APPENDIX J

Falling Weight Deflectometer (FWD) Data

Appendix J. Falling Weight Deflectometer (FWD) Data

This Appendix will be added for the final report

APPENDIX K

Resilient Modulus Data

Appendix K: Results of Resilient Modulus Testing

Table 1. Summary of resilient modulus testing specimen characteristics.

Aggregate Type	Gradation	Sample Number	Sample Height (mm)	Dry Density (Mg/m^3)	Percent of Optimum Density	Moisture Content (%)
Glacially Derived	21AA	2	304	2.2	95.5	3
		6	305	2.2	95	3
		3	304	2.21	96	3
	350AA	13	302	2.14	96	2
		12	289	2.15	101	2
		11	294	2.12	99	2
	3G	17	295	2.07	99	2
		18	297	2.07	98	2
		16	300	2.04	97	2
Quarried Limestone	21AA	22	302	2.18	96	3
		24	308	2.15	95	3
		23	310	2.15	95	3
	350AA	29	302	2.13	99	2
		32	295	2.16	100	2
		28	302	2.12	98	2
	3G	36	265	2.11	98	2
		35	298	2.1	98	2
		34	299	2.1	98	2

Table 2. Summary of analysis of resilient modulus testing data.

Aggregate Type	Gradation	Sample Number	Moisture Condition	Resilient Modulus MPa	R squared	K1	K2
Glacially Derived	21AA	2	Dry	440.111	0.9851	12979	0.5786
			Drained	442.843	0.9962	6522	0.689
			Undrained	131.342	0.3644	25976	0.2848
		6	Dry	395.575	0.9904	13773	0.5579
			Drained	386.419	0.9918	7323.4	0.6544
			Undrained	147.837	0.6516	17450	0.3901
		3	Dry	444.803	0.9869	13719	0.5721
			Drained	423.925	0.9654	12295	0.5791
			Undrained	131.685	0.1583	42092	0.1929
	350AA	13	Dry	412.513	0.9857	9389.9	0.6246
			Drained	395.209	0.9937	6726.8	0.6774
			Undrained	181.3	0.5291	21928	0.3224
		12	Dry	420.042	0.9913	9336.5	0.6254
			Drained	378.050	0.9969	7127.5	0.6575
			Undrained	125.791	0.4068	18614	0.3451
		11	Dry	403.878	0.9849	14518	0.5524
			Drained	336.259	0.9769	5949.3	0.6618
			Undrained	*			
	3G	17	Dry	386.409	0.9929	15726	0.5328
			Drained	363.412	0.9975	8472.7	0.6221
			Undrained	144.88	0.7114	10625	0.4169
		18	Dry	420.212	0.987	14090	0.5579
			Drained	400.160	0.9925	10178	0.6027
			Undrained	229.649	0.2412	64378	0.2365
		16	Dry	362.416	0.9914	14330	0.5391
			Drained	362.600	0.996	9435	0.609
			Undrained	*			
Quarried Limestone	21AA	22	Dry	431.643	0.9926	11111	0.6011
			Drained	376.853	0.9948	6040.5	0.6787
			Undrained	108.078	0.4568	10188	0.4205
		24	Dry	407.050	0.9846	12194	0.5729
			Drained	335.071	0.9929	7905	0.6151
			Undrained	*			
		23	Dry	455.812	0.9481	24051	0.4777
			Drained	341.062	0.9865	14367	0.5331
			Undrained	*			
	350AA	29	Dry	336.658	0.9919	12796	0.5416
			Drained	303.882	0.9944	10141	0.5622
			Undrained	*			
		32	Dry	358.867	0.9818	11548	0.56988
			Drained	329.643	0.9868	10290	0.5724
			Undrained	*			
		28	Dry	352.243	0.9824	12026	0.5555
			Drained	307.549	0.9886	8943.5	0.5861
			Undrained	*			
	3G	36	Dry	363.428	0.991	13503	0.5412
			Drained	317.224	0.9888	8365.4	0.6063
			Undrained	174.827	0.0013	167456	-0.0431
		35	Dry	389.226	0.9893	13792	0.5477
			Drained	349.152	0.9919	13767	0.5296
			Undrained	111.172	0.4545	14981	0.3575
		34	Dry	353.088	0.986	19432	0.4822
			Drained	315.683	0.9911	10657	0.5641
			Undrained	101.953	0.5621	16434	0.3427

Note: All MR values are for step 11 with a confining pressure of 15 psi and a deviator stress of 15 psi.
* indicates that the sample has suffered excessive deformation prior to step 11.

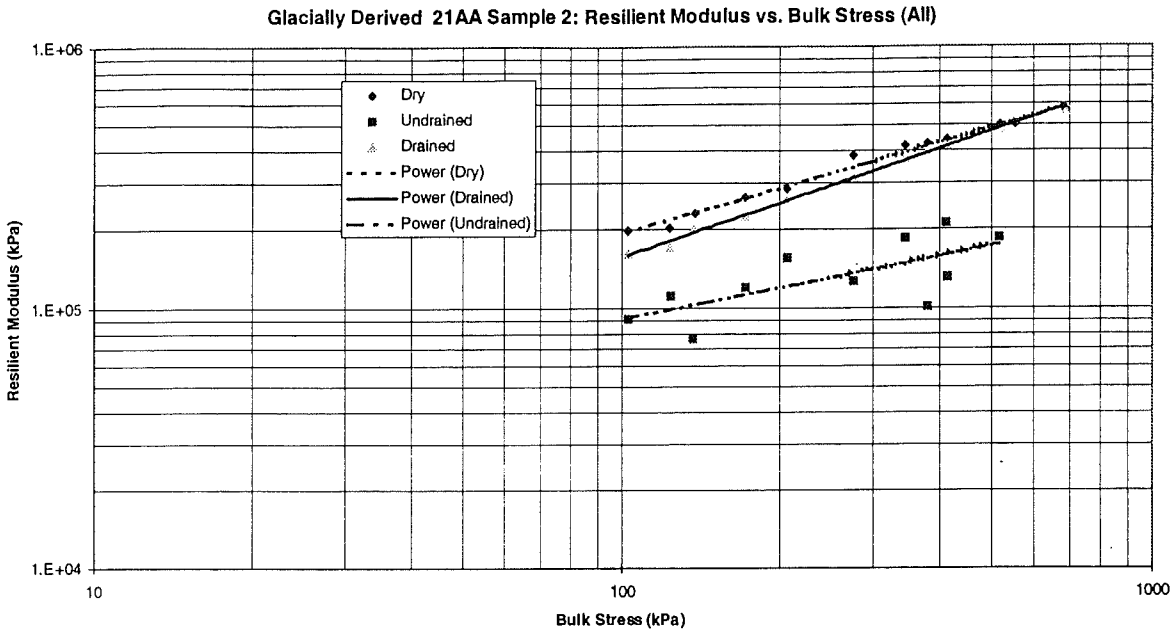

Figure 1. Resilient modulus versus bulk stress for glacially derived 21AA sample 2.

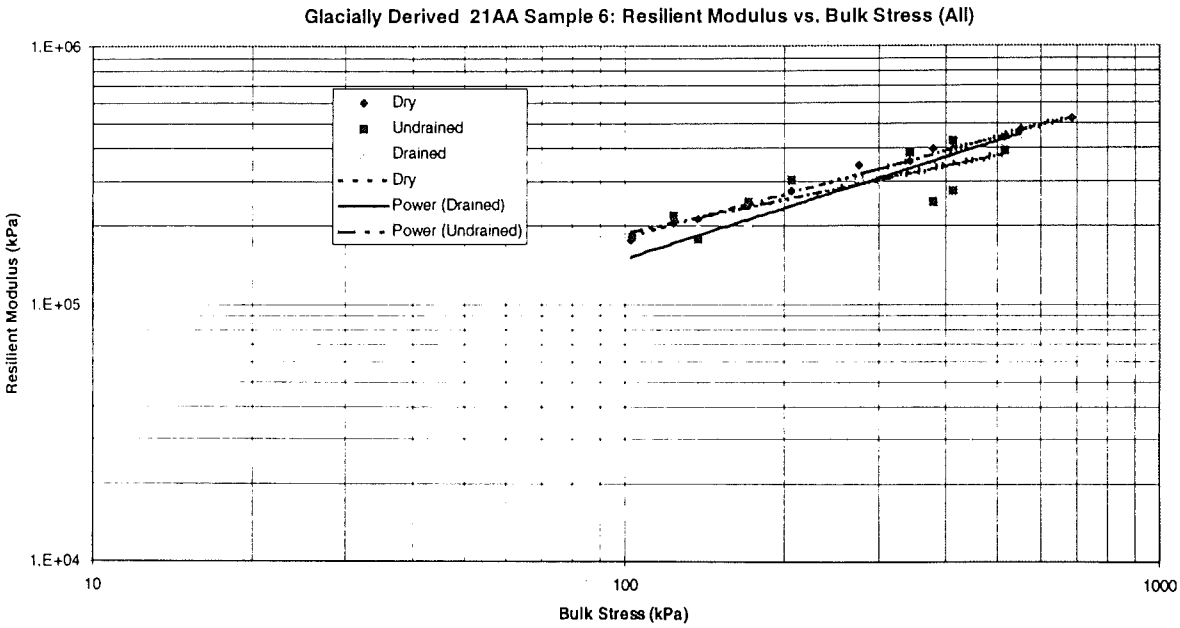

Figure 2. Resilient modulus versus bulk stress for glacially derived 21AA sample 6.

