

North American Tunneling

2010 Proceedings

Edited by Lawrence R. Eckert, Matthew E. Fowler
Michael F. Smithson, Jr., Bradford F. Townsend

Published by:

SME
Society for
Mining, Metallurgy
& Exploration

Contents

Preface	ix
---------------	----

TRACK 1: TECHNOLOGY

Session 1: Applied Technologies	1
Deep Inclined Water Intake Shafts	3
<i>Albert Ruiz, David Jurich, Guy Leary</i>	
Construction of the Railway Bosphorus Tube Crossing, Tunnels, and Stations	10
<i>Yosuke Taguchi, Fumio Koyama, Atsushi Imaishi</i>	
Ground Freezing Challenges for Horizontal Connection Between Shafts Under Difficult Geologic and Hydrostatic Conditions	26
<i>David K. Mueller, Joseph M. McCann, Kenneth E. Wigg, Paul C. Schmall, Matthew L. Bartlett</i>	
Final Lining at Devil's Slide Tunnel	35
<i>Stephen Liu</i>	
The History of Tunneling in Portland: Rail, Highways, and the Environment	43
<i>Susan L. Bednarz, Paul T. Gribbon, Joseph P. Gildner</i>	
San Vicente Pipeline Tunnel: A Sophisticated Ventilation System	55
<i>Jean-Marc Wehrli, Richard McLane, Brett Zernich</i>	
Session 2: Innovation	63
Onsite, First Time Assembly of TBMs: Merging 3D Digital Modeling, Quality Control, and Logistical Planning	65
<i>Joe Roby, Desiree Willis</i>	
Large Diameter Segmentally Lined Shafts	75
<i>Darin R. Kruse, Rodney Meadth</i>	
Large Diameter TBM Development	89
<i>Martin Herrenknecht, Karin B��ppler</i>	
ADECO as an Alternative to NATM: 22 m Wide, 14 m High, Full Face Tunnel Excavation in Clays	96
<i>Fulvio Tonon</i>	
Cutter Instrumentation System for Tunnel Boring Machines	110
<i>Aaron Shanahan</i>	
Towards Precise Under Ground Mapping System in Canada	116
<i>Mike Ghassemi, D. Zoldy, H. Javady</i>	
Session 3: Pressurized Face Tunneling	123
Lake Mead Intake No 3 Tunnel: Geotechnical Aspects of TBM Operation	125
<i>Georg Anagnostou, Linard Cantieni, Marco Ramoni, Antonio Nicola</i>	
Continuous Conveyor Design in EPB TBM Applications	136
<i>Dean Workman, Desiree Willis</i>	
International Practices for Connecting One Pass Precast Segmental Tunnel Linings	140
<i>Christophe Delus, Bruno Jeanroy, David R. Klug</i>	
Geotechnical and Design Challenges for TBM Selection on the ICE Tunnel	147
<i>Steve Dubnewych, Stephen Klein, Paul Guptill</i>	

Soft Ground Tunneling on a Mexico City Wastewater Project	158
<i>Doug Harding, Desiree Willis</i>	
Small Diameter Tunneling: Ems-Dollard Crossing	164
<i>Klaus Rieker</i>	
Session 4: Sustainability	171
Sustainable Tunnel Linings: Asset Protection That Will Not Cost the Earth	173
<i>Colin Eddie, Mike Harper, Sotiris Psomas</i>	
Design for Sustainable and Economical Tunnels	183
<i>Derek J. Penrice, Bradford F. Townsend</i>	
Sacramento UNWI Sections 1 and 2 Project: Special Tunnel Construction with Plastic-Lined PCC Segments.	191
<i>Jeremy Theys, Michael Lewis, Greg Watson</i>	
Sustainable Underground Structure Design.	200
<i>Lei Fu</i>	
Use of Underground Space in a Pristine Watershed: Chester Morse Lake Pump Plant and Intake, North Bend, WA	206
<i>Joe Clare</i>	
Session 5: Tunnel Lining and Remediation	213
High-Pressure Concrete Plug Leakage Remediation.	215
<i>Carlos A. Jaramillo, Camilo Quinones-Rozo, Robert A. McManus, Andrew Yu</i>	
Structural Inspections of Colorado's Eisenhower Johnson Memorial Tunnel, Hanging Lake Tunnel, and Reverse Curve Tunnel	224
<i>Ralph Trapani, Jon Kaneshiro, David Jurich, Michael Salamon, Steve Quick</i>	
Corrosion Protected Systems for Tunnels and Underground Structures.	233
<i>James B. Carroll, Heather M. Ivory</i>	
Lined Concrete Segments: An Alternative Construction Method for a Large Diameter Sewer Tunnel	242
<i>Galen Samuelson Klein, Michael Monaghan, Samuel Gambino, Dwayne Deutscher, Rigoberto Guizar</i>	
Portal Slope Stability and Tunnel Leakage Remediation	249
<i>Carlos A. Jaramillo, Camilo Quinones-Rozo, Robert A. McManus, Andrew Yu</i>	
Inspection and Rehabilitation of Heroes Highway Tunnel in Connecticut.	257
<i>Mohammad R. Jafari, Larry Murphy, Michael Gilbert</i>	
 TRACK 2: DESIGN	
Session 1: Design Validation by Instrumentation, Monitoring, and Mapping	267
Instrumentation of Freight Tunnel in Chicago	269
<i>Alireza Ayoubian, Richard J. Finno</i>	
Field Mapping and Photo Documentation of the Southern Nevada Water Authority's Lake Mead Intake No. 3 Project, Saddle Island, Lake Mead, Nevada	283
<i>Scott Ball, Richard Coon, Erika Moonin</i>	
Tunnel-Induced Surface Settlement on the Brightwater Conveyance East Contract	298
<i>Michael A. Lach, Farid Sariosseiri</i>	
Strategic Tunnel Enhancement Programme, Abu Dhabi, UAE: An Overview of Geology and Anticipated Geotechnical Conditions Along the Deep Sewer Tunnel Alignment	304
<i>Mubarak Obaid Al Dhaheri, Mark Marshall, Panagiota Asprouda, Suresh Parashar</i>	

