PUBLIC WORKS/HYDROLOGY

C17/D8

0000 0000. 1682

C17/D8

25×10

0000 0000 1683

FILE COPY

**City of Albuquerque**
P.O. BOX 1293 ALBUQUERQUE, NEW MEXICO 87103

April 3, 1990

Jeff Mortensen, P.E.
Jeff Mortensen & Associates, Inc.
811 Dallas, NE
Albuquerque, New Mexico 87110

RE: REVISED DRAINAGE PLAN FOR WESTERN BUILDING SUPPLY
(C-17/D8) REVISION DATED MARCH 20, 1990

Dear Mr. Mortensen:

Based on the information provided on your submittal of March 21, 1990, the above referenced plan is approved for Building Permit.

Please attach a copy of this plan to the construction sets prior to sign-off by Hydrology.

If I can be of further assistance, please feel free to call me at 768-2650.

Cordially,

for Bernie J. Montoya
Fred J. Aguirre, P.E.
Hydrologist

xc: Jerry Haltox
4201 Paseo Del Norte, NE

BJM:FJA/bsj
(WP+1625)



25×10

0000 0000 1684

FILE COPY

**City of Albuquerque**
P.O. BOX 1293 ALBUQUERQUE, NEW MEXICO 87103

April 3, 1990

Jeff Mortensen, P.E.
Jeff Mortensen & Associates, Inc.
811 Dallas, NE
Albuquerque, New Mexico 87110

RE: REVISED DRAINAGE PLAN FOR WESTERN BUILDING SUPPLY
(C-17/D8) REVISION DATED MARCH 20, 1990

Dear Mr. Mortensen:

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If I can be of further assistance, please feel free to call me at 768-2650.

Cordially,

for Bernie J. Montoya
Fred J. Aguirre, P.E.
Hydrologist

xc: Jerry Haltox
4201 Paseo Del Norte, NE

BJM:FJA/bsj
(WP+1625)



25×10

0000 0000 1685

900021

# DRAINAGE INFORMATION SHEET

PROJECT TITLE: WESTERN BUILDING SUPPLY ZONE ATLAS/DRNG. FILE #: C17/D8

LEGAL DESCRIPTION: TRACT 2, LOOP INDUSTRIAL PARK

CITY ADDRESS: 4201 PASEO DEL NORTE NE

ENGINEERING FIRM: JEFF MORTENSEN & ASSOC. INC. CONTACT: JEFF MORTENSEN

ADDRESS: 811 DALLAS, NE 87110 PHONE: 265-5611

OWNER: NOT KNOWN Jerry Hattox CONTACT: CONTRACTOR 4700 Paseo Del Norte NE

ADDRESS: PHONE:

ARCHITECT: AKT ARCHITECTS CONTACT: KENT TRAUERNICHT

ADDRESS: PHONE: 281-9560

SURVEYOR: JMA CONTACT: ENGINEER

ADDRESS: PHONE:

CONTRACTOR: JAYNES CORP. CONTACT: PAT WOODFORD

ADDRESS: PHONE: 345-8591

PRE-DESIGN MEETING:

X YES

__ NO

X COPY OF CONFERENCE RECAP SHEET PROVIDED

DRB NO. ____

EPC NO. ____

PROJ. NO. ____

TYPE OF SUBMITTAL:

__ DRAINAGE REPORT

X DRAINAGE PLAN

__ CONCEPTUAL GRADING & DRAINAGE PLAN

X GRADING PLAN

__ EROSION CONTROL PLAN

__ ENGINEER'S CERTIFICATION

CHECK TYPE OF APPROVAL SOUGHT:

__ SKETCH PLAT APPROVAL

__ PRELIMINARY PLAT APPROVAL

__ SITE DEVELOPMENT PLAN APPROVAL

__ FINAL PLAT APPROVAL

X BUILDING PERMIT APPROVAL

__ FOUNDATION PERMIT APPROVAL

__ CERTIFICATE OF OCCUPANCY APPROVAL

__ ROUGH GRADING PERMIT APPROVAL

__ GRADING/PAVING PERMIT APPROVAL

__ OTHER ____ (SPECIFY)

RECEIVED MAR 21 1990 HYDROLOGY DIVISION

DATE SUBMITTED: 3-21-90

BY: SUSAN C

25×10

0000 0000 .1686

900021

CITY OF ALBUQUERQUE
MUNICIPAL DEVELOPMENT DEPARTMENT
ENGINEERING DIVISION/DESIGN HYDROLOGY SECTION

CONFERENCE RECAP

DRAINAGE FILE/ZONE ATLAS PAGE NO.: C17 DATE: 7-15-88

PLANNING DIVISION NOS: EPC: DRB:

SUBJECT: Western Building Supply

STREET ADDRESS (IF KNOWN): Loop Industrial Pk

SUBDIVISION NAME: Tr 2

APPROVAL REQUESTED:

| | | | |
|---|---|---|---|
| ____ | PRELIMINARY PLAT | ____ | FINAL PLAT |
| ____ | SITE DEVELOPMENT PLAN | X | BUILDING PERMIT |
| ____ | OTHER | ____ | ROUGH GRADING |

| ATTENDANCE: | WHO | REPRESENTING |
|---|---|---|
| | Jeff Mortimer | |
| | Guy Jackson | |
| | Carl A Montoya | |

FINDINGS:

(1) Drainage plan per DPM

(2) Retention pond is acceptable

(A) The State has improved Paseo Del Norte. However, the inlets are directed to private property.

(B) Need to pond 100% of the total developed runoff from the site

The undersigned agrees that the above findings are summarized accurately and are only subject to change if further investigation reveals that they are not reasonable or that they are based on inaccurate information.

SIGNED: Carl A Montoya SIGNED: Jeffrey G

TITLE: TITLE:

DATE: 7-15-88 DATE: 07.15.88

**NOTE** PLEASE PROVIDE A COPY OF THIS RECAP WITH THE DRAINAGE SUBMITTAL

25 X

0000 0000 1687

400021

# DRAINAGE INFORMATION SHEET

PROJECT TITLE: WESTERN BUILDING SUPPLY ZONE ATLAS/DRNG. FILE #: C17/D8

LEGAL DESCRIPTION: TRACT 2, LOOP INDUSTRIAL PARK

CITY ADDRESS: 4201 PASEO DEL NORTE NE

ENGINEERING FIRM: JEFF MORTENSEN & ASSOCIATES INC CONTACT: JEFF MORTENSEN

ADDRESS: 811 DALLAS NE 87110 PHONE: 265-5611

OWNER: NOT KNOWN CONTACT: CONTRACTOR

ADDRESS: PHONE:

ARCHITECT: AKT ARCHITECTS CONTACT: KENT TRAUSNICHT

ADDRESS: PHONE: 281-9560

SURVEYOR: JMA CONTACT: ENGINEER

ADDRESS: PHONE:

CONTRACTOR: JAYNES COMP. CONTACT: PAT WOODFORD

ADDRESS: PHONE: 345-8591

PRE-DESIGN MEETING:

X YES

__ NO

X COPY OF CONFERENCE RECAP SHEET PROVIDED

RECEIVED FEB 05 1990 HYDROLOGY SECTION

DRB NO. ____

EPC NO. ____

PROJ. NO. ____

TYPE OF SUBMITTAL:

__ DRAINAGE REPORT

X DRAINAGE PLAN

__ CONCEPTUAL GRADING & DRAINAGE PLAN

X GRADING PLAN

__ EROSION CONTROL PLAN

__ ENGINEER'S CERTIFICATION

CHECK TYPE OF APPROVAL SOUGHT:

__ SKETCH PLAT APPROVAL

__ PRELIMINARY PLAT APPROVAL

__ SITE DEVELOPMENT PLAN APPROVAL

__ FINAL PLAT APPROVAL

X BUILDING PERMIT APPROVAL

__ FOUNDATION PERMIT APPROVAL

__ CERTIFICATE OF OCCUPANCY APPROVAL

__ ROUGH GRADING PERMIT APPROVAL

__ GRADING/PAVING PERMIT APPROVAL

__ OTHER _____ (SPECIFY)

DATE SUBMITTED: JEFF MORTENSEN

BY: 02-05-90

25X

0000 0000 1688

FILE COPY

**City of Albuquerque**
P.O. BOX 1293 ALBUQUERQUE, NEW MEXICO 87103

February 12, 1990

Jeff Mortensen
Jeff Mortensen & Associates, Inc.
811 Dallas, NE
Albuquerque, New Mexico 87110

RE: DRAINAGE PLAN FOR WESTERN BUILDING SUPPLY
(C-17/D8) ENGINEER'S STAMP DATED FEBRUARY 5, 1990

Dear Mr. Mortensen:

Based on the information provided on your submittal of February 5, 1990, the above referenced plan is approved for Building Permit.

Please attach a copy of this plan to the construction sets prior to sign-off by Hydrology.

If I can be of further assistance, please feel free to call me at 768-2650.

Cordially,

Bernie J. Montoya

Bernie J. Montoya, C.E.
Engineering Assistant

BJM/bsj
(WP+1625)



25×

0000 0000 1689

400021

CITY OF ALBUQUERQUE
MUNICIPAL DEVELOPMENT DEPARTMENT
ENGINEERING DIVISION/DESIGN HYDROLOGY SECTION

CONFERENCE RECAP

DRAINAGE FILE/ZONE ATLAS PAGE NO.: C17 DATE: 7-15-88

PLANNING DIVISION NOS: EPC: DRB:

SUBJECT: Western Building Supply

STREET ADDRESS (IF KNOWN): Loop Industrial Pk

SUBDIVISION NAME: Tr 2

APPROVAL REQUESTED:

| | |
|---|---|
| ____ PRELIMINARY PLAT | ____ FINAL PLAT |
| ____ SITE DEVELOPMENT PLAN | X BUILDING PERMIT |
| ____ OTHER | ____ ROUGH GRADING |

| ATTENDANCE: WHO | REPRESENTING |
|---|---|
| Jeff Mortimer | |
| Guy Jackson | |
| Carl A Montoya | |

FINDINGS:

(1) Drainage plan per DPM

(2) Retention pond is acceptable

(A) The State has improved Paseo Del Norte. However, the inlets are directed to private property.

