F-05 001

Geotechnical Engineering Group, Inc.

See addendum dated 5/10/06 attached to back of this report. SCB

PRELIMINARY GEOTECHNICAL INVESTIGATION
SUBGRADE INVESTIGATION
AND PAVEMENT DESIGN
Brandon Estates Subdivision
North and West of K Road and 18 1/2 Road
Fruita, Colorado

Prepared For:

Vortex Engineering
255 Vista Valley Drive
Fruita, Colorado 81521

Attention: Mr. Robert Jones II, P.E.

Job No. 2,042

October 6, 2005

Geotechnical, Environmental and Materials Testing Consultants

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SCOPE

This report presents the results of a Preliminary Geotechnical Investigation, Subgrade Investigation and Pavement Design for Brandon Estates Subdivision north and west of K Road and 18 ½ Road in Fruita, Colorado. This investigation was conducted to explore subsurface conditions, observe for evidence of geological hazards, provide preliminary foundation alternatives and provide pavement design recommendations for the proposed subdivision. The report includes a site description, geologic hazards review, descriptions of subsoil and groundwater conditions found in twenty exploratory borings, recommended pavement sections and discussion on details influenced by the subsurface conditions. This investigation was performed in general conformance with our Proposal No. 05–087 dated May 26, 2005.

This report was prepared from data developed during our field exploration, laboratory testing, engineering analysis and experience with similar conditions. A brief summary of our conclusions and recommendations follows. Detailed criteria are presented within the report.

SUMMARY OF CONCLUSIONS

1. Based on the results of this investigation, we believe development of the subject site for the proposed use is feasible. Additional discussion is included in the text of the report.

2. We did not identify geologic hazards that would preclude proposed development. A detailed discussion is included in the text of this report.

3. Subsoils found in the exploratory borings consisted of approximately 8 feet of gravelly sand underlain by sandy to silty clay to the maximum depth explored of 20 feet in exploratory boring TH-2 and 20 feet of gravelly sand in TH-3. Subsoils found in the remaining (18) exploratory borings consisted of sandy to silty clay to the maximum depths explored of 5 to 20 feet. Groundwater was noted the day of observation, at depths of approximately 5 to 10 feet below ground surface and when rechecked 23 and 24 days later at depths of 4 to 7 feet in exploratory borings TH-1 through TH-6.

4. We believe recommended foundation types may include spread footing or monolithic turned-down slab foundations. Excavation depths for spread footing or monolithic turned-down slab foundations should be limited as much as practical due to the potential of encountering relatively soft, wet conditions. A design level soils investigation should be performed to provide foundation and floor system recommendations on a lot specific basis.

5. An asphalt thickness of 5 ½ inches or 3 inches asphalt over 7 inches base course over well compacted subgrade soils are recommended for residential streets, ESAL= 45,500. Additional pavement section alternatives and design and construction criteria are presented in the text of the report.

6. Utility trench backfill should be placed in a well-compacted manner and tested during construction. Site drainage should be carefully planned and maintained to direct water away from pavements and proposed building areas.

SITE CONDITIONS

The subject site was an approximately 34-acre parcel located north and west of K Road and 18 ½ Road in Fruita, Colorado. The subject site was approximately 1.5 miles northeast of Fruita Colorado. The parcel was basically flat, nearly level (measured with hand level). Much of the subject site was being utilized as a sod farm with ongoing sod cutting and irrigation operations. A single-family residence and agricultural outbuildings were noted near the southwest portion of the subject site. Several above ground, wheeled type irrigation sprinklers were noted. Standing water (presumably from irrigation) was noted in several locations. A north-south aligned, 2 foot wide by 1 foot deep concrete headwater type ditch (dry at the time of our visit) was located between the east and central portions of the subject site. Irrigation related structures were noted near the northwest portion of the subject site. An irrigation drainage ditch was noted near the north portion of the subject site. This drainage ditch was 25 to 30 feet wide and drains toward the west. Water in the ditch at the time of our visit was 8 to 12 feet below the local ground surface. Several fence lines were noted in and around the subject site. The previously mentioned drainage ditch was north, single-family residences and agricultural land were beyond. Agricultural fields were east with single-family residences and agricultural land beyond. K Road, agricultural fields and single-family residences were south. 18.5 Road was west with a single-family residence subdivision beyond. The vicinity sloped down toward the southwest at less than1 percent (USGS, Fruita, Colorado topographic quadrangle dated 1962 revised 1973).

PROPOSED CONSTRUCTION

Plans provided by the developer indicate that proposed development includes subdivision into 100 lots for single-family residential construction and approximately 7,000 lineal feet of pavement. No below grade construction is proposed. Shallow foundations and slab on grade floors are desired. No grading changes are anticipated. There will be no offsite improvements of soil retention area type testing desired. Final construction plans have not yet been developed. If proposed construction changes or is different from what is stated, we should be contacted to review actual construction and our recommendations.

GEOLOGIC HAZARDS

The dominant surficial geologic unit identified in the subject site area was Quaternary alluvium and colluvium. Our field investigation identified sandy clay and gravelly to silty sand in the exploratory borings. Samples were tested for one-dimensional swell/consolidation characteristics and water-soluble sulfate concentrations. These samples exhibited low swell potential and low to moderate water-soluble sulfate concentrations. We believe expansive soils with higher swell potential may be identified by future study. Using sulfate resistant cements in concrete can reduce potential damages related to water-soluble sulfates.

House Bill 1041 as passed by the Colorado State Legislature in 1974 was to designate geologic hazards which, if present, may pose a threat to life or property. Geologic hazards, outlined by House Bill 1041, are discussed below.

1. Radioactivity: We did not observe conditions which indicate naturally occurring radioactive material or tailings on the site at the time of our field exploration.

2. Seismic Considerations: The nearest identified fault is about 3.5 miles south of the subject site. The subject site is located in seismic zone 1 as identified by the 2000 Uniform Building Code. Based on our observations of the site and review of available data we do not feel that significant hazard from seismic activity exists at the site.

3. Ground Subsidence: We did not observe any large-scale mining features on or near the site. We did not observe evidence of subsurface voids at the site. We recommend that a site and structure specific geotechnical study be performed to address settlement potential for each lot at the time of foundation design.

4. Landslides: Our observations of the slopes on and adjacent to the subdivision site did not indicate landslides exist on or near the property.

5. Avalanche: The site is located at an elevation which is not likely to obtain sufficient snow accumulation to result in avalanches. Avalanches typically occur on slopes with inclinations ranging from 20 to 45 degrees. No steep

slopes were observed above or influencing the site which would provide a source for avalanche. We feel that significant avalanche hazard does not exist on or influencing the subdivision site.

6. Rockfall: We did not observe formational outcrops or talus slopes on or above the site which would provide a source of rocks for rockfall hazard. Based on our observations of the site we feel that significant rockfall hazard do not exist on the subdivision site.

7. Flood: We noted a larger irrigation drainage ditch near the north portion of the subject site and a smaller irrigation ditch between the central and east portions of the subject site. The smaller ditch was dry at the time of our site visit; water in the irrigation drainage ditch was 8 to 12 feet below the ground surface of the subject site. These water sources could potentially inundate the subject site we recommend the civil engineer review site drainage to help reduce damages to structures if overtopping of irrigation ditches occurs.

8. Mudflow and Debris Fans: We did not observe mudflow and debris fans on or influencing the site.

9. Expansive Soil and Rock: Mancos shale is the formational material underlying the site. Our experience in the area indicates the Mancos Shale typically has moderate to high swell potential when wetted. The Mancos Shale weathers to a clay and shale fragment soil that is likely to be expansive. We recommend that a site and structure specific geotechnical study be performed to address the swell potential for each lot at the time of foundation design. Special foundation and/or floor system support may be warranted due to swell potential.

10. Slopes: Measured ground surface slopes across the subject site were less than 3 percent with the exception of sidewall slopes in the irrigation drainage ditch, which measured approximately 44 degrees. With proper engineering design and setback we do not believe these slopes to be detrimental to the proposed construction.

Based on our site visit and review, it is our opinion, with proper civil, structural and geotechnical, engineering design, no geologic hazards were identified which would preclude development of the subject site.

SUBSURFACE CONDITIONS

Subsurface conditions at the site were investigated by observing and sampling 20 exploratory borings. Locations of the exploratory borings are shown on Fig. 2. Graphic logs and legend of the soils encountered in the borings and field penetration resistance test results are presented on Figs. 3 through 8. Subsoils encountered in the exploratory borings consisted approximately 8 feet of gravelly sand underlain by sandy to silty clay to the maximum depth explored of 20 feet in exploratory boring TH-2 and 20 feet of gravelly sand in TH-3. Subsoils found in the remaining (18) exploratory borings consisted of sandy to silty clay to the maximum depths explored of 5 to 20 feet. The gravelly sand was silty to clean, medium dense to very loose, moist to wet, brown with sandy, silty gravel lenses noted. The sandy to silty clay had silty to clayey sand lenses, was medium stiff to very soft, moist to wet and brown. Groundwater was noted the day of observation, at depths of approximately 5 to 10 feet below ground surface and when rechecked 23 and 24 days later at depths of 4 to 7 feet in exploratory borings TH-1 through TH-6.

Six clay samples tested had moisture contents of 15.3 to 28.8 percent. Four clay samples tested had dry densities of 89 to 118 pcf. One sandy, silty clay sample was tested for one-dimensional swell consolidation characteristics. This sample consolidated 0.9 percent when wetted under a confining pressure of 500 psf. Two clay samples tested for Atterberg limits exhibited liquid limits of 51 and 23, plasticity indices of 31and 10, no material retained on the No. 4 sieve (gravel sized particles) and 90 and 71 percent passing the No. 200 sieve (silt and clay sized particles). One sandy, silty clay sample tested exhibited non-liquid / non-plastic characteristics, had no material retained on the No. 4 sieve and 60 percent passing the No. 200 sieve. Three sand samples tested had moisture contents of 6.5 to 19.6 percent, dry densities of 106 to 116 pcf, 0 to 42 percent retained on the No. 4 sieve, and 5 to 28 passing the No. 200 sieve. Results of the laboratory testing are presented in Figs. 9 through 16 and summarized on Table I.

SITE DEVELOPMENT

All pavement areas should be stripped of organic layers prior to cut or placement of fill. All pavement subgrade soils should be scarified a depth of 10-inches, moisture conditioned to within optimum moisture content to 2 percent over optimum moisture content and compacted to at least 95 percent of maximum dry density (ASTM D698). Local code may influence the compaction requirements. Structural fill material should be placed in maximum 10-inch loose lifts, moisture conditioned and compacted as stated above. On-site silty, sandy clay soils free of deleterious materials, organics and particles over 2-inches diameter can be moisture conditioned and compacted as discussed above for reuse during grading. Our representative should be called to confirm complete removal of any existing fill and organic layers and to verify compaction of fill placement. Sample site grading specifications are included in Appendix A.

Groundwater was noted across the site, the day of observation, at depths of approximately 5 to 10 feet below ground surface and when rechecked 23 and 24 days later at depths of 4 to 7 feet in exploratory borings TH-1 through TH-6. Roadway subgrade in portions of the subject site may require subgrade stabilization. Subgrade stabilization may include over excavating 2 or more feet below subgrade elevation, placing a subgrade stabilization fabric or a geotextile reinforcing grid and backfilling with a compacted granular structural fill material to subgrade elevation. The depth of overexcavation should be determined at the time of construction and is dependent on the subgrade conditions at the time of construction.

We recommend a subsurface drain constructed in the roadway be considered. The drain may be constructed beneath water or sewer utilities or adjacent to each edge of the roadway. The drain should be constructed at a depth of at least 5 feet below the planned elevation of the road surface or the existing ground surface, which ever is deeper. The drain should consist of a 4 inch or larger diameter perforated pipe surrounded by at least 4 cubic feet per linear foot of drain of free draining aggregate, wrapped by an appropriate geotextile filter fabric. The pipe size should be sufficient to carry the maximum anticipated volume of collected water. The drain should be sloped to discharge at an all weather outlet which is protected from becoming frozen or a storm drain as appropriate. If the drain is sloped to discharge at an all weather outlet the outlet should be equipped to prevent entry by small animals. The drain concept is shown on Fig. 17.

Buried Utilities

Groundwater was noted the day of observation, at depths of approximately 5 to 10 feet below ground surface and when rechecked 23 and 24 days later at depths of 4 to 7 feet in exploratory borings TH-1 through TH-6. We anticipate groundwater levels may fluctuate seasonally. As a result, there may be groundwater and/or soft to very soft soil concerns during construction, which were not identified by this investigation. Stabilization may be necessary. It may be necessary to dewater utility trench excavations and other deep excavations in the areas of shallow groundwater during construction. Further investigation of groundwater levels should be completed during the design phase geotechnical investigation.

Site grading plans were not available at the time of this investigation. We anticipate there will be less than 1 to 2 feet of cut or fill. On site soils can be reused as structural fill. Prior to fill placement, the surface of native soils below fill should be stripped and all organic and deleterious materials completely removed. The surface should be scarified to a depth of 10 inches, moisture conditioned to within 2 percent of optimum moisture content and compacted to at least 95 percent of standard Proctor (ASTM D 698) maximum dry density. On-site clay and sand soils free of deleterious materials, organics and particles over 6-inches diameter can be reused during grading. Fill placement should be moisture conditioned to within 2 percent of optimum moisture content and compacted to at least 95 percent of standard Proctor (ASTM D 698) maximum dry density in 10-inch maximum thickness loose lifts. Placement and compaction of grading fill should be observed and tested by a representative of our firm during construction.

We believe utility installation in the natural clays, silts and sands can be accomplished using conventional excavation equipment. Utility trenches should be sloped or shored to meet local, State and Federal safety regulations. Based on our investigation, we believe soils at this site may be classified as either Type B or Type C, based on OSHA standards. Excavation slopes specified by OSHA are dependent upon types of soils and groundwater conditions encountered. Contractors should identify the conditions encountered in the excavation and refer to OSHA standards to determine appropriate slopes.

Water and sewer lines will be constructed beneath pavements. Compaction of trench backfill can have a significant effect on the life and serviceability of pavements. We recommend trench backfill be placed in thin, loose lifts, moisture conditioned to within 2 percent of optimum moisture content and compacted to at least 95 percent of standard Proctor maximum dry density (ASTM D 698). The placement and compaction of utility trench backfill should be observed and tested by a geotechnical engineer during construction.

