



Huddleston-Berry
Engineering & Testing, LLC

**GEOTECHNICAL INVESTIGATION
FUOCO NISSAN
GRAND JUNCTION, COLORADO
PROJECT#01085-0001**

**FUOCO INVESTMENTS, LLC
741 N 1ST STREET
GRAND JUNCTION, COLORADO 81501**

JUNE 7, 2011

**Huddleston-Berry Engineering and Testing, LLC
640 White Avenue, Unit B
Grand Junction, Colorado 81501**

SUMMARY OF CONCLUSIONS AND RECOMMENDATIONS

A geotechnical investigation was conducted for a proposed new structure at the Fuoco Nissan dealership in Grand Junction, Colorado. The project location is shown on Figure 1 – Site Location Map. The purpose of the investigation was to evaluate the surface and subsurface conditions at the site with respect to foundation design and earthwork for the proposed construction. This summary has been prepared to include the information required by civil engineers, structural engineers, and contractors involved in the project.

Subsurface Conditions (p. 2)

The subsurface investigation consisted of two borings, drilled on May 16th, 2011. The locations of the borings are shown on Figure 2 – Site Plan. The borings generally encountered pavements and fill materials above native clay and sand soils down to depths of between 20.0 and 21.0 feet where dense gravel soils were encountered. Groundwater was encountered in the borings at a depth of 9.5 feet at the time of the investigation. The native clay soils are slightly plastic and are anticipated to tend to consolidate under loading.

Summary of Foundation Recommendations

- *Foundation Type* – Spread Footings or Helical Piers. (p. 2)

Spread Footings

- *Structural Fill* – Existing fill materials should be removed and replaced with structural fill. Imported structural fill should consist of pit-run, crusher fines, CDOT Class 6 base course, or other granular material approved by the engineer. (p. 3)
- *Maximum Allowable Bearing Capacity* – 1,500 psf. (p. 3)

Helical Piers

- *Anticipated Length* – 23 to 31 feet. (p. 4)
- *Axial Capacity* – Dependent upon structural capacity of pile and pile load testing. (p. 4)

General

- *Lateral Earth Pressure* – 50 pcf (p. 4)

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Figure 1 – Site Location Map

Figure 2 – Site Plan

APPENDICES

Appendix A – Typed Boring Logs

Appendix B – Laboratory Testing Results

1.0 INTRODUCTION

As part of extensive development in Western Colorado, Fuoco Nissan proposes to construct a new building at their Grand Junction dealership. As part of the development process, Huddleston-Berry Engineering and Testing, LLC (HBET) was retained by Fuoco Investments, LLC to conduct a geotechnical investigation at the site.

1.1 Scope

As discussed above, a geotechnical investigation was conducted at the Fuoco Nissan dealership in Grand Junction, Colorado. The scope of the investigation included the following components:

- Conducting a subsurface investigation to evaluate the subsurface conditions at the site.
- Collecting soil samples and conducting laboratory testing to determine the engineering properties of the soils at the site.
- Providing recommendations for foundation type and subgrade preparation.
- Providing recommendations for bearing capacity.
- Providing recommendations for lateral earth pressure.
- Providing recommendations for drainage, grading, and general earthwork.

The investigation and report were completed by a Colorado registered professional engineer in accordance with generally accepted geotechnical engineering practices. This report has been prepared for the exclusive use of Fuoco Investments, LLC.

1.2 Site Location and Description

The site is located at 2582 Highway 6 & 50 in Grand Junction, Colorado. The project location is shown on Figure 1 – Site Location Map.

At the time of the investigation, the majority of the site was open and asphalt paved. Two buildings were present in the western portion of the site and a large building was present in the eastern portion of the site. A moderate slope up to the east was observed with the eastern portion of the site higher than the western portion of the site. Vegetation was minimal and consisted of landscaping shrubs and lawn grasses. The property was bordered to the north and south by existing businesses, to the east by North 1st Street and to the west by Highway 6 & 50.

1.3 Proposed Construction

The proposed construction is anticipated to include an approximately 12,500 square-foot building and associated construction. The proposed structure is anticipated to be constructed over a reinforced concrete foundation.