Geotechnical Variability and Uncertainty in Long Tunnels	316
<i>Jack Raymer</i>	
Session 2: Challenging Conditions and Site Constraints.....	323
New Irvington Tunnel Design Challenges.	325
<i>Glenn Boyce, Steve Klein, Yiming Sun, Theodore Feldsher, David Tsztoo</i>	
The Sunnysdale CSO Tunnel: Dealing with Urban Infrastructure	337
<i>Renée L. Fippin, Heather E. Stewart, Richard M. Nolting III, Manfred M. Wong</i>	
New York Harbor Siphon Project	346
<i>Colin Lawrence, David Watson, Michael Schultz</i>	
Rehabilitation of Rail Tunnels with Widening the Cross-Section While Maintaining the Regular Rail Traffic	355
<i>Christian Wawrzyniak, Heiner Fromm</i>	
Development of Seismic Design Criteria for the Coronado Highway Tunnel	365
<i>David Young, Anil Dean, James R. Gingery, Tomas Gregor</i>	
Session 3: Managing Risk, Safety, and Security Through Design	373
Performance-Based Design Using Tunnel Fire Suppression.....	375
<i>Fathi Tarada, James Bertwistle</i>	
First Comprehensive Tunnel Design Manual in the United States	387
<i>James E. Monsees, Nasri A. Munfah, C. Jeremy Hung</i>	
Geotechnical Investigations for the Anacostia River Projects.....	397
<i>Amanda Morgan, Kevin Fu, Ronald E. Bizzarri, Carlton M. Ray</i>	
Session 4: Strength, Stresses, and Stability Assessment Selection.....	407
Lining Design Issues Associated with the Storage of Cryogenic Fluids in Rock Caverns	409
<i>Christopher Laughton</i>	
Design Guidelines for Sequential Excavations Method (SEM) Practices for Road Tunnels in the United States	415
<i>Vojtech Gall, Nasri Munfah</i>	
Continuum and Discontinuum Modeling of Second Avenue Subway Caverns	423
<i>Vera Nasri, William Bergeson, Nils Pettersson</i>	
Shaft, Cavern, and Starter Tunnel Construction for Lake Mead Intake No. 3: Temporary Support and Permanent Lining Solutions	433
<i>Luis Piek, Rob Harding, Jeff Hammer</i>	
Methodology for Structural Analysis of Large-Span Caverns in Rock.....	441
<i>Sanja Zlatanic, Patrick H.C. Chan, Ruben Manuelyan</i>	
Session 5: Design Optimization and Alignment Selection.....	459
Factors Influencing Tunnel Design in Mass Transit Applications.....	461
<i>Irwan Halim, Marci Benson</i>	
Transbay Transit Center Program Downtown Rail Extension Project	475
<i>Meghan M. Murphy, Derek J. Penrice, Bradford F. Townsend</i>	
A Tale of Two Capitals: Modeling Helps Designers Manage Strong Surge and Pneumatic Forces in Deep Combined Sewer Storage Tunnels	483
<i>Daniel J. Lautenbach, John K. Marr, Peter Klaver, John F. Cassidy, David Crawford</i>	
McCook Reservoir Main Tunnel Connection Marks Another Significant Milestone in Chicago's TARP.....	502
<i>Faruk Oksuz, Megan Puncke, Jeffrey Bair, Paul Headland</i>	

