

# **Automated Characterization of Bridge Deck Distress Using Pattern Recognition Analysis of Ground Penetrating Radar Data**

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## (ABSTRACT)

Many problems are involved with inspecting and evaluating the condition of bridges in the United States. Concrete bridge deck inspection and evaluation presents one of the largest problems. The deterioration of these concrete decks progresses more rapidly than any other bridge component, which leads to early concrete deck replacements that must be done before the bridge superstructure needs to be replaced. The primary cause of deterioration in these concrete decks is corrosion-induced concrete cracking, which frequently results in delaminations. Delamination distress increases the life cycle cost of maintaining a concrete bridge deck, particularly when it is not detected early on. Early detection of delamination distress can facilitate economical repair and rehabilitation work, but bridge engineers must recommend deck replacement if repairs are delayed too long or inspection tools cannot detect delaminations early enough.

The Federal Highway Administration has responded to the need for a better bridge deck inspection tool by contracting Lawrence Livermore National Laboratory to develop two new prototype ground penetrating radar systems. These two systems generate three-dimensional data that provide a representation of features that lie below the bridge deck surface. Both of these systems produce large amounts of data for an individual bridge deck, which makes automated data processing very desirable. The primary goal of the automated processing is to characterize bridge deck distress represented in the data. This study presents data collected from sample bridge deck sections using one of the prototype systems. It also describes the development and implementation of appropriate methods for automating data processing. The automated data processing is accomplished using image processing and pattern recognition algorithms developed and evaluated in the study.

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To my family and friends,  
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## Table of Contents

	<u>Page</u>
Abstract.....	i
Grant Information.....	ii
Dedication.....	iii
Acknowledgement.....	iv
List of Figures.....	viii
List of Tables.....	xi
 Chapter 1 - Introduction.....	1
1.1 Scope.....	1
1.1.1 Bridge deck distress.....	2
1.1.2 Infrastructure problems and current technological Solutions.....	3
1.1.3 Principles of GPR systems.....	7
1.1.4 The state of the art in ground penetrating radar for bridge deck applications.....	11
1.1.5 Pattern recognition and its application to GPR data collected from bridge decks.....	14
1.2 Bridge deck inspections.....	17
1.2.1 Economic problems with current bridge inspections and potential improvements.....	18
1.2.2 Prototype ground penetrating radar (GPR) systems....	19
1.3 Bridge deck distress detection using PERES and HERMES.....	23
1.3.1 Subsurface bridge deck feature detection using PERES.....	23
1.3.2 Data interpretation.....	24
1.3.3 Backpropagation algorithm.....	30
1.4 Data collection.....	32
1.5 Dissertation objective.....	34

	<u>Page</u>
Chapter 2 – Experimental study.....	35
2.1 Introduction.....	35
2.1.1 FHWA bridge deck sections.....	35
2.1.2 Data collection using PERES.....	36
2.1.3 Chain drag survey.....	38
2.2 PERES data collection from FHWA bridge deck sections.....	39
2.2.1 Deck section R13.....	40
2.2.2 Deck section R12.....	41
2.2.3 Deck section R11.....	42
2.2.4 Deck section R10.....	55
2.2.5 Deck sections R9, R8 and R7.....	60
2.3 Asphalt covered deck sections.....	61
2.3.1 Data collection from experimental slabs.....	62
2.4 Field data.....	64
Chapter 3 – Data processing algorithms.....	68
3.1 Processing algorithms for evaluating PERES data.....	68
3.1.1 Expert knowledge for processing algorithm development.....	68
3.2 Pattern recognition and image processing algorithm implementation fundamentals.....	69
3.2.1 Image processing.....	69
3.2.2 Template matching.....	69
3.2.3 Quadratic discriminant analysis.....	72
3.3 Algorithm description and implementation.....	74
3.3.1 Reinforcing steel detection algorithm.....	74
3.3.2 Distress detection algorithm.....	83
3.3.3 Combining results.....	90
Chapter 4 – Results.....	94
4.1 Pattern recognition algorithm performance.....	94
4.2 PERES system performance in use.....	94
4.3 Measurements of algorithm performance.....	100

	<u>Page</u>
4.3.1 Mean concrete cover depth.....	100
4.3.2 Reinforcing steel detection.....	104
4.3.3 Distress detection.....	109
4.4 Analysis of field data.....	114
4.5 Recommendations for improving PERES to achieve better algorithm performance.....	117
Chapter 5 – Conclusions.....	119
5.1 PERES data and analysis using pattern recognition.....	119
5.2 Comparisons of PERES (using a pattern recognition algorithm) and current bridge deck inspection techniques.....	120
5.3 Future applications of PERES with pattern recognition analysis.....	122
References.....	123
Appendix A - Bridge deck section images.....	127
Appendix B – Chain drag test results.....	134
Appendix C – FHWA concrete bridge deck sections.....	142
Appendix D – Error analysis.....	155
Appendix E – Concrete mix designs for fabricated deck sections.....	159

