July 13, 2020
IC 20020-I

RBM of California, Inc.
2999 Overland Avenue #203
Los Angeles, California 90064

Subject

Geotechnical Engineering Exploration Report
Geotechnical Engineering Exploration
Proposed Apartment Building
Lots 2 - 5, Block 47, Tract 5609
2107 - 2121 Westwood Boulevard
Los Angeles, California

References: Report by Irvine Geotechnical, Inc.:

Geotechnical Engineering Exploration, Proposed Apartment Building, Lots 2 - 5, Block 47, Tract 5609, 2107 - 2121 Westwood Boulevard, Los Angeles, California, dated March 17, 2020

City of Los Angeles Department of Building and Safety, Grading Division:

Soils Report Approval Letter, Log #113465, dated June 23, 2020

Dear Gentle Persons;

Irvine Geotechnical has prepared this supplemental report to provide additional geotechnical recommendations to the Grading Division for the design and construction of the proposed project. This supplemental report follows consultation with the client and design team. A copy of the June 23, 2020 Department letter is appended to this report for reference.

The project remains generally similar to what was analyzed for the preliminary report and presented to the Department for review. As such, most of the geotechnical design recommendations remain valid and applicable. The retaining wall height assumed for the original report has increased from 25 to 31 feet. Recommendations are presented below for design of higher retaining walls and associated shoring.

RETAINING WALLS

General Design - Static Loading

Cantilevered retaining walls for this project are still expected to be 12 feet high or less. Thus, previous recommendations for design of cantilevered retaining walls remain valid and applicable.

Basement retaining walls could support excavations up to 31 feet. Restrained basement walls that are pinned at the top by a non-yielding floor should be designed for an at-rest earth pressure. The recommended design at-rest earth pressure on restrained basement walls is an equivalent fluid pressure of 70 pcf.

Basement walls that are constructed using shoring and braced, may be designed for a trapezoidal distribution of pressure. The recommended design earth pressure on restrained shoring is 44H, where H is the retained height in feet.

Seismic Surcharge

In conformance with the Building Code, retaining walls higher than 6 feet were considered for seismic loading for the design ground motion resulting from the Maximum Considered Earthquake. The horizontal coefficient of seismic increment (K_E) and seismic increment (P_E) were estimated following procedures by Sitar, N. et. al.,2010, (*Seismic Earth Pressures on Deep Building Basements,* SEAOC 2010 Convention Proceedings). Spectral accelerations at the site were determined for the Maximum Considered Earthquake (MCE) following the procedures in ASCE 7-10 and the 2019 Building Code. The computed PGA_M for this site is 1.044g. The horizontal coefficient of seismic increment (K_E) was assumed to be ⅓(PGA_M) = 0.348g.

The force required in addition to the static design force to raise the safety factor to at least 1.0 (P_E) was checked using a computerized version of the Mononobe-Okabe method. Ground motion was assumed to be 0.348g.

The recommended static and seismic forces for 31-foot high restrained retaining walls are shown in the following table. Where the unbalanced seismic force is higher than the static design pressure, the seismic increment was converted to an equivalent fluid pressure.

DESIGN EARTH PRESSURES - WALLS > 6 FEET			
Surface Slope Gradient	Static Design Force	Seismic Force*	Seismic Surcharge
Restrained	31ft^2 * 70 pcf /2=33.635 kips	33.389 kips	0 pcf

* See Calculation sheet

TEMPORARY EXCAVATIONS

Temporary excavations will be required to construct the proposed retaining walls. The excavations could be up to 33 feet in height. Vertical excavations removing lateral or vertical support from existing foundations or property lines will require the use of temporary shoring.

Shoring

Temporary shoring should be designed for an equivalent fluid pressure of 40 pounds per cubic foot per the enclosed calculations. Shoring that is integrated into the permanent retaining walls should be designed for earth pressures conforming to the RETAINING WALL section of this report.

Shoring that is retrained by tie backs or raker braces may be designed for a trapezoidal distribution of pressure. The recommended design earth pressure on restrained shoring is 25H, where H is the retained height in feet.

