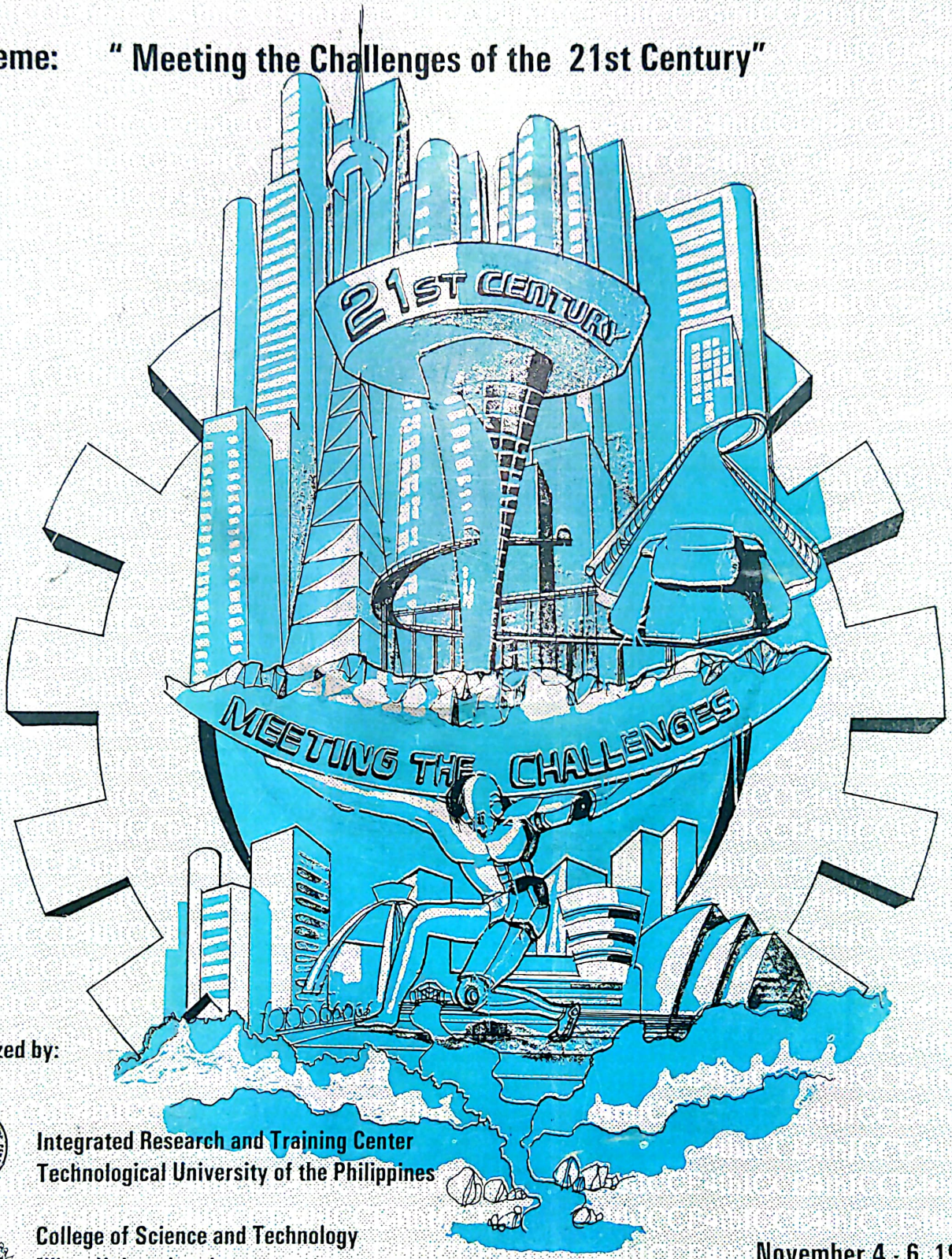
4 ICCE
4TH INTERNATIONAL CONFERENCE ON CIVIL ENGINEERING

Theme: **" Meeting the Challenges of the 21st Century"**



Organized by:

Integrated Research and Training Center
Technological University of the Philippines

College of Science and Technology
Nihon University, Japan

Integrated Research and Training Center Foundation, Inc.
Manila, Philippines

November 4 - 6, 1996
Manila, Philippines

日 本 大 学

NIHON UNIVERSITY
COLLEGE OF SCIENCE AND TECHNOLOGY

Expresses Congratulations
For The Success Of:

THE FOURTH INTERNATIONAL CONFERENCE ON CIVIL ENGINEERING

IRTC-TUP
Manila, Philippines

From

Nihon University
DEPARTMENT OF TRANSPORTATION ENGINEERING

Republic of the Philippines
TECHNOLOGICAL UNIVERSITY OF TH AT ISPORTS
Ayala Boulevard, Manila AND SPORTS

MESSAGE

My warmest greetings to the participants of the Fourth International Conference on Civil Engineering to be held on November 4-6, 1996 under the auspices of the Technological University of the Philippines (TUP)

The unprecedented rate that the contemporary society is changing is a foreboding that more is yet to come. Today's occasion which revolves around the theme, "Meeting the Challenges of the 21st Century", is a recognition of this dynamism as well as a vivid manifestation of your commitment to lead our country to progress in the face of change.

May you, as our front liners in the building of a modern and industrializing country, be always motivated by a deep sense of nationhood and social responsibility, armed by our renewed confidence and pride as a nation. Together, let us win the future by turning every challenge into an opportunity to learn, to grow and to excel.

Congratulations to the TUP for hosting the gathering and my very best wishes for the success of your conference.

MABUHAY KAYONG LAHAT!!!

MANILA
November 4, 1996

MESSAGE

We wish to commend the Civil Engineering Department of the Integrated Research and Training Center, Technological University of the Philippines, for conducting the Fourth International Conference on Civil Engineering (4ICCE) to be held on November 4-6, 1996.

Your theme, "Meeting the Challenges of the 21st Century" manifests your deep understanding of the important role the Civil Engineering sector plays in addressing the infrastructure needs brought about by the unprecedented rapid economic growth in developing countries.

We hope , therefore, that this three-day event, which focuses on the latest knowledge and techniques in various disciplines of Civil Engineering, will be a resounding success.

Best wishes and Godspeed!

ANGEL C. ALCALA
Chairman

Republic of the Philippines
TECHNOLOGICAL UNIVERSITY OF TH AT ISPORTS
Ayala Boulevard, Manila AND SPORTS

MESSAGE

To all the 4th ICCE Delegates and Guests - Mabuhay!

It is with great pleasure and honor for me to welcome all participants here today in this Fourth International Conference on Civil Engineering. This gathering is a golden opportunity for engineers, practitioners, and academicians to exchange ideas, share experiences, and keep abreast with the global advances of Science and Technology in the field of Civil Engineering.

Your personal and professional concern towards Quality and Excellence in Civil Engineering is a key towards common understanding of what is good for humanity putting aside cross cultural differences. My warmest congratulations and appreciation to our International Partners especially the College of Science and Technology of Nihon University, Japan for making this affair a reality. This is one of the more significant collaborative international projects of the University, through the synergy of all the staff of the Integrated Research and Training Center, in its continuous commitment and involvement in the promotion of research and development in Science and Technology which are imperative to National and Global Development.

It is hoped that the whole conference of this august body bring significant changes for the betterment of engineering education and practice. May your stay widen your horizon of understanding of culture, arts, and many other things of interest.

For the visitors, our Philippines will be your adopted residence. I assure you that the Philippine participants could provide you more than just the ordinary welcome.

Godspeed and good day!

FREDERICK SO. PADA
President

Integrated Research and Training Center
Technological University of the Philippines
Ayala Boulevard, Manila

MESSAGE

WELCOME to all 4th ICCE Delegates!

On behalf of the staff of the Integrated Research and Training Center, we extend our warmest greetings to all participants and guests of the 4th International Conference on Civil Engineering.

It is of particular pride and honor for the IRTC to play an active part in the convening of Civil and Architectural Engineers from all over the world to discuss, exchange ideas, and to propose and recommend solutions to the challenges of the 21st Century. It is a privilege to have experienced to work again in this international project with the College of Science and Technology - Nihon University, our co-organizer in this 4th ICCE.

The theme *"Meeting the Challenges of the 21st Century"* recognizes the unprecedented rapid growth of economy in Asia-Pacific, Europe, Africa and America. At the turn of the century, this growth will be coupled with a multiplied infrastructure needs which must be met by the Civil Engineering sector. On this occasion, the role of Civil and Architectural Engineers as nation builders and primemovers of development and industrialization is once again called to a challenge.

May this gathering help our engineers abreast with the advances in science and technology at a global perspective. I, therefore, take this opportunity to thank all the delegates who have shared their time, expertise and dedication in the promotion of Civil Engineering for global development. And to all participants, valued donors and sponsors, we say Thank You and MABUHAY!

Pablo A. Jorillo Jr.

PABLO A. JORILLO, JR.
Executive Director

REPUBLIKA NG PILIPINAS
REPUBLIC OF THE PHILIPPINES
KAGAWARAN NG EDUKASYON, KULTURA AT ISPORTS
DEPARTMENT OF EDUCATION, CULTURE AND SPORTS
UL Complex, Meralco Avenue
Pasig, Metro Manila

TANGGAPAN NG KALIHIM
(OFFICE OF THE SECRETARY)

MESSAGE

I wish to convey cordial felicitations to all the participants to the 4th International Conference on Civil Engineering (4ICCE) in Manila on November 4-6 this year. Greetings, too, to the organizers, the Civil Engineering Department of the Integrated Research and Training Center and the Technological University of the Philippines.

As we draw near to the 21st Century, we have to prepare ourselves for advancement and the improvement of infrastructures. To sustain these developments, the knowledge and the skills of civil engineers are a must.

This conference of civil engineers is, therefore, an essential element in bringing our country to the mainstream of universal progress. Efforts should be directed towards the establishment of a closer bond of cooperation and understanding among the civil engineers for a more efficient delivery of services in the country. the Conference theme: "Meeting the Challenges of the 21st Century" is, therefore, aptly chosen.

May this occasion further encourage the participants to take fresh initiatives to meet the challenges of their jobs, and to their collective civil engineering services and professional concerns

Congratulations and mabuhay

R. T. Gloria

RICARDO T. GLORIA
Secretary

November 1996

Republic of the Philippines
DEPARTMENT OF SCIENCE AND TECHNOLOGY

OFFICE OF THE SECRETARY

MESSAGE

On behalf of the Department of Science and Technology, I extend a warm welcome to the participants of the 4th International Conference on Civil Engineering (4ICCE). The conference theme, "Meeting the Challenges of the 21st Century" cannot come at a more opportune occasion. We are presented very rare privilege of witnessing the advent of a new millenium, ushered in by the 21st century.

The event signals change, even as events that have taken place in the last few years engineer such change. Technological advances have changed the way civil engineer works, as new materials, equipment, machinery and methods enable the construction of bigger, taller, stronger and more efficient structures. the demands of an ever-increasing and increasingly sophisticated population, on the other hand, force us to rethink the way we do things.

These and other challenges make the field of civil engineering dynamic and exciting as you continue to seek relevance amidst the sweeping winds of change that constantly alter the global landscape.

My wishes for a succesful undertaking and the attainment of this conference's objectives.

WILLIAM G. PADOLINA
Secretary

NIHON UNIVERSITY

COLLEGE OF SCIENCE & TECHNOLOGY

1-8, KANDA SURUGADAI, CHIYODA-KU,
TOKYO, 101 JAPAN

日 本 大 學

MESSAGE

It is my great pleasure to extend warmest greetings and best wishes to all the participants of the Fourth International Conference On Civil Engineering to be held in Manila on 4-6 November 1996.

Meeting the challenges of the 21st century is indeed a tremendous task. As significant economic concerns are being discussed by top leaders of the APEC members in Manila during the same period, let the field of Civil Engineering take advantage of this momentous event, by sharing the immense potentials of its technology in building the infrastructure of economic growth in Asia.

I am most honored to be given the opportunity to participate in this undertaking, and I fervently hope that this joint venture of the Technological University of the Philippines and the College of Science and Technology of Nihon University would further promote and strengthen friendship between the Philippines and Japan.

I admire the unyielding efforts of the IRTC staff and the many others who made this endeavor a realization. To all who worked hard for the success of this conference, my sincerest congratulations.

Tohru Wainai

Professor Tohru Wainai,
Dean of the College of Science and Technology
Nihon University

DEPARTMENT OF TRANSPORTATION ENGINEERING
COLLEGE OF SCIENCE AND TECHNOLOGY
NIHON UNIVERSITY
7-24-1 NARASHINODAI,FUNABASHI,CHIBA 274,JAPAN
日 本 大 學

MESSAGE

I am honored to be given the opportunity to extend greetings to the participants of the Fourth International Conference on Civil Engineering to be held in Manila on 4 - 6 November 1996.

As we face the challenges of the 21st century, we seek technological innovations that shall equip us meet the demands of development and modernization. This international conference, the meeting of great minds in the field of Civil Engineering, will indeed provide us with one fundamental step in facing the formidable task posed by the new century.

I commend the people behind this endeavor, particularly the IRTC, Technological University of the Philippines for hosting this conference. In this respect, I should also mention the invaluable pioneering efforts and unwavering dedication of the late Professor Masahiro Kawaguchi of the Department of Transportation and Civil Engineering of the College of Science and Technology of Nihon University, who played a key role in fostering a fruitful academic cooperation between the Technological University of the Philippines and the College of Science and Technology.

The challenge to continue aiming for excellence in the field of Civil Engineering lies to the younger Civil Engineers, who shall enjoy the blessings of this conference.

Congratulations and best wishes for a successful conference.

高田邦道

Professor Kunimichi Takada
Chairman
Transportation Engineering

Integrated Research and Training Center Foundation, Inc.
Integrated Research and Training Center
Ayala Boulevard, Manila

MESSAGE

It is with great pleasure to have this opportunity to extend my warmest greetings to the participants of the Fourth International Conference on Civil Engineering.

On behalf of the IRTCFI, I would like to extend my sincerest gratitude to all persons who made this conference a reality.

Certainly, this gathering of minds will give us insights on how we can meet the challenges in the field of civil engineering in the coming turn of century.

This exercise also paves way for IRTCFI to accomplish its mission of supporting the Integrated Research and Training Center in all its scientific, technical and educational undertakings.

Again, thank you and welcome to the 4th ICCE, and hopefully see you again in the future 5th ICCE.

Bernardo Lejano

BERNARDO A LEJANO
President, IRTCFI

4TH INTERNATIONAL CONFERENCE ON CIVIL ENGINEERING

PROGRAMME

DAY 1, NOV. 4, 1996

08:30 **SES 1: OPENING CEREMONY**
Master of Ceremony: Nenet C. Graza

National Anthem

Welcome Address — Dr. Frederick So. Pada
President, Technological University of the Philippines

Opening Address — Prof. Katsuhiko Makiuchi
Chair, International Academic Program Committee, Nihon University

Mr. Hiroshi Goto
Executive Director, Japan International Cooperation Agency Manila

Mr. Angel C. Alcala
Commissioner, Commission on Higher Education

Keynote Address — Hon. Gregorio R. Vigilar
Secretary, Department of Public Works and Highways

09:45 **SES 2: GUEST LECTURE 1**
Chair: Pablo A. Jorillo, Jr., *Technological Univ. of the Philippines*

ESSENTIALS OF PRODUCING HIGH STRENGTH CONCRETE
German M. San Juan, *San Juan and Associates Co., Ltd.*

10:30 **COFFEE BREAK**

10:45 **SES 3A: URBAN AND REGIONAL PLANNING**
Chair: Kenji Hotta
Nihon Univ., Japan

1. THE NEW APPROACH TO ESTIMATE THE POPULATION GROWTH AT LAND READJUSTMENT PROJECT SITE -APPLICATION OF MULTIPLE REGRESSION ANALYSIS AND NEURAL NETWORK MODEL
Hironori Suzuki, Atsushi Fukuda, Yuichiro Kawaguchi (*Nihon Univ., Japan*)
2. BIOPOSITIVE CITY FOR THE XXI CENTURY
Alexander N. Tetior (*Moscow State Univ. of Environmental Eng.,Russia*)
3. LANDSCAPE EVALUATION OF COASTAL ZONE AS THE AMENITY SPACE IN CITY
Mahito Nakazono, Tadashi Uchida, Masao Ukita (*Yamaguchi Univ., Japan*)
4. THE SENSE OF CONSUMERS ABOUT PLASTIC PACKING MATERIALS IN HOUSEHOLD WASTE AND SEGREGATION AND SEPARATE COLLECTION
Keita Yagyu, Shigeo Iwai, Yuji Miura (*Nihon Univ., Japan*)

SES 3B: GEOTECHNICAL ENGINEERING
Chair: Dennes T. Bergado
Asian Institute of Technology, Thailand

1. EVALUATION OF SUBSOIL LIQUEFACTION BY SPECTRUM INTENSITY
Rolando P. Orense, Ikuo Towhata (*Kiso-jiban Consultants Co. Ltd., Japan*)
2. EFFECTS OF FINE FRACTION ON LIQUEFACTION OF SAND
Choi In Ho, Katsuhiko Makiuchi, Kunio Minegishi (*Nihon Univ., Japan*)
3. FUZZY ANALYTICAL HIERARCHIES OF SANDY AND SANDY LOAM'S LIQUEFACTION
Ruan Yong Fen, Wei Min Cai (*Science and Technology Univ. of Kunming, China*)
4. A FORMULATION OF FINITE ELEMENT METHOD FOR FLUID-SATURATED POROUS MEDIA
Hiroo Shiojiri (*Nihon Univ., Japan*)

SES 3C: STRUCTURAL ENGINEERING
Chair: Victor A. Pulmano
Univ. of New South Wales, Australia

1. STOCHASTIC FINITE ELEMENT ANALYSIS WITH DIRECT INTEGRATION
C.K. Choi, H.C. Noh (*Korea Advanced Institute of Science & Technology, Korea*)
2. NONLINEAR FINITE ELEMENT ANALYSIS OF FIBROUS REINFORCED CONCRETE BEAMS
Saad A. Al-Ta'an, A.A. Abdul-Razzaq (*Univ. of Mosul, Iraq*)
3. FEASIBILITY OF CABLE-STAYED BRIDGES OF A MAIN SPAN OVER 1000M
Masa-aki Hoshino (*Nihon Univ., Japan*)
4. SYSTEM IDENTIFICATION OF PLANE GRID STRUCTURES
Andres W.C. Oreta (*De La Salle Univ., Philippines*)

12:00 **LUNCH BREAK**

13:00 **SES 4A: ENVIRONMENTAL ENGINEERING**
Chair: Shigeo Iwai
Nihon Univ., Japan

1. FILTRATION SYSTEM DESIGN FOR DEEP-WELL WATER USING INDIGENOUS MATERIALS
Danilo C. Terante, Joseph Michael P. Payumo, Alan C. Yap, Luis C. Aningat (*De La Salle Univ., Phils.*)
2. CHEMICAL QUALITY OF DRINKING WATER IN MUZAFFARABAD REGION AZAD KASHMIR
M. Arshad Khan (*Univ. of Azad Jammu and Kashmir, Pakistan*)
3. ENGINEERING TECHNOLOGY FOR IN-SITU REHABILITATION OF THE PASIG RIVER
Danilo C. Terante, Mutya D. Bautista, Angelica Frances A. Datiles, Francis Jerome N. De Jesus (*De La Salle Univ., Philippines*)
4. ULTRAVIOLET RADIATION AND REFLECTION ON COASTAL ZONE
Toshinasa Kawanishi, Toshio Chiba, Kenichi Ogata, Noguyuku Shiratsuchi (*Nihon Univ., Japan*)

SES 4B: GEOTECHNICAL ENGINEERING
Chair: Katsuhiko Makiuchi
Nihon Univ., Japan

1. LIMIT EQUILIBRIUM DESIGN GUIDELINES FOR GEOTEXTILE REINFORCED EMBANKMENT ON SOFT CLAY BASED ON FULL SCALE TEST
Dennes T. Bergado, C. C. Koh (*Asian Institute of Technology, Thailand*)
2. MECHANICAL PROPERTIES OF FIBER-REINFORCED SOIL
Katsuhiko Makiuchi, Shigeo Iwai, Kunio Minegishi, Yoh Kawaguchi (*Nihon Univ., Japan*)
3. GEOTECHNICAL ASPECTS OF EARTHQUAKES ON SOILS OF HIMALAYAN REGIONS
M. Arshad Khan (*Univ. of Azad Jammu and Kashmir, Pakistan*)
4. THE EFFECTS OF GEOTEXTILE LOCATION ON THE BEARING CAPACITY OF SAND
Gotoh Keinosuke, Abdelhadi Monther (*Nagasaki Univ., Japan*)

SES 4C: STRUCTURAL ENGINEERING
Chair: German M. San Juan
San Juan and Assoc., Thailand

1. LIMIT STATES DESIGN FOR TIMBER-FRAMED STRUCTURES
Joaquin O. Siopongco (*Laguna Coll., Philippines*)
2. LIMIT ANALYSIS OF RECTANGULAR PLATES UNDER ARBITRARY LATERAL LOADING
Victor A. Pulmano, Francis Tin-Loi (*Univ. of New South Wales, Australia*)
3. COMPUTATION OF FOUNDATION PLATES OF VARIABLE THICKNESS
Elena B. Koreneva (*Moscow State Univ., Russia*)
4. DYNAMIC RESPONSE OF SEISMIC ISOLATION CONICAL SHELL WITH EDGE BEAM SUBJECTED TO VERTICAL SEISMIC FORCES
Kiyoshi Shingu, Kinya Fukushima, Taro Niki (*Nihon Univ., Japan*)

14:00

SES 5A: HYDRAULICS AND HYDROLOGY
Chair: Teodinis P. Garcia
Technological Univ. of the Philippines

1. AN IMPROVED METHOD FOR DETERMINING CLARK MODEL PARAMETERS
Seok-Young Yoon (*Korea Institute of Construction Technology, Korea*)

2. EVALUATING THE SURFACE-WATER-INFILTRATION COMPONENT OF THE RAINFALL - RUNOFF PROCESS ON THE NASIPIT WATERSHED, CEBU
Nestor L. Sy, Renan Ma. T. Tanhueco (*Univ. of San Carlos, Philippines*)

3. FLOOD FORECASTING: INSTANTANEOUS UNIT HYDROGRAPH FOR THE UPPER CAGAYAN RIVER BASIN IN REGION II
Danilo C. Terante (*De La Salle Univ., Philippines*)

SES 5B: GEOTECHNICAL ENGINEERING
Chair: Rolando P. Orense
Kiso-jiban Consultants Co. Ltd., Japan

1. TIME-DEPENDENT BEHAVIOR OF RECONSTITUTED SOIL WITH MARINE CLAY IN KOREA
Soo-Sam Kim, Kyung-Hwan Koh, Seung-Yong Jung, Min-Soo Kang (*Chung-Ang Univ., Korea*)

2. STATISTICAL STUDIES ON RELATIONSHIPS BETWEEN HYDRAULIC CONDUCTIVITY AND BASIC PROPERTIES OF FINE-GRAINED SOILS
Roslan Hashim, Zubaidah Ismail, Norjidah Anjang Abd. Hamid, Thiam Chuan Sim (*Universiti Malaya, Malaysia*)

3. APPLICABILITY OF HETEROGENEOUS SAND-PILE MODEL TO REAL LANDSLIDES
Takashi Yoshino (*Nihon Univ., Japan*)

4. EXPERIMENTAL STUDY ON ELLIPTICAL TUNNEL OPENINGS IN BRITTLE GROUND
Tsuyoshi Domon, Kazuo Nishimura (*Tokyo Metropolitan Univ., Japan*)

SES 5C: STRUCTURAL ENGINEERING
Chair: Andres W.C. Oreta
De La Salle Univ., Philippines

1. BUILDINGS DAMAGED IN THE HYOGOKEN-NANBU EARTHQUAKE, JAPAN (1995) AND THEIR LESSONS
PART 1: CHARACTERISTICS OF DAMAGES IN REINFORCED CONCRETE STRUCTURES
Hiromi Adachi, Nobuaki Shirai, Mitsukazu Nakanishi, Bernardo A. Lejano (*Nihon Univ., Japan*)

2. PART 2: PRE-EARTHQUAKE AND POST-EARTHQUAKE COUNTERMEASURES FOR REINFORCED CONCRETE STRUCTURES
Hiromi Adachi, Nobuaki Shirai, Mitsukazu Nakanishi, Bernardo A. Lejano (*Nihon Univ., Japan*)

3. ADVANCED TECHNIQUE FOR URBAN SEISMIC RISK ANALYSIS AND MANAGEMENT
Mark A. Klyachko (*Ministry of Construction, Russia*)

