SUBSURFACE EXPLORATION REPORT
PROPOSED PAVEMENT IMPROVEMENTS
ROCKY MOUNTAIN HIGH SCHOOL
1300 WEST SWALLOW ROAD
FORT COLLINS, COLORADO
EEC PROJECT NO. 1112073

Prepared for:

Poudre School District
c/o Anderson Consulting Engineers, Inc.
375 East Horsetooth Road, Building 5
Fort Collins, Colorado 80525

Attn: Mr. Scott Parker, P.E.

Prepared by:

Earth Engineering Consultants, Inc.
4396 Greenfield Drive
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December 9, 2011

EARTH ENGINEERING
CONSULTANTS, INC.

Poudre School District
c/o Anderson Consulting Engineers, Inc.
375 East Horsetooth Road, Building 5
Fort Collins, Colorado 80525

Attn: Mr. Scott R. Parker, P.E. (srparker@acewater.com)

Re: Subsurface Exploration Report
Proposed Pavement Improvements
Rocky Mountain High School
1300 West Swallow Road
Fort Collins, Colorado
EEC Project No. 1112073

Mr. Parker:

Enclosed, herewith, are the results of the geotechnical subsurface exploration completed by Earth Engineering Consultants, Inc. (EEC) personnel for the proposed pavement improvements on the Rocky Mountain High School campus located at 1300 West Swallow Road in Fort Collins, Colorado. For this study a total of fourteen (14) soil borings extending to depths of approximately 10 to 15-feet below existing site grades were advanced within the proposed pavement reconstruction areas to develop information on existing pavement and subsurface conditions. This exploration was completed in general accordance with our proposal dated October 28, 2011.

In summary, the existing pavement thicknesses varied across the site from a relatively thin lift of approximately 2-inches of hot mix asphalt (HMA) in the general vicinity of boring No. B-7, to as thick as 5-inches of HMA in the general vicinity of boring No. B-6. The existing HMA section was underlain by approximately minimal/no aggregate base course (ABC) in the general vicinity of boring Nos. B-6 and B-7 to as much as 10 to 12-inches of ABC in the general vicinity of boring Nos. B-1 through B-3 and B-10.

The subgrade soils encountered beneath the existing pavement section generally consisted of fill materials classified sandy lean clay or lean clay with sand transitioning to native similarly classified cohesive subsoils, which extended to the depths explored or to the fine to coarse granular stratum below. Silty sand and/or clayey sand with gravel lenses were encountered in the general locations of boring Nos. B-4, B-8, B-9, and B-12 through B-14 at approximate depths of 5 to 8-feet below site grades and extended to the depths explored, approximately 10 to 15-feet below site grades.

The fill and/or native cohesive subsoils were generally medium stiff to stiff and exhibited relatively low swell potential, (i.e., less than the typical 2% swell characteristics used to determine if a swell-mitigation plan is necessary), with increase in moisture and load at current moisture and density conditions. However, a portion of the subgrade soils in the general vicinity of boring No. B-1 revealed slight consolidation prone characteristics. The subgrade soils where in-situ moisture contents appeared elevated would be expected to be unstable under construction traffic after removal of the existing pavement structure. Recommendations for subgrade/ground stabilization measures are provided within the text portion of this report.

Based on the materials observed at the test boring locations, it is our opinion the in-situ subgrade soils could be used for support of the new pavements although stabilization of the subgrade soils should be anticipated to develop a stable subgrade for construction of the new pavement structure. Instability in saturated pavement subgrades should be expected in portions of the pavement areas after removal of the existing pavement section. Geotechnical engineering recommendations concerning the design and construction of the new pavements are provided in the text of the attached report.

We appreciate the opportunity to be of service to you on this project. If you have any questions concerning this report, or if we can be of further service to you in any other way, please do not hesitate to contact us.

Very truly yours,
Earth Engineering Consultants, Inc.

David A. Richer, P.E.
Senior Geotechnical Engineer

Reviewed by: Lester L. Litton, P.E.
Principal Engineer

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INTRODUCTION

The subsurface exploration for the proposed pavement improvements on the Rocky Mountain High School (RMHS) campus at 1300 West Swallow Road in Fort Collins, Colorado has been completed. For this study a total of fourteen (14) soil borings extending to depths of approximately 10 to 15-feet below present site grades were advanced within proposed pavement improvement areas, to obtain information on existing pavement thicknesses and subsurface conditions. Individual boring logs and a site diagram indicating the approximate boring locations are included with this report.

We understand this project involves the improvement/reconstruction of existing pavement areas on the west and east sides of the existing RMHS facility, including the main drive lanes and student parking areas adjacent to the existing school building. The pavement areas included in the proposed reconstruction are indicated on the enclosed boring location diagram. We understand the existing configuration of the pavement areas, (i.e., the bus traffic and main traffic corridors, as well as the teacher and student parking areas), are expected to remain similar to the existing configurations after the reconstruction efforts are completed. The bus lanes and main corridors are anticipated to receive moderate to heavy flow of traffic; while the parking areas are expected to receive low volumes of light vehicle/automobile traffic. Based on the information we received from Anderson Consulting Engineers, the project's civil engineering consultant, up to 2-feet of vertical alignment may be necessary to accommodate the drainage improvements; while minimal to no horizontal realignment or expansion is expected in the reconstructed pavement areas.

The purpose of this report is to describe the existing pavement thickness and subsurface conditions encountered in the borings, analyze and evaluate the test data and provide geotechnical recommendations concerning design and construction of new pavements after removal of the existing pavement sections.

EXPLORATION AND TESTING PROCEDURES

The boring locations were established in the field by Earth Engineering Consultants, Inc. (EEC) personnel by pacing and estimating angles from identifiable site references. The approximate boring locations are indicated on the attached boring location diagram. The locations of the borings should be considered accurate only to the degree implied by the methods used to make the field measurements.

The borings were performed using a truck mounted, CME-45 drill rig, equipped with a hydraulic head employed in drilling and sampling operations. The boreholes were advanced using 4-inch nominal diameter continuous flight augers and samples of the subsurface materials encountered were obtained using split-barrel and California sampling techniques in general accordance with ASTM Specifications D-1586 and D-3550, respectively.

In the split-barrel and California barrel sampling procedures, standard sampling spoons are driven into the ground by means of a 140-pound hammer falling a distance of 30 inches. The number of blows required to advance the split barrel and California barrel samplers is recorded and is used to estimate the in-situ relative density of cohesionless materials and, to a lesser degree of accuracy, the consistency of cohesive soils. All samples obtained in the field were sealed and returned to the laboratory for further examination, classification and testing.

Moisture content tests were completed on each of the recovered samples. Atterberg Limits and washed sieve analysis tests were completed on selected samples to help establish the percentage of fines and plasticity of the on-site soils. Swell/consolidation tests were also performed on selected samples. A Hveem stabilometer (R-Value) test was completed on a composite sample of the subgrade materials to evaluate the subgrade strength characteristics. Results of the outlined tests are indicated on the attached boring logs and summary sheets.

As a part of the testing program, all samples were examined in the laboratory and classified in accordance with the attached General Notes and the Unified Soil Classification System, based on the soil's texture and plasticity. The estimated group symbol for the Unified Soil Classification System is shown on the boring logs and a brief description of that classification system is included with this report.

SITE AND SUBSURFACE CONDITIONS

The pavement improvement areas are generally located on the east and west sides of the existing RMHS building, with one area also situated south of the existing tennis courts north of the building. The improvement areas are indicated on the attached “Boring Location” diagram. The existing pavements appeared to be relatively thin in isolated areas for the anticipated traffic conditions and are in relatively fair to poor condition.

An EEC representative was on-site during drilling to evaluate the subsurface materials encountered and direct the drilling activities. Field logs prepared by EEC personnel were based on visual and tactual observation of disturbed samples and auger cuttings. Final boring logs included with this report may include modifications to those field logs based on the results of laboratory testing and engineering evaluation. Based on the results of the field boring and laboratory testing, subsurface conditions can be generalized as follows.

The existing pavement thicknesses varied across the site from a relatively thin lift, approximately 2-inches of hot mix asphalt (HMA) in the general vicinity of boring No. B-7, to as thick as 5-inches of HMA in the general vicinity of boring No. B-6. The existing HMA section was underlain by approximately minimal/no aggregate base course (ABC) in the general vicinity of boring Nos. B-6 and B-7 to as much as to about 10 to 12-inches of ABC in the general vicinity of boring Nos. B-1 through B-3 and B-10.

The subgrade soils encountered beneath the existing pavement sections generally consisted of fill materials classified sandy lean clay or lean clay with sand transitioning to native similarly classified cohesive subsoils, which extended to the depths explored or to a fine to coarse granular stratum below. Silty sand and/or clayey sand with gravel lenses were encountered in the general locations of boring Nos. B-4, B-8, B-9, and B-12 through B-14 at approximate depths of 5 to 8-feet below site grades and extended to the depths explored, approximately 10 to 15-feet below site grades.

The fill and/or native cohesive subsoils were generally medium stiff to stiff and exhibited relatively low swell potential, (i.e., less than the typical 2% swell characteristics used to determine if a swell-mitigation plan is necessary), with increase in moisture and load at current moisture and density conditions. However, a portion of the subgrade soils in the general vicinity of boring No. B-1 revealed slight collapsible/consolidation prone characteristics, which may coincide with the noticeable "sink-hole" as shown on Photo No. 1 on the Photograph Summary Sheet included in the Appendix of this report.

The stratification boundaries indicated on the boring logs represent the approximate locations of changes in soil types; in-situ, the transition of materials may be gradual and indistinct.

GROUNDWATER LEVEL OBSERVATION

Observations were made while drilling and after completion of the borings to detect the presence and depth to hydrostatic groundwater. Free water was not encountered in the test borings when checked immediately after completion of drilling. The boreholes were backfilled upon completion so that longer term monitoring for groundwater depth was not possible. Longer-term observations in cased holes sealed from the influence of surface water would be required to more accurately evaluate groundwater levels.

ANALYSIS AND RECOMMENDATIONS

Evaluation of Existing Pavement Structure

As illustrated on the enclosed site photographs, several areas of the asphaltic concrete surface material/hot mix asphalt (HMA) pavement materials, across the site exhibited longitudinal, transverse and/or alligator cracking. The majority of the longitudinal and transverse cracks were "crack-sealed" as evident in Photo No. 4. An area within the southeast parking area, in close proximity to boring No. B-1, and identified as Photo No. 1 herein, revealed a previous "sink-hole" that was backfilled with hot mix asphalt (HMA). Based on our experience with similarly related surface conditions/effects of the pavement section, (i.e., a circular depression), it appears that possibly an abandoned well of some sort or other man-made excavation may exist below this portion of the parking lot. Additional excavation with a backhoe within this area should be performed to verify the cause of the sink-hole and to remove and repair accordingly. It should also be noted that subsoils in boring No. B-1, as evident by the swell-consolidation test results B-1, Sample-2, at a depth of about 4-feet below site grades, revealed that the cohesive subsoils were slightly prone to collapse/consolidation characteristics with an increase of water and additional loads.

Several areas along existing concrete curb lines indicated raveling and settlement of the HMA pavement structure as well as separation between the HMA section and concrete curb, which allows for surface water infiltration to impact the underlying subsoils. The settlement of isolated pavement areas appears to have developed possibly due to an increase in moisture content. We would anticipate that during the pavement improvement/reconstruction phase for site, that these concerns would be addressed possibly by means of pavement edge drains in combination with proper placement and compaction efforts of the new pavement materials and in conjunction with the drainage improvements.

The existing pavement section for the site, as previously presented, varied from a little as 2-inches of HMA to as much as 5-inches of HMA underlain by anywhere from no ABC to as much as 12-inches of ABC. These varying thicknesses across the site would correlate to overall structural numbers for new pavements ranging from about 0.88 to 2.97, or an average of about 2.08. As further discussed in this report we have estimated structural numbers for the reconstruction efforts to be approximately 2.66 for the automobile parking areas and approximately 3.65 for the heavy duty pavement sections; thus indicating that the existing pavement section in general are deficient for the anticipated traffic conditions.

For cohesive subgrade soils, it is typically suggested to place a zone of aggregate base course (ABC) between the hot mix asphalt (HMA) section and the underlying subgrade to reduce the potential for trapped moisture. The ABC section acts as a capillary break mechanism, a load distribution, and a leveling course. For the rehabilitation/reconstruction of the on-site pavement areas we would recommend the use of a composite section over a stabilized subgrade section.

Swell – Consolidation Test Results

The swell-consolidation test is commonly performed to evaluate the swell or collapse potential of soils for determining design criteria and consolidation upon loading. In this test, relatively undisturbed samples obtained directly from the California ring barrel sampling device are placed in a laboratory apparatus and inundated with water under a predetermined load. The swell-index is the resulting amount of swell or collapse expressed as a percent of the sample's thickness prior to the inundation period. Samples obtained at the 1 to 2-foot depths are generally pre-loaded and inundated with water at an approximate 150 pounds per square foot (psf) increment to simulate the pavement loading conditions, while samples obtained at greater depths are generally pre-loaded and inundated with water at overburden pressures, (i.e., samples obtained at approximate depths of 4-foot are evaluated at 500-psf). After the inundation period additional incremental loads are applied to evaluate swell pressure and possible consolidation.

For this assessment, we conducted seven (7) swell-consolidation tests on pavement related samples (i.e., the 150 psf loading scheme) obtained at approximate depths of 1 to 2-feet below site grades, and two (2) swell-consolidation on samples obtained at approximate depths of 4-feet below site grades and evaluated at 500-psf loading criteria. The swell index values for the soil samples tested at the 150-psf and 500-psf inundation pressures revealed relatively low swell potential, on the order of (+) 0.0 to (+) 1.5 %. However a sample collected at an approximate depth of 4-feet below site grades at bring No. B-1 revealed a slight collapse/consolidation potential of (-) 2.0%. These results may coincide with the "sink-hole" as previously discussed. The (+) test results indicate the swell potential characteristics of the soil upon inundation with water. The following table summarizes the swell-consolidation laboratory test results conducted in the laboratory.