Shoring may consist of cast-in-place concrete piles with wood lagging. Shoring piles should be a minimum of 12 inches in diameter and a minimum of 8 feet into alluvium below the base of the excavation. Piles may be assumed fixed 3 feet below the base of the excavation. For the vertical forces, shoring piles may be designed for a skin friction of 450 pounds per square foot for that portion of pile in contact with the alluvium per the enclosed calculations. Soldier piles should be spaced a maximum of 10 feet on center.

The friction value is for the total of dead and frequently applied live loads and may be increased by one third for short duration loading, which includes the effects of wind or seismic forces. Resistance to lateral loading may be provided by passive earth pressure within the alluvium below the base of the excavation.

Passive earth pressure may be computed as an equivalent fluid having a density of 250 pounds per cubic foot. The maximum allowable earth pressure is 3,500 pounds per square foot. For design of isolated piles, the allowable passive and maximum earth pressures may be increased by 100 percent. Piles spaced more than 3 pile diameters on center may be considered isolated.

Surcharge Loading

Shoring that is surcharged by traffic and/or structural loads should be designed to withstand the surcharge. The surcharge loads may be computed following the guidelines in City of Los Angeles P/BC 2017-141 (*Guidelines for Determining Live Loads Surcharge from Sidewalk Pedestrian Traffic and Street Traffic*), Navfac DM 7.2 or equivalent Boussinesq methods.

Raker Footings

A bearing value of 3,000 psf may be assumed for inclined raker footings. This includes raker footings inclined at a 1.5:1 gradient. A coefficient of sliding friction of 0.40 may be assumed along the base of the footing. Passive pressure may be assumed to be 250 pcf.

Irvine Geotechnical appreciates the opportunity to provide our service on this project. Any questions concerning the data or interpretation of this or the referenced report should be directed to the undersigned.

Respectfully submitted,
Irvine Geotechnical, Inc.

Jon A. Irvine
E.G. 1691/G.E. 2891
\\IGPAFC3\Final\Cprojects\2020 Projects\IC20020 RBM Westwood\IC20020 RBM Westwood Supplemental.wpd

Enc: *Soils Report Approval Letter,* Log #113465, dated June 23, 2020
Calculation Sheets (4)

xc: (3) Addressee

CITY OF LOS ANGELES
CALIFORNIA

DEPARTMENT OF
BUILDING AND SAFETY
201 NORTH FIGUEROA STREET
LOS ANGELES, CA 90012

OSAMA YOUNAN, P.E.
GENERAL MANAGER
SUPERINTENDENT OF BUILDING

SOILS REPORT APPROVAL LETTER

June 23, 2020

LOG # 113465
SOILS/GEOLOGY FILE - 2

RBM of California, Inc.
800 Figueroa Street
Los Angeles, CA 90017

TRACT: TR 5609
BLOCK: 47
LOT(S): 2, 3,4 & 5
LOCATION: 2107-2121 S. Westwood Blvd.

CURRENT REFERENCE REPORT/LETTER(S)	REPORT No.	DATE OF DOCUMENT	PREPARED BY
Soils Report	IC 20020-I	03/17/2020	Irvine Geotechnical
Laboratory Test Report	SL20.3260	02/24/2020	Soil Labworks LLC

The Grading Division of the Department of Building and Safety has reviewed the referenced report that provides recommendations for the proposed 5-story apartment building over 2 levels of subterranean parking. The earth materials at the subsurface exploration locations consist of up to 2 feet of uncertified fill underlain by native soils. The consultants recommend to support the proposed structure(s) on conventional foundations bearing on native undisturbed soils.

The subsurface exploration encountered groundwater at a depth of 45 feet, and the depth to historical high groundwater level is about 40 feet below the surface, according to the consultants.

Engineering analyses provided by Irvine Geotechnical is based on laboratory testing performed by Soil Labworks LLC. Irvine Geotechnical is accepting responsibility for use of the data in accordance to Code section 91.7008.5 of LABC.

The referenced report is acceptable, provided the following conditions are complied with during site development:

(Note: Numbers in parenthesis ( ) refer to applicable sections of the 2020 City of LA Building Code. P/BC numbers refer the applicable Information Bulletin. Information Bulletins can be accessed on the internet at LADBS.ORG.)

