

Construction Research Institute of Canada

Cold Regions Engineering & Construction Conference & Expo 2004

May 16 – 19, 2004
Edmonton, Alberta, Canada

Volume 1 of 3

Printed from e-media with permission by:

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

ISBN: 978-1-60423-743-6

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

Construction Research Institute of Canada

Cold Regions Engineering & Construction Conference & Expo
2004

TABLE OF CONTENTS

Volume 1

Tracer Study of a Small Water Treatment System to Determine Contact Time for Microorganism Reduction.....	1
<i>R.K. Guest, C.P. Svrcek, Daniel W. Smith</i>	
Public Health Considerations in Operating and Maintaining Drinking Water Infrastructure in Cold Climates.....	16
<i>K.M.E. Emde, D.W. Smith, N. Fok, L. Gammie, S. Ancel, J.A. Talbot</i>	
Public Health Focused Risk Assessment of Water Treatment Infrastructure on First Nations Reserves in Alberta.....	23
<i>D.W. Smith, R.K. Guest, C.P. Svrcek, S. Sandhu, K. Farahbakhsh</i>	
Construction on Frozen Saline Grounds of the Arctic Coast of Eurasia	48
<i>A. Brouchkov</i>	
The Observed Performance of a Roadbed-Abutment Transition Part Structure on Permafrost.....	61
<i>Jiankun Liu, Weimeng Bao, Xudong Li, Xiaogang Han</i>	
Some Experiences with Thaw Settlements of Infrastructure	68
<i>Jim Oswell, Keith Barnes</i>	
Airshed Zone Management Approach in West Central Alberta.....	82
<i>R. Scotten, B. Korobanik, K. McCullum, W.B. Kindzierski, G. Cross</i>	
Elemental Trends in Urban Ambient Particulate Matter in Downtown Edmonton and Calgary, Alberta	94
<i>Kevin McCullum, Warren Kindzierski, Mohamed Gamal El-Din, B. Myrick</i>	
Historical PM2.5 Monitoring Data Trends in Edmonton and Calgary: Investigation of their Potential use for PM2.5 Modelling.....	111
<i>D. Su, A. Gamal El-Din, M. Gamal El-Din, A. Idriss, B. Wiens</i>	
Whitehorse Multiplex 2007 Jeux du Canada Games Centre.....	130
<i>Stephen Barr</i>	
Building Multi-Unit Residential Construction in the North with Pre-Fabricated Structural Insulated Panels	150
<i>Tony Mammone</i>	
Innovation in Panel Design	183
<i>Robert A. Murray</i>	
Pilot Study - Using Cartridge Filtration System as a Viable Treatment Process to Meet the Proposed Surface Water Treatment Rule in Colville Lake	205
<i>Vincent Tam</i>	
Arsenic Removal by Ozonation/ Filtration	217
<i>Linda Blumberg, Craig Woolard</i>	

Membrane Filtration for the Cold Regions - Impact of Cold Water on Membrane Operation.....	239
<i>Khosrow Farahbakhsh, Daniel W. Smith</i>	
Membrane Filtration for Potable Water Production at Remote Small Systems Using Surface Water Sources.....	253
<i>Greg Jones</i>	
Frost Susceptibility of Lightweight Soil Mixed with EPS Beads	266
<i>Takashi Ono, Toshihisa Furudate</i>	
Freezing Processes for a Course Sand with Varying Salinities	277
<i>Lukas U. Arenson, David Sego</i>	
Experimental Research on Wave Velocity and Drillability of Frozen Clay	N/A
<i>Qin-yong Ma</i>	
The Influence of Freezing and Thawing Action on the Dry Density and Water Content of Soil.....	293
<i>Yang Cheng-song, He Ping, Cheng Guo-dong</i>	
Investigation of Historical Data Patterns for Ozone and Related Compounds in Edmonton and Calgary and their Application to Modelling Ground-Level Ozone	294
<i>D. Su, A. Gamal El-Din, A. Idriss, M. Gamal El-Din, B. Wiens</i>	
Particle Penetration through Surrogate Cracks of Residential Buildings	311
<i>C-J Jeng, W.B. Kindzierski, D.W. Smith</i>	
Implementing New Technology with Steel Design and Fabrication for Cold Regions Engineering and Construction	324
<i>Peter Timler</i>	
Winter Construction Mass Concrete	336
<i>S. Eslamizaad, Gus Ziebart</i>	
Prestressed Foundations for Wind Towers and the Wind Energy Industry	344
<i>Dilip Khatri, Shelton Stringer</i>	
Low-Intensity Infrared Heating for Thawing Frozen Ground in Civil Construction.....	355
<i>W. Spencer Guthrie, Brandon Blankenagel, Claus Nielsen</i>	
Converting a Seasonal-Use Diversion Dam for Year-Round Operation and Exposure to Freezing Conditions	375
<i>Erling A. Juel</i>	
Grey Water Treatment to Potable Water Quality via Separation Technology	386
<i>Clint Elston</i>	
Application of Innovative On-Site Water Reuse Technology in Cold Region Communities.....	393
<i>Ken Johnson, Bill Fandrick</i>	
Indoor/Outdoor SO₂ in a Community Adjacent to Oilsand Extraction and Production Facilities in Northern Alberta	419
<i>W.B. Kindzierski, H.K.S. Ranganathan</i>	
Contaminant Concentrations in Indoor Air Compared to Outdoor Ambient Air and Personal Exposure -Results of Several Community Exposure Assessments	433
<i>A. MacKenzie, D. Prince, J. Robb, D. Schopflocher, S. Shaw, S. Chang, F. Wang, S. Wu, S. Gabos</i>	
Indoor Air Quality in a Rural Elementary School near Edmonton, Alberta.....	448
<i>S.M. Probert, E.P. Zazulak, A.K. Mak, N.M. Fok</i>	