Boring No.	Depth, ft.	Material Type	Swell Consolidation Test Results				
			Moisture Content, %	Dry Density, PCF	Inundation Pressure, psf	Swell Index, %	Swell Pressure, psf
B-1	4	Sandy Lean Clay - CL	19.4	100.9	500	(-) 2.0	---
B-3	2	Lean Clay with Sand (CL)	19.6	107.2	150	(+) 0.5	600
B-5	2	Lean Clay with Sand (CL)	18.1	109.7	150	(+) 1.5	2500
B-6	2	Lean Clay with Sand (CL)	19.1	108.3	150	(+) 0.8	600
B-9	2	Sandy Lean Clay - CL	17.7	110.5	150	(+) 0.8	700
B-10	2	Sandy Lean Clay - CL	22.5	103.1	150	(+) 0.3	400
B-11	4	Sandy Lean Clay - CL	18.1	110.2	500	(+) 0.0	---
B-12	2	Sandy Lean Clay (CL)	21.9	105.6	150	(+) 0.4	500
B-14	4	Sandy Lean Clay - CL	4.6	124.4	150	(+) 0.0	---

The average value, approximately (+) 0.6% for the seven (7) pavement related samples do not exceed the "typical pavement design standards" maximum 2 percent criteria used to determine the necessity for stabilization of the subgrade due to expansive potential. The average in-situ moisture content for the pavement related subgrade samples analyzed was approximately 19-1/2%, possibly 1 to 3 percent above the material's anticipated optimum moisture content. Cohesive subsoils placed and compacted at a drier condition may tend to exhibit slightly elevated swell-index values that those revealed during herein. It is not uncommon for pavement subgrades generally consisting of cohesive subsoils classified as lean clay with sand and/or sandy lean clay to require some sort of stabilization procedure such as a fly ash treatment to enhance the integrity of the subgrade zone prior to paving operations. The laboratory test results for the swell-consolidation testing procedures are included in the Appendix of this report.

General Considerations and Subgrade Preparation Recommendations

In general "current typical minimum standard pavement thickness sections" for most lightly loaded/automobile parking areas would require at least 4-inches of HMA underlain by at least 6-inches of aggregate base course constructed over a stable subgrade. Heavy duty/high traffic volume pavement areas would typically require anywhere from 4 to 6-inches of HMA underlain by anywhere from 6 to 10-inches of ABC depending upon actual traffic loads. For reconstruction of the RMHS pavement areas we are providing recommendations for a total reconstruction for a 20-year design life with periodic maintenance, which would also include ground modifications/subgrade stabilization prior to placement of the approved pavement section.

We understand all existing pavements will be removed from the proposed replacement pavement areas. Existing aggregate base materials, where encountered, could remain in-place beneath the new pavement sections or incorporated into the pavement subgrades. Areas of the subgrades appear to be moist to very moist beneath the existing pavements. Those areas of high moisture content will likely show instability with pumping and rutting under construction traffic loads.

After stripping and completing all cuts and prior to placement of any fill, or pavement materials, we recommend the in-place soils be scarified to a minimum depth of 12 inches, adjusted in moisture content and compacted to at least 95% of the material's maximum dry density as determined in accordance with ASTM Specification D-698, the standard Proctor procedure. The moisture content of the scarified soils should be adjusted to be within the range of ±2% of standard Proctor optimum moisture at the time of compaction. If soft or loose zones are observed during the scarification/compaction process, additional reworking of the subgrades may be required. The subgrades should be closely observed to evaluate the suitability of the in-situ soils. If the subgrades will be stabilized with the addition of Class “C” fly ash as subsequently outlined in this report, the scarification and compaction could be accomplished in conjunction with the stabilization process.

Due to the slightly elevated in-situ moisture contents in various areas across the site, after removal of the existing pavement section during the reconstruction phase, soft/compressible subgrade conditions may exist in which ground stabilization may be necessary to create a working platform for construction equipment and/or placement of additional fill, where applicable. Placement of a granular material, such as a 3-inch minus recycled concrete or equivalent, may be necessary as a subgrade enhancement layer embedded into the soft soils, prior to placement of additional fill material or operating heavy earth-moving equipment. Supplemental recommendations can be provided upon request.

If any fill soils are required to develop pavement subgrades, those fill materials should consist of approved, low-volume change materials which are free from organic matter and debris. It is our opinion the near surface sandy lean clay or clayey sand material could be used as fill in these areas. Fill soils should be placed in loose lifts with a maximum thickness of 9 inches, adjusted in moisture content and compacted to at least 95% of the material’s standard Proctor maximum dry density. The moisture content of the fill soils should be adjusted to be within ±2% of the material’s standard Proctor optimum moisture content.

We expect the subgrades exposed after removal of the existing pavements will show areas of instability, pumping and possible rutting. We suggest stabilization of the subgrades with the addition of Class “C” fly ash be considered to allow for construction of the pavement section atop a stable platform. Based on prior experience with similar materials, we recommend 13% Class “C” fly ash, based on dry weights, be incorporated with the subgrade soils for the stabilization. The stabilized zone should be 12-inches thick with compaction to at least 95% of the standard Proctor maximum dry density. The moisture content should be adjusted to -3 to +1% of standard Proctor optimum moisture at the time of compaction.

Care should be taken after preparation of the subgrades to avoid disturbing the subgrade materials. Materials which are loosened or disturbed by the construction activities or materials which become dry and desiccated or wet and softened should be removed and replaced prior to placement of the overlying fill or pavement structure. Care should be taken to maintain proper moisture contents in the subgrade soils prior to placement of any overlying improvements.

Pavement Sections

Pavement section designs are based on subgrade conditions and anticipated traffic volumes. Based on the subsurface conditions encountered across the site and the laboratory test results, we are providing the pavement thicknesses herein using a Hveem Stabilometer/R-Value of 9. The traffic volumes and estimated 18 kip equivalent single axle loads (18-kip ESAL's) are based on our experience with similarly related project and the anticipated amount of automobile and bus traffic, and current LCUASS pavement design guidelines.

For a total reconstruction of the on-site pavement areas, we recommend that at least the upper 1-foot of subgrade material beneath the final pavement section be stabilized with fly ash or replaced with an imported granular fill material, to enhance the integrity of the subgrade section and increase the life of the pavement section. The recommended pavement sections, (i.e., Alternative A for HMA and ABC composite section with fly ash or without fly ash), are provided in Table 1 of this section of the report. Alternative C pavement thickness recommendations provided assume the subgrade stabilization would consist of a Geo-Grid product, versus the use of a fly ash treated section, which would be placed directly the approved scarified moisture conditioned and compact subgrade zone beneath the ABC section. We would assume the Geo-Grid product would consist of a Tensar BX 1100 or BX 1200 or equivalent and placed in general accordance with the manufacturers' recommendations. For use with a Geo-Grid product, we would suggest the ABC consist of a recycled concrete Class 5 or 6 ABC. For Alternative D for the on-site pavement improvement areas would consist of Portland cement concrete pavement (PCCP).

Pavement design methods are intended to provide structural sections with adequate thickness over a particular subgrade such that wheel loads are reduced to a level the subgrade can support. The support characteristics of the subgrade for pavement design do not account for shrink/swell movements of a soft/compressible clay subgrade such as the soils encountered on this project.

Thus, the pavement may be adequate from a structural standpoint, yet still experience cracking and deformation due to shrink/swell related movement of the subgrade. It is, therefore, important to minimize moisture changes in the subgrade to reduce shrink/swell movements. Recommended alternatives for the on-site pavement improvements on the RMHS campus are as follows:

TABLE 1 –Minimum Pavement Thicknesses for On-Site Pavement Improvement Areas		
	Light Duty / Automobile Parking Areas	Heavy Duty/Bus Lanes and Main Traffic Corridors
18 kip Equivalent Daily Load Axles (EDLA)	10	50
18 kip Equivalent Single Axle Loads (ESAL's) 20-year	73,000	365,000
Resilient Modulus (R = 9) Reliability Serviceability Loss (Terminal Service=2.2 and 2.5) Design Structural Number – 20-year design life	3448 75% 2.3 2.66	3448 85 2.0 3.65
(1) Composite Section: Alternative A – without Fly Ash Hot Mix Asphalt Pavement: S-75, PG 58-28 Aggregate Base (Class 5 or Class 6) Structural Number	 4-1/2″ @ 0.44 = 1.76 7″ @ 0.11 = 0.77 2.75	 6″ @ 0.44 = 2.64 10″ @ 0.11 = 1.10 3.74
(2) Composite Section: Alternative B – with Fly Ash Hot Mix Asphalt Pavement: S-75, PG 58-28 Aggregate Base (Class 5 or Class 6) (4) Fly Ash treated subgrade (13% Class C Fly ash – 12") Structural Number	 3-1/2″ @ 0.44 = 1.54 6″ @ 0.11 = 0.66 12″ @ 0.05 = 0.60 2.80	 5″ @ 0.44 = 2.20 8″ @ 0.11 = 0.88 12″ @ 0.05 = 0.60 3.68
(3) Composite Section: Alternative C – with Geo-Grid Hot Mix Asphalt Pavement: S-75, PG 58-28 Recycled Concrete ABC (Class 5 or Class 6) Tensar Geo-Grid BX 1100, BX 1200 or equivalent	 4″ of HMA 6″ of RC-ABC	 5″ of HMA 9″ of RC-ABC
(5) Portland Cement Concrete Pavement – PCCP	6″ Minimum	8″ Minimum

(1) Alternative A: Total Reconstruction - Provides the minimum pavement thicknesses for use of asphalt concrete surface material, Grading S and/or SX underlain by the required minimum Class 5 or 6 aggregate base course sections as provided herein underlain by a proof roll approved non fly ash treated subgrade section.

(2) Alternative B: Total Reconstruction - Provides the minimum pavement thicknesses for use of asphalt concrete surface material, Grading S and/or SX underlain by the required minimum Class 5 or 6 aggregate base course sections as provided herein underlain by a proof roll approved fly ash treated subgrade section.

(3) Alternative C: Total Reconstruction - Provides the minimum pavement thicknesses for use of asphalt concrete surface material, Grading S and/or SX underlain by the required minimum Class 5 or 6 aggregate base course sections as provided herein placed over an approved Geo-Grid product installed in general accordance with the manufacturer's recommendations. As presented herein a direct correlation for a structural number equivalency was not provided; however the appropriate thicknesses placed over the Geo-Grid product, in our opinion should suffice.

(4) If fly ash is utilized for the on-site pavement improvement areas for stabilization purposes, it is recommended that at least the upper 12-inches of the prepared subgrade be treated with approximately 13% fly ash.

(5) Alternative D: This alternative provides the minimum PCCP section to be considered, in lieu of composite (HMA/ABC) pavement sections. We recommend, as an alternative, a minimum 6-inch or 7-inch PCCP section respectively be placed as part of a total reconstruction effort also assuming a stable subgrade section below. In our opinion, the concrete pavement would provide a more durable pavement section, especially considering the bus weights and turning radii throughout the site. The PCCP section is based on a non-reinforced concrete section with a design 28-day compressive strength of at least 4,000 psi. The concrete should be air-entrained and the use of fiber mesh and/or wire mesh could be considered to help control pavement shrinkage cracking.

Pavement Considerations

The collection and diversion of surface drainage away from paved areas is critical to the satisfactory performance of the pavement. Drainage design should provide for the removal of water from paved areas in order to reduce the potential for wetting of the subgrade soils.

Long-term pavement performance will be dependent upon several factors, including maintaining subgrade moisture levels and providing for preventive maintenance. The following recommendations should be considered the minimum if a total reconstruction is planned for the site:

- The subgrade and the pavement surface should be adequately sloped to promote proper surface drainage.
- Install pavement drainage surrounding areas anticipated for frequent wetting (e.g. along curb and gutter alignments, islands, and any potential areas where surface water intrusion may occur),
- Install joint sealant and seal cracks immediately, especially between HMA and concrete curbs, sidewalks, etc.
- Seal all landscaped areas in, or adjacent to pavements to minimize or prevent moisture migration to subgrade soils.
- Place compacted, low permeability backfill against the exterior side of curb and gutter.
- Place curb, gutter, and/or sidewalk directly on approved moisture conditioned and compacted, proof rolled soils without the use of base course material.

Preventive maintenance should be planned and provided for with an on-going pavement management program. Preventive maintenance activities are intended to slow the rate of pavement deterioration, and to preserve the pavement investment. Preventive maintenance consists of both localized maintenance (e.g. crack and joint sealing and patching) and global maintenance (e.g. surface sealing). Preventive maintenance is usually the first priority when implementing a planned pavement maintenance program and provides the highest return on investment for pavements. Prior to implementing any maintenance, additional engineering observation is recommended to determine the type and extent of preventive maintenance.

Zones of perched and/or trapped water may be encountered at different times throughout the year in more permeable zones in the subgrades. The location and amount of perched and/or trapped water and the depth to the hydrostatic groundwater can vary over time depending on hydrologic conditions and other conditions not apparent at the time of this report.

Please note that if during or after placement of the stabilization or initial lift of pavement, the area is observed to be yielding under vehicle traffic or construction equipment, it is recommended that EEC be contacted for additional alternative methods of stabilization, or a change in the pavement section.

GENERAL COMMENTS

The analysis and recommendations presented in this report are based upon the data obtained from the soil boring performed at the indicated locations and from any other information discussed in this report. This report does not reflect any variations which may occur between boring or across the site. The nature and extent of such variations may not become evident until construction. If variations appear evident, it will be necessary to re-evaluate the recommendations of this report.

It is recommended that the geotechnical engineer be retained to review the plans and specifications so that comments can be made regarding the interpretation and implementation of our geotechnical recommendations in the design and specifications. It is further recommended that the geotechnical engineer be retained for testing and observations during earthwork and foundation construction phases to help determine that the design requirements are fulfilled.

This report has been prepared for the exclusive use of Poudre School District/Anderson Consulting Engineers, Inc. for specific application to the project discussed and has been prepared in accordance with generally accepted geotechnical engineering practices. No warranty, express or implied, is made. In the event that any changes in the nature, design or location of the project as outlined in this report are planned, the conclusions and recommendations contained in this report shall not be considered valid unless the changes are reviewed and the conclusions of this report modified or verified in writing by the geotechnical engineer.

DRILLING AND EXPLORATION

DRILLING & SAMPLING SYMBOLS:

SS: Split Spoon - 13/8" I.D., 2" O.D., unless otherwise noted
ST: Thin-Walled Tube - 2" O.D., unless otherwise noted
R: Ring Barrel Sampler - 2.42" I.D., 3" O.D. unless otherwise noted
PA: Power Auger
HA: Hand Auger
DB: Diamond Bit = 4", N, B
AS: Auger Sample
HS: Hollow Stem Auger

PS: Piston Sample
WS: Wash Sample
FT: Fish Tail Bit
RB: Rock Bit
BS: Bulk Sample
PM: Pressure Meter
WB: Wash Bore

Standard "N" Penetration: Blows per foot of a 140 pound hammer falling 30 inches on a 2-inch O.D. split spoon, except where noted.

WATER LEVEL MEASUREMENT SYMBOLS:

WL : Water Level
WCI: Wet Cave in
DCI: Dry Cave in
AB : After Boring

WS : While Sampling
WD : While Drilling
BCR: Before Casing Removal
ACR: After Casting Removal

Water levels indicated on the boring logs are the levels measured in the borings at the time indicated. In pervious soils, the indicated levels may reflect the location of ground water. In low permeability soils, the accurate determination of ground water levels is not possible with only short term observations.

