



AALBORG UNIVERSITY
DENMARK

Aalborg Universitet

Hydraulic Response of Rubble Mound Breakwaters

scale effects - berm breakwaters

Andersen, Thomas Lykke

Publication date:
2006

Document Version
Publisher's PDF, also known as Version of record

[Link to publication from Aalborg University](#)

Citation for published version (APA):

Andersen, T. L. (2006). *Hydraulic Response of Rubble Mound Breakwaters: scale effects - berm breakwaters*. Hydraulics & Coastal Engineering Laboratory, Department of Civil Engineering, Aalborg University.

General rights

Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

- Users may download and print one copy of any publication from the public portal for the purpose of private study or research.
- You may not further distribute the material or use it for any profit-making activity or commercial gain
- You may freely distribute the URL identifying the publication in the public portal -

Take down policy

If you believe that this document breaches copyright please contact us at vbn@aub.aau.dk providing details, and we will remove access to the work immediately and investigate your claim.

APPENDIX F

Conventional Breakwater, Small Scale Test Results, Core 1

In the following tables the main results from the present small scale physical model tests with Core 1 are given. Results are scaled to large scale ($N_L = 5.7$) using the Froude scaling law for easier comparison.

For a description of parameters refer to page 387.

Test No.	Cross sec.	h [m]	A _c [m]	R _c [m]	Ref. Coef.	H _{m0} [m]	T _p [s]	T _{-1,0} [s]	T _{0,1} [s]	ε ₂	ε ₄	H _{1/3} [m]	H _{1/10} [m]	H _{1/100} [m]	T _z [s]	b ₁	C _t	Mean set-up	q [m ³ /m/s]	R _{u,2%} [m]	F _{max} [N]
A1	2	2.30	0.60	0.60	0.21	0.509	2.53	2.43	2.31	0.273	0.577	0.497	0.625	0.826	2.30	0.36	0.038	0.011	2.62E-05	0.437	90.5
A2	2	2.30	0.60	0.60	0.23	0.392	2.29	2.25	2.14	0.265	0.562	0.379	0.484	0.638	2.13	0.26	0.030	0.005	1.46E-06	0.338	
A3	2	2.30	0.60	0.60	0.19	0.586	2.72	2.56	2.41	0.288	0.597	0.573	0.725	0.945	2.43	0.43	0.044	0.017	1.22E-04	0.494	83.0
A4	2	2.30	0.60	0.60	0.21	0.333	2.04	2.00	1.91	0.247	0.539	0.333	0.433	0.565	1.88	0.29	0.026	0.004	5.83E-07	0.281	
A5	2	2.30	0.60	0.60	0.21	0.678	3.06	2.88	2.71	0.292	0.588	0.652	0.802	0.964	2.73	0.39	0.063	0.034	3.28E-04	0.581	118.6
A6	2	2.30	0.60	0.60	0.23	0.477	3.06	2.87	2.69	0.298	0.595	0.469	0.588	0.743	2.63	0.25	0.049	0.014	7.61E-06	0.470	56.1
A7	2	2.30	0.60	0.60	0.23	0.390	2.94	2.63	2.48	0.284	0.566	0.379	0.472	0.579	2.42	0.21	0.036	0.006	8.26E-07	0.367	
A8	2	2.30	0.60	0.60	0.23	0.462	3.06	2.81	2.64	0.291	0.577	0.452	0.563	0.718	2.58	0.23	0.041	0.012	1.07E-05	0.451	46.0
A9	2	2.30	0.60	0.60	0.23	0.427	2.83	2.68	2.53	0.288	0.578	0.413	0.523	0.702	2.44	0.24	0.042	0.010	4.68E-06	0.430	