Development of a Web-Based Graduate Course of Study in Cold Regions Utilities Design and Construction.....	455
<i>Daniel H. Schubert, Orson P. Smith</i>	
Winter Construction Methods.....	462
<i>Rod Wales</i>	
An Off-The-Shelf Approach to Winter Concreteing	485
<i>Charles Korhonen, Peter Semen, Lynette Barna</i>	
Arsenic Occurrence in Drinking Waters in Alaska	496
<i>Sara Hadden, Craig Woolard</i>	
Investigation of Dissolved Oxygen Concentrations in the Athabasca River.....	514
<i>Ellen Y Tian, Can-Hua Zhao, Preston McEachern, Tong Yu, David Zhu</i>	
Lead and Copper Control at an Elementary School in Anchorage Alaska	530
<i>Craig Woolard, Greg Jones, Daniel Schubert</i>	
Aeration System Design and Construction for Lead and Copper Control at Crooked Creek, Alaska	536
<i>Daniel Schubert, Craig Woolard, Ken Sun, Tom Parent</i>	
Construction of Water Treatment Plant Improvements in the City of Iqaluit, Nunavut	550
<i>David Benke, Ken Johnson, Glenn Prosko</i>	
Cold Weather MSS Concrete Pours	N/A
<i>Andrew Sly, Arthur Krehut</i>	
Planning the Logistics & Construction on your Arctic Worksite	N/A
<i>Andrew Clarke</i>	
Analytical Evaluation of Roof Snow Drifts	551
<i>Michael O'Rourke, Arthur DeGaetano</i>	
Analysis of Rainfall Frequency for Selected Alaskan Cities	562
<i>Rachel Armstrong, Robert Carlson</i>	
The Impacts of Hydrologic and Climatic Change on Domestic Water Supplies in the Arctic.....	577
<i>Daniel White, Lilian Alessa, Larry Hinzman, Peter Schweitzer</i>	
Climate Impacts and Adaptation in Canada's North.....	589
<i>David Malcolm</i>	
Safety, Quality and Productivity Issues Experienced During Cold Weather Construction	598
<i>Martin Cassault, Hans Wolf</i>	
Mobility in Winter Construction	617
<i>Y. Wang, Y. Mohamed, S. AbouRizk</i>	
The Use of a Flexible Geoweb Mat in the Construction of an External Sump	637
<i>Kevin Davis, Josip Peleskei, Tom Zubot</i>	
Performance and Potential Improvements to Anaerobic Sewage Lagoon in Fort McPherson, NT	647
<i>Ken Johnson, John Bulmer, Ron Rusnell, Michel Lanteigne</i>	
City of Galena, Alaska Onsite Sewage System Upgrade	661
<i>Bob Tsigonis, Keith Hanneman, Karen Brady</i>	

Volume 2

City of Galena, Alaska Onsite Sewage System Upgrade	661
<i>Bob Tsigonis, Keith Hanneman, Karen Brady</i>	

