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FOR REFERENCE

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SOILS INVESTIGATION

KAOPA SUBDIVISION UNIT 2 (PORTION)

KAILUA, KOOLAUPOKO, OAHU, HAWAII

for

ISLAND CONSTRUCTION CO., INC.

W.O. 150

June 27, 1972

ERNEST K. HIRATA & ASSOCIATES, INC.

Soils and Foundation Engineering

MUNICIPAL REFERENCE & RECORDS CENTER

City & County of Honolulu
City Hall Annex, 558 S. King Street
Honolulu, Hawaii 96813

EH



ERNEST K. HIRATA & ASSOCIATES, INC.

Soils and Foundation Engineering

1157 South King Street • Honolulu, Hawaii 96814 • Phone 531-5733

June 27, 1972

W.O. 150

Island Construction Co., Inc.
1020-E Keolu Drive
Kailua, Oahu, Hawaii

Attention: Mr. William Rus

Subject: Soils Investigation
Kaopa Subdivision Unit 2 (Portion)
Kailua, Koolaupoko, Oahu, Hawaii

Reference: Supplementary Soils Investigation
Prepared by Ernest K. Hirata & Associates
W.O. 111-B dated July 22, 1971

Soils Investigation
Prepared by Geolabs-Hawaii, Inc.
W.O. 192 dated July 8, 1970

Gentlemen:

This report presents the results of our soils investigation conducted on the subject property. The scope of this investigation was planned in collaboration with personnel of your staff and with Mr. Yasuo Arakaki, Civil Engineer. Previous soils investigations conducted by Ernest K. Hirata & Associates and Geolabs-Hawaii, Inc. has been reviewed and their results utilized to the fullest extent applicable.

SITE DESCRIPTION

This investigation encompasses approximately 4 acres of land being above Road "C" in the Kaopa Subdivision Unit 2. Topographically, the site includes portions of two ridges and

a previously graded cut slope.

The total relief for the proposed Tract will be approximately 140 feet. All areas will be in cut with no filling anticipated.

PROPOSED GRADING

The proposed Tract will include 11 graded lots. Cutting will be utilized to develop level pad areas and proper drainage to the street. Cut slopes are planned at slope gradients of $1\frac{1}{2}$:1 (horizontal to vertical).

The maximum height of cut slopes is not expected to exceed 136 feet. The maximum vertical thickness of cut will be approximately 26 feet.

Sewers have already been installed along Road "C" to handle the sewage disposal for the proposed Tract.

FIELD EXPLORATION

Field exploration was performed by visual examination of the existing cut slopes made during grading operations of Kaopa 2. Past exploratory borings made by Geolabs-Hawaii, Inc. in the vicinity of the proposed site were reviewed and found to correlate with existing conditions.

Bag samples were recovered from the slopes for laboratory testing.

LABORATORY TESTING

Laboratory testing was performed on the bag samples. Laboratory tests included Atterburg Limits and compaction tests. A summary of the laboratory test results are attached in the Appendix.

SOIL CONDITIONS

Results of the investigation indicate that five types of material will be encountered during grading.

The surface soil consists of a brown silty clay. This clay stratum varies from a few inches on the ridges to approximately 5 feet in the draw between the two ridges.

The underlying soils labeled A, B, and C are designated on the Plot Plan. All three types of soil are a form of weathered rock. The fifth type of material encountered was a gray rock, which extends into the southerly ridge.

CONCLUSIONS & RECOMMENDATIONS

I. Cut Slopes

All cut slopes should be stable at slope gradients of $1\frac{1}{2}$:1 (horizontal to vertical). In the event that during grading, the southerly ridge is found to consist wholly of the hard gray rock without underlying strata of weathered rock, a slope gradient of 1:1 (horizontal to vertical) may be used.

We recommend that all cut slopes be planted as soon as practical upon completion of grading to minimize weathering and erosion of the slope face.

II. Groundwater

Groundwater is not anticipated from any of the cut slopes, however, requirements for any possible subdrains will be determined during grading operations.

III. Expansive Soils

With the exception of the red silty clay, onsite soils are considered non-expansive. If any of the pad lots is comprised of the red silty clay, the material should be removed down to a depth of 3 feet and replaced with the non-expansive soils.

