PILE ARRANGEMENT FOR WAVE BARRIERS AND METHODS

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ABSTRACT

A pile arrangement for creating a wave barrier for waves in a body of water includes at least a first module of piles driven into the floor of the body of water at a first distance from the shoreline. The arrangement also includes at least a second module of piles driven into the floor at a second distance from the shoreline that is greater than the first distance. A method for creating a wave barrier for waves in a body of water includes driving at least a first module of piles into the floor of the body of water, and driving at least a second module of piles into the floor at a second distance from the shoreline that is greater than the first distance.
PILE ARRANGEMENT FOR WAVE BARRIERS AND METHODS

[0001] This application is being filed on 24 Aug. 2012, as a PCT International Patent application in the name of PilePro LLC, a U.S. national corporation, applicant for the designation of all countries except the U.S., and, Roberto Redondo Lopez, a citizen of Spain, Versonica Redondo Gomez, a citizen of the U.S., and Robert Wendt, a citizen of Spain, applicants for the designation of the U.S. only, and claims priority to U.S. Patent Application Ser. No. 61/527,192 filed on 25 Aug. 2011, the disclosure of which is incorporated herein by reference in its entirety.

BACKGROUND

[0002] This disclosure relates to improvements in pile arrangements. For example, this disclosure concerns improvements in pile arrangements in the form of sheet piles which can be used in bodies of water to create a barrier for waves in that body of water.

[0003] When an earthquake occurs in the middle of a body of water, such as the ocean, the immediate impact may not be noticeable from the coastal shoreline.

[0004] FIG. 1 is a schematic diagram of a wave 11 in a body of water 12, such as the ocean. Out at sea, in the ocean 12, the length of the wave 11 is longer, often hundreds of meters long, and the height is shorter. As the wave 11 approaches the shore to hit the shallow water, the energy is compressed resulting in an increase in the height of the wave 11, with massive waves crashing on the coastal shore 13.

[0005] Before the wave 11 arrives on the coastal shore 13, the water along the shoreline recedes dramatically. This is called a drawback. See FIG. 2. The water below the drawback allows the incoming wave 11 to gain strength and grow bigger and bigger.

[0006] Solutions are needed to address the problems on waves crashing onto the coastal shore. In one example, solutions are needed to address the problem of a tsunami wave from crashing onto a coastal shore.

[0007] Solutions are needed to improve the prior art.

SUMMARY

[0008] In one aspect, a barrier is created with a pile arrangement to weaken the growing force of an incoming wave in a body of water.

[0009] Independently, one of the aspects of this invention is to create a wave barrier to weaken a growing force of an incoming tsunami wave.

[0010] Independently, one aspect is a pile arrangement for creating a wave barrier for waves in a body of water, in which the first wave is weakened by introducing obstacles that make it harder for that first wave to gain strength.

[0011] Independently, one aspect of this disclosure is to strategically position a series of modules of piles to provide a force barrier to meet the needs of any coast that might be struck by large waves, including a tsunami wave.

[0012] Independently, one aspect of the disclosure includes providing modules of piles driven into the floor of the body of water to reduce a percentage of the wave force as the wave travels to the shore. By the time the wave reaches the shore, a significant percentage of the force has been weakened by the modules of piles, and the impact is lessened.

[0013] Independently, in one aspect, a pile arrangement for creating a wave barrier for waves in a body of water includes at least a first module of piles driven into the floor at a first distance from the shoreline. At least a second module of piles is driven into the floor at a second distance from the shoreline that is greater than the first distance.

[0014] The first distance where the first module is located can vary. In one non-limiting example, the first distance is where the depth of the body of water from the floor to the surface of the body of water is at least 10 meters.

[0015] Independently, another aspect of the disclosure includes each pile in the first module and second module being driven in the floor allowing at least half of each pile to extend out of the floor.

[0016] Independently, in another aspect, the second module of piles is located at least 5 meters from the first module.

[0017] Independently, in another aspect, there is at least a third module of piles driven into the floor at a third distance from the shoreline. The third distance is greater than the first and second distances.

