GRAND JUNCTION
LINCOLN DeVORE, Inc.
GEOTECHNICAL ENGINEERS – GEOLOGISTS

1441 Motor St.
Grand Junction, CO 81505

TEL: (970) 242-8968
FAX: (970) 242-1561

March 9, 2001

Jim Jeffries
2683 Delmar Dr.
Grand Junction, CO 81506

Re: Subsurface Soils Exploration
Commercial Structure, 859 Struthers, Grand Junction, CO

As requested, Grand Junction Lincoln DeVore personnel have completed a geotechnical exploratory program at the above referenced site. Six shallow exploration holes were drilled in the vicinity of the proposed building pad, in parking areas and along Struthers Avenue for design of the half street improvements, as shown on the attached sketch. These exploration holes were drilled, logged and sampled by personnel of Grand Junction Lincoln DeVore on 2-20-01. These exploration holes were drilled to a total depth of 6 to 10 ½ feet. The purpose of these holes were to determine the types and character of the underlying soils and to relate these characteristics to the proposed foundation system. This letter contains general recommendations for construction of a commercial foundation, but is not a foundation design and cannot be used as such. Our conclusions and recommendations for this site are presented below.

Excavation Observation: Grand Junction Lincoln DeVore personnel should be contacted to observe the foundation soils after the excavation has been completed, and prior to placing forms or concrete. The purpose of this is to observe the type and condition of the foundation soils throughout the excavation. If the soils are found to differ from those encountered in our exploration borings or appear to be unstable, additional recommendations may be required, prior to construction of the foundations.

Soil Classification: The geologic materials encountered under the site consist of 1 foot to possibly as much as 6 feet of sandy gravel (road base) which had been placed as controlled structural fill, which in turn overlies the native alluvial sandy gravels and cobbles and some thin lenses of fine grained soils which are all part of the Ancient Colorado River Terrace deposit. These unconsolidated alluvial soils are believed to be in excess of 25 feet thick and overlie the Mancos Shale Formation which is considered to be bedrock in this portion of Grand Junction.

For purposes of this report, the soils were divided into 3 types. Soil Type I generally reflects the imported man-made fill (road base) and native soils which are similar to the road base. Soil Type II is representative of native fine grained soils which may include some gravel. These fine grained soils are interpreted as having been deposited by over bank floods of the Ancient Colorado River, some sand bars and thin muddy type deposits which may or may not have had significant amounts of organic matter in the past. Soil Type III represents the sandy gravels and cobbles of the Ancient Colorado River Terrace deposit. These soils contains cobbles which are in excess of 6 inches in diameter. Proper sampling of these materials could not be accomplished in the 4 inch drill hole which was used for our field exploration. The finer grained portion of these soils which could be recovered in our sampling program are very similar to the sandy gravels (road base) which was installed as man-made fill. All drill holes were terminated in the coarse grained sandy gravels and cobbles of the Terrace deposit. The auger could not penetrate past the larger sized cobbles.

Soil Type I is classified as a well graded sandy gravel (GM/GW) of medium to coarse grain size under the Unified Classification System. The Standard Penetration Tests ranged from 20 blows per foot to in excess of 50 blows per foot. Penetration tests of this magnitude indicate that the soil is firm to very firm and of medium to medium high density. The moisture content varied from 4.6% to 15.3%, indicating a damp to saturated soil. This soil is non plastic and is not very sensitive to changes in moisture content. This soil will have virtually no tendency to expand upon the addition of moisture.

Settlement will be minimal under the recommended foundation loads. This soil will undergo elastic settlement upon application of static foundation pressures. Such settlement is characteristically rapid and should be virtually complete by the end of construction. If the recommended allowable bearing values are not exceeded, and if all other recommendations are followed, differential movement will be within tolerable limits. At shallow foundation depths this soil was found to have an average allowable bearing capacity of 5000 psf.

Soil Type II was classified as a sandy, silty clay (CL-ML) under the Unified Classification System. The Standard Penetration Tests ranged from 2 blows per foot to 6 blows per foot. Penetration tests of this magnitude indicate that the soil is soft and of low density. The moisture content varied from 14.3% to 22.7%, indicating a relatively wet soil. This soil is slightly plastic and is somewhat sensitive to changes in moisture content. This material is of low plasticity, of low to moderate permeability, and was encountered in a low to medium density, moist to wet condition. This material will consolidate/collapse upon saturation or excessive loading. With subsequent decreased moisture these soils will tend to shrink with some cracking upon desiccation. The maximum allowable bearing capacity for this soil was found to be 1000 psf, no minimum bearing is required as these soils are encountered at or below the water table are saturated. It is anticipated that thin strata of these soils which are encountered during the exploration process will be recognized as being somewhat unstable, removed from immediately beneath the foundations and replaced with granular material which is compacted as structural fill.

Soil Type III was classified as a sandy gravel and cobble of coarse grain size under the Unified Classification System. The Standard Penetration Tests ranged from 47 blows per foot to 89 blows per foot. Penetration tests of this magnitude indicate that the soil is very firm and of medium density. All of the blow counts encountered very large cobbles during the penetration process. The moisture content varied from 4.0% to 14.8%, indicating a slightly moist to saturated soil, depending upon the elevation of the ground water table. This soil is non plastic and is not very sensitive to changes in moisture content. This soil will have virtually no tendency to expand upon the addition of moisture. Settlement will be minimal under the recommended foundation loads. This soil will undergo elastic settlement upon application of static foundation pressures. Such settlement is characteristically rapid and should be virtually complete by the end of construction. If the recommended allowable bearing values are not exceeded, and if all other recommendations are followed, differential movement will be within tolerable limits. At shallow foundation depths this soil was found to have an average allowable bearing capacity in excess of 5000 psf.

The surface soils are deposited over the dense formational material of the Mancos Shale of Cretaceous Age. The Mancos Shale is described as a thin bedded, drab, light to dark gray marine shale, with thinly interbedded fine grain sandstone and siltstone layers. Some portions of the Mancos Shale are bentonitic, and therefore, are highly expansive. The majority of the shale, however, has only a low to moderate expansion potential. The formational shale was not encountered in any of the test borings but, based upon exploration borings in the near vicinity, it is expected to be in excess of 25 feet below the ground surface. It is anticipated that this formational shale will not affect the construction and the performance of the foundations on the site.

Man-made Fill: The site is on man-made fill believed to have been placed under controlled Moisture and Compactive effort conditions. This office does not have records regarding the placement of the fill. It is believed that at the time of foundation excavation that in-place density tests can be performed beneath the foundation elements and this in-place soil density testing in the open excavation, can be used to verify the overall condition of the fill. Based upon information available and our on-site observations/testing this fill will be verified and is believed to be suitable for use as a bearing material.

All building foundations must penetrate any low density, unstable or man-made fills which are present at the site at this time, as well as any fills which result from the excavation process. Careful examination of the open excavation will be necessary to determine the presence or absence of man-made fills. The open excavation must be examined prior to the placement of concrete to establish that materials of proper design bearing capacity have been exposed and that no soft spots or debris are present in the foundation area. A 24 hour notice is required for all field examinations to enable Grand Junction Lincoln DeVore to schedule personnel and provide service when needed.