CONSTRUCTION CONSIDERATIONS

Subsurface conditions encountered at anticipated foundation levels consisted of very soft to medium stiff, sandy to silty clay and loose to medium dense, gravelly sand. Based on the results of this investigation, we believe the recommended foundation types will include shallow spread footing foundations and turned down slab foundations. Soft conditions may be encountered and bottoming foundations as shallow as practical or stabilization may be necessary. Foundation design and construction recommendations should be developed through a more detailed geotechnical investigation on a site-specific basis, once construction plans are more clearly defined.

Slabs-on-grade supported by the soils encountered during this investigation will likely involve low risk of slab movement. In finished areas where floor movement and associated damage cannot be tolerated, structurally supported floors should be planned. Site-specific evaluation of floor slab movement potential should be addressed in a more detailed geotechnical investigation.

PAVEMENT

The pavement subgrade soils include silty, sandy clay. We visually classified each sample obtained from the borings and tested samples in our laboratory. We tested samples from TH-7, 8, 9, 15, 16 and 19 (bulk combined) and TH-10, 11, 12, 13, 14, 17, 18 and 20 (bulk combined) for pavement design purposes. The samples were tested for Atterberg limits, gradation, soluble sulfates, standard Proctor, and California Bearing Ratio (CBR). The samples tested exhibited maximum dry densities of 118.5 and 116.0 pcf, optimum moistures of 12.5 and 13.5 percent and a California Bearing Ratio (CBR) of 5.6. The laboratory testing indicated low plasticity clays with moderate pavement support characteristics. The results of laboratory testing (pavement design) are included in Figs. 13 through 16.

Our design utilized the computer program WinPAS, based on the 1993 AASHTO Guide for Design of Pavements Structures a 25-year design period and our experience. We understand pavements will be used for residential and collector streets. We used an

Equivalent Single Axle Load (ESAL) of 45,500 for residential streets and 91,000 and 182,000 for collector and collector/arterial streets. The ESAL values were calculated using a daily 18 kip axle load of 5 over a 25 year period. We used a regional factor of 2.0 and a design serviceability index of 2.0. We used a CDOT developed, non-linear relationship to relate the CBR value to the subgrade resilient modulus (M_r), for flexible pavement. Using this relationship, we calculated a M_r value of 6,300 psi. We used this M_r value for flexible pavement design. We calculated a modulus of subgrade reaction (k) value for rigid pavement design from the M_r value using the relationship $k = M_r / 19.4$. Using this equation, we calculated a k value of 325 psi / in. Table A below shows our recommendations.

TABLE A

SUMMARY OF RECOMMENDED PAVEMENT SECTIONS

Anticipated Traffic Type	Asphaltic Concrete	Asphalt and Aggregate Base Course	Portland Cement Concrete
Residential Street ESAL = 41,500	5 ½ "	3.0" + 7.0 "	selected 5.0"
Collector Street ESAL = 91,000	6.0 "	4.0" + 6.0 "	5.0"
Collector/Arterial Street ESAL = 182,000	6 ½ "	4.0" + 8.0 "	Selected K-Road 5 ½"

Prior to construction of the recommended section, the resulting subgrade should be stripped free of organics and deleterious materials, scarified at least 10-inches depth, moisture conditioned to within 2 percent of optimum moisture and compacted to at least 95 percent standard Proctor (ASTM D698) maximum dry density.

The design of a pavement system is as much a function of paving materials as supporting characteristics of the subgrade. The quality of each construction material is reflected by the strength coefficient used in the calculations. If the pavement system is constructed of inferior material, then the life and serviceability of the pavement will be substantially reduced.

The asphalt component of the pavement was designed assuming at least 1,650 pounds Marshall stability. Normally, an asphaltic concrete should be relatively impermeable to moisture and should be designed with a well-graded sand/gravel mix. The oil content, void ratio, flow and gradation need to be considered in the design. We recommend a job mix design be performed and periodic checks made to verify compliance with these specifications.

If construction materials cannot meet the above requirements, then the pavement design should be evaluated based upon available materials. We recommend the materials and placement methods conform to the requirements listed in the Colorado

Department of Transportation "Standard Specifications for Road and Bridge Construction". All materials planned for construction should be submitted and tested to confirm their compliance with these specifications.

A primary cause of early pavement deterioration is water infiltration into the pavement system. The addition of moisture usually results in softening of untreated base course and subgrade and eventual failure of the pavement. We recommend drainage be designed for rapid removal of surface runoff. Curb and gutter should be backfilled and the backfill compacted to reduce ponding adjacent to pavements. Final grading of the subgrade should be carefully controlled so that design cross-slope is maintained and low spots in the subgrade, which could trap water, are eliminated. Seals should be provided between curb and pavement and at all joints to reduce moisture infiltration. Landscaped areas and detention ponds in pavement areas should be avoided. All utility trench backfill should be placed in a well-compacted manner.

We have included construction recommendations for flexible and rigid pavement construction in Appendix A. Routine maintenance, such as sealing and repair of cracks annually and overlays at 5 to 7-year intervals, are necessary to achieve the long-term life of an asphalt pavement system. If the design and construction recommendations cannot be followed or anticipated traffic loads change considerably, we should be contacted to review our recommendations.

CONCRETE

Two soils samples (TH-3, 7, 8 and 9 at 0 to 5 feet, bulk combined and TH-10 through 14, 17,18 and 20 at 0 to 5 feet, bulk combined) were tested for water-soluble sulfates. these samples had water-soluble sulfate concentration of 460 and 40 ppm respectively. Sulfate concentrations in this range have a moderate to negligible effect on concrete that comes into contact with the soils. We recommend a Type II (sulfate resistant) cement be used for concrete that comes into contact with the subsoils. In addition, the concrete should have a water cement ratio of 0.50.

CONSTRUCTION MONITORING

Geotechnical Engineering Group, Inc. should be retained to provide general review of construction plans for compliance with our recommendations. Geotechnical Engineering Group, Inc. should be retained to provide construction-monitoring services during all earthwork and foundation construction phases of the work. This is to observe the construction with respect to the geotechnical recommendations, to enable design changes in the event that subsurface conditions differ from those anticipated prior to start of construction and to give the owner a greater degree of confidence that the development is constructed in accordance with the geotechnical recommendations.

LIMITATIONS

Twenty exploratory borings were observed. The exploratory borings are representative of conditions encountered only at the exact boring locations. Variations in the subsoil conditions not indicated by the exploratory borings are always possible. Subgrade soils compaction and fill (if any) compaction should be tested during construction. Pavement subgrade soils and construction materials should be tested during construction. Utility trench backfill compaction should be tested during placement. A design level foundation investigation should be performed in order to provide site-specific foundation and floor construction recommendations, prior to construction.

The scope of work performed is specific to the proposed construction and the client identified by this report. Any other use of the data, recommendations and design parameters (as applicable) provided within this report are not appropriate applications. Other proposed construction and/or reliance by other clients will require project specific review by this firm. Changes in site conditions can occur with time. Changes in standard of practice also occur with time. This report should not be relied upon after a period of three years from the date of this report and is subject to review by this firm in light of new information which may periodically become known.

We believe this investigation was conducted in a manner consistent with that level of care and skill ordinarily used by geotechnical engineers practicing in this area at this time. No other warranty, express or implied, is made. If we can be of further service in discussing the contents of this report or the analysis of the influence of the subsurface conditions on the design of the proposed construction, please call.

Sincerely,
GEOTECHNICAL ENGINEERING GROUP, INC.

Randall G. Dean
Staff Geologist

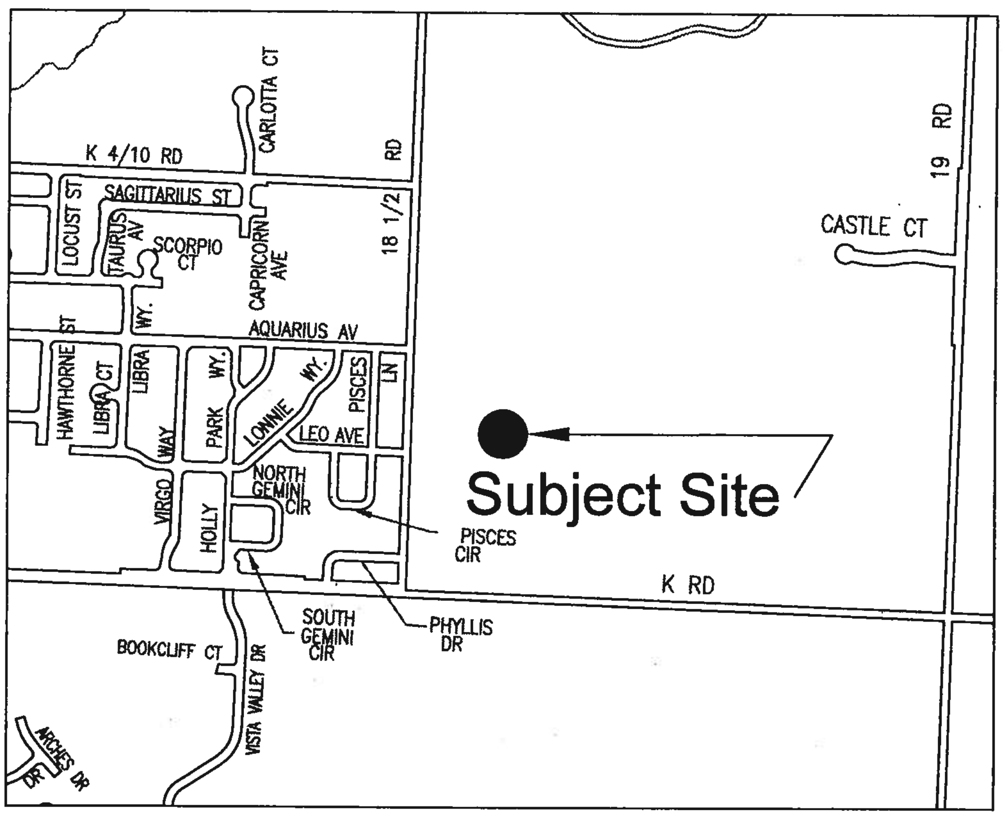
Reviewed by:

Norman W. Johnston, P.E.
Senior Engineer

COLORADO REGISTERED PROFESSIONAL ENGINEER NORMAN W. JOHNSTON 22644 7 Oct 05

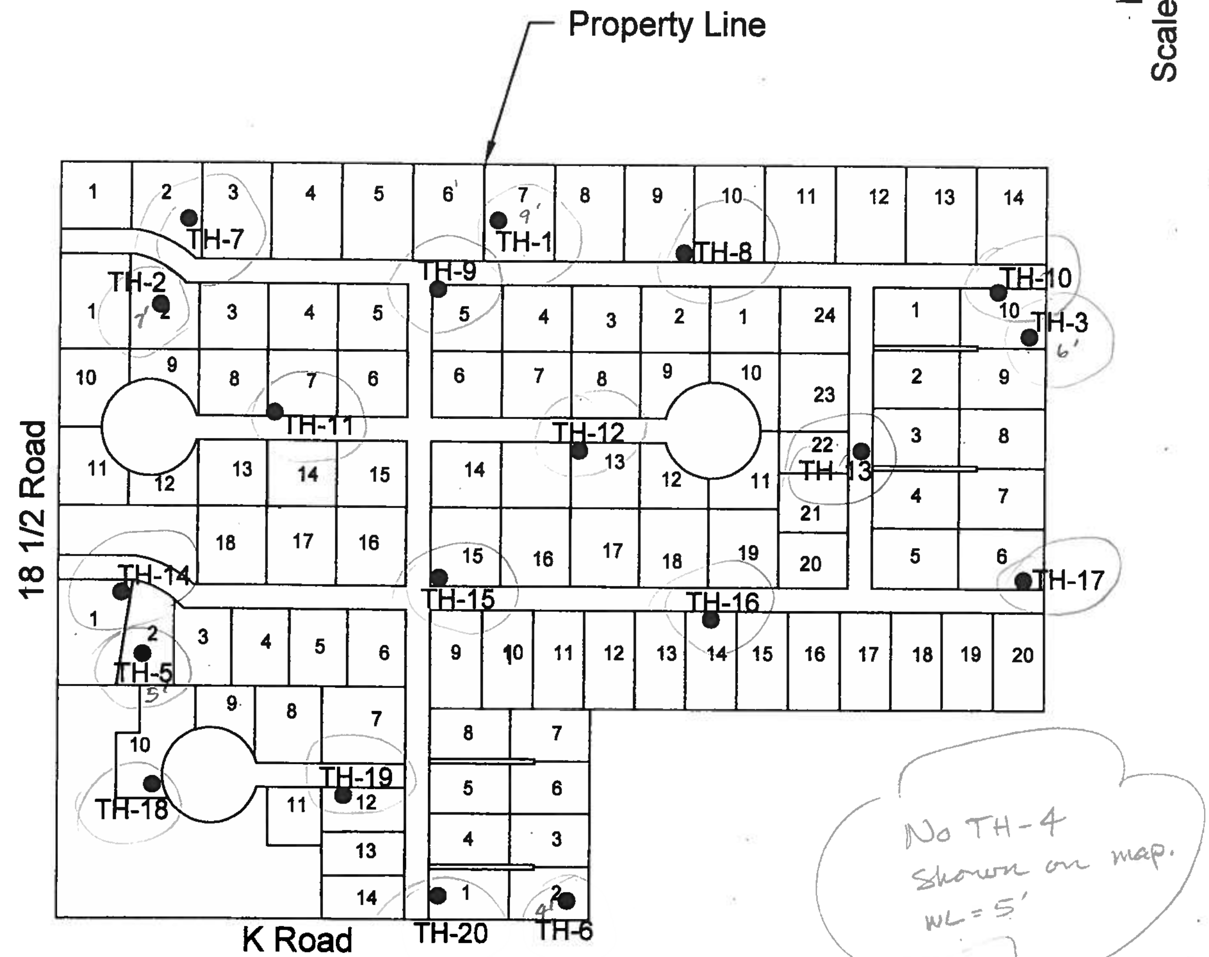
RGD:NWJ:cb
(3 copies sent)

Preliminary Geotechnical Investigation
Brandon Estates Subdivision
North & East of K Road and 18 1/2 Road
Fruita, Colorado



