

กำลังรับน้ำหนักในแนวแกนของเสาเข็มเซ

นาย ประยูร รุ่งเรืองรัตนกุล



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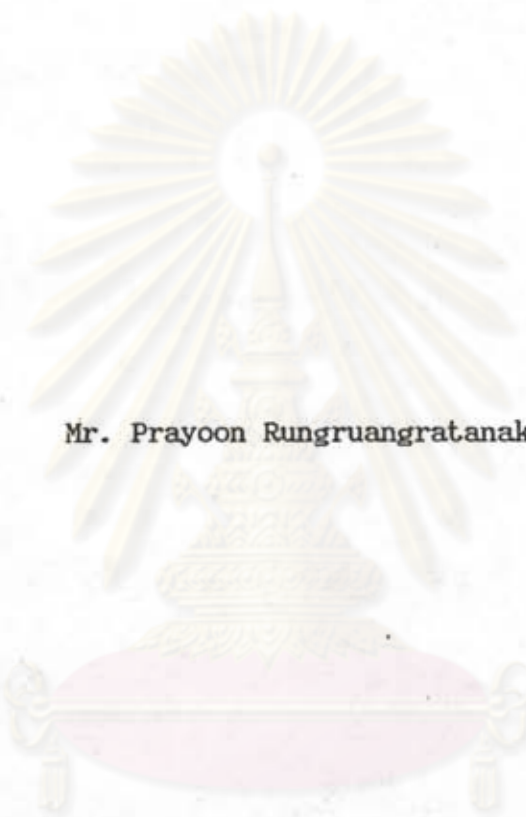
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CAPACITY OF AXIALLY LOADED SWAY PILES



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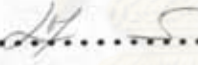
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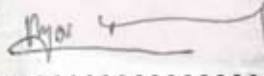
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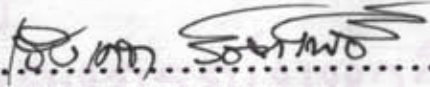
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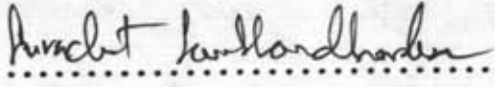

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This research presents a method of analysis for predicting the capacity of axially loaded piles forced to sway by horizontal soil movements arising from some external causes. The method employs the finite element for large deformation elastic static analysis and the computation of pile curvatures. Attention is confined to the case of a long sway pile situated in a soft soil stratum with the pile tip embedded in an underlying stiff soil stratum, in which failure occurs when the maximum bending moment developed in the pile is equal to the plastic or yield moment of the pile section. To obtain a suitable idealized finite element used in the analysis of the practical problems, parametric solutions for a wide range of idealized cases are presented and their advantages and limitations are discussed. Application of the proposed method to practical problems is then presented and discussed. Finally, the pile movements predicted by the proposed method and by conventional method are compared to field measurements and it is at once obvious that the proposed method leads to better accuracy.



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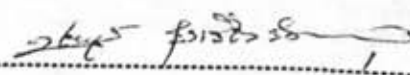
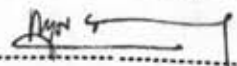
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งานวิจัยนี้เสนอวิธีการวิเคราะห์เพื่อหาค่ากำลังรับน้ำหนักบรรทุกของเสาเข็มเซ เนื่องจากถูกดินดัน โดยเน้นหนักเฉพาะกรณีของเสาเข็มยาวที่ฝังตัวอยู่ในชั้นดินอ่อนโดยปลายจมปลากลลงในชั้นดินแข็ง เบื้องล่าง ซึ่งการวิบัติเกิดขึ้นเมื่อโมเมนต์ในเสาเข็ม เท่ากับโมเมนต์ประลัยของหน้าตัดเสาเข็มนั้น วิธีการนี้ใช้การวิเคราะห์แบบสถิตย์ของไฟไนท์เอลลิเมนต์ที่ใช้กับปัญหาระยะเคลื่อนและการคำนวณหาความโค้งดัดของเสาเข็ม เพื่อหาแบบจำลองไฟไนท์เอลลิเมนต์ที่เหมาะสมสำหรับการวิเคราะห์ปัญหาที่เกิดขึ้นจริง ผลลัพธ์สำหรับการแปรเปลี่ยนพารามิเตอร์ที่เกี่ยวข้องพร้อมทั้งข้อจำกัดและข้อได้เปรียบได้จัดแสดงไว้ วิธีการที่เสนอนี้ให้ค่าตอบการเซของเสาเข็มใกล้เคียงกับที่วัดได้ในสนามและดีกว่าวิธีพื้นฐาน



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LIST OF SYMBOLS

| | |
|----------------------------|--|
| ${}^1A, {}^2A$ | the part of the area in the current, a second deformed configurations |
| B | linear strain-displacement transformation matrix |
| C_0, C_1, C_2 | the undeformed, the current deformed, a second deformed configurations |
| C_{IJMN} | component of constitutive matrix |
| d | width or diameter of the pile |
| ${}^2E_{i,j}, {}^1E_{i,j}$ | component of strain at a second, the current deformed configurations |
| $E_{i,j}$ | component of incremental strain between the current and a second deformed configurations |
| E_p, E_s | modulus of elasticity of pile, soil |
| $e_{i,j}$ | linear part of incremental strain |
| ${}^2f_i, {}^1f_i$ | component of body force at a second, the current deformed configurations |
| I_p | moment of inertia of the pile |
| K | nonlinear stiffness matrix |
| K_G | geometric stiffness matrix |
| K_L | linear stiffness matrix |
| L | depth of soil movement distribution |
| L_p | length of pile |
| M | moment in the pile |
| P | axial compression |

| | |
|--------------------------------------|--|
| 2P | generalized nodal load vector due to the body forces and the conservative surface tractions |
| Q_{mk} | component of incremental displacement at node m |
| 1R | consistent nodal load vector in equilibrium with the state of stress in the current deformed configuration |
| (s,t) | natural coordinates |
| ${}^2S_{IJ}, {}^1S_{IJ}$ | component of stress at a second, the current deformed configurations |
| S_{IJ} | component of incremental stress between the current and a second deformed configurations |
| ${}^2t_i, {}^1t_i$ | component of surface traction at a second, the current deformed configurations |
| ${}^2U_i, {}^1U_i$ | component of displacement at a second, the current deformed configurations |
| U_i | component of incremental displacement between the current and a second deformed configurations |
| ${}^0V, {}^1V, {}^2V$ | volume of the body in the undeformed, the current deformed, a second deformed configurations |
| W_{ext}, W_{int} | virtual work of external forces, internal forces |
| X_{mk} | component of nodal coordinate |
| z | depth below the ground surface |
| ${}^0\Omega, {}^n\Omega, {}^f\Omega$ | initial, current, final equilibrium stages |
| ψ | pile curvature |
| η_{IJ} | nonlinear part of incremental strain |
| $\phi^m(x)$ | interpolation function at node m |
| γ_p, γ_s | unit weight of pile, total unit weight of soil |
| ν_p, ν_s | Poisson's ratio of pile, soil |
| ρ_s | magnitude of soil displacement |

P_{sm}

maximum soil displacement



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จุฬาลงกรณ์มหาวิทยาลัย