone: (03) 9464 4617  
 Email: chris@groundscience.com.au

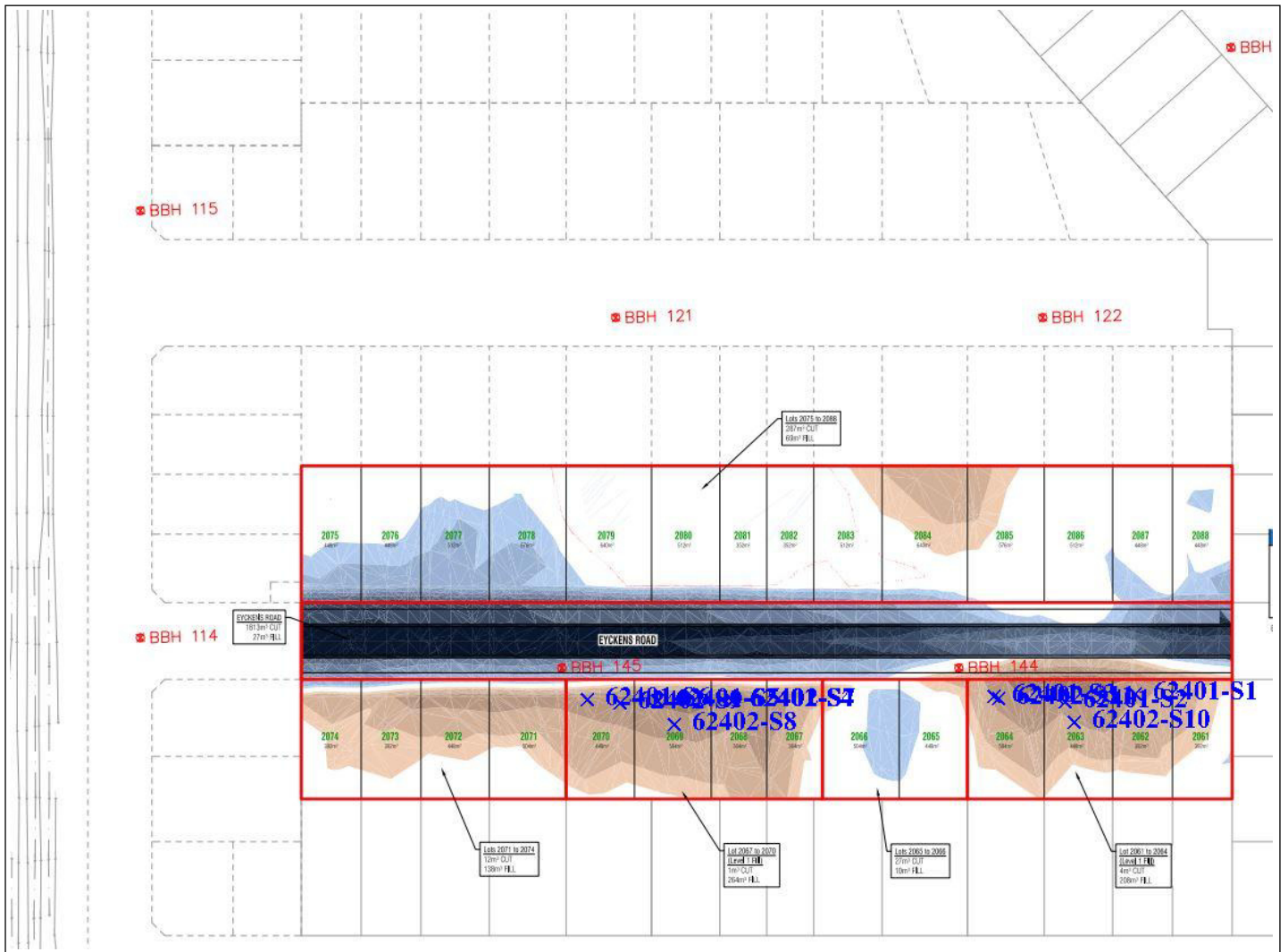
Lot #	Sample #	Date Sampled	Location	Latitude	Longitude	Elevation (m)	Layer	Relative Compaction (%)	Moisture Variation (%)	Moisture Content (%)	Field Wet Density (t/m3)
**	62401-S1	02/06/2022	From s/w corner of lot 2062	4m south	4m east	**	1	95.5	1.0	22.1	1.87
**	62401-S2	02/06/2022	From s/w corner of lot 2063	4m south	4m east	**	2	90.0	0.5	22.0	1.80
**	62401-S3	02/06/2022	From s/w corner of lot 2064	4m south	4m east	**	3	102.0	-0.5	13.9	2.40
**	62401-S4	02/06/2022	From s/w corner of lot 2068	4m south	4m east	**	2	90.5	-2.0	24.8	1.87
**	62401-S5	02/06/2022	From s/w corner of lot 2069	4m south	4m east	**	3	97.0	-1.0	21.7	1.90
**	62401-S6	02/06/2022	From s/w corner of lot 2070	4m south	4m east	**	1	93.5	2.0	16.9	1.83
**	62402-S7	29/07/2022	From W/E corner of lot 2068	5m S	8m S	**	2	103.0	-1.0	31.1	2.01
**	62402-S8	29/07/2022	From W/E corner of lot 2069	5m S	8m S	**	FSL	97.0	-1.0	22.0	2.03
**	62402-S9	29/07/2022	From W/E corner of lot 2070	5m S	8m S	**	1	95.0	-1.5	24.3	1.96
**	62402-S10	29/07/2022	From W/E corner of lot 2063	5m S	8m S	**	2	104.5	-2.0	25.8	2.14
**	62402-S11	29/07/2022	From W/E corner of lot 2064	5m S	8m S	**	FSL	103.0	-1.0	25.4	2.09
**	62402-S12	01/09/2022	Retest of 2	**	**	**	2	98.5	-2.0	26.7	2.03
**	62402-S13	01/09/2022	Retest of 4	**	**	**	2	103.5	0.0	21.6	2.19
**	62402-S14	01/09/2022	Retest of 6	**	**	**	1	96.5	-0.5	23.9	2.06

