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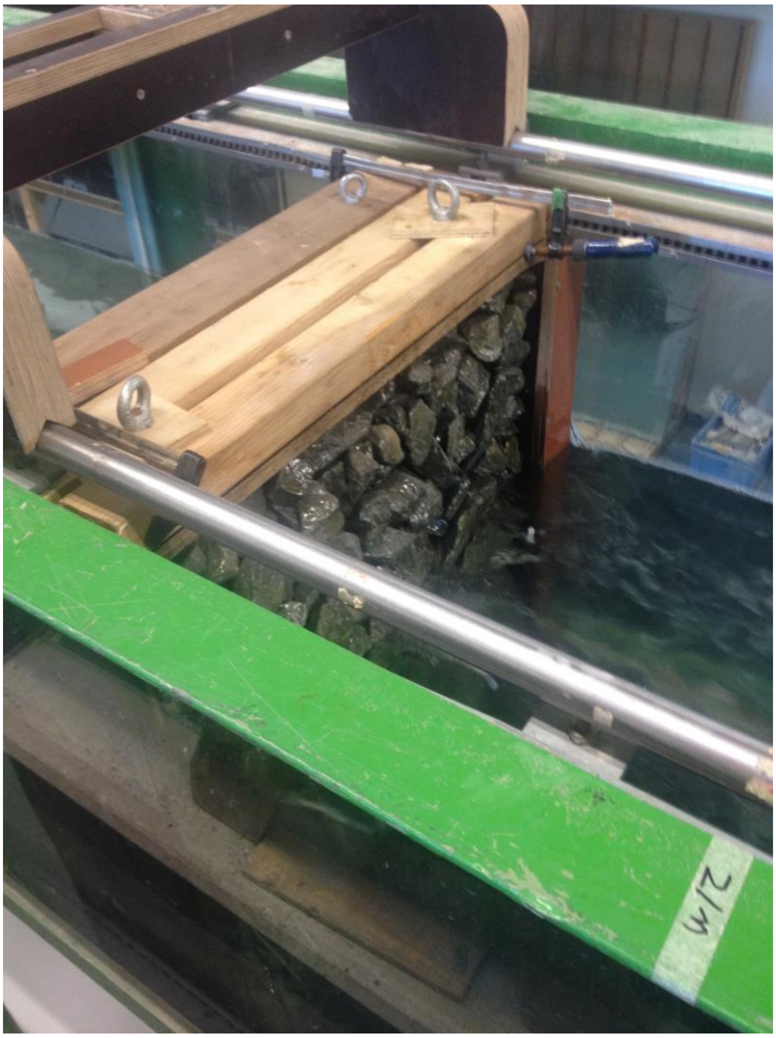
Reflection and transmission through a vertical, permeable breakwater

for the purpose of validating mathematical models

Report of measurements and observations



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This report is produced in the framework of the general research programme of the Department of Hydraulic Engineering. Tests were performed by Gerben Jan Vos, Henk Jan Verhagen, Coen Kuiper and Jeroen van den Bos. The report has been compiled by Jeroen van den Bos. Data, pictures and videos are publicly available via the 3TU datacenter (http://data.3tu.nl/repository/)

1. Introduction

From 18.07.2014 to 07.08.2014, physical model tests were carried out in the Environmental Fluid Mechanics Laboratory at TU Delft. The purpose of the tests was to measure wave reflection and transmission on/through porous structures representing strongly simplified rubble-mound breakwater configurations. These tests were carried out against the background of a more general research programme into wave-structure interaction. The main goal of these tests was to create a dataset that can be used for validation of numerical prediction methods.

The tests are a continuation of work done by Bart Mellink in the context of his MSc thesis (Mellink 2012). Mellink tested four different simple, single porous vertical blocks (see below for details) using regular waves. These additional tests represent slightly more complex configurations including double blocks, reflective boundaries, irregular waves and sloping structures.

This present document is a factual test report covering the details of the test setup, observations, data management and results.

2. Test setup

Elastocoast™ blocks

The structures used in these tests consisted of rectangular porous blocks made of Elastocoast™. Six of these blocks were previously made by BSc students (Zeelenberg and Koote 2012). The porous flow parameters of these blocks have been measured and are constant throughout the tests because the stones are glued together. This makes the test setup very suitable for validation purposes of numerical models. The parameters of the six blocks are given below.

	Material	Thickness (mm)	d_{n50} (m)	n (-)	k (m/s)	α (-)	β (-)	Re_d (-)
1	Yellow sun limestone 8-11 mm	39	0.007	0.386	0.065	700	1.1	220
2	Yellow sun limestone 20-40 mm	88	0.020	0.405	0.136	1200 (est.)	1.25 (est.)	2100
3	Yellow sun limestone 20-40 mm	132	0.020	0.423	0.131	1200	1.25	2700
4	Norwergian >40 mm	80	0.039	0.41	0.154	1900	1.7	6000
5	Norwergian >40 mm	160	0.039	0.466	0.214	1150	1.6	7850
6	Norwergian >40 mm	240	0.039	0.46	0.213	1020	1.45	8300

Figure 1: Block parameters (Zeelenberg and Koote 2012)

Original tests

The original tests (Mellink 2012) consisted of four different configurations consisting of a single block, placed vertically in the wave flume (see Figure 2 for an illustration).

- Series M1[1]: Block 2
- Series M2: Block 3
- Series M3: Block 5
- Series M4: Block 6

Each series was loaded by sixteen different wave conditions (using regular waves), consisting of all possible combinations of four different wave heights (H = 0.075 m, H = 0.10 m, H = 0.125 m and H = 0.15 m) and four different wave periods (T = 1.0 s, T = 1.5 s, T = 2.0 s and T = 3.0 s).

The instrumentation consisted of six wave gauges, setup in two three-probe arrays, one before the structure and one behind the structure. The array before the structure allows for the decomposition of the wave signal into incoming and reflected components and direct calculation of the reflection coefficient $R = H_{ref}/H_{in}$. The array behind the structure allows for the separation of the transmitted wave and the wave that is (re-)reflected off the far end of the wave flume. The transmission coefficient can then be calculated as $T = H_{trans}/H_{in}$. Details of the probe setup and spacing are given in Figure 3.

The water depth was h = 0.65 m for all tests. The full test matrix and other relevant details can be found in Mellink (2012).

