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INVESTIGATION OF HOUSE DISTRESS

Lot 1 - Tract 30383
3548 Hightide
Rancho Palos Verdes, California

Owner

Anthony and Hedrig Posgay

Client

Boise Cascade Building Company

September 14, 1978

Job No. 378-518

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INVESTIGATION OF HOUSE DISTRESS

Introduction

This report presents the results of our investigation of reported distress to the subject residence located at 3548 Hightide, Rancho Palos Verdes, California. The investigation was made to determine the cause of distress and to present recommendations for correction, and was authorized by Bill Moore of Boise Cascade Building Company.

Scope

The investigation consisted of:

1) A review of existing records, including

   a) Grading plans by Millet, King & Associates dated January 27, 1965 (scale: 1"=40').

   b) Geologic and Soils Investigation report by Moore & Taber dated December 3, 1964.

   c) Report of Compacted Fill by Moore & Taber dated December 9, 1965.

2) An inspection of interior and exterior house distress, including plotting of major cracks on the attached plan.

3) Taking detailed level measurements on the floor slab.

Grading

The pad of Lot 1 is located on both cut and fill, the northwestern one-third being composed of cut and the southeastern two-thirds underlain by compacted fill. The fill was placed in the western and central portion of a southerly trending swale. Comparison of the original topography and final pad level shows a maximum depth of fill of approximately 17 feet at the southeastern corner of the pad.

House Construction

The house is a one-story, wood-frame, and stucco structure with slab-on-grade concrete floors. Reinforced footings and slabs were recommended in the original soil reports.

Surface Drainage

Surface drainage and provisions for collection and dispersal are generally poor, allowing water to pond and saturate the underlying soil, particularly in the following areas:

1) Outside of livingroom in front of the house where a depression has been created by landscaping.

2) Southeast corner next to gate where a board and blocks impede drainage from the rear yard.

3) Very low to flat gradient in rear yard associated with a low, two-course high block wall along the top of slope which allows water to collect and migrate downward.

4) Low depressed area adjacent to the above wall south of the patio.

5) Roof water drains to the rear of the house where it falls directly on the lawn, planter or patio area. No gutters or downspouts are provided.

Description of Distress

The house has suffered moderate distress. Damage is concentrated in the southeast portion of the house in the vicinity of the familyroom and kitchen. A large crack in the concrete floor at the front entry was reported by the owner. It has subsequently been covered by a new wood floor. Other signs of distress are cracks in the wall corner of the familyroom and in the ceiling in the livingroom and hall.

On the exterior of the house, cracks were observed in the stucco over windows and sliding glass door along the south (rear) side of the house. Cracks and separations were also observed in the exterior patio.

Level Measurements

In order to evaluate the distribution and magnitude of movement, relative elevation measurements were made on the floors of the various rooms. Although concrete slabs are not constructued precisely level, the tolerance is normally close enough that post-distress level measurements can reveal both the location and approximate magnitude of either settlement or heave.

The measurements were taken at a number of points throughout the structure, corrected for the differenct thicknesses of floor coverings, and the readings plotted on a house plan. Based on all available information, a level of "no movement" was chosen and elevation contours were drawn at 0.5-inch intervals to produce a topographic plot.

The resulting contours, as plotted on the attached plan, show the southeastern corner of the house floor to be depressed with a slight rise in the westerly portion. An elevation differential of about 4.5 inches was measured from the entry hall to the corner of the kitchen. The remainder of the floor in the west wing has a broad, slightly raised, domed surface, and much of the variation seen is attributed to irregularities of the finished concrete or soil expansion in the vicinity of the cut/fill daylight line.

Laboratory Testing

An expansion test was performed on a representative sample of the surficial soil obtained at the location shown on the attached plan. The test was done in accordance with the Expansion Index Test (UBC Standard 29-2). The bulk sample was remolded, confined under a pressure of 144 psf, and allowed to soak for twenty-four hours. The resulting volume change due to increase in moisture content determined an expansion index of 57, which is considered indicative of a moderate expansion potential and capable of producing substantial distress.

Analysis and Conclusions

Distress to structures from geologic or soil conditions can be produced by settlement, expansive soils, soil creep or landslides. Based on the grading plan and pattern of movement, we conclude the primary cause of distress is local settlement due to consolidation within the foundation soils. The general congruity of the original ground contours and the settlement pattern, as measured on the floor, indicates that the fill soils are consolidating, with the greatest movement in the direction of deepest fill. This problem may have been accelerated by the recent heavy rains and most certainly by the poorly controlled rear yard and roof drainage which has permitted greater saturation of the fill. Since the greatest

depression is centered in the vicinity of the kitchen, the possibility of a plumbing leak is also speculated as a source of water. The basic problem may also be aggravated by expansive soils as reflected by the level contours in the area of the rear bedrooms.

