ACE 2018



13th INTERNATIONAL CONGRESS ON ADVANCES IN CIVIL ENGINEERING

organized by Ege University

12 - 14 September 2018

Radisson Blu / Çeşme - İzmir, Turkey







13th INTERNATIONAL CONGRESS ON ADVANCES IN CIVIL ENGINEERING

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PROCEEDINGS

PROGRAMME OUTLINE

DAY	TIME	CESME I HALL	CESME II HALL	DALYAN HALL
12 September 2018	09:30-10:15	**Opening Ceremony**		
	10:15-11:00	**Keynote Speech** ***Çelik Özyıldırım***		
	11:00-11:30			**Coffee Break**
	11:30-13:00	**STR1**	**STR2**	**MAT1**
		Earthquake Design	System and Damage Identification of Structural Systems	Self-Healing
	13:00-14:00			**Lunch**
	14:00-14:45	**Keynote Speech** ***B. Mutlu Sümer***		
	14:45-15:45	**STR3**		**MAT2**
		Damage and Mechanical Observation		Sustainability
	15:45-16:15			**Coffee Break**
	16:15-17:45	**STR4**	**STR5**	**MAT3**
		Structural Mechanics, Repair and Strengthening	Structural Performance	Sustainability, Mechanical Properties and Uniformity
13 September 2018	09:15-10:00	**Keynote Speech** ***F. Necati Çatbaş***		
	10:00-11:00	**STR6**		**MAT5**
		Seismic Response Modification Devices		Geopolymer and Alkali Activated Mixtures
	11:00-11:30			**Coffee Break**
	11:30-13:00	**STR7**	**STR8**	**MAT6**
		Steel Structures	Structural Mechanics, Repair and Strengthening	Temperature Effect on Behavior of Materials
	13:00-14:00			**Lunch**
	14:00-14:45	**Keynote Speech** ***Burçin Becerik-Gerber***		
	14:45-15:45	**STR9**		**MAT7**
		Infill-Structural Frame Interaction		Durability
	15:45-16:15			**Coffee Break**
	16:15-17:45	**STR10**	**STR11**	**MAT8**
		Soil-Structure Interaction and Response of Buried Structures	Experimental and Numerical Modeling	Fresh State Properties
	20:00-23:00			**Networking Event (Cocktail Prolange)**
14 September 2018	09:15-10:00	**Keynote Speech** ***Erik Schlangen***		
	10:00-11:00	**STR12**		**MAT10**
		Bridges		Binders
	11:00-11:30			**Coffee Break**
	11:30-13:00	**STR13**		**MAT11**
		Dynamic Analysis and Earthquake Engineering		Fiber Reinforced and ECC Mixtures
	13:00-13:30			**Closing Ceremony**
	13:30-16:00			**ACE Advisory Committee Meeting**

PROGRAMME OUTLINE

FOCA HALL	URLA HALL	ILICA HALL	ALACATI HALL
Coffee Break			
HYD1	**TRA1**	**GEO1**	**MAN1**
Computational Hydraulics	Transportation Engineering I	Environmental Geotechnics	Project & Construction Management I
Lunch			
HYD2	**TRA2**	**GEO2**	**MAN2**
Fluvial Hydraulics and Environmental Engineering	Transportation Engineering II	Foundation Engineering / Geosynthetics	Education
Coffee Break			
HYD3	**TRA3**	**GEO3**	**MAT4**
Flood and Drought	Transportation Engineering III	Soil Improvement	Characterization and Application
HYD4			
Sediment Modelling			
Coffee Break			
COAS1	**TRA4**	**GEO4**	**MAN3**
Coastal Engineering	Transportation Engineering IV	Soil Modeling and Numerical Methods	Project & Construction Management II
Lunch			
HYD5	**TRA5**		**MAN4**
Water Resources and Statistical Hydrology	Transportation Engineering V		Energy & Sustainability
Coffee Break			
HYD6	**TRA6**	**GEO5**	**MAT9**
Spatial Modeling in Hydrology	Transportation Engineering VI	Geotechnical Earthquake Engineering	Binders
Networking Event (Cocktail Prolange)			
HYD7	**TRA7**		
Pipe Flow	Transportation Engineering VII		
Coffee Break			
HYD8	**TRA8**	**GEO6**	
Open Channel Hydraulics	Transportation Engineering VIII	Soil Behavior	
Closing Ceremony			
ACE Advisory Committee Meeting			

PROGRAMME

12 SEPTEMBER 2018

09:30-10:15 **OPENING CEREMONY**

10:15-11:00 **KEYNOTE SPEECH 1 – SPEAKER: ÇELİK ÖZYILDIRIM / CESME I HALL**
Chair: Sinan Turhan Erdoğan

11:00-11:30 **COFFEE BREAK**

11:30-13:00 **STR 1- EARTHQUAKE DESIGN / CESME I HALL**
Chair: Cem Topkaya

ASSESSMENT OF THE SEISMIC DESIGN CODE-BASED VERTICAL SPECTRUM FUNCTIONAL FORMS
Ö. Kale

CALCULATION OF EARTHQUAKE DAMAGE COST AND EVALUATION OF ITS EFFECT ON PERFORMANCE BASED DESIGN
G. Olgun, O. Bozdag

HIGH RISE BUILDING DESIGN ACCORDING TO THE NEW PROPOSED EARTHQUAKE CODE IN TURKEY
G. Tunç, T. Tanfener

NUMERICAL MODELING OF COLD-FORMED STEEL SHEAR WALLS WITH WOOD-BASED SHEATHING UNDER LATERAL LOADING
Y. Topcuoglugil, E. Baran, C. Topkaya

COMPARATIVE ANALYSIS OF EARTHQUAKE LOADS ON REINFO RCED CONCRETE STRUCTURES USING TSEC-2018 AND TEC-2007
A. Şahin, C. Aksoylu, M. H. Arslan

THE EFFECT OF SOFT STORY IRREGULARITY ON PERFORMANCE OF THE EXISTING BUILDINGS
B. T. Cayci, I. Avci, M. Inel

11:30-13:00 **STR 2- SYSTEM AND DAMAGE IDENTIFICATION OF STRUCTURAL SYSTEMS / CESME II HALL**
Chair: F. Necati Çatbaş

DAMAGE IDENTIFICATION STUDIES OF A REINFORCED CONCRETE PORTAL FRAME BY SENSITIVITY-BASED FINITE ELEMENT MODEL UPDATING METHOD
E. Durmazgezer, U. Yucel, O. Ozcelik

MODEL UPDATING STUDIES OF A MASONRY COURTYARD WALL OF ISABEY MOSQUE USING OUT-OF-PLANE AMBIENT VIBRATION MEASUREMENTS
O. Ozcelik, I. S. Misir, U. Yucel, O. Girgin, E. Durmazgezer, C. Amaddeo, F. Kuran, E. Tuna, G. Yucel, I. B. Youssouf

DETERMINATION OF P-WAVE VELOCITY IN CONCRET E
S. Tayfur, A. Nuhoğlu, N. Alver

USE OF AVS TO DETERMINE THE DYNAMIC MODES OF AN OVERPASS BRIDGE IN ISTANBUL
F. Aras

PERIOD PREDICTION EQUATION FOR CONCRETE GRAVITY DAMS
A. Aldemir

PERFORMANCE EVALUATION OF A RC BUILDING EXPOSED TO REBAR CORROSION FROM ONE OR TWO FACADES
G. B. Sakcalı, İ. Yüksel

12 SEPTEMBER 2018

11:30-13:00 **MAT 1- SELF-HEALING / DALYAN HALL**
Chair: Mustafa Tokyay

ENGINEERED CEMENTITIOUS COMPOSITES FOR REDUCING HIGH CO_2 EMISSIONS THROUGH INTRINSIC SELF-HEALING MECHANISMS
O. Öztürk, G. Yıldırım, Ü. S. Keskin, M. Şahmaran, H. Siad, M. Lachemi

SELF-HEALING OF CEMENTITIOUS COMPOSITES WITH NANO-POLYMERIC AGENTS
O. Üzüm, C. Türkcan Kayhan, E. Feyzioğlu Demir, E. Özçalışkan, S. Akgöl, Ö. Andiç-Çakır

OPTIMIZATION OF MORPHOLOGY OF SODIUM SILICATE/POLYURETHANE MICROCAPSULES USED FOR SELF-HEALING IN CEMENTITIOUS MATERIALS
A. Beglarigale, D. Eyice, Y. Seki, H. Yazıcı

MULTI-FUNCTIONAL CEMENTITIOUS COMPOSITES WITH AUTOGENOUS HEALING FUNCTIONALITY
H. Ulugöl, G. Yıldırım, O. Coşkun, B. Tolunay, M. Şahmaran

PARTICLE SIZE OPTIMIZATION APPROACH IN ENGINEERED CEMENTITIOUS COMPOSITES DESIGN
S. B. Keskin, Ö. Kasap Keskin, K. Tekin, H. Karaca

11:30-13:00 **TRA 1- TRANSPORTATION ENGINEERING I / URLA HALL**
Chair: Baha Vural Kök

EFFECT OF COMPACTION DEGREE ON MOISTURE DAMAGE OF ASPHALT PAVEMENTS
E. İskender, G. Malkoç, A. Sayın, C. İskender, A. Aksoy

ENGINEERING PROPERTIES OF AGED POLYPROPYLENE-MODIFIED ASPHALT MIXTURES
A. H. Al

EVALUATION OF WATER –INDUCED DAMAGE OF HOT MIX ASPHALT PREPARED WITH WASTE PERIDOTITE AGGREGATE AND HYDRATED LIME
İ. Ç. Görkem, M. Özkan

EVALUATION OF AGGREGATE SIZE EFFECT ON ASPHALT MIXTURE HOMOGENEITY USING IMAGE ANALYSIS
A. O. Yucel, M. Guler

INVESTIGATING MATERIAL TOUGHNESS OF ASPHALT CONCRETE UNDER DIRECT TENSION LOADING
Y. Karakaya, M. Guler

LASER SCANNING COUPLED WITH HIGH-DEFINITION COLOR IMAGING FOR DEFECT LOCALIZATION AND QUANTIFICATION
B. Güldür Erkal

12 SEPTEMBER 2018

11:30-13:00 **HYD 1- COMPUTATIONAL HYDRAULICS / FOCA HALL**
Chair: Dejana Djordjevic

TRAJECTORY LENGTH DETERMINATION FOR BOTTOM OUTLET OF INOREN REGULATOR AND HEPP
C. Yavuz, S. Gokmener, K. Yilmaz

CFD STUDY OF DRAG FORCE ON THE PIERS OF ONGÖZLÜ BRIDGE IN DIYARBAKIR, TURKEY
M. M. Bülbül, N. Denli Tokyay, T. E. Tokyay

NUMERICAL INVESTIGATION OF TURBULENT FLOW THROUGH POROUS ZONE INSIDE A CONTACT TANK
M. A. Kizilaslan, E. Demirel

MODELLING OF SURFACE TENSION WITH VARIOUS TYPES OF FLUID INTERACTIONS USING SMOOTHED PARTICLE HYDRODYNAMICS
B. K. Cirpici, B. D. Rogers, Y. C. Wang

SMOOTHED PARTICLE HYDRODYNAMICS (SPH) MODELLING OF BUBBLE FORMATION AND RISE THROUGH A SUBMERGED ORIFICE
B. K. Cirpici, B. D. Rogers, Y. C. Wang