Job No. 2,042 Vicinity Map Fig. 1

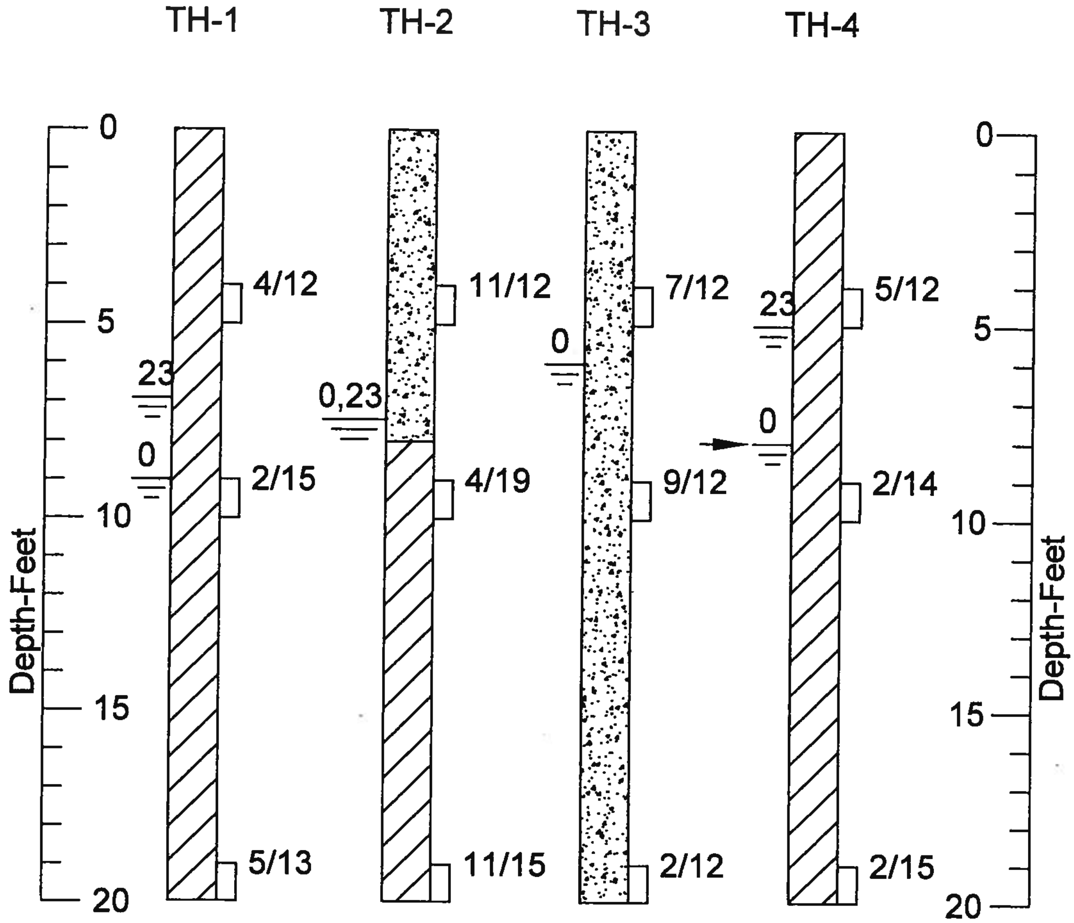
Note: This figure was prepared based on a site plan provided by Vortex Engineering.



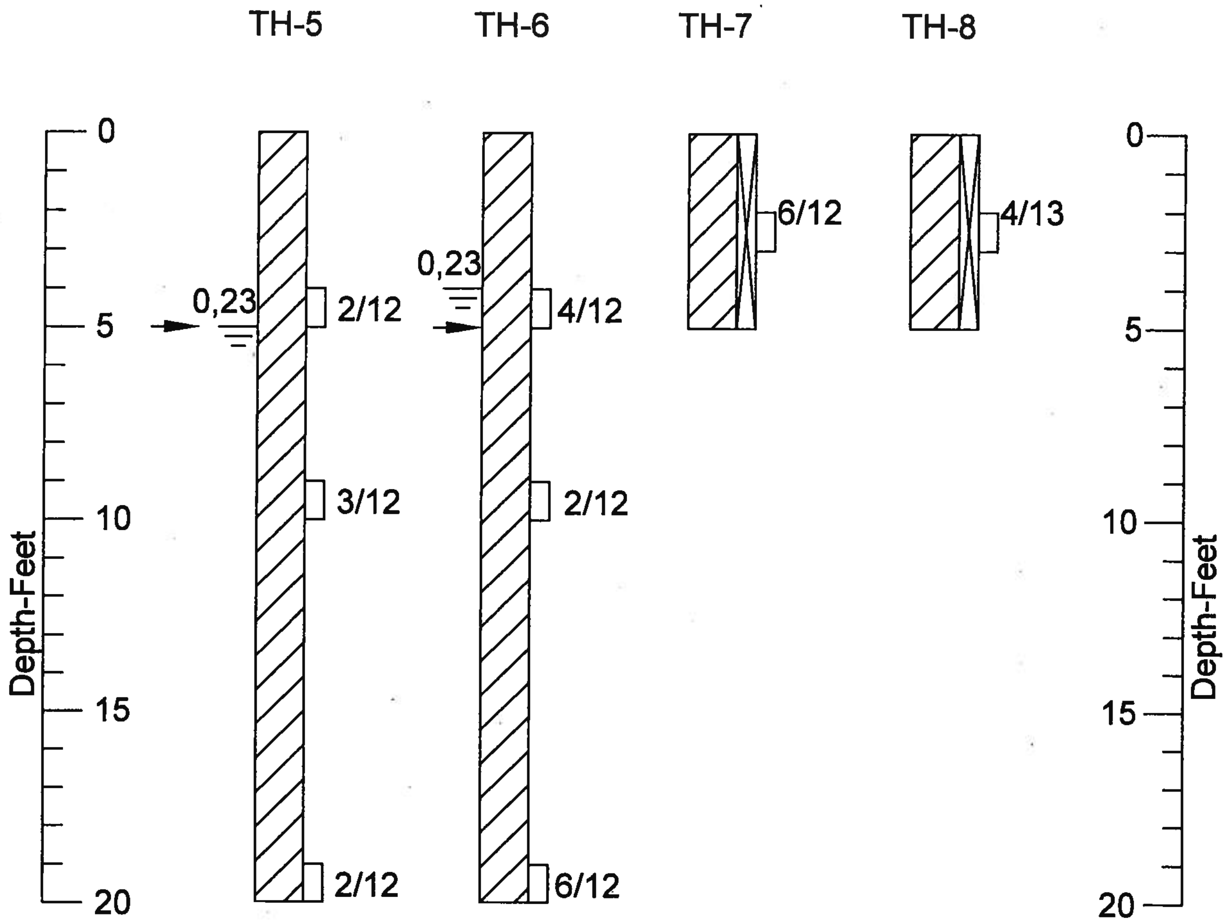
Legend

● Indicates location of exploratory borings.

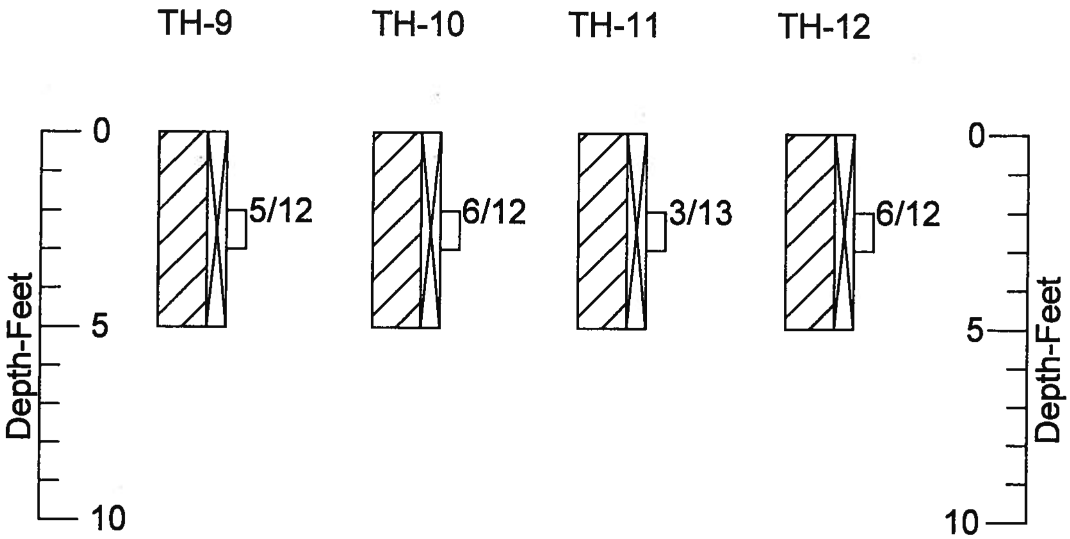
Job No. 2,042 **Location of Exploratory Borings** Fig. 2



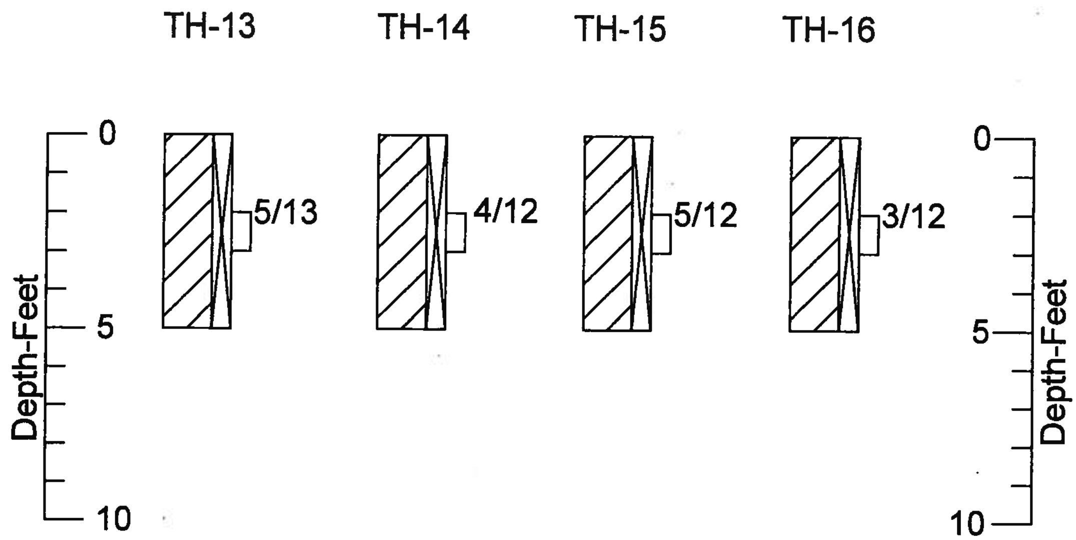
Job No. 2,042 **Logs of Exploratory Borings** Fig. 3



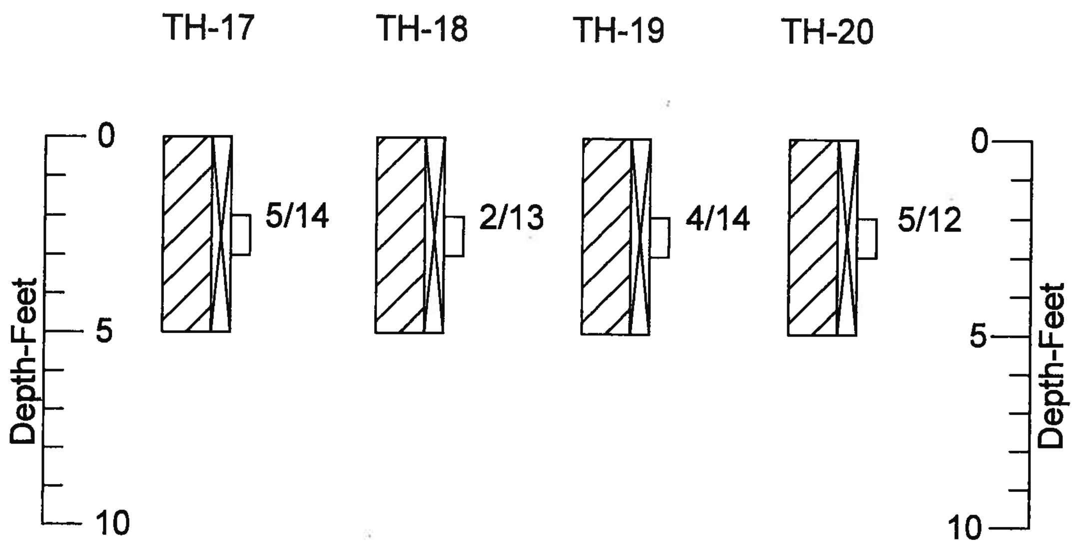
Job No. 2,042 **Logs of Exploratory Borings** Fig. 4



Job No. 2,042 **Logs of Exploratory Borings** Fig. 5



Job No. 2,042 **Logs of Exploratory Borings** Fig. 6



Job No. 2,042 **Logs of Exploratory Borings** Fig. 7

Legend

Clay, silty to sandy, Sand, silty to clayey lenses, medium stiff to very soft, moist to wet, brown. (CL,CH)

Sand, gravelly, silty to clean, Gravel, sandy, silty lenses, medium dense to very loose, moist to wet, brown. (SM,SP)

Indicates drive sample. The symbol 4/12 indicates that 4 blows of a 140 pound hammer falling 30 inches were required to drive a 2.5 inch O.D. sample barrel 12 inches.

Indicates location of bulk sample collected from auger cuttings.

Indicates depth at which exploratory boring caved.

23 Indicates free water level. Numeral indicates number of days after drilling that measurement was taken.

Notes

1. Exploratory borings were drilled and sampled on July 11 and 12, 2005 using a 4-inch diameter solid stem, continuous flight auger and a truck mounted drill rig.
2. These logs are subject to the explanations, limitations and conclusions as contained in this report.

