

SEABROOK UPDATED FSAR

APPENDIX 2G

STATIC DYNAMIC ROCK PROPERTIES

The information contained in this appendix was not revised, but has been extracted from the original **FSAR** and is provided for historical information.

APPENDIX 2G

STATIC AND DYNAMIC ROCK PROPERTIES

TABLES

<u>Table</u>	<u>Title</u>
2G-1	Unconfined Compression Tests
2G-2	Laboratory Compression Wave Velocity Measurements
2G-3	Strength, Velocity and Hardness Data, Samples from Tunnel Alignments

TABLE 2G-1

UNCONFINED COMPRESSION TESTS									
Test No.	Location	Hole No.	Depth (ft)	Rock Type	Unconfined Compressive Strength q_u (psi)	Axial Strain@ Failure %	Initial Tangent Modulus (psi)	Secant Modulus @ 50% q_u (psi)	Poisson's Ratio Initial Load Value @ 50% Secant Value @ 50%
E1A	Reactor 1	E1-1	31.4-31.8	Diorite	22,400	.21	12 x 10 ⁶	12 x 10 ⁶	.29
E1D			78.3-78.7	Diorite	19,520				.25
E1F			79.1-79.5	Diorite	19,820	.21	9.3 x 10 ⁶	9.3 x 10 ⁶	.25
E1G			79.5-79.9	Diorite	19,400	.20	13 x 10 ⁶	11 x 10 ⁶	---
E2A	Reactor 2	E2-1	49.6-50.0	Diorite	18,020	.20	12 x 10 ⁶	10 x 10 ⁶	.36
E2B			50.0-50.4	Diorite	Failed by splitting.		Do not report.		
E2C			50.4-50.8	Diorite	15,530	.17	12 x 10 ⁶	9.9 x 10 ⁶	.18
E2G			138.7-139.1	Diorite	5,970				.23
E2J			139.4-139.8	Diorite	11,610	.21	12 x 10 ⁶	9.7 x 10 ⁶	.21
E2M			141.9-142.3	Diorite	18,610	.20	10 x 10 ⁶	10 x 10 ⁶	.23
B7B	Near Reactors	B7	27.8-28.2	Schist	17,940	.20	11 x 10 ⁶	10 x 10 ⁶	.17
B42D	Contact	B42	123.5-123.9	Diabase	27,600	.27	11 x 10 ⁶	10 x 10 ⁶	.21
B42F			141.3-141.7	Schist	16,500	.21	9.1 x 10 ⁶	8.0 x 10 ⁶	.18
B42H			142.7-143.1	Schist	11,970	.18	10 x 10 ⁶	7.4 x 10 ⁶	---
F1A	Tunnel	F1A	127.5-127.9	Diorite	16,130	.19	11 x 10 ⁶	9.9 x 10 ⁶	.33
F1B			127.9-128.3	Diorite	13,950				.28
F2A	Tunnel	F2	246.3-246.7	Schist	6,060				
F2C			247.2-247.6	Schist	6,000				
F2F			260.3-260.7	Schist	6,330				

NOTE: In tests for which values of axial strain at failure, modulus, and Poisson's ratio are omitted, the strain-gage readings appear to be unreliable. No stress-strain curves are plotted for these tests.

TABLE 2G-2

LABORATORY COMPRESSION WAVE VELOCITY MEASUREMENTS

<u>Test No.</u>	<u>Location</u>	<u>Hole No.</u>	<u>Depth (Feet)</u>	<u>Rock Type</u>	<u>Density (gm/cm³)</u>	<u>Laboratory Compression Wave Velocity</u>	
						<u>@ 0 psi</u>	<u>@ 3000 psi</u>
E 1 H	Reactor 1	E 1 - 1	79.9 - 80.3	Diorite	2.81	19,460	19,880
E 2 E	Reactor 2	E 2 - 1	51.2 - 51.6	Diorite	2.83	18,860	19,090
E 2 H	Reactor 2	E 2 - 1	139.1 - 139.4	Diorite	2.77	20,050	20,300
B 42 B	Contact	B 42	122.5 - 123.0	Diabase	2.84	18,600	18,800
B 42 G	Contact	B 42	141.8 - 142.3	Schist	2.77	16,960	17,320
F 1 D	Tunnel	F 1 A	128.7 - 129.2	Diorite	2.79	20,050	20,340
F 2 D	Tunnel	F 2	259.0 - 259.4	Schist	2.86	18,110	18,370

TABLE 2G-3

STRENGTH, VELOCITY, AND HARDNESS DATA
SAMPLES FROM TUNNEL ALIGNMENTS

SERIES 1

Series No.	Depth, ft.	Rock Mechanical Laboratory Number	Unit Weight, pcf	Split Velocity, ft/sec				Ultimate Unconfined Compressive Strength, psi	L/P Ratio	Dynamic Modulus of Elasticity, psi x 10 ⁶		Rock Hardness				Rock Description	Remarks
				Ks(f) Load						E ₁	E ₂	T ₁	T ₂	T ₃	T ₄		
				0	100	200	300										
M - 1	167.2-267.1	72-49	2.53	17,444	17,606	17,464	17,591	22,864	3.72	0.24	1.25	92	70	122	16.7	Diorite - fine grained; some quartz, feldspar, mafic, and iron sulfides	Failed along iron stained joint
AUT-2	258.4-267.5	72-50	2.66	18,882	18,482	18,183	18,568	22,437	2.76	0.34	4.44	40	81	105	12.9	Diorite - coarse grained; primarily feldspar and mafic; slight foliation developed	
AUT-2	267.0-267.7	72-51	2.44	18,271	18,312	18,437	18,479	15,400	3.28	1.46	6.32	31	68	77	16.0	Quartz diorite - very fine grained; quartz, feldspar, iron sulfides; some mafic; some foliation developed	
AUT-4	250.0-256.8	72-52	2.73	18,370	18,434	18,496	18,631	19,306	4.83	0.80	6.01	31	62	67	9.9	Diorite - medium to fine grained; highly microcrystalline; quartz, feldspar, iron sulfides; some mafic; some foliation developed	
M - 1	255.4-256.0	72-53	2.11	16,410	16,616	16,570	16,872	20,895	2.26	0.51	4.04	33	71	77	8.9	Diorite - medium grained; quartz, feldspar, iron sulfides; mafic; some foliation developed	Failed along pre-existing but healed fracture
AUT-11	222.8-222.8	72-54	---	14,886	16,014	15,914	16,071	19,060	2.61	0.33	2.46	34	88	79	12.1	Schistose diorite - fine grained; high biotite content; foliation developed to fair degree	
AUT-13	213.0-213.7	72-56	2.71	17,063	18,066	17,358	17,611	---	2.71	---	---	47	88	125	9.1	Diorite - med. to coarse grained; quartz, feldspar, biotite, mafic; and iron sulfides	
M - 17	189.5-189.8	72-57	3.81	17,207	17,007	17,079	17,071	7,025	4.04	0.63	5.40	50	32	100	16.4	Gabbro - fine grained; feldspar, pyrite and mafic; dark gray	Failed along calcite filled joint
AUT-1	250.0-250.9	72-57	2.89	18,343	18,423	18,747	18,624	21,490	3.42	1.44	6.16	61	14	106	8.5	Quartz diorite - coarse grained; high quartz-feldspar schist; also some iron sulfides	Failed along pre-existing but healed fracture
AUT-7	196.8-196.8	72-1	---	14,652	14,482	14,789	14,846	6,810	2.61	0.31	1.70	46	97	99	10.1	Schistose schist - med. to fine grained; quartz, feldspar, and mafic; fine foliation developed	Failed along iron stained joint
AUT-8	196.0-196.2	72-49	2.63	17,646	17,646	17,624	17,624	19,183	2.72	1.43	2.81	37	89	80	11.1	Schistose schist - med. grained; well developed fine foliation with quartz-rich layers; med. gray	
F-6	196.2-196.9	72-49	2.11	18,652	18,646	18,664	18,771	22,312	3.16	1.38	6.11	46	73	107	16.1	Schistose quartz diorite - fine to med. grained; quartz, feldspar biotite; foliation fair; med. to sh. gray	
F-5	205.3-205.9	72-41	2.78	18,989	18,989	18,986	18,113	24,796	3.41	1.22	4.87	46	70	84	11.1	Gabbro - very fine grained; primarily feldspar and mafic; dark gray	Failed along pre-existing but healed fracture
AUT-16	141.2-141.3	72-42	2.82	16,493	16,627	16,627	16,621	19,405	4.01	1.07	6.38	39	71	33	11.1	Quartzitic Schist - med. grained; mostly quartz, feldspar, and biotite with iron sulfides; foliation only fairly developed; med. gray	