Ozone Treatment for the Degradation of Resin and Unsaturated Fatty Acids at Low Temperatures	673
<i>Fares Almomani, Mohamed Gamal El-Din, Daniel W. Smith</i>	
Laboratory Studies of Gas Permeability of Frozen Soil.....	698
<i>Gang Chen, Qing Lin, Scott Huang, Wei Zhou</i>	
Effects of a Crude Oil Spill on Permafrost after 24 years in Interior Alaska.....	716
<i>Daniel White, Charles M. Collins, David Barnes, Helena Byard</i>	
The Effects of a Crude Oil Spill on the Thermal Stability of Permafrost	731
<i>Katya Matveeva, Daniel White, Kenji Yoshikawa, David Barnes, Charles M. Collins</i>	
Performance of Yukon-Kuskokwim Delta Airport Embankments	N/A
<i>David C. Esch, Kurt O. Stangl</i>	
Investigation and Assessment of Runways Overlying Warm Permafrost, Yellowknife Airport.....	743
<i>Jack Seto, Neil Parry, Don Hayley, Laurin Trudeau</i>	
Permafrost Thawing Impacts on Road and Airfields; Problem Assessment and Review of Possible Solutions	760
<i>Isabelle Beaulac, Guy Dore, Yuri Shur, Michel Allard</i>	
A Study on Quality Improvement of Earthwork in Winter	781
<i>Satoshi Nishimoto, Eiji Watanabe</i>	
Performance of Vibratory Machines on Frozen Ground	793
<i>S. Eslaamizaad</i>	
Cold Weather Challenges in the Crane Industry.....	800
<i>Ted Melnyk</i>	
Freeze Separation to Manage Mine Wastewater	818
<i>David Sego, D.W. Smith, Kevin Biggar</i>	
Freeze-Separation for Nutrient Recovery for High Intensity Hog Farm Wastes.....	819
<i>Amanda Willoughby, Kevin Biggar, David Sego</i>	
Low Temperature Wastewater Treatment Using Fungal Peroxidase	820
<i>Xiaojian Mao, Ian Buchanan, Stephen Stanley</i>	
Study of the Wastewater and Water Supply systems at the Eureka Weather Station	833
<i>Daniel W. Smith</i>	
A Hierarchy of Snowmelt Modeling Methods of Different Complexity: Temperature-Index, Modified Temperature Index and Energy-Balance	885
<i>Purushottam Raj Singh, Thian Yew Gan, Adam Kenea Gobena</i>	
Water Quality Testing in Rainwater Catchments Across Alaska	908
<i>Corianne Hart, Daniel White</i>	
Modeling the Impact of Snowmelt on TP Concentration of Forested Watersheds, Northern Alberta: Implications to the Applicability of Time Series and Artificial Neural Networks	923
<i>Mohamed H. Nour, Daniel W. Smith, Mohamed Gamal El-Din, E.E. Prepas</i>	
Retrieving Snow Water Equivalent from SSM/I Passive Microwave Data using Artificial Neural Network, Projection Pursuit & Nonlinear Regressions	943
<i>Thian Yew Gan, Oscar Kalina, Purushottam Singh</i>	
Disturbance from Off-Road Vehicle During Spring Thaw	960
<i>R.T Affleck, S. Shoop, K. Simmons, P. Ayers</i>	