[0018] Independently, in another aspect, the third module of piles is located at least 10 meters from the second module.

[0019] Independently, in another aspect, there are a first plurality of modules of piles located at the first distance, with each module in the first plurality being laterally spaced from a second adjacent module. There are a second plurality of modules of piles located at the second distance, with each module in the second plurality being laterally spaced from a next adjacent module.

[0020] Independently, in another aspect, the second plurality of modules are located laterally between adjacent modules in the first plurality.

[0021] Independently, in another aspect, each of the modules is arranged in any one of: a straight row; a V-shape; or a row having at least one segment being in a V-shape.

[0022] Independently, in another aspect, the piles in each module are sheet piles.

[0023] Independently, in another aspect, the piles in each module are a pile tube.

[0024] Independently, in another aspect, there are at least 5 pile tubes in each module.

[0025] Independently, in another aspect, the pile tubes are connected together serially.

[0026] Independently, in another aspect, the pile tubes are connected together by a welded connection.

[0027] Independently, in another aspect, the piles in each module are connected together serially.

[0028] Independently, in another aspect, the piles in each module are connected together by a welded connection.

[0029] Independently, in another aspect, a method for creating a wave barrier for waves in a body of water is provided. The body of water will have a floor and a shoreline. The method includes driving at least a first module of piles into the floor at a first distance from the shoreline. The method also includes driving at least a second module of piles into the floor at a second distance from the shoreline that is greater than the first distance.

[0030] Independently, in another aspect, the method includes driving at least first module of piles at the first distance, where the depth of the body of water from the floor to the surface of the body of water is at least 10 meters.

[0031] Independently, in another aspect, there is a step of driving a plurality of modules of piles into the floor at a distance from the shoreline that increases in multiples of 5 meters.
Independently, in another aspect, the step of driving at least a first module of piles into the floor includes driving a first plurality of modules into the floor at the first distance, with each module in the first plurality being laterally spaced from a next adjacent module. The step of driving at least a second module of piles into the floor at a second distance includes driving a second plurality of modules into the floor at the second distance, each module in the second plurality being laterally spaced from the next adjacent module.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a schematic diagram of a body of water, such as an ocean, showing how waves change in length and height as they draw closer to the shoreline;

FIG. 2 is a schematic diagram illustrating the drawback during a tsunami wave movement;

FIG. 3 is a perspective diagram of one embodiment of a pile arrangement made in accordance with principles of this disclosure, depicting the forces during a drawback;

FIG. 4 is a perspective diagram of the pile arrangement of FIG. 3 showing the incoming force of a wave;

FIG. 5 is a schematic, side view showing a pile arrangement driven in the ocean floor, in accordance with principles of this disclosure;

FIG. 6 is a top view of one embodiment of a pile arrangement including pile tubes arrangement in a module, in accordance with principles of this disclosure;

FIGS. 7A-7D show schematic diagrams of modules of pile arrangements, in accordance with principles of this disclosure;

FIG. 8 is a schematic diagram of one embodiment of a pile arrangement for creating a wave barrier, in accordance with principles of this disclosure; and

FIG. 9 is a schematic diagram of a second embodiment of a pile arrangement for creating a wave barrier, in accordance with principles of this disclosure.

DETAILED DESCRIPTION

In general, to improve the prior art, pile arrangements are provided to create a barrier for waves, in which the pile arrangement will weaken the growing force of an incoming wave, for example, an incoming tsunami wave.

In the embodiment of FIGS. 3-5, a pile arrangement made in accordance with principles of this disclosure is shown generally at reference numeral 10. In FIGS. 3-5, a body of water, such as an ocean, is schematically shown at 12. The body of water 12 has a floor 14 and a shoreline 13, being the location where the edge of the body of water 12 meets land.

In FIGS. 3-5, the pile arrangement 10 includes at least a first module 16 of piles 18 driven into the floor 14 at a first distance A (FIG. 5) from the shoreline 13. The pile arrangement 10 includes at least a second module 20 of piles 18 driven into the floor 14 at a second distance from the shoreline. The second distance is greater than the first distance A. That is, the second module 20 is spaced farther out from the shoreline 13 than the first module 16. In FIG. 5, the second distance is shown as distance A added to distance B.

