Electrical Transmission and Substation Structures 2018

Dedicated to Strengthening Our Critical Infrastructure

Proceedings of the Electrical Transmission and Substation Structures Conference 2018

Atlanta, Georgia, USA
4-8 November 2018

Editor:

Michael Miller

ISBN: 978-1-5108-7550-0
Contents

Construction Challenges

Structural Design and Construction Challenges on the South and West of Edmonton Area Development Project ................................................................. 1
Jondy Britton, Meagan Moeller, Wellan Cowan, Jacob Merriman, and Chih-Hung Chen

Keeping the Project on Schedule—A Case Study about Emergency Weld Repairs Required on a Newly Installed Vibratory Caisson ........................................ 11
Zachary J. Oliphant, Justin W. Curtis, Benjamin S. Jessup, and Christopher W. Schnetzler

Mechanically Spliced Full Length Anchor Bolts—Bringing It All Together ........... 23
Kolleen L. Backlund, Adam G. Bowland, Aaron P. Darby, Keith S. Yamatani, and Nancy Z. Fulk

Construction Challenges in Paradise Hawaiian Electric Company—138 kV System Rebuild .............................................................. 36
Mitchell Cowen and Garett Muranaka

Foundations

Peter M. Kandaris, Ashley E. Evans, and Asim Haldar

Practical Collaborative Approach to Alternative T-Line Foundations .................. 62
Bridget Honsey, Jacob Hexum, Cole Vosters, Michael Bradley, and Cliff Van Den Elzen

The Value of Structure-Specific Borings: Statistical Analysis of Electrical Transmission Line Structure Foundation Costs Based on Structure-Specific Borings versus No Borings or Variable Boring Spacing ........................................ 70
Robert Chantome, James Knutelski, Darren Ratliff, Kevin Schilling, and Daniel Whalen

Groundwork for Developing Comprehensive Transmission Line Foundation Design Guidelines ................................................................. 84
Peter M. Kandaris, Steve Davidow, and Ashley E. Evans

Posters

Composite Transmission Towers: Analysis, Behavior, Slip Investigation, and Interaction Diagrams ................................................................. 94
Mustafa Mahamid, Kamel Bilal, and Cenk Tort

© ASCE
Failure Analysis on Transmission Tower Struck by Tropical Storms ...................... 108
Jian Zhang and Qiang Xie

Effective Length Factor of Leg Member in Latticed Steel Tower ...................... 122
M. L. Lu, M. Hao, and D. Chakrabarti

Seismic Effects on Transmission Lines and Their Major Components .................. 132
Leon Kempner Jr., Scott Schlechter, and Asim Haldar

Program Considerations for Analysis of Drilled Shaft Foundations .................. 146
Sanchit Chitre, Joel Coker, and Brian Sedgwick

Flood Design of Substation Structures ................................................................. 157
Jared Augustine, Emily Larson, and Emily Bonini

Consideration of Sustained Loads and Creep Effects in Specifying and Designing Fiber Reinforced Polymer (FRP) Utility Poles ........................... 167
Diego S. Arabbo, Matthew C. Richie, and Scott J. DiFiore

A Full-Scale Crash Test for a Transmission Wood Pole ....................................... 176
Haijian Shi

Seismic Design of Substation Steel Structures: What Code Should I Follow? ........... 185
Hannah M. Hillegas and Prapon Somboonyanon

Analysis, Prediction, and Mitigation of Vortex Induced Vibrations in Substation Structures ................................................................. 191
Hossein Qarib and Diaaeldin Mohamed

Managing Aging Substation Structures ................................................................. 199
Harinee Trivedi and Stefanie Gille

Seismic

Evolution of Electrical Grid Seismic Resiliency ................................................. 209
John Dai, John Eidinger, Florizel Bautista, and Roderick Dela Cruz

Seismic Design of Substations—IEEE Standard 693 Gets a Major Update ............. 219
Eric Fujisaki, Leon Kempner Jr., Brian Knight, and Craig Riker

