

## SPECIAL SECTION

# Civil Engineering – Ongoing Technical Research. Part 2

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Special section “Civil Engineering – Ongoing Technical Research. Part I” was published in the *Bulletin of the Polish Academy of Sciences: Technical Sciences* in 2016 [1]. This initiative has met with interest of readers and authors, but also left an impression of a yet unfinished action. This was the reason to continue the action in Part 2. Civil engineering as a discipline of applied science is always seeking for its place on the map of knowledge. Each of the papers included in this special section consists of two components: science and engineering balanced in various ways. One of the dilemmas of the civil engineering discipline is the controversy: requirement of durability (> 50 years) versus risk of progress. We need to ensure that the construction element meets the requirements not only at the time of testing, but also that it would be good enough after tens of years of service life.

The invited paper opening the special section in 2016 was entitled “Scientific basis and rules of thumb in civil engineering: conflict or harmony?” [2]. Science and engineering intermingle in the area of construction, which results in the emergence of the title question. The answer has been formulated with reference to the statement by J.M. Keynes: “it is better to be roughly right, than precisely wrong”. The study makes us realize the dilemma of accuracy and simplification, of how our data and models are far from the truth and what consequences this might have for the field of safety and reliability. Estimating this “distance from truth” [3] and its effects gradually progresses, based on the scientific grounds. The scientific task is to define the construction performance within categories that correspond with the contemporary level of knowledge and technology. Ten papers published in the previous civil engineering section (Part I), which illustrated this statement, were assigned under the headlines as following:

- risk of performance evaluation – the influence of the uncertainty in the assessment of materials properties tested in laboratories [4] and on site [5];
- the building performance: sustainability [6], fire treatment [7, 8] and frost durability [9];
- the analytical [10] and numerical [11] models seeking for the technological [11] and construction [10] solution;
- seeking for new materials solutions by better understanding of the nature of materials [12], material composition modification [13] and the use of the relatively new mechanism

of creating synergy by chemical interaction between organic and nonorganic components [14].

The invitation to special section Part 2 has been addressed to the researchers working in this area in order for them to submit papers with latest results particularly focused on the following topics:

- new technological research in civil engineering in cross-sectional perspective,
- philosophy of dedicated fields in civil engineering,
- materials and constructions.

Following those appeals, the invited paper opening Part 2 is titled “Innovations in construction materials engineering versus sustainable development” [15]. The study underlines the scientific background of construction innovation, due to the scope of its impact and responsibility when applied in construction and building structures. In construction, “new” does not necessarily mean “better”. It does not stop the building innovation, but makes it more sophisticated. The main driving force is the fact that great material mass and energy consumption require the sustainable development of construction in service of civilization.

Six papers presented in Part 2 not only allow us to state the cross-section of the present publishing activity, but also create a characteristic momentary picture of civil engineering. This picture seems to be wondrously all-around-one. The keywords selected for each paper could stand for characteristic sets: “idea-object” with the particular feedback. These sets are:

- modification – durability – concrete [16];
- modification – recycling – pavement [17];
- numerical analysis – test results – thin walled corrugated elements [18];
- numerical analysis – test results – rectangular tank [19] or, in other words: simulation – load capacity [18, 19];
- simulation – wave propagation – numerical analysis – scientific tool – diagnosis [20];
- criteria – optimization – energy-efficient building [21].

It is worth to stress that Part I ended with the paper that opens the gate to the development of new generations of highly performing concretes [14]. Nowadays, the challenge is not oriented toward the progressive material, but toward low-energy building. The present set of papers covers almost in total “ongoing” research topics in civil engineering from product mod-

ification [16, 17], prediction methods of the response of an engineering structure to the given loads throughout its service life [18–20], even for very sophisticated structures [18–19], to new diagnostic tools [20]. In almost all cases, the leading idea is computer simulation (in virtual laboratory) of the real performance of the subjects. Frequently the subject of the study is the analysis of relations between numerical calculation and lab test results [18–20]. This “ongoing section” once again has proved how deeply science and engineering are entangled in civil engineering.

