

CENTRAL EUROPEAN CONGRESS
ON CONCRETE ENGINEERING

**INFLUENCE OF PARTICULAR COMPONENTS
OF CONCRETE COMPOSITION TO RESIDUAL
STRENGTH AFTER TEMPERATURE LOADING**



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INTRODUCTION



Fire of Windsor Tower in 2005 [Bailey, 2013]



Fire in Mont Blanc Tunnel in 1999 (on the left), Eurotunnel in 1996 (on the right)



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[Phys.tue.nl, 2011]

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TEST PARAMETERS

Previous studies indicated that mix properties significantly influence the residual strength after high temperature loading.

[SCHNEIDER, 1988] [OMER, 2007] [BALÁZS, LUBLÓY 2009] [FEHÉRVÁRI, NEHME, 2009] [THIELEN, 1994] [HINRICHSMEYER, 1987]

Our study mainly focused on the effects of w/c ratio, cement paste content, cement content and the relative porosity.

Parameter	Mix1	Mix2	Mix3	Mix4	Mix5
c [kg/m ³]	360	360	360	410	320
w [kg/m ³]	216	180	144	164	192
w/c [-]	0.6	0.5	0.4	0.4	0.6
cement paste content [l / m ³]	332	296	260	296	295
aggregate 0/4 mm [%]	40	40	40	40	40
aggregate 4/8 mm [%]	25	25	25	25	25
aggregate 8/16 mm [%]	35	35	35	35	35

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EXPERIMENTAL STUDIES

Compressive strength

Cylindrical specimens
diameter of 60 mm
height of 120 mm



Flexural strength

Prisms of
70×70×250 mm sides

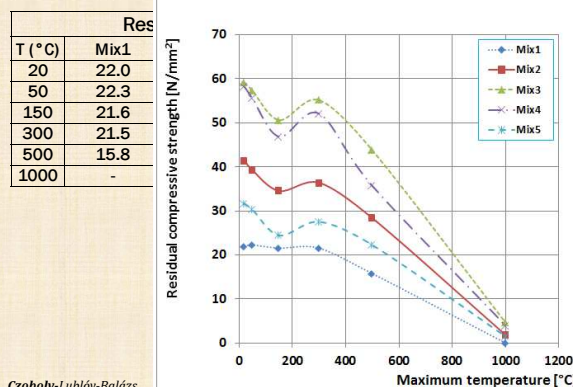


Each mixture was tested: without temperature loading, with 50°C; 150°C, 300°C, 500°C or 1000°C maximum temperature load.

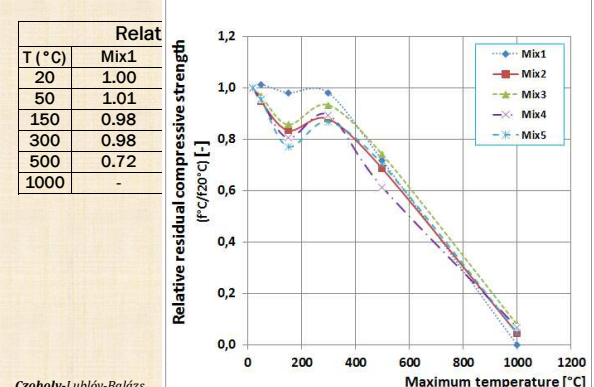
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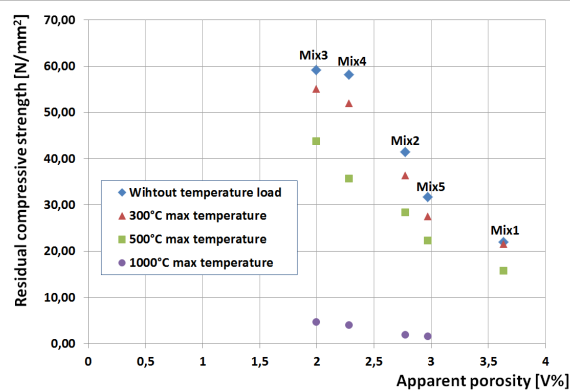
RESIDUAL COMPRESSIVE STRENGTH



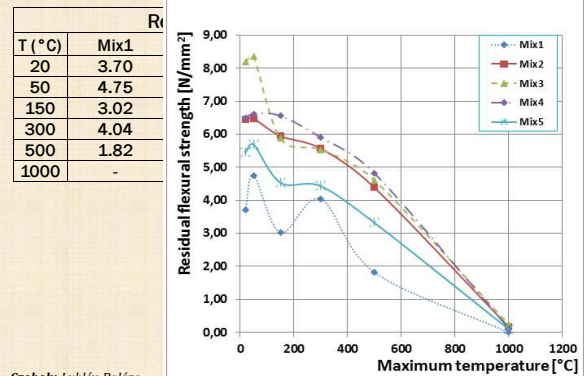
RELATIVE RESIDUAL COMPRESSIVE STRENGTH



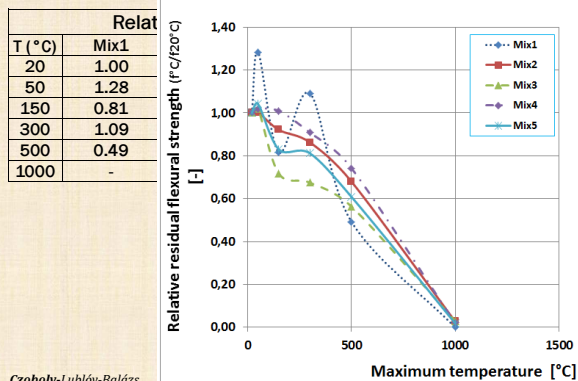
POROSITY OF THE SPECIMENS



RESIDUAL FLEXURAL STRENGTH



RELATIVE RESIDUAL FLEXURAL STRENGTH



CONCLUSIONS

- Lower w/c ratio causes higher residual compressive strength.
- Similar w/c ratios and lower cement paste content resulted in higher residual compressive strength.
- The capillary system significantly affects the residual strength, the higher the apparent porosity, the lower the initial and residual strengths.
- Decrease in residual strength around 150°C of maximum temperature is less pronounced in case of higher apparent porosity.

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Thank you
for your kind attention!