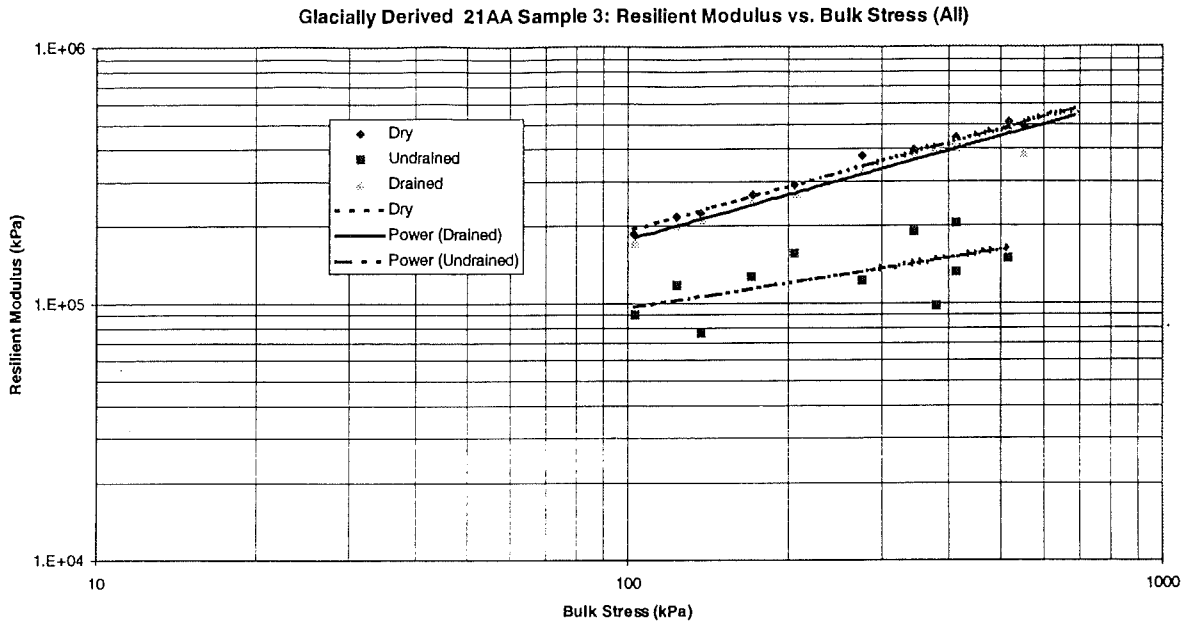

Figure 3. Resilient modulus versus bulk stress for glacially derived 21AA sample 3.

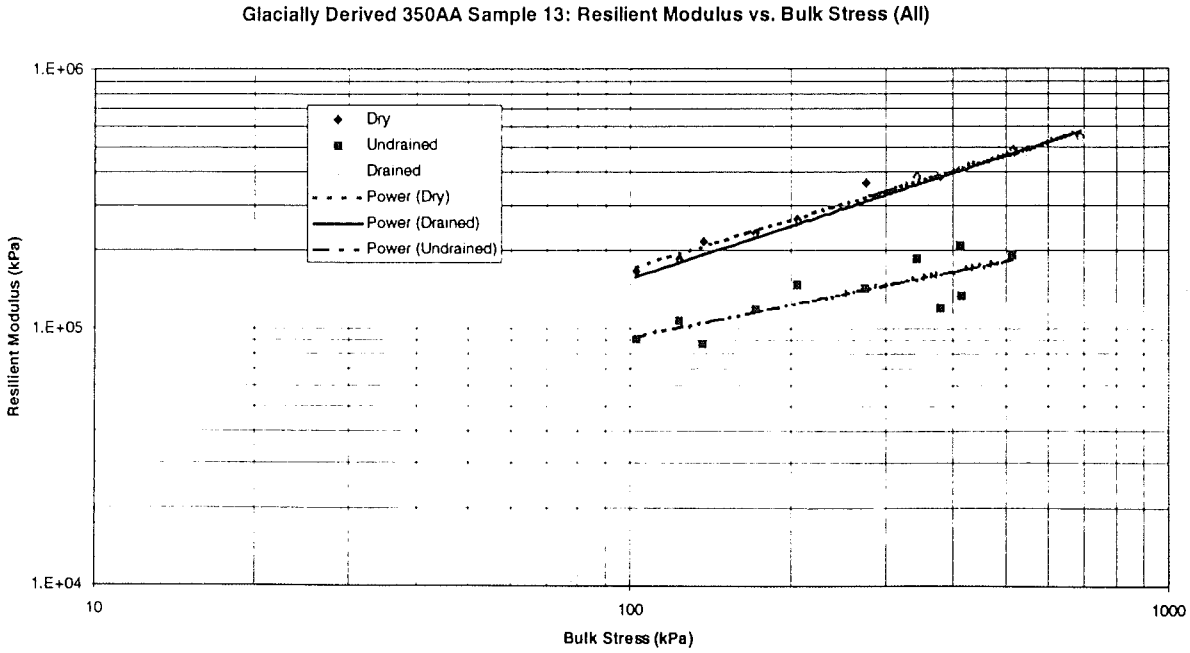

Figure 4. Resilient modulus versus bulk stress for glacially derived 350AA sample 13.

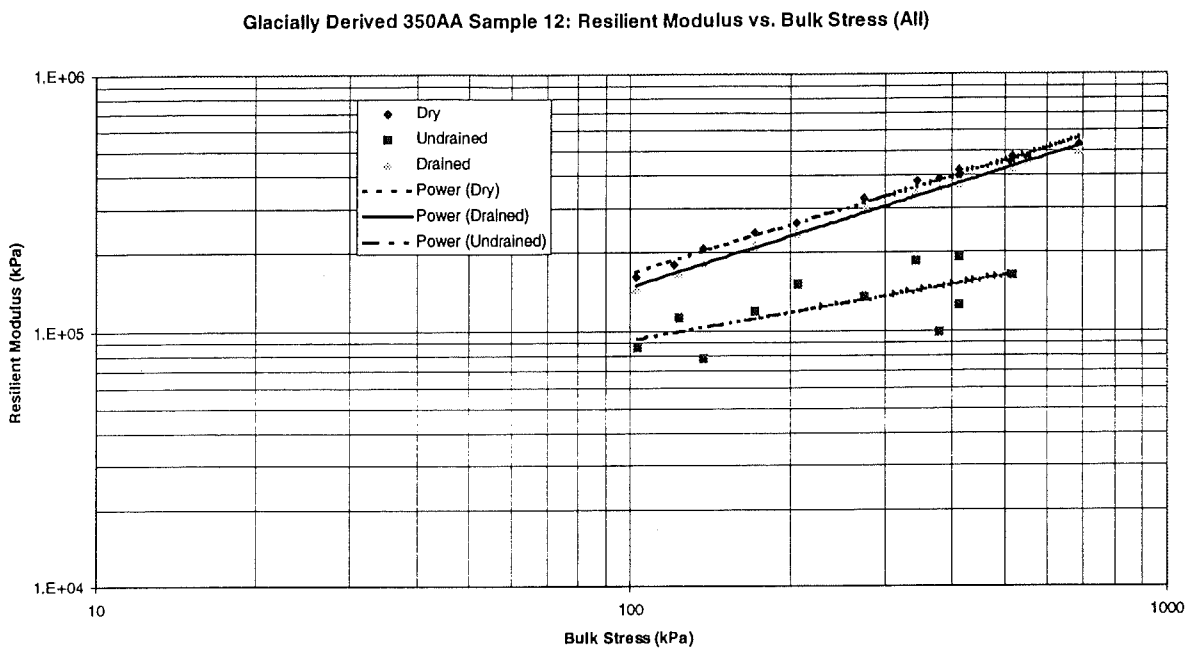

Figure 5. Resilient modulus versus bulk stress for glacially derived 350AA sample 12.

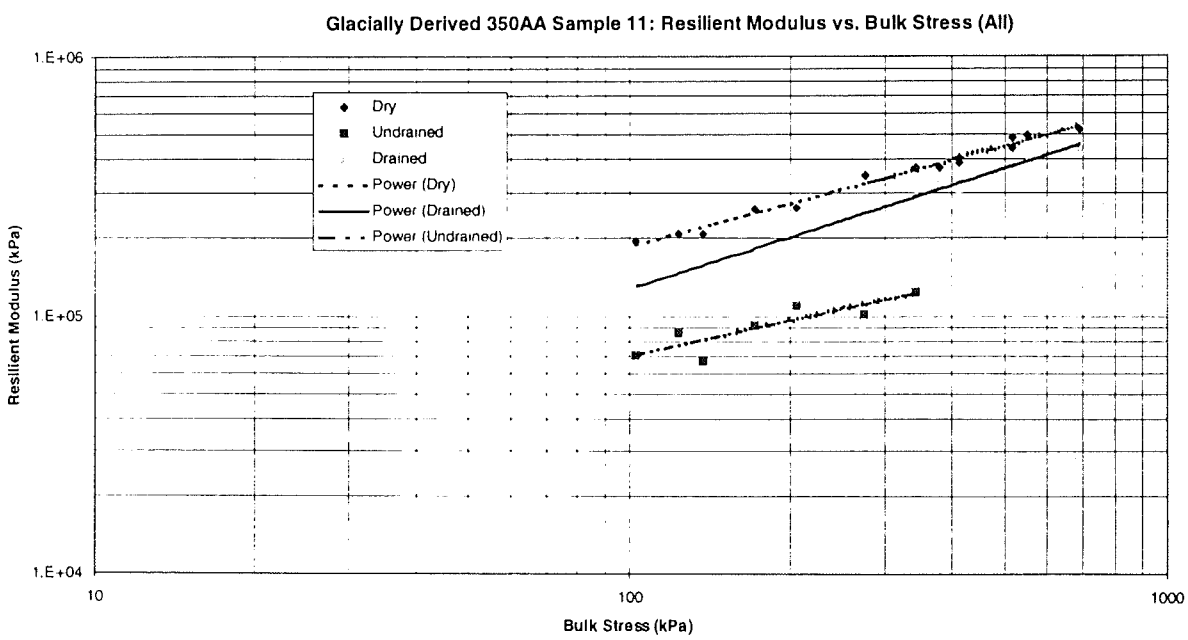

Figure 6. Resilient modulus versus bulk stress for glacially derived 350AA sample 11.