4. SEISMIC ANALYSIS OF RIGID AND FLEXIBLE LIQUID STORAGE TANKS
B. Tiliouine, A Yahiaoui (*Ecole Nationale Polytechnique, Algeria*)

15:00 **COFFEE BREAK**

15:30

SES 6A: HYDRAULICS & HYDROLOGY
Chair: Teofilo Monge Rufin, Jr.
Wakachiku Construction Co., Japan

1. DESIGN FLOOD IN DAMS WITH GREAT CAPACITY
Ma. Teresa Vasquez-Conde, Ramon Dominguez-Mora, Oscar Fuentes-Mariles (*National Center for Disaster Prevention, Mexico*)

2. ON THE MECHANISM FOR THE RUNOFF IN THE URBANIZED RIVER OF UPTOWN TOKYO
Kazuo Sato, Toshio Nakayama, Kiyoshi Izumi, Mitsuo Takezawa (*Tokyo Metropolitan Government Construction Bureau, Japan*)

3. DETERMINATION OF LAND USE MANAGEMENT FACTORS OF THE USLE IN REDUCING SOIL EROSION LOSS USING SATELLITE IMAGERY
Roslan Zainal Abidin, Tew Kia Hui (*Institut Teknologi Malaysia*)

SES 6B: GEOTECHNICAL ENGINEERING
Chair: Reynaldo O. Baarde
Technological Univ. of the Philippines

1. DEVELOPMENT OF A RECYCLING SYSTEM FOR EXCAVATED SOIL
Ko Goto, Atsuo Tanaka (*Nippon Telegraph & Telephone Corp., Japan*)

2. PERMEABILITY OF COMPACTED SOIL LINERS FOR SANITARY LANDFILLS
Haron Hj. Ismail, Badariah Abu Bakar (*Mara Institute of Technology, Malaysia*)

3. SOME EFFECTS IN AN EXPEDIENT RAPID CONSOLIDATION TEST
Kunio Minegishi, Katsuhiko Makiuchi (*Nihon Univ., Japan*)

4. EARTHWORKS AND FOUNDATIONS IN TONDO AREA: A GEOTECHNICAL ANALYSIS
Lydia C. De Castro (*De La Salle Univ., Philippines*)

SES 6C: STRUCTURAL ENGINEERING
Chair: William Tanzo
Saitama Univ., Japan

1. APPLICATION OF FRICTION-MOVING JOINT CONSTRUCTIONS RESISTANT TO EARTHQUAKES
Alexander M. Uzdin (*Min. of Construction, Russia*)

2. INFLUENCE OF GIRDER DUCTILITY ON THE SEISMIC SAFETY OF REINFORCED CONCRETE RAILWAY VIADUCTS
William Tanzo, Hiroshi Mutsuyoshi, Atsuhiko Machida, Takao Kamiyama (*Saitama Univ., Japan*)

3. A STUDY ON RESPONSES OF A SOFT-SETTLED-TYPE OFFSHORE STRUCTURE SUBJECTED TO SEISMIC FORCES
Kiyoshi Shingu, Masaaki Sakuta (*Nihon Univ., Japan*)

16:30

SES 7A: HYDRAULICS AND HYDROLOGY
Chair: Teofilo Monge Rufin, Jr.
Wakachiku Construction Co., Japan

1. A NUMERICAL STUDY OF GENERATION AND DEGENERATION OF KARMAN VORTEX STREET DUE TO THE TEMPERATURE INDUCED BUOYANCY FORCE
Katsumori Hatanaka (*Nihon Univ., Japan*)

2. MODIFIED RESPONSE EQUATION FOR A SINGLE HOT-WIRE PROBE ON A FLUID STREAM
Gerardo L. Augusto, Yutaka Hasegawa, Koji Kikuyama (*Nagoya Univ., Japan*)

SES 7B: GEOTECHNICAL ENGINEERING
Chair: Jedel G. Agron
Technological Univ. of the Philippines

1. ENGINEERING GEOLOGICAL CONSIDERATIONS IN SALT RANGE AREA NORTHERN PAKISTAN
M. Arshad Khan (*Univ. of Azad Jammu and Kashmir, Pakistan*)

2. DETERMINATION OF LIQUID AND PLASTIC LIMITS OF SOILS BY FALL CONE TEST
Satoru Shimobe, Kunio Minegishi (*Nihon Univ., Japan*)

3. A RAPID MEASURING METHOD FOR MOISTURE CONTENT OF SOILS
Katsuhiko Makiuchi, Kunio Minegishi, Satoru Shimobe (*Nihon Univ., Japan*)

SES 7C: STRUCTURAL ENGINEERING
Chair: William Tanzo
Saitama Univ., Japan

1. THE PROBLEMS AND REGULATIONS FOR SEISMIC SAFETY OF THE EXISTING BUILDINGS AND STRUCTURES
Mark A. Klyachko & Alexander M. Uzdin (*Ministry of Construction, Russia*)

2. EARTHQUAKE RESPONSE OF RIGID STRIP FOUNDATIONS TO STOCHASTIC WAVE FIELDS
Mohamed Hadid, Mounir Khaled Berrah (*Centre National de Recherche Appliquee en Genie Parasismique, Algeria*)

3. PARAMETER IDENTIFICATION OF BI-LINEAR HYSTERETIC MODEL IN EARTHQUAKE RESPONSE ANALYSIS OF STEEL FRAME STRUCTURES
Huang Zongming, Li Yingmin (*Chongqing Jianzhu Univ., China*)

DAY 2, NOV 5, 1996

08:00 **SES 8A: GUEST LECTURE 2**
Chair: Benjamin D. Verdejo
Technological Univ. of the Philippines

"MANAGEMENT OF DREDGING, QUAYWALL STEEL-PILE DRIVING, AND PORT-ISLAND COASTAL-PROTECTION WORKS AT NAGOYA PORT"
Teofilo Monge Rufin, Jr., Kuniaki Tenjin, Eisuke Yamamoto (*Nagoya Univ.,Japan*)

09:00 **SES 9A: CONSTRUCTION MATERIALS AND METHODS**
Chair: Goro Shimizu
Nihon University, Japan

1. MT. PINATUBO EJECTA AS A CONSTITUENT MATERIAL FOR STRUCTURAL CONCRETE
PART 1: OUTLINE OF THE DEVELOPMENTAL PROJECT
Goro Shimizu, Pablo A. Jorillo (*Nihon Univ., Japan*)
2. *PART 2*: STUDY ON THE POZZOLANIC REACTIVITY AND ALKALI-SILICA REACTION POTENTIAL
Goro Shimizu, Kasuhiro Seki, Pablo Jorillo, (*Nihon Univ., Japan*)
3. *PART 3*: STUDY ON THE FRESH AND MECHANICAL PROPERTIES OF LIGHTWEIGHT CONCRETE
Pablo Jorillo, Charlie Manalo, Henry Tadios, Ermaluipe Tirol, Mario Balagtas (*Technological Univ. of the Phils., Philippines*)
4. *PART 4*: STUDY ON THE VARIABILITY OF THE MINE-RALOGICAL PROPERTIES OF MT. PINATUBO EJECTA
Reynaldo Baarde, Pablo Jorillo, Benjamin Verdejo, Goro Shimizu, Kazuhiro Seki (*Technological Univ. of the Phils., Philippines*)

10:00 COFFEE BREAK

10:30 **SES 10A: CONSTRUCTION MATERIALS AND METHODS**
Chair: Pablo A. Jorillo, Jr.
Technological Univ. of the Philippines

1. APPLICATION OF SUPER WORKABLE CONCRETE TO BASEMENT COLUMNS AND WALLS CAUSED BY CONCRETE CONSTRUCTION BY UPSIDE-DOWN METHOD
Yasuhiko Abe, Masayoshi Kakizaki,Yoshikiyo Okita, Akira Abe, Hiromasa Hara (*Nihon Univ., Japan*)
2. MECHANICAL BEHAVIOR OF PLACING-JOINT OF THE HIGH STRENGTH AND HIGH FLUIDITY CONCRETE
Kazutoshi Fujii, Torao Kemi, Goro Shimizu, Masaaki Sakuta (*Nihon Univ.,Japan*)
3. MICRO-CONCRETE ROOFING TECHNOLOGY IN THE PHILIPPINES
Daniel S. Mostrales, Mariquita S. Dimamay, Vicente E. Empig (*Mindanao State Univ. -Iligan Institute of Technology, Philippines*)
4. ZAMBOARD, A VERY PROMISING ALTERNATIVE CONSTRUCTION MATERIAL
Domingo A. Abarro III (*Western Mindanao State Univ., Philippines*)
5. A NOVEL APPROACH TO SOIL IMPROVEMENT BY USING ALBUMIN
Abdel hadi Monther, Gotoh Keinosuke, Yoshihiko Tanabashi (*Nagasaki Univ., Japan*)

12:00 LUNCH BREAK

SES 8B: GUEST LECTURE 3
Chair: German T. Velasquez
United Nations Centre for Regional Devt.

"SUSTAINABLE DEVELOPMENT" INFRASTRUCTURE DESIGN AND CONSTRUCTION IN THAILAND
Veera Vasinvarthana, Charles R. Heidengren (*STS Engineering Consultants Co., Ltd., Thailand*)

SES 9B: CONSTRUCTION PLANNING AND MANAGEMENT
Chair: Jesus Manalastas
Technological University of the Philippines

1. PRELIMINARY STUDY ON FUNDAMENTAL PRINCIPLES AND PRACTICE OF CONSTRUCTION MANAGEMENT IN THE PHILIPPINES
Keizo Baba (*Asian Institute of Technology, Thailand*)
2. STOCHASTIC SIMULATION OF THE PERFORMANCE OF A CONSTRUCTION PROJECT ON A MICROCOMPUTER
Zakaria Harun, Tan Seow Yee, Gurdev Singh (*Universiti Malaya, Malaysia*)
3. EVALUATION OF CIVIC DESIGN METHOD OF HIGHWAY
Mahito Nakazono, Yutaka Shono, Yoshiyuki Inoue, Koji Nakagawa (*Yamaguchi Univ., Japan*)
4. CONSTRUCTION OF A DOUBLE SKIN SHEET PILE COFFERDAM FOR THE REHABILITATION OF A 65 YEARS OLD DAM IN MALAYSIA
Paman Singh (*L&M Structures Sdn Bhd, West Malaysia*)

SES 10B: PAVEMENT ENGINEERING
Chair: Lydia C. De Castro
De La Salle Univ., Philippines

1. POST-PROCESSING TECHNIQUE FOR THE MULTI-LAYERED PAVEMENT SYSTEM
Byung-wan Jo, Sang-ju Han, Seok-gu Suh, Oh-hyuk Kwon (*Han-Yang Univ., Korea*)
2. COUNTERMEASURE OF RUTTING FOR WEARING COURSES AND THE PREVENTION OF NOISE CAUSED BY RUNNING VEHICLES AT TRUNK ROADS IN TOKYO
Jun-ichi Minegishi, Fumiitu Tatsushita (*Institute of Civil Eng'g. of Tokyo Metropolitan Gov't., Japan*)
3. DEGRADATION AND STRENGTH CHARACTERISTICS OF AGGREGATES IN HIGHWAY BASE AND SUBBASE
Haron Ismail (*Mara Institute of Technology, Malaysia*)
4. BASIC RESEARCH ON THE MEASUREMENT OF RESILIENT MODULUS OF GRANULAR BASE COURSE MATERIALS
Yukio Todoroki, Yuji Miura, Dominador Pagbilao, Tomoyuki Nishimori (*Nihon Univ., Japan*)
5. CONDITION SURVEYS ON ROADWAY BRIDGES IN THE REPUBLIC OF KOREA
SeungBum Park, MyungSuk Bang (*Chungnam National University, Korea*)

SES 8C: GUEST LECTURE 4
Chair: Dennes T. Bergado
Asian Institute of Technology

"A STATE OF THE ART ON GEOSYNTHETICS IN JAPAN"
Katsuhiko Makiuchi (*Nihon University, Japan*)

SES 9C: STRUCTURAL ENGINEERING
Chair: Kiyoshi Shingu
Nihon Univ., Japan

1. ENHANCED SEISMIC LATERAL LOAD DISTRIBUTION IN CONTINUOUS GIRDER BRIDGES FITTED WITH VISCOELASTIC DEVICES
William Tanzo, Akio Tsuzuki (*Saitama Univ., Japan*)
2. A NEW TYPE OF BRIDGE RESTRAINER DEVICE POSSESSING HIGH-DAMPING MECHANISM FOR PREVENTING SPAN FALL-OFF DURING STRONG EARTHQUAKES
William Tanzo, Jaime Hernandez Jr., Yoshifumi Uno, Manabu Kawai (*Saitama Univ., Japan*)
3. TEST OF FULL-SCALE HIGH-DAMPING RUBBER BEARINGS FOR SEISMIC ISOLATION OF BRIDGES
William Tanzo, Jaime Hernandez Jr., Yoshifumi Uno, Einosuke Sawa (*Saitama Univ., Japan*)
4. AN INVESTIGATION ON LATERAL DISPLACEMENT OF CONCRETE STRUCTURES UNDER EARTHQUAKE, USING NONLINEAR MODELS
Ali Reza Rahai (*Amirkabir Univ. of Tech., Iran*)

SES 10C: STRUCTURAL ENGINEERING
Chair: Victor R. Macam, Jr.
Technological Univ. of the Philippines

1. FRACTURE CHARACTERISTICS AND SIZE EFFECT FOR HIGH-STRENGTH CONCRETE BEAMS
Seok-Hong Eo, Gyu-Seok Kwak, Neil M.Hawkins (*Chang Won National Univ., Korea*)
2. SIMULATION OF SHEAR AND FLEXURAL BEHAVIOR OF HIGH STRENGTH REINFORCED CONCRETE COLUMNS
Bernardo A. Lejano, Hiromi Adachi, Nobuaki Shirai, Mitsukazu Nakanishi (*Technological Univ., of the Philippines*)
3. AN INVESTIGATION INTO THE EFFECT OF SPALLING ON THE FIRE RESISTANCE OF REINFORCED CONCRETE COLUMNS
Kamal N. Mustapha, John A. Purkiss, Siti A. Osman (*Universiti Kebangsaan, Malaysia*)
4. THE POINT-ESTIMATE METHOD IN STRUCTURAL RELIABILITY ANALYSIS
Tong Xiaoli, Zhao Guofan (*Dalian Univ. of Technology, China*)
5. FRACTURE STUDY OF KOLNBREIN ARCH DAM
O.A. Pekau, Lingmin Feng, Zhang Chuhan, (*Concordia Univ., Canada*)

13:00 **SES 11A: CONSTRUCTION MATERIALS AND METHODS**
Chair: Daniel S. Mostrales
Mindanao State Univ.-IIT, Philippines

1. EFFECTIVENESS OF CRUSHED CONCRETE AS COARSE AGGREGATES IN CONCRETE
H.B. Mahmud, N.B.A.A. Hamid, M.J. Ismail (*Univ. of Malaya, Malaysia*)

2. DURABILITY OF CONCRETE WITH INFERIOR QUALITY AGGREGATES EXPOSED TO MARINE ENVIRONMENT
Shigemi Sakoda, Nobufumi Takeda, Shigeyuki Sogo (*Tokai Univ., Japan*)

3. GEOTECHNICAL CHARACTERISTICS OF MIOCENE SANDSTONES OF AZAD KASHMIR AS CONCRETE AGGREGATES
M. Arshad Khan (*Univ. of Azad Jammu and Kashmir, Pakistan*)

4. MT. PINATUBO EJECTA AS A CONSTITUENT MATERIAL FOR SRUCTURAL CONCRETE PART 4: STUDY ON THE POZZOLANIC REACTIVITY OF EJECTA UNDER NATURAL AND ACCELERATED CURING CONDITIONS
Benjamin D. Verdejo, Pablo A. Jorillo (*Technological Univ. of the Phils., Philippines*)

SES 11B: TRANSPORTATION ENGINEERING
Chair: Atsushi Fukuda
Nihon Univ., Japan

1. ANALYSIS OF HEADWAYS AT SIGNALIZED INTERSECTIONS IN THE PHILIPPINES
Alexis M. Fillone, Atsushi Fukuda (*De La Salle Univ., Philippines*)

2. ON TRAFFIC IMPACT AND SYSTEM MANAGEMENT OF URBAN AREA
Haron Hj. Ismail, Bahardin Baharom, Mohd Yusof Abd. Rahman (*Mara Inst. of Tech., Malaysia*)

3. THE OPTIMAL TIMING OF PARKING GUIDANCE AND INFORMATION (PGI) SIGN BOARDS
R.G. Thompson, K. Takada, S. Kobayakawa (*Univ of Melbourne, Australia*)

4. IDENTIFYING THE INFORMATION NEEDS OF DRIVERS
R.G. Thompson, K. Takada, S. Kobayakawa (*Nihon Univ.,Japan*)

SES 11C: ENGINEERING EDUCATION
Chair: Perla S. Roxas
Technological Univ. of the Philippines

1. NEW ENGINEERING EDUCATIONAL COURSE FOR XXI CENTURY - "HEALTHY CITIES"
Alexander N. Tetior (*Moscow State Univ. of Environmental Engineering, Russia*)

2. TRAINING OF CIVIL ENGINEERING TECHNOLOGISTS FOR INFRASTRUCTURE DEVELOPMENT IN INDONESIA
Audie Rumayar, Bonny Sompie, Jorry Pangow (*Sam Ratulangi Univ., Indonesia*)

3. SYSTEMS THINKING LEARNING IN ENGINEERING EDUCATION USING STELLA
Atsushi Fukuda, Ryouichi Ebisawa (*Nihon Univ., Japan*)

4. MECHANICAD: UNDERGRADUATE LEARNING EXPERIENCE IN DEVELOPING COMPUTER AIDED ENGINEERING SOFTWARES
Joann F. Aquino (*Pamantasan ng Lungsod ng Maynila, Philippines*)

14:00 **SES 12A: CONSTRUCTION MATERIALS AND METHODS**
Chair: Benjamin D. Verdejo
Technological Univ. of the Philippines

1. STUDY ON THE COMPRESSIVE STRENGTH CHARACTERISTICS OF ANTIPOLO SOIL STABILIZED WITH CEMENT AND LAHAR
Reynaldo O. Baarde (*Technological Univ. of the Phils., Philippines*)

2. AN EXPERIMENTAL STUDY ON HARDENING PROPERTIES OF MARINE SLUDGE FOR ITS UTILIZATION
Keinosuke Gotoh, Minoru Yamanaka, Minoru Tanaka, Hiroki Ohwaki (*Nagasaki Univ., Japan*)

3. PHYSICAL EVALUATION METHOD OF PEOPLE'S NEGATIVE PERCEPTIONS OF BADLY STAINED EXTERNAL COATED WALLS
Shinobu Ishigami, Hirotake Ikenaga, Goro Shimizu, Masaaki Sakuta (*Nihon Univ., Japan*)

4. LAHAR SAND CONCRETE PAVING BLOCKS
Jedel G. Agron, Dominador S. Pagbilao (*Technological Univ. of the Phils., Philippines*)

5. DURABILITY STUDY OF CEMENT-LAHAR CONCRETE PAVING BLOCK
Jedel G. Agron (*Technological Univ. of the Phils.*)

6. RAMBO PRESS: A BLOCK MAKER
Lot B. Ramirez, Loreto G. Aguila (*Technological Univ., of the Philippines*)

SES 12B: TRANSPORTATION ENGINEERING
Chair: Russel G. Thompson
Univ. of Melbourne, Australia

1. SPEEDING IN URBAN AND RESIDENTIAL STREETS
Mohamed R. Karim, Norjidah A. Abd Hamid (*Univ. of Malaya, Malaysia*)

2. STUDY ON CHARACTERISTICS OF MOBILE NOISE SOURCES IN KLANG VALLEY, MALAYSIA
Mohamed R. Karim, S. Yusoff (*Univ. of Malaya, Malaysia*)

3. MODAL CHOICE BETWEEN LRT AND CONVENTIONAL RAILWAY
Toshikazu Shimazaki, Koichi Arakawa (*Nihon Univ., Japan*)

4. A STUDY OF A METHOD OF APPLYING ZONE SCHEDULING TO A BUS ROUTE
Atsushi Fukuda, Alexis M. Fillone, Takahiro Kurita (*Nihon Univ., Japan*)

5. DEMAND FORECASTING SYSTEM FOR A RAILWAY PROJECT USING GIS
Hironori Suzuki, Atsushi Fukuda, Tsutomu Inui (*Nihon Univ., Japan*)

SES 12C: ENGINEERING EDUCATION
Chair: Adora Pili
Technological Univ. of the Philippines

1. INTERNATIONAL COURSES ON CIVIL ENGINEERING AT JAPANESE UNIVERSITIES-EXPERIENCE OF THE GRADUATE PROGRAM FOR FOREIGN STUDENTS ON ENVIRONMENTAL MANAGEMENT AND INFRASTRUCTURE DEVELOPMENT ENGINEERING AT SAITAMA UNIVERSITY
William Tanzo, Hiroshi Mutsuyoshi, Hiroki Yamaguchi, Hideji Kawakami (*Saitama Univ., Japan*)

2. QUAKE BUSTERS: AN ALTERNATIVE APPROACH TO EARTHQUAKE DISASTER AWARENESS EDUCATION IN JAPAN
German T. Velasquez, Koichi Takimoto (*United Nations Centre for Regional Development, Japan*)

3. THE LESSON FROM THE MINDORO EARTHQUAKE: THE NEED FOR INTEGRATING DISASTER MANAGEMENT INTO DEVELOPMENT PLANNING
German T. Velasquez (*United Nations Centre for Regional Development, Japan*)

4. COASTAL DEVELOPMENT AND SOCIO-ECONOMIC EFFECTS: JAPAN, ITS UNSUCCESSFUL EXAMPLE
Kenji Hotta (*Nihon Univ., Japan*)

COFFEE BREAK

16:00 **SES 13: CLOSING CEREMONY**
Master of Ceremony: Nenet C. Graza

Impressions
- Dr. Victor R. Macam, Jr., *Chairman, HCCE Organizing Committee*
- Shigeo Iwai, *Co-Chairman, HCCE Conference Secretariat*
- Participants

Closing Address
- Dr. Emiliana V. Tadeo, *Vice President for Research and Extension, TUP*
- Dr. Frederick So. Pada, *President, TUP*

ABSTRACTS

GUEST LECTURE1

ESSENTIALS OF PRODUCING HIGH STRENGTH CONCRETE

G.M. San Juan, THAILAND

High Strength Concrete is a relative term which depends on geographical region and on the basis of comparison. It can be generally defined as concrete which possesses compressive strength properties which are difficult to obtain using common materials and practice. A high strength in one place may mean a low strength in another place. By relative standard (422 ksc or 6,000 psi cylinder strength) of cube strength, concrete of 563 ksc or 8,000 psi can be termed as high strength concrete. To produce concrete above this standard, it would need more strict quality control, selection of cement and type and size of aggregate, and use of admixtures.

High strength concrete can be produced in several ways depending on the level of strength to be attained. Based upon past commercial practice, high strength concrete differs with normal strength concrete in certain details attributing to the quality of its ingredients and mix proportion.

The apparent advantage of using high strength concrete, for example in concrete high rise building, is reduced columns, beams and shearwalls satisfying modern architectural requirements with increase in strength two to three times as ordinary concrete. Such performance can save on foundation costs and consequently electrical and mechanical cost too, when building story heights are reduced.

This paper describes the important variables involving cement, aggregates, water and air that influence high strength concrete.

GUEST LECTURE 2

MANAGEMENT OF DREDGING, QUAYWALL STEEL-PILE DRIVING, AND PORT-ISLAND COASTAL- PROTECTION WORKS AT NAGOYA PORT

T.M. Rufin, Jr., K. Tenjin, E. Yamamoto, JAPAN

Since the designation of Port Nagoya in 1906 as an international trading port, great efforts have been made to expand the sphere of its function as a port, in particular the container-related facilities. Nagoya port links more than 200 major ports around the world via regular foreign-trade navigation routes, and plays a significant role as the sea entrance to the Chubu region with the arrival of 21st century Construction projects, such as the reinforcement of container-related facilities and the development of the waterfront are being initiated to meet the increasing demands, In the development of container yard, major works involve are dredging, sand compaction, steel pile driving, foundation, slab and coastal-protection works. This lecture aims to discuss the construction planning, work management, methodologies, and all the pertinent factors, guidelines and specifications and theories involved in dredging, quaywall steel pile driving, and port-island coastal-protection works. A 196,238 cubic meter dredging work for reclamation project, 42-steel pile driving work on a 14-meter depth quaywall, and port-island coastal protection works were conducted in a separate container expansion projects at Nagoya Port. The work management used was categorized into jobsite progress, quality control, completion, photo and environment preservation management. The set concrete blocks and foundation works, dredging, and steel pile driving works have met all the allowable standards of marine construction. Common problems encountered during the construction phase of the projects, and strategies for the improvement of construction phase of the projects, and strategies for the improvement of construction safety performance were fully identified. Moreover, the optimization of construction schedule was explained by considering the labor utilization factor, relationship between schedule and weather, and relationship of schedule and resource supply.