- E₁ - Initial tangent modulus
- E₂₅₀ - tangent modulus at 50% of the ultimate unconfined strength
- H₁₀ - Schmidt (L-type) Rebound Hardness
- H₅ - Shore Sclerometer (C-2 type) Hardness
- H_A - Modified Taber Abrasion Hardness
- H_T - H₁₀/T₁
- A₁₀ - Rock Abrasiveness

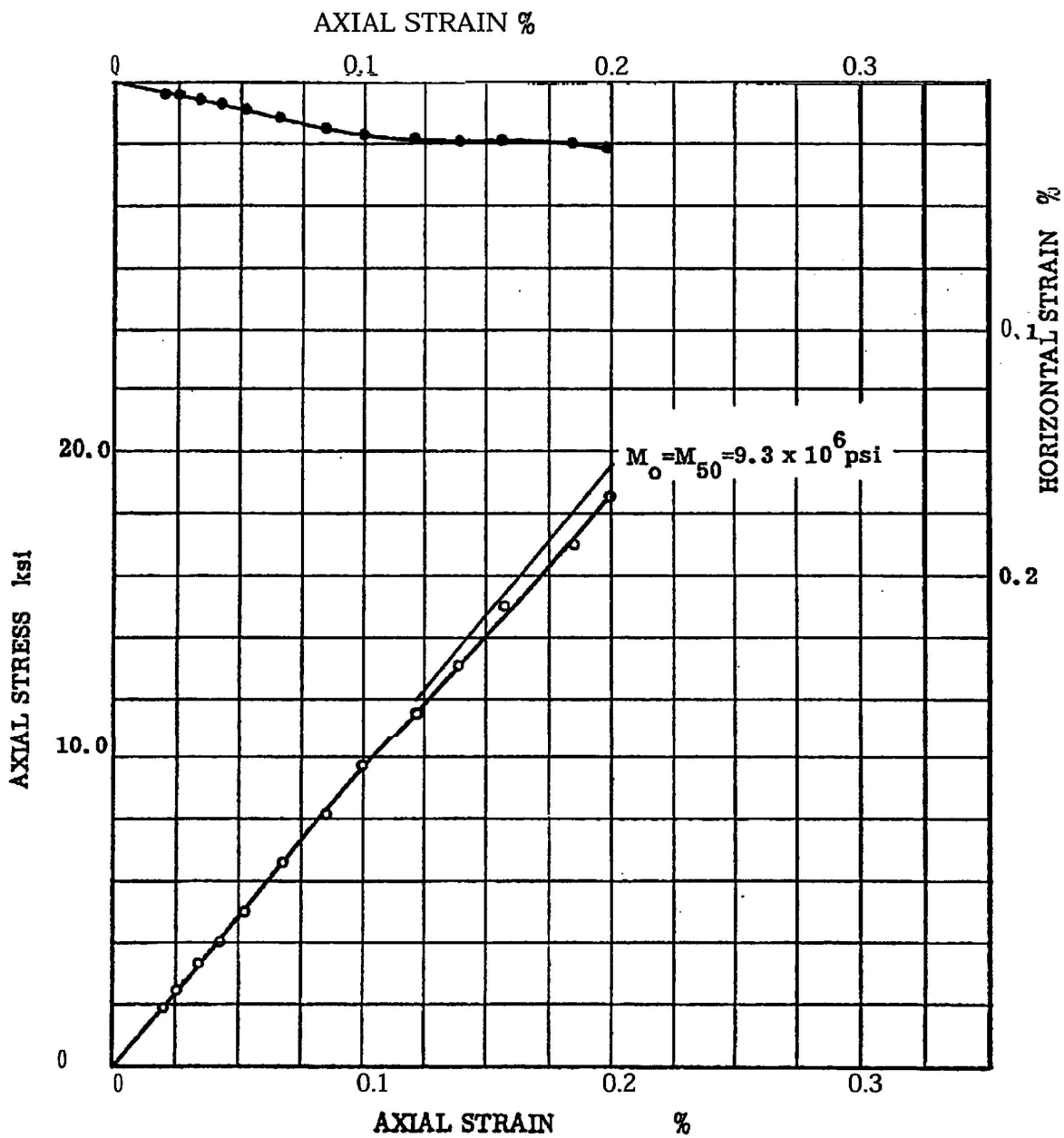
APPENDIX 2G

STATIC AND DYNAMIC ROCK PROPERTIES

FIGURES

<u>Figure</u>	<u>Title</u>
2G-1	Unconfined Test E1F Stress-Strain Curve
2G-2	Unconfined Test E1G Stress-Strain Curve
2G-3	Unconfined Test E2A Stress-Strain Curve
2G-4	Unconfined Test E2C Stress-Strain Curve
2G-5	Unconfined Test E2J Stress-Strain Curve
2G-6	Unconfined Test E2M Stress-Strain Curve
2G-7	Unconfined Test B7B Stress-Strain Curve
2G-8	Unconfined Test B42D Stress-Strain Curve
2G-9	Unconfined Test B42F Stress-Strain Curve
2610	Unconfined Test B42H Stress-Strain Curve
2611	Unconfined Test F1A Stress-Strain Curve