**Moisture Variation Note:**

Positive values = test is dry of OMC

Negative values = test is wet of OMC

# Sample Locations Plan



**APPENDIX B**

Field Density Test Report Sheets

# Material Test Report



**Report Number:** GS6240/1-4A  
**Issue Number:** 1  
**Date Issued:** 04/08/2022  
**Client:** BildGroup  
 7 Metrolink Circuit, Campbellfield, Melbourne VIC 3061  
**Contact:** Jamie Lancaster  
**Project Number:** GS6240/2  
**Project Name:** Lucas Estate - Stage K3 (Level 1)  
**Project Location:** Ballarat  
**Work Request:** 8674  
**Date Sampled:** 03/06/2022 13:00  
**Dates Tested:** 03/06/2022 - 06/06/2022  
**Sampling Method:** AS 1289.1.2.1 6.4 (b) - Sampling from layers in earthworks or pavement - compacted  
**Specification:** 95% Standard Compaction & +/- 3% Moisture Variation  
**Site Selection:** Selected by Client  
**Location:** Ballarat  
**Material:** Silty CLAY, medium to high plasticity, brown

Ground Science Pty Ltd  
 Ground Science Laboratory  
 13 Brock Street Thomastown Victoria 3074  
 Phone: (03) 9464 4617  
 Email: brent@groundscience.com.au