GUEST LECTURE 3

SUSTAINABLE DEVELOPMENT - INFRASTRUCTURE DESIGN AND CONSTRUCTION IN THAILAND

V. Vasinvarthana, C.R. Heidengren, THAILAND

This paper demonstrates the importance of the concept of "sustainable development" in the planning, design, and construction of infrastructure facilities such as highways, bridges, transit systems, airports, ports and harbors and industrial complexes. The "sustainable development" concept recognizes that meeting long term human needs will be impossible unless we also conserve the earth's physical chemical and ecological systems. In Thailand, the particular geographical, climatological, and geological conditions are related to the cost-effective and environmentally compatible solutions for foundation systems which must be designed and constructed for infrastructure projects.

In order to avoid costly and environmentally unsuitable project planning, design and construction for infrastructure development projects, a number of state-of-the-art technology systems can be incorporated into the project development. These include: Geotechnical Investigation, Geotechnical Instrumentation, Quality Assurance, Environmental Impact Assessment, and Construction Supervision.

For geotechnical investigation, soil and rock boring and sampling are supplemented with in-situ and laboratory testing

and the latest technology in geotechnical analysis and design. Geotechnical instrumentation is used to monitor and evaluate the actual behavior of earth structures. The system provide valuable data which permit cost effective decisions to be made related to civil engineering design and construction.

In order to confirm the integrity, durabiltiy, and proposed life of civil engineering structures, it is necessary to implement in-situ testing and monitor actual construction methods and procedures. Quality control and assurance systems which verify and confirm the quality of the constructed project include: Pile and structural load testing, Non-destructive testing, Pile Dynamic and integrity testing, Plate load bearing testing, In-situ concrete testing, Field density and CBR, and Vibration testing and monitoring.

Environmental Impact Assessment (EIA) reports are prepared in accordance with the office of the Environmental Policy and Planning (OEPP) for Thailand. These EIA reports on significant development projects are prepared prior to their implementation and for issuance of operation of renewal permits of concerned government agencies.

The current boom in Thailand for infrastructure and environmental protection projects has greatly expanded the need for construction management services. A multi-disciplined staff is required who are completely familiar with design concepts, technical specifications, engineering drawings, construction methods and installation procedures. The requirements of quality, timely and cost-effective execution of construction are the essential criteria which guide the staff in daily management and supervision duties for a wide variety of infrastructure projects.

Specific project case histories in Thailand over the past five (5) years will be discussed. Data and interpretation thereof, related to design criteria and construction methodology for these projects are presented.

The importance of the five (5) major services as applied to a "new way of thinking" (sustainable development) for planning, design and construction, of infrastructure development projects is reviewed as related to the approach from now to the beginning of the 21st century. Comments are made on the suitability of implementing the "sustainable development" concept in a developing country like Thailand.

GUEST LECTURE 4

TECHNOLOGY WITH GEOSYNTHETICS IN JAPAN - A STATE OF THE ART REPORT -

K. Makiuchi, JAPAN

Recently a geosynthetic technology became to play a momentous role in geotechnical engineering. In this report, a historical development and the present market activity of geosynthetics utilization in Japan are briefly reviewed and followed by the presentation and discussion of specific characteristics and capabilities of each product, and principal functions, major current applications, design methodology, test methods, quality assurance of geosynthetics and direction of future research and development.

Geosynthetics is a newly established generic term for all synthetic materials used in geotechnics; it includes geotextiles (geowoven, geononwoven and geoknitted), geogrid, geonet, geomembrane, geocomposite and geo-others such as geostrip, geocell and geopipe. Geotextiles are widely employed for various purposes. Geogrids and geostrips are only used for soil reinforcements. Geomembrane systems including a geosynthetic clay liner (GCL) are in use for landfill, waterway and reservoir.

Primary functions of geosynthetics are reinforcement, filtration, drainage, separation and others. Most applications lend themselves to a unique dominant function design. However, some geosynthetics often serve multiple or combined functions. To form a quantitative connection between applications, performance and geosynthetic materials are designing, testing and selection of materials. These relationships and problems awaiting solution are discussed.

Designing with geosynthetics is strongly related to a soil-geosynthetic interaction, design situations such as loadings, ground properties and other environmental conditions. Principal design methods are commented with regard to design value of parameters, safety margins and stability analyses such as ultimate and serviceability limit states.

A large number of testing methods for geosynthetics are prepared hitherto as standards or specifications by International Organization for Standardization (ISO), American Society for Testing and Materials (ASTM), Japanese Industrial Standards (JIS), JGS (Japan Geotechnical Society's Standards) and the like. A recommended new concept of building-up testing method system is described. The system includes all index and performance tests on physical, mechanical, hydraulic, endurance and degradation properties of geosynthetics.

The latest information as to topics of laboratory testing methods, in-situ inspection techniques and quality assurance systems is presented; for example, the friction tests composed of pullout test and direct shear box test, hydraulic properties tests, clogging test, leak detection system and other significant tests.

THE NEW APPROACH TO ESTIMATE THE DEGREE OF URBANIZATION AT LAND READJUSTMENT PROJECT SITE- APPLICATION OF MULTIPLE REGRESSION ANALYSIS AND NEURAL NETWORK MODEL

H. Suzuki, A. Fukuda, Y. Kawaguchi, JAPAN

Numerous studies have been made to estimate the trend of urbanization in land readjustment projects. In these studies , the method of using growth curves such as the logistics curve and gompertz curve are widely used because of its simplicity and applicability.

However, recently in Japan, socio-economic factors such as the land prices, the official rate, to mention a few, are very unstable.

Moreover, nuclear families are increasing and the population which flows into the Metropolitan area is decreasing so that in most projects, the speed of urbanization declines.

In this paper, the urbanization curve is estimated by using both multiple regression analysis and a neural network model, and the results were compared. The reasons why these two methods are used are as follows:

* Many socio-economic factors can be taken into these methods, for example the rate of interest, population density, and so on, while only the convergent value is taken into the method using growth curve.

* Especially in a neural network model, the type of function is not sepcified.

The proposed two models were applied to 22 project areas out of 55 areas along the private suburban railway in which the population density does not reach its expected level. From the results both models show goodness of fit equivalently to estimate the degree of urbanization, more than the gompertz curve. Hence, both models are recommended for use in estimation of urbanization in land readjustment areas. Furthermore, the neural network model has more potential because it includes a feedback process.

BIOPOSITIVE CITY FOR THE XXI CENTURY

A. N. Tetior, RUSSIA

The author here proposes the basic principles of biopositive city creation for the XXI century.

Biopositive cities must be built in exchange of existing unecological cities by their eco-reconstruction.

Biopositive city (town) is a city adapting to coexistence with nature and a city which increase the quality of life. The city allows to live and promote nature's life. Biopositive city contains a wide complex of biopositve decisions from buildings and streets to biopositive reconstruction of works and broken landscapes.

All biopositive buildings and engineering structures are multi-functional objects. They carry out basic functions and nature-preserving or nature restoring fucntion.

All buildings and structures must be passive or active biopositives and "clever" objects. They allow to coexist a biota (a total of organisms on territory of city). They exchange similar to live organism matters and energy with environment without their pollution.

Biopositive city contains small-story constructions of high density with greenery.

There are in biopositive city the buildings for construction on any unsuitable plots of land (steep, slopes, ravines, hills, etc.) The city receives big level territories for gardens and parks.

There is an admissible mastering of underground space. This action allows to receive a free territory in the center of their city.

There are in the city various biopositive structures; seashore consolidating biopositive structures; biopositive supporting walls; biopositve walls; biopositive roads; streets; pavements; biopositive noise protected walls; biopositive columns of light; biopositve fences; wide complex of biopositive reconstruction of old unbiopositive buildings and structures in old cities.

There are in this biopositive structures minimum biopositive qualities (all structures allow to plant and allow to live little animals) or much biopositive qualities (they allow also to purify the air and atmosphere and underground water).

There is a net of gardens and plantations along streets. This net must cover the work of the city and be connected with the parks around the city.

All buildings, structures and other objects in a biopositive city must be proportionat to landscape elements. Big buildings and gigantic objects are not encouraged to use the principle of miniaturization.

There is a use of sense on ecology demands.

Buildings are erected by bioarchitectural methods

(natural materials are used). They are energy-effective where purification of water and air is possible through their surfaces.

Biopositive transport is used in the city.

There exist in the city a biopositive industry and energy complex, biopositive transport, and provisions for the recycling of water and recycling of waste.

Some projects were built in Crimea such as biopositive buildings, supporting walls, shore protecting structures.

LANDSCAPE EVALUATION OF COASTAL ZONE AS THE AMENITY SPACE IN THE CITY

M. Nakazono, T. Uchida, M. Ukita , JAPAN

Coastal zone is the main element that produces the identity like as amenity or landscape of city. However, by the reclamation of coastal zone, natural beach is decreasing rapidly. On the other hand, the upgrading of wharf equipped with amenity and the development of artificial seashore have advanced in recent years. From the view point of improving the amenity of water front, it is needed to evaluate the value of beach for citizens and to discuss about the importance of natural beach in city.

Hakata-bay (the object of this study) is positioned as the precious harbor which has much natural seashore in Japan. The twelve beaches where space use differs are selected. Landscape evaluation frequency and purpose of use, consciousness to beach development et. al. were evaluated using the 739 questionnaire votes collected for the study. By the statistical analysis method, the classification of beach and individual regarding the evaluation and consciousness analysis about the future of beach are carried out.

The beaches are classified into 4 groups based on landscape evaluation (G1: evaluation is highest, natural beach where the season or purpose of use is particular, G3: evaluation is low, natural beach at ebb tide where the daily use is main et al.). The evaluation of individual is categorized to 6 groups. The evaluation of natural beach is highest and the one of the beach at ebb tide is high also in one type. On the other hand there are types that the evaluation is generally low. Thereupon, the difference of relative evaluation is examined. As a result the difference between natural beach and other is large, and the height of evaluation to natural beach has become clear. The intention of security and restoration of natural beach is strong and the charm degree evaluation to the artificial seashore is low, so this result means that the refusal intention to artificial change of beach is strong.

When citizens evaluate beach landscape, the natural degree and space use pattern of beach influence and the landscape of natural beach is preferred more than the artificial one. The intention to preservation and restoration of natural beach is strong but the beach that has leisure function is preferred also. In conclusion it is an important concern for the future regarding the preservation of precious natural beach and the upgrading of artificial beach to the water front with amenity for citizens.

THE SENSE OF CONSUMERS ABOUT PLASTIC PACKING MATERIALS IN HOUSEHOLD WASTE AND SEGREGATION AND SEPARATE COLLECTION

K. Yagyu, S. Iwai, Y. Miura, JAPAN

Treatment and disposal of waste is one serious social problem in Japan due to difficulty of securing disposal area. The waste is treated for possible recycle utilization in order to decrease its amount before transport to final disposal process.

Generally, the amount of plastic waste is correlated to one's consumption and lifestyle. Along this line, it can be clarified why customers choose packed foods in plastic materials. Likewise, people behavior can be possibly analyzed based on how they dispose their plastic waste.

On this investigation, questionnaire survey was employed to secure customers' opinion. From the result. a set of data was gathered regarding the sense of consumers about plastic packing materials and collecting garbage. Futhermore, the study pointed out segregation and separate collection schemes necessary to increase recycling efficiently.

ENVIRONMENTAL ENGINEERING

FILTRATION SYSTEM DESIGN FOR DEEP-WELL WATER USING INDIGENOUS MATERIALS

D. C. Terante, J. M. P. Payumo, A. C. Yap, L. C. Aningat, PHILIPPINES

This study aims to provide a good filtration system design for deep-well water utilizing indigenous materials;e.g., sand, airstone, activated charcoal, coconut husks, bamboo, etc. The system is designed to possibly eliminate or reduce the physical (e.g., turbidity, color, conductance, total dissolved solids) and chemical contaminants (e.g., pH concentration, alkalinity, total hardness, chlorides, nitrates, iron, manganese), present in deep-well water to an acceptable level prescribed by the Department of Health. The treated water is considered safe for household use only. The designed set-up has been successfully adapted to deep-

well water of Dinalupihan, Bataan, Philippines as the project area of the study.

CHEMICAL QUALITY OF DRINKING WATER IN MUZAFFARABAD REGION AZAD KASHMIR

M. A. Khan, PAKISTAN

The drinking water in Muzaffarabad region is available from three main sources, 1] the spring 2] the river 3] streams. The major and minor chemical constituents [Ca, Mg, $ClCO_3$, TDS, Na, K, PH] from three types of water [spring, river and stream water] are determined using atomic absorption. The contamination further increases through organic and inorganic matter and mixing alum potash in different quantities for water treatment. After treatment pH value increases from 8.6 to 9.2, TDS 45 to 580 ppm. hardness 50 to 560, calcium, 16 to 146 ppm. potassium, 0 to 50 ppm., carbonates, 0 to 69 ppm, bicarbonates, 12 to 356 ppm, and chlorides 0 to 53 ppm. The use of alum potash increase the total aluminum sulphate concentration from 0.1 to 50 ppm, and potassium sulphate from 0.2 to 30 ppm, in raw water and 30 to 409 ppm in filtered water. Approximately 80 % of the alum potash input is directly transported throughout the distribution system. The treated water contained large amount [20 to 30 ppm per liter] of aluminum crystals. Remaining [1 to 2 ppm per liter], 40 % is associated with organic matter [2 to 22 ppm per liter], 50 % is present as aluminum hydroxide complexes. About 10 % is complexed with fluorine. Results indicate that chemical addition associated with water treatment [fluoridation, chlorination, sulphate addition] waste disposal from the city area, waste disposal of chemicals in sanitary and other disposed off material from Combined Military Hospital [CMH], and sanitary water mixing in river are largely responsible for water contamination.

ENGINEERING TECHNOLOGY FOR IN-SITU REHABILITATION OF THE PASIG RIVER

D.C. Terante, M.D. Bautista, A.F.A. Datiles, F.J.N. De Jesus, PHILIPPINES

This study aims to improve the water quality of the Pasig River (now considered biologically dead) physically, biologically and chemically through appropriate and most efficient engineering technology. The BOD and COD analyses reveal that the Pasig River had been experiencing dissolved oxygen deficit. The oxygen deficiency causes prolonged decomposition of organic matter, promoting algal growth, foul odor and killing aquatic life. Consequently, toxic gases are released causing the nutrient concentration to increase. This paper presents quantitatively the suitability of an in-situ aeration which promotes inversion process to uniformly oxygenate from surface to bottom, stabilize the amount of oxygen of river, and at the same time preventing further development of nutrient intensification. This study identifies a micro-porous diffuser type of aerator to be the most efficient engineering technology which would bring the water quality to class C after six (6) years of continuous operation. Consequently, the recovery of the balanced ecological cycle of the Pasig River could be made possible with the results of this study.

ULTRAVIOLET RADIATION AND REFLECTION ON COASTAL ZONE

T. Kawanishi, T. Chiba, K. Ogata, N. Shiratsuchi, JAPAN

Recent activities around coastal areas have extended to ocean development and various life styles of humanity. People playing on seaside have been exposed to a lot of ultraviolet radiation. The effect of ultraviolet radiations in coastal zones is higher than that in terrestial zones due to the reflection from the sea surface and sand. Ultraviolet radiation induces human erythema, melanization and photokerato-conjunctiva. This report shows measurements of ultraviolet reflectance on the sand in order to investigate the relationship between reflectance and sand components. From the measurement results the ultraviolet reflectance on sand is about 5-31%.

HYDRAULICS AND HYDROLOGY

AN IMPROVED METHOD FOR DETERMINING CLARK MODEL PARAMETERS

S.Y. Yoon, KOREA

In this paper, an improved method referred to as CLARK-KICT method is presented to construct the time-area diagram using average maximum velocity which is calculated from basin holding time and the average stream lenght. The basin holding time consists of channel holding time and hill slope holding time. The average stream length is calculated using Horton-Strahler's stream ordering system. Considering the information obtained from gauged basin, a simple regression equation is then derived to allow the easy calcualtion of the parameters of the Clark model for use in flood flow estimation in ungauged basin. The accuracy of the proposed method is assesed by comparing the computed hydrographs with those obtained using data from six stream gauging stations located at Wi stream basin in South Korea.

EVALUATING THE SURFACE-WATER-INFILTRATION COMPONENT OF THE RAINFALL-RUNOFF PROCESS ON THE NASIPIT WATERSHED, CEBU

N. L. Sy, R. M. T. Tanhueco, PHILIPPINES

The response of a catchment to single rainfall events was estimated using the Horton (1940), Green-Ampt (1911) and Philip (1957) models in the Dona Rita-Nasipit catchment. Double-ring infiltrometer tests were performed in the field to

ascertain the parameters in the Horton model. The soil physical properties (percent sand, percent silt and porosity) were determined in the laboratory by taking samples from within the watershed. The parameters of the Green-Ampt and Philip models were determined from these soil properties using the relations of Rawls-Brakensiek (1985) from soil data. Using rainfall data for the year 1995, the runoff hydrograph was simulated and compared to the actual hydrograph of the catchment.

Results indicate the rainfall excess determined using the Green-Ampt model better simulate the actual discharge hydrographs than the Philip and Horton model. The Green-Ampt assumption of a one-dimensional coarse-textured and initially dry soil system was best represented in the basin and the rainfall events.

Measurements were made in the field to evaluate the significance of certain factors affecting infiltration like presence or absence of vegetation, direction of subsurface flow, presence of gravel and roots in the soil profile. Infiltrometer tests show that somehow points in vegetated areas have higher infiltration rates than throughfall points. The consideration of interception in the model calculations would decrease the discharge volume as it will be an amount deducted to the gross rainfall. Paint tests were made in the field in order to assess the flow path where the water takes. Generally, the flow path is vertical; the presence of roots and gravel in the soil material would cause lateral subsurface movement of the flow especially in sloped areas. Moreover, permeability tests show that these gravel and roots in the soil material will tend to give higher conductivity values. These promotes subsurface flow as a major form of water movement and will increase the calculated runoff volume when used with the models.

FLOOD FORECASTING : INSTANTANEOUS UNIT HYDROGRAPH FOR THE UPPER CAGAYAN RIVER BASIN IN REGION II

D. C. Terante, PHILIPPINES

Theoretically, as the duration of the unit hydrograph approaches zero, the discharge sequence represents the outflow from the instanteneous application of unit rainfall excess over the watershed. [Linsley et al, 1988]. This defines the instantaneous unit hydrograph derived from the convolution integral given below. Mathematically , the rate of direct runoff at a time t is given by

$$q_t = \int_0^t (\tau) i_e (t - \tau) d\tau$$

where $f(\tau)$ is the IUH ordinate at time τ, i_e is the intensity of rainfall excess at time $(t - \tau)$ and τ is the time in the past. This paper attempts to derive the IUH by routing the time-area of the catchment and using Nash's conceptual model where parameters, K and N, were evaluated by methods of moments. Thirty five flood hydrographs of the Upper Cagayan River Basin in Region II have been used in the analysis . The analysis shows some distinct hydrologic characteristics of the basin. Based on statistical analysis , peak discharge of flood hydrograph has a linear relationship with the volume of the runoff for Naguillian, Echague and Diadi watersheds. Since a good correlation has also been found to exist, principles of linearity and suspension can be applied to hydrograph analysis in predicting and estimating flood for the basin. More so, a good correlation has also been found to exist between effective rainfall duration and watershed area. These unique characteristics of the basin are good indicators that the short duration unit hydrographs can be used to develop an instantaneous unit hydrograph on the assumption that the effective rainfall is uniformly distributed with respect to time and space.

The author successfully applied results from the IUH analysis to some ungaged watershed of the basin. It is established, then, in this study that instantaneous unit hydrograph for any ungaged watershed of the Upper Cagayan River Basin in Region II can be derived by simply knowing the area of the watershed and using the regression formula. Furthermore, the flood hydrograph with a given duration can also be determined by applying the incomplete Gamma function where it is suggested that further validation should be made by considering more flood hydrographs of smaller watershed in the basin.

The results of this study were further used by the author to verify the results of the previous study conducted by the author on the same basin which employed another method [Terante, 1991]. Findings showed that the derived IUH deviates on bigger watersheds but predicts more accurately on smaller watersheds.

DESIGN FLOOD IN DAMS WITH GREAT CAPACITY

T. Vasquez-Conde, R. Dominguez-Mora, O. Fuentes-Mariles, MEXICO

A method is proposed to estimate flood design in dams with important regulation capacity. This method contemplates, besides the maximum discharge, the volume and the shape of the flood. It introduces the expected value concept into the flood design computing. The idea is to contribute to a better design in hydraulic works in order to diminish as far as possible damage in all sense when a disaster occur.

The method is based on the statistical analysis of the historical data of maximum volumes (converted to mean discharge) and of the hydrograph shape. The first step is

divided in three main activities; a) synthesis procedure - the mean maximum annual floods associated to duration from one to several days are defined, b) statistical extrapolation - the mean maximum annual floods are statistically analyzed, c) dissociation procedure - the shape of the flood design is defined. It can be computed in accordance with the maximum historical flood or by a systematical procedure, which lastly eliminates the subjectivitiy of the maximum historical procedure.

Once the floods design are computed using the historical or systematical procedure, they are routed through the dam basin and if this procedure is used it is defined as the maximum overflow discharge expected value. The method was applied to several mexican dams and the results (obtained in terms of maximum outflow discharge and elevation) were compared with the method mostly used in Mexico (traditional method) and with the most important adverse historical values.

In accordance with the results obtained, it was concluded that this statistical method considering volumes provides more information about floods than the traditional method.

It is convenient to use the maximum outflow discharge and elevation expected values in the flood design computing, because many historical floods can be considered for this purpose.

Due to the valuable and useful information that the proposed method provides, it allows to make revisional and operational studies in dams with great capacity.

ON THE MECHANISM FOR THE RUNOFF IN THE URBANIZED RIVER OF UPTOWN TOKYO

K. Sato, T. Nakayama, K. Izumi, M. Takezawa, JAPAN

The mechanism for the runoff of the smaller rivers in the urbanized areas in uptown Tokyo is elucidated by using the observed data in this paper. Quantitative analyses are carried out for the changes in runoff characteristics due to the development of the land use and the adjustment of the drainage facilities. Thus the relationship between the changes in flood flow and the urbanization is also made clear.

The relationship between the transitions of the flow characteristics such as effective rainfall intensity, flood's time lag, peak flow, runoff coefficient, base-flow curve, etc. and the urbanization is analyzed for each step of the river course and the conditions of sewage facilities at the standard point of each river under this study.

The effect of river course, sewage facilities and land use on flood flow was quantitatively analyzed by using the correlation of the rate of sewage facilities to flood's time lag and peak flow, and the relation of impermeable area of roads to flow rate. Subsequently, a runoff model was constructed by using the results of these analyses.

The model was applicable to the runoff analysis accompanying the extent of adjustment of the river course and sewage facilities, or facilities controlling rain flow. The model was verified by using field data and proved to be valid fro the analysis of the flood flow characteristics of the smaller rivers of uptown Tokyo.

DETERMINATION OF LAND USE MANAGEMENT FACTORS OF THE USLE IN REDUCING SOIL EROSION LOSS USING SATELLITE IMAGERY

R. Z. Abidin, T. K. Hui, MALAYSIA

Cameron Highlands, an idyllic highland resort in Malaysia are mostly covered by thick tropical rainforest acquiring 59,153 hectares (86.22 %). With the cool temperature averaging between 10 degree centigrade to 23 degree centigrade makes it an ideal retreat for holiday makers. The climate and soil encourages tea, vegetables, citrus fruits, coffee, strawberry and mushroom cultivation. However, the agricultural activities carried out in Cameron Highlands are at an alarming rate to meet the increasing demand of vegetable and cash crops from all over Peninsular Malaysia. This has led to indiscriminate clearing of new lands, no proper covering provided after harvesting of the crops thus leaving the soil bare towards direct rainfall making it vulnerable for landslides to occur. This has been supported by the fact that recent developments has taken its toll in the highland itself with many on-going and new proposed development projects. As a result of human ignorance , a spate of landslips and flash floods had since occurred in Cameron Highlands lately to which incurred loss of lives.