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## REFERENCES

- [1] L. Czarnecki and D. Van Gemert, “Civil Engineering – Ongoing Technical Research. Part I”, *Bull. Pol. Ac.: Tech.* 64 (4), 661–663 (2016).
- [2] L. Czarnecki and D. Van Gemert, “Scientific basis and rules of thumb in civil engineering: Conflict or harmony?”, *Bull. Pol. Ac.: Tech.* 64 (4), 665–673 (2016).
- [3] L. Czarnecki, “Material model and revealing the truth”. *Bull. Pol. Ac.: Tech.* 63 (1), 7–14 (2015).
- [4] E. Szewczak and A. Piekarczyk, “Performance evaluation of the construction products as a research challenge. Small error – big difference in assessment?”, *Bull. Pol. Ac.: Tech.* 64 (4), 675–686 (2016).
- [5] L. Brunarski and M. Dohojda, “An approach to in-situ compressive strength of concrete”, *Bull. Pol. Ac.: Tech.* 64 (4), 687–695 (2016).
- [6] R. Geryło, “Energy-related conditions and envelope properties for sustainable buildings”, *Bull. Pol. Ac.: Tech.* 64 (4), 697–707 (2016).
- [7] J. Fangrat, “Combustibility of building products versus fire safety”. *Bull. Pol. Ac.: Tech.* 64 (4), 709–717 (2016).
- [8] W. Węgrzyński and P. Sulik, “The philosophy of fire safety engineering in the shaping of civil engineering development”, *Bull. Pol. Ac.: Tech.* 64 (4), 719–730 (2016).
- [9] J. Wawrzęńczyk, T. Juszcak, and A. Molendowska, “Determining equivalent performance for frost durability of concrete containing different amounts of ground granulated blast furnace slag”, *Bull. Pol. Ac.: Tech.* 64 (4), 731–737 (2016).
- [10] P. Obara and W. Gilewski, “Dynamic stability of moderately thick beams and frames with the use of harmonic balance and perturbation methods”, *Bull. Pol. Ac.: Tech.* 64 (4), 739–750 (2016).
- [11] M. Kadela, “Model of multiple-layer pavement structure-subsoil”, *Bull. Pol. Ac.: Tech.* 64 (4), 751–762 (2016).
- [12] M. Iwański, P. Buczyński, and G. Mazurek, “The use of gabbro dust in the cold recycling of asphalt paving mixes with foamed bitumen”, *Bull. Pol. Ac.: Tech.* 64 (4), 763–773 (2016).
- [13] T. Tracz, “Open porosity of cement pastes and their gas permeability”, *Bull. Pol. Ac.: Tech.* 64 (4), 775–783 (2016).
- [14] W. Ru, L. Jian, Z. Tao, and L. Czarnecki, “Chemical interaction between polymer and cement in polymer-cement concrete”, *Bull. Pol. Ac.: Tech.* 64 (4), 785–792 (2016).
- [15] L. Czarnecki and D. Van Gemert, “Innovation in construction materials engineering versus sustainable development”, *Bull. Pol. Ac.: Tech.* 65 (6), 765–772 (2017).
- [16] J. Zapała-Sławeta and Z. Owsiak, “Effect of lithium nitrate on the reaction between opal aggregate and sodium and potassium hydroxides in concrete over a long period of time”, *Bull. Pol. Ac.: Tech.* 65 (6), 772–778 (2017).
- [17] A. Chomicz-Kowalska, “Laboratory testing of low temperature asphalt concrete produced in foamed bitumen technology with fiber reinforcement”, *Bull. Pol. Ac.: Tech.* 65 (6), 779–790 (2017).
- [18] A. Piekarczyk, “Test-supported numerical analysis for evaluation of the load capacity of thin-walled corrugated profiles”, *Bull. Pol. Ac.: Tech.* 65 (6), 791–798 (2017).
- [19] W. Buczkowski, A. Szymczak-Graczyk, and Z. Walczak, “Experimental validation of numerical static calculations for a monolithic rectangular tank with walls of trapezoidal cross-section”, *Bull. Pol. Ac.: Tech.* 65 (6), 799–804 (2017).
- [20] M. Rucka, W. Witkowski, J. Chróścielewski, S. Burzyński, and K. Wilde, “A novel formulation of 3D spectral element for wave propagation in reinforced concrete”, *Bull. Pol. Ac.: Tech.* 65 (6), 805–814 (2017).
- [21] M. Basińska, “The use of multi-criteria optimization to choose solutions for energy-efficient buildings”, *Bull. Pol. Ac.: Tech.* 65 (6), 815–826 (2017).



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