## 1 Sole of Concrete—Mix Proportion

1.1 Theoretical Foundation for Past Mix Proportion
   
   1.1.1 Specific Surface Area Method
   1.1.2 Maximum Density Method
   1.1.3 Weymouth Grap Grading Method

1.2 Inadaptability Between Old Mix Proportion and Modern Concrete

1.3 Reasons and Puzzles

1.4 Thinking About Establishing the Modern Concrete Mix Proportion Theory

A.1 Others
   
   A.1.1 Different Opinions

References

## 2 Important Raw Material—Coarse Aggregate

2.1 Aggregate Varieties and Causes Overview

2.2 Effects of Different Rock Aggregate on Performance of Concrete
   
   2.2.1 Effects on Strength
   2.2.2 Effects of Rock Mechanical Property on Other Performances of Concrete

2.3 Two Different Opinions
   
   2.3.1 Different Opinions About Rock Strength Requirement in Specification
   2.3.2 Utilization of Gravel

References

## 3 Core Raw Material—Cement

3.1 Effects of Cement Property Indexes on Concrete Performance

3.2 Overview of Cement Production Process
3.3 Effect of Modern Cement Production Process on Quality of Concrete ........................................... 40
3.4 Where Is the Correct Direction of Cement Production Technology? ........................................... 43
3.5 Ending Words ........................................... 45
References ........................................... 45

4 Alkali-Aggregate Reaction, Where Are You? ........................................... 47
References ........................................... 52

5 Is Air-Entraining Agent a Panacea for Solving Frost Resistance Problem? ........................................... 53
5.1 Freeze-Thaw Damage on Engineering ........................................... 53
5.2 World-Recognized Measure for Enhancing Frost Resistance—Adding Air-Entraining Agent ........................................... 56
5.3 Overview of Freeze-Thaw Damage Theory ........................................... 59
5.4 Research on Method and Measure for Enhancing Frost Resistance of Practical Engineering ........................................... 60
5.5 What is the Correct Using Method and Range of Air-Entraining Agent (AEA) ........................................... 62
5.6 Ending Words ........................................... 67
References ........................................... 68

6 Breeding and False Setting, Which Is Better? ........................................... 69
6.1 Reasons for Breeding ........................................... 70
6.2 Reasons for False Setting ........................................... 76
6.3 Detriment of Breeding and False Setting ........................................... 81
6.4 Prevention Method for Breeding and False Setting ........................................... 82
References ........................................... 83

7 Fiber, When Is Useful? ........................................... 85
7.1 Fate and Experience with Fiber-Reinforced Concrete ........................................... 85
7.2 Experimental Method and Conclusion ........................................... 86
7.3 Reason Analyzing ........................................... 89
7.4 Ending Words ........................................... 91
References ........................................... 91

8 Cancer of Modern Concrete—Cracks ........................................... 93
8.1 General Remarks ........................................... 93
8.2 Cause Analysis ........................................... 96
8.2.1 Fine Questions Which Field Engineers Are Unable to Solve ........................................... 96
8.2.2 Seven Problems Which Field Engineers Are Different to Solve ........................................... 98
8.2.3 Eleven Problems Which Field Engineers Can Solve .......................................................... 99
8.3 Category of Cracks .................................................................................................................. 101
  8.3.1 Dehydration Cracks. ........................................................................................................... 101
  8.3.2 Temperature Crack ............................................................................................................ 101
  8.3.3 Drying Shrinkage Crack .................................................................................................... 102
  8.3.4 Stress Cracks ...................................................................................................................... 102
8.4 Cause, Detriment, and Prevention of Dehydration Crack ....................................................... 104
  8.4.1 Cause for Dehydration Crack ............................................................................................. 105
  8.4.2 Harmfulness of Dehydration Crack .................................................................................... 105
  8.4.3 Prevention and Cure for Dehydration Crack ....................................................................... 106
References ...................................................................................................................................... 107

9 Fly Ash, Really Only Advantages? ............................................................................................ 109
  9.1 Problems Unsolved in the Utilization of Fly Ash ................................................................. 109
    9.1.1 Problems Unsolved Theoretically .................................................................................... 109
    9.1.2 Unsolved Technological Problems in Engineering .......................................................... 110
  9.2 Several Practical Projects ...................................................................................................... 111
    9.2.1 The Concrete Surface of a Parking Apron in South China .............................................. 111
    9.2.2 The Concrete Surface of a Parking Apron in North China ............................................. 114
    9.2.3 Universal Harmless Cracks Phenomena in the Construction of Airport ......................... 115
    9.2.4 The Floorslab of Terminal Buildings in an Airport in North China ................................. 115
    9.2.5 Floor in a Plant in Southwest China .................................................................................. 117
    9.2.6 Other Cases ...................................................................................................................... 119
  9.3 Summary .................................................................................................................................. 121
References ...................................................................................................................................... 122

10 Admixtures: All Medicines Have Their Own Side Effects ..................................................... 123
  10.1 Understanding on Negative Effects of Several Main Chemical Admixtures of the Author .... 123
    10.1.1 Water Reducer ................................................................................................................. 123
    10.1.2 Air-Entraining Agent ....................................................................................................... 124
    10.1.3 Expansive Agent .............................................................................................................. 125
    10.1.4 Early-Strength Agent ....................................................................................................... 125
  10.2 Serious Quality Accident Cause by Improper Chemical Admixture Dosage ......................... 126
    10.2.1 Water Reducer ................................................................................................................. 126
    10.2.2 Retarding Agent .............................................................................................................. 127
10.2.3 Early-Strength Agent .............................................. 129
10.2.4 Others .............................................................. 129
10.3 What Is the Correct Using Method of Chemical
Admixture? ................................................................. 130
10.4 Conclusion ............................................................. 130
References ................................................................. 131

11 Fatal Factor for Durability: Drying Shrinkage .................. 133
11.1 Generating Process of Drying Shrinkage Crack ............... 133
11.2 Harmfulness of Dehydration Crack ......................... 134
  11.2.1 Drying Shrinkage Crack has Great Effect on Flexural
        Strength and Directly Threatens Safety of Concrete
        Structure .......................................................... 137
  11.2.2 Destroying Structure Directly in Some Individual
        Severe Regions .................................................... 139
  11.2.3 Reducing Frost Resistance and Impermeability
        of Pavement Concrete in Cold Regions ...................... 142
  11.2.4 Thin-Walled Structure and Reinforced Concrete
        Structure with Small Protection Layer Direct Impact
        on Their Durability and Usage Security ..................... 142
  11.2.5 In Partial Regions in the South and North, Drying
        Shrinkage Crack is also Manifested as a Kind
        of Shallow and Harmless Crack Which has
        no Practical Effect on Security and Durability
        of Engineering .................................................... 146
11.3 Cause for Drying Shrinkage Crack .............................. 147
11.4 Ending Words ........................................................ 149
References ................................................................. 150

12 Doctor of Concrete—Self-healing ........................................ 151
12.1 Discovery of Self-curing Phenomenon ........................... 151
12.2 Cause Analysis ..................................................... 160
12.3 Application of Self-curing Principle During Practical
        Engineering ......................................................... 161
12.4 Ending Words .......................................................... 164

13 High-Performance Concrete, Really High Performance? .......... 167
13.1 Difference Between Normal Concrete
        and High-Performance Concrete .................................. 167
13.2 Comparison of Application Effect During Practical
        Engineering .......................................................... 170
13.3 Ending Words .......................................................... 171
References ................................................................. 172