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Procedures for Diagnosis and Assessment of Concrete Buildings

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Contents

List of Figures	ix
List of Tables	xii
Summary	xiii
Statement of Originality	xv
Acknowledgements	xvi
Principal Notations	xvii
1 Introduction	1
1.1 Background	1
1.2 Dealing With Defective Concrete Structures — An Overview . . .	5
1.2.1 General Procedure	5
1.2.2 Condition Survey of Existing Concrete Structures	7

1.2.3	Diagnosis of Defective Concrete Buildings	8
1.2.4	Condition Evaluation of Existing Concrete Structures . .	12
1.2.5	Decision-making and Repair Techniques	17
1.2.6	Non-destructive Test-based Approaches	20
1.2.7	Summary and Conclusions	21
1.3	The Overall Process for Dealing With Defective Concrete Build- ings	23
1.4	Objectives and Scope of Thesis	26
1.5	General Terminology	26
1.6	Layout and Contents of Thesis	27
2	Diagnosis of Defective Concrete Buildings	29
2.1	Introduction	29
2.2	Diagnostic Methods In Other Fields	30
2.2.1	The Overall Process of Diagnosis	30
2.2.2	Probabilistic Reasoning for Diagnosis	32
2.2.3	Diagnosis Using Fuzzy Reasoning	42
2.2.4	Other Approaches for Diagnostic Reasoning	44
2.3	Summary and Conclusions	48

2.4	A Method for Diagnosing Defective Concrete Buildings	50
2.4.1	Introduction	50
2.4.2	The Representation of Diagnostic Data	51
2.4.3	The Candidate Set of Hypotheses	55
2.4.4	Formation of Hypotheses	57
2.4.5	Diagnostic Reasoning	59
2.4.6	The Bayesian Interpretation of Diagnostic Reasoning	64
2.4.7	Sequential Diagnosis	64
2.4.8	Stopping Rule and Test Selection	68
2.5	Summary of This Chapter	70
3	Condition Evaluation of Existing Concrete Buildings	72
3.1	Introduction	72
3.2	Structural Reliability Analysis	74
3.2.1	Classical Reliability Method	74
3.2.2	Monte-Carlo Simulation Technique	76
3.2.3	First Order Second Moment Method	78
3.2.4	Advanced First Order Second Moment Method	81
3.2.5	Brief Summary of Structural Reliability Theory	84

3.3	Reliability Analysis Relevant to the Evaluation of Existing Structures	85
3.3.1	Safety Revision Using Bayesian Updating	86
3.3.2	Other Approaches for the Revision of Structural Reliability	92
3.3.3	Brief Summary on Reliability Updating	96
3.4	Structural Safety Evaluation Using Fuzzy Sets	97
3.5	Summary on Fuzzy-Based Safety Evaluation	102
3.6	Summary and Conclusions on This Review	102
3.7	Safety Study of Existing Concrete Buildings	104
3.7.1	Reliability-Based Safety Evaluation	105
3.7.2	Assessment for Safety Conditions Using β Values	114
3.7.3	Experience-Based Safety Assessment	117
3.8	Assessment for Serviceability Conditions	119
3.9	Assessment for Durability Conditions	121
3.10	Prognosis Procedure	122
3.11	Summary of This Chapter	123
4	A Method of Decision-making for Dealing With Existing Concrete Buildings	124
4.1	Introduction	124