Soil Moisture Conditions: A free water table came to equilibrium during drilling at 3 to 6 feet below the present ground surface. This is probably very close to the true phreatic surface rather than a perched water table. In our opinion the subsurface water conditions shown are a permanent feature on this site. The depth to free water would be subject to fluctuation on this site depending upon external environmental effects.

Because of capillary rise, the soil zone within a few feet above the free water level identified in the borings will be quite wet. Pumping and rutting may occur during the excavation process, particularly if the bottom of the foundations are near the capillary fringe. Pumping is a temporary, quick condition caused by vibration of excavating equipment on the site. If pumping occurs, it can often be stopped by removal of the equipment and greater care exercised in the excavation process. In other cases, geotextile fabric layers can be designed or cobble sized material can be introduced into the bottom of the excavation and worked into the soft soils. Such a geotextile or cobble raft is designed to stabilize the bottom of the excavation and to provide a firm base for equipment.

Data presented in this report concerning ground water levels are representative of those levels at the time of our field exploration. Groundwater levels are subject to change seasonally or by changed environmental conditions. Quantitative information concerning rates of flow into excavations or pumping capacities necessary to dewater excavations is not included and is beyond the scope of this report. If this information is desired, permeability and field pumping tests will be required.

Foundation Type Recommended: We recommend the use of a conventional shallow foundation system consisting of continuous spread footings beneath all bearing walls and isolated spread footings beneath all columns and other points of concentrated load. Such a shallow foundation system, resting on the sandy gravels of Soil Type I, which has been placed as structural fill, may be designed on the basis of an allowable bearing capacity of 5000 psf maximum. No minimum dead load is required but, 150 psf is recommended.

Contact stresses beneath all continuous walls should be balanced to within + or - 200 psf at all points. Isolated interior column footings should be designed for contact stresses of about 150 psf less than the average used to balance the continuous walls. The criterion for balancing will depend somewhat upon the nature of the structure. Single-story, slab on grade structures may be balanced on the basis of dead load only. Multi-story structures may be balanced on the basis of dead load plus ½ live load, for up to 3 stories.

If the design of the upper structure is such that loads can be balanced reasonably well or if minor amounts of differential settlement can be tolerated, a floating structural slab or raft type of foundation could be used on this site. If the slab is to be a floating structural slab, similar in appearance to the "monolithic" slab used in the Grand Junction area, the slab should be underlain by a minimum of 2 feet of structural fill, placed in accordance with recommendations contained in this report. Such a slab would require heavy reinforcing to resist differential bending. This structural slab, using the granular structural fill as part of the foundation system, could be designed assuming the top of the structural fill has a modulus of subgrade reaction of k=250 pci. If large concentrated loads are located in the interior of this fill or if minor

construction problems are encountered in the placement of the fill, the use of geosynthetic fabric or geogrid as part of the fill construction would significantly improve the performance of the fill and foundation system.

It is possible to design either the floating structural slab or the raft type of slab either as a solid or ribbed slab, but in either case a rimwall must be used for confinement. Any such slab must be specifically designed for the anticipated loading. Such a foundation system will settle to some degree as the softer, underlying soils consolidate, but differential movement is held to a minimum. Because the soils may settle in varying amounts, some minor cracking and heave are possible unless the slabs are specifically designed with the movement in mind.

Settlement: Provided the recommendations presented in this report are completely followed, total and differential settlements should be less than one inch.

Seismic Data: Utilizing the criteria of the 2000 International Building Code, Section 1615 and our interpretation of figures 1615(1) and 1615(2), Structures in Grand Junction, Colorado should be designed with **Special Response Acceleration factors, S_s=0.35 & S_1 = 0.08.** Based upon our analysis of the soils which are expected to be present beneath the building foundations, the **Site Classification is E**. These values can be used to determine the **Values of Site Coefficient, F_a & F_v** from Tables 1615.1.2(1) & 1615.1.1(2), to calculate **Sms, Sm_1, Sps & SP1** and to determine the **Seismic Design Categories** from Tables 1616.3(1) and 1616.3(2).

Voids Beneath Foundation Walls: Voids are not required to mitigate expansive pressures, but may be used to attain proper balance around the structure.

Reinforcing: All foundation stem walls should be designed as "grade beams" capable of spanning at least 10 feet. Where the foundation stem walls are relatively shallow in height, vertical reinforcing will not be necessary. However, in the walls retaining soil in excess of 4 feet in height, vertical reinforcing may be necessary to resist the lateral pressures (restrained case) of the soils along the wall exterior. To aid in designing such vertical reinforcing, an equivalent fluid pressure (E.F.P) on the order of 30 pcf would be appropriate for the native soils.

The foundation shall be reinforced as shown on the foundation design. No changes shall be made to this placement of reinforcing without written approval of the design engineer or architect.

Floor Slabs: Non-Structural floor slabs on grade, if any, should be positively separated from all structural portions of this building and allowed to float freely. Frequent scoring (control joints) of the slabs should be provided to allow for possible shrinkage cracking of the slab. These control joints should be placed to provide maximum slab areas of approximately 200 to 360 square feet. Any man-made fill placed below floor slabs on grade should be compacted to a minimum of 90% of its maximum Modified Proctor dry density, ASTM D-1557. These soils should be placed at a moisture content conducive to the required compaction (usually Proctor optimum moisture content ±2%.

Drainage and Grading: Adequate site drainage should be provided in the foundation area both during and after construction to prevent the ponding of water and the wetting or saturation of the subsurface soils. We recommend that the ground surface around the structure be graded so that surface water will be carried quickly away from the building. The minimum gradient within 10 feet of the building will depend on surface landscaping. We recommend that paved areas maintain a minimum gradient of 2%, and that landscaped areas maintain a minimum gradient of 8%. It is further recommended that roof drain downspouts be carried at least 5 feet beyond all backfilled areas and discharged a minimum 10 feet away from the structure. **Proper discharge of roof drain downspouts may require**

the use of subsurface piping in some areas. Under no circumstances should a 'dry well discharge' be used on this site, unless specifically sited by a Geotechnical Engineer. Planters, if any, should be so constructed that moisture is not allowed to seep into foundation areas or beneath slabs or pavements.

The existing drainage on the site must either be maintained carefully or improved. We recommend that water be drained away from structures as rapidly as possible and not be allowed to stand or pond within 15 feet of the building or foundation. We recommend that water removed from one building not be directed onto the backfill areas of adjacent buildings.

Should an automatic lawn irrigation system be used on this site, we recommend that the sprinkler heads, irrigation piping and valves be installed no less than 5 feet from the building. In addition, these heads should be adjusted so that spray from the system does not fall onto the walls of the building and that such water does not excessively wet the backfill soils.

It is recommended that lawn and landscaping irrigation be reasonably limited, so as to prevent undesirable saturation of subsurface soils or backfilled areas. Several methods of irrigation water control are possible, to include, but not limited to:

* Metering the Irrigation water.
* Sizing the irrigation distribution service piping to limit on-site water usage.
* Encourage efficient landscaping practices.
* Enforcing reasonable limits on the size of high water usage landscaping within 5 feet of the building or foundation.
* Incorporating 'xeriscaping' landscaping and irrigation techniques.

A plastic membrane placed on any Crawlspace ground surfaces may retain/trap excessive amounts of water beneath the membrane. If future moisture problems develop or are anticipated, the Foundation Design Engineer or the Geotechnical Engineer may require that the membrane be partially or completely removed from the crawlspace area.