By "piles", it is meant a deep foundation adapted to be driven into the earth for use as a structural element in a foundation or wall. Any type of pile can be used including various sheet piles such as tube (or pipe) piles, Z piles, U piles, or H piles. By the term "module", it is meant a group of piles forming a component that can be used in combination with other groups of piles.

Independently, in one non-limiting example, the first distance A from the shoreline that the first module 16 is located will be at the approximate location where the depth G (FIG. 5) from the floor 14 to the surface of the body of water 12 is at least 10 meters. It should be noted that in some instances, the first module 16 can be arranged in various configurations, including a straight configuration (FIGS. 7A) or other shapes such as V-shape (FIGS. 7B and 7C) or a row having at least one segment being in a V-shape (FIG. 7D). In the variations such as those shown in FIGS. 7B, 7C, and 7D, the floor 14 may be sloping among the piles 18 in a single module, so the depth G can vary among the piles 18 in a single module. In such instances, it should be understood that the first distance A in which the depth G from the floor 14 to the surface is an approximation and it can vary, even among individual piles in a single module.

In one example, and independently of other aspects, each pile 18 in the first module 16 is driven in the floor 14 to allow at least half of each pile 18 to stick out or extend out of the floor 16. This can be seen in FIG. 5, in which pile 18 includes a portion 22 above the floor 14 and a portion 23 driven in and being embedded within the floor 14.

Independent of other aspects, each pile 18 in the second module 20 is driven in the floor 14 to allow at least half of each pile 18 in the second module 20 to extend out of the floor 14. In FIG. 5, portion 25 can be seen above the floor 14, while portion 26 can be seen driven in and extending into the floor 14.

Although at least half of each pile is shown as one example, it should be understood that in other arrangements, this may vary, depending upon conditions. The length of the pile 18 itself is determined according to the location conditions and the ocean to floor depth.

Independently of other aspects, the second module 20 is located a distance B from the first module 16. In one example, distance B is at least 5 meters. That is, a difference between the second distance from the shoreline and first distance A from the shoreline is distance B, which is preferably at least 5 meters. This arrangement will allow for a gradual reduction of the income force of the wave.

Independently of other aspects, at least a third module 28 of piles 18 is driven into the floor 14 at a third distance from the shoreline. The third distance is greater than the first and second distances.

In one non-limiting example, the third module 28 is located a distance C from the second module 20. In one example, distance C is at least 10 meters from the second module 20. The third module 28 would also be located at least 15 meters from the first module 16. In other words, the third module 28 is located at least 15 meters farther from the shoreline than the first module 16, and is located at least 10 meters farther from the shoreline than the second module 20.

Independent of other aspects, a plurality of modules of piles 18 are driven into the floor 14 at a distance from the shoreline that increases in multiples of 5 meters. This strategy will allow for a gradual reduction of the incoming force of the wave. This can be seen in FIG. 5 for example. In FIG. 5, there is depicted a forth module at 30, a fifth module at 32, and a sixth module at 34. It should be understood that more or fewer modules than those shown in FIG. 5 can be used.
[0054] Independently of other aspects, in FIG. 5 the rows of modules are placed following an increasing order system of multiples of 5. For example, the first module 16 is located at the first distance A, which is determined by the depth from the floor 14 to the surface of the ocean 12. The distance B between the first module 16 and second module 20 is at least 5 meters. The distance C between module 28 and the second module 20 would be the second multiple of 5, so that would be at least 10 meters. The distance D between the fourth module 30 and third module 28 is the next increasing multiple of 5, which would be at least 15 meters. The distance E between the fifth module 32 and the fourth module 30 is at least the next multiple of 5, which is at least 20 meters. The distance F between the sixth module 34 and the fifth module 32 is at least the next multiple of 5, which is at least 25 meters.

