

**World Tunnel Digital Congress 2020**  
**11 - 16 September 2020 (Live Event)**  
**17 - 23 September 2020 (On Demand Event)**

**Post Show Report**

**Registered Users**

AUTHORS	272
DELEGATES	655
EXHIBITORS	169
<b>TOTAL</b>	<b>1,096</b>

**Logged In Users**

	Day 1	Day 2	Day 3	Day 4	Day 5	TOTAL
	11-09-2020	12-09-2020	14-09-2020	15-09-2020	16-09-2020	
AUTHORS	0	0	94	102	110	306
DELEGATES	58	89	184	154	157	642
EXHIBITORS	0	0	86	79	80	245
<b>TOTAL</b>	<b>58</b>	<b>89</b>	<b>364</b>	<b>335</b>	<b>347</b>	<b>1,193</b>

	Day 6	Day 7	Day 8	Day 9	Day 10	TOTAL
	17-09-2020	18-09-2020	19-09-2020	20-09-2020	21-09-2020	
AUTHORS	85	47	15	13	24	184
DELEGATES	117	50	15	11	22	215
EXHIBITORS	59	25	9	5	24	122
<b>TOTAL</b>	<b>261</b>	<b>122</b>	<b>39</b>	<b>29</b>	<b>70</b>	<b>521</b>

	Day 11	Day 12				TOTAL
	22-09-2020	23-09-2020				
AUTHORS	15	25				40
DELEGATES	25	37				62
EXHIBITORS	22	25				47
<b>TOTAL</b>	<b>62</b>	<b>87</b>				<b>149</b>

**On-Demand Playback Count (not including Live views)**

<b>Total Views</b>	<b>3,283</b>
--------------------	--------------

Day 1	11-09-2020
-------	------------

Sub-Total	690
-----------	-----

Welcome and Opening	88
Overview of mega underground infrastructure development in Malaysia (Khoo Chee Min)	86
Challenges Related to Ground water on Underground Works (Ooi Lean Hock)	90
Underground Sustainable Solutions for Urban Planning	85

'A Guide for Young Professionals- Navigating the legal professional landscape as a tunnelling professional in a big and diverse world (Arnold Dix- ITA vice President)	72
The reuse of tunnel excavation material - Challenges (Robert Galler - ITA-CET committee chairman)	80
Tunnelling health and safety - moving forward (Donald Lamont - WG5)	74
Specific Funding Sources for Underground Structures (Harald Wagner)	63
Innovations in Conventional Tunnelling (Nasri Munfah - WG19)	52

Day 2	12-09-2020	Sub-Total	1,101
Welcome Address by SYTA Organising Chairman		80	
Address by IEM WTC2020 and TUSTD Chairman		79	
Address by ITAym Chair		78	
Presentation 1: Excavating in Weak Ground, where Risk of Landslide is High, T.Suzuki		76	
Presentation 2 : Features of Urban-Ring method adopted for construction of underground structures, Y.Suenaga		75	
Presentation 3 : Challenges in Tunnelling - UGC02 Mumbai Metro Line -3, A.K. Chaudhary		75	
Presentation 4 : Tunnelling in Granites : Case study of a highway project in Afghanistan, A. Chauhan		75	
Presentation 5 : Construction of INA Metro Station over Operational Twin Tunnels, by Mr V.K. Sattawan		73	
Presentation 6 : A Comparison of Empirical and Numerical Approaches for Estimating Rock Support Pressure on Tunnel Lining, F.K.L. To		73	
Presentation 7 : On blow-out in tunnelling and a case study in Ho Chi Minh Metro Line 1, M.N. Vu, N.T. Dung		72	
Presentation 8 : Ground Vibration Study in Karstic Limestone Formation for Controlled Blasting Works in Klang Valley, N. Ravichandran		71	
Presentation 9 : Design of steel fiber reinforced concrete segment with curved radial joints, S.S Nirmal		71	
Presentation 10 : Tunnelling in an urban environment and managing 3rd party interfaces in London, by Mr. D. Bandopadhyaya		70	
Future Plans for 2nd SYTA by ITAym Steering Board		68	
Closing Remarks		65	

Day 3	14-09-2020	Sub-Total	650
Welcome Speech by WTC2020 Organising Chairman, Ir. Dr Ooi Teik Aun		95	
Speech by ITA President, Prof. Jenny Yan		85	
Speech by Minister of Tourism, Arts and Culture Malaysia, YB Dato Sri Hajah Nancy Shukri		84	
Speech by IEM President, Ir. Ong Ching Loon		79	
Landmark Lecture on Three-dimensional Tunnel-tunnel and Tunnel pile Foundation Interactions : Centrifuge and Numerical Modelling by Prof. Charles WW Ng		79	
Keynote Lecture 1 on High-precision Acquisition, Analysis and Service of Rock Tunnel Information Based on is3 Platform by Prof. HeHua Chu		78	
Keynote Lecture 2 on Geosynthetics in Tunnel Construction - A Tunneller's Perspective by Prof. Chungsik Yoo		75	
Keynote Lecture 3 on Future Engineers - Application of BIM and Digital Engineering Advancement for The Design and Delivery of Underground Mass Rapid Transit Project in Malaysia by Er. Poh Seng Tiok		75	

Day 4	15-09-2020	Sub-Total	578
Necessity is the Mother of All Inventions: Inventions and Innovations in SMART Project by Mr Param Sivalingam		83	
Lessons Learned from TBM Tunneling in Singapore's Tropical Weathered Rock Formations by Dr. Ruben Duhme, General Manager, Herrenknecht Asia Headquarters		83	
Design of Badaling Great Wall Station of the Beijing-Zhangjiakou High-Speed Railway by LV Gang and Liu Jianyou		76	
Resequencing TBMs to Avoid Project Delays by Mr. Alexander William Terry, Mass Rapid Transit Corporation Sdn Bhd (MRTC), Director of Tunnels and Underground Structures		73	
Managing Geological Risk Across 2 Metro Lines in Kuala Lumpur by Ir. Dr Ooi Lean Hock		72	
In Pursuit of the Autonomous TBM by Mr. Ng Hau Wei		67	

Amplification of Safety Risks Within the Tunnel Environment by Mr. Christopher John Fenton	61
Moderator Q&A Deck	63

<b>Day 5</b>	<b>16-09-2020</b>	Sub-Total	264
Closing Ceremony Emcee			52
Closing Report by WTC 2020 Organising Chairman			88
Video of Copenhagen WTC 2021			74
End of Congress			50

#### Booth's Visit Count

Booth's Visit Count			Total Visit	7,352
No	Sponsor / Exhibitor	Booth Number	Total Visit	
1	ITA-AITES	PA1	407	
2	WTC 2020	PA2	570	
3	MyCEB	PA3	205	
4	MMC GAMUDA KVMRT (T) SDN BHD	PB1	261	
5	CCCC	PB2	229	
6	NORMET INTERNATIONAL LTD	PB7	241	
7	BASF	PC1A	218	
8	CHINA RAILWAY ENGINEERING EQUIPMENT GROUP CO., LTD	PC4	162	
9	HERRENKNECHT AG	PC5	225	
10	MAPEI UTT	PC6	194	
11	ACCIONA CONSTRUCCI&Oacute;N, S.A.	PC7	154	
12	SIKA	GS3	124	
13	NORWEGIAN TUNELLING SOCIETY	GS4	105	
14	Turkish Road Association	GS5	57	
15	ORICA	GS7	77	
16	TPH - Waterproofing Systems	GS8	76	
17	BEKAERT	GS9	104	
18	&Ouml;STU-STETTIN HOCH- UND TIEFBAU GmbH	GS10	79	
19	E-BERK TUNNEL TECHNOLOGIES	GS11	96	
20	TERRATEC LTD.	GS12	145	
21	TRADECC	GS13	64	
22	LIEBHERR-COMPONENTS AG	GS14	95	
23	ARCELORMITTAL FIBRES	GS15	97	
24	THYSSENKRUPP ROTHE ERDE GmbH	GS16	78	
25	THE ROBBINS COMPANY	GS17	132	
26	Cireco (MALAYSIA) Sdn Bhd	GS18	49	
27	MC-BAUCHEMIE	GS19	95	
28	ETEX BUILDING PERFORMANCE	GS20	53	
29	DSI Underground	GS21	100	
30	WCT BERHAD	GS22	107	
31	GREEK TUNNELLING SOCIETY - OFFICIAL CANDIDATE FOR WTC2023	GS23	86	
32	Liaoning Censcience Industry Co., Ltd	SS1	69	
33	JAPAN TUNNELLING ASSOCIATION	SS3	125	