Provided all recommendations found herein pertaining to site surface drainage, grading and soil compaction are closely followed, a perimeter foundation drain would not be required.

If a concrete slab on grade is planned on this site at or below the existing ground surface then, the high ground water level found on this site should be controlled to prevent large upward fluctuations of this water surface. For this purpose, we recommend that this be accomplished by construction of an area drain beneath the building area. To control water surface movement, it is recommended that the drain outfall in a free gravity drain. If a gravity outfall is not possible, a sealed sump and pump is recommended to remove the water.

Backfill: To reduce settlement and aid in keeping water from reaching beneath this building, all backfill around this building should be mechanically compacted to a minimum of 90% of its maximum Modified Proctor dry density ASTM D-1557. The only exception to this would be the components of the perimeter foundation drain, if any. All backfill should be composed of the native soils and should not be placed by soaking, jetting or puddling. All backfill placed in utility trenches around this structure or below foundation walls should be mechanically compacted to a minimum of 90% of its maximum Modified Proctor dry density ASTM D-1557. These soils should be placed at a moisture content conducive to the required compaction (usually Proctor optimum content $\pm$2%).

Cement Type: Type II, Type I-II or Type II-V cement is recommended for all concrete which is in contact with the soils on this site. Calcium chloride should not be added to a Type II, Type I-II or Type II-V cement under any circumstances.

Remarks: We recommend that the bottom of all foundation components rest a minimum of 1-1/2 feet below finished grade or as required by the local building codes. Foundation components must not be placed on frozen soils.

Structural slab-on-grade (Monolithic) foundation systems typically have an effective soil cover of less than 12 inches. Under normal use, the building and foundation system radiates sufficient heat that frost heave from the underlying soils is not normally a problem. However, additional protection can be provided by applying an insulation board to the exterior of the foundation and extending this board to approximately 18 inches below the final ground surface grade. This board may be applied either prior to or after the concrete is cast and it is very important that all areas of soil backfill be compacted. Local building officials should be consulted for regulatory frost protection depths.

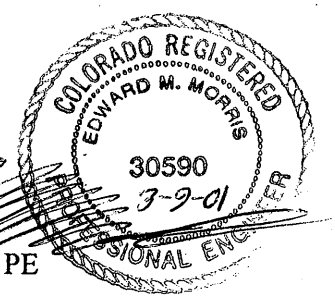
Limitations: This report is issued with the understanding that it is the responsibility of the owner, or his representative to ensure that the information and recommendations contained herein are brought to the attention of the architect and engineer for the project, and are incorporated into the plans. In addition, it is his responsibility that the necessary steps are taken to see that the contractor and his subcontractors carry out these recommendations during construction. The findings of this report are valid as of the present date. However, changes in the conditions of a property can occur with the passage of time, whether they be due to natural processes or the works of man on this or adjacent properties. In addition, changes in acceptable or appropriate standards may occur or may result from legislation or the broadening of engineering knowledge. Accordingly, the findings of this report may be invalid, wholly or partially, by changes outside our control. Therefore, this report is subject to review and should not be relied upon after a period of 3 years.

The recommendations of this report pertain only to the site investigated and are based on the assumption that the soil conditions do not deviate from those described in this report. If any variations or undesirable conditions are encountered during construction or the proposed construction will differ from that planned on the day of this report, Grand Junction Lincoln DeVore should be notified so that supplemental recommendations can be provided, if appropriate.

Grand Junction Lincoln DeVore makes no warranty, either expressed or implied, as to the findings, recommendations, specifications or professional advice, except that they were prepared in accordance with generally accepted professional engineering practice in the field of geotechnical engineering.

Respectfully submitted,

GRAND JUNCTION
LINCOLN-DeVORE, INC.



By: Edward M. Morris PE
Principal Engineer

GJLD Job # 88473-GJ

SOILS DESCRIPTIONS

SYMBOL	USCS	DESCRIPTION
		Topsoil - Organic
		Man-Made Fill
	GW	Gravel Well-Graded
	GP	Gravel Poorly-Graded
	GM	Silty Gravel
	GC	Clayey Gravel
	SW	Sand Well-Graded
	SP	Sand Poorly-Graded
	SM	Silty Sand
	SC	Clayey Sand
	ML	Silt Low-Plastic
	CL	Silty Clay Low-Plastic
	OL	Organic Silt & Clay Low-Plastic
	MH	Silt High-Plastic
	CH	Clay High-Plastic
	OH	Organic Clay High-Plastic
	Pt	Peat
	GW/GM	Silty Gravel Well-Graded
	GW/GC	Clayey Gravel Well-Graded
	GP/GM	Silty Gravel Poorly-Graded
	GP/GC	Clayey Gravel Poorly-Graded
	GM/GC	Silty Clayey Gravel
	SW/SM	Silty Sand Well-Graded
	SW/SC	Clayey Sand Well-Graded
	SP/SM	Silty Sand Poorly-Graded
	SP/SC	Clayey Sand Poorly-Graded
	SM/SC	Silty Clayey Sand
	CL/ML	Silty Clay-Clayey Silt Low-Plastic

ROCK DESCRIPTIONS

SYMBOL	DESCRIPTION
	Sedimentary Rocks
	CONGLOMERATE
	SANDSTONE
	SILTSTONE
	SHALE
	CLAYSTONE
	MUDSTONE
	COAL
	LIMESTONE
	DOLOMITE
	MARLSTONE
	GYPSUM
	Other Sedimentary Rocks
	Igneous Rocks
	GRANITIC ROCKS
	DIORITIC ROCKS
	GABBRO
	BASALT
	RHYOLITE
	TUFF & ASH FLOWS
	BRECCIA & Other Volcanics
	Other Igneous Rocks
	Metamorphic Rocks
	GNEISS
	SCHIST
	PHYLLITE
	HORNFELS
	METAQUARTZITE
	MARBLE
	Other Metamorphic Rocks

SYMBOLS & NOTES

SYMBOL	DESCRIPTION
SPT 09/12	Standard Penetration Drive ASTM D-1586 Disturbed Sample Numbers indicate 9 Blows To drive the Spoon 12" into ground.
CS 09/12	'California Lined Sampler' Modified Penetration Drive ASTM D- Disturbed Sample Numbers indicate 9 Blows To drive the Spoon 12" into ground.
D&M 09/12	'Dames & Moore Lined Sampler' Modified Penetration Drive ASTM D- Disturbed Sample Numbers indicate 9 Blows To drive the Spoon 12" into ground.
ST	Thin-Walled 'Shelby' Tube ASTM D-1586 - 2.625"od 2.5" id 'Relatively Undisturbed Sample'
BULK	Disturbed, Bulk Sample ASTM D- Disturbed Sample
	Free Water Table
Wx	Weathered Rock Formation
	Test Boring Location
	Test Pit Location
	Seismic or Resistivity Station

Standard Penetration Drives are made by driving a standard 2" od, 1-5/8" id Split Spoon Sampler into the ground by dropping a 140 lb. weight 30".
No Thinwall Shoe Extension and the Sample is Disturbed.