IV. Bearing Capacity

An allowable bearing pressure of 3000 PSF may be used for footings founded on the natural soils.

V. Grading

Most of the onsite soils can be graded with conventional earth moving equipment. However when the rock seam is encountered, blasting will be necessary.

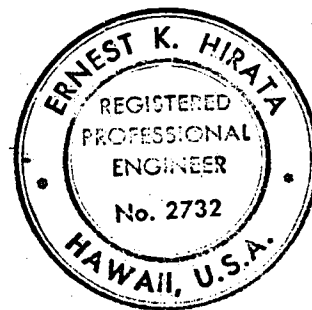
Our standard grading specification is enclosed in the Appendix and should be considered a part of this report.

We appreciate this opportunity to be of service. Should you have any questions concerning this report, please call on us.

Respectfully submitted,

Ernest K. Hirata & Associates, Inc.


Ernest K. Hirata P.E. 2732



ERNEST K. HIRATA & ASSOCIATES INC.

STANDARD GRADING SPECIFICATIONS

These specifications present the usual and minimum requirements for grading operations performed under the control of Ernest K. Hirata & Associates Inc.

No deviation from these specifications will be allowed, except where specifically superseded in the preliminary soils report, or in other written communication signed by the Soils Engineer.

I. GENERAL

- A. The Soils Engineer is the Owner's or Builder's representative on the project. For the purpose of these specifications, supervision by the Soils Engineer includes that inspection performed by any person or persons employed by, and responsible to, the licensed Civil Engineer signing the soils report.
- B. All clearing, site preparation or earthwork performed on the project shall be conducted by the Contractor under the supervision of the Soils Engineer.
- C. It is the Contractor's responsibility to prepare the ground surface to receive the fills to the satisfaction of the Soils Engineer and to place, spread, mix, water and compact the fill in accordance with the specifications of the Soils Engineer. The Contractor shall also remove all material considered unsatisfactory by the Soils Engineer.
- D. It is also the Contractor's responsibility to have suitable and sufficient compaction equipment on the job site to handle the amount of fill being placed. If necessary, excavation equipment will be shut down to permit completion of compaction. Sufficient watering apparatus will also be provided by the Contractor, with due consideration for the fill material, rate of placement and time of year.
- E. A final report shall be issued by the Soils Engineer attesting to the Contractor's conformance with these specifications.

II. SITE PREPARATION

- A. All vegetation and deleterious material such as rubbish shall be disposed of offsite. This removal must be concluded prior to placing fill.
- B. Soil, alluvium or rock materials determined by the Soils Engineer as being unsuitable for placement in compacted fills shall be removed and wasted from the site. Any material incorporated as a part of a compacted fill must be approved by the Soils Engineer.
- C. After the ground surface to receive fill has been cleared, it shall be scarified, disced or bladed by the Contractor until it is uniform and free from ruts, hollows, hummocks or other uneven features which may prevent uniform compaction.

The scarified ground surface shall then be brought to optimum moisture, mixed as required, and compacted as specified. If the scarified zone is greater than twelve inches in depth, the excess shall be removed and placed in lifts restricted to six inches.

Prior to placing fill, the ground surface to receive fill shall be inspected, tested and approved by the Soils Engineer.

- D. Any underground structures such as cesspools, cisterns, tunnels, septic tanks, wells, pipelines or others not located prior to grading are to be removed or treated in a manner prescribed by the Soils Engineer.

III. COMPACTED FILLS

- A. Any material imported or excavated on the property may be utilized in the fill, provided each material has been determined to be suitable by the Soils Engineer. Roots, tree branches and other matter missed during clearing shall be removed from the fill as directed by the Soils Engineer.