34	Denka CO. LTD	SS4	67
35	ZITR&Oacute;N	SS5	59
36	Chr. Mayr GmbH + Co. KG	SS6	45
37	SOIL INSTRUMENTS (M) SDN BHD	SS7	49
38	MARTI TECHNIK AG	SS8	62
39	SANDVIK MINING AND ROCK TECHNOLOGY	SS9	68
40	VMT GmbH	SS10	56
41	DEXTRA	SS11	63
42	BARCHIP ASIA PTE. LTD.	SS14	89
43	ADFIL NV	SS15	59
44	ASSOCIATION FRANÇAISE DES TUNNELSET DE L'ESPACE SOUTERRAIN (AFTES)	SBP2	71
45	PALMIERI GROUP	SBP3	68
46	CP TECHNOLOGY	SBP4	54
47	IMPIANTI SDN BHD	SBP5	56
48	ENGRO CORPORATION LIMITED	SBP6	49
49	IDS GeoRadar - part of Hexagon	SBP7	54
50	WASTE & ENVIRONMENTAL TECHNOLOGIES LTD	SB1	84
51	ToughCrete Steel Fibres	SB2	51
52	DAEIN CO. LTD.	SB3	51
53	HILTI CORPORATION	SB4	49
54	MESSE BERLIN GmbH	SB5	44
55	SENCEIVE LTD	SB6	52
56	WEBAC-CHEMIE GmbH	SB7	60
57	KOSTEEL CO. LTD	SB8_SB9	70
58	Morgan Advanced Materials - Thermal Ceramics	SB10	49
59	SAS Asia Bar Systems Pte. Ltd.	SB11	55
60	ZHEJIANG PRETEC METAL PRODUCTS CO. LTD	SB12	44
61	BROKK AB	SB14	45
62	SVILUPPO TECNOLOGIE MECCANICHE (STM)	SB15	45
63	MAI INTERNATIONAL GmbH	SB16	41
64	FISCHERWERKE GMBH & CO.KG	SB17	47
65	GEODATA ZT GmbH	SB18	51
66	MIGHTY SHIELD INDUSTRIES SDN BHD	SB19	56
67	MINE SITE TECHNOLOGIES PTY LTD	SB20	40
68	AMBERG GROUP LTD	SB21	95
69	NINGBO JINTAI FASTENER CO. LTD	SB23	47
70	AECOM	SB24	85
71	TUNELMAK CONSTRUCTION MACHINERY INC	SB25	52
72	DESOI GmbH	SB26	55
73	FORTA INNOVATIVE CONSTRUCTION	SB27	46
74	EPC GROUPE	SB28	38
75	ENCARDIO RITE ELECTRONICS PVT. LTD	SB29	37
76	A.S.T. BOCHUM GmbH	SB30	46
77	JAMES HARDIE EUROPE GmbH	SB32	20
78	BABENG GmbH	SB34	49

**Technical Paper Presentation**

<b>Total Views</b>	<b>16,560</b>
--------------------	---------------

No	Paper ID	Title	Author	Views
1	Paper ID 130	Galleria Olmata, from Survey to Construction: an Integrated Design Approach for the Renewal of Railway Tunnels	Federico Foria, Riccardo Giordano, Davide Tommasi and Gabriele Miceli	758
2	Paper ID 338	ZhangJiHuai Railway project &dash; The Use of a New Innovative System for Scanning In A Drill & Blast Excavation	Chuan Deng, Shuan Xiao and Oliver Schneider	656
3	Paper ID 006	Kolkata EW Metro &dash; Removal of Abandoned H-Piles Using NATM in Soft Ground to Facilitate the TBM Operations in Package UG02	Harvinder Rana, Alvaro Casaus, Leonid S. Troitski and Eshita Mishra	568
4	Paper ID 011	Advantages of Mechanized Tunnelling in Confined Urban Area Using the Example of Grand Paris Express	Karin B&auml;ppler,&nbsp;&nbsp;Michael Str&auml;sser&nbsp;&nbsp;and&nbsp; Fr&eacut e;d&eacute;ric Battistoni	218
5	Paper ID 022	Investigations into Heaving of Railway Roadbed in Mountain Tunnels and Effect of Countermeasure Work	Koichiro Mizuno, Minoru Komiyama, Syoichi Asada, Takeru Kubohara and Masahiko Tomori	172
6	Paper ID 008	Modelling the Palaeotopography of Bedrock Hidden by Urban Development	Helen Baxter-Crawford, Ceinwen J. Mackay, Kimberley Saffian and Trevor G. Carter	168
7	Paper ID 374	The Brenner Base Tunnel, Selected Aspects of Tunnelling Works at the Austrian	Michael Rehbock-Sander and Romed Insam	168
8	Paper ID 194	Identification of a Fine &lsquo;Tuff&rsquo;; Lamination in the Rouse Hill Siltstone Member of the Ashfield Shale, Sydney Basin, Australia and Its Implications	David J. Och,&nbsp;&nbsp;Sven Thorin,&nbsp;&nbsp;Ian T. Graham,&nbsp;&nbsp;Robert S. Nicoll&nbsp;&nbsp;and&nbsp; Geoff Bateman	160
9	Paper ID 035	Innovations in the Use of Fibre Reinforced Precast Segmental Tunnel Linings in Klang Valley Mass Rapid Transit Project	Mohd Yusri Bin Mustafha, Ray Mun Chin, Reynaldo Lamson, Hazwan Arif Bin Hamzah and Logesan Ranjeevan	157
10	Paper ID 012	Verification and Proposal of the Segment Design Method, Considering Construction Loads on Shield Curved Alignment Portions at Great Depths and Under High Water Pressure	Masayuki Matsuura, Jun Sugiyama, Takumi Nirei and Toshiyuki Suenaga	154
11	Paper ID 036	The Pursuit of an Autonomous Tunnel Boring Machine	John Lim Ji Xiong, Sam Liew Kit Shen, Russell Jon Batty and Justin Chin Jing Ho	147
12	Paper ID 120	LTA Contract T219: Platform Link between TEL Orchard Station and NSL Orchard Station	Thomas Friedl,&nbsp;&nbsp;Nay Lin Maung&nbsp;&nbsp;and&nbsp; Chandrasegaran Sundararaju	140
13	Paper ID 013	Design of Large Span and Shallow Ramp Tunnels	Shijie Liu and David Oliveira	134

14	Paper ID 025	Influence of Radial Joints in Segmental Lining 3D Modelling	Alessandro Rama, Matteo Ceccarelli, Matteo Iacorossi and Rob Harding	134
15	Paper ID 152	Design and Construction of the Montreal Largest Transit System	Verya Nasri, Xavier De Nettancourt, Philippe Patret and Thomas Mitsch	121
16	Paper ID 591	Construction of Single Twin-Track Railway Tunnel in Kenny Hill Formation at Serdang, Malaysia	Lee Loong Tat, Athirah Kelana and Mohamad Shahril Zaidon	117
17	Paper ID 038	An Overview of TBM Tunnels in Hong Kong	Shu Fan Chau, Chor Kin Tsang and Jessica Sun	116
18	Paper ID 015	Comparison of Interior Structures in Expressway Tunnels	Yuki Murata,&nbsp;Tetsuo Ito,&nbsp;Shinobu Kaise,&nbsp;Hitoshi Katoh&nbsp;and&nbsp;Hiroyuki Oneyama	111
19	Paper ID 028	Characteristics and Comparison of Various Seismic Sources for Tunnel Seismic Prediction Method	Al Adzam Shah Bin Azman, Dohta Awaji, Hidesato Kojima and Ryou Hemmi	110
20	Paper ID 103	Tunnel Shotcrete Linings &ndash; Recent Experiences from Design and Certification of Tunnels in Sydney, Australia	Sabrina Kost&nbsp;and&nbsp;Sang Chun	108
21	Paper ID 059	Full-scale Tests on Precast Tunnel Segments with Newly High Performance Steel Fibre	Benoit De Rivaz	105
22	Paper ID 019	Minimization of Compensation Measures Based on a Probabilistic Risk Simulation Concept	Markus Obel and Peter Mark	97
23	Paper ID 086	Earthquake Impacts to A Tunnel at Fault Zone and Its Repair	Shu Fan Chau, Roque Alea and Mark Stocks	97
24	Paper ID 065	Mega Transport Projects and Politics: East Coast Rail Link, Malaysia	Hongkok Wang,&nbsp;Cheemin Khoo&nbsp;and&nbsp;Teikaun Ooi	95
25	Paper ID 254	A Study on the Criteria for Rehabilitation of Old Mountain Tunnels Considering the Risk on Damages by Big Earthquake	Keiki Urakawa, Hisashi Hayashi and Masato Shinji	92
26	Paper ID 114	Some Double Shield TBM Behaviours Tunnelling through Rock Fault in Water Diversion Project in Northern Thailand	Wiwat Phukamchat, Thanu Harnpattanapanich, Kompanart Kwansirikul and Jitaphol Rodploy	91
27	Paper ID 014	Investigation on Middle Flow Tunnel Lining Concrete Using Thickener-containing Fluidizing Agent	Yoshikatsu Maeda,&nbsp;Tetsuo Ito,&nbsp;Shinobu Kaise,&nbsp;Yuuki Murata&nbsp;and&nbsp;Hiroshi Yagi	90

