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A Case Study on Pile Damage Assessment by Dynamic Monitoring

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SYNOPSIS : Pile foundations must have adequate soil support and the pile material must structurally be sound. Driven piles including predrilled ones are the most common installation methods of piles. When hammer impacts the pile, impact stresses are induced and the pile would probably be faced the most severe conditions in its life. Thus piles are easily damaged during driving. Unfortunately even the most experienced engineers cannot always identify the pile damage from the pile driving records. Dynamic monitoring using the PDA would provide the useful informations for pile damage assessment. This paper presents the cases obtained from several dynamic pile tests where pile damages have been verified. Case studies of damaged piles include concrete and steel pipe piles.

Key words : pile damage, pile driving analyzer, driving stress, compression stress, tension stress

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PDA(Pile Driving Analyzer) 가 (, 1998). PDA 가 가

PDA 가 PDA PDA

2 . PDA

(PDA) (dynamic monitoring)

가 가

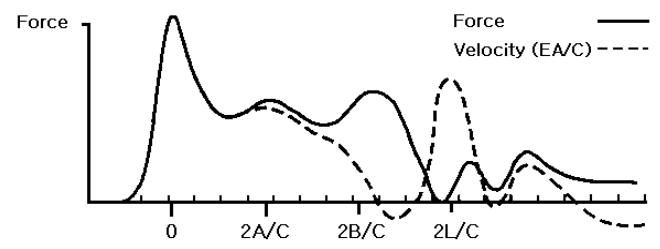
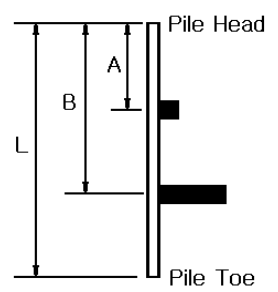
PDA (strain transducer) 가 (accelerometer)

PDA (force) (velocity) (stress wave propagation)

(proportionality) 가 가

가

1



1. (Hannigan, 1990)

1

"A"

"B"

"L"

2A/C(C : wave speed)가

2A/C , A

가

가 가

2A/C 2B/C

가

가

2B/C

A

가

가

2L/C가

(tensile wave)가

가

가

2

가

(a)

(warning box)

PDA

(b)

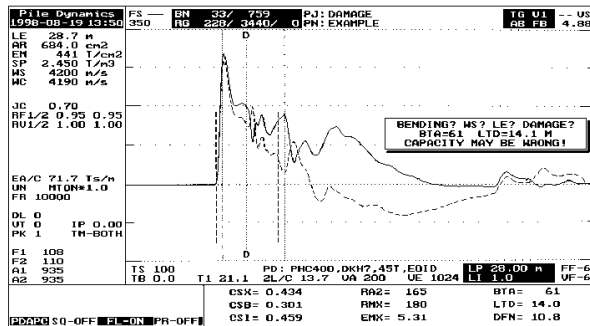
2

가

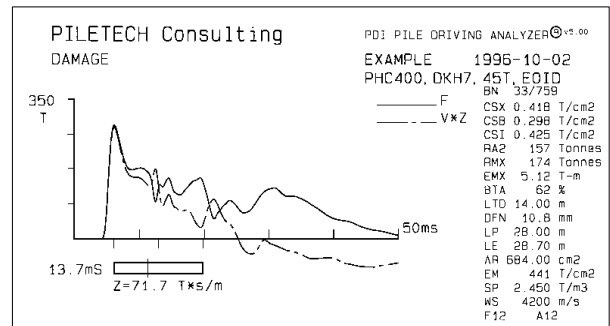
가

14 m

가



(a)



(b)

2.

(impedance : EA/C)가

PDA

(

(BTA)

(LTD)

(BTA)

Rausche and Goble(1979)

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1. Pile Damage Guidelines(Rausche and Goble, 1979)

BTA(%)	severity of damage
100	undamaged
80 - 100	slightly damaged
60 - 80	damaged
below 60	broken

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BTA

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CAPWAP

BTA

3. PDA

3.1 1

(PC, PHC)

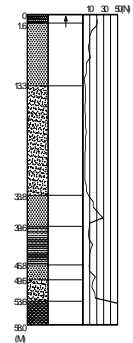
(compression stress)

(tension stress)

(bending stress)

0.5 0.6

f_c ('97 , $f_c:28$),
 $0.025\sqrt{f_c+f_{pe}}$ (FHWA, AASHTO, f_{pe} :)가



∅ 600 mm PHC(A-type: $f_{pe} = 0.040$

3.