Integration of Operations and Underground Construction: Sound Transit University Link	517
<i>John Sleavin, Peter Raleigh, Samuel Swartz, Phaidra Campbell</i>	

TRACK 3: PLANNING

Session 1: Project Cost Estimating/Finance	525
Size Matters If You're a Tunnel.	527
<i>Lee W. Abramson</i>	
Setting the Owner's Budget: A Guideline	536
<i>Paul T. Gribbon, Julius Strid</i>	
Show Me the Money: The Real Savings in Tunnel Contract Payment Provisions	541
<i>John M. Stolz</i>	
Planning Level Tunnel Cost Estimation	548
<i>Hamid Javady, Jamal Rostami</i>	
Session 2: Project Delivery	557
Lake Mead Intake No. 3, Las Vegas, NV: A Transparent Risk Management Approach Adopted by the Owner and the Design-Build Contractor and Accepted by the Insurer	559
<i>Michael Feroz, Erika Moonin, James Grayson</i>	
Tunneling MegaProjects: They Are Different	566
<i>David J. Hatem, David H. Corkum</i>	
Alternative Contracting and Delivery Methods.	570
<i>Janette Keiser, John J. Riley</i>	
Design of the Waller Creek Tunnel, Austin, Texas	576
<i>Tom Saczynski, Nieves Alfaro, Prakash Donde</i>	
Tunneling as a PPP-Project: Risks from the Viewpoint of the Insurer on a Case Study of a Tunnel Collapse	588
<i>Christian Wawrzyniak, Winfried Luig, Achim Dohmen</i>	
DCWASA's Project Delivery Approach for the Washington DC CSO Program.	593
<i>Ronald E. Bizzarri, Carlton Ray, William W. Edgerton</i>	
How to Deliver Your Project On Time: An Owners Procurement Strategy	601
<i>Wayne Green</i>	
Session 3: Project Planning and Implementation I	607
Sustainability Drives Jollyville Transmission Main Tunnel Design	609
<i>Clay Haynes, Tom Knox</i>	
Sustainable Underground Solutions for an Above Ground Problem.	613
<i>Laura S. Cabiness, Steven A. Kirk, Stephen A. O'Connell, Jason T. Swartz</i>	
Large Diameter TBM Solution for Subway Systems	621
<i>Verya Nasri</i>	
Digging Deep to Save Green While Being Green and Sustainable.	629
<i>S. Nielsen, J. Morgan, J. McKelvey, J. Trypus</i>	
Design and Construction Considerations for Shafts at Grand Central Terminal for the MTACC's East Side Access Project	635
<i>A.J. Thompson</i>	
The Urban Ring Project: Planning a New Bus Rapid Transit Tunnel for Boston	641
<i>D.M. Watson, J.P. Davies, J.A. Doyle</i>	