28	Paper ID 233	Evaluation of Slurry TBM Performance Through Challenging Rock Conditions in Singapore	Fauzan Reza Maulana, Rasa Rasanavaneethan, Nikolaos Gklotsos and Chris Knight-Hassell	89
29	Paper ID 320	Ground Improvement for Shallow Overburden of Bored Tunnels: Case Study of 8th Drive in Klang Valley MRT Line 2	Xin Hui Poon and Guofeng Zhang	88
30	Paper ID 062	Impact and Back Analysis of Deep Excavation on Existing MRT Line under Complex Surrounding Conditions	Yuqian Zhou, Jinrong Yuan, Sowhon Leong and Xiaochun Xiao	87
31	Paper ID 057	Public Funds and Accountability - Keep Mega Underground Infrastructure Projects Free from Corruption	Arnold Dix	85
32	Paper ID 048	Application of Design and Construction Management System for Underground Cavern	Myung Kyu Song, Dae Young Kim and Ebrahim Farrokh	83
33	Paper ID 079	Support Design for the Largest Cavern in Hong Kong and Thoughts on Improved Design and Construction Approaches for Future Large Caverns	Ivan Haryono, Phil Woodmansey and Szymon Kowalczyk	83
34	Paper ID 216	BIM-based Design of Underground Works for the Réseau Express Métropolitain (REM) Project in Canada	Theodora Vovou, Kiseok Jeon and Verya Nasri	81
35	Paper ID 221	Uncertainty Assessment of Fault Zones in 3D Geologic Models of Mountain Tunnels	Ashton Krajnovich, Wendy Zhou and Marte Gutierrez	80
36	Paper ID 256	New Development in Durable Segments for Utility Tunnels	Ralf Winterberg and Mike Garbeth	80
37	Paper ID 055	TBM Risk Assessment and Selection for Hydropower Tunnels	Dean Brox	79
38	Paper ID 133	Progress in Small Diameter Tunnelling: Challenges and Technology	Peter Schmalz and M. Lübbert	79
39	Paper ID 164	Investigation into the Stabilizing Effect of Pipe Umbrellas	Artem Syomik and Georg Anagnostou	78
40	Paper ID 225	Effects of EPB Shield Tunnelling on Ground Surface Settlements: A Case Study in Kenny Hill Formation	Chee Min Khoo, Thanath Gopalan, Nurfatimah Afifah Abdul Rahman and Alexander William Terry	78
41	Paper ID 094	TBM Cutting Performance in Hard and Abrasive Granite in Hong Kong	Ivan S. Haryono, J.N. Shirlaw, T.O. Henderson, F. Dudouit and D. Salisbury	77

42	Paper ID 298	Challenges of Tunnelling below the Operating Pasar Seni LRT Station, Kuala Lumpur	Chee Min Khoo, Alan Chiew Soon Teoh, Alexander William Terry and Kong Fuat Yau	77
43	Paper ID 078	Fire Safety Strategy in Metro Projects &dash; The Case of the &ldquo;Metro Bucharest Line 4 Extension&rdquo; Project	Marco Bettelini, Alberto Arigoni and Catalin Boroianu	77
44	Paper ID 177	Taking Advantage from Building Information Modelling and Digital Data Management in TBM Tunnelling	Felix Hegemann,&nbsp;Janosch Stascheit, and Ulrich Maidl	75
45	Paper ID 063	Construction Simulation of Large Diameter TBM Tunnelling in a Sharp Curve Alignment in Soft Clay Using 3D Numerical Analysis	Yuqian Zhou, Jinrong Yuan, Tingxuan Du and Xiaochun Xiao	74
46	Paper ID 359	The Three Rivers Protection &amp; Overflow Reduction Tunnel (3RPORT) &dash; Slurry TBM Operation in Difficult Ground Conditions	Paolo Perazzelli, Roberto Schuerch, Giuseppe Moranda, M. Piemontese, Ludovica Pizzarotti and Emidio Tamburri	74
47	Paper ID 073	A STUDY OF EXCAVATION PERFORMANCE OF DONUT-SHAPED TUNNEL BORING MACHINE BY EXCAVATION TESTS ON HIGH STRENGTH MORTAR SPECIMENS	Kokichi Kabuki, Mitsuo Takeda and Yukinori Koyama	73
48	Paper ID 102	Considerations on the Practical Development of the Geotechnical Baseline Report (GBR) for the FIDIC Emerald Book and Similar Contract Forms	Alexandre R.A. Gomes	73
49	Paper ID 222	Strategic Underground Space and Cavern Development	Antonia Cornaro,Marco Bettelini and Michael Rehbock	72
50	Paper ID 061	Importance of Identifying Defects Which Occur during Tunnel Construction for Maintenance, and Examples of Such Defects	Daisuke Kobayashi and Masahiro Nakata	71
51	Paper ID 453	Durability of Shotcrete Tunnel Linings due to Steel Fibre Corrosion in Cracks	Anders Ansell, Erik Nordstr&ouml;m and Larissa Str&ouml;mbergDurability of Shotcrete Tunnel Linings due to Steel Fibre Corrosion in Cracks	71
52	Paper ID 084	Excavating a Metro Tunnel under a Lake with an EPB TBM Used for Istanbul 3th Airport	Ali Aslanbas and Nuh Bilgin	70
53	Paper ID 167	The Challenge of TBM Push-through and Mine-through in Malaysia MRT Line 2	Feng Qingyuan, Du Zhiyun, Huang Bing and Cheng Yuan	70
54	Paper ID 280	Overcoming the Ethical and Engineering Challenges in the Planning, Design and Construction of &quot;La L&iacute;nea&quot; Tunnel (8.6 km) in the Central Andean Mountain Range,	Paola Castillo and Germ&acute;n Pardo	68
55	Paper ID 123	Innovations Introduced in the Mechanized Excavation of the Tunnel Included in the Extension Project of the Dubai Metro	Rolando Justa Camara	68



56	Paper ID 384	Design and Construction of the Deepest North American Underground Station - Station &acute;douard-Monpetit, Montreal, Canada	Virginie Urli, Verya Nasri and Agustin Rey	66
57	Paper ID 105	A Comparative Experimental Study on Precast Tunnel Segments	Oguz Tengilimoglu,&nbsp;Ugurhan Akyuz, Erhan Talu and Selcuk Mert	66
58	Paper ID 391	Finite Element Evaluation of Tunnel-Piled Structure Interaction in Complex Ground Conditions	Frankie Peng Leong Cheah, Teik Aun Ooi, Chee Min Khoo, Law Kim Hing and Mohd Ashraf Mohd Ismail	66
59	Paper ID 116	Brussels Metro North: Design and Technical Challenges	Laurence Delplace, Anne Caroline Kiekens and Morgan Laitat	65
60	Paper ID 282	Tunneling through 48 Fault Zones and High Water Pressures on Turkey&rsquo;s Gerede Water Transmission Tunnel	Doug Harding and Yunus Alpagut	65
61	Paper ID 801	Investigating the Causes of Cracks and the Repair of Precast Reinforced Concrete Segmental Lining of an Existing Rail Tunnel in Singapore	P. Fok, J. Kumarasamy, Z.Q. Guo and R.H. Siok	64
62	Paper ID 090	TBM Hyperbaric Intervention Beneath a Highway in New Å°stanbul Airport Metro Project	Ulas Erboylu, SÄ°nan Acun, Turker Senyurt and Dogancan Bayram	64
63	Paper ID 684	United Kingdom Leads the SFRC Usage for the Tunnel Lining Segments - A success story: Thames Tideway Tunnel - Central Section	Bruno Rossi	64
64	Paper ID 137	Tunnelling and Underground Metro Stations in the Ground Condition of Kathmandu Valley, Nepal	Binod L. Amatya and Alan G. Bloodworth	64
65	Paper ID 302	Overcoming Multiple Caverns: Successful TBM Tunneling in Karstic Geology at Galerie des Janots	Detlef Jordan	63
66	Paper ID 085	Excavating Metro Tunnels with an EPB TBM under Risk of Methane Explosion	Ali Aslanbas and Nuh Bilgin	62
67	PaperID 106	A Method for the Design of FRC Tunnel Linings Reinforced with GFRP Bars	Mutlu Demir,&nbsp;Ugurhan Akyuz&nbsp;and Gokhan Erkus	62
68	Paper ID 404	3D-Nonlinear Finite Element Analysis of Staged Shield-driven Tunnel Excavation with a Focus on Response of Segmental Tunnel Linings	Navid Allahverdi, Verya Nasri, Mehdi Bakhshi and Maziar Partovi	62
69	Paper ID 139	Unexpected Cavern in Double Shield TBM Water Transfer Tunnel Construction Project in Northern Thailand	Chawalit Tanomtin, Koson Kongdang and Jitaphol Rodploy	62