Though, we cannot halt development that brings benefit to the country, it should, however be environmentally sound and suitable. In this regard, a study on the land use management factors (Cover Management factor, C and Support Practice factor, P) of the Universal Soil Loss Equation (USLE) is certainly timely as this parameter emphasizes on the land covers in the study area and its effect on the amount of soil erosion loss. With the use of recent technologies, colour infrared interpretative key is used to determine the combined land use management factor, C and P Coupled with the remote sensing imagery using Landsat Thematic Mapper, the Ringlet location in Cameron Highlands has been determined as having the highest erosion risk/loss based on CP factor justified by the highest ranking of residential location shows the highest reduction areas compared to other locations. Conversely, the Sg. Ikan location shows the highest reductions in the amount of soil loss as well as erosion risk with most of this area are still

covered with forest. Results of this study highlights some of the important land uses at various locations in Cameron Highlands as it would give some indication about the possibility of reducing any further erosion risk/loss that will occur in time to come so that development of any new projects can be well planned and decided in ensuring quality environment.

A NUMERICAL STUDY OF GENERATION AND DEGENERATION OF KARMAN VORTEX STREET DUE TO THE TEMPERATURE INDUCED BUOYANCY FORCE

K. Hatanaka, JAPAN

The vortex shedding around a cylinder and the von Karman vortex street behind a cylinder have received much attention by many researchers in both experimental and numerical fluid dynamics. Also this problem is a well-known benchmark problem for the numerical simulation of unsteady, incompressible, viscous fluid flow. Successful simulations have been reported by numerous authors using a wide range of numerical methods. However, the problem of vortex shedding for mixed natural and forced convection have not been investigated sufficiently. In the mixed convection the flow of situation is physically complex owing to the temperature induced buoyancy force added to the viscous phenomenon.

This paper presents a finite element analysis of the vortex shedding around heated / cooled cylinders, particularly the analysis of transient flow behavior near the critical value of the Richardson number in which drastic change of the flow of situation can be observed. Numerical results will show a generation of von Karman vortex street behind a cylinder in case that the cylinder surface cooled and a degeneration of vortex street in case that the cylinder surface is heated. The understanding of those phenomena will also be discussed in this paper.

MODIFIED RESPONSE EQUATION FOR A SINGLE HOT-WIRE PROBE ON A FLUID STREAM

G. L. Augusto, Y. Hasegawa, K. Kikuyama, JAPAN

As the 21st century approaches, the method of measuring any physical quantities is becoming sophisticated; thus, intensive research on the improvement of measurement has received considerable attention from numerous investigators. A systematic approach of determining the governing physical parameter is deemed necessary in the full description of the actual phemomenon on a fluid domain. In a given fluid domain, an accurate measurement of the velocity field is very essential. The accuracy of measurement depends largely on the probe instrumentation. In the process of modifying probe-response equation, fundamental parameter and assumptions significant to flow fields should always be considered in using hot-wire anemometer. Previous studies in probe-response modelling were theoretically derived from the empirical equation known as King's Law. This equation is based on the idealized situation of potential flow around an infinitely long cylinder in cross flow. Other researchers used Cosine Law for the effective cooling velocity, which does not include the heat loss effect parallel tot he hot-wire probe. Furthermore, it is valid only for insignificant effect of the angle between the flow direction and the plane normal to the probe axis. For significant value of angle, the effective cooling velocity by Champagne et al. should be adopted particularly when the probe orientations during calibration and use are different. This paper aims to discuss the modified hot-wire probe-response equation considering the heat loss effect. Results show an increase in the accuracy of velocity measurement.

CONSTRUCTION MATERIALS AND METHODS

MT. PINATUBO EJECTA AS A CONSTITUENT MATERIAL FOR STRUCTURAL CONCRETE

Part I - Outline of the Development Project

G. Shimizu, JAPAN
P.A. Jorillo, PHILIPPINES

This paper discusses the outline of the developmental program of utilization of Mt. Pinatubo ejecta as a material for construction specifically for structural purposes. The objective of the joint study is to harness all resources (expertise, facilities and logistics) of the two institutions - College of Science and Technology of Nihon University and Integrated Research and Training Center of the Technological University of the Philippines, in coming up with a series of R&D project/activities for the massive utilization of Mt. Pinatubo ejecta as a structural concrete material for various applications. One of the ultimate target of the joint project is to come up with a pilot socialized-modular housing unit for the Philippines urban and rural centers.

The paper presents the overall plan and design for this research program. Detailed parallel activities by both institutions as enumerated below are highlighted.

1. Mineralogical characterization of Pinatubo ejecta
2. Potential Pozzolanic Reactivity with CaO-based binder
3. Utilization as ordinary fine aggregates in concrete materials
4. Pumice as lightweight aggregate for structural lightweight concrete
5. Durability study of Pinatubo-based concrete material
6. Architectural Design of socialized-modular housing units

7. Design and Testing of modular structural components
8. Theoretical analysis of structural efficiencies of modular structural components
9. Connection and Installation of module components
10. Construction Technique for module housing units
11. Prototype and field testing of units

Part 2: Study On The Pozzolanic Reactivity And Alkali-Silica Reaction Potential

G. Shimizu, K. Seki, JAPAN
P.A. Jorillo, Jr., PHILIPPINES

This study evaluates the pozzolanic reactivity of selected Mt. Pinatubo ejecta with the Type-1 Portland Cement binder. Free lime method and mineralogical characterization in combination with high temperature curing was employed as an accelerated method of determining the degree of reactivity of a given sample. Results of accelerated tests were evaluated in the light of the strength development of Pinatubo blended cement mortar cured under natural condition.

The study also evaluates the Alkali-Silica Reactivity potential of a concrete material with Pinatubo aggregates. JIS A 5308-1989 Mortar bar method was used in the examination of potential expansion for concrete material due to ASR under accelerated condition. Test results showed that the Pinatubo-based concrete material showed satisfactory expansion properties, i.e., within the 0.05% expansion limit set by the JIS under ASR Bar Method.

Part 3 - Study on Fresh and Mechanical Properties of Ligthweight Concrete

P.A. Jorillo, Jr., C. Manalo, H. Tadios, E. Tirol, M. Balagtas, PHILIPPINES

This study deals with the evaluation of Mt. Pinatubo aggregate as a lightweight structural constituent for lightweight concrete. The objective of the study is to establish a baseline information on the fresh and mechanical properties of concrete with Pinatubo pumice as lightweight fine and coarse aggregates.

Various mix design parameters such as cement content, types of fine and coarse aggregates, grading and size distribution, dosage of mineral admixture were investigated to examine its effect to workability and strength properties of the hardened structural lightweight concrete. Varying cement content of 400, 300 and 200 kg/m^3 in combination with different types of fine aggregates and lightweight coarse aggregates were prepared, mixed and tested in order to establish baseline data on the mix quantities and fresh properties of this type of lightweight concrete. Varying workability and dosage of mineral admixture such as fly-ash extends the range of mix proportioning and combination of constituent materials necessary for all types of lightweight concrete mixes Corresponding mechanical properties such as compression, tension and bending were correlated with the fresh properties and mix proportion parameters necessary for effective mix design of Pinatubo lightweight concrete.

Part 4: Study on the Pozzolanic Reactivity of Ejecta under Natural and Accelerated Curing Conditions

B.D.Verdejo, P.A. Jorillo, Jr., PHILIPPINES

This paper describes the results of the study on the evaluation of the pozzolanic behavior of Mt. Pinatubo ejecta under natural and accelerated curing conditions. The study is essentially a developmental research aimed at providing a comprehensive characterization of the volcanic ejecta in comparison with the local fly-ash. Two types of accelerated curing were examined viz., high pressure steam curing and boiling-cooling method. Various types of ejecta materials and percentage cement replacements were investigated to determine the optimum type and proportion in a cement based mortar matrix based on the criteria of strength and dimension stability.

Part 5 - Study on the Variability of the Mineralogical Properties of Mt. Pinatubo Ejecta

R.O. Baarde, P.A. Jorillo, B.D. Verdejo, PHILIPPINES
G. Shimizu, K. Seki, JAPAN

The study deals with the comprehensive mineralogical characterization of Mt. Pinatubo ejecta samples from various locations. The objective of the study is to identify the properties of ejecta and its variability from the point of location and time of sampling, which is most critical if this type of material will be used as a material for cement or construction industry.

Physical characterization evaluation of specific gravity, unit weight, absorption characterization, size distribution and fineness modulus were carried out to determine its appropriateness as an ordinary aggregate for any type of construction purposes. Mineralogical characterization such as oxide analysis, X-Ray diffraction and SEM were likewise based matrix. It is the objective of the study to shed light on the probable future behavior of the material in concrete in terms of reactivity, expansion, shrinkage and strength properties development.

APPLICATION OF SUPERWORKABLE CONCRETE TO BASEMENT COLUMNS AND WALLS CAUSED BY CONCRETE CONSTRUCTION BY UPSIDE-DOWN METHOD

Y. Abe, M. Kakizaki, Y. Okita, A. Abe, H. Hara, JAPAN

We applied superworkable concrete to concrete construction by upside-down method for the first time in this country. We made the best use of characteristics of super workable concrete that is superior in concrete flowability and stability and studied systematically concrete construction by upside-down method.

The following conclusions may be drawn from the study: (a) the quality of concrete satisfied the condition of little scattering, (b) the quality of honeycomb on the surface of the skeleton using this construction method was less than 1/8 that of actual construction method, (c) the space between the new and old concrete construction joint was less than 0.8mm., (d) the lateral pressure of the superworkable concrete was about 65% of liquid pressure. The form of normal concrete was sufficient for applying the superworkable concrete, (e) the construction, in days was about 1/2 of that of actual construction method.

It is clear that this method was a superior construction technology resulting to improvement in quality of concrete in structures, high compactibility, high safety, economical construction and elimination of labor.

MECHANICAL BEHAVIOR OF PLACING-JOINT OF HIGH STRENGTH AND HIGH FLUIDITY CONCRETE

K. Fujii, T. Kemi, G. Shimizu, M. Sakuta, JAPAN

High strength and high fluidity concrete has super workability and segregation resistance and it can be placed in superlative compactibility with compaction.

Cold joint occurs at the boundary surface between additional concrete to pre-placed concrete on account of long interval of placing concrete, and this leads to internal damage of the structures.

In this study, some series of tests at the placing joint (simulated real cold joint) of high strength and high fluidity concrete. Three types of cement were used: ordinary portland cement, betile rich cement and silica fume cement, were carried out to discuss the performance of placing joint affected by the placing method.

MICRO-CONCRETE ROOFING TECHNOLOGY IN THE PHILIPPINES

D.S. Mostrales, M.S. Dimamay, V.E. Empig, PHILIPPINES

The paper presents the integrated approach which was developed for the introduction of micro-concrete roofing (MCR) technology. The MCR technology was developed in the 1900s based on generations of experience with concrete tiles and asbestos cement sheets. It has found applications in many countries as alternative roofing material.

The production of MCR elements is labor intensive. It can take place close to the point of use and in a small workshop. A minimum of infrastructure, equipment and at least 2-3 workers are needed to work with one vibrating table.

The MCR technology was adopted in the Philippines to demonstrate the market potential of locally produced building material by promoting small production enterprises. The proponents were Mindanao State University - Iligan Institute of Technology (MSU-IIT) and the Mindanao Shelter Foundation, Inc. (MSFI). Reference Center was established to provide initial back-up services. It was made clear from the beginning that long-term self sustainability should be aimed at and that external supports (national and international) should cease in the future. Towards this end, efforts were made in establishing MCR entrepreneurs with the assistance from the MCR Reference Center in creating an environment that is conducive to the technology. Together with the transfer of technology with the emphasis on continuing quality control, activities include studies conducted for local adaptation of the technology, product promotions and networking with government and private agencies.

ZAMBOARD

D.A. Abarro III, PHILIPPINES

With the alarming present condition of our wood industry due to the depletion of our forest coupled with the backlog on the demand for low cost/marginal housing/socialized housing due to scarcity and rising cost of conventional construction materials (C H B, plywood, plyboard and lumber), an alternative construction material is offered. This is Zamboard and has the following attributes: 1) Raw materials is abundant in the locality; 2) It uses agricultural/wood as by products; 3) It is environment friendly, uncomplicated and employs efficient production or manufacturing process; 4) It is versatile in usage and has various construction applications; 5) It is cheap/affordable.

Zamboard (Wood Wool Cement Bonded Board) is a building material made of shredded wood or agri-waste material bonded with ordinary cement, water and suitable cement setting accelerator, cold-pressed under low pressure at ambient temperature. This wood cement composite product has been known in Europe for so many years. It was introduced in Germany in 1921 and in the Philippines in the '70s. The manufacturing process was introduced by DOST using "Palo Verde" (Piper Aborecens), a small evergreen tree

which is abundantly growing in sub-marginal medium elevated area in Zamboanga Peninsula.

Zamboard is manufactured in 2' x 8' sheet size with thickness varying from 8mm to 50mm. It is termite/buk-bok free, fire retardant, earthquake resilient, water resistant, thermal insulator, acoustic insulator, and rot/fungi/vermin proof. It is also nailable, paintable, sawable, plasterable, sanderable, glueable, and practically workable using ordinary carpentry tools. Zamboard can be extensively used as ceiling, wall partitions, fascia boards, baseboards, upper level flooring, exterior walls and doors, roofing and furnishings. Creative Modular Design Innovative Construction Method and cheap Zamboard can bring down the cost of housing to be more affordable, comfortable and longlasting to the multitude who are in dire need of shelters.

A NOVEL APPROACH TO SOIL IMPROVEMENT BY USING ALBUMIN

M. Abdel Hadi, K. Gotoh, Y. Tanabashi, JAPAN

Recent development has created the need for new methods, techniques and materials in order to meet the new demands for safe and applicable soil improvement practices for earth stabilization. This paper describes the applicability and performance of artificially manufactured albumin (the white portion of the egg) in an attempt to improve the strength parameters of soil. Based on published literature, albumin was used since long time ago in Japan (Kumamoto Prefecture) as a major component of the mortar used in building masonry-arch bridges which are still in service until now and in Arabia as a prime-coat under painting. Shirasu, considered as one of the most problematic soils in Japan is used as the target in this research due to its erosivity and high liquefaction potential upon the absorbency of water. In this research shirasu was mixed with 1.0%, 1.50% and 2.0% of albumin powder based on its dry weight and compacted to a constant density and then oven dried at different temperatures. Four sets of tests were carried out namely, direct shear tests, unconfined compression tests, slaking tests, and permeability tests. Test results show that the performance of shirasu-albumin admixture improved as compared with the untreated shirasu. Finally, grouting shirasu with hot albumin solution also yielded a very good result from the point of view of settlement reduction.

EFFECTIVENESS OF CRUSHED CONCRETE AS COARSE AGGREGATES IN CONCRETE

H.B. Mahmud, N.B.A.A. Hamid, M.J. Ismail, MALAYSIA

Recylcing of concrete debris as aggregates for new concrete is very attractive because it can solve two problems of increasing intensity. Firstly, in urban areas, demolition of concrete structures creates disposal problems due to the limited availability of dumping sites. Secondly, due to the increasing volume of construction activity, the availability of good quality aggregates may diminish. With these aspects in view, research into the recycling of concrete debris as aggregates for new concrete has gathered momentum globally.

This paper reports the results of an experimental investigation into the effects of using crushed concrete as coarse aggregates in new concrete. Crushed concrete passing through 20 mm but retained on 5 mm sieves were used as coarse aggregates. The new concrete was designed to have a target mean strength of 40N/mm^2. The effects of using these recycled aggregates on the workability and some engineering properties of new concrete were investigated.

The results show that these recycled aggregates have lower specific gravity and higher absorption characteristics than crushed granite. The workability of concrete containing these recycled aggregates are marginally lower than the control concrete. The compressive, tensile and flexural strengths of this type of concrete is between 5 - 20% lower than the control concrete. The elastic modulus and drying shrinkage is 20% lower and 25% higher respectively. The incorporation of fly ash and/or superplasticizer can improve most of these concrete properties.

DURABILITY OF CONCRETE WITH INFERIOR QUALITY AGGREGATES EXPOSED TO MARINE ENVIRONMENT

S. Sakoda, N. Takeda, S. Sogo, JAPAN

In certain places, it may be difficult to obtain good quality aggregates for concrete. In which case inferior quality aggregates, that is, aggregates with high absorption and low specific gravity, have been used in concrete. However, information about the properties of concrete with aggregates of inferior quality, specially when exposed to marine environment is not readily available especially in Japan. Hence, presented in this paper are the results of a study on the durability of concrete with inferior quality aggregates exposed to marine environment. Experimental study conducted over ten years on such properties as compressive strength, diffusion coefficients of chloride ion and corrosion of reinforcing bars, will be reported.

GEOTECHNICAL CHARACTERISTICS OF MIOCENE SANDSTONES OF AZAD KASHMIR AS CONCRETE AGGREGATES

M. Arshad Khan, PAKISTAN

The mechanical characteristics of sandstone have been investigated to know the quality of the sandstone as concrete aggregates for rational exploitation. The study of mineralogical composition show the percentage of deleterious material present in the rocks.

The alkali-silica reaction involves disorder form of silica particularly chert, muscovite and clays. The concrete deterioration due to alkali-silica reaction has been reported from all the major geographic regions of Azad Kashmir. In the south expansive cherts have been found. These cherts show a low level of alkali-expansivity but when these are combined with other sand and gravels containing chlorite, muscovite, magnetite and clays the resulting concrete show a high level of alkali-expansivity. Aggregates with high level of alkali-expansivity are also known from Mirpur and Kotli area. The classical areas where aggregates show alkali-silica reactions occur in Bagh, Rawalakot, Blouch and Kotli.

Phyllites and argillites associated with alkali expansive reaction in concrete have been described.

STUDY ON THE COMPRESSIVE STRENGTH CHARACTERISTICS OF ANTIPOLO SOIL STABILIZED WITH CEMENT AND LAHAR

R O. Baarde, PHILIPPINES

This paper describes the results on the investigation on the durability properties of soil stabilized with cement and lahar under natural and accelerated weathering. The study is essentially a developmental research geared towards the improvement of stabilized soil blocks here in the Philippines by evaluating the durability of stabilized soil.

Soil stabilized with cement and lahar blocks was evaluated after the curing process by compressive and split tensile test. Alternative wetting and drying was used to examine the cement losses and volume changes of the stabilized soil blocks.

It was also observed that the permeability properties of soil affect the strength of stabilized soil. The soil stabilized with cement and lahar deteriorates easily upon contact with water resulting in the loss of compressive and tensile strength of the blocks.

AN EXPERIMENTAL STUDY ON HARDENING PROPERTIES OF MARINE SLUDGE FOR ITS UTILIZATION

K. Gotoh, M. Yamanaka, M. Tanaka, H. Ohwaki, JAPAN

The Omura Bay is located in Nagasaki Prefecture at the southwest extremity of Japan, and is a closed water area. The bay has an area of about 320 square kilometers. Because of life waste water inflow and feed remnants from some fish farm, a large quantity of marine sludge is accumulated on the sea bottom. This sludge causes chronic water pollution, and is endangering the environment.

In general, marine sludge contains some pollutants, and has high-moisture content and ultra-soft. Therefore, it cannot be used as it is, but if the sludge is hardened it can be utilized as a submerged breakwater or fish reef for instance. In order to ascertain these applications, the physical properties of the marine sludge must be examined, and more mechanical and chemical properties of the hardened sludge must be also grasped.

In this paper, the authors discussed some results of a series of laboratory tests of the marine sludge and more is investigated on the measure and the application for its utilization.

Samples of marine sludge were collected with the Egman barge type of mud sampler from boat. A series of physical properties test was carried out. Preliminary examination revealed that high strength would not be attained if the marine sludge only is used. Therefore, volcanic sandy soil taken from Unzen Volcano near Omura Bay was mixed as strength rising materials.

The marine sludge was agitated in order to make homogeneous mixture. Some hardening materials, the unseen volcanic sandy soil, were added in various mix proportions. These were mixed thorougnly with the Hobart type mixer. The pH-value of mixed sample was measured. Three types of cement were mixed. After mixing, the sample was molded by non-compaction method, and was cured for a maximum time of 91 days. The cure method was carried in air and in water, temperature was kept constant at 20 degrees. The unconfined compressive test was carried out after curing. The pH-value of the crushed sample was likewise measured.

As a result of above experiment, we arrived at the following: 1) This marine sludge is classified as sandy clay containing a lot of low-plasticity sand. 2) The strength by curing in water is higher about 20% than one by curing in air. The hardening material which gave the maximum strength is the Portland blast-furnace slag cement. There is a great relation between the water-cement ratio and the strength. The pH-value of specimen rose by 3-4 degrees by adding the hardening material, and is constant for curing period.

From the above results, the soil properties of the marine sludge could be grasped, and from convenient cultivation we conclude that the marine sludge is a useful material as a submerged breakwater or a fish reef of middle scale.

PHYSICAL EVALUATION METHOD OF PEOPLE'S NEGATIVE PERCEPTIONS OF BADLY STAINED EXTERNAL COATED WALLS

S. Ishigami, H. Ikenaga, G. Shimizu, M. Sakuta, JAPAN

Many countries adopt a system wherein the administration prescribes the color or texture of external

building walls to keep a good townscape. In Japan, although not a general case, as a part of building agreement which is established by the neighborhood group, color of external building walls is prescribed. The basis of administrative control is not always on the sense of color, but on visual unpleasantness which stains bring. Many materials used for modern buildings are highly artificial. When stained, they tend to be more unpleasant than natural materials. Therefore, it is necessary to sufficiently examine stains of external building walls to keep them beautiful in long term. For such reason, to get fundamental data to keep good townscape. we tried some experiments about materials that would make beautiful external building walls. We examined the effect of stain on the material's color and got the following results. 1) The color located in the outline of the materials tends to stand out stains in case of soil or volcanic ashes as contaminant. And the high lightness materials color tends to stand out in case of charcoal as contamination. 2) We can indicate physically the sense of stains with lightness difference between the stained material and the unstained one. And in case of charcoal as contamination, we can indicate more precisely sense of stains with multiple regression equation which use both lightness difference and chroma difference.

LAHAR SAND CONCRETE PAVING BLOCKS

J G. Agron, D.S. Pagbilao, PHILIPPINES

The aftermath of the eruption of Mt. Pinatubo eventually gave rise to unending discussions and controversies, re: the funding of the rehabilitation particularly of the much affected areas as Central Luzon and of the infrastructure projects along lahar river channels. The tragedy has since become worse after it has robbed millions of Filipinos of their livelihood and means, apart from the countless lives lost and being lost. With this condition, some indigenous steps must be realized to provide alternative source of livelihood for the people. The development of a simple and transferable technology to transform lahar into what will benefit the people and this country proves to be a practical directive to answer specific needs caused by the devastating eruption.

One of the major concerns in the Central Luzon area is the prevention of damages caused by the flow of lahar. The uncontrolled accumulation of pyroclastic materials also calls for its massive utilization. Much research activities both in preventing the lahar flow causing damage and utilizing lahar as materials for construction are being undertaken. The use of lahar in the production of blocks for paving purposes was identified to be among the bright prospects by which a massive utilization of the unwanted materials is possible.

In investigating lahar as the main material component of concrete blocks for paving, two factors were considered in order that the maximum benefits may be delivered. First, the technology for its production shall be made simple and easily transferable to provide opportunities to people whose means of livelihood were displaced by the inflow of lahar. Secondly, it must be economically competitive with other materials for paving. These two considerations guided this research undertaking.

DURABILITY STUDY OF CEMENT-LAHAR CONCRETE PAVING BLOCK

J.G. Agron, *PHILIPPINES*

The results of investigation into the influence of various pre-treatment on the abrasion resistance and compressive strength with a selected standard method, ASTM Standard C 936-1982 and C 779 test method under natural and accelerated curing condition of cement-lahar concrete paving block specimen are discussed in this paper. Three mix proportion were used. The water cement ratio is maintained at 60%. The loss of mass was measured by exposing the specimen to rotating cutter at a period of time at a different ages and cycles.

The experiment results that were obtained show that the long-term abrasion resistance and the compressive strength of cement-lahar concrete paving block are improved more by an increase of volumetric percentage of pea-gravel and by exposing the specimen to longer age. This means that the strength and abrasive resistance of concrete paving block increase practically indefinitely.

GEOTECHNICAL ENGINEERING

EVALUATION OF SUBSOIL LIQUEFACTION BY SPECTRUM INTENSITY

R. P. Orense, I. Towhata, JAPAN

There is a need to detect the liquefaction of the ground immediately after an earthquake so that appropriate measures can be implemented as quickly as possible to minimize the damage. Conventionally, the evaluation of liquefaction potential of soil deposits employs a design maximum acceleration at the ground surface, suggesting that the extentt of liquefaction can be assessed by using the observed maximum acceleration in place of the design acceleration. However, since the observed acceleration simply reveals the maximum value does not show anything about the number of cycles of earthquake load application, the earthquake-induced shear stresses are often overestimated, especially for high values of surface acceleration.