[0055] FIG. 6 illustrates a top view of one embodiment of one usable module 40 of piles 18. While the piles 18 can be various types of piles including sheet piles including Z, U, or H, in the example shown, the piles 18 are pile tubes 42.

[0056] Each of the pile tubes 42 can be in the form of steel pipes.

[0057] Independent of other aspects, in the example shown in FIG. 6, the module 20 includes a plurality of pile tubes. The particular example shows at least 5 pile tubes 42 in the module 40. This number can vary, depending on conditions.

[0058] Independent of other aspects, the pile tubes 42 may be connected together serially. By serially, it is meant that each pile tube 42 is connected to its next adjacent pile tube 42 with a connector 44.

[0059] Independent of other aspects of this disclosure, each pile tube 42 is connected to its next adjacent pile tube 42 by a welded connection 46. In the embodiment shown, the welded connection 46 includes a male connecting element 48 welded to one side of one of the pile tubes 42, and a female connecting element 50 welded to the opposite side of the pile tube 42 over the length, and in some instances, the entire length, of the pile tube 42. The pile tubes 42 are driven into the floor 14, one at a time, with the male connecting element 48 welded to one pile tube 42 inserted in and interlocked with the female connecting element 50 that is welded to the next adjacent pile tube 42. This is just one type of connection illustrated. It should be understood that many alternative connections can be used.

[0060] The module 40 in FIG. 6 is arranged in a straight row 52. As explained in connection with FIGS. 7A-7D, the modules 40 can be arranged in other shapes.

[0061] In one example, the module 40 has an overall width between the outside edges of the outer pile tubes 42 of approximately 10 meters. This width, of course, can vary.

[0062] FIGS. 7A-7D illustrate a few example configurations of module 40. Also shown in FIGS. 7A-7D are the forces of the wave 11 as they hit the module 40. In each of FIGS. 7A-7D, the piles are in the form of pile tubes 42, but could be other types of piles. However, pile tubes 42 are preferred because of certain advantages.

[0063] In FIG. 7A, the module 40 is shown in a straight row 52. This straight row 52, in general, would be about approximately parallel to the shoreline. It can be seen how the wave 11 hits the module 40 directly, and its energy is diffused and directed along the outer sides of the module 40.

[0064] FIG. 7B illustrates module 40 in the form of a V-shape 54. In this embodiment, there are two rows 56, 57 of pile tubes 42 that are angled relative to each other to form the V-shape 54. In this example, the vertex 58 of the V-shape 54 is pointed closer to the shoreline. The income waves can be seen directed inside of the V-shape 54 between row 56 and row 57. The wave 11 is then deflected back along the rows 56, 57, to help diffuse the energy of the wave.

[0065] FIG. 7C is a reverse V-shape 60 made of first and second rows 61, 62 of pile tubes 42 at angles relative to each other and having a vertex 63. The reverse V-shape module 60 is oriented in an opposite direction as the V-shape module 54 relative to the shoreline. In FIG. 7C, the wave 11 can be seen engaging the vertex 63 and then diffusing along the rows 61, 62.

[0066] FIG. 7D shows a module 40 arranged in a shape including a row 66 having at least one segment 68 in a V-shape. Although many variations are possible, in the particular illustrated embodiment, the module 40 of FIG. 7D includes first and second straight row segments 72, 73 having the V-shaped segment 68 therebetween. The V-shaped segment is made of rows 75, 76 angled next to each other and forming a vertex 77 in-between. The row 75 is connected to and angled relative to the first straight row segment 72. The row 76 is connected to and angled relative to the second straight row segment 73. The force of the wave 11 can be seen as it hits the vertex 77, and the energy is diffused along rows 75, 76 and first and second segments 72, 73.

[0067] Independent of other aspects, the pile arrangement 10 can include a first plurality 80 of modules 40 located at the first distance A from shore 13. Each module 40 in the first plurality 80 will be laterally spaced from a next adjacent module 40. An example is shown in FIGS. 8 and 9. FIG. 8 illustrates three modules 78, 79, 81 in the first plurality 80. FIG. 9 illustrates two modules 98, 99 in the first plurality 80. It should be understood that the first plurality 80 includes at least two modules 40, and may include more than three modules 40. The lateral spacing between each for the modules 40 can vary depending upon conditions. In some examples, the lateral spacing can include the spacing of a typical width of the module 40. In one example, this can be approximately 10 meters. It should be understood that this lateral spacing can vary to be more or less than the width of the module 40 and can include many distances.