CONTAMINANT TRANSPORT IN MULTILAYERED DISCONTINUOUS AQUIFERS USING MODFLOW
S. Korkmaz

11:30-13:00 **GEO 1- ENVIRONMENTAL GEOTECHNICS / ILICA HALL**
Chair: Selim Altun

TRIAXIAL RESPONSE OF THE SAND-WASTE TIRE RUBBER MIXTURES
Z. Karabash, A. F. Cabalar, M. M. Khalaf

COMPRESSIBILITY BEHAVIOR OF IZMIR BAY'S DREDGED MATERIAL
I. Develioglu, H. F. Pulat

INDEX PROPERTIES AND SHEAR STRENGTH BEHAVIOR OF IZMIR BAY'S DREDGED SOIL BLENDED WITH SILICA FUME
G. Gormus, I. Develioglu, H. F. Pulat

ENGINEERING ASSESSMENT OF COFFEE WASTE BASED GEOPOLYMER
T. Eskişar

EXPERIMENTAL STUDY ON THE EFFECT OF CRUDE OIL AND TOLUENE ON EXPANSIVE SOIL
S. Rehab Bekkouche, G. Boukhatem, D. Mendjel

CHANGE IN SWELL INDEX OF POLYMER TREATED BENTONITES DEPENDING ON SAMPLING AND DRYING CONDITIONS
T. Özdamar Kul, İ. Çirkin, A. H. Ören

12 SEPTEMBER 2018

11:30-13:00 **MAN 1- PROJECT & CONSTRUCTION MANAGEMENT I / ALACATI HALL**
Chair: Gürkan Emre Gürcanlı

CALCULATION OF DAILY OCCUPATIONAL SAFETY RISK SCORES FOR CONSTRUCTION INDUSTRY
S. Bilir, G. E. Gurcanli

BENEFITS AND CHALLENGES OF BUILDING COMMISSIONING PROCESS IN TURKEY
B. Ozorhon, S. Caglayan, E. Ilicali

CONSTRUCTION DELAYS ASSESSMENT - A CASE STUDY OF INTERCHANGE PROJECT IN PAKISTAN
M. B. Ali, K. Ateeq, H. M. Ali, S. S. S. Gardezi

INVESTIGATING THE IMPACT OF PROJECT MANAGER SKILLS ON PROJECT SUCCESS
B. Ozorhon, O. F. Akgemik, S. Caglayan

EFFECTS OF INTERNATIONAL RELATIONS ON MULTINATIONAL CONTRACTS
G. Gelisen

A STRATEGIC PLAN FOR THE IMPLEMENTATION AND MONITORING OF PERFORMANCE - BASED MAINTENANCE CONTRACTING (PBMC) FOR TURKISH CONSTRUCTION SECTOR
H. I. Ozturk, G. Atasoy, K. Ates

13:00-14:00 **LUNCH**

14:00-14:45 **KEYNOTE SPEECH 2 – SPEAKER: B. MUTLU SÜMER / CESME I HALL**
Chair: Gökçen Bombar

14:45-15:45 **STR 3- DAMAGE AND MECHANICAL OBSERVATION / CESME I HALL**
Chair: Sadık Can Girgin

ESTIMATION OF DETERIORATION IN REINFORCED CONCRETE USING VIBRATION PROCESSING TECHNIQUES
A. S. Kırlangıç

EFFECT OF ELEVATED TEMPERATURE ON BOND STRENGTH OF CONCRETE
M. M. Molla, M. H. Rashid, I. M. Taki

LEAK DETECTION IN HIGH PRESSURE PIPES USING ACOUSTIC EMISSION METHOD
T. Arslan, E. Ercan, T. Erünlü, N. Alver

INFLUENCE OF NANO CLAY ON ACOUSTIC EMISSION BEHAVIOR OF CONCRETE UNDER FLEXURE
S. Tayfur, H. Y. Ünal, Y. Pekbey, N. Alver

12 SEPTEMBER 2018

14:45-15:45 **MAT 2- SUSTAINABILITY / DALYAN HALL**
Chair: Şakir Erdoğdu

INFLUENCE OF SOURCE CONCRETE QUALITY ON RECYCLED AGGREGATE CONCRETE
B. Çelik, T. Özturan

DETERMINATION OF POZZOLANIC ACTIVITY AND MECHANICAL PROPERTIES OF STANDARD MORTARS INCORPORATING RECYCLED GLASS POWDER
H. Ö. Öz, H. E. Yücel, M. Güneş

PHYSICAL PROPERTIES AND STRENGTH OF CONCRETE CONTAINING LIGHTWEIGHT AGGREGATE PRODUCED BY RECYCLING SILT OF A DAM
B. Rabehi, Y. Ghernouti and K. Boumchedda

USE OF RECYCLED BRICK AND MARBLE POWDERS AS REPLACEMENT OF CEMENT FOR IMPROVING DIMENSIONAL STABILITY OF SELF-COMPACTING MORTAR
D. Boucherit, F. Debieb, Z. Skendar

14:45-15:45 **TRA 2- TRANSPORTATION ENGINEERING II / URLA HALL**
Chair: Ilgın Gökaşar

INVESTIGATION OF TRAFFIC SAFETY EFFECTS OF SPEED LIMIT INCREASES IN MAIN ARTERIALS
F. Ture Kibar, H. Tuydes Yaman

EFFECTS OF THE ROAD CONDITIONS FOR TRAFFIC ACCIDENTS
E. Cicek

ANALYZING OF KARSIYAKA TRAM ACCESSIBILITY WITH DIFFERENT ROUTES
E. Odabasi, Y. Alver

BUS NETWORK FREQUENCY OPTIMIZATION USING FIREFLY ALGORITHM FOR OPERATOR COST MINIMIZATION: A CASE STUDY FOR KARAMAN, TURKEY
M. M. Mutlu, I. C. Aksoy, Y. Alver

14:45-15:45 **HYD 2- FLUVIAL HYDRAULICS AND ENVIRONMENTAL ENGINEERING / FOCA HALL**
Chair: Serdar Korkmaz

MORPHODYNAMIC DIFFERENCES INDUCED BY A WIDENING OF THE TRIBUTARY CHANNEL IN A RIVER CONFLUENCE
P. M. Abreu, G. Bombar, A. H. Cardoso

ON THE EFFECT OF BED ELEVATION DISCORDANCE IN CONFLUENCES WITH UNEQUAL CHANNEL WIDTHS
D. Djordjevic

LIFE CYCLE ASSESSMENT OF WIND TURBINE FOUNDATIONS IN A WIND FARM
M. Secer, H. F. Erdem

ESTIMATION OF BIOCHEMICAL OXYGEN DEMAND WITH MULTIVARIABLE ADAPTIVE REGRESSION SPLINES (MARS)
O. T. Baki, E. Aras, S. Nacar

AN EXPERIMENTAL INVESTIGATION OF METHODS TO REDUCE THE MAXIMUM SCOUR DEPTH AROUND LABYRINTH SIDE WEIRS
M. Tunc, M. E. Emiroglu

12 SEPTEMBER 2018

14:45-15:45 **GEO 2- FOUNDATION ENGINEERING / GEOSYNTHETICS / ILICA HALL**
Chair: Ali Hakan Ören

ABRASIVE WEAR IN GEOMEMBRANES AND RESULTING INTERFACE SHEARING MECHANISM MOBILIZED AGAINST GRANULAR MATERIALS IN COMPOSITE LAYERED INFRASTRUCTURAL SYSTEMS
T. Karademir

PULLOUT BEHAVIOR OF GEOCELL IN GRANULAR SOIL
A. Işık, A. Ayhan

SEISMIC PERFORMANCE OF HIGHWAY EMBANKMENTS ON GEOGRID REINFORCED SAND
A. Edinçliler, Y. S. Toksoy

EFFECT OF DIFFERENT LOADING RATES ON THE BEARING CAPACITY OF STRIP FOUNDATIONS
A. İçen, H. S. Aksoy, M. Gör

OVERALL STABILITY ANALYSIS OF NAILED RETAINING WALLS
L. Belabed, F. Z. Benamara

14:45-15:45 **MAN 2- EDUCATION / ALACATI HALL**
Chair: Zeynep Işık

EXPERIMENTAL STUDY ON USAGE LEVELS OF LATERAL THINKING SYSTEMS IN CONSTRUCTION ENGINEERING STUDENTS
G. (Tantekin) Çelik, S. Aydınlı, B. Bağrıaçık

STUDENT ATTENTION PREDICTION MODELS WITH OPERATIVE TEMPERATURE AND CO_2 CONCENTRATION
M. Kuru, G. Calis

IS CIVIL ENGINEERING EDUCATION AT KOCAELI UNIVERSITY HELPING STUDENTS REALIZE THEIR POTENTIALITIES?
H. Erdoğan, C. Gazeloğlu, S. Engin, S. B. Coşkun, M. T. Atay, S. Mert Kutsal

CIVIL ENGINEERING STUDENTS AND INSTRUCTORS VIEWS ON USING DIGITAL MATERIALS IN LABORATORY COURSES
Ö. Andiç-Çakır, F. Sarsar, A. Rovshenov, İ. H. Özdemir

15:45-16:15 **COFFEE BREAK**

12 SEPTEMBER 2018

16:15-17:45 **STR 4- STRUCTURAL MECHANICS, REPAIR AND STRENGTHENING / CESME I HALL**
Chair: Ninel Alver

BUCKLING ANALYSIS OF CIRCULAR CYLINDRICAL STEEL TANK UNDER LATERAL EXTERNAL PRESSURE
A. Hayır, F. Kadioglu

NUMERICAL LARGE DEFLECTION ANALYSIS OF ANNULAR PLATES
E. Demirkan, S. Kömürcü, M. Yılmaz

BENDING BEHAVIOR OF A COMPOSITE LAMINATED PLATE UNDER TEMPERATURE RISING
Y. Z. Yüksel, Ş. D. Akbaş

ANALYTICAL APPROXIMATIONS FOR ELASTIC STRESSES AND DISPLACEMENTS OF VARIABLE THICKNESS ROTATING DISKS VIA IMPROVED ADOMIAN DECOMPOSITION METHOD
S. Mert Kutsal, S. B. Coşkun

REPAIR OF DAMAGED REINFORCED CONCRETE BEAMS BY EPOXY INJECTION TECHNIQUE
B. Aykaç, A. Yavuzcan, İ. Kalkan

PERFORMANCE OF AERATED AUTOCLAVED BRICK MASONRY WALLS STRENG THENED BY PLASTER WITH GFRP NET AND FIBERS
A. M. Turk

16:15-17:45 **STR 5- STRUCTURAL PERFORMANCE / CESME II HALL**
Chair: Kadir Güler

PERFORMANCE EVALUATION OF A HISTORICAL BRICK MASONRY BUILDING USING LINEAR AND NONLINEAR ANALYSES
K. Demirlioglu, S. Gonen, S. Soyoz

INVESTIGATION OF THE CROSS INTERACTION BETWEEN CLOSELY SPACED STRUCTURES
M. Ada, Y. Ayvaz

THE EFFECT OF HYSTERETIC MODELS ON THE CALCULATED BEHAVIOR OF EXISTING STRUCTURES
E. Ozer, M. Kamal, M. Inel

INVESTIGATION OF SECTION DAMAGE LIMITS BASED ON DIFFERENT METHODS
C. C. Karakas, A. Kalkan, M. Palanci, S. M. Senel

