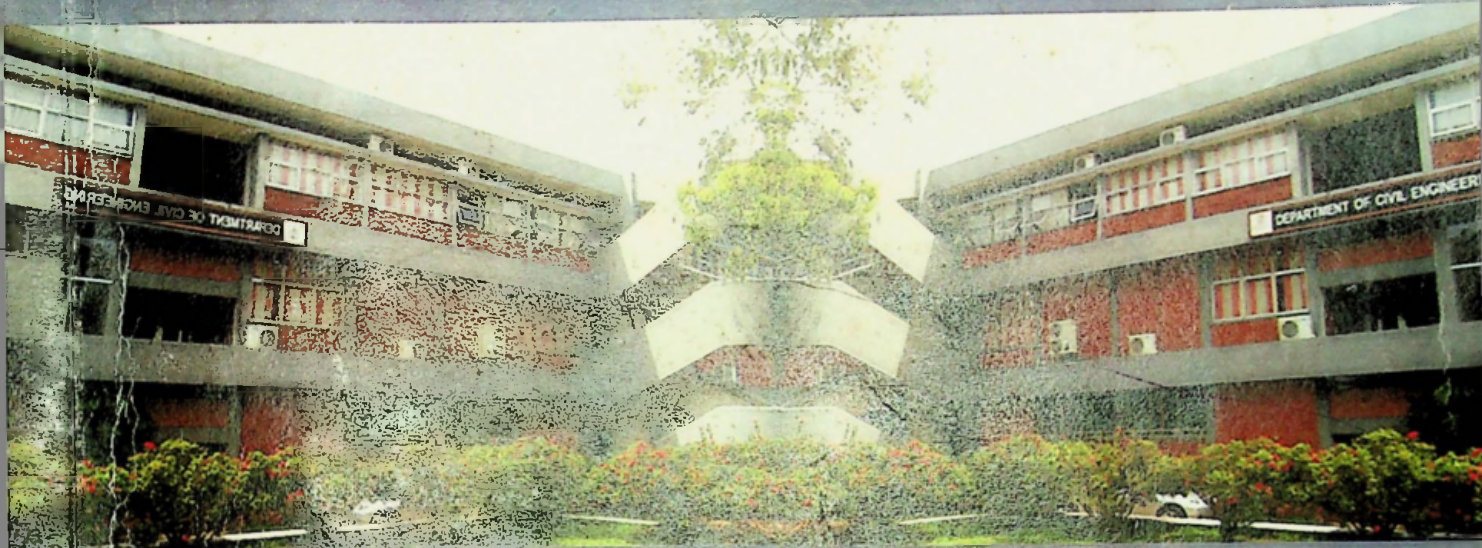


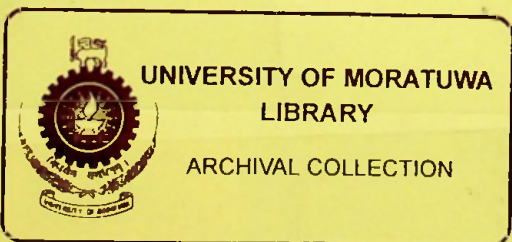
Proceedings of the Symposium



Symposium on

Civil Engineering Research for Industry-2011
Dedicated to Prof. S. R. De S. Chandrakeerthy