RECOMMENDATIONS

Basic Considerations

The pattern of movement and history of damage suggests continued settlement and commensurate increase in structural distress. Corrective measures, in addition to cosmetic repair and drainage improvements, are recommended. In light of the present magnitude of the settlement, distress, and affected area, the most reasonable remedial method for stabilizing compressible foundation soils (minimizing future settlement and achieving some structural lift) appears to be compaction grouting. Preliminary estimates of the scope of work required are provided below.

Compaction Grouting

Due to the generally uniform, localized nature of the settlement and moderate fill depths, compaction grouting probably offers the most economical method of remedial repair.

Compaction grouting involves the injection of a sand-cement grout into small diameter cased holes drilled or driven in the ground. This technique differs from conventional or penetration grouting in that the grout is of thick mortar-like consistency and accomplishes stabilization by displacement and compaction of the soil rather than by filling the voids between soil grains. The intent is to densify the underlying fill soils, reduce the

potential for future consolidation, and achieve lift of the structure. It is not always possible to accomplish as much lift as desired due to limitations imposed by the structure response and the ability of the soil to confine the grout pressures. If only partial lift can be obtained and remaining leveling is desired, it would need to be completed by mechanical jacking procedures.

The grouting provides valuable data on the subsurface conditions that should be recorded, analyzed, and used to modify the grouting program as appropriate in order to provide an adequate job at the least cost.

Tentatively, ten grout injection points have been located along the southeastern and eastern exterior walls. The holes would be both vertical and angled beneath the structure. Based on the depth to original ground shown on the grading plans, it is estimated that the holes could penetrate to a maximum depth of about 20 feet at the southeast corner, but all holes should extend to firm material. We anticipate that the necessary compaction could be achieved from outside the house without the need for interior grout points. It is estimated that an increase in soil density of 10% would require emplacement of approximately 1500 cubic feet of grout. Compaction grouting could be done on a time and material basis or fixed cost basis. A cost estimate can be developed, if desired.

Soil Moisture Control

The soil moisture content is critical to the long-term behavior of both expansive material and potentially compressible soils. Measures should be taken to substantially improve the drainage conditions in the rear yard and provide positive control of the moisture content of all soil influencing the structure. The primary approach is to take all precautions to establish and maintain a uniform level of moisture. In order to accomplish this objective, we recommend the following:

1) Surface Drainage - The accumulation and discharge of surface waters should be controlled by positive drainage devices to minimize local high infiltration such as occurs at several locations. Planters or grass areas adjacent to the house should be fine graded or raised to provide at least a 6% slope for a distance of five feet from the house or the same area paved. All accumulated water should be directed to the street via positive flow channels, paved ditches or underground pipes. Gutters and downspouts should be installed to collect roof run-off. Under no circumstances should water be allowed to accumulate or pond on the lot. Particular attention should be given to improvement of drainage from the backyard to the street. Depressed areas (front and rear) should be filled and regraded to accomplish the above. Obstacles to free flow of surface water should be removed, such as at the gate at the southeastern corner of the house. Water should be directed away from the low block wall along the top of slope or collected in a paved drain next to the wall and directed to a catch basin - collector pipe system for ultimate dispersal to the street.

2) Landscape Irrigation - Watering of the yard planting should be regularly performed during the drier portions of the year. The irrigation of planted areas should be sufficient to maintain a soil moisture equivalent to that occurring during the normal rainy season. Generally, good watering practice requires frequent application of relatively limited quantities of water.

Plumbing

The plumbing should be pressure tested to locate any leaks, particularly in the kitchen and rear bathroom areas. Leaking pipes could be adding water to the subsoils.

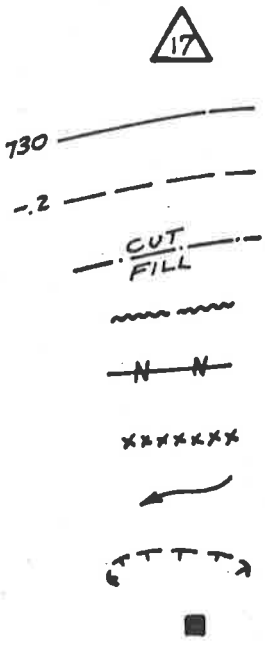
MOORE & TABER

Greg F. Rzonca
GFR/JTE:de

Reviewed by Jack T. Eagen
Engineering Geologist 231

(3) Copies to Boise Cascade Building Company

LEGEND FOR HOUSE DISTRESS



Vertical distance from original topography and pad elevation

Original ground surface contours

Relative floor elevation contours (inches)

Cut-fill line

Concrete slab cracks showing separation

Wall cracks

Ceiling cracks

Generalized surface drainage

Closed drainage areas

Bulk sample