

PLATE TYPE OBSTACLES USED FOR COASTAL PROTECTION AND POWER GENERATION

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INTRODUCTION

Rubble mound breakwaters are widely used for coastal protection, despite they are responsible for several collateral affectations to the environment and the tourist sector. Due to the need of having coastal protection structures, breakwaters are necessary, but in order to minimize their negative impacts, alternative designs must be proposed. In this regards, a submerged horizontal plate can serve as a coastal protection element that can dissipate wave energy minimizing the negative effects mentioned above (Verduzco-Zapata et al., 2017). Moreover, such structures have the potential to be used as Wave Energy Converters (WEC), as they form, when interacting with incoming waves, a pulsating flow beneath the plate (Graw, 1992), which can be harnessed for energy extraction with a turbine.

The main objective of this study is to test in a wave flume, different types of submerged plates to evaluate the formation of the pulsating flow beneath the plates, using two Vectrino Profilers; and to estimate the hydrodynamic coefficients (reflection and transmission coefficients), using an arrangement of six wave staff, three before and three after the obstacle, following the recommendation by Mansard and Funke (1980). Four different prototypes (1/50 scale) were tested interacting with regular and irregular waves: a) a Solid Plate (SP); b) two Solid Plates (2SP); c) Venturi Plate Type (VPT); and d) a Ramp Plate Type (RPT). All had a length of 0.40 m and a thickness of 0.02 m. Each of the prototypes can be seen in Figure 1.

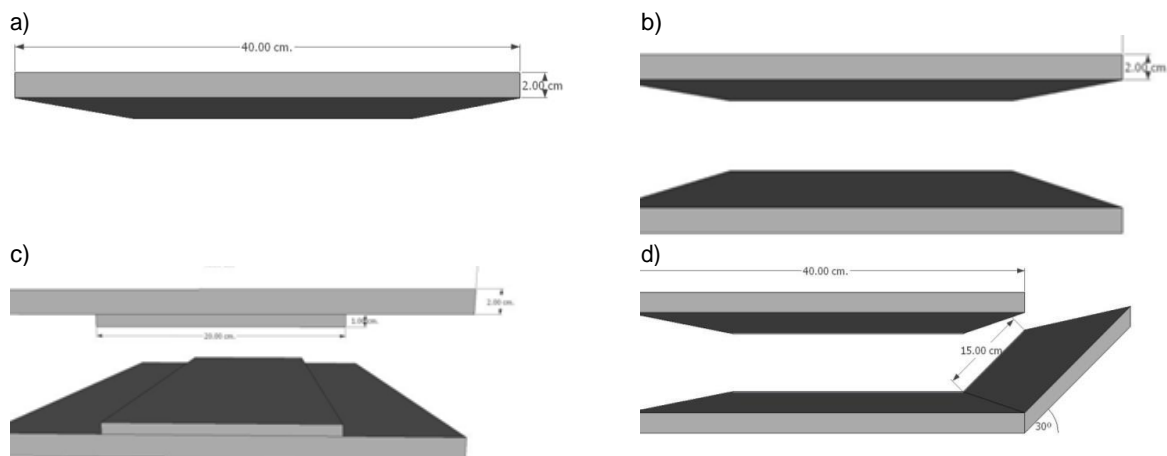


Figure 1. Lateral view of the: (a) SP plate; (b) 2SP plate; (c) VPT plate; and (d) RPT plate.

AVAILABLE BACKGROUND INFORMATION & DATA

The present study is performed in laboratory, in a wave flume 40m long, 0.85m wide and 1m high, located at the Marine Sciences Faculty of the University of Colima, in Manzanillo, Colima, Mexico. The wave flume features a piston-type wave generator equipped with an active wave absorbing system. The properties of the wave forcing system used in the experiments were chosen to be representative of the Tropical Pacific coast of Mexico. Ideally, the plates proposed in this study should be tested in a natural laboratory (a small area in the sea fully instrumented). The location of one of the laboratories will be in front of Campos beach (Figure 2), located in the southern part of Manzanillo. This beach is several km long with a regular morphology surrounded by fully vegetated boulders.

BRIEF STATE OF THE ART

The plates used for coastal protection and as a wave energy converters has called the attention of several researchers worldwide. Carter (2005), used BEM and linear potential theory to measure the diffraction velocity potential around the plate. It was found that when the plates induce high dissipation of the wave energy, its efficiency as a WEC would decrease. Orer and Ozdamar (2007), used a wave flume to study the effect of the wave

period and height in the magnitude of the pulsating flow beneath the plate. They included several structures below the main plate to reduce the gap between the plate and the bottom of the flume. Kharati-Koopae and Kiali-Kooshkghazi (2019), performed numerical experiments finding that an increase in wave height and wave period produces a more intense undercurrent, considering different opening areas beneath the plate and submergence depths.