The method proposed in this paper attempts to interpret the seismic data obtained at the ground surface and

to assess the thickness of the liquefied layer The investigation was conducted through shaking table tests to study the liquefaction mechanism of a model ground. The test results suggested that the ground is in a state of resonance at the onset of liquefaction. Therefore, the shaking of the ground at this instant of time can be investigated by assuming harmonic ground motion. Furthermore, the spectrum intensity (SI), which is approximately equal to the maximum velocity, was demonstrated to occur at the time of maximum acceleration, which also occurs at resonance and at the onset of liquefaction. With these findings, the maximum values of acceleration and velocity of harmonic motion recorded at the surface can be combined to give the maximum displacement at the ground surface. A combination of the surface displacement, together with the theory of resonant motion, makes it possible to assess the thickness of liquefied layer immediately after the earthquake. Therefore, the extent of liquefaction can be evaluated by using the maximum acceleration and the SI value observed at the ground surface. The validity of the above approach was examined through model tests as well as seismic case histories, and the results obtained were found to be reasonable.

EFFECTS OF FINE FRACTION ON LIQUEFACTION OF SAND

C. I. Ho, K. Makiuchi, K. Minegishi, JAPAN

One of the effective methods to prevent liquefaction is to modify the gradation of ground sand material by blending fine-grained components or by mixing with some cementing additives such as lime or portland cement.

A laboratory cyclic triaxial test was carried out on cylindrical sand specimens of 50 mm in diameter and 100 mm in height and the axial strain and the pore pressure were measured during axial repetitive loadings of 1 Hz. The saturated lose specimens with/without fine clay and lime were prepared by a freezing method.

It was found from the results of a series of test that the partial liquefaction occurred before the full one and the increase in the content of fine fraction contributed to the delay of the occurrence of liquefaction. It was also observed that the void ratio of specimen affected the mobilizing of the liquefaction. Finally the mechanism of fine components in sands to restrain the liquefaction is considered and discussed.

FUZZY ANALYTICAL HIERARCHIES OF SANDY AND SANDY LOAM'S LIQUEFACTION

R Yong Fen, W Min Cai CHINA

This paper is aimed at discussing the relation between the liquefiable soil and its index affect the liquefaction according to the practical characteristic of sandy and sandy loam. On the basis of fuzzy set theory and analytical hierarchies in decision theory, the fuzzy analytical hierarchies method for evaluating the liquefaction of soil in site has been proposed. Starting from the application practice of projects, the method puts its criterion for dividing damage degrees of liquefaction given by the professional specification on the base of fuzzy set theory and combines the final vector of evaluation with its index of liquefaction so as to adopt the appropriate measurement. The physical concept suggested in the paper is clear and of solid mathematics basis, also it is simple and convenient with its higher evaluation rate. The final result of evaluation is much more reasonable and accurate than others.

A FORMULATION OF FINITE ELEMENT METHOD FOR FLUID-SATURATED POROUS MEDIA

H. Shiojiri, JAPAN

Two kinds of finite element formulation for fluid-saturated porous media were proposed so far. One is the u-w form and the other is the u-π form. The objective of the paper is to propose a new formulation which excels the abovementioned two methods in both accuracy and computational efficiency.

The method is based on Biot's theory. Frequency domain analysis is cocnsidered first. In that case, relative displacements w of pore water can be explicitly expressed as a function of displacement of solid phase u - π and pore pressure without introducing any sort of approximations, and Biot's equaltions and constitutive equations can be rewritten so that only u and π appear in them. Based on the rewritten equations, a formulation for finite element discretization are introduced, where u and π are nodal variables. Resulting coefficient matrix is symmetric, contrary to the conventional u-π formulations. It is also shown that extension to time domain analysis is possible and that the derived elements are easily connected with solid or fluid elements.

It is clear that the proposed method is computationally more efficient than conventional methods using the same mesh, since number of nodal variables are smaller than u-w form, and a coefficient matrix is symmetric. Using simple one-dimensional models, the accuracy of the proposed method are examined. It is shown that in every case the accuracy of the proposed method is better than that of conventional u - π form, and that the proposed method gives even better approximation than u - w form especially when there exists discontinuity of permeabiiity, if the same mesh is used.

LIMIT EQUILIBRIUM DESIGN GUIDELINES FOR GEOTEXTILE REINFORCED EMBANKMENT OF SOFT CLAY BASED ON FULL SCALE TEST

D.T. Bergado, THAILAND
C. C. Koh, TAIWAN

This paper investigates the design guidelines for using geotextiles as a tensile reinforcement to improve the embankment stability on soft Bangkok clay. A total of ten design guidelines, based on limit equilibrium method, were reviewed and discussed. The recommended procedures for design and analyses of geotextile reinforced embankment on soft Bangkok clay were further based on the back-analyses of three full scale test embankments on soft Bangkok clay. Two test embankments were each reinforced with 4 layers of low strength and one layer of high strength geotextiles. The corresponding failure heights of these two reinforced test embankments were 4.20 m and 6.0 m, respectively. For comparison, another control embankment without reinforcement was also constructed to failure. This contol embankment failed at 4.0 m high. Based on limit equilibrium method using STABL6 computer software, the effects of geotextile reinforcements on embankment stability were evaluated by comparing the predicted and measured behavior of reinforced and unreinforced test embankments. The factors that influenced the embankment stability such as the embankment backfill properties, reinforcing tensile force, direction of reinforcing force, shape of slip surface, variation of undrained shear strength of underlying soft caly, and presence of the uppermost weathered crust in the foundation subsoil, were evaluated based on the review and comparison with ten current design guidelines. Based on the results of this study, a procedure for design and analysis of geotextile reinforced embankment of soft Bangkok clay Is recommended.

MECHANICAL PROPERTIES OF FIBER-REINFORCED SOIL

K. Makiuchi, S. Iwai, K. Minegishi, Y. Kawaguchi, JAPAN

A fiber-reinforced soil is one of the recently developed soil reinforcement methods. However its reinforcing mechanism and the quantitative evaluation are not revęaled yet. A series of experimental work was conducted and the fundamental mechanical characteristics of short fiber reinforced sandy soils were investigated using an unconfined compression test. Reinforcing materials used in the tests were nylon, jute, cotton, rubber strings and pins, and steel pins and rings. A soil specimen used was the mixture of a pit-sand and clay and compacted in the condition of the optimum moisture and the maximum dry density.

Test results demonstrated that the remarkable increase in the compressive strength was obtained for the cases of ring-shape fibers. It became clearly evident that the considerable improvement for all cases were made in the region of residual strength. It was found from the experiments that the fiber reinforcement was not effective for purely cohesionless and cohesive soils. The effects of reinforcing material, shape, size and mixing rate are discussed in more detail in the paper.

GEOTECHNICAL ASPECTS OF EARTHQUAKES ON SOILS OF HIMALAYAN REGIONS

M. A. Khan, PAKISTAN

Historical data on earthquakes show that in Himalayan regions soil have been highly influenced by the effects caused by the earthquakes. The results of the effects of earthquakes on geotechnical charateristics of soils have been presented which create dynamic instabilities in the area. In situ data and laboratory investigations have been used to elaborate the effects of earthquakes on geotechnical properties of soils. It has been concluded that geotechnical properties highly influenced the frequency and amplitude of earthquakes in different soil media. The earthquakes are characterised by slope instabilities and liquefaction in the Himalayan regions. The phenomena have been studied by standard cyclic strain method and potential earthquake caused problems in soils have been described.

THE EFFECTS OF GEOTEXTILE LOCATION ON THE BEARING CAPACITY OF SAND

K. Gotoh, A. Monther, JAPAN

In the present time, there are so many papers published about using geotextiles in the field of earth reinforcement practice. This is mainly due to its advantages in increasing

the soil bearing capacity aside from its relatively low cost. From this point of view, this paper describes and discusses a laboratory model test results of the ultimate bearing capacity of square footing supported by sand reinforced with geogrid layers. Based on this model, the critical depths of reinforcement, its shape and its dimensions were determined and compared. The usage and performance of geotextiles will be based on a pre-determined location based on the deformation analysis. For this purpose, an elastic-plastic modeling of sand using the finite element analysis was carried out in order to study and to determine the deformations' planes beneath the model footing prior to the geotextiles lay out. This method helps in determining the exact position, area and the shape of geotextile to be used without making so many experiments by using trial and error procedure. For the above mentioned purposes, a well-graded volcanic sand obtained from the foot of Mt. Unzen in Nagasaki, Japan was used together with two kinds of commercially available geotextiles namely Tensar SR2 and Tensar SS 2. After adjusting the density of the sand to a specific relative density, the friction coefficient between sand and geotextiles at any imposed vertical load is estimated by

conducting a set of pullout tests. Finally, load settlement tests were conducted in order to check the increase of the bearing capacity at each condition.

TIME-DEPENDENT BEHAVIOR OF RECONSTITUTED SOIL WITH MARINE CLAY IN KOREA

S.S. Kim, K. H. Koh, S. Y. Jung, M. S. Kang, KOREA

The studies on soil behaviors in Korea have been progressed up to the present giving priority to time-independent behavior which is based on elasto-plastic theory and the limit equilibrium theory so far. For the analysis of long-term behavior of marine cohesive soils in Korea, this study was to consider the time effects and to investigate the time-dependent behavior of soils at undrained stress path especially by establishing the stress-strain-time relationship.

The data used in this study were obtained from triaxial compression tests for the reconstituted samples of marine cohesive soils collected from seaside area of Busan in Korea, and for the test methods, both the constant strain-rate controlled test and the constant stress controlled test were carried out to obtain soil parameters for marine clay in Korea.

Particularly, during the triaxial compression tests (-) back pressure was applied to shorten the time for the saturation of specimens and an apparatus for the undrained creep test was devised. For the constant strain-rate of 0.4, 0.04, 0.004 mm/min under consolidation pressure of 1, 2, 3 kg/cm^2.

The samples with the constant stress controlled test were loaded with 30, 50, 90%of the yield strength under the same consolidation pressure condition.

Through all the above tests, stress, discplacement and porewater pressure with prolonged time were measured and from those data the following terms and conditions were examined.

(1) The investigation on the applicability of Cam-Clay Model and Modified Cam-Clay Model and the comparison of soil parameters.

(2) The variation of undrained stress paths with the various strain rates.

(3) The comparison of soil parameters according to the creep equation

(4) The variation of undrained stress paths according to the variation of pore water pressure at the constant stress controlled test.

(5) The comparative analysis of experimental data with theoretical values

From the results the range of soil parameters for marine cohesive soil used in the study was obtained and time-dependent behavior of the soil could be confirmed.

And from the comparative analysis with theoretical values it was known that the experimental data from the constant strain-rate analysis with theoretical values of Modified Cam-Clay Model and Singh and Mitchell's equation among other theoretical creep equation shows good agreements with the results from the constant stress controlled test.

STATISTICAL STUDIES ON RELATIONSHIPS BETWEEN HYDRAULIC CONDUCTIVITY AND BASIC PROPERTIES OF FINE-GRAINED SOILS

R. Hashim, Z. Ismail, N.A. Abd. Hamid, T. C. Sim, MALAYSIA

The strength, compressibility, and flow behaviour of a soil are reflections of its basic properties. It has been shown that basic soil properties can be correlated with engineering behaviour of soils. On the other hand, statistics provides models that are need to study situations involving uncertainties. Combining the two disciplines, logical and systematic decisions can be made on soil characteristics based on observed data. This is an alternative method to replace testing so that time and cost can be saved.

In this paper, statistical approach is used to study permeability of fine-grained soils with regard to the relationship between some basic soil properties and permeants. Simple and multiple linear regression have been carried out using the statistical software SPSS Version 6 to establish the dependence of permeability on these properties. From the statistical relationship established, statistical hypothesis testing is carried out to test the significance of the relationship. Equations governing flow behaviour are then developed and experimental work are conducted for the purpose of verification.

From this study, permeability of fine-grained soils are found to be log-normal distributed. Grain size and uniformity coefficient are significant affecting factors on permeability of this type of soils whereas fineness modulus has no significant effect on permeability. It was also seen that a strong positive linear trend existed between permeability and void ratio. Furthermore, permeability of fine-grained soils are inversely related with Atterberg limits and dielectric constant.

APPLICABILITY OF HETEROGENEOUS SANDPILE MODEL TO REAL LANDSLIDES

T. Yoshino, JAPAN

We incorporated the field dispersion in a sandpile model proposed by Bak, Tang, and Wisenfeld (BTW) [Phys. Rev. A38, 364, 1988] to analyze the applicability of the model to

real landslides. BTW's sandpile model is known as the one which simply describes a behavior of a pile of granular materials. Because numerical calculation of the sandpile model costs less in time than any other methods, it is worth challenging to determine the applicability of the model.

The field dispersion occurs in many situations when we actually construct the slope of granular materials. It is, therefore, important to examine the effect of field dispersion to the sandpile model when we consider the application of the sandpile model to real conditions. To estimate the effect, we calculated a new sandpile model namely heterogeneous sandpile model.

Heterogeneous sandpile model is composed by random thresholds, which are constant in the case of the original sandpile model. However, there is no difference in the procedure of time evolution between the two models. Therefore the simpleness of the calculation of the new model is same as that of the BTW's. Using the new model, we obtained the time series of many sizes of landslides. We calculated the probability distribution of the landslide sizes and the power spectra.

Two characteristic features were obtained; these are 1) the scaling law of the probability distribution of landslide sizes and 2) $1/f^2$ power spectra of landslide sizes. These properties agree with the ones of BTW's model. The results indicate that the effect of field dispersion is negligible when we describe the landslides using the sandpile model. Our results are also consistent with experimental data of the slopes of granular materials.

EXPERIMENTAL STUDY ON ELLIPTICAL TUNNEL OPENINGS IN BRITTLE GROUNDS

T. Domon, K. Nishimura, JAPAN

Large sectional tunnels have increased greatly with public transport needs in recent years. In Japan, for example, the ultra large tunnels which are planned in The Second Toumei-Meishin Expressway are designed with cross-section area of about 200 m^2. In this case, the adoption of conventional horse-shaped or chestnut-shaped tunnels, then, bring superfluity of excavated area and increase in construction cost. Thus, elliptical tunnels with the ratio of the height *(b)* to the width *(a)* of the section equal to 0.65 are used for engineering pre-design calculations in the highway. It is necessary to investigate the mechanism and patterns of failure of elliptical tunnels, because only few elliptical tunnels have been excavated to date.

In this study, several fracture model tests are performed to investigate the failure mode of elliptical tunnel openings. The openings consider four kinds of *b/a* (0.32, 0.56, o.79, and 1.00), including a circular opening, inscribed in a clearance limit. Other purpose of this study is to establish artificial material for a brittle ground model and a biaxial loading apparatus for plain strain condition.

The material selected as the model of a brittle ground is a mixture of Toyoura sand and a small quantity of wheat, which is baked in a dry kiln at 110°C for 24 hours. This ground model is 25 cm long, 25cm wide and 5cm thick. An elliptical tunnel opening or a circular tunnel opening is located at the center of the ground.

Models are tested in biaxial compression and isotropic loading, i.e. $K_0 = 1.0$ ($K_0 \neq 1.0$ in progress).

The results from model tests are as follows;

1) The crack generated on the opening wall tend to concentrate at the springline as *b/a* increases. 2) Its crack propagates from the springline to the crown or invert of the opening without reaching to the outside circumference of the model ground. 3) As a result of this propagation, a wedge block happened at the crown or invert. 4) Cracks of a circular opening distribute uniformity around its periphery. 5) These oehavior are well suited to quantitative evaluation by the elastic analysis, using complex function, associated with Mohr-Coulomb criterion.

From these results, we may conclude as follows. 1)Shotcrete and/or rock bolts need to prevent the initiation of crack at the springline on the occurrence of wedge block at the crwon, especialy in *b/a*=0.32 and 0.56. 2) The elastic analysis contributes to understanding the extent of failure zones.

DEVELOPMENT OF A RECYCLING SYSTEM FOR EXCAVATED SOIL

K. Goto, A. Tanaka , JAPAN

NTT has developed a compact system which recycles the excavated soil produced by conduit extension work, which is usually done in the roadbed sections. Excavated soil is not reburied In the roadbed since its supportive strength does not satisfy Japanese road to refill roadbed sections. However, environmental concerns are leading industries to consider recycling methods due to soil disposal problems.

NTT's soil recylcing system is intended for use in areas lacking disposal sites, such as the Tokyo metropolitan region where securing of large-scale disposal sites is extremely difficult. Further, since NTT's construction work is at numerous small-scales sites, the development of a compact and easily movable system was required.

A lime stabilization process is employed in which fixed

quantities of soil is fed by a belt conveyor into an impact mixer containing lime. The mixture of soil and lime is crushed and mixed and passed through a vibrating sieve to ensure granular texture of this high quality improved soil. A soil evaluation tester is employed to rapidly measure the improved soil's supportive strength.

The results of test construction are; (1) the quality of the improved soil fulfills the quality needed for roadbed refill materials, (2) the system is compact and achieves soil improvement at small sites, and (3) lower noise levels have been achieved with current levels below 65dB. Further the improved soil created by this system has received certification as "high quality improved soil" from the Civil Engineering Research and Development Center, which is an organ of the Japanese Ministry of Construction.

NTT is examining business opportunities offered by the recycled soil produced by this system. Currently, this system is being used in Kobe to resolve the problem of insufficient disposal sites for excavated soil caused by massive restoration work required after last year's Great Hanshin Earthquake. In the fufure, construction of soil recycling systems is planned for the Tokyo area, which also lacks sufficient soil disposal sites.

PERMEABILITY OF COMPACTED SOIL LINERS FOR SANITARY LANDFILLS

H. Hj. Ismail, B. Abu Bakar, MALAYSIA

One of the most important geotechnical criteria in evaluating the suitability of landfills for waste containment is permeability. Though considerable work has been done to study water permeability of compacted soils in landfill situation or in laboratories, very few studies have been conducted on chemical permeability or air and gas permeability through compacted soils. Studies on chemical, air and gas permeability would provide a better understanding of the fundamental behaviour of leachate migration in sanitary landfills.

This paper, therefore, examines some fundamental parameters that affect permeability of compacted soils. Specific emphasis of this paper is on checmical and air permeability of compacted soils. Different compactive efforts, moulding water content and soil types were examined.

From the results obtained, the chemical constituent of leachate influence the permeability values. The results of 'synthetic' leachate indicate that the permeability values is greater than those obtained for water. In other words, the criteria for compacted soil liners permeability should be less than 1x10-9 m/s may be exceeded if chemical contaminant were present. The results of gas/air permeability indicated that they increase with time to a threshold value.

Finally, several recommended practices and specification in landfill design were proposed.

SOME EFFECTS IN AN EXPEDIENT RAPID CONSOLIDATION TEST

K. Minegishi, K. Makiuchi, JAPAN

A standard consolidation test requires generally more than a week for one case of a soil. In an attempt to shorten the testing time, a rapid consolidation test is proposed using the conventional consolidation test equipment.

Effects of testing procedures and specimen conditions on the consolidation constants of soils were investigated using several artificially blended clays with different plasticity. The duration of loading time were selected for the range of 10 min to 24 h and the height of specimens were controlled from 10 to 40 mm. A continuous step-loading for the specified period was applied to one specimen.

Experimental results indicated that there was no significant difference in the time-settlement relationships of low plasticity soils between the proposed and conventional methods. The yield stress, the compression index and the coefficient of consolidation for relatively higher plasticity clays were able to be estimated by applying a modification procedure. Finally the reliability and accuracy of this proposed rapid testing method was shown to compare very well with the existing standard method.

EARTHWORKS AND FOUNDATIONS IN TONDO AREA: A GEOTECHNICAL ANALYSIS

L. C. De Castro, PHILIPPINES

This descriptive research attempted to analyze the data presented by the soil engineers of the DPWH-NCR, as a result of the survey they have conducted around the Tondo Area, sometime in November, 1995.

Using the Standard Penetration Test (SPT) result, the strength parameters were evaluated. the findings show that a spread footing is appropriate to a limit of four storey building. for high-rise buildings up to 40 storey, pile foundation is highly recommended.

ENGINEERING GEOLOGICAL CONSIDERATIONS IN SALT RANGE AREA NORTHERN PAKISTAN

M. A. Khan, PAKISTAN

Engineering geological studies for ground conditions are presented for salt range area situated in a shallow marine

environment. Major geological features in the investigated area consist of sand underlain by salt rock. It has been found that the extensive damage to buildings and roads are due to subsidence associated with dissolution of the underlying salt rock. Collapsing behaviour of the sand appears to be a contributing factor to the damage in combination with subsidence. The geotechnical properties of the sediments and the potential geotechnical engineering problems have been described. It has been concluded that the deterioration in construction materials are due to high evaporites in sandstone sediments.

DETERMINATION OF LIQUID AND PLASTIC LIMITS OF SOILS BY FALL CONE TEST
S. Shimobe, K. Minegishi, JAPAN

This paper describes the use of fall cone (BS cone penetrometer) to determine the liquid and plastic limits of soils, following the procedures proposed by Wroth and Wood and Yudhbir and Shukla, respectively. In order to verify these procedures, both the liquid and plastic limit values for various soils covering a wide range of plasticity obtained from the fall cone tests were compared with those determined by the Casagrande methods.

The liquid limits obtained by the Casagrande and fall cone methods show good accordance for liquid limit values up to about 150, which is the approximate upper limit in most natural soils. Besides, the above-mentioned two different cone testing procedures present almost similar values of liquid limits. For soils with liquid limits larger than 150,the fall cone test data indicate much smaller liquid limit values than the Casagrande method. On the other hand, with respect to the plastic limits values, the correspondence of these fall cone testings with the standard method shows some scatter and is no good in comparison with the case of liquid limits. Especially, the Wroth and Wood's method gives unreasonable results for the artificial soil samples (e.g. bentonite and kaolinite soil mixtures). Therefore, in this study, Yudhbir and Shukla's method explains well the fall cone test data over a wide range of penetration values, and is an effective index test procedure for practical use, as the simultaneous determination of consistency limits obtained using a single cone.

Further, the one-point method for liquid limits determined with the fall cone test is also re-examined and discussed. From the engineering point of view, a simple predicted model is proposed to represent the liquidity index - cone penetration behaviour of remoulded and undisturbed fine grained soils.

A RAPID MEASURING METHOD FOR MOISTURE CONTENT OF SOILS
K. Makiuchi, K. Minegishi, S. Shimobe, JAPAN

Moisture content is one of the fundamental indices of geotechnical materials in identifying their mechanical characteristics and other properties in-situ condition. At present a worldwide standard testing method for water content of soils is the oven dry method at 100^{0}C. It is however recognized that the method takes in general more than 18 hours and is inconvenient to practical uses.

A new rapid test method described in this paper is the black-lead block heating method in which a soil specimen in flat aluminum container is placed between two black-lead blocks and heated quickly. Results showed that the data demonstrated no significant difference compared with those obtained by the conventional oven dry method.

It was found that in this new method the final temperature increased within about 10 minutes was important in viewpoint of the control in this new method and the appropriate temperature of specimen was around 180^{0}C. Further observations revealed that the duration of drying was not an influential factor.

The accuracy is fairly good for samples of low water content such as sandy soils and at least + 3% for high water content such as very high plasticity clays. These few percent difference may be negligible in consideration of non-homogeneity of specimens and some errors in these testing techniques and apparatus.

CONSTRUCTION PLANNING AND MANAGEMENT

PRELIMINARY STUDY ON FUNDAMENTAL PRINCIPLES AND PRACTICES OF CONSTRUCTION MANAGEMENT IN THE PHILIPPINES
K. Baba, THAILAND

From the end of this century to the beginning of the next century, in Asia there will be a boom of construction.

In order to implement these projects efficiently the method developed in the field of construction management shall be adopted.

However, in some cases, there have been strong resistance against the application of these methods in the practice of actual construction works. These resistance mainly come from the differences in the cultures of the people who developed these methods and that of the people who want to employ these methods and systems.

Up to today, almost all methods and systems in construction management have been developed either in United Kingdom or U.S.A. Therefore, if these methods and

systems will be employed for the implementation of the projects in Asia, there will be high possibility of conflict and they will not work as expected.

In order to apply the methods and systems of construction management to the actual construction works in Asian countries of Eastern Culture, urgent development and adjustment of existing methods and systems which have been developed in Western Culture will be necessary

There are many discussions concerning the differences of cultures of East and West. However, culture of East itself is monolith. As anyone can find, there are many varieties in culture such as different languages, even with different letters, religions, etc. in the region of Asia. Therefore, it is impossible to discuss all countries of Asia by using one common term.