2.0 SUBSURFACE INVESTIGATION

The subsurface investigation was conducted on May 16th, 2011 and consisted of two borings drilled to a depth of 23.0 feet below the existing ground surface. The locations of the borings are shown on Figure 2 – Site Plan. The borings were located in the field relative to existing site features. Typed boring logs are included in Appendix B. Samples of the native soils were collected during Standard Penetration Testing (SPT) and using bulk sampling methods at the locations shown on the logs.

As indicated on the logs, the subsurface conditions at the site were fairly consistent. The borings generally encountered 3.0 inches of asphalt pavement above granular base course to depths of between 1.5 and 2.0 feet. The base course was underlain by brown to gray to black, moist to very moist, soft to hard silty clay with gravel to depths of between 5.0 and 5.25 feet. In B-2, peat materials were observed in the fill. Below the fill, brown to gray, moist to wet, soft to stiff lean clay extended to a depth of 10.0 feet. The clay was underlain by brown, wet, loose silty sand to depths of between 20.0 and 21.0 feet. Below the sand, brown, wet, medium dense to dense sandy gravel extended to the bottoms of the borings. Groundwater was encountered in the borings at a depth of 9.5 feet.

3.0 LABORATORY TESTING

Selected native soil samples collected from the test pits were tested in the Huddlestone-Berry Engineering and Testing LLC geotechnical laboratory for natural moisture and density, grain size analysis, Atterberg limits, swell/consolidation, and soluble sulfates content. The laboratory testing results are included in Appendix C.

The laboratory testing results indicate that the native clay soils are slightly plastic. In addition, the native soils were shown to tend to consolidate under loading. Water soluble sulfates were detected in the site soils in a concentration of 2.1%.

4.0 RECOMMENDATIONS

4.1 Foundations

As discussed previously, a significant quantity of fill materials was encountered at the site. In addition, peat materials were observed within the fill. Based upon information provided to HBET, prior to development, the area consisted of marshland and that the marshland was filled in.

While shallow foundations are typical for this type of structure, the risk of settlement is significant due to the presence of organic rich peat materials in the existing fill. As a result, it would be necessary to remove the existing fill and replace it with structural fill. However, due to the presence of shallow groundwater, the native soils below the fill may be soft and subgrade stabilization may be required.

An alternative to removing and replacing the existing fill in conjunction with shallow foundations would be to use a helical pier and grade beam foundation system. This would eliminate the need to completely remove and replace the existing fill materials. Shallow foundations and helical piers will both be discussed in the following sections.

Shallow Foundations

In general, spread footings are the recommended shallow foundation alternative. However, as discussed previously, to reduce the risk of excessive differential settlements, it is recommended that the existing fill materials below the footings be completely removed and replaced with structural fill.

Based upon the results of the subsurface investigation, some of the existing fill materials may be able to be reused as structural fill. However, the materials will have to be evaluated by HBET during construction. Imported structural fill should consist of a granular, non-expansive, non-free draining material such as pit-run, crusher fines, or CDOT Class 6 base course. However, if pit-run is used as structural fill below the foundations, a minimum of six inches of crusher fines or Class 6 base course should be placed on top of the pit-run to prevent large point stresses on the bottoms of the foundations due to large particles in the pit-run.

Prior to placement of structural fill, it is recommended that the bottoms of the foundation excavations be scarified to a depth of 6 to 8-inches, moisture conditioned, and compacted to a minimum of 95% of the standard Proctor maximum dry density within $\pm 2\%$ of the optimum moisture content as determined in accordance with ASTM D698. However, soft native soils were encountered in the borings. As a result, compaction of the subgrade may be difficult and geotextile and/or geogrid reinforcement may be required below and/or within the structural fill to provide a stable foundation subgrade. HBET should be contacted to provide specific recommendations for stabilization based upon the actual conditions in the bottoms of the foundation excavations.

Structural fill should extend laterally beyond the edges of the foundation a minimum of 30-inches. Structural fill should be moisture conditioned, placed in maximum 8-inch loose lifts, and compacted to a minimum of 95% of the standard Proctor maximum dry density for fine grained soils or modified Proctor maximum dry density for coarse grained soils, within $\pm 2\%$ of the optimum moisture content as determined in accordance with ASTM D698 or D1557C, respectively. Pit-run materials used as structural fill should be proofrolled to the Engineer's satisfaction.

For the foundation building pad prepared as recommended with structural fill consisting of suitable existing fill materials or imported granular materials, a maximum allowable bearing capacity of 1,500 psf may be used. Foundations subject to frost should be at least eighteen inches below the final grade.