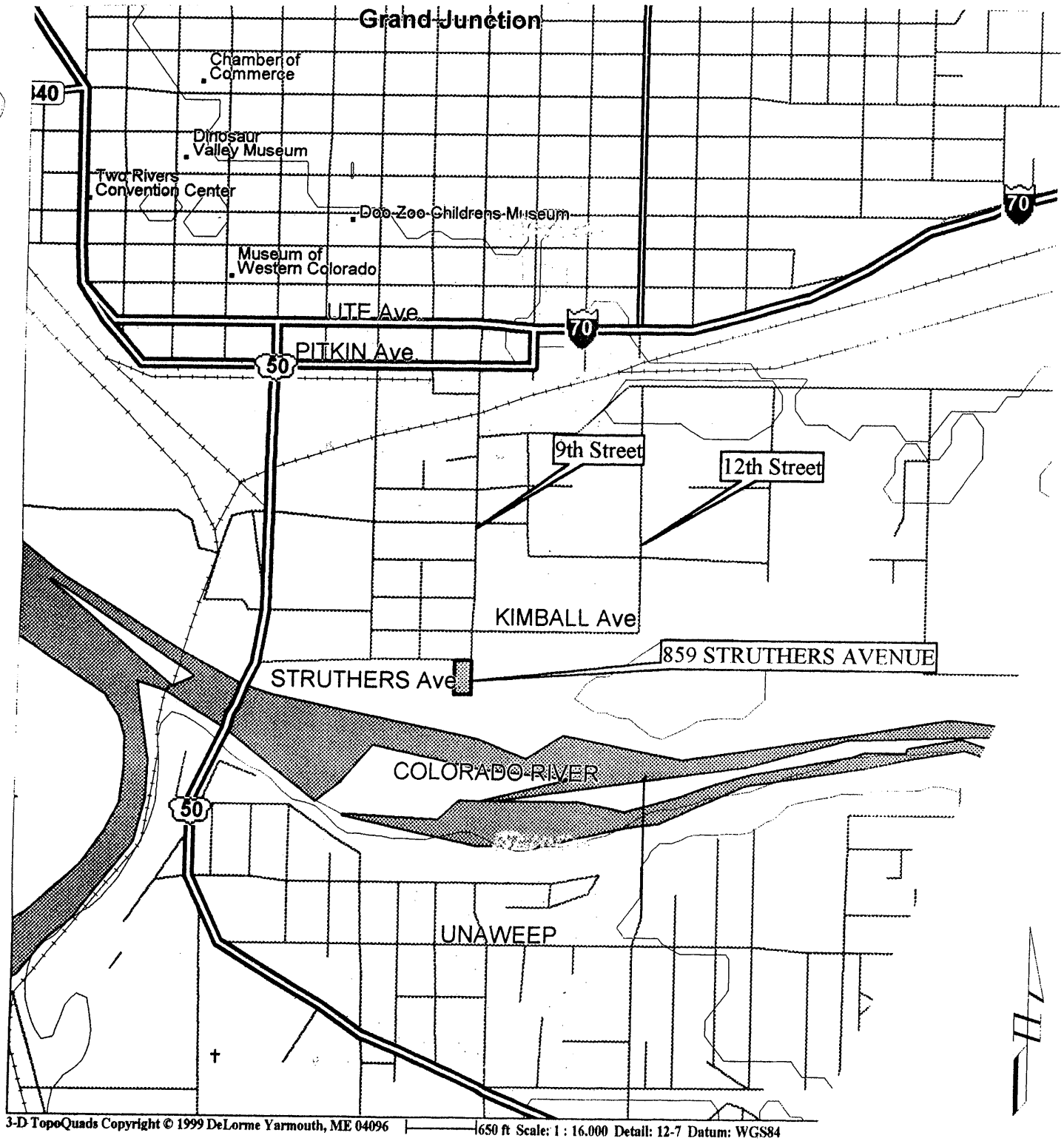
Modified Penetration Drives are made by driving a 2-1/2" od, 1.875" id California Spoon Sampler or a 3" od, 2-3/8" id California Spoon Sampler into the ground by dropping a 140 lb. weight 30".
No Thinwall Shoe Extension and the Sample is Disturbed.

The Boring Logs show subsurface conditions at the dates and locations shown, and it is not warrented that they are representative of subsurface conditions at times and other locations.

GRAND JUNCTION
LINCOLN - DeVORE, Inc.
Geotechnical Consultants
Grand Junction, Colorado

EXPLANATION OF BOREHOLE LOGS AND LOCATION DIAGRAMS

Form No.	Drawn	Date
GJLDFORM-EXPL	EMM	10-15-98



SITE LOCATION DIAGRAM

GRAND JUNCTION
LINCOLN - DeVORE, Inc.
Geotechnical Consultants
Grand Junction, Colorado

COMMERCIAL PROJECT 859 STRUTHERS, Grand Junction, CO.		
Mr. JIM JEFFRIES Grand Junction, Colorado		Date 3-7-2001
Job No. 88473-GJ	Drawn EMM	

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	COAL
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	DOLOMITE
	MARLSTONE
	GYPSUM
	Other Sedimentary Rocks
	Igneous Rocks
	GRANITIC ROCKS
	DIORITIC ROCKS
	GABBRO
	BASALT
	RHYOLITE
	TUFF & ASH FLOWS
	BRECCIA & Other Volcanics
	Other Igneous Rocks
	Metamorphic Rocks
	GNEISS
	SCHIST
	PHYLLITE
	HORNFELS
	METAQUARTZITE
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GRAND JUNCTION
LINCOLN - DeVORE, Inc.
Geotechnical Consultants
Grand Junction, Colorado

EXPLANATION OF BOREHOLE LOGS AND LOCATION DIAGRAMS

Form No.	Drawn	Date
GJLDFORM-EXPL	EMM	10-15-98

BORING NO. 1 DRILL: GJLD CME-45B

SOUTHWEST CORNER OF STAKED BUILDING SITE

BORING ELEVATION: AUGER/TOOLS: 4" od, SOLID

DEPTH (FT.)	SOIL LOG	DESCRIPTION		BLOW COUNT /inch	SOIL DENSITY pcf	WATER %
		SURFACE SOILS ARE SLIGHTLY LOOSE				
		COMPACTED MAN-MADE FILL	SULFATES			
		GM/GW SANDY GRAVEL	occ.COARSE GRAVEL & SMALL COBBLE			
		I SI. COMPRESSIBLE	SI.DAMP	SPT	24/6	4.6%
5		FREE WATER ⏚ MANUFACTURED AGGREGATE BASE		5	50/6	
		GM/GW SANDY GRAVEL & COBBLE	HARD to DRILL			
		GM NATIVE ??? LARGE, ROUNDED COBBLES				
		III HOLE CAVING				
		COLORADO RIVER ALLUVIAL DEPOSITS				
10				10		
15		TD @ 8'		15		
20				20		
25				25		
30				30		
35				35		

Blow Counts are counted for each 6 inches of sampler penetration.

Free Water @ 4-1/2'

During Drilling 2-20-2001

LOG OF SUBSURFACE EXPLORATION

GRAND JUNCTION
LINCOLN - DeVORE, Inc.
Geotechnical Consultants
Grand Junction, Colorado

COMMERCIAL PROJECT
859 STRUTHERS, Grand Junction, CO.