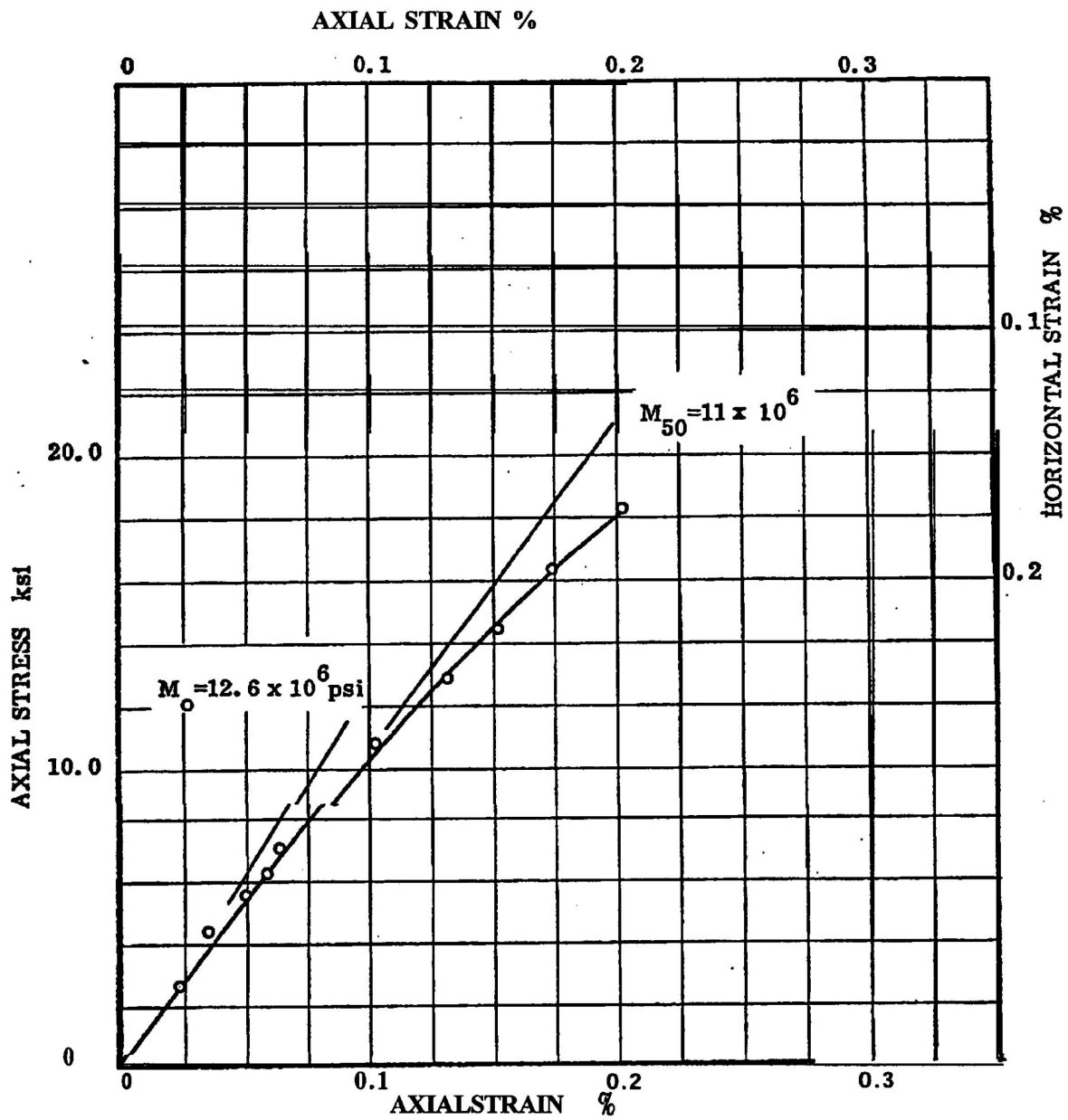
NOTE: The stress-strain curves shown in Figures **2G-1** through **2G-11** are terminated at the last strain reading before sudden, brittle failure. The maximum compressive load at failure was recorded by the testing machine and was used to calculate the compressive strengths contained in Table **2G-1**.