[0068] Independently of other aspects, there is a second plurality 82 of modules 40 located at the second distance. Each module 40 in the second plurality 82 is laterally spaced from a next adjacent module 40. In the example shown in FIG. 8, there are two modules 84, 85 in the second plurality 82. In the example shown in FIG. 9, there are three modules 101, 102, 103 in the second plurality 82. The second plurality 82 can include at least two modules 40 and may include many more than three modules 40. These are examples only.

[0069] The lateral spacing between the modules 40 in the second plurality 82 can vary, depending upon conditions. In one example, the spacing will be about the same as a typical overall width of the module 40, but again, this can vary depending upon conditions and objectives.

[0070] Independent of other aspects, in one example pile arrangement 10, at least some of the second plurality 82 of modules 40 is located laterally between adjacent modules 40 in the first plurality 80. This arrangement will help to break up the incoming waves and reduce the energy of a tsunami wave. As can be seen in FIG. 8, the module 84 in the second plurality 82 is spaced laterally from the module 85 in the second plurality 82. The module 84 is also located laterally between
module 78 and module 79 of the first plurality 80. Module 85 is located laterally between module 79 and module 81 of the first plurality 80.

[0071] Independently of other aspects, there is a third plurality 88 of modules 40 located at the third distance. Each module 40 in the third plurality 88 is laterally spaced from a next adjacent module 40. In FIG. 8, there are three modules 89, 90 and 91 shown in the third plurality 88, while in FIG. 9, there are four modules 105, 106, 107, 108 in the third plurality 88. It should be understood that the third plurality 88 includes at least two and can include many more than three modules 40. In FIG. 8, module 88 is laterally spaced from module 90, and module 90 is laterally spaced from module 91.

[0072] Independent of other aspects, at least some of the module 40 in the third plurality 88 is located laterally between adjacent modules in the second plurality 82. For example, module 90 is located between modules 84 and 85 in the second plurality 82. Module 89 is located laterally of module 84. Module 91 is located laterally to the side of module 85.

[0073] Independent of other aspects, the pile arrangement 10 can include a fourth plurality 94 of modules 40 of piles located at the fourth distance. Each module 40 in the fourth plurality 94 is laterally spaced from a next adjacent module in the fourth plurality 94. FIG. 8 illustrates the fourth plurality as having two modules 95, 96. It should be understood that there can be more than two modules in the fourth plurality 94. The spacing between the modules 95, 96 can include at least a typical width of the module 40, but the spacing can vary depending upon conditions.

[0074] Independent of other aspects, the fourth plurality 94 of modules 40 includes some that are located laterally between adjacent modules in the third plurality 88. In the example shown in FIG. 8, module 95 is located laterally between modules 89 and 90 of the third plurality 88. Module 96 is located laterally between the modules 90, 91 in the third plurality 88.

[0075] In the placement of the pile arrangement 10 shown in FIG. 8, there are only four pluralities 80, 82, 88, and 94 illustrated. Each plurality represents a group of modules 40, wherein each specific group is located at the same approximate distance from the shoreline 13. It should be understood that more or fewer pluralities (or groups) of modules 40 can be used than those illustrated in FIG. 8.

[0076] In FIG. 8, in this example arrangement, all of the modules 40 are illustrated as straight row modules 52. It should be understood that any variety of shapes of modules 40, including V-shape 54 or reverse V-shape 60, or a module including the shape shown in FIG. 7D of a row 66 with a V-shaped segment 68 can be used. Other shaped modules 40 could be used, in addition to those shown in FIGS. 7A-7D.

[0077] In FIG. 9, another arrangement of pile arrangement 10 is illustrated. The first plurality 80, in this example, includes two modules 98, 99 located at first distance A and spaced laterally from each other. In this example, modules 98, 99 are straight row modules 52, but other shapes can be used.

