

GARNER ENGINEERING PA

Soil and Foundation Study
Junior High School Addition
Stuttgart School District
Stuttgart, Arkansas

Report
To

STUTTGART SCHOOL DISTRICT
C/O LEWIS ARCHITECTS-ENGINEERS
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July 4, 2026

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To: Stuttgart School District
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From: Carl W Garner P.E.

Re: Soil and Foundation Study
Junior High School Addition
Stuttgart School District
Stuttgart, Arkansas



Summarized herein are the results of the subsurface investigation performed for the new Addition to the existing Stuttgart School District Junior High School. This study was based on the Lewis Architects-Engineers Site Plan A0.2 dated 6-15-2025 and subsequent Floor Plan A2.1 dated 6-30-2026. Preliminary structural criteria was provided by Greeson Gatlin Gangluff. A Site Grading Plan was not available for this report.

The approximately 5600 sq ft Addition will include three (3) Classrooms and a Saferoom of primarily masonry design with slab on grade. Foundation loads are expected to generally be light with moderate wall loads for the Saferoom. The Addition will extend from the south wall of the existing Junior High constructed in 2015-2016.

The primary purposes of the study were to:

- (A) Develop basic soil and foundation conditions in the area of the building Addition as well as develop subgrade soil conditions for the new drives and parking areas, and
- (B) Prepare conclusions and recommendations to aid in design and construction of safe and economical foundation and floor slab and new pavement structures as well as for site grading planning and construction.

In order to accomplish these purposes, the following study was conducted:

- Field investigation comprised of sample borings, a test pit and examination of existing building and site conditions including review of prior grading activity;

- Laboratory testing to evaluate basic engineering properties of the foundation and subgrade soils; and
- Preparation of an engineering report based on results of the field and laboratory studies and available site grading and structural criteria to include recommendations to aid in foundation and slab design, pavement structure design and related construction as well as site grading planning and performance.

GENERAL SITE FEATURES

The new, approximately 5600 sq. ft building will abut the south side of the existing building. The Addition will extend over an area previously graded for the existing building and drive. As a result of prior filling, existing grades in the Addition footprint were observed to slope down to the south. Specific topographic information was not available for this report. The new south parking area is relatively flat lying with grass cover.

From review of historical photographs and discussions with school personnel, a former building was removed from the south portion of the new south parking and drive. Specifics regarding the demolition activity were not available although it is likely that some remnant debris or uncontrolled fill may be present in the former building area. See Appendix A for Google historical photographs.

FIELD AND LABORATORY

The subsurface conditions in the new building area were investigated by two (2) auger sample borings and one (1) sample test pit. Three (3) auger sample borings were located in the new pavement areas. The approximate locations of the borings and test pit are shown on the Plan of Borings and Test Pit, Plate 1. The stratigraphy encountered and results of field and laboratory testing are presented on the Log of Boring and Log of Test Pit, Plates 2 through 6. A Key to Terms and Symbols is included as Plate 7.

The borings were performed with a track mounted rotary drill rig using continuous flight augers and Standard Penetration Test (SPT) procedures. The test pit was excavated with a mini-excavator. During the June 2026 field study, the grassy portion of the site was readily accessible due, in part, to extended dry conditions.

Representative samples of the soils were obtained via the SPT. N-values established by the automatic hammer assisted SPT are tabulated on the log forms in the Blows Per Foot (BPF) column. The estimated insitu cohesive shear strength of samples was obtained with a calibrated hand penetrometer. Cohesion estimates in Tons Per Sq. Ft (TSF) are plotted at appropriate depths on the logs as small circles filled with an X, ⊗, using the scale shown.

The natural soils encountered consist predominantly of clayey alluvial soil types. The surficial existing fill soils were clays. Therefore, soil strength characteristics were

established primarily from cohesion estimates obtained with the calibrated hand penetrometer.

To verify soil classification and establish basic volumetric stability characteristics i.e., shrink-swell, Atterberg Limits were performed in the laboratory. The Atterberg Limits are plotted on the logs using the scale shown in the upper right corner. Natural water content tests were performed to establish soil water content profiles for the borings and test pit. Natural water content results are also plotted on the log forms using the scale and symbols shown.