M = Modulus of Deformation

Diorite
Borehole El-1 Depth 79.1 to 79.5 ft

UNCONFINED TEST E 1 F STRESS -STRAIN CURVE
FIGURE 2G-1



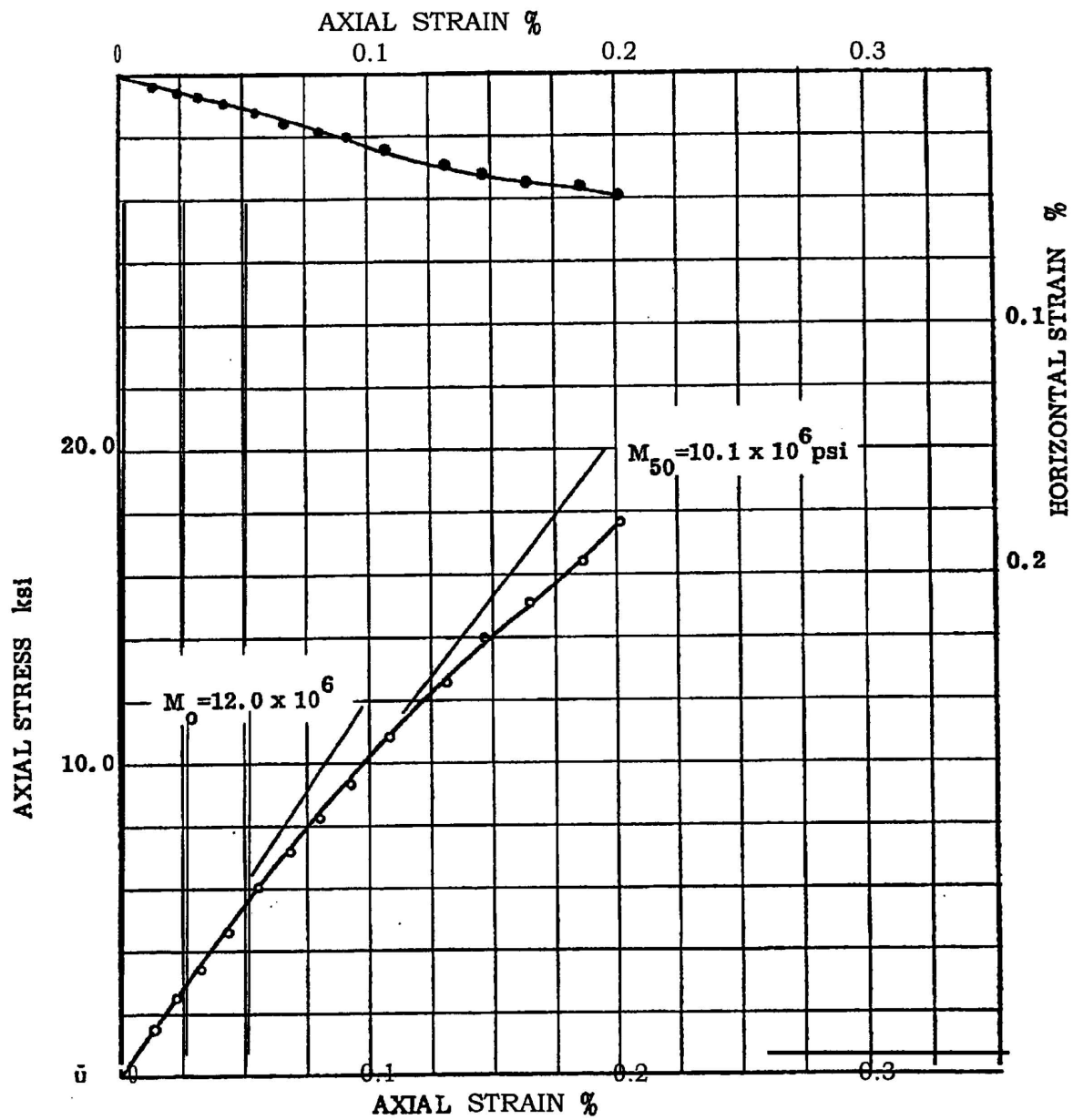
Diorite

M = Modulus of Deformation

Borehole E1-1 Depth 79.5 to 79.3 ft

UNCONFINED TEST EIG STRESS-STRAIN CURVE

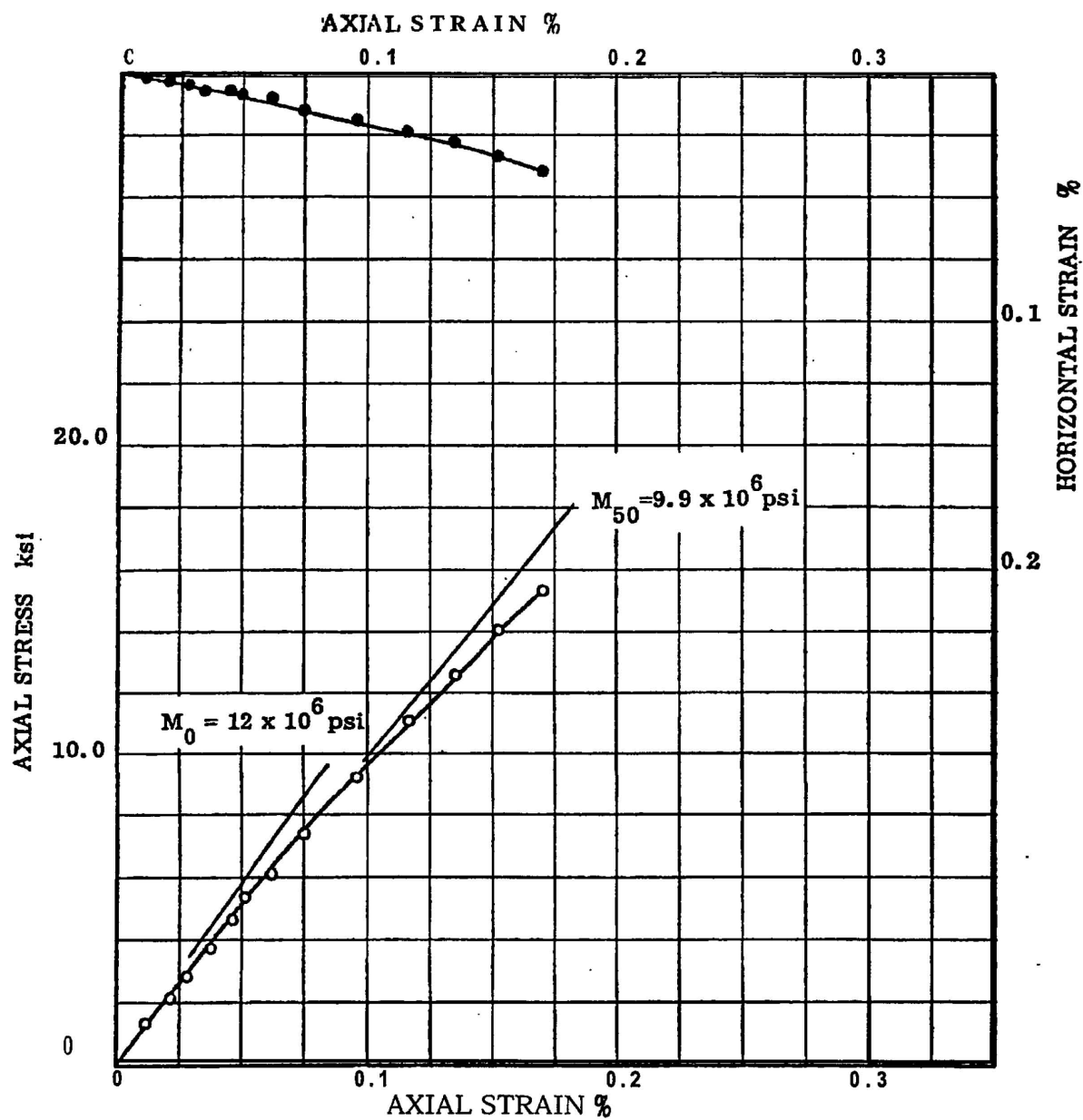
FIGURE 2G-2