DESCRIPTIVE SOIL CLASSIFICATION

Soil Classification is based on the Unified Soil Classification system and the ASTM Designations D-2488. Coarse Grained Soils have move than 50% of their dry weight retained on a #200 sieve; they are described as: boulders, cobbles, gravel or sand. Fine Grained Soils have less than 50% of their dry weight retained on a #200 sieve; they are described as : clays, if they are plastic, and silts if they are slightly plastic or non-plastic. Major constituents may be added as modifiers and minor constituents may be added according to the relative proportions based on grain size. In addition to gradation, coarse grained soils are defined on the basis of their relative in-place density and fine grained soils on the basis of their consistency. Example: Lean clay with sand, trace gravel, stiff (CL); silty sand, trace gravel, medium dense (SM).

CONSISTENCY OF FINE-GRAINED SOILS

Unconfined Compressive Strength, Qu, psf	Consistency
< 500	Very Soft
500 - 1,000	Soft
1,001 - 2,000	Medium
2,001 - 4,000	Stiff
4,001 - 8,000	Very Stiff
8,001 - 16,000	Very Hard

RELATIVE DENSITY OF COARSE-GRAINED SOILS:

N-Blows/ft	Relative Density
0-3	Very Loose
4-9	Loose
10-29	Medium Dense
30-49	Dense
50-80	Very Dense
80 +	Extremely Dense

PHYSICAL PROPERTIES OF BEDROCK

DEGREE OF WEATHERING:

Slight	Slight decomposition of parent material on joints. May be color change.
Moderate	Some decomposition and color change throughout.
High	Rock highly decomposed, may be extremely broken.

HARDNESS AND DEGREE OF CEMENTATION:

Limestone and Dolomite:

Hard	Difficult to scratch with knife.
Moderately	Can be scratched easily with knife.
Hard	Cannot be scratched with fingernail.
Soft	Can be scratched with fingernail.

Shale, Siltstone and Claystone:

Hard	Can be scratched easily with knife, cannot be scratched with fingernail.
Moderately Hard	Can be scratched with fingernail.
Soft	Can be easily dented but not molded with fingers.

Sandstone and Conglomerate:

Well Cemented	Capable of scratching a knife blade.
Cemented	Can be scratched with knife.
Poorly Cemented	Can be broken apart easily with fingers.

UNIFIED SOIL CLASSIFICATION SYSTEM

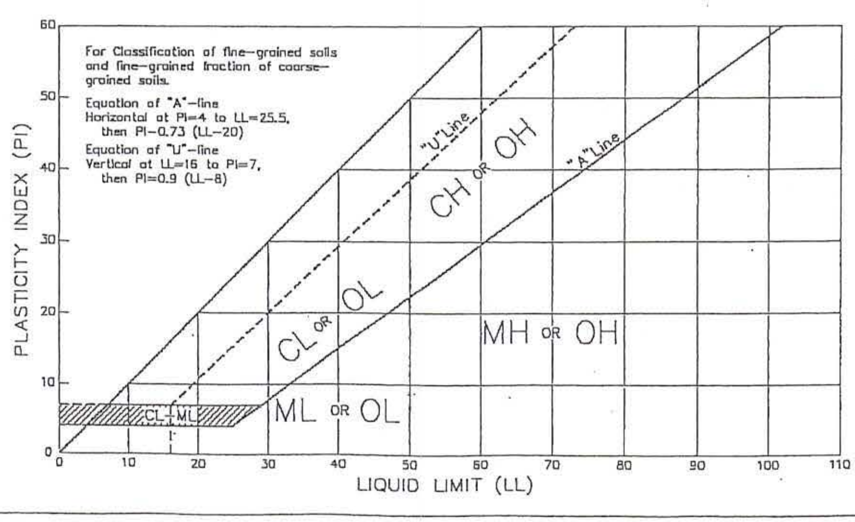
Criteria for Assigning Group Symbols and Group names Using Laboratory Tests				Soil Classification: Group Symbol	Soil Classification: Group Name
Coarse-Grained Soils more than 50% retained on No. 200 sieve	Gravels more than 50% of coarse fraction retained on No. 4 sieve	Clean Gravels Less than 5% fines	Cu≥4 and <Cc≤3[E]	GW	Well-graded gravel[F]
			Cu<4 and/or 1>Cc>3[E]	GP	Poorly-graded gravel[F]
		Gravels with Fines more than 12% fines	Fines classify as ML or MH	GM	Silty gravel, G,H
			Fines classify as CL or CH	GC	Clayey Gravel[F,G,H]
	Sands 50% or more coarse fraction passes No. 4 sieve	Clean Sands Less than 5% fines	Cu≥6 and 1<Cc≤3[E]	SW	Well-graded sand[I]
			Cu<6 and/or 1>Cc>3[E]	SP	Poorly-graded sand[I]
		Sands with Fines more than 12% fines	Fines classify as ML or MH	SM	Silty sand[G,H,I]
			Fines classify as CL or CH	SC	Clayey sand[G,H,I]
Fine-Grained Soils 50% or more passes the No. 200 sieve	Silts and Clays Liquid Limit less than 50	inorganic	PI>7 and plots on or above "A"Line[J]	CL	Lean clay[K,L,M]
			PI<4 or plots below "A"Line[J]	ML	Silt[K,L,M]
		organic	Liquid Limit – oven dried / Liquid Limit – not dried <0.75	OL	Organic clay[K,L,M,N]
					Organic silt[K,L,M,O]
	Silts and Clays Liquid Limit 50 or more	inorganic	PI plots on or above "A"Line	CH	Fat clay[K,L,M]
			PI plots below "A"Line	MH	Elastic Silt[K,L,M]
		organic	Liquid Limit – oven dried / Liquid Limit – not dried <0.75	OH	Organic clay[K,L,M,P]
					Organic silt[K,L,M,Q]
Highly organic soils		Primarily organic matter, dark in color, and organic odor		PT	Peat

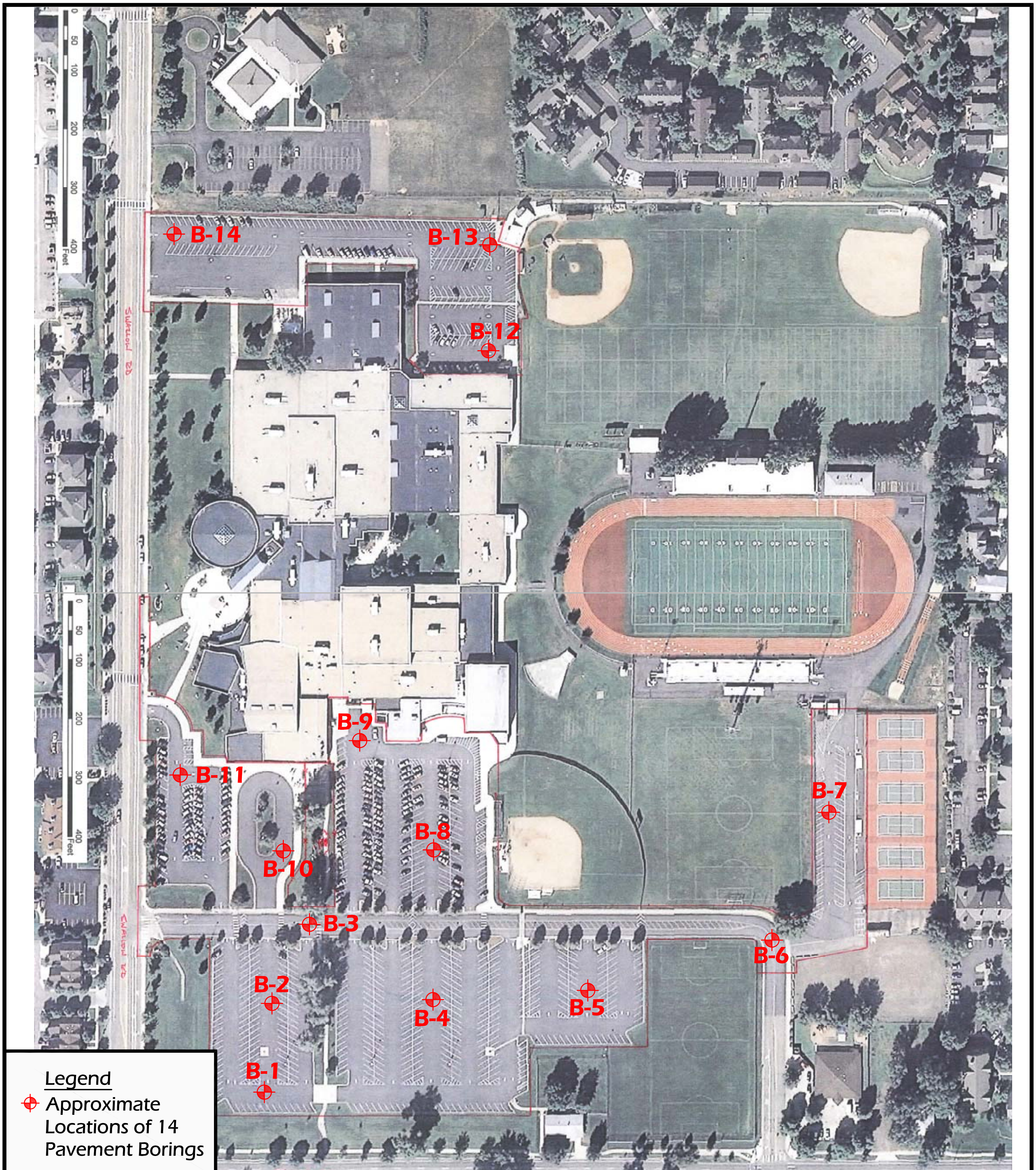
[A]Based on the material passing the 3-in. (75-mm) sieve
[B]If field sample contained cobbles or boulders, or both, add "with cobbles or boulders, or both" to group name.
[C]Gravels with 5 to 12% fines required dual symbols:
GW-GM well graded gravel with silt
GW-GC well-graded gravel with clay
GP-GM poorly-graded gravel with silt
GP-GC poorly-graded gravel with clay
[D]Sands with 5 to 12% fines require dual symbols:
SW-SM well-graded sand with silt
SW-SC well-graded sand with clay
SP-SM poorly graded sand with silt
SP-SC poorly graded sand with clay

[E]$Cu=D_{60}/D,\ Cc= \frac{(D_{30})}{D \times D}$

[F]If soil contains ≥15% sand, add"with sand"to group name.
[G]If fines classify as CL-ML, use dual symbol GC-CM, or SC-SM.
[H]If fines are organic, add"with organic fines"to group name
[I]If soil contains >15%gravel, add"with gravel" to group name.
[J]If Atterberg limits plots shaded area, soil is a CL-ML, cilty clay.

[K]If soil contains 15 to 29%plus No. 200, add "with sand" or "with gravel", whichever is predominant.
[L]If soil contains ≥ 30" plus No. 200 predominantly sand, add "sandy to group name.
[M]If soil contains ≥ 30% plus No. 200 predominantly gravel, add "gravely" to group name.
[N]PI≥4 and plots on or above "A" line.
[O]PI≤4 or plots below "A" line.
[P]PI plots on or above "A" line.
[Q]PI plots below "A" line.





North
Not to Scale

Boring Location Diagram
Rocky Mountain High School Pavement Evaluation
Fort Collins, Colorado
EEC Project Number: 1112073 Date: November 2011

Rocky Mountain High School - 1300 West Swallow Road - Fort Collins, Colorado

Existing Pavement Distress Conditions - Photographs Taken During Field Exploration - November 2011

EEC Project No. 1112073

PHOTO NO. 1: Close-up view of major POT-HOLE located within the southeastern student parking area near Boring B-1.

PHOTO NO. 2: View of pavement in general vicinity of Boring No. B-3. Pavement distress/failure adjacent to the concrete curb radius along with longitudinal cracking.

PHOTO NO. 3: View of pavement in general vicinity of Boring No. B-8. Pavement distress generally consisting of longitudinal and transverse cracking.

PHOTO NO. 4: View of pavement in general vicinity of Boring No. B-9. Pavement distress of alligator cracking. Note crack sealant applied to increase pavement longevity.

ROCKY MOUNTAIN HIGH SCHOOL PAVEMENT EVALUATION
FORT COLLINS, COLORADO

PROJECT NO: 1112073		DATE: NOVEMBER 2011
	LOG OF BORING B-1	
RIG TYPE: CME45	SHEET 1 OF 1	WATER DEPTH
FOREMAN: DG	START DATE 11/23/2011	WHILE DRILLING: None
AUGER TYPE: 4" CFA	FINISH DATE 11/23/2011	AFTER DRILLING: N/A
SPT HAMMER: MANUAL	SURFACE ELEV N/A	24 HOUR: N/A

SOIL DESCRIPTION	TYPE	D (FEET)	N (BLOWS/FT)	QU (PSF)	MC (%)	DD (PCF)	A-LIMITS LL	A-LIMITS PI	-200 (%)	SWELL PRESSURE	SWELL % @ 500 PSF
EXISTING HMA: Approximately 3-3/4-Inches											
EXISTING ABC: Approximately 12-inches		1									
SANDY LEAN CLAY (CL)		2									
Fill Material/Subgrade transitioning to native											
Sandy Lean Clay with depth	CS	3	7	4000	24.5	92.9					
brown, moist, medium stiff											
		4									
	CS	5	4	4000	19.4	98.6	42	19	52.8	<500 psf	None
		6									
		7									
		8									
		9									
*Intermittent sand and gravel lenses with depth											
	SS	10	4	2000	18.3						
		11									
		12									
		13									
		14									
very moist to wet	SS	15	9	1000	17.5						
BOTTOM OF BORING DEPTH 15.5'		16									
		17									
		18									
		19									
		20									
		21									
		22									
		23									
		24									
		25									

ROCKY MOUNTAIN HIGH SCHOOL PAVEMENT EVALUATION
FORT COLLINS, COLORADO

PROJECT NO: 1112073		DATE: NOVEMBER 2011
	LOG OF BORING B-2	
RIG TYPE: CME45	SHEET 1 OF 1	WATER DEPTH
FOREMAN: DG	START DATE 11/23/2011	WHILE DRILLING None
AUGER TYPE: 4" CFA	FINISH DATE 11/23/2011	AFTER DRILLING N/A
SPT HAMMER: MANUAL	SURFACE ELEV N/A	24 HOUR N/A

