

**OPTIMASI PRODUKTIVITAS DAN PENGURANGAN *WASTE* PADA  
PEKERJAAN *BORED PILE* MELALUI PENERAPAN *ADVANCED  
VALUE STREAM MAPPING* DAN SIMULASI *BUILDING  
INFORMATION MODELLING 4D***

**STUDI KASUS: GEDUNG SIDANG PARIPURNA IBU KOTA  
NUSANTARA, PENAJAM PASER, KALIMANTAN TIMUR**

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**ABSTRAK**

Pekerjaan *bored pile* pada Proyek Gedung Sidang Paripurna Ibu Kota Nusantara memiliki tingkat kompleksitas tinggi karena dipengaruhi oleh kondisi tanah, kinerja alat, alur kerja, dan koordinasi pelaksanaan di lapangan. Penelitian ini bertujuan menganalisis produktivitas pekerjaan *bored pile* berdasarkan nilai *Rate of Penetration* (ROP) dan *Cycle Time* (C/T), mengidentifikasi *waste* menggunakan *5 Why Analysis*, menyusun *Current State* dan *Future State Value Stream Mapping*, serta mengembangkan simulasi *Building Information Modelling* (BIM) 4D sebagai media visualisasi alur dan jadwal pekerjaan. Penelitian menggunakan pendekatan campuran (*mixed methods*). Data diperoleh dari 302 sampel titik *bored pile* dan dianalisis melalui perhitungan *Cycle Time*, ROP, identifikasi *waste*, penyusunan *Advanced Value Stream Mapping* (AVSM), serta simulasi BIM 4D menggunakan *Autodesk Revit*, *Microsoft Project*, dan *Autodesk Navisworks Manage*. Hasil penelitian menunjukkan bahwa Zona 21 memiliki produktivitas tertinggi dengan nilai ROP sebesar 15,06 m/jam dan C/T terendah sebesar 81 menit 03 detik. *Waste* yang paling dominan adalah *waiting*, terutama pada aktivitas menunggu kedatangan *ready mix* saat pengecoran. Hasil penyusunan *Future State Value Stream Mapping* menunjukkan potensi penurunan total *cycle time* dari 549,38 menit menjadi 269,76 menit atau sebesar 50,8%, sedangkan waktu aktivitas bernilai tambah tetap sebesar 89,76 menit. Simulasi BIM 4D menunjukkan potensi pengurangan durasi pelaksanaan dari 78 hari menjadi 62 hari atau lebih cepat 20,51%. Dengan demikian, penerapan AVSM dan BIM 4D menunjukkan potensi dalam mendukung optimasi produktivitas dan pengurangan *waste* pada pekerjaan *bored pile* melalui perbaikan alur kerja.

**Kata kunci:** *bored pile*, produktivitas, *value stream mapping*, BIM 4D.

**PRODUCTIVITY OPTIMIZATION AND WASTE REDUCTION IN BORED  
PILE CONSTRUCTION THROUGH THE IMPLEMENTATION OF  
ADVANCED VALUE STREAM MAPPING AND BUILDING  
INFORMATION MODELLING 4D SIMULATION**

**CASE STUDY: NUSANTARA CAPITAL CITY PARIPURNA BUILDING,  
PENAJAM PASER, EAST KALIMANTAN, INDONESIA**

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**ABSTRACT**

*Bored pile construction at the Paripurna Building Project, Nusantara Capital City, Indonesia, is characterized by a high level of complexity due to variations in soil conditions, equipment performance, workflow, and field coordination. This study aims to analyze the productivity of bored pile construction based on the Rate of Penetration (ROP) and Cycle Time (C/T), identify waste using the 5 Why Analysis, develop Current State and Future State Value Stream Mapping, and develop a Building Information Modelling (BIM) 4D simulation as a visualization tool for construction workflow and scheduling. A mixed methods approach was employed. Data were collected from 302 bored pile samples and analyzed using Cycle Time calculations, ROP analysis, waste identification, Advanced Value Stream Mapping (AVSM), and BIM 4D simulation developed using Autodesk Revit, Microsoft Project, and Autodesk Navisworks Manage. The results indicate that Zone 21 achieved the highest productivity, with the highest ROP of 15.06 m/h and the lowest C/T of 81 minutes and 3 seconds. The dominant type of waste was waiting, particularly during waiting for ready-mix concrete delivery prior to concrete casting. The Future State Value Stream Mapping demonstrated the potential to reduce the total Cycle Time from 549.38 minutes to 269.76 minutes (50.8%), while the value-added time remained constant at 89.76 minutes. Furthermore, the BIM 4D simulation indicated the potential to reduce the construction duration from 78 days to 62 days (20.51%). Therefore, the implementation of AVSM and BIM 4D demonstrates the potential to improve productivity and reduce waste in bored pile construction through workflow optimization.*

**Kata kunci:** bored pile, produktivitas, value stream mapping, BIM 4D.