COMPARISON OF RECOMMENDED SHEAR CAPACITY EXPRESSIONS FOR FIBER REINFORCED POLYMER WRAPPED BEAMS
O. Gedik

INVESTIGATION OF A THEORY FOR DETERMINING HAILSTONE RESISTANCE
T. Bircan, M. E. Uz, H. Kirnak, E. Erdem, M. Gören, D. Kop

12 SEPTEMBER 2018

16:15-17:45 **MAT 3- SUSTAINABILITY, MECHANICAL PROPERTIES AND UNIFORMITY / DALYAN HALL**
Chair: Halit Yazıcı

ENHANCING WATER ABSORPTION CHARACTERISTIC OF COARSE RECYCLED CONCRETE AGGREGATES
H. Hosseinnezhad, Ş. Orhan, G. E. Başarmak, K. Ramyar

THE EFFECTS OF CEMENT DOSAGE ON THE MECHANICAL PROPERTIES OF CONCRETE PRODUCED WITH WASTE MARBLE AGGRE GATE
E. T. Tunc

APPLICATION OF VORONOI POLYGONS AND 3-POINT CORRELATION FOR IDENTIFYING UNIFORMITY OF THE CONCRETE SAMPLES
M. Ozen, M. Guler

EVALUATION OF THE COMPRESSIVE STRENGTH OF CONCRETE BY MEANS OF CORES TAKEN FROM DIFFERENT CASTING DIRECTION
Ş. Erdoğdu, Ş. Kurbetci, U. Kandil, M. Nas, S. Nayır

16:15-17:45 **MAT 4- CHARACTERIZATION AND APPLICATION / ALACATI HALL**
Chair: Tahir Kemal Erdem

PRELIMINARY STUDY FOR CHARACTERIZING THE BRICKS OF AL-HADBA' MINARET, MOSUL-IRAQ
A. Al-Omari, S. Khattab

ADVANCEMENTS AND CHALLENGES IN GLASS CONCEPTS, MANUFACTURING AND APPLICATIONS
C. J. de Lima, F. Veer, O. Çopuroglu, R. Nijsse

COMPARISON OF SEVERAL LABORATORY COMPACTION PRACTICES APPLIED ON ROLLER COMPACTED CONCRETE PAVEMENTS
E. Sengun, R. Shabani, B. Alam, M. A. Aykutlu, I. O. Yaman

CONCRETE CANOE PRODUCTION: MATERIAL DEVELOPMENT, STRUCTURAL ANALYSIS AND DESIGN
A. Beglarigale, Ç. Yalçınkaya, B. Göksu, S. C. Girgin, K. E. Erginer, S. Kahraman, H. Yazıcı

TECHNICAL CONCRETE APPLICATIONS OF CALCIUM ALUMINATE CEMENT: NOVEL CASE STUDIES
M. Sucu, M. Severoğlu, T. Delibaş

PROPERTIES OF REINFORCED CONCRETE BEAMS WITH CO-POLYMER SYNTHETIC FIBERS
S. Bekele, H. Karaca, O. I. Taş, S. B. Keskin, R. Birgul

12 SEPTEMBER 2018

16:15-17:45 **TRA 3- TRANSPORTATION ENGINEERING III / URLA HALL**
Chair: Yalçın Alver

PREDICTING MINIMUM DELAY FOR MULTI-LANE TRAFFIC CIRCLES
S. Tanyel, S. P. Çalışkanelli, M. Özuysal

AN IMPROVED DIFFERENTIAL EVOLUTION ALGORITHM FOR COORDINATED SIGNALIZED NETWORKS
C. Ozan, O. Baskan

TRAFFIC FLOW CHARACTERISTICS OF AN URBAN ARTERIAL BASED ON DIFFERENT TRAFFIC FLOW MODELS
O. Altintasi, H. Tuydes-Yaman, K. Tuncay

DISTRIBUTION OF TIME HEADWAYS ON APPROACH LEGS OF AN URBAN SIGNALIZED ROUNDABOUT: A CASE STUDY IN KONYA
E. C. Saltık, H. T. Yaman

CALIBRATION OF AASIDRA FOR CAPACITY OF MULTI-LANE ROUNDABOUTS IN TURKEY
İ. Hepdurgun, N. Büyükkamacı, S. Tanyel

EVALUATION OF THE EFFECTS OF AUTONOMOUS PUBLIC TRANSPORTATION VEHICLES ON TRAFFIC CONDITIONS
I. Gökaşar, A. A. Arısoy

16:15-17:45 **HYD 3- FLOOD AND DROUGHT / FOCA HALL**
Chair: Nuray Tokyay

SPI-BASED DROUGHT SEVERITY-DURATION-FREQUENCY ANALYSIS
H. Aksoy, B. Onoz, M. Cetin, M. I. Yuce, E. Eris, B. Selek, H. Aksu, H. I. Burgan, M. Esit, S. Orta, Y. Cavus

METEOROLOGICAL DROUGHT ANALYSIS IN SINOP, TURKEY
U. Zeybekoglu, H. Alrayess, A. Ulke Keskin

FLOOD INUNDATION ASSESSMENT; A CASE STUDY
N. Beden, A. Ulke Keskin

NUMERICAL MODELING OF TWO-DIMENSIONAL UNSTEADY DAM-BREAK FLOW
O. Şimşek, N. G. Soydan, M. Salih Kırkgöz, M. S. Aköz

INVESTIGATING THE EFFECT OF PRECIPITATION DEFICITS ON HYDROLOGICAL SYSTEMS IN DAM BASINS WITH DIFFERENT GEOGRAPHICAL CHARACTERISTICS IN THE MARMARA REGION USING THE SPI METHOD
G. Aktürk, O. Yıldız

12 SEPTEMBER 2018

16:15-17:45 **GEO 3- SOIL IMPROVEMENT / ILICA HALL**
Chair: Yeliz Yükselen Aksoy

IMPACT OF DURABILITY TESTS ON THE STABILITY OF LIME TREATED SOIL
A. H. Aldaood, A. A. Khalil, I. M. Alkiki

MAPPING OF HIGH PLASTICITY CLAY SOILS IN THE CITY OF KIRIKKALE AND IMPROVEMENT RECOMMENDATIONS FOR REDUCING SWELLING POTENTIAL
B. Toprak, İ. Kalkan, E. Totiç

A THEORETICAL METHOD FOR THE INVESTIGATION OF THE EFFECTS OF SOIL IMPROVEMENT ON TRAIN INDUCED GROUND-BORNE VIBRATIONS
C. Bayındır, A. S. Kesten, E. Etminan

IMPROVEMENT OF EXPANSIVE SOILS BY USING PHOSPHOGYPSUM
İ. Özkan, E. Çokça

COMPARISON OF ENGINEERING PROPERTIES OF A SOIL STABILIZED WITH CALCIUM CARBIDE AND CEMENT
T. Eskişar, S. Altun

EFFECT OF BLAST FURNACE SLAG ON STRENGTH AND COMPRESSIBILITY OF BENTONITE CLAY
G. Bilgen, Ö. F. Çapar, D. C. Turhan, E. Dağlı

13 SEPTEMBER 2018

09:15-10:00 **KEYNOTE SPEECH 3 – SPEAKER: F. NECATI ÇATBAŞ / CESME I HALL**
Chair: Ninel Alver

10:00-11:00 **STR 6- SEISMIC RESPONSE MODIFICATION DEVICES / CESME I HALL**
Chair: Cemalettin Dönmez

INFLUENCE OF FRP REINFORCEMENT RATIO ON THE DUCTILITY VALUES OF CONCRETE BEAMS WITH HYBRID FRP-STEEL REINFORCEMENT
S. Kartal, I. Kalkan, H. C. Mertol, E. Baran

INTRODUCING AN INNOVATIVE PLATE ANCHORAGE SYSTEM FOR FRP FLEXURAL-STRENGTHENED RC BEAMS
J. Esmaeili, O. R. Aghdam, M. Rakhshanimehr, J. Kasaei, K. Andalibi

USE OF STEEL CUSHIONS MECHANISMS ON REINFORCED CONCRETE FRAME AS ENERGY DISSIPATION MECHANISM
G. Gökdağ, A. A. Dindar, F. Karadoğan

IMPROVEMENT OF A LOCKING MECHANISM FOR THE SEISMIC ISOLATION SYSTEM MADE OF SPRING TUBE BRACES
H. Doluyurt, A. A. Dindar, E. Yüksel

BEHAVIOR OF HOLD DOWN DEVICES USED IN CFS CONSTRUCTION
B. M. Pehlivan, E. Baran, C. Topkaya

10:00-11:00 **MAT 5- GEOPOLYMER AND ALKALI ACTIVATED MIXTURE S / DALYAN HALL**
Chair: İsmail Özgür Yaman

PRODUCTION OF SILICA FUME-BASED GEOPOLYMER FOAMS
S. Shakouri, S. T. Erdoğan

EFFECT OF ACTIVATOR PROPERTIES ON FLEXURAL PERFORMANCE OF ALKALI-ACTIVATED SLAG MORTARS UNDER QUASI-STATIC AND IMPACT LOADING
S. Aydın, M. Y. Yardımcı

THE INVESTIGATION OF MECHANICAL EFFECTS OF NANO SIO_2 PARTICLES FOR DIFFERENT SODIUM ION CONCENTRATIONS ON FLY ASH BASED GEOPOLYMER MORTAR
U. Durak, O. Karahan, B. Uzal, S. İlkentapar, C. D. Atiş

EFFECT OF SODIUM HYDROXIDE ON FRESH STATE PROPERTIES OF SODIUM CARBONATE ACTIVATED BLAST FURNACE SLAG PASTES
B. Akturk, A. B. Kızılkanat, N. Kabay

13 SEPTEMBER 2018

10:00-11:00 **HYD 4- SEDIMENT MODELLING / FOCA HALL**
Chair: Özgür Kırca

A RELATIONSHIP BETWEEN FLOW DISCHARGE, SEDIMENT DISCHARGE AND SUB-BASIN AREAS IN CEYHAN CATCHMENT
M. İ. Yüce, M. Eşit, B. Ercan

SEDIMENT DEPOSITION IN HASANLAR DAM RESERVOIR BY BATHYMETRIC FIELD STUDIES
Y. Darama, B . Selek, Z. Selek

COUPLED 1-D HYDRODYNAMICS AND SEDIMENT TRANSPORT MODELLING IN FLOOD ANALYSIS: SAMSUN-TERME RIVER APPLICATION
G. Onder, Z. Akyurek

COMPARISON OF PERFORMANCES OF TEACHING LEARNING-BASED OPTIMIZATION AND CLASSICAL REGRESSION FOR SUSPENDED SEDIMENT PREDICTION
B. Yılmaz, E. Aras, O. T. Baki

WATER SURFACE PROFILES OVER A BROAD -CRESTED WEIR
N. A. Ghaznawi, S. Korkmaz

11:00-11:30 **COFFEE BREAK**

11:30-13:00 **STR 7- STEEL STRUCTURES / CESME I HALL**
Chair: Özgür Eğilmez

ESTIMATION OF THE LATERAL DISTORTIONAL BUCKL ING (LDB) MOMENTS OF DOUBLY-SYMMETRIC STEEL CELLULAR I-BEAMS
S. Bas, F. Ertenli, I. Kalkan

