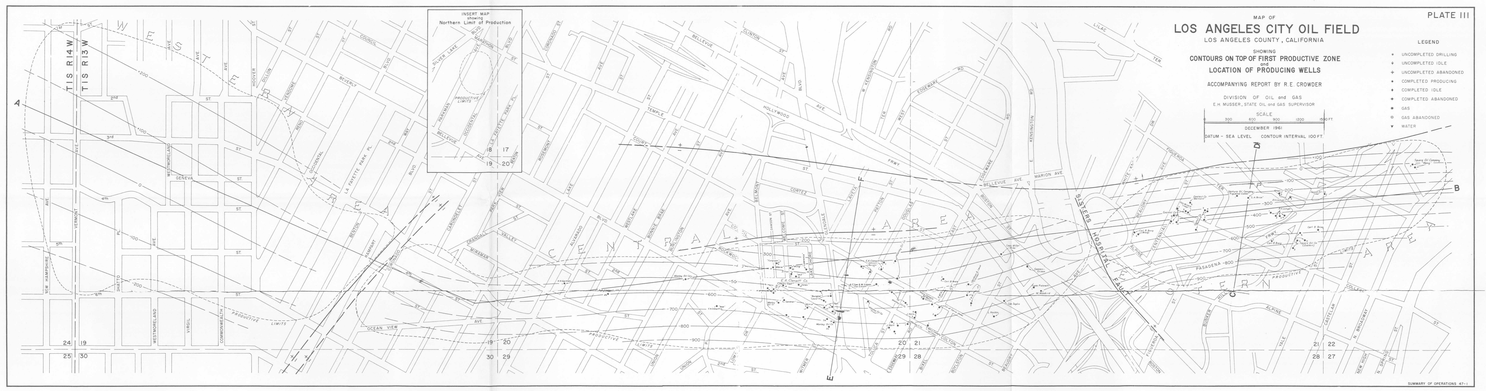
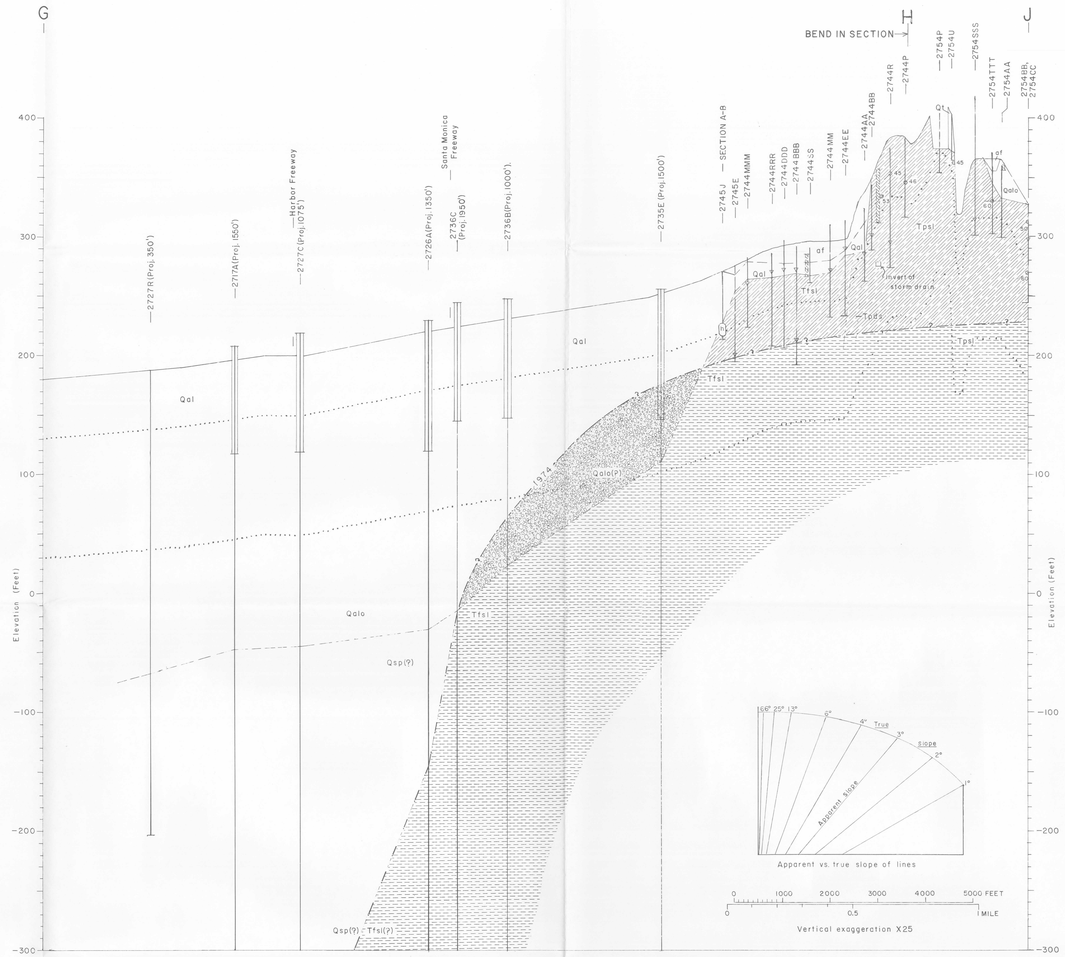
DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY

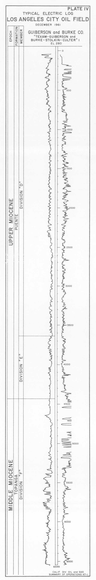
PREPARED IN COOPERATION WITH
THE UNITED STATES DEPARTMENT OF TRANSPORTATION

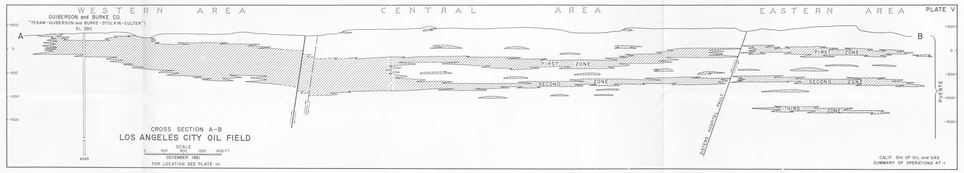
MISCELLANEOUS FIELD STUDIES
MAP MF-866
SHEET 5 OF 5

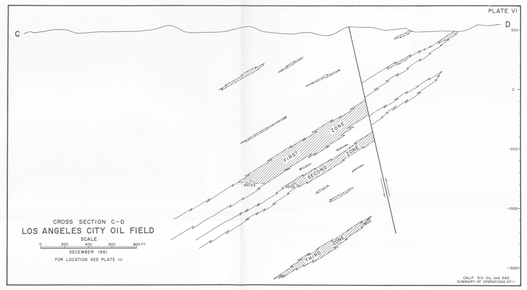
YERKES AND OTHERS- GEOLOGIC ASPECTS OF TUNNELING IN LOS ANGELES AREA CALIF.

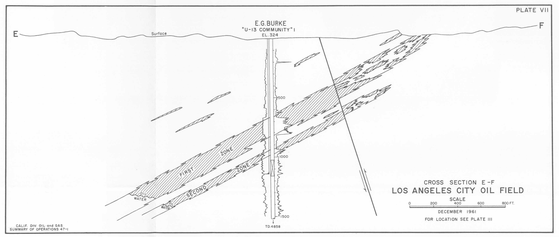












EXPLANATION

Geologic units and tunneling conditions

Approximate tunneling conditions for a given geologic unit may be inferred from its position relative to the water table and reference to the table:

Symbol	Geologic Unit	Lithology	Approximate Penetration Resistance, 50 ft. subsurface (BPF[1])	Inferred Tunneling Conditions[2] Dry	Wet
		SUBRICIAL DEPOSITS			
af	Artificial fill	Silt, sand, gravel; admixed clay, asphalt, concrete		4-5 10*	6 10*
Qal	Alluvium	Silty to sandy gravel, locally with cobbles and boulders; locally petroliferous; locally slightly consolidated	>40	4-5 10*	6 10*
Qalo, Qt	Old alluvium Terrace deposits	Slightly consolidated gravel; clayey, with cobbles and boulders; commonly uncemented	>40	3-5 10*	5-6 10*
Qsp	San Pedro Formation of Thomas, Landry, and Turney (1961)	Semiconsolidated sand and fine gravel (<¼ in.), interbedded silty sand, sandy silt, and clay		3-5	5-6
		BEDROCK UNITS			
Tfsl	Siltstone, Fernando Formation of Lamar (1970)	Soft, massive siltstone, local layers hard pebble (<¼ in.) conglomerate; rare hard calcareous beds; locally petroliferous	>22	3-4	4-5
Puente Formation of Lamar (1970):					
Tpds	Diatomaceous shale and diatomite	Soft, punky, blocky weathering, thinly laminated; rare beds soft friable sandstone and massive, hard limestone	damp: >38 dry: 24-38	3-4	4-5
Tpsl	Siltstone and very fine-grained sandstone	Poorly cemented, closely jointed, blocky; beds <5 ft. thick; layers shale chips, pebbles, and slabs of hard limestone; few beds <3 in. thick of hard limestone	>30	3-4	4-5
Tpss	Sandstone	Hard and well cemented (dolomite?) with very hard calcareous concretions; beds <10 ft. thick; local thin beds of shale, fragments shale and siltstone			3-4
Tpun	Undivided sandstone and shale	Hard and well cemented to poorly cemented sandstone; very hard, fissile, siltceous shale and blocky siltstone; some beds <3 ft. hard limestone; also some conglomerate of angular fragments <2 in. of shale and quartz			3-4
Topanga Formation of Lamar (1970):					
Ttsl	Siltstone, sandstone and shale	Commonly very hard, closely jointed, blocky; shale siltceous, hard rhythmically bedded <2 in.; sandstone beds <3 ft.; limestone beds <2 ft.; some very hard tuff and tuffaceous sandstone			3-4
Ttcg	Pebbly sandstone and conglomerate	Commonly hard, well cemented (calcareous?) in beds <4 ft.; pebbles hard rock average 2 in. but contains boulders to 3 ft.			3-4
		BASEMENT ROCKS			
fgd	Feliz Granodiorite of Lamar (1970)	Deeply weathered, soft, crumbly			4-6

Lines and symbols

Contact between geologic units
Solid, well located; long dash, approximately located; short dash, location inferred; queried where doubtful

Fault
Long dash, approximately located; short dash, location inferred; queried where doubtful

Dip of strata
Horizontal — 65 Apparent — Vertical

Symbol shows amount and direction of apparent dip as viewed normal to line of section (not corrected for scale distortion); number gives true dip

pw 1974
Approximate location of water table
Number shows year of measurement. Solid triangle, location of 1974 measurement; open triangle, location of pre-1974 measurement.
pw, perched water table; queried where inferred

Special symbols

Locus of points 50 ft. and 150 ft. below ground surface

Approximate location of existing tunnel

Well or boring

Identifying number (Sheet 3, table 1)

Surface casing

Significant conditions
b, boulders (>10 in. in diameter)
c, cobbles (2½ - 10 in.)
h, H_2S odor (1962)
p, petroliferous
v, very hard drilling (rotary equipment)

[1] 2-in. split spoon, 140-lb. hammer, 30-in. drop; units tested along line of section A-D; see fig. 3 for complete results of tests.

[2] Summary of soft-ground tunneling conditions used (see table 2 for definitions):
2 - Hard stratified or schistose
3 - Very firm ground
4 - Firm ground; may ravel when wet
5 - Very blocky or seamy; may ravel when wet
6 - Unconsolidated or crushed materials; may run or flow when wet
10 - Bouldery (hard rock fragments >10 in. in long diameter)

*If bouldery

SHEET 5- SECTION SHOWING GEOLOGY AND TUNNELING CONDITIONS
BY
R. F. YERKES, J. M. McMANUS AND ERIK LAYMAN

MAPS AND SECTIONS OF THE LOS ANGELES CITY OIL FIELD
BY
R. E. CROWDER
(1961)

GEOLOGIC ASPECTS OF TUNNELING IN THE LOS ANGELES AREA, CALIFORNIA

BY
R. F. YERKES, J. C. TINSLEY, AND K. M. WILLIAMS
1977

Interior—Geological Survey, Reston, Va.—1977