SOIL DESCRIPTION	TYPE	D (FEET)	N (BLOWS/FT)	QU (PSF)	MC (%)	DD (PCF)	A-LIMITS LL	A-LIMITS PI	-200 (%)	SWELL PRESSURE	SWELL % @ 500 PSF
EXISTING HMA: Approximately 3-1/2-Inches											
EXISTING ABC: Approximately 10-inches		1									
SANDY LEAN CLAY (CL)		2									
Fill Material/Subgrade transitioning to native											
Sandy Lean Clay with depth	CS	3	7	4000	21.6	93.0					
brown, moist, medium stiff											
		4									
	CS	5	8	8000	21.7	99.5					
		6									
		7									
		8									
		9									
	SS	10	10	3500	14.8						
BOTTOM OF BORING DEPTH 10.5'		11									
		12									
		13									
		14									
		15									
		16									
		17									
		18									
		19									
		20									
		21									
		22									
		23									
		24									
		25									

ROCKY MOUNTAIN HIGH SCHOOL PAVEMENT EVALUATION
FORT COLLINS, COLORADO

PROJECT NO: 1112073			DATE: NOVEMBER 2011	
	LOG OF BORING B-3			
RIG TYPE: CME45	SHEET 1 OF 1		WATER DEPTH	
FOREMAN: DG	START DATE	11/23/2011	WHILE DRILLING	None
AUGER TYPE: 4" CFA	FINISH DATE	11/23/2011	AFTER DRILLING	N/A
SPT HAMMER: MANUAL	SURFACE ELEV	N/A	24 HOUR	N/A

SOIL DESCRIPTION		D	N	QU	MC	DD	A-LIMITS		-200	SWELL	
	TYPE	(FEET)	(BLOWS/FT)	(PSF)	(%)	(PCF)	LL	PI	(%)	PRESSURE	% @ 500 PSF
EXISTING HMA: Approximately 3-Inches											
EXISTING ABC: Approximately 10-inches		1									
LEAN CLAY with SAND (CL)		2									
Fill Material/Subgrade transitioning to native											% @ 150 psf
Sandy Lean Clay with depth	CS	3	12	9000+	19.6	102.0	42	23	80.1	600 psf	0.5%
brown, moist, medium stiff to stiff											
		4									
* moist zone of cohesive subsoils noted	CS	5	12	6000	26.3	95.7					
		6									
		7									
		8									
		9									
	SS	10	12	6000	14.7						
BOTTOM OF BORING DEPTH 10.5'		11									
		12									
		13									
		14									
		15									
		16									
		17									
		18									
		19									
		20									
		21									
		22									
		23									
		24									
		25									

ROCKY MOUNTAIN HIGH SCHOOL PAVEMENT EVALUATION
FORT COLLINS, COLORADO

PROJECT NO: 1112073			**DATE: NOVEMBER 2011**	
	LOG OF BORING B-4			
RIG TYPE: CME45	**SHEET 1 OF 1**		**WATER DEPTH**	
FOREMAN: DG	**START DATE**	**11/23/2011**	**WHILE DRILLING**	**None**
AUGER TYPE: 4" CFA	**FINISH DATE**	**11/23/2011**	**AFTER DRILLING**	**N/A**
SPT HAMMER: MANUAL	**SURFACE ELEV**	**N/A**	**24 HOUR**	**N/A**

SOIL DESCRIPTION	TYPE	D (FEET)	N (BLOWS/FT)	QU (PSF)	MC (%)	DD (PCF)	A-LIMITS LL	A-LIMITS PI	-200 (%)	SWELL PRESSURE	SWELL % @ 500 PSF
EXISTING HMA: Approximately 3-Inches											
EXISTING ABC: Approximately 8-inches		1									
SANDY LEAN CLAY (CL)		2									
Fill Material/Subgrade transitioning to native											
Sandy Lean Clay with depth	CS	3	**8**	**4000**	**15.8**	**105.5**					
brown, moist, medium stiff to stiff											
		4									
	CS	**5**	**16**	**7000**	**14.3**	**113.0**					
SILTY SAND with GRAVEL (SP-SM)		6									
red / brown											
medium dense		7									
		8									
		9									
	SS	**10**	**14**	**--**	**4.7**						
		11									
		12									
		13									
		14									
SANDY LEAN CLAY (CL)											
red / brown	SS	**15**	**5**	**2000**	**20.7**						
medium stiff											
BOTTOM OF BORING DEPTH 15.5'		16									
		17									
		18									
		19									
		20									
		21									
		22									
		23									
		24									
		25									

ROCKY MOUNTAIN HIGH SCHOOL PAVEMENT EVALUATION
FORT COLLINS, COLORADO

PROJECT NO: 1112073			DATE: NOVEMBER 2011	
	LOG OF BORING B-5			
RIG TYPE: CME45	SHEET 1 OF 1		WATER DEPTH	
FOREMAN: DG	START DATE	11/23/2011	WHILE DRILLING	None
AUGER TYPE: 4" CFA	FINISH DATE	11/23/2011	AFTER DRILLING	N/A
SPT HAMMER: MANUAL	SURFACE ELEV	N/A	24 HOUR	N/A

SOIL DESCRIPTION	TYPE	D (FEET)	N (BLOWS/FT)	QU (PSF)	MC (%)	DD (PCF)	A-LIMITS LL	A-LIMITS PI	-200 (%)	SWELL PRESSURE	SWELL % @ 500 PSF
EXISTING HMA: Approximately 4-Inches											
EXISTING ABC: 0-Inhces (No ABC observed)		1									
LEAN CLAY with SAND (CL)		2									
Fill Material/Subgrade transitioning to native											% @ 150 psf
Sandy Lean Clay with depth	CS	3	16	8000	18.1	109.7	47	27	80.5	2500 psf	1.5%
dark brown, moist, stiff to medium stiff											
		4									
* very moist zone of cohesive subsoils noted	CS	5	7	7000	29.6	87.3					
		6									
		7									
SANDY LEAN CLAY to CLAYEY SAND (CL/SC)		8									
stiff / medium dense											
		9									
	SS	10	4	9000+	11.5						
BOTTOM OF BORING DEPTH 10.5'		11									
		12									
		13									
		14									
		15									
		16									
		17									
		18									
		19									
		20									
		21									
		22									
		23									
		24									
		25									

ROCKY MOUNTAIN HIGH SCHOOL PAVEMENT EVALUATION
FORT COLLINS, COLORADO

PROJECT NO: 1112073		DATE: NOVEMBER 2011
	LOG OF BORING B-6	
RIG TYPE: CME45	SHEET 1 OF 1	WATER DEPTH
FOREMAN: DG	START DATE 11/23/2011	WHILE DRILLING None
AUGER TYPE: 4" CFA	FINISH DATE 11/23/2011	AFTER DRILLING N/A
SPT HAMMER: MANUAL	SURFACE ELEV N/A	24 HOUR N/A

SOIL DESCRIPTION	TYPE	D (FEET)	N (BLOWS/FT)	QU (PSF)	MC (%)	DD (PCF)	A-LIMITS LL	A-LIMITS PI	-200 (%)	SWELL PRESSURE	SWELL % @ 500 PSF
EXISTING HMA: Approximately 5-Inches											
EXISTING ABC: 0-Inhces (No ABC observed)		1									
		2									
LEAN CLAY with SAND (CL)											
Fill Material/Subgrade transitioning to native											% @ 150 psf
Sandy Lean Clay with depth	CS	3	13	6000	19.1	106.3	45	26	77.6	600 psf	0.8%
brown, moist, medium stiff to stiff											
		4									
	CS	5	7	7000	29.4	92.8					
		6									
		7									
		8									
		9									
*Intermittent SILTY/CLAYEY SAND lenses with	SS	10	45	--	4.0						
increase depths - medium dense to dense											
		11									
		12									
		13									
		14									
	SS	15	24	--	4.3						
BOTTOM OF BORING DEPTH 15.5'		16									
		17									
		18									
		19									
		20									
		21									
		22									
		23									
		24									
		25									

ROCKY MOUNTAIN HIGH SCHOOL PAVEMENT EVALUATION
FORT COLLINS, COLORADO

PROJECT NO: 1112073		**DATE: NOVEMBER 2011**	
	LOG OF BORING B-7		
RIG TYPE: CME45	**SHEET 1 OF 1**	**WATER DEPTH**	
FOREMAN: DG	**START DATE** 11/23/2011	**WHILE DRILLING**	**None**
AUGER TYPE: 4" CFA	**FINISH DATE** 11/23/2011	**AFTER DRILLING**	**N/A**
SPT HAMMER: MANUAL	**SURFACE ELEV** N/A	**24 HOUR**	**N/A**

SOIL DESCRIPTION	TYPE	D (FEET)	N (BLOWS/FT)	QU (PSF)	MC (%)	DD (PCF)	A-LIMITS LL	A-LIMITS PI	-200 (%)	SWELL PRESSURE	SWELL % @ 500 PSF
EXISTING HMA: Approximately 2-Inches											
EXISTING ABC: 0-Inhces (No ABC observed)		1									
LEAN CLAY with SAND (CL)		2									
Fill Material/Subgrade transitioning to native											
Sandy Lean Clay with depth	CS	3	**10**	**7000**	**20.2**	**105.0**					
brown, moist, medium stiff to stiff											
		4									
	CS	**5**	**9**	**6000**	**24.9**	**98.6**					
		6									
		7									
SANDY LEAN CLAY (CL)		8									
red / brown											
medium stiff		9									
	SS	**10**	**4**	**6000**	**14.1**						
BOTTOM OF BORING DEPTH 10.5'		11									
		12									
		13									
		14									
		15									
		16									
		17									
		18									
		19									
		20									
		21									
		22									
		23									
		24									
		25									

ROCKY MOUNTAIN HIGH SCHOOL PAVEMENT EVALUATION
FORT COLLINS, COLORADO

PROJECT NO: 1112073			**DATE: NOVEMBER 2011**
	LOG OF BORING B-8		
RIG TYPE: CME45	**SHEET 1 OF 1**		**WATER DEPTH**
FOREMAN: DG	**START DATE**	**11/23/2011**	**WHILE DRILLING** None
AUGER TYPE: 4" CFA	**FINISH DATE**	**11/23/2011**	**AFTER DRILLING** N/A
SPT HAMMER: MANUAL	**SURFACE ELEV**	**N/A**	**24 HOUR** N/A

SOIL DESCRIPTION	TYPE	D (FEET)	N (BLOWS/FT)	QU (PSF)	MC (%)	DD (PCF)	A-LIMITS LL	A-LIMITS PI	-200 (%)	SWELL PRESSURE	SWELL % @ 500 PSF
EXISTING HMA: Approximately 3-1/4-Inches											
EXISTING ABC: Approximately 3-inches		1									
SANDY LEAN CLAY (CL)		2									
Fill Material/Subgrade transitioning to native											
Sandy Lean Clay with depth	CS	3	9	9000	19.7	108.5					
brown, moist, medium stiff											
		4									
	CS	5	20	9000+	19.9	107.2					
		6									
		7									
SILTY SAND with GRAVEL (SP-SM)		8									
red / brown											
medium dense		9									
	SS	10	14	--	4.0						
BOTTOM OF BORING DEPTH 10.5'		11									
		12									
		13									
		14									
		15									
		16									
		17									
		18									
		19									
		20									
		21									
		22									
		23									
		24									
		25									

ROCKY MOUNTAIN HIGH SCHOOL PAVEMENT EVALUATION
FORT COLLINS, COLORADO

PROJECT NO: 1112073		DATE: NOVEMBER 2011
	LOG OF BORING B-9	
RIG TYPE: CME45	SHEET 1 OF 1	WATER DEPTH
FOREMAN: DG	START DATE 11/23/2011	WHILE DRILLING None
AUGER TYPE: 4" CFA	FINISH DATE 11/23/2011	AFTER DRILLING N/A
SPT HAMMER: MANUAL	SURFACE ELEV N/A	24 HOUR N/A

SOIL DESCRIPTION	TYPE	D (FEET)	N (BLOWS/FT)	QU (PSF)	MC (%)	DD (PCF)	A-LIMITS LL	A-LIMITS PI	-200 (%)	SWELL PRESSURE	SWELL % @ 500 PSF
EXISTING HMA: Approximately 3-1/2-Inches											
EXISTING ABC: Approximately 5-inches		1									
SANDY LEAN CLAY (CL)		2									
Fill Material/Subgrade transitioning to native											% @ 150 psf
Sandy Lean Clay with depth	CS	3	16	8000	17.7	107.6	43	23	61.0	700 psf	0.8%
brown, moist, medium stiff											
		4									
	CS	5	10	7000	19.1	104.3					
		6									
		7									
SILTY SAND with GRAVEL (SP-SM)		8									
red / brown											
medium dense		9									
	SS	10	8	--	5.5						
		11									
		12									
		13									
		14									
	SS	15	6	--	6.3						
BOTTOM OF BORING DEPTH 15.5'		16									
		17									
		18									
		19									
		20									
		21									
		22									
		23									
		24									
		25									

ROCKY MOUNTAIN HIGH SCHOOL PAVEMENT EVALUATION
FORT COLLINS, COLORADO

PROJECT NO: 1112073		DATE: NOVEMBER 2011
	LOG OF BORING B-10	
RIG TYPE: CME45	SHEET 1 OF 1	WATER DEPTH

FOREMAN: DG	START DATE	11/23/2011	WHILE DRILLING	None
AUGER TYPE: 4" CFA	FINISH DATE	11/23/2011	AFTER DRILLING	N/A
SPT HAMMER: MANUAL	SURFACE ELEV	N/A	24 HOUR	N/A

SOIL DESCRIPTION		D	N	QU	MC	DD	A-LIMITS		-200	SWELL	
	TYPE	(FEET)	(BLOWS/FT)	(PSF)	(%)	(PCF)	LL	PI	(%)	PRESSURE	% @ 500 PSF
EXISTING HMA: Approximately 3-3/4-Inches											
EXISTING ABC: Approximately 11-inches		1									
SANDY LEAN CLAY (CL)		2									
Fill Material/Subgrade transitioning to native											% @ 150 psf
Sandy Lean Clay with depth	CS	3	13	5500	22.5	103.0	43	19	69.1	400 psf	0.3%
brown, moist, medium stiff											
		4									
	CS	5	22	6000	21.6	97.4					
		6									
SANDY LEAN CLAY (CL)		7									
red / brown											
stiff to very stiff		8									
moist											
		9									
	SS	10	13	9000+	11.8						
BOTTOM OF BORING DEPTH 10.5'		11									
		12									
		13									
		14									
		15									
		16									
		17									
		18									
		19									
		20									
		21									
		22									
		23									
		24									
		25									

