

Wave Pool Acoustic Noise Test

Site: Wadi Adventure Surf Pool, Al Ain, United Arab Emirates.

Test Date: October 22nd, 2014



Site Description:

Wadi Adventure's wave pool is located 13km south of Al Ain, approximately 125km from Dubai and 150km from Abu Dhabi. The site is relatively remote extra urban one, although suburban developments are currently being constructed around and up to the perimeter of the of the park site. The wave pool is set at the very foot of the Jebel Hafeet Mountain with the pump room set to the hill and the wave pool fanning out towards to the main buildings of the park. There are no other significant geological features in the surrounding area.

The location does result in exposure to the prevailing southerly wind. Due to the winds on the test day there were some minor, but noticeable, fluctuations.

Test Purpose:

The subsequent test is designed to establish the LAeq and LAFmax acoustic energies generated by the Wadi Adventure surf wave measured in decibel (dB) for set wave configurations as detailed in the test parameters section.

Test Parameters:

As per the specifications of the client the following wave configurations were tested

1. 1.5m plunging wave
 - a. This corresponded to an A Frame wave set at level 6 given the current operating conditions of Wadi's surf pool.
2. 1.2m peeling wave
 - a. This corresponded to either a left or right breaking wave at level 5 again given the current operating conditions of the pool.
 - b. The test was conducted with a right break.
3. 0.6m peeling wave
 - a. This corresponded to a left or right break set at level 2 given the current operating conditions.
 - b. The test was conducted at a right break.
4. Ambient acoustic levels

Test locations:

As provided by the client the following locations were tested twice for each wave configuration.



Fig 1: Client's Requested Test Sites

A: 10m from the pool edge at the break line of the wave. Site A was as shown in Fig 1 for the ambient, 1.5m and 1.2m tests. For the 0.6m test A was moved to the site shown in Fig 2:

B: 50m from the break line in the center of the pool. Site B was as shown in Fig 1 for ambient, 1.5m and 1.2m tests. For the 0.6m test, B was moved to the water line as shown in Fig 2 due to the wave breaking closer to the shore.

C: 2m from the surface of the building facing the pool. This test site was consistent with all tests. Please see Fig 3 and 4 as site references.

D: 75m from the central line of the break. The site was used as shown in Fig 1 for the ambient and 1.5m tests. For the 1.2m and 0.6m it was moved to the opposite side of the pool to reduce interference from construction that was taking place just outside the facility's southern limit.

5m Test: This was conducted for the ambient, 1.5m and 1.2m tests. No data for the 0.6m wave was recorded at this location. Please see Fig 2 and 5 for the position.
This is the only accessible location at that height.