September 20, 2011



62(066)(548.7)
S8
N3697



Organized By

Department of Civil Engineering
University of Moratuwa
Sri Lanka

Symposium on Civil Engineering Research for Industry-2011

Dedicated to Prof. S.R. De S. Chandrakeerthy

December 20, 2011

Editor-in-Chief

Prof. (Mrs.) N. Ratnayake

Organizing Committee

Prof. M.T.R.Jayasinghe - Symposium Co-Chair

Dr. U.P. Nawagamuwa

Prof. Manjriker Gunaratne- Symposium Co-Chair

Mr. Loshaka Perera

Prof. (Mrs.) N. Ratnayake

Mr. Janaka Bamunawala

Prof. (Mrs.) C. Jayasinghe

Reviewers

Prof. (Mrs.) N. Ratnayake

Dr. J.M.A. Manatunge

Prof. S.M.A. Nanayakkara

Mr. A.H.R. Ratnasooriya

Prof. S.P. Samarawickrama

Dr. R.L.H.L. Rajapakse

Prof. H.S. Thilakasiri

Symposium Secretary

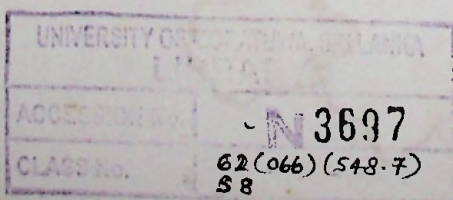
Dr. U.P. Nawagamuwa

Organized by:

Department of Civil Engineering

University of Moratuwa

Sri Lanka





LIBRARY
UNIVERSITY OF MORATUWA, SRI LANKA
MORATUWA

**SYMPOSIUM ON
CIVIL ENGINEERING RESEARCH FOR INDUSTRY-2011**

Dedicated to Prof. S. R. De S. Chandrakeerthy

62 (066) (548.7)
58

20th December 2011

University of Moratuwa



N3697

Department of Civil Engineering

University of Moratuwa

Sri Lanka

N 3697

N 3697

Arch,



UNIVERSITY OF MORATUWA
SRI LANKA

SYMPOSIUM ON

CIVIL ENGINEERING RESEARCH FOR INDUSTRY-2011

Dedicated to Prof. S. R. De S. Chandrasekery

Proceedings of the Symposium on Civil Engineering Research for Industry-2011

20th December 2011, University of Moratuwa

UNIVERSITY OF MORATUWA SRI LANKA	
ACCESSION No.	N 3697
CLASS No.	62(066)(548.7) S8

Published by the Department of Civil Engineering
Faculty of Engineering
University of Moratuwa, Katubedda, 10400, Moratuwa, Sri Lanka

© 2011 Department of Civil Engineering

Message from the Head/ Department of Civil Engineering and Co-Chair of the Symposium

It is a privilege to be associated with this first symposium organized by the Department of Civil Engineering on "Civil Engineering Research for Industry - 2011" as a Co-chair while being the Head of the Department of Civil Engineering. This symposium also marks a very special occasion. It is the retirement of Prof S. R. De S. Chandrakeerthy after 43 years of dedicated service to the Department of Civil Engineering, who acted as a pillar of strength from its very inception nearly 43 years ago. To pay our heartfelt gratitude to this dedicated teacher, researcher and the colleague, the academic staff members took a timely decision to organize this symposium and to dedicate it to Prof S. R. De S. Chandrakeerthy.

The timing of the symposium is also ideal since it comes immediately after the conclusion of International Conference on Structural Engineering, Construction and Management - 2011 (ICSECM - 2011) that has been organized as an annual event and held at Earl's Regency Hotel of Kandy. This conference is a joint effort of Engineering Faculties of Peradeniya, Moratuwa and Ruhuna universities along with the Institution of Engineers, Sri Lanka. The expectation was to have at least few well recognized researchers of the world gracing this symposium at Moratuwa due to their presence in Sri Lanka.

With this symposium also having the potential to become an annual event for dissemination of state of the art research and development carried out in collaboration with the Industry of Sri Lanka and also with some collaboration with well-known universities of other countries, I believe Civil Engineering Research for Industry - 2011 will be a start of a long journey for success and innovation. It will also be a window of opportunity for initiating further collaborations that will sharpen the dynamic research culture that has been established by the well qualified and dedicated staff of the Department of Civil Engineering that has 41 academics in its cadre. It will also be an important impetus in realizing the Government of Sri Lanka's goal of improving universities of Sri Lanka to have a better world ranking while producing "World Class Graduates".

I wish the participants and presenters a very fruitful and enjoyable time at this symposium that is dedicated to Prof S. R. De S. Chandrakeerthy.

Prof M. T. R. Jayasinghe

Senior Professor/ Head of the Department,
Department of Civil Engineering,
University of Moratuwa,
Moratuwa, Sri Lanka.

