UNIVERSITI TEKNOLOGI MARA

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MEC299

RESISTANCE OF FLOW OVER SUBMERGE PILLAR OF DIFFERENT SURFACE ROUGHNESS - AN EXPERIMENT

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ABSTARCT

This impact force could not only alter the dynamic load pattern on the pillar, but it could also cause significant structural vibration. The precise effect of roughness on fluid flow is unknown, but a working estimate has been offered by a number of authors over time. to investigate the relationship between surface roughness of pillar and flow over a submerged body using Circulation Water Channel. The application that will be used for this experiment is a circulation water channel. The purpose of the circulation water channel is to teach the fundamentals of fluid mechanics as they relate to hydraulic flow. According to the experiment, the flow of water around the pillar should increase as the velocity of water increases. To clarify the phenomenon, the graph of water flow rate is directly proportional to water velocity. When static analysis is performed on the pillar around which the wave flows in a stable state, the influence of fluid-structure coupling effect can be ignored.

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CHAPTER 1: INTRODUCTION

1.1 background study

Offshore oil and gas operations are growing rapidly with the high demand for energy and oil being the most important source of energy. Many studies indicate that discovery of future oil will be based more in offshore than onshore areas. However, vast offshore facilities and activities create negative social impacts, such as safety issues. Therefore, sustainability in offshore operation and design is a major challenge in the offshore industry. A framework for stakeholders in the offshore industry which can be used as an effective tool to evaluate and assess the design and materials selection, considering sustainability, at the conceptual stage of a project has been developed. (Al-Yafei, 2018)

Offshore areas are rough and high energy areas. Therefore, offshore constructions are prone to high technical risks. This chapter elaborates on the technical risks of corrosion and biofouling and technical risks through mechanical force.(Buck & Langan, 2017)

The construction of offshore facilities for development of oil and gas deposits is preceded by careful Conceptual Studies, Front-End Engineering Design Studies (FEED studies) and a Detailed Engineering phase including accurate construction planning. Still, incidents during the Construction Phase could lead to needs for implementation of physical strengthening of construction details or changes to the construction process. These incidents could emerge from information coming from the construction of other facilities, detection of design errors or aspects which were overseen during the engineering phase. Serious consequences, like loss of assets or fatalities, could occur in case the unexpected information was not assessed and changes were not implemented.(Gudmestad, 2019)

Forward for underwater pillar.(Al-Yafei, 2018). In the course of the propagation of waves from the offshore to the nearshore zone, the wave may break due to the shoaling effect. Strong impact forces are observed when the breaking wave acts on the pillar of the bridge. This impact force might not only change the dynamic load pattern on the pillar but also cause strong structural vibration. Finally, Discussion is provided on four emerging ideas to investigate breaking wave forces on the pillar from both science and engineering perspectives.(Wei et al., 2022)

Considering the studies of wave load on bridge pillars are lack of systematic summary and review, especially breaking wave load, This work provides an in-depth analysis of current research on breaking wave load on bridge piers in such aspect like: physical experiment, wave surrounding around the pillar with response of bridge pillar.(Wei et al., 2022)

1.2 problem statement

Surface roughness (texture) influences fluid flow in networks which has been studied for well over a century. The exact effect roughness has on fluid flow has not been completely understood, but a working estimate has been offered by a variety of authors over time.(Taylor et al., 2005) High water velocity underwater cause danger for construction of offshore structures and underwater projects(Ben C. Gerwick, 2014). Due to make increase more safety for construction the surface roughness of pillar can be examined to make movement flowing water to be more safety for the construction. Surface roughness is typically characterized using average amplitude parameters. The concept is that the surface roughness increases momentum transfer in the boundary layer near the wall. But this model includes a coefficient that must be determined experimentally.(Wagner & Kandlikar, 2012) When the surface roughness increases the flow of water will be safer for the construction. The water will be moving slowly and steady. This is because more roughness the water will be slower because there are so many obstacles that water crash when going through it.(Huang et al., 2010)

From the experiment from Rebecaa Noelani Wagner, it is useful to consider structured roughness to both control and measure those aspects of surface geometry individually, and also understand the effect of asperity height, slope, density, etc. of roughness on fluid flow,. The average amplitude parameters which are sufficient for uniform roughness are insufficient in representing structured or periodic roughness.(Wagner & Kandlikar, 2012)

Based on the DEM-CFD coupling method, In Weishuo Yan studies simulate the diffusion and movement of pillar in flowing water and discusses the effects of pouring velocity and water flow velocity on pillar. The main scope was to obtain numerical results which allowed us to show the influence of the dynamic pressure over each construction configuration type. (Yan et al., 2022)Additionally, improving surface roughness and decreasing water flow velocity could significantly reduce the velocity of the water flow.

However, there are not experimented to find resistance of flow over submerge pillar of different surface roughness that have been done before. The experiment will be done to find the velocity of the water and vortex water around some pillars that coated with different roughness.