(B) Need to pond 100% of the total developed runoff from the site

The undersigned agrees that the above findings are summarized accurately and are only subject to change if further investigation reveals that they are not reasonable or that they are based on inaccurate information.

SIGNED: Carl A Montoya SIGNED: Jeffrey G

TITLE: TITLE:

DATE: 7-15-88 DATE: 07.15.88

**NOTE** PLEASE PROVIDE A COPY OF THIS RECAP WITH THE DRAINAGE SUBMITTAL

25 X

0000 0000 1690

CITY OF ALBUQUERQUE
MUNICIPAL DEVELOPMENT DEPARTMENT
ENGINEERING DIVISION/DESIGN HYDROLOGY SECTION

CONFERENCE RECAP

DRAINAGE FILE/ZONE ATLAS PAGE NO.: C-17 DATE: 7-15-88

PLANNING DIVISION NOS: EPC: _____ DRB: _____

SUBJECT: Western Auto Supply

STREET ADDRESS (IF KNOWN): Lodge Industrial Pk

SUBDIVISION NAME: Tr 2

APPROVAL REQUESTED:

| | | | |
|---|---|---|---|
| ____ | PRELIMINARY PLAT | ____ | FINAL PLAT |
| ____ | SITE DEVELOPMENT PLAN | X | BUILDING PERMIT |
| ____ | OTHER | ____ | ROUGH GRADING |

| | WHO | REPRESENTING |
|---|---|---|
| ATTENDANCE: | Jeff Mortenson | |
| | Guy Tyler | |
| | Chas A Mott | |

FINDINGS:

(1) Drainage plan per DPM

(2) Retention pond is acceptable

(A) The State has improved Paseo Del Norte. However, the inlets are directed to private property

(B) Need to pond 100% of the total developed runoff from the site

The undersigned agrees that the above findings are summarized accurately and are only subject to change if further investigation reveals that they are not reasonable or that they are based on inaccurate information.

| | | | |
|---|---|---|---|
| SIGNED: | Chas A Mott | SIGNED: | Jeffrey C. [illegible] |
| TITLE: | | TITLE: | |
| DATE: | 7-15-88 | DATE: | 07-15-88 |

**NOTE** PLEASE PROVIDE A COPY OF THIS RECAP WITH THE DRAINAGE SUBMITTAL

25 x 10

0000 0000 1691

PLANS/PLATS ON FILE

FILE DESC: C17/D8

# PLANS/PLATS 1

25×10

0000 0000 1692

25×10

HYDROLOGY C17/D8 ONE PLAN

C 17-D8

1 PLAN

**City of Albuquerque**
P.O. BOX 1293 ALBUQUERQUE, NEW MEXICO 87103

April 8, 1981

Doug Muchmore
11000 C Spain Rd., N.E.
Albuquerque, New Mexico 87111

REFERENCE: ADDRESS FOR TRACT 1, LOOP INDUSTRIAL PARK

Dear Mr. Muchmore:

I understand that the request for an address was presented to this office and that the indication was given that a drainage report was required.

Since this indication has caused you some perplexity, I would like to clarify the City's position. From the brief review of the land division that created lots 1 and 2, Loop Industrial Park, it is clear that said land division was performed without complying with the requirements of the subdivision ordinance. It also appears that the approval granted on 12/1/76 by Mr. Kleston Laws formerly with this office and acting for AMAFCA, was given in error since supporting documentation required by the Resolution 72-2, was not supplied.

In view of the above, be advised that the City has assigned the address 4001 Los Angeles Blvd., N.E. to lot 1, Loop Industrial Park. With this letter the City also puts you on notice that no beneficial occupancy can be granted to any structure on this property at this time, since the City cannot guarantee protection from flooding.

If and when the owner of the property wishes to obtain beneficial use, including human occupancy, a drainage report and grading plan will have to be submitted and found acceptable by this office.

Very truly yours,

Charles M. Easterling
Principal Assistant City Engineer
Hydrology
FOR CONCURRENCE:

Mac ~~Mike~~ DeVesty, ~~Acting~~ Assistant City Attorney

CC: Ron Hagen
J. Davenport
R. Heller

# CITY OF ALBUQUERQUE

ALBUQUERQUE, NEW MEXICO

INTER-OFFICE CORRESPONDENCE April 10, 1981 REF. NO._____

TO: Charles M. Easterling,
Principal Asst. City Engineer/Hydrology

FROM: Malcolm W. deVesty, Assistant City Attorney MWdV

SUBJECT: MUCHMORE MATTER

I have not initialed this letter because it is not as I had requested. I suggested that a specific sentence be inserted to the effect that the property in question, with its current grade level, is subject to flooding and that this is the reason for withholding the building certificate of occupancy.

I am aware that the letter contains a phrase that the City cannot guarantee the protection from this flooding, but this is somewhat ambiguous because first of all, the City never guarantees against flooding and, secondly, it does not come right out and say that there is a potential flood problem on this property.

MWdV/dh

Attachment

RECEIVED
APR 15 1981
CITY ENGINEER

HYDRO FILE

**City of Albuquerque**
P.O. BOX 1293 ALBUQUERQUE, NEW MEXICO 87103

April 15, 1981

Mr. Doug Muchmore
11000 C Spain Rd., N.E.
Albuquerque, New Mexico 87111

RE: ADDRESS FOR TRACT 1, LOOP INDUSTRIAL PARK

Dear Mr. Muchmore:

I understand that the request for an address was presented to this office and that the indication was given that a drainage report was required.

Since this indication has caused you some perplexity, I would like to clarify the City's position. From the brief review of the land division that created Lots 1 and 2, Loop Industrial Park, it is clear that said land division was performed without complying with the requirements of the Subdivision Ordinance, since no drainage or flood protection facilities were provided. It also appears that the approval granted on 12/1/76 by Mr. Kleston Laws formerly with this office and acting for AMAFCA, was given in error since the supporting documentation required by the Resolution 72-2 (See Sec. 5,6,12) was not supplied.

In view of the above, be advised that the City has assigned the address 4001 Los Angeles Blvd., N.E. to Lot 1, Loop Industrial Park. With this letter the City also puts you on notice that no beneficial occupancy can be granted to any structure on this property at this time, since the City cannot guarantee protection from flooding.

If and when the owner of the property wishes to obtain (a) building permit(s) or beneficial use, including human occupancy, a drainage report and grading plan will have to be submitted, found acceptable by this office and implemented.

Very truly yours,

Charles M. Easterling
Charles M. Easterling
Principal Asst. City Engineer/Hydrology

CC: Vern Hagen
G. Davenport
R. Heller

CME:fs

DRAINAGE REPORT & GRADING PLAN

WESTERN BUILDING SUPPLY

on

LOS ANGELES BLVD. N.E.

March, 1981

RECEIVED
MAR 26 1981
CITY ENGINEER

CHRISTOPHER L. NEISS
NEW MEXICO
6858
REGISTERED PROFESSIONAL ENGINEER

DRAINAGE REPORT & GRADING PLAN MARCH 1981

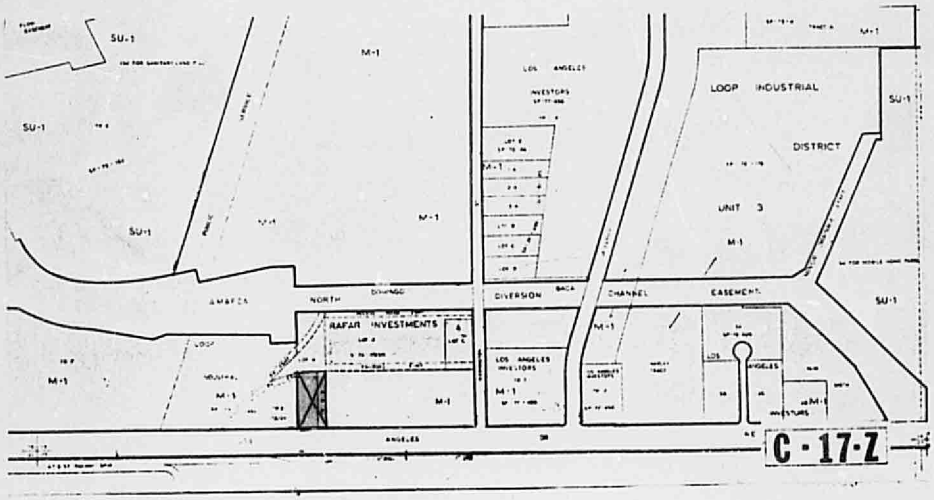
WESTERN BUILDING SUPPLY on
LOS ANGELES BLVD. N.E.

## I N T R O D U C T I O N

At the request of Bill Shelton and Associates, Architects for the proposed office/warehouse complex, Consultants/Terra-Sol, Inc., has investigated the storm drainage for the site. This investigation follows the design procedure which uses a precipitation profile for a one hour period of the 2.4" 6 hr.-100yr. average storm for a total precipitation of 2.05". (See Calcs).

## S I T E  L O C A T I O N

The proposed site (1.84 Acres) is located in the north-east quadrant of the City. It lies north of and adjacent to Los Angeles Blvd., east of the interceptor channel and west of Washington St., and is bordered on the north by a railroad spur and on the east by an existing warehouse complex.



WESTERN BUILDING SUPPLY on MARCH 1981
LOS ANGELES BLVD. N.E.

## P R O P O S E D  D E V E L O P M E N T

The proposed development will occupy only 1.84 acres of the overall 3.3 acre site with building and parking areas comprising Phase I of development. Phase II comprises the remaining acreage, left undeveloped at this time.

Proposed construction features which are pertinent to drainage are as follows:

1. The structure will drain to the east and west sides with no roof ponding. All sides around the building will be sloped away for positive drainage to the common pond.
2. The ponding area will be located in the rear of the building on the west side of the site. The ponding area will be a total surface pond with a positive discharge provided to the west.
3. The sides of the pond area will be constructed to a maximum 3:1 slope.

## T O P O G R A P H I C  M A P

The topographic map used as a basis for the grading plan was supplied by the Architect. This map agrees with the City Ortho-photo within its limits of accuracy of 1'-0", plus or minus.

## S O I L S  R E P O R T

The surface soil-type for the site consists of sandy silt, silty sand and one test hole of clayey sand. Specific drainage recommendations require positive site drainage away from the structure. No specific minimum pond distances were detailed in the report. (Soils report submitted by Architect).