1. Approval shall be obtained from the Department of Public Works, Bureau of Engineering, Development Services and Permits Program for the proposed removal of support and/or retaining of slopes adjoining to public way (3307.3.2).

1828 Sawtelle Blvd., 3rd Floor, West LA (310) 575-8388

2. In the event tie-back anchors are proposed for shoring purposes, provide a notarized letter from all adjoining property owners allowing tie-back anchors on their property (7006.6).

3. The soils engineer shall review and approve the detailed plans prior to issuance of any permit. This approval shall be by signature on the plans that clearly indicates the soils engineer has reviewed the plans prepared by the design engineer; and, that the plans included the recommendations contained in their reports (7006.1).

4. All recommendations of the report(s) that are in addition to or more restrictive than the conditions contained herein shall be incorporated into the plans.

5. A copy of the subject and appropriate referenced reports and this approval letter shall be attached to the District Office and field set of plans (7006.1). Submit one copy of the above reports to the Building Department Plan Checker prior to issuance of the permit.

6. A grading permit shall be obtained for all structural fill and retaining wall backfill (106.1.2).

7. Prior to the issuance of any permit, an accurate volume determination shall be made and included in the final plans, with regard to the amount of earth material to be exported from the site. For grading involving import or export of more than 1000 cubic yards of earth materials within the grading hillside area, approval is required by the Board of Building and Safety. Application for approval of the haul route must be filed with the Board of Building and Safety Commission Office. Processing time for application is approximately 8 weeks to hearing plus 10-day appeal period.

8. All man-made fill shall be compacted to a minimum 90 percent of the maximum dry density of the fill material per the latest version of ASTM D 1557. Where cohesionless soil having less than 15 percent finer than 0.005 millimeters is used for fill, it shall be compacted to a minimum of 95 percent relative compaction based on maximum dry density. Placement of gravel in lieu of compacted fill is only allowed if complying with LAMC Section 91.7011.3.

9. Existing uncertified fill shall not be used for support of footings, concrete slabs or new fill (1809.2, 7011.3).

10. Drainage in conformance with the provisions of the Code shall be maintained during and subsequent to construction (7013.12).

11. Grading shall be scheduled for completion prior to the start of the rainy season, or detailed temporary erosion control plans shall be filed in a manner satisfactory to the Grading Division of the Department and the Department of Public Works, Bureau of Engineering, B-Permit Section, for any grading work in excess of 200 cubic yards (7007.1).

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12. All loose foundation excavation material shall be removed prior to commencement of framing (7005.3).

13. The applicant is advised that the approval of this report does not waive the requirements for excavations contained in the General Safety Orders of the California Department of Industrial Relations (3301.1).

14. Temporary excavations that remove lateral support to the public way, adjacent property, or adjacent structures shall be supported by shoring, as recommended. Note: Lateral support shall be considered to be removed when the excavation extends below a plane projected downward at an angle of 45 degrees from the bottom of a footing of an existing structure, from the edge of the public way or an adjacent property. (3307.3.1)

15. Where any excavation, not addressed in the approved reports, would remove lateral support (as defined in 3307.3.1) from a public way, adjacent property or structures, a supplemental report shall be submitted to the Grading Division of the Department containing recommendations for shoring, underpinning, and sequence of construction. Report shall include a plot plan and cross-section(s) showing the construction type, number of stories, and location of adjacent structures, and analysis incorporating all surcharge loads that demonstrate an acceptable factor of safety against failure. (7006.2 & 3307.3.2)

16. Prior to the issuance of any permit that authorizes an excavation where the excavation is to be of a greater depth than are the walls or foundation of any adjoining building or structure and located closer to the property line than the depth of the excavation, the owner of the subject site shall provide the Department with evidence that the adjacent property owner has been given a 30-day written notice of such intent to make an excavation (3307.1).

17. The soils engineer shall review and approve the shoring plans prior to issuance of the permit (3307.3.2).

18. Prior to the issuance of the permits, the soils engineer and the structural designer shall evaluate the surcharge loads used in the report calculations for the design of the retaining walls and shoring. If the surcharge loads used in the calculations do not conform to the actual surcharge loads, the soil engineer shall submit a supplementary report with revised recommendations to the Department for approval.