Design of Passive Permafrost Cooling Systems for an Interior Alaska Roadway	979
<i>Douglas J. Goering, Steve Saboundjian</i>	
Permafrost Response Following Reconstruction of the Yellowknife Highway	993
<i>Ed Hoeve, Jack Seto, Don Hayley</i>	
Environmental Stewardship and Cold Weather Construction of Watercourse Crossings in the Boreal Forest of Alberta	1010
<i>A. Highmoor, T. Gooding, S. Gooding</i>	
The Forest Watershed and Riparian Disturbance (FORWARD) Project: Hypothesis Development for Watershed Disturbance Modeling in the Canadian Boreal Forest	1028
<i>E.E. Prepas, J.M. Burke, I.R. Whitson, G. Putz, and D.W. Smith</i>	
Subsurface Winter Soils Temperatures in the Western Canadian Boreal Plain Forest: Preliminary Implications for Winter Harvesting Operations.....	1048
<i>I.R. Whitson, T. McCready</i>	
Framework for Evaluation of a Cost-Effective Method for Placing and Removing Seasonal Load Restrictions on Low Volume Roads—The Portable Falling Weight Deflectometer	1065
<i>Maureen Kestler, Richard Berg</i>	
Windrow Composting of Municipal Biosolids in Cold Temperatures.....	1086
<i>Daryl McCartney, Grant Eftoda</i>	
Groundwater Investigation of Sunderby Landfill, Lulea, Sweden.....	1099
<i>D. Yoshisaka, W.B. Kindzierski, C. Jonasson</i>	
Preliminary Assessment of Hydrology and Hydraulics for a Tanana River Bridge near Fairbanks, Alaska	1117
<i>Caroline Maniaci, Nathanael Vaughan, Jakob Theurich, Robert Carlson</i>	
Streamflow And Water Quality Monitoring In Small Watersheds In The Western Canadian Boreal Forest: Procedures And Challenges	1133
<i>M.S. Serediak, G. Putz</i>	
Use of Low Density Asphalt in Base-Course as a Mitigation for Frost Action in Pavements.....	1146
<i>J. Cote, J.M. Konrad, P.T. Dorchies</i>	
Long Term Performance and Cost Effectiveness of Insulated Pavements	1158
<i>Sylvain Juneau, Guy Dore, Pascale Pierre, Yves Savard</i>	
Temperature Difference between Pavement and Air at Some Road Weather Stations in Finland in 2003	1177
<i>Saarelainen Seppo</i>	
DCRMS—An Oil Sand Daily Construction Record Management System	1187
<i>Dr. Song (Bruce) Li, Lee Nichols, Jamel Sagaoula, Norman Eenkooren, Samuel Saforo</i>	
Use of Preserved Wood Foundations for Structural Rehabilitation of Failed Basements of Old Residences.....	1197
<i>Konstantin Ashkinadze</i>	
Hydronic Air Heaters: Flameless and Moistureless Jobsite Construction Heaters	1217
<i>Ed Jaroszewicz</i>	
Thermal Loads & Expansion Joints in Industrial Pipe Racks	1238
<i>S. Gowri Gowrichankar</i>	
Project Management Issues Related to Trenchless Construction in Cold Climates	1239
<i>Jason S. Lueke, Janaka Ruwanpura</i>	

Horizontal Directionally Drilled Pipelines in Icy Permafrost. Comparisons Between Predicted and Measured Data for the Colville River Crossing in Alaska	1263
<i>Beez Hazen, Dean Carson</i>	
A Simplified Solution for Frost Heave Prediction of Chilled Pipelines	1282
<i>Bipul Hawlader, Vincent Morgan, Jack Clark</i>	
Impacts of Ice Forces on Stream Bank Protection	1290
<i>Nathanael Vaughan, Robert Carlson</i>	
Analysis of Ice Jam Release Surges on the Athabasca River near Fort McMurray, AB	1300
<i>Twyla Kowalczyk, Faye Hicks</i>	

Volume 3

A Modified Temperature Index Method Using Near-Surface and Air Temperatures for Modeling Snowmelt in the Canadian Prairies.....	1315
<i>Purushottam Raj Singh, Thian Yew Gan, Adam Kena Gobena</i>	
An Experimental Study of Ice Effects on Scour at Bridge Piers	1331
<i>Decker Hains, Leonard Zabilansky, Richard Weisman</i>	
Seasonal Effects on the International Roughness Index of Roadways in Cold Regions	1350
<i>Dave Palsat, Darel Mesher, Allan Kwan, Chuck McMillan</i>	
Climate Impacts and Adoptions on Roads in Northern Canada.....	1370
<i>Ralph Haas, Lynne Crowe Falls, Donaldson MacLeod, Susan Tighe</i>	
Transportation Engineering in Cold Regions: State of the Practice Review	1388
<i>Robert L. Mokwa</i>	
Test Study of Concrete Cover Crack Form Due to Corroded Rebar.....	1406
<i>Wu Shengxing, Wang Qiaping</i>	
Hydronic Heaters Partner with New Insulation Blanket Technology: Curing Concrete in Cold Weather	1407
<i>Sue Meekhof</i>	
Effect of Temperature Decrease on Concrete Slab Cracking.....	1455
<i>Samir Shoukry, Gergis William, Mourad Riad</i>	
Cellular Concrete: Engineering and Technological Advancement for Construction in Cold Regions	1469
<i>Brad Dolton, Craig Hannah</i>	
Performance Evaluation of a Full-scale Ultrafiltration Membrane in Gold Bar Wastewater Treatment Plant	1487
<i>Daniel W. Smith</i>	
Aspects of Municipal Waste Management in Cold Climates	1505
<i>Bud Latta, Charles Labatiuk</i>	
Research Needs in Managing Wastewater Treatment Residuals in Cold Climates	1527
<i>Darryl Seehagel</i>	
Field-scale Assessment of Phytotechnologies for Remediation of Industrial Sites Impacted with Weathered Hydrocarbons	1543
<i>J.J. Germida, R.E. Farrell</i>	
Public Health Concerns with Remediation of Contaminated Sites.....	1567
<i>Elson P. Zazulak, Karen M.E. Emde, William S. Hohn</i>	

