Concept application for pipelines using a submerged floating tunnel for use in the oil and gas industry

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Abstrak

This paper describes the effort to develop a pipeline concept as a substitute for conventional pipelines that lie on the seabed. A submarine pipeline in a submerged floating tunnel (SFT) is presented as a potential way to avoid pipeline-related environmental concerns. The key task in developing this submarine pipeline concept is to integrate solutions to the environmental challenges associated with submarine pipelines into the SFT structure. From a technical standpoint, one of the most important design tasks is to calculate the SFT's buoyancy weight ratio (BWR) value, thereby determining the tunnel's stability. The greatest threat to stability is the phenomenon of tether slack, which occurs at a specific BWR value. The pipeline's weight affects its BWR value, so the weight must be restricted to ensure that tether slack does not occur. In the present study, the proposed SFT's BWR value was simulated by testing a laboratory model in various ballasts. Significant waves and individual waves in a hundred-year return period were investigated based on data related to Java Sea waves at the Indonesian Hydrodynamic Laboratory (IHL). This study tested the SFT laboratory model against regular waves to find the BWR value at which tether slack might occur. The obtained BWR value was used to determine the requirement for total pipeline weight. Using a 1:100 scale of the real environmental conditions, the laboratory results revealed that slack occurs in a significant wave when the BWR value is 1.2, making the maximum pipeline weight to be placed in the SFT 534 tons. For the individual wave, slack occurs when the BWR value is 1.4, making the maximum pipeline weight to be placed in the SFT267.214 tons.