A10	2	2.30	0.60	0.60	0.23	0.343	2.72	2.49	2.35	0.287	0.583	0.337	0.426	0.563	2.27	0.21	0.030	0.013	5.60E-07	0.328	
A11	2	2.30	0.60	0.60	0.23	0.550	3.34	3.03	2.85	0.291	0.575	0.530	0.662	0.830	2.78	0.27	0.050	0.019	3.78E-05	0.524	37.7
A12	2	2.30	0.60	0.60	0.23	0.433	2.83	2.70	2.54	0.290	0.583	0.423	0.526	0.673	2.53	0.26	0.040	0.009	2.80E-06	0.408	
A13	2	2.30	0.60	0.60	0.30	0.466	3.87	3.56	3.36	0.288	0.575	0.454	0.561	0.678	3.27	0.27	0.061	0.014	1.37E-06	0.479	
A14	2	2.30	0.60	0.60	0.26	0.373	3.50	3.22	3.05	0.273	0.557	0.361	0.449	0.577	3.00	0.20	0.051	0.007	1.76E-07	0.393	
A15	2	2.30	0.60	0.60	0.34	0.526	3.87	3.83	3.57	0.308	0.607	0.520	0.659	0.846	3.49	0.29	0.075	0.027	1.06E-04	0.567	115.1
A16	2	2.30	0.60	0.60	0.28	0.410	3.67	3.38	3.19	0.277	0.550	0.395	0.504	0.644	3.12	0.20	0.055	0.010	1.30E-06	0.441	35.7
A17	2	2.30	0.60	0.60	0.31	0.484	3.87	3.60	3.38	0.295	0.583	0.471	0.591	0.767	3.34	0.26	0.061	0.015	2.60E-05	0.496	52.9
A18	2	2.30	0.60	0.60	0.29	0.465	3.87	3.51	3.30	0.285	0.566	0.457	0.577	0.755	3.25	0.24	0.063	0.013	2.05E-05	0.492	89.8
A19	2	2.30	0.60	0.60	0.29	0.422	3.50	3.42	3.21	0.287	0.567	0.412	0.522	0.676	3.13	0.22	0.057	0.014	1.99E-06	0.465	
A20	2	2.01	0.89	0.89	0.19	0.665	3.06	2.87	2.69	0.301	0.595	0.449	0.801	0.985	2.69	0.48	0.038	0.024	7.35E-05	0.698	68.6
A21	2	2.01	0.89	0.89	0.21	0.597	2.94	2.68	2.52	0.286	0.576	0.581	0.719	0.881	2.55	0.43	0.033	0.015	3.45E-05	0.567	96.4
A22	2	2.01	0.89	0.89	0.22	0.431	2.53	2.32	2.19	0.288	0.602	0.420	0.540	0.738	2.18	0.38	0.022	0.005	1.61E-06	0.418	
A23	2	2.01	0.89	0.89	0.21	0.495	2.72	2.50	2.36	0.284	0.576	0.485	0.606	0.789	2.33	0.34	0.028	0.008	4.91E-06	0.502	
A24	2	2.01	0.89	0.89	0.24	0.595	3.34	3.06	2.86	0.301	0.590	0.583	0.728	0.921	2.84	0.37	0.043	0.017	2.74E-05	0.633	91.2
A25	2	2.01	0.89	0.89	0.24	0.548	3.34	3.03	2.83	0.297	0.583	0.534	0.681	0.869	2.78	0.37	0.041	0.014	1.20E-05	0.599	
A26	2	2.01	0.89	0.89	0.23	0.432	2.72	2.67	2.52	0.283	0.565	0.419	0.528	0.683	2.47	0.27	0.031	0.006	7.80E-07	0.450	
A27	2	2.01	0.89	0.89	0.23	0.480	2.94	2.87	2.70	0.286	0.560	0.463	0.596	0.787	2.62	0.29	0.035	0.008	4.87E-06	0.537	
A28	2	2.01	0.89	0.89	0.35	0.525	3.87	3.74	3.47	0.320	0.616	0.513	0.638	0.788	3.42	0.36	0.049	0.014	4.42E-06	0.633	11.9
A29	2	2.01	0.89	0.89	0.31	0.400	3.67	3.51	3.30	0.291	0.586	0.393	0.490	0.617	3.23	0.27	0.042	0.006	1.13E-07	0.476	
A30	3	2.30	0.60	0.80	0.21	0.626	3.06	2.84	2.67	0.289	0.576	0.607	0.750	0.942	2.64	0.34	0.052	0.022	1.06E-04	0.569	44.3
A31	3	2.30	0.60	0.80	0.20	0.539	2.72	2.60	2.45	0.286	0.582	0.525	0.665	0.841	2.44	0.35	0.041	0.014	1.81E-05	0.485	38.9
A32	3	2.30	0.60	0.80	0.22	0.394	2.29	2.26	2.15	0.263	0.560	0.384	0.489	0.623	2.14	0.26	0.025	0.007	8.90E-07	0.290	