Message from the Dean/ Faculty of Engineering

I am glad to note the organization of the Symposium of Civil Engineering Research for Industry 2011 dedicated to Prof. S. R. De S. Chandrakeerthy, as a special event this year.

It is with immense gratitude that I recall the long and esteemed service rendered to the University of Moratuwa by Prof. S. R. De S. Chandrakeerthy.

He has taught and moulded generations of civil engineers for this country, commencing in February 1968, when he joined the academic staff at the then Ceylon College of Higher Technology, Katubedda, which became a university four years later. He was a dedicated teacher who took great interest in each and every student he came across to teach. I can distinctly recall the personal attention he accorded us when I was in the first year of the engineering degree programme, which was continued right throughout until our graduation.

Prof. Chandrakeerthy was an accomplished researcher who contributed immensely to the local industry. He was also involved in research contributions at international level, particularly during his many sabbatical periods spent in UK and Canada.

I convey my best wishes to Prof. Chandrakeerthy and his family for a happy and content life in retirement.

I wish to convey my thanks to Prof. Thishan Jayasinghe, Head, Department of Civil Engineering, Dr. Udeni Nawagamuwa, Symposium Secretary, and all the staff at the Department of Civil Engineering for organizing and contributing their research work to the Research Symposium dedicated to Prof. Chandrakeerthy.

Prof. U. G. A. Puswewala

Dean, Faculty of Engineering
University of Moratuwa,
Moratuwa, Sri Lanka.

Message from the Vice-Chancellor

I was delighted to note the holding of Symposium - Civil Engineering Research for Industry 2011 as a special event this year dedicated to recently retired Prof. S.R. De S. Chandrakeerthy, one of the pioneers and legendary contributors for Civil Engineering education and research as a gratitude for his 43 years of untiring and dedicated service. This Symposium will therefore create an unforgettable history in the Department of Civil Engineering.

I was also pleased to note the enthusiasm of the Department to organize this focused symposium with over 21 papers demonstrating its individual contribution for university research. The Department of Civil Engineering is therefore a trend setter for the other departments to drive research and to hold focused research symposia.

One of the goals that the University strives to achieve is to have a thriving and sustainable research and innovation culture in our march towards a world class university. In addition to University research allocation attempts are made to attract private sector funding leveraging the 300% tax concession for research investment by the private sector. This is a great opportunity for Civil Engineering to significantly contribute for development of alternative/new materials, new construction technologies, and new building components to support rapid infrastructure development of our country which is a pre-requisite for our march towards a middle income nation.

It is my hope that this Symposium will not only disseminate Civil Engineering research findings but also create further opportunities to identify new directions, obtain ideas for more development oriented research and attract further research funding.

While expressing my appreciation to the Head Department of Civil Engineering Prof. M.T.R.Jayasinghe for this initiative Dr. UdeniNawagamuwa, the Secretary of the symposium for dedicatedly organizing this Symposium, I wish Civil Engineering Research for Industry 2011 Symposium great success.

Prof. AnandaJayawardane

The Vice - Chancellor,
University of Moratuwa,
Moratuwa, Sri Lanka.

Acknowledgement

Civil Engineering Research for Industry -2011 is the first of an annual event that could bring immense benefits to the civil and construction industry of Sri Lanka. The success of this one day symposium is a joint effort of the academic staff members and the research students of the Department of Civil Engineering, University of Moratuwa. Their efforts are acknowledged very much.

This symposium is held with the blessings of the Vice Chancellor and the Dean of Faculty of Engineering. This year, this important symposium coincides with the retirement of Prof S. R. De S. Chandrakeerthy after 43 years of dedicated service. Hence, the symposium is dedicated to Prof S. R. De S. Chandrakeerthy.