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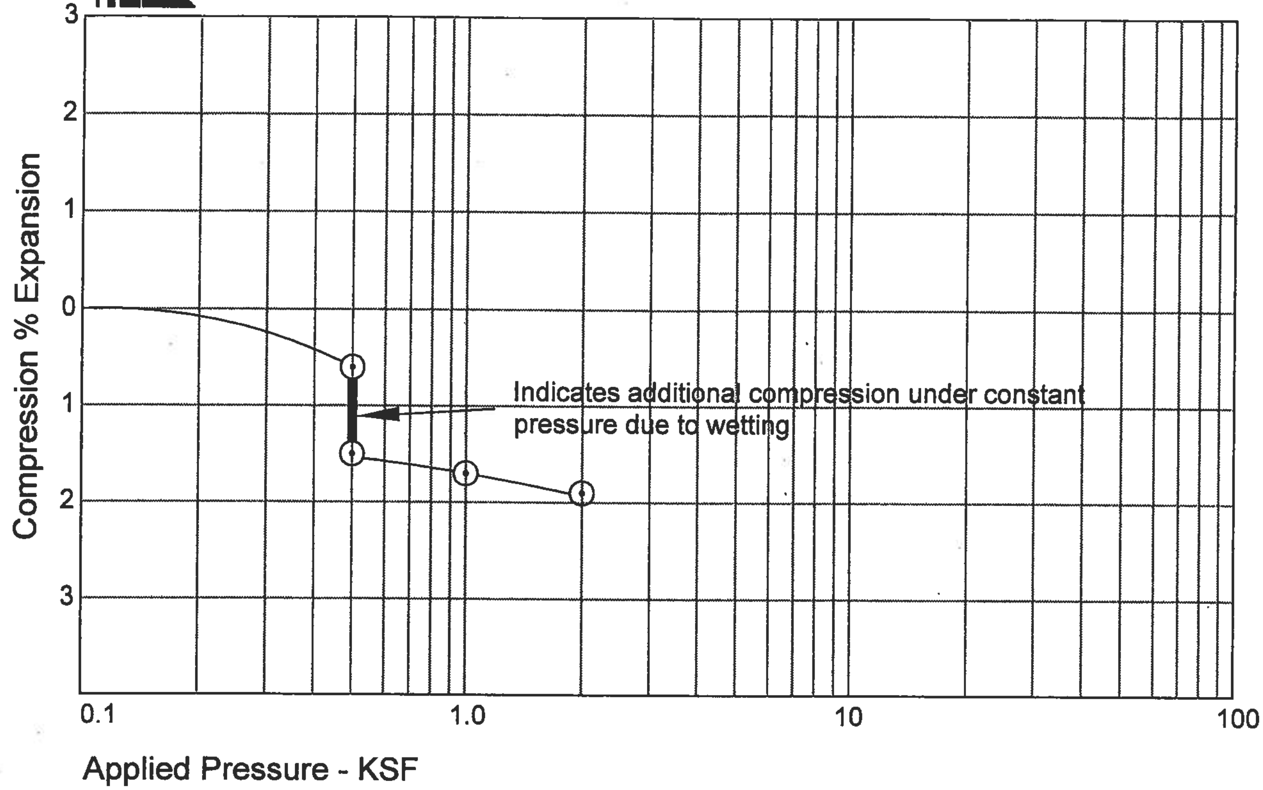
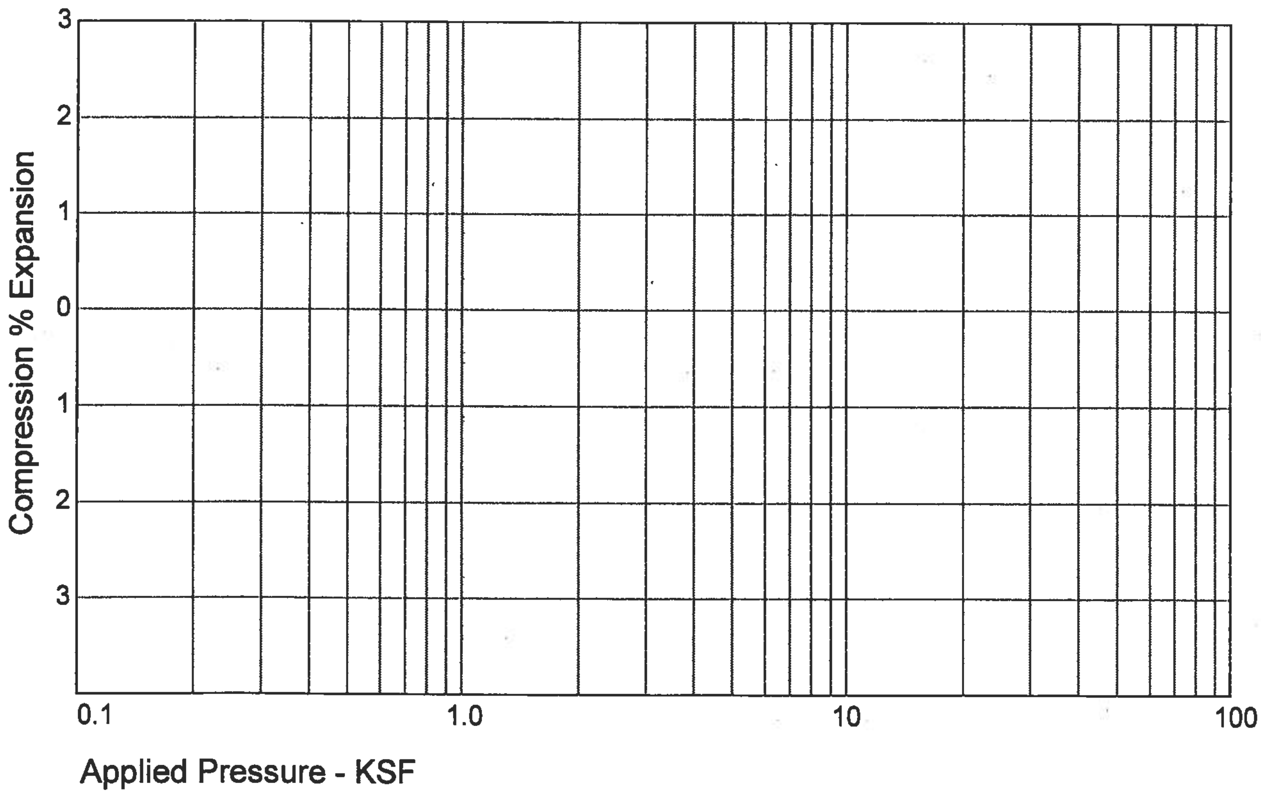


Sample of: Clay, silty, sandy (CL)
From: TH-5 @ 4 foot depth

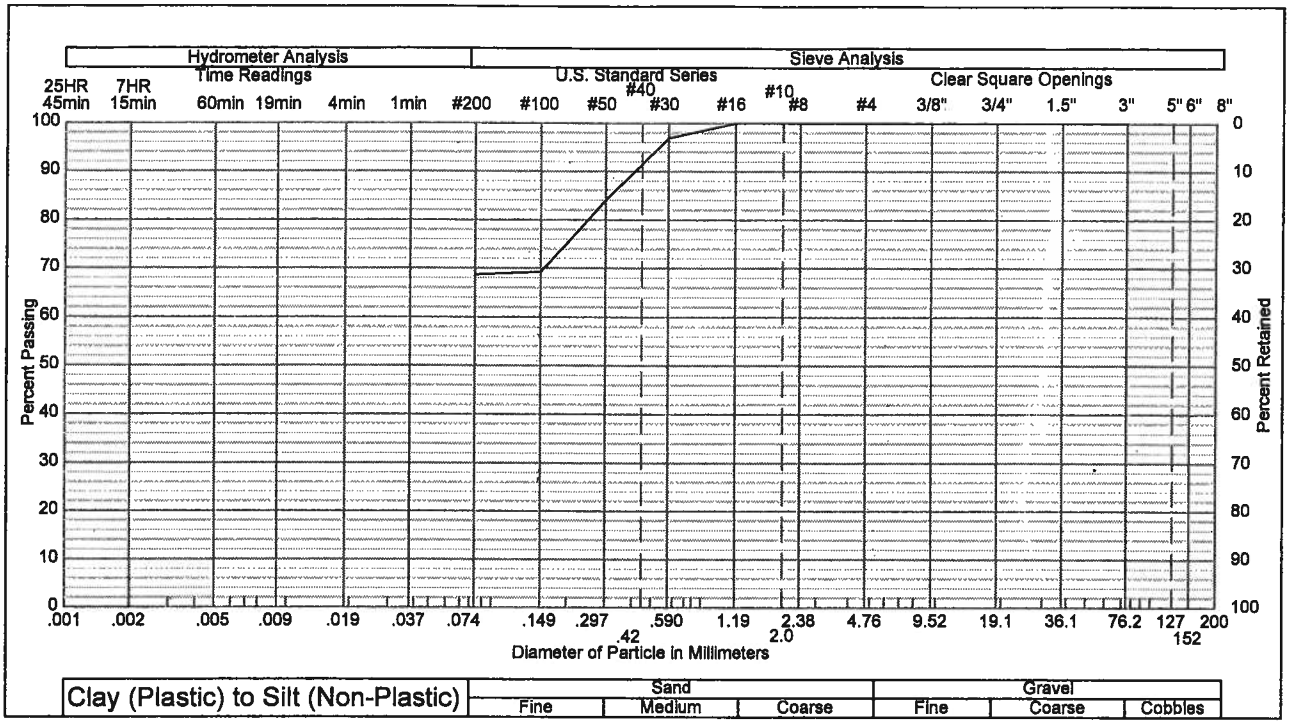
Dry Unit Weight= 118 PCF
Moisture Content= 24.3 %



Sample of:
From:

Dry Unit Weight= PCF
Moisture Content= %

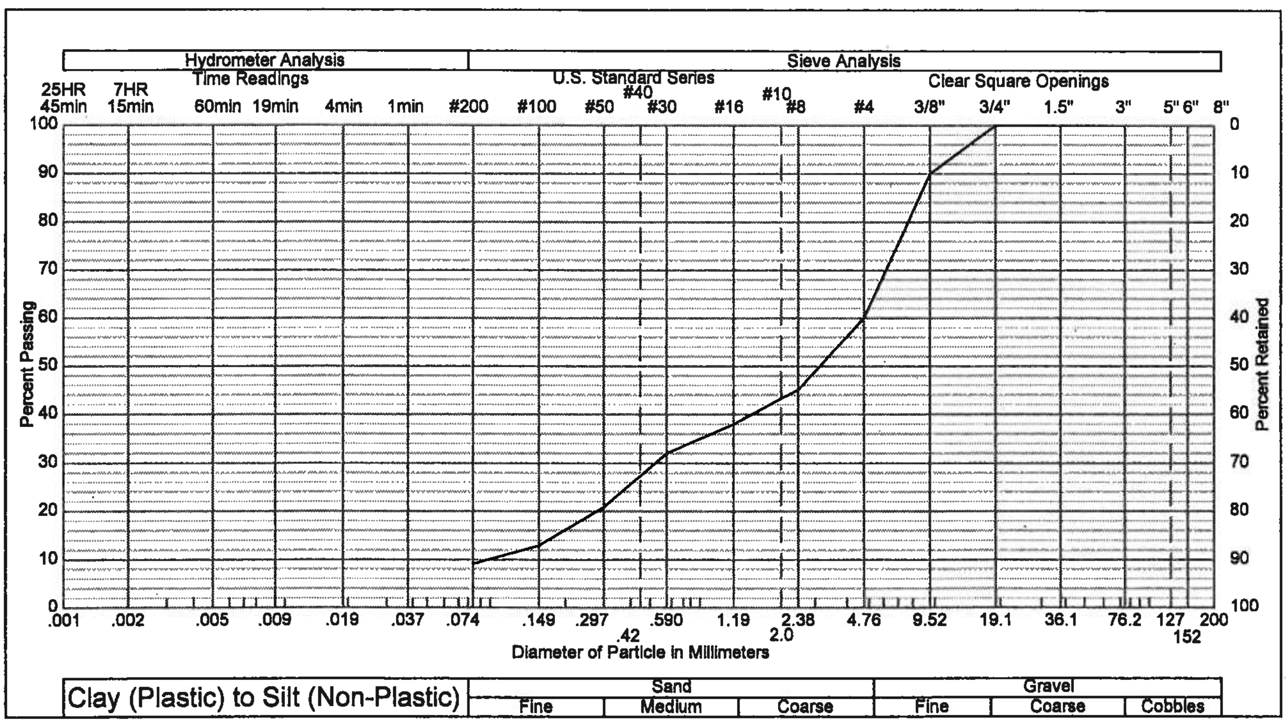
Job No. 2,042 **Swell Consolidation Test Results** Fig. 9



Sample of: Clay, silty, sandy (CL)
From: TH-1 @ 4 foot depth

Gravel: 0 %
Silt & Clay: 68 %
Plasticity Index:

Sand: 32 %
Liquid Limit:



Sample of: Sand, gravelly, silty (SM)
From: TH-2 @ 4 foot depth

Gravel: 40%
Silt & Clay: 9 %
Plasticity Index:

Sand: 51 %
Liquid Limit:

Gradation Test Results

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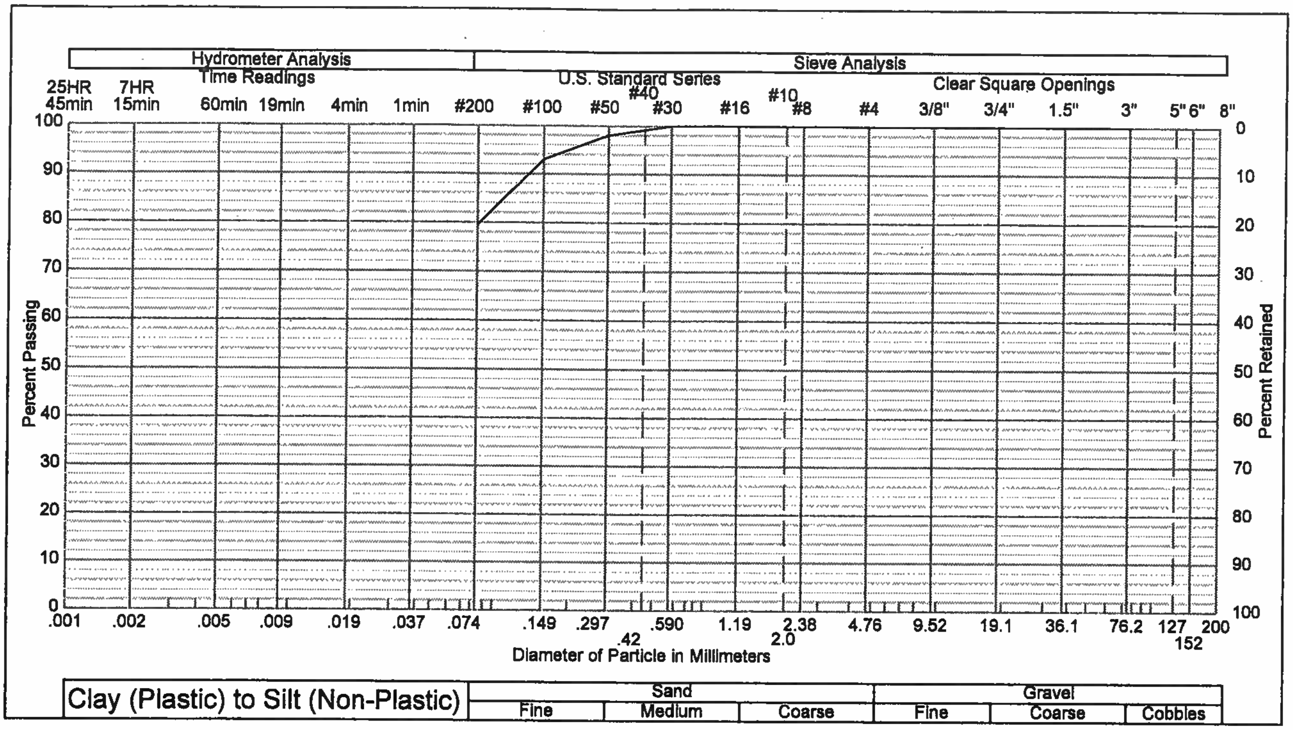
Date: September, 2005