For this reason, we should analyze the managerial characteristics and principles of management together with actual practice of construction management of each country in Asia. As one of case study, principles and actual practice of the construction management of the Philippines are discussed in comparison with those of U.S.A. and Japan.

As a result, there are quite strong influence by America in construction management systems in the Philippines. However, at same time, there is one question whether these systems are truly based on the nature of the people there.

A fundamental approach to establish construction management systems suitable to Asian countries is discussed.

STOCHASTIC SIMULATION OF THE PERFORMANCE OF A CONSTRUCTION PROJECT ON A MICROCOMPUTER

Z. Harun, T.S. Yee, G. Singh, MALAYSIA

Nowadays, construction business and its environment are more complex than before, and the trend towards increasing complexity is continuing. These changes have made the process of managerial decision making more complicated. It is very risky to rely on a trial and error approach in decision making. construction mangers must resort to the use of more powerful management techniques and tools that are available in this field.

A microcomputer program has been developed by the authors to demonstrate the feasibility of the stochastic simulation concept which made use of the Monte Carlo simulation technique. This programme was developed using the Visual Basic language under the MS Windows environment. This programme was used to model the profitability of a construction company and sensitivity analysis of the same was carried out. Data was obtained from local construction project which was then used to run the model. The results from the, simulation model was then compared with he actual ones. Sensitivity analysis was carried out by varying the value for each variable in the model and observing the results on the overall output.

The flexibility of the programming language, Visual Basic, also enabled a visual manipulation facility to be incorporated into this programme. This facility enabled the user to input and adjust the probability value of each variable via using the pointing device (mouse). This facility is especially useful and attractive to new users and those who are not well-versed with the probabilistic approach.

The paper will highlight certain points such as how the Monte Carlo simulation approach can be practically used by professionals and non-professionals as a powerful management tool. It will demonstrate the Visual Basic programming language as a versatile language and suitable for use in developing the simulation package as a learning tool. Finally, it will show how the package developed has a great potential as a decision support system for any construction company to model the profitability of their projects. The package is made to be tolerant, interactive and user friendly.

EVALUATION OF CIVIC DESIGN METHOD OF HIGHWAY

M. Nakazono, Y. Shono, Y. Inoue, K. Nakagawa, JAPAN

Concerning the method of civic design in the construction and planning of highway, the evaluative examination is conducted and the relation between design processes and evaluation is analyzed to prove the validity of a method which is to make a total design concept at first and next to design the structures individually according to the concept in the first stage of construction.

The line of this study is from Mikono I.C. to Tatsunonishi I.C. in Sanyo highway. The line is divided into three sections. The first section was designed before the total concept was decided. In the second section, the concept was decided in the fiscal year of construction and design term was short. The third section was designed from the first stage based on the concept. A psychological experiment with semantic differential method (166 students) is carried out about the structures (tunnel gate, noise barrier et al). The relation between characteristic of design and evaluation is analyzed by multivariable statistical method.

The structure designed based on the concept have gained the novel design compared with standard type because of the existence of evident design objective. As the

civic design is positioned in the early stage of construction, the degree of freedom is high and the time for design is secured enough. Therefore new form of high level is predicted. About the evaluation of favorable impression, the structures designed based on the concept are gained high point. Especially such evaluation is done with tunnel gate, noise barrier, tower for water tank of the second section and tower of the third one. The difference of the evaluation is relying on the form mainly and concretely saying it is brought about by the impression whether the structure gives nimble image or not.

In case of the linear facility like as highway, it is an effective method to make a total design concept of the line next to develop the concrete design based on the concept for creating new molding and securing the unification of design. It is important to position the civic design in the early stage of construction in order to keep the time examination of concept and concrete design. As a result the possibility of producing the creative design harmonized with peripheral environment and the peculiar design including the historical motif of each area will be expanded.

CONSTRUCTION OF A DOUBLE SKIN SHEET PILE COFFERDAM FOR THE REHABILITATION OF A 65 YEARS OLD DAM IN MALAYSIA

P. Singh, MALAYSIA

The Chen deroh Dam in Perak, West Malaysia was constructed by the Perak River Hydro-Electric Power Company during the period 1927 to 1930. The development consisted of a three unit power house with a concrete hollow buttress dam to close the Perak river. The power house is situated immediately downstream of the intake set into the right bank of the river channel. Having served its purpose for more than 65 years a rehabilitation scheme was initiated in 1995 to replace the existing three number of turbine units in the power house.The objective of the rehabilitation scheme was to replace existing turbines with generating equipment capable of producing maximum practicable capacity with associated modifications to existing draft tubes, outlet profile, penstocks and intake gates. The rehabilitation work was programmed to avoid interference with normal day-to-day operations of the power station. In order to carry out the rehabilitation programme it was found necessary to construct a cofferdam at the tail race end of the power house. This paper attempts to highlight the construction technique and choice of materials employed for the construction of a double skin sheet pile cofferdam at the downstream end of the power house. It also discusses the various alternatives considered for the purpose of design and construction of the cofferdam including site constraints faced during the implementation stage.

PAVEMENT ENGINEERING

POST-PROCESSING TECHNIQUE FOR THE MULTI-LAYERED PAVEMENT SYSTEM

B.W. Jo, S.J. Han, S.G. Suh, O.H. Kwon, KOREA

As modern industry go further, a rigid concrete pavement has been widely constructed. Some of them has been viewed with great concerns by highway engineers due to the severe cracking and failure problem. This paper deals with the development of post-processor program for the concrete pavement using finite element theory on the equivalent nodal loads and stiffness for the multi-layered rectangular elements

COUNTERMEASURE OF RUTTING FOR WEARING COURSES AND THE PREVENTION OF NOISE CAUSED BY RUNNING VEHICLES AT TRUNK ROADS IN TOKYO

J. Minegishi, F. Tatsushita, JAPAN

The important task in pavement management of trunk roads in Tokyo are to: 1. Make the occurrence of rutting a few, 2. Make noise caused by running vehicles a few.

This paper reports the results of laboratory tests and field experiments, about the countermeasures of rutting for wearing courses and the prevention of noise caused by running vehicles.

For countermeasures of rutting for wearing courses, it was valid to use thermoplastic modified asphalt mixtures and semi-flexible pavement.

Where modified asphalt was the case, cracks occured and it was rather more valid not to make viscosity relatively high when selecting a material.

Concerning cutting down of the noise in a pavement, an application of open graded asphalt mixtures using modified asphalt of high viscosity was found effective.

Filling of sand and surface cloggage made a progress together with a sequence of events of time cutting down the effect of noise gradually.

This paper reports about the recovery effect of filling of sand and the use of high pressure washing machine.

DEGRADATION AND STRENGTH CHARACTERISTICS OF AGGREGATES IN HIGHWAY BASE AND SUBBASE

H. Ismail, MALAYSIA

Breakdown of aggregates or aggregate degradation under compaction, compression, bearing and shear is a phenomenon that occurs in the unbound layers of highway

base and subbase. This phenomenon has been identified by many researchers as one of the many causes of road failures.

This paper examines the characterisitics of mechanical degradation of unbound aggregates. A laboratory programme that includes the fabrications of Modified Bearing Ratio (MBR) mould and large Shear Box focused on the influence of aggregate type in terms of high strength versus low strength and high absorption versus low absorption. Aggregate gradation, compacting efforts, MBR test, compression test and large shear box test are addressed herein. Criteria in assessing degradation under these test condition are examined.

From the results obtained, the following conclusions may be drawn:

1. the degree of degradation is influenced amongst others by initial gradation and compactive effort used

2. particle breakdown in gravel (high strength, low absorption) occur at points of contacts, reducing its angularity and increasing its uniformity (rounding off)

3. partcile breakdown in crushed brick (low strength, high absorption) is by breaking and by splitting rather than rounding-off)

4. under different vertical load for shearing, uniformly graded aggregates undergo greatest degradation while the gap graded aggregates undergo the least.

BASIC RESEARCH ON THE MEASUREMENT OF RESILIENT MODULUS OF GRANULAR BASE COURSE MATERIALS

Y. Todoroki, Y. Miura, T. Nishimori, JAPAN
D.S. Pagbilao, PHILIPPINES

As for designing asphalt pavement, the design method based on mechanical analysis is used in many countries and organizations. In such a case, the mechanical constant of each layer comprising the pavement structure, particularly, the resilient modulus or stiffness modulus, need to be known.

The resilient modulus of granular base course materials is determined generally from dynamic triaxial tests. However, the device for this test is complicated and high-priced. Hence, the development of a convenient test method which measures the resilient modulus is needed.

This paper presents a simple test method devised, wherein rubber is used to provide the confining pressure. Even if the materials are nonfree-standing, such as granular materials, the preparation of test specimens is easy. The resilient modulus of granular materials, can be meausred easily when there is a dynamic loading device. The method was tested using crushed stones which are widely used as base course materials.

CONDITION SURVEYS ON ROADWAY BRIDGES IN THE REPUBLIC OF KOREA

S.B. Park, M.S. Bang, KOREA

Statistical analyses based on the inspection data of roadway bridges were conducted in this study. A total number of 13,628 bridges were classified into 6 groups by both the road class and the office responsible for maintenance. The appraisal in the inspection was conducted by the Condition Ratings Criteria (CRC) developed with continual modifications through repeated applications and evaluating data was processed in the Bridge Management Systems (BMS). The results show that many bridges have structural deficiencies and obstacles on the traffic service due to sustaining damages, and reveal that existing repairing and strengthening methods are inefficient.

TRANSPORTATION ENGINEERING

ANALYSIS OF HEADWAYS AT SIGNALIZED INTERSECTIONS IN THE PHILIPPINES

A.M. Fillone, PHILIPPINES
A. Fukuda, JAPAN

Several intersections were observed using a videotape in order to establish important key variables of signalized intersections in major Philippine cities and in Metro Manila. The video images were then analyzed in the laboratory These key variables include saturation headway, start-up lost time and saturation flow rate. Other factors such as the effect of the number of approach lanes, mixed flows and lane markings on the average headway were also considered.

The results were then compared to established variables used in other countries such as the United States and Japan. It was gathered that headway variables vary considerably in the Philippines. Underlying factors affecting the obtained values are then discussed.

ON TRAFFIC IMPACT AND SYSTEM MANAGEMENT OF URBAN AREA

H. Hj. Ismail, B. Baharom, M.Y. Abd. Rahman, MALAYSIA

New urban redevelopment would generate and attrract additional traffic. This cause enormous strains on to the existing highway system.

This paper examines traffic impact and traffic system management techniques that can be used to evaluate

additional development generated traffic. Several traffic impact assessment principles are discussed. One case study involving traffic impact assessment of the proposed new urban redevelopment at Tampoi, Johore involving almost 300 acres of land. This mixed development includes commercial centers, office towers, hotels, water front marina and condominiums. Scenario testings were undertaken for year 1995 to 2010. The results of the analysis indicate the need for staging development of two diamond interchanges. In conclusion, several problems and uncertainties in executing such assessment were also presented.

THE OPTIMAL TIMING OF PARKING GUIDANCE AND INFORMATION (PGI) SIGN BOARDS

R.G. Thompson, AUSTRALIA
K. Takada, S. Kobayakawa, JAPAN

Parking Guidance and Information (PGI) systems are amongst the most common form of intelligent transport systems in use today, with over 40 cities currently operating such systems in Japan. PGI systems typically present car park availability information to drivers via variable message signboards located at the roadside.

Since these signboards are located in advance of car parks and there is a time lag between the actual accumulation at car parks and that displayed on the signboards, there exists the potential to present inaccurate availability status information to drivers. That is, drivers may observe either a FULL or AVAILABLE status for a car park on a signboard and find the availability status different when they reach that car park. This problem has revenue impacts for the owners of car parks and can reduce the overall credibility of PGI systems.

This paper presents details of a simulation model that has been developed to test methods for determining when to change the availability status messages on PGI sign-boards. A dynamic car park accumulation prediction algorithm was found to perform better than rules based on fixed accumulation thresholds. The prediction algorithm contains procedures that incorporate departure rates and accumulation update time of car parks as well the distance of signboards from car parks. This algorithm provides PGI system operators with a means of reducing the likelihood of drivers receiving inaccurate car park availability information.

IDENTIFYING THE INFORMATION NEEDS OF DRIVERS

R.G. Thompson, AUSTRALIA
K. Takada, S. Kobayakawa, JAPAN

In many cities, Intelligent Transport Systems (ITS) offer drivers a wide range of information on the performance of the transport system. However, the demand for specific types of information will be strongly influenced by perceived information needs of drivers. Advanced Parking Guidance and Information systems (PGI) offer the possibility of presenting a range of real time information, including car park location, availability, waiting times and prices. In order to understand the potential market for these systems as well as how they will effect transport choices, a study of the information needs of drivers is required.

This paper present results of a study of drivers attitudes towards parking and traffic information in Shinjuku, Japan. Drivers were found to be non-homogeneous with respect to their parking information needs. Several trip and personal characteristics affecting drivers desire for different types of information were identified. Many of these factors were found to be directly related to the drivers' perceived knowledge of the traffic and parking system. The nature of these market segments should be helpful in designing future ITS and PGI systems.

SPEEDING IN URBAN AND RESIDENTIAL STREETS

M.R. Karim, N.A. Abd Hamid, MALAYSIA

The main objective of the paper is to present some of the findings of a study on the problem of speeding in urban and residential streets in Malaysia. The study aims to investigate the extent to which speeding is a problem since this has been envisaged as being one of the main factors that lead to road accidents. The effectiveness of some of the traffic calming measures, particularly those which would result in speed reduction is also investigated.

A number of study locations were chosen based on geometric characteristics and traffic control features present on site. The accident data available was used as an aid to locate accident-prone locations from non-accident prone locations. A thorough assessment of the sutdy locations were done before traffic data were collected.

Traffic flow and speed data were collected using automatic vehicle data acquisition equipment (for this study, the VDAS was used). The relevant data were processed and analysed using normal computer techniques. Statistical analysis were conducted (using SPSS) to verify the results obtained.

Among others, the results obtained indicated that the problem of speeding do exist in those areas. Relationship between speed characteristics and location types (ie. with geometric differences, as well as accident-prone and non-accident prone etc.) were established. Relationships between speed and other flow variables as well as time of the day were also derived. The results obtained were found to be statiscally significant.

The problem of speeding which is found to exist in urban

and residential streets need to be addressed and the findings from this study would be beneficial in formulating appropriate countermeasures.

STUDY ON CHARACTERISTICS OF MOBILE NOISE SOURCES IN KLANG VALLEY, MALAYSIA

M.R. Karim, S. Yusoff, MALAYSIA

The main objective of the paper is to present some of the findings of a study to characterize the different acoustical natures of various motor vehicle noise sources when engaged under different modes of operation.

A reasonable noise sample size was obtained for singular vehicles from under different modes of services. Subsequently, the L_{eq}, L_{10}, L_{50}, and L_{90} noise indices have been identified and determined. A semi-empirical method for predicting or estimating motor vehicle noise levels have been developed by synthesizing existing sound wave propragation theories and noise level data sets yielded from field investigations. Rigorous statistical methods have been employed to determine the method's accuracy and reliability. Simultaneously, public survey has also been conducted to gauge the existing public attitude and degree of awareness towards contemporary motor vehicle noise pollution problems.

L_{eq}, L_{10}, L_{50}, and L_{90} noise indices was identified and determined from the data samples. The L_{eq}, L_{10}, L_{50}, and L_{90} noise index percentiles have been statistically derived with a 95% level of confidence for their relevant accuracies. Public survey results reflect the public attitude and degree of awareness with contemporary motor vehicle noise pollution problems

From field investigations:

* highest characteristic noise levels were found to be during acceleration and cruising modes
* mini buses and heavy lorries produces highest noise level within 83-88dBA
* automobiles identified as class of vehicle which generate lowest noise level within the range of 68-81 dBA.

Formulation of motor vehicle noise level prediction method:

* The semi-empirical expression developed for predicting motor vehicle noise levels is highly versatile for adaptation for calculation of noise level indices for different traffic flow pattern.

Public survey:

* Public are becoming more sensitive and beginning to take better notice on the existing environmental quality around them. However, most are still ignorant about the relevant statutory rights in legislation pertaining to noise pollution.

MODAL CHOICE BETWEEN LRT AND CONVENTIONAL RAILWAY

T. Shimazaki, K. Arakawa, JAPAN

Recently, light rail transit systems are planned or being under construction in several Asian cities, such as Manila and Bangkok in order to solve the traffic congestion problem. In these cases, the fare of the LRT tend to be decided from the political view point, rather than the financial view point. Even though, it is important to predict the number of passengers for financial planning. The paper analyzed the influence of the fare change for LRT system (Kanzawa Seaside Line) against the conventional railway system (Keihin Kyukou Line). The analyzed LRT system is located about 40 km southeast of Tokyo Metropolitan Area. The LRT is running almost parallel with the conventional railway system. The fare system of the LRT system was changed in last August, while the fare for the conventional railway system was kept unchanged. Questionnaire survey was conducted for the people living in the area between LRT and the conventional railway system. Data for preference for the two systems before and after the fare increase of LRT system were obtained along with the basic characteristic data of the correspondents. The data are statistically analyzed to obtain the influence of the fare change. The result shows that the fare change has slight influence in this case due to several reasons.

A STUDY OF A METHOD OF APPLYING ZONE SCHEDULING TO A BUS ROUTE

A. Fukuda, A.M. Fillone, T. Kurita, JAPAN

In this research, we proposed to apply the zone scheduling for bus operation in Manila to improve its operation efficiency and service reliability, and estimate the impact of zone scheduling on both. The zone scheduling which consists of local service zones and express zones bound to a terminal, is one of the most popular scheme to improve operation efficiency and service reliability. In this research , operation efficiency was defined as the reduction of average travel time and service reliability as indicated by travel time and waiting time variability.

Using this model, we evaluated the scheme to improve bus operations on EDSA which can be realized with the construction of flyover or elevated highway.

DEMAND FORECASTING SYSTEM FOR A RAILWAY PROJECT USING GIS

H. Suzuki, A. Fukuda, T. Inui, JAPAN

The aim of this research is the development of a demand

forecasting system for a suburban railway project to carry out its financial analysis more efficiently. Because urbanization used to come after the opening of a suburban railway, it is quite hard to forecast the future demand of a railway operator. Furthermore, the urban development within a railway corridor usually consist of small housing developments which undergo changes when the railway network are in place. Hence, it is quite impossible to collect, store and manage these changes in information daily and feedback data to the demand forecasting and financial analysis. Thus a system was developed consisting of two sub-models, the demand forecasting model and financial analysis model based on system dynamics, with the data stored and managed by GIS.

STRUCTURAL ENGINEERING

STOCHASTIC FINITE ELEMENT ANALYSIS WITH DIRECT INTEGRATION

C.K. Choi, H.C. Noh, KOREA

In stochastic analysis the mean and the variance of response, due to the inherent uncertainties or randomness of the structure and the applied load, is obtained. In the stochastic finite element analysis the discretization of the random field can follow the same scheme of the discretization of displacement field in the finite element analysis.

For the dynamic problems the direct integration method is one way to obtain the time history of the response in the time domain. For the stochastic analysis, with the dynamic problems in the time domain with direct integration method, a new formulation is needed in obtaining the variance of the response. There are several direct integration schemes and stochastic central difference is already established. For the other direct integration schemes the formulation for the stochastic analysis is not proposed.

In this study the stochastic direct integration method with Newmark method will be presented. The Newmark method gives an unconditionally stable scheme for appropriate parameters. The structure is assumed to be subjected to the random excitation and the material properties of the structure are considered as having deterministic values. The accuracy of the method will be compared with exact solutions for some example problems and the applicability of the method to the real structures will be discussed.

NONLINEAR FINITE ELEMENT ANALYSIS OF FIBROUS REINFORCED CONCRETE BEAMS

S. A. Al-Ta'an, A. A. Abdul-razzaq, IRAQ

An attempt has been made to develop a procedure for the nonlinear analysis of fibrous reinforced concrete beams. The finite element method have been used to investigate the behaviour in the pre and post-cracking levels and particularly near ultimate load. Degenerate quadratic thick shell elements, which is the general shear deformable eight node Serendipity elements, have been employed. A layered approach is adopted to discretize the fiber concrete and steel reinforcement through the thickness. The beams were also simulated as a plane stress problem using the same elements.

Both an elastic perfectly plastic and strain hardening plasticity approach have been employed and a dual criterion for yielding and crushing in terms of stresses and strains is considered for concrete. Post-cracking behaviour of fibrous concrete is investigated. An attention is given to the tension stiffening phenomena, post-cracking shear strength, and the degrading effect cracking has on compressve strength of concrete parallel to the crack direction.

Geometric nonlinearity is considered in the mathematical model, which is based on the total Lagrangian approach taking into account Von Karman assumptions.

Many examples are analyzed using the proposed model and showed good agreement with the available published experimental results.

FEASIBILITY OF CABLE-STAYED BRIDGES OF A MAIN SPAN OVER 1000 m

M. Hoshino, JAPAN

The purpose of the paper is to investigate the feasibility of cable-stayed bridges of a main span over 1000m. Some investigations were already done for a cable-stayed bridge of a main span 1000m, the results of which have been published in a journal. Now, a cable-stayed bridge of a main span 1500m is treated as an example for long span cable-stayed bridges. The main structural elements i.e, the girder, cables and towers of the bridge are roughly proportioned under consideration of the effects of wind, earthquake and temperature in addition to dead and live loads according to the Japanese specifications. The influences of cable sag and the stress amplitude of the cables caused by live loads are evaluated. A vibration analysis and a total buckling analysis are also conducted. Based on the investigations mentioned above, the feasibility of long span cable-stayed bridges is discussed.

SYSTEM IDENTIFICATION OF PLANE GRID STRUCTURES

A. W. C. Oreta, PHILIPPINES

The identification of plane grid structures is of practical importance in bridge structures because the grillage

analogy is commonly used in the analysis of bridges. An identification method was developed for grid structures wherein the structural parameters such as torsional rigidity, flexural rigidity and damping parameters of arbitrary grid members are identified. Numerical simulations were carried out to test the applicability of the identification method. Different forcing functions were used to induce vibration to the grid structure and the parameters were identified. Still, improvement of the method has to be done for it to be applied in the field. One problem identified is how to measure rotational displacements velocities and accelerations.

LIMIT STATES DESIGN FOR TIMBER-FRAMED STRUCTURES

J. O. Siopongco, PHILIPPINES

The overall objective is to formulate limit states code for structural design of engineered timber structures for the Philippines.

Wood properties were characterized. An analytical procedure or formula relating wood strength or resistance to loads or forces was derived. Reliability-based design methods were applied to structural members and a floor system. Accurate and reliable distribution characteristics for some strength properties were established from available data. Different methods of estimating distributional properties were explored. With appropriate probabilistic information on mean resistances, mean loads and forces, and their coefficients of variation, the safety index or reliability was evaluated. Design for ultimate-strength limit state was illustrated on a floor system with uniformly distributed load. the failure criteria for modulus of rupture formulated considered the beam size, shape, spacing and span as part of the resistance of the beam. the design was checked for serviceability limit states, taking into account the required limitations on the maximum live load deflection and the modulus of elasticity.

Considering a dead load (DL) to live load (LL) ratio of 1:4 and a performance factor, partial safety factor, of 0.7, the standard deviation and coefficient of variation of total load obtained were 0.886 and 0.164 respectively. Using the MOR strength values obtained from standard test of small clear specimens under laboratory test conditions and the average coefficient of variation in MOR in bending for 23 different species of Philippine woods, the coefficient of variation of the actual strength, fa, is found to be 0.171. The safety index is then B = 2.75.

The concepts of reliability analysis to provide a quantitative estimate of probability of failure for wood members is demonstrated by examples on ultimate-strength and serviceability limit states design of a floor system. A limit states code of structural design of engineered timber structures is proposed and is recommended for incorporation into the structural code of the Philippines.

LIMIT ANALYSIS OF RECTANGULAR PLATES UNDER ARBITRARY LOADING

V. A. Pulmano, F. Tin-Loi, AUSTRALIA

The limit analysis of perfectly plastic rectangular plates under arbitrary loading is presented as a linear programming problem. The formulation, based on direct application of the static theorem of elasticity, involves maximization of a monotonically increasing load parameter under linearized equilibrium and yield constraints. In this case, the governing plate equilibrium equations are expressed in finite difference form, and piecewise yield conditions are enforced at the finite difference node points. Note that there are three active bending stress resultants contributing to the yield condition, thereby resulting to a three-dimensional yield surface. While a lower bound solution is not guaranteed in view of possible yield violation at unchecked points, suitable discretization refinement can lead to accurate solutions. Simple illustrative examples are given to illustrate the simplicity and generality of the method.