19. Unsurcharged temporary excavations over 5 feet exposing soil shall be trimmed back at a gradient not exceeding 1:1, as recommended.

20. Shoring shall be designed for the lateral earth pressures specified in the section titled "Temporary Excavations" starting on page 15 of the 03/17/2020 report; all surcharge loads shall be included into the design.

21. Shoring shall be designed for a maximum lateral deflection of ½ inch where a structure is within a 1:1 plane projected up from the base of the excavation, and for a maximum lateral deflection of 1 inch provided there are no structures within a 1:1 plane projected up from the base of the excavation, as recommended.

22. A shoring monitoring program shall be implemented to the satisfaction of the soils engineer.

23. All foundations shall derive entire support from native undisturbed soils, as recommended and approved by the soils engineer by inspection.

24. Footings supported on approved compacted fill or expansive soil shall be reinforced with a minimum of four (4), ½-inch diameter (#4) deformed reinforcing bars. Two (2) bars shall be placed near the bottom and two (2) bars placed near the top of the footing.

25. The foundation/slab design shall satisfy all requirements of the Information Bulletin P/BC 2017-116 "Foundation Design for Expansive Soils" (1803.5.3).

26. Slabs placed on approved compacted fill shall be at least 3½ inches thick and shall be reinforced with ½-inch diameter (#4) reinforcing bars spaced a maximum of 16 inches on center each way.

27. Concrete floor slabs placed on expansive soil shall be placed on a 4-inch fill of coarse aggregate or on a moisture barrier membrane. The slabs shall be at least 3½ inches thick and shall be reinforced with ½-inch diameter (#4) reinforcing bars spaced a maximum of 16 inches on center each way.

28. The seismic design shall be based on a Site Class D, as recommended. All other seismic design parameters shall be reviewed by LADBS building plan check. According to ASCE 7-16 Section 11.4.8, the long period coefficient (Fv) may be selected per Table 11.4-2 in ASCE 7-16, provided that the value of the Seismic Response Coefficient (Cs) is determined by Equation 12.8-2 for values of the fundamental period of the building (T) less than or equal to 1.5Ts, and taken as 1.5 times the value computed in accordance with either Equation 12.8-3 for T greater than 1.5Ts and less than or equal to TL or Equation 12.8-4 for T greater than TL. Alternatively, a supplemental report containing a site-specific ground motion hazard analysis in accordance with ASCE 7-16 Section 21.2 shall be submitted for review and approval.

29. Retaining walls up to 12 feet in height with a level backfill shall be designed for the lateral earth pressures specified in the section titled "Retaining Walls" starting on page 12 of the 03/17/2020 report. Note: All surcharge loads shall be included into the design.

30. Retaining walls higher than 6 feet shall be designed for lateral earth pressure due to earthquake motions as specified on page 14 of the 03/17/2020 report (1803.5.12).

    Note: Lateral earth pressure due to earthquake motions shall be in addition to static lateral earth pressures and other surcharge pressures.

31. Basement walls and other walls in which horizontal movement is restricted at the top shall be designed for at-rest pressure as specified on page 13 of the 03/17/2020 report (1610.1). All surcharge loads shall be included into the design.

32. All retaining walls shall be provided with a standard surface backdrain system and all drainage shall be conducted in a non-erosive device to the street in an acceptable manner (7013.11).

33. With the exception of retaining walls designed for hydrostatic pressure, all retaining walls shall be provided with a subdrain system to prevent possible hydrostatic pressure behind the wall. Prior to issuance of any permit, the retaining wall subdrain system recommended in the soils report shall be incorporated into the foundation plan which shall be reviewed and approved by the soils engineer of record (1805.4).

34. Installation of the subdrain system shall be inspected and approved by the soils engineer of record and the City grading/building inspector (108.9).

35. Basement walls and floors shall be waterproofed/damp-proofed with an LA City approved "Below-grade" waterproofing/damp-proofing material with a research report number (104.2.6).

36. Prefabricated drainage composites (Miradrain, Geotextiles) may be only used in addition to traditionally accepted methods of draining retained earth.