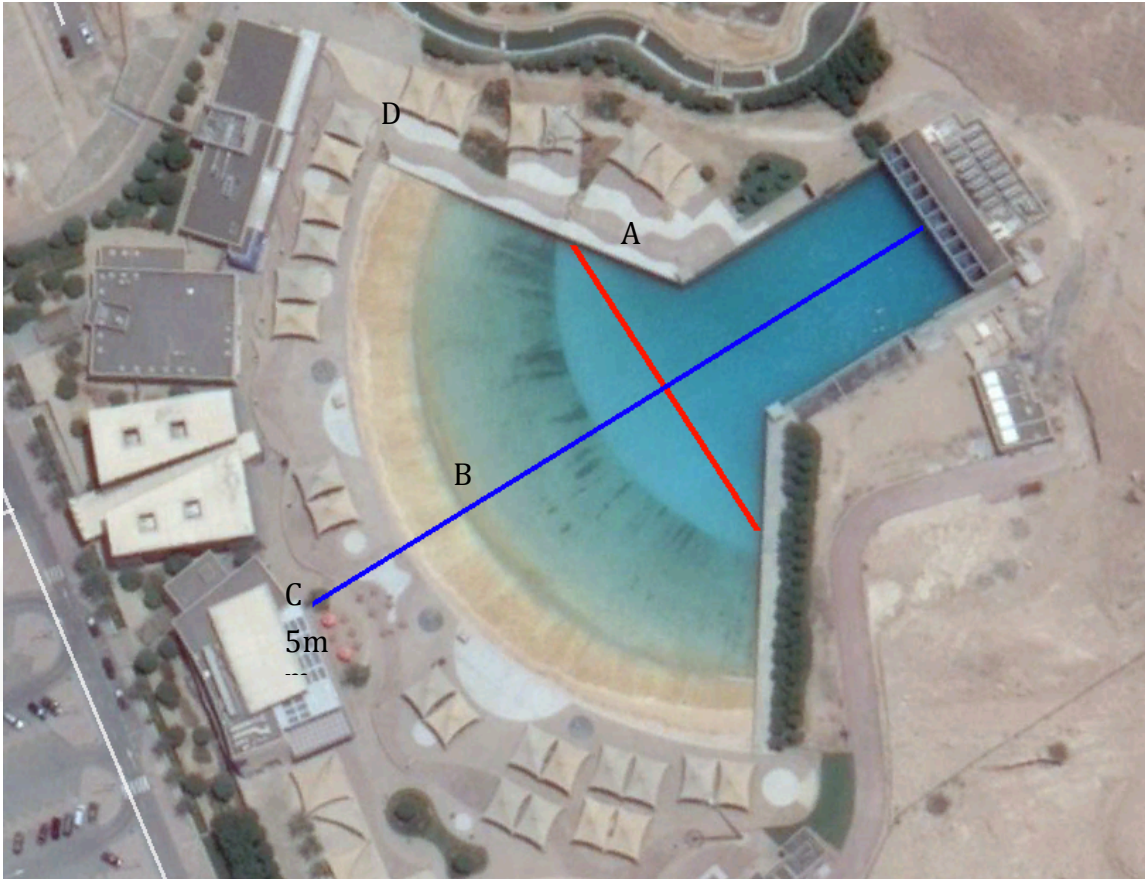


Fig 2: Alternate sites for the 0.6m wave due to different break point as indicated by the red line.



Fig 3: Test site C location



Fig 4: Test site C alternate view



Fig 5: 5m Test site

Results Summary:

Position	Wave	Noise Level, dB	
		LAeq	LAFmax
A	1.5m Plunging	61.8	64.3
	1.2m Peeling	60.6	61.5
	0.6m Peeling	60.9	62.1
	Ambient	60.2	N/A
B	1.5m Plunging	75.1	79.2
	1.2m Peeling	72.1	77
	0.6m Peeling	60.7	67.2
	Ambient	64.1	N/A
C	1.5m Plunging	63.6	66.2
	1.2m Peeling	63.4	66.1
	0.6m Peeling	60	64.8
	Ambient	59.4	N/A
D	1.5m Plunging	58.7	61.2
	1.2m Peeling	58.1	60.3
	0.6m Peeling	58.7	60.4
	Ambient	58.1	N/A
5m	1.5m Plunging	64.8	67.3
	1.2m Peeling	65.1	68
	0.6m Peeling	N/A	N/A
	Ambient	59.6	N/A

The results clearly indicate that test position B produced significantly higher readings than any other position. As you can note in the appendix with the full time sequenced results that the LAFmax dB readings all occurred approximately 9-10 seconds after the wave break when the whitewater approached and passed the testing point.

An LAFmax of 79.2dB occurred at 10 seconds after the break during the second test at site B with the 1.5plunging wave.

It should be noted that this time portion of all waves recorded at site B showed all the highest readings as the wave passed the test point.

The LAeq results over the course of the 12 seconds it took the wave to break and travel to shore show little increase over the ambient levels in sites A and D. These side-on sites demonstrate little increase in levels throughout the wave period.

The LAeq results for B show the highest levels over the course of the wave period in addition to the highest ambient levels of the whole test. While conducting the test it should be noted that this was largely observed due to the positioning of the pool intakes and grating system which cause a significant degree of background noise.

Ambient levels for each location were calculated using the recorded levels preceding the wave for each test at a given location. This ensured that the ambient levels were an accurate reflection throughout the test period, with similar weather, external and contributing, such as construction, wind and fluctuating background noise.

Equipment and Methods:

The Ethos 4300 Environment Multimeter was used to measure the levels during the test set in A-weighted.

The device measures in real time and levels were recorded using video in order to log the data in relation to the wave period.

Appendix:

Elapsed Time (sec)		1	2	3	4	5	6	7	8	9	10	11	12	Laeq	Lafmax
Position		1.5 Plunging													
A: Test 1		60.1	64.3	62.9	60.9	62.5	63	62.3	62.2	61.7	60.9	61	61.2	61.81	64.3
A: Test 2		61.1	62.6	61.2	60.8	60.9	61.1	61.5	62.5	61.8	61.6	61.7	61.2		
B: Test 1		65.5	69	68.6	70.4	71.4	73.6	74.7	75.2	76.5	79	78.4	75.8	75.09	79.2
B: Test 2		64.1	69.1	67.8	68.8	71.5	73.4	75	76.3	77.5	78.9	79.2	78		
C: Test 1		58.6	60.8	62.5	62.8	63	64.3	64.4	64.7	64.3	64.2	64.3	64	63.63	66.2
C: Test 2		59.9	60.1	60.2	62.8	62.5	62.7	64.2	64.7	65.5	66.2	65.7	65.1		
D: Test 1		57.5	60.2	59	56.7	58.2	59.2	57.8	58	59.2	57.2	61.2	57.1	58.73	61.2
D: Test 2		58	60.3	59.8	60.4	58.1	56.6	55.3	60.5	58.5	59.3	57	58.8		
5m: Test 1		59.5	62.9	61.4	62.4	64.6	64.9	64.8	66	66.5	67.3	67.2	66.4	64.78	67.3
5m: Test 2		59.9	62.6	61.8	63.6	63.2	63.8	63.4	64.8	65.9	66.5	66.8	66.4		