Session 4: Project Risk, Budget, and Schedule	653
Blast and Post Blast Behavior of Tunnels	655
<i>Sunghoon Choi, Ian Chaney, Taehyun Moon</i>	
Decision-Making Case History for Municipal Infrastructure Improvements	664
<i>Lizan N. Gilbert, Jennifer Stark, Gopal Guthikonda, Joe Hoepken</i>	
Risk Management to Make Informed, Contingency-Based CIP Decisions	676
<i>Paul Gribbon, Gregory Colzani, Christa Overby, Julius Strid</i>	
Linear Schedules for Tunnel Projects	683
<i>Mun Wei Leong, Daniel E. Kass</i>	
Building Mined Underground Stations in Soft Ground with NATM Construction Practices	695
<i>Gerhard Sauer, Juergen Laubbichler, Sebastian Kumpfmüller, Thomas Schwind</i>	
Cost and Schedule Contingency for Large Underground Projects: What the Owner Needs to Know ...	710
<i>Christopher Laughton</i>	
Management of Cost and Risk to Meet Budget and Schedule	718
<i>John Reilly, Dwight Sangrey, Steve Warhoe</i>	
Overhead and Uncertainty in Cost Estimates: A Guide to Their Review	725
<i>John M. Stolz</i>	
 Session 5: Project Planning and Implementation II	 731
Sedimentary Rock Tunnel for CSO Storage and Conveyance in Cincinnati, Ohio	733
<i>Michael Deutscher, Samer Sadek, Roger Ward</i>	
Tunneling to Preserve Tollgate Creek	740
<i>Michael Gilbert, Jacqueline Wesley, Swirvine Nyirenda</i>	
Tunneling Under Downtown Los Angeles	750
<i>Mohammad Jafari, Jeffrey Woon, Osman Pekin, Amanda Elioff, Girish Roy</i>	
Selecting an Alignment for the Blacklick Creek Sanitary Interceptor Sewer Tunnel— Columbus, Ohio.	758
<i>Valerie R. Rebar, Heather M. Ivory</i>	
 TRACK 4: CASE HISTORIES	
 Session 1: Small Diameter	 769
Microtunneling Challenges: Crossing Under Major Railroad and Highways in Very Soft Glacial Soils—The Evolution of a Ground Treatment Assessment Process	771
<i>Philip W. Lloyd, Glenn Duyvestyn, Zhenqi Cai</i>	
Marysville Trunk Interceptor Project: A Case History	788
<i>Paul de Verteuil</i>	
Case History: Innovative CSO Pipe Installation in a Congested Urban Setting.	796
<i>Emad Farouz</i>	
Pipe Jacking Through Hardpan: A Case History—North Gratiot Interceptor Drain Phase I	804
<i>Joseph B. Alberts, Jason R. Edberg, Keith Graboske, Gordon Wilson, Steven Mancini</i>	
Construction Challenges for Small Diameter Soft Ground Tunnels	813
<i>William Bergeson, Verna Nasri, Alan Pelletier, Leo Martin, Richard Palmer</i>	
 Session 2: NATM/SEM	 823
Past and Present Soft Ground NATM for Tunnel and Shaft Construction for the Washington, D.C. Metro	825
<i>John Rudolf, Vojtech Gall, Timothy O'Brien</i>	

The Lincoln Square Tunnel: Tunneling Between Two Parking Garages Using Sequential Excavation Mining	836
<i>Chris D. Breeds, Larry Leone, Don Gonzales</i>	
Case History: Complex Design and Construction of Tunnel and SOE to Accommodate Challenging Site Conditions	843
<i>Emad Farouz, John I. Yao</i>	
Session 3: Challenging Conditions	853
Tunneling on Brightwater West.	855
<i>Glen Frank, Mina M. Shinouda, Greg Hauser</i>	
New York City Transit No. 7 Subway Extension Underpinning and Construction Under the 8th Ave. Subway	863
<i>Aram Grigoryan, Raymond J. Castelli, Fuat Topcubasi, Sankar Chakraborty</i>	
Consolidation Grouting of the Riverbank Filtration Tunnel	876
<i>Adam L. Bedell, Steve Holtermann, Kay Ball</i>	
Gotthard Base Tunnel: Micro Tremors and Rock Bursts Encountered During Construction	880
<i>Michael Rehbock-Sander, Rolf Stadelmann</i>	
Optimization in Blasting Production and Vibration Mitigation for Shaft and Tunnel Construction at Lake Mead	889
<i>Jordan Hoover, Dan Brown, Caroline Boerner, Shimi Tzobery, Erika Moonin</i>	
Session 4: Conventional Tunneling	895
A Conventionally Tunneled River Undercrossing.	897
<i>Adrian A.J. Holmes, Sangyoon Min, Klaus G. Winkler, Jim Brunkhorst</i>	
Tunneling Ground Reinforcement by TAM Grouting: A Case History.	906
<i>Ahmad Samadi, Gary Seifert</i>	
The Construction of the Tunnels and Shafts for the Project XFEL (X-Ray Free Electron Laser)	916
<i>Paul Erdmann</i>	
Canadian Fast-Track Drill and Blast: Excavating the Rupert Transfer Tunnel at James Bay, Québec, Canada.	923
<i>C.H. Murdock, R.W. Glowe</i>	
Re-Design of Water Tunnels for Croton Water Treatment Plant, New York City.	926
<i>Jozef F. Zurawski, Paul J. Scagnelli</i>	
Keys to Success in Managing a Complicated Tunnel Project: City of Columbus— Big Walnut Sanitary Trunk Sewer Extension	938
<i>Michael J. Hall, John G. Newsome</i>	
Drop Structures and Diversion Structures for the East Side Combined Sewer Overflow Project, Portland, Oregon	944
<i>Roy F. Cook, Tammy R. Cleys, Tony O'Donnell, Tom Corry</i>	
Special Session: Operational Criteria and Functionality for Highway Tunnels	955
National Tunnel Inspection Standards (NTIS)	957
<i>Jesus M. Rohena y Correa</i>	
U.S. Domestic Scan Program—Best Practices for Roadway Tunnel Design, Construction, Operation, and Maintenance	960
<i>Jesus Rohena</i>	
Index.	965