ROCKY MOUNTAIN HIGH SCHOOL PAVEMENT EVALUATION
FORT COLLINS, COLORADO

PROJECT NO: 1112073			DATE: NOVEMBER 2011
	LOG OF BORING B-11		
RIG TYPE: CME45	SHEET 1 OF 1		WATER DEPTH
FOREMAN: DG	START DATE	11/23/2011	WHILE DRILLING: None
AUGER TYPE: 4" CFA	FINISH DATE	11/23/2011	AFTER DRILLING: N/A
SPT HAMMER: MANUAL	SURFACE ELEV	N/A	24 HOUR: N/A

SOIL DESCRIPTION		D	N	QU	MC	DD	A-LIMITS		-200	SWELL	
	TYPE	(FEET)	(BLOWS/FT)	(PSF)	(%)	(PCF)	LL	PI	(%)	PRESSURE	% @ 500 PSF
EXISTING HMA: Approximately 3-Inches											
EXISTING ABC: Approximately 4-inches		1									
SANDY LEAN CLAY (CL)		2									
Fill Material/Subgrade transitioning to native											
Sandy Lean Clay with depth	CS	3	11	5000	13.0	115.3					
brown, moist, medium stiff											
		4									
	CS	5	8	7000	18.1	107.0				<500 psf	None
		6									
red / brown		7									
with gravel											
		8									
		9									
	SS	10	5	5000	12.0						
		11									
		12									
		13									
		14									
very moist											
	SS	15	5	2000	21.2						
BOTTOM OF BORING DEPTH 15.5'		16									
		17									
		18									
		19									
		20									
		21									
		22									
		23									
		24									
		25									

ROCKY MOUNTAIN HIGH SCHOOL PAVEMENT EVALUATION
FORT COLLINS, COLORADO

PROJECT NO: 1112073			DATE: NOVEMBER 2011
	LOG OF BORING B-12		
RIG TYPE: CME45	SHEET 1 OF 1		WATER DEPTH
FOREMAN: DG	START DATE	11/23/2011	WHILE DRILLING: None
AUGER TYPE: 4" CFA	FINISH DATE	11/23/2011	AFTER DRILLING: N/A
SPT HAMMER: MANUAL	SURFACE ELEV	N/A	24 HOUR: N/A

SOIL DESCRIPTION	TYPE	D (FEET)	N (BLOWS/FT)	QU (PSF)	MC (%)	DD (PCF)	A-LIMITS LL	A-LIMITS PI	-200 (%)	SWELL PRESSURE	SWELL % @ 500 PSF
EXISTING HMA: Approximately 3-Inches											
EXISTING ABC: Approximately 5-inches		1									
		2									
SANDY LEAN CLAY (CL)											
Fill Material/Subgrade transitioning to native											% @ 150 psf
Sandy Lean Clay with depth	CS	3	**9**	**5000**	**21.9**	**104.4**	**40**	**26**	**68.6**	**500 psf**	**0.4%**
brown, moist, medium stiff											
		4									
red / brown	CS	**5**	**17**	**9000+**	**28.6**	**95.5**					
		6									
		7									
SILTY SAND with GRAVEL (SP-SM)		8									
red / brown											
medium dense		9									
	SS	**10**	**6**	**--**	**7.1**						
		11									
		12									
SILTY SAND (SM)		13									
red / brown, moist											
loose		14									
	SS	**15**	**5**	**2000**	**23.2**						
BOTTOM OF BORING DEPTH 15.5'		16									
		17									
		18									
		19									
		20									
		21									
		22									
		23									
		24									
		25									

ROCKY MOUNTAIN HIGH SCHOOL PAVEMENT EVALUATION
FORT COLLINS, COLORADO

PROJECT NO: 1112073 | **DATE: NOVEMBER 2011**

LOG OF BORING B-13
SHEET 1 OF 1

RIG TYPE: CME45			**WATER DEPTH**
FOREMAN: DG	**START DATE** 11/23/2011	**WHILE DRILLING**	**None**
AUGER TYPE: 4" CFA	**FINISH DATE** 11/23/2011	**AFTER DRILLING**	**N/A**
SPT HAMMER: MANUAL	**SURFACE ELEV** N/A	**24 HOUR**	**N/A**

SOIL DESCRIPTION	TYPE	D (FEET)	N (BLOWS/FT)	QU (PSF)	MC (%)	DD (PCF)	A-LIMITS LL	A-LIMITS PI	-200 (%)	SWELL PRESSURE	SWELL % @ 500 PSF
EXISTING HMA: Approximately 3-Inches											
EXISTING ABC: Approximately 2-inches		1									
SANDY LEAN CLAY (CL)		2									
Fill Material/Subgrade transitioning to native											
Sandy Lean Clay with depth	CS	3	7	6000	23.2	99.1					
brown, moist, medium stiff											
		4									
	CS	5	11	6000	15.7	110.9					
		6									
		7									
SILTY SAND with GRAVEL (SP-SM)		8									
red / brown											
medium dense		9									
	SS	10	9	--	7.6						
BOTTOM OF BORING DEPTH 10.5'		11									
		12									
		13									
		14									
		15									
		16									
		17									
		18									
		19									
		20									
		21									
		22									
		23									
		24									
		25									

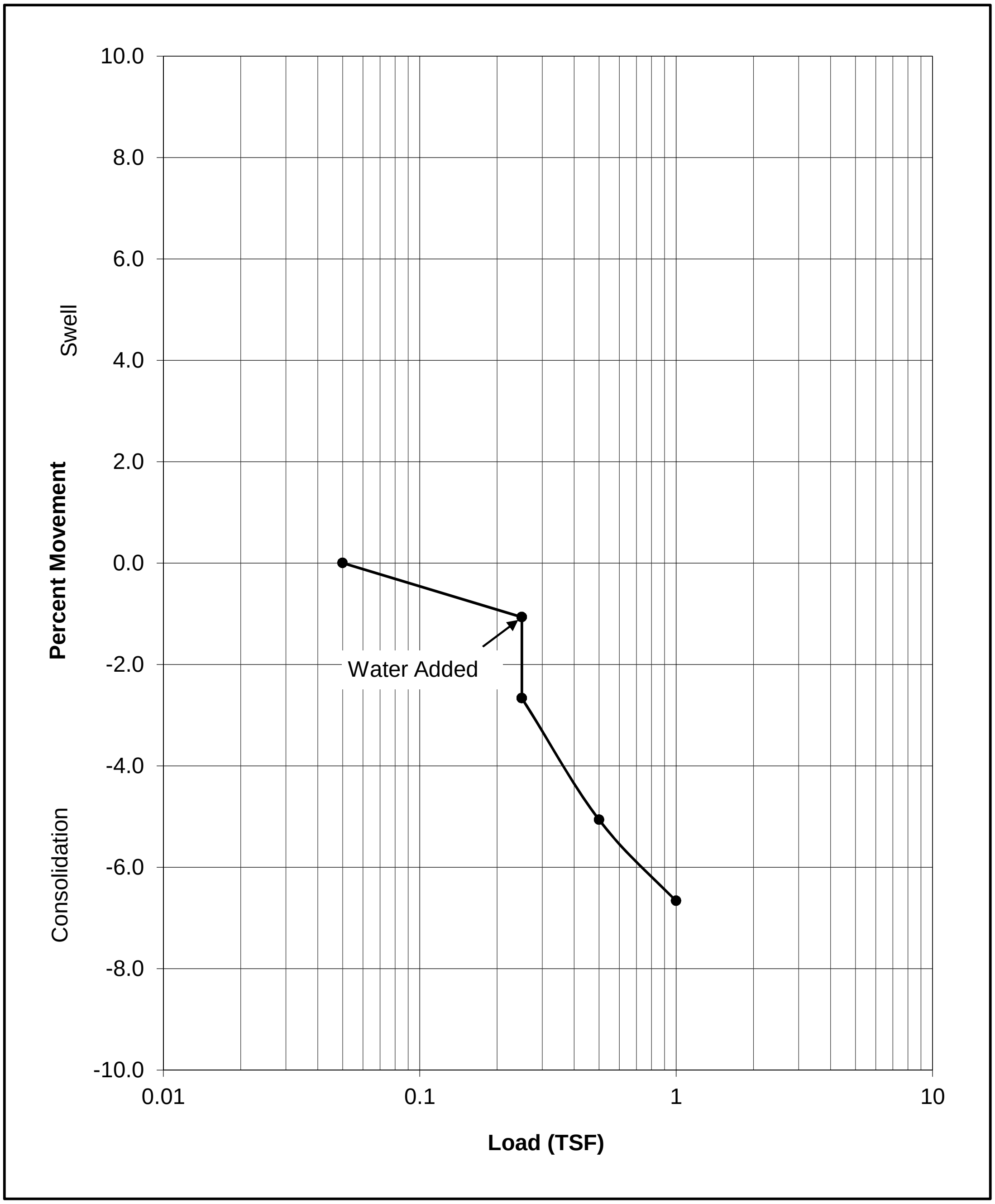
ROCKY MOUNTAIN HIGH SCHOOL PAVEMENT EVALUATION
FORT COLLINS, COLORADO

PROJECT NO: 1112073		DATE: NOVEMBER 2011
	LOG OF BORING B-14	
RIG TYPE: CME45	SHEET 1 OF 1	WATER DEPTH
FOREMAN: DG	START DATE 11/23/2011	WHILE DRILLING None
AUGER TYPE: 4" CFA	FINISH DATE 11/23/2011	AFTER DRILLING N/A
SPT HAMMER: MANUAL	SURFACE ELEV N/A	24 HOUR N/A

SOIL DESCRIPTION	TYPE	D (FEET)	N (BLOWS/FT)	QU (PSF)	MC (%)	DD (PCF)	A-LIMITS LL	A-LIMITS PI	-200 (%)	SWELL PRESSURE	SWELL % @ 500 PSF
EXISTING HMA: Approximately 4-1/2-Inches											
EXISTING ABC: Approximately 4-inches		1									
SANDY LEAN CLAY (CL)		2									
Fill Material/Subgrade transitioning to native											
Sandy Lean Clay with depth	CS	3	6	6000	16.8	108.4					
brown, moist, medium stiff											
moist		4									% @ 150 psf
	CS	5	8	8000	8.6	113.8				<500 psf	None
		6									
		7									
		8									
SILTY SAND with GRAVEL (SP-SM)		9									
red / brown											
medium dense	SS	10	7	3000	13.6						
		11									
		12									
		13									
		14									
	SS	15	15	--	4.3						
BOTTOM OF BORING DEPTH 15.5'		16									
		17									
		18									
		19									
		20									
		21									
		22									
		23									
		24									
		25									

SWELL / CONSOLIDATION TEST RESULTS

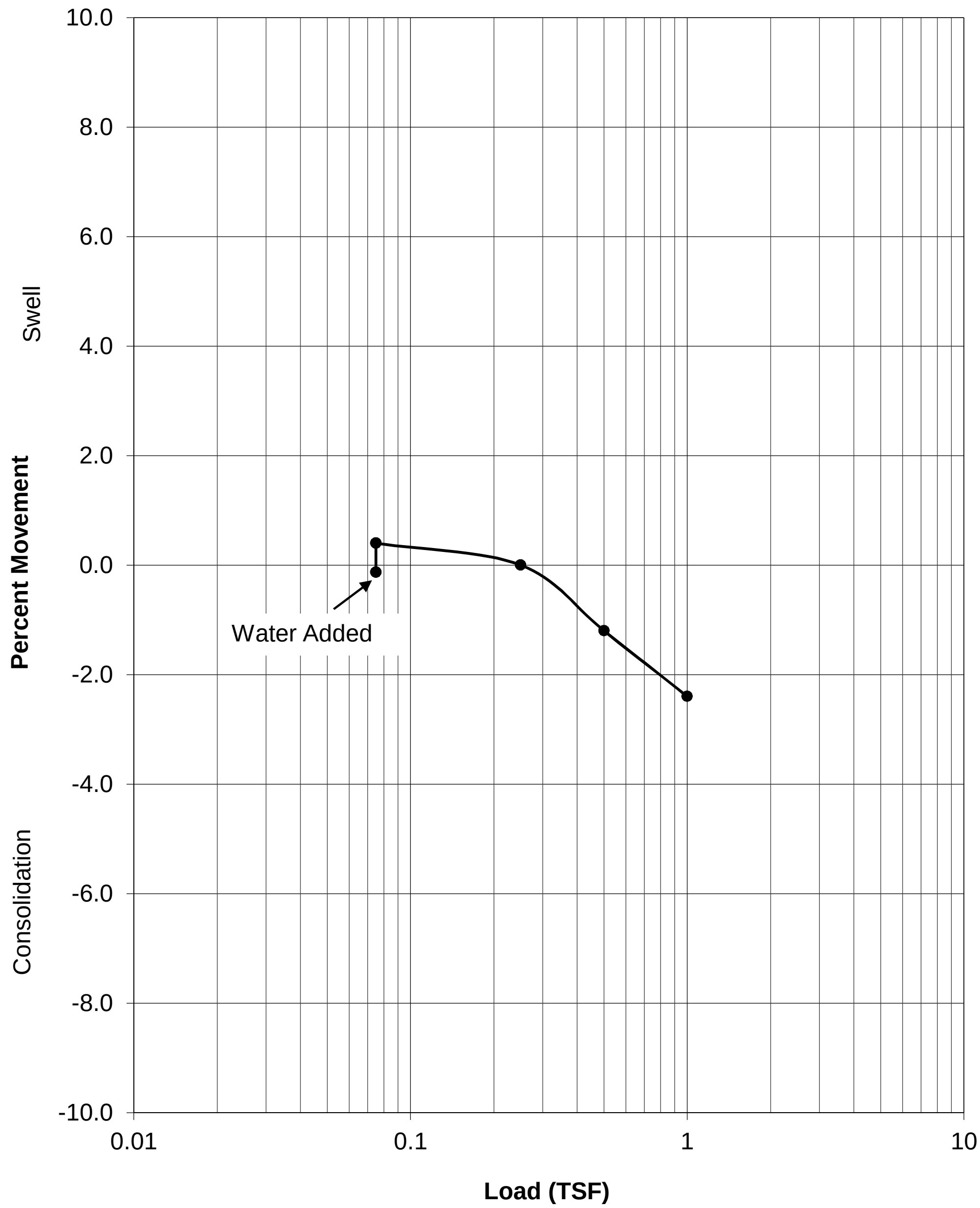
Material Description:	Brown SANDY LEAN CLAY (CL)	
Sample Location:	Boring 1, Sample 2, Depth 4'	
Liquid Limit: 42	Plasticity Index: 19	% Passing #200: 52.8%
Beginning Moisture: 19.4%	Dry Density: 100.9 pcf	Ending Moisture: 21.5%
Swell Pressure: <500 psf	% Swell @ 500: None	



Project: Rocky Mountain High School Pavement Evaluation
Fort Collins, Colorado
Project #: 1112073
Date: December 2011