Elapsed Time (sec)		1	2	3	4	5	6	7	8	9	10	11	12	Laeq	Lafmax
Position		1.2m Spilling													
A: Test 1		60.1	60.7	60.3	61.3	60.7	60.4	61.5	61.3	60.8	60.9	60.4	60.4	60.58	61.5
A: Test 2		59.4	60.6	59.8	60.8	61.3	60.5	60.7	61.4	60.4	60.3	59.4	59.7		
B: Test 1		63.7	65.5	65.1	66.9	66.2	68.8	69.1	69.8	72.3	74.2	74.9	75.9	72.05	77
B: Test 2		63.9	65.3	65.9	67.3	68.9	69.9	72.1	73.2	73.9	75.4	76.9	77		
C: Test 1		59.4	61.5	62	61.9	61.5	62	62.2	63.8	65.4	66	66.1	65.1	63.41	66.1
C: Test 2		59.7	60.9	62.2	62.1	62	61.5	61.9	63.5	64.5	65.3	65.9	64.8		
D: Test 1		57.2	56.6	58.8	57.4	56.5	56.9	58.7	56.5	56.9	58.8	58	58.1	58.11	60.3
D: Test 2		58.2	58.5	57.6	57.8	59.9	60.3	59.4	57.8	57.3	57.9	58.2	58.6		
5m: Test 1		58.6	60.8	62.5	62.3	64.2	63.8	64.3	65.8	67.1	67	66.6	65.6	65.10	68
5m: Test 2		60.2	62.5	63.2	62.5	65.8	65.2	64.5	66.7	66.8	66.9	68	67		

Elapsed Time (sec)		1	2	3	4	5	6	7	8	9	10	11	12	Laeq	Lafmax
Position		0.6 Spilling													
A: Test 1		60.1	59.9	60.5	60.2	61.2	61.4	61	60.5	60.7	61.4	62	62.1	60.94	62.1
A: Test 2		59.4	60	60.3	61	61.3	60.9	60.7	61.2	61.4	61	61.5	61.7		
B: Test 1		63.1	65.9	67.2	65.5	62.2	61.5	61.9	62.4	63.2	62	62	63	63.78	67.2
B: Test 2		64	66	66.9	66.1	63.2	62.1	62.5	62.9	63.4	63.1	62.5			
C: Test 1		59.9	60.1	62.8	64.8	64	62.8	62.2	60.1	61.1	61.8	59.1	58.8	61.92	64.8
C: Test 2		58.9	61.1	62.9	63.9	64.2	63.1	62.4	61.2	60.9	60.8	61	60.3		
D: Test 1		57.9	57.5	59.4	58.9	57.8	57.5	58	57.4	58.2	58.4	57.8	57.1	58.70	60.4
D: Test 2		58.3	59.4	59.1	59.2	58.8	59.5	59.9	60.2	60.4	58.9	58.3	58.6		

Fergus Coffey

26/10/2014

Wave Pool Acoustic Noise Test: Additional Testing

Site: Wadi Adventure Surf Pool, Al Ain, United Arab Emirates.

Test Date: November 16th, 2014

The following data is in response to the clarifications asked for after the initial report.

Test Location:

The subsequent tests were conducted as close to position A1, as shown in Fig 1 below. The platform could not be positioned directly at site A1 due to restrictions by the operators. Due to this the platform was positioned between A1 and the original site A as shown in the initial report.