EFFECT OF DIFFERENT BRACING CONFIGURATION ON GLOBAL RESPONSE OF BUCKLING RESTRAINED BRACED FRAMES
M. B. Bozkurt, Y. O. Özkılıç, C. Topkaya

TOP WIND STIFFENER AND SHELL INTERACTION FOR OPEN-TOP CYLINDRICAL STEEL TANKS
Ö. Zeybek, C. Topkaya

EVALUATION OF A STEEL ROOF OF A FOOTBALL FIELD THAT COLLAPSED DUE TO A HEAVY SNOWFALL
İ. Ustabaş, V. Süme, V. A. Baki, A. Gürbüz

DIRECTIVITY-PULSE AND FLING-STEP EFFECTS ON STEEL ARCH BRIDGES
D. Yılmaz, K. Soyluk

INVESTIGATION ON CONNECTION DETAILS FOR WELDED OVERLAP CORE STEEL ENCASED BUCKLING RESTRAINED BRACES
M. B. Bozkurt, Y. O. Özkılıç, C. Topkaya

13 SEPTEMBER 2018

11:30-13:00 **STR 8- STRUCTURAL MECHANICS, REPAIR AND STRENGTHENING / CESME II HALL**
Chair: Egemen Teomete

DESIGN OF REINFORCED CONCRETE DEEP BEAMS USING PARTICLE SWARM OPTIMIZATION TECHNIQUE
Q. F. Hasan

EXPLICIT FORMULATION OF ELASTOPLASTIC BENDING BY NEURAL NETWORKS
A. E. Kurtoğlu, A. Çevik, İ. H. Güzelbey

OVERLAPPING LATTICE APPROACH FOR NONLINEAR ANALYSIS OF REINFORCED CONCRETE COLUMNS
B. B. Aydın, K. Tuncay, B. Binici

INVESTIGATION OF AERODYNAMIC AND STRUCTURAL FEATURES OF TWISTED TALL BUILDINGS
S. Bilgen, B. Ö. Ay, N. Sezer Uzol, E. Orbay

INVESTIGATING THE FLEXURAL BEHAVIOR OF LIGHTWEIGHT CONCRETE BEAMS REINFORCED WITH BASALT (BFRP) BARS
S. Bakirci Er, E. Avanoglu Sicacik, N. Kaya, A. Filazi, I. Elmas

EVALUATION AND REHABILITATION OF BOMBED DAMAGED REINFORCED CONCRETE BUILDINGS
H. M. Albegmprli, M. Abbu, A. Alhayani

11:30-13:00 **MAT 6- TEMPERATURE EFFECT ON BEHAVIOR OF MATERIALS / DALYAN HALL**
Chair: Lütfullah Gündüz

EFFECT OF TEMPERATURE ON RHEOLOGICAL PROPERTIES OF LIME-BASED GROUTS
B. Dinc, N. Yuzer, D. Oktay

EFFECTS OF DIFFERENT CURING CONDITIONS ON SOME MECHANICAL AND DURABILITY PROPERTIES OF CONCRETES CONTAINING SILICA FUME
Ş. Erdoğdu, Ş. Kurbetci, U. Kandil, S. Nayır, M. Nas

ELECTRICAL HEATING PERFORMANCE OF MULTI WALL CARBON NANO TUBE REINFORCED CEMENT COMPOSITES
A. Karagöz, E. Teomete

ENERGY CONSUMPTION OF A DAY-OCCUPIED BUILDING UTILIZING PHASE CHANGING MATERIAL INCORPORATING GYPSUM BOARDS
Ç. Meral Akgül, İ. Gürsel Dino, B. Şimşek

COMPARISON OF THREE ALTERNATIVES FOR DETERMINING DATUM TEMPERATURE AND APPARENT ACTIVATION ENERGY TO ESTIMATE CONCRETE STRENGTH BY MATURITY METHOD
M. Atasever, M. Tokyay

RECOVERY OF REINFORCED CONCRETE BEAMS AFTER ISO-834 FIRE EXPOSURE
A. H. Akca, N. Özyurt

13 SEPTEMBER 2018

11:30-13:00 **TRA 4- TRANSPORTATION ENGINEERING IV / URLA HALL**
Chair: Jülide Öner

A NEW TEST METHOD TO DETERMINE THE COHESION PROPERTIES OF MODIFIED BINDER
B. V. Kök, M. Yılmaz, Y. Erkuş

THE EFFECTS OF COMBINED USAGE OF THREE DIFFERENT ADDITIVE ON RHEOLOGICAL PROPERTIES OF BITUMEN
B. V. Kök, M. Yılmaz, Y. Erkuş

EVALUATION OF MOISTURE CHARACTERISTICS ON DIFFERENT SOURCES BITUMENS
J. Oner, B. Sengoz

SHORT TERM AND LONG TERM AGING PERFORMANCE EFFECTS OF MIXING CONDITIONS ON THE RHEOLOGICAL CHARACTERISTICS OF STYRENE-BUTADIENE-STYRENE MODIFIED BITUMEN
D. Kaya, A. Topal, B. Sengoz, P. Aghazadeh Dokandari

INVESTIGATION OF PHASE SEPARATION AND STORAGE STA BILITY BEHAVIOUR OF SBS POLYMER MODIFIED BITUMENS CONTAINING SEPIOLITE NANOCLAY
D. Uncu, A. Topal, M. O. Seydibeyoglu, B. Sengoz

DETERMINING THE CONSISTENCY VALUES OF SLURRY SEAL MIXTURES HAVING DIFFERENT AMOUNTS OF WATER, EMULSION AND MINERAL FILLER
Ş. Aslan, B. Aktaş

11:30-13:00 **GEO 4- SOIL MODELING AND NUMERICAL METHODS / ILICA HALL**
Chair: Devrim Ş. Erdoğan

A COMPARISON OF HIGH MODULUS COLUMNS AND RAMMED AGGREGATE PIERS IN GROUND IMPROVEMENT USING NUMERICAL MODELING
H. Mungan, A. B. Sunbul, F. Sunbul

TAILOR-MADE REHABILITATION OF HYDRAULIC STRUCTURES – INNOVATIVE SOLUTIONS
A. Schmitt, W. Weckbecker, J. Franzmann

ASSESSMENT OF PERFORMANCE OF STEEL SLAG USED IN ROAD BASE BY FINITE ELEMENT ANALYSIS
H. Karatağ, S. Fırat, N. S. Işık

A NUMERICAL STUDY OF EFFECTIVENESS OF JET-GROUT COLUMNS ON THE SETTLEMENTS OF SATURATED SOILS
M. Mahmudi, D. S. Erdogan

APPLICATION OF SANICLAY-D MODEL ON THE BEHAVIOR OF FULL-SCALE SAINT ALBAN EMBANKMENT
M. Hajialilue-Bonab, A. Shirmohammadi, D. Dadras-Ajirloo, M. Mahmudi

FIELD MEASUREMENTS AND NUMERICAL EVALUATION OF REINFORCED JET GROUTING COLUMNS AS A SHORING SYSTEM ON SATURATED SOILS
M. Mahmudi, D. S. Erdogan, M. Hajialile Bonab, A. Shirmohammadi

13 SEPTEMBER 2018

11:30-13:00 **MAN 3- PROJECT & CONSTRUCTION MANAGEMENT II / ALACATI HALL**
Chair: Selim Baradan

PROJECT PLANNING AND MANAGEMENT USING BUILDING INFORMATION MODELING (BIM)
R. R. Politi, E. Aktaş, M. E. İlal

COMPARISON OF CONSTRUCTION COSTS OF PILED RAFT FOUNDATIONS AND JET GROUTING SYSTEMS
S. Aydınlı, B. Bağrıaçık, E. Oral

ROLE OF CONSTRUCTION-ASSOCIATED PARAMETERS IN FLOOD DISASTER MANAGEMENT
K. Koç, Z. Işık

OWNERSHIP OF FLOAT: AN OVERVIEW
G. Polat, H. Turkoglu, A. Damci

EVALUATING THE NEED TO APPLY BUILDING INFORMATION MODE LING (BIM) CAPABILITIES TO FACILITATE THE IMPLEMENTATION OF OPERABILITY AND MAINTAINABILITY PRINCIPLES IN THE INFRASTRUCTURE PROJECTS
M. Hashemi, E. Saghatforoush

REVIEW OF CLASSIFICATION SYSTEMS FOR FACILITIES MANAGEMENT
B. Kula, E. Ergen

11:30-13:00 **COAS 1- COASTAL ENGINEERING / FOCA HALL**
Chair: Elçin Kentel

PROBABILISTIC TSUNAMI RISK ASSESSMENT USING MONTE CARLO SIMULATIONS
C. Yavuz, E. Kentel

NEAR FIELD DILUTION OF BRINE DISCHARGES
A. İnan, L. Balas

LOWER SLOPE STABILITY WITH CUBE IN A BERM BREAKWATER
Ö. Gülver, Y. Yüksel, E. Çevik

LONG TERM WIND AND WAVE CLIMATE STUDY FOR TURGUTREIS COASTAL AREA
L. Balas, A. Numanoğlu Genç

GEOMETRICAL PROPERTIES OF THE JET TRAJECTORY OF BRI NE DISCHARGES
M. C. Höke, G. Bombar, N. Alpaslan, D. Dölgen

A MODIFIED PIPING CRITERION FOR DETERMINATION OF EFFECTIVE FILTER THICKNESS UNDER REVETMENT SLOPES
E. Kılcı, V. S. Ö. Kırca

13:00-14:00 **LUNCH**

14:00-14:45 **KEYNOTE SPEECH 4 – SPEAKER: BURÇİN BECERİK-GERBER / CESME I HALL**
Chair: Gülben Çaltış

13 SEPTEMBER 2018

14:45-15:45 **STR 9- INFILL-STRUCTURAL FRAME INTERACTION / CESME I HALL**
Chair: Serhan Şensoy

BEHAVIOR OF AUTOCLAVED AERATED CONCRETE INFILL WALLS UNDER COM BINED IN-PLANE AND OUT-OF-PLANE ACTIONS
B. Binici, E. Canbay, A. Aldemir, I. O. Demirel, U. Uzgan, Z. Eryurtlu, K. Bulbul, A. Yakut

ELASTIC STIFFNESS REDUCTION FACTORS FOR EXTERIOR AND INTERIOR INFILL WALLS WITH OPENINGS
T. Ucar, O. Ozturkoglu

MODELLING OF GLAZED CURTAIN WALLS AND CALIBRATION VIA EXPERIMENTAL DATA
Y. S. Erdogan, B. Zengin, B. Toydemir, A. S. İbrahimcioğlu, A. Koçak

14:45-15:45 **MAT 7- DURABILITY / DALYAN HALL**
Chair: Özge Andiç Çakır

SMART CONSTRUCTIONS: AN OVERVIEW FROM THE BU ILDING PHASE TO THE DURABILITY SURVEILLANCE
S. Chaves Figueiredo, O. Çopuroğlu, E. Schlangen