Mr. JIM JEFFRIES
Grand Junction, Colorado

Date 3-7-2001

Job No. **88473-GJ**

Drawn **EMM**

BORING NO. 2 DRILL: GJLD CME-45B

NORTHEAST CORNER OF STAKED BUILDING SITE

BORING ELEVATION: AUGER/TOOLS: 4" od, SOLID

DEPTH (FT.)	SOIL LOG	DESCRIPTION					BLOW COUNT /inch	SOIL DENSITY pcf	WATER %
		MANUFACTURED AGGREGATE BASE							
	GM/GW I	SANDY GRAVEL SI. COMPRESSIBLE COMPACTED	HARD TO DRILL MAN-MADE FILL	V. DAMP WET		SPT SPT	18/6 22/6 18/6		12.8% 15.3%
5	GM/GW	MANUFACTURED AGGREGATE BASE			5		12/6		
	FREE WATER ▽						8/6		
	SM	SILTY SAND NATIVE	VERY STRATIFIED				4/6		
	CL-ML	SANDY, SILTY CLAY COMPRESSIBLE	SCATTERED GRAVELS SOFT TO DRILL			SPT	18/6		7.6%
10	GM III	SANDY GRAVEL & COBBLE NATIVE	SI. COMPRESSIBLE STRATA		10		22/6 25/6		
		AUGER REFUSAL ON LARGE COBBLE							
15					15				
		TD @ 10.5'							
20					20				
25					25				
30					30				
35					35				

Blow Counts are counted for each 6 inches of sampler penetration.

Free Water @ 6'

During Drilling 2-20-2001

LOG OF SUBSURFACE EXPLORATION

GRAND JUNCTION
LINCOLN - DeVORE, Inc.
Geotechnical Consultants
Grand Junction, Colorado

COMMERCIAL PROJECT

859 STRUTHERS, Grand Junction, CO.

Mr. JIM JEFFRIES
Grand Junction, Colorado

Date: 3-7-2001

Job No.: 88473-GJ

Drawn: EMM

BORING NO. 3 DRILL: GJLD CME-45B

ABOUT 55' SOUTH EAST of STAKED SOUTH BUILDING CORNER

BORING ELEVATION: AUGER/TOOLS: 4" od, SOLID

DEPTH (FT.)	SOIL LOG	DESCRIPTION		BLOW COUNT /inch	SOIL DENSITY pcf	WATER %
		GM/GW SANDY GRAVEL	COMPACTED			
		I	MANUFACTURED AGGREGATE B/ WET			
		FREE WATER ▽	SOFT TO DRILL SULFATES			
		CL-ML SANDY, SILTY CLAY	SAND STRATA	SPT	7/18	14.3%
5		III COMPRESSIBLE	SCATTERED GRAVELS	5		
		GM SANDY GRAVEL & COBBLE				
		III	V. FIRM to DRILL			
			LARGE, ROUNDED COBBLES	BULK		18.3%
10				10		
		TD @ 8'				
15				15		
20				20		
25				25		
30				30		
35				35		

Blow Counts are counted for each 6 inches of sampler penetration.

Free Water @ 3'

During Drilling 2-20-2001

LOG OF SUBSURFACE EXPLORATION

GRAND JUNCTION
LINCOLN - DeVORE, Inc.
Geotechnical Consultants
Grand Junction, Colorado

COMMERCIAL PROJECT

859 STRUTHERS, Grand Junction, CO.

Mr. JIM JEFFRIES
Grand Junction, Colorado

Date: 3-7-2001

Job No.: 88473-GJ

Drawn: EMM

BORING NO. 4 DRILL: GJLD CME-45B

NORTHEAST OF STAKED BUILDING SITE

BORING ELEVATION: AUGER/TOOLS: 4" od, SOLID

DEPTH (FT.)	SOIL LOG	DESCRIPTION				BLOW COUNT /inch	SOIL DENSITY pcf	WATER %
		MANUFACTURED AGGREGATE BASE						
	GM	SANDY GRAVEL	COMPACTED					
	I	SI. COMPRESSIBLE	HARD TO DRILL	SULFATES				
	GM	SANDY GRAVEL & COBBLE		SI.DAMP	SPT	33/6		4.0%
5	III	STRATIFIED			5	30/6		
		INCREASING MOISTURE				30/6		
		LARGE, ROUNDED COBBLES						
		AUGER REFUSAL ON LARGE COBBLE						
10					10			
		TD @ 6'						
15					15			
20					20			
25					25			
30					30			
35					35			

Blow Counts are counted for each 6 inches of sampler penetration.

NO Free Water During Drilling 2-20-2001

LOG OF SUBSURFACE EXPLORATION

GRAND JUNCTION
LINCOLN - DeVORE, Inc.
Geotechnical Consultants
Grand Junction, Colorado

COMMERCIAL PROJECT
859 STRUTHERS, Grand Junction, CO.

Mr. JIM JEFFRIES
Grand Junction, Colorado

Date **3-7-2001**

Job No. **88473-GJ**

Drawn **EMM**

BORING NO. 5 DRILL: GJLD CME-45B

STRUTHERS AVENUE, WEST END OF PROPERTY

BORING ELEVATION: AUGER/TOOLS: 4" od, SOLID

DEPTH (FT.)	SOIL LOG	DESCRIPTION		BLOW COUNT /inch	SOIL DENSITY pcf	WATER %
		4" A.C. 1-1/2" ABC	NEAR ROAD SHOULDER			
	SM	GRAVELLY, SILTY SAND w/GRAVELLY CLAYS				
	GM	NATIVE	SMALL LENSES of ORGANIC SILT			
	SM		SI. STIFF to DRILL WET	SPT 4/6		19.2%
5	CL-ML	SANDY, SILTY CLAY	AS THIN STRATA	5 6/6		
	FREE WATER ▽		SMALL LENSES of ORGANIC SILT	6/6		
			SOFT TO DRILL			
	GM	SANDY GRAVEL & COBBLE				
	III		HARD TO DRILL	SPT 33/6		14.8%
10				10 39/6		
				50/5		
		TD @ 10'				
15				15		
20				20		
25				25		
30				30		
35				35		

Blow Counts are counted for each 6 inches of sampler penetration.

Free Water @ 6'

During Drilling 2-20-2001

LOG OF SUBSURFACE EXPLORATION

GRAND JUNCTION
LINCOLN - DeVORE, Inc.
Geotechnical Consultants
Grand Junction, Colorado

COMMERCIAL PROJECT

859 STRUTHERS, Grand Junction, CO.

Mr. JIM JEFFRIES
Grand Junction, Colorado

Date **3-7-2001**

Job No. **88473-GJ**

Drawn **EMM**

BORING NO. 6 DRILL: GJLD CME-45B

STRUTHERS AVENUE, EAST END OF PROPERTY

BORING ELEVATION: AUGER/TOOLS: 4" od, SOLID

DEPTH (FT.)	SOIL LOG	DESCRIPTION		BLOW COUNT /inch	SOIL DENSITY pcf	WATER %
		3" A.C. 6"+ ABC	V. WEATHERED SURFACE			
		ALLUVIAL	SOFT TO DRILL			
		CL-ML SANDY, SILTY CLAY	STRATIFIED	ST		22.7%
5		I V. COMPRESSIBLE		5		
		FREE WATER ▽	SOFT TO DRILL			
		CL-ML	NO COBBLES			
		V. COMPRESSIBLE				
		SM GRAVELLY, SILTY SAND w/GRAVELLY CLAYS		SPT	2/6	30.9%
10		V. COMPRESSIBLE	SOFT TO DRILL	10	2/6	
		NO COBBLES			3/6	
15		TD @ 10'		15		
20				20		
25				25		
30				30		
35				35		

Blow Counts are counted for each 6 inches of sampler penetration.