A33	3	2.30	0.60	0.80	0.22	0.542	3.19	2.95	2.78	0.293	0.583	0.530	0.677	0.892	2.72	0.32	0.055	0.016	3.81E-05	0.537	43.2
A34	3	2.30	0.60	0.80	0.22	0.474	3.06	2.78	2.62	0.284	0.567	0.462	0.575	0.719	2.58	0.27	0.039	0.014	3.89E-06	0.453	
A35	3	2.30	0.60	0.80	0.22	0.439	2.72	2.67	2.51	0.287	0.584	0.425	0.540	0.698	2.45	0.29	0.039	0.010	3.36E-06	0.380	
A36	3	2.30	0.60	0.80	0.23	0.383	2.72	2.59	2.45	0.280	0.569	0.371	0.464	0.569	2.38	0.21	0.035	0.007	1.29E-06	0.313	
A37	3	2.30	0.60	0.80	0.38	0.581	4.32	4.06	3.78	0.307	0.595	0.563	0.709	0.907	3.69	0.30	0.088	0.027	9.91E-05	0.627	88.8
A38	3	2.30	0.60	0.80	0.33	0.443	3.87	3.70	3.47	0.298	0.593	0.434	0.543	0.722	3.37	0.24	0.072	0.015	1.83E-06	0.539	14.8
A39	3	2.30	0.60	0.80	0.36	0.503	4.08	3.88	3.63	0.303	0.597	0.498	0.621	0.771	3.59	0.29	0.080	0.020	3.20E-06	0.587	23.7
A40	3	2.30	0.60	0.80	0.37	0.557	4.32	4.02	3.73	0.311	0.596	0.537	0.671	0.925	3.65	0.29	0.079	0.032	9.95E-05	0.618	154.7
A41	3	2.01	0.89	1.09	0.20	0.657	3.06	2.86	2.68	0.298	0.592	0.642	0.801	1.016	2.67	0.49	0.056	0.024	4.47E-05	0.624	29.9
A42	3	2.01	0.89	1.09	0.20	0.541	2.83	2.61	2.46	0.288	0.581	0.527	0.654	0.835	2.46	0.40	0.031	0.012	9.02E-06	0.547	
A43	3	2.01	0.89	1.09	0.21	0.459	2.62	2.40	2.28	0.274	0.564	0.446	0.561	0.726	2.24	0.36	0.027	0.006	1.42E-06	0.492	
A44	4	2.01	0.89	1.09	0.20	0.661	3.06	2.86	2.68	0.301	0.596	0.645	0.806	1.027	2.63	0.49	0.055	0.024	4.80E-05	0.633	18.0
A45	4	2.01	0.89	1.09	0.20	0.541	2.83	2.62	2.47	0.284	0.577	0.526	0.654	0.833	2.48	0.40	0.031	0.012	5.39E-06	0.486	
A46	4	2.01	0.89	1.09	0.19	0.451	2.62	2.41	2.29	0.269	0.557	0.446	0.562	0.720	2.28	0.36	0.028	0.006	9.44E-07	0.451	
A47	4	2.30	0.60	0.80	0.20	0.641	3.06	2.84	2.67	0.288	0.574	0.620	0.767	0.959	2.65	0.34	0.047	0.027	1.03E-04	0.538	42.1
A48	4	2.30	0.60	0.80	0.21	0.549	2.83	2.60	2.46	0.276	0.563	0.535	0.676	0.863	2.45	0.33	0.041	0.017	2.31E-05	0.484	
A49	4	2.30	0.60	0.80	0.24	0.401	2.45	2.26	2.15	0.262	0.500	0.392	0.499	0.643	2.15	0.27	0.024	0.007	1.20E-06	0.291	
A50	4	2.30	0.60	0.80	0.23	0.555	3.19	2.95	2.78	0.290	0.578	0.544	0.695	0.919	2.74	0.31	0.055	0.019	3.45E-05	0.533	17.6
A51	4	2.30	0.60	0.80	0.23	0.484	3.06	2.78	2.62	0.282	0.565	0.471	0.589	0.729	2.56	0.26	0.039	0.013	7.49E-06	0.446	
A52	4	2.30	0.60	0.80	0.22	0.448	2.72	2.67	2.53	0.281	0.576	0.437	0.555	0.722	2.49	0.29	0.039	0.009	4.84E-06	0.383	
A53	4	2.30	0.60	0.80	0.24	0.394	2.72	2.59	2.45	0.277	0.562	0.380	0.476	0.581	2.38	0.22	0.033	0.006	3.01E-07	0.316	
A54	4	2.30	0.60	0.80	0.38	0.594	4.32	4.04	3.76	0.310	0.597	0.573	0.721	0.922	3.65	0.31	0.087	0.029	1.12E-04	0.631	62.5
A55	4	2.30	0.60	0.80	0.33	0.452	3.87	3.70	3.46	0.297	0.589	0.442	0.554	0.735	3.36	0.24	0.070	0.018	4.40E-06	0.535	28.9