- B. Rock fragments less than six inches in diameter may be utilized in the fill, provided:
 - 1. They are not placed in concentrated pockets.
 - 2. There is a sufficient percentage of fine-grained material to surround the rocks.
 - 3. The distribution of the rocks is supervised by the Soils Engineer.
- C. Rocks greater than six inches in diameter shall be taken offsite, or placed in accordance with the recommendations of the Soils Engineer in areas designated as suitable for rock disposal.
- D. Material that is spongy, subject to decay, or otherwise considered unsuitable shall not be used in the compacted fill.
- E. Representative samples of materials to be utilized as compacted fill shall be analyzed in the laboratory by the Soils Engineer to determine their physical properties. If any material other than that previously tested is encountered during grading, the appropriate analysis of this material shall be conducted by the Soils Engineer as soon as possible.
- F. Material used in the compacting process shall be evenly spread, watered, processed and compacted in thin lifts not to exceed six inches in thickness to obtain a uniformly dense layer. The fill shall be placed and compacted on a horizontal plane, unless otherwise approved by the Soils Engineer.
- G. If the moisture content or relative density varies from that required by the Soils Engineer, the Contractor shall rework the fill until it is approved by the Soils Engineer.
- H. Each layer shall be compacted to 90 percent of the maximum density in compliance with the testing method specified by the controlling governmental agency.

If compaction to a lesser percentage is authorized by the controlling governmental agency because of a specific land use or expansive soil conditions, the area to receive fill compacted to less than 90 percent shall either be delineated on the grading plan or appropriate reference made to the area in the soil report.

- I. All fills shall be keyed and benched through all topsoil, colluvium, alluvium or creep material, into sound bedrock or firm material where the slope receiving fill exceeds a ratio of five horizontal to one vertical, in accordance with the recommendations of the Soils Engineer.
- J. The key for side hill fills shall be a minimum of 15 feet within bedrock or firm materials, unless otherwise specified in the soils report.
- K. Drainage terraces and subdrainage devices shall be constructed in compliance with the ordinances of the controlling governmental agency, or with the recommendations of the Soils Engineer.
- L. The Contractor will be required to obtain a minimum relative compaction of 90 percent out to the finish slope face of fill slopes. This may be achieved by either overbuilding the slope and cutting back to the compacted core, or by direct compaction of the slope face with suitable equipment, or by any other procedure which produces the required compaction.

If a method other than overbuilding and cutting back to the compacted core is to be employed, slope tests will be made by the Soils Engineer during construction of the slopes to determine if the required compaction is being achieved. Where failing tests occur or other field problems arise, the Contractor will be notified of such conditions by written communication from the Soils Engineer in the form of a conference memorandum, to avoid any misunderstanding arising from oral communication.

If the method of achieving the required slope compaction selected by the Contractor fails to produce the necessary results, the Contractor shall rework or rebuild such slopes until the required degree of compaction is obtained, at no additional cost to the Owner or Soils Engineer.

- M. All fill slopes should be planted or protected from erosion by methods specified in the soils report.
- N. Fill-over-cut slopes shall be properly keyed through topsoil, colluvium or creep material into rock or firm materials; and the transition shall be stripped of all soil prior to placing fill.

IV. CUT SLOPES

- A. If any conditions not anticipated in the preliminary report such as perched water, seepage, lenticular or confined strata of a potentially adverse nature are encountered during grading, these conditions shall be analyzed by the Soils Engineer; and recommendations shall be made to treat these problems.
- B. Unless otherwise specified in the soils report, no cut slopes shall be excavated higher or steeper than that allowed by the ordinances of controlling governmental agencies.
- C. Drainage terraces shall be constructed in compliance with the ordinances of controlling governmental agencies, or with the recommendations of the Soils Engineer.

V. GRADING CONTROL

- A. Inspection of the fill placement shall be provided by the Soils Engineer during the progress of grading.
- B. In general, density tests shall be made at intervals not exceeding two feet of fill height of every 500 cubic yards of fill placed. This criteria will vary