WESTERN BUILDING SUPPLY on
LOS ANGELES BLVD. N.E.

MARCH 1981

## DRAINAGE/GRADING EXHIBIT

The drainage/grading plan located in the back of this report shows the location of the proposed drainage improvements and the proposed final grades of the site.

## EXISTING DRAINAGE

Existing conditions indicate that the site is subject to minimal offsite flows in the form of sheet flow at the southeast corner of the site. The area draining to the site consists of the face of a berm which forms the access drive of the adjoining warehouse site. The remaining area east of the site either drains directly toward Los Angeles Blvd. or to the back of the railroad spur, which drains to the Domingo Baca arroyo.

Surface runoff from the site discharges to the west onto open land before being collected by an existing 24" CMP drainage outlet located at the intersection of the railroad spur with Los Angeles Blvd.

The site is not located in a flood hazard area, as shown on Page 2 of the Flood Hazard Boundary Map, dated December 4, 1979.

## DEVELOPED DRAINAGE

### Offsite Flows

Minimal offsite flows will be accepted onto the parking lot and routed through the site to the pond for discharge to the west.

### Onsite Flows

Onsite flows will be routed directly into the common pond area, or be routed through the parking/access areas to the pond. The pond area will have a positive discharge

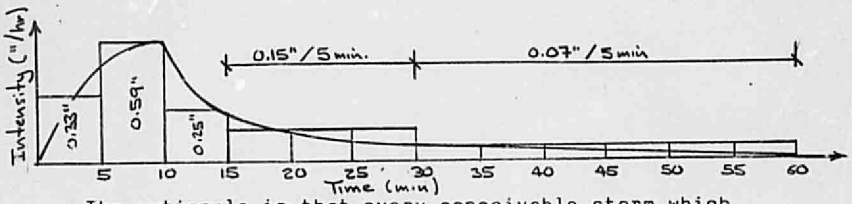
provided at the west side of the site. This will drain onto an open land which presently drains to the existing drainage pipe located under the railroad spur at Los Angeles Blvd. Because Phase I, the proposed warehouse complex, and Phase II, the open land to the west, are both under common ownership, the pond discharge route will not require special easements.

A spillway overflow of the pond area for this project will be provided at the west mid-point of the site with the discharge following the outlet pipe flow pattern to the west.

## D R A I N A G E  C A L C U L A T I O N S

The inflow-outflow hydrograph method used for this report is based on data supplied by the City Engineer's Office for new development, using the Rational Method as the model for the rainfall-runnoff process.

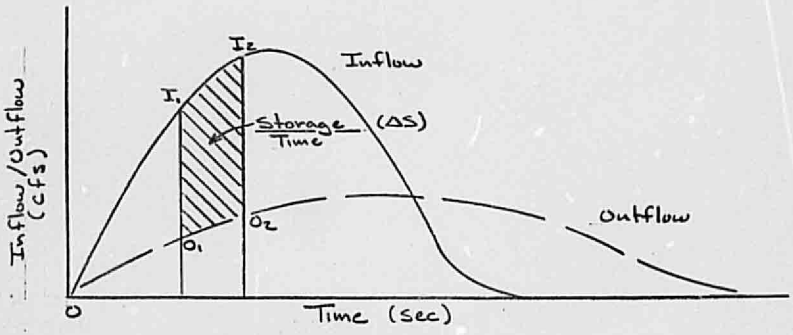
In particular, the 6 hr.-100 yr. storm of 2.4" was used to form a precipitation profile for a one hour period of the 6 hr.-100 yr. average storm of total "P" for the one hour of 2.05".




The rationale is that every conceivable storm which results in a total precipitation of 2.05" in one hour is by definition a 100 yr. storm event. This is a sound procedure for designing detention basins capable of intercepting the entire 100 yrs. developed runoff volume, with a Q5 release rate, irregardless of whether the peak intensity

occurs at the beginning or toward the end of the storm period. The net result is a more effective detention basin design and use of the affected land.

General Data




Typical Inflow/Outflow Hydrograph

Equations Used

$$\Delta S = \frac{I_1+I_2}{2}\Delta t - \frac{O_1+O_2}{2}\Delta t = S_2 - S_1$$

$$\Delta S = S_2\,\Delta t - S_i\Delta t$$

$$I_1+I_2+A_1 = R_2; \quad \text{where } A_1 = \frac{2S_1}{\Delta t} - O_1$$

$$R_2 = \frac{2S_2}{\Delta t} + O_2$$

$$I = S/\Delta t = \frac{[C_1 x P x A_2 x 43,560/12]}{\Delta t}$$

Where $C_1$ = Runoff coefficent

P = Local Area Precipitation (inches) = (SE/2.40) Po

Ar = Drainage Basin (Ac.)

SE = Local 6 hr.-100yr. storm event

Po = 1 hr. (6 hr.-100 yr. average storm) Precipitation (inches)

WESTERN BUILDING SUPPLY on LOS ANGELES BLVD. N.E.

MARCH 1981

Base Data

Site Area = 1.84 Acres
Runoff Coefficient before development = 0.40
Runoff Coefficient after development = 0.80
Q100 Runoff = (0.80)(5.4)(1.84) = 8cfs (Spillway design)
Q5 Runoff = (0.40)(2.6)(1.84) = 2cfs (Outlet pipe design)
Local Area Precipitation = 2.4"
Total Developed Volume = (2.4/12)(0.80)(1.84) = 12,800 $ft.^3$

Spillway Data

Available Head = 0.2', minimum flow capacity = 8 cfs
Spillway Breadth = 36 (Eq. Q = CLH 3/2)

Pipe Data

Available Head = 1.5', maximum Q discharge for head available = 1.5 cfs
Area = 27.5 $ft.^2$ (Eq. $Q = CA\sqrt{2gh}$)

Results (See Data Sheets in Back of Report)

Peak Volume stored while outflowing Q5 of 1.5 cfs (maximum achieved for pipe size and head available)
= 6393 $ft.^3$ at time interval of 45 minutes at a depth in pond at 1.36'

Outlet Facilities

The pond outlet facilities will be defined by a block wall, as shown on the grading plan. The outlet will consist of 1) a 6" diameter pipe with a flowline at elevation 5085.00 to release the entire ponded volume from the site at a controlled rate of 1.5 cfs, and 2) a 36' long spillway with its lip at elevation 5086.36. The capacity of the spillway is based on the site developed runoff of 8 cfs.

If the pipe remains open for the entire storm cycle, the maximum volume to be stored temporarily in the pond would equal 6393 $ft.^3$ at a high water elevation of 5086.36.

If the pipe should become plugged, ponded waters would have the potential to rise briefly to elevation 5086.56 to

discharge peak flows over the spillway.

In any event, all points of the adjacent building and related improvements are higher than the estimated flood limits.

## R E C O M M E N D A T I O N S

1. Grade site with positive drainage away from the structure to carry runoff to common pond area.
2. Locate common pond area at rear of site with a positive discharge pipe emptying onto open land to the west. Pipe size = 6" at a flow line invert of 5085.00.
3. Construct an overflow spillway wier along the top of the block wall above the pipe to discharge flow volume should a pipe blockage occur. Build the wier 0.2' deep by 36' long with the flow line at 5086.36.
4. Construct offsite grading of adjacent land to allow the pipe discharge to reach the existing downstream system to the west of the site.

## C O N C L U S I O N

The proposed developed site will discharge runoff at a lower runoff rate, with overflow protection provided in the event of pipe blockage, without adverse effect on the proposed development, or the areas downstream from the discharge point. These factors enable the proposed site to meet the drainage criteria established by the City for the area.

```
*****************************************
*                                       *
*   STORMWATER DETENTION POND DESIGN    *
*          SMALL DRAINAGE AREA          *
*                                       *
*****************************************
```

PROGRAM PARAMETERS

| | | |
|---|---|---|
| A2 = | DRAINAGE BASIN SIZE(ACRES)..... | 1.84 |
| C1 = | RUNOFF COEFFICIENT..... | .8 |
| C2 = | FIRST GEOMETRIC VOLUME COEFFICIENT..... | 3640 |
| C3 = | SECOND GEOMETRIC VOLUME COEFFICIENT..... | 780 |
| C4 = | HEAD LOSS COEFFICIENT..... | 1.26 |
| C5 = | PRECIPITATION COEFFICIENT..... | 1 |
| D = | DISCHARGE PIPE DIAMETER(FT)..... | .5 |
| J = | INCREMENTAL DEPTH SIZE(FT)..... | .05 |
| K = | NUMBER OF ROUTING TIME PERIODS..... | 24 |
| T = | ROUTING TIME(SECS)..... | 300 |
| X = | DEPTH OF DETENTION POND(FT)..... | 1.5 |
| Z = | DRAIN PIPE ELEVATION-EXIT TO ENTRANCE(FT).... | 0 |

