

Modulus elasticity of the graded concrete, a preliminary research



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Introduction

- The elastic modulus of materials plays a role in determining the stiffness of a structural element and its level of serviceability
- Previous research indicates that the concrete modulus of elasticity could be improved by combining 2 (two) concrete mixes using a gradual compacting method.
- Information about the modulus of elasticity of graded concrete is not yet widely available
- This research aims to experimentally investigate the modulus of elasticity of graded concrete at a preliminary level.

Concrete mix proportion

Concrete strength (MPa)	Weight to cement ratio				
	Cement	Water	Fine agg.	Coarse agg.	Superplasticizer
30	1.00	0.46	1.93	1.58	0.006
40	1.00	0.36	1.38	1.13	0.006
50	1.00	0.31	1.10	0.90	0.006

Sample preparation

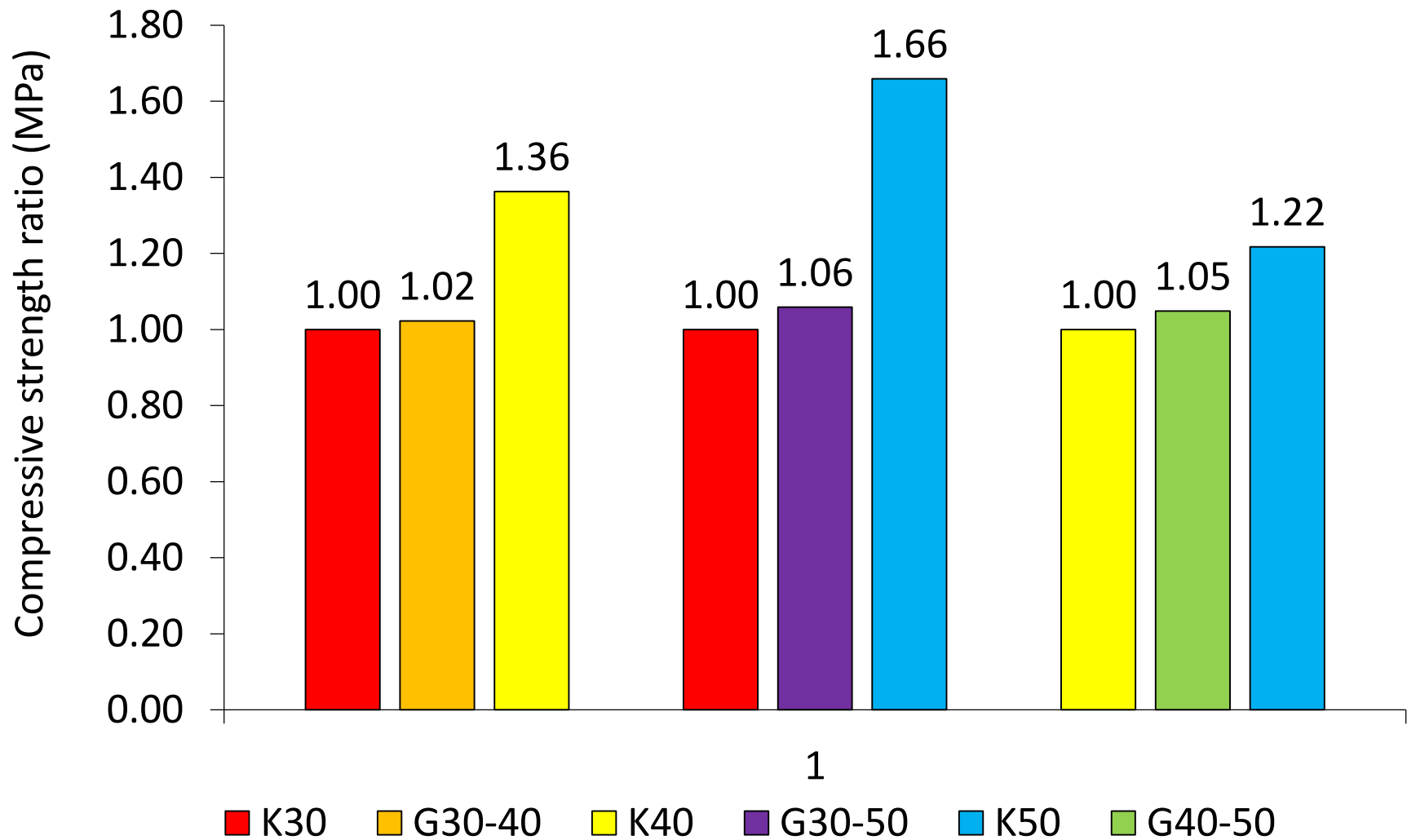
- Cylindrical concrete specimens 150 x 300 mm
- K – controlling specimens
- G – graded concrete specimens
- Casting method (Gan, 2015)

