

## **The Riad T. Sadek Chair in Civil Engineering 2021-2022 Activity Report**



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# 1. RESEARCH ACTIVITIES (2021-2022)

## 1.1 Research Activities (Continuing)

The research in strengthening reinforced concrete beams using different materials has progressed smoothly and with high productivity as evident by the list of journal and conference publications shown below. The development of Engineered Cementitious Composites (ECC) has also progressed very well with a full scale testing of the entire test matrix completed, however more specimens need to be cast and tested to reinforce some of the findings observed on the tested specimens. Several publications are currently under preparation that will come out of the results of the conducted tests and the additional specimens. The conducted tests and the planned ones were on samples for investigating the following research topics:

### 1. Mechanical Properties of High Strength ECC with Oil Contaminated Dune Sand

The influence of oil contaminated dune sand on the mechanical performance of HSHD-ECC where dune sand with different oil contaminated percentage is incorporated into HSHD-ECC has been investigated. The mechanical performance of HSHD-ECC with the incorporation of oil contaminated dune sand will be characterized via the compressive/tensile/four-point bending tests. A full scale test was carried out and the results were analyzed, however, more specimens were cast and will be tested soon.

### 2. Thermal Impact on Properties of High Strength ECC

The mechanical properties and behavior of HSHD-ECC will be investigated under elevated temperature. Large and full scale test specimens were carried out for different design mixes of HSHD-ECC at different temperatures ranging from 25 to 800 °C. The results will be analyzed and used for publication. Four conference papers were already published using some of the test results.

### 3. Development of High Strength and High Ductility ECC (HSHD-ECC) for Strengthening of RC Beams in Shear

The research topic of Development of High Strength and High Ductility Engineered Cementitious Composites (HSHD-ECC) material for strengthening of Reinforced concrete beams in shear and in flexure will continue. Large test specimens (beams) will be strengthened in flexure and in shear with HSHD-ECC and they will be tested.

The Structures and Materials laboratory was under renovation for the last 18 months or so, this resulted in delay of testing the prepared specimens.

## 1.2 Research Grants

Finalization of internal and external research grants:

- Awarded an Exploratory research grant (FRG22-E-E38: AED 120,250) as a PI on Development of Sustainable Polyethylene-Engineered Cementitious Composites (PE-ECC) for Repair and Strengthening of Aging Concrete Structures.

- Awarded a Comprehensive research grant (FRG22-C-E26: AED 595,000) as co-PI on Performance of reinforced concrete beams strengthened in flexure with carbon fiber-reinforced polymer (CFRP) laminates anchored with spikes.
- Continued working as the PI for purchasing, commissioning and facilitated training for the actuators for the load frame and for upgrading the controller of the existing UTM (cost AED 1,590,000). The actuators and their accessories has been delivered to the Structures Laboratory and they will be installed and commissioned soon.
- Worked, as co-PI, on finalizing the awarded (FRG19-M-E31: AED 140,000) Research Grant (2019-2022) on Strengthening of Shear Deficient RC beams using Anchored CFRP sheets.

### **1.3 Highlights of Scholarly Activities (2021-2022)**

- Published 14 journal papers out of which 11 are in Q1 journals, two are in Q2 journals and one in a new Elsevier Journal that is indexed by Scopus.
- Published four papers in a special issue of the Procedia Structural Integrity Journal that is indexed by Scopus.
- Published five conference papers in IEEE Xplore that is indexed by Scopus.
- Submitted six journal papers for review.