INVESTIGATION ON STRENGTH AND DURABILITY PROPERTIES OF CONCRETE CONTAINING ZEOLITE
M. Nas, Ş. Kurbetci, S. Nayır

INVESTIGATION ON STRENGTH AND DURABILITY PROPERTIES OF CONCRETE WITH METAKAOLIN
M. Nas, Ş. Kurbetci

DURABILITY PERFORMANCE OF RUBBERISED FIBRE MORTAR
A. M. Mukaddas, F. N. A. Abdul Aziz, N. A. M. Nasir, A. M. Maleka

14:45-15:45 **TRA 5- TRANSPORTATION ENGINEERING V / URLA HALL**
Chair: Serhan Tanyel

EVALUATION OF PARK AND RIDE FACILITIES IN ISTANBUL THROUGH ACCESSIBILITY PERSPECTIVE
G. Salih, M. S. Yardım, S. Dündar

PERCEPTION OF PARKING PRICING AND WILLINGNESS-TO-PAY (WTP): A PRELIMINARY EVALUATION AMONG METU CAMPUS USERS
B. Ipekyuz, V. Gen el, O. F. Ozturk, B. Oz, H. I. Ozturk, H. Tuydes-Yaman

INTEGRATION OF CARSHARING WITH RAIL TRANSIT FOR AIRPORT GROUND ACCESS: A CASE OF ISTANBUL SABIHA GÖKÇEN INTERNATIONAL AIRPORT (SAW)
I. Gokasar, G. Gunay

THE EVALUATION OF THE EFFECTS OF AUTONOMOUS VEHICLES USING ARTIFICIAL NEURAL NETWORKS
I. Gökaşar, S. Dündar, Y. Çetinel

13 SEPTEMBER 2018

14:45-15:45 **HYD 5- WATER RESOURCES AND STATISTICAL HYDROLOGY / FOCA HALL**
Chair: Hafzullah Aksoy

QUALITY AND HOMOGENEITY ANALYSIS OF PRECIPITATION DATA IN NORTH CYPRUS
H. Zaifoğlu, B. Akıntuğ, A. M. Yanmaz

CYPRUS WATER SUPPLY PROJECT: FEATURES AND OUTCOMES
N. Ağıralioğlu, A. Danandeh Mehr, Ö. Aakdeğirmen, E. Taş

HOMOGENEITY AND TREND ANALYSIS OF LONG TERM TEMPERATURES IN THE MIDDLE BLACK SEA REGION
V. Demir, U. Zeybekoglu, N. Beden, A. Ulke Keskin

DETERMINATION OF SEASONAL CHANGES OF WATER QUALIT Y IN FILYOS STREAM
B. Aksoy, İ. H. Özölçer, E. Doğan, A. R. Birben, K. Özdemir

SNOW COVERED AREA AND WATER LEVEL VARIATIONS OF GÜLDÜRCEK DAM BETWEEN 2004-2016
S. Dönmez, A. E. Tekeli

14:45-15:45 **MAN 4- ENERGY & SUSTAINABILITY / ALACATI HALL**
Chair: Burçin Becerik-Gerber

PERFORMANCE-BASED FAÇADES: RETROFIT STRATEGIES FOR ENERGY EFFICIENCY AND COMFORT IN EXISTING OFFICE BUILDINGS
N. Jahed, I. Gürsel Dino

THE COMPARISON OF REAL-TIME ENERGY CONSUMPTION AND OCCUPANT SURVEY RESULTS
G. Kazar, S. Comu

MINIMIZATION TECHNIQUES OF CONSTRUCTION AND DEMOLITION (C&D) WASTE: THE CASE OF TURKEY
G. Polat, A. Damci, H. Turkoglu

CONSTRUCTION AND DEMOLITION (C&D) WASTE MANAGEMENT BY APPLYING BUILDING INFORMATION MODELING (BIM) APPROACHES
İ. Bayram, Y. Ö. Tetik, Ö. Akboğa Kale, S. Baradan

15:45-16:15 **COFFEE BREAK**

13 SEPTEMBER 2018

16:15-17:45 **STR 10- SOIL-STRUCTURE INTERACTION AND RESPONSE OF BURIED STRUCTURES / CESME I HALL**
Chair: Kadir Güler

PARAMETRIC FORCED VIBRATION ANALYSIS OF MINDLIN PLATES RESTING ON WINKLER FOUNDATION WITH NEWMARK METHOD
Y. I. Özdemir

VARIATION OF BURIED BOX CULVERT DEFORMATIONS WITH RESPECT TO VARIOUS PARAMETERS UNDER EARTHQUAKE LOADING
S. Uzun, Y. Ayvaz

EXPERIMENTAL STUDIES ON REINFORCED CONCRETE PRESSURE TUNNELS
M. T. Kalaycıoğlu, U. Albostan, G. Işık, E. Canbay, Y. Arıcı, B. Binici, K. Tuncay

SEISMIC POUNDING BETWEEN ADJACENT BUILDINGS CONSIDERING SOIL-STRUCTURE INTERACTION
M. Kamal, E. Ozer, B. T. Çaycı, M. Inel

NUMERICAL MODELING OF REINFORCED CONCRETE PRESSURE TUNNELS USING THE OVERLAPPING LATTICE METHOD
G. Işık, M. T. Kalaycıoğlu, U. Albostan, E. Canbay, Y. Arıcı, B. Binici, K. Tuncay

SEISMIC BEHAVIOR OF PRESTRESSED CONTAINMENT VESSEL OF A REACTOR BUILDING
E. E. Oyguc, R. A. Oyguc

16:15-17:45 **STR 11- EXPERIMENTAL AND NUMERICAL MODELING / CESME II HALL**
Chair: Serhan Şensoy

EXPERIMENTAL DIFFICULTIES AND SOLUTION PROPOSALS IN A THREE-DIMENSIONAL REINFORCED CONCRETE FRAME
A. Özbayrak, F. Altun

THE TEST SETUP OF REINFORCED CONCRETE WALL SUBJECTED TO PURE TORSION
A. Türkay, F. Altun

EFFECT OF SLAB THICKNESS IN SEISMIC ASSESSMENT OF REINFORCED CONCRETE BUILDINGS
E. Akın, N. M. Rahmany, A. M. O. M. Salih, B. Yıldız

THE MEAN AND VARIATION OF DRIFT RATIO DEMANDS OF RC BUILDINGS
C. Tellal, A. Demir, A. H. Kayhan

EXPERIMENTAL AND NUMERICAL INVESTIGATION OF STEEL-HIGH STRENGTH CONCRETE COMPOSITE BEAM
E. Ercan, M. Tuyan

GEOMETRICAL NONLINEAR INTERACTION MODEL OF THIN INSULATING GLASS UNITS
M. Yılmaz, S. Kömürcü, E. Demirkan

13 SEPTEMBER 2018

16:15-17:45 **MAT 8- FRESH STATE PROPERTIES / DALYAN HALL**
Chair: Oğuzhan Çopuroğlu

EFFECTS OF FLY ASH AGGREGATE ON THE RHEOLOGY AND COMPRESSIVE STRENGTH OF SELF-CONSOLIDATING CONCRETE
E. Bilgiç, S. M. Karahan, H. Y. Ersöz, T. K. Erdem

CHARACTERIZATION OF HEAT-TREATED SELF-COMPACTING CONCRETE CONTAINING GROUND-GRANULATED BLAST-FURNACE SLAG OF EL HADJAR
R. Derabla, F. Sajedi

USE OF MICROORGANISMS TO IMPROVE VISCOSITY AND RHEOLOGY OF CEMENT-BASED MATERIALS
M. Azima, Z. B. Bundur

EFFECT OF MICRO FIBER CONTENT ON WORKABILITY OF SELF-COMPACTING CONCRETE
E. Oztekin, C. Kina, K. Turk

EFFECT OF ANIONIC MONOMER CHANGE OF POLYCARBOXYLATE-BASED WATER REDUCING ADMIXTURE ON FRESH PROPERTIES AND COMPRESSIVE STRENGTH OF SELF-COMPACTING CONCRETE
A. Mardani-Aghabaglou, S. Özen, M. G. Altun, K. Ramyar, T. Kaptı, A. Ünlü

16:15-17:45 **MAT 9- BINDERS / ALACATI HALL**
Chair: Ali Uğur Öztürk

COMPRESSIVE STRENGTH OF MORTAR MIXTURES CONTAINING CLINOPTILOLITE AND ANALCIME BLENDED CEMENTS
Y. Akgün, Ö. F. Yazıcıoğlu

PRODUCTION OF CALCIUM SULFOALUMINATE CEMENTS USING INDUSTRIAL BYPRODUCTS IN TURKEY
O. Canbek, S. T. Erdoğan

EFFECTIVENESS OF BINARY AND TERNARY CEMENTITIOUS SYSTEMS IN REDUCING ALKALI-SILICA REACTION EXPANSION
E. Tosun, C. Yüksel, K. Ramyar

PREDICTION OF THE STRENGTH OF GYPSUM PASTES CONTAINING FLY ASH
O. Cengiz, T. K. Erdem, G. Tayfur

PREDICTION OF THE STRENGTH OF GYPSUM PASTES CONTAINING GROUND GRANULATED BLAST FURNACE SLAG
O. Cengiz, T. K. Erdem, G. Tayfur

13 SEPTEMBER 2018

16:15-17:45 **TRA 6- TRANSPORTATION ENGINEERING VI / URLA HALL**
Chair: Mustafa Özuysal

COMMUTE MODAL PREFERENCES OF MIDDLE EAST TECHNICAL UNIVERSITY (METU) STUDENTS
G. Dalkic, P. Karatas-Sevinen, H. Tuydes-Yaman

A METHOD FOR DETERMINING ALIGHTING LOCATIONS OF BUS PASSENGERS
I. Gökaşar, A. Fidanoğlu

ANALYSIS OF THE EFFECT OF TIME OF DAY ON BUS SPEEDS NEAR A BUS STOP USING GPS DATA
I. Gökaşar, Y. Cetinel, A. A. Arısoy

PASSENGER DEMAND ESTIMATION FOR RAILWAYS IN TURKEY
K. Y. Göka, H. Ceylan, S. Haldenbilen

IMPACT OF RAISED PEDESTRIAN CROSSWALK DESIGN ON VEHICLE TRAVEL: CASE STUDY AT METU
A. A. Kazemi Afshar, F. Ture Kibar, H. Tuydes Yaman

AN EVALUATION INDEX FOR MONITORING INTELLIGENT TRANSPORTATION SYSTEMS (ITS) DEVELOPMENT
H. Tuydes Yaman, S. Dundar, P. Karatas Sevinen, B. Ipekyuz, E. E. Hun er, G. Evren

16:15-17:45 **HYD 6- SPATIAL MODELING IN HYDROLOGY / FOCA HALL**
Chair: Mehmet İshak Yüce

IMPACT OF THE PERIOD OF RECORD ON THE PERFORMANCE OF THE MAP CORRELATION METHOD
D. Ocal, E. Kentel

DETERMINATION OF THE RIVER BASIN BOUNDARIES WITH THE HELP OF GIS IN TURKEY
F. Çay, V. Demir, M. F. Sevimli

SEDIMENT YIELD MAP OF TURKISH RIVERS
Ö. L. Asikoglu, E. Eris

SPATIAL AND TEMPORAL DISTRIBUTION OF THE LINKAGES BETWEEN THE NORTH ATLANTIC OSCILLATION (NAO) AND HYDROLOGICAL DROUGHTS IN TURKEY
F. Tosunoglu, I. Can