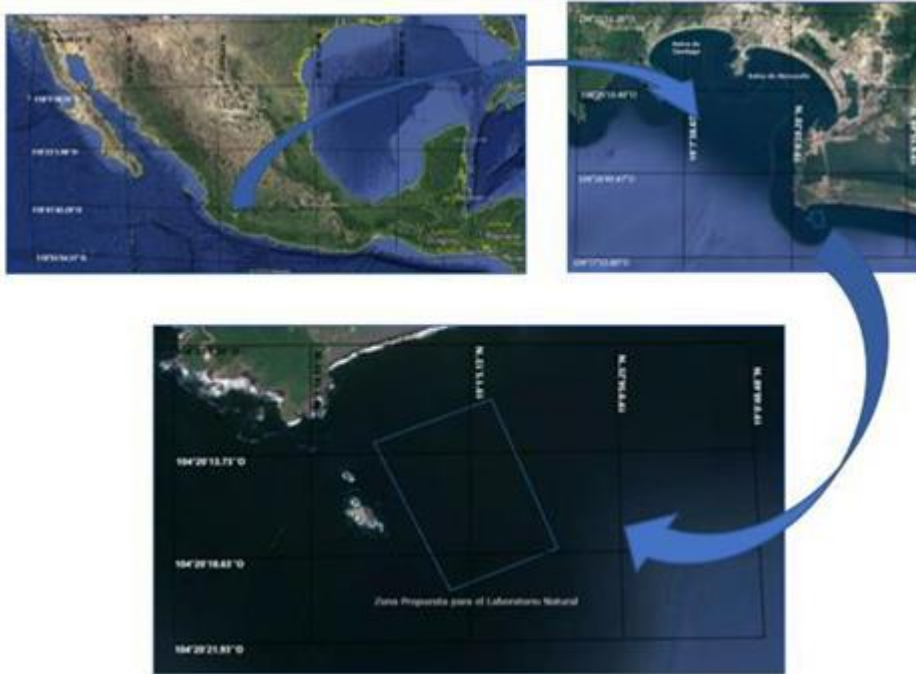


Figure 2. Future location of the natural laboratory in Campos Beach, Manzanillo, Colima, Mexico.

SUMMARY

A submerged horizontal plate obstacle can be used for coastal protection and as a WEC, considering that the pulsating flow formed below the plate, due to its interaction with the incoming waves, can be harvested using a turbine. Four prototypes (1/50 scale) with different plate geometries were tested with regular and irregular waves to evaluate their efficiency to generate the under current: a) a Solid Plate (SP); b) two Solid Plates (2SP); c) Venturi Plate Type (VPT); and d) a Ramp Plate Type (RPT). The tests were carried out in a wave flume 40m long, 0.85m wide and 1m high, located at the Marine Sciences Faculty of the University of Colima, in Manzanillo, Colima, Mexico. The preliminary results showed that the four types of plates gave a pulsating flow and are suitable to be used as coastal protection structures.

REFERENCES

Carter (2005): Wave energy converters and a submerged horizontal plate. Master Thesis. Master thesis. University of Hawai'i.

Grav (1992): The submerged plate as a wave filter the stability of the pulsating flow phenomenon, in: Proceedings of the International Conference on Coastal Engineering. pp. 1153-1160.

Kharati-Koopae, Kiali-Kooshkghazi (2019): Assessment of Plate-Length Effect on the Performance of the Horizontal Plate Wave Energy Converter. Journal of Waterway, Port, Coastal, and Ocean Engineering, vol. 145, pp.1-14.

Mansard, Funke (1980): The measurement of incident and reflected wave spectra using a least squares method. In: Proceedings of the 17th International Conference on Coastal Engineering, pp. 154-172.

Orer, Ozdamar (2007): An experimental study on the efficiency of the submerged plate wave energy converter. Renewable Energy, vol. 32, pp. 1317-1327.

Verduzco-Zapata, Ocampo-Torres, Mendoza, Silva, Cabello, Torres (2017): Optimal submergence of horizontal plates for maximum wave energy dissipation. Ocean Engineering, vol.142, pp. 78-86.

EXCEED - SWINDON Conference 2019

THE FUTURE OF WATER RESOURCES

October 13th - 16th, Mérida, Mexico



Programme and Book of Abstracts

PROGRAMME

Sunday, 13 th		Arrival	
19:00	-	21:00	Welcome cocktail

Monday, 14 th		Conference Day 1	
08:30	-	09:00	Registration
09:00	-	09:30	Opening Ceremony <ul style="list-style-type: none"> • Norbert Dichtl • Andreas Haarstrick • Rodolfo Silva • Local authority
09:30	-	10:00	Keynote speech <ul style="list-style-type: none"> • Norbert Dichtl
10:00	-	10:10	Break
Session 1: The impact/performance/role of SDGs Chairman: Valeria Chávez			
10:10	-	10:30	Exploring some ocean energy possibilities in Latin America (Jassiel Hernández)
10:30	-	10:50	Water energy nexus in the MENA region (Abbas Al-Omari)
10:50	-	11:10	Ocean energy and marine biodiversity affectations: a life cycle assessment review (Dora Ruiz-Méndez)
11:10	-	11:40	Coffee Break
Session 2: Water-Energy-Nexus (I) Chairman: Dwi Andreas Santosa			
11:40	-	12:00	Wastewater/waste to energy in MENA region: A review for opportunities (Zeinab Abou Elnaga)
12:00	-	12:20	Water-energy nexus in a wastewater treatment plant: Energy efficiency and recovery (Wang Hongtao)
12:20	-	12:40	From wastewater treatment plants to a resources recovery facility (Marcelo Nolasco)
12:40	-	13:00	Seasonal assessment of the energetic potential associated with salinity gradient: Champoton River, Mexico (Gregorio Posada Vanegas)
13:00	-	14:30	Lunch
Session 3: Water, ecosystem and socio-economic integrating aspects (I) Chairman: Germán Rivillas			
14:30	-	14:50	Decolourization and mineralization of acid green 25 dye through single and catalytic ozonation (Liliana Amaral Féris)