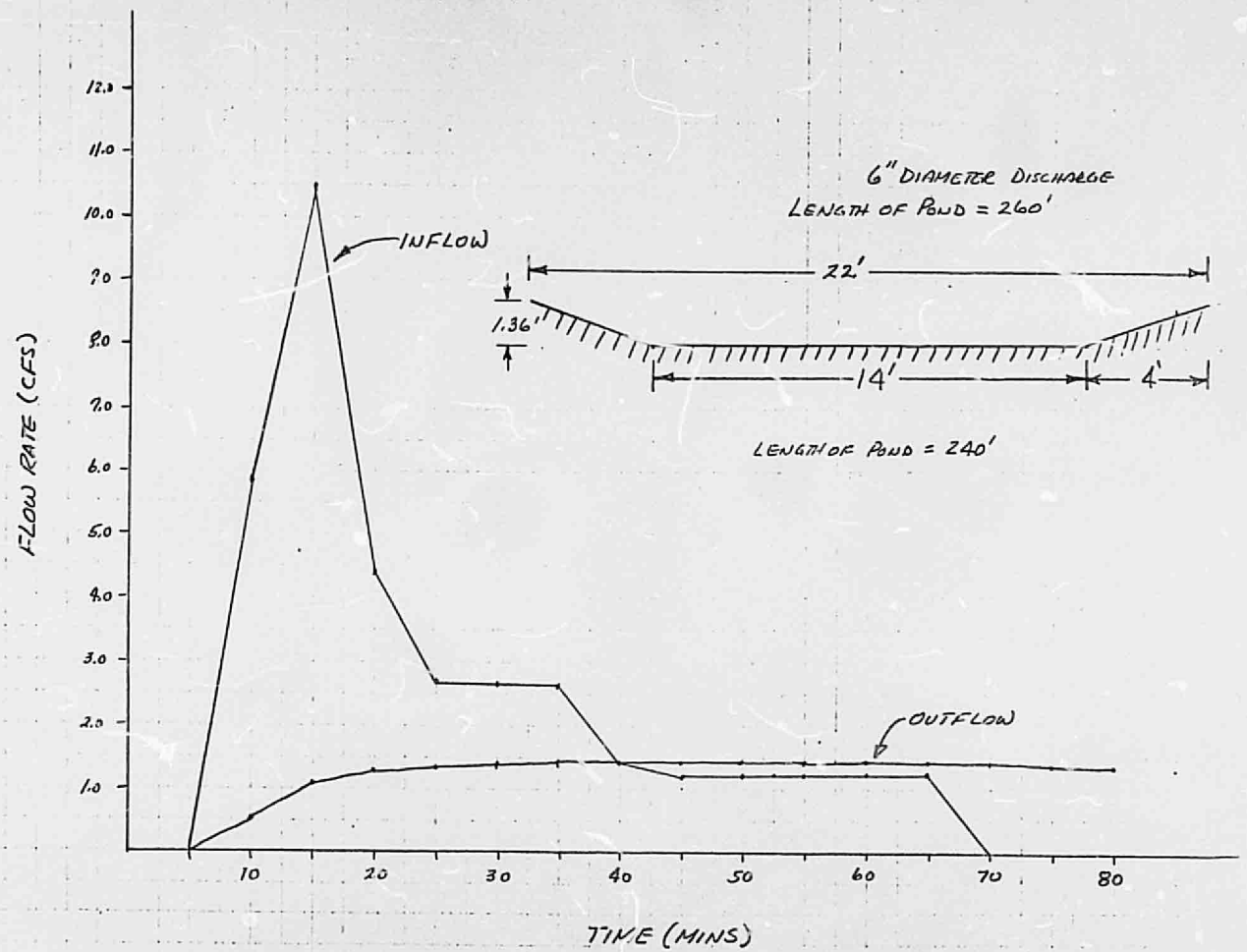
PART ONE

ROUTING ELEMENT VS DISCHARGE RATE
FOR A KNOWN STORAGE VOLUME

| DEPTH TO INVERT (FEET) | STORAGE VOLUME (CUBIC FEET) | DISCHARGE RATE (CU. FT/SEC) | ROUTING ELEMENT (CU. FT/SEC) |
|---|---|---|---|
| 0 | 0 | 0 | 0 |
| .05 | 183 | .28 | 1 |
| .1 | 371 | .39 | 2 |
| .15 | 563 | .48 | 4 |
| .2 | 759 | .56 | 5 |
| .25 | 958 | .63 | 7 |
| .3 | 1162 | .69 | 8 |
| .35 | 1369 | .74 | 9 |
| .4 | 1580 | .79 | 11 |
| .45 | 1795 | .84 | 12 |
| .5 | 2015 | .89 | 14 |
| .55 | 2237 | .93 | 15 |
| .6 | 2464 | .97 | 17 |
| .65 | 2695 | 1.01 | 18 |
| .7 | 2930 | 1.05 | 20 |
| .75 | 3168 | 1.09 | 22 |
| .8 | 3411 | 1.12 | 23 |
| .85 | 3657 | 1.16 | 25 |
| .9 | 3907 | 1.19 | 27 |
| .95 | 4161 | 1.22 | 28 |
| 1 | 4420 | 1.26 | 30 |
| 1.05 | 4681 | 1.29 | 32 |
| 1.1 | 4947 | 1.32 | 34 |
| 1.15 | 5217 | 1.35 | 36 |
| 1.2 | 5491 | 1.38 | 37 |
| 1.25 | 5768 | 1.4 | 39 |
| 1.3 | 6050 | 1.43 | 41 |
| 1.35 | 6335 | 1.46 | 43 |
| 1.4 | 6624 | 1.49 | 45 |
| 1.45 | 6917 | 1.51 | 47 |
| 1.5 | 7214 | 1.54 | 49 |
| 1.55 | 7515 | 1.56 | 51 |

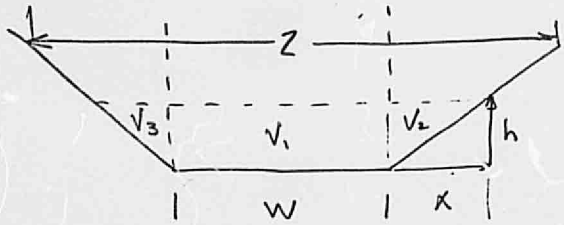
CALCULATE ROUTING EQUATION ELEMENTS

| T (MIN) | I2 (CFS) | SV (CF) | A1 (CFS) | R2 (CFS) | Q2 (CFS) | WL (FT) |
|---|---|---|---|---|---|---|
| 5 | 0 | 0 | 0 | 0 | 0 | 0 |
| 10 | 5.87 | 680 | 4 | 5 | .53 | .18 |
| 15 | 10.5 | 3025 | 19 | 21 | 1.06 | .72 |
| 20 | 4.45 | 4947 | 31 | 34 | 1.32 | 1.1 |
| 25 | 2.67 | 5546 | 35 | 38 | 1.38 | 1.21 |
| 30 | 2.67 | 5937 | 38 | 41 | 1.42 | 1.28 |
| 35 | 2.67 | 6278 | 40 | 43 | 1.45 | 1.34 |
| 40 | 1.42 | 6393 | 41 | 44 | 1.46 | 1.36 |
| 45 | 1.24 | 6393 | 41 | 44 | 1.46 | 1.36 |
| 50 | 1.24 | 6393 | 41 | 44 | 1.46 | 1.36 |
| 55 | 1.24 | 6278 | 40 | 43 | 1.45 | 1.34 |
| 60 | 1.24 | 6278 | 40 | 43 | 1.45 | 1.34 |
| 65 | 1.24 | 6106 | 39 | 42 | 1.44 | 1.31 |
| 70 | 0 | 5937 | 38 | 41 | 1.42 | 1.28 |
| 75 | 0 | 5546 | 35 | 38 | 1.38 | 1.21 |
| 80 | 0 | 5055 | 32 | 35 | 1.33 | 1.12 |
| 85 | 0 | 4629 | 30 | 32 | 1.28 | 1.04 |
| 90 | 0 | 4316 | 27 | 30 | 1.24 | .979999 |
| 95 | 0 | 3907 | 25 | 27 | 1.19 | .899999 |
| 100 | 0 | 3607 | 23 | 25 | 1.15 | .839999 |
| 105 | 0 | 3313 | 20 | 23 | 1.11 | .78 |
| 110 | 0 | 2882 | 18 | 20 | 1.04 | .69 |
| 115 | 0 | 2556 | 16 | 18 | .99 | .62 |
| 120 | 0 | 2283 | 14 | 16 | .94 | .56 |
| 125 | 0 | 1970 | 13 | 14 | .88 | .49 |


6" DIAMETER DISCHARGE
LENGTH OF POND = 260'
22'
1.36'
14'
4'
LENGTH OF POND = 240'
INFLOW
OUTFLOW
FLOW RATE (CFS)
12.0
11.0
10.0
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
10
20
30
40
50
60
70
80
TIME (MINS)

## CALCULATION OF $C_2$ & $C_3$

1. ASSUME A STORAGE VOLUME CONFIGURATION.




L = POND LENGTH.

$$V = V_1 + V_2 + V_3$$
$$V_1 = WLh$$
$$V_2 = V_3 = 2V_2 = 2(1/2)XLh = XLh.$$

$V = WLh + XLh$. ; BUT $X = mh$ ; WHERE $m$ = SIDE SLOPE RATIO

$$V = WLh + mLh^2$$
$$= C_2 h + C_3 h^2 \; ; \; C_2 = WL, \; C_3 = mL$$

$Z$ = POND WIDTH $= W + 2X = W + 2mh$.

## CALCULATION OF $C_4$

1. DETERMINE PIPE SIZE FOR MAXIMUM ALLOWABLE DISCHARGE.
2. ASSUME A POND DEPTH (H)
3. C is given (entrance pipe coefficient).

$$Q(H) = CA\sqrt{2gH} \Rightarrow D^2 = \frac{4Q}{\pi C\sqrt{2gH}} \therefore$$

$$Q = CA\sqrt{2g}\sqrt{h} = C_4\sqrt{h} \; ; \; C_4 = C\left(\frac{D^2}{4}\right)\pi\sqrt{2g}$$

SERGENT, HAUSKINS & BECKWITH

SOIL & FOUNDATION INVESTIGATION REPORT

Warehouse

Los Angeles, near Washington, N.E.

Albuquerque, New Mexico

SHB Job No. E81-1004

Consulting Geotechnical Engineers

PHOENIX • ALBUQUERQUE

SERGENT, HAUSKINS & BECKWITH

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SERGENT, HAUSKINS & BECKWITH CONSULTING GEOTECHNICAL ENGINEERS

APPLIED SOIL MECHANICS • ENGINEERING GEOLOGY • MATERIALS ENGINEERING

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February 2, 1981

Bill J. Shelton & Associates
1113 Rhode Island, N.E.
Albuquerque, New Mexico 87110

SHB Job No. E81-1004

Attention: Bill J. Shelton

RECEIVED
MAR 26 1981
CITY ENGINEER

Re: Warehouse
Los Angeles, near Washington, N.E.
Albuquerque, New Mexico

Gentlemen:

Our Soil and Foundation Investigation Report on the referenced project is herewith submitted. The report includes the results of test drilling, laboratory analyses, and recommended criteria for foundation design and slab support.

Should any questions arise concerning this report, we would be pleased to discuss them with you.

Respectfully submitted,
Sergent, Hauskins & Beckwith Engineers

By Benny E. McMillan
Benny E. McMillan, P.E.

Reviewed by Robert D. Booth
Robert D. Booth, P.E.