37. Where the ground water table is lowered and maintained at an elevation not less than 6 inches below the bottom of the lowest floor, or where hydrostatic pressures will not occur, the floor and basement walls shall be damp-proofed. Where a hydrostatic pressure condition exists, and the design does not include a ground-water control system, basement walls and floors shall be waterproofed. (1803.5.4, 1805.1.3, 1805.2, 1805.3)

38. The structure shall be connected to the public sewer system per P/BC 2020-027.

39. All roof, pad and deck drainage shall be conducted to the street in an acceptable manner in non-erosive devices or other approved location in a manner that is acceptable to the LADBS and the Department of Public Works (7013.10).

40. An on-site storm water infiltration system at the subject site shall not be implemented, as recommended.

41. All concentrated drainage shall be conducted in an approved device and disposed of in a manner approved by the LADBS (7013.10).

42. The soils engineer shall inspect all excavations to determine that conditions anticipated in the report have been encountered and to provide recommendations for the correction of hazards found during grading (7008, 1705.6 & 1705.8).

43. Prior to pouring concrete, a representative of the consulting soils engineer shall inspect and approve the footing excavations. The representative shall post a notice on the job site for the LADBS Inspector and the Contractor stating that the work inspected meets the conditions of the report. No concrete shall be poured until the LADBS Inspector has also inspected and approved the footing excavations. A written certification to this effect shall be filed with the Grading Division of the Department upon completion of the work. (108.9 & 7008.2)

44. Prior to excavation an initial inspection shall be called with the LADBS Inspector. During the initial inspection, the sequence of construction; shoring; protection fences; and, dust and traffic control will be scheduled (108.9.1).

45. Installation of shoring shall be performed under the inspection and approval of the soils engineer and deputy grading inspector (1705.6, 1705.8).

46. The installation and testing of tie-back anchors shall comply with the recommendations included in the report or the standard sheets titled "Requirement for Tie-back Earth Anchors", whichever is more restrictive. Research Report #23835

47. Prior to the placing of compacted fill, a representative of the soils engineer shall inspect and approve the bottom excavations. The representative shall post a notice on the job site for the LADBS Inspector and the Contractor stating that the soil inspected meets the conditions of the report. No fill shall be placed until the LADBS Inspector has also inspected and approved the bottom excavations. A written certification to this effect shall be included in the final compaction report filed with the Grading Division of the Department. All fill shall be placed under the inspection and approval of the soils engineer. A compaction report together with the approved soil report and Department approval letter shall be submitted to the Grading Division of the Department upon completion of the compaction. In addition, an Engineer's Certificate of Compliance with the legal description as indicated in the grading permit and the permit number shall be included (7011.3).

48. No footing/slab shall be poured until the compaction report is submitted and approved by the Grading Division of the Department.

Leila Etaat

LEILA ETAAT
Structural Engineering Associate II

LE/le
Log No. 113465
213-482-0480

cc: Irvine Geotechnical, Project Consultant
WL District Office

IRVINE GEOTECHNICAL Inc

RETAINING WALL

IC: **20020** CONSULT: **JAI**
CLIENT: **RBM WESTWOOD**

CALCULATION SHEET #

CALCULATE THE DESIGN MINIMUM EQUIVALENT FLUID PRESSURE (EFP) FOR PROPOSED RETAINING WALLS. THE WALL HEIGHT AND BACKSLOPE AND SURCHARGE CONDITIONS ARE LISTED BELOW. ASSUME THE BACKFILL IS SATURATED WITH NO EXCESS HYDROSTATIC PRESSURE. USE THE MONONOBE-OKABE METHOD FOR SEISMIC FORCES.