COMPUTATION OF FOUNDATION PLATES OF VARIABLE THICKNESS

E. B. Koreneva, RUSSIA

Rectangular foundation plates with varying thickness are under study. The work examines isotropic and orthotropic rectangular plates with linear and exponential flexural rigidities and resting on an elastic medium which nature is described by Winkler's and Pasternak's models. The discussed foundation slabs are subjected to an action of constant loads and loads obeying linear and power laws distributed over their surfaces.

For their computation the equation decomposition method based on the consideration of simplier auxiliary problems which contain additional unknown functions is used. The work examines plates of variable thickness with simply supported and clamped edges and also with an elastic contour. The magnitudes of displacements and stresses are obtained. In extreme case for simply supported rectangular plate of constant thickness resting on Winkler's basis the results do in fact coincide with the precise solution. The derived approximate analytical formulae are highly accurate and convenient for engineering computation.

DYNAMIC RESPONSE OF SEISMIC ISOLATION CONICAL SHELL WITH EDGE BEAM SUBJECTED TO VERTICAL SEISMIC FORCES

K. Shingu, K. Fukushima, T. Niki, JAPAN

Japan is located on the Pan-Pacific earthquake belt, and many Japanese researchers have investigated base isolation and vibration control of rigid-frame structures. In the aftermath of several recent major earthquakes, it is necessary to develop earthquake-proof technology further.

On the other hand, the demand for long-span structures for auditoriums, exhibition halls, gymnasiums, etc., has been on the increase. The use of a shell structure to cover a large space is ideal, although effect of earthquakes, especially in the vertical direction, on a shallow shell can be severe.

There has been no effecttive research conducted on vibration contol of a distributed system such as a shell structure. However, it is possible to exercise accurate control of the structure using fuzzy control which does not require a numerical formula in its system presentation. This research was conducted by Shingu and Harumoto. A base isolation system comprising a rotational shell with springs and dampers between the shell and the ground was proposed by Shingu and Fukushima. The shell shakes due to forced vibration caused by vertical seismic motion, then a base system is activated, and stresses on the structure are reduced. The authors call this system the "Base isolation Shell" or "Seismic Isolation Shell".

In this paper, the natural vibration and the dynamic response of a base isolation conical shell with an edge beam subjected to vertical seismic forces are presented, and the characterisitcs of the shell are clarified.

BUILDINGS DAMAGED IN THE HYOGOKEN-NANBU EARTHQUAKE, JAPAN (1995) AND THEIR LESSONS

Part 1. Characteristics of Damages in Reinforced Concrete Structures

H. Adachi, N. Shirai, M. Nakanishi, JAPAN
B.A. Lejano, PHILIPPINES

The Hyogoken-Nanbu earthquake which occurred on January 17, 1995, caused severe building damages and killed over 5,500 people due to building collapse resulting from the severe ground shaking and the ensuing fires. It was found that most building damages could be closely correlated with the service age of the buildings. In this paper, a correlation between the degree of damages and service age of the buildings is presented. In addition, the history of the seismic code provisions in Japan after World War II is summarized. Furthermore, the characteristics of damages in reinforced concrete buildings are described.

Part 2: Pre-Earthquake and Post-Earthquake Countermeasures for Reinforced Concrete Structures

H. Adachi, N. Shirai, M. Nakanishi, JAPAN
B.A. Lejano, PHILIPPINES

In this paper, pre-earthquake and post-earthquake countermeasures learned from lessons of the great disaster due to the Hyogoken-Nanbu earthquake in 1995 are summarized under the following items; (1) post-earthquake inspection and damage evaluation of buildings, (2) evaluation of seismic capacity of existing reinforced concrete buildings and (3) retrofitting technology of buildings.

ADVANCED TECHNIQUE FOR URBAN SEISMIC RISK ANALYSIS AND MANAGEMENT

M. A. Klyachko, RUSSIA

The Disaster Damage Scenarios (DISC) and the Scale for Disaster Magnitude integrated powerful tool for EQ-disaster understanding and mitigation in the Socio-Economic System for Urbanization (SESURB). It is carried out in the framework of Programme of Preventive Seismic Safety (PRESS)

The DISC composition and creation sequence are:

1) Study and Certification of the SESURB and GIS creation;

2) Urban Vulnerability Assessment;

3) Damage and Losses Estimation (in according with the specially developed technique "DAMESTEC");

4) Urban Seismic Risk (SR) Analysis, including:

(a) the development of DISC-1, DISC-2 and DISC-3 - in depending of the perfection of SESURB's GIS:
DISC-1 - to estimate direct damage causing by EQ;
DISC-2 - to take into account of secondary disasters;
DISC-3 - includes also a state of lifelines, survival and other factors of emergency readiness;

(b) the playing-out of various DISC's to estimate the losses and damages and to understand the SR; the mapping of the SR fro various seasons, day-times, weather conditions, DISC's levels etc.

(c) the assessment of EQ disaster by means of DIMAK Scale and the comparison of estimated SR with acceptable SR.

5) Urban SR Management

The application of DISC and DIMAK are demonstrated on the example of the Petropavlovsk City, Kamchatka, Russia.

SEISMIC ANALYSIS OF RIGID AND FLEXIBLE LIQUID STORAGE TANKS

B. Tiliouine, A. Yahiaoui, ALGERIA

The complexity of numerical methods for the dynamic analysis of liquid storage tanks coupled with the large scale structural damage observed during past earthquakes, underlines the need for development of fast and reliable design tools to assess the seismic performance of this special class of structures.

To this end, we first propose a criterion for the assessment of the expected behavior (rigid or flexible) of liquid storage cylindrical tanks thus allowing for the choice of the most appropriate dynamic model.

We then carry out a detailed study of the analytical and numerical formulations of the problem of cylindrical shells under hydrodynamic pressure. We show practical means of determining the dynamic characterisitcs of fluid-shell systems, and proceed to the development of design charts for the maximal stress resultants of rigid as well as flexible liquid storage tanks.

Finally, we present the main conclusions of a numerical investigation into the applicability domains of the various mechanical models of fluid-structure interaction for the analysis of flexible liquid storage tanks under seismic excitation.

APPLICATION OF FRICTION - MOVING JOINT CONSTRUCTIONS RESISTANT TO EARTHQUAKES

A. M. Uzdin, RUSSIA

From 1980, special joints of structural members are being used in Russia. These joints ensure sound structural design when the parameters of marginal states are given. It is possible to use these joints to dish dry erection dampers too. Dry friction dampers are blocks of steel sheets braced by high-strength bolts, which are pulled through oval holes are very effective in the system of seismodamping. As the results of seismic impact, mutual displacements of block sheet occur. Such connection of steel sheets into block have been developed in Scientific Research Institute of bridges are called as frictional movable joints (FMJ) on high-strength bolts. At the first stage, the friction force between the sheets is not overcome and the connection works as an elastic one in accordance with the tradition scheme. At the second stage, there occur the mutual sliding of the block sheets with the heads of the bolt jammed. Due to the bending of the bolt tightness is increased and the block sheets under the intensive wearing of rubbing surfaces will sharply be increased. The latter results in decrease of the friction force. The investigations showed that it is possible to reach the stable diagram of damping by the connection if the sheet surfaces have been properly treated. At the third stage of the work the friction coefficient is described by equation.

$$k_{fr}=k_{fr}^{(0)}e^{-as} \qquad (1)$$

where k_{fr} - initial friction coefficient, a - coefficient of degradation, s - total mutual displacement of the pair of sheets connected. When calculating the FMJ, the dependence (1) is to be under regarded. The theory of FMJ behavior and structures with FMJ under earthquake loads is presented in the report. FMJ was applied in several projects of bridges for earthquake prone areas.

INFLUENCE OF GIRDER DUCTILITY ON THE SEISMIC SAFETY OF REINFORCED CONCRETE RAILWAY VIADUCTS

W. Tanzo, H. Mutsuyoshi, A. Machida, T. Kamiyama, JAPAN

In recent years, many reinforced concrete (RC) framed bridge pier structures have been constructed for expressways, commuter railways and high-speed Shinkansen railways, especially in urban areas where space is at a great premium. This type of framed structures is usually of two stories with the upper level serving as the tracks.

Although numerous analytical and experimental investigations have been conducted for building framed structures, framed bridge pier structures differ in several ways from building framed structures and have not been studied as much. While building structures may have more stories and multiple bays, framed bridge pier structures are usually single bay with two stories and may have restrictive height-to-base ration due to encroached space. In addition, the heavy mass due to the girder superstructure is concentrated at the top level unlike in building structures where the story masses are more or less evenly distributed among the stories.

While building structures may be designed to be flexible, framed bridge pier structures are relatively rigid. Safety is of primary concern, as these structures supports vehicles carrying many people running at high speed and also serves as important lifelines after severe earthquakes.

Unlike single piers supporting simple bridge, damage to

some portions does not necessarily lead to collapse of the whole structure. In order to fully understand the seismic behavior and safety of such structures, it is necessary to understand how the characteristics (strength, stiffness, ductility, dots) of its constituent member elements affect the response of the total structure, and how the failure process progresses from each member to collapse of the total structure. However, seismic response behavior of the whole structure as well as a part of the structure such as the first-level girder is not yet completely understood. Moreover, the required strength and ductility that should be provided for each member of the structure in order to achieve a rational earthquake-resistant design of this type of structures are not yet well established. Owing to this deficiency in our understanding of the seismic behavior of this type of structures, several framed structures constructed in Japan had been damaged, in particular during the 1978 Off-Miyagi Earthquake and the 1995 Hyogo-ken Nanbu Earthquake.

In this paper, a newly developed pseudo-dynamic test method combining a non-linear response analysis based on one-component model with an online loading test is carried out on small-scale two-story R/C bridge pier models. In order to verify the influence of first-level girder on the response properties of the whole framed structure, the first-level girder was loaded as an experimental member in order to obtain accurately the highly nonlinear restoring forces, while the response of the other members was numerically simulated. In this manner, the required strength and ductility that should be given to the first-level girder can be properly studied and identified as to how they affect the response of the total structure.

A STUDY ON RESPONSES OF A SOFT SETTLED TYPE OF OFFSHORE STRUCTURE SUBJECTED TO SEISMIC FORCES

K. Shingu, M. Sakuta, JAPAN

A soft settled type of structure is one type of offshore structures. The concept of this structure was proposed by one of the authors, and after that, the English name of this structure was named by the authors. The structure exerts much less weight on the seabed. This allows it to resist wave forces while being able to slide against seismic forces, with a magnitude greater than a certain level. The structure does this by adjusting the friction forces between the structure and the ground. Therefore, the soft settled type offshore structure has the following characteristics;

1) We can avoid the consolidation settlement of the submarine ground by controlling the weight in water of the structure.

2) We can expect the reduction of the dynamic responses of the structure when there are strong earthquakes.

In the past, the dynamic behavior of independent or moored-type soft settled type offshore structure, mainly with rectangular cross section, were researched. In this paper, dynamic response analysis of a moored-type structure with circular cross section subjected to seismic forces in the horizontal direction are presented. Further, experiments on a model of such a structure are presented, and the characteristics of the structure are clarified.

THE PROBLEMS AND REGULATIONS FOR SEISMIC SAFETY OF THE EXISTING BUILDINGS AND STRUCTURES

M. A. Klyachko, A. M. Uzdin, RUSSIA

Nowadays the problem of seismic reliability and safety (R&S) of existent buildings and structure became more actual and important. Even most progressive building codes could not prevent and mitigate the EQ-disaster in Kobe (Japan) and Neftegorsk (Russia). Structural and planning vulnerability of this urban area lead to unacceptable seismic risk and to unexpected human losses and property damages. As consequence, the reasonable Disaster Mitigation Policy has to combine the development and implementation of both modern seismic code for new construction, and codes and rules concerning existing buildings and structures under operation. Of course this process must be accompanied by such non-engineering measures as a land-use regulations, insurance and tax policies, etc.

At the same time, in spite of the continuous progress in the development of necessary knoledge, the special regulation for R&S of existing construction are lacking, even in developed countries. Moreover, the modern seismic building codes are unfit for existing buildings. This speedy aging, wear and tear, operational flaws of existing buildings must be taken into consideration.

The basic objective to develop modern rules and R&S regulations for existing building and structures under operation are:

- o ensure an admissible seismic risk (allowable or tolerable level)
- o correspond to urban planning & developement policy
- o satisfy condition of cost-benefit analysis

The problem at issue: the new approaches, rules, recommendations, theoretical and designed decisions are presented.

EARTHQUAKE RESPONSE OF RIGID STRIP FOUNDATIONS TO STOCHASTIC WAVE FIELDS

M. Hadid, M. K. Berrah, ALGERIA

Earthquakes are very complex phenomena that

cannot be ignored in estimating the safety of structures. In most analyses of response of structures to earthquake ground motions, the seismic excitation is assumed to be the result of non vertically propagating SH, SV, P and Rayleigh plane waves. However, this assumption only approximates the excitation actually applied to the structure, since the earth's crust is heterogeneous so that the seismic waves undergo multiple reflection and refractions, the resulting ground motion at the soil surface is highly variable in time and space.

This paper presents a 2D-soil foundation probabilistic kinematic interaction by means of simple physical models for stochastic combinations of P, SV, and Rayleigh waves travelling within a homogeneous soil at varying angles. It assumes that the input motion of the foundation is the result of the superposition of many planes; stationary, uncorellated waves coming at different angles and having a common spectral density function. An advanced computational procedure such as boundary element method is used to evaluate kinematic interaction for the case of stochastic waves propagation.

The results obtained indicate that the effect of ground motion incoherence on the response of the foundations is qualitatively similar to the wave passage effect. Both effects involve a reduction of the translational components of the response at intermediate and high frequencies and creation of rotational response component at intermediate frequencies which decreases at high frequencies.

PARAMETER INDENTIFICATION OF BI-LINEAR HYSTERETIC MODEL IN EARTHQUAKE RESPONSE ANALYSIS OF STEEL FRAME STRUCTURES

H. Zongming, L. Yingmin, CHINA

Bi-linear hysteretic model is widely used in non-linear earthquake response analysis of steel frame structures, due to mathematical simplicity. The model is effective for getting equivalent maximum displacement-history response of structures. But it remains a problem whether the model is suitable for getting equivalent displacement-history response and hysteretic energy response which are very important in estimating cumulative damage of structures, and if it does, how to determine the parameters of the model.

In this paper, seven non-linear dynamic tests of three small steel frames were performed. From the data of the tests, dominant parameters of bi-linear hysteretic model were identified with dynamic time-history analysis method. In the identification, three different equivalent response objects were chosen separately, they are the maximum displacement response MD, the sum of squares of displacement response SSD, and the total input energy EI. Two of the three dominant parameters of bi-linear model were considered, the nominal yielding displacement x_y and the post-yielding stiffness coefficient p, while the third one, the initial stiffness of the structure, was measured directly in the tests.

Identification results show that;

1) The maximum displacement response is relatively insensitive to x_y and p in time-history analysis. The displacement histories analysed with the parameters x_y and p identified for equivalent object SSD meet the tested results very well, and therefore meet the requirement of object MD, while the results analysed with the x_y and p identified for equivalent MD can not meet the requirement of SSD and have obvious discrepancy with the tested displacement-histories in most cases.

2) the displacement value corresponding to the turning point from the straight line segment to the curve segment of the mono direction load-deflection relationship can be used as x_y, for equivalent displacement-history response. The post-yielding stiffness coefficient p may be a constant for a given structure, but the value of p needs to be determined by identification procedure. The response equivalence effect of bi-linear model is better when the structural displacement is relatively large.

3) Bi-linear model is not suitable for getting equivalent total input energy EI. Generally, a given pair of xy and p can not meet SSD, MD and EI simultaneously. It is more difficult to meet the requirement of EI than that of SSD and MD with bi-linear model.

ENHANCED SEISMIC LATERAL LOAD DISTRIBUTION IN CONTINUOUS GIRDER BRIDGES FITTED WITH VISCOELASTIC DEVICES

W. Tanzo, A. Tsuzuki, JAPAN

Many bridges suffered damages during strong earthquakes due to the concentration of large forces on just a few load-resisting subsystems, i.e., piers and substructures supporting fixed bearing supports. On the other hand, piers supporting movable supports remained undamaged but simply let the girders fall off during large displacements, resulting in catastrophic collapse of bridges. Previous retrofitting programs to prevent span fall-off in both the U.S. and Japan had put priorities on the development and installation of hinge and joint restrainers. However, recent bridge failures during the 1994 Northridge and 1995 Hyogo-ken Nanbu earthquakes had reported several bridge damages retrofitted with restainers. One simple reason is that restrainers are not designed to improve seismic resistance of the total bridge, but simply to hold on the girders that are about to be displaced off the supports. A more complicated situation exists when the restrained supports transfer large forces to weak piers and substructures. It has

been generally accepted that a better solution would be to distribute the lateral forces among the piers.

A new viscoelastic device to enable load transmission to piers supporting movable bearings has been developed consisting of a piston inside a cylinder housing filled with silicon putty compound. The silicon putty readily deforms under slowly applied pressure but becomes rigid when subjected to shock or impact loads. Utilizing this property, the new device connecting the girder to the piers supporting the movable supports will enable the earthquake lateral forces to be distributed among the piers, while allowing the deck unrestrained movements at the movable supports during ambient temperature changes.

The newly developed device has been tested for its cyclic mechanical behavior as well as its effectiveness in a simple span bridge model. The device was first tested under cyclic loads. The parameters investigated were loading frequency effects (0.001 Hz to 7.0 Hz), sizes of orifice, and types of silicon putty compounds. In the second phase of the test, the device is fitted to the movable support of a simple span bridge model. Load distribution between the two piers were measured during the loadings consisting of low to high frequencies. Test results have shown the effectiveness of the newly developed device.

Lastly, a 5-parameter fractional derivative hysteretic model has been proposed to simulate the frequency-dependent behavior of a device that provide supplement damping and stiffness to the primary structure.

A NEW TYPE OF BRIDGE RESTRAINER DEVICE POSSESSING HIGH-DAMPING MECHANISM FOR PREVENTING SPAN FALL-OFF DURING STRONG EARTHQUAKES

W. Tanzo, J. Hernandez, Y. Uno, M. Kawai, JAPAN

Previous retrofitting programs to prevent span fall-off in both the U.S. and Japan had put priorities on the development and installation of hinge and joint restrainers. However, recent bridge failures during the 1994 Northridge and 1995 Hyogo-ken Nanbu earthquakes had reported several bridge damages retrofitted with restrainers. One simple reason is that restrainers are not designed to improve seismic resistance of the total bridge, but simply to hold on the girders that are about to be displaced off the supports. Furthermore, not a few cases of the damages has shown that restrainers are torn apart in the direction other than these are supposed to perform.

In a restrainer, no load resistance is induced within the gap distance. For deformation beyond this gap distance, added stiffness is provided by the restrainers to prevent fall of span due to excessive displacement. As mentioned above, this may be ineffective in a lot of cases as the demand on the restrainers at this about to collapse state is very high.

A new type of seismic restrainer is developed in which high-damping mechanism is provided in the interval of the gap distance. With significant energy absorption on this stage, the demand on the restrainers in case the displacement goes beyond is very much lessened. The device consists of a cylindrical bushing of high-damping rubber materials. The device is mainly designed to absorb energy in the longitudinal direction but can accommodate displacement in the radial directions with proper design of the thickness of the rubber materials.

In this paper, test results of a prototype of the seismic restrainer with high-damping mechanism are presented. Load-deformation characteristics were investigated as well as the equivalent damping and stiffnesses. Frequency dependency on these properties were also investigated.

A simple analysis of a bridge structure fitted with this new device is investigated analytically.

TEST OF FULL-SCALE HIGH-DAMPING RUBBER BEARINGS FOR SEISMIC ISOLATION OF BRIDGES

W. Tanzo, J. Hernandez, Y. Uno, E. Sawa, JAPAN

The use of high-damping rubber laminated bearings in seismic isolation is increasing in Japan and in other countries. Such type of bearings has been selected for the UNIDO program on seismic isolation for developing countries with the first project in China. In the aftermath of the 1995 Hyogo-ken Nanbu Earthquake, a lot of new highway bridge projects in Japan are using seismic isolation as protection against extremely powerful earthquakes and high damping rubber bearings are being adopted along with lead-rubber bearings.

A test facility capable of subjecting a full-scale isolation bearing is introduced. The test bed is more than 1m x 1m in size. The horizontal actuator has a loading capacity of 200 ton with 300mm stroke capacity. The vertical actuator has a maximum capacity of 800 tonf.

Test programs capable of providing information on cyclic load-deformation characteristics are developed. Important data on equivalent damping ratios and equivalent stiffnesses at each level of shear stress are provided. Furthermore, degradation of load-deformation characteristics under numerous deformation cycles at a certain shear strain level also provide information on the stability of the energy dissipations capacity. The developed test facility is also used in preloading the high-damping rubber bearings before shipments due to the undesirable high stiffness of the bearings in its virgin state.

In this paper, earthquake response analysis of seismically-isolated bridge system are evaluated using bilinear hysteretic models with parameters taken from the experimental results. It is shown that the use of high-damping rubber bearing as seismic isolation has drastically reduced response of the structures.

AN INVESTIGATION ON LATERAL DISPLACEMENT OF CONCRETE STRUCTURES UNDER EARTHQUAKE, USING NONLINEAR MODELS

A. R. Rahai, IRAN

One of the major problems relating to the assessment of stability of structures located in the seismic zones, is the storey drift control, as well as the control of the joint width between adjacent buildings. Such a problem is of considerable importance in structures that the stability system against vertical and lateral loads in moment resistant space frame and will be controlling the frame element dimensions in high-rise structures in comparison with other cases. In the present paper different models of concrete structures with various numbers of storeys consisting of moment resisting space frames or moment frames and shear walls have been selected and studied. Knowing that the concrete structures behavior under various loads especially earthquake effects with regard to the amortization problem comes within the nonlinear state, selected models in two linear and non-linear states from the viewpoint of materials have been analyzed where the histeric models are of the takda and Advanced takda Type.

In analyzing the models, static and spectral methods have been performed, where in the second method the Elcentro, Noghan, Tabas and Abhar spectra have been used. In such analyses, applying limit states method and employing interaction diagrams, column cross-sections have been decreased by trial and error to some extent such that the maximum capacity of materials have been utilized.

Following an analysis of all models, a maximum storey drift and relative displacement of storeys have been specified based from results of:

-- Linear and Non-Linear Analysis,
-- Static and pseudo-Dynamic Analyses,
-- Spectral Analysis under various spectra

Results show that, the earthquake period of consistency holds a major effect on the structural behavior and the storey drift resulted from the maximum lateral displacement of the models under different spectra is related to the resisting system and its height.

The Lateral deformation of limit states is in accordance with the resisting system type between 0.6% to 1.3% of the structural height. With due consideration of such results and measuring the joint width required in various models and presenting comparable charts, the storey drift limits and the joint width have been proposed upon the type of structural resisting system.

FRACTURE CHARACTERISTICS AND SIZE EFFECT FOR HIGH-STRENGTH CONCRETE BEAMS

S.H. Eo, KOREA
G.S. Kwak, N. M. Hawkins, U.S.A

In order to obtain more information on the fracture characteristics and the size effect for HSC, a series of 3-point bend tests were carried out for total 48 plain concrete specimens. Four beam sizes of 2", 4", 8" and 16" with three initial-notch to beam depth ratios of 0, 0.2, and 0.4 were considered. Two levels of compressive strengths of 4000 psi (NSC) and 12000 psi (HSC) were considered for each test series. The load-CMOD, load-LLD diagrams and the flexural strains at 5 points along the center line of the beam specimens were measured. The experimental results will be discussed in terms of the effect of beam depth, initial-notch to beam depth ratio and the compressive strength on the fracture characteristics and size effect relationships. A finite element analysis, using bilinear fictitious crack model (FCM) will be made for comparison with the experimental results.

SIMULATION OF SHEAR AND FLEXURAL BEHAVIOUR OF HIGH STRENGTH REINFORCED CONCRETE COLUMN

B.A. Lejano, PHILIPPINES
H. Adachi, N. Shirai, M. Nakanishi, JAPAN

This paper presents an analytical model that considers both the shear and flexural behaviour of high strength reinforced concrete column when subjected to high and fluctuating axial load. A model for shear and a model for flexure were separately formulated and then later coupled into a single model. Although the formulation is purely theoretical, the concept of the model is based on the observed test results of several reinforced concrete column specimens. The validity of the proposed model is confirmed from the similarity of the analytical results and the experimental test results. Furthermore, a parametric study using the proposed model showed that the magnitude of axial load and the volume of transverse reinforcement affects greatly the failure mode of the column, i.e. whether flexural failure or shear failure.

