

ITA-AITES World Tunnel Congress 2016 (WTC 2016)

San Francisco, California, USA
22 – 28 April 2016

Volume 1 of 4

ISBN: 978-1-5108-2262-7

Printed from e-media with permission by:

Curran Associates, Inc.
57 Morehouse Lane
Red Hook, NY 12571



Some format issues inherent in the e-media version may also appear in this print version.

Copyright© (2016) by the Society for Mining, Metallurgy and Exploration
All rights reserved.

Printed by Curran Associates, Inc. (2016)

For permission requests, please contact the Society for Mining, Metallurgy and Exploration
at the address below.

Society for Mining, Metallurgy and Exploration Inc.
12999 East Adam Aircraft Circle
Englewood, CO 80112-4167

Phone: (303) 948-4200

Fax: (303) 973-3845

cs@smenet.org

Additional copies of this publication are available from:

Curran Associates, Inc.
57 Morehouse Lane
Red Hook, NY 12571 USA
Phone: 845-758-0400
Fax: 845-758-2633
Email: curran@proceedings.com
Web: www.proceedings.com

TABLE OF CONTENTS

VOLUME 1

TUNNEL INFORMATION MODELLING IN MOST RECENT FORM	1
<i>Marko Žibert, Scott Keniston, Jurij Karlovšek</i>	
CENTRIFUGE MODELLING OF TUNNELING-INDUCED SETTLEMENT DAMAGE TO 3D-PRINTED SURFACE STRUCTURES	11
<i>S. Ritter, G. Giardina, M. J. Dejong, R. J. Mair</i>	
DESIGN DIAGRAMS FOR ESTIMATING TUNNEL FACE STAND-UP TIME IN WATER-BEARING GROUND	21
<i>R. Schuerch, R. Poggiati, G. Anagnostou</i>	
INVESTIGATIONS IN THE FIELD OF LONG-TERM STABILITY OF TUNNEL CONSTRUCTIONS	31
<i>Stefan Lorenz, Robert Galler</i>	
ACI GUIDELINE ON DESIGN AND CONSTRUCTION OF PRECAST CONCRETE TUNNEL SEGMENTAL LINING	39
<i>M. Bakhshi, V. Nasri</i>	
CONCURRENT SEGMENT LINING AND TBM DESIGN: A COORDINATED APPROACH FOR TUNNELING SUCCESS	49
<i>E. Comis, M. Younis, R. Goodfellow</i>	
FIRE DESIGN FOR THE CONCRETE LINING OF THE OHIO RIVER BRIDGES EAST END CROSSING TUNNEL	61
<i>Wern-Ping Nick Chen</i>	
EFFECTIVE OPENING SUPPORT FOR CROSS PASSAGES	72
<i>Anthony Harding, Dean Treweek</i>	
UTILIZING COMPOSITE ACTION TO ACHIEVE LINING THICKNESS EFFICIENCY FOR SPRAYED CONCRETE LINED (SCL) TUNNELS	84
<i>Jiang Su, Alan Bloodworth</i>	
A DIFFERENT VIEW ON TBM FACE EQUILIBRIUM IN PERMEABLE GROUND	94
<i>Tiago Gerheim Souza Dias, Adam Bezuijen</i>	
APPLICATION OF ROCK MASS QUALITY RATING (RMQR) TO DESIGN OF SUPPORT SYSTEMS FOR TUNNELS AND UNDERGROUND CAVERNS	104
<i>Ö. Aydan, R. Ulusay, M. Imazu</i>	
ASSESSMENT OF TBM GRIPPER PERFORMANCE IN THE BEDDED SEDIMENTARY ROCK OF SYDNEY, AUSTRALIA	114
<i>David Oliveira</i>	
CHOICE OF PUMPING PRESSURE IN PRE-GROUTING IN SCANDINAVIAN TUNNELING PROJECTS	124
<i>Jalaeddin Y. Rafi, Fredrik Johansson, Hakan Stille</i>	
INTERACTION MODELS FOR MECHANIZED TUNNELING	135
<i>G. Meschke</i>	
PERFORMANCE OF MACRO SYNTHETIC FIBER REINFORCED TUNNEL LININGS	146
<i>Axel G. Nitschke, Ralf Winterberg</i>	
PRIMARY-SECONDARY LINING INTERACTIONS FOR COMPOSITE SPRAYED CONCRETE LINED TUNNELS USING SPRAYED WATERPROOFING MEMBRANE	159
<i>Jiang Su, Michal Uhrin</i>	
PROPOSAL OF THE TUNNEL FACE STABILITY INDEX (TFI) BASED ON THE CRITICAL SHEAR STRAIN THEORY	169
<i>Toru Sasaki, Shingo Morimoto, Masato Shinji</i>	
SFRC SEGMENTAL LINING DESIGN FOR A PRESSURISED TUNNEL	175
<i>Sotiris Psomas, Colin M Eddie</i>	
STRUCTURAL DESIGN OF COMPOSITE SHELL LININGS	188
<i>Johannes Jäger</i>	
DETAILED FIRE SAFETY DESIGN OF SUBWAYS FOR ARSON-INITIATED DESIGN FIRES	197
<i>Baljinder Bassi, Mike Deevy, James Fletcher, Marc Morgan, Nishant Nayan, Sandeep Upadhya</i>	
A COMPARISON AMONG DIFFERENT TECHNIQUES OF THE FIRE PROTECTION IN THE FIELD OF ROAD TUNNELS	207
<i>Taher Elsammi, Takaya Takimoto, Takayoshi Otsuka, Ashraf Bou-Krishna</i>	

MECHANICAL VENTILATION OF UNDERGROUND CONSTRUCTION WORKS IN FRANCE	217
<i>Chris Norris, Alain Mercusot, Patrick Oriez</i>	
VENTILATION AND SAFETY OF LONG AND DEEP TUNNELS—STATE OF THE ART AND NEW PERSPECTIVES	228
<i>Marco Bettelini, Samuel Rigert</i>	
SWISS QUARTZ DUST GUIDELINE: A TOOL FOR MANAGING THE HEALTH RISK RELATED TO QUARTZ DUST IN EARLY PROJECT STAGES	238
<i>Matthias Neuenschwander, John Singer, Ömer Ündül, Andreas Theiler, Markus Weh, Martin Vogel, Patrick Steinle, Diego Martini</i>	
EXPERIMENTAL QUANTIFICATION OF TUNNEL FIRE HEAT FLUX	248
<i>Timothy Gibson, Timothy Shaw, Jurij Karlovsek, Richard Emberley, José L. Torero</i>	
VENTILATION CHALLENGES DURING CONSTRUCTION OF EMERGENCY GALLERIES	260
<i>Rainer Anretter</i>	
ECONOMICAL APPROACH TO ENGINEERING FIRE DURABILITY OF STRUCTURES	270
<i>Taehyun Moon, Sean Cassidy, Jason Liu, Sanja Zlatanic, Chris Devery</i>	
SPRAYED CONCRETE LINING FALLS AND EXCLUSION ZONE MANAGEMENT	280
<i>Mike King, Adrian St. John, David Brown, John Comins</i>	
DO RAIL TUNNELS REQUIRE MECHANICAL VENTILATION FOR SMOKE MANAGEMENT?	291
<i>Lachlan Henderson, David Barber, Peter Johnson</i>	
HOW THE GLOBAL EXPERIENCE AND REACH OF TUNNELLING’S TRUE MULTI-NATIONALS HELPED SOLVE A DIFFICULT ROAD TUNNEL FIT-OUT CHALLENGE	300
<i>Tim Brown, Simon Strong, Luis Ignacio Sanz Vivanco</i>	
HUMAN FACTORS IN THE DUTCH TUNNEL STANDARD	313
<i>Bart H. M. Hendrix, Patrick J. Maessen</i>	
I-70 EISENHOWER–JOHNSON MEMORIAL TUNNEL FIXED FIRE SUPPRESSION SYSTEM PROJECT CASE HISTORY	323
<i>James Carroll, Steve Rondinelli, Jason Miller, Raelene Shelly, Joe Silvestri</i>	
RAIL SYSTEMS APPROACH TO DESIGN FIRES	332
<i>David Barber, Lachlan Henderson, Peter Johnson</i>	
STRUCTURAL FIRE PROTECTION TO NFPA 502: PERFORMANCE-BASED DESIGN AND ASSESSMENT OF PASSIVE AND ACTIVE FIRE PROTECTION SYSTEMS	342
<i>Mike Deevy, Miguel Fuentes-Llanos, Alberto Jaen-Toribio, Robinson Leon-Diaz, Raymond Blanchard</i>	
THE MOVE TO LED TUNNEL LIGHTING: LED TUNNEL LUMINAIRES ARE REPLACING TRADITIONAL TUNNEL LIGHTING FIXTURES	352
<i>Michael N. Maltezos</i>	
TUNNEL SAFETY—COMMAND AND FIRE CODE OFFICIAL PERSPECTIVE	359
<i>Gary English</i>	
TECHNICAL APPROACH TO LINING DESIGN FOR INTERNAL PRESSURE AND FAULT OFFSETS ON THE JWPCP EFFLUENT OUTFALL TUNNEL	368
<i>Jan Van Greunen, Yiming Sun, Geoffrey Hughes, Roozbeh Geraili Mikola, Jon. Y. Kaneshiro, David Haug, Mark Vanderzee</i>	
SYNTHETIC-FIBER-REINFORCED CONCRETE SEGMENTAL LINING: LABORATORY AND FIELD TESTING PROGRAM AND RESULTS	379
<i>Donald C. Wotring, Michael G. Vitale, Douglas A. Gabriel</i>	
ADAPTION OF PROTECTIVE LININGS FOR SEWER TUNNELS TO PROJECT NEEDS	389
<i>Jörg Riechers, Albert Lueghamer, Gilles Recher</i>	
MONITORING MECHANISMS OF TUNNEL LINING SETTLEMENT USING INSTRUMENTED BOLTS AND CONVENTIONAL SURVEY METHOD: ASSESSING NEUTRAL AXIS OF LONGITUDINAL FLEXURE	398
<i>Matthew Wilcock, Kenichi Soga, Peter Wright</i>	
HIGH PERFORMANCE GROUND PREDICTION AHEAD OF TBMS: THE NETTUN SYSTEM "TULIPS"	408
<i>Thomas Camus</i>	
THE LEE TUNNEL BECKTON LONDON: AN INNOVATIVE USE OF FRC FROM DESIGN TO CONSTRUCTION PHASE	418
<i>Benoit De Rivaz, John Greenhalgh</i>	
TUNNELING UNDER THE NORRIS CUT CHANNEL: WORLD FIRSTS TO OVERCOME THE ADVERSE GROUND OF MIAMI	428
<i>Bernard Theron, Boris Caro Vargas</i>	