ROBERT D. BOOTH
NEW MEXICO
5711
REGISTERED PROFESSIONAL ENGINEER

Copies: Addressee (4)

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SHB Job No. E81-1004

Warehouse
Los Angeles, near Washington, N.E.
Albuquerque, New Mexico
SHB Job No. E81-1004

## 1. INTRODUCTION

This report is submitted pursuant to a soil and foundation investigation made by this firm of the site of the proposed Warehouse to be located on Los Angeles, west of Washington in the northeast quadrant of Albuquerque, New Mexico. The object of the investigation was to evaluate the physical properties of the subsoils underlying the site to provide recommendations for foundation design and slab support.

## 2. PROPOSED CONSTRUCTION

Details of the proposed construction were provided by Bill J. Shelton, A.I.A. It is understood that the proposed building will be single story of steel frame, high bay construction. No basement is planned, and floor slabs will be cast on-grade. It is anticipated that some concentrated loads ranging to approximately 50 kips will probably be involved.

Should details of final design vary significantly from those outlined above, this firm should be notified for review and possible revision of recommendations.

## 3. INVESTIGATION

### 3.1 Subsurface Exploration

Six exploratory borings were drilled to depths of 26

feet below existing grade. Standard penetration testing and open-end drive sampling were performed at selected intervals in the borings. During the test drilling, the soils encountered were continuously examined, visually classified, and logged. The results of the field investigation are presented in Appendix A along with a brief description of drilling and sampling equipment and procedures, a site plan showing boring locations, and logs of the test borings.

### 3.2 Laboratory Analysis

Moisture content determinations were made on all tube samples recovered while dry densities were determined for selected 2.42 inch diamater open-end drive samples. Results of these tests are shown on the boring logs.

Grain-size analysis and Atterberg limits tests were performed on selected samples to aid in classification. A consolidation test was performed on a selected 2.42 inch diameter open-end drive sample to evaluate the settlement characteristics of the foundation soils. Results of these tests are presented in Appendix B.

## 4. SITE CONDITIONS & SOIL PROFILE

### 4.1 Site Conditions

The site slopes gently to the west with approximately 2 feet differential elevation across the building area

feet below existing grade. Standard penetration testing and open-end drive sampling were performed at selected intervals in the borings. During the test drilling, the soils encountered were continuously examined, visually classified, and logged. The results of the field investigation are presented in Appendix A along with a brief description of drilling and sampling equipment and procedures, a site plan showing boring locations, and logs of the test borings.

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## 4. SITE CONDITIONS & SOIL PROFILE

### 4.1 Site Conditions

The site slopes gently to the west with approximately 2 feet differential elevation across the building area

and, at present, is covered by a moderate growth of native grass. An existing railroad spur is located to the north and west of the property. No other evidence of previous construction on the site was observed.

## 4.2 Soil Profile

As indicated by the exploratory borings, a surface stratum is present consisting predominantly of silts and silty sands which are nonplastic to low plasticity. However, a high plasticity silt was encountered near the surface in one boring. These soils, which extend to depths of between 4 and 9 feet, range from soft to moderately firm at the boring locations.

Underlying the surface stratum, intercalated layers of silt, clay, and silty sand, along with an occasional thin layer of clean, poorly graded sand, were encountered. These relatively thin layers of moderately firm, finer grained soils extended to a dense to very dense sand and gravel layer which was encountered at depths ranging from 12 to 20 feet in the borings.

## 4.3 Soil Moisture Contents

No free ground water was encountered in the borings. Soil moisture contents were relatively low, being well below the plastic limit for the cohesive materials, except the high plasticity silt encountered in boring no. 5 contained moisture very near the plastic limit.

## 5. DISCUSSION & RECOMMENDATIONS

### 5.1 Analysis of Results

The near surface soils underlying the site possess a relatively high settlement potential at their present, relatively low moisture contents. Thus, significant post-construction moisture increases in the supporting soils would have the potential to create large downward movements of even lightly loaded shallow footings or slabs. It is estimated that, should a source of moisture become available, several inches of downward movement of slabs and shallow footings would occur. Thus, a relatively high degree of risk of excessive foundation or slab movements would be involved with shallow spread-type footings bearing on native soils.

Drilled cast-in-place concrete piers, with the provision for at least 1.5 feet of engineered fill beneath floor slabs cast on-grade, would greatly reduce the degree of risk involved and appears to be the most practical approach. However, careful site drainage and moisture protection provisions will be necessary with this system as large moisture increases could create excessive slab movements. Detailed recommendations for this type of foundation system and required site grading are presented in the following sections of this report.

Overexcavation of the softer surface soils (3 feet below base of footing elevation) and replacement with properly

compacted engineered fill and the use of spread-type footings bearing in the fill may be considered as an alternate design. There is more risk of post-construction foundation movement with this alternate design should the native soils beneath the engineered fill become saturated.

## 5.2 Foundations

### 5.2.1 Drilled Foundations

Straight drilled cast-in-place concrete piers are recommended for the support of the structure. Recommended safe downward capacities for drilled piers are presented on the design chart below. The chart presents the safe downward capacity of various diameters of drilled piers extending to the recommended depth below existing grade. The capacities apply to full dead plus realistic live loads and can be safely increased by one-third for total loads including wind or seismic forces. Fifteen feet below existing grade or contact with the dense sand and gravel layer whichever is deeper, is the minimum recommended depth of drilled piers. Due to the variable depth to the sand and gravel layer, the depth of drilled piers will vary somewhat. However, a fairly accurate evaluation of total length of pier required can be made based upon the exploratory borings.

All foundation excavations should be inspected by a representative of the soils engineer to insure proper contact with the bearing stratum. Careful machine cleaning will be possible in the soils involved. Measurements should be taken of the maximum advance of the drilling tools, and the piers should be inspected to see that disturbed soils are sufficiently removed to that depth. It may be necessary to add a small amount of water in order to clean out some of the more granular soils. Depths of all drilled foundations should be measured.

Safe allowable downward loads for piers drilled to the depths recommended above are:

| Pier Diameter | Allowable Bearing |
|---|---|
| 18 inches | 42 kips |
| 24 inches | 58 kips |
| 30 inches | 75 kips |

It is estimated that maximum settlements of foundations designed in accordance with criteria presented above will not exceed 1/2 inch. The majority of this settlement will take place during construction and initial application of live loads. These estimates are based upon moisture contents of the supporting soils remaining essentially the same as those encountered during test drilling.

5.2.2 Spread Footings

Provided a minimum of 3.0 feet of engineered fill constructed in accordance with Section 5.3 underlies the foundations, shallow spread footings bearing in the fill would provide safe support for the structure. The recommended allowable load for spread footings bearing on the fill is 2500 psf. Minimum depth of footings should be 2.0 feet below lowest adjacent finished grade for exterior footings and 1.0 foot below finished floor for interior footings. The recommended bearing applies to full dead plus realistic live loads and can be safely be increased by one-third for total load including wind and seismic forces.

Two feet and 1.33 feet are the minimum recommended widths of square and continuous footings, respectively.

5.2.3 Lateral Loads

The passive soil resistance against grade beams, etc., with properly compacted backfill, should be considered as being equal to the forces exerted by a fluid of 300 pounds per cubic foot unit weight.

A passive earth pressure of 800 pounds per square foot per foot of depth is recommended for the design of isolated drilled piers against lateral forces. The recommended passive resistance can be used to evaluate the lateral capacity of isolated drilled piers

by methods outlined by Hansen (1)*, Broms (2), or Czerniak (3).

## 5.3 Site Grading & Slab Support

### 5.3.1 Site Grading

All vegetation and debris should be removed from building, exterior slab, and pavement areas. The entire building and exterior slab areas should then be overexcavated to a minimum of 1.5 feet below the bottom of slab elevation and 3.0 feet below footings, if the spread footing alternate is used, and replaced with engineered fill meeting the requirements outlined in paragraph 5.4. Prior to placement of the fill, the upper 8 inches of the exposed surface of the native soils should be scarified, brought to the optimum moisture content or above, and compacted to at least 95 percent of maximum density as determined in accordance with ASTM D 1557.

### 5.3.2 Slab Support

The subgrades prepared in accordance with the recommendations presented in section 5.3.1 will provide

* Numbers in parentheses refer to references listed at the end of this report.

adequate structural support for slabs cast on-grade. However, if desired as a working surface, a 4-inch course of granular base can be placed beneath concrete floor slabs.

If used, granular base should meet the following grading requirements as determined in accordance with ASTM D 422.

| Sieve Size (Square Openings) | Percent Passing By Weight |
|---|---|
| 1 inch | 100 |
| 3/4 inch | 95-100 |
| no. 4 | 45-95 |
| no. 200 | 0-8 |

The granular base should have a plasticity index of no greater than 3 when tested in accordance with ASTM D 423 and D 424. The coarse aggregate should have a percent of wear when subjected to the Los Angeles abrasion test (ASTM C 131) of no greater than 50. Compaction of granular base should be accomplished to a minimum of 95 percent of maximum density as determined in accordance with ASTM D 1557.

5.3.3 Moisture Protection of Slabs

Granular base would tend to act as a capillary barrier to moisture but will not provide a positive barrier against the rise of moisture through slabs. If the

moisture sensitivity of floor coverings is considered critical, an impervious membrane vapor barrier should be placed beneath floor slabs. A 2-inch layer of clean nonplastic sand should be placed beneath the floor slab to minimize differential shrinkage cracking of the slabs.

## 5.4 Engineered Fill

Engineered fill should be free of vegetation, debris and other deleterious material and meet the following grading requirements as determined in accordance with ASTM D 422.

| Sieve Size (Square Openings) | Percent Passing By Weight |
|---|---|
| 3 inch | 100 |
| no. 4 | 40-70 |
| no. 200 | 15-65 |

The plasticity index of the engineered fill material should be no greater than 15 when tested in accordance with ASTM D 423 and D 424.

All engineered fill should be compacted at or near the optimum moisture content (±2 percent) to at least 95 percent of the maximum dry density as determined in accordance with ASTM D 1557.

