Recommendations for Design and Construction of Ultra High Strength Concrete Structures, - Draft

September 2006

Japan Society of Civil Engineers

CONTENTS

Cha	apter 1 General·····	
1.1	Scope of Application	1
1.2	Definition of Terms	3
1.3	Notations ·····	4
		_
Cha	apter 2 Design Basics ·····	5
	General ·····	
2.2	Design Life of Structure	
2.3	Basic Principles for Examination of Performance	7
2.4	Safety Factors ·····	··· 8
Cha	apter 3 Design Values of Materials	9
3.1	General ····	9
3.2	Strength	10
	3.2.1 Characteristic Values ······	
	3.2.2 Compressive Strength ······	
	3.2.3 First Cracking Strength ······	
	3.2.4 Tensile Strength and Tension Softening Characteristics	
	3.2.5 Other Types of Strength ·····	
3.3	Stress –Strain Curve ·····	
	3.3.1 Compressive Stress-Strain Curve	
	3.3.2 Tensile Stress-Strain Curve ······	· 23
3.4	Young's Modulus ·····	25
3.5	Poisson's Ratio	26
3.6	Thermal Characteristics ······	
3.7	Shrinkage ·····	
3.8	Creep	
3.9	Fatigue Strength	29
C1		00
	apter 4 Load·····	
4.1	General ·····	32
Cha	apter 5 Structural Analysis·····	33
5.1	General ·····	33
5.2	Calculating Response Values to Evaluate ULS	33
5.3	Calculating Response Values to Evaluate Serviceability Limit State	
0.0	Calculating Response values to Evaluate Serviceasinty Emili State	01
Cha	apter 6 Verification of Structural Safety ·····	35
	General	25
6.1		
6.2	Safety Verification for Flexural Moment and Axial Forces	
	6.2.1 Design Capacity of Member Cross Section	35
	6.2.2 Details of Structure ·····	
6.3	Examination for Safety against Shear ·····	
	6.3.1 General	. 39
	6.3.2 Design Shear Force on Linear Members	39
	6.3.3 Shear Capacity of Linear Members	. <u>4</u> 0
	6.3.4 Design Punching Shear Capacity of Planar Members	. 17
	6.2.5 Design Member Ference of Diegon Members Cubicated to In Diego Ference	10
	6.3.5 Design Member Forces of Planar Members Subjected to In-Plane Forces	40

6.3.6 Design Capacity of Planar Members Subjected to In-Plane Forces	48
6.4 Examination of Safety against Torsion	48
6.4.1 General·····	
6.5 Examination of Safety for Rigid Body Stability	49
Chantan 7 Vanification of Commissability	50
Chapter 7 Verification of Serviceability	
7.1 General	
7.3 Limiting Value of Stresses	51
7.5 Examination of Displacement and Deformation	53
7.0 Examination of vibration	34
Chapter 8 Verification of Fatigue Resistance	55
8.1 General ·····	55
8.2 Examination of Safety for Fatigue	
8.3 Design Variable Force and Equivalent Number of Cycles	
8.4 Calculation of Stress Caused by Variable Loading	
8.5 Fatigue Resistance of Structural Members to Shear	57
Chapter 9 General Structural Details	58
9.1 General ····	58
9.2 Concrete Cover · · · · · · · · · · · · · · · · · · ·	58
9.3 Clear distance of Reinforcing Steel ·····	59
9.4 Beveling	59
Chapter 10 Prestressed Concrete	
10.1 General·····	
10.2 Prestressing Force	
10.3 Examination for Serviceability Limit State (SLS)	
10.3.1 Examination for Flexural Moment and Axial Forces	
10.3.2 Examination for Shear and Torsion	
10.4 Examination for Ultimate Limit State (ULS)	
10.5 Examination for Fatigue Limit State (FLS)	
10.6 Examination during Construction	63
10.7 Examination for Durability	
10.8 Structural Details	
10.8.1 Tendons	
10.8.2 Precast Concrete Members ·····	65
Chapter 11 Verification of Durability	88
11.1 General······	
11.2 Examination of Carbonation ······	
11.3 Examination of Corrosion of Reinforcing Fibers from Chloride Ion Ingress	
11.4 Examination of Steel Corrosion from Chloride Ion Ingress	\mathbf{o}
11.5 Examination of Freeze-and-Thaw Action	
11.0 Danimation of Ficele and Thay Action	70
	70 71
11.6 Examination of Chemical Attack	70 71 72
11.6 Examination of Chemical Attack	70 71 72 73
11.6 Examination of Chemical Attack	70 71 72 73

12.1 Gen	eral				
	stituent Materials ······ 75				
12.2.1					
12.2.2					
12.2.3					
	Admixtures ······ 78				
	Reinforcing Fiber ······ 79				
	Proportions				
	General				
	Consistency				
12.3.3	Examination of Strength 83				
	Form for Expressing Mix Proportions ······ 84				
	duction 85				
12.4.1					
	Batching86				
	Mixing 87				
	rsportation······ 88				
	ting ······ 89				
	sh90				
	ing 91				
	nwork and Support ······ 94				
	spection				
	1 Inspection in Receipt of Materials 95				
12.10	2 Inspection of Production				
	3 Inspection of Construction ······ 96				
	4 Inspection of Concrete 97				
12.10	5 Inspection of Products······ 99				
	•				
Chapter 1	3 Cold Weather Concreting ······101				
13.1 Gen	eral101				
	erials and Mix Proportions ······101				
	nsportation and Placement ······102				
13.4 Cur	ing102				
Chapter 1	4 Hot Weather Concreting ······ 104				
14.1 Gen	eral104				
	r				
14.3 Transportation and Placement					
14.4 Cur	ing106				