UNIQUE CHARACTERISTICS FOR THE DESIGN AND CONSTRUCTION OF THE NEW TWIN TUNNEL “CALTANISSETTA”, ON HIGHWAY 640 IN SICILY, ITALY: PRACTICAL EXPERIENCE IN USING ϕ 15.08 M (50 FEET) DIAMETER E.P.B. MACHINE	437
<i>Gian Luca Menchini, Pier Francesco Paglini, Pier Francesco Boschi</i>	
ISTANBUL STRAIT ROAD TUBE CROSSING: CHALLENGES, RISKS AND MITIGATION STRATEGIES	447
<i>Nasri Munfah, Gordon Clark, Basar Arioglu, Sanja Zlatanovic, Tolga Togan</i>	
CHALLENGES AND SOLUTIONS RELATED TO THE INTERACTION OF SOIL CONDITIONING AND MAIN DRIVE ON LARGE DIAMETER EPB TBM'S: A CASE HISTORY	457
<i>Jens Classen</i>	
IMPROVEMENT OF PRECAST CONCRETE SEGMENTAL LINING BY POST-TENSIONED STRANDS	469
<i>Behzad Khorshidi</i>	
INNOVATIVE SUPPORT OF CROSS-PASSAGE OPENINGS IN SEGMENTED LINER	478
<i>Karel Rössler, Petr Vitek</i>	
RISK REDUCTION AND PERFORMANCE IMPROVEMENT THROUGH TBM ROBOTIZATION	484
<i>Salam Moubarak, Thomas Camus</i>	
USE OF TWO NOVEL HYBRID-TYPE “CROSSOVER” TBMS FOR HARD ROCK CONDITIONS WITH WATER INFLOWS	494
<i>Missy Isaman</i>	
RECENT TRENDS IN CONVENTIONAL TUNNELING (SEM/NATM) IN THE US	505
<i>Nasri Munfah, Vojtech Gall, Steffen Matthei</i>	
DESIGN AND ENGINEERING DURING THE CONSTRUCTION OF LOS LEONES STATION (LINE 6, SANTIAGO SUBWAY, CHILE)	515
<i>Benjamín Celada, Jaime Adasme, Héctor González</i>	
UPGRADING OF CITY OF GENOA RAILWAY JUNCTION: UNDER-CROSSING WITH SHALLOW DISTANCE OF EXISTING TUNNELS IN URBAN ENVIRONMENT	527
<i>Andrea Pigorini, Ezio Pedone, Nicola Beltrandi, Holad Mohamed Dahir</i>	
THE NORSBORG METRO DEPOT: CASE STUDY OF A MODERN URBAN DEVELOPMENT IN STOCKHOLM	538
<i>Hans Hogard, Jenny Alsén</i>	
AN INNOVATIVE METHOD OF LARGE SPACE UNDERGROUND CONSTRUCTION IN SOFT AND SHALLOW GROUND USING CONCRETE ARCH PRE-SUPPORTING SYSTEM, CAPS METHOD	548
<i>Mohammad Hossein Sadaghiani</i>	
CONSTRUCTION OF EXPRESSWAY BRANCH JUNCTION STRUCTURE USING NON-CUT-AND-COVER ENLARGEMENT METHOD TO COMBINE TWO SHIELD TUNNELS IN SEDIMENTARY SOFT ROCK	558
<i>Kenji Namikawa, Yoshihiro Terashima, Takahiro Inoue, Junichi Koseki, Yukika Miyashita, Masashi Matsumoto</i>	
TECHNOLOGIES ON SEM TUNNELING IN HAZARDOUS MATERIAL-BEARING SOFT ROCK WITH SMALL OVERBURDEN	569
<i>Takeshi Kudo, Akira Ishikuro, Masamichi Shintaku, Futoshi Kusumoto</i>	
THE EFFECT OF EXCAVATION PROGRESS ON THE BEHAVIOR OF HAKIM HIGHWAY TUNNEL USING GEOTECHNICAL INSTRUMENTATION	580
<i>Majid Sadeghi, Seyed Mahdi Pourhashemi, Ali Naghi Dehghan, Kaveh Ahangari</i>	
THE HIRSCHHAGEN HIGHWAY TUNNEL (BAB 44) IN GERMANY: PRE-SUPPORT IN EXTREMELY DIFFICULT AND INHOMOGENEOUS GROUND CONDITIONS	591
<i>Günther M. Volkmann</i>	
40 YEARS OF EXPERIENCE IN THE USE OF UMBRELLA ARCH METHOD IN TUNNELING: PROBLEMS AND SOLUTIONS	601
<i>Sebastiano Pelizza, Carlo Alessio, Georgios Kalamaras</i>	
CONVENTIONAL TUNNELING CHALLENGES IN THE HIMALAYAS: A CASE STUDY	611
<i>Rakesh Kumar Khali, Sharanappa Yalal</i>	
NUMERICAL FEASIBILITY STUDY ON GROUND DEFORMATION CAUSED BY ENLARGEMENT OF SHALLOW BOX TUNNEL	622
<i>Yohan Cha, Gye-Chun Cho, Eun-Soo Hong</i>	
PERFORMANCE OF REINFORCED RIBS OF SHOTCRETE (RRS) UNDER DIFFERENT STRESS REGIMES	630
<i>Panagiotis Chryssanthakis</i>	

PERFORMANCE REQUIREMENT OF IMMEDIATE RING CLOSURE METHOD FOR DIFFICULT GROUND CONDITIONS IN CONVENTIONAL TUNNELING	640
<i>Dohta Awaji, Nobuharu Isago, Atsushi Kusaka, Kosuke Kawata</i>	
TECHNICAL ISSUES AND NECESSARY DESIGN ADAPTATIONS DURING CONSTRUCTION OF CONCRETE PLUGS FOR HYDROCARBON UNDERGROUND STORAGE: PRESENTATION OF FOUR CASES OF DESIGN CHANGES IMPLEMENTED DURING CONSTRUCTION.....	650
<i>Pascal Deschamps</i>	
UNDERGROUND CAR PARK IN THE ANCIENT “MORELLI” CAVERN IN NAPLES	660
<i>Massimiliano Bringiotti, Aldo Bellone, Francesca Rossano</i>	
THEY WANT TO DIG A 100-FOOT HOLE IN FRONT OF MY HOUSE FOR TWO YEARS!	670
<i>William P. Levy, Thomas Lindberg, Carlton M. Ray</i>	
TUNNELLING UNDER THE FRASER RIVER AT 6 BAR: DESIGN AND CONSTRUCTION OF THE PORT MANN MAIN WATER SUPPLY TUNNEL.....	682
<i>Stephanie Robillard, Steve Skelhorn, Tim Langmaid, Allen Mitchell</i>	
PRESSURIZED FACE TUNNELING UNDER VERY HIGH GROUNDWATER HEADS.....	692
<i>Steven W. Hunt</i>	
RELIABILITY OF SWELLING PRESSURE TESTING FOR TUNNEL SUPPORT EVALUATION.....	703
<i>Bjørn Nilsen</i>	
EVALUATION OF GROUND IMPROVING MEASURES TO PREVENT TBM JAMMING IN SQUEEZING GROUND.....	713
<i>Rohola Hasanpour, Jamal Rostami, Jürgen Schmitt</i>	
CONSTRUCTION PROGRESS OF THE OTTAWA LRT LINE: FROM EARLY DESIGN STAGES TO CURRENT CONSTRUCTION MILESTONES	723
<i>Franz Wilhelmstoetter, Christian Karner</i>	
COMPARISON BETWEEN SPRAYED AND CAST IN SITU CONCRETE SECONDARY LININGS AT BOND STREET AND FARRINGDON STATIONS.....	733
<i>Edward Batty, Nathan Bond, Eleanor Kentish, Alan Skarda, Simon Webber</i>	
PIPELINE TUNNELING BY CONNECTING CONVENTIONAL AND TBM METHODS UNDER HIGH GROUNDWATER PRESSURE.....	743
<i>Kazumori Jimbo, Jinya Mitsui, Kaoru Toya, Masafumi Matsumoto, Toshinori Tsuji, Tsunenori Shibata</i>	
TUNNEL EXCAVATION SOLUTION IN HIGHLY TECTONIZED ZONES: EXCAVATION THROUGH THE CONTACT BETWEEN TWO CONTINENTAL PLATES.....	753
<i>Fuoco Stefano, Zurlo Raffaele, Marini David, Pigorini Andrea</i>	
BACK ANALYSIS OF HIGH TUNNEL CONVERGENCES IN CLAYEY MARLS	763
<i>Edoardo Misano, Fabiola Espinoza Carmona, Elena Chiriotti</i>	
DESIGN AND CONSTRUCTION OF THE MANHATTAN SOUTH STRUCTURES CONTRACT OF THE EAST SIDE ACCESS PROJECT.....	773
<i>William Cao, Hamed Nejad, Alfredo Valdivia, Vincent Monaco</i>	
DESIGN CONSIDERATIONS FOR TOP-DOWN WALL CONSTRUCTION IN CARBONATE ROCK FOR OHIO RIVER BRIDGES—EAST END CROSSING TUNNELS.....	785
<i>Eric C. Wang, Charles A. Stone, Wern-Ping Nick Chen</i>	
THE NEW CABLE WAY ON THE MONT BLANC IN ITALY: UNDERGROUND CONSTRUCTION AT HIGH ALTITUDES.....	796
<i>Bragonzi Gianluca, Cancelli Paolo, Pelizza Sebastiano</i>	
INITIAL FILLING OF 15 KM LONG, 10.50 M DIAMETER VOLUMINOUS WATER CONDUCTOR SYSTEM CONSTRUCTED IN FRAGILE HIMALAYAN GEOLOGY.....	806
<i>Rakesh Sehgal, Pushkar Verma, Mohit Sharma</i>	

