SWATI MAITRA
Scientist, WOS-A scheme, DST, Govt. of India
Department of Civil Engineering
Indian Institute of Technology Kharagpur
Kharagpur-721302, India
E-mail: swati@civil.iitkgp.ernet.in, swatimiit@gmail.com

Academic Records

Degree	Period of Study From – To	University/ Institution	Subjects
Ph. D.	2004 -2010	Indian Institute of Technology, Kharagpur	Transportation/Structural Engineering
M. Tech	1999 – 2001	Indian Institute of Technology, Bombay	Structural Engineering
B.E.	1985 – 1989	B. E. College, Calcutta University	Civil Engineering

Professional/ Employment Record

From January 2013 : **till date**
Indian Institute of Technology, Kharagpur
Research Scientist, Civil Engineering Department, under WOS-A scheme, DST, Government of India

From May 2010 : **to December 2010**
Research Work (Honorary) in Technische Universitat Darmstadt, Germany

From July 2004 : **to April 2010**
Indian Institute of Technology, Kharagpur
Research Scholar, Department of Civil Engineering

From February 1998 **to June 2001**
Employer : Indian Institute of Technology, Bombay
Position Held : Research Associate, Department of Civil Engineering
Description of Duties : Execution of Research and Industrial Projects

From April 1991 **to January 1998**
Employer : Apex Techno Consultants Pvt. Ltd., Kolkata
Position Held : Senior Design Engineer
Description of Duties : Execution of Civil Engineering Projects; Design, Estimation and Supervision of Drawing and Drafting

From August 1989 **to April 1991**
Employer : D. Sinha and Associates, Kolkata
Position Held : Assistant Engineer
Description of Duties : Execution of Civil Engineering Projects

Professional Experience

Research Work – WOS-A scheme, DST

Title: Investigation of Crack Propagation and Fatigue Fracture Characteristics of Cement Concrete Pavement

Summary: Pavements are subjected to repetitive traffic loads along with temperature and moisture variation. As a result, cracks may develop at the highly stressed regions and propagate within the structure leading to failure of the pavement due to fatigue. In most of the design guides, fatigue cracking is considered as the main criterion for failure. Miner's concept of 'cumulative linear fatigue damage' is adopted for evaluating the adequacy of the slab against fatigue failure. However, recent research on pavement indicates that the accumulation of damage in concrete is not linear as assumed in Miner's hypothesis. Fatigue in concrete has been found due to progressive internal damage in the form of crack initiation and its growth within the structure. The fracture properties of concrete govern the progressive internal damage within concrete. Therefore, experimental and theoretical investigations have become necessary to understand the crack sensitivity and the post-crack behavior of concrete under cyclic loading. In this research, the post-crack behavior and the fatigue performance of concrete are being investigated both experimentally and numerically using nonlinear fracture mechanics approach. A number of laboratory tests will be performed on different concrete specimens (beams) with varying parameters to investigate the crack sensitivity of concrete under monotonic and cyclic loading. Numerical analysis has been performed using nonlinear fracture mechanics approach to develop a model for predicting the crack resistance and the fatigue life of concrete pavement. In India, very limited experimental and theoretical studies have been done so far on the post-crack behavior of concrete. The proposed research will contribute in understanding the crack propagation and the fatigue fracture characteristics of concrete and as a result will contribute to improve the rationality in the design of concrete pavement.

Research Experience (Honorary) in Technischen Universitat Darmstadt (May 2010-December 2010)

Carried out research work (Honorary) at Institute of Road and Pavement Engineering & Institute for Concrete, Technischen Universitaet Darmstadt, Germany during May 2010 to December 2010 after the submission of Ph.D thesis. The works included

- Numerical modeling of Concrete structures
- Numerical modeling of Bituminous pavement

Ph. D. Work (2004 – 2010)