## 5.5 Site Drainage & Moisture Protection

Significant moisture increase in the subsoils would create some movements of the structure and slabs on-grade. Accordingly, positive site drainage should be provided during construction and maintained thereafter. Free drainage should be afforded for roof runoff and excess irrigation waters from planting areas adjacent to or near the structure. The possibility of moisture infiltration into supporting soils, in the event of plumbing leaks, should be considered in the design and inspection of underground water and sewer conduits.

## REFERENCES

1. Hansen, J. Brinch, "The Ultimate Resistance of Rigid Piles Against Transversal Forces", Danish Geotechnical Institute Bulletin No. 12, 1961.

2. Broms, Bengt B., "Lateral Resistance of Piles in Cohesive Soils", Journal of the Soil Mechanics & Foundation Division, ASCE, Volume 90, No. SM2, March, 1964.

3. Czerniak, E., "Resistance to Overturning the Single Short Piles", Paper #1188, Journal of the Structural Division, Proceedings ASCE. 1957.

## TEST DRILLING EQUIPMENT & PROCEDURES

Drilling Equipment Truck-mounted CME-55 drill rigs powered with 6 cylinder Ford industrial engines are used in advancing test borings. The 6 cylinder engines are capable of delivering about 6,500 foot/pounds torque to the drill spindle. The spindle is advanced with twin hydraulic rams capable of exerting 12,000 pounds downward force. Drilling through soil or softer rock is performed with 6-1/2 inch O.D., 3-1/4 I.D. hollow stem auger or 4-1/2 inch continuous flight auger. Carbide insert teeth are normally used on the auger bits so they can often penetrate rock or very strongly cemented soils which require blasting or very heavy equipment for excavation. Where refusal is experienced in auger drilling, the holes are sometimes advanced with tricone gear bits and NX rods using water or air as a drilling fluid.

Sampling Procedures Dynamically driven tube samples are usually obtained at selected intervals in the borings by the ASTM D1586 procedures. In most cases, 2" O.D., 1-3/8" I.D. samplers are used to obtain the standard penetration resistance. "Undisturbed" samples of firmer soils are often obtained with 3" O.D. samplers lined with 2.42" I.D. brass rings. The driving energy is generally recorded as the number of blows of a 140 pound 30 inch free fall drop hammer required to advance the samplers in 6 inch increments. However, in stratified soils, driving resistance is sometimes recorded in 2 or 3 inch increments so that soil changes and the presence of scattered gravel or cemented layers can be readily detected and the realistic penetration values obtained for consideration in design. These values are expressed in blows per foot on the logs. "Undisturbed" sampling of softer soils is sometimes performed with thin walled Shelby tubes (ASTM D1587). Where samples of rock are required, they are obtained by NX diamond core drilling (ASTM D2113). Tube samples are labeled and placed in watertight containers to maintain field moisture contents for testing. When necessary for testing, larger bulk samples are taken from auger cuttings.

Continuous Penetration Tests Continuous penetration tests are performed by driving a 2" O.D. blunt nosed penetrometer adjacent to or in the bottom of borings. The penetrometer is attached to 1-5/8" O.D. drill rods to provide clearance to minimize side friction so that penetration values are as nearly as possible a measure of end resistance. Penetration values are recorded as the number of blows of a 140 pound 30 inch free fall drop hammer required to advance the penetrometer in one foot increments or less.

Boring Records Drilling operations are directed by our field engineer or geologist who examines soil recovery and prepares boring logs. Soils are visually classified in accordance with the Unified Soil Classification System (ASTM D2487) with appropriate group symbols being shown on the logs.

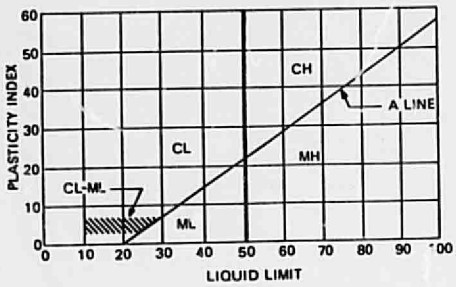
# UNIFIED SOIL CLASSIFICATION SYSTEM

Soils are visually classified by the Unified Soil Classification system on the boring logs presented in this report. Grain-size analysis and Atterberg Limits Tests are often performed on selected samples to aid in classification. The classification system is briefly outlined on this chart. For a more detailed description of the system, see "The Unified Soil Classification System" Corp of Engineers, US Army Technical Memorandum No. 3-357 (Revised April 1960) or ASTM Designation: D2487-66T.

| MAJOR DIVISIONS | | | | GRAPHIC SYMBOL | GROUP SYMBOL | TYPICAL NAMES |
|---|---|---|---|---|---|---|
| COARSE-GRAINED SOILS (Less than 50% passes No. 200 sieve) | GRAVELS (50% or less of coarse fraction passes No. 4 sieve) | CLEAN GRAVELS (Less than 5% passes No. 200 sieve) | | | GW | Well graded gravels, gravel-sand mixtures, or sand-gravel-cobble mixtures. |
| | | | | | GP | Poorly graded gravels, gravel-sand mixtures, or sand-gravel-cobble mixtures. |
| | | GRAVELS WITH FINES (More than 12% passes No. 200 sieve) | Limits plot below "A" line & hatched zone on plasticity chart | | GM | Silty gravels, gravel-sand-silt mixtures. |
| | | | Limits plot above "A" line & hatched zone on plasticity chart | | GC | Clayey gravels, gravel-sand-clay mixtures. |
| | SANDS (More than 50% of coarse fraction passes No. 4 sieve) | CLEAN SANDS (Less than 5% passes No. 200 sieve) | | | SW | Well graded sands, gravelly sands. |
| | | | | | SP | Poorly graded sands, gravelly sands. |
| | | SANDS WITH FINES (More than 12% passes No. 200 sieve) | Limits plot below "A" line & hatched zone on plasticity chart | | SM | Silty sands, sand-silt mixtures. |
| | | | Limits plot above "A" line & hatched zone on plasticity chart | | SC | Clayey sands, sand-clay mixtures. |
| FINE-GRAINED SOILS (50% or more passes No. 200 sieve) | SILTS (Limits plot below "A" line & hatched zone on plasticity chart) | SILTS OF LOW PLASTICITY (Liquid Limit Less Than 50) | | | ML | Inorganic silts, clayey silts with slight plasticity. |
| | | SILTS OF HIGH PLASTICITY (Liquid Limit More Than 50) | | | MH | Inorganic silts, micaceous or diatomaceous silty soils, elastic silts. |
| | CLAYS (Limits plot above "A" line & hatched zone on plasticity chart) | CLAYS OF LOW PLASTICITY (Liquid Limit Less Than 50) | | | CL | Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays. |
| | | CLAYS OF HIGH PLASTICITY (Liquid Limit More Than 50) | | | CH | Inorganic clays of high plasticity, fat clays, sandy clays of high plasticity. |

**NOTE:** Coarse grained soils with between 5% & 12% passing the No. 200 sieve and fine grained soils with limits plotting in the hatched zone on the plasticity chart to have double symbol.

## PLASTICITY CHART




## DEFINITIONS OF SOIL FRACTIONS

| SOIL COMPONENT | PARTICLE SIZE RANGE |
|---|---|
| Cobbles | Above 3 in. |
| Gravel | 3 in. to No. 4 sieve |
| Coarse gravel | 3 in. to ¾ in. |
| Fine gravel | ¾ in. to No. 4 sieve |
| Sand | No. 4 to No. 200 |
| Coarse | No. 4 to No. 10 |
| Medium | No. 10 to No. 40 |
| Fine | No. 40 to No. 200 |
| Fines (silt or clay) | Below No. 200 sieve |

## TERMINOLOGY USED TO DESCRIBE THE RELATIVE DENSITY, CONSISTENCY, OR FIRMNESS, OF SOILS

The terminology used on the boring logs to describe the relative density, consistency, or firmness of soils relative to the standard penetration resistance is presented below. The standard penetration resistance (N) in blows per foot is obtained by ASTM D1586 procedure using 2" O.D., 1-3/8" I.D. samplers.

1. Relative Density. Terms for description of relative density of cohesionless, uncemented sands and sand-gravel mixtures.

| N | Relative Density |
|---|---|
| 0-4 | Very loose |
| 5-10 | Loose |
| 11-30 | Medium dense |
| 31-50 | Dense |
| 50+ | Very dense |