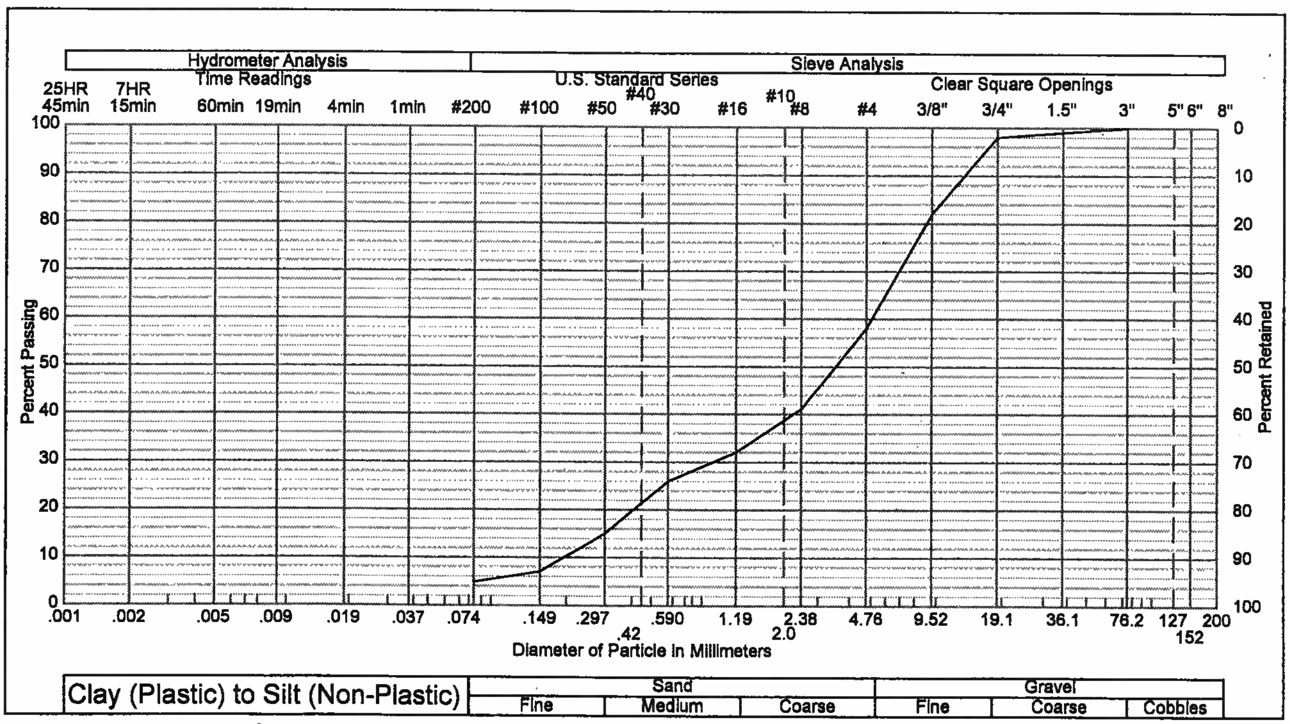
Fig. 10



Sample of: Clay, silty, sandy (CL)
From: TH-2 @ 19 foot depth

Gravel: 0 %
Silt & Clay: 80 %
Plasticity Index:

Sand: 20 %
Liquid Limit:



Sample of: Sand, gravelly, clean (SP)
From: TH-3 @ 9 foot depth

Gravel: 42 %
Silt & Clay: 5 %
Plasticity Index:

Sand: 53 %
Liquid Limit:

Gradation Test Results

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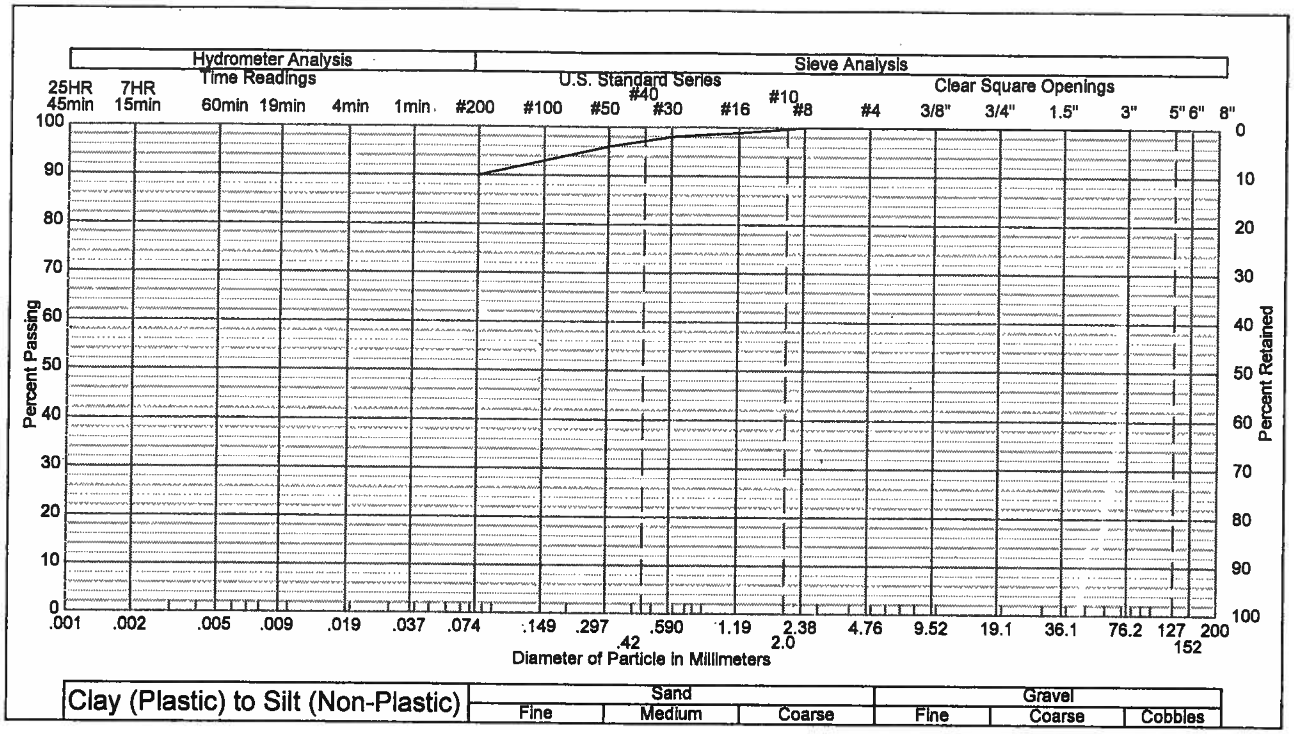
Date: September, 2005

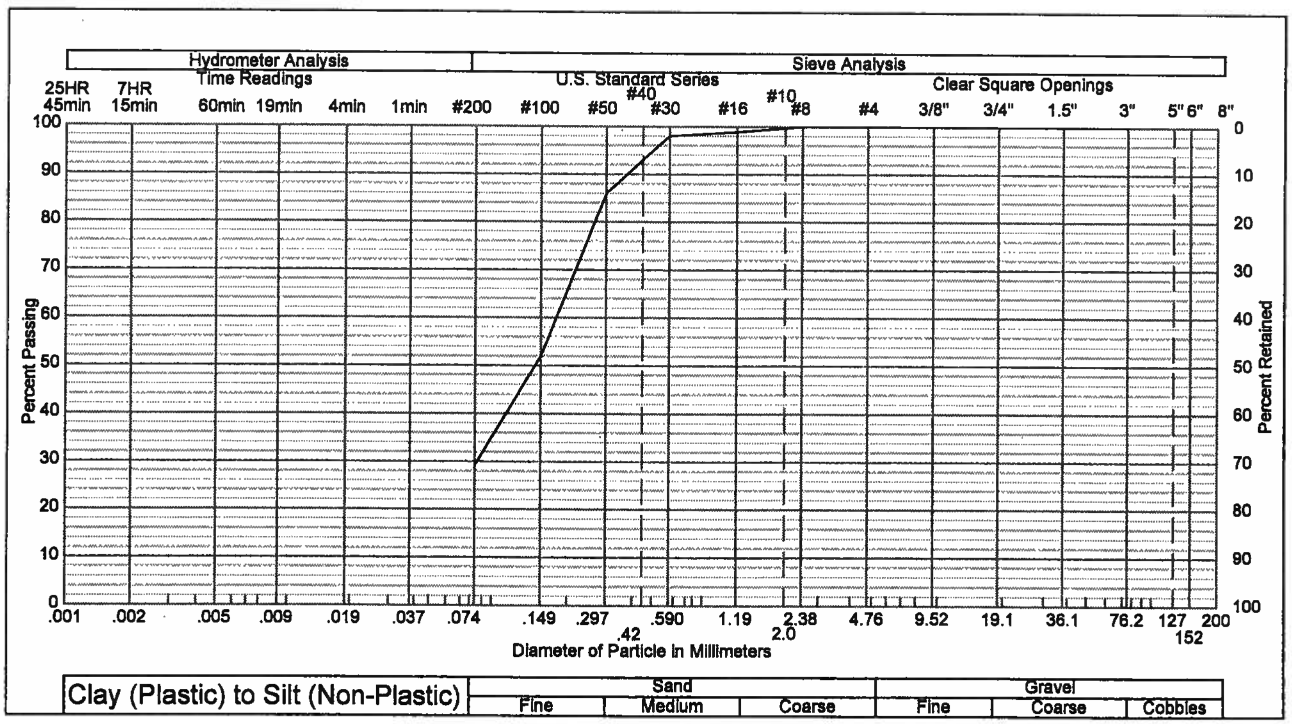
Fig. 11



Sample of: Clay, sandy (CH)
From: TH-5 @ 9 foot depth

Gravel: 0 %
Silt & Clay: 90 %
Plasticity Index:

Sand: 10 %
Liquid Limit:



Sample of: Sand, clayey (SC)
From: TH-6 @ 19 foot depth

Gravel: 0 %
Silt & Clay: 28 %
Plasticity Index:

Sand: 72 %
Liquid Limit:

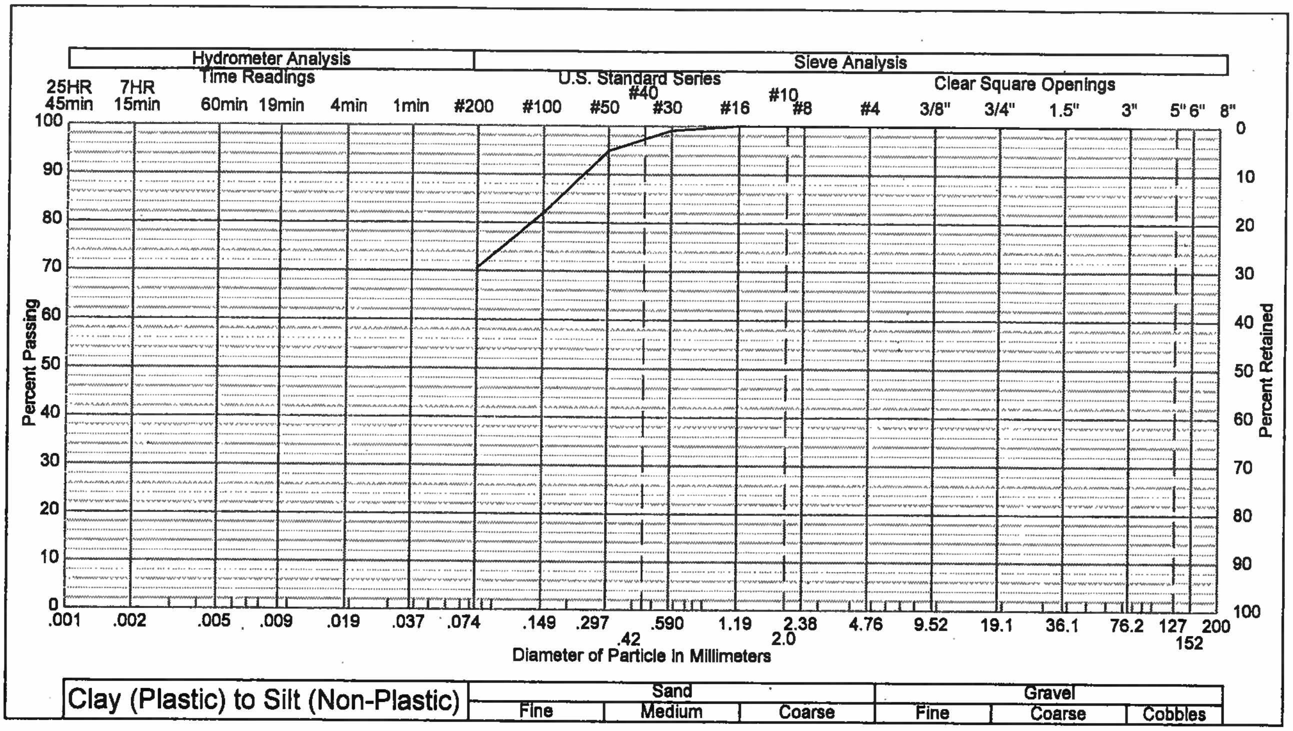
Gradation Test Results

Job No. 2,042

Geotechnical Engineering Group, Inc.

