



February 18, 2020

Gale Homes II, Inc.
400 SW Longview Blvd, Suite 210
Lee's Summit MO 64081

Re: 208 NW Carson Drive
Lot 1453, Winterset Valley
Lee's Summit Permit #20200246

Apex Engineers, Inc. observed the site located at the address above. The sub-grade bearing conditions were evaluated.

Subgrade

The excavation terminates on original limestone. Handheld pocket penetrometer readings were in excess of 4000 psf. In addition, probing the exposed sub-grade with an engineer's t-rod resulted in relatively hard resistance and no soft spots were encountered.

Based on the observations during our firm's on-site visit, the current conditions of the native sub-grade material exposed at the base of the proposed footing elevation appears to be capable of supporting an allowable bearing capacity of 2000 psf subject to the "Recommendations" and "Limitations" given in this report.

Due to the high bearing capacity of the limestone, the footing thickness may be reduced to 6" for high points in the limestone.

Frost Footing

The walk-out portion of the foundation was not able to achieve 36" in depth due to a solid limestone shelf. Using the limestone for frost protection is in compliance with IRC 2003/2006 Section R403.1.4.1.

Our firm recommends placing the frost trench portion of the foundation directly on the limestone shelf. Drill 24" long #4 bars a minimum of 5" into the limestone shelf every 36" on center and bend into the footing. Limestone is not susceptible to frost heave; therefore, the combination of the limestone shelf and concrete footing will provide the needed frost protection. The remaining thin clay seems are encapsulated and do not pose a frost heave risk.

Please call if our firm can be of further assistance.

RECOMMENDATIONS

The surface drainage must be designed to effectively move water away from the home and to prevent ponding. Poor drainage near a structure can also contribute to settlement problems. The failure to control drainage can result in the saturation and weakening of the surrounding soil causing settlement. A proper drain system, consisting of a drain tile draining

to daylight and/or sump pit and pump (where applicable), shall be installed and maintained to properly move water away from beneath the structure. The drain tile shall drain to a centralized location where water can be removed by a properly sized sump pump and pit, or, shall adequately drain to daylight. The drain tile shall also be installed at the base of the footing level, wrapped with a proper filter fabric, and covered with a minimum of 12" of $\frac{3}{4}$ " (minimum) clean gravel. It is also recommended, unless otherwise noted, that all slabs be placed on a minimum 4" granular base consisting of $\frac{3}{4}$ " (minimum) clean gravel (do NOT use crushed rock, AB-3, or equal). A build-up of water beneath the foundation can cause heaving of the foundation (pier pads) and basement slab resulting in sheet rock cracks and damage to the structure.

Due to the unpredictable nature of expansive clay soils, no guarantees can be made as to if and when future movement may occur. However, precautionary measures can be taken. Poor drainage increases the stresses on foundation walls, and therefore, a proper grade must be maintained away from the foundation. A positive slope of 1 inch per foot drop for 6 to 10 feet away from the house is required. Rain gutters and downspouts with extensions should be installed to direct water safe distances away from the house and from existing structures that could be adversely affected. Proper watering of the foundation system should also be maintained throughout the year, especially during extremely dry periods. In addition, all permanent slopes should be no steeper than 3:1 (horizontal to vertical) to help ensure their future stability and the accommodation of normal mowing equipment.

Apex Engineers, Inc. cannot be held responsible for the impact and/or damages caused to the structure if the aforementioned recommendations are not followed and maintained.

LIMITATIONS

The scope of our services was only to visually observe and report the existing bearing conditions (capacity only) beneath the foundation elements for the new home. When making visual observations, it should be clearly understood that certain assumptions must be made regarding the existing conditions without the aid of drilling and/or testing, which could reveal additional information that could change the recommendations and conclusions given in this report. No evaluation of slope stability, foundation wall backfill, slab-on-grade support, pavements, retaining wall structures or the suitability of any material removed from the basement excavation for any particular purpose was made unless specifically addressed herein. As a result, Apex Engineers, Inc. cannot be held responsible for the impact of those conditions on the project or future performance of the structure. Finally, a standard footing inspection should be made to verify the actual bearing conditions prior to the placement of reinforcing steel and concrete.

Shrink, swell characteristics are inherent with all clay soils and can adversely affect or jeopardize the performance of the foundation system. Apex Engineers, Inc. has not been retained to evaluate the potential expansive properties of any existing bearing material(s). Apex Engineers, Inc.'s services are not insurance, nor can it guarantee or predict future movement caused by the natural movement attributed to the shrinking and swelling of clay sub soils. Therefore, Apex Engineers, Inc. cannot be held responsible for future movement and/or damage to the structure associated with such movement (including, but not limited to, foundations elements supported by continuous strip footings, isolated pier pads, or drilled piers). The contractor shall retain sole liability and responsibility for the quality of work, for

adhering to plans, specifications, appropriate codes, and for repairing defects, deficiencies, or damages regardless of cause and/or when they are found. Apex Engineers, Inc. has performed our services in a manner consistent with the standard of care and skill ordinarily exercised by firms of our type practicing under similar conditions at this time and locality.

To the fullest extent permitted and allowed by law, Apex Engineers, Inc.'s client shall indemnify and hold harmless Apex Engineers, Inc., his or her owners, partners, officers, directors, employees, agents and sub-consultants from and against all damage, liability and costs, including reasonable attorney's fees and cost of defense, to the extent caused by the performance of the services under this report, excepting only those damages, liabilities or costs attributable to the sole negligence or willful misconduct of Apex Engineers, Inc. or Apex Engineers Inc.'s consultants.

The recommendations and conclusions given in this report are based on the observed conditions at the time of this site visit. These conditions may be altered over time and/or with changes in the weather. If ground water ponds in the basement excavation, soft soil conditions may require further excavation and/or filling to provide uniform support beneath all the footings and floor slab. Therefore, if water ponds in this excavation or other changes occur that could affect any of the recommendations given in this report, Apex Engineers, Inc. shall be called back and allowed to re-evaluate our previous recommendations and/or conclusions. If changes in the condition of the site occur and Apex Engineers, Inc. is not allowed the opportunity to re-evaluate the site to respond to any of these changes, our firm cannot be responsible for the effect of any of the conditions that differed from those reported herein.

The scope of our services does not include any environmental assessment (such as, but not limited to mold, mildew, presence of hazardous or toxic materials in the soil, surface water, ground water, etc.). An environmental specialist should be consulted for these types of issues.

Please call if Apex Engineers, Inc. can be of further assistance.