VOLUME 2

MANAGEMENT OF OBSTRUCTIONS AND ADVERSE GROUND CONDITIONS: SCL TUNNEL WORKS ON CROSSRAIL C300/410.....	817
<i>Olivia Perkins, Adrian St. John, Shawn Sismondi, Vicky Potts</i>	
TUNNELING SETTLEMENT EFFECT ON AN ESCALATOR SHAFT AT BOND STREET STATION UPGRADE.....	827
<i>Anita Wu</i>	
THE CALTANISSETTA TWIN TUNNEL: SEGMENTAL LINING DESIGN AND EPBS TBM PERFORMANCE DURING THE CONSTRUCTION OF THE 4KM-LONG Ø15.08M TUNNEL.....	838
<i>Georgios Kalamaras, Mario Liti, Filippo Avesani, Sebastiano Pelizza, Ivano Andreis</i>	

EVALUATION AND CONSTRUCTION IMPACT OF A DEEP EXCAVATION FOR THE 73-STORY WILSHIRE GRAND TOWER ON THE EXISTING METRO RED LINE TUNNELS IN DOWNTOWN LOS ANGELES	848
<i>John Yao, Matthew R. Crow, Yiming Sun, John T. Waggoner, Roozbeh Geraili Mikola, Martin B. Hudson</i>	
EFFECTS OF TUNNEL EXCAVATION ON HISTORICAL BUILDINGS BY A FULLY COUPLED SOIL-STRUCTURE INTERACTION 3D ANALYSIS: A CASE STUDY FROM COPENHAGEN "CITYRINGEN" METRO LINE	860
<i>Alessandro Damiani, Luisa Alfieri, Spencer Cavagnet, Sergio Notarianni, Giorgio Fantauzzi</i>	
CONSTRUCTION OF AN UNDERPASS CROSSING IN PROXIMITY OF A RAILWAY TRACK	873
<i>Satoshi Honda, Toshinori Takahashi, Hiroyuki Itoi, Mitsuru Shimizu, Hirokazu Izumi, Motoaki Kurisu, Tatsuji Nagao</i>	
SEISMIC PERFORMANCE OF WINE CAVES	883
<i>Andrew Kositsky, Scott Lewis</i>	
TUNNEL DEFORMATION MODE AND LOADING MAGNITUDE DURING LARGE EARTHQUAKE	893
<i>Atsushi Kusaka, Kosuke Kawata, Nobuharu Isago</i>	
TUNNEL DEFORMATIONS CAUSED BY COMPENSATION GROUTING AT CROSSRAIL FARRINGTON STATION	902
<i>Angelos Gakis, Thomas Schwind, Benedikt Grau</i>	
TIME-DEPENDENT DEFORMATIONS OF EXCAVATIONS AND TUNNELS IN THE GREATER TORONTO AREA	912
<i>Andrew Cushing, Jon Hurt, Joe Carvalho</i>	
ISTANBUL STRAIT ROAD TUNNEL PROJECT—SEISMIC JOINT AND PASSIVE FIRE PROTECTION IN DOUBLE DECK TBM TUNNEL	925
<i>Jaeung Kim, Dongho Lee, Mehmet Öztürk, Jinmoo Lee, Taek-Kon Kim, Basar Arioglu</i>	
ASSESSING THE INTERACTION BETWEEN THE EXCAVATION OF A LARGE CAVERN AND EXISTING TUNNELS IN THE ALPS	935
<i>Martino Semeraro, Edoardo Misano, Magali Schivre, Alain Bochon</i>	
3-DIMENSIONAL ANALYSIS OF EPB TBM OPERATION IN CLOSE PROXIMITY TO PILE FOUNDATIONS	945
<i>Mahmoud Sepehrmanesh, Verya Nasri, Maziar Partovi</i>	
BORED TUNNELLING IN CLOSE PROXIMITY TO BUILDINGS—SINGAPORE PRACTICES	954
<i>Teoh Yaw Poh, Qiao Yue Tung, Keat Chuan Chew</i>	
DYNAMIC INTERACTION BETWEEN RAILWAY TUNNELS AT MULTI-LEVELLED TUNNEL INTERSECTION	964
<i>Ho-Jong Kim, Kang-Hyun Kim, Jong-Ho Shin, Hoon-Ki Moon</i>	
LABORATORY TEST ON THE EFFECT OF RISK MITIGATION MEASURES AGAINST EARTHQUAKE FOR EXISTING ROCK TUNNEL	972
<i>Kosuke Kawata, Nobuharu Isago, Atsushi Kusaka</i>	
SEISMIC RESPONSE OF CYLINDRICAL TUNNEL WITH VOID BEHIND THE LINING BASED ON THREE-DIMENSIONAL ELASTODYNAMICS	982
<i>Naotoshi Yasuda, Kazuhiko Tsukada, Toshihiro Asakura</i>	
STRUCTURAL CONCEPTION OF AN UNDERCROSSING TUNNEL SUPPORTED BY PIPE CANOPIES: ANALYTICAL AND NUMERICAL SOLUTIONS OF A CASE STUDY	991
<i>Vinicius Resende Domingues, Bernardo Cascão Pires E Albuquerque, André Pacheco De Assis</i>	
STRUCTURAL IMPACTS TO TUNNELS DUE TO FLOODING	1000
<i>Raymond Sandiford, Taehyun Moon</i>	
TUNNELING IN CLOSE PROXIMITY TO STRUCTURES IN DOWNTOWN LOS ANGELES	1006
<i>Hong Yang, Shawna Von Stockhausen, Kevin Huynh, Derek Penrice, Tung T. Vu</i>	
CHICAGO TARP MCCOOK MAIN TUNNEL: WORLD'S LARGEST LIVE TUNNEL CONNECTION IS UNDERWAY AT CHICAGO'S TUNNEL AND RESERVOIR PLAN (TARP)	1016
<i>Faruk Oksuz, Miguel Sanchez, Mike Padilla, Dave Schiemann, Carmen Scalise, Matt Trotter</i>	
A NOVEL CONTINUOUS CONVEYOR SYSTEM AND ITS ROLE IN RECORD-SETTING RATES AT THE INDIANAPOLIS DEEP ROCK TUNNEL CONNECTOR	1025
<i>Dean Workman, Dan Martz, Stuart Lipofsky</i>	
DESIGNING AND BUILDING CSO TUNNELS IN MIDWESTERN GEOLOGY: A CRITICAL REVIEW AND STUDY OF PROJECT IMPLEMENTATION AND CONSTRUCTION METHODS	1032
<i>Paul Smith, David Day, Matthew Anderson</i>	
SQUEEZING GROUND: CONDITIONS & LESSONS LEARNED AT THE NEW IRVINGTON TUNNEL	1041
<i>Adam M. Wirthlin, Rebecca Fusee, Rick Nolting, Yiming Sun, David Tsztoo</i>	

CONSTRUCTION OF HEADRACE TUNNEL OF UMA OYA WATER CONVEYANCE PROJECT, SRI LANKA	1051
<i>Ataollah Rahbar, Jamal Rostami</i>	
EVALUATION OF THE PERFORMANCE OF A RAISE BORING MACHINE IN PB-ZN UNDERGROUND MINE, BALYA, TURKEY	1062
<i>Aydin Shaterpour Mamaghani, Tayfun Erdogan, Engin Dogan, Nuh Bilgin</i>	
SETTLEMENTS DUE TO BLASTING VIBRATIONS	1072
<i>Werner Bilfinger, Marcelo Waimberg, Claudio Nahas</i>	
THE DYNAMIC RESPONSE OF THE TARU-TOGE TUNNEL DURING BLASTING	1082
<i>Ö. Aydan, M. Imazu, M. Soya</i>	
GEOTECHNICAL INVESTIGATION OF A FAULT ZONE USING A HORIZONTAL GEOTECHNICAL BORING	1092
<i>Greg Sanders, James G. Shaughnessy, Michael Gilbert</i>	
AVOIDING KARST BY GETTING UNDER IT: JEFFERSON BARRACKS TUNNEL, ST. LOUIS	1102
<i>Patricia Pride, Jack Raymer, Kurt Bettger</i>	
OVERCOMING MASSIVE SQUEEZING GROUND UTILIZING CURVED TUNNEL FACE AND FULL-FACE EXCAVATION WITH EARLY RING CLOSURE	1110
<i>Hiroyuki Tamaru, Kosuke Tanimura, Atsuyuki Kimura, Futoshi Kusumoto</i>	
PERCUSSION DRILLING AS FAST AND EFFICIENT INVESTIGATION IN CONSTRUCTION STAGE: A CASE STUDY FROM KORALM BASE TUNNEL, AUSTRIA	1120
<i>Giorgio Höfer-öllinger, Peter Pointner, Manfred Stadlober</i>	
RECURSIVE REFINEMENT OF GEOTECHNICAL DESIGN FOR COPENHAGEN CITYRING METRO	1128
<i>Nataša Katic, Carsten Bonde, Georgios Kafantaris</i>	
THE WIDENING OF THE “MONTEDOMINI” A14 MOTORWAY TUNNEL IN THE PRESENCE OF TRAFFIC	1138
<i>Giuseppe Lunardi, Saverio Agresti, Donato Basta, Roberto Trapasso</i>	
NEW MAPPING TECHNOLOGIES FOR TUNNEL INSPECTIONS	1148
<i>Bernhard Spoerr, Chris Laughton</i>	
A COMPARISON BETWEEN MONITORING SOLUTIONS WITHIN SCL TUNNELS AT CROSSRAIL FARRINGDON STATION	1158
<i>Petr Salak, Angelos Gakis, Adrian St. John</i>	
EVALUATION OF ALTERNATIVE TECHNIQUES FOR EXCAVATION DAMAGE CHARACTERIZATION	1168
<i>Jeroen Van Eldert, Henrik Itner, Hakan Schunnesson, Daniel Johansson</i>	
NON-DESTRUCTIVE APPROACH FOR SHOTCRETE LINING STRENGTH MONITORING	1178
<i>Vishwajeet Ahuja, Benoit Jones</i>	
ROBOTIC APPLICATION OF A 50MM THICK SPRAYED CONCRETE FIREPROOFING LAYER	1188
<i>Edward Batty, Eleanor Kentish, Alan Skarda</i>	
SUCCESSFUL COMPLETION OF MAJOR LARGE-SCALE TUNNEL INFRASTRUCTURE PROJECTS IN THE SOUTHERN HEMISPHERE WITH XXL MACHINES	1199
<i>Karin Bäßler</i>	
AN ADVANCED SHAFT CONSTRUCTION METHOD TO INSTALL TEN VENTILATION SHAFTS, AS APPLIED IN THE NAPLES METRO PROJECT	1210
<i>Vittorio Manassero, Filippo Cavuoto, Antonello De Risi</i>	
ISTANBUL STRAIT ROAD CROSSING TUNNEL: PROJECT CHALLENGES AND TBM SOLUTIONS	1220
<i>Werner Burger, Ergin Arioglu</i>	
CRACK WIDTH REDUCTION IN REINFORCED CONCRETE MEMBERS USING BARCHIP MACRO-SYNTHETIC FIBERS	1232
<i>Erik S Bernard</i>	
DESIGN AND CONSTRUCTION ASPECTS OF PNEUMATICALLY APPLIED CONCRETE FINAL TUNNEL LININGS: RECENT EXPERIENCE AT THE EAST SIDE ACCESS (ESA) PROJECT IN NEW YORK	1242
<i>Vojtech Gall, Andrew J. Thompson, Alfredo Valdivia, William Cao, Curt Cicileo, Jesus Schabib</i>	
EXPERIENCES WITH SPRAY APPLIED WATERPROOFING MEMBRANES: EXPERIENCES AND INVESTIGATIONS WITH A EVA BASED MEMBRANE IN A TUNNEL ENVIRONMENT	1252
<i>Frank Clement, Karl Gunnar Holter</i>	
LIFETIME OF POLYETHYLENE GEOMEMBRANES FOR WATER PROOFING OF TUNNELS	1262
<i>Markus Haager, David Nitsche, Márton Bredács, Andreas Frank, Gerald Pinter</i>	