M= Modulus of Deformation

Diorite
Borehole E2-2 Depth 49. 6 to 50. 0ft

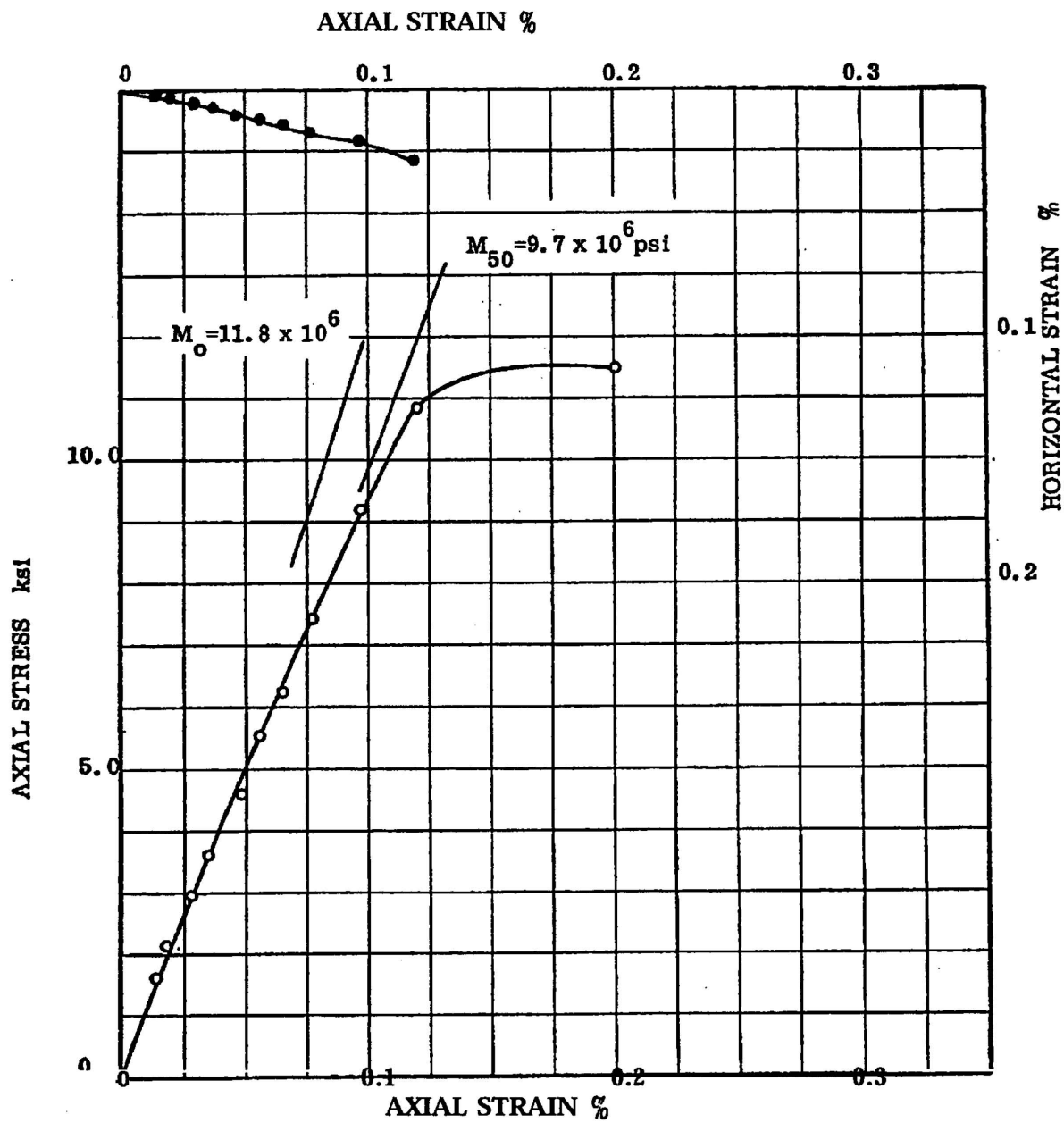
UNCONFINED TEST E2A STRESS-STRAIN CURVE
FIGURE 2G-3



M = Modulus of Deformation

Diorite
Borehole E2-2 Depth 50.4 to 50.8 ft

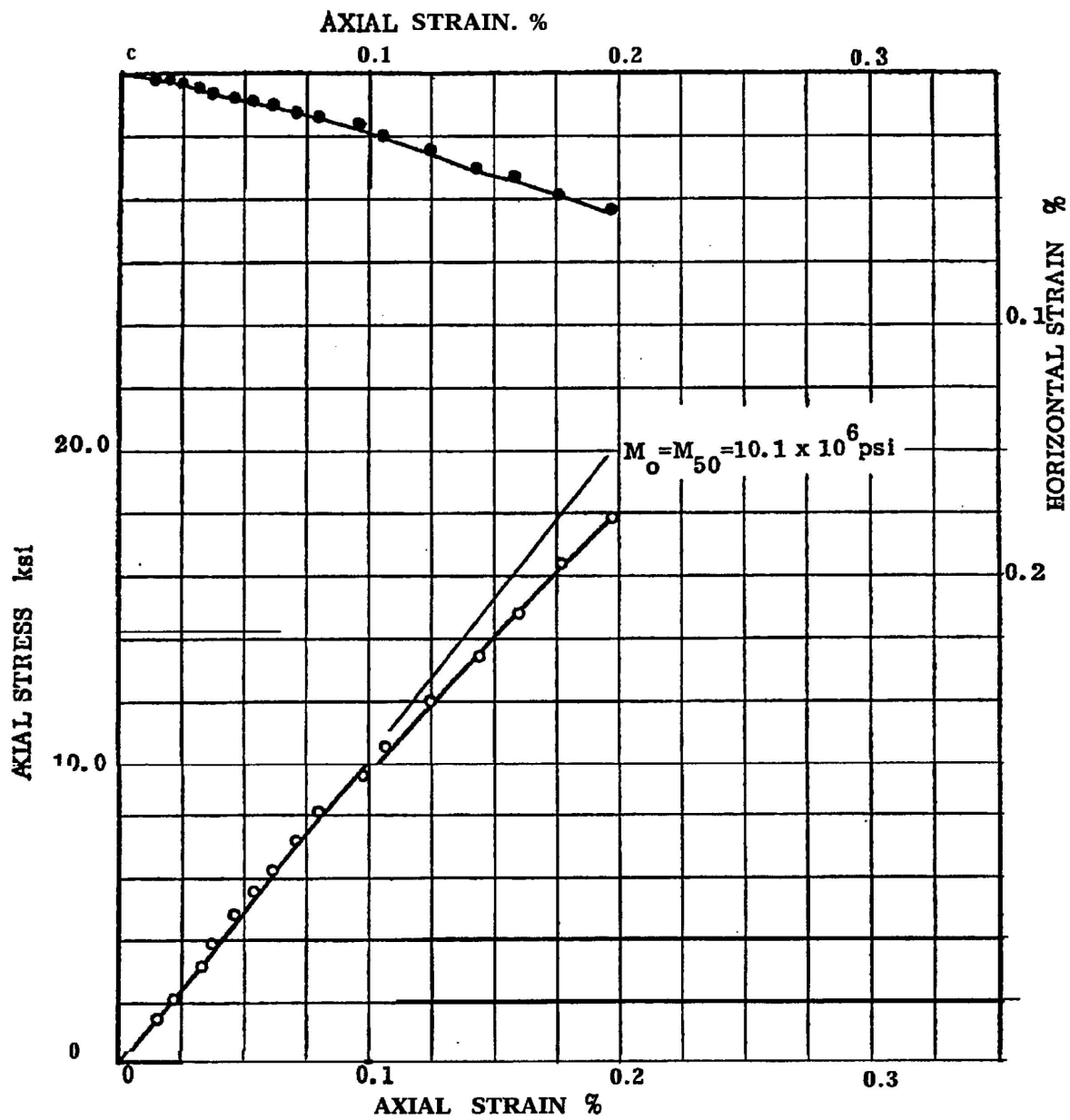
UNCONFINED TEST E2C STRESS-STRAIN CURVE
FIGURE 2G-4