SWELL / CONSOLIDATION TEST RESULTS

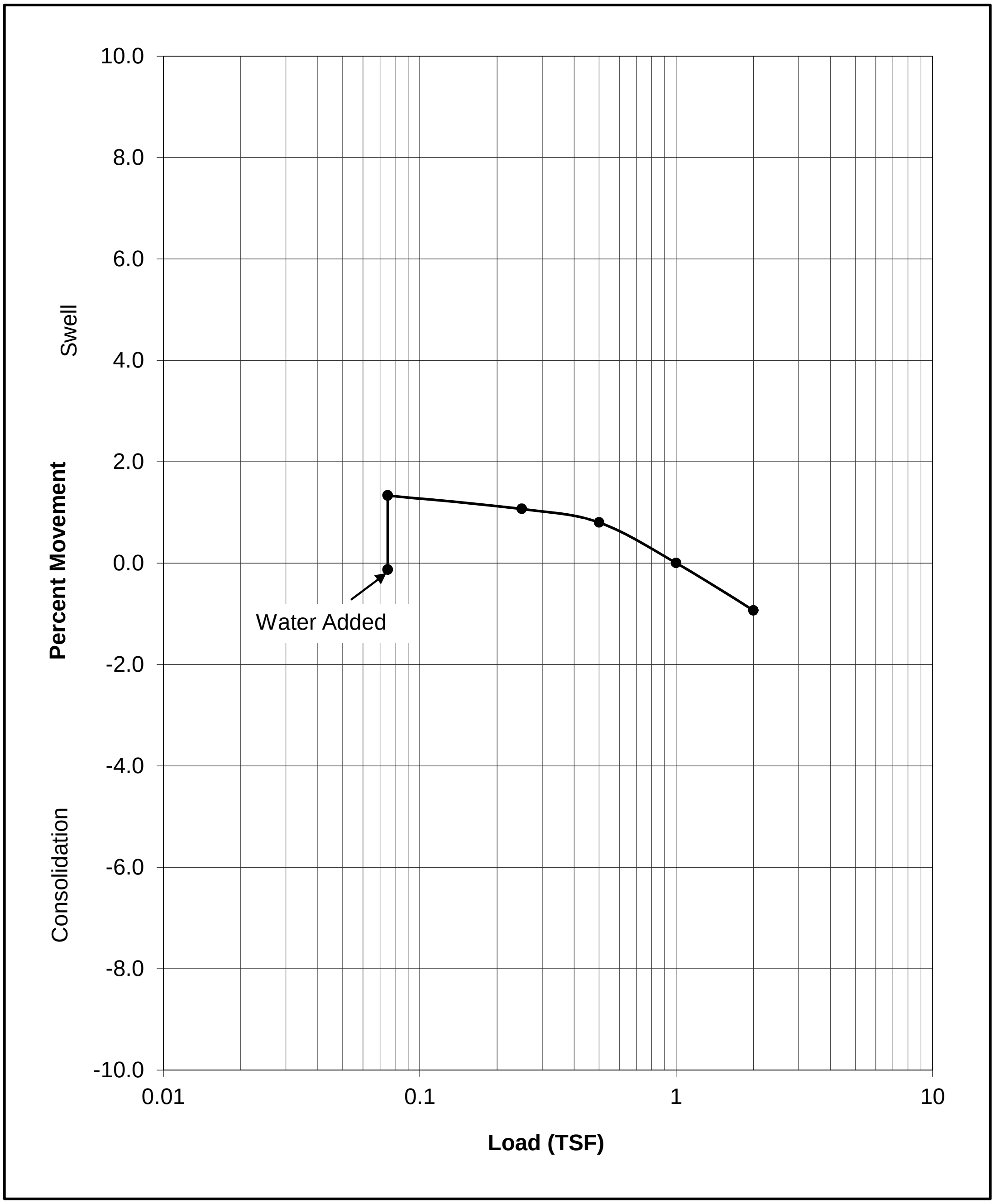
Material Description:	Brown LEAN CLAY with SAND (CL)	
Sample Location:	Boring 3, Sample 1, Depth 2'	
Liquid Limit: 42	Plasticity Index: 23	% Passing #200: 80.1%
Beginning Moisture: 19.6%	Dry Density: 107.2 pcf	Ending Moisture: 21.3%
Swell Pressure: 600 psf	% Swell @ 150: 0.5%	



Project: Rocky Mountain High School Pavement Evaluation
Fort Collins, Colorado
Project #: 1112073
Date: December 2011

SWELL / CONSOLIDATION TEST RESULTS

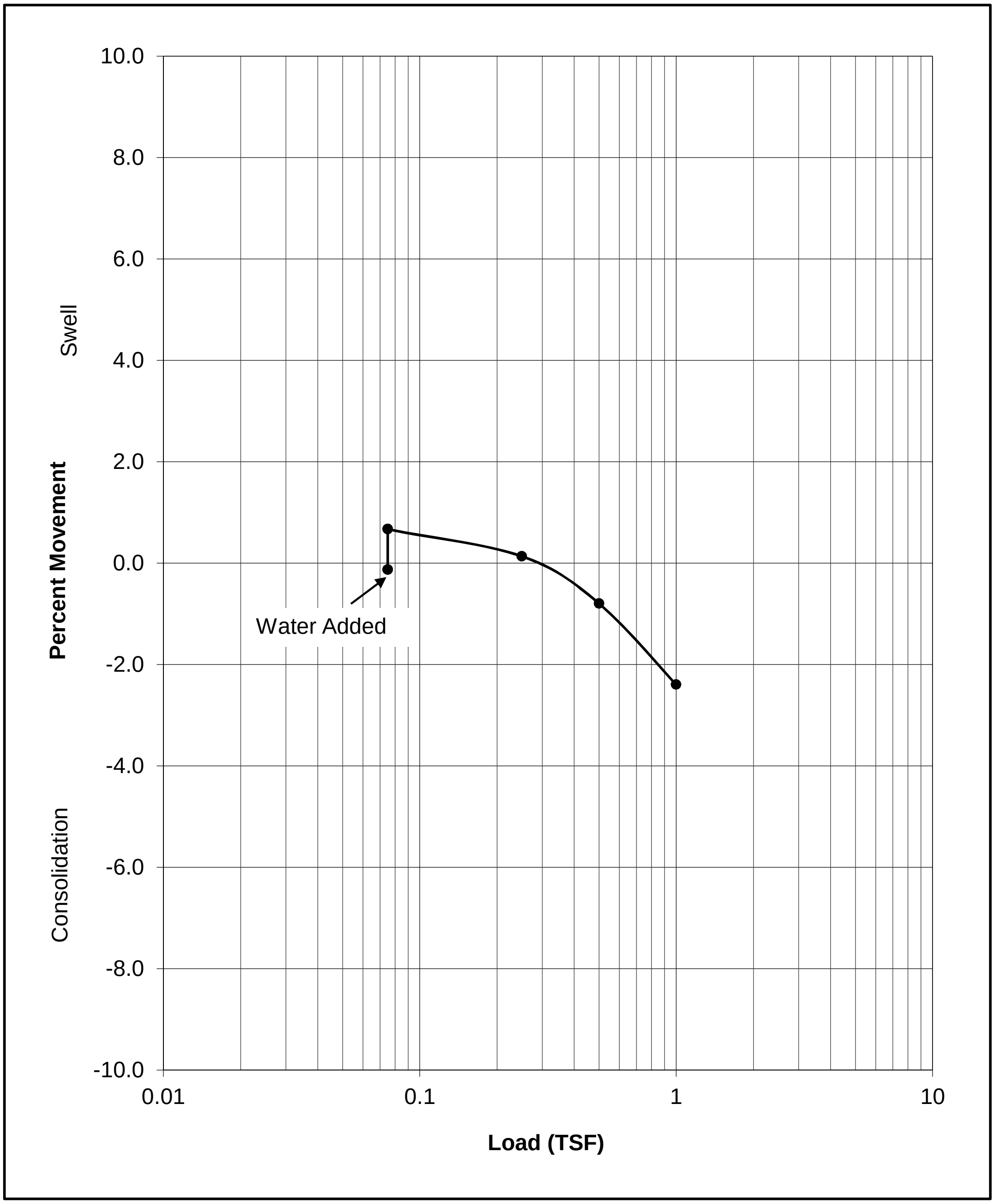
Material Description:	Brown / Dark Brown LEAN CLAY with SAND (CL)				
Sample Location:	Boring 5, Sample 1, Depth 2'				
Liquid Limit: 47	Plasticity Index: 27		% Passing #200: 80.5%		
Beginning Moisture: 18.1%		Dry Density: 109.7 pcf		Ending Moisture: 20.0%	
Swell Pressure: 2500 psf		% Swell @ 150: 1.5%			



Project: Rocky Mountain High School Pavement Evaluation
Fort Collins, Colorado
Project #: 1112073
Date: December 2011

SWELL / CONSOLIDATION TEST RESULTS

Material Description:	Brown LEAN CLAY with SAND (CL)		
Sample Location:	Boring 6, Sample 1, Depth 2'		
Liquid Limit: 45	Plasticity Index: 26	% Passing #200: 77.6%	
Beginning Moisture: 19.1%	Dry Density: 108.3 pcf	Ending Moisture: 21.6%	
Swell Pressure: 600 psf	% Swell @ 150: 0.8%		



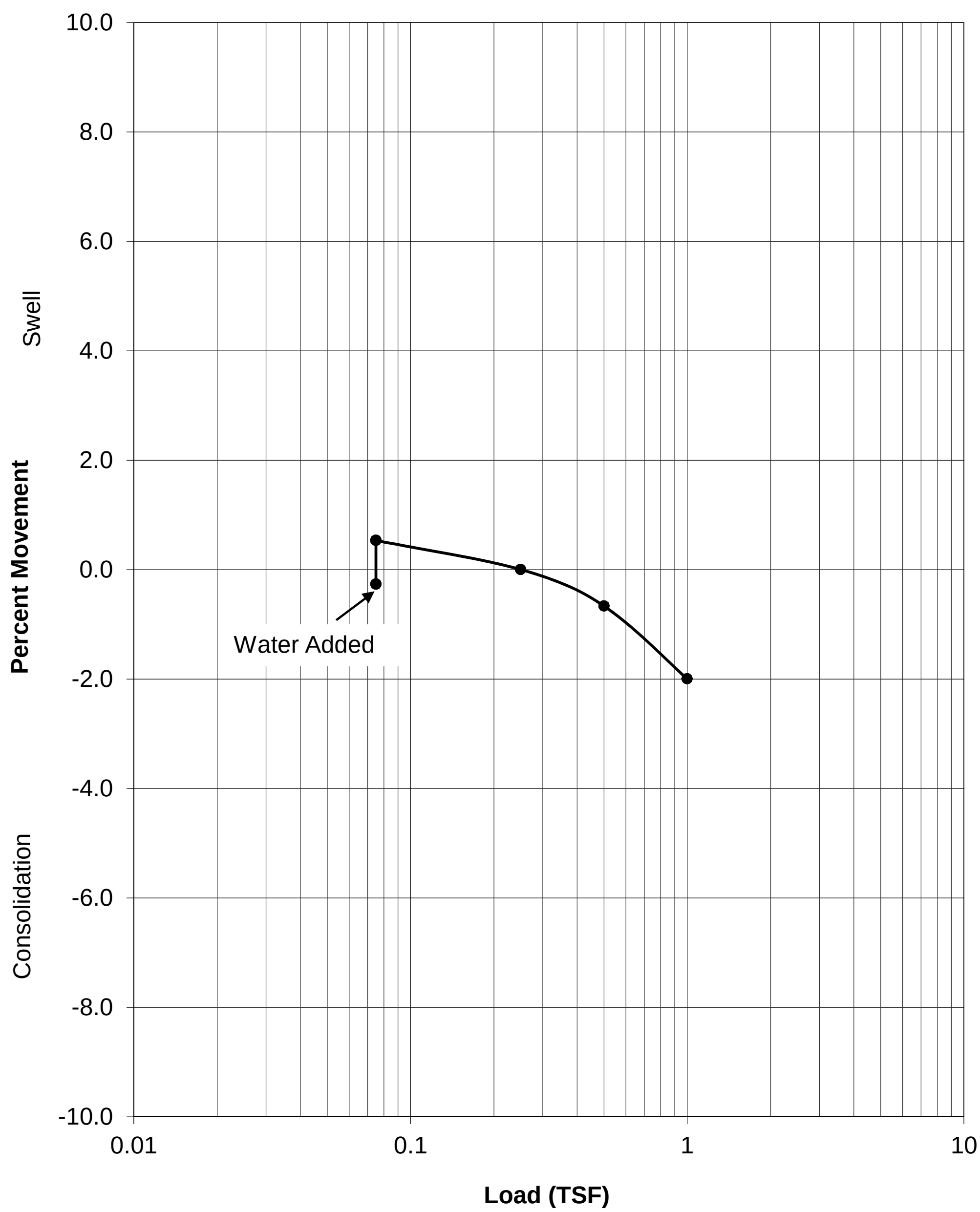
Project: Rocky Mountain High School Pavement Evaluation
Fort Collins, Colorado