[0078] Still in reference to FIG. 9, the second plurality of modules 82 includes modules 101, 102, 103. Module 102 is laterally between modules 101 and 103 and is spaced laterally from them. Module 102 is also laterally spaced between modules 98 and 99 in the first plurality 80. In this embodiment, however, it can be seen how module 102 has some portions that overlap laterally with modules 98, 99. However, module 102 is arranged to fill the gap and spacing between module 98 and 99. Although a variety of arrangements can be used, in this example, the second plurality 82 of modules 101, 102, 103 are in reverse V-shape 60 (FIG. 7C).

[0079] In FIG. 9, the third plurality 88 of modules is shown, which will be at the third distance. The third plurality 88 includes modules 105, 106, 107, and 108. Each of the modules 40 in the third plurality 88 are spaced laterally from each other. The module 106 can be seen filling the lateral gap between module 101 and 102 of the second plurality 82. Module 107 fills the lateral gap between module 102 and 103 of the second plurality 82. The modules 105-108 in the third plurality 88 are illustrated as V-shape modules 54 (FIG. 7B). It should be understood that any shape or arrangement of modules 40 could be used.

[0080] In FIGS. 8 and 9, the waves 11 can be seen impacting the modules 40 and being deflected or deflected around them. This will reduce the energy in the waves, and will weaken the growing force of the incoming wave, such as an incoming tsunami wave.

[0081] Returning again to FIG. 3, it can be seen how the pile arrangement 10 helps to weaken the water suction from the drawdown that adds force to the incoming tsunami wave. The drawdown force is broken up by the pile arrangement 10. In the example shown in FIG. 3, the first plurality 80 includes at least three modules 40, which have the form of reverse V-shaped modules 60. The second plurality 82 located at the second distance includes at least two modules 40 having V-shaped modules 54. The third plurality 88 located at the third distance from the shoreline 13 include at least three modules 40, which have the reverse V-shape 60.

[0082] In FIG. 4, the incoming force of the wave is shown with respect to the pile arrangement 10 of FIG. 3. The force of the incoming wave is weakened by the pile arrangement 10. As the wave hits the third plurality 88, it reduces a percentage of the wave force, and so on, as the wave 11 travels to the shore 13.

[0083] A method for creating a wave barrier for waves in a body of water, such as the ocean, is provided. The body of water will have a floor and a shoreline. The method includes driving at least a first module of piles into the floor at a first distance from the shoreline. The first module can include modules such as first module 16 being driven into floor 14 at the first distance.

[0084] The method can also include driving at least a second module of piles into the floor at a second distance from the shoreline that is greater than the first distance. This step can include driving at least a second module of the type shown at 20 into the floor 14 at a second distance greater than the first distance.

[0085] The first distance may be a distance where the depth of the body of water from the floor 14 to a surface of the body of water is at least 10 meters. This distance can vary depending upon conditions.

[0086] The method may also include driving a plurality of modules into the floor of the body of water. The plurality of modules can be driven into the floor at a distance from the shoreline that increases in multiples of 5 meters. For example, the second plurality will be spaced from the shoreline at a distance that is 5 meters farther than the first plurality. A third plurality would be spaced from the shoreline at a second multiple of 5 meters (e.g., 10 meters).

[0087] In one example, the step of driving at least a first module of piles into the floor will include driving a plurality...
of modules into the floor at the first distance, with each module in the first plurality being laterally spaced from a next adjacent module.

[0088] In one example, the step of driving at least a second module of piles into the floor at a second distance from the shoreline will include driving a second plurality of modules into the floor at the second distance, with each module in the second plurality being laterally spaced from a next adjacent module.

[0089] While many of the examples illustrated show pile tubes 42, it should be understood that many different forms of piles can be used. The piles in the modules can be connected. The connection can include many alternatives, including a welded connection.

[0090] The above specification, examples and data provide a complete description of principles including manufacture, use, arrangements, and methods of the invention. Many embodiments can be made using principles explained herein.