70	Paper ID 347	Road Tunnel Fire Safety: Developments in Standards and Fire Protection Technologies	Allan Beeston	61
71	Paper ID 377	An Experimental Study on the Behavior of Precast Tunnel Segments Reinforced by Macro-synthetic Fibers During Temporary Loading Stages	Ivan Trabucchi, Antonio Mudadu,&nbsp;Giuseppe Tiberti, Antonio Conforti, Giovanni Plizzari and Ralf Winterberg	61
72	Paper ID 402	New ACI 533 Guide - Design, Manufacturing, Construction and Durability Aspects of Precast Tunnel Segments	Mehdi Bakhshi and Varya Nasri	61
73	Paper ID 269	Innovations Applied in the Design and Construction of the Arroyo Vega Flood Relief Tunnel	Agust&iacute;n Guastavino,&nbsp;Bruno Vicente&nbsp;and&nbsp;Ram&oacute;n Sol&aacute;	61
74	Paper ID 111	Is a Full Face Drive Safer and More Effective Than Sequential Excavation in Mixed Ground?	Bair Jin Yueih	61
75	PaperID_678	Sidewall Reinforcement of Extremely Large Cross-sectional Tailrace Tunnel Passing Through a Fractured Zone	Tomoyuki Fukudome, Shoichi Taniguchi, Takashi Suenaga, Shoichi Murakami, Seigo Igarashi, Akira Fujimi and Satoru Hagino	60
76	Paper ID 410	Swelling Control in Tunnelling by Heating	Georgios Anagnostou&nbsp;and&nbsp;Erich Pimentel	60
77	Paper ID 435	Cross-border Innovations: Technologies Successfully Transferred from Shipbuilding to Tunnelling Industry	Tobias Vraetz, Kris Zych and Hans Greve	60
78	Paper Id 266	Brenner Base Tunnel, Italian Side, Lot Mules 2-3: Monitoring, Surveys, Investigations and Checks during Construction	Enrico Maria Pizzarotti, Maura Rivoltini, Matteo Moja, Santina Bellini and Antonio Voza	60
79	Paper ID 286	Implementation of a Geotechnical Instrumentation and Monitoring Scheme within Sensitive Urban Environment &ndash; A Case Study	Alistair D. Green	59
80	Paper ID 800	Settlements of Soils of Bukit Timah Granite Formation Due to Underdrainage during Deep Excavation	Jeyatharan Kumarasamy, Fu Jiajun, V. Sanathanan, and Y.Y. Jee	59
81	Paper ID 293	Adding to the Busiest Railway Station in Australia &ndash; Design and Construction Planning to Insert Sydney Metro&rsquo;s Proposed Station Box Into Sydney&rsquo;s Existing Central Station	Geoffrey Charlesworth, Ken Bagget, Ian Whitton, Daniel Armstrong and P. Greaterix	59
82	Paper ID 361	Construction Challenges of Urban Tunnelling in Klang Valley, West Malaysia: Case Study of 8th Drive in SSP Line	Xin Hui Poon, Guofeng Zhang and Howie Ho	58
83	Paper ID 658	Pregrouting Executed from a Double Shield TBM in the Follo Line Project (Oslo)	Fernando Vara Ortiz De La Torre	58

84	Paper ID 109	On the Safety Requirements for Persons with Disabilities in Underground Infrastructures	Marco Bettelini and Amanda Bettelini	58
85	Paper ID 081	Effectiveness of Early Contractor Involvement (ECI) in Procurement of Underground Works Projects	Andrew Wilson	57
86	Paper ID 376	Selected Aspects and Comparison of Metro Projects in Europe and Asia	Rakesh Pandita and Michael Rehbock-Sander	57
87	Paper ID 438	Maintenance Approach for Sustainable Metro Tunnels	Salah Al-Dilimi and Issam Amin Mohammad	57
88	Paper ID 159	Robust Design Method of Large-diameter Shield Tunnels Through Multiple Strata	Dongmei Zhang, Song Chen, Ruichuan Wang, Jie Zhang and Shijin Feng	57
89	Paper ID 201	Potential of the Newly Developed High Density Support Medium (HDSM) for the Application of Variable Density (VD)-TBM in Highly Permeable Ground	Michael Straesser, Britta Schoesser and Markus Thewes	57
90	Paper ID 210	Risk Level Control by Geotechnical Monitoring on Different Tunnel Projects Stages	Vladimir A. Maslak, Mikhail O. Lebedev and Kirill V. Romanevich	57
91	Paper ID 236	Singapore North-South Tunnel Contract NS2- Construction Challenges Met in Tunnelling and Mitigation Measures Adopted to Deliver on Time	Rasanayagam Rasanavaneethan, Hing Yang Wong, Nikolaos Gklotsos and Chris Knight Hassell	57
92	Paper ID 142	Mountain Tunneling Method of Excavation Work between Two Shield Tunnels in Permeable Sandy Soil	Yutaka Okuda, T. Ozeki, Yoshimasa Kyoya, Masanobu Nagai and Shoji Yoshida	57
93	Paper ID 520	Practical Considerations for the Design of Large Diameter Segmental Linings	Anthony Harding, Nick Chen and Samer Sadek	56
94	Paper ID 126	Study on the Damage Evolution in Secondary Tunnel Lining under the Combined Actions of Corrosion Degradation of Preliminary Support and Creep Deformation of Surrounding Rock	Marte Gutierrez and Guowen Xu	56
95	Paper ID 560	Analysis & Design of Head Race Tunnel for Mangdechhu 720MW Hydropower Project, Bhutan	Satyashil Patil and Sandip Potnis	56
96	Paper ID 334	Experimental and Numerical Study on Waterproof Behavior of Segmental Joints in Hydraulic Shield Tunnels	Dongmei Zhang, Jie Liu, G. Yang, Y. Jiang and K. Jia	55
97	Paper ID 323	The Use of Polymer Fibre Reinforced Concrete in Underground Construction Projects in Asia	Chuchai Sujivorakul and Isaac Ching Ngew Hoe	55

98	Paper ID 083	Investigation of the Seismic Performance of the Tunnel Sections with Non-Uniform Heights	Hiroki Nitta, Tsutomu Otsuka, Shinji Konishi, Takeshi Seto, Kohei Koshiba, Yuto Aso, Kiwamu Tsuno, Satoshi Tsuchiya and Koichi Maekawa	55
99	Paper ID 414	Design of Precast Concrete Segmental Lining for the Montreal Express Link (REM) Airport Tunnel	Mehdi Bakhshi and Verya Nasri	55
100	Paper ID 470	Optimization of Ring Length, Staggered Joints, Alignment Negotiation, and Virtual Build of TBM Tunnels with BIM Modeling	Edward Dalton, Mehdi Bakhshi, Verya Nasri, Kiseok Jeon and Theodora Vovou	55
101	Paper ID 232	Experimental Study on Strength and Deformation of Fiber Blended Drymix Mortar Sprayed In Order To Prevent a Rockfall From Cutting Face	Naotaka Kikkawa,&nbsp;Shinya Ito,&nbsp;Kikuo Sakai&nbsp;and&nbsp;Nobutaka Hiraoka	55
102	Paper ID 284	TBM Excavation in Himalayan Geology: Over 1,200 Meters per Month at the Bheri Babai Diversion Multipurpose Project	Brad Grothen, Missy Isaman, Prajwal M. Shrestha, Tianran Hu, Hua Chai and Fengfan Liu	55
103	Paper ID 321	Strategy for the Permanent Technical Solution Under the Lake M&#228;#229;laren in the Stockholm Bypass Project	Bj&#228;#229;rnl Stille, Francisco R&#228;#229;os Bayona, Fredrik Johansson, Louise Sj&#228;#229;lund, Rocio Batres Estrada and Mattias Roslin	54
104	Paper ID 097	The Project which Uses an Innovative Construction Method to Expand an Operating Subway Tunnel Built by the Caisson Method under the Soft Ground	Keisuke Okanoya, Yasushi Arai, Tsutomu Otsuka, Tadashi Nishimura and Shinichi Watanabe	54
105	Paper ID 689	Changing the Future of Transportation in Montreal - Upgrading the Mont Royal Tunnel	Saeid Rashidi, Verya Nasri and Nader Shahcheraghi	54
106	Paper ID 417	Ventilation of Tunnels and Underground Stations in Transit Systems	Nader Shahcheraghi and Verya Nasri	54
107	Paper ID 124	Positive Experiences Obtained in the Execution of the Quito Metro	Rolando Justa Camara	54
108	Paper ID 154	Present Status and Technology of Shield Tunneling Method of Urban Railway System in Chengdu, China (2005-2019)	Xue Li, Qi Huang, Peng Huo, Weiming Hu and Dapeng Zhu	54
109	Paper ID 561	Challenges in Planning and Designing of New Railway Tunnel Parallel to Existing Tunnel between Laxmipur Road Station and Baiguda Station	Nilesh Irale, Sandeep Singh Nirmal and Sandeep Potnis	54
110	Paper ID 238	Leveraging Super-computing and High-density LiDAR Technologies for Real-time Verification and Rectification of Tunnel Construction Against Design	Benny Chen,&nbsp;David Mares,&nbsp;Nick Carter,&nbsp;Peter Ayres&nbsp;and&nbsp;Greer Voysey	54
111	Paper ID 166	Shield Machines in Fine Grained Soils: Results from Laboratory Research to Reduce the Clogging Potential	Christoph Budach and Eugen Kleen	54