Figure 2: Illustration of original tests with single blocks (Mellink 2012)

Additional tests

In these present tests, 8 different additional configurations were tested. Details of the configurations are provided in Figure 4.

- **Configuration A:** Block 5 combined with block 3, representing a two-layer breakwater (armour and filter layer). Block 5 is the 'armour' layer placed on the wave maker side. Between the blocks an 18 mm gap is left which allows the measurement of the water table between the blocks. The wave probe setup is exactly the same as in the Mellink tests, with the exception of the addition of a 7th probe in between the two blocks. The structure is loaded by the same 16 regular wave conditions as used by Mellink.
- **Configuration B:** The two blocks are placed next to each other, without gap. The central wave probe is no longer used. The same 16 wave conditions are used.
- **Configuration C:** An impermeable wooden plate is constructed on the far side of Block 3, representing a breakwater structure with an impermeable (reflective) core. Subsequently no transmission is measured any more. The same 16 wave conditions are used.

[1] The numbering 'M1, M2 etc' was not used in Mellink 2012 but is introduced in this present report in order to distinguish the original test series from the additional test series.

- **Configuration D:** The plate is removed again and configuration B is repeated, but this time with irregular waves (both JONSWAP spectra with γ =3.3). Two conditions are defined: H_{m0} = 0.10 m / T_p **=** 1.5 s and H_{m0} = 0.10 m / T_p **=** 3.0 s. The wave probe spacing is adapted, using in-house TU Delft recommendations, to x_{12} = 0.30 m and x_{23} = 0.40 m.
- **Configuration E:** Block 3 is removed and only block 5 remains[2]. The same two irregular wave conditions are applied.
- **Configuration F:** As E, but the probe spacing is adjusted to x_{12} = 0.70 m and x_{23} = 1.10 m. This is done in order to verify the in-house recommendations and check the sensitivity of the results. Only a single wave condition (H_{m0} = 0.10 m / T_p **=** 3.0 s) was used.
- **Configuration G:** The wooden plate was placed back behind block 5, representing a single-layer breakwater with an impermeable core. The original probe spacing was restored, and the 16 regular wave conditions were used.
- **Configuration H:** The structure, including wooden plate, was tilted 45 degrees representing a sloped structure and loaded by the 16 regular wave conditions. Loose rocks were added in the toe of the slope to fill the gap between the tilted support frame and the flume bottom.

The target water depth for all these tests was h = 0.65 m. The actual value deviates slightly between tests because the flume was drained and re-filled occasionally. The actual values were recorded and are logged in the test matrix. The water level was measured by means of a tape rule.

The overall test matrix, for a total of 85 tests, is given in appendix A.

Test duration

The test duration was approximately 300 seconds for each test, with the exception of:
- Most of the tests with T = 1.0 s, which were aborted earlier when a lateral standing wave pattern evolved
- The tests with irregular waves, which were run for approximately 1000 waves which results in a duration in the range 1400 s – 2800 s depending on the wave period.

The exact test duration (measured by the duration of the recorded signal) is included in the test matrix.

3. Instrument calibration

The tests were carried out over the course of 8 different sessions. The wave probes were calibrated at the start of each session. The obtained conversion factors (Volts to meters) are given in the table below. The probe numbers in this table correspond to the setup illustrated in Figure 4.

Table 1: Wave gauge calibration

Ses-sion	Date	Configu-ration	Calibration coefficient (m/V)						
			0	1	2	3	4	5	6
1	18-Jul-14	A	0.0240	0.0218	0.0265	0.0271	0.0231	0.0251	0.0242
2	23-Jul-14	A	0.0239	0.0216	0.0265	0.0266	0.0229	0.0251	0.0250
3	24-Jul-14	B	0.0238	0.0215	0.0264	-	0.0229	0.0251	0.0251
4	25-Jul-14	C	0.0240	0.0217	0.0265	-	-	-	-
5	26-Jul-14	D	0.0240	0.0217	0.0266	-	0.0233	0.0251	0.0249
6	30-Jul-14	E, F	0.0241	0.0215	0.0266	-	0.0231	0.0249	0.0249
7	31-Jul-14	G	0.0242	0.0216	0.0266	-	-	-	-
8	07-Aug-14	H	0.0240	0.0215	0.0264	-	-	-	-

[2] During the execution of the tests it was erroneously believed that the number of the remaining block was #3. Consequently all entries in the logbook, file names etc have used number 3. During the writing of this present measurement report all references and file names were corrected to number 5 in order to avoid confusion for future use.

4. Observations

Detailed observations during each test have been recorded in the test logbook, see appendix B. Some observations might be relevant in the interpretation of these tests and the use of the acquired data for validation of numerical models:

- During all tests with the shortest wave period T = 1.0 s (regular waves) a lateral standing wave pattern (i.e sideways across the flume, from glass wall to the other) formed after some time. This happened typically after some 30-60 s into the tests. When this happened, the test was aborted and only the first part of the test, before the formation of the lateral standing wave pattern, was recorded.
- During the tests with the impermeable wooden plate, leakage was observed between the plate and the flume walls.
- During some tests with the impermeable wooden plate, the frame in which the blocks are placed and/or the plate became undone and the blocks moved out of position during the tests. The results from these tests are therefore less reliable. These tests are marked with an asterisk (*) in the test matrix.

5. Data management

All tests have been given a unique file name, as recorded in the test matrix. The raw data, i.e. the direct output of the seven wave probes (in Volts) as recorded by the lab computer, was written to a ".asc" file.

The processing of this data into wave records (in meters) was performed by a purpose-written matlab script. (The standard scripts available in the lab work with a graphical user interface that allows only one analysis at a time, and values need to be input by hand. This would be rather time-consuming for a total of 85 tests . The purpose-written scripts allow for bulk processing). The translation from volts to metres was made using the calibration coefficients for the appropriate test session. The results were written into a '.wave' file with the same filename. For convenience of future analysis, the processed wave signals are split in 3 separate files:

- One file containing the 3 gauges before the structure, denoted "_wave_heights_123.wave".
- One file containing the gauge in between the two plates, denoted "_wave_heights_4.wave".
- One file containing the 3 gauges behind the structure, denoted "_wave_heights_567.wave".

The files are stored together in a subdirectory labeled with the test name.

