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LEVEL 1 INSPECTION & TESTING
LUCAS GRANGE ESTATE - STAGE 1B

Prepared for Bild Group

Report Reference: GS5572.1 AA

Date: 29 June 2021

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PROJECT DETAILS

Project Reference	GS5572.1	Rev	AA
Project Title	Lucas Grange Estate stage 1B		
Project Location	Alfredton, Ballarat	State	VIC
Date	29 June 2021		

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, MIEAust (NER)
Senior Geotechnical Engineer

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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 Grange Estate stage 1B, Alfredton, Ballarat, Victoria (the site).

Ground Science was engaged to provide Level 1 Inspection and Testing services for the construction of building platforms to support proposed residential allotments, as part of the bulk earthworks phase of the project. Authorisation to proceed was provided by Bild Group (the 'Client').

Level 1 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 Level 1 Inspection and Testing services described in this report was undertaken by experienced geotechnicians from Ground Science.

2. SCOPE OF WORK

2.1 AREAS OF WORK

The areas requiring Level 1 Inspection & Testing are shown on site plan, Figure 1, in Appendix A, which is based on plans prepared by Integra (LUG1B-CD-001 REV A). This report details the Level 1 earthworks process performed on site which commenced on 4th March 2021 and was completed on 2nd June 2021, which included 2 days of filling operations.

2.2 PLACEMENT METHODOLOGY

A technical specification for the works was not provided. The placement of controlled fill on the above-mentioned areas was carried out in accordance with modified Level 1 fill procedures as detailed in AS3798 (2007) 'Guidelines on Earthworks for Commercial and Residential Developments'. The following fill placement guideline was adopted for the works:

- All existing loose surficial fill, topsoil, soft material, vegetation and materials containing significant organic matter were removed to expose the natural soil subgrade;
- Suitable fill material, sourced by the contractor and approved by Ground Science, was placed in loose horizontal layers not exceeding 300mm in thickness;
- The controlled fill material was compacted to achieve a target Dry Density Ratio of at least 95% Standard Compaction (AS 1289: 5.1.1, 5.4.1 or 5.7.1), based on the sites proposed use for residential purposes;
- The fill was moisture conditioned to within 85% – 115% of the standard optimum moisture content;
- The fill material was sorted and mixed to remove particles greater than 20% by volume, particles coarser than 37.5mm and no particle over 200mm in any dimension;
- The frequency of field density testing adopted for the project was generally in line with the requirements for large scale developments (Type 1), as detailed in AS3798 (2007), which nominates a frequency of not less than:
    - 1 test per layer or 200mm per 2500m^2;
    - 1 test per 500m^3 distributed reasonably evenly throughout the full depth and area; or
    - 3 tests per site visit; whichever requires the most tests.

3. INSPECTION AND TESTING

3.1 SUBGRADE PREPARATION

The subgrade preparation process normally involved the removal of all surface vegetation, topsoil and any saturated soils and was completed without the supervision of GITA representative. The subgrade typically comprises of silty CLAY (CI- CH), medium to high plasticity, brown, no vegetation and clean.

The above subgrade was visually assessed using tactile methods described in AS1726 (2017) and approved by the GITA representative throughout the project. Typically, the subgrade soils were found to be dry and in a stiff or better consistency and approved for subsequent fill placement. Subgrade soil was moisture conditioned and proof rolled prior to the placement of the fill layers.

3.2 CONSTRUCTION MATERIALS

The fill material used in this project was nominated by the on-site contractor. The nominated fill used for the project was sourced from onsite excavations.

The material was carted to site and stockpiled adjacent to the fill zones. Ground Science performed an assessment of the fill source to identify the following material characteristics:

- Material suitability as an engineering property;
- Cohesiveness;
- Free of building debris and vegetative matter;
- Free of 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 of silty CLAY(CI-CH), medium to high plasticity, brown/dark brown, dry of the optimum moisture content (OMC).

Ground Science did not perform any chemical or environmental analysis of the above fill sources. Oversize particles typically measured around 150mm in size and were removed from the fill placement zones. Fill materials that were found to be dry were moisture conditioned using a water cart prior and during placement. All fill materials hauled to the site were however generally considered suitable for use as engineered fill.