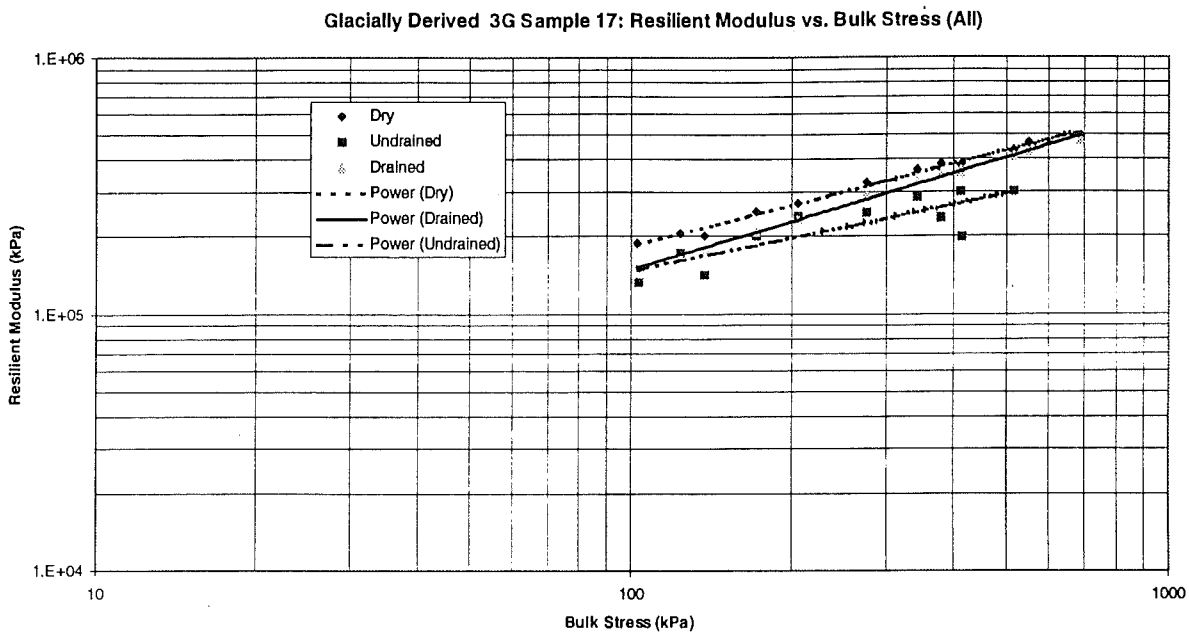

Figure 7. Resilient modulus versus bulk stress for glacially derived 3G sample 17.

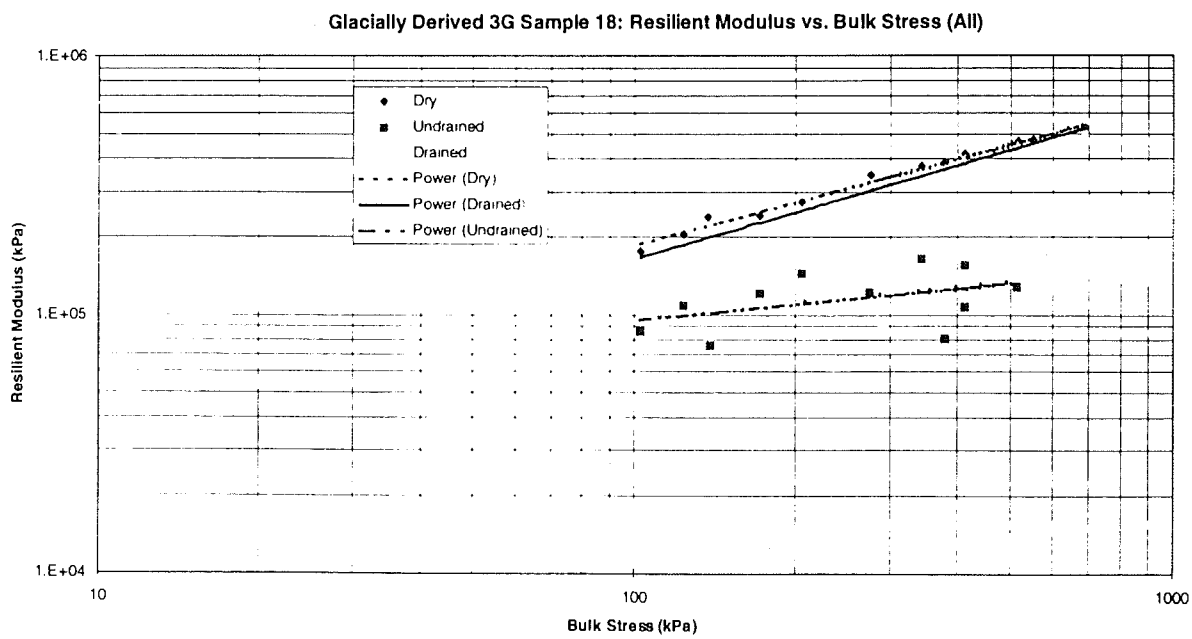

Figure 8. Resilient modulus versus bulk stress for glacially derived 3G sample 18.

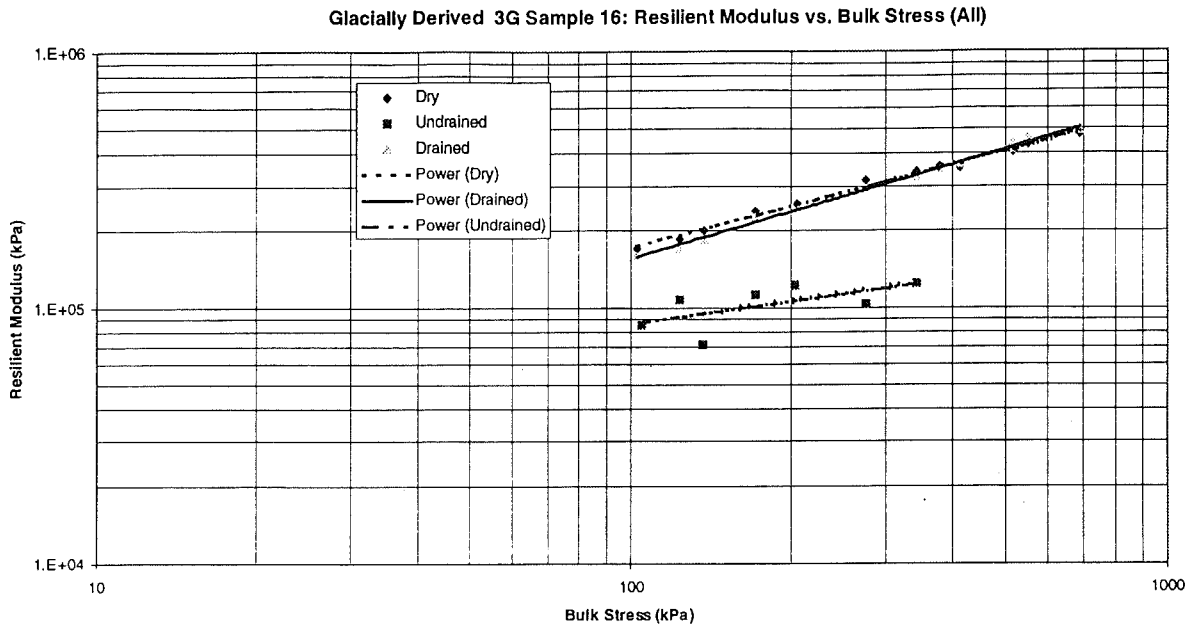

Figure 9. Resilient modulus versus bulk stress for glacially derived 3G sample 16.

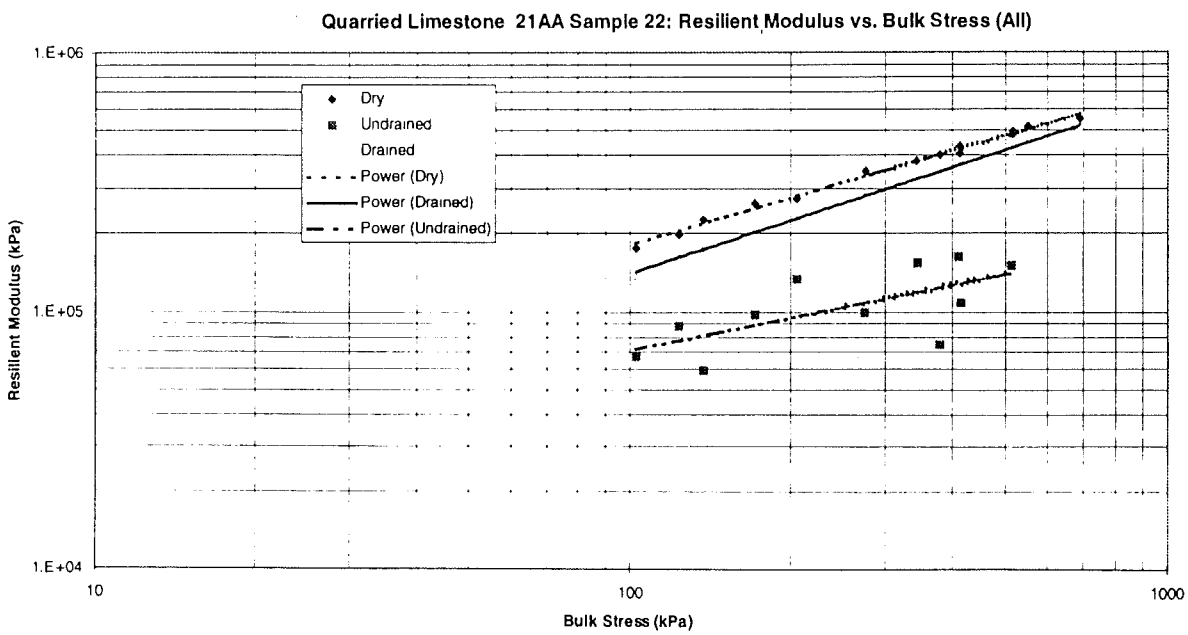

Figure 10. Resilient modulus versus bulk stress for quarried limestone 21AA sample 22.