Free Water @ 6'

During Drilling 2-20-2001

LOG OF SUBSURFACE EXPLORATION

GRAND JUNCTION
LINCOLN - DeVORE, Inc.
Geotechnical Consultants
Grand Junction, Colorado

COMMERCIAL PROJECT

859 STRUTHERS, Grand Junction, CO.

Mr. JIM JEFFRIES
Grand Junction, Colorado

Date **3-7-2001**

Job No. **88473-GJ**

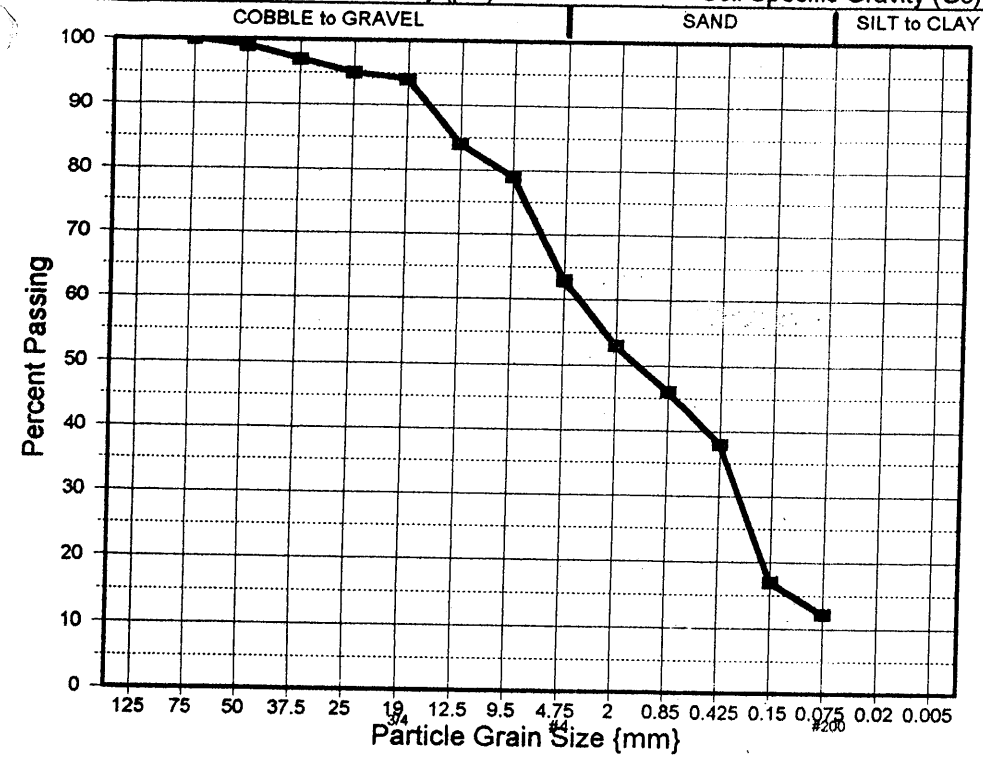
Drawn **EMM**

Soil Sample: **SANDY GRAVEL, Well Graded (GM/GW)** Sample No.: **1** (Typical)

Geologic Origin: **MAN-MADE FILL [Controlled moisture & Density** Test by: **LRS**

Natural Water Content (w): **4.0%** Boring No.: **4** Depth: **3'**

In-Place Density (pcf): Soil Specific Gravity (Gs):



Effective size **0.02** mm

Cu **200**

Cc **1.5**

Plastic Limit (PL) **N.P.**

Liquid Limit (LL) **N.P.**

Plasticity Index (PI) **N.P.**

Shrinkage Limit (SL)

Shrinkage Ratio

DIRECT SHEAR: **CD**

Ult. Res.

Shear Angle: deg.

Tan Shear:

Cohesion: psf

Sieve	(mm)	% Passing
5"	125	
3"	75	100
2"	50	99
1-1/2"	37.5	97
1"	25	95
3/4"	19	94
1/2"	12.5	84
3/8"	9.5	79
# 4	4.75	63
#10	2	53
#20	0.85	46
#40	0.425	38
#100	0.15	17
#200	0.075	12.2
	0.02	
	0.005	

Maximum Size Allowed By Sampler 2-1/2"

MOISTURE / DENSITY RELATIONSHIP:

ASTM Method: **D-698 A** **D 4718 - 30% Correction**

Max. Dry Density : pcf pcf

Optimum Moisture :

HVEEM-CARMANY: **FHA Soil Swell:**

'R' Value @ 300 psi: **80** % Swell

Displacement 300 psi: **3.72** psf

Expansion @ 300 psi: **0** psf Remolded Sample

ALLOWABLE BEARING (net): psf by Consolidometer

Standard Penetration (SPT): **5000** psf by Penetrometer

Unconfined Compression (qu): psf

CONSTANT VOLUME SWELL: psf

COLLAPSE OF **DURING SWELL PHASE**

CONSOLIDATION: @ psf

CONSOLIDATION: @ psf

SULFATE SALTS: **2000** ppm

PERMEABILITY:

K (20 C) Remolded cm/sec @ pcf

SOIL ANALYSIS and SUMMARY

GRAND JUNCTION
LINCOLN - DeVORE, Inc.
Geotechnical Consultants
Grand Junction, Colorado