3.3 FILL CONSTRUCTION

The contractor had the following plant available on site during the construction period for use in the fill placement;

- Padfoot Roller;
- Water Cart;
- Scraper;
- Grader.

During fill placement, the weather conditions were generally cool and windy with temperatures typically ranging from 15 to 20 degrees Celsius.

The filling process was generally consistent throughout the project and involved the approved fill sources stockpiled adjacent to the fill placement zones. The material was hauled and spread using a grader into thin loose layers and moisture conditioned. Each layer was compacted using a Padfoot compactor applying a minimum of 6-12 passes, per layer observed. The thin layers of fill were compacted to form a composite layer of up to a maximum of 150mm thick, prior to undertaking the field density testing. Generally, up to 2 layers were placed and compacted. The

compacted fill was moisture conditioned prior to the application of subsequent layers of fill. This process was adopted for the fill placement works.

Throughout the filling process and/or at the completion of the day's production, compaction testing was performed to assess the achieved density ratio of each layer. Figure 1 provides a guide to the fill placement and is limited to the areas described in this report. It is considered that a 100mm to 150mm 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.

3.4 RESULTS OF COMPACTION CONTROL TESTING

Level 1 Inspection and Testing was undertaken by experienced technicians from Ground Science who attended the site for the duration of the construction phase and nominated the location of the in-situ density tests. Testing comprised a total of 8 in-situ density tests using a nuclear moisture-density gauge in accordance with Australian Standard (AS1289 5.8.1) and 8 "Rapid HILF" Compaction tests (AS1289 5.7.1) which included associated re-tests of areas that did not achieve the target density ratio of 95% Standard Compaction.

A summary of the field density tests performed for the project, including failed tests and re-tests, is presented in Appendix B. Field density and compaction control testing report sheets are presented in Appendix C. It should be noted that the tests are a representation of the fill placed and support the visual assessment of the works completed.

Test #2, and #3 failed to meet the required target density ratio and the area of these tests were subsequently reworked, recompacted and retested with compliant test results achieved (Test #7 and #8). The moisture condition of the compacted fill material varies and typically dry of optimum moisture level.

3.5 FINAL SURFACE LEVELS

Observations were made by a Ground Science staff member that filling had been complete up to the nominated finished levels as per confirmation provided from the contractor's site foreman. The observed final levels are the constructed finished surface levels of the controlled fill. 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 on site may change over time. True fill depths should be obtained from the contractor's survey data.

4. COMPLIANCE

Ground Science Staff have undertaken Level 1 Inspection and Testing services of the construction of the controlled fill in the areas designated on Figure 1. Ground Science field staff have also observed that the prepared subgrade provided an adequate base for the subsequent placement of controlled fill.

Based on observations made by Ground Science staff and the results of density tests, we consider that the controlled fill placed has been constructed in accordance with the guidelines provided by AS3798 (2007) and AS2870 (2011).

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 200mm to 300mm 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 amounts of fill placed and do not necessarily reflect an accurate survey of the fill levels.

5. UNDERSTANDING LEVEL 1 INSPECTION & TESTING

The purpose of performing Level 1 Inspection and Testing is to ensure compliance of the fill with the specification. The engagement of a Geotechnical Inspection Testing Authority (GITA) allows the contractor to perform their role in the construction of the filling operation while the GITA monitors the quality control process of the fill placement.

The visual observations of thorough processes and work practices by the contractor allows the GITA to approve the subsequent placement of fill without having to wait for the completion of testing and the extended time it takes to get a test result back. The GITA will however, carry out random spot checks of the filling operations throughout the day's production as confirmation that the placement procedures and the fill moisture content is appropriate. At the end of a day's production the GITA will sign off the completed works as satisfactory. Any failed tests will result in that particular area of operation requiring rectification in the following mornings activities. This may be as simple as extra rolling with compaction plant if moisture conditioning is suitable. Sometimes these areas may be retested if the GITA feels it is necessary.