Title: Numerical and Experimental Investigations of Jointed Concrete Pavement

Summary: Cement concrete pavements are being constructed in many new road projects in India as they are considered to be economical especially for the highly trafficked segments of national highways. In the present work, a three-dimensional finite element model has been developed for the analysis of jointed concrete pavement. The FE modeling considers several aspects of analysis and design like slab-foundation interaction, interface behavior between concrete slab and foundation, load transfer at joints by dowel bar and aggregate interlocking mechanisms, effect of temperature variation, nonlinear deformational response of concrete etc. Push-off tests have been conducted in the laboratory on model concrete pavements with different interface conditions (smooth and rough) and on different types of foundations (base and subbase) to obtain the values of coefficient of friction, which is a parameter for modeling interface condition. The FE model has been validated with the experimental results available in the literature and also from the results of structural evaluation of in-service concrete pavements carried out in the present work using Falling Weight Deflectometer.

Using the validated FE model, some of the current design issues have been examined. The effect of different pavement and joint related parameters on the load transfer characteristics of a doweled joint has

been evaluated. The group action of the dowel bar system was also examined and useful relationships have been developed for estimation of the relative load shared by the individual dowel bars. The effect of different interface conditions on critical stresses under individual or combined action of wheel load and temperature differential has been studied. A generalized expression has been proposed for estimating the critical (edge) stress in the slab subjected to the combined action of axle loading and positive temperature gradient. A fatigue performance model has been developed based on fracture mechanics principles for predicting crack propagation within the concrete slab under cyclic loading.

M. Tech Dissertation (1999 – 2001)

Title: Fiber Reinforced Polymer Composites in the Rehabilitation and Strengthening of Reinforced Concrete Columns

Summary: Application of Fiber Reinforced Polymer Composites (FRPC) in the rehabilitation and strengthening of deteriorating structural members as well as in new constructions was explored. Effective utilization of FRPC as a confining material was found to increase substantially the strength and ductility of concrete columns. The behavior of concrete columns having different cross sections with different levels of confinement and loading conditions was studied. A number of experiments were performed to observe these effects. Based on the experimental observations, an analytical model was developed for standard short circular column and also for non-circular columns. The theoretical model could predict the response of concrete columns confined by FRPC. A design method for confined concrete column was proposed which involved the determination of the amount of confinement required for a desired increase in strength.

Research Project Sponsored by ISRO (as Research Associate in IIT Bombay, 1998 - 2001)

Title: Role of Fiber Matrix Interface in Fracture Toughness of Brittle Matrix Components

Summary: Ceramic materials have the property to withstand very high temperature without losing their strength but are prone to catastrophic brittle failure due to their lack of toughness, particularly in the presence of flaws. By reinforcing these ceramic materials with different ceramic fibers fracture toughness can be increased and the material is termed as Ceramic Matrix Composite (CMC). The properties of CMC are dominated by Fiber-matrix interface. It is found that, a weak fiber-matrix interface is desirable to impart sufficient toughness, whereas a strong interface bonding leads to catastrophic brittle failure. An analytical study was performed for the determination of optimum property profiles for the interfaces for different fiber-matrix combinations. A Finite Element model for CMC was developed for conducting sensitivity studies on different samples and the results obtained were synthesized into an Artificial Neural Network model to obtain the desired properties of CMC.

Industrial experience as Design Engineer in Apex Techno Consultants Pvt. Ltd. Kolkata (1991 – 1998)

Projects Associated With

- Durgapur Steel Plant Modernisation
- Primary Washing Station at Dudhichua
- Graphite Beneficiation Plant, Madras
- Rourkella Steel Plant Modernisation
- TISCO Bhelatand Washery
- Hot Strip Mill Project, Dolvi
- Offsites & Utilities for Spic Petrochemicals Ltd.
- IPITATA Sponge Iron Plant
- Bulk Cement Terminal, Mangalore
- Bakreshwar Thermal Power Project
- Polypropylene Project, Jamnagar