Schist
Borehole E2-2 Depth 139.4 to 139.8

M = Modulus of Deformation

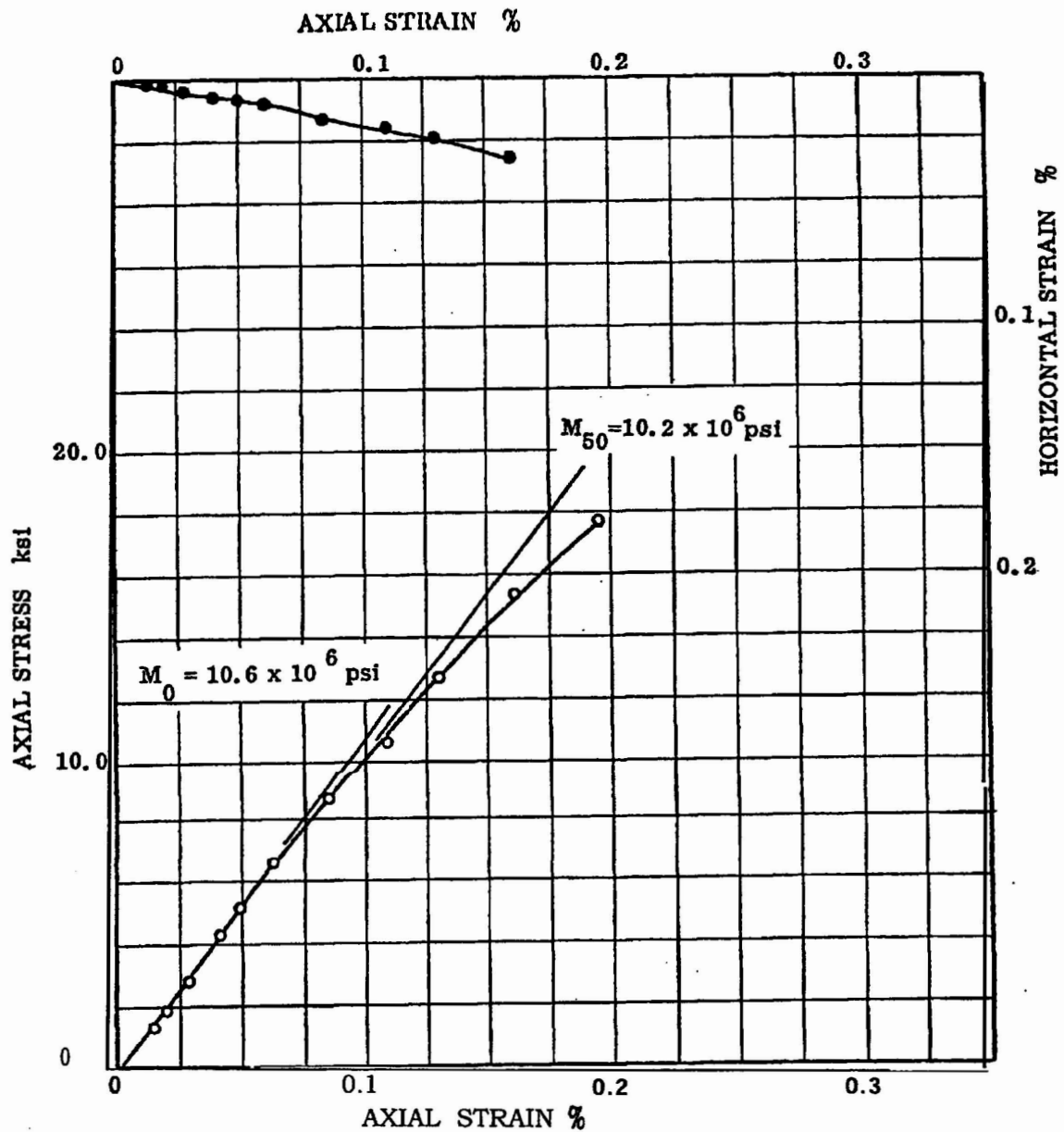
UNCONFINED TEST E2 J STRESS-STRAIN CURVE
FIGURE 2G-5



M = Modulus of Deformation

Schist
Borehole E2-2 Depth 141.9 to 142.3 ft

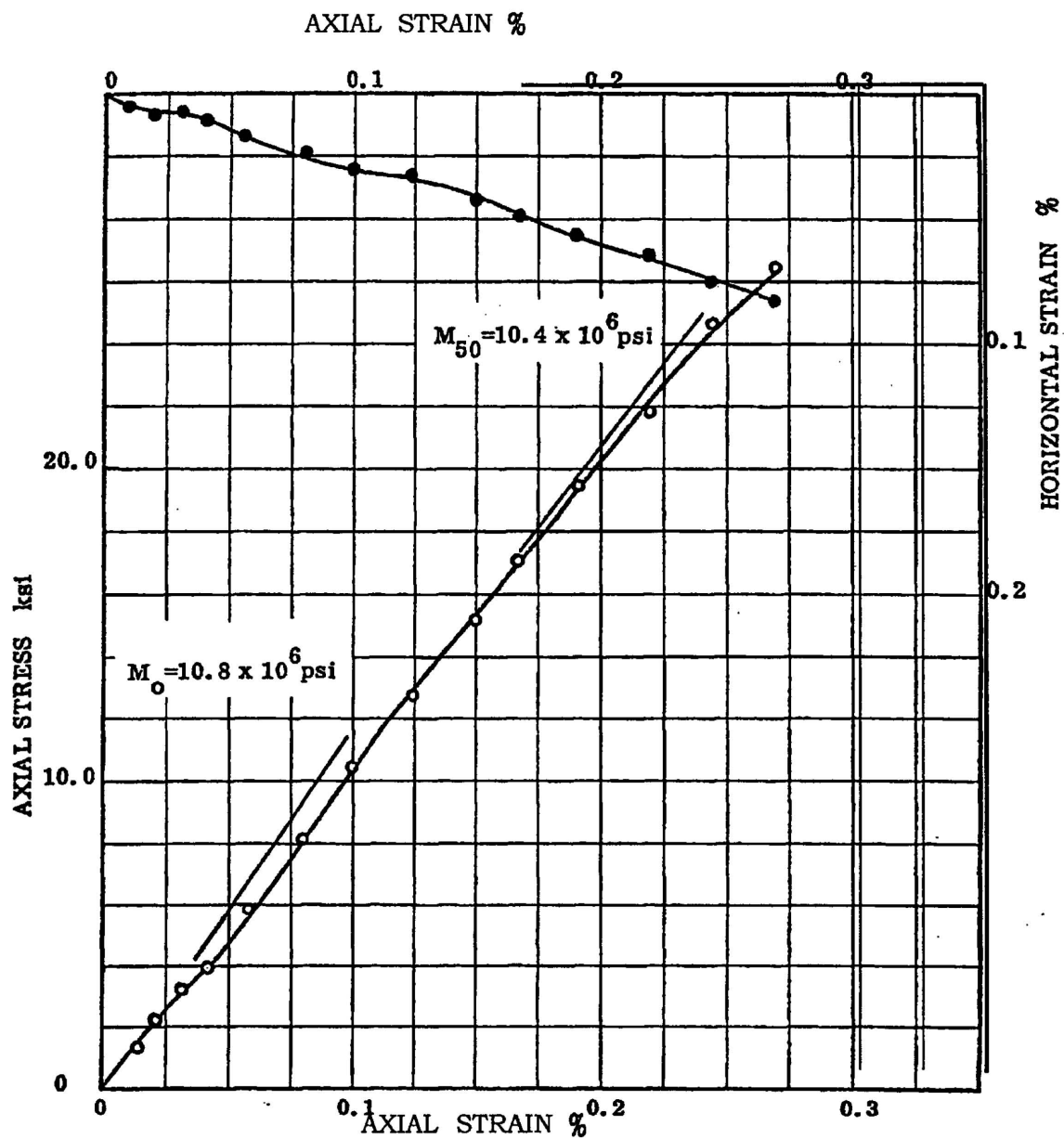
UNCONFINED TEST E2M STRESS -STRAIN CURVE
 FIGURE 2G-6