CHANGE IN SATELLITE DERIVED SNOW COVER PROBABILITIES OVER TURKEY
A. E. Tekeli, S. Dönmez

EVALUATION OF POINT BASED SNOWPACK MODELING FOR SNOTEL SITES IN TURKEY
M. C. Ertaş, A. A. Şorman

13 SEPTEMBER 2018

16:15-17:45 **GEO 5- GEOTECHNICAL EARTHQUAKE ENGINEERING / ILICA HALL**
Chair: Tuğba Eskişar

DISPERSION OF THE NEAR-SURFACE SEISMIC WAVES IN ELASTIC -VISCOELASTIC LAYERED HALF-SPACE OF THE OCEAN FLOOR
S. D. Akbarov, M. Negin

A PARAMETRIC STUDY ON THE AMPLIFICATION EFFECT OF BURIED BOX CULVERTS ON SEISMIC SITE RESPONSE UNDER LINEAR ELASTIC SOIL CONDITIONS
R. Şişman, Y. Ayvaz

ESTIMATION OF SHEAR STRAIN AT SURFACE SOIL LAYER BY 1D DYNAMIC ANALYSIS AND MICROTREMOR MEASUREMENT FOR A SPECIFIC SITE
O. Subaşı, M. E. Haşal, B. Özaslan, R. İyisan

NONLINEAR SITE RESPONSE ANALYSIS OF LIQUEFIABLE SITE IN ISTANBUL SEISMIC ZONE: A CASE STUDY
A. Edinçliler, M. Çalıkoğlu

EQUIVALENT LINEAR AND NONLINEAR SITE RESPONSE ANALYSIS FOR THE SAKARYA REGION
A. Edinçliler, G. Sezgin Tunçay

20:00-23:00 **NETWORKING EVENT (COCKTAIL PROLANGE)**

14 SEPTEMBER 2018

09:15-10:00 KEYNOTE SPEECH 5 – SPEAKER: ERIK SCHLANGEN / CESME I HALL
Chair: Özge Andiç Çakır

10:00-11:00 STR 12- BRIDGES / CESME I HALL
Chair: Özgür Eğilmez

SPAN-SKEWED EFFECT ON THE RESPONSE OF THE I- GIRDER PRESTRESSED CONCRETE BRIDGES
O. Ghzayel, M. T. Karimi, S. Adanur, A. C. Altunışık

THE EFFECT OF SHEAR CONNECTOR RATIOS ON THE CONCRETE-TO-CONCRETE INTERFACE
Q. T. Nguyen, C. Serhatoğlu, R. Livaoğlu

RATING ANALYSIS OF STEEL TRUSS RAILWAY BRIDGE WITH DIFFERENT PORTING CONFIGURATION
M. F. Yilmaz , K. Ozakgul, B. O. Caglayan

10:00-11:00 MAT 10- BINDERS / DALYAN HALL
Chair: Ali Mardani Aghabaglou

POZZOLANICITY EVALUATION OF ROCK-CUT BUILDING'S WASTE MATERIAL IN CAPPADOCIA REGION
V. Bek, N. Yüzer, S. Ulukaya, Ş. Özata

EFFECTS OF DIFFERENT CELLULOSE ETHERS ON WHITE CEMENT BASED CERAMIC ADHESIVES
M. Tangüler-Bayramtan, C. Üstoğlu, B. Alam, M. Sucu, İ. Ö. Yaman

EFFECT OF WASTE HAZELNUT SHELL POWDER ON THE TECHNICAL PROPERTIES OF CEMENT MORTARS
Ş. O. Kalkan, L. Gündüz

EFFECTS OF FILLER INCORPORATION ON THE PROPERTIES OF BLENDED CEMENTS
Ö. Bozdoğan, M. K. Ardoğa, B. Alam, İ. Ö. Yaman

MECHANICAL PROPERTIES OF CONCRETE MADE WITH PLAIN AND SURFACE TREATED RECYCLED AGGREGATES
H. Yıldırım, T. Özturan

10:00-11:00 TRA 7- TRANSPORTATION ENGINEERING VII / URLA HALL
Chair: Hediye Tüydeş Yaman

PRIORITIZATION AND MODEL DEVELOPMENT FOR URBAN BUS PUBLIC TRANSPORTATION SYSTEMS
J. S. Qul, S. Haldenbilen, H. Ceylan

EVALUATION OF LEVEL-OF-SERVICE WITH HCM 2010 IN WEAVING SEGMENTS IN IZMIR, TURKEY
P. Onelcin, M. Uysal, M. M. Mutlu, Y. Alver

AN INVESTIGATION OF DRIVERS' PARKING CHOICE BEHAVIOR IN IZMIR, TURKEY
M. Uysal, Y. Alver

EVALUATION OF BLUETOOTH TECHNOLOGY TO MEASURE TRAVEL TIME ALONG ARTERIALS
A. Ozden, A. Faghri, N. Attoh-Okine, K. Partridge

14 SEPTEMBER 2018

10:00-11:00 **HYD 7- PIPE FLOW / FOCA HALL**
Chair: Zafer Bozkuş

AN EMPIRICAL CORRELATION FOR FRICTION FACTOR ESTIMATION OF NEWTONI AN FLUID IN ANNULUS
M. Sorgun, E. Ulker, E. Tuncer

FUZZY LOGIC AND SUPPORT VECTOR REGRESSION MODELS FOR NON-NEWTONIAN FLUID FLOW THROUGH ANNULUS WITH PIPE ROTATION
E. Ulker, M. Sorgun, M. S. Tuna

INTRODUCING A NEW COMPUTER CODE, H-HAMMER, TO SOLVE FLUID TRANSIENTS IN PIPE FLOW
H. Dalgıç, Z. Bozkuş

EXPERIMENTAL INVESTIGATION OF A SLUG MOTION IN AN INCLINED PIPE SYSTEM
A. E. Dinçer, Z. Bozkuş

11:00-11:30 **COFFEE BREAK**

11:30-13:00 **STR 13- DYNAMIC ANALYSIS AND EARTHQUAKE ENGINEERING / CESME I HALL**
Chair: Cemalettin Dönmez

THE COMPARISON OF EXACT AND APPROXIMATE GEOMETRY OF CONICAL HELIX OVER STATIC AND DYNAMIC ANALYSIS
M. Ermis, B. Ayhan, A. Kutlu, N. Eratlı, M. H. Omurtag

DUCTILITY EFFECT ON INELASTIC INPUT ENERGY SPECTRA
T. Uçar, O. Merter

COMPARISON OF ENERGY-BASED SEISMIC STRUCTURAL RESPONSES BASED ON SIMULATED GROUND MOTIONS WITH EXISTING EMPIRICAL RELATIONSHIPS
S. Karimzadeh, A. Askan, M. A. Erberik

CRITICAL ANGLE FOR EARTHQUAKE LOADS FOR IRREGULAR BUILDINGS
B. Ayar, A. A. Dindar

SIGNIFICANCE OF STRONG GROUND MOTION ORIENTATION ON SEISMIC RESPONSE OF A SHORT PERIOD REINFORCED CONCRETE STRUCTURE
D. Birlik Kayı, B. Bayhan, G. Özdemir

SEISMIC PERFORMANCE OF HOCAALIZADE MINARET STRENGTHENED BY STEEL TUBE
C. Serhatoğlu, R. Livaoğlu

14 SEPTEMBER 2018

11:30-13:00 **MAT 11- FIBER REINFORCED AND ECC MIXTURES / DALYAN HALL**
Chair: Mert Yücel Yardımcı

SHRINKAGE RESISTANCE OF MICRO SYNTHETIC FIBER REINFORCED CONCRETES
A. Niş, N. Ozyurt, B. Erdal, I. Izmit

AN EXPERIMENTAL STUDY ON THE FIBER BRIDGING STRESS – CRACK OPENING RELATIONSHIP OF PSEUDO STRAIN-HARDENING CEMENT-BASED COMPOSITES
M. Keskinateş, B. Felekoğlu

EFFECT OF DIFFERENT CURING CONDITIONS ON THE TECHNICAL PROPERTIES OF INORGANIC-BONDED FIBER COMPOSITES
L. Gündüz, Ş. O. Kalkan, A. M. İsker, C. Mocan, S. Hacıoğlu

AN EVALUATION ON FLEXURAL CAPACITIES OF PVA, BASALT AND GLASS FIBRE REINFORCED CEMENTITIOUS COMPOSITES WITH NANO-CLAY REPLACEMENT
Z. C. Girgin

A PRELIMINARY RESEARCH ON THE EARLY AGE PROPERTIES OF FIBER REINFORCED CONCRETE WITH LIGHTWEIGHT EXPANDED CLAY AGGREGATE
T. K. Erdem, E. Bilgiç, S. Öztürk

MECHANICAL PROPERTIES OF SINGLE AND HYBRID FIBER REINFORCED CONCRETES CONTAINING FLY ASH AND BLAST FURNACE SLAG
T. K. Erdem, F. G. Şahin, N. A. Karimzada, T. Yıldırım, C. Türkyener

11:30-13:00 **TRA 8- TRANSPORTATION ENGINEERING VIII / URLA HALL**
Chair: Atakan Aksoy

DEVELOPMENTS OF SELF-HEALING TECHNOLOGIES ON ASPHALT MATERIALS
B. Sengoz, A. Onsori, A. Z. Albayrak, A. Topal, J. Oner

SYNTHESIS OF SAFFLOWER OIL AND BORIC ACID- CONTAINING ORGANIC ADDITIVE FOR BITUMEN MODIFICATION
Ş. Oruç, D. Şahin, K. Sancak

EVALUATION OF DIFFERENT CONDITIONS AFFECTING THE INDIRECT TENSILE STRENGTH OF HYDRATED LIME ADDITIVE BITUMINOUS MIXTURES BY USING ARTIFICIAL NEURAL NETWORKS METHOD
M. S. Yardım, S. Dündar, B. D. Şitilbay

EFFECT OF HYDRATED LIME ON INDIRECT TENSILE STRENGTH OF ASPHALT CONCRETE
B. Varlı Bingöl, M. Güler

EFFECT OF BIOCHARS OBTAINED FROM PYROLYSIS OF NATURAL BIOMASSES AT DIFFERENT TEMPERATURES ON THE RHEOLOGICAL PROPERTIES OF BITUMINOUS BINDERS
M. E. Çeloğlu, M. Yılmaz, B. V. Kök

EFFECTS OF RECYCLE POLYMER WASTE ON THE PROPERTIES OF BITUMINOUS BINDERS
E. Yalçın, E. Ş. Seyrek, M. Yılmaz, B. V. Kök, H. Arslanoğlu, M. E. Çeloğlu

14 SEPTEMBER 2018

11:30-13:00 **HYD 8- OPEN CHANNEL HYDRAULICS / FOCA HALL**
Chair: İsmail Aydın

FLOW RESISTANCE IN CONVEYANCE CHANNELS
İ. Aydin

ANALYSIS OF ENERGY DISSIPATION AT THE END SILL OF A SPILLWAY
J. B. Mumputu, M. İ. Yüce

A NUMERICAL AND EXPERIMENTAL STUDY ON THE FLOW FIELD IN AN OPEN CHANNEL
B. Kılınç, M. Aksen, N. Bahadıroğlu, G. Bombar, Ş. Elçi, M. Köken, A. H. Cardoso