(ton/cm²)

7 ton

3

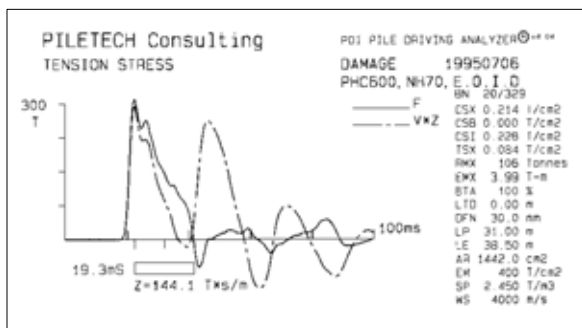
40 m

50

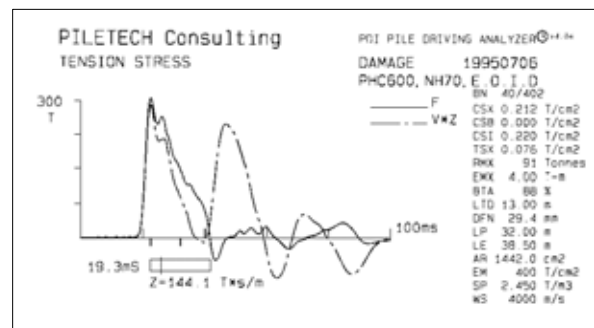
m

4

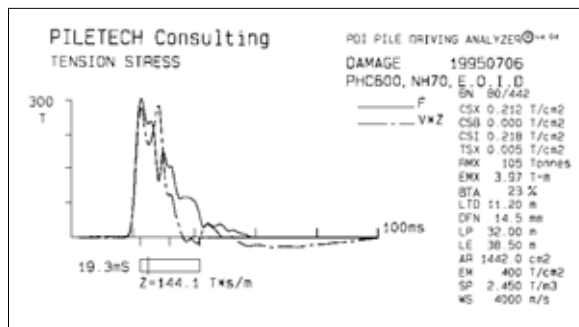
PDA



(a)



(b)



(c)

4.

4 (a)

PDA

(2

L/C, 19.3 m/s)

가

driving) 가

(easy
(BTA =

100). ()

(CSX) 0.214 ton/cm²

PHC

0.48 ton/cm²

(TSX) 0.084 ton/cm²

0.062 ton/cm² (0.025√f_c + f_{pe} = 0.062 ton/cm²)

4 (b)

13 m(LTD = 13 m)

가

(BTA) 88

%

4 (c)

11.2 m

(BTA) 23 %

(broken)

가

(B-type:

f_{pe} = 0.080 ton/cm²)

(13 ton)

PDA

3.2 2

가
가

0.9f_y('97

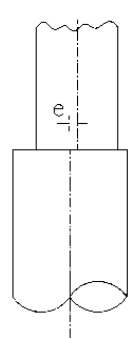
, FHWA , f_y :)가

driving) 가

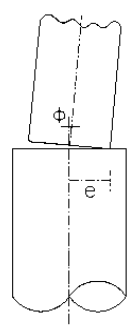
(eccentric

5

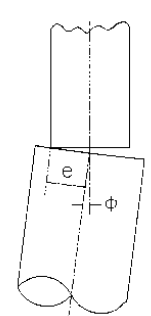
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(a)



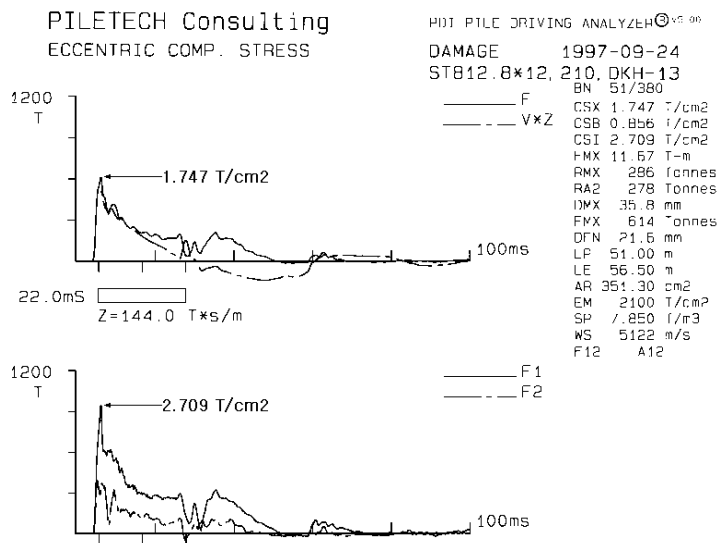
(b) 가



(c)

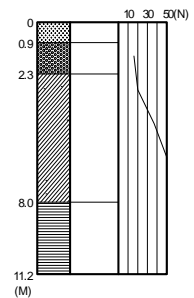
5.

