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**Implementation
Package**

**WAVE
EQUATION
ANALYSIS
OF PILE
DRIVING**



**WEAP
PROGRAM**

Volume I – Background

Updated March 1981



U.S. DEPARTMENT OF TRANSPORTATION
Federal Highway Administration
Offices of Research and Development
Implementation Division
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Wave Equation Analysis of Pile Driving

WEAP PROGRAM

Vol. 1: Background

by

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Submitted to

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PREFACE

During the past 15 years wave equation computer programs have enjoyed a gradual but continual increase in use for the analysis of pile driving. The motivation for the preparation of the WEAP program (Wave Equation Analysis of Piles) came from problems which were experienced by the New York Department of Transportation when they attempted to implement routine wave equation analyses into their pile driving practice. They used a program prepared by the Texas Transportation Institute. In spite of the fact that this program is probably the most widely used wave equation program in the United States, serious difficulties were encountered in that unrealistic stresses were sometimes obtained for piles driven by diesel hammers.

The authors of this report have performed extensive research studies on pile driving emphasizing the measurement of force and acceleration during driving. These measurements involving piles driven by all types of hammers have been made for several states including New York. In order to take advantage of these measurements the Federal Highway Administration contracted with the authors to prepare a wave equation program which would accurately model the diesel hammer. Several years have passed since the TTI program was developed, so it could be expected that other general improvements could be introduced into the program for all types of hammers. Finally the large

volume of available measurements of force and acceleration at the pile top were used to test the program performance. No currently available program has been subjected to such a demanding and thorough testing.

This report is presented in four volumes. The first presents a general discussion of the use of the wave equation and how this particular program models the hammer-pile-soil system. Emphasis is placed on a discussion of the operation of diesel hammers and how that operation is modeled by WEAP. The second volume provides a description of program input and output and can serve as a user's manual for the program. It is strongly recommended that all users read Volume I prior to the User's Manual so that they will understand the assumptions contained in the program and how it is intended that it be used. The third volume was prepared to aid the computer operator during the initial stages of program and data file loading. It also contains a flow chart which may be of interest to those users who want to study the program in greater detail. The fourth volume contains the three parts of a lecture which is also available in the form of a tape/slide show. The contents of this narrative report deal with background, models and applications of the Wave Equation.

This "Background Report" together with program, "Manual" and "Documentation" was updated in 1980. As far as the Background Report is concerned, only typographical errors were eliminated. Manual and Documentation were more thoroughly reedited.

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LIST OF TABLES

<u>NO.</u>	<u>TITLE</u>	<u>PAGE</u>
1	DESCRIPTION OF TEST DATA	75
2	COMPARISON OF COMPUTED WITH OBSERVED QUANTITIES FOR TESTED DATA	77

LIST OF FIGURES

<u>NO.</u>	<u>TITLE</u>
2-1	A BEARING GRAPH DERIVED FROM THE ENGINEERING NEWS FORMULA
2-2	(A) THE SYSTEM TO BE ANALYZED; (B) THE WAVE EQUATION MODEL AND (C) THE COMPONENTS OF THE SOIL RESISTANCE MODEL
3-1	WORKING PRINCIPLE OF THE OPEN END DIESEL HAMMER
3-2	(A) SCHEMATIC AND (B) MODEL OF OPEN END DIESEL HAMMER
3-3	(A) STIFFNESS VS. COMPRESSION RELATION (B) STIFFNESS VS. COMPRESSION VELOCITY RELATION; BOTH FOR DRIVING SYSTEM COMPONENTS
3-4	EXAMPLE OF FORCE VS. DEFORMATION RELATION FOR COMPONENTS OF DRIVING SYSTEM
3-5	THE FOUR PHASES OF THE THERMODYNAMIC MODEL
3-6	MEASURED COMBUSTION CHAMBER PRESSURE
3-7	SCHEMATICS OF CLOSED END DIESEL HAMMERS (A) UNIFORM (B) NON- UNIFORM RAM
3-8	SCHEMATIC OF A VACUUM CHAMBER DIESEL HAMMER
3-9	SIMPLE ACTING AIR/STEAM HAMMER (A) DURING FALL (B) AFTER IMPACT
3-10	DIFFERENTIAL ACTING AIR/STEAM HAMMER (A) AFTER IMPACT (B) DURING FALL
3-11	AIR/STEAM HAMMER (A) SCHEMATIC AND (B) WEAP MODEL
3-12	(A) SCHEMATIC REPRESENTATION OF PILE AND (B) PILE AND SOIL MODEL
4-1	THE REAL LOAD DEFLECTION CURVE AND ITS MODEL. IN A CORRECT ANALYSIS QUAKES SMALLER THAN REAL MUST BE USED.
5-1	BLOCK DIAGRAM OF PROGRAM FLOW