Project #: 1112073

Date: December 2011

SWELL / CONSOLIDATION TEST RESULTS

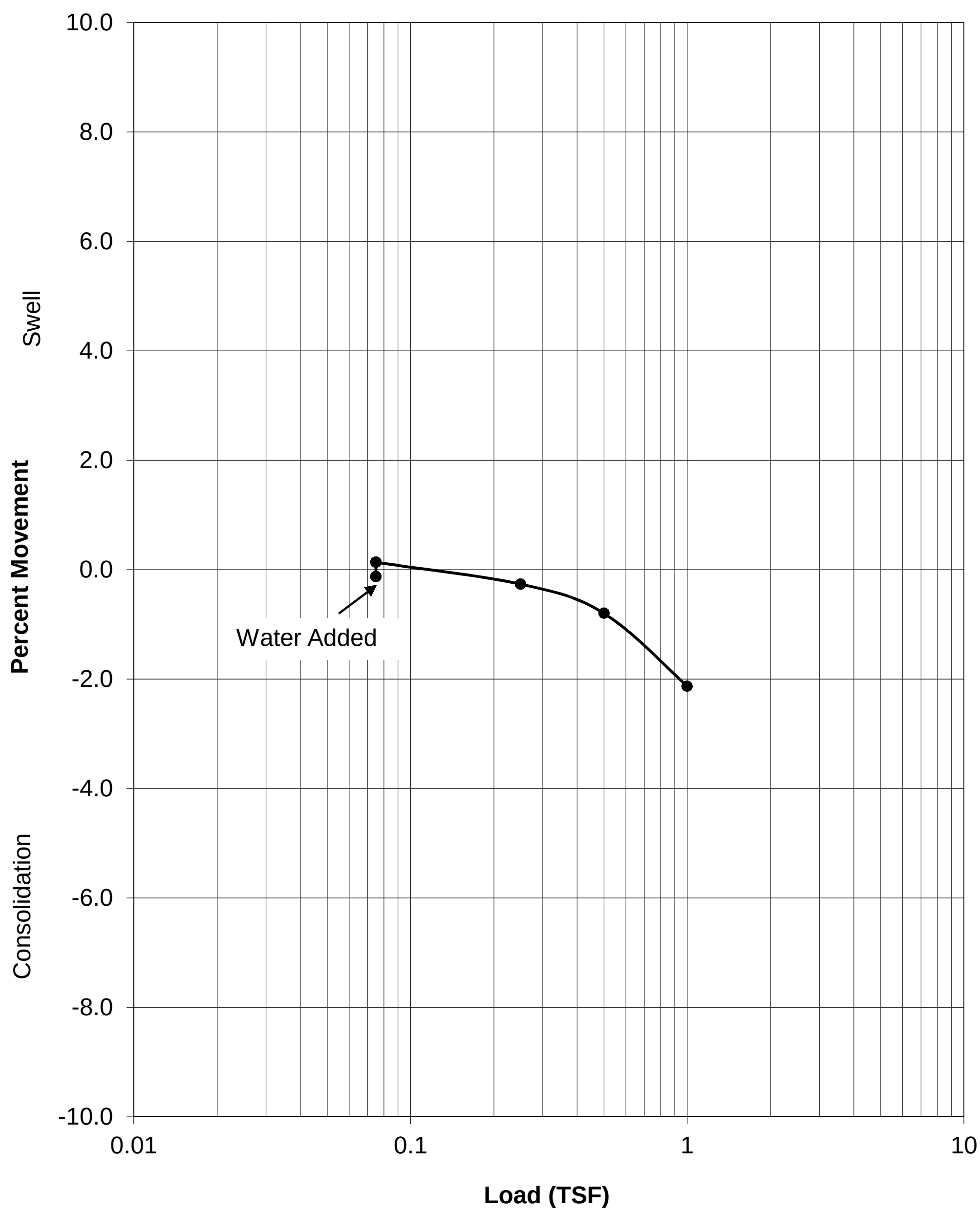
Material Description:	Brown SANDY LEAN CLAY (CL)	
Sample Location:	Boring 9, Sample 1, Depth 2'	
Liquid Limit: 43	Plasticity Index: 23	% Passing #200: 61.0%
Beginning Moisture: 17.7%	Dry Density: 110.5 pcf	Ending Moisture: 19.7%
Swell Pressure: 700 psf	% Swell @ 150: 0.8%	



Project: Rocky Mountain High School Pavement Evaluation
Fort Collins, Colorado
Project #: 1112073
Date: December 2011

SWELL / CONSOLIDATION TEST RESULTS

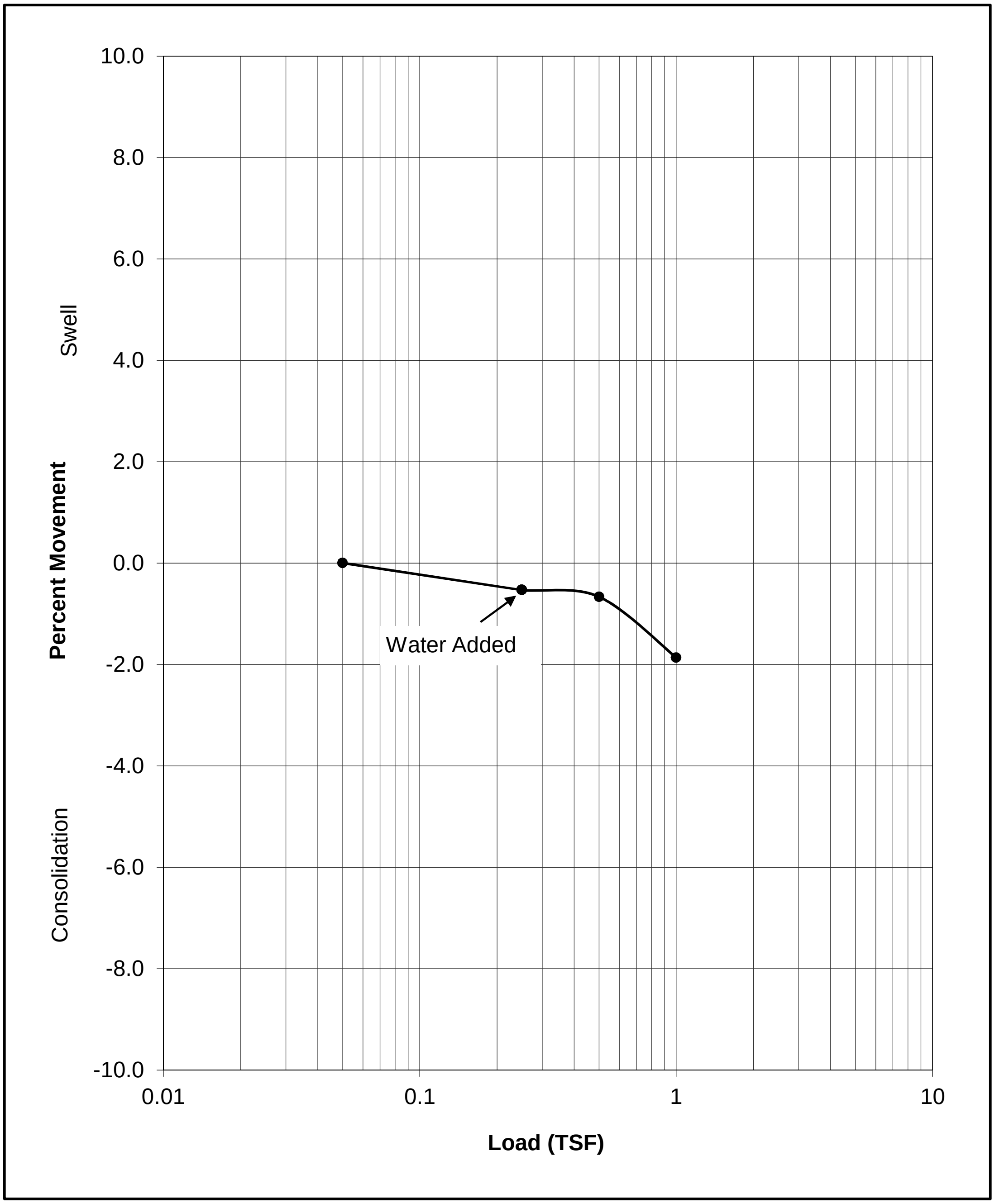
Material Description:	Dark Brown SANDY LEAN CLAY (CL)		
Sample Location:	Boring 10, Sample 1, Depth 2'		
Liquid Limit: 43	Plasticity Index: 19	% Passing #200: 69.1%	
Beginning Moisture: 22.5%	Dry Density: 103.1 pcf	Ending Moisture: 22.4%	
Swell Pressure: 400 psf	% Swell @ 150: 0.3%		



Project: Rocky Mountain High School Pavement Evaluation
Fort Collins, Colorado
Project #: 1112073
Date: December 2011

SWELL / CONSOLIDATION TEST RESULTS

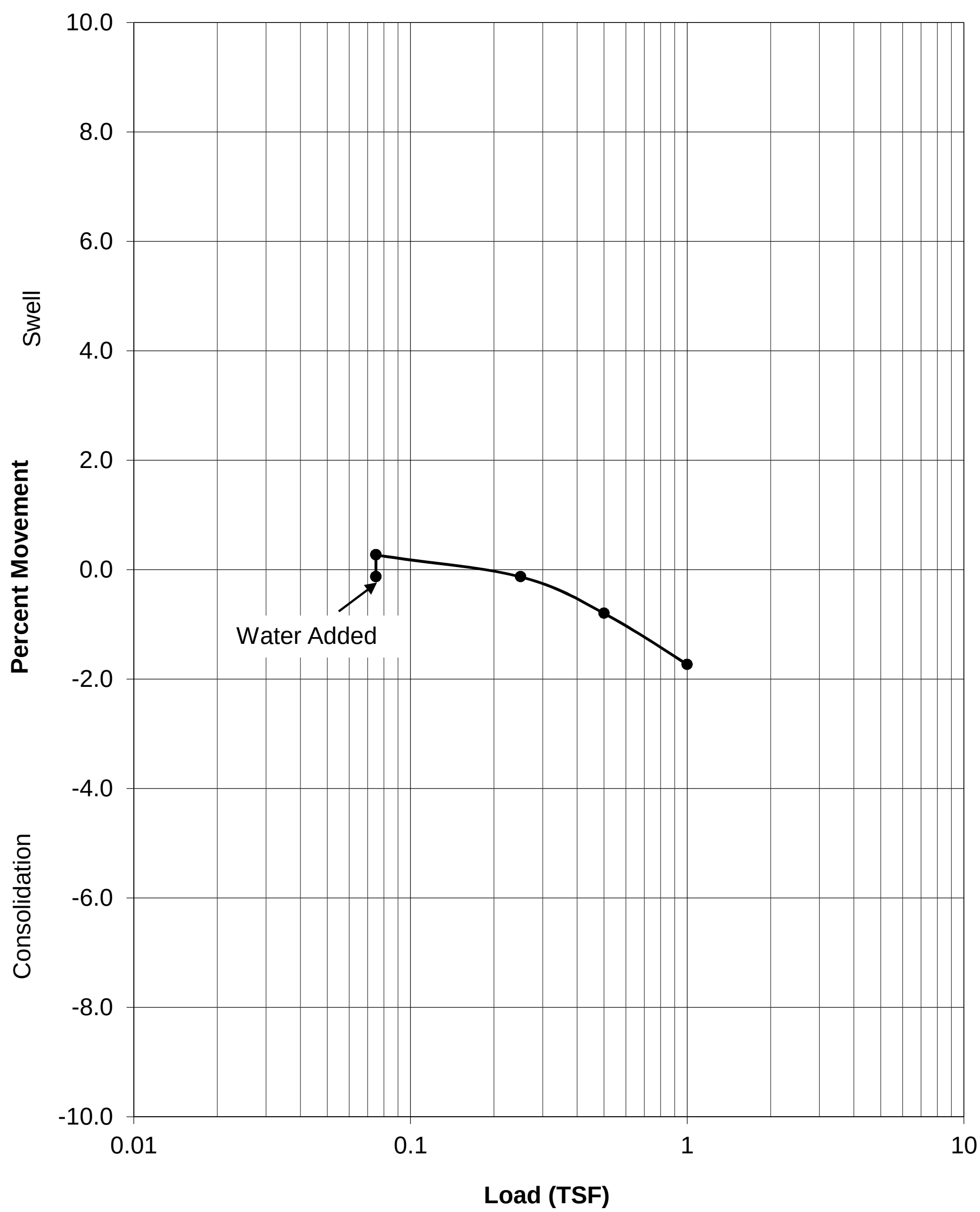
Material Description:	Brown SANDY LEAN CLAY (CL)	
Sample Location:	Boring 11, Sample 2, Depth 4'	
Liquid Limit: - -	Plasticity Index: - -	% Passing #200: - -
Beginning Moisture: 18.1%	Dry Density: 110.2 pcf	Ending Moisture: 18.1%
Swell Pressure: <500 psf	% Swell @ 500: None	



Project: Rocky Mountain High School Pavement Evaluation
Fort Collins, Colorado
Project #: 1112073
Date: December 2011

SWELL / CONSOLIDATION TEST RESULTS

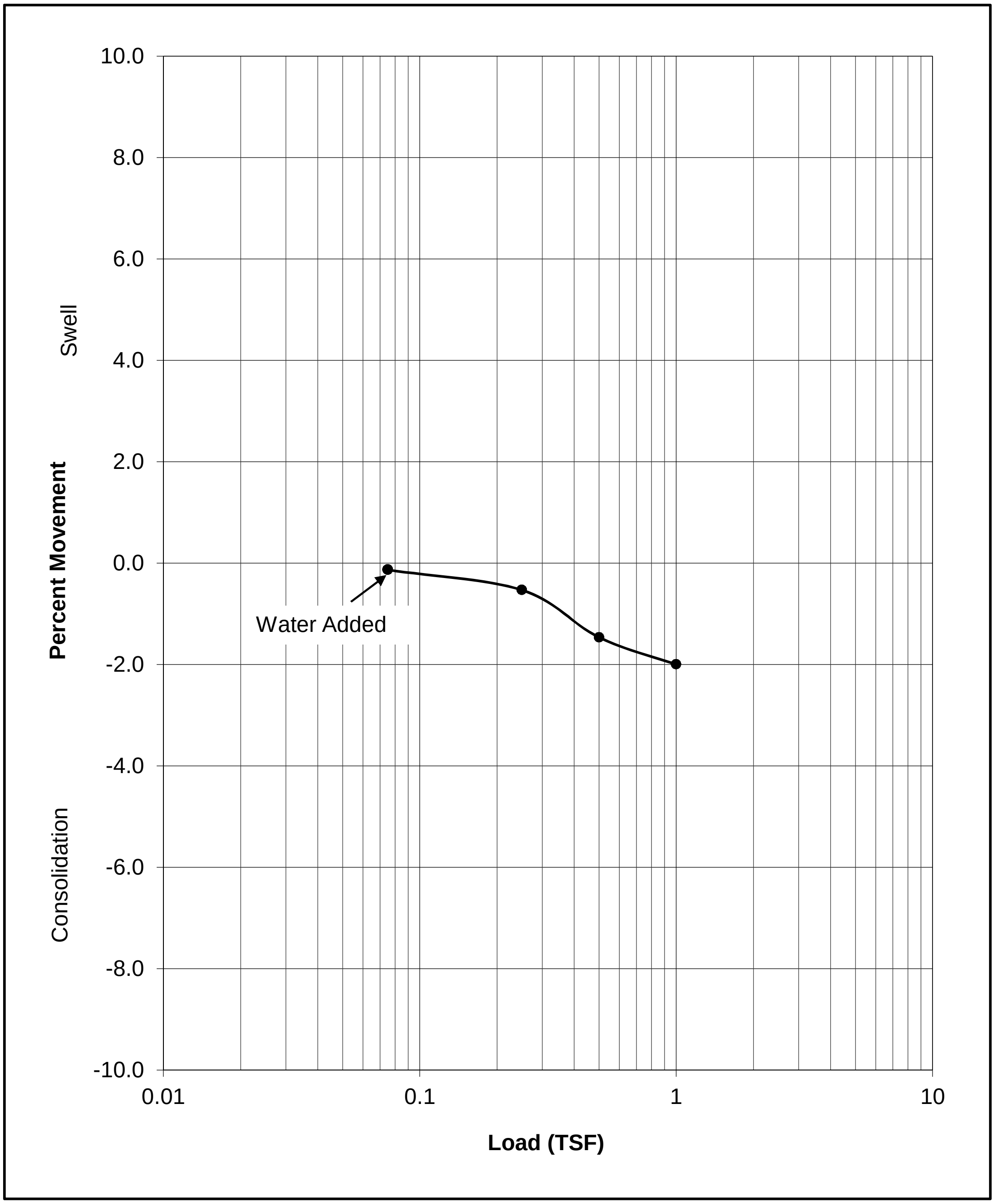
Material Description:	Brown SANDY LEAN CLAY (CL)			
Sample Location:	Boring 12, Sample 1, Depth 2'			
Liquid Limit: 40	Plasticity Index: 26		% Passing #200: 68.6%	
Beginning Moisture: 21.9%		Dry Density: 105.6 pcf		Ending Moisture: 19.6%
Swell Pressure: 500 psf		% Swell @ 150: 0.4%		