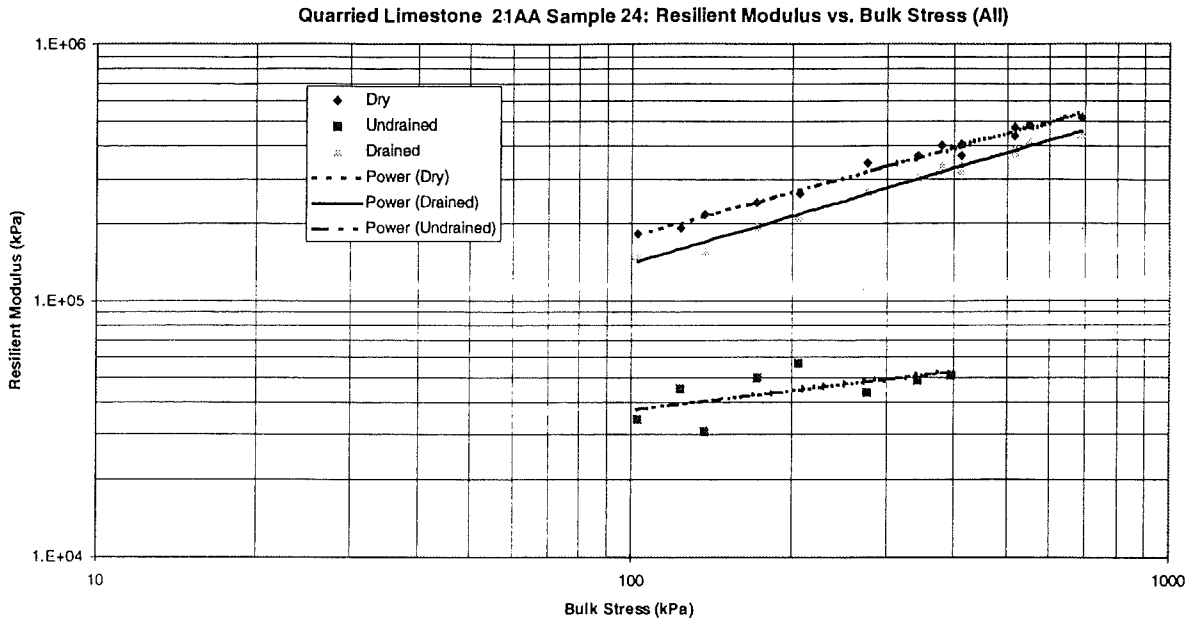

Figure 11. Resilient modulus versus bulk stress for quarried limestone 21AA sample 24.

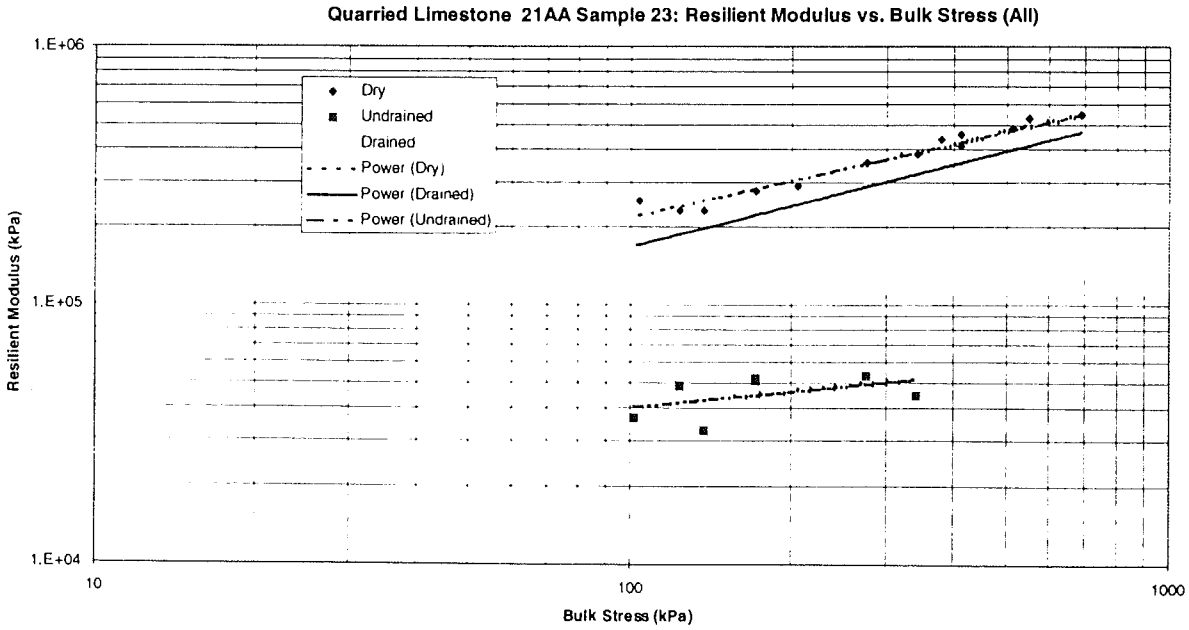

Figure 12. Resilient modulus versus bulk stress for quarried limestone 21AA sample 23.

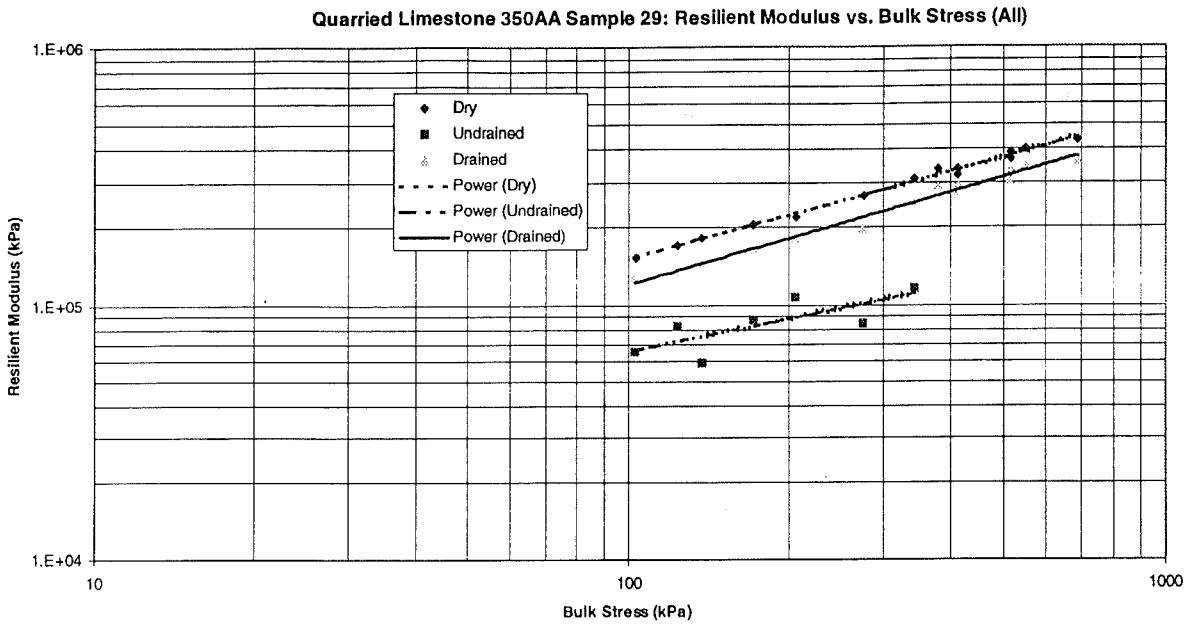

Figure 13. Resilient modulus versus bulk stress for quarried limestone 350AA sample 29.