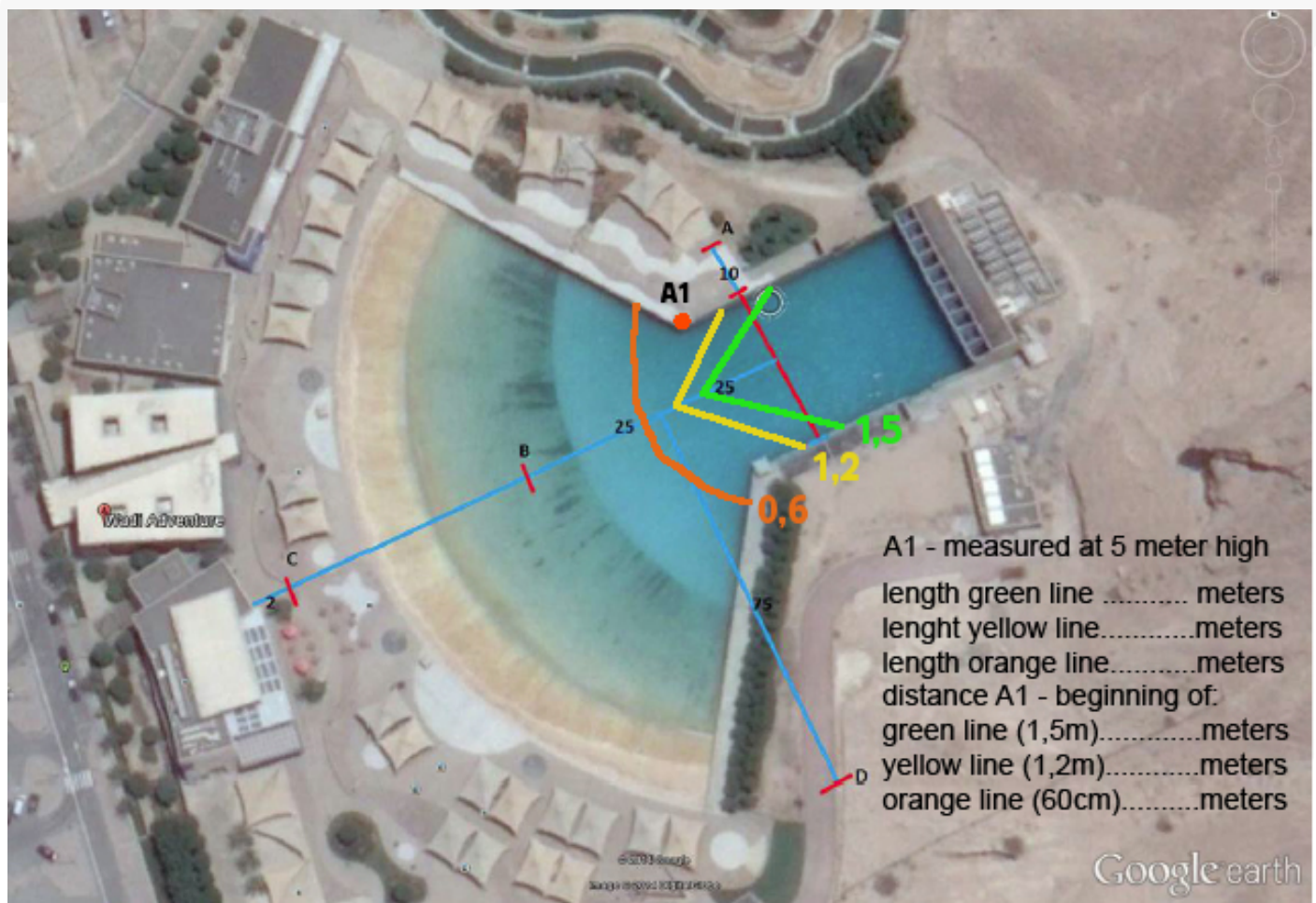


Fig 1:

Test conditions:

The test was conducted on a 3.75m platform with the Ethos 4300 mounted on a tripod setting it's vertical height at exactly 5m above ground.

The test was conducted between 8 and 9pm with some wind and environmental background noise but with slightly less than the initial test. There was no audible construction work during this test.

Test site to break distance:

These distances are for the left hand breaks closest to the test site

1. 1.5m left hand break horizontal distance to the start of the break = 7m
2. 1.2m left hand break horizontal distance to the start of the break = 7m
3. 0.6m left hand break horizontal distance to the start of the break = 13m

Freeboard Height = 2.5m at position A1. (Flat pool surface)

Break Travel Distances:

As shown above in Fig 1: the closeout breaks from both sides of the pool to meet in the middle. Below are the approximate distances of each of these breaks for one leg of the V.

1. 1.5m closeout travels approximately 44m from break to closeout
2. 1.2m closeout travels approximately 39m from break to closeout
3. 0.6m wave travels approximately 29 meters from the break to the middle of the pool

Please note that these are estimations based on prior knowledge of exactly where the waves break and close out for the 1.5 and 1.2m closeouts.