While AS3798 (2007) is a guideline on the minimum requirements of filling on commercial and residential developments, some projects require a more detailed project specification to deal with site specific issues. While moisture conditioning of fill sources aids in the ease with which compaction is achieved, it is not necessarily a physical characteristic that determines if the placed fill is acceptable. In some situations, the moisture requirement is an extremely important function of the final constructed product. In these situations, a specific project specification should apply to the project as detailed by the designing geotechnical engineer. These are typical of clay liners for wet lands, dams, landfill liners and caps and an array of other engineering situations. Creating a consolidated platform of which is similar to equivalent surrounding natural conditions is the primary aim of level one processes, preventing the occurrence of differential ground movements to footing structures.

Level 1 Inspection & Testing requires full time inspection and testing of the fill placement undertaken on a site. Ground Science (project GITA), are notified daily (or at the completion of each day's work) by the project foreman where subsequent days of fill placement under Level 1 is to occur. On projects that rely upon the importation of a fill source, there can be delays in the receipt of sufficient materials to warrant fill placement works which may result in periods of time where a GITA representative is not required on site. It is the contractor's responsibility to notify the GITA when works proceed and their attendance on site is required again. A GITA relies upon the integrity of the contractor to advise when site attendance is required and makes all reasonable visual attempts to assess if the works are the same as the previous days attendance.

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.

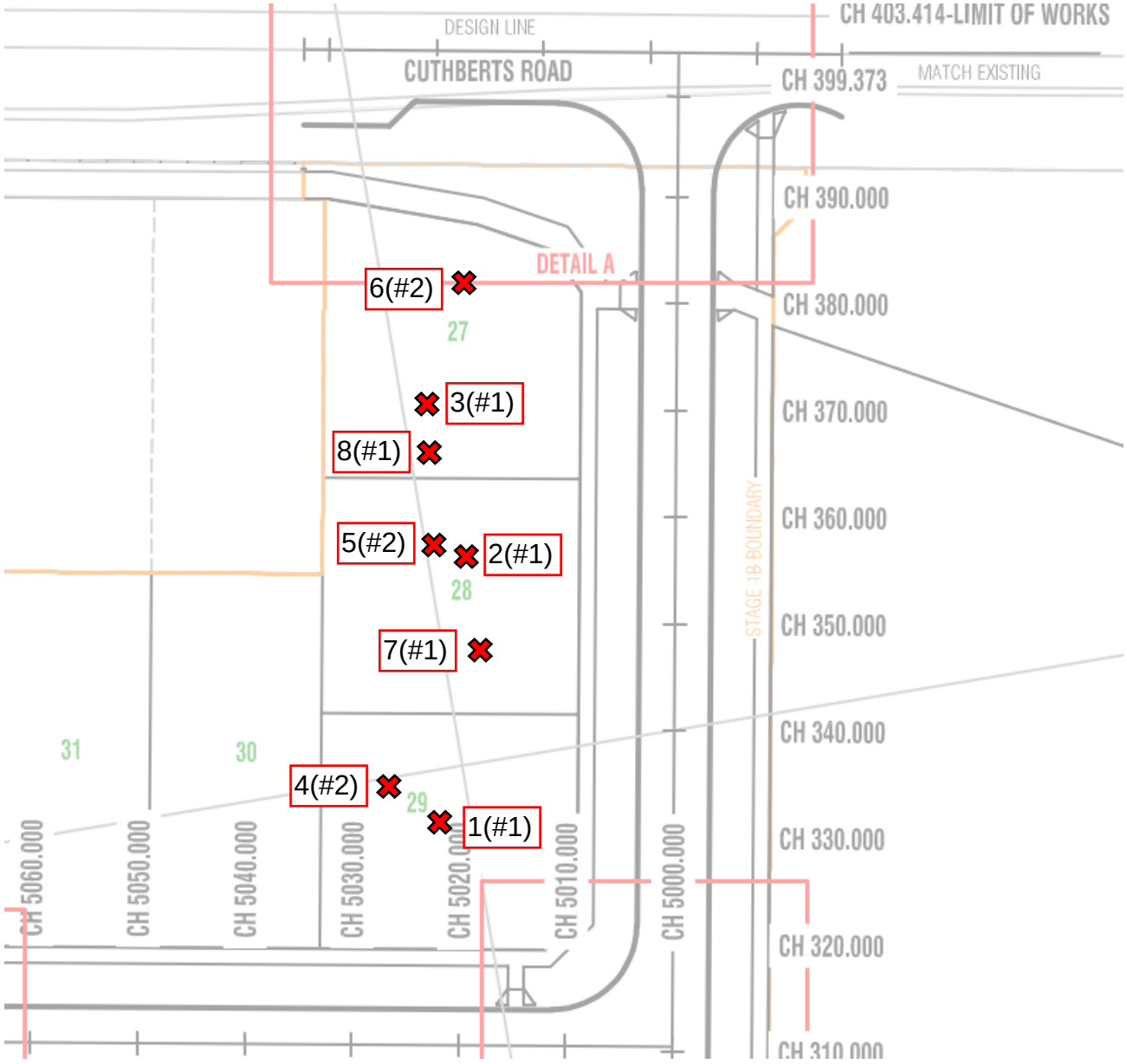
Any drawings or figures presented in this report should be considered only as pictorial evidence of our work. Therefore, unless otherwise stated, any dimensions should not be used for accurate calculations or dimensioning.