Helical Piers

In general, the precise type, size, and quantity of helical piers should be established by the contractor in conjunction with the structural engineer. However, HBET provides the following design comments.

Helical piers should be designed to penetrate the fill materials, native clay, and native sand soils and bear into the dense gravel and cobble soils. In addition, to eliminate reductions in capacity from group effects, helical piers should be spaced a distance equal to three times the diameter of the largest helix. It is anticipated that the helical piers will reach refusal within 3 to 10 feet of the top of the gravel and cobble layer. Therefore, pile lengths of up to approximately 31 feet may be possible.

For helical piers taken to refusal in the gravel and cobble soils, the allowable capacity will be based upon the structural capacity of the pile. However, the actual allowable capacity should be determined based upon the results of pile load testing conducted in the vicinity of the proposed structure.

With regard to the pile cap, the bottom of pile cap elevation should be a minimum of 18-inches below the finished grade for frost protection. In addition, it is recommended that a minimum of 1 foot of soil cover be maintained above the tops of the pile caps.

4.2 Non-Structural Floor Slabs and Exterior Flatwork

In order to limit the potential for movement of non-structural floor slabs, it is recommended that floor slabs be constructed above a minimum of 12-inches of structural fill with subgrade preparation and fill placement in accordance with the *Foundations* section of this report. It is recommended that exterior flatwork be constructed above the existing fill materials that have been scarified to a depth of 9 to 12-inches, moisture conditioned, and compacted to a minimum of 95% of the standard Proctor maximum dry density, within $\pm 2\%$ of optimum moisture content as determined in accordance with ASTM D698.

4.3 Lateral Earth Pressures

Stemwalls and/or retaining walls should be designed to resist lateral earth pressures. For backfill consisting of the existing fill materials, native soils, or imported granular, non-free draining, non-expansive material, we recommend that the walls be designed for an equivalent fluid unit weight of 50 pcf in areas where no surcharge loads are present. Lateral earth pressures should be increased as necessary to reflect any surcharge loading behind the walls.

4.4 Water Soluble Sulfates

As discussed previously, water soluble sulfates were detected in the site soils in a concentration of 2.1%. This concentration represents a severe degree of potential sulfate attack on concrete exposed to these materials. Therefore, Type V sulfate resistant cement is recommended for construction at this site in accordance with the International Building Code (IBC). However, Type V cement can be difficult to obtain in Western Colorado. Where Type V cement is unavailable, Type I-II cement is recommended

4.5 Drainage

In order to improve the long-term performance of the foundations and slabs-on-grade, grading around the structure should be designed to carry precipitation and runoff away from the structure. It is recommended that the finished ground surface drop at least twelve inches within the first ten feet away from the structure. However, where impermeable surfaces (i.e. concrete, pavements, etc.) are adjacent to the structure, the grade can be reduced to three inches within the first ten feet away from the structure. Downspouts should empty beyond the backfill zone. It is recommended that landscaping within five feet of the structure include primarily desert plants with low water requirements. In addition, it is recommended that automatic irrigation within ten feet of foundations be minimized or controlled with automatic shut off valves.

4.6 Excavations

Excavations in the soils at the site may stand for short periods of time but should not be considered to be stable. Trenching and excavations should be sloped back, shored, or shielded for worker protection in accordance with applicable OSHA standards. The existing fill materials and native soils generally classify as Type C soil with regard to OSHA's *Construction Standards for Excavations*. For Type C soils, the maximum allowable slope in temporary cuts is 1.5H:1V.

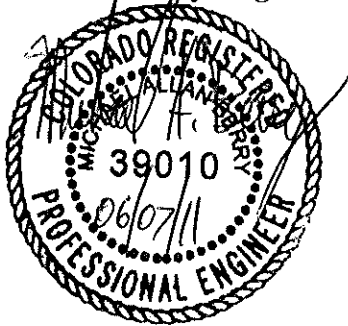
5.0 GENERAL

The recommendations included above are based upon the results of the subsurface investigation and on our local experience. These conclusions and recommendations are valid only for the proposed construction.

As discussed previously, the subsurface conditions at the site were fairly consistent. However, the precise nature and extent of subsurface variability may not become evident until construction. Therefore, it is recommended that a representative of HBET be retained to provide engineering oversight and construction materials testing services during the foundation and earthwork phases of the construction. This is to verify compliance with the recommendations included in this report or permit identification of significant variations in the subsurface conditions which may require modification of the recommendations.