The '.wave' file does not use header lines, which allows for easier processing. The first column of the '.wave' files is the time, the next columns are the measured water levels for the relevant gauges. Note that a "_4.wave" and "_567.wave" file are always created even for the tests in which these gauges were not used. In that case the signal column simply contains zeros.

The raw data ('.asc'), the calibrated wave data ('.wave') and the applied matlab script are uploaded onto the 3TU datacentre (http://data.3tu.nl/repository) for further use.

References

Mellink, B (2012) *Numerical and experimental research of wave interaction with a porous breakwater*, MSc thesis Delft University of Technology, Delft, The Netherlands

Zeelenberg W, and Koote M (2012) *The use of Elastocoast in breakwater research*, Technical report, Delft University of Technology, Delft, The Netherlands

Appendices

A. Test matrix
B. Logbook

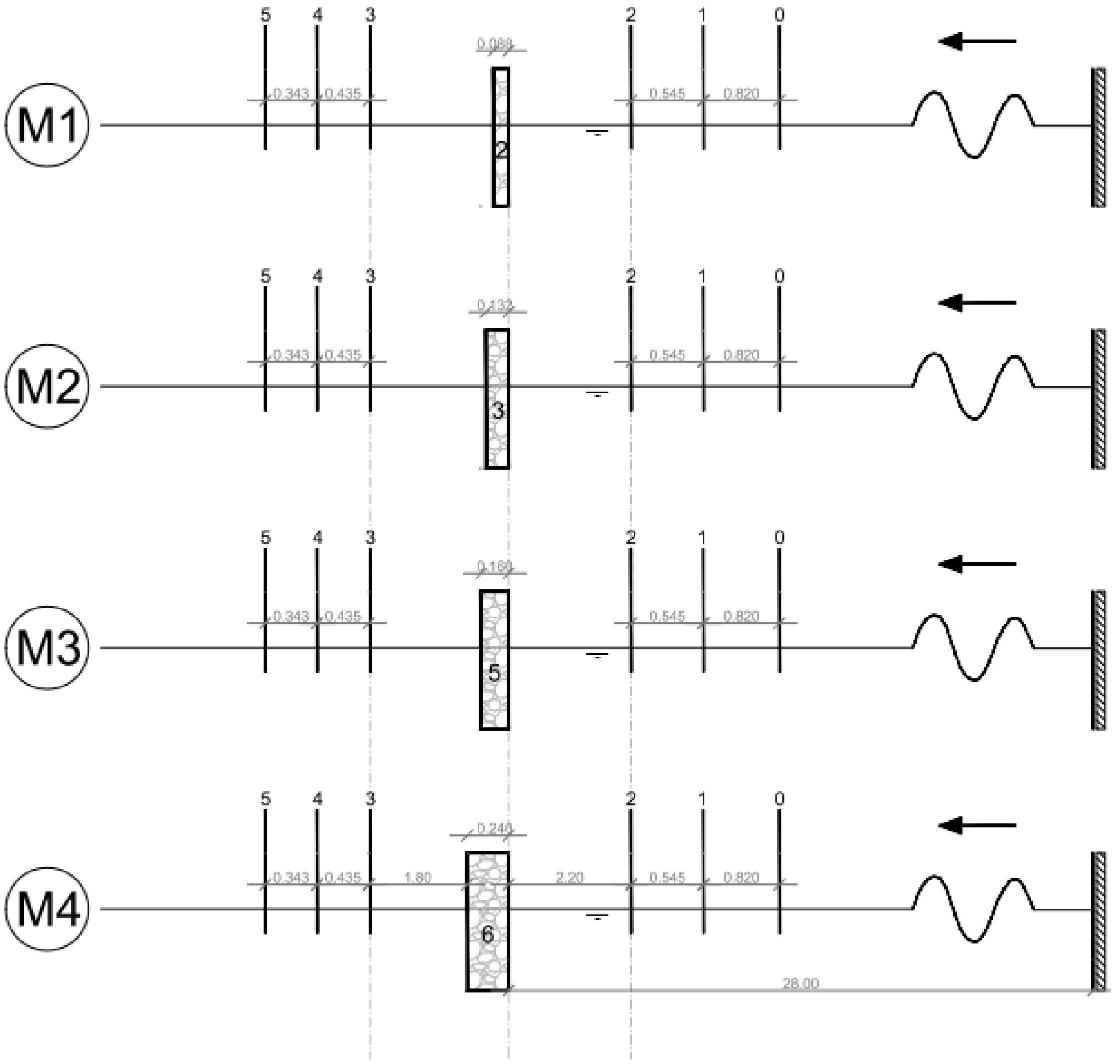

Figure 3: Test setup original tests Mellink

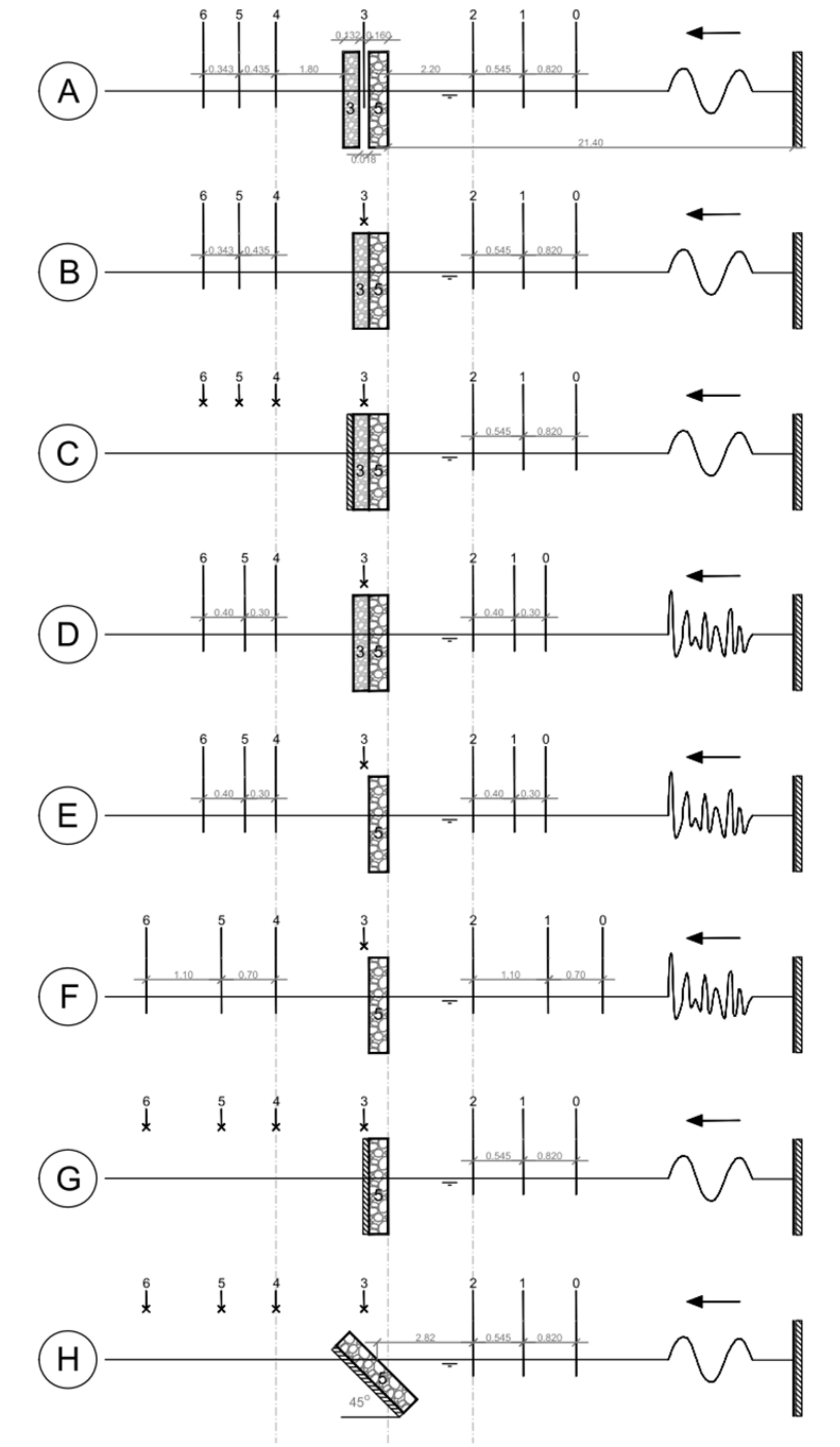

Figure 4: Test setup details additional tests

APPENDIX A

Test matrix

Test				Input					Calibration (m/V) wave gauges							Spacing between gauges (m)				Recorded
ID	Filename	Session	Configuration	H (m)	T (s)	Hm0 (m)	Tp (s)	depth (m)	0	1	2	3	4	5	6	0-1	1-2	4-5	5-6	duration (s)
1	T07510_Block3_Block5_Vert_Gap18	18-Jul-14	A	0.075	1.0			0.655	0.024	0.022	0.027	0.027	0.023	0.025	0.024	0.82	0.545	0.435	0.343	64.0
2	T07515_Block3_Block5_Vert_Gap18	18-Jul-14	A	0.075	1.5			0.655	0.024	0.022	0.027	0.027	0.023	0.025	0.024	0.82	0.545	0.435	0.343	206.7
3	T07520_Block3_Block5_Vert_Gap18	18-Jul-14	A	0.075	2.0			0.655	0.024	0.022	0.027	0.027	0.023	0.025	0.024	0.82	0.545	0.435	0.343	214.4
4	T07530_Block3_Block5_Vert_Gap18	18-Jul-14	A	0.075	3.0			0.655	0.024	0.022	0.027	0.027	0.023	0.025	0.024	0.82	0.545	0.435	0.343	309.8
5	T10010_Block3_Block5_Vert_Gap18	18-Jul-14	A	0.100	1.0			0.655	0.024	0.022	0.027	0.027	0.023	0.025	0.024	0.82	0.545	0.435	0.343	83.2
6	T10015_Block3_Block5_Vert_Gap18	18-Jul-14	A	0.100	1.5			0.655	0.024	0.022	0.027	0.027	0.023	0.025	0.024	0.82	0.545	0.435	0.343	201.0
7	T10020_Block3_Block5_Vert_Gap18	18-Jul-14	A	0.100	2.0			0.655	0.024	0.022	0.027	0.027	0.023	0.025	0.024	0.82	0.545	0.435	0.343	227.8
8	T10030_Block3_Block5_Vert_Gap18	18-Jul-14	A	0.100	3.0			0.655	0.024	0.022	0.027	0.027	0.023	0.025	0.024	0.82	0.545	0.435	0.343	332.8
9	T12510_Block3_Block5_Vert_Gap18	23-Jul-14	A	0.125	1.0			0.645	0.024	0.022	0.026	0.027	0.023	0.025	0.025	0.82	0.545	0.435	0.343	304.6
10	T12515_Block3_Block5_Vert_Gap18	23-Jul-14	A	0.125	1.5			0.645	0.024	0.022	0.026	0.027	0.023	0.025	0.025	0.82	0.545	0.435	0.343	432.0
11	T12520_Block3_Block5_Vert_Gap18	23-Jul-14	A	0.125	2.0			0.645	0.024	0.022	0.026	0.027	0.023	0.025	0.025	0.82	0.545	0.435	0.343	405.8