Winter Construction of a Tidal Barrier on an Active Military Firing Range.....	1575
<i>Jon E. Zufelt, Michael Walsh, Charles M. Collins, Terry Edwards</i>	
Strategies to Minimize Cost and Time Overruns in Alaska's Highway Construction Field: An Analytical Approach	1590
<i>Felix Krause, Robert Perkins</i>	
Creating and Interpreting Alaska's Highway Construction Cost Index.....	1606
<i>Thomas-Felix Krause, Robert Perkins</i>	
Storage Best Management Practices and Disposal Options for Alaskan Highway Snow	1618
<i>Nathanael Vaughan, Robert Carlson, David Barnes</i>	
Stormwater Management in Fairbanks Alaska.....	1642
<i>Jason Albert, David Barnes, Robert Carlson, Stephanie Gould</i>	
Release of Pollutants from Urban Snow Deposits	1655
<i>W. Gao, D.W. Smith</i>	
Oil Sand Water Management— R&D Opportunities	1671
<i>Ross Chow, Ernie Perkins</i>	
Solid Waste Residuals Treatment	1685
<i>Daryl McCartney</i>	
More than Manure—Agri-Food Waste Management.....	1686
<i>Jerry Leonard</i>	
Wrap-Up and Question Period	N/A
<i>Salim Abboud</i>	
How Chemical Differences in Soil Leachates Relate to Groundcover	1702
<i>Sarah Seelen, Daniel White, Kenji Yoshikawa, Vincent Autier</i>	
Remediation of White Phosphorus Contamination in an Alaskan Wetland.....	1713
<i>Michael Walsh</i>	
Dew Line Landfill Design and Construction.....	1724
<i>William T. Horne, Ed. M. Grozic, Roland Merkowsky, Kevin W. Jones</i>	
Enhanced Bioremediation of Petroleum Contaminated Soil by Cold-Adapted Bacteria Screened from a Western Canada Site	1738
<i>B.Y. Zhang, G. Huang, Q. Guo, B. Chen</i>	
Ice Roads in the Mackenzie Delta.....	1754
<i>Steve Barnett</i>	
Application of Special Purpose Simulation Modeling for Tunnel Construction.....	1786
<i>K.C. Er, Siri Fernando, Janaka Ruwanpura</i>	
Earthquake Hazards: Geotechnical Design Concerns. A Review based on the November 3, 2002 Mw 7.9 Alaska Earthquake	1829
<i>Stephen Adamczak Jr., Rohn D. Abbott, Frank J. Wuttig</i>	
Thermal Analysis, Construction and Monitoring Methods for Frozen Ground	1840
<i>Duane L. Miller, Erwin L. Long, John P. Zarling, Daniel Mageau, Yuri Shur</i>	
Mine Waste Management Using Freezing and Thawing	1841
<i>Dave Sego</i>	
Rock Creek Gold Mine Near Nome, Alaska Geotechnical Investigation/Studies for Open Pit, Tailings Impoundment, Waste Dumps and the Plant Facility	1842
<i>Thomas G. Krzewinski, Travis E. Ross, Doug Nicholson</i>	

Fast Track Weather-Tolerant Framing/Enclosure System for Cold Region Construction	1855
<i>Wilfred Siu</i>	
Engineering for Sustainable Development in Canada's North.....	1873
<i>David Malcolm, Robert M. Bone</i>	
Sustainable Concrete: Using Fly Ash Concrete in Cold Climates	1881
<i>Diana Klein</i>	
Application of the Viscoelastoplastic Continuum Damage Model to Thermal Cracking of Asphalt Concrete Pavements.....	1887
<i>Ghassan R. Chehab</i>	
An Investigation into the Strengthening of Timber Piles Using FRP in Regions of Permafrost.....	1907
<i>Alfred Dorey, J.J. Roger Cheng, Orlan Webber</i>	
The Trout River Bridge—A Low Maintenance Design for Remote Bridges	1919
<i>Ramon Caluttung, Hugh Hawk, Stan Reimer</i>	
Cold Weather Considerations for Building Envelope Components	1934
<i>Nick Trovato</i>	
Development of a “Self Contained Micro Infrastructure Appliance”	1935
<i>Udo Staschik, Grant Morrison, Christopher Ives</i>	
Impacts of Climate Change on Communities and Community Infrastructure in Cold Region Communities	1944
<i>Ken Johnson</i>	