GENERAL SOIL CONDITIONS

Geologically, the site is underlain by Quaternary Age Terrace deposits of alluvial origin. The Quaternary Terrace units in the site vicinity consist predominantly of surficial soils of low to moderate plasticity silty clays and clays overlying deeper sand deposits. As noted, the native soils are capped locally by fill placed during prior construction.

The soil stratigraphy encountered in the borings and test pit may be generalized as follows. In Borings 1, 2 and 4, existing pavement consisting of 2 to 4 ins. of asphalt over 3 to 6 ins. of crushed stone base was present of the surface.

Existing Fill: In Borings 1 and 2 and Test Pit A, the soils encountered to depths of near 6 ft consisted of fill of variable type and engineering properties.

In Boring 1 the fill found to depths of about 5.5 ft consisted of very stiff grading with depth to stiff and firm reddish tan and gray silty clay and clay, CL, CH. Cohesion values ranged generally from 0.7 to over 1.2 TSF. However, local pockets of very moist to wet silty clay, CL, were encountered with cohesion near 0.5 TSF.

The fill found in Boring 2 and Test Pit A located near the east end of the Addition was firm to soft reddish tan with gray silty clays and clays, CL, CH. These fill soils possessed water contents at or near saturation with related cohesion values of 0.1 to 0.3 TSF and N-values of 1 and 2 BPF.

Stratum I: As noted, Boring 4 was located on existing asphalt pavement. The soils encountered below the pavement section consisted of about 1.5 ft of soft gray silty clay, CL, underlain by firm reddish brown and gray silty clay, CL, that extended to near 4 ft. These soils were moist to wet with cohesion near 0.1 to 0.4 and N-values of 1 to 4 BPF.

Stratum II: In Borings 3 and 5, located in an existing grassy area, the surficial soils consist of about 1.5 to 2 ft of brownish gray clayey silt, ML-CL. Grass/weed roots were present in the upper 4 to 6 ins. The soils possess low plasticity and moderate moisture sensitivity. Soil water contents were found to be significantly below the Plastic Limit. Cohesion estimates in these dry to desiccated soils were over 1.4 TSF. However, the cohesion values are considered to be apparent

and primarily a result of low water contents related to extended dry weather.

Stratum III: The Existing Fill, Strata I and II soils were underlain by very stiff some stiff brown, gray and tan silty clay, CL, was encountered to the 5.5 ft completion depths in Borings 3, 4 and 5 and to near 12 ft in deeper Borings 1 and 2. Apparent cohesive shear strengths typically exceeded 1.0 TSF with water contents below the Plastic Limits. This unit possesses generally low plasticity with pockets of moderately high plasticity clay subject to moderate shrink-swell with water content variation.

Stratum IV: The basal strata found in Borings 1 and 2 below depths of about 12 to 13 ft consisted generally of medium dense tan fine sand, SP. The sandy soils were dry with representative N-values ranging from about 10 to 12 BPF.

Perched groundwater was not encountered during the June 2026 field study. This condition is believed to represent typical static groundwater conditions on the site. However, as noted, the Existing Fill soils were generally moist or saturated notably in Boring 2 and Test Pit A. Permanent static groundwater is at great depth.

The surface and subsurface conditions considered to be of primary consequence to design and performance of the new building, parking areas and drives are:

- (a) The encountered presence of 5 to 6 ft of stiff clay Existing Fill in Borings 1, 2 and Test Pit A. These fill soils possessed high water contents with low strength, high compressibility and high moisture sensitivity. Additionally, the clayey soils exhibit high potential for loss of stability under construction equipment with seasonal or induced high water content increase;
- (b) The low strength of the clayey silt, ML-CL, Stratum I soils encountered below the existing parking area in Boring 4 and probable instability during pavement demolition and/or site grading;
- (c) The moderate moisture sensitivity of the surficial seasonally dry clayey silts, Stratum II, found in Borings 3 and 5 and potential for loss of stability during wetter seasons;
- (d) The high strength and low moisture sensitivity, but generally low to locally moderate shrink-swell potential inherent to the silty clay, CL, trace CH, Stratum III. These soils were encountered at depths of about 2 to 6 ft below existing grade across the project area extending to near 12 ft or more;
- (e) The possible development of limited, and localized, wet season perched groundwater and saturation in the Existing Fill and/or Stratum I; and
- (f) The possible presence of remnant debris or loose or unsuitable fill in the area of the former building demolition in the south-central portion of the new drive and parking.