Wave condition considerations:

The current operating condition of the pool has 4 of the 5 pumps used to fill the chambers operating. This leaves the middle two chambers almost completely empty until the overflow point in the adjacent chambers is reached during the fill. The result is that the wave is underpowered relative to the initial test. In order to compensate for this and in the interest of trying to replicate a “closeout” lefts and rights were recorded from the test position at Level 6 for 1.5m and Level 5 for 1.2m.

At optimal operating conditions the closeout would have mirrored breaks comparable to what was tested. For reference a video of the Level 6 Closeout has been included to demonstrate the wave form without the middle two chambers filling. It should be noted that the wave breaks weakly on the surfers left just before the fan of the pool and fails to break on surfers right until almost halfway to the beach. This can be noted in the attached video (Level_6_Closeout_with_no_middle_pump.MOV).

Results Summary:



Wave Noise recorded from A1 at height of 5m	Noise Level , dB	
	L _{Aeq}	L _{AFmax}
1.5m Right break	63.01	63.9
1.5m Left break	63.35	64.7
1.2m Right break	63.01	64.4
1.2m Left break	62.79	63.9
0.6m Left break	61.9	63.2
Ambient with machine running pool settling	60.49	61.3
Ambient with machine and pool off	51.46	51.9

The above results show a little elevated level of ambient noise with regards to the original test at position A conducted at 1.5m. This could be attributed to the quay wall stifling some of the sound, however the max levels recorded are very similar to the original results indicating a reasonable level of consistency between the test sites.

The most notable sets of data are the ambient results with and without the machinery running. A Difference of 9dBs can be noted in the L_{Aeq} over the test period.

As before the wave break occurred at the elapsed time (seconds) 2.

Full data sets are included in the appendix below.

Fergus Coffey

17/11/2014

Appendix:



Elapsed Time (sec)		1	2	3	4	5	6	7	8	9	10	11	12	Laeq	Lafmax
Position		1.5 Right Break													
A: Test 1		63.7	63.3	63	63.6	63.5	63.6	63.9	62.9	62.8	63.1	62.9	62.9	63.01	63.9
A: Test 2		62.5	62.9	62.5	63.1	62.8	63.2	53.3	63.2	63.1	63.3	63.2	63.6		

Elapsed Time (sec)		1	2	3	4	5	6	7	8	9	10	11	12	Laeq	Lafmax
Position		1.5 Left Break													
A: Test 1		62.3	61.4	64.2	63.6	64.2	64.6	64	63.1	63.6	63	63.1	62.9	63.35	64.7
A: Test 2		62.9	61.5	62.2	62.7	64.7	64.4	64.3	63.5	63	63.4	62.9	62.8		

Elapsed Time (sec)		1	2	3	4	5	6	7	8	9	10	11	12	Laeq	Lafmax
Position		1.2 Right Break													
A: Test 1		61.7	62.1	64	63.3	64.4	64	63	62.8	62.2	62.9	63	62.5	63.01	64.4
A: Test 2		62.2	63.2	62.9	62.4	63.9	63.4	63.1	63.8	62.7	62.1	62.8	62.5		

Elapsed Time (sec)		1	2	3	4	5	6	7	8	9	10	11	12	Laeq	Lafmax
Position		1.2 Left Break													
A: Test 1		61.2	61.3	63.7	63.7	63.2	63.9	63.7	63.4	63.2	63.1	63	63.1	62.79	63.9
A: Test 2		61.3	60.3	61.5	62.1	63.8	63.1	62.6	62.4	63.1	62.9	62.7	62.3		

Elapsed Time (sec)		1	2	3	4	5	6	7	8	9	10	11	12	Laeq	Lafmax
Position		0.6m Left Break													
A: Test 1		59.5	60.1	61.5	62	62.9	61.9	62.3	62.3	61.8	62.4	62.3	61.9	61.90	63.2
A: Test 2		60.3	60.3	60.7	62.7	63.2	63	62.5	62.2	61.9	62.1	61.7	61.8		

Elapsed Time (sec)		1	2	3	4	5	6	7	8	9	10	11	12	Laeq	Lafmax
Position		Ambient with machine running and wave settling													
A: Test 1		60.1	60.7	60.2	60.4	61.3	60.9	60.2	60.3	60.4	60.5	60.2	60.5	60.49	61.3

Elapsed Time (sec)		1	2	3	4	5	6	7	8	9	10	11	12	Laeq	Lafmax
Position		Ambient with machine off and pool settled													
A: Test 1		51.7	51.9	51.7	51.3	51.8	51.8	51.9	51	51.1	51.2	51.2	50.7	51.46	51.9