THE FIRST ADOPTION OF SOIL CEMENT STEEL DIAPHRAGM WALLS IN THE CONSTRUCTION OF UNDERGROUND RAILWAY STATION	1272
<i>Yasuhiro Morimoto, Koji Nakanishi, Masayoshi Karasawa</i>	
TUNNEL LINING FOR DRILL AND BLAST TUNNELS	1282
<i>Björn Johansson</i>	
REDEFINING SETTLEMENT CONTROL INDUSTRY STANDARDS WITH MODERN MECHANIZED EPB TUNNELLING: EGLINTON CROSSTOWN LRT TUNNEL CASE STUDY	1292
<i>A. Solecki, A. Taghavi, I. Hassan</i>	
OBSERVED LOADING BEHAVIOR DURING CROSS PASSAGE CONSTRUCTION	1302
<i>John Kuyt, Michael Mooney, Michele Mangione, Zili Li</i>	
EVALUATION OF SETTLEMENT MONITORING OVER 6.75 MILES OF TUNNELING: UPDATING PREDICTION METHODS AND DESIGNING BETTER MONITORING PROGRAMS	1312
<i>Lynn Salvati, Colin Lavassar, Lynette Sla, Joel Theodore, Loic Galisson</i>	
A CASE HISTORY: CONVERGENCE IN A SHEAR ZONE AT DEVIL'S SLIDE.....	1322
<i>Jeremy B. Decker, Paul H. Madsen</i>	
SAPROLITE TO HARD ROCK AND EVERYTHING IN BETWEEN: SEM TUNNELING THROUGH CORESTONE LADEN GROUND IN HONG KONG.....	1331
<i>Seth Pollak, Hannes Lager, Foteini Vasilikou, Gilles Cachia</i>	
UNDERPINNING AND INSTRUMENTATION: TEMPORARY STRUCTURES FOR CRITICAL SOLUTIONS	1344
<i>Eric Prantil, Jon Isaacson, Frank Perrone</i>	
ASSESSMENT OF PROGRESSIVE FAILURE OF AN EXPANDED CONCRETE SEGMENTALLY LINED TUBE TUNNEL	1354
<i>Peter Wright, Andrew Thomson</i>	
EVALUATION OF ROCK MASS STIFFNESS AHEAD OF TUNNEL FACE BY SMALL DIAMETER INCLINOMETERS	1365
<i>Takuya Tani, Kazuo Saskai, Tomoyuki Aoki</i>	
USE OF SATELLITE RADAR INTERFEROMETRY (INSAR) TO MONITOR URBAN TUNNELING PROJECTS—REAL CASE APPLICATIONS	1374
<i>Loic Galisson</i>	
HOW GEODETICAL MEASUREMENTS HELP TO REDUCE COSTS AND RISKS IN TUNNELING	1384
<i>Oliver Schneider, Martin Wehrli</i>	
MONITORING AND DATA MANAGEMENT CHALLENGES AT THE METRO PROJECT CITYRINGEN COPENHAGEN.....	1393
<i>Klaus Chmelina, Klaus Rabensteiner</i>	
PERFORMANCE OF NATM HARD ROCK TUNNELLING FOR LARGE SPAN MINED TUNNEL UNDERNEATH CROSS HARBOUR TUNNEL	1403
<i>Conrad Ng, Peter Poon, Tim Leung, Lawrence Tsang</i>	
SURFACE SETTLEMENTS DUE TO A SHALLOW TUNNEL EXCAVATION IN SOFT GROUND: A CASE STUDY OF THE ZIZHI TUNNEL IN HANGZHOU, CHINA.....	1415
<i>Penglu Gan, Yu Zhao, Xiaowu Tang, Jinjie Zou, Chenglang Pan</i>	
VICTORIA STATION UPGRADE: PROTECTION OF SENSITIVE STRUCTURES DURING TUNNELLING	1426
<i>Paul Pandrea, Robert Essler, Paul Marsden</i>	
PIPE JACKING BIG TIME!.....	1436
<i>Klaus Rieker</i>	
PUSHING THE LIMITS OF SLURRY MICROTUNNELING AND DIRECT PIPE® IN NORTH AMERICA.....	1446
<i>Gerhard Lang</i>	
SHALLOW MICROTUNNELING BELOW A CRITICAL RUNWAY.....	1456
<i>Matthew Grzelak, David R. Chapman, Gulsah Erinc</i>	
DISASTER AVERTED AFTER MTBM/ACTIVE GAS MAIN COLLISION: UTILIZING CAPTIVATING CASE HISTORIES TO EDUCATE STAKEHOLDERS WITH REGARDS TO TUNNELING IN URBAN ENVIRONMENTS	1467
<i>Martin Dix, Rory P. A. Ball, Mark Briggs</i>	
MECHANIZED TUNNELLING DRIVING TORONTO'S BIG MOVE: EGLINTON-SCARBOROUGH CROSSTOWN TUNNEL CONSTRUCTION (ECLC1-15)	1477
<i>Jumpei Yamashita, Malcolm Sheehan, Osamu Nishikokura, Darrell Liebno</i>	
LESSONS LEARNED FROM EPB AND SLURRY TUNNELING IN GLACIALLY DEPOSITED SOILS IN SEATTLE, WASHINGTON, USA.....	1486
<i>Gary Nishimura, Shinichi Konda</i>	

CROSSRAIL C310 THAMES TUNNEL—MIXSHIELD TBM TUNNELING IN ALTERNATING GROUND CONDITIONS WITH LOW OVERBURDEN	1495
<i>Andreas Rädle, Chris Ashton, Taner Aydogmus</i>	
TUNNELING WITH FULL FACE SHIELDED MACHINES: A STUDY ON THE BACKFILLING OF THE TAIL VOID	1505
<i>Ravi Shah, Daniele Peila, Augusto Lucarelli</i>	
PROPERTIES AND REQUIREMENTS OF TWO-COMPONENT GROUTS IN MECHANIZED TUNNELING	1515
<i>Bou-Young Youn, Christoph Schulte-Schrepping, Rolf Breitenbücher</i>	
A MECHANIZED TUNNELLING INNOVATION—RING PIPE JACKING METHOD (RPJM).....	1525
<i>Zhi Liu, Yun Bai, Ang Cheng</i>	
EFFECTS OF COVER DEPTH ON GROUND MOVEMENTS INDUCED BY SHALLOW TUNNELLING	1534
<i>Minh Ngan Vu, Wout Broere, Johan Bosch</i>	
KEY TECHNOLOGIES OF LARGE RECTANGULAR PIPE JACKING MACHINE	1545
<i>Yali Han, Lianhui Jia</i>	
SIMULATION-BASED ANALYSIS OF MAINTENANCE STRATEGIES FOR MECHANIZED TUNNELING PROJECTS	1555
<i>Hannah Mattern, Markus Scheffer, Alena Conrads, Markus Thewes, Markus König</i>	
STABILIZING FLOWING SANDS ON THE MILLWOODS DOUBLE BARREL REPLACEMENT PROJECT: UNITING ACADEMIA AND THE "REAL WORLD" FROM FIELD TO LAB TO FIELD	1567
<i>James J. Brady, Chadi El Mohtar, Kenneth L. Faught, Chaoshi Hu</i>	
DSU TBM FOR VISHNUGAD PIPALKOTI: TBM DESIGN DEVELOPMENT FOR LARGE DIAMETER ROCK TUNNELS UNDER THE HIGH COVERS OF THE HIMALAYA	1577
<i>Remo Grandori</i>	
COMPARISON OF SHEAR ELEMENTS FOR CROSS PASSAGES IN TBM-TUNNELS	1587
<i>Benno Ring</i>	
JINHAE GEOJE SUBSEA TUNNEL TBM DESIGN AND PERFORMANCE EVALUATION	1599
<i>Dae Young Kim, Ebrahim Farrokh, Ki Chang Hyun, Jun Ho Lee</i>	
ENCAPSULATED OIL ADDITIVE APPLICATION IN EARTH PRESSURE BALANCED (EPB) TUNNELING – A CASE STUDY	1609
<i>Lisa Mori, Ehsan Alavi, Cliff Baratta, Timothy Dobbs, Bryce Sullivan</i>	
EXPERIMENTAL STUDY ON THE EFFECTS OF HIGH-CONCENTRATED LOADS EXERTED BY TBM HYDRAULIC JACKS	1619
<i>Antonio Conforti, Giuseppe Tiberti, Giovanni Plizzari, Sandro Moro</i>	
DCCR CASE STUDY ON GUIDELINES FOR ACHIEVING AN EXTENDED DESIGN LIFE IN CSO PROJECTS	1629
<i>Christopher Caruso, Zachary Spera, Thomas Hennings, Joel Kantola, Richard Stacy Kinchen, William Levy, Moussa Wone</i>	