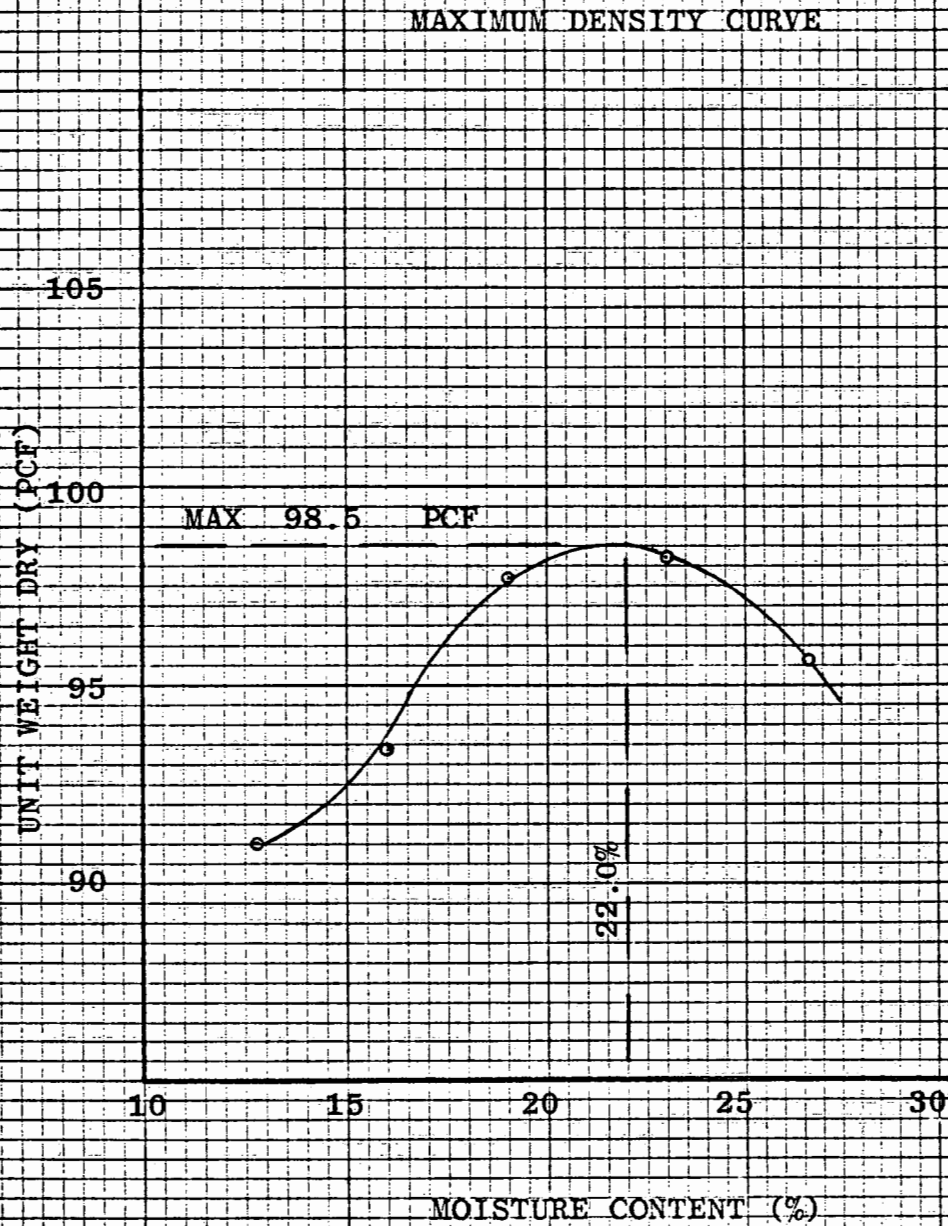
depending on soil conditions and the size of the job. In any event, an adequate number of field density tests shall be made to verify that the required compaction is being achieved.

- C. Density tests shall also be made on the surface material to receive fill as required by the Soils Engineer.
- D. All cleanout, processed ground to receive fill, key excavations, subdrains and rock disposal must be inspected and approved by the Soils Engineer prior to placing any fill. It shall be the Contractor's responsibility to notify the Soils Engineer when such areas are ready for inspection.

VI. CONSTRUCTION CONSIDERATIONS

- A. Erosion control measures, when necessary, shall be provided by the Contractor during grading and prior to the completion and construction of permanent drainage controls.
- B. Upon completion of grading and termination of inspections by the Soils Engineer, no further filling or excavating, including that necessary for footings, foundations, large tree wells, retaining walls, or other features shall be performed without the approval of the Soils Engineer.
- C. Care shall be taken by the Contractor during final grading to preserve any berms, drainage terraces, interceptor swales, or other devices of a permanent nature on or adjacent to the property.