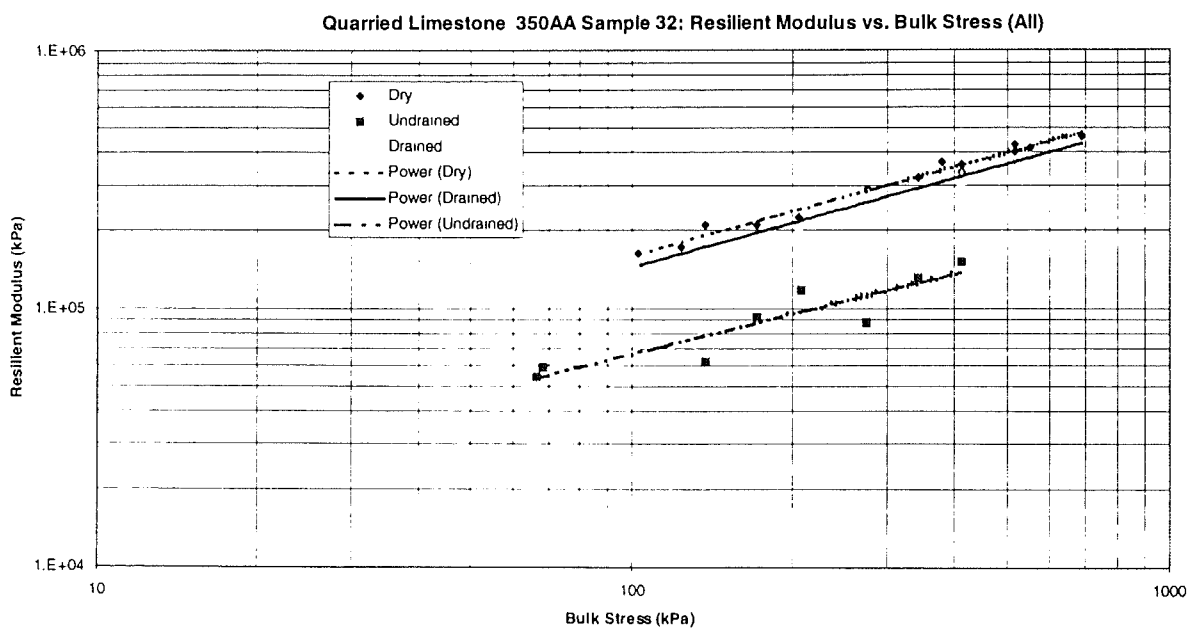

Figure 14. Resilient modulus versus bulk stress for quarried limestone 350AA sample 32.

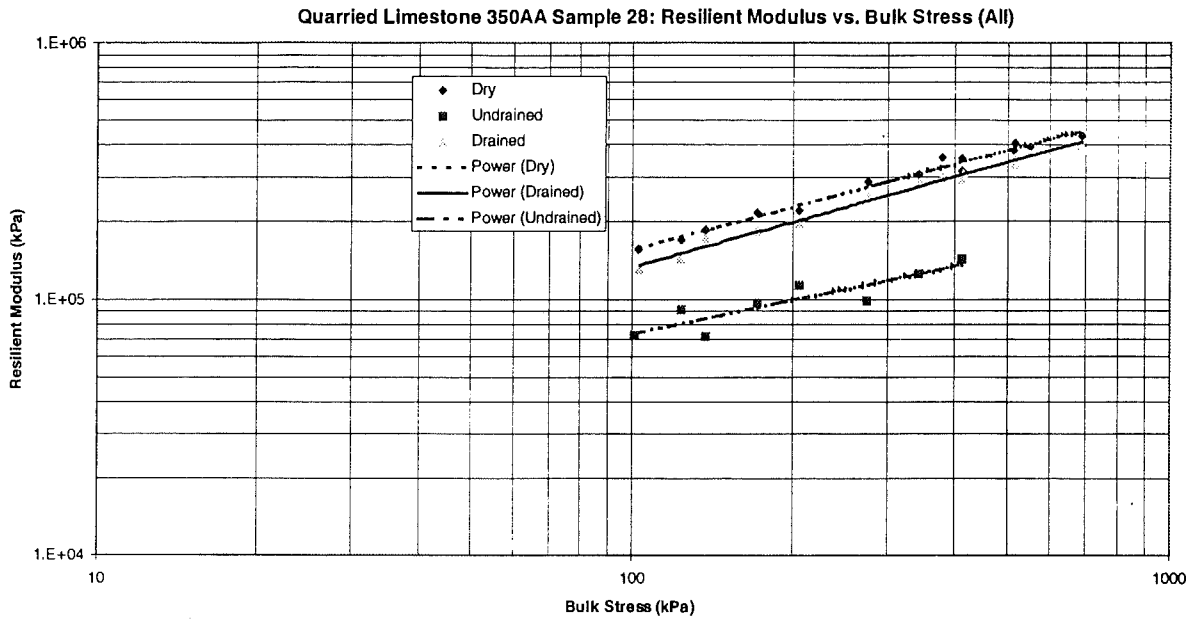

Figure 15. Resilient modulus versus bulk stress for quarried limestone 350AA sample 28.

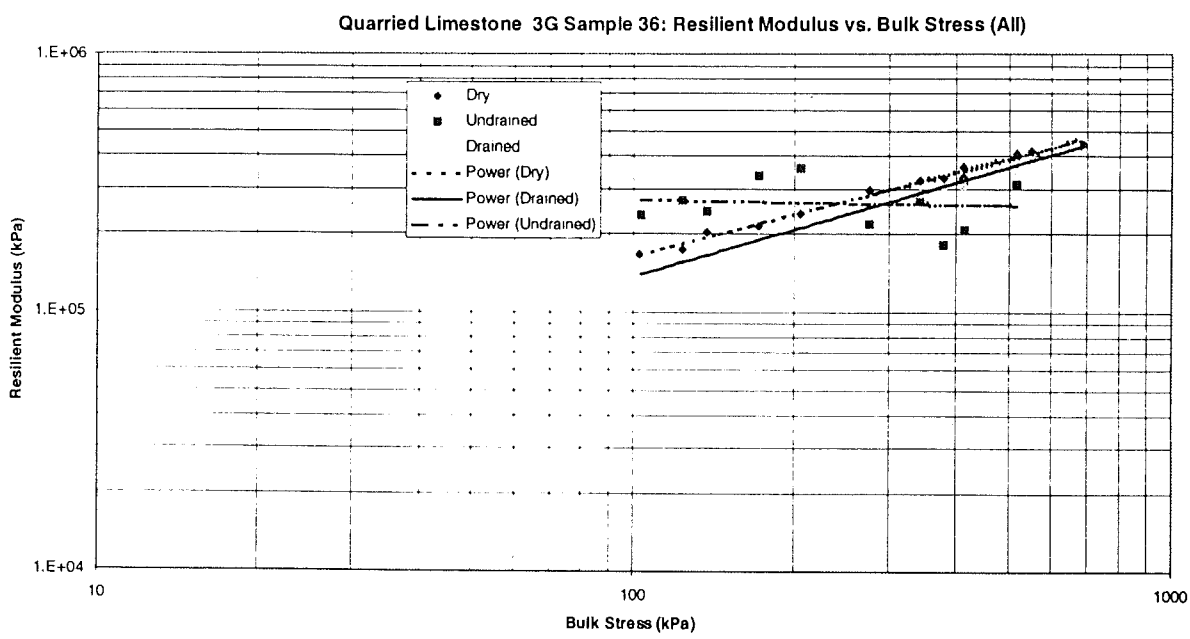

Figure 16. Resilient modulus versus bulk stress for quarried limestone 3G sample 36.

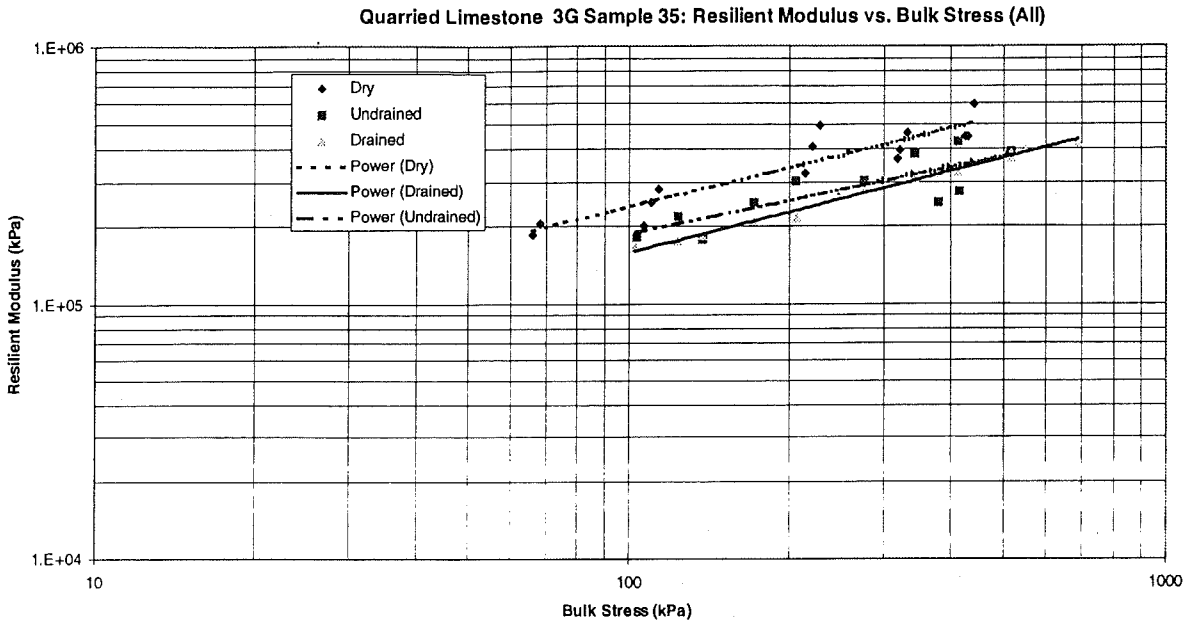

Figure 17. Resilient modulus versus bulk stress for quarried limestone 3G sample 35.

