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CORROSION AND MARINE FOULING IMPACTS ON OFFSHORE STRUCTURE INTEGRITY

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This study evaluates the corrosion and marine fouling impacts on offshore structure integrity in different marine zones. The time-dependent Melchers and Paik corrosion models consider different marine zones such as atmospheric, splash, and immersion. Meanwhile, time-dependent marine fouling is evaluated from Schoefs and Tran models. In addition, two aged offshore jacket platform models of the originally installed platform were selected to investigate the effect of corrosion along with marine fouling on the global strength of the jacket platforms. Malaysian waters' metocean data from a 100-year return period (extreme condition) is used to predict the jacket platform's behaviour by evaluating its global strength. The SACS software, a nonlinear finite element analysis software, is used to calculate the jacket platform's global strength, called pushover analysis. In addition, the jacket platform's global strength is calculated by the Reserve Strength Ratio (RSR) value, which is always used to estimate overall structure strength. The PETRONAS Technical Standard (PTS) evaluates safety assessments. According to this study, immersion zone corrosion is the most influential zone after splash zone corrosion. It was found that using Melchers corrosion model at the immersion zone, platform four legs and three legs can withstand

safe operation for 36 years and 55.5 years, respectively. Meanwhile, according to Paik corrosion model at the immersion zone, platform four legs and three legs can withstand safe operation for 37.5 years and 54.5 years, respectively. Furthermore, the addition of approximately 40% of the structural weight from marine fouling to the jacket platform reduces the global strength and shortens the safety lifetime. It was found that using Melchers corrosion model with the addition of the marine fouling model from Schoefs and Tran, platforms with four legs and three legs can withstand safe operation for 29 years and 50 years, respectively. Meanwhile, Paik corrosion model, with the addition of the fouling model from Schoefs and Tran, has four legs and three legs that can withstand safe operation for 29.5 years and 49.5 years, respectively. The study's findings indicate that the overall result of this study is useful for the oil and gas industry to estimate corrosion and marine fouling allowances at the early design stage and is very important for the safe design and operation of offshore structures.

Abstrak tesis yang dikemukakan kepada Senat Universiti Malaysia Terengganu sebagai memenuhi keperluan untuk Ijazah Sarjana Sains Teknologi Maritim dan Kejuruteraan

IMPAK KARATAN DAN KOTORAN MARIN TERHADAP INTEGRITI STRUKTUR LUAR PESISIR

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Kajian ini menilai kesan kakisan dan kekotoran marin terhadap integriti struktur luar pesisir di zon marin yang berbeza. Model kakisan bergantung masa Melchers dan Paik, mempertimbangkan zon marin yang berbeza, iaitu, atmosfera, percikan, dan rendaman. Sementara itu, fouling marin bergantung masa dinilai daripada model Schoefs dan Tran. Di samping itu, dua model platform jaket luar pesisir berumur bagi platform yang dipasang pada asalnya telah dipilih untuk menyiasat kesan pembaziran kakisan bersama-sama dengan kekotoran marin pada kekuatan global platform jaket. Data metocean perairan Malaysia daripada tempoh pulangan 100 tahun (keadaan melampau) digunakan untuk meramalkan gelagat platform jaket dengan menilai kekuatan globalnya. Perisian SACS, perisian analisis unsur terhingga tak linear, digunakan untuk mengira kekuatan global platform jaket, yang dipanggil analisis pushover. Selain itu, kekuatan global platform jaket dikira oleh nilai Nisbah Kekuatan Rizab (RSR), yang sentiasa digunakan untuk menganggar kekuatan struktur keseluruhan. Piawaian Teknikal PETRONAS (PTS) menilai penilaian keselamatan.

Menurut kajian ini, kakisan zon rendaman adalah zon paling berpengaruh selepas hakisan zon percikan. Didapati bahawa menggunakan model kakisan Melchers di zon rendaman, platform empat kaki dan tiga kaki boleh menahan operasi selamat selama 36 tahun dan 55.5 tahun, masing-masing. Sementara itu, menurut model kakisan Paik di zon rendaman, platform empat kaki dan tiga kaki boleh menahan operasi selamat selama 37.5 tahun dan 54.5 tahun, masing-masing. Tambahan pula, penambahan kira-kira 40% berat struktur daripada fouling marin ke platform jaket mengurangkan kekuatan global dan memendekkan jangka hayat keselamatan. Didapati menggunakan model kakisan Melchers dengan tambahan model fouling marin dari Schoefs dan Tran, platform dengan empat kaki dan tiga kaki boleh menahan operasi selamat selama 29 tahun dan 50 tahun, masing-masing. Sementara itu, model kakisan Paik, dengan tambahan model fouling daripada Schoefs dan Tran, mempunyai empat kaki dan tiga kaki yang boleh menahan operasi selamat selama 29.5 tahun dan 49.5 tahun, masing-masing. Dapatan kajian menunjukkan bahawa hasil keseluruhan kajian ini berguna untuk industri minyak dan gas untuk menganggarkan elaun kakisan dan kekotoran marin pada peringkat awal reka bentuk dan sangat penting untuk reka bentuk selamat dan operasi struktur luar pesisir.