112	Paper ID 101	Performance of Raise Boring Machine (RBM) in Low to Moderately Hard Hornfels Rocks: A Case Study of Efemcukuru Gold Mine in Turkey	Aydin Shaterpour-Mamaghani, Hanifi Copur, Deniz Tumac, Cemal Balci, Ergun Altintas and Tayfun Erdogan	53
113	Paper ID 674	Waterproofing Sprayed Concrete Linings - Existing Methods and Potential Developments	Sivanathan Sivakanthan, Pedro Ferreira, Peter Wright and Don Wimpenny	53
114	Paper ID 138	Experimental Approach to Testing the Vibration on Excavation Machines	Okan Su, Xiang Wang and Y.P. Liang	53
115	Paper ID 206	A Current State of Defects Due to Material Degradation on Road Tunnels in Japan	Atsushi Kusaka, Satoshi Morimoto, Tomoya Yoshioka and Yoshihiko Hasegawa	53
116	Paper ID 136	Streamlined Stormwater Conveyance Tunnel Planning and Design for Flood Control in Central Copenhagen	Joss Plant, Alastair Smith, Jesper Heick Thyme, Henrik Jensen, Bo Tvede-Jensen and Jakob Badsberg Larsen	53
117	Paper ID 050	Impact of Cyclic Shear Stress on the Durability of a Composite Shell Lining	Wolfgang Seidl, Frank Clement, Klaus Bonin and Christine Köster	52
118	Paper ID 098	Sydney Heads Rail Tunnel - A Treasure Trove of Planning Opportunities	E. Nye, Peter Prince and Sam Lackey	52
119	Paper ID 587	Design Considerations and Impact Assessment of Underground Construction in Close Proximity to Deep Tunnel Sewerage System (DTSS) Tunnel	Woei Tong Lai, Bee Yen Lim and Veeresh Chepurthy	52
120	Paper ID 514	Design and Planning of Large Diameter Underground Surge-shafts	Rakesh Kumar Khali and Naveen Bahuguna	52
121	Paper ID 128	Ventilation System in Large Hydro Projects in India: A Case Study of Successful Implementation of Effective Ventilation System at Tehri Pump Storage Project	Rakesh Kumar Khali	52
122	Paper ID 253	Study on Application of Simple Dust Sensor to Tunnel Construction Site	Koshiro Kakeya, Hisashi Hayashi, T. Otsuka, K. Nakamura and Masato Shinji	52
123	Paper ID 645	Operation & Maintenance Costs of Subsea Road Tunnels in Norway	Cristobal Manquehual, Johnny Johansen, Per Drevland Jakobsen and Bjørn Nilsen	51
124	Paper ID 596	Challenges and Innovations in the Deepest Underground Space Development in Restricted Urban Areas of Kuala Lumpur	Vui Wei Pong, Yean Guan Tan, Cheng Eng The, Sar Pang and Teik Aun Ooi	51
125	Paper ID 555	Underpinning Live MRT Tunnels, Ground Freezing and Mined Tunnelling Works at Marina Bay Station in Singapore	Sim Zhan Rui, Benigno Gundayao Rosario, Mohd Mohaideen and Esen Sze Yu Sheng	51

126	Paper ID 294	Dealing with the Challenges of Ground Response on Deep Urban Excavations Adjacent to Underground Transport Infrastructure in Australia	Paul Hewitt&nbsp;&nbsp;&nbsp;Visvalingam Suthagaran	51
127	Paper ID 353	Rock Reinforcement Mechanisms in Horizontally Layered Jointed Rock: Reinforced Rock Unit, Beam Building and Suspension	Chia Weng Boon	50
128	Paper ID 429	Prediction of Ground Movement Utilising 3D Numerical Analysis in Proximity to Deep Excavations in Urban Projects	Wai Yee Soo and Jay Lee	50
129	Paper ID 160	Study on Section Repair Method for Cut and Cover Tunnels	Takeshi Seto, Masumi Taguchi, Hiroki Nitta, K. Sato, Shinji Konishi, Satoshi Sakata, Yukihiro Ishikawa and Toshiharuru Kishi	50
130	Paper ID 213	Definition of Confining Pressure for Large Diameter EPB Tunnels in the Parisian Basin	Michael Mains, Nomiki Kottaki and Eric Mathieu	50
131	Paper ID 283	Estimation of Rock Mass Conditions at Ten Shafts Excavated with the Raise Boring Method	Kimihiro Hashiba, Katsunori Fukui, Ryujiro Kiyama and Kentaro Okutsu	50
132	Paper ID 309	Technology and Application of Large Diameter Slurry Shield Machine for Qiantang River Bo&rsquo; Tunnel Project	Shunhui Tan and Heng Sun	49
133	Paper ID 121	Effect of Soil Conditioning on the EPB-TBM Excavation Performance: A Case Study of Dudullu-Bostanci Metro Project, Turkey	Deniz Tumac, Mirali Seyedrezaei, Aydin Shaterpour-Mamaghani, Enver Koc, Hanifi Copur and Emre Avunduk	49
134	Paper ID 479	Tunnelling below Barcelona Airport: Lessons Learned in the Control of EPB TBM Face Support Pressure for Settlement Risk Management	Xavier Torell&oacute; Ciriano, Xavier Gost Mayans and Helena Castellvi	49
135	Paper ID 565	Case Study on the Design of Tunnel by NATM in Urban Environment	Rushi Yatish Randeia, Prasad Ganesh Sansare and Sandeep Potnis	49
136	Paper ID 255	Research and Application of BIM in Mountain Tunnel by Shielded TBM	Dongya Duan, Wenge Qiu and Yunjian Cheng	49
137	Paper ID 072	Underground Space Use &ndash; Case Study of Parking Garages in Bras&iacute;l&iacute;l&iacute;a	Max Gabriel T. Barbosa, Andr&eacute; P. Assis, Lucas O. Mendes and&nbsp;&nbsp;Max Valerio R. Barbosa	48
138	Paper ID 367	Case Studies of Jammed TBM in Rock Tunnels	Andrea Oss, Paolo Cucino and Luca Schiavinato	48
139	Paper ID 368	An Integrated Framework to Optimize Site- Investigations for Tunneling Applications	Rajat Gangrade, Whitney Trainor-Guitton and Mike Mooney	48