Works Involved

- Design of Industrial / Residential RCC and Steel Structures
- Design of Water tanks, Reservoirs, Cooling Towers
- Design of Steel Junction House, Pump House, Control Room, Substation Building
- Design of Tripper Conveyor Structure
- Design of Trestles, Conveyor Gallery and Supporting Structures
- Design of Equipment/Machine Foundations
- Design of Cable Trenches, Drains and Culverts
- Design of RCC Thickeners and Bins

Research Interests

Finite element modeling of concrete structures considering several aspects of analysis and design like slab-foundation interaction, interface behavior between concrete slab and foundation, load transfer at joints by dowel bar and aggregate interlocking mechanisms, effect of temperature variation, nonlinear deformational response of concrete using fracture mechanics, fatigue performance of concrete structures, application of fiber reinforced polymer composites in rehabilitation of deteriorated structures etc.

Reviewer of Journals

- Journal of Transportation Engineering, ASCE
- International Journal of Pavement Engineering

List of Publications

Maitra, S. R., Reddy, K. S. and Ramachandra, L. S. (2014). "Numerical Investigation of Fatigue Characteristics of Concrete Pavement." *International Journal of Fracture,* 189(2), 181-193.

Maitra, S. R., Reddy, K. S. and Ramachandra, L. S. (2013). "Estimation of Critical Stress in Jointed Concrete Pavement." Under review, *Proceedings of the 2nd International Conference of Transportation Research Group of India (CTRG, 2011)*, Agra, India.

Maitra, S. R., Reddy, K. S. and Ramachandra, L. S. (2011). "Structural Evaluation of an In-Service Concrete Pavement." *Proceedings of the 1st International Conference of Transportation Research Group of India (CTRG, 2011)*, Bangalore, India.

Maitra, S. R. (2011). Abstract, Ph. D. thesis. *Newsletter, International Society for Concrete Pavements* 8(3).

Maitra, S. R., Reddy, K. S. and Ramachandra, L. S. (2010). "Load Transfer Characteristics of Aggregate Interlocking in Concrete Pavement." *Journal of Transportation Engineering,* ASCE, 136 (3), 190-195.

Maitra, S. R., Reddy, K. S. and Ramachandra, L. S. (2009). "Load Transfer Characteristics of Dowel Bar System in Jointed Concrete Pavement." *Journal of Transportation Engineering,* ASCE, 135(11), 813-821.

Maitra, S. R., Reddy, K. S. and Ramachandra, L. S. (2009). "Experimental Evaluation of Interface Friction and Study of its Influence on Concrete Pavement response." *Journal of Transportation Engineering,* ASCE, 135(8), 563-571.

Maitra, S. R., Reddy, K. S. and Ramachandra, L. S. (2007). "Load Transfer in Dowel-Jointed Concrete Pavement." *Proceedings of the International Conference on Civil Engineering in New Millennium: Opportunities and Challenges (CENeM-2007),* Bengal Engineering and Science University, Shibpur, India. Vol. III, 2132-2138.

Maitra, S. R., Reddy, K. S. and Ramachandra, L. S. (2007). "Influence of interface condition on concrete pavement response - an experimental evaluation." *Proceedings of the International Conference on Advanced Characterisation of Pavement and Soil Engineering Materials*, Athens, Greece, Vol. 2, 1455-1462.

Maitra, S. R., Reddy, K. S. and Ramachandra, L. S. (2006). "Interface Behavior in Concrete Pavement." *Proceedings of 2nd International Congress of Computational Mechanics and Simulations (ICCMS 2006),* Indian Institute of Technology, Guwahati, India.

Mukherjee, A., Boothby, T. E., Bakis, C. E., Joshi, M. V. and **Maitra, S. R.** (2004). "Mechanical Behavior of Fiber-Reinforced Polymer-Wrapped Concrete Columns—Complicating Effects." *Journal of Composites for Construction*, ASCE, 8(2), 97-103.

Mukherjee, A., **Maitra, S. R.** and Joshi, M. V. (2002). "FRPC confined concrete columns - Experimental and analytical studies." *Proceedings of the International Conference on Advances in Civil Engineering (ACE-2002),* Indian Institute of Technology, Kharagpur, India.