VOLUME 3

120-YEAR DESIGN LIFETIME OF PLASTICS	1639
<i>Stefan Lemke, Martin Eckl, Martin Londschien</i>	
THE PRACTICAL IMPORTANCE OF ACCOUNTING FOR LARGE DEFORMATIONS IN TUNNEL ANALYSIS AND DESIGN	1650
<i>Apostolos Vrakas, Georgios Anagnostou</i>	
INFLUENCE OF FIBRES ON THE CREEP BEHAVIOUR OF REINFORCED SPRAYED CONCRETE	1657
<i>Catherine Larive, Damien Rogat, David Chamoley, André Regnard, Thibaut Pannetier</i>	
DESIGN OF INCLINED BRACELESS EXCAVATION SUPPORT WITH INCLINED BUTTRESS APPLICABLE TO DEEP EXCAVATION	1667
<i>Yoichi Shimada, Katsuyuki Nishida, Yasushi Okada, Sigehiko Sugie, Shinichi Takahashi, Taichi Terui, Kazumori Oshiro, Yohei Nakamichi</i>	
ANALYSIS OF TUNNEL GROUTING AND WATER PRESSURE TESTS IN RAMPUR HYDROELECTRIC PROJECT (412MW), SJVN LIMITED, INDIA	1677
<i>Ashok Kumar Chadha, Ramesh Kumar Chauhan, Manwendra Pratap Singh, Umakant Sharma</i>	
ASSESSMENT OF LINING PERFORMANCE OF TUNNELS BUILT IN CEMENTED FINE-GRAINED STIFF SOILS	1688
<i>Juan Manuel Mayoral, Damián Vital, Daniel De La Rosa</i>	

CHALLENGES IN THE DESIGN OF SEGMENTALLY LINED TUNNELS FOR COMBINED SEWER OUTFALLS	1698
<i>Rodolfo D. Aradas, Juan M. Fernandez, Anthony Harding, Darío Tsingas</i>	
CROSSING FAULT ZONES: DETAILED ANALYSIS FOR RADIOACTIVE WASTE REPOSITORY DESIGN	1708
<i>Dániel Borbély, Tamás Megyeri, Vera Szántó, László Kovács</i>	
DESIGN OF A LARGE DIAMETER GALLERY FOR A NUCLEAR WASTE STORAGE PROJECT: APPLICATION TO THE FRENCH REPOSITORY PROJECTS (CIGEO)	1718
<i>Roland Plassart, François Laigle, François Martin</i>	
ENHANCEMENT OF SEISMIC RESISTANCE OF REINFORCED CONCRETE MEMBERS USING EMBOSSED MACRO-SYNTHETIC FIBERS	1728
<i>Erik S Bernard</i>	
EXPERIMENTAL INVESTIGATION ON THE STATIC SHEAR STIFFNESS OF AN IMMERSION JOINT	1743
<i>Wenhao Xiao, Luc Taerwe, Yong Yuan</i>	
MINNE LUSA STORMWATER CONVEYANCE SEWER PROJECT – OMAHA, NE	1753
<i>Mahmood Khwaja, Daryl Poduska, Prakash Donde, Todd Wanless</i>	
SKewed PORTAL APPROACH FOR STEEP SLOPES	1763
<i>Darío Ángel Bulla, Leonardo Rosas Sánchez</i>	
STRUCTURAL ANALYSIS OF COMPOSITE SUPPORT FOR TUNNEL DESIGN CONSIDERING THE PERFORMANCE OF STEEL SETS	1773
<i>Han-Kyu Yoo, Jung-Joo Kim, Jong-Uk Kim, Turab H. Jafri</i>	
TUNNELS FOR THE MURUM HYDROELECTRIC PROJECT: PRESSURE TUNNELS	1781
<i>Carlos A. Jaramillo, Seng Hing Ngu</i>	
UNDERGROUND SPACE FOR OIL MINING	1789
<i>Bill Zietlow, Mohamed Gamal</i>	
ADVANCED PLANNING FOR NORTHEAST OHIO REGIONAL SEWER DISTRICT’S CLEAN LAKE PROGRAM YIELDS COST SAVINGS AND REDUCES RISKS: A CASE STUDY IN BALANCING HYDRAULIC PERFORMANCE AND TUNNEL ENGINEERING CHALLENGES	1795
<i>Kellie Rotunno, Doug Lopata, Tim O’Rourke, Kevin Vander Tuig, Dan Dobbels, Rick Vincent</i>	
PROCUREMENT, PROGRAM MANAGEMENT, RISK, AND FINANCING OF UNDERGROUND PROJECTS: CHANGING THE PARADIGM	1805
<i>Moussa Wone, David H. Corkum, Carlton M. Ray, William W. Edgerton</i>	
ISTANBUL STRAIT ROAD TUNNEL PROJECT – FROM CONCEPT TO OPERATION	1813
<i>Basar Arioglu, Seok Jae Seo, Mustafa Tanriverdi</i>	
COMPARISON BETWEEN BORED TUNNEL AND IMMERSed TUNNEL OPTIONS DEVELOPED FOR THE SILVERTOWN TUNNEL BENEATH THE RIVER THAMES	1825
<i>Jonathan Baber, Jason Saldanha, Andrew Evans</i>	
GEOTECHNICAL INVESTIGATIONS AND PRELIMINARY DESIGN FOR THE LBNF FAR SITE CONVENTIONAL FACILITIES	1835
<i>Jon Hurt, Seth Pollak, Mark Havekost, James Schick, David Vardiman</i>	
GROUND INVESTIGATION AND TUNNEL DESIGN FOR THE LIANTANG/HEUNG YUEN WAI BOUNDARY CONTROL POINT AND ASSOCIATED WORKS	1848
<i>Guy Bridges, Owen Ng, Elton Ko, Giovanni Chang, Robert Anderson, Cheng Ting Ning</i>	
THE 3D GEOLOGICAL MODEL OF THE KARAVANKE TUNNEL, USING LEAPFROG GEO	1858
<i>Tina Živec, Marko Žibert</i>	
RECENT SWEDISH STUDIES ON THE EXTENT OF BLAST DAMAGE AFTER EXCAVATION	1868
<i>Henrik Itner, Urban Åkeson, Rolf Christiansson, Mats Olsson, Daniel Johansson</i>	
LARGE-SCALE RENOVATION WORK TO IMPROVE OPERATION IN THE TOKYO SUBWAY NETWORK: PLANS TO IMPROVE TURN-BACK FACILITIES BETWEEN IIDABASHI STATION AND KUDANSHITA STATION	1878
<i>Yasushi Arai</i>	
A SHEAR-WAVE SEISMIC SYSTEM TO LOOK AHEAD OF A TUNNEL BORING MACHINE	1886
<i>Pawan Bharadwaj, Guy Drijkoningen, Wim Mulder, Thomas Tscherner, Rob Jenneskens</i>	
ADVANCE EXPLORATION BY STOCHASTIC INVERSION OF TUNNEL SEISMIC WAVES: A NUMERICAL STUDY	1896
<i>Luan T. Nguyen, Tamara Nestorovic</i>	
ARCHITECTURE IN A HIGH-TECH UNDERGROUND STRUCTURE DESIGN: NAPES EXPERIENCE	1907
<i>Ignazio Carbone</i>	