7. REFERENCES

- AS3798 (2007) Guidelines on Earthworks for Residential and Commercial Developments.
- AS1289 Methods of Testing Soils for Engineering Purposes.
- AS1726 (1993): Geotechnical Site Investigations

APPENDIX A

Figure 1: Site Layout & Test Location Plan



Rev		Drawn	Date	Checked	Scale
0	Figure 1: Density Test Locations	AM	17/6/2021	GS	NTS

Legend

✖ Density Test Location (#Layer number)

LUCAS GRANGE ESTATE STAGE 1B

Prepared For: Bild Group

Job No: GS5572/1.1 AA

GroundScience

APPENDIX B

Field Density Test Summary

LEVEL 1 - COMPACTION TEST SUMMARY

Client: Bitu-mill	**Job No: GS5572/1**
Project: Lucas Grange Estate stage 1b	**Tech: LEE**
Location: Alfredton	

Date	Test No.	Location	Layer No.	Density Ratio (%)	Moisture Ratio (%)	Moisture variation	(P) Pass (F) Fail	Comments
4/03/2021	1	lot 29 14m east 14m south	1	95.0		0.0	P	
4/03/2021	2	lot 28 15m east 10m south	1	94.5		0.0	F	
4/03/2021	3	lot 27 10m east 16m south	1	85.0		-1.0	F	
2/06/2021	4	Lot 29 5m e 4m s	2	97.5		-2.0	P	
2/06/2021	5	Lot 28 7me 4m s	2	105.5		0.5	P	
2/06/2021	6	Lot 27 10m e 4m s	2	99.5		-1.0	P	
2/06/2021	7	Retest of 2	1	106.0		2.0	P	
2/06/2021	8	Retest of 3	1	101.5		1.0	P	

APPENDIX C

Field Density Test Report Sheets

Material Test Report

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

Accredited for compliance with ISO/IEC 17025 - Testing

Approved Signatory: Chris Senserrick
Laboratory Manager
NATA Accredited Laboratory Number: 15055

Report Number: GS5572/1-1
Issue Number: 1
Date Issued: 09/03/2021
Client: Bitu-Mill
133 Metrolink Circuit Campbellfield, Melbourne VIC 3061
Contact: Amanda Veljanovski
Project Number: GS5572/1
Project Name: Lucas Grange Estate - Stage 1B (Level 1)
Project Location: Ballarat
Work Request: 2440
Date Sampled: 04/03/2021 7:00
Dates Tested: 04/03/2021 - 06/03/2021
Sampling Method: AS 1289.1.2.1 6.4 (b) - Sampling from layers in earthworks or pavement - compacted
Specification: 95% Standard Compaction
Location: Lucas Grange Estate stage 1B
Material: Silty CLAY, medium to high plasticity, brown