1. A pile arrangement for creating a wave barrier for waves in a body of water, the body of water having a floor and a shoreline, the pile arrangement comprising:
   (a) at least a first module of piles driven into the floor at a first distance from the shoreline; and
   (b) at least a second module of piles driven into the floor at a second distance from the shoreline that is greater than the first distance.

2. A pile arrangement according to claim 1 wherein:
   (a) the first distance is where the depth of the body of water from the floor to a surface of the body of water is at least 10 meters.

3. A pile arrangement according to claim 1 wherein:
   (a) each pile in the first module and second module is driven in the floor allowing at least half of each pile to extend out of the floor.

4. A pile arrangement according to claim 1 wherein:
   (a) the second module of piles is located at least 5 meters from the first module.

5. A pile arrangement according to claim 1 further comprising:
   (a) at least a third module of piles driven into the floor at a third distance from the shoreline, the third distance being greater than the first and second distances.

6. A pile arrangement according to claim 5 wherein:
   (a) the third module of piles is located at least 10 meters from the second module.

7. A pile arrangement according to claim 1 wherein:
   (a) there are a first plurality of modules of piles located at the first distance, each module in the first plurality being laterally spaced from a next adjacent module; and
   (b) there are a second plurality of modules of piles located at the second distance, each module in the second plurality being laterally spaced from a next adjacent module.

8. A pile arrangement according to claim 7 wherein:
   (a) the second plurality of modules includes at least some located laterally between adjacent modules in the first plurality.

9. A pile arrangement according to claim 5 wherein:
   (a) there are a first plurality of modules of piles located at the first distance, each module in the first plurality being laterally spaced from a next adjacent module; and
   (b) there are a second plurality of modules of piles located at the second distance, each module in the second plurality being laterally spaced from a next adjacent module.

10. A pile arrangement according to claim 9 wherein:
   (a) the second plurality of modules includes at least some located laterally between adjacent modules in the first plurality; and
   (b) the third plurality of modules includes at least some located laterally between adjacent modules in the second plurality.

11. A pile arrangement according to claim 1 wherein:
   (i) straight row;
   (ii) a V-shape; or
   (iii) a row having at least one segment being in a V-shape.

12. A pile arrangement according to claim 1 wherein:
   (a) the piles in each module is a sheet pile.

13. A pile arrangement according to claim 1 wherein:
   (a) the piles in each module is a pile tube.

14. A pile arrangement according to claim 13 wherein:
   (a) there are at least 5 pile tubes in each module.

15. A pile arrangement according to claim 14 wherein:
   (a) the pile tubes are connected together serially.

16. A pile arrangement according to claim 15 wherein:
   (a) the pile tubes are connected together by a welded connection.

17. A pile arrangement according to claim 1 wherein:
   (a) the piles in each module are connected together serially.

18. A pile arrangement according to claim 17 wherein:
   (a) the piles in each module are connected together by a welded connection.

19. A method for creating a wave barrier for waves in a body of water, the body of water having a floor and a shoreline; the method comprising:
   (a) driving at least a first module of piles into the floor at a first distance from the shoreline; and
   (b) driving at least a second module of piles into the floor at a second distance from the shoreline that is greater than the first distance.

20. A method according to claim 19 further comprising:
   (a) driving a plurality of modules of piles into the floor at a distance from the shoreline that increase in multiples of 5 meters.

21. A method according to claim 19 wherein:
   (a) the step of driving at least a first module of piles into the floor at a first distance from the shoreline includes driving the first module at the first distance being where the depth of the body of water from the floor to a surface of the body of water is at least 10 meters.

22. A method according to claim 19 wherein:
   (a) the step of driving at least a first module of piles into the floor at a first distance from the shoreline includes driving a first plurality of modules into the floor at the first distance, each module in the first plurality being laterally spaced from a next adjacent module; and
   (b) the step of driving at least a second module of piles driven into the floor at a second distance from the shoreline includes driving a second plurality of modules into
the floor at the second distance, each module in the second plurality being laterally spaced from a next adjacent module.