

Electrical Transmission and Substation Structures Conference 2012

**Columbus, Ohio, USA
4-8 November 2012**

Editors:

Archie D. Pugh

ISBN: 978-1-62748-027-7

Printed from e-media with permission by:

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



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

Copyright© (2012) by the American Society of Civil Engineers
All rights reserved.

Printed by Curran Associates, Inc. (2013)

For permission requests, please contact the American Society of Civil Engineers
at the address below.

American Society of Civil Engineers
1801 Alexander Bell Drive
Reston, VA 20191

Phone: (800) 548-2723
Fax: (703) 295-6333

www.asce.org

Additional copies of this publication are available from:

Curran Associates, Inc.
57 Morehouse Lane
Red Hook, NY 12571 USA
Phone: 845-758-0400
Fax: 845-758-2634
Email: curran@proceedings.com
Web: www.proceedings.com

Table of Contents

Extreme Events

Systematic Plan for Re-Constructing the TVA Transmission System: April 27, 2011	1
Clayton L. Clem and Brenda Hall	
April's Fury: Alabama Power's Transmission Organization Battles Historic Losses after April 27th Storms	14
Sarah J. Barnes and Frank W. Agnew	
500 kV Broadford-Sullivan Storm Restoration	26
J. Kelly Bledsoe, Keith Yamatani, Drew Glover, Mary Jane McMillen, Page Wilson, Dale Williams, and John Edwards	
Vulnerability of Lattice Towers to Blast Induced Damage Scenarios	38
Daniel D. McClure and Arash E. Zaghi	

Line Design

But It's Just a Distribution Line!	47
Otto J. Lynch	
What a Transmission Line Design Engineer Needs to Know about HVDC	61
Ronald Carrington	
Curbing It at the Source: Tehachapi Renewable Transmission Project—Segments 4-11	75
Jason Weller, Harinee Trivedi, and Clinton Y. W. Char	
Transmission Line Rating, Re-Rating, and Upgrading, a Utility Perspective: Experiences at Public Service Company of New Mexico (PNM)	84
E. B. Dohleman and B. G. Forbes	

Structure Design

Development and Validation of "Forged Rings" for Base Plate Material Use	98
Dick Aichinger	
A Comparison of Tubular Steel Pole Fabrication Technologies—Roll Formed vs. Press Broken Shapes	109
Wesley J. Oliphant	
V-String Swing Angle Derivation, Design Considerations, and Structure Design Impacts	119
D. M. Boddy	

Substation Design

Mitigation and Monitoring of Structural Distress in the Whitely Electrical Substation Due to Mine Subsidence	132
Michael Horn, Paul Cass, and Enrique Bazan-Zurita	
Static Analysis of a Substation Rigid Bus Using the Finite Element Program	144
Prapon Somboonyanon	
Substation Expansion on a Challenging Site—Case Study	156
Casey Allums, Jerry Landis, and Joseph Godwin	

Structure Loading

The Effect of Broken Wire Loads on EHV Transmission Structure Design	166
Bruce Freimark, Robert Nickerson, Eddie Hannah, Anne Vitale, Kelly Bledsoe, Dave Parrish, and Nancy Zhu	
Risk Assessment of a Transmission System under Earthquake Loading	183
J. M. Eiding and L. Kempner, Jr.	
Behaviour of Guyed Transmission Line Structures under Tornado Wind Loads—Case Studies	193
A. A. El Damatty and A. Hamada	
Limiting the Effects of Longitudinal Loads on Small Angle Lattice Transmission Towers	205
Philip Joel Bryant	

Foundations

ETT/CREZ Direct Embedded Pole Foundation Load Tests	217
B. Tucker, M. N. Zhu, J. K. Bledsoe, T. D. Parrish, R. E. Gray, A. M. DiGioia, Jr., and D. R. Robinson	

Pipe Pile Foundations with Grouted Inner Steel Pipe for a Transmission Line in an Environmentally Sensitive Area of Southeastern Virginia	227
Bruce L. Roth, Robert B. Smith, and Steven S. Miller	
Unique Solution for 230kV Transmission Tower Grillage Foundation Corrosion	239
Harry V. Durden, Jr., Jonathan M. Maddox, and Stacy S. Sprayberry	

Design and Analysis

Effect of the Dynamic Soil-Structure Interaction on Rigid Transmission Line Towers Subjected to Wind and Impulse Loads	250
A. Jendoubi and F. Legeron	
Aeolian Vibration of Conductors: Theory, Laboratory Simulation, and Field Measurement	262
Robert Whapham	
Transmission Towers with Cruciform Legs	275
David E. O'Claire and David M. Hesse	

Full Scale Testing

Tower Testing—Why Bother?	288
Kelly Bledsoe, Mary Jane McMillen, Robert Nickerson, Dave Parrish, and Nancy Zhu	
Load Tests of Transmission Line Structures and Structural Components	303
C. Jerry Wong	
Historical Perspective of Full-Scale Latticed Steel Transmission Tower Testing	313
Juan Nuño, Michael Miller, and Leon Kempner, Jr.	

Construction Challenges

Building "Constructability" into the Design	323
Michael E. Roos and Kenneth Kallis	
Avian Impact on Overhead Transmission Line Construction	336
Darel Tracy, Lynn Askew, Ben Bainbridge, and Dave Dean	
Construction Challenges on Trans-Allegheny Interstate Line (TrAIL) Project	348
Brian Berkebile, James Buckner, and Ryan Townsend	
Executing Energized Re-Conductoring of Transmission Line Projects	363
Hans Candia, Gregory Bell, and David Elizondo	

Case Studies

500 kV Lattice Tower Development for Energy Gateway	374
Joe C. Hallman and Chuck L. Wright	
Case Study: 220 kV Y-Frames for Southern California Edison	386
Kunjai Pathak and William Gundy	
Brazilian Transmission System: A Race for the Future	401
Rogerio P. Guimarães and Michael D. Miller	

Poster Display

Design Guidelines for Steel Pole Drilled Pier Foundations	416
M. M. ElZayat	
Applying the 2010 ASCE 7 Wind and Ice Requirements to Transmission Line Design	427
Adam J. Beyer	