COMMERCIAL PROJECT

859 STRUTHERS, Grand Junction, CO.

Mr. JIM JEFFRIES
Grand Junction, Colorado

Date **3-7-2001**

Job No. **88473-GJ**

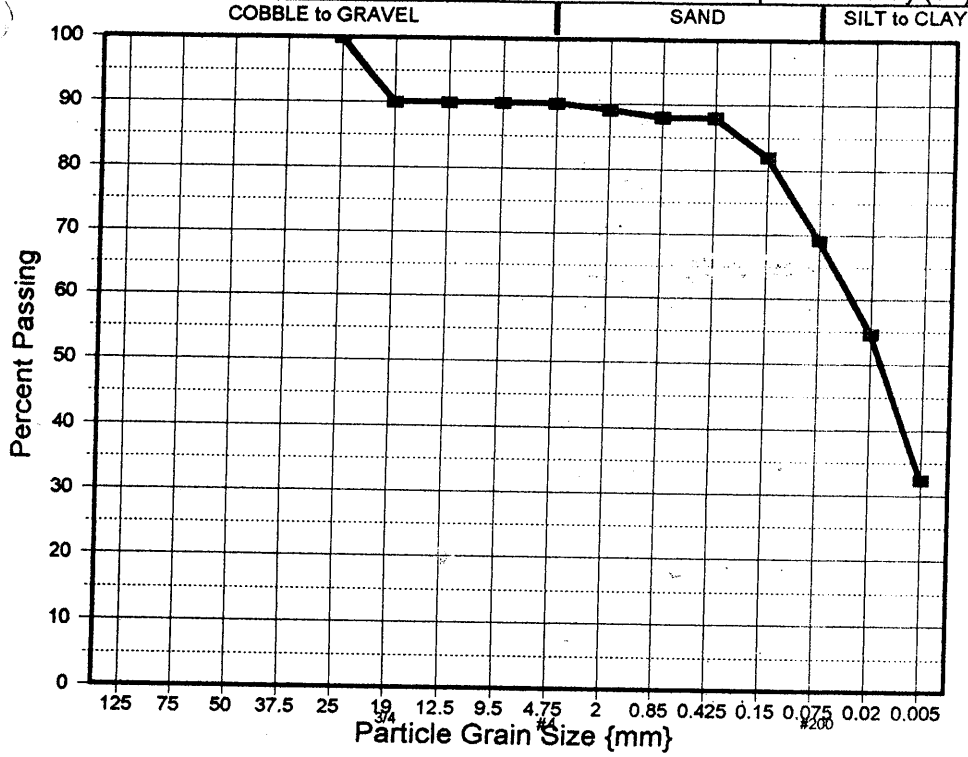
Drawn **EMM**

Soil Sample: **SANDY, SILTY CLAY (CL-ML)** Sample No.: **II** **(Typical)**

Geologic Origin: **ALLUVIAL DEPOSITS** Test by: **LRS**

Natural Water Content (w): **22.7%** Boring No.: **6** Depth: **3'**

In-Place Density (pcf): Soil Specific Gravity (Gs):



Effective size mm

Cu

Cc

Plastic Limit (PL) 18%

Liquid Limit (LL) 25%

Plasticity Index (PI) 7%

Shrinkage Limit (SL)

Shrinkage Ratio

DIRECT SHEAR: **CD**

Ult. Res.

Shear Angle: deg.

Tan Shear:

Cohesion: psf

Sieve	(mm)	% Passing
5"	125	
3"	75	
2"	50	
1-1/2"	37.5	
1"	25	100
3/4"	19	90
1/2"	12.5	90
3/8"	9.5	90
# 4	4.75	90
#10	2	89
#20	0.85	88
#40	0.425	88
#100	0.15	82
#200	0.075	69.1
	0.02	55
	0.005	32

Maximum Size Allowed By Sampler 2-1/2"

MOISTURE / DENSITY RELATIONSHIP:

ASTM Method: D-698 A D 4718 - 30% Correction

Max. Dry Density : pcf pcf

Optimum Moisture :

HVEEM-CARMANY: **FHA Soil Swell:**

'R' Value @ 300 psi: % Swell

Displacement 300 psi: psf

Expansion @ 300 psi: psf Remolded Sample

ALLOWABLE BEARING (net): psf by Consolidometer

Standard Penetration (SPT): psf by Penetrometer

Unconfined Compression (qu): psf

COLLAPSE @ Wetting: @ psf

CONSOLIDATION: @ psf

CONSOLIDATION: @ psf

SULFATE SALTS: 1500 ppm

PERMEABILITY:

K (20 C) Remolded cm/sec @ pcf

SOIL ANALYSIS and SUMMARY

GRAND JUNCTION
LINCOLN - DeVORE, Inc.
Geotechnical Consultants
Grand Junction, Colorado

COMMERCIAL PROJECT

859 STRUTHERS, Grand Junction, CO.

Mr. JIM JEFFRIES
Grand Junction, Colorado

Date **3-7-2001**

Job No. **88473-GJ**

Drawn **EMM**

GRAND JUNCTION
LINCOLN DeVORE, Inc.
GEOTECHNICAL ENGINEERS – GEOLOGISTS

1441 Motor St.
Grand Junction, CO 81505

TEL: (970) 242-8968
FAX: (970) 242-1561

April 24, 2002

Mr. Jim Jefferies
2683 Delmar Drive
Grand Junction, Colorado, 81506

Re: Proposed Pavement Sections, 859 Struthers Ave., Grand Junction

Dear Mr. Jefferies;

At the request of Mr. Dan Brennecke, Roy F. Weston, Inc., the proposed road sections for the Interior Parking/Delivery Area and the South shoulder/travel lane of Struthers Avenue was drilled and sampled by personnel of GRAND JUNCTION LINCOLN-DeVORE, INC., as part of our Report of Subsurface Soils Exploration, Job #88473-GJ, March 9, 2001. The samples were subjected to Laboratory Testing and appropriate road sections were computed. Following are our findings and recommendations.

Samples of the surficial native soils that may be required to support pavements have been evaluated using the Hveem-Carmany method (ASTM D-2844) to determine their support characteristics. The results of the laboratory testing are as follows:

AASHTO Classification - **A-4(4)** Unified Class. - **GM/GW** (similar to 'Pit-Run')
Soil Type #I Sandy Gravel & Cobble, to include the imported gravel fill

R	= 80
Expansion @ 300 psi	= 0 psf
Displacement @ 300 psi	= 4.41

It is anticipated that Soil Type #I will comprise the majority of road section subgrade material in the development and beneath Struthers Avenue. The Geotechnical Engineer should make observations of the initial road cuts to determine if the proper subgrade soils have been encountered or if any of the road sections will require modification.

Traffic Counts or anticipated volumes within the development are anticipated to be rather low. For purposes of this study, an 18K EAL of 5 has been used for all interior parking areas The main entry area, subjected to significant truck loads, has been assigned an 18K EAL of 25. The traffic loading on Struthers Avenue is rather high and an 18K EAL of 37 has been used.

The 1986/93 AASHTO procedure, recognized by the Colorado Department of Transportation was utilized for this project. A design life of 30 years was used, with an annual growth rate of 3%.

Based upon the existing topography, the anticipated final road grades and subsurface soils conditions encountered during the drilling program, a Drainage Factor of 0.8 (1986/93 AASHTO procedure) has been utilized for the section analysis.

Calculated Pavement Sections

	18K EAL = 5 Low Volume Parking Lot		18K EAL = 37 Struthers Ave. (High Loading)
AC	3"		3" or 4" AC
ABC	4"		6" or 6" ABC
Subbase	0"		0" or 0" Subbase
	12"	Compacted Subgrade	12"

Full Depth	AC	3"	4"	FULL DEPTH AC
		12" Compacted Subgrade	12"	

Rigid Concrete: "R" Value = 80 k = 200 psi
Doweled, not tied to shoulder slabs or curbing

	18K EAL = 5 Low Volume Parking Lot		18K EAL = 25 Road Entry/Truck Use
Portland cement pavement	PCCP	6"	on 6" PCCP
optional aggregate base	ABC	4"	on 4" ABC
recompacted native material	Subgrade	12"	on 12" Subgrade

It is recommended that 4" of aggregate base coarse (ABC) be placed beneath the Concrete Slab, to provide a 'leveling surface' and to provide a lower 'blotting' layer for concrete finishing purposes.

Due to the possibility of very high soil moisture in the subgrade soils, the use of a Geotextile Fabric for separation and minor reinforcement placed beneath the Structural Section, may be required along portions or isolated areas of these road alignments. It is recommended a woven fabric, such as Amoco 2002 or Contech C-180 or Mirafi 500-X, be utilized unless free water is present in the excavation. If free water is present, the non-woven fabric, such as Amoco 4547, Contech C-50NW or Mirafi 140N, while possessing lower strength generally provides better constructability.