2. Relative Consistency. Terms for the description of clays which are saturated or near saturation.

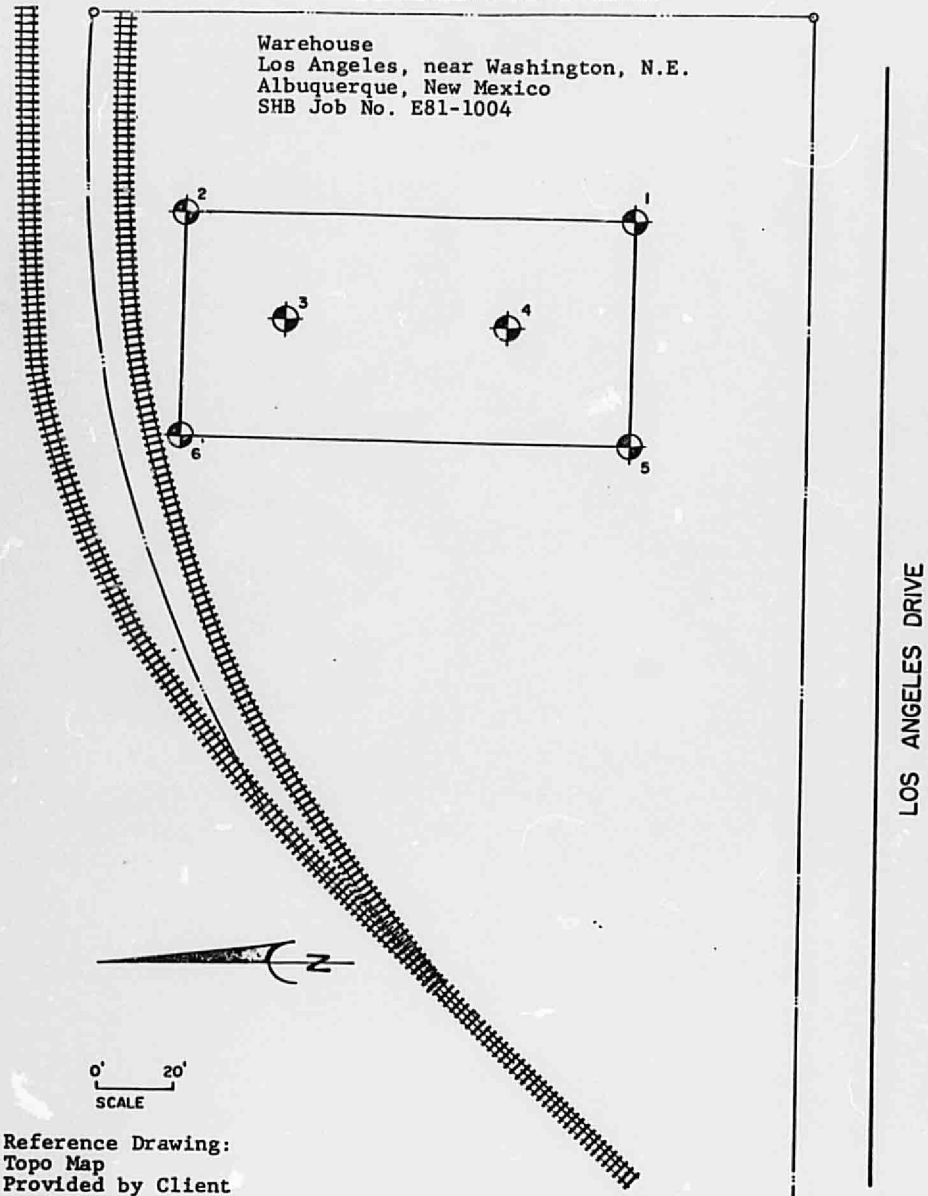
| N | Relative Consistency | Remarks |
|---|---|---|
| 0-2 | Very soft | Easily penetrated several inches with fist |
| 3-4 | Soft | Easily penetrated several inches with thumb |
| 5-8 | Medium stiff | Can be penetrated several inches with thumb with moderate effort |
| 9-15 | Stiff | Readily indented with thumb, but penetrated only with great effort |
| 16-30 | Very stiff | Readily indented with thumbnail |
| 30+ | Hard | Indented only with difficulty by thumbnail |

3. Relative Firmness. Terms for the description of partially saturated and/or cemented soils which commonly occur in the Southwest including clays, cemented granular materials, silts and silty and clayey granular soils:

| N | Relative Density |
|---|---|
| 0-4 | Very soft |
| 5-8 | Soft |
| 9-15 | Moderately firm |
| 16-30 | Firm |
| 31-50 | Very firm |
| 50+ | Hard |

# SITE PLAN

SHOWING LOCATIONS OF TEST BORINGS




Reference Drawing:
Topo Map
Provided by Client
No date

SERGENT, HAUSKINS & BECKWITH

CONSULTING SOIL AND FOUNDATION ENGINEERS
PHOENIX • TUCSON • ALBUQUERQUE

PROJECT Warehouse

JOB NO. E81-1004 DATE 1/15/81

**LOG OF TEST BORING NO. 1**

RIG TYPE CME-55

BORING TYPE 6¼" Hollow Stem Auger

SURFACE ELEV. 5090.0±

DATUM Topo

| Depth in Feet | Continuous Penetration Resistance | Graphical Log | Sample | Sample Type | Blows per foot 140 lb. 30" free-fall drop hammer | Dry Density Lbs. per cu. ft. | Moisture Content Per Cent of Dry Wt. | Unified Soil Classification | REMARKS | VISUAL CLASSIFICATION |
|---|---|---|---|---|---|---|---|---|---|---|
| 0 | | | X | S | 9 | | 7 | | moderately firm | SANDY SILT, nonplastic, tan |
| | | | X | S | 10 | | 7 | ML | | |
| 5 | | | X | S | 16 | | 6 | | | |
| 10 | | | X | S | 23 | | 7 | CL | firm | SILTY SAND, low plasticity, brown |
| 15 | | | X | S | 17 | | 2 | SP | medium dense | SAND, some silt, predominantly fine, nonplastic, tan |
| 20 | | | X | S | 40 | | 2 | SP | dense to very dense | SAND, clean, predominantly fine, tan<br>note: gravel seam at 18' 19' intercalated with seam of silty sand, occasional cobbles |
| 25 | | | X | S | 14-50/5" | | 2 | | | Stopped auger at 24'6"<br>Sampler refused at 25'5" |
| 30 | | | | | | | | | | |

**GROUND WATER**

| DEPTH | HOUR | DATE |
|---|---|---|
| | none | |

**SAMPLE TYPE**

A – Auger cuttings. B – Block sample
S – 2" O.D. 1.38" I.D. tube sample.
U – 3" O.D. 2.42" I.D. tube sample.
T – 3" O.D. thin-walled Shelby tube.

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PROJECT Warehouse

JOB NO. E81-1004 DATE 1/15/81

**LOG OF TEST BORING NO. 2**

RIG TYPE CME-55

BORING TYPE 6½" Hollow Stem Auger

SURFACE ELEV. 5090.0±

DATUM Topo

| Depth in Feet | Continuous Penetration Resistance | Graphical Log | Sample | Sample Type | Blows per foot 140 lb. 30" free-fall drop hammer | Dry Density Lbs. per cu. ft. | Moisture Content Per Cent of Dry Wt. | Unified Soil Classification | REMARKS | VISUAL CLASSIFICATION |
|---|---|---|---|---|---|---|---|---|---|---|
| 0 | | | X | S | 9 | | 5 | | moderately firm | SANDY SILT, nonplastic, tan |
| | | | X | S | 10 | | 4 | | | |
| 5 | | | X | U | 63(no recovery) | | | ML | | |
| 10 | | | X | S | 14 | | 6 | SM | moderately firm | SILTY SAND, predominantly fine, nonplastic, tan<br>note: possible intercalated sand, silty sand and sandy silt |
| 15 | | | X | S | 31 | | 2 | | dense to very dense | SAND, some silt, predominantly fine, nonplastic, tan |
| 20 | | | X | S | 50 | | 2 | SP | | |
| 25 | | | | S | 50/5" | | 1 | GP | very dense | SANDY GRAVEL & COBBLES, predominantly coarse, tan |
| 30 | | | | | | | | | | Stopped auger at 24'6"<br>Sampler refused at 24'11" |

**GROUND WATER**

| DEPTH | HOUR | DATE |
|---|---|---|
| | none | |

**SAMPLE TYPE**

A – Auger cuttings. B – Block sample
S – 2" O.D. 1.38" I.D. tube sample.
U – 3" O.D. 2.42" I.D. tube sample.
T – 3" O.D. thin-walled Shelby tube

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# LOG OF TEST BORING NO. 3

PROJECT Warehouse
JOB NO. E81-1004 DATE 1/15/81

RIG TYPE CME-55
BORING TYPE 6¼" Hollow Stem Auger
SURFACE ELEV. 5089.5±
DATUM Topo

| Depth in Feet | Continuous Penetration Resistance | Graphical Log | Sample | Sample Type | Blows per foot 140 lb. 30" free-fall drop hammer | Dry Density Lbs. per cu. ft. | Moisture Content Per Cent of Dry Wt. | Unified Soil Classification | REMARKS | VISUAL CLASSIFICATION |
|---|---|---|---|---|---|---|---|---|---|---|
| 0 | | | X | S | 5 | | 7 | SM | soft | SILTY SAND, predominantly fine, nonplastic, tan |
| | | | X | S | 6 | | | | | |
| 5 | | | X | U | 10(no recovery) | | | SP | loose | SAND, some silt, predominantly medium, tan |
| 10 | | | X | S | 13 | | 7 | GL | moderately firm to firm | SANDY CLAY, low plasticity, tan |
| 15 | | | X | S | 19 | | 5 | | | |
| 20 | | | X | S | 91 | | 1 | GP | very dense | SANDY GRAVEL, predominantly fine, gray |
| 25 | | | X | S | 96(no redovery) | | | | | Stopped auger at 24'6" Stopped sampler at 26' |
| 30 | | | | | | | | | | |

**GROUND WATER**

| DEPTH | HOUR | DATE |
|---|---|---|
| | none | |

**SAMPLE TYPE**

A – Auger cuttings. B – Block sample
S – 2" O.D. 1.38" I.D. tube sample.
U – 3" O.D. 2.42" I.D. tube sample.
T – 3" O.D. thin-walled Shelby tube.

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PROJECT Warehouse

JOB NO. E81-1004 DATE 1/15/81

**LOG OF TEST BORING NO. 4**

RIG TYPE CME-55

BORING TYPE 6½" Hollow Stem Auger

SURFACE ELEV. 5089.0±

DATUM Topo

| Depth in Feet | Continuous Penetration Resistance | Graphical Log | Sample | Sample Type | Blows per foot 140 lb. 30" free-fall drop hammer | Dry Density Lbs. per cu. ft. | Moisture Content Per Cent of Dry Wt. | Unified Soil Classification | REMARKS | VISUAL CLASSIFICATION |
|---|---|---|---|---|---|---|---|---|---|---|
| 0 | | | X | S | 10 | | 4 | | moderately firm | SILTY SAND, predominantly fine, nonplastic, tan |
| | | | X | S | 12 | | 4 | SM | | |
| 5 | | | X | S | 11 | | 4 | | moderately firm to firm | SILTY CLAY, considerable fine sand, low plasticity, brown |
| 10 | | | X | U | 28 | 100 | 6 | CL-ML | | |
| 15 | | | X | S | 23 | | 6 | | | |
| 20 | | | X | S | 40(no recovery) | | | SP | dense | SAND, predominantly medium, some gravel, tan |
| | | | | | | | | GP | very dense | SANDY GRAVEL, predominantly fine, tan |
| 25 | | | X | S | 91 | | 1 | | | |
| 30 | | | | | | | | | | Stopped auger at 24'6" Sampler refused at 24'11" |

**GROUND WATER**

| DEPTH | HOUR | DATE |
|---|---|---|
| | none | |
| | | |

**SAMPLE TYPE**

A – Auger cuttings. B – Block sample
S – 2" O.D. 1.38" I.D. tube sample.
U – 3" O.D. 2.42" I.D. tube sample.
T – 3" O.D. thin-walled Shelby tube