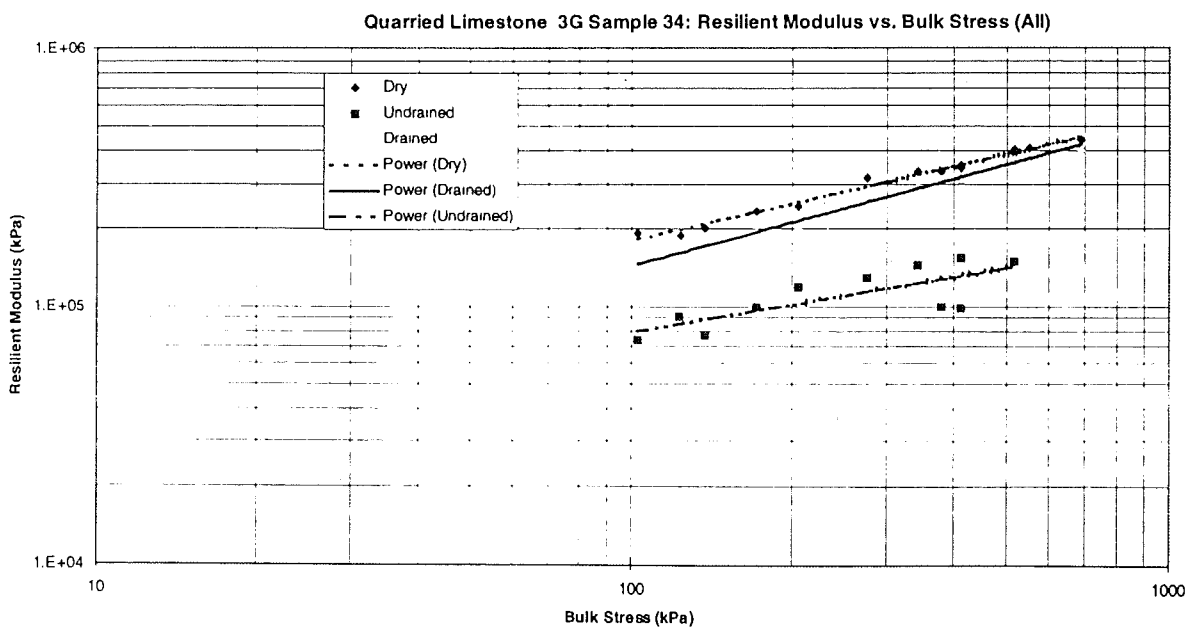

Figure 18. Resilient modulus versus bulk stress for quarried limestone 3G sample 34.

Table 3: Permanent deformation data for glacially derived materials.

Step Number	Deformation (mm)								
	21AA			350AA			3G		
	Sample2	Sample6	Sample3	Sample13	Sample12	Sample11	Sample17	Sample18	Sample16
1	0	0	0	0	0	0	0	0	0
2	0.03353798	0.02054553	0.2244922	0.3699433	0.53431659	0.1361	0.04131659	0.13120168	0.0187
3	0.04755116	0.04789268	0.2585	0.40032513	0.55845331	0.1586	0.07004109	0.16007616	0.0490
4	0.06059463	0.0599597	0.2303	0.41308581	0.32193862	0.1542	0.08041524	0.17056202	0.0645
5	0.07264267	0.0747519	0.2880	0.42984512	0.59415025	0.1840	0.10837328	0.18235406	0.0812
6	0.10014372	0.11612626	0.3210	0.46837065	0.63169636	0.2113	0.16604845	0.21701626	0.1237
7	0.12725415	0.14616082	0.3502	0.50371935	0.66295388	0.2421	0.22183929	0.24241737	0.1551
8	0.15571095	0.18227094	0.3786	0.53380478	0.7022737	0.2706	0.27069221	0.2727586	0.1993
9	0.21547798	0.27963697	0.4548	0.61824601	0.80409848	0.3378	0.42433411	0.34202917	0.3226
10	0.22072798	0.28658402	0.4549	0.62410147	0.80892922	0.3404	0.43528871	0.34643102	0.3313
11	0.2264353	0.29304442	0.4626	0.63188192	0.81748733	0.3470	0.44518786	0.35096731	0.3394
12	0.25448807	0.33046181	0.4956	0.66468662	0.8599611	0.3764	0.50741969	0.38405463	0.3875
13	0.2647588	0.34300502	0.5050	0.67579181	0.87121523	0.3884	0.53044836	0.39256203	0.4016
14	0.2686086	0.34698728	0.5088	0.68105505	0.87874687	0.3936	0.54014028	0.39864657	0.4085
15	0.31531866	0.4103602	0.5602	0.7328263	0.95274085	0.4413	0.63821901	0.44543705	0.4999
16	0.31531866	0.4103602	0.5602	0.7328263	0.95274085	0.4413	0.63821901	0.44543705	0.4999
17	0.3291786	0.43952438	0.7504	0.88741595	1.03131497	0.5436	0.65781138	0.46472166	0.5138
18	0.3389515	0.45268014	0.7605	0.90457912	1.05111265	0.5757	0.68512727	0.47851952	0.5303
19	0.3510525	0.46733623	0.7318	0.91320735	1.05228144	0.5716	0.70225318	0.4898802	0.5450
20	0.36567155	0.48023497	0.7822	0.92942818	1.07906986	0.5892	0.72662857	0.50085151	0.5607
21	0.38811147	0.50311762	0.7981	0.94756058	1.10148926	0.6317	0.76715662	0.52111035	0.5843
22	0.41775255	0.53599145	0.8241	0.9806207	1.13192779	0.6468	0.81892975	0.55251509	0.6132
23	0.4409865	0.55963832	0.8451	1.00040844	1.15919085	0.6823	0.8575733	0.57175069	0.6433
24	0.47354894	0.59974123	0.8795	1.03457253	1.20290493	0.7439	0.93744925	0.60748997	0.6500
25	0.47582341	0.60694842	0.8811	1.03952604	1.20694888	0.7346	0.94912933	0.61136675	0.6999
26	0.4827831	0.61213064	0.8883	1.04485658	1.21375352	0.7412	0.95720587	0.61687238	0.7094
27	0.50374167	0.6370843	0.9112	1.06932901	1.24290739	0.7749	1.00224871	0.63866571	0.7363
28	0.51469897	0.64841144	0.9196	1.07771498	1.25316571	0.7769	1.02086622	0.65076724	0.7499
29	0.52011043	0.65478152	0.8969	1.08285707	1.25882721	0.7836	1.02871498	0.65452274	0.7570
30	0.55160923	0.65468384	0.9662	1.11769423	1.30351888	0.8330	1.10094907	0.68631784	0.7962
31	0.55160923	0.65468384	0.9662	1.11769423	1.30351888	0.8330	1.10094907	0.68631784	0.7962
32	0.57274024	0.76312133	1.0613	1.14532637	1.49129831	0.9339	1.5107248	0.77501943	0.9703
33	0.66284853	0.83054871	1.1638	1.26906078	1.64725444	1.1927	2.0643049	0.8242684	1.1576
34	0.63178016	0.81311942	1.1437	1.24808803	1.62080943	1.1326	1.96589404	0.79856874	1.1251
35	0.70508959	0.85088546	1.2423	1.33154709	1.71773852	1.3560	2.25669425	0.83490229	1.2707
36	0.83702125	0.94581568	1.4104	1.56968624	1.93196153	1.9911	3.01510936	0.93580002	1.6933
37	0.8047011	0.93984466	1.4104	1.53972187	1.90344761	1.9061	2.91121105	0.8938662	1.7216
38	0.97288344	0.99766169	1.6642	1.72980544	2.1338322	2.7034	3.474048	1.05930797	2.8971
39	1.55365968	1.2283445	2.5098	2.737405	3.14330456	7.1644	7.39315402	2.31701305	8.4563
40	1.4722745	1.15873948	2.5210	2.60578263	3.05818939		7.07170516	2.29295041	
41	1.61279411	1.18039476	2.7422	2.81846725	3.31854473		7.42183723	2.59577795	
42	2.58058813	1.46203502	5.1447	4.18705089	5.25771153			4.21431604	
43	2.57091002	1.40296567	5.6689	4.14323499	5.3613827			4.74418166	
44	3.13821201	1.4802741	7.0567	4.55815812	4.30351888			3.68631784	
45	7.4673465	2.42910813	7.0056	7.36864627	8.57234109			7.95514005	

Table 4: Permanent deformation data for quarried limestone materials.