CALCULATION PARAMETERS

EARTH MATERIAL:	ALLUVIUM	WALL HEIGHT	31 feet
SHEAR DIAGRAM:	B-1	BACKSLOPE ANGLE:	0 degrees
COHESION:	85 psf	SURCHARGE:	0 pounds
PHI ANGLE:	28 degrees	SURCHARGE TYPE:	U Uniform
DENSITY	125 pcf	INITIAL FAILURE ANGLE:	30 degrees
SAFETY FACTOR:	1	FINAL FAILURE ANGLE:	70 degrees
WALL FRICTION	18.67 degrees	INITIAL TENSION CRACK:	2 feet
CD (C/FS):	85.0 psf	FINAL TENSION CRACK:	31 feet

PHID = ATAN(TAN(PHI)/FS) = 28.0 degrees

HORIZONTAL PSEUDO STATIC SEISMIC COEFFICIENT (k_h) 0.348 %g

VERTICAL PSEUDO STATIC SEISMIC COEFFICIENT (k_v) 0 %g

CALCULATED RESULTS

CRITICAL FAILURE ANGLE	41 degrees
AREA OF TRIAL FAILURE WEDGE	543.3 square feet
TOTAL EXTERNAL SURCHARGE	0.0 pounds
WEIGHT OF TRIAL FAILURE WEDGE	67913.5 pounds
NUMBER OF TRIAL WEDGES ANALYZED	1230 trials
LENGTH OF FAILURE PLANE	41.1 feet
DEPTH OF TENSION CRACK	4.1 feet
HORIZONTAL DISTANCE TO UPSLOPE TENSION CRACK	31.0 feet
CALCULATED HORIZONTAL THRUST ON WALL	**33388.9 pounds**

THE CALCULATION INDICATES THAT FOR THE DESIGN GROUND MOTION, THE UNBALANCED FORCE ON RETAINING WALLS UP TO 31 FEET IS 33.389 KIPS.

IRVINE GEOTECHNICAL Inc

SHORING PILE

IC: **20020** CONSULT: **JAI**
CLIENT: **RBM WESTWOOD**

CALCULATION SHEET #

CALCULATE THE DESIGN MINIMUM EQUIVALENT FLUID PRESSURE (EFP) FOR PROPOSED RETAINING WALLS. THE WALL HEIGHT AND BACKSLOPE AND SURCHARGE CONDITIONS ARE LISTED BELOW. ASSUME THE BACKFILL IS SATURATED WITH NO EXCESS HYDROSTATIC PRESSURE. USE THE MONONOBE-OKABE METHOD FOR SEISMIC FORCES.

CALCULATION PARAMETERS

EARTH MATERIAL:	ALLUVIUM	RETAINED LENGTH	33 feet
SHEAR DIAGRAM:	B-1	BACKSLOPE ANGLE:	0 degrees
COHESION:	85 psf	SURCHARGE:	0 pounds
PHI ANGLE:	28 degrees	SURCHARGE TYPE:	U Uniform
DENSITY	125 pcf	INITIAL FAILURE ANGLE:	30 degrees
SAFETY FACTOR:	1.25	FINAL FAILURE ANGLE:	70 degrees
PILE FRICTION	18.7 degrees	INITIAL TENSION CRACK:	2 feet
CD (C/FS):	68.0 psf	FINAL TENSION CRACK:	31 feet

PHID = ATAN(TAN(PHI)/FS) = 23.0 degrees

HORIZONTAL PSEUDO STATIC SEISMIC COEFFICIENT (k_h) 0 %g

VERTICAL PSEUDO STATIC SEISMIC COEFFICIENT (k_v) 0 %g

CALCULATED RESULTS

CRITICAL FAILURE ANGLE	53 degrees
AREA OF TRIAL FAILURE WEDGE	409.8 square feet
TOTAL EXTERNAL SURCHARGE	0.0 pounds
WEIGHT OF TRIAL FAILURE WEDGE	51226.4 pounds
NUMBER OF TRIAL WEDGES ANALYZED	1230 trials
LENGTH OF FAILURE PLANE	39.9 feet
DEPTH OF TENSION CRACK	1.2 feet
HORIZONTAL DISTANCE TO UPSLOPE TENSION CRACK	24.0 feet
CALCULATED THRUST ON PILE	**21830.3 pounds**
CALCULATED EQUIVALENT FLUID PRESSURE	**40.0 pcf**
DESIGN EQUIVALENT FLUID PRESSURE	**40.0 pcf**

THE CALCULATION INDICATES THAT THE PROPOSED SHORING PILES MAY MAY BE DESIGNED FOR AN EQUIVALENT FLUID PRESSURE OF 40 POUNDS PER CUBIC FOOT. THE FLUID PRESSURE SHOULD BE MULTIPLIED BY THE PILE SPACING.