12	T12530_Block3_Block5_Vert_Gap18	23-Jul-14	A	0.125	3.0			0.645	0.024	0.022	0.026	0.027	0.023	0.025	0.025	0.82	0.545	0.435	0.343	295.7
13	T15010_Block3_Block5_Vert_Gap18	23-Jul-14	A	0.150	1.0			0.645	0.024	0.022	0.026	0.027	0.023	0.025	0.025	0.82	0.545	0.435	0.343	30.1
14	T15015_Block3_Block5_Vert_Gap18	23-Jul-14	A	0.150	1.5			0.645	0.024	0.022	0.026	0.027	0.023	0.025	0.025	0.82	0.545	0.435	0.343	302.7
15	T15020_Block3_Block5_Vert_Gap18	23-Jul-14	A	0.150	2.0			0.645	0.024	0.022	0.026	0.027	0.023	0.025	0.025	0.82	0.545	0.435	0.343	311.0
16	T15030_Block3_Block5_Vert_Gap18	23-Jul-14	A	0.150	3.0			0.645	0.024	0.022	0.026	0.027	0.023	0.025	0.025	0.82	0.545	0.435	0.343	399.4
17	T07510_Block3_Block5_Vert_Gap0	24-Jul-14	B	0.075	1.0			0.624	0.024	0.022	0.026	0.000	0.023	0.025	0.025	0.82	0.545	0.435	0.343	130.6
18	T07515_Block3_Block5_Vert_Gap0	24-Jul-14	B	0.075	1.5			0.624	0.024	0.022	0.026	0.000	0.023	0.025	0.025	0.82	0.545	0.435	0.343	302.7
19	T07520_Block3_Block5_Vert_Gap0	24-Jul-14	B	0.075	2.0			0.624	0.024	0.022	0.026	0.000	0.023	0.025	0.025	0.82	0.545	0.435	0.343	306.6
20	T07530_Block3_Block5_Vert_Gap0	24-Jul-14	B	0.075	3.0			0.624	0.024	0.022	0.026	0.000	0.023	0.025	0.025	0.82	0.545	0.435	0.343	325.8
21	T10010_Block3_Block5_Vert_Gap0	24-Jul-14	B	0.100	1.0			0.624	0.024	0.022	0.026	0.000	0.023	0.025	0.025	0.82	0.545	0.435	0.343	51.8
22	T10015_Block3_Block5_Vert_Gap0	24-Jul-14	B	0.100	1.5			0.624	0.024	0.022	0.026	0.000	0.023	0.025	0.025	0.82	0.545	0.435	0.343	306.6
23	T10020_Block3_Block5_Vert_Gap0	24-Jul-14	B	0.100	2.0			0.624	0.024	0.022	0.026	0.000	0.023	0.025	0.025	0.82	0.545	0.435	0.343	303.4
24	T10030_Block3_Block5_Vert_Gap0	24-Jul-14	B	0.100	3.0			0.624	0.024	0.022	0.026	0.000	0.023	0.025	0.025	0.82	0.545	0.435	0.343	318.7
25	T12510_Block3_Block5_Vert_Gap0	24-Jul-14	B	0.125	1.0			0.624	0.024	0.022	0.026	0.000	0.023	0.025	0.025	0.82	0.545	0.435	0.343	23.7
26	T12515_Block3_Block5_Vert_Gap0	24-Jul-14	B	0.125	1.5			0.624	0.024	0.022	0.026	0.000	0.023	0.025	0.025	0.82	0.545	0.435	0.343	303.4
27	T12520_Block3_Block5_Vert_Gap0	24-Jul-14	B	0.125	2.0			0.624	0.024	0.022	0.026	0.000	0.023	0.025	0.025	0.82	0.545	0.435	0.343	302.7
28	T12530_Block3_Block5_Vert_Gap0	24-Jul-14	B	0.125	3.0			0.624	0.024	0.022	0.026	0.000	0.023	0.025	0.025	0.82	0.545	0.435	0.343	302.7
29	T15010_Block3_Block5_Vert_Gap0	24-Jul-14	B	0.150	1.0			0.624	0.024	0.022	0.026	0.000	0.023	0.025	0.025	0.82	0.545	0.435	0.343	32.6
30	T15015_Block3_Block5_Vert_Gap0	24-Jul-14	B	0.150	1.5			0.624	0.024	0.022	0.026	0.000	0.023	0.025	0.025	0.82	0.545	0.435	0.343	309.1
31	T15020_Block3_Block5_Vert_Gap0	24-Jul-14	B	0.150	2.0			0.624	0.024	0.022	0.026	0.000	0.023	0.025	0.025	0.82	0.545	0.435	0.343	305.9