14:50	-	15:10	Adsorption of naphtholate-as dye in wastewater of batik industry using green synthesized zn layered hydroxyl salts (Sri Juari Santosa)
15:10	-	15:30	Adsorption of hexavalent chromium in coal beneficiation tailing in fixed bed column (Liliana Amaral Féris)
15:30	-	15:50	Kinetics of the adsorption of anionic and cationic dyes in aqueous solution by low-cost activated carbons prepared from sea cake and cotton cake (Ibrahim Tchakala)
15:50	-	16:10	Distribution of microplastics in water and sediment in a Biosphere Reserve (Cecilia Enriquez)
16:10	-	16:30	Evaluation of microplastics contamination in the margins of the Patos Lagoon in south of Brazil (Eduardo Saldanha Vogelmann)
16:30	-	17:00	Coffee Break
Session 4: Water, ecosystem and socio-economic integrating aspects (II) Chairman: Rodolfo Silva			
17:00	-	17:20	Hydrodynamic modelling of the Huave Lagoon System, Oaxaca (María Fernanda González Amador)
17:20	-	17:40	Impact effects of hard infrastructure in Salamanca Natural Park (Juan Carlos Caez-Perez)
17:40	-	18:00	The decision-making in face to coastal squeeze, analysis between social and economic impacts: Case study of Campeche, Mexico (Debora L. Ramírez-Vargas)
18:00	-	18:30	Keynote speech • Elvis Carissimi
20:00			Dinner

Tuesday, 15th		Conference Day 2	
Session 5: Water, ecosystem and socio-economic integrating aspects (III) Chairman: Arwa Naser Damen Hamaideh			
09:00	-	09:20	Dispersion of submarine groundwater discharges in reef lagoons and associated environmental effects (Arlett Rosado Torres)
09:20	-	09:40	Salt intrusions into a freshwater spring in a tropical coastal lagoon, Yucatán, Mexico (Xaní Malagón)
09:40	-	10:00	Variability of the saline gradient in a hypersaline coastal lagoon (Brenda Natalia Fitch Geymonat)
10:00	-	10:20	Sedimentation and water quality status of lake Tana, the headwaters of the Blue Nile, Ethiopia (Seifu A Tilahun)
10:20	-	10:40	An innovative approach to mitigate risks on the existing iron tailings dams in Brazil (Jose Araruna)

10:40	-	11:00	Urban sustainable water management and water efficiency improvement for buildings – a case study for Istanbul (Ahmet Baban)
11:00	-	11:30	Coffee Break
Session 6: Water-Energy-Nexus (II) Chairman: Eduardo Saldanha Vogelmann			
11:30	-	11:50	Reverse electrodialysis for energy and water: coupled systems based in salinity gradients (Mateo Roldan-Carvajal)
11:50	-	12:10	Development of graphene oxide membranes for its use in reverse electrodialysis systems (Eddie López Honorato)
12:10	-	12:30	Development of graphene oxide based materials for water treatment (Ana Cecilia Reynosa Martinez)
12:30	-	12:50	Laboratory experiences on marine energy conversion devices for supplying electricity demand of remote coastal communities (Jassiel Hernández)
12:50	-	13:10	Plate type obstacles used for coastal protection and power generation (Luis Eduardo Pérez Paez)
13:10	-	14:40	Lunch
Session 7: Water, ecosystem and socio-economic integrating aspects (IV) Chairman: Thi Thanh Van Ngo			
14:40	-	15:00	Evaluating combinatorial water treatment by locally available materials (Chrispin Kowenje)
15:00	-	15:20	Desalination by capacitive deionization as a tool to provide drinkable water to small communities in the Brazilian semiarid (Luis Augusto Martins Ruotolo)
15:20	-	15:40	Fluoride ions removal from groundwater by alumina adsorption (Elvis Carissimi)
15:40	-	16:00	Bio-refineries: A new concept towards green energy production from agroindustrial wastewater (Víctor Alcaraz)
16:00	-	16:20	The importance of water and nutrients management in paddy fields as an effort to increase crop yields and producing an electrical energy through microbial fuel cells (Dwi Andreas Santosa)
16:20	-	16:50	Coffee Break
16:50	-	17:20	Keynote speech • Klaus Fricke
16:50	-	18:00	Panel discussion Moderators: Edmilson Santos de Lima and Norbert Dichtl
20:00			Gala dinner