## List of Figures

<u>Figure</u>	<u>Page</u>
1.1 Diagram depicting delamination and void flaws.....	2
1.2 Raw two-dimensional GPR data.....	6
1.3 Distributions of measurement values for two feature classes.....	15
1.4 PERES transmitting and receiving antenna pair.....	20
1.5 PERES robotic cart.....	21
1.6 Reflected waveform from a metal plate collected using PERES.....	21
1.7 Power spectral density of metal plate reflection.....	22
1.8 HERMES trailer.....	22
1.9 Fabricated concrete bridge deck R13.....	25
1.10 Locations of simulated delaminations in bridge deck R13.....	26
1.11 Plan view 3-D image of PERES data for deck R13.....	27
1.12 Plan view 2-D image of PERES data for deck R13.....	28
1.13 Concept of antenna beamwidth.....	30
1.14 Radar pulses for generating a real aperture.....	31
2.1 PERES system setup for a fabricated deck section.....	37
2.2 Off diagonal view of reconstructed 3-D bridge deck R13 data.....	41
2.3 Location of high chloride content pooled water for deck R12.....	43
2.4 Plan view 3-D image of PERES data for deck R12.....	44
2.5 Side view 3-D image of PERES data for deck R12.....	45
2.6 Plan view 2-D image of PERES data for deck R12.....	46
2.7 Plan view 3-D image of PERES data for deck R11.....	48
2.8 Side view 3-D image of PERES data for deck R11.....	49
2.9 Plan view 2-D image of PERES data for deck R11.....	50
2.10 Plan view 3-D image of PERES data for deck R10.....	51
2.11 Plan view 3-D image of PERES data for deck R10 (2).....	52
2.12 Plan view 2-D image of PERES data for deck R10.....	53

<u>Figure</u>	<u>Page</u>
2.13 Plan view 2-D image of PERES data for deck R10.....	54
2.14 End view 3-D image of PERES data for deck R9.....	56
2.15 Plan view 3-D image of PERES data for deck R9.....	57
2.16 Plan view 2-D image of PERES data for deck R7.....	58
2.17 Plan view 2-D image of PERES data for deck R7.....	59
2.18 Experimental slab 1.....	62
2.19 Experimental slab 1 with 8 cm thick asphalt pieces.....	63
2.20 Form for experimental slab 2.....	63
2.21 Field data collection using PERES at the Van Buren St. Bridge.....	65
2.22 Plan view 2-D image of Van Buren St. Bridge (depth=6.0 cm).....	66
2.23 Plan view 2-D image of Van Buren St. Bridge (depth=9.0 cm).....	66
3.1 Template matching example signals.....	71
3.2 Elliptical decision boundary for the bivariate normal case.....	73
3.3 3-D image of tomographic radar data.....	75
3.4 Representation of example data layer sampled at constant depth.....	76
3.5 Plot of variance values calculated for tomographic layers.....	76
3.6 Hilbert transform of phase response for deck R7 (depth=3.9 cm)....	77
3.7 Hilbert transform of phase response for deck R7 (depth=7.4 cm)....	78
3.8 Filter for reinforcing steel template matching.....	79
3.9 Template matching result from deck R7 (top half).....	80
3.10 Template matching result from deck R7 (bottom half).....	81
3.11 Detected reinforcing steel locations, (traffic direction).....	81
3.12 Detected reinforcing steel locations, (transverse direction).....	82
3.13 Averaged responses to simulated distress and sound concrete.....	84
3.14 Distress detection template.....	86
3.15 Training data clusters plotted in measurement space.....	88
3.16 Binary image of pattern recognition results from deck R13.....	89
3.17 Filtered binary image of pattern recognition results from deck R13.	89
3.18 Reinforcing steel detection in the traffic direction.....	90
3.19 Reinforcing steel detection in the transverse direction.....	91

<u>Figure</u>	<u>Page</u>
3.20 Three largest detected distress areas (deck R13).....	93
3.21 Thirty largest detected distress areas (deck R13).....	93
4.1 Plain concrete experimental deck with 3 cm thick asphalt tiles.....	95
4.2 PERES waveform sampled from experimental slab 1.....	95
4.3 Raw PERES data from bridge deck R4.....	97
4.4 Raw PERES response to an aluminum pole.....	97
4.5 Experimental slab 2.....	98
4.6 Cross section image of PERES data from experimental slab 2.....	98
4.7 Mean cover depth (algorithm, measured and design values).....	101
4.8 Mean cover depth (algorithm and expert values).....	101
4.9 Detected reinforcing steel in the vertical direction (deck R8).....	105
4.10 Detected reinforcing steel in the horizontal direction (deck R8).....	105
4.11 Detected reinforcing steel in the horizontal direction (deck R12)....	108
4.12 Detected reinforcing steel in the horizontal direction (deck R9).....	108
4.13 Thirty largest detected distress areas in deck section R13.....	110
4.14 Three largest detected distress areas in deck section R12.....	111
4.15 Three largest detected distress areas in deck section R9.....	112
4.16 Three largest detected distress areas in deck section R8.....	112
4.17 Three largest detected distress areas in deck section R7.....	113
4.18 Reinforcing steel detection for Van Buren St. data (horizontal).....	115
4.19 Reinforcing steel detection for Van Buren St. data (104 degrees)...	115
4.20 Thirty largest distress detection responses (Van Buren St. data)....	116

## List of Tables

<u>Table</u>	<u>Page</u>
3.1 Pattern recognition classification for training data.....	88
4.1 Phase changes per meter for FHWA bare concrete deck sections....	103
4.2 Reinforcing steel detection performance (top layer, top mat).....	106
4.3 Reinforcing steel detection performance (bottom layer, top mat)....	106