140	Paper ID 601	Ground Conditioning for the Excavation of a Rock Mass with High Hydrostatic Pressure using an EPB: the Experience in the Toluca & Mexico Railway Tunnel	Jorge Pereyra, Lazaro Romero, Carlos Rodolfo De la Mora, Sergio Ocampo, Alessandro Boscaro and Enrico Dal Negro	48
141	Paper ID 205	Research on Vibration Characteristics of TBM Disc Cutters Based on DEM	Xue Yadong, Zhou Jie and Wang Jiaxu	48
142	Paper ID 208	KOINOR - Development of a Sprayable Geopolymer Concrete for Fire Protection Improvement and Upgrading of Underground Traffic Structures	Goetz Vollmann, Eugen Kleen, Anna-Lena Hammer, D. Uhlmann, Thorsten Weiner, Joachim Budnik, Markus Thewes, Christian Thienert, Frank Leismann and Christoph Klapproth	48
143	Paper ID 211	Geomechanical and Geophysical Investigations in Repaired Underground Structures	Mikhail O. Lebedev and Kirill V. Romanevich	48
144	Paper ID 373	Tunnel Process Control for Klang Valley Metro Phase 2 using Machine Learning and Artificial Intelligence	Jacob Grasmick, H. Yu, Angus Maxwell, Michael Mooney, Hau Wei Ng, Gusztav Klados and Paul Trevisin	48
145	Paper ID 434	Shatin to Central Link Cross-Harbour Railway Immersed Tube Tunnel	Fumihiko Aikawa and Ozturk Ozgur	47
146	Paper ID 439	Environmentally Friendly Tunnel Sealing and Stabilization with Novel Hybrid Injection System (HIS)	Anton Reichert, Simon Prescher and Meik Weickenmeier	47
147	Paper ID 466	Structural and Geotechnical Design Considerations and Construction of Paseo del Bajo Corridor in Buenos Aires	Yael Zaidenknop, Claudio Rimauro, & Florencia Di Giacomo & Carla Killinger	47
148	Paper ID 802	Directional Drilling for Tunnel Investigation and Associated Testing Techniques	Ian Gray	46
149	Paper ID 202	A Case Study on Construction Technology of Large Section Horseshoe-Shaped EPB-TBM Tunnel	Xufeng Ai, Wenge Qiu, Yuchao Zheng and Mei Zhang	46
150	Paper ID 212	Design of a Tunnel Face Reinforcement for Underground Structures in Geological Condition of Saint-Petersburg	Mikhail O. Lebedev, Maxim A. Karasev and Roman I. Larionov	46
151	Paper ID 305	The S. Caterina Road Tunnel in Sicily (Italy): Intensive Use of Jet-Grouting Stabilization	Enrico Maria Pizzarotti, Maura Rivoltini, Gloria Ciceri and Santina Bellini	45
152	Paper ID 697	Hydro Power Tunnels & Innovation Challenges Innovation Drivers and Obstacles	Harald Wagner	45
153	Paper ID 088	The Effect of Rock Weathering on the Performance of an EPB TBM in a Complex Geology in Istanbul	Sinan Acun and Nuh Bilgin	45

154	Paper ID 395	1989 Tunnel Collapse Revisited: New Findings from 3D Finite Element Back Analyses	Luis Eduardo Sozio, Argimiro Alvarez Ferreira and Hugo Cassio Rocha	45
155	Paper ID 467	Fire Protection and Life Safety System of Paseo del Bajo corridor in Buenos Aires	Carla Killinger,&nbsp;Yael Zaidenknop, Claudio Rimauro and&nbsp;Florencia Di Giacomo	45
156	Paper ID 129	Accurately Assessing the Effects of Build Tolerances and Friction on Stress Distributions at the Longitudinal Joints of Precast Tunnel Linings	Brian Adjetej Boye	45
157	Paper ID 203	Design of a Tunnel Supervisory Controller Using Synthesis-based Engineering	Lars Moormann, Patrick Maessen, Martijn A. Goorden, Joanna van de Mortel-Fronczak and Jacobus Rooda	45
158	Paper ID 542	Geotechnical Aspects of Rock Tunnel and Semi-Cavern Works for Tseung Kwan O &ndash; Lam Tin Tunnel in Hong Kong	Franklin Kwok Leung To, Ivan H. K. Tsang, Clayton Yuk Kin Chan, Sunny. S. P. Lo, Paul. K.F. Lee and Steven. N. F. Tsang	45
159	Paper ID 333	Fissure Grouting for the Design and Construction of the North-South Cable Transmission Tunnel	Fauzan Reza Maulana, Rasa Rasanavaneethan, Nikolaos Gklotsos and Chris Knight-Hassell	44
160	Paper ID 670	Impact Assessment of Tunnelling on Adjacent Flyover Pile Foundation in Mumbai Metro Project	Angad Kadam, Sandeep Potnis and Rajib K Sinharay	44
161	Paper ID 419	Tunnel and Underground Hydropower Risk &ndash; A Lender&rsquo;s Technical Advisor&rsquo;s Perspective	Andrew Noble	44
162	Paper ID 584	Design for Stability of Slopes for Portal Development Works in Himalayan Geology	Ahmed Shaz, Sandeep Singh Nirmal, Lalit Kumar and Amit Kumar	44
163	Paper ID 272	Proposal of Tunnel Excavation Analysis Considering the Effect of the Ground Weight	Mizuki Nishiuchi, Hisashi Hayashi and Masato Shinji	44
164	Paper ID 686	Construction of a Shinkansen Tunnel Running Through a Shallow Overburden Just Under Roads with Heavy Traffic	Hiroki Kumahara, Yuji Kuwayama and Yasutomo Morita	43
165	Paper ID 672	Construction of Subway in Cohesionless Soil by Method of Box Pushing Technique: A Case Study of Bhikaji Cama Place Metro (BKCP) Station of DMRC	Avinash Sahu and Ashwani Kumar	43
166	Paper ID 426	Roof Collapse in a Tunnel of Kiratpur Ner Chowuk (KNCEL), Project in state of Himachal Pradesh, India and lesson Learnt for Future	Nishant Shrivastava	43
167	Paper ID 512	Seismic Monitoring During the Excavation of a Shallow NATM Tunnel Using the Plasma Blasting Method	Felipe S. Santos,&nbsp;Aline F. Heleno,&nbsp;Luis C. Ribotta,&nbsp;Patr&iacute;cia D. G. Orlando&nbsp;and&nbsp;Wilson S. Iyomasa	43



168	Paper ID 132	Analysis on Floating Mechanism of Shield Tunnel in Liquefied Foundation using Shaking Table Test	Penglu Gan, Zihai Yan, Yanwei Zang and Xiaochun Zhong	43
169	Paper ID 204	Monitoring and Characterization of Water Leakage Behavior for Aged Concrete Lining of Urban Metro Lines by using Plastic Optic Fiber Sensor	Satoshi Ito, Shinji Konishi, Naoya Imaizumi, Yuki Enokidani, Junichi Nagaya, Yuichi Machijima, T. Masumoto and Shinichi Akutagawa	43
170	Paper ID 227	Demonstration of High-Speed Laser Hammering System for the Lining Concrete Inspection	Noboru Hasegawa, Masaharu Nishikino, Hajime Okada, Shuji Kondo, Toshiyuki Kitamura, Masamichi Abe, Kazuhisa Masuzoe and Shigeru Kogure	43
171	Paper ID 235	Conceptual Scheme for Accommodating Rock Processing, Concrete Batching and Asphalt Production Plants in Caverns	Julian S. H. Kwan, Don T. C. Sum, Fred H. Y. Ng, Clayton Y. K. Chan, Leo K. W. Lo, Gary G. H. Au and Marco S. G. Bettelini	43
172	Paper ID 448	Fair and Transparent Payment for Excavation and Lining Works / How Bill of Quantities Are Utilized According to the FIDIC Emerald Book	Hannes Ertl, Matthias Neuenschwander and Jim Maclure	43
173	Paper ID 369	Probabilistic Subsurface Modelling in Tunnelling Applications: Suggestions for Use in Practice	Jacob Grasmick, Angus Maxwell, Rajat Gangrade and Michael Mooney	43
174	Paper ID 644	Crossing Nee Soon Fault and Springleaf Station (TE4) with Slurry TBM	Bryan Kyaw Thet Oo and Kyi Khin	43
175	Paper ID 679	Performance Analysis of a Tunnel Supported with Ribs Reinforced Shotcrete	Zorany Zapata	42
176	Paper ID 621	Dubai's Deep Tunnel Storm Water System - Engineering for Sustainability	Jayapregasham Tharamapalan and Fahed Ahmed Al Awadhi	42
177	Paper ID 563	Geotechnical Design of Bored Tunnels for Pune Phase 1 Underground section	Sreekanth Reddy Siddavatam, Ankur Chauhan and Sandeep Potnis	42
178	Paper ID 573	Investigation on Response of Segmental Lining due to Adjacent Pile under Loading	Pornkasem Jongpradist and K. Trakoonjannak	42
179	Paper ID 299	Progressive Design Build Tunnel Procurement in Silicon Valley	Nik Sokol, Mike Jaeger and Jack Suciisky	42
180	Paper ID 677	Assessment of Tunnelling Rock Spoils from Highly Weathered Lithology Using Rolling Friction Contact Models in Discrete Element Modelling	Nicholas Yong Jie Ng, Mohammad Irfaan Peerun, Chung Siung Choo and Dominic Ek Leong Ong	41
181	Paper ID 631	Green Square - Trenchless Construction for Australia's Largest Urban Renewal Project	Paul Hewitt and Nick Taylor	41