Project: Rocky Mountain High School Pavement Evaluation
Fort Collins, Colorado
Project #: 1112073
Date: December 2011

SWELL / CONSOLIDATION TEST RESULTS

Material Description:	Brown SANDY LEAN CLAY (CL)	
Sample Location:	Boring 14, Sample 2, Depth 4'	
Liquid Limit: - -	Plasticity Index: - -	% Passing #200: - -
Beginning Moisture: 4.6%	Dry Density: 124.4 pcf	Ending Moisture: 11.8%
Swell Pressure: <500 psf	% Swell @ 150: None	



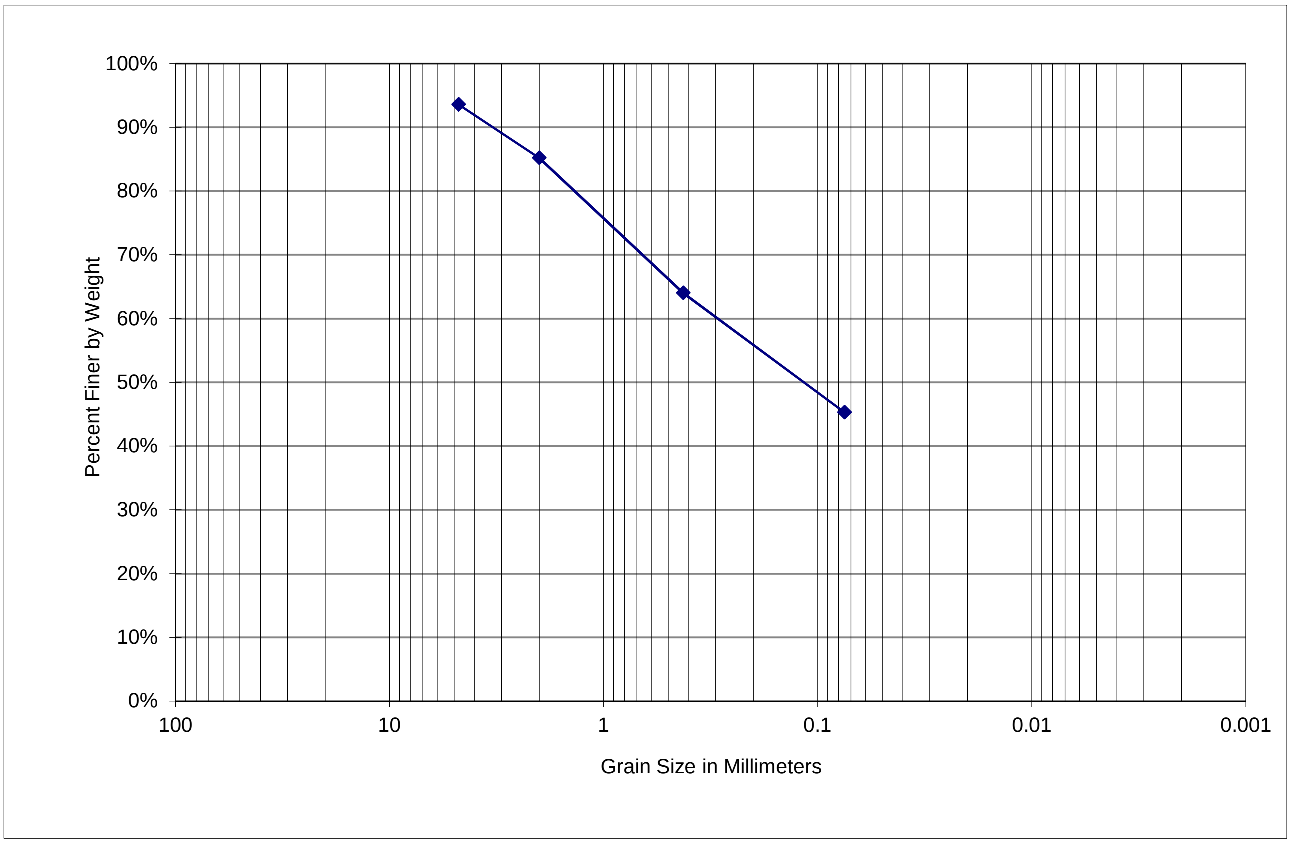
Project: Rocky Mountain High School Pavement Evaluation
Fort Collins, Colorado
Project #: 1112073
Date: December 2011

Earth Engineering Consultants, Inc.

Summary of Laboratory Classification

Sieve Size	Percent Passing
No. 4	94%
No. 10	85%
No. 40	64%
No. 200	45.3%

Atterberg Limits (ASTM D-4318)	
Liquid Limit:	34
Plastic Limit:	15
Plasticity Index:	19



Material Designation: Borings 1-5
Sample Location: Borings 1-5
Material Description: Composite

Project: Rocky Mountain High School
Fort Collins, Colorado
Project No: 1112073
Date December 2011

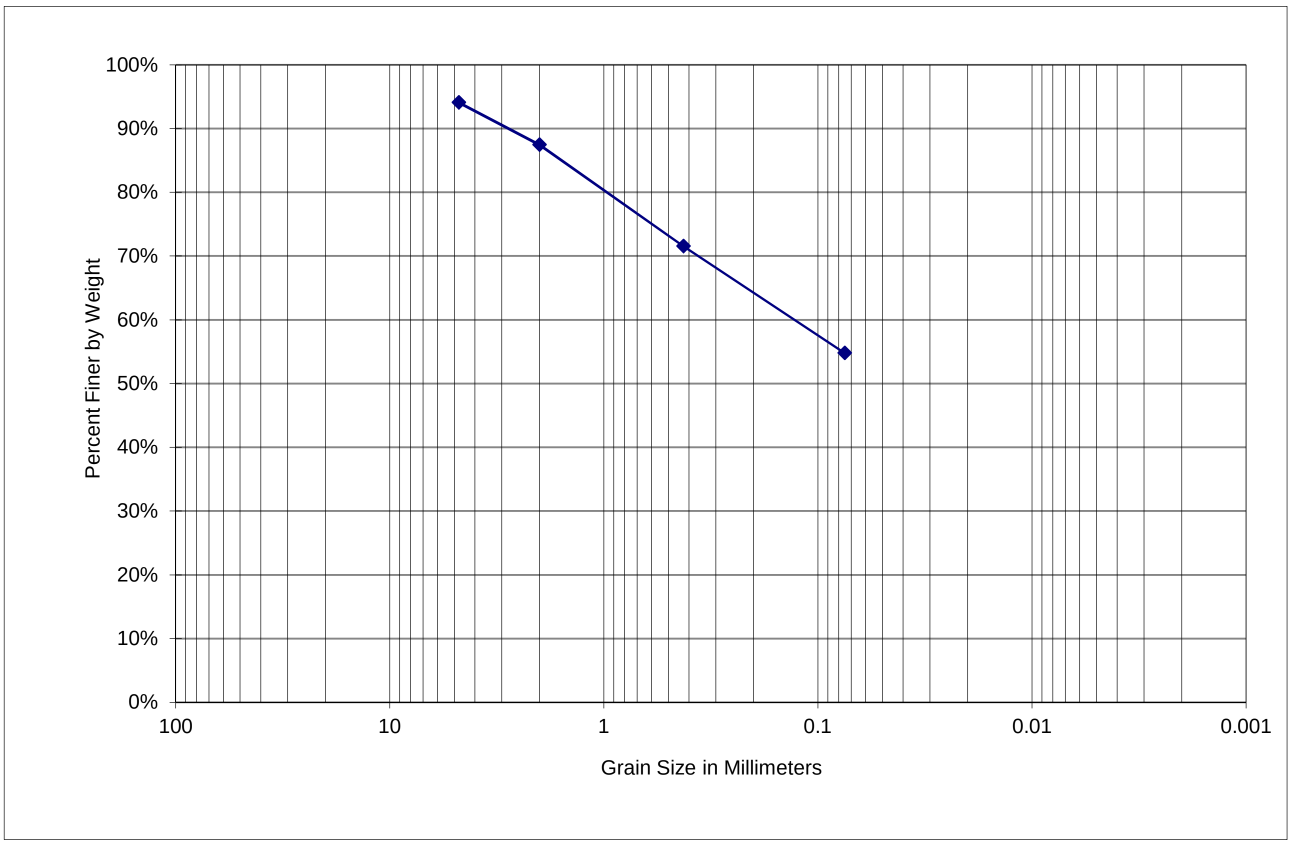
EEC

Earth Engineering Consultants, Inc.

Summary of Laboratory Classification

Sieve Size	Percent Passing
No. 4	94%
No. 10	87%
No. 40	72%
No. 200	54.8%

Atterberg Limits (ASTM D-4318)	
Liquid Limit:	41
Plastic Limit:	14
Plasticity Index:	27



Material Designation: Borings 8-11
Sample Location: Borings 8-11
Material Description: Composite

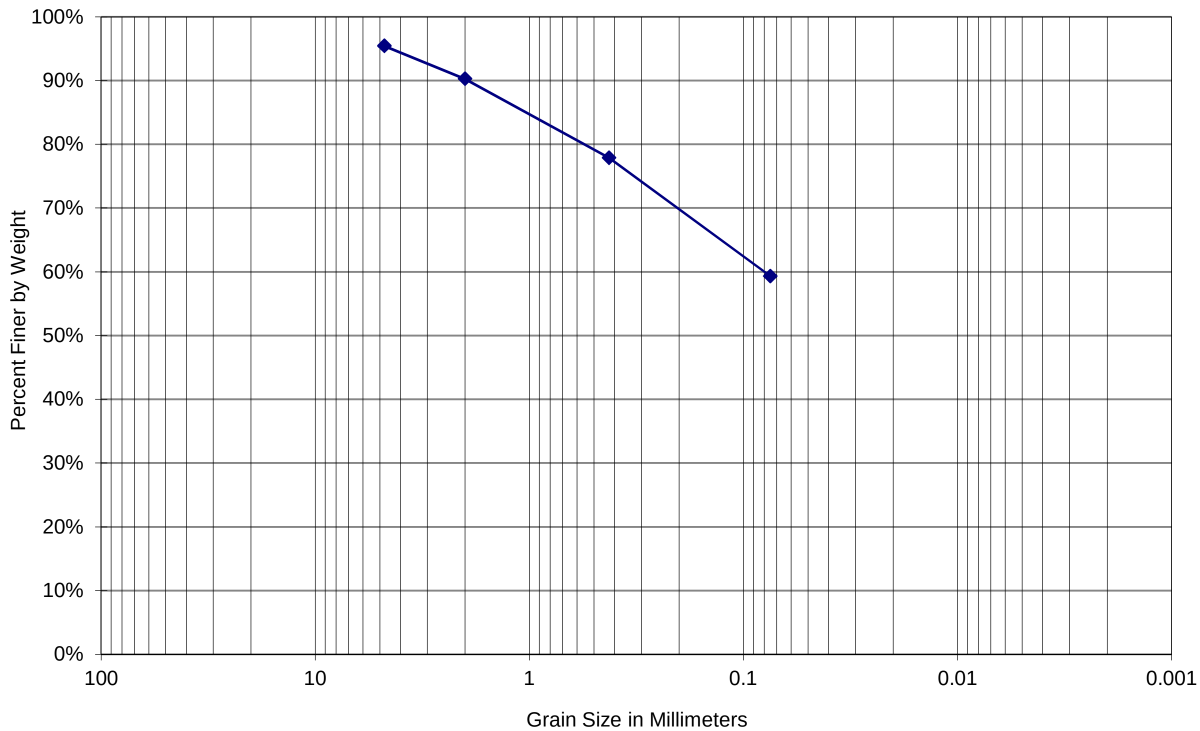
Project: Rocky Mountain High School
Fort Collins, Colorado
Project No: 1112073
Date December 2011

Earth Engineering Consultants, Inc.

Summary of Laboratory Classification

Sieve Size	Percent Passing
No. 4	95%
No. 10	90%
No. 40	78%
No. 200	59.3%

Atterberg Limits (ASTM D-4318)	
Liquid Limit:	41
Plastic Limit:	15
Plasticity Index:	27



Material Designation: Borings 12-14
Sample Location: Borings 12-14
Material Description: Composite

Project: Rocky Mountain High School
Fort Collins, Colorado
Project No: 1112073
Date December 2011

EEC

RESISTANCE R-VALUE & EXPANSION PRESSURE OF COMPACTED SOIL - ASTM D2844

PROJECT:	Rocky Mountain High School - Pavement Evaluation	**PROJECT NO.**	1112073
LOCATION:	1300 W. Swallow Road - Fort Collins, Colorado	**DATE**	Dec-11
MATERIAL DESCRIPTION:	Sandy Lean Clay (CL) - AASHTO A-6		
SAMPLE LOCATION:	Composite Subgrade Sample - Test Borings B-8 thru B-11 @ 1 - 4-feet		

LIQUID LIMIT:	41	**PLASTICITY INDEX:**	27	**%PASSING #200:**	55

R-VALUE LABORATORY TEST RESULTS

TEST SPECIMEN NO.	**1**	2	3
COMPACTION PRESSURE (PSI)	100	100	100
DENSITY (PCF)	109.5	112.1	113.2
MOISTURE CONTENT (%)	18.3	17.5	16.4
EXPANSION PRESSURE (PSI)	0.00	0.00	0.00
HORIZONTAL PRESSURE @ 160 PSI	146	141	136
SAMPLE HEIGHT (INCHES)	2.45	2.47	2.50
EXUDATION PRESSURE (PSI)	206.0	275.0	354.4
UNCORRECTED R-VALUE	6.2	8.3	11.5
CORRECTED R-VALUE	6.2	8.3	11.5

R-VALUE @ 300 PSI EXUDATION PRESSURE =	**9**	**RESILIENT MODULUS, PSI =**	**3,448**