The interaction of these soil conditions as well as other site factors, project schedule and site grading requirements were paramount to development of subsequent conclusions and recommendations.

CONCLUSIONS/RECOMMENDATIONS

General

The new Addition area contains, in part, the existing building canopy and asphalt pavement with curbs and related utilities that will be removed. The south portion of the footprint is grass covered. The existing grades in the building area vary from El 212 to 213. Planned new Finish Floor is set at El 214.05. Grading from existing grades, would involve less than about 1.5 ft of new Select Fill for the planned FFE.

Site grading for the existing Junior High building included the recommendation for undercutting the upper soils to provide at least 5 ft of Select Fill beneath the floor slab and at least 2 ft below the footings. See General Notes in Appendix B. The Existing Fill found in Borings 1 and 2 and Test Pit A was apparently placed to accommodate the General Notes. Based on discussions with school personnel, it is understood that the existing building slab on grade has experienced some post construction movement.

As noted, elements of the existing structure and pavement will be removed. This demolition may significantly impact the condition of the clayey Existing Fill soils, especially during wetter seasons. Consequently, the moisture sensitive silty clay Existing Fill in the building area as well as Stratum I in the new pavement areas should be undercut and replaced in strict accordance with procedures outlined in Special Subgrade Preparation and Site Grading sections of this report.

Special Subgrade Preparation

Since the Existing Fill encountered in Borings 1 and 2 and Test Pit A exhibited low strength and moderate compressibility, undercut and replacement is recommended. Specially, undercut to depths on the order of 5 to 6 ft should be anticipated in the building area to expose the underlying stiff/very stiff silty clay, Stratum III. Replacement Select Fill should be the type and compaction outlined in Site Grading.

Weak clayey silt/silty clay, ML-CL, Stratum I soils were encountered in Boring 4 in the planned new pavement and drive area. Additionally, stiff dry clayey silt, ML-CL, soils were present to depths of 1.5 to 2 ft in Borings 3 and 5 also in planned new pavement areas. Due to the moisture sensitivity of the Strata I and II soils, selective and general undercut and replacement will be required for the new parking and drives. It is anticipated that wet season undercut depths on the order of 2 to 4 ft would be required in the pavement areas.

As is typical, the depth and area of undercut will be dependent, in part, upon weather i.e., wet or dry, and drying conditions existing at the time of site grading. It is

recommended that a unit price allowance for undercut and replacement of weak, unstable and/or unsuitable should be included in the base bid. The following undercut quantities cross section basis (CSB) were estimated for wet season conditions.

- Building Area - 1800 cu yds cross section basis
- Pavement Areas - 3100 cu yds cross section basis

The actual area and depth of undercut/replacement must be determined after demolition activity and prior to site grading. Final payment quantities should be computed from field measurements before undercut and prior to infilling.

Foundation Considerations

The selection and design of an appropriate foundation system for the structure must include consideration of both soil shear strength and volumetric stability factors. It is understood that maximum Saferoom wall loads may be on the order of 3000 lbs. per ln. ft. Lateral and uplift loads were not available. Based on foundation soil conditions encountered, site grading per Special Subgrade Preparation and preliminary structural criteria, it is concluded that the structure may be founded on shallow spread footings. The spread footing system should be supported on Select Fill placed and compacted per Site Grading criteria.

The structure may be supported on individual and continuous spread footings with a slab on grade. Individual and continuous footings should be founded at a depth of at least 2 ft below finish exterior grade. Footings founded on Select Fill may be sized for net allowable soil bearing pressures of 2800 and 2400 lbs. per sq. ft, (PSF) respectively under the maximum combination of DL, LL, WL and Seismic. A minimum footing dimension of 24 ins. is however recommended. Lateral load resistance may be calculated using a footing base sliding coefficient of 0.35.

