MOORE & TABER CONSULTING ENGINEERS AND GEOLOGISTS
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REPORT OF COMPACTION GROUTING

Posgay Residence
Lot 1, Tract 30383
Rancho Palos Verdes, California

Client

Boise Cascade Company

July 19, 1979

Job No. 079-817

REPORT OF COMPACTION GROUTING

General

This report presents a summary and the results of a remedial compaction grouting program performed at 3548 Hightide, Rancho Palos Verdes, California, by Moore & Taber during June, 1979. The described work was done to increase the compaction of low-density foundation soils underlying portions of the site and concurrently lift portions of the structure. Grouting was performed essentially as discussed in our "*Investigation of House Distress*" report for the property, dated September 14, 1978 (Job No. 378-518), except that fewer grout points were needed due to favorable ground acceptance and response to the injections.

Procedures

Low slump, sand-cement grout was injected at eight points in the area to be treated (see attached plan, page A-1). The location of these points was adjusted in some cases from the originally planned program to conform more closely to requisite structural support or due to soil response as grout emplacement progressed.

The general method used consisted of first driving casing at each point shown on the plan to competent soil as determined by penetration resistance and the known depth of fill. The casing was then withdrawn in stages and a thick grout pumped into the open hole after each withdrawal. The maximum depth of soil treated was 15 feet. Grout was pumped progressively from the bottom to the shallowest stage in short intervals of about one to two feet.

Pumping was terminated on each interval upon achieving sufficient structural lift, or at least 0.01-inch lift of the overlying ground surface, which is considered indicative of adequate compactive effort, or when cracks or other distress were noted. Surface motion was monitored by water manometers stationed over the area grout emplacement.

The grout points were angled beneath exterior footings of the structure to provide influence on interior floor areas at depth. As the casing was withdrawn and grout pumped into shallower soils, near-surface support was provided for the foundation. Nearly all lift was obtained by the grout placed in the deepest stages.

Detailed records were kept of the casing/driving, grout pressures, volumes, lift, and all other aspects of the operation throughout the job. The pressure at which each stage accepted grout was monitored by a gauge at the injection point, and the volume of grout was measured to the nearest cubic foot. Most injection pressures ranged from 100 to 150 psi, and a total of 680 cubic feet (about 34 tons) of grout was pumped into the soil. The attached Table, page A-2, shows the grout volume for each grout point by stages. It should be noted that most stages were pumped by withdrawing the casing six inches to a foot at a time to assure treatment of the total thickness of fill.

CONCLUSIONS

Compaction

We believe that the completed grouting program accomplished significant compaction of the compressible soil in the area treated, and alleviated the settlement problems in the area treated. Although refusal, lift or incipient distress were the criteria used in the field to determine when to terminate pumping, the grout take and lift figures were subsequently analyzed to evaluate the effect of the injections.

Using a five-foot effective radius around each grout point as the area compacted, the total area affected by the grouting computes to approximately 628 square feet. For the 680 cubic feet of grout injected, a calculated average layer of grout 1.08 feet thick was emplaced in this area. Subtracting the average lift at the surface from this figure shows that--theoretically--about 0.9 feet of grout was applied to compacting the compressible soil. This figure shows there obviously was potential for future settlement in these areas. The amount of grout injected yields a calculated average increase in soil density of 7 percent over the area treated, excluding the upper five feet.

Lift

The southwest corner of the house was raised substantially by the grout injections. Level surveys of the floor area before and after completion of the work indicates as much as 2.5 inches of lift. The final slab elevation contours in the area of treatment are plotted on the attached plan and show major improvement over pre-grouting conditions. Care was

taken to allow lift to the point of correcting perceivable deflections in the floor and misalignment of the house framework. In most instances, cracks were closed to facilitate cosmetic repair while producing a minimum amount of new distress from ground movement during the grout injections.

Recommendations

Some minor readjustments of stress and settlement may occur the first few weeks after grouting, especially if the soil moisture content increases. As a precautionary measure, we normally recommend at least four weeks delay before starting cosmetic repair of the house even though experience has shown that it is not usually necessary. Flexible and/or high strength patching materials should be utilized wherever possible to protect against minor damage from any future movement.

Laboratory testing described in our report of September, 1978, indicated typical foundation soil is moderately expansive (5.7 percent swell from about optimum moisture to saturation). As a result, some of the structure distress is undoubtedly due to soil expansion and contraction as it experiences cycles of wetting and drying. The expansive soil condition is expected to continue to cause some movement with seasonal variations in soil moisture content.

