

TABLE OF CONTENTS

LIST OF FIGURES.....	<i>iv</i>
LIST OF TABLES.....	<i>vi</i>
CHAPTER 1 – INTRODUCTION.....	1
CHAPTER 2 – REVIEW OF LITERATURE ON LATERAL LOAD RESISTANCE OF PILE CAPS.....	2
CHAPTER 3 – REVIEW OF LITERATURE ON INTEGRAL BRIDGE ABUTMENTS.....	6
Mechanisms of Interaction between Abutment and Approach Fill.....	6
Temperature-Induced Forces.....	12
Advantages and Disadvantages of Integral Bridges.....	12
Unresolved Issues.....	16
Research Needs for Integral Abutment Bridges.....	17
CHAPTER 4 – FIELD LOAD TEST FACILITY.....	18
In-Ground Facility.....	18
Piles.....	18
Concrete for Pile Caps and Integral Abutment.....	18
Reinforcing Steel for Pile Caps and Integral Abutment.....	22
Roads, Drainage, and Weatherproofing.....	24
Loading Equipment.....	27
Instrumentation.....	27
Data Acquisition Hardware.....	32

Data Acquisition Software.....	32
Schedule.....	34
Costs.....	34
CHAPTER 5 – SUBSURFACE CONDITIONS AT THE FIELD LOAD TEST SITE.....	35
Site Description.....	35
Geology.....	35
Subsurface Conditions.....	35
Subsurface Investigation.....	36
Soil Borings.....	39
Observation Well.....	39
Dilatometer Tests.....	39
Block Samples.....	41
CHAPTER 6 – RESULTS OF LABORATORY TESTS ON SAMPLES FROM THE FIELD LOAD TEST SITE.....	43
Soil Description.....	43
Unit Weight Relations and Index Properties.....	43
Consolidation Tests.....	43
Strength Tests.....	49
CHAPTER 7 – LATERAL LOAD TESTS.....	56
Introduction.....	56
Load Test Results.....	56
Summary.....	60

CHAPTER 8 – CONCLUSION.....	62
REFERENCES CITED.....	63
APPENDIX A – COMPLETE LIST OF REFERENCES.....	66
APPENDIX B – DETAILS OF LOAD TEST FACILITY AND COST OF CONSTRUCTION.....	86
APPENDIX C – SOIL BORING LOGS.....	96

LIST OF FIGURES

Figure 1.	Comparison of published load-deflection curves.....	4
Figure 2.	Schematic integral bridge.....	7
Figure 3.	Details of integral bridges.....	8-9
Figure 4.	Integral backwall bridge.....	10
Figure 5.	Effects of temperature changes.....	11
Figure 6.	Earth pressures and temperature changes.....	13
Figure 7.	Plan view of field test site.....	19
Figure 8.	Foundation construction photos.....	20
Figure 9.	Plan view of anchor rod layout.....	21
Figure 10.	Tent shelter photos.....	25
Figure 11.	Hydraulic ram and steel struts positioned in loading trench...	26
Figure 12.	NE pile cap instrumentation plan.....	29
Figure 13.	Instrumentation in place for measuring deflections during lateral load test.....	30
Figure 14.	Photos of data collection system.....	33
Figure 15.	Timeline of construction and testing activities.....	35
Figure 16.	Site location map.....	37
Figure 17.	Subsurface profile at field test site.....	38
Figure 18.	Site plan and subsurface investigation drawing.....	40
Figure 19.	Excavating soil block samples.....	42
Figure 20.	Moist unit weight versus depth.....	44
Figure 21.	Liquid limit, plasticity index, natural moisture content, and percent passing No. 200 sieve versus depth for soils from the field test site.....	46

Figure 22.	Consolidation curves, strain versus log p.....	47
Figure 23.	Maximum values of p versus q for UU tests.....	53
Figure 24.	Maximum values of p' versus q for CU and CD tests.....	54
Figure 25.	Load deflection curves recorded at the ground surface. Pile caps in contact with undisturbed ground.....	57
Figure 26.	Load deflection curves recorded at the ground surface. Soil removed from sides of pile caps.....	58
Figure 27.	Vertical rotation of 36" deep cap. Front of cap moved down, back of cap moved up. Soil removed from sides of pile cap.....	59
Figure 28.	Deflection increase caused by removing soil from the sides of the pile caps.....	61
Figure B1.	Building a 200 kip load cell using 1/4" strain gauges connected in a full Wheatstone bridge circuit.....	92
Figure B2.	Load cell strain gauge circuit for measuring load.....	93
Figure B3.	Calibration curve for 200 kip load cell.....	94
Figure B4.	Calibration curve for deflection transducer No. 11.....	95

LIST OF TABLES

Table 1.	Summary of previous load tests to determine the lateral load resistance of pile caps.....	3
Table 2.	Advantages of integral abutment bridges.....	14
Table 3.	Principal disadvantages of integral bridges.....	15
Table 4.	Summary of index test results, unit weights, and soil classification for samples obtained from the field test site.....	45
Table 5.	Summary of consolidation test results on samples obtained from the field test site.....	48
Table 6.	Summary of UU test results on samples obtained from the field test site.....	50
Table 7.	Summary of CU test results on samples obtained from the field test site.....	51
Table 8.	Summary of CD test results on samples obtained from the field test site.....	52
Table 9.	Strength parameters from triaxial tests on undisturbed samples obtained from the field test site.....	55
Table B2.	Summary of pile driving data.....	88
Table B3.	Potentiometer standard specifications.....	89
Table B4.	Instrument calibration data.....	90
Table B5.	Cost of equipment and materials.....	91