4.2 A Brief Review of Statistical Decision Theory 126

4.2.1 Basic Steps in Simple Decision Analysis 126

4.2.2 Concepts of Preference and Utility 129

4.2.3 The Estimation of Utilities 131

4.2.4 Decision-making With Incomplete Knowledge 135

4.2.5 Multi-stage Decision-making 137

4.2.6 Different Decision Rules 141

4.3 Decision Analysis in Relevant Engineering Problems 144

4.4 Summary on This Review 146

4.5 A Method of Decision-making for Dealing With Structural Defects 146

4.5.1 Introduction 146

4.5.2 Identification of Objectives and Their Associated At-
tributes 147

4.5.3 The Consequence Space 150

4.5.4 Assessment of Utility Values 152

4.5.5 Creating Courses of Action 156

4.5.6 Single-stage Decision-making 158

4.5.7 Multi-stage Decision-making 160

4.5.8 Risk Control for Making a Terminal Decision 165

4.5.9	A Special Case	168
4.6	Some Comments on the Proposed Method	170
4.7	Summary of This Chapter	171
5	The Detailed Process for Dealing With Defective Concrete Buildings	173
5.1	Introduction	173
5.2	The Detailed Process for Dealing With Existing Defective Buildings	174
5.3	Taking Urgent Action	180
5.4	Summary of This Chapter	182
6	Examples	183
6.1	Example 1	183
6.1.1	Identification of Anomalies	184
6.1.2	Available Information	184
6.1.3	Identification of Possible Explanations	185
6.1.4	Creating the Hypothesis Set H	186
6.1.5	Assessment of Subjective Probabilities for Each Hypothesis	187
6.1.6	Need for an Urgent Action ?	188
6.1.7	Conducting More Tests ?	190
6.1.8	The Second Cycle of Diagnosis	191

<i>Contents</i>	vii
6.1.9 The Final Decision	193
6.2 Example 2	193
7 Summary and Future Work	196
7.1 Summary	196
7.1.1 The Method of Diagnosis	197
7.1.2 The Method of Condition Evaluation	197
7.1.3 The Method of Decision-making	198
7.1.4 The Complete Process	198
7.2 Concluding Remarks and Future Work	199
Appendix	200
A Statistical Data on Basic Variables	200
A.1 Introduction	200
A.2 Statistical Properties on Concrete Strength	201
A.3 Statistical Properties on Dimensions	202
A.4 Statistical Properties on Reinforcement	203
B Probabilistic Models for Building Live Loads	205
B.1 Introduction	205

B.2 Probabilistic Models for Sustained Live Load 207

B.3 Probabilistic Models for Extraordinary Live Load 210

B.4 The Combined Maximum Live Load 211

Summary

Given the enormous stock of existing concrete structures in Australia, the maintenance, rehabilitation and treatment of ageing structures (especially those potentially defective) is of national importance. Due to the lack of previous research in this field, there is an urgent need to develop systematic methodologies that can be used in the treatment of structural defects.

In this thesis, an attempt has been made to establish a practically useful process for dealing with existing concrete buildings based on sound theories and techniques. Three key procedures, i.e. diagnosis, condition evaluation and decision-making, are proposed, and relevant methods for implementing these procedures are described.

The proposed method for diagnosis is an *hypothesis-and-test* procedure through which the most likely explanations of the observed anomalies in structural behaviour can be identified. An hypothesis is a set of explanations that fully covers the observed pattern of anomalies, and a test is any information-gathering activity. To take account of the uncertainties involved, an informal probabilistic reasoning procedure is used to rank all possible hypotheses. The most likely hypothesis is the one which has the highest subjective probability. The diagnostic method can be continued until an hypothesis is identified which has an acceptably high level of probability.

Condition evaluation, as defined in this thesis, consists of procedures for the assessment of structural adequacy regarding safety, serviceability and durability. Both experience and structural reliability theory are used in the assessment procedure.

The decision-making procedure is used to plan appropriate corrective work for the structure. Based on the framework of probabilistic decision theory, the best action is selected from a set of alternatives according to the preferences

of the owner of the structure, in regard to factors such as structural safety, serviceability, durability and incurred costs. The proposed method forms a multi-stage process in which the engineer can also decide on whether to gather more data or to take action at any stage, using the results obtained from diagnosis and condition evaluation.

By integrating systematically the iterative procedures of diagnosis, assessment and decision-making, a comprehensive process is developed for dealing with existing concrete structures, which allows the engineer to decide rationally on what to do about a given structure in a well-structured manner. Two examples are used to show how the proposed process is practically useful.