Huddleston-Berry Engineering and Testing, LLC is pleased to be of service to your project. Please contact us if you have any questions or comments regarding the contents of this report.

Respectfully Submitted:
Huddleston-Berry Engineering and Testing, LLC



Michael A. Berry, P.E.
Vice President of Engineering

FIGURES

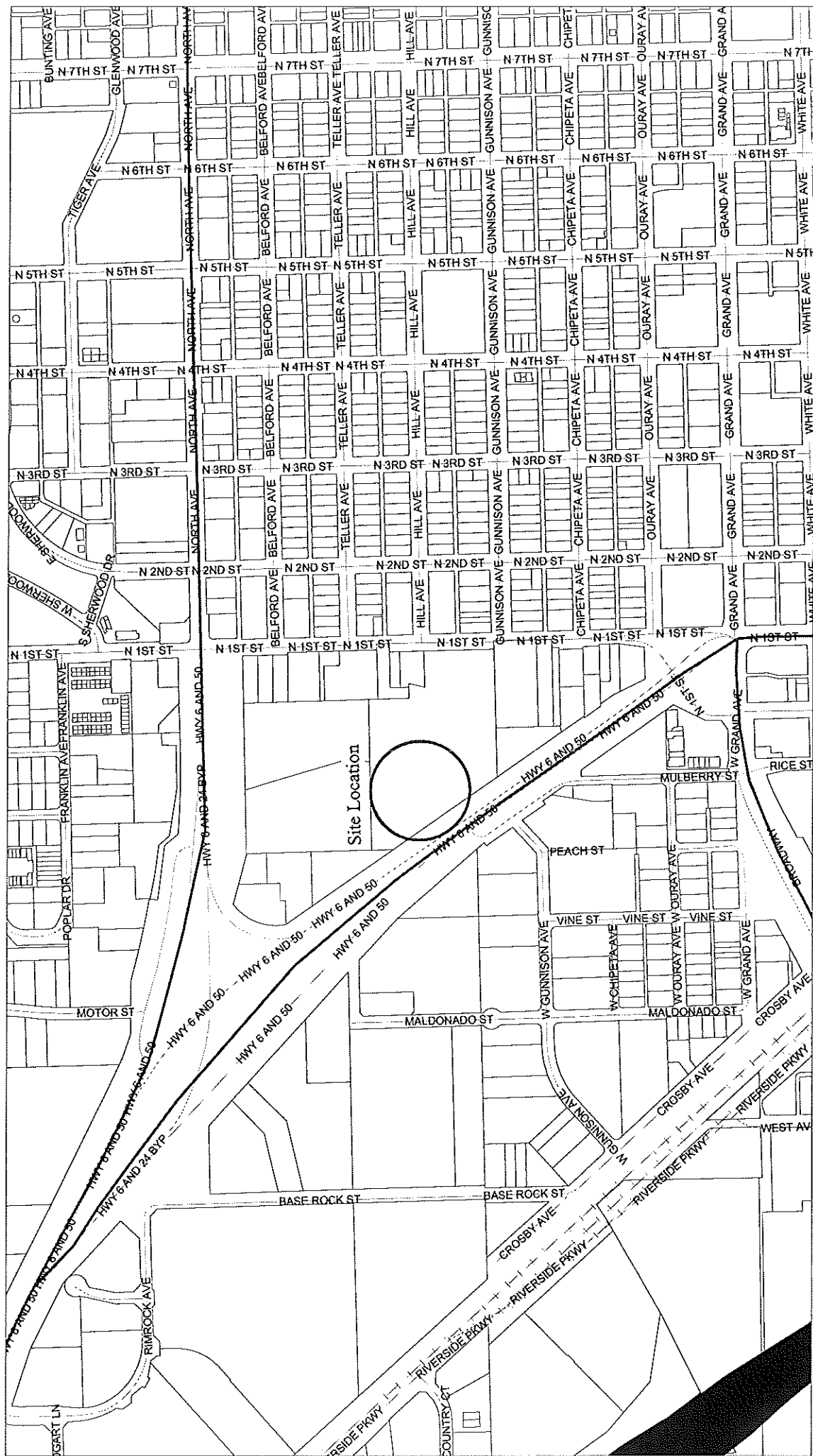
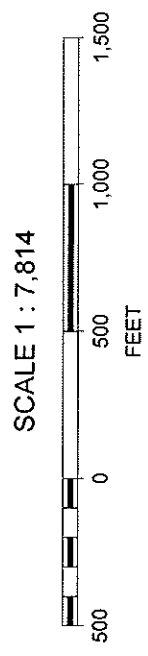