M = Modulus of Deformation

Schist
Borehole B7 Depth 27.8 to 28.2 ft

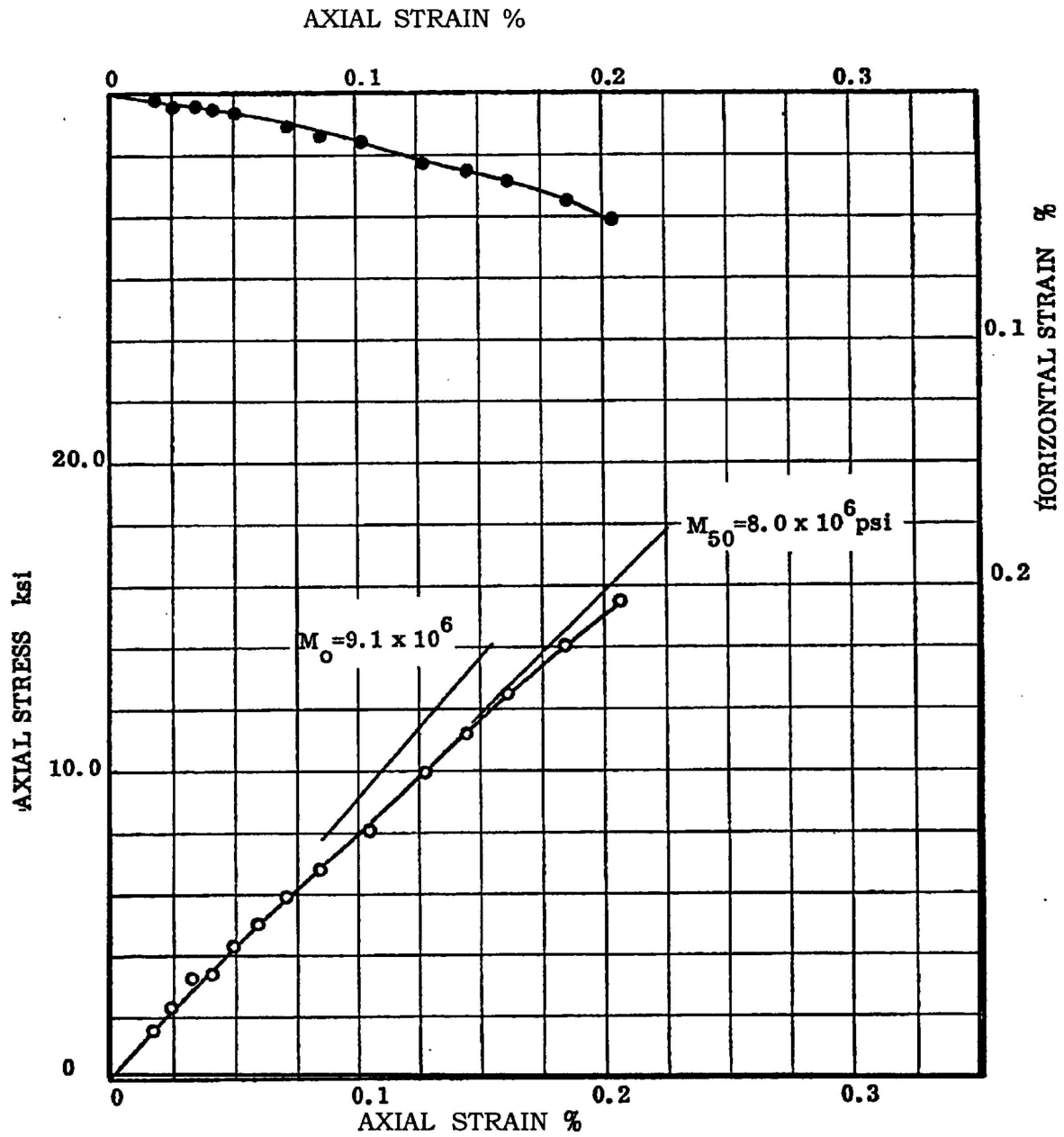
UNCONFINED TEST B7B STRESS-STRAIN CURVE
FIGURE 2G- 7