32	T15030_Block3_Block5_Vert_Gap0	24-Jul-14	B	0.150	3.0			0.624	0.024	0.022	0.026	0.000	0.023	0.025	0.025	0.82	0.545	0.435	0.343	309.8
33	T07510_Block3_Block5_Vert_Plate	25-Jul-14	C	0.075	1.0			0.650	0.024	0.022	0.027	0.000	0.000	0.000	0.000	0.82	0.545			58.2
34	T07515_Block3_Block5_Vert_Plate	25-Jul-14	C	0.075	1.5			0.650	0.024	0.022	0.027	0.000	0.000	0.000	0.000	0.82	0.545			302.7
35	T07520_Block3_Block5_Vert_Plate	25-Jul-14	C	0.075	2.0			0.650	0.024	0.022	0.027	0.000	0.000	0.000	0.000	0.82	0.545			329.0
36	T07530_Block3_Block5_Vert_Plate	25-Jul-14	C	0.075	3.0			0.650	0.024	0.022	0.027	0.000	0.000	0.000	0.000	0.82	0.545			307.8
37	T10010_Block3_Block5_Vert_Plate	25-Jul-14	C	0.100	1.0			0.650	0.024	0.022	0.027	0.000	0.000	0.000	0.000	0.82	0.545			40.3
38	T10015_Block3_Block5_Vert_Plate	25-Jul-14	C	0.100	1.5			0.650	0.024	0.022	0.027	0.000	0.000	0.000	0.000	0.82	0.545			302.1
39	T10020_Block3_Block5_Vert_Plate	25-Jul-14	C	0.100	2.0			0.650	0.024	0.022	0.027	0.000	0.000	0.000	0.000	0.82	0.545			310.4
40	T10030_Block3_Block5_Vert_Plate	25-Jul-14	C	0.100	3.0			0.650	0.024	0.022	0.027	0.000	0.000	0.000	0.000	0.82	0.545			342.4
41	T12510_Block3_Block5_Vert_Plate	25-Jul-14	C *	0.125	1.0			0.650	0.024	0.022	0.027	0.000	0.000	0.000	0.000	0.82	0.545			28.2
42	T12515_Block3_Block5_Vert_Plate	25-Jul-14	C *	0.125	1.5			0.650	0.024	0.022	0.027	0.000	0.000	0.000	0.000	0.82	0.545			302.1
43	T12520_Block3_Block5_Vert_Plate	25-Jul-14	C *	0.125	2.0			0.650	0.024	0.022	0.027	0.000	0.000	0.000	0.000	0.82	0.545			387.2
44	T12530_Block3_Block5_Vert_Plate	25-Jul-14	C *	0.125	3.0			0.650	0.024	0.022	0.027	0.000	0.000	0.000	0.000	0.82	0.545			303.4
45	T15010_Block3_Block5_Vert_Plate	25-Jul-14	C *	0.150	1.0			0.650	0.024	0.022	0.027	0.000	0.000	0.000	0.000	0.82	0.545			29.4
46	T15015_Block3_Block5_Vert_Plate	25-Jul-14	C *	0.150	1.5			0.650	0.024	0.022	0.027	0.000	0.000	0.000	0.000	0.82	0.545			340.5
47	T15020_Block3_Block5_Vert_Plate	25-Jul-14	C *	0.150	2.0			0.650	0.024	0.022	0.027	0.000	0.000	0.000	0.000	0.82	0.545			302.1
48	T15030_Block3_Block5_Vert_Plate	25-Jul-14	C *	0.150	3.0			0.650	0.024	0.022	0.027	0.000	0.000	0.000	0.000	0.82	0.545			303.4
49	HS10TP15_Block3_Block5_Vert_Gap0	26-Jul-14	D			0.100	1.5	0.648	0.024	0.022	0.027	0.000	0.023	0.025	0.025	0.30	0.40	0.30	0.40	1353.6
50	HS10TP30_Block3_Block5_Vert_Gap0	26-Jul-14	D			0.100	3.0	0.648	0.024	0.022	0.027	0.000	0.023	0.025	0.025	0.30	0.40	0.30	0.40	2649.6
51	HS10TP15_Block5	30-Jul-14	E			0.150	1.5	0.650	0.024	0.022	0.027	0.000	0.023	0.025	0.025	0.30	0.40	0.30	0.40	1461.1
52	HS10TP30_Block5	30-Jul-14	E			0.150	3.0	0.650	0.024	0.022	0.027	0.000	0.023	0.025	0.025	0.30	0.40	0.30	0.40	2729.0
53	HS10TP30_Block5_7001100	30-Jul-14	F			0.150	3.0	0.650	0.024	0.022	0.027	0.000	0.023	0.025	0.025	0.70	1.10	0.70	1.10	2719.4