Notation	Number of specimens	Notation	Number of specimens
K30	6	G30-40	6
K40	6	G30-50	6
K50	6	G40-50	6

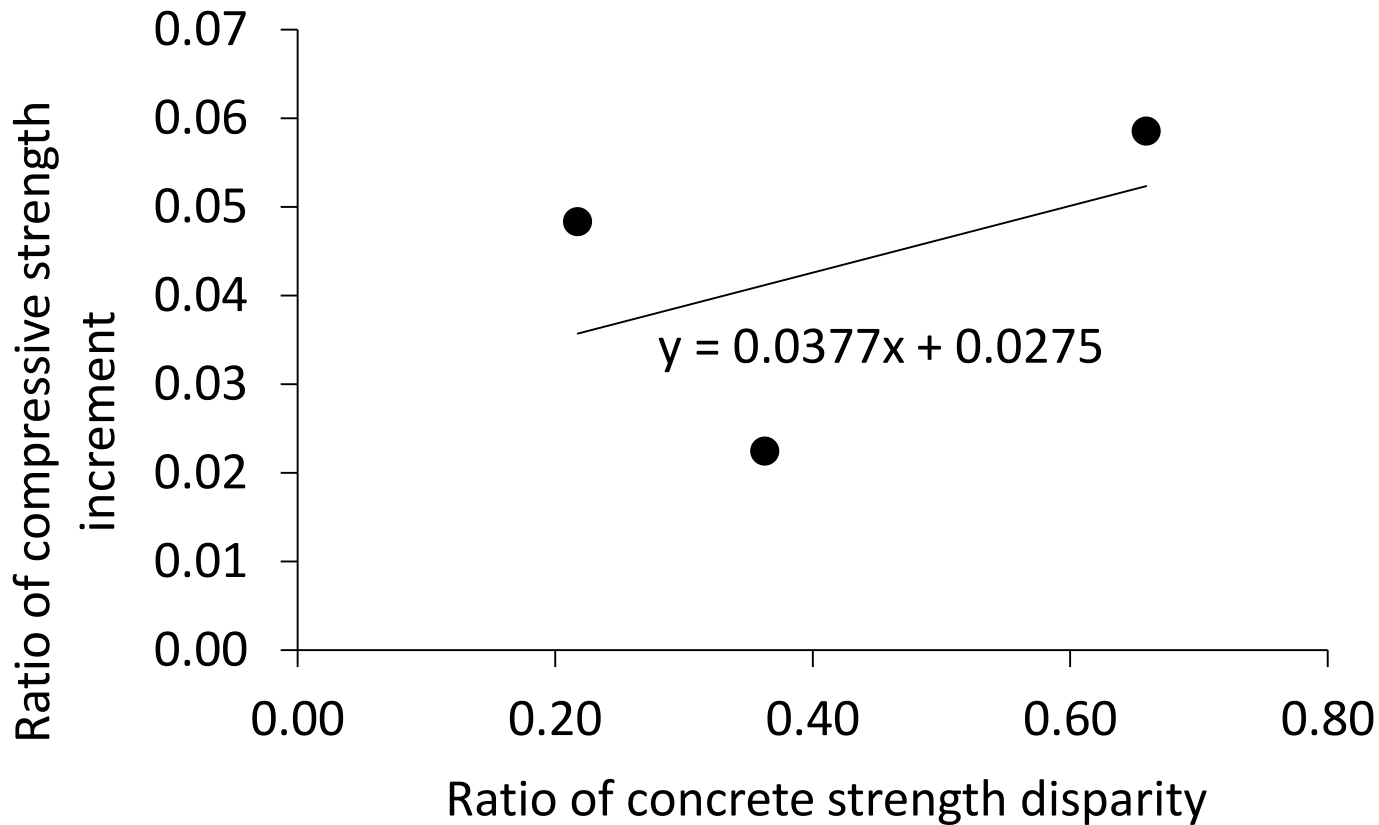
Concrete compressive strength

Specimens' type	Mean concrete compressive strength (MPa)	Specimens' type	Mean concrete compressive strength (MPa)
K ₃₀	34,35	G ₃₀₋₄₀	35,12
K ₄₀	46,81	G ₃₀₋₅₀	36,36
K ₅₀	56,99	G ₄₀₋₅₀	49,07