FIGURE 1
Site Location Map



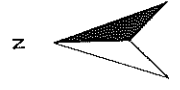
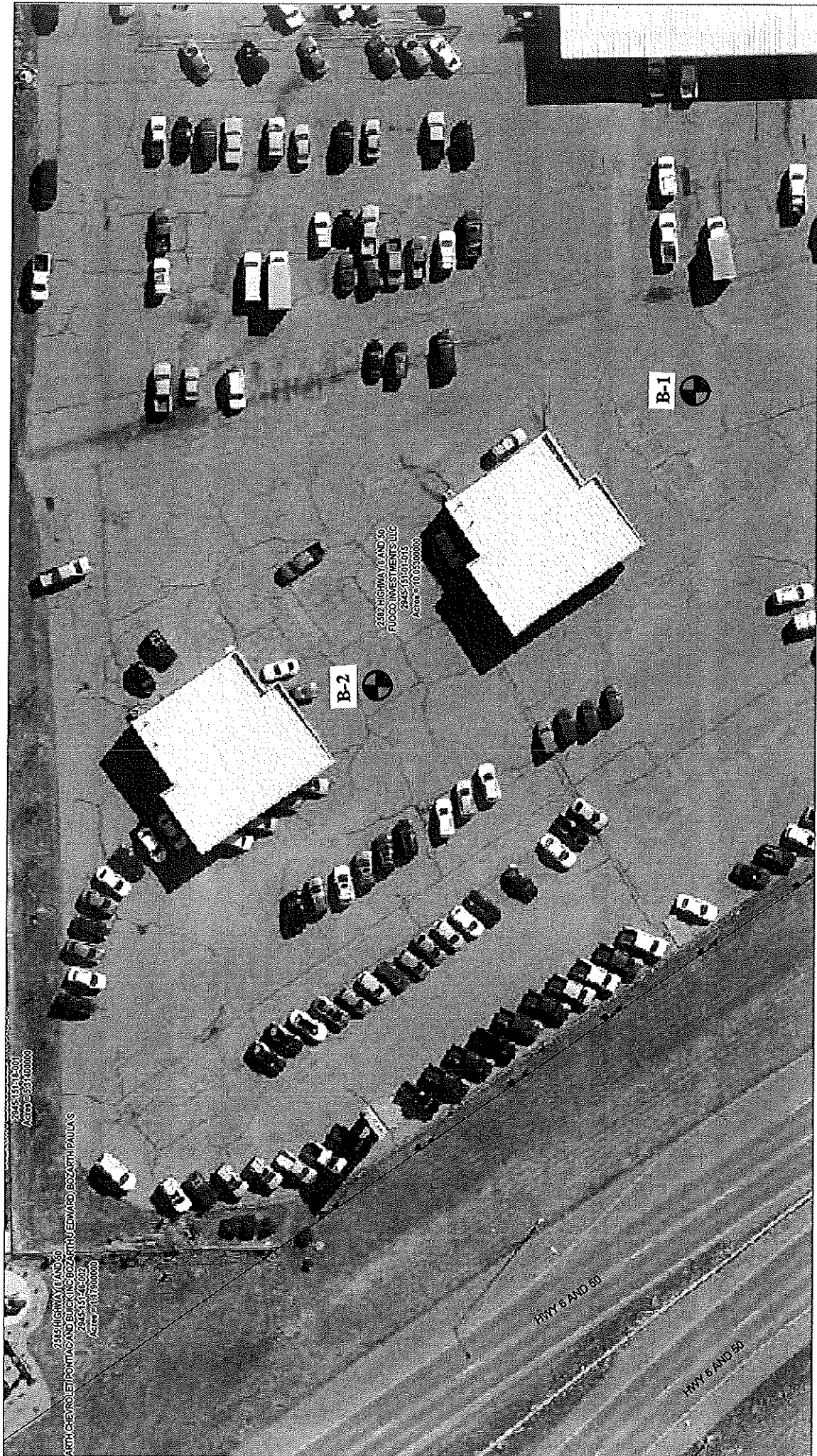
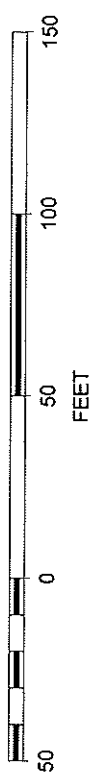
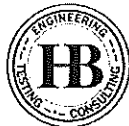