AN INVESTIGATION INTO THE EFFECT OF SPALLING ON THE FIRE RESISTANCE OF REINFORCED CONCRETE COLUMNS

K. N. Mustapha, J. A. Purkiss, MALAYSIA
S. A. Osman, UNITED KINGDOM

In a fire scenario, thermal gradients and thermal expansion of structural elements are sources of internal

stresses. As a consequence, cracking, crushing and spalling can occur and reduction in strength and stiffness of the structural members result. The combination of these phenomena controls the fire response of structural elements. The analysis of structural elements exposed to fire is thus complicated because of the many variables involved. However, through the development of appropriate computer models to predict the response of structures exposed to fire, the analysis of structural elements under realistic fire conditions has been made possible. Unlike traditional furnace test methods and empirically derived solutions, the computer generated approach provides the engineer with a solution considerably closer to that experienced in an actual structure. the advent of computer modelling has thus opened new ways to assess fire risks of intricate structural systems. This paper describes the method adopted for the computer modelling of reinforced concrete columns exposed to fire.

A series of computer simulations is used to model concrete columns exposed to fire which incorporates the effect of spalling by varying the amounts of concrete lost during a specified period of exposure to fire. The assessment of the relative effect of spalling on the fire resistance and the deformation of reinforced concrete columns is described using the results from a series of analyses on columns loaded concentrically while heated on three sides so as to produce substantial thermal gradients.

In order to model the fire response of reinforced concrete columns, it has been assumed that the heat flow is separable from the structural analysis. A finite element heat transfer analysis is used to determine the thermal response of reinforced concrete columns when exposed to ISO 834 furnace environment. The temperature distribution histories obtained are then used in conjunction with a structural response program which together provide an overall capability of predicting the structural response of the reinforced concrete columns. The results from the simulation appear to indicate that the reduction of the fire resistance is greatly influenced by the amount of spalling and that the normalized loss in fire resistance is around 0.026 times the area of the spalled concrete.

THE POINT-ESTIMATE METHOD IN STRUCTURAL RELIABILITY ANALYSIS
T. Xiaoli, Z. Guofan, CHINA

Two point-estimate methods, the improved Rosenblueth method and the response surface method in conjunction with geometric method in structural reliability analysis are proposed in this paper. These methods are based on the point estimate of system response, i.e. response which corresponds to particular realizations of the system parameters. Compatible with numerical modeling technique such as finite element method, they can be easily applied in large complex structural engineering analysis where the limit surface is usually close formed. Meanwhile, the two methods are compared and numerical examples are give to illustrate the discussion.

FRACTURE STUDY OF KOLNBREIN ARCH DAM
O.A. Pekau, L.M. Feng, CANADA
Z. Chuhan, CHINA

The aim of this paper is to demonstrate the application of a simplified fracture model to the cracking of the Kolnbrein arch dam in Austria as a case study.

The fracture model is based on the principles of linear elastic fracture mechanics (LEFM), wherein the arch dam itself is discretized by 3-D boundary elements. The criterion for crack propagation employs the strain energy factor theory, or so-called S-theory, with certain simplifications for crack growth. The latter involve primarily the assumption of a through crack, which implies that the crack front advances as a straight line. The accuracy of the computation of the 3-D stress intensity factors by this model, as well as the foregoing through crack simplification, has been confirmed by comparisons with available classical problems and also by field observations of typical cracking in arch dams.

Presented are the results of applying the above fracture model to study the first upstream cracking of the Kolnbrein arch dam, which occurred in 1978. Typical results in the form of predicted crack mouth openings, depending on whether the cracking originated at the base of the dam and propagates upwards or at the corner point of the dam-foundation interface at elevation 1720 m and propagates downwards are shown in figures.

In general, it is concluded that the numerical fracture model predicts satisfactorily the observed first upstream cracking of the Kolnbrein dam in terms of the relevant reservoir level, temperature and pattern of cracking.

ENGINEERING EDUCATION

NEW ENGINEERING EDUCATIONAL COURSE FOR XXI CENTURY - "HEALTHY CITIES"
A.N. Tetior, RUSSIA

New educational course "Healthy Cities" (architectural-construction ecology) must be a synthesis of general and special knowledge. Author here proposes the contents of this new course for future students:

1. Ecologization of thinking and technologies, including global ecology, life and ecological factors of

environment, ecocycles in nature and technics, ecological theorems, ecology and religion.

2. Ecology and building including history of builders and nature interaction, architectonic (urban aspects of building ecology), ecological reliability and safety, building bionics and ecology, biopositive materials, biodamages of materials, sense ecology (sight ecology, smell ecology, acoustic ecology)

3. Earth surface and relief preservation with building

4. Biopositive buildings and engineering structures, including "clever" building and structures

5. Urban ecology (biopositive city and country), including an ecological ethics and love to city

6. Saving of nature resources and energy

7. Ecological techniques and technologies in city

8. Ecological reconstruction of city and restoration of landscapes

9. Environment quality control and management

10. Conclusion/Code of ecological builder

Supplements:

- Ecology building dictionary
- Sample program of city sustainable development
- Summary of "Agenda 21"
- Sanitary - ecological passport of building

Charter of European cities and towns for sustainable development.

There is in this new course fundamental contents of engineering ecology referred as building ecology. In building ecology there are two complexes of knowledge involved - complex of general ecology, knowledge which allows to form the ecology thinking of future builder; and complex of special ecology thinking for ecologization of building.

A complex of general ecology knowledge includes a learning about biosphere and ecosystem, ecocycles and antropogenic influences, data about ecological postulates (theorems) and their connection with construction, as well as modern data about city sustainable development.

A special knowledge includes all the necessary concepts and ideas - from biopositive buildings fundamentals and earth surface preservation, to existing city ecorestoration and ecological city (eco-city) buildings.

This new course was used successfully in Crimean Institute.

TRAINING OF CIVIL ENGINEERING TECHNOLOGISTS FOR INFRASTRUCTURE DEVELOPMENT IN INDONESIA

A. Rumayar, B. Sompie, J. Pangow, INDONESIA

It is no doubt that infrastructure development in developing countries has to be given high priority. Likewise, the application of advanced and modern knowledge are also needed. To successfully implement these concerns, skilled workers, technicians and engineers should be well prepared.

Engineering education particularly in civil engineering is one of the key factors that could answer this phenomenon. In Indonesia all Polytechnic institutions take control in education regarding the general part of regular engineering courses, e.g. civil, electrical and mechanical engineering. The students here are trained for two years at the diploma level.

This paper describes the strategy adopted in developing control courses for the training of civil engineering at Sam Ratulangi Polytechnic, Indonesia.

SYSTEMS THINKING LEARNING IN ENGINEERING EDUCATION USING STELLA

A. Fukuda, R. Ebisawa, JAPAN

This is a report of our experience in introducing STELLA into civil and traffic engineering class for the technical college and university students aimed for the development of system thinking-learning. The STELLA is one of the powerful softwares which assists the development and simulation of a dynamic model based on System Dynamics concepts. This STELLA has been applied in many college classes in the United States and Europe to develop the ability of system thinking of students.

At the pre-workshop of International System Dynamics Conference in Japan, STELLA Class for Japanese students was held with the purpose of introducing the "why" of the system thinking-learning in the United States. Based on this experience, a program was developed for civil and traffic engineering classes.

This paper consists of three parts. First, we summarized the circumstances of the engineering education and the use of computer in a class based on the result of a

questionnaire survey. The second part, we explored the possibilities of how STELLA can fulfill its function in a Japanese education system together with some experience. Finally, our newly developed teaching materials for the traffic engineering and its evaluation results in a classroom were also discussed.

MECHANICAD: Undergraduate Learning Experience in Developing Computer Aided Engineering Softwares
J.F. Aquino, PHILIPPINES

The development of Mathematics softwares help the educators to arouse the interests of the students with these subjects plus they could visibly realize their relevance because of computer-aided graphical illustrations. The use of softwares in dealing with iterative solutions saves much time and effort but not necessarily weakens the mental ability of the user but instead develop the much timely learn and apply academic attitude. The use of computer mathematics softwares helps a lot in producing the desired result in an engineering problem.

This paper discusses the development, uses, features and operating procedures of Mechanicad. Some are also expressed on the effort of continuous improvement and development of more useful softwares in the field of Engineering Science.

Mechanicad is a software for a computer-aided solutions of problems in Mechanics of Materials. The software also includes solutions for problems in some topics involving Engineering Mathematics and Numerical Methods. It aims to serve as an instructional material for engineering educators and study guide for engineering students.

The above-mentioned subjects have always been a waterloo for most engineering students for the reasons; the subjects are quite difficult, they could not appreciate the relevance of these subjects with their chosen field of endeavor (one civil engineering student taking Engineering Mathematics have even commented "what does it have to do with our major subjects") and majority are not really interested but simply these are part of their curriculum. that they have to pass the subjects. Furthermore, a larger number of problems concerning these subjects involve iterations which means long solutions.

INTERNATIONAL COURSES ON CIVIL ENGINEERING AT JAPANESE UNIVERSITIES - Experience of the Graduate Program for Foreign Students on Environmental Management and Infrastructure Development Engineering at Saitama University
W. Tanzo, H. Mutsuyoshi, H. Yamaguchi, H Kawakami. JAPAN

In a remarkable transformation in a period of less than 50 years, Japan has developed into a modern state playing an active role in world politics and economics. Civil engineering plays an important role in creating and maintaining the various infrastructure needs of a modern society. Operating in a resource-scarce and disaster-prone environment Japanese civil engineering technologies have made tremendous advances and these achievements have been recognized in many countries through the publications in technical conferences and projects done by Japanese companies. However, the transfer of these important technologies has not been totally successful and has been very limited in scope. Probably in part due to the language barrier, many Asian countries still look to U.S. and Western Europe for their technological requirements inspite of their proximity to Japan and similarities of their engineering problems such as natural hazards like earthquakes and typhoons.

Foreign students started to come to Japan to study civil engineering in the latter part of 1970's with the successful completion of the first of many megaprojects especially long-span bridges and tunnels. However, the number of students and the universities accepting these foreign students were few and far in between due to the language problem and the Japanese university system. The situation has improved a lot with the introduction to the international courses on civil engineering in which the medium of instruction is the English language. The first such course was established at the University of Tokyo in 1982, followed by Nagoya University in 1986, Yokohama Natitonal University in 1989, Saitama University in 1992, and the Tokyo Institute of Technology in 1993. The high number of international programs on civil engineering, out of a total of about 20 Monbusho (Japanese Ministry of Education) accredited international courses and its rapid expansion in just a decade have demonstrated the importance and the urgency the Japanese civil engineering profession has put on its role in the development and sustaining the rapid growth in many developing counrties especially in the Asia-Pacific region. The first part of this paper will introduce the international courses on civil engineering at Japanese universities. In the second part of this paper, the experience at Saitama University will be used to discuss the objectives and implementation of the program. The difficulties, as well as the successes, will also be discussed so that important feedback will serve as important input in enhancingg these courses.

The continuing spread of the programs among the universities and expansion within itself attests to its early successes. The programs are presently attracting a total of about 160-180 foreign students with about 40-50 graduating with master's and doctoral degrees in civil engineering each year. The number of students and graduates are specially significant in that about 80% of them are from the Asia-Pacific

region, an area presently going through explosive growth. The rapid growth has already felt the shortage of qualified engineers as in Thailand, taxed the insufficient infrastructures creating power crunches and monstrous traffic problems, created environmental problems. The courses will help transfer the experiences learned by Japan during its rapid growth 2-3 decades ago to these countries in solving these problems.

The advantages of long-term education through graduate programs over short-term training cannot be overly emphasized. The graduate program focuses on producing graduates well grounded on the fundamentals of engineering principles with the objectives of nurturing the young graduates mostly in their lates 20's and 30's of age the ability to think and devise solutions to various problems as diverse and evolving as in Asia. As most of the graduates and candidates are of the top quality and potential occupying future important positions in governments, industries, and academes, the education imparted to them will hopefully be self-generating on its own in further training of their people. In addition, the graduates also maintain important links with their former institutions which will serve as important conduit for technology exchanges. With increasing quantity in the graduates and strength of these programs, the international courses on civil engineering are no doubt a form of very successful technology transfer.

QUAKE BUSTERS: AN ALTERNATIVE APPROACH TO EARTHQUAKE DISASTER AWARENESS EDUCATION IN JAPAN

G.T. Velasquez, K. Takimoto, JAPAN

In 1983, the Japan Sea coast in the Tohoku region of Northern Honshu Island was struck by the Nihonkai-Chubu earthquake. Of the one hundred and four people who died, one hundred were killed by the tsunami subsequent to the earthquake including thirteen school children who were on a picnic by the shore.

After the earthquake, it was found out that not only were the children unaware about the potential of a tsunami attacking the shore after an off-shore earthquake but so were the accompanying teachers and bus drivers since they came from a village in a mountainous region and had no experience of tsunamis. This highlights the importance of earthquake education in Japan irrespective of locality, especially for school children.

Although seemingly comprehensive, disaster education programmes in Japan are still lacking especially with regards to teacher education or training. Community involvement in school education is also low which further lowers the effect of the current system.

In other areas, because of the state of technology of the Japanese society, it has been found that not only was the system inadequate, it was also boring and lacked a means of getting the attention of the students. As an example, in 1988 and 1990, Yamaguchi University researchers distributed about 1800 questionnaires to schools in seven prefectures in Japan in order to examine the state of knowledge about earthquake preparedness in those schools. The surveys showed that many teachers understood the necessity of earthquake preparedness education, but felt that the available passive audio visual materials were unsatisfactory. This led tot he development by Yamaguchi University and UNCRD of a multimedia software for teachers introducing them to earthquake disasters called "Quake Busters".

This software was intially designed for use by teachers in elementary and junior high schools and was called "Quake Busters" after the American movie which was very popular in Japan. To maintain user interest, animation, sound effects and narration were used wherever possible. The software was divided into three parts "Understanding earthquakes." "Past earthquake disasters and survival", and "Preparation for earthquake hazards". This software was distributed to a total of 10 elementary and junior high schools and its effectiveness was evaluated by testing the teacher's understanding before and after its introduction.

By April 1996, UNCRD had finished the English and Japanese versions of Quake Busters version 2. The new version of the software is divided into two sub-versions, namely; the normal version and the child version. The normal version targets an audience ten years old and above and is divided into six steps. This version is presented in an interactive narrative from where only the basic information of each topic is initially discussed and further information (such as animation, an explanation of the term, etc.) is shown when the user clicks on certain "hot" regions of the screen.

The software was created to be binary compatible to both Macintosh and Sintel platforms and would be disrtibuted in a hybrid (dual format) CD-ROM which can be read by both platforms.

THE LESSON FROM THE MINDORO EARTHQUAKE: THE NEED FOR INTEGRATING DISASTER MANAGEMENT INTO DEVELOPMENT PLANNING

G.T. Velasquez, JAPAN

Mindoro is not only touted as the Philippines "Paradise Island" with its preserve of white sands and lush green forests, it is also hailed as the rice granary and fruit basket of the Southern Tagalog Region due to its fertile soil which produces its main agricultural crops of rice, coconut, sugar, corn and abaca to name a few. The province is largely rural, with about 70% of the population engaged in agriculture or

fishing. With this framework was launched Mindoro 2000 which is a 10-year comprehensive development master plan for the province. Started as a campaign promise by then Congress-aspirant (now Governor) Rodolfo G. Valencia and is to be implemented from 1988 to 1998, Mindoro 2000 covers a 10-point plan which includes the preservation and conservation of natural resources, construction and rehabilitation of roads and other infrastructures, and eco-tourism. The project was to cost 3 billion pesos (US$120 million) for ten years and was to be financed by both local and international sources. The project was started using a US$22 million loaned from the Asian Development Bank (ADB).

Under the program, Mindoro's natural ecology was greatly improved with the cancellation of logging licenses and the launching of reforestation programs. Roads and infrastructure was constructed and maintained and anti-crime and social services was improved. Community programs were also put into place along with employment and livelihood programs. During Mindoro 2000, the province saw a growth of 8 to 10 percent in income with the total reaching 180 million pesos (US$7.2 million) by 1993.

Unexpectedly, three typhoons attacked the province around December 1993 inflicting massive damages on irrigation facilities and other infrastructures totaling to an estimated 1.2 billion pesos (US$48 million). However, before enough money could be found for total rehabilitation of damaged infrastructures, a big earthquake struck the island on November 15, 1994.

The earthquake struck the northeastern area of Mindoro island at 3:15 AM local time (19:15, 14 Nov. GMT) with a magnitude of 7.1 on the open-ended Richter scale. The epicenter was about 10 kilometers off the eastern side of the island and the maximum intensity in Calapan, Mindoro Oriental reached VII in the Rossi-Forrel Scale (VI on the Modified Mercalli Scale). Majority of the damages was caused by movement of the Aglubang River Fault. The ground ruptures was as much as 3.4 meter horizontal and 1.0 meter vertical in some areas. The earthquake also produced a tsunami which devastated several coastal areas.

Seventy eight people died, 430 were injured and 22,452 families were affected. At least 41 deaths were attributed to drowning by tsunami, half of which were children below 10 years of age. Houses, schools as well as local and provincial (both public and private) infrastructure were damaged with the total rehabilitation cost estimated to be about 500 million pesos (US$20 million). Lifelines were cut including electricity and transportation causing further losses to farmers who cannot transport or process perishable goods.

Although most of the people of Mindoro have experienced other terrible disasters in the past, an earthquake and its accompanying tsunami attack was a first for the residents and the devastation took them by surprise. Interviews with residents have showed that most acted in panic during the disaster. At least three people were confirmed to have died due to shock or heart failure. Most people still feel terrified, especially children, during the aftershocks which followed the main quake.

Upon careful study of the disaster, the UNCRD investigation team has found that most development plans have to be stopped in favor of reconstruction of damaged infrastructures and that the master plan has to be re-started and finished at least five years more than planned. This is unfortunate for the province since Mindoro 2000 was not only admirable but was also making concrete gains for the province. In retrospect it should be noted that even though it is very praiseworthy for a local government in the Philippines to have its own development master plan parallel to the national government's, it is now generally realized that neglecting to integrate disaster management planning into Mindoro 2000 was an unfortunate mistake.

In August of 1995, UNCRD along with PHIVOLCS, DECS and PAGASA started a project to develop disaster awareness education materials for the most vulnerable people of Mindoro. This project led to the development of a Calendar poster which was produced January 1996 and was distributed in Mindoro.

COASTAL DEVELOPMENT AND SOCIO-ECONOMIC EFFECTS: JAPAN, ITS UNSUCCESSFUL EXAMPLE

K. Hotta, JAPAN

Japan is a small, overpopulated country of some 120 million people with an area of 370,000 square kilometers of which Only 20% habitable.

From older times, the Japanese people have reclaimed land as living and industrial production space. Especially in the post war era, land reclamation has progressed in the urban coastal area, and reclaimed land has been used for manufacturing and distribution locations in promoting Japan's economic development.

As a result of the effective utilization of reclaimed land, Japan has achieved a stable standard of living for its people and has become one of the most affluent societies in the world.

However, while Japan has achieved tremendous economic growth, the rapid and roughly planned coastal development and ocean space utilization has also brought environmental destruction, accelerated the gravitation of the population toward the cities, and caused land price to surge,

resulting in adverse effects on the national life, culture and overall social system in Japan. This is partly due to the fact that priority was given to economic growth, while other important factors were virtually ignored.

This paper will present first a historical overview of Japan's coastal development and utilization. Then, some examples will be given to illustrate the influence of past forms of uitlization on living conditions, including the natural sociconoeomic environments.

RAMBO PRESS: A BLOCK MAKER

L. B. Ramirez, L. G. Aguila, PHILIPPINES

A manually operated compactor, named RAMBO block press was developed at the Integrated Research and Training Center in support of a DOST-funded study on the manufacture of lahar-based paving blocks. The compactor is portable and simply designed. It is made of only 24 detachable components. The size and shape of the final product depends upon the mold, mold cover and piston setting used.

The compactor can compress various materials. The utility model, however, was designed to produce soil, clay or aggregate and cement mixture blocks with maximum dimensions of 196 mm long and 96 mm wide of variable thickness, depending upon the piston setting. Four workers can easily manufacture 60 blocks in one hour. Hundreds of concrete blocks made of lahar, 196x96x50 mm in size, were produced.. These blocks are being site-tested as road pavement blocks.

The compactor is expected to widen the utilization of lahar and to provide employment in lahar-ravaged areas of Central Luzon.

DEVELOPMENT OF LOW-HEAT CONCRETE USING LIGNITE FLY-ASH

S. Tangtermsirikul, B. Chatveera, THAILAND

This paper was aimed to study a low heat concrete using lignite fly ash from Thailand. Tests were conducted on concrete with varied replacement percentage of lignite fly ash from 0%, 40%, 50% and 60%, and w/c from 0.45, 0.50 and 0.60. Another parameter was cementitious material content which was varied from 333, 400 and 444 kg/m^3. Adiabatic temperature rise by insulation test was measured together with compressive strength, flexural strength, shrinkage and depth of carbonation. The tests results showed that when comparing the lignite fly ash concrete with the conventional concrete with the same cementitious material content and same w/(c+f), increasing the fly ash percentage reduced the adiabatic temperature rise, drying shrinkage and compressive strength of the lignite fly ash concrete, however, the depth of carbonation increased. It was also found that the compressive strength of the lignite fly ash concrete with various mix proportions has a correlation with the parameter CaO_{equiv}.

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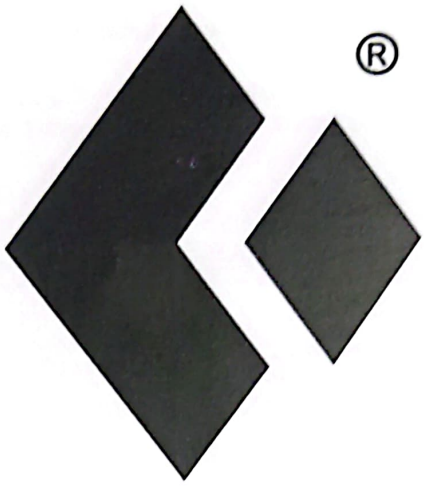

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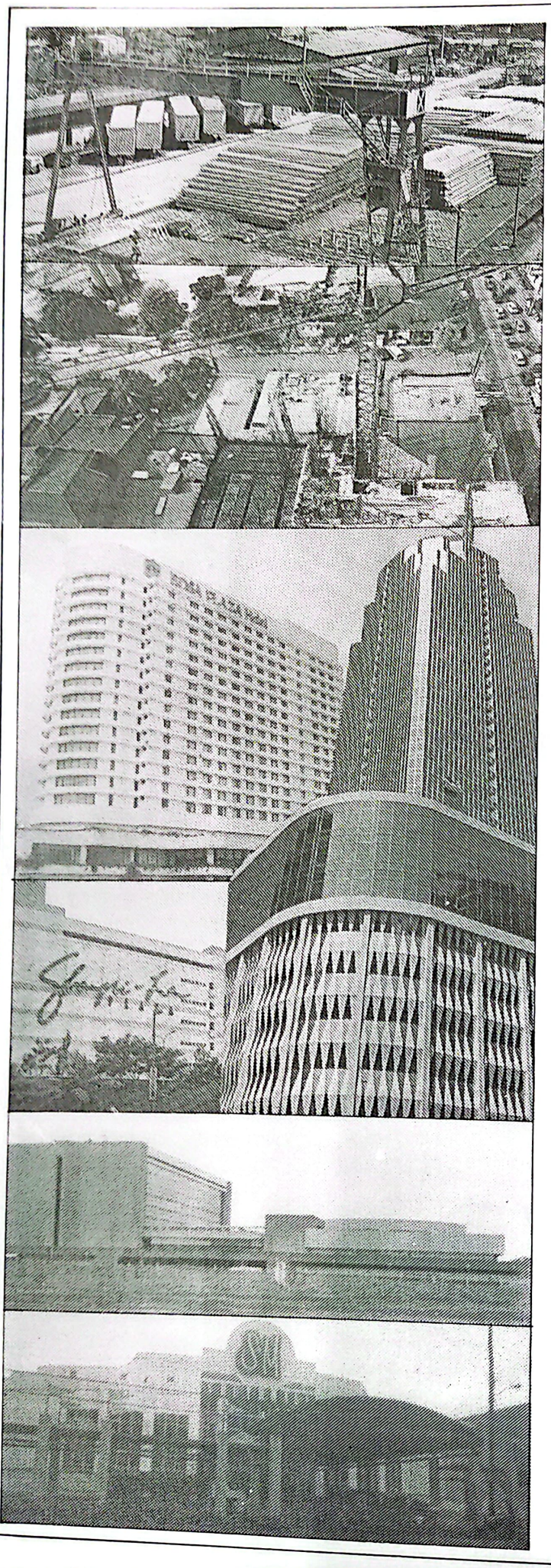

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