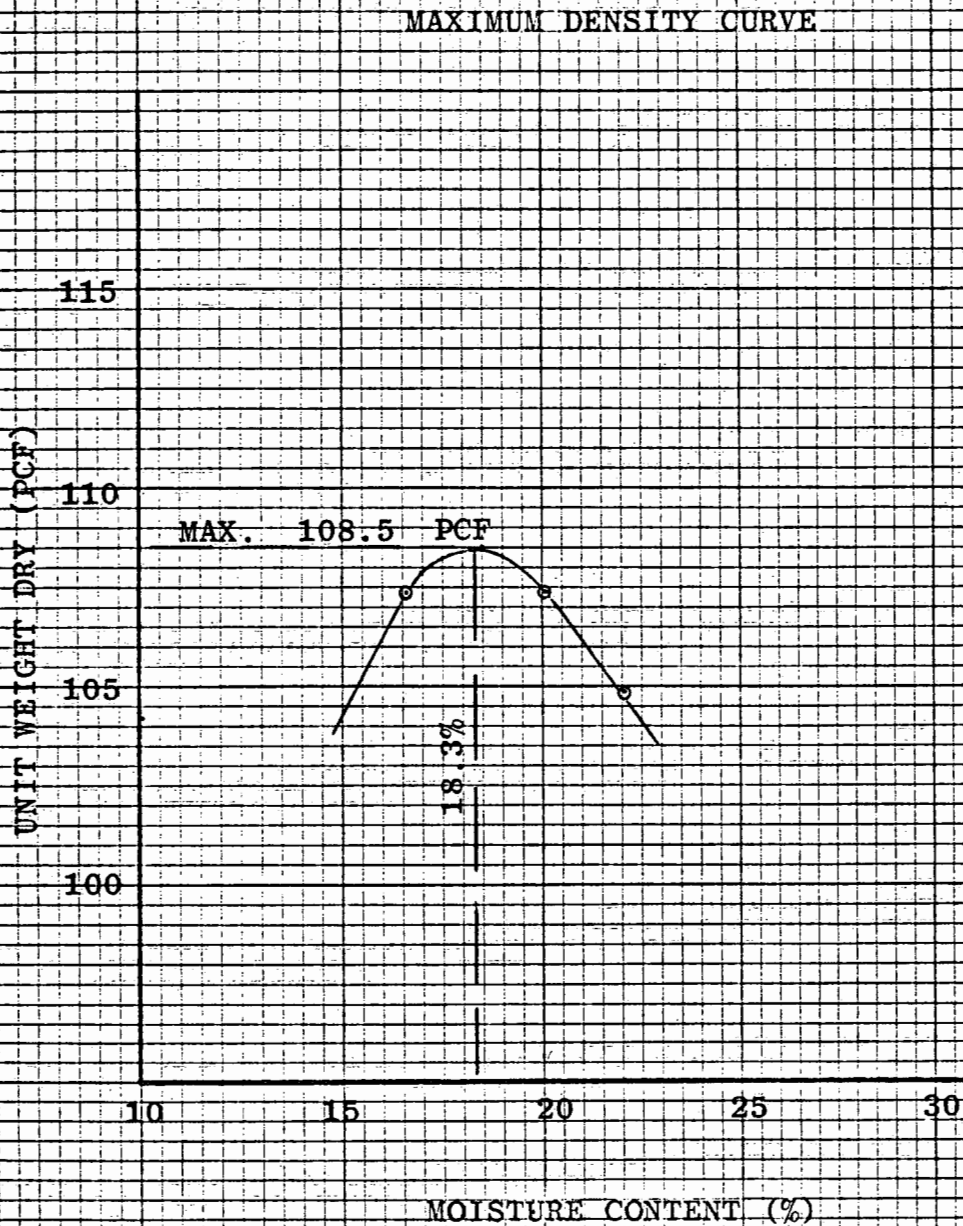
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The A. Lietz Co., San Francisco
Made in U. S. A.