FIGURE 2
Site Plan

SCALE 1 : 634



APPENDIX A
Typed Boring Logs



Huddlestone-Berry Engineering & Testing, LLC
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 Grand Junction, CO 81501
 970-255-8005
 970-255-6818

BORING NUMBER B-1

PAGE 1 OF 1

CLIENT Fuoco Investments, LLC PROJECT NAME Fuoco Nissan
 PROJECT NUMBER 01085-0001 PROJECT LOCATION Grand Junction, CO
 DATE STARTED 5/16/11 COMPLETED 5/16/11 GROUND ELEVATION _____ HOLE SIZE 4"
 DRILLING CONTRACTOR S. McKracken GROUND WATER LEVELS:
 DRILLING METHOD Simco 2000 Truck Rig ▽ AT TIME OF DRILLING 9.5 ft
 LOGGED BY AS CHECKED BY MAB ▽ AT END OF DRILLING 9.5 ft

NOTES _____ AFTER DRILLING --

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS			FINES CONTENT (%)
									LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	
0		ASPHALT										
		Sandy GRAVEL (BASE COURSE), brown, moist, medium dense										
		Silty CLAY with Gravel (FILL), brown, moist, hard	SS 1	83	5-18-19 (37)							
5		LEAN CLAY (CL), with clayey sand lenses, brown to gray, moist to wet, soft to stiff, abundant sulfates	MC 1	94	4-5-6 (11)		106	18				
		GB1: Lab Classified	GB 1					20	25	15	10	94
10		Silty SAND (sm), brown, wet, loose	SS 2	67	0-2-4-4 (6)							
15												
20		Sandy GRAVEL (gw), brown, wet, medium dense to dense										
		Bottom of hole at 23.0 feet.										

GEOTECH BH COLUMNS 01085-0001 FUOCO NISSAN.GPJ GINT US LAB.GDT 6/7/11



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 970-255-8005
 970-255-6818

BORING NUMBER B-2

PAGE 1 OF 1

CLIENT <u>Fuoco Investments, LLC</u>	PROJECT NAME <u>Fuoco Nissan</u>
PROJECT NUMBER <u>01085-0001</u>	PROJECT LOCATION <u>Grand Junction, CO</u>
DATE STARTED <u>5/16/11</u> COMPLETED <u>5/16/11</u>	GROUND ELEVATION _____ HOLE SIZE <u>4"</u>
DRILLING CONTRACTOR <u>S. McKracken</u>	GROUND WATER LEVELS:
DRILLING METHOD <u>Simco 2000 Truck Rig</u>	▼ AT TIME OF DRILLING <u>9.5 ft</u>
LOGGED BY <u>AS</u> CHECKED BY <u>MAB</u>	▼ AT END OF DRILLING <u>9.5 ft</u>
NOTES _____	AFTER DRILLING ---

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS			FINES CONTENT (%)
									LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	
0		ASPHALT										
		Sandy GRAVEL (BASE COURSE), tan, mist, medium dense										
		Silty CLAY with Gravel (FILL), Peat lenses, brown, gray and black, moist to very moist, soft to stiff, odoriferous										
5		LEAN CLAY (cl), with clayey sand lenses, brown to gray, moist to wet, stiff, abundant sulfates	MC 1	89	3-4-6 (10)							
			GB 1									
10		Silty SAND (sm), brown, wet, loose	SS 1	63	3-3-3-3 (6)							
15												
20		Sandy GRAVEL (gw), brown, wet, medium dense										
		Bottom of hole at 23.0 feet.										