Test				Input					Calibration (m/V) wave gauges							Spacing between gauges (m)				Recorded
ID	Filename	Session	Configuration	H (m)	T (s)	Hm0 (m)	Tp (s)	depth (m)	0	1	2	3	4	5	6	0-1	1-2	4-5	5-6	duration (s)
54	T07510_Block5_Plate	31-Jul-14	G	0.075	1.0			0.655	0.024	0.022	0.027	0.000	0.000	0.000	0.000	0.82	0.545			69.1
55	T07515_Block5_Plate	31-Jul-14	G	0.075	1.5			0.655	0.024	0.022	0.027	0.000	0.000	0.000	0.000	0.82	0.545			302.7
56	T07520_Block5_Plate	31-Jul-14	G	0.075	2.0			0.655	0.024	0.022	0.027	0.000	0.000	0.000	0.000	0.82	0.545			338.6
57	T07530_Block5_Plate	31-Jul-14	G	0.075	3.0			0.655	0.024	0.022	0.027	0.000	0.000	0.000	0.000	0.82	0.545			303.4
58	T10010_Block5_Plate	31-Jul-14	G	0.100	1.0			0.655	0.024	0.022	0.027	0.000	0.000	0.000	0.000	0.82	0.545			30.7
59	T10015_Block5_Plate	31-Jul-14	G	0.100	1.5			0.655	0.024	0.022	0.027	0.000	0.000	0.000	0.000	0.82	0.545			323.2
60	T10020_Block5_Plate	31-Jul-14	G	0.100	2.0			0.655	0.024	0.022	0.027	0.000	0.000	0.000	0.000	0.82	0.545			307.2
61	T10030_Block5_Plate	31-Jul-14	G	0.100	3.0			0.655	0.024	0.022	0.027	0.000	0.000	0.000	0.000	0.82	0.545			321.9
62	T12510_Block5_Plate	31-Jul-14	G	0.125	1.0			0.655	0.024	0.022	0.027	0.000	0.000	0.000	0.000	0.82	0.545			28.8
63	T12515_Block5_Plate	31-Jul-14	G	0.125	1.5			0.655	0.024	0.022	0.027	0.000	0.000	0.000	0.000	0.82	0.545			310.4
64	T12520_Block5_Plate	31-Jul-14	G	0.125	2.0			0.655	0.024	0.022	0.027	0.000	0.000	0.000	0.000	0.82	0.545			328.3
65	T12530_Block5_Plate	31-Jul-14	G	0.125	3.0			0.655	0.024	0.022	0.027	0.000	0.000	0.000	0.000	0.82	0.545			312.3
66	T15010_Block5_Plate	31-Jul-14	G *	0.150	1.0			0.655	0.024	0.022	0.027	0.000	0.000	0.000	0.000	0.82	0.545			25.0
67	T15015_Block5_Plate	31-Jul-14	G *	0.150	1.5			0.655	0.024	0.022	0.027	0.000	0.000	0.000	0.000	0.82	0.545			359.7
68	T15020_Block5_Plate	31-Jul-14	G *	0.150	2.0			0.655	0.024	0.022	0.027	0.000	0.000	0.000	0.000	0.82	0.545			304.0
69	T15030_Block5_Plate	31-Jul-14	G *	0.150	3.0			0.655	0.024	0.022	0.027	0.000	0.000	0.000	0.000	0.82	0.545			357.8
70	T07510_Block5_Plate_slope	07-Aug-14	H	0.075	1.0			0.650	0.024	0.021	0.026	0.000	0.000	0.000	0.000	0.82	0.545			62.1
71	T07515_Block5_Plate_slope	07-Aug-14	H	0.075	1.5			0.650	0.024	0.021	0.026	0.000	0.000	0.000	0.000	0.82	0.545			544.0
72	T07520_Block5_Plate_slope	07-Aug-14	H	0.075	2.0			0.650	0.024	0.021	0.026	0.000	0.000	0.000	0.000	0.82	0.545			309.1
73	T07530_Block5_Plate_slope	07-Aug-14	H	0.075	3.0			0.650	0.024	0.021	0.026	0.000	0.000	0.000	0.000	0.82	0.545			308.5
74	T10010_Block5_Plate_slope	07-Aug-14	H	0.100	1.0			0.650	0.024	0.021	0.026	0.000	0.000	0.000	0.000	0.82	0.545			60.8
75	T10015_Block5_Plate_slope	07-Aug-14	H	0.100	1.5			0.650	0.024	0.021	0.026	0.000	0.000	0.000	0.000	0.82	0.545			455.7
76	T10020_Block5_Plate_slope	07-Aug-14	H	0.100	2.0			0.650	0.024	0.021	0.026	0.000	0.000	0.000	0.000	0.82	0.545			321.3
77	T10030_Block5_Plate_slope	07-Aug-14	H	0.100	3.0			0.650	0.024	0.021	0.026	0.000	0.000	0.000	0.000	0.82	0.545			377.6
78	T12510_Block5_Plate_slope	07-Aug-14	H	0.125	1.0			0.650	0.024	0.021	0.026	0.000	0.000	0.000	0.000	0.82	0.545			34.6
79	T12515_Block5_Plate_slope	07-Aug-14	H	0.125	1.5			0.650	0.024	0.021	0.026	0.000	0.000	0.000	0.000	0.82	0.545			309.1
80	T12520_Block5_Plate_slope	07-Aug-14	H	0.125	2.0			0.650	0.024	0.021	0.026	0.000	0.000	0.000	0.000	0.82	0.545			303.4
81	T12530_Block5_Plate_slope	07-Aug-14	H	0.125	3.0			0.650	0.024	0.021	0.026	0.000	0.000	0.000	0.000	0.82	0.545			399.4
82	T15010_Block5_Plate_slope	07-Aug-14	H	0.150	1.0			0.650	0.024	0.021	0.026	0.000	0.000	0.000	0.000	0.82	0.545			73.6
83	T15015_Block5_Plate_slope	07-Aug-14	H	0.150	1.5			0.650	0.024	0.021	0.026	0.000	0.000	0.000	0.000	0.82	0.545			303.4
84	T15020_Block5_Plate_slope	07-Aug-14	H	0.150	2.0			0.650	0.024	0.021	0.026	0.000	0.000	0.000	0.000	0.82	0.545			371.2
85	T15030_Block5_Plate_slope	07-Aug-14	H	0.150	3.0			0.650	0.024	0.021	0.026	0.000	0.000	0.000	0.000	0.82	0.545			307.8