EXPERIMENTAL INVESTIGATION FOR THE EFFECTS OF TURBULENCE ON THE SETTLING VELOCITIES OF SEDIMENTS
Ş. Elçi, G. Bombar, B. Vural, M. Ay

11:30-13:00 **GEO 6- SOIL BEHAVIOR / ILICA HALL**
Chair: Mehmet M. Berilgen

A PARAMETRIC STUDY ON THE BULK DENSITY DETERMINATION OF SOIL SPECIMENS USING CLOSE-RANGE PHOTOGRAMMETRY
A. Gharehaghajlou, O. Önal

METHYLENE BLUE ADSORPTION AND SWELLING CHARACTERISTICS OF A LIME-TREATED EXPANSIVE CLAY
İ. Süt-Ünver, M. A. Lav, E. Çokça

EFFECT OF PRE-CONSOLIDATION PRESSURE ON SETTLEMENT TIME RELATIONSHIP
D. C. Turhan, O. Göktürk, Ö. F. Çapar, E. Dağlı

INVESTIGATION OF BEHAVIORAL THRESHOLDS IN SAND -SILT-CLAY MIXTURES CONSIDERING CONSISTENCY AND COMPACTION
D. Erdoğan

13:00-13:30 **CLOSING CEREMONY**

13:30-16:00 **ACE ADVISORY COMMITTEE MEETING**

Comparison of Three Alternatives for Determining Datum Temperature and Apparent Activation Energy to Estimate Concrete Strength by Maturity Method

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Abstract

Application and scheduling of various critical processes like formwork removal, post – tensioning, ending protection against cold temperatures, opening a road to traffic, transportation of prefabricated elements during concrete construction usually require a reasonable strength prediction of concrete. Maturity method a means of estimating the combined effect of time and temperature during the curing process on the development of concrete properties can be used for this purpose. Several methods were developed to predict concrete strength in relation to its age and curing temperature. Among these, the maturity and equivalent age functions have become the standard practice since 1974 in ASTM C 1074 (Estimating Concrete Strength by Maturity Method). The former function requires the determination of a datum temperature whereas the latter requires the determination of the activation energy. ASTM C 1074 offers three alternative methods for determining the datum temperature or activation energy. The prime interest of this study is to be critically compared of the methods by an experimental investigation on standard mortars prepared by using CEM I 42.5. Strength specimens were prepared according to EN 196 – 1 and continuously moist – cured at 5^0C, 20^0C, and 40^0C for 2, 7, 14, 28, and 90 days of age.

Keywords: *Maturity Method, Equivalent Age Functions, Strength Development.*

1 Introduction

Non – destructive testing methods have been devised to predict properties of concrete without damaging the concrete or by keeping it at minimal level. Maturity method, which is one of the non – destructive methods, has been employed to estimate compressive strength of a known concrete with the time – temperature history in question. Many methods have been proposed to examine the relationship time and temperature of concrete. Among of them, Nurse – Saul maturity function (Saul, 1951) and Arrhenius equivalent age function (Hansen and Pedersen, 1977) are the ones that received general acceptance and shown in Equation (1) and (2), respectively.

$$M = \sum_{0}^{t} (T - T_0) \cdot \Delta t \tag{1}$$

where,
M: Maturity index at age t, [degree – days or degree – hours],
T: Average concrete temperature during the time interval, Δt, [°C],
T_0 : Datum temperature [°C], and
Δt : A time interval [days or hours].

$$t_e = \sum_{0}^{t} e^{-\frac{E_a}{R}\left(\frac{1}{T} - \frac{1}{T_r}\right)} \cdot \Delta t \tag{2}$$

For $T \geq 20°C$ $\quad E_a = 33\,500$ J/mol
For $T < 20°C$ $\quad E_a = 33\,500 + 1470\,[20 - T]$ J/mol

where,

t_e : Equivalent age [days or hours]
E_a : Apparent activation energy, [J/mol]
R : Gas constant, [8.314 J/mol – °K]
T : Average concrete temperature during the time interval, Δt, [°K],
T_r : Reference temperature [°K],
Δt : A time interval [days or hours].

Nurse – Saul maturity function can be basically expressed by integration of concrete temperature and time and assumes that there is a linear relationship between initial rate of strength gain (i.e during the acceleratory period) and a limit temperature, which is known as datum temperature, as the concrete gains strength above a specified temperature (Carino and Lew, 2001). Nixon et al. (2008) also defined the datum temperature as the lowest temperature at which the concrete will not gain strength. On the other hand, apparent activation energy is another critical variable as expressed in Equation (2). Shukla and Mishra (2015) emphasized activation energy is the minimum energy required to initiate any chemical reaction among the molecules. In view of maturity method, apparent activation energy may be defined as a minimum energy for concrete to gain strength.

Datum temperature and apparent activation energy are determined by utilizing ASTM C 1074. However, there are three different alternatives in this standard practice. These alternatives can be named as Option A1.1.7, Option A1.1.8.1 and Option A1.1.8.2. The main difference among them is the age when strength development is assumed begin. The three options take it as the final setting time, an age beyond the final setting time during the acceleration period of hydration so long as accepting a reasonable ultimate strength, and right after mixing, respectively. The significance of the difference occurs especially upon some parameters such as extreme cold conditions or addition of mineral admixtures into concrete have a great effect on this age. Hence, sufficient knowledge about concrete ingredients and weather conditions should be obtained before applying the method on concrete.

In the literature, most studies on maturity method were mainly conducted by adopting only one of the alternative ways in ASTM C 1074 (Kasap, 2002 ; Barnett et al., 2006 ; Voight et al., 2006). Thus, the purpose of this study is to determine datum temperature and apparent activation energy according to three different alternatives in ASTM C 1074 and compare the differences between them.

2 Methodology

2.1 Materials

The experiments were conducted on mortars containing CEM I 42.5 R portland cement and CEN standard sand in this study. Chemical and physical properties of the portland cement are shown in Table 1.

Table 1. Chemical and Physical Properties of the Portland Cement Used

Properties (%)	**PC**
SiO_2	18.62
Al_2O_3	4.94
Fe_2O_3	2.46
CaO	61.61
MgO	2.27
SO_3	3.29
Na_2O	0.32
K_2O	0.80
TiO_2	–

Cl^-	0.0091
LOI	5.12
Fineness [cm^2/g]	3400
Density [g/cm^3]	3.04

2.1 Testing Methods

2.2.1 Setting Time Tests

The normal consistency test was applied on pastes having a mixing procedure in accordance with ASTM C 305 standard, as compatible with ASTM C 187 standard. After water – cement ratio (w/c) for normal consistency was determined, setting time tests were done according to ASTM C 191 standard and initial and final setting time results for mortar are also shown in Table 2.

Table 2. Initial and Final Setting Times and Water – Cement Ratio for Normal Consistency

w/c	Initial Setting Time (min)	Final Setting Time (min)
0.287	170	300

2.2.1 Flow, Compressive Strength Tests and Curing Conditions

The mortars with 110 ± 5 % flow, in accordance with ASTM C 1437 were moist cured at 5°C, 20°C and 40°C. The compressive strength test method of EN 196 – 1 was used at 2 d, 7 d, 14 d, 28 d and 90 d. Three batches of cement mortar consisted of 3 prismatic specimens of 40 mm x 40 mm x 160 mm for each group were tested for the specified age. Compressive strength were the average of six broken pieces obtained after flexural testing.

3 Discussion and Results

The compressive strength values at ages 2, 7, 14, 28 and 90 days for mortars moist – cured at 5°C, 20°C and 40°C are summarised in Table 3.

Table 3. Compressive strength test results (MPa)

Age (days)	Curing Temperature (°C)		
	5	20	40
2	14.13	20.82	28.42
7	24.47	33.02	41.02
14	32.53	40.9	46.87
28	38.35	46.95	49.93
90	48.27	52.15	50.42

3.1 Determination of Datum Temperature and Apparent Activation Energy

The idea behind determination of datum temperature and apparent activation energy is selection of an acceptable point (rate constants or k–values) which is valid for all ages and all temperatures to which concrete may be exposed. Strictly speaking, datum temperature and apparent activation energy calculations for the three methods in ASTM C 1074 can be examined in two parts: calculations up to k–values and calculations after k–values. While there are some differences among the three options in ASTM C 1074 for the former, each of them follows the same procedure for the latter. The former mainly consists of determination of ultimate strength and strength gain per days or hours. The reason for both the determination of ultimate strength and that of strength gain per days or hours is completely same for Option A1.1.7 and Option A1.1.8.2. However, it is debated that the ages prior to the

final setting time, should not be considered for the determination of datum temperature and apparent activation energy in Option A1.1.7. On the other hand, it is thought that even the beginning of pre-induction period has an effect on datum temperature and apparent activation energy for Option A1.1.8.2. In the just the same way as Option A1.1.8.2, the mechanism for Option A1.1.8.1 is based on a non-linear equation system.

Option A1.1.8.1 considers a time that strength development starts. This may seem as an arbitrary point during the course of hydration (Carino and Lew, 2001). Besides, the strength at infinity may sometimes become lower than the strength at later age (i.e strength at 90-day) obtained by experimental results. Even if they are seen as significant drawbacks for the Option A1.1.8.1, it has been observed that these problems may be practically reduced by introducing some constraints to the equation system as the strength at infinity is greater than that of 90-day. Eventually, datum temperature and apparent activation energy values regarding the principles of three approaches in the relevant standard are shown in Table 4.

Table 4. Datum temperature and apparent activation energy values according to three different approach in ASTM C 1074

A1.1.7		**A1.1.8.1**		**A1.1.8.2**	
Datum Temperature (°*C*)	Apparent Activation Energy (J/mol)	Datum Temperature (°*C*)	Apparent Activation Energy (J/mol)	Datum Temperature (°*C*)	Apparent Activation Energy (J/mol)
-15.86	19283	-10.34	25898	1.61	37923

3.2 Strength – Maturity and Experimental Strength – Predicted Strength Relationship According to Three Different Alternatives in ASTM C 1074

Figure 1 (a) represents the strength development of mortars measured over time at the curing temperatures of 5°*C,* 20°*C* and 40°*C.* As the temperature increases, the increase in the strength of mortars was expected due to acceleration of hydration reactions with temperature. However, at 90 days, the strength of mortar cured at 40°C was slightly lower than that at 20°C. Malhotra and Carino (2004) explained the reason of this with cross – over effect which is a phenomena clarifying fast formed hydration products under the high temperatures bringing about a considerable amount of porosity within the matrix. There eventually will be a loss of strength owing to the increase in porosity. The single curve plotted in Figure 1 (b), (c) and (d), on the other hand, shows the relationship between experimental strength – maturity by adopting three different datum temperatures determined according to three different alternatives in ASTM C 1074. The maturity or temperature – time factor in Figure 1 (b), (c) and (d) was determined by Nurse – Saul maturity function.

Many equations for strength – maturity have been proposed since there is no a standard strength development differs from one concrete to another as specified ASTM C 1074 (2011). The concrete, in other words, consists of three phases which are aggregate particles, cement paste and interfacial transition zone (ITZ). These are so complicated phenomenons that the effect of them on strength of concrete can even show differences within batches. Hence, there is no model that fully describe the concrete (Tokyay, 2016). Therefore, it was thought that adaption of logarithmic trend line for the strength – maturity relationship may be more reasonable in this study. After plotting of strength – maturity graphs, it is necessary to determine which of the three alternatives is the best one. For that purpose, coefficient of determination, R^2, is confirmed to interpret goodness – of – fit measure (Cameron and Windmeijer, 1997 ; Cornell and Berger, 1986). In light of this expression, it can be inferred that the best goodness – of – fit measure in view of strength – maturity relationship is ensured by the Option A.1.1.8.1 owing to its higher R^2 value.