With proper subgrade preparation and new fill placement, a slab on fill integral with the foundation elements should be appropriate for the structure. A minimum 4 in. layer of clean, free draining stone or gravel should be provided as a capillary barrier below the slab. The floor slab design may be based on a subgrade modulus value of 120 PCI with the granular fill/Select Fill system. A positive vapor barrier membrane such as 10 mil Visqueen should be placed between the slab and stone fill. More extensive moisture control procedures may be warranted in areas of moisture sensitive floor coverings.

Control joints should be provided in general accordance with ACI suggested practice or as dictated by slab geometry. A saw cut depth of at least 30 percent of the slab thickness is recommended.

The allowable bearing pressures should provide a factor of safety on the order of 3.0 with respect to strength properties of the compacted Select Fill. Based on conditions encountered in the borings and proper implementation of procedures and criteria outlined

in Site Grading it is opined that total post construction settlement or shrink-swell related movement should be less than 0.5 ins. and differential movement of less than about 0.5 ins.

Seismic Criteria

As per Arkansas Act 1100, Arkansas County is located within Seismic Zone 2 “area of moderate anticipated seismic damage.” Based on conditions encountered on the site and other geotechnical criteria available, it is concluded that the structures may be designed using a Soil Profile Type S 1. For the profile type a seismic Site Coefficient (S) of 1.0 is considered appropriate. Liquefaction potential is considered to be negligible for the clayey and underlying sandy foundation soils. As outlined in Act 1100 1991, structural design may be based on an Effective Peak Velocity Related Acceleration (A_v) of 0.20. More specifically, Seismic Values $A_v = 0.11$ and $A_a = 0.08$, as provided by Arkansas SBS may be applied.

For seismic analysis under current AFPC criteria, Site Class C is recommended.

Pavement Design

New Parking and Drives will be located south of the Addition in part over areas of existing pavement that will be removed. Existing surficial soils, Strata I and II, in the pavement areas were found to generally exhibit moderate to high moisture sensitivity. Accordingly, the potential for undercut of subgrade soil as outlined in Special Subgrade Preparation is considered to be moderate to high in wetter seasons. At the time of the June 2026 field investigation, the Stratum II surface soils exhibited high apparent strength due to the dry conditions. However, these soils are subject to loss of strength and stability during wetter seasons. It is recommended that the condition of Strata I and II soils be specifically evaluated during demolition and at the time of site grading.

With proper undercut/replacement of weak, moisture sensitive silty soils per Special Subgrade Preparation and Site Grading or verification of suitable support of the existing clayey silts, ML-CL, and silty clay, CL, pavement design may be based on a Subgrade Modulus, k , of 100 pci, and CBR of 6.

It is understood that as presently planned, asphalt pavement will be utilized for the drives and light duty parking. The drives will be subject to bus traffic as well as low volume medium duty delivery trucks and trash service vehicle traffic. New parking will be subject primarily to passenger vehicles.

The following asphalt pavement designs were developed on the basis of Select Fill or natural soils consisting of stiff silty clay, sandy clay, CL, exhibiting a CBR of at least 6. It is recommended that at least 12 ins. of Select Fill or approved Strata II or III soils be provided below the pavement sections. The designs are also based on positive surface and subsurface drainage away from the completed pavement.

Component	Thickness
Light Duty Traffic	
Hot-mixed Asphaltic Concrete, or approved ArDOT mix	: 2 ins.
Crushed Stone Base ArDOT Class 7	: 7 ins. compacted to 96 percent Modified Compaction ASTM D 1557
Subgrade	: 12 ins. Select Fill compacted to 92 percent Modified ASTM D 1557 or existing subgrade approved by proofrolling
Medium Duty Truck Drives	
Hot-mixed Asphaltic Concrete, or approved ArDOT mix	: 3 ins.
Crushed Stone Base ArDOT Class 7	: 8 ins. compacted to 96 percent Modified Compaction ASTM D 1557
Subgrade	: 12 ins. Select Fill compacted to 92 percent Modified ASTM D 1557 or existing subgrade approved by proofrolling

Concrete pavement is recommended for dumpster service vehicle drives and maneuvering areas as follows:

- 6 ins. PCCP $f_c = 4000$ psi with dowel baskets and 18 ins dowels on 15 ins. centers with 3 – 5 % entrained air
- 4 ins. ArDOT Class 7 crushed stone base minimum

In the event a heavy-duty asphalt drive is to be provided, specific design recommendations will be provided.