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JOB NO. E81-1004 DATE 1/21/81

**LOG OF TEST BORING NO. 5**

RIG TYPE CME-55

BORING TYPE 6½" Hollow Stem Auger

SURFACE ELEV. 5088.5±

DATUM Topo

| Depth in Feet | Continuous Penetration Resistance | Graphical Log | Sample | Sample Type | Blows per foot 140 lb. 30" free-fall drop hammer | Dry Density Lbs. per cu. ft. | Moisture Content Per Cent of Dry Wt. | Unified Soil Classification | REMARKS | VISUAL CLASSIFICATION |
|---|---|---|---|---|---|---|---|---|---|---|
| 0 | | | X | S | 6(no recovery) | | | SC | soft | CLAYEY SAND, predominantly fine, low plasticity, brown |
| | | | X | S | 7(no recovery) | | | MH | soft | CLAYEY SILT, medium to high plasticity, tan |
| 5 | | | X | U | 44 | | 24 | CL | firm | SANDY CLAY, medium plasticity, brown |
| 10 | | | X | S | 10 | | 19 | CL | moderately firm | SILTY CLAY, medium plasticity, brown |
| 15 | | | X | U | 10 | 86 | 11 | ML | soft | SANDY SILT, low plasticity, brown |
| | | | | | | | | SC | | CLAYEY SAND, predominantly fine, low plasticity, brown |
| 20 | | | X | S | 20(no recovery) | | | SP | medium dense | SAND, predominantly medium, tan<br>note: gravel strata at 17' |
| 25 | | | X | S | 32 | | 14 | CL | very firm | SANDY CLAY, medium plasticity, brown |
| 30 | | | | | | | | | | Stopped auger at 24'6"<br>Stopped sampler at 26' |

**GROUND WATER**

| DEPTH | HOUR | DATE |
|---|---|---|
| | none | |
| | | |

**SAMPLE TYPE**

A – Auger cuttings. B – Block sample
S – 2" O.D. 1.38" I.D. tube sample.
U – 3" O.D. 2.42" I.D. tube sample.
T – 3" O.D. thin-walled Shelby tube.

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JOB NO. E81-1004 DATE 1/21/81

**LOG OF TEST BORING NO.** 6

RIG TYPE CME-55

BORING TYPE 6½" Hollow Stem Auger

SURFACE ELEV. 5088.5±

DATUM Topo

| Depth in Feet | Continuous Penetration Resistance | Graphical Log | Sample | Sample Type | Blows per foot 140 lb. 30" free-fall drop hammer | Dry Density Lbs. per cu. ft. | Moisture Content Per Cent of Dry Wt. | Unified Soil Classification | REMARKS | VISUAL CLASSIFICATION |
|---|---|---|---|---|---|---|---|---|---|---|
| 0 | | | X | S | 8 | | 6 | SM | soft to moderately firm | SILTY SAND, predominantly fine, nonplastic, brown |
| | | | X | S | 15 | | 4 | | | |
| 5 | | | X | S | 22(no recovery) | | | GP | medium dense | SANDY GRAVEL, predominantly fine, tan |
| 10 | | | X | S | 24 | | 4 | SM | firm | SILTY SAND, predominantly fine, nonplastic, tan |
| 15 | | | X | S | 26 | | 5 | SC | firm | CLAYEY SAND, predominantly fine, low plasticity, tan |
| 20 | | | X | S | 60 | | 1 | GP | very dense | SANDY GRAVEL, predominantly coarse, gray<br>note: 12" seam of sand at 22½' |
| | | | | S | 50/5"(no recovery) | | | | | |
| 25 | | | | | | | | | | Stopped auger at 24'6"<br>Sampler refused at 24'11" |
| 30 | | | | | | | | | | |

**GROUND WATER**

| DEPTH | HOUR | DATE |
|---|---|---|
| | none | |

**SAMPLE TYPE**

A – Auger cuttings. B – Block sample
S – 2" O.D. 1.38" I.D. tube sample.
U – 3" O.D. 2.42" I.D. tube sample.
T – 3" O.D. thin-walled Shelby tube.

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A-10

## LABORATORY TESTING PROCEDURES

Consolidation Tests Soiltest or Clockhouse apparatus of the "floating-ring" type are employed for the one-dimensional consolidation tests. They are designed to receive one inch high 2.5 inch O.D. brass liner rings with soil specimens as secured in the field. Procedures for the tests generally are those outlined in ASTM D2435. Loads are applied in several increments to the upper surface of the test specimen and the resulting deformations are recorded at selected time intervals for each increment. For soils which are essentially saturated, each increment of load is maintained until the deformation versus log of time curve indicates completion of primary consolidation. For partially saturated soils, each increment of load is maintained until the rate of deformation is equal or less than 1/10,000 inch per hour. Applied loads are such that each new increment is equal to the total previously applied loading. Porous stones are placed in contact with the top and bottom of the specimens to permit free addition or expulsion of water. For partially saturated soils, the tests are normally performed at in situ moisture conditions until consolidation is complete under stresses approximately equal to those which will be imposed by the combined overburden and foundation loads. The samples are then submerged to show the effect of moisture increase and the tests continued under higher loadings. Generally, the tests are continued to about twice the anticipated curve due to overburden and structural loads with a rebound curve then being established by releasing loads.

Expansion Tests The same type of consolidometer apparatus described above is used in expansion testing. Undisturbed samples contained in brass liner rings are placed in the consolidometers, subjected to appropriate surcharge loads and submerged. The loads are maintained until the expansion versus log of time curve indicates the completion of "primary swell".

# TABULATION OF TEST RESULTS

Job No. E81-1004

Project Warehouse

Los Angeles, near Washington, N.E.

Material

Source

| HOLE NO. | LOCATION | DEPTH | UNIFIED CLASS. | LL | PI | SIEVE ANALYSIS – ACCUM. % PASSING | | | | | | | | | | | | LAB. NO. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | 200 | 100 | 40 | 10 | 4 | 3/8 | 1/2 | 3/4 | 1 | 1-1/2 | 3 | 6 | |
| 1 | See Site Plan | 2½' | ML | NV | NP | 52 | 72 | 82 | 88 | 90 | 91 | | 100 | | | | | 04-1 |
| 3 | See Site Plan | 2½' | ML | NV | NP | 53 | 85 | 100 | | | | | | | | | | 04-2 |
| 4 | See Site Plan | 9½' | CL-ML | 26 | 5 | 72 | 93 | 98 | 99 | 100 | | | | | | | | 04-3 |
| 5 | See Site Plan | 4½' | MH | 56 | 24 | 87 | 92 | 96 | 97 | 98 | 98 | | 100 | | | | | 04-4 |
| 6 | See Site Plan | 2½' | SM | NV | NP | 38 | 66 | 80 | 91 | 96 | 98 | | 100 | | | | | 04-6 |

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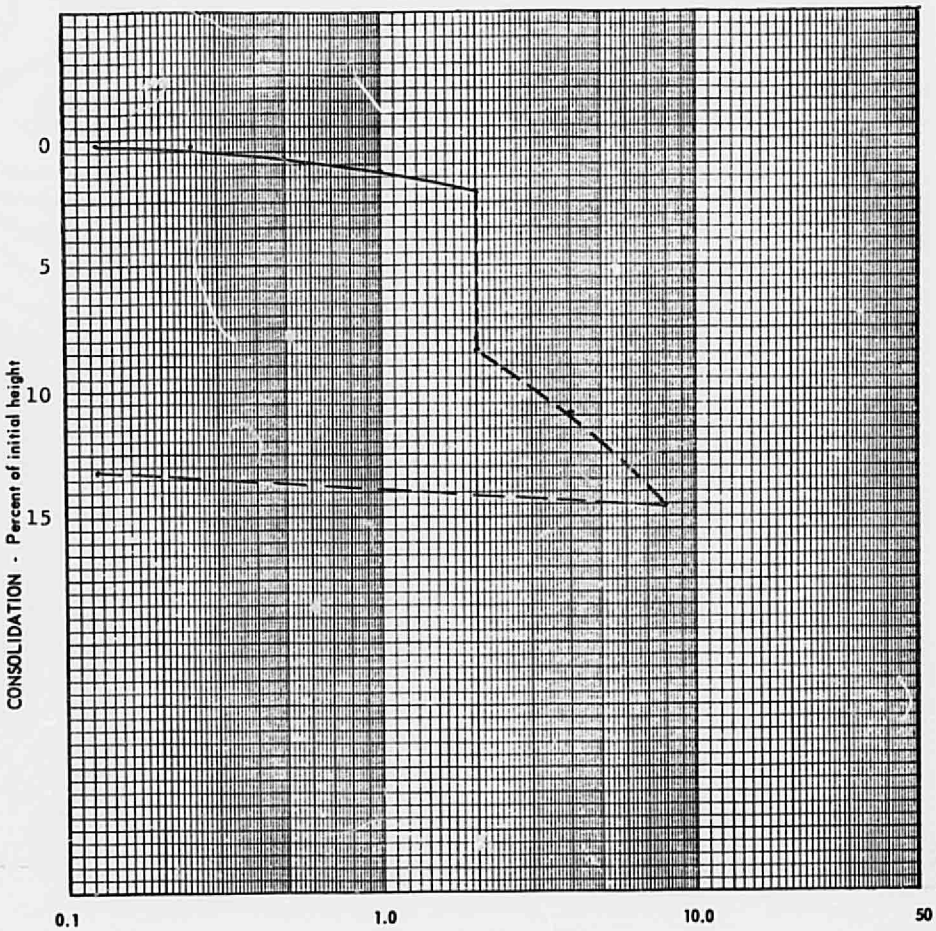
## SUMMARY OF CONSOLIDATION TESTS

PROJECT Warehouse JOB NO. E81-1004




| CURVE | SAMPLE | INITIAL DRY DENSITY LBS./CU. FT. | MOISTURE CONTENT % DRY WEIGHT | | UNIFIED SOIL CLASSIFICATION |
|---|---|---|---|---|---|
| | | | INITIAL | FINAL | |
| | Boring #4 @ 9½' | 99.6 | 6.4 | 28.4 | CL-ML |
| | | | | | |
| | | | | | |

SOIL MOISTURE CONDITION

——— INSITU

– – – – SUBMERGED

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