Accredited for compliance with ISO/IEC 17025 - Testing



*Brent Elliott*

Approved Signatory: Brent Elliott  
Laboratory 21C

NATA Accredited Laboratory Number: 15055

Compaction Control AS 1289 5.7.1 & 5.8.1 & 2.1.1						
Sample Number	62401-S1	62401-S2	62401-S3	62401-S4	62401-S5	62401-S6
Date Tested	02/06/2022	02/06/2022	02/06/2022	02/06/2022	02/06/2022	02/06/2022
Time Tested	13:23	13:29	13:45	13:54	14:15	14:22
Test Request #/Location	From s/w corner of lot 2062	From s/w corner of lot 2063	From s/w corner of lot 2064	From s/w corner of lot 2068	From s/w corner of lot 2069	From s/w corner of lot 2070
Latitude	4m south	4m south	4m south	4m south	4m south	4m south
Longitude	4m east	4m east	4m east	4m east	4m east	4m east
Layer / Reduced Level	1	2	3	2	3	1
Thickness of Layer (mm)	200	200	200	200	200	200
Soil Description	Silty CLAY, low to medium plasticity, brown	Silty CLAY, low to medium plasticity, brown	Silty CLAY, low to medium plasticity, brown	Silty CLAY, low to medium plasticity, brown	Silty CLAY, low to medium plasticity, brown	Silty CLAY, low to medium plasticity, brown
Test Depth (mm)	175	175	175	175	175	175
Sieve used to determine oversize (mm)	19.0	19.0	19.0	19.0	19.0	19.0
Percentage of Wet Oversize (%)	0	0	0	0	0	0
Field Wet Density (FWD) t/m <sup>3</sup>	1.87	1.80	2.40	1.87	1.90	1.83
Field Moisture Content %	22.1	22.0	13.9	24.8	21.7	16.9
Field Dry Density (FDD) t/m <sup>3</sup>	1.53	1.47	2.10	1.50	1.56	1.56
Peak Converted Wet Density t/m <sup>3</sup>	1.96	1.99	2.35	2.07	1.96	1.95
Adjusted Peak Converted Wet Density t/m <sup>3</sup>	**	**	**	**	**	**
Moisture Variation (Wv) %	1.0	0.5	-0.5	-2.0	-1.0	2.0
Adjusted Moisture Variation %	**	**	**	**	**	**
Hilf Density Ratio (%)	95.5	90.0	102.0	90.5	97.0	93.5
Compaction Method	Standard	Standard	Standard	Standard	Standard	Standard
Report Remarks	**	**	**	**	**	**

**Moisture Variation Note:**

Positive values = test is dry of OMC  
 Negative values = test is wet of OMC

# Material Test Report



**Report Number:** GS6240/2-4A  
**Issue Number:** 1  
**Date Issued:** 24/08/2022  
**Client:** BildGroup  
 7 Metrolink Circuit, Campbellfield, Melbourne VIC 3061  
**Contact:** Jamie Lancaster  
**Project Number:** GS6240/2  
**Project Name:** Lucas Estate - Stage K3 (Level 1)  
**Project Location:** Ballarat  
**Work Request:** 9538  
**Date Sampled:** 29/07/2022 9:00  
**Dates Tested:** 29/07/2022 - 03/08/2022  
**Sampling Method:** AS 1289.1.2.1 6.4 (b) - Sampling from layers in earthworks or pavement - compacted  
**Specification:** 95% Standard Compaction & +/- 3% Moisture Variation  
**Location:** lucas  
**Material:** Silty CLAY, medium to high plasticity, brown  
**Material Source:** onsite

Ground Science Pty Ltd  
 Ground Science Laboratory  
 13 Brock Street Thomastown Victoria 3074  
 Phone: (03) 9464 4617  
 Email: brent@groundscience.com.au

Accredited for compliance with ISO/IEC 17025 - Testing



*Brent Elliott*

Approved Signatory: Brent Elliott  
Laboratory 21C

NATA Accredited Laboratory Number: 15055

Compaction Control AS 1289 5.7.1 & 5.8.1 & 2.1.1					
Sample Number	62402-S7	62402-S8	62402-S9	62402-S10	62402-S11
Date Tested	29/07/2022	29/07/2022	29/07/2022	29/07/2022	29/07/2022
Time Tested	11:30	12:00	12:30	12:45	12:52
Test Request #/Location	From W/E corner of lot 2068	From W/E corner of lot 2069	From W/E corner of lot 2070	From W/E corner of lot 2063	From W/E corner of lot 2064
Latitude	5m S	5m S	5m S	5m S	5m S
Longitude	8m S	8m S	8m S	8m S	8m S
Layer / Reduced Level	2	FSL	1	2	FSL
Thickness of Layer (mm)	300	300	300	300	300
Soil Description	Silty CLAY, medium to high plasticity, brown	Silty CLAY, medium to high plasticity, brown	Silty CLAY, medium to high plasticity, brown	Silty CLAY, medium to high plasticity, brown	Silty CLAY, medium to high plasticity, brown
Test Depth (mm)	275	275	275	275	275
Sieve used to determine oversize (mm)	19.0	19.0	19.0	19.0	19.0
Percentage of Wet Oversize (%)	0	0	0	0	0
Field Wet Density (FWD) t/m <sup>3</sup>	2.01	2.03	1.96	2.14	2.09
Field Moisture Content %	31.1	22.0	24.3	25.8	25.4
Field Dry Density (FDD) t/m <sup>3</sup>	1.53	1.66	1.57	1.70	1.66
Peak Converted Wet Density t/m <sup>3</sup>	1.96	2.09	2.06	2.05	2.02
Adjusted Peak Converted Wet Density t/m <sup>3</sup>	**	**	**	**	**
Moisture Variation (Wv) %	-1.0	-1.0	-1.5	-2.0	-1.0
Adjusted Moisture Variation %	**	**	**	**	**
Hilf Density Ratio (%)	<b>103.0</b>	<b>97.0</b>	<b>95.0</b>	<b>104.5</b>	<b>103.0</b>
Compaction Method	<b>Standard</b>	<b>Standard</b>	<b>Standard</b>	<b>Standard</b>	<b>Standard</b>
Report Remarks	**	**	**	**	**