Date: September, 2005

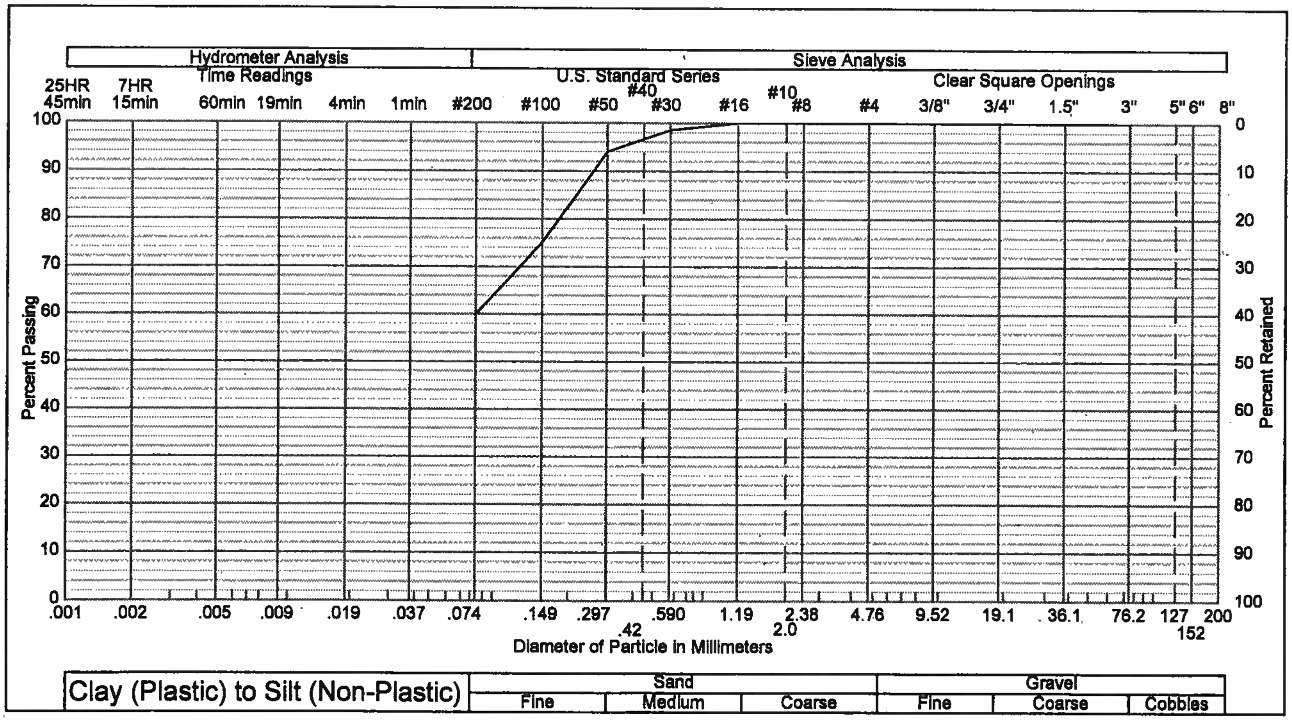
Fig. 12



Sample of: Clay, silty, sandy (CL)
From: TH-7, 8, 9, 15, 16, 19
@ 0-5 foot depth

Gravel: 0 %
Silt & Clay: 71 %
Plasticity Index: 10

Sand: 29 %
Liquid Limit:



Sample of: Clay, silty, sandy (CL)
From: TH- 10, 11, 12, 13, 14, 17, 18, 20
@ 0-5 foot depth

Gravel: 0 %
Silt & Clay: 60 %
Plasticity Index:

Sand: 40 %
Liquid Limit:

Gradation Test Results

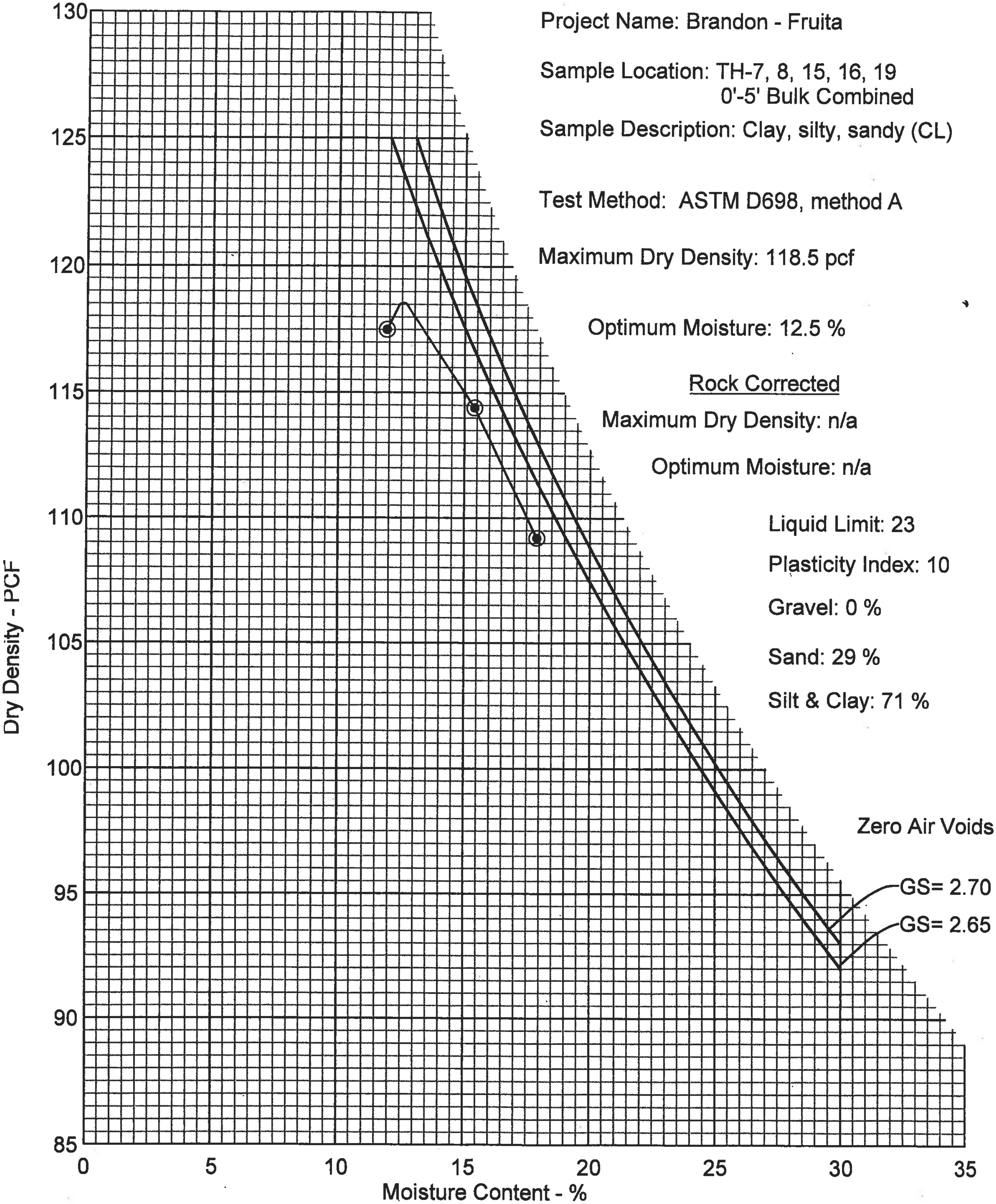
Geotechnical Engineering Group, Inc.

Job No. 2,042

Date: September, 2005

Fig. 13

Geotechnical Engineering Group, Inc.
Moisture- Density Relationship



Project Name: Brandon - Fruita

Sample Location: TH-7, 8, 15, 16, 19
0'-5' Bulk Combined

Sample Description: Clay, silty, sandy (CL)

Test Method: ASTM D698, method A

Maximum Dry Density: 118.5 pcf

Optimum Moisture: 12.5 %

<u>Rock Corrected</u>

Maximum Dry Density: n/a

Optimum Moisture: n/a

Liquid Limit: 23

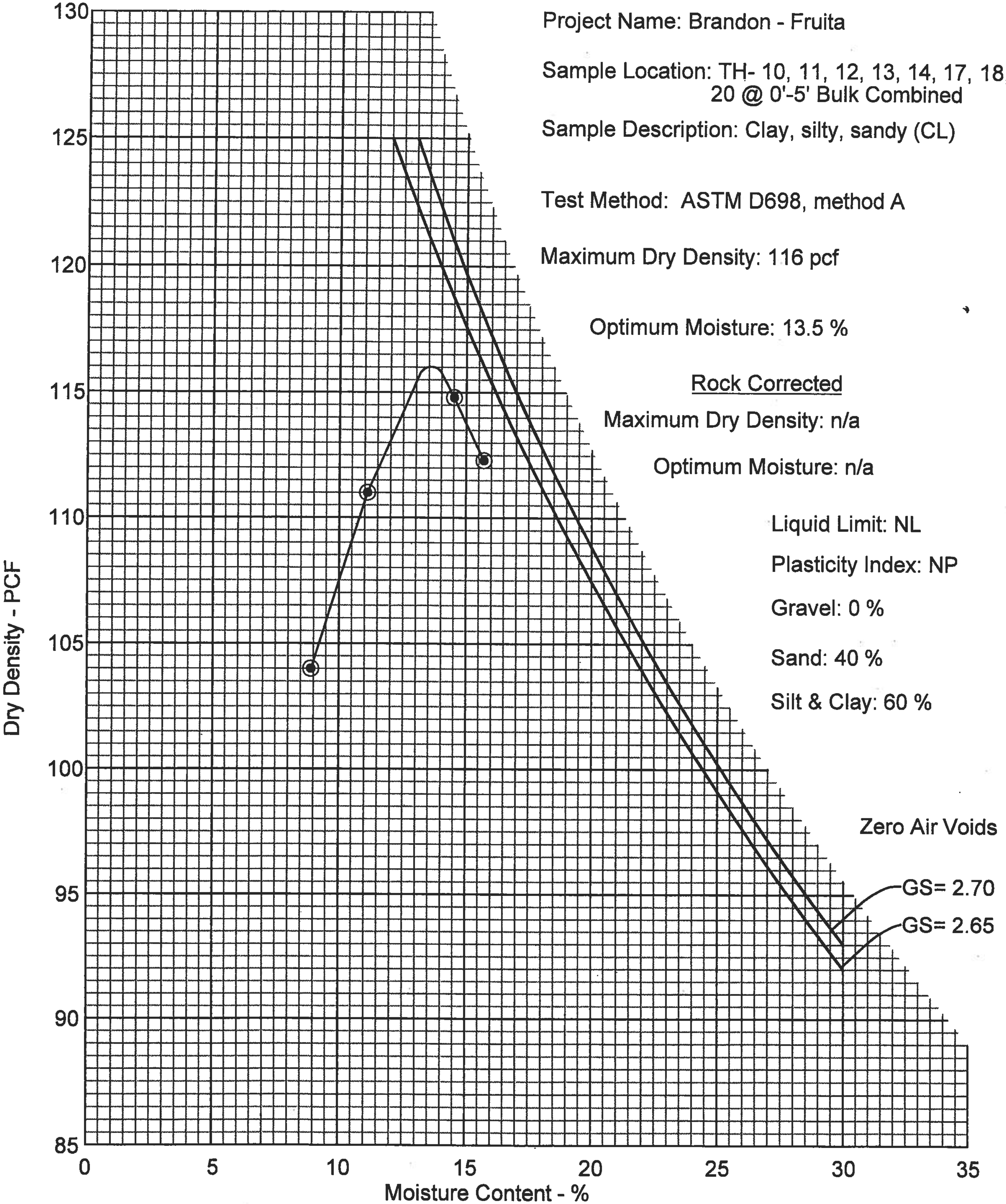
Plasticity Index: 10

Gravel: 0 %

Sand: 29 %

Silt & Clay: 71 %

Geotechnical Engineering Group, Inc.
Moisture- Density Relationship



Project Name: Brandon - Fruita

Sample Location: TH- 10, 11, 12, 13, 14, 17, 18, 20 @ 0'-5' Bulk Combined

Sample Description: Clay, silty, sandy (CL)