Test No.	Cross sec.	h [m]	A _c [m]	R _c [m]	Ref. Coef.	H _{m0}	T _p	T _{-1,0}	T _{0,1}	ε ₂	ε ₄	H _{1/3}	H _{1/10}	H _{1/100}	T _z	b ₁	C _t	Mean set-up	q	R _{u,2%}	F _{max} [N]
						[m]	[s]	[s]	[s]			[m]	[m]	[m]	[s]				[m ³ /m/s]	[m]	
A56	4	2.30	0.60	0.80	0.36	0.514	4.08	3.87	3.62	0.303	0.595	0.507	0.632	0.781	3.55	0.29	0.078	0.020	7.82E-06	0.595	
A57	4	2.30	0.60	0.80	0.37	0.568	4.32	4.02	3.72	0.312	0.596	0.546	0.683	0.934	3.63	0.30	0.080	0.024	1.00E-04	0.611	146.9
A58	1	2.30	0.60	0.40	0.21	0.595	2.72	2.68	2.55	0.278	0.579	0.582	0.723	0.902	2.55	0.38	0.053	0.024	1.76E-04	0.538	153.0
A59	1	2.30	0.60	0.40	0.21	0.574	2.94	2.67	2.53	0.273	0.557	0.554	0.686	0.859	2.52	0.30	0.050	0.018	1.06E-04	0.503	160.3
A60	1	2.30	0.60	0.40	0.20	0.500	2.62	2.52	2.39	0.275	0.571	0.492	0.619	0.801	2.40	0.32	0.043	0.013	2.33E-05	0.462	44.6
A61	1	2.30	0.60	0.40	0.23	0.400	2.45	2.25	2.14	0.266	0.561	0.395	0.513	0.649	2.10	0.27	0.036	0.007	4.60E-06	0.380	
A62	1	2.30	0.60	0.40	0.24	0.324	2.10	2.08	1.99	0.246	0.525	0.323	0.423	0.552	1.96	0.23	0.024	0.003	9.39E-07	0.284	
A63	1	2.30	0.60	0.40	0.24	0.553	3.34	3.09	2.89	0.300	0.584	0.536	0.678	0.881	2.83	0.26	0.060	0.022	1.75E-04	0.529	345.4
A64	1	2.30	0.60	0.40	0.23	0.488	3.06	2.87	2.69	0.296	0.586	0.469	0.591	0.744	2.62	0.24	0.047	0.017	1.43E-05	0.476	49.4
A65	1	2.30	0.60	0.40	0.23	0.402	2.83	2.65	2.51	0.277	0.561	0.385	0.484	0.620	2.40	0.21	0.036	0.008	2.12E-06	0.399	
A66	1	2.30	0.60	0.40	0.24	0.513	3.06	2.98	2.79	0.296	0.576	0.495	0.609	0.767	2.73	0.22	0.047	0.015	3.49E-05	0.500	
A67	1	2.30	0.60	0.40	0.26	0.316	2.53	2.37	2.26	0.258	0.542	0.311	0.395	0.518	2.21	0.20	0.029	0.004	3.89E-07	0.280	
A68	1	2.30	0.60	0.40	0.29	0.502	3.87	3.48	3.28	0.287	0.571	0.482	0.604	0.783	3.20	0.27	0.067	0.017	7.37E-05	0.526	149.3
A69	1	2.30	0.60	0.40	0.32	0.425	3.87	3.60	3.38	0.292	0.577	0.415	0.523	0.677	3.30	0.23	0.067	0.014	1.89E-05	0.484	101.8