#### **1.3.1 Journal Papers Published**

1. Rami A Hawileh, Haya H Mhanna, Ahmad Al Rashed, Jamal A Abdalla, MZ Naser. Flexural behavior of RC beams externally bonded with polyethylene terephthalate (PET) fiber reinforced polymer (FRP) laminates. *Engineering Structures*. Vol. 256, 1 April 2022, 114036, 2022.
2. Abuzaid, W., Hawileh, R., and Abdalla, J.A. Mechanical Properties of Strengthening 5083-H111 Aluminum Alloy Plates at Elevated Temperatures. *Infrastructures*, MPDI, 2022.
3. Thomas, B. S., Yang, J., Bahurudeen, A., Chinnu, S. N., Abdalla, J. A., Hawileh, R. A., ... & Hamada, H. M. Geopolymer concrete incorporating recycled aggregates: A comprehensive review. *Cleaner Materials*, 100056, 2022.
4. Hawileh, R. A., Al Nuaimi, N., Nawaz, W., Abdalla, J. A., & Sohail, M. G. Flexural and Bond Behavior of Concrete Beams Strengthened with CFRP and Galvanized Steel Mesh Laminates. *Practice Periodical on Structural Design and Construction*, 27(1), 04021068, 2022.
5. Abokwiek, R., Al Sharabati, M., Hawileh, R., Abdalla, J. A., Sabouni, R., & Hussein, G. A. A Finite Element Model for the Analysis of Seepage Flow of Water under Concrete Dams. *Geotechnical and Geological Engineering*, 1-19, 2022
6. Thomas, B.S., Yang, J., Bahurudeen, A., Abdalla, J.A., Hawileh, R.A., Hamada, H.M., Nazar, S., Jittin, V., and Ashish, D.K. Sugarcane bagasse ash as supplementary cementitious material in concrete – A review. *Materials Today Sustainability*, 100086, 2021.
7. Naser, M. Z., Kodur, V., Thai, H. T., Hawileh, R., Abdalla, J., & Degtyarev, V. V. StructuresNet and FireNet: Benchmarking databases and machine learning algorithms

- in structural and fire engineering domains. *Journal of Building Engineering*, 44, 102977, 2021.
8. Mahmoud, H. S., Hawileh, R. A., & Abdalla, J. A. Strengthening of high strength reinforced concrete thin slabs with CFRP laminates. *Composite Structures*, 275, 114412, 2021.
  9. Mhanna, H. H., Hawileh, R. A., & Abdalla, J. A. Shear behavior of RC T-beams externally strengthened with anchored high modulus carbon fiber-reinforced polymer (CFRP) laminates. *Composite Structures*, 272, 114198, 2021.
  10. Abuodeh, O. R., Hawileh, R. A., & Abdalla, J. A. Nonlinear finite element models of reinforced concrete beams strengthened in bending with mechanically fastened aluminum alloy plates. *Computers & Structures*, 253, 106573, 2021.
  11. Mhanna, H. H., Hawileh, R. A., Abdalla, J. A., Salama, A. S., & Alkhrdaji, T. Shear Strengthening of Reinforced Concrete T-Beams with Anchored CFRP Laminates. *Journal of Composites for Construction*, 25(4), 04021030, 2021.
  12. Thomas, BS, Yang, J, Mo, KH, Abdalla, JA, Hawileh, RA and Ariyachandra, RA. Biomass ashes from agricultural wastes as supplementary cementitious materials or aggregate replacement in cement/geopolymer concrete: A comprehensive review. *Journal of Building Engineering*, 102332, 2021.
  13. Hamada, HM, Thomas, BS, Yahaya, FM, Muthusamy, K, Yang, J, Abdalla, JA and Hawileh, RA. Sustainable use of palm oil fuel ash as a supplementary cementitious material: A comprehensive review. *Journal of Building Engineering*, 102286, 2021.
  14. Abuodeh, O. R., Hawileh, R. A., & Abdalla, J. A. Finite element modelling of aluminum alloy plated reinforced concrete beams. *Computers and Concrete*, 27(6), 585-596, 2021.