Boring:

Depth: SURFACE

Classification: ML-MH W.O. 150
Tan Sandy SILTL.L. = 51.6
P.L. = 36.6
P.I. = 20.0



Boring:

Depth: SURFACE

Classification: SM

W.O. 150

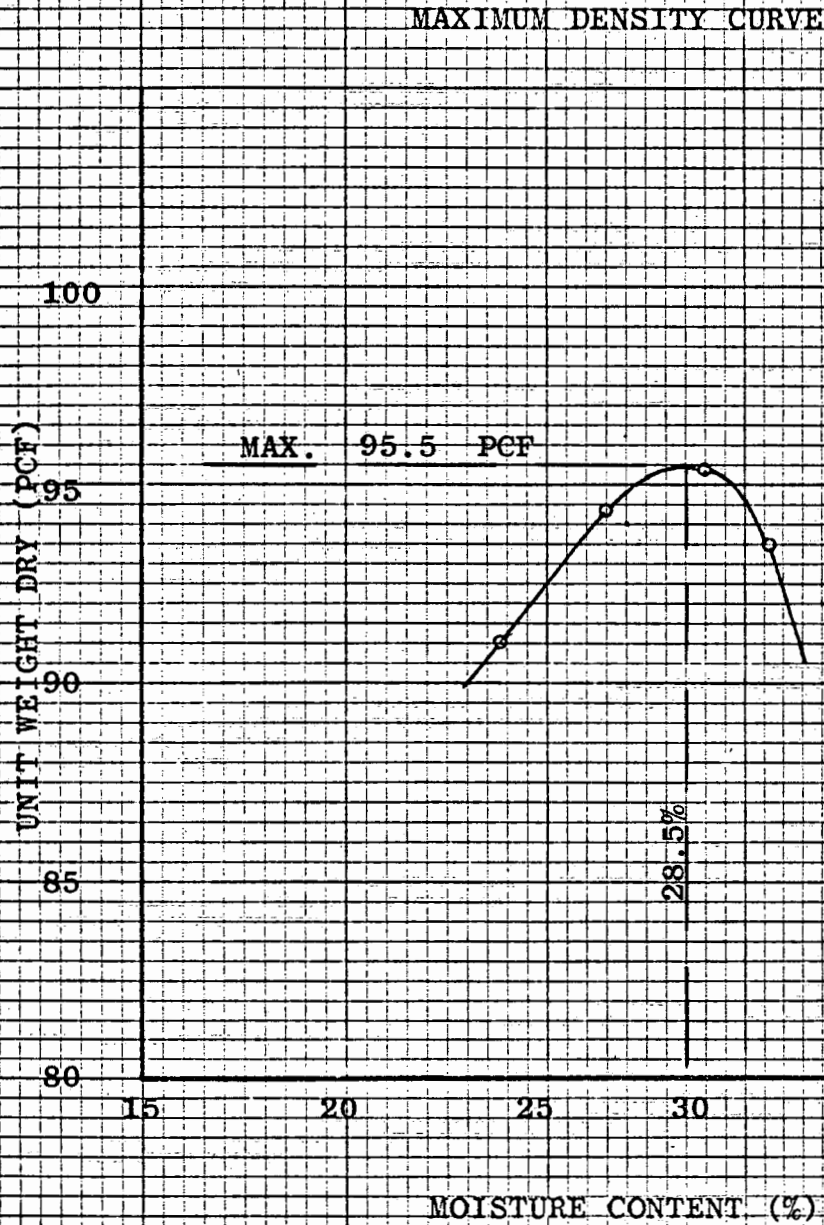
Mottled Orange SILTY SAND

L.L. = 37.1

P.L. = 37.3

P.I. =

No. 910-9, 10 x 10 to 1"
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Boring:

Depth: SURFACE

Classification: MH-OH

W.O. 150

Red Silty Clay

L.L. = 60.8
P.L. = 39.6
P.I. = 21.2

LABORATORY TEST RESULTS

Project: KAOPA #2 (Portion)

W.O. 150

Boring or Test Pit No.	A	B	C		
Depth (ft.)	Surface	Surface	Surface		
Atterburg Limit Tests					
Liquid Limit	51.6	37.1	60.8		
Plastic Limit	36.6	37.3	39.6		
Plastic Index	20.0	—	21.2		
Soil Classification	ML-MH	SM	MH-OH		
Expansion @ PSF					
Natural					
Remolded			9.3		
Expansion @ PSF					
Natural					
Remolded			3.0		
Unconfine Stress (PSF)					
Proctor					
Max. Dry Unit Wt. (PCF)	98.5	108.5	95.5		
Optimum Water (%)	22.0	18.3	28.5		
Wet Density In-Place (PCF)					
Moisture In-Place (%)					
Dry Unit Wt. In-Place (PCF)					