The grouting does not remedy the expansive soils condition. To help minimize the effects of expansive soils and protect against local settlement problems, good surface drainage is essential. The recommendations provided on page 8 of the referenced report should be followed to establish and maintain appropriate drainage conditions.

If you have any questions concerning this project, please contact us.

MOORE & TABER

Jack Eagen

Jack T. Eagen
Engineering Geologist 231
DWC/JTE:ds

Attachments: Page A-1 (Grout Quantity vs Depth)
Page A-2 (Plan)

(4) Copies to Boise Cascade
Attention Bill Moore

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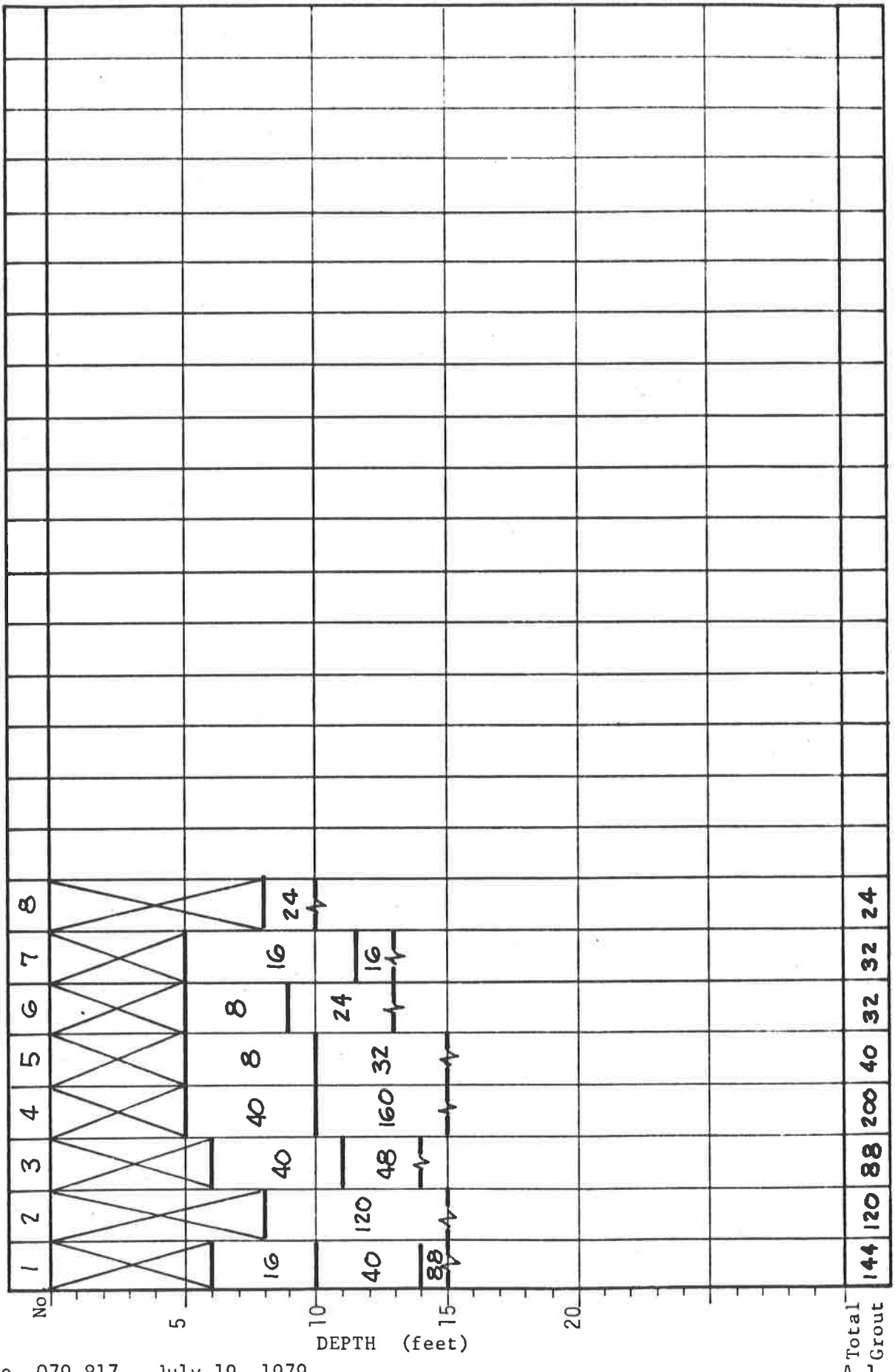

TOTAL GROUT VOLUME 680 c.f.