GEOTECH BH COLUMNS 01085-0001 FUOCO NISSAN.GPJ_GINT US LAB.GDT 6/7/11

APPENDIX B
Laboratory Testing Results



Huddlestone-Berry Engineering & Testing, LLC
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 970-255-8005
 970-255-6818

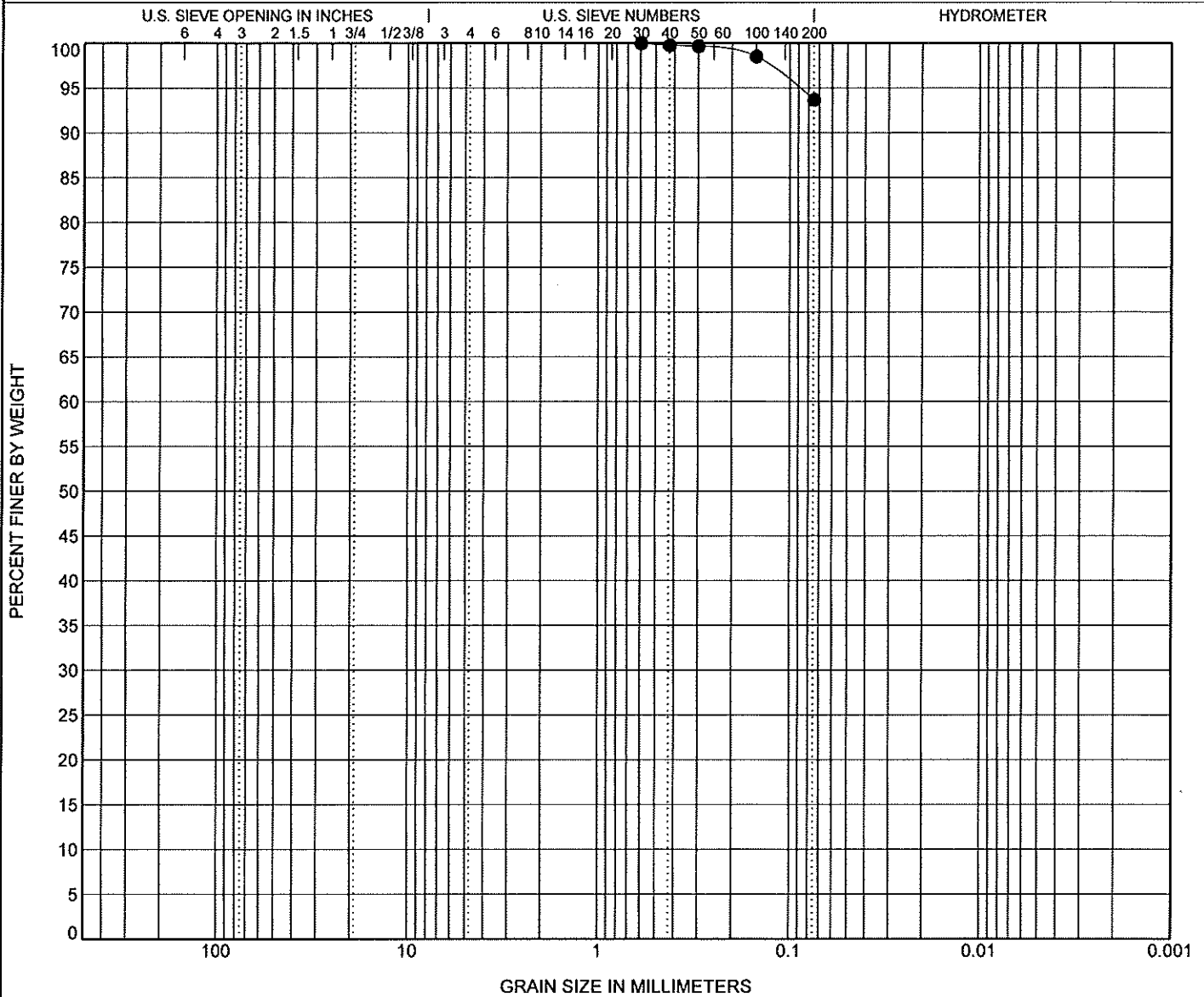
GRAIN SIZE DISTRIBUTION

CLIENT Fuoco Investments, LLC

PROJECT NAME Fuoco Nissan

PROJECT NUMBER 01085-0001

PROJECT LOCATION Grand Junction, CO



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification	Classification	LL	PL	PI	Cc	Cu
● B-1 GB-1 5/2011	LEAN CLAY(CL)	25	15	10		

Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
● B-1 GB-1 5/2011	0.6				0.0	6.3	93.7	