6 13 ton ϕ 812.8×12(t) mm
 (SPS 400) PDA 2
 (F_1, F_2)
 (CSX, 2) 1.747 ton/cm² 2.16
 ton/cm² ($0.9f_y : 0.9 \times 2.4 = 2.16 \text{ ton/cm}^2$) 가 2
 (CSI, F_1) 2.709 ton/cm² 가
 가

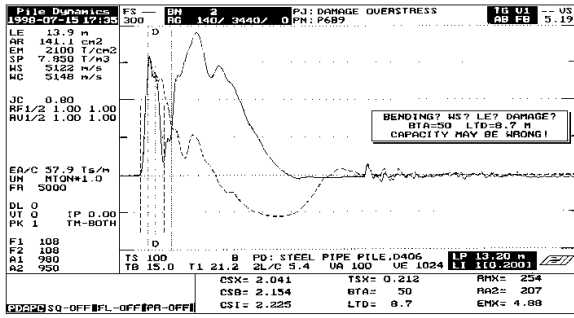


6.

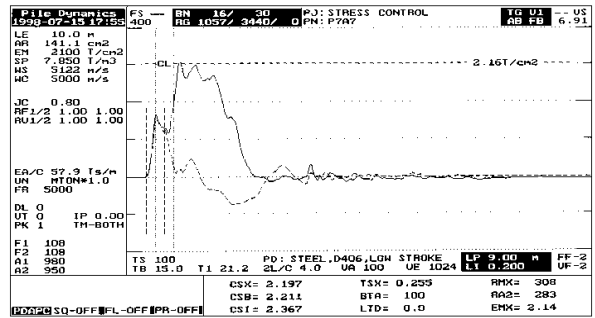
3.3 3 가 7
 ϕ 406×9(t) mm 7 ton
 가 2
 가 (restrike) 가
 8 PDA 0.8 m(EMX)
 : 4.88 ton-m
 9 0.8 m 0.4 m(EMX)
 : 2.14 ton-m (CSX) (CSB)
 PDA



7.



8.



9.

4. PDA

1994 PDA가
가 . PDA

30

PDA

. PDA

PDA

가

PDA

가

PDA

가

가

PDA

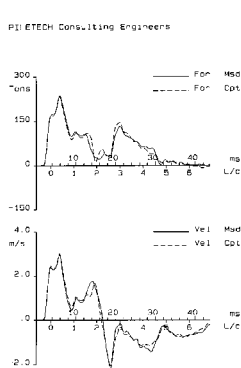
(SAIP)
10

ø 400 mm PHC
가

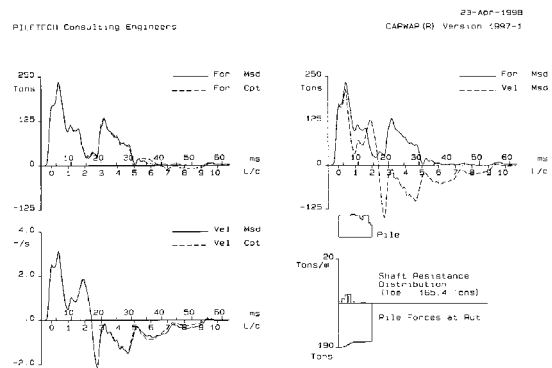
CAPWAP

11

10 CAPWAP



- MQ_{no} 7.87
 - R_s : 23.0, R_t : 200.4, R_u : 223.4
 10. (CAPWAP)



- MQ_{no} 3.42
 - R_s : 25.1, R_t : 165.4, R_u : 190.5
 11. (CAPWAP)

10 (For, Vel Msd) (For, Vel Cpt)가 CAPWAP
 MQno(Match Quality Number)가 7.87
 3.0 , () 가 . ,
 10 가
 5.
 PDA 가 .
 가
 가
 가 PDA
 가
 PDA 가
 PDA 가

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