Diabase
 Borehole B-12 Depth 123.5 to 125.9 ft

M = Modulus of Deformation

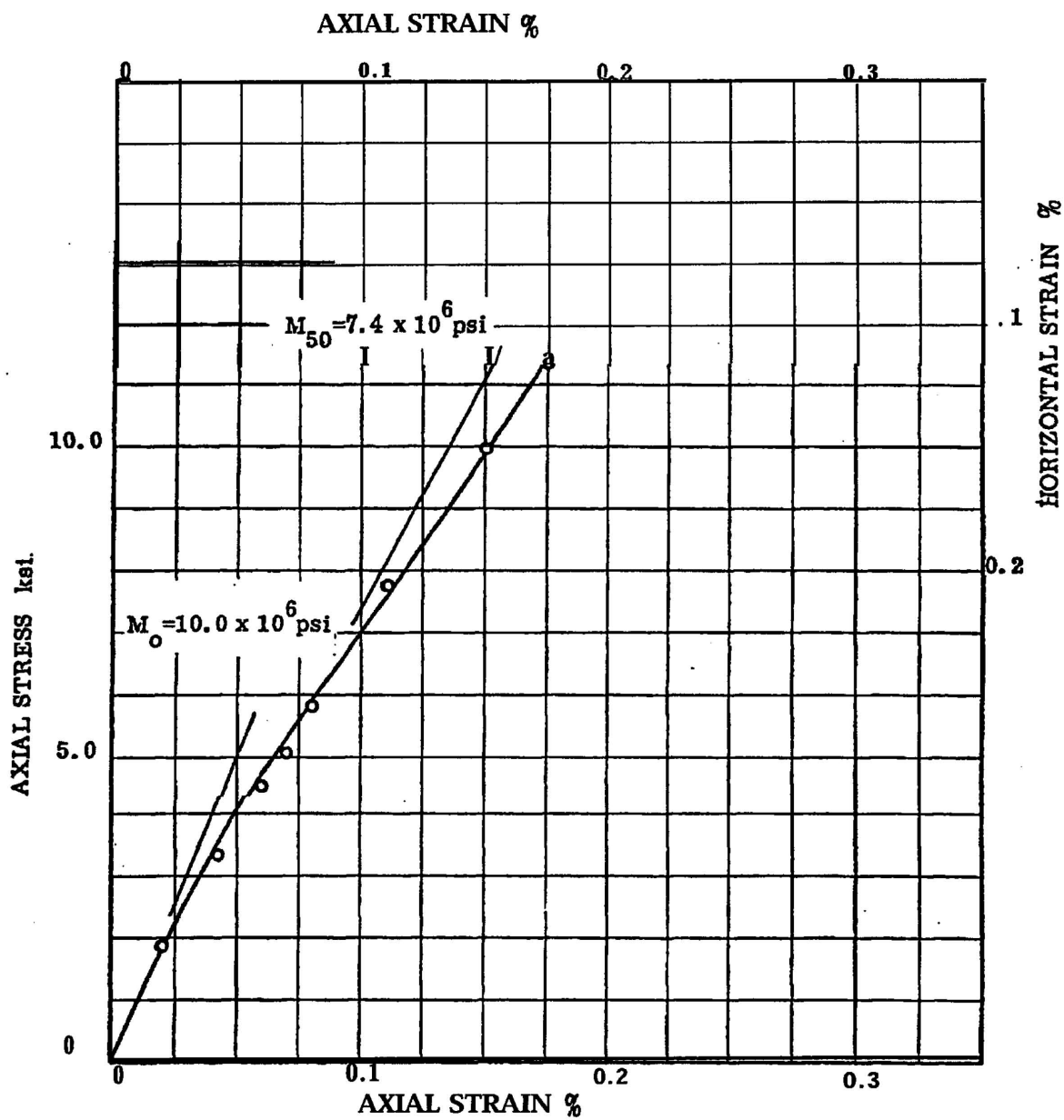
UNCONFINED TEST B42D STRESS-STRAIN CURVE
 FIGURE 2G-8



M = Modulus of Deformation

Schist
Borehole B42 Depth 141.3 to 141.7 ft

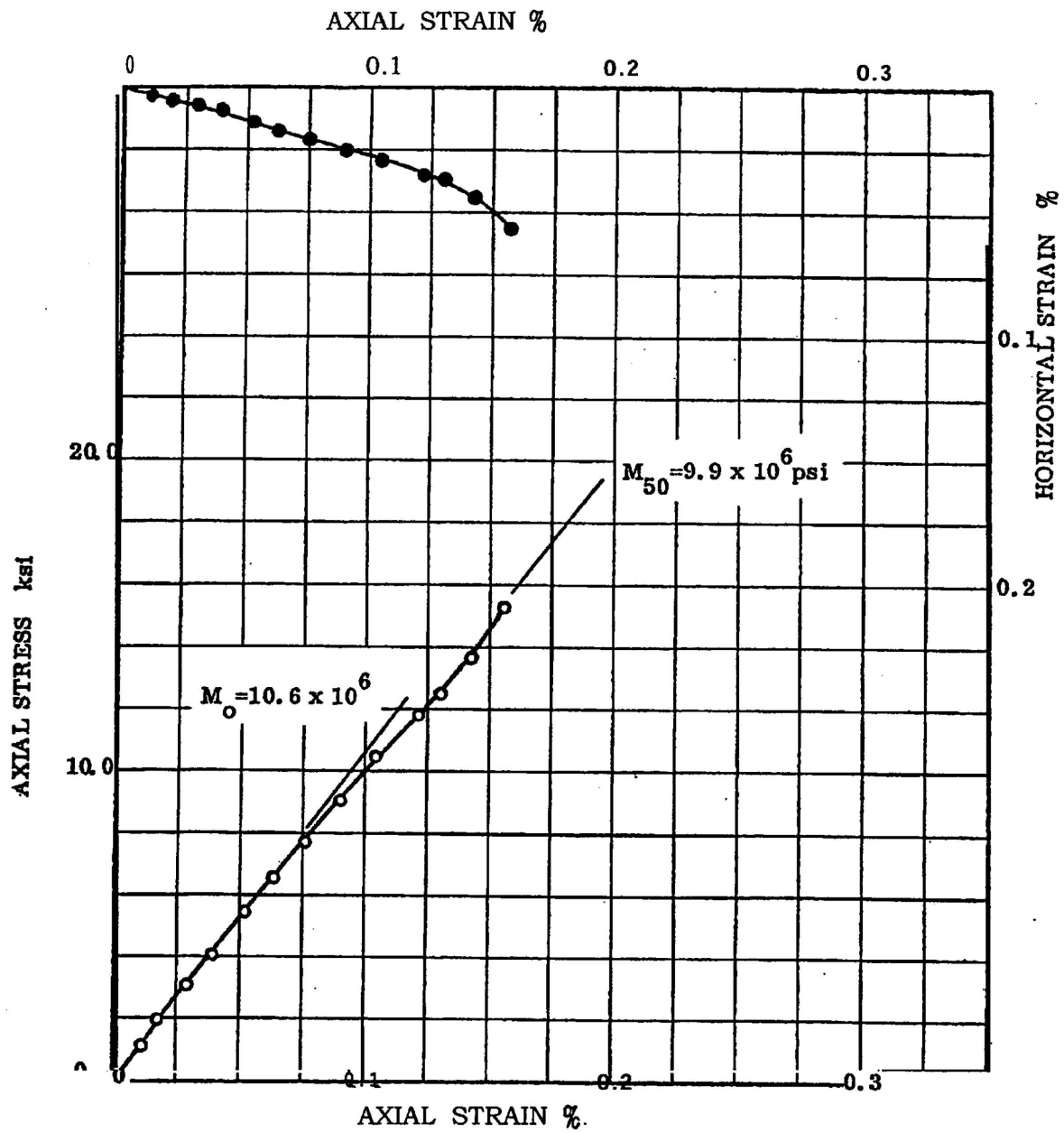
UNCONFINED TEST B42F STRESS-STRAIN CURVE
FIGURE 2G-9



M = Modulus of Deformation

Schist
Borehole B42 Depth 142.7 to 143.1 ft

UNCONFINED TEST B42H STRESS-STRAIN CURVE
FIGURE 2G-10



M = Modulus of Deformation

Diorite
Borehole F1A Depth 127.5 to 127.8 ft

UNCONFINED TEST F1A STRESS-STRAIN CURVE

FIGURE 2G-11