Hubert Bachmann/Alfred Steinle

## Precast Concrete Structures



## **Contents**

Prefac	e	VII
Autho	rs	IX
	ninary remarks  ards, leaflets and directives	
1	General	5
1.1	The advantages of factory production	5
1.2	Historical development	6
1.3	European standardisation	9
2	Design of precast concrete structures	15
2.1	Boundary conditions for precast concrete design	16
2.1.1	Production process	
2.1.2	Tolerances	
2.1.3	Transport and erection	
2.1.4	Fire protection	
2.2	Stability of precast concrete structures	
2.2.1	Arrangement of stability elements	
2.2.2	Loads on stability elements	
2.2.3	Distribution of horizontal loads	
2.2.4	Verification of building stability	
2.2.5	Structural design of floor diaphragms	
2.2.6	Structural design of vertical stability elements	
2.2.7	Design of perimeter ties to DIN 1045-1	
2.3	Loadbearing elements	
2.3.1	Suspended floor elements	
2.3.2	Floor and roof beams	
2.3.3	Columns	
2.3.4	Walls	
2.3.5	Foundations	
2.4	Precast concrete façades	
2.4.1	Environmental influences and the requirements of building physics	
2.4.2	Façade design	
2.4.3	Joint design	
2.4.4	Façade fixings	
2.4.5	Architectural façades	
2.5	Connections	
2.6	Current design issues	
2.6.1	Additions to cross-sections, floors with concrete topping	. 139

2.6.2 2.6.3	Corbels and notched beam ends	
2.6.4	Pad foundations	
2.6.5	Design for fire	
2.0.0	240.61.101.100	10,
3	Joints between precast concrete elements	175
3.1	Compression joints	175
3.1.1	Butt joints	175
3.1.2	Zones of support to DIN 1045-1	180
3.1.3	Elastomeric bearings to DIN 4141	181
3.1.4	Elastomeric bearings to DIN EN 1337	188
3.2	Tension joints	190
3.2.1	Welded joints	190
3.2.2	Anchoring steel plates, dowels, studs and cast-in channels	193
3.2.3	Shear dowels	195
3.2.4	Screw couplers	198
3.2.5	Transport fixings	
3.2.6	Retrofitted corbels	201
3.3	Shear joints	203
3.3.1	General	
3.3.2	Floor diaphragms and wall plates – in-plane shear forces	
3.3.3	Joints in suspended floor slabs – out-of-plane shear forces	209
4	Factory production	213
<b>4</b> 4.1	Factory production Production methods	
	• •	213
4.1	Production methods	213 219
4.1 4.2	Production methods	213 219 220
4.1 4.2 4.2.1	Production methods Types of concrete in precast concrete construction Processing properties	213 219 220 220
4.1 4.2 4.2.1 4.2.2	Production methods Types of concrete in precast concrete construction Processing properties Strength	213 219 220 220 223
4.1 4.2 4.2.1 4.2.2 4.2.3	Production methods Types of concrete in precast concrete construction Processing properties Strength Self-compacting concrete (SCC)	213 219 220 220 223 224
4.1 4.2 4.2.1 4.2.2 4.2.3 4.2.4	Production methods Types of concrete in precast concrete construction Processing properties Strength Self-compacting concrete (SCC) Fibre-reinforced concrete	213 219 220 220 223 224 225
4.1 4.2 4.2.1 4.2.2 4.2.3 4.2.4 4.2.5	Production methods Types of concrete in precast concrete construction Processing properties Strength Self-compacting concrete (SCC) Fibre-reinforced concrete Coloured and structured concrete surfaces	213 219 220 220 223 224 225 227
4.1 4.2 4.2.1 4.2.2 4.2.3 4.2.4 4.2.5 4.3	Production methods Types of concrete in precast concrete construction Processing properties Strength Self-compacting concrete (SCC) Fibre-reinforced concrete Coloured and structured concrete surfaces Producing the concrete in the factory	213 219 220 220 223 224 225 227 227
4.1 4.2 4.2.1 4.2.2 4.2.3 4.2.4 4.2.5 4.3.1	Production methods Types of concrete in precast concrete construction Processing properties Strength Self-compacting concrete (SCC) Fibre-reinforced concrete Coloured and structured concrete surfaces Producing the concrete in the factory Heat treatment and curing	213 219 220 220 223 224 225 227 227 229
4.1 4.2 4.2.1 4.2.2 4.2.3 4.2.4 4.2.5 4.3.1 4.3.1	Production methods Types of concrete in precast concrete construction Processing properties Strength Self-compacting concrete (SCC) Fibre-reinforced concrete Coloured and structured concrete surfaces Producing the concrete in the factory Heat treatment and curing Working hardened concrete surfaces?	213 219 220 220 223 224 225 227 227 229 231
4.1 4.2 4.2.1 4.2.2 4.2.3 4.2.4 4.2.5 4.3.1 4.3.2 4.3.3	Production methods  Types of concrete in precast concrete construction  Processing properties  Strength  Self-compacting concrete (SCC)  Fibre-reinforced concrete  Coloured and structured concrete surfaces  Producing the concrete in the factory  Heat treatment and curing  Working hardened concrete surfaces?  Coating and cladding	213 219 220 220 223 224 225 227 227 229 231 233
4.1 4.2 4.2.1 4.2.2 4.2.3 4.2.4 4.2.5 4.3.1 4.3.2 4.3.3 4.4	Production methods Types of concrete in precast concrete construction Processing properties Strength Self-compacting concrete (SCC) Fibre-reinforced concrete Coloured and structured concrete surfaces Producing the concrete in the factory Heat treatment and curing Working hardened concrete surfaces? Coating and cladding Installing the reinforcement in the factory Round bars and meshes	213 219 220 220 223 224 225 227 227 229 231 233 233
4.1 4.2 4.2.1 4.2.2 4.2.3 4.2.4 4.2.5 4.3.1 4.3.2 4.3.3 4.4	Production methods Types of concrete in precast concrete construction Processing properties Strength Self-compacting concrete (SCC) Fibre-reinforced concrete Coloured and structured concrete surfaces Producing the concrete in the factory Heat treatment and curing Working hardened concrete surfaces? Coating and cladding Installing the reinforcement in the factory	213 219 220 220 223 224 225 227 227 229 231 233 233 237
4.1 4.2 4.2.1 4.2.2 4.2.3 4.2.4 4.2.5 4.3 4.3.1 4.3.2 4.3.3 4.4 4.4.1 4.4.2	Production methods Types of concrete in precast concrete construction Processing properties Strength Self-compacting concrete (SCC) Fibre-reinforced concrete Coloured and structured concrete surfaces Producing the concrete in the factory Heat treatment and curing Working hardened concrete surfaces? Coating and cladding Installing the reinforcement in the factory Round bars and meshes Prestressing beds Quality control	213 219 220 220 223 224 225 227 227 229 231 233 233 237 242
4.1 4.2 4.2.1 4.2.2 4.2.3 4.2.4 4.2.5 4.3 4.3.1 4.3.2 4.3.3 4.4 4.4.1 4.4.2	Production methods Types of concrete in precast concrete construction Processing properties Strength Self-compacting concrete (SCC) Fibre-reinforced concrete Coloured and structured concrete surfaces Producing the concrete in the factory Heat treatment and curing Working hardened concrete surfaces? Coating and cladding Installing the reinforcement in the factory Round bars and meshes Prestressing beds	213 219 220 220 223 224 225 227 227 229 231 233 233 237 242