A70	1	2.30	0.60	0.40	0.26	0.339	3.19	3.01	2.85	0.269	0.546	0.329	0.409	0.504	2.78	0.14	0.043	0.009	2.25E-07	0.349	
A71	1	2.30	0.60	0.40	0.28	0.463	3.50	3.36	3.16	0.287	0.577	0.447	0.561	0.735	3.09	0.26	0.058	0.012	2.50E-05	0.481	
A72	1	2.30	0.60	0.40	0.26	0.364	3.34	3.11	2.94	0.272	0.546	0.356	0.454	0.604	2.87	0.18	0.051	0.010	2.71E-06	0.417	
A73	1	2.30	0.60	0.40	0.26	0.337	3.34	3.00	2.85	0.264	0.535	0.329	0.421	0.546	2.76	0.17	0.045	0.005	8.03E-07	0.375	
A74	1	2.01	0.89	0.69	0.20	0.510	2.72	2.53	2.40	0.273	0.565	0.497	0.621	0.806	2.43	0.38	0.028	0.011	4.65E-06	0.521	29.5
A75	1	2.01	0.89	0.69	0.19	0.558	2.72	2.54	2.41	0.274	0.562	0.549	0.685	0.833	2.42	0.44	0.031	0.013	9.53E-06	0.571	13.0
A76	1	2.01	0.89	0.69	0.21	0.672	3.06	2.86	2.69	0.297	0.590	0.647	0.809	0.979	2.68	0.48	0.048	0.024	7.46E-05	0.678	74.5
A77	1	2.01	0.89	0.69	0.20	0.461	2.45	2.42	2.29	0.283	0.590	0.457	0.591	0.795	2.26	0.43	0.027	0.007	7.75E-06	0.498	47.3
A78	1	2.01	0.89	0.69	0.21	0.433	2.53	2.33	2.22	0.273	0.580	0.419	0.524	0.670	2.22	0.32	0.025	0.005	1.18E-06	0.419	
A79	1	2.01	0.89	0.69	0.22	0.428	2.94	2.73	2.58	0.277	0.562	0.422	0.529	0.669	2.52	0.29	0.029	0.006	1.26E-06	0.482	
A80	1	2.01	0.89	0.69	0.24	0.511	3.06	2.97	2.78	0.296	0.579	0.502	0.625	0.813	2.77	0.33	0.033	0.011	5.84E-06	0.561	27.6
A81	1	2.01	0.89	0.69	0.26	0.596	3.34	3.16	2.94	0.311	0.600	0.573	0.726	0.957	2.90	0.42	0.054	0.019	4.26E-05	0.627	111.7
A82	1	2.01	0.89	0.69	0.31	0.414	3.67	3.42	3.20	0.294	0.578	0.403	0.511	0.675	3.16	0.31	0.044	0.007	2.55E-07	0.514	
A83	1	2.01	0.89	0.69	0.29	0.371	3.50	3.29	3.10	0.282	0.567	0.358	0.454	0.602	3.01	0.26	0.038	0.005	7.53E-08	0.468	
A84	1	2.01	0.89	0.69	0.39	0.552	4.32	3.88	3.57	0.332	0.630	0.542	0.678	0.871	3.51	0.43	0.058	0.018	1.45E-05	0.701	40.7
A85	1	2.01	0.89	0.69	0.36	0.482	3.87	3.70	3.44	0.314	0.605	0.474	0.596	0.745	3.39	0.37	0.054	0.016	8.87E-07	0.597	