Test Method: ASTM D698, method A

Maximum Dry Density: 116 pcf

Optimum Moisture: 13.5 %

Rock Corrected

Maximum Dry Density: n/a

Optimum Moisture: n/a

Liquid Limit: NL

Plasticity Index: NP

Gravel: 0 %

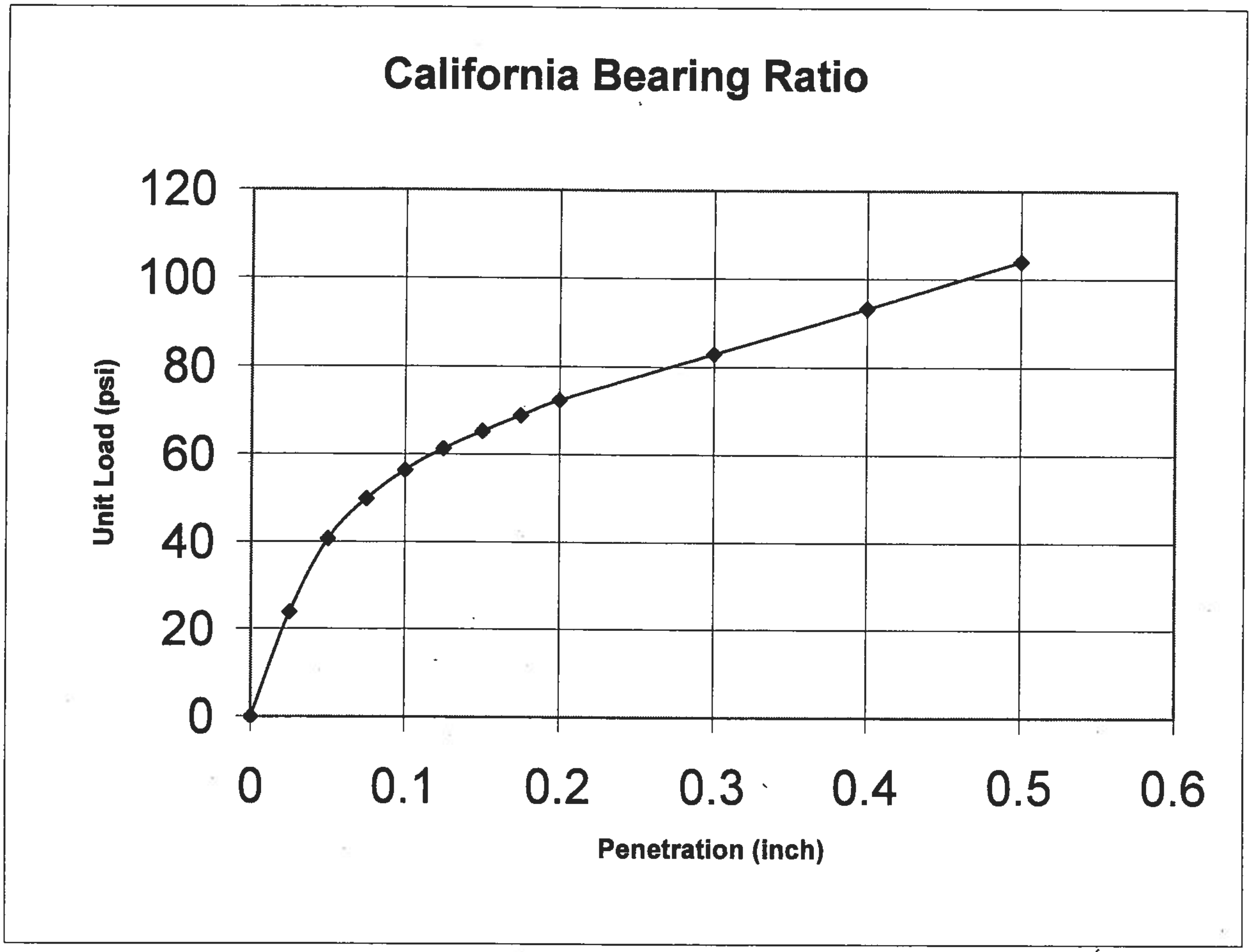
Sand: 40 %

Silt & Clay: 60 %

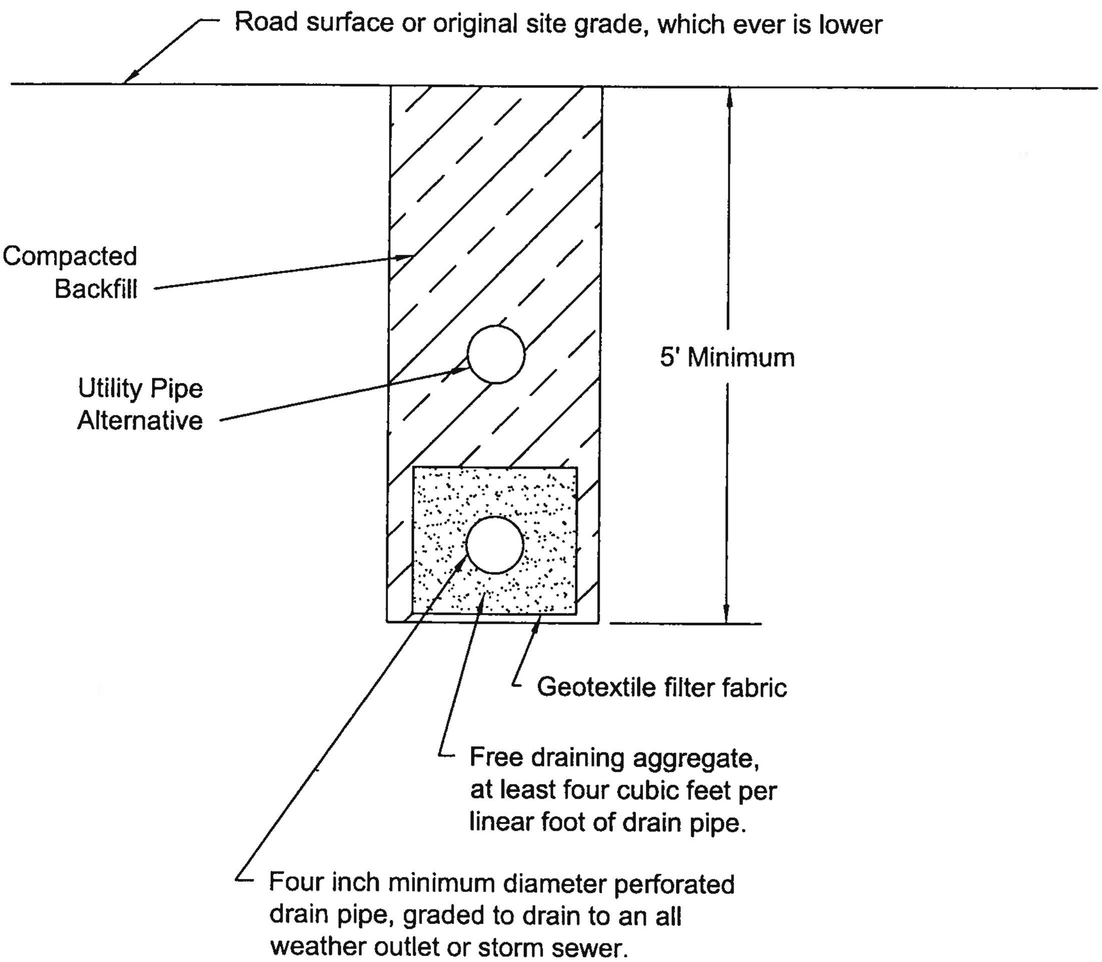
Job No. 2,042

Fig. 15

Geotechnical Engineering Group, Inc.



CBR @ 0.1" Penetration	5.6
CBR @ 0.2" Penetration	4.8
Maximum Dry Density (pcf)	116.0
Optimum Moisture Content (%)	13.5
Dry Density (pcf)	106.4
Dry Density (% Maximum)	92.0
Surcharge Weight (lbs)	12.6
Swell (%)	0.2
Before Soaking Moisture Content	13.6
After Soaking Moisture Content:	13.8
Top Inch	17.3
Average	16.2



Job No. 2,042 Roadway Drain System Concept Fig. 17

Geotechnical Engineering Group, Inc.

TABLE I

SUMMARY OF LABORATORY TEST RESULTS

HOLE	DEPTH (FEET)	NATURAL MOISTURE (%)	DRY DENSITY (PCF)	Atterberg Limits		Swell / Consolidation		PASSING NO. 200 SIEVE (%)	WATER SOLUBLE SULFATES (ppm)	SOIL TYPE
				LIQUID LIMIT (%)	PLASTICITY INDEX (%)	SWELL (%)	CONFINING PRESSURE (PSF)			
TH-1	4	22.9	103					68		Clay, silty, sandy (CL)
TH-2	4	6.5	107					9		Sand, gravelly, silty (SM)
	19	22.4	94					80		Clay, silty, sandy (CL)
TH-3	9	9.8	115					5		Sand, gravelly (SP)
TH-4	19	27.8	67							Clay, silty, sandy (CL)
TH-5	4	24.3	118			-0.9	500			Clay, silty, sandy (CL)
	9	28.8	89	51	31			90		Clay, sandy (CH)
TH-6	19	19.6	106					28		Sand, clayey (SC)
TH-7, 8, 9, 15, 16, 19	0-5	16.8	--	23	10			71	460	Clay, silty, sandy (CL)
TH-10, 11, 12, 13, 14, 17, 18, 20	0-5	15.3	--	NL*	NP*			60	40	Clay, silty, sandy (CL)

* NL – Indicates sample did not exhibit liquid characteristics.
* NP – Indicates sample did not exhibit plastic characteristics.

APPENDIX A
SAMPLE SITE GRADING SPECIFICATIONS

Brandon Estates
Fruita, Colorado
Job No. 2,042

1. DESCRIPTION

This item shall consist of the excavation, transportation, placement and compaction of materials from locations indicated on the plans, or staked by the Engineer, as necessary to achieve preliminary street and overlot elevations. These specifications shall also apply to compaction of excess cut materials that may be placed outside of the subdivision and/or filing boundaries.

2. GENERAL

The Soils Engineer shall be the Owner's representative. The Soils Engineer shall approve fill materials, method of placement, moisture contents and percent compaction, and shall give written approval of the completed fill.

3. CLEARING JOB SITE

The Contractor shall remove all trees, brush, and rubbish before excavation or fill placement is begun. The Contractor shall dispose of the cleared material to provide the Owner with a clean, neat appearing job site. Cleared material shall not be placed in areas to receive fill or where the material will support structures of any kind.

4. REMOVAL OF PREVIOUS FILL

The contractor shall expose fill subgrade entirely and remove all existing previous fill, organics and deleterious materials. These materials shall be completely removed from the proposed fill area. These materials shall be removed until the removal is as deemed satisfactory by the Soils Engineer.

5. SCARIFYING AREA TO BE FILLED

All topsoil and vegetable matter shall be removed from the ground surface upon which fill is to be placed. The surface shall then be plowed or scarified until the surface is free from ruts, hummocks or other uneven features, which would prevent uniform compaction by the equipment to be used.

6. COMPACTING AREA TO BE FILLED

After the foundation for the fill has been cleared and scarified, it shall be disked or bladed until it is free from large clods, brought to the proper moisture content (within 2 percent above or below optimum) and compacted to not less than 100 percent of maximum density as determined in accordance with ASTM D 698.

7. FILL MATERIALS

Fill soils shall be free from vegetable matter or other deleterious substances, and shall not contain rocks or lumps having a diameter greater than six (6) inches. Fill materials shall be obtained from cut areas shown on the plans or staked in the field by the Engineer.

On-site materials classifying as CL, CH, SC, SM, SW, SP, GP, GC and GM are acceptable. Concrete, asphalt, organic matter and other deleterious materials or debris shall not be used as fill.

8. MOISTURE CONTENT

Fill materials shall be moisture treated to within 2 percent below to 2 percent above optimum moisture content specified for soils classifying as CH. Non-expansive soils classifying as CL, SC, SM, SP, GP, GC and GM shall be moisture treated to within 2 ± percent of optimum moisture content as determined from Proctor compaction tests. Sufficient laboratory compaction tests shall be made to determine the optimum moisture content for thee various soils encountered in borrow areas.

The Contractor may be required to add moisture to the excavation materials in the borrow area if, in the opinion of the Soils Engineer, it is not possible to obtain uniform moisture content by adding water on the fill surface. The Contractor may be required to rake or disk the fill soils to provide uniform moisture content through the soils.

The application of water to embankment materials shall be made with any type of watering equipment approved by the Soils Engineer, which will give the desired results. Water jets from the spreader shall not be directed at the embankment with such force that fill materials are washed out.

Should too much water be added to any part of the fill, such that the material is too wet to permit the desired compaction from being obtained, rolling and all work on that section of the fill shall be delayed until the material has been allowed to dry to the required moisture content. The Contractor will be permitted to rework wet material in an approved manner to hasten its drying.

9. COMPACTION OF FILL AREAS

Selected fill material shall be placed and mixed in evenly spread layers. After each fill layer has been placed, it shall be uniformly compacted to not less than the specified percentage of maximum density. Expansive soils classifying as CL, CH, or SC shall be compacted to at least 95 percent of the maximum dry density as determined in accordance with ASTM D 698 (100 percent for fill deeper than 15 feet below final grade). At the option of the Soils Engineer, soils classifying as SW, SP, GP, GC or GM may be compacted to 90 percent of the maximum density as determined in accordance with ASTM D 1557 (95 percent for fill deeper than 15 feet below final grade). Fill materials shall be placed such that the thickness of loose material does not exceed 10 inches and the compacted lift thickness does not exceed 6 inches.

Compaction, as specified above, shall be obtained by the use of sheepsfoot rollers, multiple-wheel pneumatic-tired rollers, or other equipment approved by the Engineer for soils classifying as CL, CH, or SC. Granular fill shall be compacted using vibratory equipment or other equipment approved by the Soils Engineer. Compaction shall be accomplished while the fill material is at the specified moisture content. Compaction of each layer shall be continuous over the entire area. Compaction equipment shall make sufficient trips to insure that the required density is obtained.

10. COMPACTION OF SLOPES

Fill slopes shall be compacted by means of sheepsfoot rollers or other suitable equipment. Compaction operations shall be continued until slopes are stable, but not too dense for planting, and there is no appreciable amount of loose soil on the slopes. Compaction of slopes may be done progressively in increments of three to five feet (3' to 5') in height or after the fill is brought to its total height. Permanent fill slopes shall not exceed 3:1 (horizontal to vertical).

11. DENSITY TESTS

Field density tests shall be made by the Soils Engineer at locations and depths of his choosing. Where sheepsfoot rollers are used, the soil may be disturbed to a depth of several inches. Density tests shall be taken in compacted material below the disturbed surface. When density tests indicate that the density or moisture content of any layer of fill or portion thereof is below that required, the particular layer or portion shall be reworked until the required density or moisture content has been achieved.

12. COMPLETED PRELIMINARY GRADES

All areas, both cut and fill, shall be finished to a level surface and shall meet the following limits of construction:

A. Overlot cut or fill areas shall be within plus or minus 2/10 of one foot.

B. Street grading shall be within plus or minus 1/10 of one foot.

The civil engineer, or duly authorized representative, shall check all cut and fill areas to observe that the work is in accordance with the above limits.

13. SUPERVISION AND CONSTRUCTION STAKING

Observation by the Soils Engineer shall be continuous during the placement of fill and compaction operations so that he can declare that the fill was placed in general conformance with specifications. All inspections necessary to test the placement of fill and observe compaction operations will be at the expense of the Owner. All construction staking will be provided by the Civil Engineer or his duly authorized representative. Initial and final grading staking shall be at the expense of the owner. The replacement of grade stakes through construction shall be at the expense of the contractor.

14. SEASONAL LIMITS

No fill material shall be placed, spread or rolled while it is frozen, thawing, or during unfavorable weather conditions. When work is interrupted by heavy precipitation, fill operations shall not be resumed until the Soils Engineer indicates that the moisture content and density of previously placed materials are as specified.

15. NOTICE REGARDING START OF GRADING

The contractor shall submit notification to the Soils Engineer and Owner advising them of the start of grading operations at least three (3) days in advance of the starting date. Notification shall also be submitted at least 3 days in advance of any resumption dates when grading operations have been stopped for any reason other than adverse weather conditions.