### 1.3.2 Conferences and Special Issue Publications

1. Abdalla, Jamal A., Abokwiek, Raed, Hawileh, Rami A. Models for Predicting Strength of RC Columns Strengthened with NSM-CFRP Strips and CFRP-Fabric Wraps. Special Issue of the ICSI2021, *Procedia Structural Integrity*, 37, 660-667, 2022.
2. Abdalla, Jamal A., Hawileh, Rami A., Rasheed, Hayder A. Behavior of Reinforced Concrete Beams Strengthened in Flexure using Externally Bonded Aluminum Alloy Plates. Special Issue of the ICSI2021, *Procedia Structural Integrity*, 37, 652-659, 2022.
3. Alshami, G. S., Hawileh, R. A., Abdalla, J. A., & Mhanna, H. H. Evaluation on the effect of anchor embedment depth on the flexural capacity of concrete prisms. Special Issue of the ICSI2021, *Procedia Structural Integrity*, 37, 367-374, 2022.
4. Mhanna, H. H., Hawileh, R. A., & Abdalla, J. A. Comparative analysis of design guidelines for FRP contribution to shear capacity of strengthened RC beams. Special Issue of the ICSI2021, *Procedia Structural Integrity*, 37, 359-366, 2022.
5. A. H. Selim, F. Mahmoudi, J. A. Abdalla, R. A. Hawileh, F. Abed and M. Kyaure, "Finite Element Modeling of Engineered Cementitious Composite (ECC) Prisms and Beams," 2022 *Advances in Science and Engineering Technology International Conferences (ASET)*, 2022, pp. 1-6, doi: 10.1109/ASET53988.2022.9734820, 2022.
6. F. Mahmoudi, A. H. Selim, J. A. Abdalla, R. A. Hawileh, F. Abed and M. Kyaure, "Finite Element Modeling and Prediction of Tensile Behavior of PE-ECC Dogbones," 2022 *Advances in Science and Engineering Technology International Conferences*

- (ASET), 2022, pp. 1-5, doi: 10.1109/ASET53988.2022.9735005, 2022.
7. M. Assad, R. A. Hawileh, J. A. Abdalla and F. Abed, "Heat Transfer Analysis of Reinforced Concrete Walls in ANSYS and ABAQUS: A Comparative Study," 2022 Advances in Science and Engineering Technology International Conferences (ASET), 2022, pp. 1-5, doi: 10.1109/ASET53988.2022.9735001, 2022.
  8. Mhanna, H. H., Hawileh, R. A., & Abdalla, J. A. (2021, December). Effect of FRP Anchor Inclination Angle on Shear Strengthening of Reinforced Concrete T-beams. In International Conference on Fibre-Reinforced Polymer (FRP) Composites in Civil Engineering (pp. 2169-2179). Springer, Cham., 2021.

## **2. Teaching and Academic Activities (2021-2022)**

### **2.1 Teaching Activities**

1. Taught and coordinated five different courses during this academic year
2. Revised and updated the contents of CVE301, CVE312, CVE325, CVE490 and CVE491.
3. Taught CVE 325 after 15 years of absence and taught CVE490 after 13 years of absence.
4. Supervised/co-supervised two capstone projects (CVE490/CVE491), a total of six students.
5. Supervised four MSCVE graduate students (two as Major Advisor and two as Co-advisor).
6. Supervised one MSCVE as co-advisor (graduated in Fall 2021).
7. Currently supervising one Ph.D. graduate students as a Major Advisor.

### **2.2 Academic and Professional Service Activities**

1. Served on the Faculty Evaluation Committee at CEN level.
2. Served on the Engineering Faculty Council at CEN level.
3. Served on the Ministry of Education (MoE) Committee for Skill Test for UG Seniors and chaired the civil engineering subcommittee that developed a database of 300 MCQs.
4. Served on the Admission Committee of Material Science and Engineering PhD Program.
5. Lead the effort of training, transportation, installation and commissioning of the actuators for the Load Frame.

## **3. Professional Activities and Collaboration (2021-2022)**

1. Served as ABET Program Evaluator (PEV).
2. Served as a member of the Editorial Board of the Journal of Computers and Concrete.
3. Served on the Board of Directors of the International Society for Computing in Civil and Building Engineering (ISCCBE).

4. Served as a member of Mohammed Bin Rashid Academy of Science (MBRAS).
5. Served on the Advisory Board of Engineering and Technology from Emirates Scientist Council (ESC) (MBRAS).
6. Initiated and established ASCE SEI Graduate Student Chapter which is the first outside USA.
7. Served on SEI Advances in Information Technology (AIT) and SEI Global Activities Division (GAD) Committees.
8. Reviewed several papers for Q1 and Q2 journals.
9. Served as Guest Editor for a special issue of Elsevier Journal of Cleaner Materials.
10. Served as a Guest Editor for Materials Today Proceedings special issue for the International Conference on Construction Materials and Structures (ICCMS 2021).