Note: tests marked (*) may be less reliable because the support frame and/or the blocks were not properly fixed during the tests - see logbook

APPENDIX B

Logbook

Date	18.07.14 - 07.08-14
Experiment by	Coen Kuiper, Jeroen van den Bos, Henk Jan Verhagen, Gerben-Jan Vos

Test	Time approx	h0 (m)	Input file	Output file	Remarks
18-Jul					
1	15h05	0.655	R07530	T07530_Block3_Block5_Vert_Gap18	
2	15h15	0.655	R07520	T07520_Block3_Block5_Vert_Gap18	
3	15h22	0.655	R07530	T07530_Block3_Block5_Vert_Gap18	First test (#1) turned out to be too short, test repeated and output file overwritten
4	15h31	0.655	R07515	T07515_Block3_Block5_Vert_Gap18	
5	15h50	0.655	R10030	T10030_Block3_Block5_Vert_Gap18	
6	15h55	0.655	R10020	T10020_Block3_Block5_Vert_Gap18	
7	16h05	0.655	R10015	T10015_Block3_Block5_Vert_Gap18	
8	16h50	0.655	R10010	T10010_Block3_Block5_Vert_Gap18	tests terminated after 85s because of of lateral standing wave. pattern was visible after 20-30 s.
9	16h55	0.655	R07510	T07510_Block3_Block5_Vert_Gap18	tests terminated after 50s because of of lateral standing wave. pattern was visible after 20-30 s.
23-Jul					
10	11h33	0.645	R12530	T12530_Block3_Block5_Vert_Gap18	some lateral standing waves
11	12h04	0.645	R12520	T12520_Block3_Block5_Vert_Gap18	
12	12h10	0.645	R12515	T12515_Block3_Block5_Vert_Gap18	
13	12h21	0.645	R12510	T12510_Block3_Block5_Vert_Gap18	test immediately terminated because of lateral standing wave.
14	12h30	0.645	R15030	T15030_Block3_Block5_Vert_Gap18	
15	12h40	0.645	R15020	T15020_Block3_Block5_Vert_Gap18	
16	12h47	0.645	R15015	T15015_Block3_Block5_Vert_Gap18	
17	12h54	0.645	R15010	T15010_Block3_Block5_Vert_Gap18	test immediately terminated because of lateral standing wave.
24-Jul					
	10h27	0.642	R07530	T07530_Block3_Block5_Vert_Gap0	
	10h35	0.642	R07520	T07520_Block3_Block5_Vert_Gap0	
	10h42	0.642	R07515	T07515_Block3_Block5_Vert_Gap0	
	10h48	0.642	R07510	T07510_Block3_Block5_Vert_Gap0	tests terminated after 180s because of of lateral standing wave.
	10h52	0.642	R10030	T10030_Block3_Block5_Vert_Gap0	
	11h03	0.642	R10020	T10020_Block3_Block5_Vert_Gap0	
	11h10	0.642	R10015	T10015_Block3_Block5_Vert_Gap0	
	11h20	0.642	R10010	T10010_Block3_Block5_Vert_Gap0	test immediately terminated because of lateral standing wave.
	11h24	0.642	R12530	T12530_Block3_Block5_Vert_Gap0	
	11h34	0.642	R12520	T12520_Block3_Block5_Vert_Gap0	
	11h41	0.642	R12515	T12515_Block3_Block5_Vert_Gap0	
	11h48	0.642	R12510	T12510_Block3_Block5_Vert_Gap0	test immediately terminated because of lateral standing wave.
	11h52	0.642	R15030	T15030_Block3_Block5_Vert_Gap0	
	12h13	0.642	R15020	T15020_Block3_Block5_Vert_Gap0	
	12h20	0.642	R15015	T15015_Block3_Block5_Vert_Gap0	
	12h28	0.642	R15010	T15010_Block3_Block5_Vert_Gap0	test terminated after 30s because of lateral standing wave.
25-Jul					
	09h57	0.65	R07530	T07530_Block3_Block5_Vert_Plate	
	10h04	0.65	R07520	T07520_Block3_Block5_Vert_Plate	
	10h11	0.65	R07515	T07515_Block3_Block5_Vert_Plate	
	10h20	0.65	R07510	T07510_Block3_Block5_Vert_Plate	test terminated after 50s because of lateral standing wave.
	10h24	0.65	R10030	T10030_Block3_Block5_Vert_Plate	
	11h19	0.65	R10020	T10020_Block3_Block5_Vert_Plate	
	11h27	0.65	R10015	T10015_Block3_Block5_Vert_Plate	
	11h36	0.65	R10010	T10010_Block3_Block5_Vert_Plate	test terminated after 20-30s because of lateral standing wave.
	11h40	0.65	R12530	T12530_Block3_Block5_Vert_Plate	frames were with unwanted gap of 50mm vertical, 0.04 m/m horizontal, exact time unknown
	11h56	0.65	R12520	T12520_Block3_Block5_Vert_Plate	frames were with unwanted gap of 50mm vertical, 0.04 m/m horizontal, exact time unknown
	12h06	0.65	R12515	T12515_Block3_Block5_Vert_Plate	frames were with unwanted gap of 50mm vertical, 0.04 m/m horizontal, exact time unknown
	12h15	0.65	R12510	T12510_Block3_Block5_Vert_Plate	frames were with unwanted gap of 50mm vertical, 0.04 m/m horizontal, exact time unknown ; test terminated after 10-20s because of lateral standing wave.
	12h44	0.65	R15030	T15030_Block3_Block5_Vert_Plate	frames were with unwanted gap of 50mm vertical, 0.04 m/m horizontal, exact time unknown
	12h36	0.65	R15020	T15020_Block3_Block5_Vert_Plate	frames were with unwanted gap of 50mm vertical, 0.04 m/m horizontal, exact time unknown
	12h24	0.65	R15015	T15015_Block3_Block5_Vert_Plate	frames were with unwanted gap of 50mm vertical, 0.04 m/m horizontal, exact time unknown
	12h19	0.65	R15010	T15010_Block3_Block5_Vert_Plate	frames were with unwanted gap of 50mm vertical, 0.04 m/m horizontal, exact time unknown; test terminated after 10s because of lateral standing wave.