16. REPORTING OF FIELD DENSITY TESTS

Density tests made by the Soils Engineer, as specified under "Density Tests" above, shall be submitted progressively to the Owner. Dry density, moisture content, of each test taken and percentage compaction shall be reported for each test taken.

17. DECLARATION REGARDING COMPLETED FILL

The Soils Engineer shall provide a written declaration stating that the site was filled with acceptable materials, or was placed in general accordance with the specifications.

18. DECLARATION REGARDING COMPLETED GRADE ELEVATIONS

A registered Civil Engineer or licensed Land Surveyor shall provide a declaration stating that the site grading has been completed and resulting elevations are in general conformance with the accepted detailed development plan.

APPENDIX B
PAVEMENT DESIGN CALCULATIONS

WinPAS

Pavement Thickness Design According to
1993 AASHTO Guide for Design of Pavements Structures
American Concrete Pavement Association

Flexible Design Inputs

Agency:
Company:
Contractor:
Project Description: 2042 Brandon Estates
Location: K Road and 18.5 Road, Fruita, Colorado

Flexible Pavement Design/Evaluation

Structural Number	2.04		**Soil Resilient Modulus**	6,300.00	**psi**
Design ESALs	45,500.00		**Initial Serviceability**	4.50	
Reliability	80.00	**percent**	**Terminal Serviceability**	2.50	
Overall Deviation	0.45				

Layer Pavement Design/Evaluation

Layer Material	Layer Coefficient	Drainage Coefficient	Layer Thickness	Layer SN
Asphalt Cement Concrete	0.40	1.00	5.10	2.04
Crushed Stone Base	0.00	0.00	0.00	0.00
Granular Subbase	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00
			Σ SN	2.04

WinPAS

Pavement Thickness Design According to

1993 AASHTO Guide for Design of Pavements Structures

American Concrete Pavement Association

Flexible Design Inputs

Agency:
Company:
Contractor:
Project Description: 2042 Brandon Estates
Location: K Road and 18.5 Road, Fruita, Colorado

Flexible Pavement Design/Evaluation

Structural Number	2.04		**Soil Resilient Modulus**	6,300.00	**psi**
Design ESALs	45,500.00		**Initial Serviceability**	4.50	
Reliability	80.00	**percent**	**Terminal Serviceability**	2.50	
Overall Deviation	0.45				

Layer Pavement Design/Evaluation

Layer Material	Layer Coefficient	Drainage Coefficient	Layer Thickness	Layer SN
Asphalt Cement Concrete	0.40	1.00	3.00	1.20
Crushed Stone Base	0.12	1.00	7.00	0.84
Granular Subbase	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00
			Σ SN	2.04

WinPAS

Pavement Thickness Design According to

1993 AASHTO Guide for Design of Pavements Structures

American Concrete Pavement Association

Flexible Design Inputs

Agency:
Company:
Contractor:
Project Description: 2042 Brandon Estates
Location: K Road and 18.5 Road, Fruita, Colorado

Flexible Pavement Design/Evaluation

Structural Number	2.29		**Soil Resilient Modulus**	6,300.00	**psi**
Design ESALs	91,000.00		**Initial Serviceability**	4.50	
Reliability	80.00	**percent**	**Terminal Serviceability**	2.50	
Overall Deviation	0.45				

Layer Pavement Design/Evaluation

Layer Material	Layer Coefficient	Drainage Coefficient	Layer Thickness	Layer SN
Asphalt Cement Concrete	0.40	1.00	5.73	2.29
Crushed Stone Base	0.12	1.00	0.00	0.00
Granular Subbase	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00
			Σ SN	2.29

WinPAS

Pavement Thickness Design According to

1993 AASHTO Guide for Design of Pavements Structures

American Concrete Pavement Association

Flexible Design Inputs

Agency:
Company:
Contractor:
Project Description: 2042 Brandon Estates
Location: K Road and 18.5 Road, Fruita, Colorado

Flexible Pavement Design/Evaluation

Structural Number	2.29		**Soil Resilient Modulus**	6,300.00	**psi**
Design ESALs	91,000.00		**Initial Serviceability**	4.50	
Reliability	80.00	**percent**	**Terminal Serviceability**	2.50	
Overall Deviation	0.45				

Layer Pavement Design/Evaluation

Layer Material	Layer Coefficient	Drainage Coefficient	Layer Thickness	Layer SN
Asphalt Cement Concrete	0.40	1.00	4.00	1.60
Crushed Stone Base	0.12	1.00	5.73	0.69
Granular Subbase	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00
			Σ SN	2.29

WinPAS

Pavement Thickness Design According to

1993 AASHTO Guide for Design of Pavements Structures

American Concrete Pavement Association

Flexible Design Inputs

Agency:
Company:
Contractor:
Project Description: 2042 Brandon Estates
Location: K Road and 18.5 Road, Fruita, Colorado

Flexible Pavement Design/Evaluation

Structural Number	2.56		**Soil Resilient Modulus**	6,300.00	**psi**
Design ESALs	182,000.00		**Initial Serviceability**	4.50	
Reliability	80.00	**percent**	**Terminal Serviceability**	2.50	
Overall Deviation	0.45				

Layer Pavement Design/Evaluation

Layer Material	Layer Coefficient	Drainage Coefficient	Layer Thickness	Layer SN
Asphalt Cement Concrete	0.40	1.00	6.40	2.56
Crushed Stone Base	0.12	1.00	0.00	0.00
Granular Subbase	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00
			Σ SN	2.56

WinPAS

Pavement Thickness Design According to
1993 AASHTO Guide for Design of Pavements Structures
American Concrete Pavement Association

Flexible Design Inputs

Agency:	
Company:	
Contractor:	
Project Description:	2042 Brandon Estates
Location:	K Road and 18.5 Road, Fruita, Colorado

Flexible Pavement Design/Evaluation

Structural Number	2.56		**Soil Resilient Modulus**	6,300.00	**psi**
Design ESALs	182,000.00		**Initial Serviceability**	4.50	
Reliability	80.00	**percent**	**Terminal Serviceability**	2.50	
Overall Deviation	0.45				

Layer Pavement Design/Evaluation

Layer Material	Layer Coefficient	Drainage Coefficient	Layer Thickness	Layer SN
Asphalt Cement Concrete	0.40	1.00	4.00	1.60
Crushed Stone Base	0.12	1.00	8.00	0.96
Granular Subbase	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00
			Σ SN	2.56

WinPAS

Pavement Thickness Design According to
1993 AASHTO Guide for Design of Pavements Structures
American Concrete Pavement Association

Rigid Design Inputs

Agency:	
Company:	
Contractor:	
Project Description:	Brandon Estates Subdivision
Location:	K Road and 18.5 Road Fruita, Colorado

Rigid Pavement Design/Evaluation

PCC Thickness	4.18	**inches**	**Load Transfer, J**	3.40	
Design ESALs	91,000.00		**Mod. Subgrade Reaction, k**	325	**psi/in**
Reliability	80.00	**percent**	**Drainage Coefficient, Cd**	1.00	
Overall Deviation	0.45		**Initial Serviceability**	4.50	
Modulus of Rupture	500	**psi**	**Terminal Serviceability**	2.50	
Modulus of Elasticity	3,375,000	**psi**			

Modulus of Subgrade Reaction (k-value) Determination

Resilient Modulus of the Subgrade	6,300.0	**psi**
Resilient Modulus of the Subbase	0.0	**psi**
Subbase Thickness	0.0	**inches**
Depth to Rigid Foundation	0.0	**feet**
Loss of Support Value (0,1,2,3)	0.0	

Modulus of Subgrade Reaction	324.70	**psi/in**

WinPAS

Pavement Thickness Design According to
1993 AASHTO Guide for Design of Pavements Structures
American Concrete Pavement Association

Rigid Design Inputs

Agency:	
Company:	
Contractor:	
Project Description:	Brandon Estates Subdivision
Location:	K Road and 18.5 Road Fruita, Colorado

Rigid Pavement Design/Evaluation

PCC Thickness	5.07	**inches**	**Load Transfer, J**	3.40	
Design ESALs	182,000.00		**Mod. Subgrade Reaction, k**	325	**psi/in**
Reliability	80.00	**percent**	**Drainage Coefficient, Cd**	1.00	
Overall Deviation	0.45		**Initial Serviceability**	4.50	
Modulus of Rupture	500	**psi**	**Terminal Serviceability**	2.50	
Modulus of Elasticity	3,375,000	**psi**			

Modulus of Subgrade Reaction (k-value) Determination

Resilient Modulus of the Subgrade	6,300.0	**psi**
Resilient Modulus of the Subbase	0.0	**psi**
Subbase Thickness	0.0	**inches**
Depth to Rigid Foundation	0.0	**feet**
Loss of Support Value (0,1,2,3)	0.0	

Modulus of Subgrade Reaction	324.70	**psi/in**

APPENDIX C
CONSTRUCTION RECOMMENDATIONS FOR FLEXIBLE AND RIGID PAVEMENT

FLEXIBLE PAVEMENT CONSTRUCTION RECOMMENDATIONS

Experience has shown that construction methods can have a significant effect on the life and serviceability of a pavement system. We recommend the proposed pavement be constructed in the following manner:

1. The subgrade should be stripped of organic matter and deleterious materials, scarified, moisture treated, and compacted. Soils should be moisture treated to within 2 percent of optimum moisture content and compacted to at least 95 percent of maximum standard Proctor dry density (ASTM D 698).

2. After final subgrade elevation has been reached and the subgrade compacted, the area should be proof-rolled with a heavy pneumatic-tired vehicle (i.e., a loaded 10-wheel dump truck). Subgrade that is pumping or deforming excessively should be stabilized.

3. If areas of soft or wet subgrade soils are encountered, the material should be subexcavated and replaced with properly compacted structural backfill. Where extensively soft, yielding subgrade is encountered, we recommend the excavation be inspected by a representative of our office.

4. Aggregate base course should be laid in thin, loose lifts, moisture treated to within 2 percent of optimum moisture content, and compacted to at least 95 percent of maximum modified Proctor dry density (ASTM D 1557, AASHTO T 180).

6. Asphaltic concrete should be hot plant-mixed material compacted to at least 95 percent of maximum Marshall density. The temperature at laydown time should be at least 235 degrees F. The maximum compacted lift should be 3.0 inches and joints should be staggered.

7. The subgrade preparation and the placement and compaction of all pavement material should be observed and tested. Compaction criteria should be met prior to the placement of the next paving lift. The additional requirements of the Colorado Department of Transportation and Mesa County Specifications should apply.

RIGID PAVEMENT CONSTRUCTION RECOMMENDATIONS

Rigid pavement sections are not as sensitive to subgrade support characteristics as flexible pavement. Due to the strength of the concrete, wheel loads from traffic are distributed over a large area and the resulting subgrade stresses are relatively low. The critical factors affecting the performance of a rigid pavement are the strength and quality of the concrete, and the uniformity of the subgrade. We recommend subgrade preparation and construction of the rigid pavement section be completed in accordance with the following recommendations:

1. Subgrade areas should be stripped of organics and deleterious materials. The pavement subgrade shall be compacted within 2% of optimum moisture content to at least 95% of maximum standard Proctor dry density (ASTM D 698). Moisture treatment and compaction recommendations also apply where additional fill is necessary.

2. The resulting subgrade shall be checked for uniformity and all soft or yielding materials should be replaced prior to paving. Concrete should not be placed on soft, spongy, frozen, or otherwise unsuitable subgrade.

3. The subgrade shall be kept moist prior to paving.

3. Concrete should not be placed in cold weather or on frozen subgrade

5. Curing procedures should protect the concrete against moisture loss, rapid temperature change, freezing, and mechanical injury for at least 3 days after placement. Traffic should not be allowed on the pavement for at least one week.

6. A white, liquid membrane-curing compound, applied at the rate of 1 gallon per 150 square feet, should be used.

7. Construction joints, including longitudinal joints and transverse joints, should be formed during construction or should be sawed shortly after the concrete has begun to set, but prior to uncontrolled cracking. All joints should be sealed.

8. Construction control and inspection shall be carried out during the subgrade preparation and paving procedures. Concrete shall be carefully monitored for quality control. The additional requirements of the Mesa County and Colorado Department of Transportation Specifications should apply.

9. Deicing salts should not be used for the first year after placement.

Geotechnical Engineering Group, Inc.

May 10, 2006

Vortex Engineering
255 Vista Valley Drive
Fruita, Co. 81521

Attention: Mr. Robert Jones

Subject: Addendum 1
Preliminary Geotechnical Investigation
Subgrade Investigation and Pavement Design
Brandon Estates
Fruita, Colorado
Job No. 2,042

Dear Mr. Jones,

As requested Geotechnical Engineering Group reviewed the previous report dated October 6, 2005. Based on our May 8, 2006 telephone conversation, we understand a positive gravity outlet for a subsurface drain system a depth of 5 feet below the roadway subgrade elevation does not exist. We understand existing outfall options would result in drain elevations near the roadway subgrade. Subsurface drains installed this shallow will not likely provide significant drainage of the subgrade soils. The subsurface drain recommendations presented in the October 6, 2005 report were intended as a suggestion for providing relief of groundwater if encountered at shallow depths but may not be practical.

Based on our understanding of the proposed construction and site constraints it may not be possible to install a subsurface drain at a sufficient depth to provide practical drainage of shallow groundwater. An alternative to a subsurface drain may include observation of subgrade conditions in utility trenches and at roadway subgrade at the time of construction and any area with observed very moist or wet condition be stabilized to help provide improved support of the pavement section should groundwater become shallow enough in these areas to influence the moisture condition of the road base aggregates in the pavement section. Roadway and utility installation should be observed for wet and yielding conditions by a Geotechnical Engineering Group, Inc. representative and stabilized as required on an as needed basis.

We believe the information presented in this letter was prepared in a manner consistent with that level of care and skill ordinarily used by geotechnical engineers in this area at this time. No other warranty, expressed or implied, is made. All other suggestions and recommendation presented in the October 6, 2005 report should be included in the planning and design of the proposed subdivision. If we may be of further service in discussing the contents of this letter or the geotechnical engineering aspects of your project please contact us.

Sincerely,
GEOTECHNICAL ENGINEERING GROUP, INC

Norman W. Johnston, P.E.
Senior Engineer

Reviewed By:

John P Withers, P.E.
Principal Engineer

NWJ:JPW:cb
(3 copies sent)