Crushed stone base should meet ArDOT Class 7 criteria. Base course should be compacted to at least 96 percent of maximum Modified Proctor ASTM D 1557 unit dry weight. Asphalt surface course should be compacted per ArDOT criteria.

Site Grading

As noted, the surface soils over most of the site are moisture sensitive or locally weak, Existing Fill and Strata I and II, ML-CL. The location and extent of the Existing Fill should be established by observations during construction or by proofrolling with a minimum 20,000 lb. pneumatic-tired roller, loaded dump truck, or similar equipment. As noted, due to the silty nature and high seasonal variability, the Existing Fill and selected Strata I and II soils designated by the Soils Engineer should be removed per Special Subgrade Preparation.

On-site evaluation of actual soil conditions should be performed by the Geotechnical Engineer after demolition and prior to and/or during initial stages of grading. Final decisions on undercutting of existing weak natural soils should be determined on the basis of this evaluation.

Fill, required for backfill or to establish finish grade for the building and pavement areas should consist of select sandy clay, CL/clayey sand, SC, having a Liquid Limit less than 40, and a Plasticity Index of less than 20. In addition, the Select Fill should exhibit a low mass permeability on the order of 10^{-5} cm/sec or less to reduce infiltration. Fill soils should be specifically approved by the Soils Engineer.

Select Fill within the building area should be compacted to at least 95 percent of maximum Modified Proctor dry density (ASTM D-1557) and at least 92 percent in other areas. Placement and compaction should be performed within a water content range of minus 1 to plus 3 percent of Optimum Water Content. Lift thickness should typically be less than 8 ins. or as dictated by compaction equipment type and size.

CONSTRUCTION PROCEDURES

The Existing Fill and Stratum I soils were found to be weak and highly moisture sensitive. Additionally, the Stratum II clayey silt soils encountered to depths of about 1.5 to 2 ft below existing grade in Borings 3 and 5 are subject to strength loss with saturation and may develop pumping and rutting under heavy wheel load equipment during wet seasons, thus increasing construction difficulties. Therefore, we recommend that site grading and also foundation installation be conducted during drier seasons of the year, if possible.

Positive surface drainage should be established and maintained at the site to reduce potential difficulties. Temporary surface drainage improvements should be provided around the site as required to prevent ponding. If construction is initiated during wetter seasons of the year, saturated soils and minor perched groundwater should be anticipated, particularly in the south portion of the site.

Undercutting and excavations for shallow spread footings should be accomplished with conventional excavation equipment with smooth bucket. Prolonged exposure or inundation may result in significant changes in strength, compressibility and volumetric change characteristics of the soil. Therefore, foundation excavations, steel placement, and forming must be completed promptly to reduce the possibility of changes in conditions. Foundation strata disturbed due to exposure or saturation should be undercut to unaltered strata.

Undercut of Existing Fill will require removal along and potentially below existing building footings. Consequently, the Contractor is solely responsible for specific undercut planning for protection of existing footings. Consideration must be given to the potential for Existing Fill sloughing below existing footings. The use of incremental undercut along the building with expeditious infilling with Select Fill must be a priority.

It should be restated that the area of former building demolition extends into the new south parking and uncontrolled filling may be present requiring selective deeper undercut. Supplemental recommendations may be required for grading in the area of the former building.

Site grading work and foundation installation should be monitored by the Soils Engineer or representative. Subsurface conditions significantly at variance with those encountered in the borings, particularly in areas of Existing Fill, should be brought to the attention of the Soils Engineer and work delayed pending evaluation and/or preparation of additional recommendations, if warranted.

The following illustrations are attached and complete this report:

Plan of Borings and Test Pit	Plate 1
Log of Boring	Plates 2 through 5
Log of Test Pit	Plate 6
Key to Terms and Symbols	Plate 7
Historical Photographs	Appendix A
General Notes from Existing Building Construction	Appendix B

We have appreciated the opportunity to be of service to you on this project. If we may be of additional assistance during final design or construction, please contact us.

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