Seismic Resiliency: What Utilities Should Know to Keep the Lights On ................. 233
Robert S. Cochran

Special Design Considerations

Aesthetics and Infrastructure: Accomplishing Both with Better Overall Results for Power Delivery Projects ................................................................. 244
Kenneth Sharpless and Lynda Kiejko

© ASCE
Case Study for Behaviour of Transmission Line Structures under Full-Scale Flow Field of Stockton, Kansas, 2005 Tornado .......................................................... 257
Ashraf A. El Damatty, Nima Ezami, and Ahmed Hamada

Evaluation and Implementation of Alternate Pole Materials to Meet Regulatory Aesthetic Requirements ................................................................. 269
Clinton Y. Char and Alaira Bilek

Leon Kempner Jr.

Securing Steel Davit Arms: When and How? ........................................... 290
Meihuan Fulk, Blake Tucker, and David Parrish

Modeling and Quantifying the Aerodynamic Characteristics of Transmission Line Structures to Avoid and Mitigate Aeolian-Induced Vibrations ........................................... 302
Erik Ruggeri

Embrittlement in T.L. Lattice Steel Structures Specifying Energy Absorption Criteria ............................................................................................. 312
Katherine Bridwell, Bhargava Vantari, Jonathan Kell, and Cesar Aguilar

Structural Analysis

Lattice Tower Deflection and Modeling of the Structure and Spans in Practice .......... 325
Saumya Nag, Steve Beilstein, Loren Jessen, Jonathan Frantz, Matthew Nicholson, Khaled Kator, and Kevin Heller

Recent Duke Energy Studies to Develop Transmission Pole Standard ................ 337
Prasad Yenumula, Jimmy Robinson Jr., and Neal Murray

Lattice Transmission Structures: Challenging Modeling Scenarios That Require Non-Traditional Analysis Methods ........................................... 349
Kevin M. Wortmann and Ryan Z. Hann

Wood v. Steel: Dawn of Justice ..................................................................... 362
Otto J. Lynch

Heel or Toe? The Transmission Engineer’s Guide to Single Angles in Flexure ........ 372
Aaron Darby, Mary Jane McMillen, Nancy Fulk, and Robert Nickerson

Crossing the Delaware with PECO and a 300 ft Tall H-Frame Structure .......... 385
Guy Faries and Kalpesh Patel

Updated Fall Protection Efforts for Transmission Structures ......................... 393
David E. O’Claire and Mark D. Nelson
Structural Failure Analysis and Investigation

Evaluation of Typical Arm-to-Pole Connections in Slender Steel Pole Transmission Structures for Wind Induced Vibration and Fatigue ........................................... 407
Lawrence G. Griffis and Karl H. Frank

Fatigue Testing and Finite Element Modeling of Arm-to-Pole Connections in Steel Transmission Pole Structures ................................................................................. 419
Francisco J. Bonachera Martin, Jason B. Lloyd, Robert J. Connor, and Amit Varma

Welding Challenges in Typical Connections Used in Steel Pole Transmission Structures ............................................................................................................. 435
Jim Merrill and Wesley J. Oliphant

Challenges in Design and Mitigation of Wind-Induced Vibration for Slender Steel Pole Transmission Structures ................................................................. 445
Daryl Boggs

Structure Upgrading

Great River Energy Transmission Line Tower Repairs ........................................... 458
Kerby M. Nester and James M. McGuire

Teaching an Old Line New Tricks ........................................................................... 472
Jimmy Buker and Deborah Knudtzon

Steel Transmission Pole Structural Capacity Uprating for High Voltage Transmission Line and Substation Upgrade Projects ......................................................... 484
Chad Hines, Matthew Lohry, and Christopher Facklam

Substation Design Issues

Prefabricated Foundations—Construction Efficiencies and Economic Impacts .......... 496
Daniel S. Cuffman, Aaron P. Darby, and Olivialin A. Miller

Design and Construction of Riser Structures in Alberta ........................................... 506
Kumar Kishor and Andrew Rees

Going against the Current: Short Circuit Force Background ................................... 519
Alex J. Kladiva