Step Number	Deformation (mm)								
	21AA			350AA			3G		
	Sample22	Sample24	Sample23	Sample29	Sample32	Sample28	Sample36	Sample35	Sample34
1	0	0	0	0	0	0	0	0	0
2	0.18056967	0.13547148	0.0209	0.02714184	0.05	0.0492	0.01551362	0.13498808	-0.0002
3	0.21714353	0.16654017	0.0545	0.05184307	0.08898244	0.0798	0.0407803	0.15784898	0.0334
4	0.23115599	0.16562393	0.0598	0.06414609	0.09921487	0.0934	0.05613894	0.16708958	0.0437
5	0.25075559	0.19505076	0.0773	0.08460726	0.12319947	0.1149	0.07175419	0.18331664	0.0645
6	0.29305032	0.23774925	0.1110	0.13415733	0.17189448	0.1705	0.10721082	0.2154025	0.1024
7	0.32269093	0.26744416	0.1370	0.17024629	0.21026881	0.2060	0.14214216	0.24690051	0.1367
8	0.36545695	0.31474634	0.1701	0.23203278	0.2568988	0.2570	0.17915999	0.28093756	0.1875
9	0.4602227	0.41426363	0.2387	0.43160602	0.36768355	0.3933	0.26560705	0.35960333	0.3527
10	0.4592397	0.41341571	0.2408	0.4400731	0.37315585	0.4027	0.26912013	0.36214632	0.3484
11	0.46890489	0.4246423	0.2442	0.44820339	0.38060641	0.4108	0.27699497	0.37192657	0.3680
12	0.51105122	0.4733444	0.2785	0.51405482	0.42735538	0.4585	0.31622047	0.40827994	0.4351
13	0.52089135	0.48103053	0.2628	0.52708515	0.43842106	0.4732	0.32833533	0.41875616	0.4508
14	0.52801219	0.48883788	0.2914	0.53668279	0.44584413	0.4788	0.33458128	0.42549178	0.4586
15	0.59784795	0.57586377	0.3453	0.65771118	0.52097227	0.5647	0.39818457	0.48415408	0.5795
16	0.59784795	0.57586377	0.3453	0.65771118	0.52097227	0.5647	0.39818457	0.48415408	0.5795
17	0.60636183	0.79784795	0.4753	0.66768605	0.56397262	0.6836	0.42336649	0.509336	0.6047
18	0.62734806	0.7970117	0.4921	0.69778506	0.59174977	0.7075	0.44591428	0.53188378	0.6273
19	0.63710653	0.78474766	0.4977	0.71329199	0.60357884	0.7237	0.45845939	0.54442889	0.6398
20	0.65751423	0.82433762	0.5099	0.73418383	0.62720267	0.7434	0.47836896	0.56433846	0.6597
21	0.6810305	0.85399248	0.5340	0.77374583	0.66196926	0.7835	0.50465851	0.59062802	0.6860
22	0.71497872	0.88597537	0.5576	0.81430397	0.70349198	0.8240	0.54275311	0.62872262	0.7241
23	0.74303173	0.92486451	0.5864	0.85592568	0.73974775	0.8655	0.57426546	0.66023497	0.7556
24	0.79692938	0.99589834	0.6333	0.97614623	0.83150586	0.9522	0.63628045	0.72224995	0.8176
25	0.79571784	0.99183297	0.6272	0.98305171	0.83518435	0.9586	0.64263394	0.72860345	0.8240
26	0.80400984	1.0028711	0.6314	0.99180137	0.84410112	0.9656	0.6491356	0.73510511	0.8305
27	0.83708338	1.04787156	0.6674	1.05226842	0.89297278	1.0136	0.68716326	0.77313277	0.8685
28	0.8497371	1.05549026	0.6730	1.06591789	0.90418009	1.0264	0.69980303	0.78577254	0.8812
29	0.85224058	1.06358036	0.6733	1.07629634	0.9107764	1.0361	0.70929334	0.79526285	0.8906
30	0.91039235	1.13279693	0.7308	1.19285573	0.99401198	1.1179	0.77027179	0.85624129	0.9516
31	0.91039235	1.13279693	0.7308	1.19285573	0.99401198	1.1179	0.77027179	0.85624129	0.9516
32	1.00134605	1.31279693	0.9108	1.34959773	1.21401198	1.3621	0.80035372	0.88632322	0.9817
33	1.10521173	1.44278385	1.0230	1.82474562	1.60143868	1.6095	0.81685713	0.90282664	0.9982
34	1.06525908	1.40096847	0.9852	1.79445826	1.45678924	1.5762	0.82401759	0.9099871	1.0054
35	1.17084796	1.56647454	1.1213	2.17292879	1.7844268	1.7539	0.85240787	0.93837738	1.0338
36	1.3585352	2.26889443	1.1926	3.52148224	2.5742041	2.4542	0.8744841	0.96045361	1.0558
37	1.33548988	2.34496748	1.2674	3.61920931	2.57675162	2.4120	0.83103182	0.91700133	1.0124
38	1.64677636	6.09893959	4.8940	6.01186754	3.80413852	3.4133	1.50882193	1.59479143	1.6902
39	3.43060671	7.72227313	8.2349		7.25699843	8.0037	3.5854962	3.6714657	3.7668
	3.46018058						3.47534451	3.56131402	3.6567
	4.09558186						3.76783922	3.85380872	3.9492
	7.60235534						5.41603529	5.50200479	5.5974
							5.38869584	5.47466535	5.5700
							5.83671936	5.92268887	6.0181
							6.80964159	6.8956111	6.9910

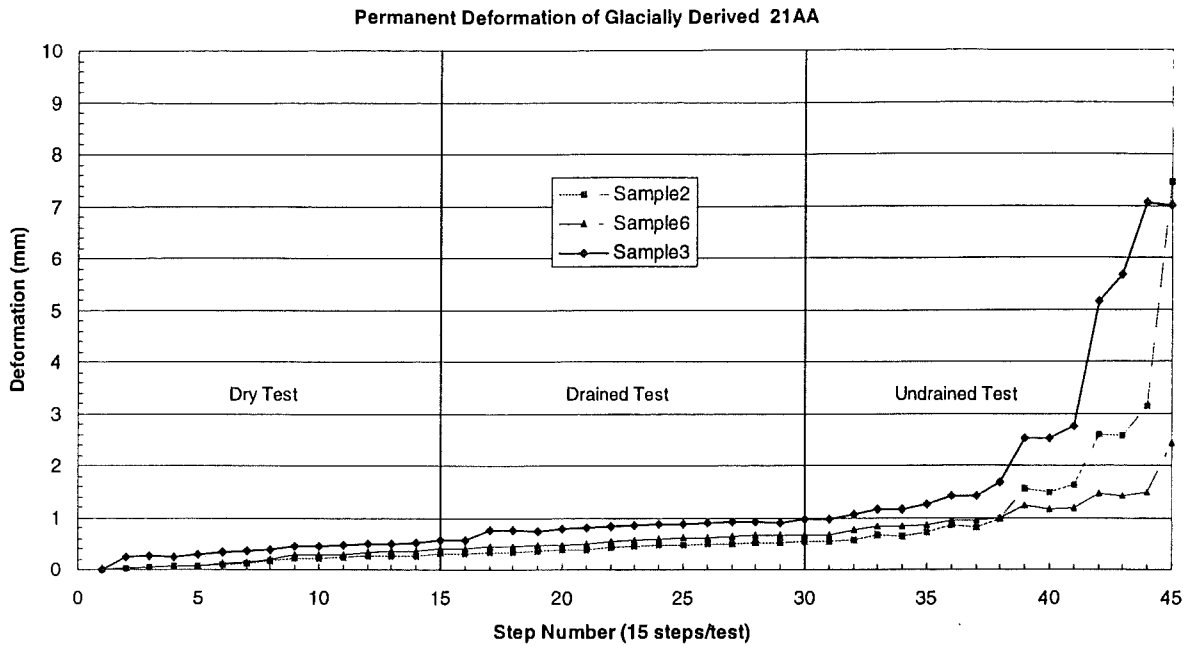

Figure 19. Permanent deformation recorded for glacially derived 21AA.

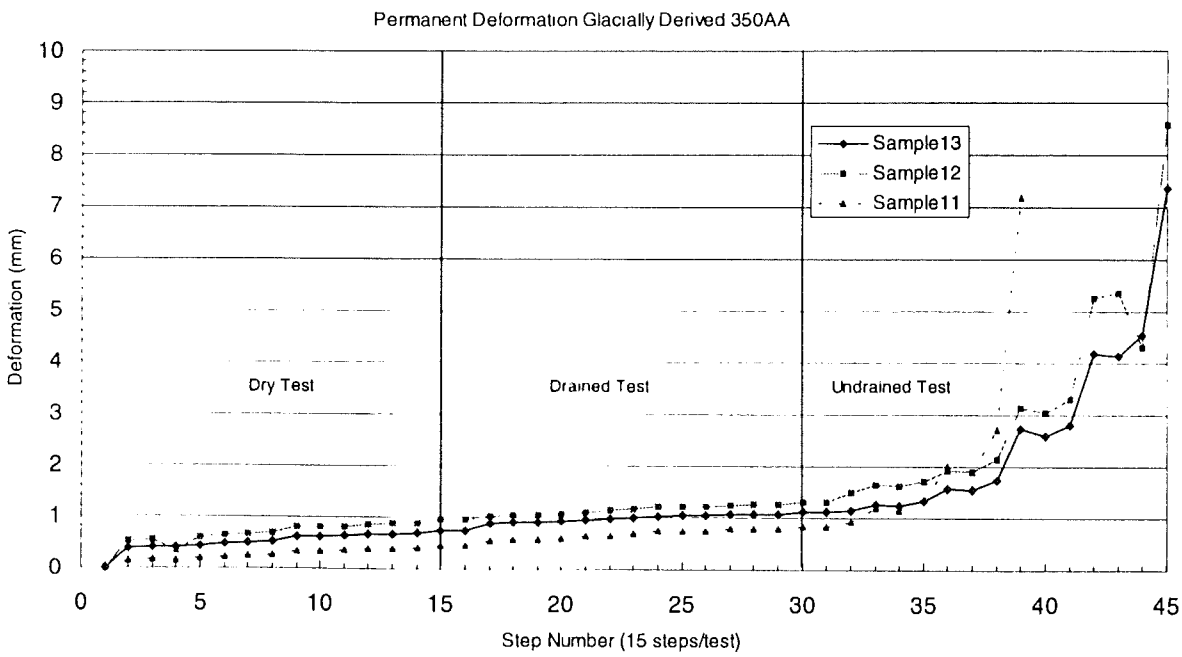

Figure 20. Permanent deformation recorded for glacially derived 350AA.