BIM USE IN THE INFRASTRUCTURAL FIELD: THE CASE OF THE EXTENSION OF THE RAILWAY IN THE UNDERGROUND TRACK OF CATANIA, FROM THE CENTRAL STATION F.S. TO THE AIRPORT	1917
<i>Luca Schiavinato, Stefano Colombelli, Gabriele Eccher, Domenico Nave, Paolo Cucino, Nicola Bona</i>	
DURABILITY DESIGN REQUIREMENTS FOR REINFORCED CONCRETE UNDERGROUND STRUCTURES	1926
<i>Michael Joye, Pooyan Asadollahi, Praveen Krishna</i>	
EXPLORING THE BENEFITS OF ADDITIONAL CONVEYANCE TUNNELS FOR THE CHICAGO AREA'S COMBINED SEWER SYSTEM	1936
<i>Carmen Scalise, Kevin Fitzpatrick, Patrick Jensen</i>	
GOOD PROJECT MANAGER/BAD PROJECT MANAGER: A TRAINING DOCUMENT	1946
<i>James Wonneberg, William Edgerton</i>	
PREDICTING ANOMALOUS ZONE AHEAD OF TBM TUNNEL FACE UTILIZING ELECTRICAL RESISTIVITY	1955
<i>Jinho Park, Kang-Hyun Lee, Byung-Kyu Kim, Seoung-Won Lee, In-Mo Lee</i>	
RIYADH METRO TBM CONSTRUCTION AND KNOWLEDGE TRANSFER	1965
<i>Anas Almousa, Henning Schwarz, Ade Ogunsola</i>	
SUBSURFACE INVESTIGATIONS AND PRELIMINARY DESIGN CONSIDERATIONS OF THE MONTREAL METRO BLUE LINE EXTENSION PROJECT	1975
<i>Jean Habimana, Giovanni Osellame</i>	
THE MUSAIIMEER OUTFALL TUNNEL: VENTURING INTO UNCHARTED TERRITORY OF SUB-SEA SABKHA DEPOSITS	1985
<i>Ulf Georg Gwildis, Mohammad Reza Jafari, Mike Hall, Tim Kelly</i>	
URBAN TUNNELING IN SAN FRANCISCO: A REPLACEMENT FOR SEISMIC RESILIENCY AND REDUNDANCY	1995
<i>Manfred Wong, Art Hamid, Carlos Jaramillo, John Caulfield, Greg Raines</i>	
CONSTRUCTION OF THE SR-99 TBM RECOVERY SHAFT	2005
<i>John Starceovich, Lance Rasband, Richard Hanke</i>	
INCLINED SHAFTS DRILLED BY A RAISE BORING MACHINE AND MGS MAGNETIC GUIDANCE EQUIPMENT—PARATRACK II	2014
<i>Matteo Cortinovia, Giuseppe Gelmi</i>	
SLURRY WALLS, TIEBACKS, AND TIEDOWNS: MAXIMIZING THE EFFICIENCY OF UNDERGROUND STATION SPACE	2024
<i>James Parkes</i>	
GROUND TREATMENT FOR RISK MITIGATION DURING TUNNELLING AT THE PORT OF MIAMI	2035
<i>Roger Storry, Donald Bruce, Arnaud Hochart</i>	
MEASUREMENT OF GROUT INJECTION PRESSURE IN SITU	2045
<i>Lloyd Tunbridge, Elisabeth Tønnesen</i>	
BREAKING THROUGH: SHAFT DESIGN AND CONSTRUCTION CONSIDERATIONS FROM MIAMI'S NORRIS CUT PROJECT	2055
<i>Boris Caro Vargas, Richard Giffen, Terrence Carroll</i>	
GROUND FREEZING TO REPAIR LEAKS IN A SLURRY WALL SHAFT	2069
<i>Shawn P. Coughlin, Michael A. Schimmenti, Juan Leonardo Tello Del Pino</i>	
GROUND FREEZING FOR CONSTRUCTION AT THE PORT OF MIAMI TUNNEL	2079
<i>Roger Storry, Olivier Martin, David Harris, Arnaud Hochart</i>	
CONVENTIONAL EXCAVATION OF CONNECTING TUNNELS IN C13 METRO STATION (POLAND—WARSAW—LINE 2)	2089
<i>Massimiliano Bringiotti, Ferdinando De Angelis, Marco Aurelio Piangatelli</i>	
COMBINED GROUND FREEZING APPLICATION FOR THE EXCAVATION OF CONNECTION TUNNELS FOR CENTRUM NAUKI KOPERNIK STATION—WARSAW UNDERGROUND LINE II	2099
<i>Achille Balossi Restelli, Elena Rovetto, Andrea Pettinaroli</i>	
METRO ROME LINE "C": ARTIFICIAL GROUND FREEZING APPLICATION FOR THE UNDERPASS OF THE EXISTING METRO STATION SAN GIOVANNI, LINE "A"	2109
<i>Alessandro Bertero, Ferruccio Cribari, Amerigo Tanzi, Salvatore Fancello, Tommaso Gondolini, Fabio Giannelli, Massimo Lodico, Mauro D'Angelo, Eliano Romani</i>	
MODELLING OF TUNNEL SETTLEMENT INDUCED BY TRAIN VIBRATION CONSIDERING DIFFERENT BOUNDARY PERMEABILITY CONDITIONS	2120
<i>Qiang Huang, Hong-Wei Huang, Dong-Mei Zhang, Bin Ye, Feng Zhang</i>	
PERFORMANCE BENEFITS OF COLLOIDALLY MIXED TWO-COMPONENT GROUTS	2131
<i>Philip Antunes, A. E. (Tony) Reschke</i>	

SPRAYED CONCRETE FOR FROZEN GROUND IN HONG KONG	2139
<i>Kenny Lo</i>	
THE DESIGN OF DEEP ROCK SHAFTS OF THE RONDOUT-WEST BRANCH BYPASS TUNNEL	2149
<i>Christopher E. Dianora, Matthew Sorrell, Eileen Test</i>	
RESOLVING DIFFICULT PUBLIC TRANSPORTATION TUNNELING PROBLEMS THROUGH THE CONDUCT OF INDUSTRY PEER REVIEWS	2159
<i>Martin P. Schroeder</i>	
RISK MANAGEMENT IN TUNNELING: A REVIEW OF CURRENT PRACTICES AND NEEDS FOR FUTURE DEVELOPMENT FROM THE DESIGNER'S PERSPECTIVE	2167
<i>Piergiorgio Grasso, Moreno Pescara, Luca Soldo</i>	
MULTIPHASE RISK MANAGEMENT METHOD (MRMM) AND ITS APPLICATION IN QUASI RECTANGLE SHIELD TUNNEL IN CHINA	2177
<i>Ang Chen, Yun Bai, Yanfei Zhu, Gang Li, Xiangdong Hu</i>	
USE OF NUMERICAL MODELLING AND GIS TO ANALYSE AND SHARE THE RISKS RELATED TO URBAN TUNNELLING: GREATER PARIS - RED LINE - SOUTH SECTION	2187
<i>Samy Mahdi, Fatima-Zahra Houmymid, Elena Chiriotti</i>	
RISK MANAGEMENT – CORRELATION AND DEPENDENCIES FOR PLANNING, DESIGN AND CONSTRUCTION	2198
<i>Philip Sander, A. Moergeli, John Reilly</i>	
RISK MANAGEMENT OF LONG AND DEEP TUNNELS—THE EUROPEAN EXPERIENCE	2209
<i>Yves Boissonnas, Marco Bettelini</i>	
RISK MANAGEMENT FOR SOFT GROUND TUNNELS IN NEW YORK	2219
<i>Andy Thompson, Frank Perrone</i>	
AVOIDING DISPUTES ON CHALLENGING GROUND CONDITIONS IN THE LAKE MEAD INTAKE NO. 3 TBM STARTER TUNNEL	2229
<i>Jim Nickerson, Marcus Jensen, Erika Moonin</i>	
RISK SHARING PRINCIPLES IN TUNNEL CONTRACTS	2238
<i>Eivind Grøv</i>	
ROAD-TESTING THE ITA CONTRACTUAL PRACTICES CHECKLIST	2248
<i>Alan Hodgkinson, David Caiden, Petros Fortsakis</i>	
CHALLENGES IN ADAPTING TUNNEL CONSTRUCTION CONTRACTS TO ACTUAL GROUND CONDITIONS	2257
<i>Lena Paar</i>	
CMAR DELIVERY METHOD ON THE LAKE MEAD INTAKE NO. 3 LOW LAKE LEVEL PUMPING STATION	2265
<i>Jordan Hoover, Erika Moonin, Chuck George</i>	
CONSIDERATIONS FOR A DISTRICT-LEVEL, TUNNEL-RISK, SCREENING TOOL	2272
<i>Ehsan Moradabadi, Debra F. Laefer</i>	
DECISION ANALYSIS OF ALTERNATIVE CONTRACTING STRATEGIES FOR TUNNEL PROJECTS: CONTRACTING STRATEGY CAN MAKE OR BREAK A PROJECT WHERE THE SUCCESS IS MEASURED WITH KEY PERFORMANCE INDICATORS	2280
<i>Cary Hirner, Faruk Oksuz, Ray Brainard</i>	
DEVELOPMENT AND EXECUTION OF A RISK TRANSFER STRATEGY FOR THE EGLINTON CROSSTOWN LRT	2290
<i>Brian T. Hamilton, Cian Murphy, Richard Piliounis</i>	
EMPLOYING A UNIQUE PROCUREMENT PROCESS FOR THE CITY OF OTTAWA COMBINED SEWAGE STORAGE TUNNEL	2302
<i>Gerald Bauer, Colin Goodwin, Steve Courtland, Randy Dempsey</i>	
MEGAPROJECTS: 50 YEARS, WHAT HAVE WE LEARNED?	2312
<i>John Reilly</i>	
PREDICTED RISKS VERSUS ACTUAL OUTCOMES: FOUR RECENT U.S. ROCK TUNNEL PROJECTS	2326
<i>Lee W. Abramson, Daniel McMaster, Andrew J. Thompson, Michael Vitale</i>	
QUALITY MANAGEMENT SYSTEM ON SOUND TRANSIT UNDERGROUND CONSTRUCTION PROJECTS	2337
<i>Mohammad Saleem, Indra Banerjee, Kevin Sapp, Jim Salley</i>	
SHOULD THE TBM OPERATORS BE CERTIFIED?	2346
<i>Dan Ifrim, Steve Skelhorn</i>	
TBM RISK MANAGEMENT SYSTEM CONSIDERING PREDICTED GROUND CONDITION AHEAD OF TUNNEL FACE: METHODOLOGY DEVELOPMENT AND APPLICATION	2356
<i>Hee-Young Chung, Jeongjun Park, Seok-Won Lee, Hangseok Choi, In-Mo Lee</i>	

TUNNEL LOSSES: CAUSES, IMPACT, TRENDS AND RISK ENGINEERING MANAGEMENT	2366
<i>Thomas Konstantis, Spyridon Konstantis, Panagiotis Spyridis</i>	
RHEOLOGY OF FOAM-CONDITIONED SANDS IN EPB TUNNELING	2377
<i>Mario Galli, Markus Thewes</i>	
A MODEL TO PREDICT THE PERFORMANCE OF EPB-TBMS IN A COMPLEX GEOLOGY IN ISTANBUL	2387
<i>Nuh Bilgin, Mucahit Namli, Hanifi Copur, Cemal Balci, Aydin Shaterpour Mamaghani</i>	
PRESSURE DISTRIBUTION ALONG THE TBM BODY IN EPB TUNNELING	2397
<i>Brian Hagan, Ehsan Alavi, Glen Frank, Michael A. Diponio, Lisa Mori, Michael Mooney</i>	
ANALYSIS OF EFFECT OF WATERHEAD ON STABILITY OF EXCAVATION FACE OF SLURRY BALANCED SHIELD	2409
<i>Zhong-Nian Yang, Quan-Wei Liu, Ming-Yi Zhang, Xiao-Ming Guan</i>	
SHIELD TUNNELING IN PURE SANDS: MERGING THE APPLICATION FIELDS OF EPB AND SLURRY SHIELD TECHNOLOGIES	2421
<i>Ulrich Maidl, Marc Comulada, Carlos Henrique Turolla Maia, Julio Claudio Di Dio Pierri</i>	
EARTH PRESSURE BALANCE TBM SOIL CONDITIONING: IT'S ABOUT THE PRESSURE	2433
<i>Mike Mooney, Yuanli Wu, Lisa Mori, Rick Bearce, Minsu Cha</i>	
STUDY OF WEAR IN CONDITIONED GRANULAR SOIL BY USING A NEW TEST DEVICE	2445
<i>Cristina Gabriela Oñate Salazar, Daniele Martinelli, Carmine Todaro, Daniele Peila, Alessandro Boscaro</i>	