GRAIN SIZE 01085-0001 FUOCO NISSAN.GPJ GINT US LAB.GDT 6/7/11



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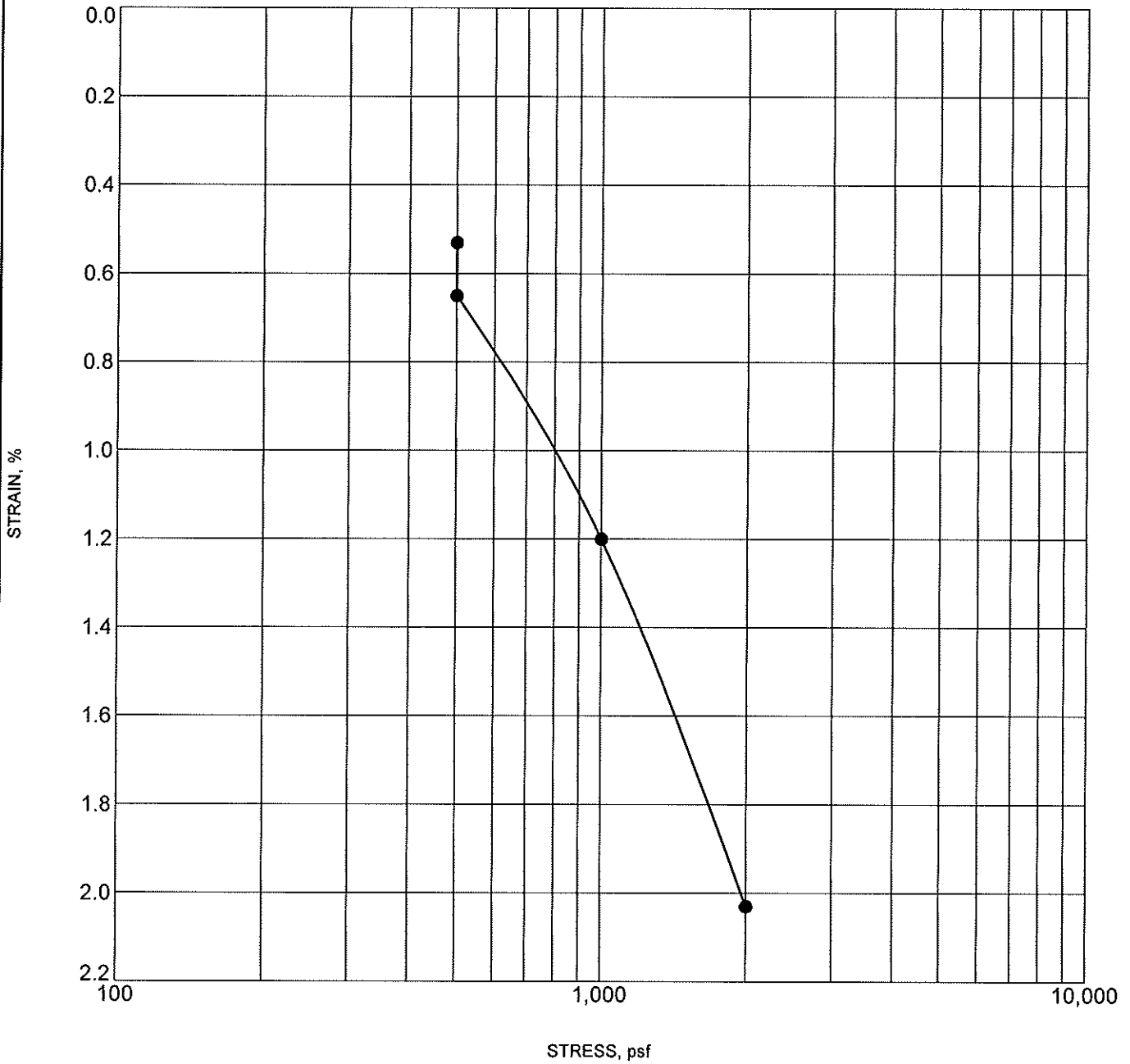
CONSOLIDATION TEST

CLIENT Fuoco Investments, LLC

PROJECT NAME Fuoco Nissan

PROJECT NUMBER 01085-0001

PROJECT LOCATION Grand Junction, CO



CONSOL-STRAIN 01085-0001 FUOCO NISSAN.GPJ GINT US LAB.GDT 6/7/11

Specimen Identification	Classification	γ_d	MC%
● B-1 5.0		106	18