3.8 Experimental research conducted in the Faculty of Civil Engineering, Warsaw, University of Technology

Kowalski R., Poland

Experimental research conducted in the Faculty of Civil Engineering, Warsaw University of Technology

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1

What am I going to speak about ???

Tests performed in the past
- The influence of rapid cooling on compressive strength of concrete heated up to high temperature
- Thermal inertia of concrete heated up to high temperature
- RC beams (specimens) subjected simultaneously to mechanical load and high temperature

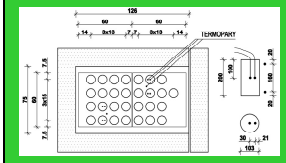
Our plans for future
- Testing of reinforcing bars subjected to tension and high temperature
- Testing of RC beams (specimens); estimation cross-section stiffness decrease

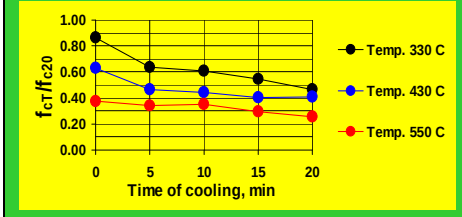
Supplement – the advertisement of my poster
- The evaluation of required fire resistance of building structural elements on the basis of Polish legal regulations

2

Tests performed in the past

The influence of rapid cooling on compressive strength of concrete heated up to high temperature



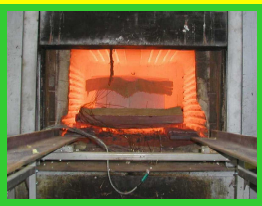


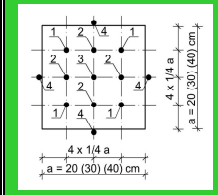
Cylindrical specimens
Diameter 103 mm
Height 200 mm
Concrete C25/30
Siliceous aggregate
Moisture content 3.8%

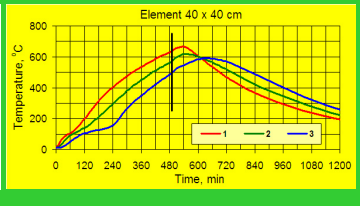
3

Tests performed in the past

Thermal inertia of concrete heated up to high temperature





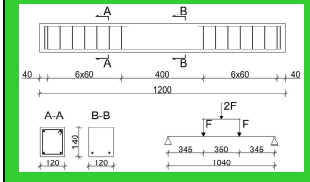


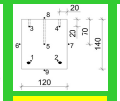
20x20x20 cm
30x30x20 cm
40x40x20 cm
Concrete C25/30
Siliceous aggregate
Moist. cont. 3.8%

4

Tests performed in the past

RC beams (specimens) subjected simultaneously to mechanical load and high temperature





12 x 14 cm
l = 105 cm
C30/37
C60/75

5

Tests performed in the past

RC beams (specimens) subjected simultaneously to mechanical load and high temperature

Residual load bearing capacity (after heating)

Type of beam	Load bearing capacity (bending moments, kNm)			Ratio after / before	Type o damage
	Before hot tests	After hot tests (residual)			
	Average	Test result	Average		
C30/37	9.54	3.64 3.29 3.23	3.39	0.35	Concrete
C60/75	10.39	9.16 8.90 (3.94)	9.03	0.87	Steel

SiF 2010, Michigan

6

Our plans for future

Testing of reinforcing bars

- **Non steady temperature state**
  constant load (stress) → temperature – strain (elongation)
- **Steady temperature state**
  constant temperature → load (stress) – strain (elongation)

Testing of RC beams (specimens) b x h = 14 x 30 cm, l = 300 cm

Estimation of cross-section stiffness decrease

- Concrete compressed zone exposed to high temperature
- Tensile zone (reinforcement) exposed to high temperature

What next ? ? ? → COST Action → ? ? ?

The advertisement of my poster

The evaluation of required fire resistance of building structural elements on the basis of Polish legal regulations


cost COST Action TU0904 Integrated Fire Engineering and Response Workshop, Barcelona 5-6 July 2010

The evaluation of required fire resistance of building structural elements on the basis of Polish legal regulations

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Step 1 – What kind of building is considered ?

Step 2 – What is the class of (fire protection of) a building R, E, I, S, M ?

EP

Building	EPI	EPII	EPIII	EPIV	EPV
Low	B	B	C	D	C
Middle height	B	B	B	C	B
High	B	B	B	B	B
Skyscrapers	A	A	A	A	A

PW

The load density MJ/m²	One floor buildings	Multi floor buildings: Low	Middle h.	High	Skyscrapers
q ≤ 500, garages	C	D	C	B	B
500 < q ≤ 1000	C	C	C	B	B
1000 < q ≤ 2000	C	C	C	B	B
2000 < q ≤ 4000	D	D	B	–	–
q > 4000	A	A	A	–	–

Step 3 – The required fire resistance of structural elements

The class of building	The main structural elements of a roof	Structural elements of floors	External walls	Internal walls
A	R 240	R 30	REI 120	EI 120	EI 30
B	R 120	R 30	REI 60	EI 60	EI 30
C	R 60	R 15	REI 60	EI 30	EI 15
D	R 30	–	REI 30	EI 30	–
E	–	–	–	–	–

Next steps – Eurocode recommendations, Experimental test results

THANK YOU VERY MUCH