Concrete compressive strength



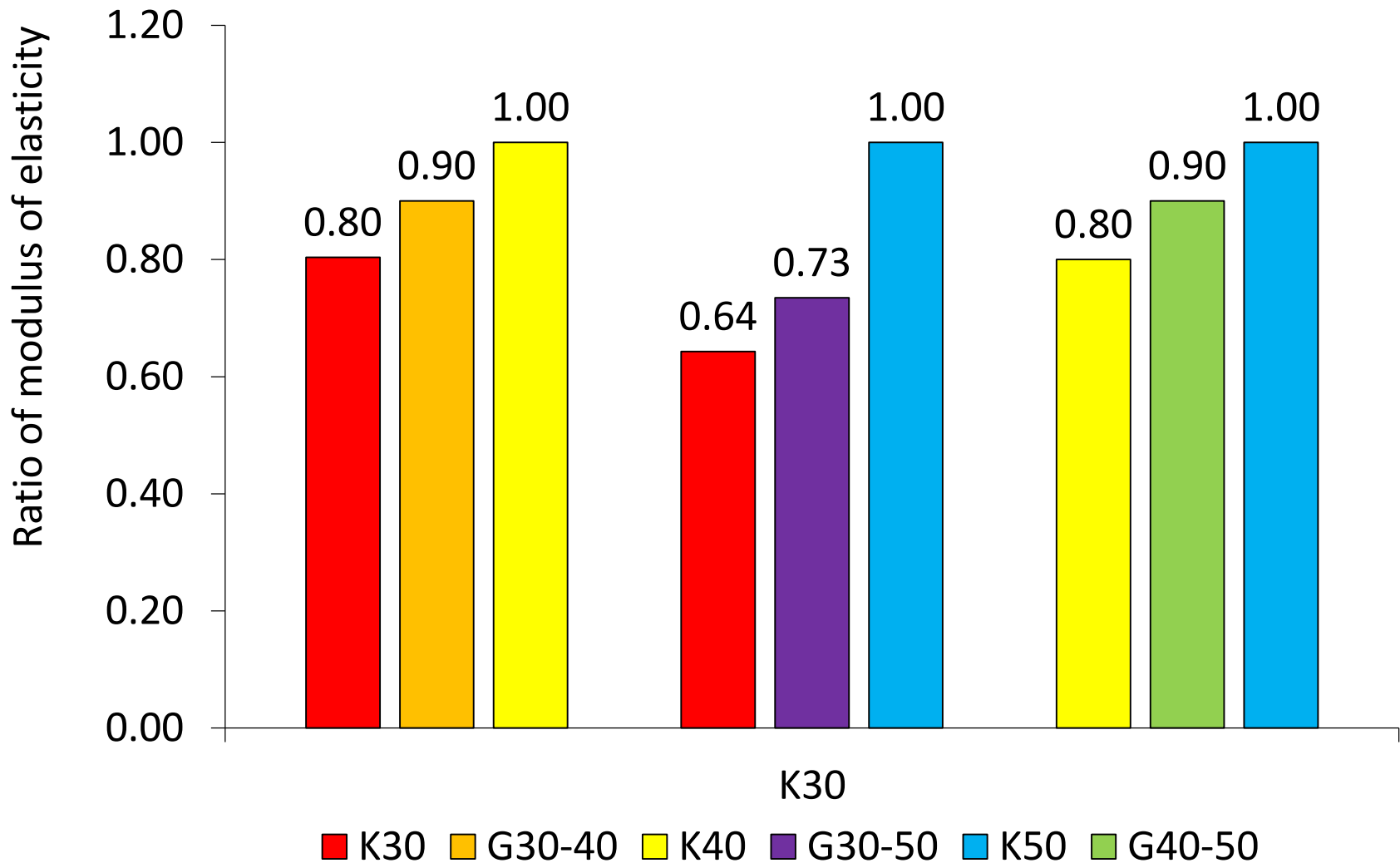
Concrete compressive strength



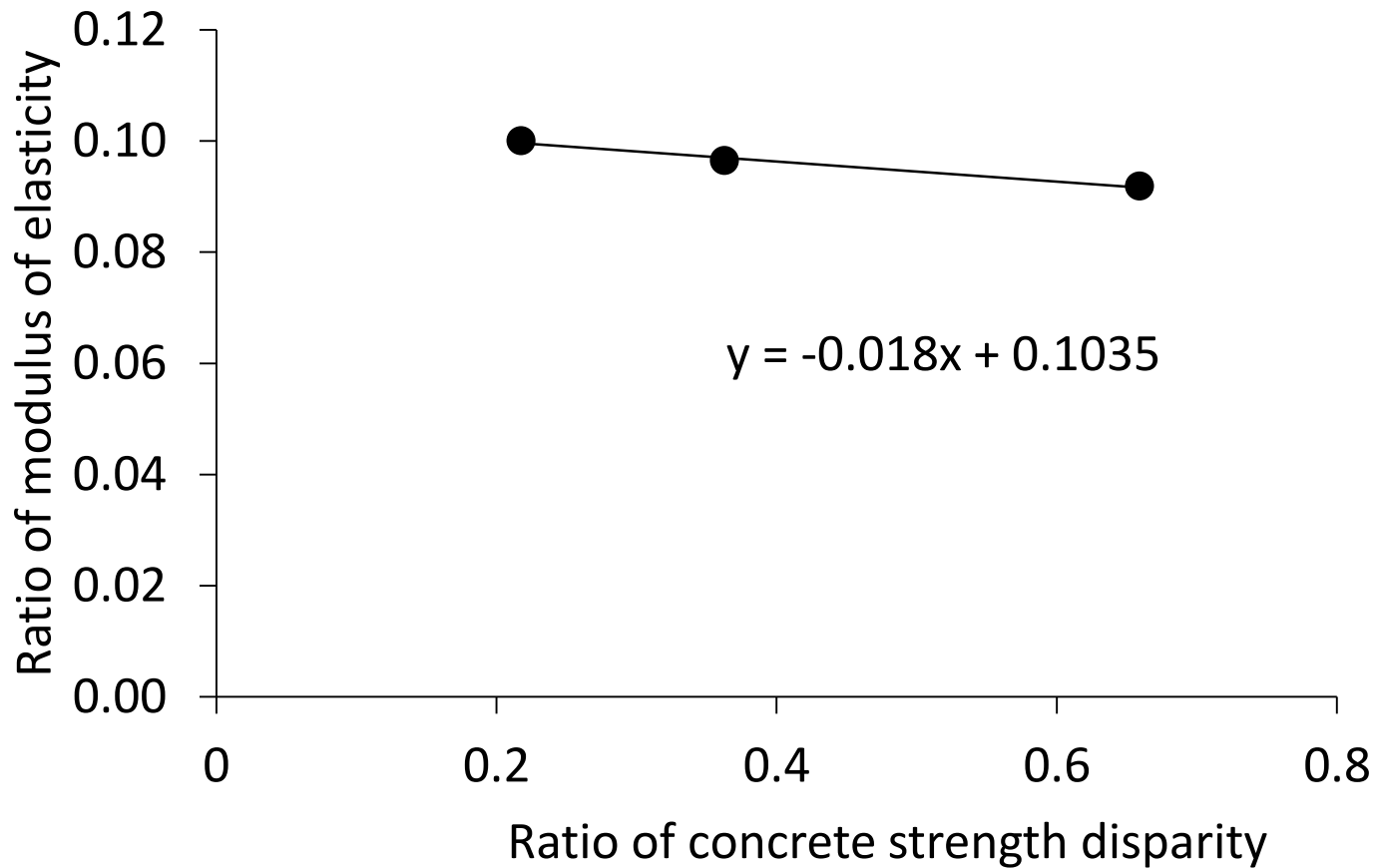
Concrete modulus of elasticity

Specimens' type	Modulus of elasticity (MPa)	Specimens' type	Modulus of elasticity (MPa)
K ₃₀	35.714,3	G ₃₀₋₄₀	40.000,0
K ₄₀	44.444,4	G ₃₀₋₅₀	40.816,3
K ₅₀	55.555,6	G ₄₀₋₅₀	50.000,0

Concrete modulus of elasticity



Concrete modulus of elasticity



Conclusions

- The compressive strength of graded concrete is determined by the contribution of the lowest concrete strength. An addition to higher compressive strength does not provide a substantial increase in compressive strength.
- The modulus of elasticity of graded concrete is proportionally influenced by both concrete compositions, meaning that graded concrete inherits the characteristics of its constituents, each by half.
- The concrete strength disparity increases the resulting graded concrete strength.
- The strength disparity in graded concrete results in the decrease of the modulus of elasticity due to premature cracking at the beginning of loading.