The organizers of the symposium wishes to thank the Vice Chancellor for granting permission to have this event at the Department of Civil Engineering as a follow up event of the International Conference that will generally be held in Kandy each year jointly organized by the Universities of Peradeniya, Moratuwa and Ruhuna along with the active support from Institution of Engineers, Sri Lanka. This year, it is organized as a follow up event of the International Conference on Structural Engineering, Construction and Management that has been scheduled for 15th, 16th and 17th of December, 2011. The expectation is the participation of some of these delegates of the International Conference at the *Civil Engineering Research for Industry, 2011*. Some of the leading researchers of the world have agreed to be the keynote speakers and the important participants. Their efforts and presence is appreciated very much.

The organizers also wish to thank Dean, Faculty of Engineering for his wholehearted support. A symposium of this nature will be successful only if it is well attended. All the delegates from other universities and the industry who participated in this symposium are appreciated for devoting their valuable time amidst their busy schedules.

A special thank is due for the authors of the papers and the editorial panel led by Senior Professor Niranjani Ratnayake for their tireless efforts to finalize the papers. The organizers appreciate the dedication of the reviewers very much and hope that they would extend similar support in future as well.

Academic staff members were amply supported by many other members and research students of the Department of Civil Engineering in organizing this symposium. A special thank is due for Mr. Chameera de Silva for designing the cover page. Mr. Janaka Bamunawala, Mr. Sahan Tharaka, Dilanth De Silva, Miss. Tharanga Ranasinghe, Miss. Suvetha B., Miss. Manori Perera, Mr. Chamila Rankoth, Mr. Mayooraan S., Mr. M. S. Perera and Ms. Dharshani Senanayake assisted the organization and also printing of the proceedings.

Organizers also wish to thank all those who assisted in numerous ways and hope that their unflinching support could be expected in the future as well.

Finally, we wish to extend our heartfelt gratitude to our principal sponsor of the event, Holcim Lanka, for their generous contribution. The platinum sponsor, *the Civil Engineering Society of the Department of Civil Engineering*, for its unflinching support in organizing important events of the Department of Civil Engineering, both with sponsorships and in kind is appreciated very much.

On behalf of the Organizing Committee,
Prof. M. T. R. Jayasinghe
Dr. U. P. Nawagamuwa
20th December 2011.

TABLE OF CONTENTS

	Page
Message from the Head/ Department of Civil Engineering and Co-Chair of the Symposium	III
Message from the Dean/ Faculty of Engineering	IV
Message from the Vice-Chancellor	V
Acknowledgement	VI
Table of Contents	VII
Abstracts	
Keynote address: Prof. R. Sri Ravindrarajah	1
Developments In Concrete Technology For Sustainable Construction	
Special speech: Prof. S. R. De S. Chandrakeerthy	2
Successes, Pitfalls, And Failures Of Civil Engineering Research For Industry: A Personal Perspective	
Invited Speeches	
I. <i>Prof. Manjriker Gunaratne</i>	3
Assessment Of Hydroplaning Crash Conditions In Florida's Highways	
II. <i>Prof. Nimal Rajapakse</i>	4
Continuum Modelling Of Nanobeams	
III. <i>Prof. W. P. S. Dias</i>	5
Lessons From Historic Buildings	
IV. <i>Eng. Gratian Peiris</i>	6
Using Value Chain Approach To Decide On Research Priorities And Allocate Scarce Research Resources	
Structural Engineering	
1) Ultimate Strength Prediction For Reinforced Concrete Slabs Externally Strengthened By Fiber Reinforced Polymer (FRP)	7
Aarna Sivarajah, Anushka Abeysinghe, Malith Lakshitha, Dr. Sujeewa Lewangamage	
2) State Of The Art Of Concrete Paving Blocks In Sri Lanka (CPBS)	13
Gopinath, K., Dr. Baskaran, K.	
3) Strength Assessment Of Steel Towers	21
Jeneevan, G., Jayasinghe, J. P. L. M., Hettiarachchi, H. H. A. N. C., Dr. Baskaran, K.	
4) Experimental Approach To Investigate Concrete-Masonry Interface	27
Induprabha, S.A.D., Premadasa, P. K. S., Liyanage, S. K., Ariyaratna, H. D. A. R., Dr. (Mrs) Dilrukshi, K.G.S.	