VOLUME 4

PERFORMANCE OPTIMIZATION IN CLOGGING SOILS THROUGH PROCESS CONTROLLING	2455
<i>Ulrich Maidl, Marc Comulada, Janosch Stascheit</i>	
TRANSIENT FACE SUPPORT IN SLURRY SHIELD TUNNELING DUE TO DIFFERENT TIME SCALES FOR EXCAVATION SEQUENCE OF CUTTING TOOLS AND PENETRATION TIME OF SUPPORT FLUID	2465
<i>Markus Thewes, Britta Schoesser, Zdenek Zizka</i>	
AN EXPERIMENTAL APPARATUS TO ESTIMATE THE SHEAR STRENGTH OF CONDITIONED SOIL FOR EPB	2475
<i>Daniele Martinelli, Rodrigo Winderholler, Daniele Peila</i>	
ASSESSMENT OF EPB SOIL CONDITIONING ON TWO TBMS BY USING APPARENT DENSITY	2482
<i>Lisa Mori, Mike Mooney, Ehsan Alavi, Glen Frank, Michael Diponio</i>	
MICROSCOPIC AND EXPERIMENTAL ANALYSIS OF THE TRIBOLOGICAL SYSTEM OF TBM TOOLS	2494
<i>J. K�pferle, A. R�ttger, W. Theisen, M. Alber</i>	
SOIL CONDITIONING IN DOHA METRO PROJECT—QATAR	2504
<i>Andrea Picchio, Dal Negro Enrico, Boscaro Alessandro</i>	
THE INTERPLAY OF FACE SUPPORT PRESSURE AND SOIL PERMEABILITY ON FACE STABILITY IN EPB TUNNELING	2514
<i>Panagiotis Sitarenios, Dimitrios Litsas, Michael Kavvadas</i>	
USING LABORATORY TESTING FOR DESIGNING AN OPTIMUM FIELD GROUT FOR THE MILLWOODS DOUBLE BARREL REPLACEMENT PROJECT	2524
<i>Chadi El Mohtar, James J. Brady, Ritika Sangroya, Hamza Jaffal, Wing Shun Kwan, Anna Kate Miller</i>	
NATIONAL TUNNEL INSPECTION PROGRAM: MANUAL FOR TUNNEL OPERATIONS, MAINTENANCE, INSPECTION, AND EVALUATION	2534
<i>William Bergeson</i>	
OPTIC FIBER STRUCTURAL MONITORING SYSTEM FOR PAVONCELLI BIS HYDRAULIC TUNNEL	2544
<i>Gabriele Eccher, Michele Caponero, Roberto D'Angelis, Paolo Cucino</i>	
INSPECTION EQUIPMENT STUDY ON SUBWAY TUNNEL DEFECTS	2554
<i>Yan Sun, Yadong Xue, Hongwei Huang, Fei Wang</i>	
INNOVATIVE REHABILITATION APPROACH FOR OVERSTRESSED EXISTING LININGS USING AN ADAPTABLE YIELDING SUPPORT SYSTEM	2563
<i>Axel G. Nitschke, Wolfgang Dolsak, Vojtech Gall, Ingo Ossenb�hl</i>	
HYDRAULIC ASSESSMENT AND REHABILITATION OF A DEEP STORMWATER TUNNEL	2574
<i>Michael Haggerty, Brandon Barnes</i>	

UNEXPECTED POST-EXCAVATION DAMAGE TO A 28"-THICK SEGMENT LINING: FAILURE MECHANISM AND REHABILITATION MEASURES	2584
<i>Jens Classen, Martino Gatti</i>	
REHABILITATION OF FARNWORTH TUNNELS: MODIFYING VICTORIAL TUNNELS FOR THE 21ST CENTURY	2596
<i>Eoin Murphy, Stephen Beauchamp, Steven Cowell</i>	
THE FOUR FATES OF THE 140-YEAR-OLD BALTIMORE AND POTOMAC TUNNEL	2606
<i>Kyle R. Ott, William A. Prosser Jr., Philip Rice</i>	
THE LIGHT AT THE END OF A 40 YEAR OLD TUNNEL: RETROFITTING OF AN EXISTING TUNNEL AS PART OF THE NEW SECOND AVE SUBWAY PROJECT, NEW YORK.....	2616
<i>Michael Trabold, Richard Giffen, Pablo Lemus</i>	
ACCELERATING TUNNEL INSPECTIONS USING SCANNING TECHNOLOGY	2626
<i>Raymond E. Sandiford, Nasri Munfah</i>	
ALTERNATIVE STUDY OF REHABILITATION OPTIONS FOR HEROES TUNNEL: A NEW APPROACH	2631
<i>Mohammad R. Jafari, Larry Murphy, Sharat K. Kalluri, David M. Giel</i>	
DEVELOPMENT OF NON-DESTRUCTIVE INSPECTION METHOD FOR CONCRETE ELEMENTS IN TUNNEL LININGS USING REMOTE LASER SENSING	2641
<i>Norikazu Misaki, Toshihiro Asakura, Naotoshi Yasuda, Yoshinori Shimada, Oleg Kotiaev, Masahiro Shinoda, Hiroaki Sakamoto</i>	
EFFICIENT LIGHTING FOR THE PRESIDIO PARKWAY TUNNELS.....	2648
<i>Pierre Longtin</i>	
LIFE-CYCLE COSTING: AN ECONOMIC APPROACH TO EVALUATE THE OPERATIONAL EQUIPMENT OF TUNNELS	2658
<i>Hans Adden, Markus Thewes, Anne Lehan</i>	
STRUCTURAL RETROFITTING OF OLDER GERMAN ROAD TUNNELS—POSSIBILITIES TO FULFILL CURRENT REQUIREMENTS REGARDING STRUCTURAL FIRE PROTECTION	2673
<i>Ingo Kaundinya</i>	
VOID DETECTION BEHIND TUNNEL LINER UTILIZING GROUND PENETRATING RADAR	2683
<i>Tyler A. Dawson, Ryan P. Butler, Jason R. Edberg, Timothy Gualandri</i>	
TBM TECHNOLOGY FOR AN AUSTRALIAN COAL DRIFT: THE GROSVENOR PROJECT	2693
<i>Enrico Dal Negro, Richard Schulkins, Robert Marks</i>	
HARD-ROCK TBM CUTTER LIFE EVALUATION: A CASE STUDY OF NS3 PROJECT MIXSHIELD TBM.....	2701
<i>Ki Chang Hyun, Ebrahim Farrokh, Dae Young Kim, Sim Bo Kyung</i>	
DOUBLE DISC CUTTER CONSUMPTION OF AN EPB TBM IN TUZLA WASTEWATER TUNNEL	2711
<i>Utku Gumus, Ugur Altay, Ahmet Rifai Bilgin, Ertan Bostanci, Hanifi Copur</i>	
AGED HARD ROCK TBM PROVES ITS VALUE FOR SECOND AVENUE SUBWAY PROJECT IN NEW YORK CITY	2721
<i>Taehong Kim, Changsoo (Kevin) Moon, Anil Parikh</i>	
SUBSEA TUNNELS SUPPLY WATER TO THE DRIEST PLACE ON EARTH.....	2733
<i>Stephen O'Connell, Cary Hirner, Ross Webb, Dan Lopez</i>	
THE FOLLO LINE PROJECT: A LARGE PROJECT THAT INCLUDES A COMPLEX EXCAVATION OF THE LONGEST RAILWAY TUNNEL IN NORWAY	2743
<i>Anne Kathrine Kalager</i>	
LAKE MEAD INTAKE NO. 3: THE TBM TUNNELING EXPERIENCE.....	2752
<i>R. Schuerch, P. Perazzelli, J. Nickerson, C. Cimiotti, G. Anagnostou</i>	
STUDY OF TBM PERFORMANCE PREDICTION USING ROCK MASS CLASSIFICATION	2762
<i>Alireza Salimi, Christian Moormann, Jamal Rostami</i>	
MDC'S HARTFORD, CONNECTICUT SOUTH TUNNEL PROJECT: INTEGRATING SITE INVESTIGATION TECHNOLOGY, GEOLOGY AND GEOTECHNICAL ENGINEERING FOR EFFECTIVE GROUND CHARACTERIZATION	2772
<i>Robin Dill, Leo Martin, Wei Song, Andrew Perham</i>	
ANALYSIS OF TBM PERFORMANCE AND DISC CUTTER CONSUMPTION IN YINHANJIWEI WATER CONVEYANCE TUNNEL PROJECT	2784
<i>Ya-Dong Xue, Zhen-Xing Diao, Feng Zhao</i>	
ASSESSMENT OF ROCK CUTTING EFFICIENCY BY TBM DISC CUTTER USING SPH/FE MODELLING	2797
<i>Ho-Young Jeong, Seokwon Jeon</i>	