LIST OF FIGURES (cont)

<u>NO.</u>	<u>TITLE</u>
6-1	COMPARISON OF PREDICTED WITH MEASURED PILE TOP FORCES AND COMBUSTION PRESSURES FOR PILE NO. 1
6-2	COMPARISON OF PREDICTED WITH MEASURED PILE TOP FORCE AND VELOCITY FOR (A) PILE NO. 2 AND (B) PILE NO. 3
6-3	FORCE AND VELOCITY MATCH FOR PILE NO. 4 (PURDUE)
6-4	FORCE AND VELOCITY MATCH FOR PILE NO. 5 (MIAMI DTP 3)
6-5	FORCE, VELOCITY AND PRESSURE MATCH FOR PILE NO. 6
6-6	FORCE AND VELOCITY MATCH FOR PILE NO. 7 (A) NORMAL PROGRAM PERFORMANCE, (B) USING PREIGNITION AND REDUCED FUEL SETTING
6-7	FORCE AND VELOCITY MATCH FOR PILE NO. 8 USING PREIGNITION AND REDUCED FUEL SETTING
6-8	FORCE AND VELOCITY MATCH FOR PILE NO. 9
6-9	FORCE AND VELOCITY MATCH FOR PILE NO. 10 (GEORGIA)
6-10	FORCE AND VELOCITY MATCH FOR PILE NO. 11
6-11	FORCE AND VELOCITY MATCH FOR PILE NO. 12 (CUYAHOGA RIVER)
6-12	FORCE AND VELOCITY MATCH FOR PILE NO. 13
6-13	FORCE AND VELOCITY MATCH FOR PILE NO. 14 (PHILADELPHIA)
6-14	FORCE AND VELOCITY MATCH FOR PILE NO. 15
6-15	FORCE AND VELOCITY MATCH FOR PILE NO. 16
6-16	FORCE MATCH AND THREE DIMENSIONAL FORCE PLOT FOR PILE NO. 17
A1	COMPARISON OF COMPUTED WITH MEASURED COMBUSTION AND EXPANSION CYCLE

WAVE EQUATION ANALYSIS FOR PILES
RESEARCH REPORT

TABLE OF CONTENTS

	Page No.	
PREFACE	ii	
ACKNOWLEDGEMENTS	iv	
LIST OF TABLES	v	
LIST OF FIGURES	vi	
TABLE OF CONTENTS	viii	
<u>CHAPTER 1</u>	<u>INTRODUCTION</u>	1
<u>CHAPTER 2</u>	<u>BASIC OPERATION AND USE OF THE WAVE EQUATION</u>	4
<u>CHAPTER 3</u>	<u>MATHEMATICAL MODELS</u>	13
	3.1 Introduction	13
	3.2 Hammer	13
	3.2.1 Working principle of Open End Hammer	13
	3.2.2 The Mechanical Model of the Open End Diesel Hammer	16
	3.2.3 The Thermodynamic Model of the OED Hammer	22
	3.2.4 Working Principle of the Closed End Diesel Hammer	29
	3.2.4.1 Hammer with Uniform Rams	31
	3.2.4.2 Hammers with non-Uniform Rams and Compression Tanks	33
	3.2.5 The Vacuum Chamber Hammer	35
	3.2.6 The Air/Steam Hammer Model	36
	3.3 Pile	42
	3.4 Soil	45
	3.5 Numerical Treatment	47

TABLE OF CONTENTS (Continued)

<u>CHAPTER 4</u>	<u>PROGRAM INPUT INFORMATION</u>	51
	4.1 Introduction	51
	4.2 Open End Diesel Hammer	51
	4.3 Closed End Diesel Hammers	53
	4.4 Air Steam Hammers	53
	4.5 Other Hammer Related Input Information	54
	4.6 Driving Accessories	57
	4.7 Pile	58
	4.8 Soil	62
	4.9 Other Program Options	64
<u>CHAPTER 5</u>	<u>PROGRAM FLOW</u>	67
<u>CHAPTER 6</u>	<u>PROGRAM PERFORMANCE</u>	72
	6.1 Introduction	72
	6.2 Data Selection	73
	6.3 Representation of Results	74
	6.4 Results	76
<u>CHAPTER 7</u>	<u>CONCLUSIONS AND RECOMENDATINS</u>	102
<u>APENDIX A</u>	<u>COMBUSTION CALCULATIONS USING COMBUSTION CHARTS</u>	104
	A.1 General Remarks	104
	A.2 Sample Calculations	105
	A.3 Discussion	108
<u>REFERENCES</u>		112
METRIC CONVERSION FACTORS		114