182	Paper ID 625	Instrumentation and Monitoring for MRT Orange Line (East Section) Project	Amnarj Yanuviriyakul and Sahaphol Timpong	41
183	Paper ID 627	Challenges in Design and Construction of Bangkok MRT Orange Line Project	Surachet Laophulsuk, Pairat Prom-In, Worachat Suwasin, Woraphon Wiriyatharakij, Pastsakorn Kitiyodom and Noppadol Phien-Wej	40
184	Paper ID 617	Research@ZaB As A Full-scale Test Site for Geophysical Measurements	Irene Hartl, Ingrid Schloegel, David Kusnirak, Robert Wenighofer, Alexander Radinger and Robert Galler	40
185	Paper ID 613	Diverting the North Yarra Main Sewer & Making Way for the West Gate Tunnel	T. Sheikh, Michael Henein, Stuart Oakey, Sarah Duckworth	40
186	Paper ID 436	Design and Construction of the Island Line Underpinning at Admiralty Station, Hong Kong	Roger Lau and Robert Cook	40
187	Paper ID 551	Test Blast and Prediction of Vibrations, Planning for Excavation by Blasting at the Storages for Spent Nuclear Fuel in Forsmark, Sweden	Mathias Jern	40
188	Paper ID 162	Lubrication of Pipejacking in Soft Alluvial Deposits under Impacts of Misalignment, Geology and Lubricant Injection Mode	Wen-Chieh Cheng, Ge Li and Wengang Zhang	40
189	Paper ID 170	Behavior of Parallel Shield Tunnels Lining with a Large Cross-section and High-proximity	Yuki Minamiguchi, Masaaki Isa, Kazuhisa Jinno, Satoshi Ishihara, Tomoyoshi Idei and Takahiro Konda	40
190	Paper ID 197	Criteria for Describing the Arch Effect of Weak Surrounding Rock in Super-large-section Tunnels	Yibo Ma, Yongchang Cai and Pengfei Yan	40
191	Paper ID 291	Evaluation of Multi-Standpipe Grouting Technique for Mae Ngad - Mae Kuang Water Diversion Tunnel Project	Phichet Morya, Kuo Chieh Chao and Noppadol Phien-Wej	40
192	Paper ID 695	Machine Learning to Predict the Water Drawdown Due to Tunnelling using Gene Expression Programming	Sobhan Mousavi, Ali Noorzad, Amir Hossein Hosseini and Faramarz Foroutan	39
193	Paper ID 471	Displacement Control Effect of the Ground in front of the Main Tunnel Face with the Drift using High Rigidity Supports in the Fragile Ground	Sadatashi Ohmori, Tadashi Okabe and Nobuharu Isago	39
194	Paper ID 274	Experimental Study on the Effect of Localized Weak Zones on the Seismic Behavior of Shallow Tunnels	Saddy Ahmed, Takuya Kobata and Ying Cui	39
195	Paper ID 619	Maturity Modelling for Non-destructive Strength Development Monitoring of Wet-mix Sprayed Concrete	Vishwajeet Ahuja	39

196	Paper ID 610	Sensitivity Analysis of Enlarging A Large-Diameter Shield Tunnel Using the Pile-Beam-Arch Method to Construct a Metro Station	Masoud Sedghi and Aliakbar Golshani	38
197	Paper ID 603	The Common Communication Cable Duct for Bangkok Metropolis	Oravit Hemachudha	38
198	Paper ID 567	Design of Storm Water Tunnel Lining & Ground Settlement Analysis of Stabling Track & Storm Water Tunnel	Vinay Deokate, Akshay Gupta and Sandeep Potnis	38
199	Paper ID 263	Study on Construction Feature of Key Technology for Reconstruction and Extension of Existing Nanling Tunnel	Qian Bai, Wen Zhao, Xin Wang and Zhiguo Wang	38
200	Paper ID 312	Application of Porous Concrete to Pavement Base Course at the Cut and Cover Tunnel for Countermeasure of Water Leaking	Akira Sezaki, Koichi Sugioka, Toru Takaiso, Tetuya Hoshizumi, Osamu Kamada and Toshio Nakamura	37
201	Paper ID 702	An Overview of Dalian Bay Udersea Tunnel Construction Technique	Fanli Meng, Haiying Zhang, Xiaoshu Wang and Xinwei Xu	37
202	Paper ID 682	The Method of the "Underwater Concrete Slab" to Prevent Water Inflow in a Cut-and-cover Tunnel	Andrea Antiga, Alberto Checchi and Christian Gilbert	37
203	Paper ID 642	An Explicit Numerical Manifold Method and Its Application on Modelling Tunnel Failure Process	Jun He, Shuling Huang, Xiuli Ding and Yuting Zhang	37
204	Paper ID 608	Deformational Behaviour of Ground and Control Measures in Urban Tunneling – A Case Study	Shesh Mani Sonkar, Ali Hayri and Trilok Nath Singh	37
205	Paper ID 425	Planning and Construction of the Lung Shan Tunnel	Cheuk Ho Lai, Guy Bridges, Francis Leong and Alan Ho	37
206	Paper ID 465	Design Considerations and Construction of Paseo del Bajo corridor in Buenos Aires	Yael Zaidenknop,&nbsp;Floencia Di Giacomo,&nbsp;Carla Killinger&nbsp;and Claudio Rimauro	37
207	Paper ID 507	The Lower Thames Crossing: Unlocking Underground Space for Strategic Development in a Sustainable Way	Robinson Herberto Leon-Diaz and Jorge Banos-Lloredo	37
208	Paper ID 696	Multi-dimensional Evaluation of Tunnelling Pre-grouting Methodology Based on Excavation and Overhead Costs Considering Environmental Aspects	Sobhan Mousavi, Ali Noorzad, Amir Hossein Hosseini and Faramarz Foroutan	36
209	Paper ID 657	Numerical Simulation Analysis on Piston Effect Induced by a Running Train in Subway Station	Xiaonan Yan, Haoran Wang, Liangliang Tao, Yanhua Zeng and Yun Bai	36

210	Paper ID 655	Use of Spile Umbrellas for Load Transfer and Prevention of Settlements	Andy Klinger and Jochen Fillibeck	36
211	Paper ID 595	Some Experiences from Microtunnelling through the Highly Erratic Lithologies of the Tuang Formation, Kuching	Lee Yoon Tai, Simon Kiing Kang Lau, Yih Seng Sim, Vincent Yun Khan Liew, Dominic Ek Leong Ong, Fredrik Phangkawira and Chung Siung Choo	36
212	Paper ID 626	Ground Improvement Applications for MRT Orange Line (East Section) Project	Wiset Jangjit, Sahaphol Timpong, Pastsakorn Kitiyodom and Noppadol Phien-Wej	36
213	Paper ID 487	Challenges in Implementation of Tunnel Ventilation System Upgrade in Singapore North-South and East-West Line Underground Stations	Tony Chiu, Alex Wan, German Cheung, Melvyn Thong and Cheong MK	36
214	Paper ID 585	Planning and Designing of Underground Metro Rail Project in Pune, India	Balasaheb Ohol, Manoj Kumar and Sandeep Potnis	35
215	Paper ID 207	Discussion on Engineering Treatment Consideration for Encountering Gas in New Wu-shan-ling Divert Water Tunnel	Kun-Hsien Chou and Wen-Long Wu	35
216	Paper ID 548	Challenges in Design and Construction of MRTA Tunnel and Station in Recent Bangkok Blue Line Extension Project	Ochok Duangsano, Aphichat Sramoon, Noppadol Phien-Wej and Auttakit Asanprakit	35
217	Paper ID 502	Turin-Lion Railway Base Tunnel: TBM Excavation, Management and Underground Disposal of 300 m of Potentially Asbestos Ophiolite Hard Rock at the Eastern Portal	Sebastiano Pelizza, M.Vigone, Vigone Paolo and Giuseppe Amaro and C. Targhetta	35
218	Paper ID 703	Submerged Floating Tunnel Overall Structural Behaviour Mechanism Test Study 1: General	Lin Wei, Lin Ming, Yin Haiqing, Zhang Ningchuan and Liu Mengyuan	34
219	Paper ID 329	Stabilization of the Occidental Sector of the Ancient Quarry of Punta Lucero in the Port of Bilbao (Spain)	Jose Manuel Baraibar, Jose Luis Garcia Mochales, Iigo Escobal, Johnatan Gonzalez, Manuel Arlandi and Alberto Bernardo	34
220	Paper ID 460	Comparison of Greenhouse Gas Emissions from Highway Tunnels of China and Norway	Jianfeng Xu, Chun Guo, Chen Dong and Lu Yang	34
221	Paper ID 483	Fit for Purpose and Design Risk in the FIDIC Emerald Book	Jim Maclure	34
222	Paper ID 516	Grand Paris Line 16 Tunnel Connection: Comparison between Different Types of Ground Treatment	Laurent Samama, Mariane Senechal, Mariano Ferrari, Hadi Karam, Frederic Noel, Alexandre Giroux and Laurent Soyez	34
223	Paper ID 528	Analytical and Numerical Study of the Support Pressure for the Stability of Shallow Underground Openings	Tsuyoshi Nishimura, Kintoki Ogawa and Masanori Kohno	34