IMPACT OF CUTTER RING DESIGN ON TBM PERFORMANCE IN EXCEPTIONALLY HARD ROCK: CASE STUDY OF TBM TUNNELING IN HARD ROCK FORMATION IN UMA OYA PROJECT, SRI LANKA	2807
<i>Ataollah Rahbar, Jamal Rostami, Jürgen Paulzen</i>	
NUMERICAL EVALUATION AND OPTIMIZATION OF GROUT BACKFILL STRATEGY FOR A SUBSURFACE GAS TUNNEL	2818
<i>Deepak Kandra, Davar Abi-Zadeh, Cillian Brown</i>	
PERFORMANCE PREDICTION OF TBMS USING A NEW GENERATION OF PORTABLE LINEAR ROCK CUTTING MACHINE PLCM	2828
<i>Cemal Balci, Ramazan Comakli, Can Polat, Deniz Tunc, Hanifi Copur, Nuh Bilgin</i>	
RIYADH METRO DESIGN AND CONSTRUCTION: DESIGN AND CONSTRUCTION ON THE FAST TRACK	2837
<i>Henning Schwarz, Anas Almousa, Faisal Al Arifi</i>	
SPECIAL SUPPORT SYSTEMS USED FOR THE EXECUTION OF A HYDROTECHNICAL GALLERY EXCAVATED IN DIFFICULT GEOLOGICAL CONDITIONS	2847
<i>Alexandru Corneliu Stematiu, Catalin Popescu, Radu Sarghiuta</i>	
THE NEXT GENERATION OF TBMS AND CONVEYOR SYSTEMS FOR MINING APPLICATIONS	2857
<i>Dennis Ofiara, Greg Watson</i>	
THE SHORTCUT: A SUBSEA RAIL TUNNEL BETWEEN SWEDEN AND GERMANY	2869
<i>Robert Sturk, Knut O Halvorsen</i>	
THE BRENNER BASE TUNNEL	2878
<i>Romed Insam, Michael Rehbock-Sander</i>	
THE PLANNING FOR ULTRA LONG SUBSEA TUNNEL PROJECT UNDER HIGH WATER PRESSURE	2888
<i>Seon-Hong Kim, Ki-Lim Kim, Eui-Joon Hong, Chan-Dong Kim, Young-Joon Lee, Jung-Hum Lee, Keon-Woong Jeong</i>	
DESIGN FOR THE BOLTED AND GASKETED SEGMENT LINING FOR THE BYPASS TUNNEL WITH HIGH HEAD CONDITIONS	2898
<i>Paolo M. Brion, Z. Bade Sozer</i>	
ESPEJO DE TARAPACÁ: AN INNOVATIVE PUMPED HYDRO STORAGE FACILITY IN CHILE WITH MANY CHALLENGES FROM A ROCK MECHANICAL POINT OF VIEW	2908
<i>T. Marcher, S. Bauer, C. Mathiesen, M. Allende</i>	
DIGGING TO THE BEACH: THE FINAL DESIGN OF THE JWPCP EFFLUENT OUTFALL TUNNEL PROJECT	2916
<i>David Haug, D. Yankovich, J. Kaneshiro, G. Hughes</i>	
PLANNING AND CONSTRUCTION OF TUNNELS BELOW THE SUEZ CANAL IN VERY SOFT SOIL CONDITIONS UNDER COMPLEX CIRCUMSTANCES	2926
<i>Roland Trunk, Yves Boissonnas, Jan Vesely, Marcel Imbach</i>	
DESIGN OF THE UNDERGROUND STRUCTURES OF THE RAILWAY LINK BETWEEN THE TOWN OF THUMRAIT AND THE PORT OF SALALAH: SEGMENT 4C OF THE “OMAN NATIONAL RAILWAY PROJECT”	2936
<i>Pedone Ezio Michele, Mohamed Dahir Holad</i>	
ADVANCED TECHNICAL STUDIES FOR TUNNEL ENLARGEMENT IN HONG KONG	2946
<i>Roger Storry, Daniel Altier, Vincent Tricot</i>	
SEPARATING UNDERGROUND METRO LINES UNDER OPERATION IN BAKU	2956
<i>Federico Valdemarin, Jan Cenek, Elena Chiriotti</i>	
TURNING GRAY INTO GREEN: EMPHASIZING THE SUSTAINABLE BENEFITS OF TUNNEL PROJECTS	2966
<i>Brian Gettinger, Alston Noronha, Jim Schlaman</i>	
SERVICE LIFE PREDICTION FOR THE OHIO RIVER BRIDGE EAST END CROSSING TUNNEL	2977
<i>Wern-Ping Nick Chen</i>	
THE CROSSRAIL EXPERIENCE	2988
<i>Bill Tucker, Mike Black</i>	
COPENHAGEN CITYRINGEN PROJECT: URBAN MINING CHALLENGES IN CONTAMINATED GROUND	2998
<i>Valerio Violo, Antonio Raschillà, Livia Cicinelli</i>	
SPOIL MANAGEMENT AT ALPTRANSIT CENERI BASE TUNNEL: KEY ELEMENTS FOR A SUCCESSFUL NATURAL RESOURCE MANAGEMENT	3008
<i>Paolo Lanfranchi, Emanuele Catelli, Manuel Petitat, Paolo Vicentini</i>	

ON THE VIBRATION INDUCED BY SHIELD TUNNELING THROUGH GRAVEL FORMATIONS	3018
<i>Keh-Jian Shou</i>	
HIGH QUALITY REBUILDS FOR ENSURING RESOURCE AND ECOLOGICAL EFFICIENCY IN TUNNELING	3027
<i>Olivier Kraft, Olaf Kortz</i>	
PLANNING THE UNDERGROUND: HOW UNDERGROUND SOLUTIONS CAN INFORM CONTEMPORARY CITY URBAN DESIGN	3037
<i>Stefano Ceccotto, Eugenio Trussoni</i>	
CHALLENGES IN METRO CONSTRUCTION IN INDIA	3047
<i>Paul Nicholas, Raju Gottumukkala</i>	
70-FOOT-DEEP SHEET PILE COFFERDAMS DRIVEN BY THE PRESS-IN PILING METHOD	3057
<i>Lee Roesner, Takayuki Sakai, Takefumi Takuma</i>	
CARBON-EMISSION CALCULATION OF LARGE SHIELD TUNNELING—BASED ON DATA-MINING METHODOLOGY	3064
<i>Xuehui Zhang, Huiming Wu, Qiaosong Li, Yun Bai</i>	
DC WATER FIRST STREET TUNNEL – INTEGRATED ENGINEERING AND CONSTRUCTION	3074
<i>Ravi Jain, Ivan Hee, Stephen Njoloma, Mina Shinouda</i>	
DESIGN AND CONSTRUCTION ASPECTS OF CSO TUNNEL AND PUMP STATION SYSTEMS	3084
<i>Verya Nasri, James Sullivan, Alex Varas</i>	
NAPOLI UNDERGROUND	3095
<i>Antonello De Risi, Paolo Prevedini</i>	
NEW SOLUTIONS APPLIED TO USUAL TUNNELLING OPERATIONS: CROSSRAIL C305	3105
<i>Alejandro Sanz, Enrique Fernández, Juan Ares, Francisco González</i>	
REVIVING BURIAL IN TUNNELS	3116
<i>Arik Glazer</i>	
SOUND TRANSIT EAST LINK—DOWNTOWN BELLEVUE TUNNEL	3122
<i>Derek Penrice, Jeff Schutt, Jerry Dorn, Joe Hachey</i>	
THE FIRST EPB TBM TUNNELING APPLICATION IN NEW YORK CITY AND ITS COMPLETION THROUGH SUPERSTORM SANDY	3135
<i>Andrew Cho, Changsoo (Kevin) Moon, Richard Flanagan, Brian Larsen</i>	
THE SECOND METRO LINE IN WARSAW—LESSONS LEARNT	3148
<i>Monika Mitew-Czajewska, Anna Sieminska-Lewandowska</i>	
TBM OPERATION CHALLENGES AT DTL3 C931 PROJECT IN SINGAPORE	3158
<i>Ebrahim Farrokh, Dae Young Kim, Bo Kyung Sim, Jae Won Lee</i>	
SOFT GROUND TUNNELING UNDER A MAJOR PROVINCIAL HIGHWAY IN ONTARIO: SHEPPARD EAST LRT, TORONTO	3168
<i>Hiva Mahdavi, Verya Nasri, Kevin Akbarpour</i>	
FROM BUILDING INFORMATION MODELING TO REAL-TIME SIMULATION IN MECHANIZED TUNNELING: AN INTEGRATED APPROACH APPLIED TO THE WEHRHAHN-LINE DUSSELDORF	3178
<i>A. Alsahly, V. E. Gall, A. Marwan, J. Ninic, G. Meschke, A. Vonthron, M. König</i>	
PORT MANN MAIN WATER SUPPLY TUNNEL—GROUND FREEZING THE TBM FACE UNDER THE FRASER RIVER	3187
<i>Joseph A. Sopko, Behzad Khorshidi, Brian McInnes</i>	
INFLUENCE OF EPB-TBM HEADING CONFINEMENT PRESSURE ON SURFACE SETTLEMENTS: COMPARISON BETWEEN 3D FE NUMERICAL PREDICTIONS AND IN SITU MEASUREMENTS	3198
<i>Jean-Pierre Janin, Pierre Renier, Anne Bergère, Hervé Le Bissonnais</i>	
EXPERIENCES GAINED IN HETEROGENEOUS GROUND CONDITIONS AT THE TWIN TUBE EPB SHIELD TUNNELS IN SAO PAULO METRO LINE 5	3208
<i>Marc Comulada, Ulrich Maidl, Marco A. Peixoto Silva, Gustavo Aguiar, Argemiro Ferreira</i>	
IMPACT OF TUNNELING ON PILE STRUCTURES ABOVE THE TUNNEL: EXPERIMENTAL STUDY ON A 1G REDUCED SCALE MODEL OF TBM	3219
<i>J. Bel, D. Branque, H. Wong, G. Viggiani, N. Losacco</i>	
AN EMPIRICAL RELATIONSHIP FOR PREDICTING THE SURFACE SETTLEMENT DUE TO EPB-TBM EXCAVATION – CASE STUDY: MASHHAD METRO LINE 2	3230
<i>Behnam Eslami, Aliakbar Golshani</i>	
COMPARISON BETWEEN CALCULATED AND ACTUAL FACE PRESSURES IN EPB TBMS—CASE STUDIES IN SEATTLE, WA	3240
<i>Ehsan Alavi, Glen Frank, Brian Hagan, Colin Lavassar, Lisa Mori, Derek Dugan, Rick Capka</i>	

EPB BYPASS AND HANGING OF 2.6 M DIA. SEWER UNDER LIVE FLOW CONDITIONS.....	3253
<i>Jordan A. Schreiner, Matthew Geary, Stephen J. Marino</i>	
EVALUATION OF 3D FE PREDICTIONS OF GROUND MOVEMENTS CAUSED BY EPB TUNNELING IN STIFF CLAY	3263
<i>Vasiliki Founta, Andrew J. Whittle</i>	
TREATING PEAT-SOIL OVER SÃO PAULO METRO LINE 5: ENABLING 10.6M EPB SHIELD ADVANCE UNDER DRAINAGE GALLERY FOUNDATIONS.....	3272
<i>Akira Koshima, José Ricardo Lopes, Alfredo Dacio Moraes Filho, Marco Gomes, Alaor Coelho Jr</i>	
Author Index	