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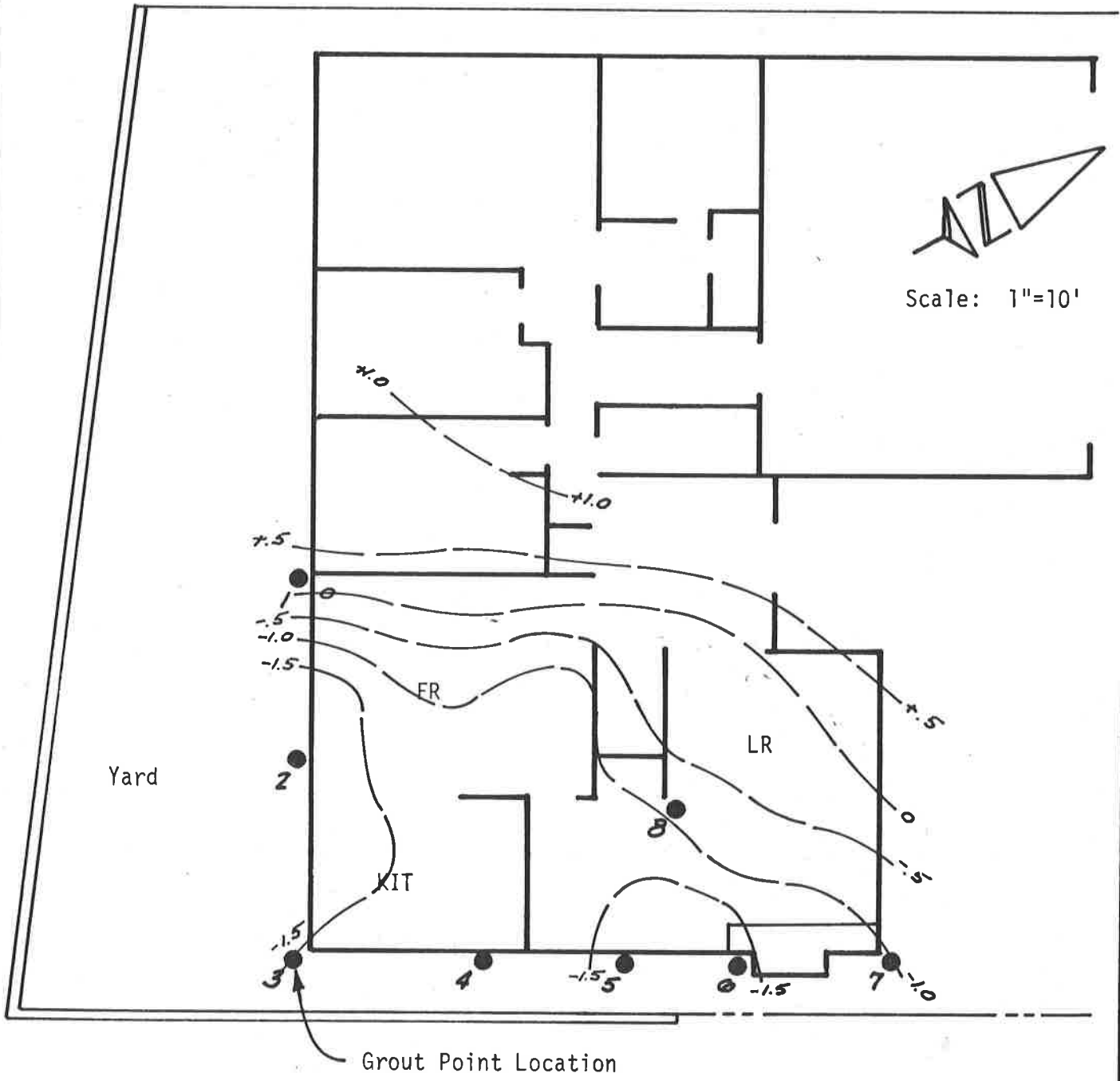

3548 Hightide Drive

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LOCATION OF GROUT POINTS

MOORE & TABER – *Engineers·Geologists*

DATE 7/19/79	JOB Nº 079-817