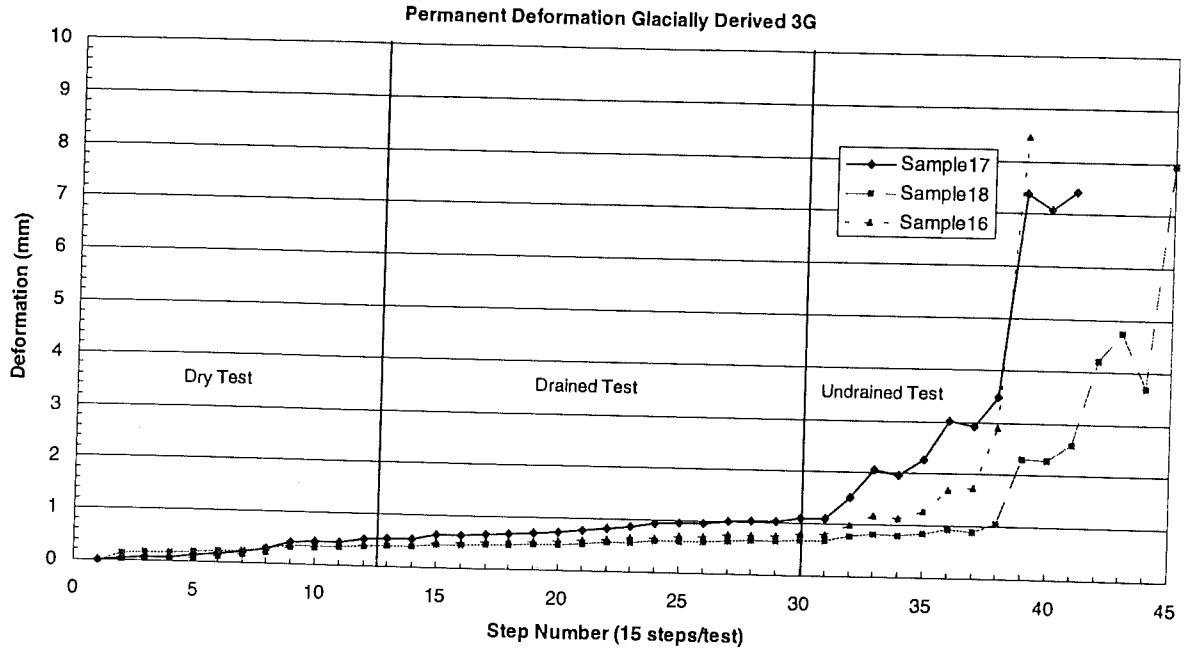

Figure 21. Permanent deformation recorded for glacially derived 3G.

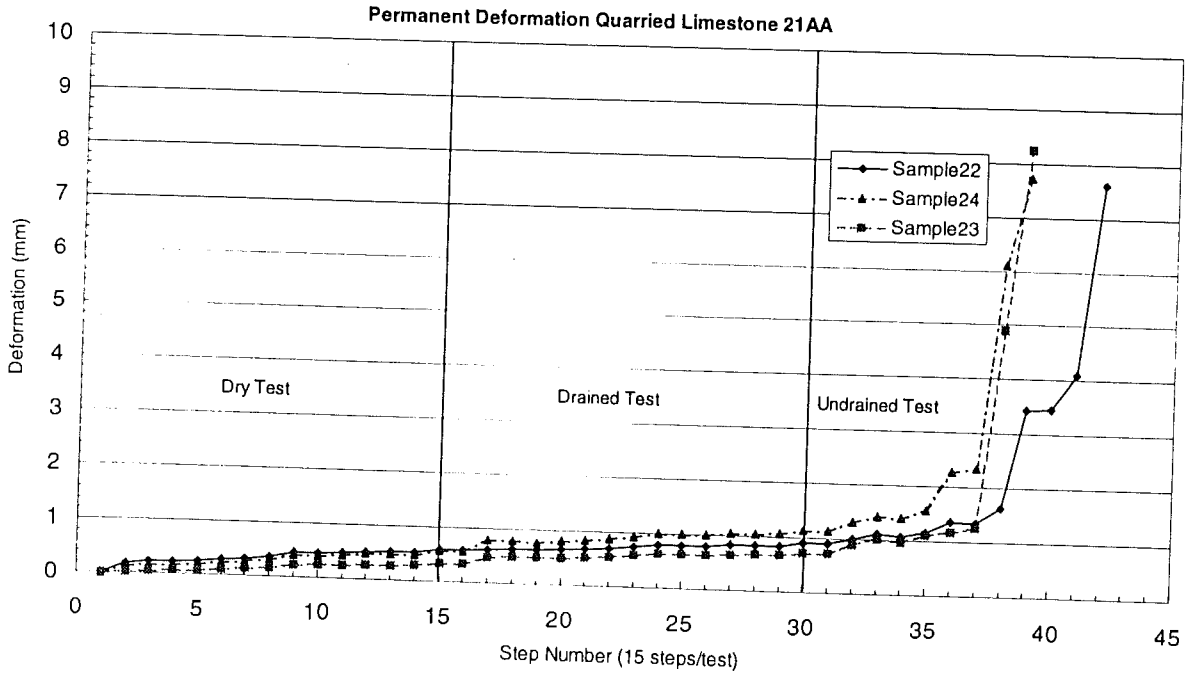

Figure 22. Permanent deformation recorded for quarried limestone 21AA.

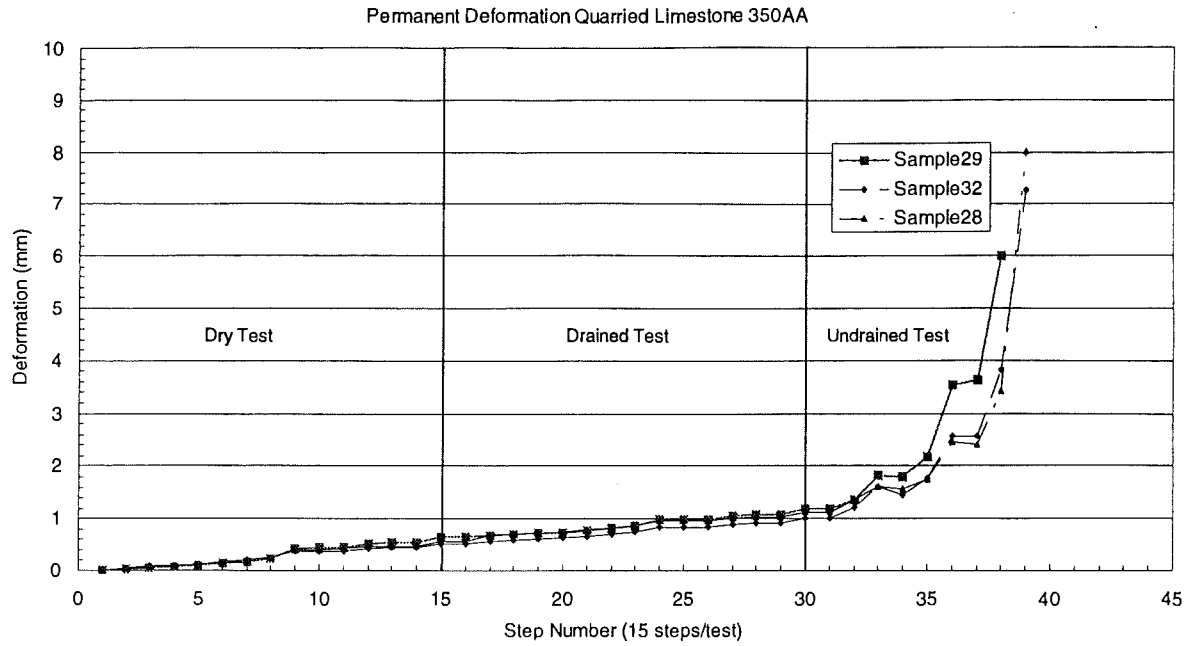

Figure 23. Permanent deformation recorded for quarried limestone 350AA.

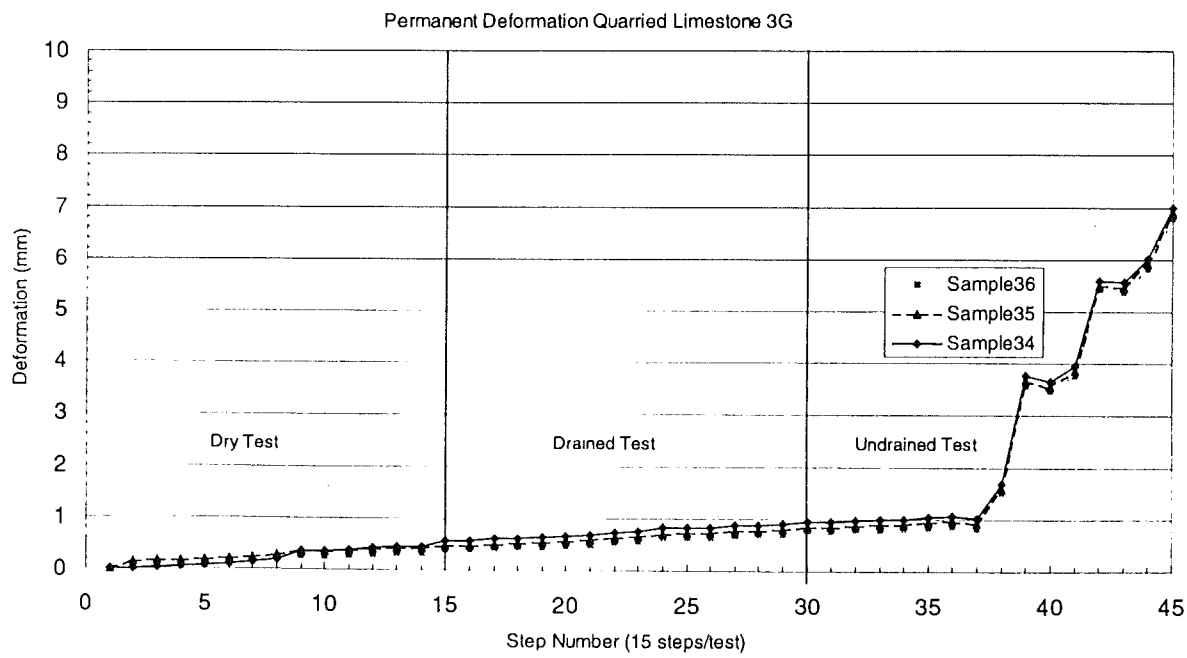

Figure 24. Permanent deformation recorded for quarried limestone 3G.