IRVINE GEOTECHNICAL Inc

SKIN FRICTION TABLE

IC: **20020** CONSULT: **JAI**
CLIENT **RBM WESTWOOD**

CALCULATION SHEET # **1A**

CALCULATE ALLOWABLE SKIN FRICTION RESISTANCE FOR DRILLED, CAST IN PLACE CONCRETE PILES. SKIN FRICTION IS TABULATED AS A FUNCTION OF EMBEDMENT DEPTH. (REFERENCES: NAVFAC DM-7.2, PAGES 193-194 AND J.E. BOWLES, "*FOUNDATION ANALYSIS AND DESIGN*," 1988.)

CALCULATION PARAMETERS

EARTH MATERIAL:	ALLUVIUM	PILE DIAMETER:	2 feet
SHEAR DIAGRAM:	B-1	INITIAL PILE DEPTH:	8 feet
COHESION:	85 psf	FINAL PILE DEPTH:	8 feet
PHI ANGLE:	28 degrees	EXTERNAL SURCHARGE:	3400 pounds
DENSITY:	125 pcf	ADHESION VALUE:	1.5
SAFETY FACTOR:	1.5	PILE/SOIL FRICTION:	19.5 degrees
COMPRESSION/TENSION:	T	LATERAL COEFF. (Ko)	0.40
PILE TYPE:	TENSION PILE	NO GROUNDWATER	0.0 feet

PILE EMBEDMENT DEPTH (feet)	CALCULATED AVERAGE SKIN FRICTION (psf)	PILE CAPACITY (kips)	AVERAGE NORMAL EARTH PRESSURE (psf)
8	453.3	26.6	1,560.0

CONCLUSIONS:

THE CALCULATED SKIN FRICTION FOR A PILE EMBEDDED AT LEAST 8 FEET BELOW THE BASE OF THE EXCAVATION IS ON THE TABLE.

IRVINE GEOTECHNICAL Inc

BEARING CAPACITY ANALYSIS

IC: **20020** CONSULT: **JAI**
CLIENT: **RBM WESTWOOD**

CALCULATION SHEET #

CALCULATE THE ULTIMATE AND ALLOWABLE BEARING CAPACITIES OF THE BEARING MATERIAL LISTED BELOW USING HANSEN'S METHOD. (REFERENCE: J. BOWLES, *FOUNDATION ANALYSIS AND DESIGN*, 1988, p. 188-194).

CALCULATION PARAMETERS

EARTH MATERIAL:	ALLUVIUM	EMBEDMENT DEPTH:	2 feet
SHEAR DIAGRAM:	B-1	PAD LENGTH:	2 feet
COHESION:	85 psf	PAD WIDTH:	2 feet
PHI ANGLE:	28 degrees	SLOPE ANGLE:	0 degrees
DENSITY:	125 pcf	PAD INCLINATION:	34 degrees
SAFETY FACTOR:	3	HORIZ. COMPONENT:	pounds
FOOTING TYPE:	P Pad	VERTICAL COMPONENT:	pounds

CALCULATED RESULTS

HANSEN'S SHAPE, DEPTH, AND INCLINATION FACTORS

Nq =	14.72	Dq =	1.30	Sy =	0.60
Nc =	25.80	Gc =	1.00	Dy =	1.00
Ny =	10.94	Bc =	0.77	Iy =	1.00
Sc =	1.57	Iq =	1.00	Gy =	1.00
Sq =	1.53	Ic =	1.00	Gq =	1.00
Dc =	1.40	Bq =	0.81	By =	0.81

CALCULATED ULTIMATE BEARING CAPACITY (Qult)	10,297.5 pounds
ALLOWABLE BEARING CAPACITY (Qa = Qult / fs)	3,432.5 pounds
PERCENT INCREASE FOR EMBEDMENT DEPTH	28.3%

CONCLUSIONS:

THE ULTIMATE AND ALLOWABLE BEARING CAPACITIES OF THE ALLUVIUM WERE CALCULATED USING HANSEN'S METHOD. THE RECOMMENDED DESIGN BEARING PRESSURE IS 3,000 POUNDS PER SQUARE FOOT.