224	Paper ID 570	Combination Forces Between Dowels and EPDM Gasket	Stefano Varotto,&nbsp;Chiara Dalle Nogare and Giorgio Violato	34
225	Paper ID 257	Numerical Modelling of Bolt Corrosion Impact on Performance of Segmental Shield Tunnel Lining	Dong-Mei Zhang, Bing- Li Zhang, Tai-Lai Luo and Jie Zhang	34
226	Paper ID 707	Geological and Geotechnical Characterization of Guadalupe Tuff Formation	Ramon D. Quebral, Roy Anthony C. Luna, Monica P. Baniquett, Mark Jay P. Armario, Emmanuel D. Marasigan, Patrick Adrian Y. Selda, Karen Joy R. Leobrera, and Satoru Shibata	33
227	Paper ID 344	Simulation on Shield Behavior at A Sharp Curve by Kinematic Shield Model	Mitsutaka Sugimoto, Jian Chen, Y. Souma, Katsutoyo Yasui and Ryoma Takemoto	33
228	Paper ID 390	Full-scale Experimental Investigation on Influence of Active Temporary Column on Column-free quasi-rectangular Shield Tunnel During Construction Period	Zipeng Zhao, Zhen Liu and Xian Liu	33
229	Paper ID 397	Study on Maintenance System for Cut and Cover Tunnels Showed Signs of Deterioration by Chloride Attack	Masumi Taguchi, Yuji Morohashi, Takeshi Seto, Shinj. Konishi, Kazumi Nomoto, Masaru Kameyama and Toshiharu Kishi	33
230	Paper ID 590	Interface Shearing Characteristic between Biopolymer-treated Soil and Underground Structures	Minhyeong Lee, Yeong Man Kwon, Ilhan Chang and Gye-Chun Cho	33
231	Paper ID 654	Influencing Factors of Metro Light Environment Satisfaction	Chen Dong, Chun Guo, Jixuan Liao and Kun Yang	33
232	paper ID 358	Local-stiffness-modified Beam Spring Model Simulation on Column-free Quasi-Rectangular Segmental Tunnel Lining	Zhen Liu, Xian Liu and Zipeng Zhao	32
233	Paper ID 671	Challenges in Construction of Underground Metro Station Adjacent to Flyover with Top Down and Partial Bottom Up Technique: A Case Study of Vinobapuri Metro Station of DMRC	Nitin Singh Rajput and Ashwani Kumar	32
234	Paper ID 660	Sustainable and Strategic Use of Underground Space- Ashram Underground Metro Station	Sunil Patel and Ashwani Kumar	32
235	Paper ID 515	3D Subsurface Profile Development Using IDW Method for Tunnel Design	Mohd Faiz Mohammad Zaki,&nbsp;Mohd Ashraf Mohamad Ismail and Darvintharen Govindasamy	32
236	Paper ID 540	Prediction of TBM Performance Based on Full-scale 3.54m Shield TBM Tunnelling Tests in Artificial Homogeneous Rock Mass Conditions	Kyoung Yul Kim, Hee Hwan Ryu, Seon Ah Jo, Jung Joo Kim, Sung Yun Hong, Ju Hwan Jung and Du San Bae	32
237	Paper ID 706	Design and Construction of Subway-municipal Underground Complex	Zhou Bing, Xing Qiong, Xiong Chaohui and Li Wensheng	31

238	Paper ID 685	Construction Techniques of the Shallowly Buried Large Cross-section Haicang Double-arch Tunnel in Xiamen China	Zhou Xiaoqi, Gao Haidong, Cai Jie, Liu Yang and Shi Peixin	31
239	Paper ID 605	The Importance and Significant Role of Design in Forming and Delineating an Underground Project's Risk Profile	Thomas Konstantis	31
240	Paper ID 474	Challenges in the Lowering of Victorian Railway Tunnels Inverts	Manuel Neves, Neil Thompson and Robert McConnell	31
241	Paper ID 477	Prediction of Large Strain Solution for Cavity Contraction Problems from Small Strain Deformation Considering Effects of Intermediate Principal Stress	Chunfeng Zhao and You-Bao Wang	31
242	Paper ID 536	COBie+ Interpretable and Complex Spatio-temporal Relation Reasoning Network-based Decision Analysis Method For the Tunnel Equipment Maintenance	Gang Yu, Shuang Zhang, Zeyu Mao and Min Hu	31
243	Paper ID 683	An Application of the Observational Method to Deal with Sudden Water Level Changes: The 4 Tunnels for the Extension of the Line 1 of the Milan Subway	Giuseppe Iagulli, Maria Silvestri, Leonardo Messineo and Andrea Antiga	30
244	Paper ID 628	Exploiting Civil Underground Space for Sustainable Urban Development in Vietnam	Hai Nguyen Tuan	30
245	Paper ID 662	A Study on Optimization of Re-construction of Inverted-arch While Keeping Traffic Lane Based on Actual Test in Abandoned Tunnel	Takaaki Koide, Atsushi Kusaka and Yoshitomo Tatsumi	29
246	Paper ID 637	Influence of Ground Stiffness on H&V Shield Behavior	Ngoc Thi Huynh, Mitsutaka Sugimoto, Salisa Chaiyaput, Thai Khiem Nguyen, Duc Nha Nguyen and Thanh Binh Le	29
247	Paper ID 476	Design Model of Residual Water Pressure on the Tunnels Act as Drains	Kang-Hyun Kim, No-Hyeon Park, Jae-Ho Jung, Sang-Hwan Kim and Jong-Ho Shin	29
248	Paper ID 531	The Longitudinal Curve Pipe Jacking River Crossing Technology Under Complex Conditions	Wang Le, Chang Xiping, Wu Yiquan and He Jianqun	29
249	Paper ID 394	Study on the Working Mechanism of Prefabricated Subway Station Structure under Earthquake	Peng Ding, Lianjin Tao, Peng Lin, Xiuren Yang, Pengcheng Wei, Cheng Shi, Weisheng Du and Ji Zhao	28
250	Paper ID 624	Pressure Distribution in the Mixing Chamber of an EBP Shield	Adam Bezuijen and G&Uuml;nther Meschke	28
251	Paper ID 586	A Study of Worker Satisfaction and Soft Management Initiatives: A Case Study of Swat Expressway Tunnel Construction Project in Pakistan	Asif Riaz, Zia Ud Din and Muhammad Umair Usman	28

252	Paper ID 524	Online Multidimensional Time Series Anomaly Detection Algorithm based on Shield Construction	Min Hu, Xue Bai, Bingjian Wu and Bin Zhang	28
253	Paper ID 450	Excavation of the Underground Power Plant of Romanche Gavet Scheme	Jeremie Moreau	28
254	Paper ID 478	Segment Floating during Shield Tunnelling Considering the Influence of Dynamic Construction Steps	Yu Liang, Xumin Huang and Linchong Huang	27
255	Paper ID 525	The Stade de France Underground Station: Allotment and Phasing of a Complex Grand Paris Station at the Interface between Line 16 and Line 15	Antonin Guillard, Damien Grasset, Marianne S&eacute;n&eacute;chal and Morgane Wernert	27
256	Paper ID 667	Experimental Trial of Three-dimensional Location Detection of Workers Using the Safeguarding Supportive System (SSS) at a Tunnel Construction Site	Shoken Shimizu, Kyoko Hamajima, Shigeo Umezaki and Rieko Hojo	26
257	Paper ID 413	The Effect of Tunnel Ring Joints on the Dynamic Responses from Underground Tunnels	Chao He, Peijun Guo and Shunhua Zhou	26
258	Paper ID 623	Prototype Loading Tests on the Mechanical behaviors of the Shield Lining Structure of a Water Storage and Sewage Tunnel	Yeting Zhu, Yanfei Zhu, Qi Wang, Zixin Zhang, Xin Huang and Wei Liu	26
259	Paper ID 496	Present and Future Application of Air Purification System (APS) for Vehicular Tunnels	Cathy M.Y. Kam, Chris C.K. Ma, and Steven K.H. Lai	25
260	Paper ID 334	Experimental and Numerical Study on Waterproof Behavior of Segmental Joints in Hydraulic Shield Tunnels	Dongmei Zhang, Jie Liu, G. Yang, Y. Jiang and K. Jia	24
261	Paper ID 668	Detection of Dangerous Points and Behavioral Modification from Environmental Change by Behavior Analysis Procedure Under the Safeguarding Supportive System (SSS) at a	Rieko Hojo, Kyoko Hamajima, Shigeo Umezaki and Shoken Shimizu	24
262	Paper ID 629	Design and Construction of an Intervention Shaft of MRT Orange Line Project	Anucha Yamchoo, Phongkai Vonghirunyika, Lalita Loahawiwaththanawong, Pichet Klaharn, Piyawit Srichumpaung and Noppadol Phien-Wej	24
263	Paper ID 532	Research and Optimization of Wood Cushions&rsquo; Compression Deformation Characteristics in Curved Pipe Jacking	He Jianqun and Wang Le	24