Compaction Control AS 1289 5.7.1 & 5.8.1 & 2.1.1			
Sample Number	55721-S1	55721-S2	55721-S3
Date Tested	04/03/2021	04/03/2021	04/03/2021
Time Tested	14:35	14:40	14:47
Test Request #/Location	2440 From s/w corner of Lot 29	2440 From s/w corner of Lot 28	2440 From s/w corner of Lot 27
Easting	14m east	15m east	10m east
Northing	14m south	10m south	16m south
Layer / Reduced Level	1	1	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
Percentage of Dry Oversize (%) (AS1289.5.4.1)	**	**	0
Field Wet Density (FWD) t/m^3	2.05	2.04	1.75
Field Moisture Content %	18.4	19.1	19.2
Field Dry Density (FDD) t/m^3	1.74	1.72	1.47
Peak Converted Wet Density t/m^3	2.16	2.17	2.06
Adjusted Peak Converted Wet Density t/m^3	**	**	**
Adj. Optimum Moisture Content % (AS1289.5.4.1)	**	**	18.2
Adj. Field Moisture Content % (AS1289.5.4.1)	18.4	19.1	19.2
Moisture Ratio % (AS1289.5.4.1)	100.5	100.5	105.5
Adjusted Moisture Ratio % (AS1289.5.4.1)	**	**	**
Moisture Variation (Wv) %	0.0	0.0	-1.0
Adjusted Moisture Variation %	**	**	**
Hilf Density Ratio (%)	**95.0**	**94.5**	**85.0**
Compaction Method	**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

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

Approved Signatory: Brent Elliott
NATA Accredited Laboratory Number: 15055

Report Number: **GS5572/1-2**
Issue Number: 1
Date Issued: 07/06/2021
Client: BildGroup
7 Metrolink Circuit, Campbellfield, Melbourne VIC 3061
Contact: Amanda Veljanovski
Project Number: GS5572/1
Project Name: Lucas Grange Estate - Stage 1B (Level 1)
Project Location: Ballarat
Work Request: 3678
Date Sampled: 02/06/2021 8:30
Dates Tested: 02/06/2021 - 04/06/2021
Sampling Method: AS 1289.1.2.1 6.4 (b) - Sampling from layers in earthworks or pavement - compacted
Specification: 95% Standard Compaction
Location: Lucas Grange Stage 1B
Material: siltt CLAY, medium to high plasticity, brown

Compaction Control AS 1289 5.7.1 & 5.8.1 & 2.1.1					
Sample Number	55721-S4	55721-S5	55721-S6	55721-S7	55721-S8
Date Tested	02/06/2021	02/06/2021	02/06/2021	02/06/2021	02/06/2021
Time Tested	08:16	08:20	08:24	08:30	08:36
Test Request #/Location	From n/w corner of lot	From n/w corner of lot	From n/w corner of lot	Retest of 2	Retest of 3
Latitude	4m e	7m e	10m e	**	**
Longitude	4m s	4m s	4m s	**	**
Layer / Reduced Level	2	2	2	1	1
Thickness of Layer (mm)	150	150	150	150	150
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)	125	125	125	125	125
Sieve used to determine oversize (mm)	19.0	19.0	19.0	19.0	19.0
Percentage of Wet Oversize (%)	0	0	0	4	11
Field Wet Density (FWD) t/m^3	1.98	2.04	1.96	2.17	2.13
Field Moisture Content %	23.9	29.1	23.2	17.4	19.9
Field Dry Density (FDD) t/m^3	1.60	1.58	1.59	1.85	1.78
Peak Converted Wet Density t/m^3	2.03	1.93	1.97	**	**
Adjusted Peak Converted Wet Density t/m^3	**	**	**	2.05	2.10
Moisture Variation (Wv) %	-2.0	0.5	-1.0	**	**
Adjusted Moisture Variation %	**	**	**	2.0	1.0
Hilf Density Ratio (%)	**97.5**	**105.5**	**99.5**	**106.0**	**101.5**
Compaction Method	**Standard**	**Standard**	**Standard**	**Standard**	**Standard**
Report Remarks	**	**	**	**	**

Moisture Variation Note:
Positive values = test is dry of OMC
Negative values = test is wet of OMC

APPENDIX D

Site Photographs


SHERRINRentals
132 138
WT09006
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132 138
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FUSO
Bitu-mill
CAT


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