15h30 verbouwd; plank verwijderd en monsters weer tegen elkaar gezet
golfhoogtemeters verzet. Meter het dichts bij het model is blijven staan
afstand tussen golfhoogtemeters is 30 cm en 40 cm (30 cm is het dichtst bij het golfshot)

26/07/2014					
	15h31	0.648	HS10TP15	HS10TP15_Block3_Block5_Vert_Gap0	test duration of 22 min.
	15h57	0.648	HS10TP30	HS10TP30_Block3_Block5_Vert_Gap0	test duration of 45 min.

Block 3 verwijderd, block 5 is blijven staan
(Opm: in originele versie van dit logboek is per abuis vermeld dat dit andersom was, nl block 3 is blijven staan. Alle filenamen etc ware ook consequent verkeerd gelabeld.
In deze huidige versie van dit logboek is dit hersteld).

30/07/2014					
	10h12	0.65	HS10TP15	HS10TP15_Block5	test duration of 22 min.
	11h08	0.65	HS10TP30	HS10TP30_Block5	test duration of 45 min.

12h01 golfhoogtemeters verzet. Meter het dichts bij het model is blijven staan
afstand tussen golfhoogtemeters is 70 cm en 1100 cm (70 cm is het dichtst bij het golfshot)

	12h21	0.65	HS10TP30	HS10TP30_Block5_7001100	test duration of 45 min., sensor distance 700mm and 1100mm

31/07/2014
09h30 block 3 with plate
afstand tussen golfhoogtemeters teruggebracht naar oorspronkelijke opzet
Only wave height meters on wave-maker side are used

	9h35	0.655	R07530	T07530_Block5_Plate	
	9h43	0.655	R07520	T07520_Block5_Plate	
	9h52	0.655	R07515	T07515_Block5_Plate	
	9h59	0.655	R07510	T07510_Block5_Plate	test terminated after 50s because of lateral standing wave.
	10h03	0.655	R10030	T10030_Block5_Plate	
	10h13	0.655	R10020	T10020_Block5_Plate	
	10h35	0.655	R10015	T10015_Block5_Plate	
	10h28	0.655	R10010	T10010_Block5_Plate	test terminated after 20-30s because of lateral standing wave.
	10h45	0.655	R12530	T12530_Block5_Plate	
	10h53	0.655	R12520	T12520_Block5_Plate	
	11h00	0.655	R12515	T12515_Block5_Plate	
	11h08	0.655	R12510	T12510_Block5_Plate	test terminated after 20-30s because of lateral standing wave.
	11h11	0.655	R15030	T15030_Block5_Plate	frame started moving into -1.5 degree vertical angle
	11h30	0.655	R15020	T15020_Block5_Plate	frame started moving into -1.5 degree vertical angle
	11h36	0.655	R15015	T15015_Block5_Plate	frame started moving into -1.5 degree vertical angle
	11h44	0.655	R15010	T15010_Block5_Plate	frame started moving into -1.5 degree vertical angle, test terminated after 20-30s because of lateral standing wave.

07/08/2014
slope constructed 45 degreed, with plate
distance on waterline from slope to first waveheight gauge (G20) is 282 cm
distances inbetween are 545 and 820 mm

	9h40	0.65	R07530	T07530_Block5_Plate_slope	
	9h50	0.65	R07520	T07520_Block5_Plate_slope	
	9h55	0.65	R07515	T07515_Block5_Plate_slope	
	10h05	0.65	R07510	T07510_Block5_Plate_slope	test terminated after 50s because of lateral standing wave.
	10h17	0.65	R10030	T10030_Block5_Plate_slope	
	10h25	0.65	R10020	T10020_Block5_Plate_slope	
	10h30	0.65	R10015	T10015_Block5_Plate_slope	
	10h41	0.65	R10010	T10010_Block5_Plate_slope	test terminated after 50s because of lateral standing wave.
	10h44	0.65	R12530	T12530_Block5_Plate_slope	leakage on the right edge of the plate
	10h55	0.65	R12520	T12520_Block5_Plate_slope	leakage on the right edge of the plate
	11h06	0.65	R12515	T12515_Block5_Plate_slope	
	11h13	0.65	R12510	T12510_Block5_Plate_slope	test terminated after 20-30s because of lateral standing wave.
	11h18	0.65	R15030	T15030_Block5_Plate_slope	leakage on the right edge of the plate
	11h29	0.65	R15020	T15020_Block5_Plate_slope	leakage on the right edge of the plate
	11h37	0.65	R15015	T15015_Block5_Plate_slope	leakage on the right edge of the plate
	11h47	0.65	R15010	T15010_Block5_Plate_slope	leakage on the right edge of the plate