5) Traffic Induced Vibration Analysis Of Existing Steel Bridge In Padeniya- Anuradhapura Road	33
Kodikara, K. A. T. L., Morawaka, U. D., Gunathilake, I. A. P. M. P., Dr. Lewanagamage, C. S.	
6) Bond Performance Of CFRP Strengthened Concrete Subjected To Fire	37
Ranasinghe, R. A. T. M., Jinadasa, D. V. L. R., Srilal, H. P. S., Dr. (Mrs) Gamage, J. C. P. H.	
7) Strength Enhancement In Concrete Confined By Spirals	43
Kaneswaran, U., Reginthan, J., Perera, H. M. P., Dr. Baskaran, K.	
8) Assessing The Cracks Developed In Dematamal Viharaya, Butthala	49
Manori Perera, Suganya Paskaran, Dhanushka Kumara, Prof. Thishan Jayasinghe	
9) FE Modeling Of CFRP Strengthened Concrete Beam Exposed To Cyclic Temperature, Humidity And Sustained Loading	55
Bandara, H. R. C. S., Aravinda, M. D., Weerakon, S. D., Dr. (Mrs) Gamage, J. C. P. H.	
 Geotechnical and Highway Engineering	
10) Effect Of Relict Joints In Rain Induced Slope Failures	61
Neethimappiriya Tharmalingam, Lakshamana, N. W. H., Kumarasinghe, R. D. T. B. Prof. Kulathilaka, S. A. S.	
11) The Experimental Investigation Of Failure Mechanism And Bearing Capacity Of Different Types Of Shallow Foundations	67
Nissanka Fernando, Eranga Sendanayake, Dulan Sendanayake, Dr. Nalin De Silva	
12) Framework For The Estimation Of Overall Probability Of Dam Failure Of Ancient Earth Dams In Sri Lanka	73
Premkumar. S, Dr. De Silva, L. I. N.	
13) Study On The Possible Improvements Of ICTAD Specifications For Cohesionless Soil To Be Used As A Highway Construction Material	79
Suvetha, B., Tharaka, D. G. S., Ranasinghe, J. A. C. L., Dr. Mampearachchi, W. K., Prof. Thilakasiri, H. S.	
14) Effects Of Global Warming On Landslide Frequencies In Ratnapura District, Sri Lanka- 2011	83
Rathnaweera, T. D., Dr. Nawagamuwa, U. P.	
 Hydraulic and Environmental Engineering	
15) A Study On Sustainable Consumption Practices In Sri Lanka Hotel Sector	89
Eng Prof (Mrs) N Ratnayake, Eng. Srilal Miththapala	
16) Long Term Performance Of A Constructed Wetland Planted With Typha Angustifolia	95
Ayoma Witharana, Dr. Mahesh Jayaweera	

17) An Aquifer Characteristic Analysis For Identifying Groundwater Resource Development Alternatives In The Wet Zone Of Sri Lanka	101
Mayooran, S., Manarathna. S. P, Gogulan, N., Dr. Rajapakse, R. L. H. L.	
Construction Engineering and Management	
18) Evaporative Cooling For Occupational Health In Trpoical Climates	107
Arandara, K. P., Prof. (Mrs) Jayasinghe, C., Prof. Jayasinghe, M. T. R.	
19) Developing Psychological Contract To Sustain Construction Industry Workforce: A Review Of Literature	113
Vindya Chandradasa, Dr. Lesly Ekanayake	
20) Cement Stabilized Rammed Earth For Wall Junctions Of Two Storey Houses	119
Kandamby, T., Prof. (Mrs) Jayasinghe, C.	
Contribution from the Industry	
(By the Graduates of the University of Moratuwa)	
21) FRP Strengthening Of Concrete Structures - Design And Practical Emphasis In Sri Lanka	125
Shiromal Fernando, Dilina Hettiarachchi	
22) Innovative Earth Retaining System Adopted At The Proposed Printing Complex Project For Aitken Spence (Pvt) Ltd. At Mawaramandiya	131
Shiromal Fernando, Vasana Jayasena, Neomal Ferdinando	