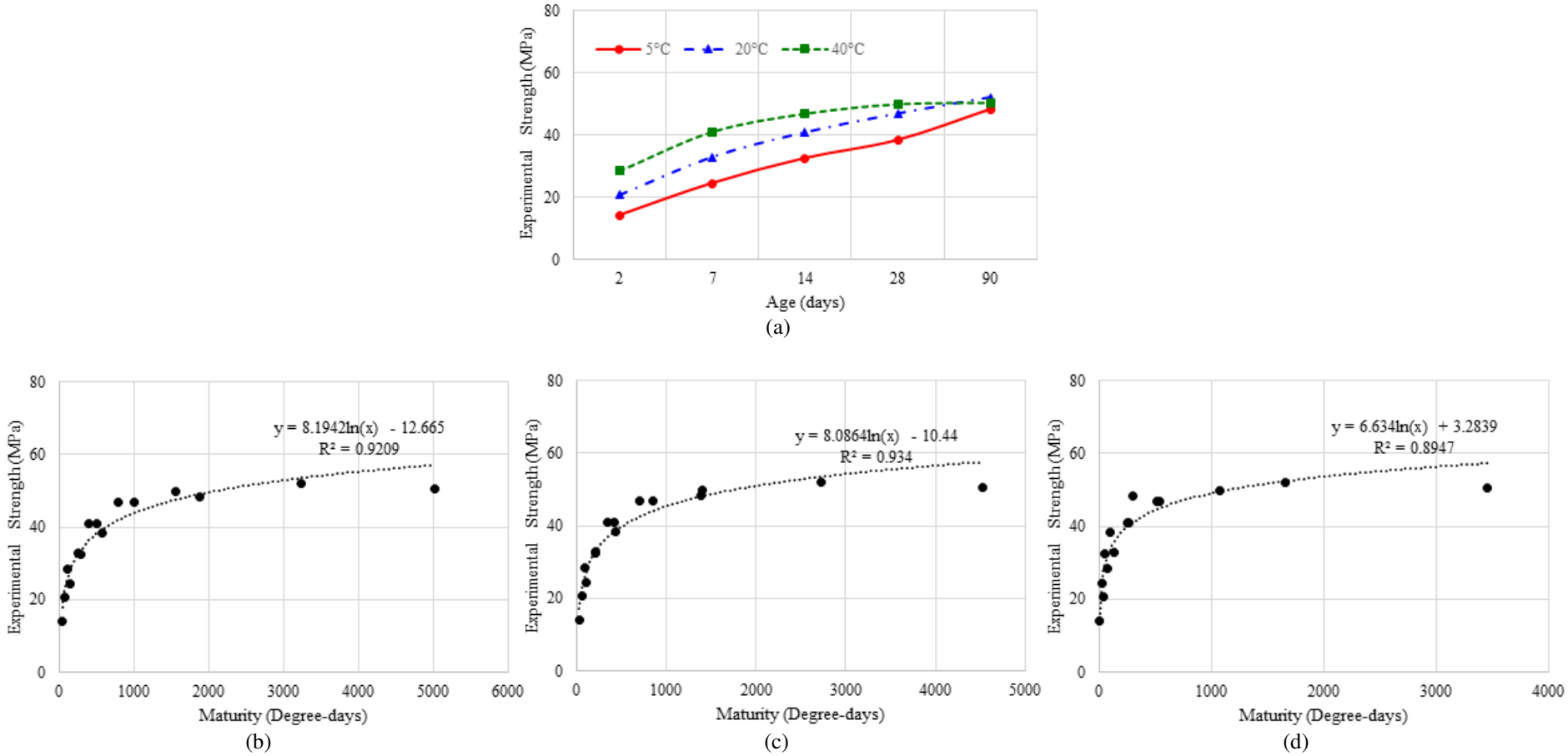


Figure 1. (a) Experimental strength – age relationship (b) Experimental strength – maturity relationship for Option A1.1.7 (c) Experimental strength – maturity relationship for Option A1.1.8.1 (d) Experimental strength – maturity relationship for Option A1.1.8.2.

The validity of each of three methods in ASTM C 1074, however, should also be assessed. Thus, the strength functions of Option A1.1.7, Option A1.1.8.1 and Option A1.1.8.2 were derived and then shown from Equation (3) to (5), respectively.

$$\frac{1}{S} = \frac{1}{S_u} + \frac{S_u \cdot k_t}{(t - t_f)} \tag{3}$$

$$S = S_{\mathrm{u}} \cdot \frac{k_{\mathrm{T}} \cdot (t - t_0)}{1 + k_{\mathrm{T}} \cdot (t - t_0)} \tag{4}$$

$$S = S_u \cdot \frac{k_T \cdot t}{1 + k_T \cdot t} \tag{5}$$

where,
S : Compressive strength at age t, (days),
S_{u} : Ultimate strength,
k_{T} : Rate constant, (1/days),
t_0 : Age at start of strength development, (days),
t_{f} : Final setting time, (days).

By using these strength development functions, the validity of the alternatives in ASTM C 1074 was examined and it was seen that the best relationship between experimental and predicted strength was established in Option A1.1.8.2 as specified in Figure (2) even if the strength maturity relationship was best established for Option A1.1.8.1. The reason for that may associated with selected temperature range or no use of any type of additives within the mixtures. For example, if the temperature below five degrees Celsius were chosen as curing temperature or any type of admixtures (any type of mineral admixtures or set retarder chemical admixture) were incorporated within the mixtures, the age to begin strength of the mortars would be extended. Thus, it is thought that the best alternative in the relevant standard is Option A1.1.8.1.

Another significant point to be considered is the effect of mechanism of cement hydration on maturity – experimental strength and experimental strength – predicted strength relationships. The mechanism is a rather complex process due to simultaneous and successive reactions. Alite contributes most of the strength at early ages while belite is responsible strength at later ages (Tokyay, 2016; Mehta and Monteiro, 2006). Upon considering the reactivity of alite and belite and the amount of products (i.e. CH and $C_3S_2H_3$) produced by alite and belite, it can be inferred that there occur some differences between early and late ages in determining datum temperature and apparent activation energy. Consequently, these differences affect maturity and strength prediction, also. Hence, the examination of early age (up to 14 days) and late age (beyond 14 days) hydration behavior of portland cements separately is proposed to decrease discrepancies between predicted and actual strength values or maturity and experimental strength relationships.

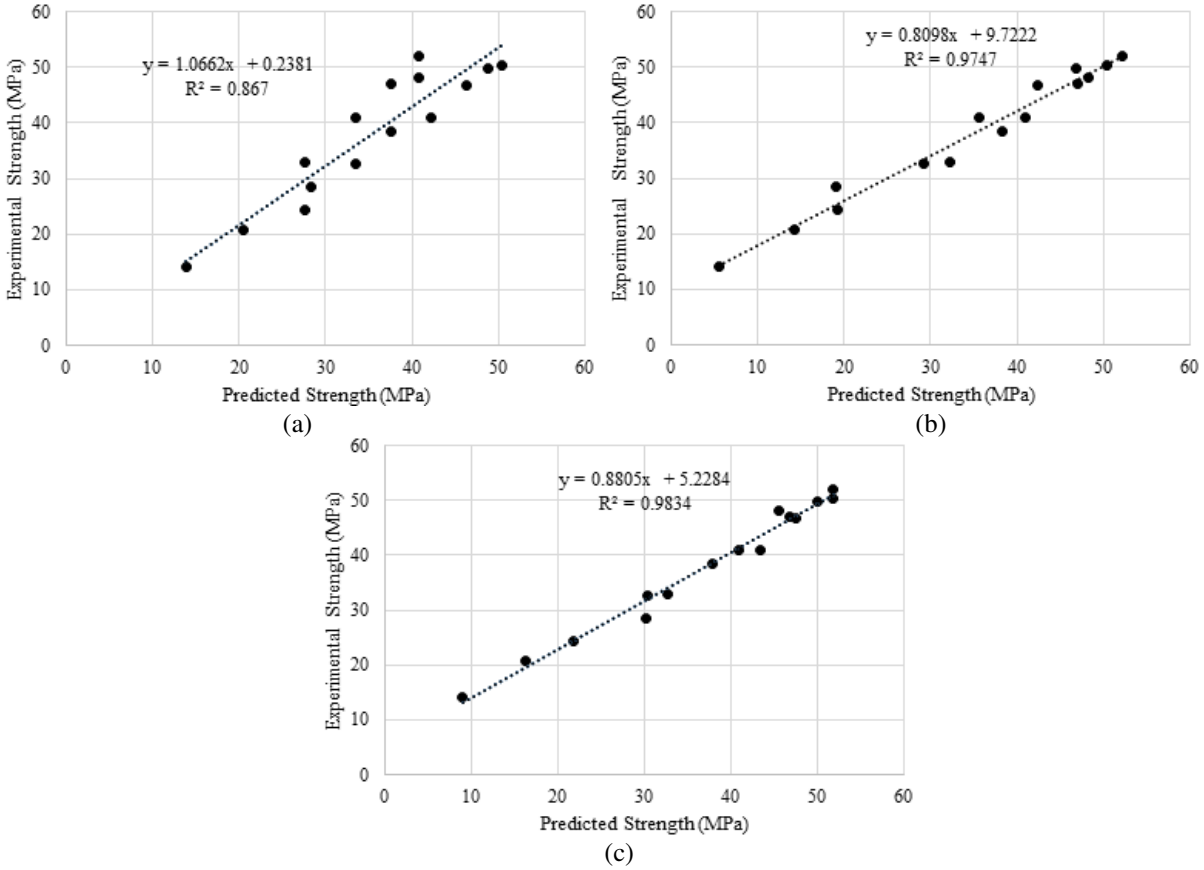


Figure 2. (a) Experimental strength – predicted strength relationship for Option A1.1.7 (b) Experimental strength – predicted strength relationship for Option A1.1.8.1 (c) Experimental strength – predicted strength relationship for Option A1.1.8.2

4 Conclusion

In this study the comparison of three different alternatives for datum temperature and apparent activation energy determination given in ASTM C 1074 was examined for portland cement mortars. The conclusions drawn are as follows:

(1) The fundamental difference among the alternatives is the age to begin strength development. The age is considered as the final setting time, an age beyond the final setting time during the acceleration period of hydration provided that a reasonable limiting strength is introduced to Equation (4), and right after mixing for Option A1.1.7, Option A1.1.8.1 and Option A1.1.8.2, respectively.

(2) A logarithmic trendline for strength maturity relationship may be more reasonable instead of proposed empirical equations due to difficulties of the establishment of common strength model for all concretes.

(3) The examination of early age (up to 14 days) and late age (beyond 14 days) hydration behavior of portland cements separately is proposed due to the differences in cement hydration mechanism at early and late ages.

(4) Elevation of curing temperature increases both early term and long term compressive strength of the mortar mixture except for the 90-day strength of mortar cured at 40°C owing to cross – over effect.

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