The additional materials and effort expended in subgrade stabilization is to provide a construction platform, so the actual Road Section can be placed and compacted. The specific areas which will require placement of the Geotextile Fabric will depend on the actual conditions encountered during construction. The subgrade and road section construction should be monitored by representatives of the Geotechnical Engineer.

Geotextile Fabric for separation and minor reinforcement should be either a woven with a minimum Grab Strength of 180 lb., in the weakest direction (such as Amoco 2002 or Contech C-180 or Mirafi 500-X). If free water is encountered, Equivalent Reinforcement Strength (minimum Grab Strength of 180 lb., in the weakest direction) can be obtained by using Amoco 4552 or Contech C-70NW or Mirafi 180N may be used for better constructability. In instances requiring only separation properties, a non-woven/needle punched Geotextile with a minimum Grab Strength of 120 lbs., in the weakest direction (such as Amoco 4506, Contech C-50NW or Mirafi 140N) may be utilized, even though it is a weaker fabric.

The imported structural fill (Hveem-Carmany R>70 , swell not critical) is to be Granular, Medium to Coarse Grained, Very low plastic (PI<4), Non Freedraining, Compactable and within the following Gradation:

Maximum size, by screening	8"
Passing the #4 screen	20% - 85%
Passing the #40 screen	10% - 60%
Passing the #200 screen	3% - 15%

The maximum aggregates size may be exceeded if the contractor can provide evidence of proper compaction of the matrix material while avoiding excessive particle size segregation of the fill material.

Imported Structural Fill and Aggregate Base Course (ABC) to be compacted to 90% of its maximum Modified Proctor dry density (ASTM-D-1557) at a moisture content within $\pm$ 2% of optimum moisture. The use of light weight tracked equipment will minimize subgrade degradation, vibratory compaction equipment is not recommended.

During the placement of any structural fill, it is recommended that a sufficient amount of field tests and observation be performed under the direction of the Geotechnical Engineer. The Geotechnical Engineer should determine the amount of observation time and field density tests required to determine substantial conformance with these recommendations.

Any areas of Fill or Subgrade instability encountered during construction are to be immediately brought to the attention of the Geotechnical Engineer, so recommendations for stabilization can be given.

The Subgrade Stabilization is normally considered effective if the imported structural fill materials are confined, if specified imported fill and specified asphalt densities are obtained and the final traffic surface is stable according to local practices. Some 'pumping and rolling' of the finish Base Course (ABC) surface is anticipated but, rutting should not occur.

EXISTING PAVEMENT SECTIONS

The existing road pavement sections along the South Shoulder of Struthers Ave. alignment were measured and found to be:

Boring #	Surface Coarse	Base Coarse	
P # 5	4" A.C.	1-1/2" of A.B.C.	West End of Property
P # 6	3" A.C.	6" of A.B.C.	East Portion of Property

PAVEMENT SECTION CONSTRUCTION
FLEXIBLE PAVEMENT

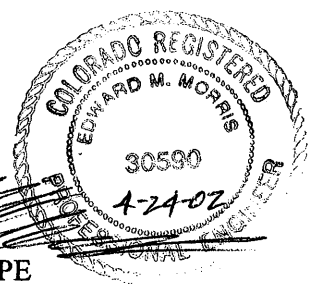
We recommend that the asphaltic concrete pavement meet the State of Colorado requirements for a Grading *S* or *SX* mix. In addition, the asphaltic concrete pavement should be compacted to 92% to 96% of its Maximum Theoretical Specific Gravity. The aggregate base coarse should meet the requirements of State of Colorado Class 5 or Class 6 material, and have a minimum R value of 78. We recommend that the base coarse be compacted to a minimum of 95% of its maximum Modified Proctor dry density (ASTM D-1557), at a moisture content within + or -2% of optimum moisture. The native subgrade shall be scarified and recompacted to a minimum of 90% of their maximum Modified Proctor day density (ASTM D-1557) at a moisture content within + or -2% of optimum moisture.

All pavement should be protected from moisture migrating beneath the pavement structure. If surface drainage is allowed to pond behind curbs, islands or other areas of the site and allowed to seep beneath pavement, premature deterioration or possibly pavement failure could result.

It is believed that all pertinent points have been addressed. If any further questions arise regarding this project or if we can be of any further assistance, please do not hesitate to contact this office at any time.

Respectfully Submitted,

GRAND JUNCTION
LINCOLN DeVORE, Inc.



by: Edward M. Morris PE
Principal Engineer

GJLD Job No.: 88473-GJ

ROAD LOCATION: Parking Lot

	DESIGN ADT	446
VEHICLE %	Equiv Factor	VEHICLE TYPE	18k EDLA
66.0%	0.800	PASSENGER	0.24
33.0%	9.093	PICK-UPS	1.34
0.5%	176.908	SINGLE UNIT	0.38
0.2%	1008.151	COMBINATION	0.72
100%		TOT. 18k EDLA	2.67

PER LANE 18k		
ROAD TYPE	TRAFFIC %	18k EDLA
Turning Lane	40%	1.1
SINGLE LANE	100%	2.7
2 LANE ROADWAY	60%	1.6
4 LANE ROADWAY	45%	1.2
6 LANE ROADWAY	40%	1.1

ROAD LOCATION: STRUTHERS Avenue, Realistic

	DESIGN ADT	1800
VEHICLE %	Equiv Factor	VEHICLE TYPE	18k EDLA
63.4%	0.800	PASSENGER	0.91
31.6%	9.093	PICK-UPS	5.17
3.5%	176.908	SINGLE UNIT	11.15
1.5%	1008.151	COMBINATION	27.22
100%		TOT. 18k EDLA	44.45

PER LANE 18k		
ROAD TYPE	TRAFFIC %	18k EDLA
Turning Lane	40%	17.8
SINGLE LANE	100%	44.5
2 LANE ROADWAY	60%	26.7
4 LANE ROADWAY	45%	20.0
6 LANE ROADWAY	40%	17.8

ROAD LOCATION: STRUTHERS Avenue, High End

	DESIGN ADT	2500
VEHICLE %	Equiv Factor	VEHICLE TYPE	18k EDLA
63.4%	0.800	PASSENGER	1.27
31.6%	9.093	PICK-UPS	7.18
3.5%	176.908	SINGLE UNIT	15.48
1.5%	1008.151	COMBINATION	37.81
100%		TOT. 18k EDLA	61.74

PER LANE 18k		
ROAD TYPE	TRAFFIC %	18k EDLA
Turning Lane	40%	24.7
SINGLE LANE	100%	61.7
2 LANE ROADWAY	60%	37.0
4 LANE ROADWAY	45%	27.8
6 LANE ROADWAY	40%	24.7

TRAFFIC / 18k EAL WORKSHEET

GRAND JUNCTION
LINCOLN - DeVORE, Inc.
Geotechnical Consultants
Grand Junction, Colorado

859 STRUTHERS Ave., Grand Junction, CO.
HIGH SIDE BREWERY

Mr. JIM JEFFRYES (Owner)		Date
ROY F. WESTON, Inc. (Engineer)		4-15-2002
Job No. 88985-GJ	Drawn EMM	