INTISARI

Pemancangan fondasi tiang pada tanah pasir dapat menimbulkan perpindahan butiran tanah yang bersifat vertikal maupun lateral. Penelitian ini bertujuan untuk mengevaluasi pola perpindahan butiran tanah akibat pemancangan fondasi tiang dengan variasi kepadatan relatif (Dr) menggunakan metode *Geo-PIV* berbasis *Digital Image Correlation* (DIC). Penelitian dilakukan pada media uji pasir dengan variasi kepadatan 65%, 70%, 75%, 80%, 85%, 90%, dan 95%, menggunakan tiang baja berdiameter 10 mm yang dipancang ke dalam benda uji akrilik.

Data perpindahan diperoleh dari hasil *vectorial displacement*, *vertical-horizontal displacement*, serta visualisasi kontur zona pengaruh (*Influence zone*). Analisis dilakukan dengan pendekatan nilai ambang (*threshold*) yang ditentukan melalui proses *trial and error* agar hasil Geo-*PIV* terbebas dari *noise* akibat cahaya dan tekstur akrilik. Hasil penelitian menunjukkan bahwa jangkauan zona pengaruh cenderung meningkat seiring kenaikan kepadatan hingga 90%. Namun, menurun pada kepadatan 95% akibat resistansi dan *interlocking* antar butiran yang tinggi. Arah dominan perpindahan umumnya lateral, namun perpindahan vertikal maksimum tercatat sebesar 24.98 mm pada kepadatan 90%, dengan nilai rasio R/D vertikal tertinggi sebesar 2.50 dan horizontal kumulatif sebesar 4.55.

Penelitian ini membuktikan bahwa metode Geo-*PIV* efektif dalam memvisualisasikan pola perpindahan tanah akibat pemancangan, serta menunjukkan bahwa terdapat kepadatan optimum yang menghasilkan jangkauan pengaruh maksimal sebelum tanah menjadi terlalu kaku.

Kata kunci: pasir, pemancangan tiang, perpindahan tanah, kepadatan relatif.

ABSTRACT

Pile driving in sandy soil induces particle displacement in both vertical and lateral directions. This research aims to evaluate the displacement pattern of sand particles due to pile installation under varying relative densities using the Geo-PIV method based on Digital Image Correlation (DIC). The study was conducted using a sand test medium with relative densities of 65%, 70%, 75%, 80%, 85%, 90%, and 95%, and a steel pile with a diameter of 10 mm driven into an acrylic test box.

Displacement data were obtained from vectorial displacement, vertical-horizontal displacement, and visualized through contour plots of the Influence zone. Threshold values were determined through a trial-and-error approach to eliminate noise from lighting and acrylic surface irregularities. The results show that the extent of the Influence zone generally increases with density up to 90%, then decreases at 95% due to high resistance and interlocking between particles. While the dominant direction of displacement is generally lateral, the highest vertical displacement of 24.98 mm was recorded at 90% density, with the highest vertical R/D ratio of 2.50 and a cumulative horizontal R/D of 4.55.

This study demonstrates that the Geo-PIV method is effective in visualizing particle displacement patterns during pile driving and highlights the presence of an optimum density level that maximizes the Influence zone before the soil becomes excessively rigid.

Keywords: sand, pile driving, soil displacement, relative density.