**Moisture Variation Note:**

Positive values = test is dry of OMC  
 Negative values = test is wet of OMC

# Material Test Report



**Report Number:** GS6240/2-5  
**Issue Number:** 1  
**Date Issued:** 06/09/2022  
**Client:** BildGroup  
 7 Metrolink Circuit, Campbellfield, Melbourne VIC 3061  
**Contact:** Jamie Lancaster  
**Project Number:** GS6240/2  
**Project Name:** Lucas Estate - Stage K3 (Level 1)  
**Project Location:** Ballarat  
**Work Request:** 9957  
**Date Sampled:** 02/09/2022 8:00  
**Dates Tested:** 02/09/2022 - 05/09/2022  
**Sampling Method:** AS 1289.1.2.1 6.4 (b) - Sampling from layers in earthworks or pavement - compacted  
**Specification:** 95% Standard Compaction & +/- 3% Moisture Variation  
**Location:** Ballarat  
**Material:** Silty CLAY, medium to high plasticity, brown  
**Material Source:** On-site

Ground Science Pty Ltd  
 Ground Science Laboratory  
 13 Brock Street Thomastown Victoria 3074  
 Phone: (03) 9464 4617  
 Email: brent@groundscience.com.au

Accredited for compliance with ISO/IEC 17025 - Testing



*Brent Elliott*

Approved Signatory: Brent Elliott  
Laboratory 21C

NATA Accredited Laboratory Number: 15055

Compaction Control AS 1289 5.7.1 & 5.8.1 & 2.1.1			
Sample Number	62402-S12	62402-S13	62402-S14
Date Tested	01/09/2022	01/09/2022	01/09/2022
Time Tested	08:10	08:15	08:23
Test Request #/Location	Retest of 2	Retest of 4	Retest of 6
Layer / Reduced Level	2	2	1
Thickness of Layer (mm)	200	200	200
Soil Description	Silty CLAY, medium to high plasticity, brown	Silty CLAY, medium to high plasticity, brown	Silty CLAY, medium to high plasticity, brown
Test Depth (mm)	175	175	175
Sieve used to determine oversize (mm)	19.0	19.0	19.0
Percentage of Wet Oversize (%)	0	0	0
Field Wet Density (FWD) t/m <sup>3</sup>	2.03	2.19	2.06
Field Moisture Content %	26.7	21.6	23.9
Field Dry Density (FDD) t/m <sup>3</sup>	1.60	1.80	1.67
Peak Converted Wet Density t/m <sup>3</sup>	2.07	2.11	2.14
Adjusted Peak Converted Wet Density t/m <sup>3</sup>	**	**	**
Moisture Variation (Wv) %	-2.0	0.0	-0.5
Adjusted Moisture Variation %	**	**	**
Hilf Density Ratio (%)	<b>98.5</b>	<b>103.5</b>	<b>96.5</b>
Compaction Method	<b>Standard</b>	<b>Standard</b>	<b>Standard</b>
Report Remarks	**	**	**

## Moisture Variation Note:

Positive values = test is dry of OMC  
 Negative values = test is wet of OMC

## **APPENDIX C**

Site Photographs



2 Jun 2022 at 1:51:13 pm  
K3 placed with out our supervision



2 Jun 2022 at 1:51:45 pm  
K3 placed with out our supervision



2 Jun 2022 at 2:22:05 pm  
K3 placed with out our supervision





2 Jun 2022 at 1:51:31 pm  
K3 placed with out our supervision

