

## **MICHAEL PLUIMER, PhD**

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### **EDUCATION**

2016 Ph.D., Civil and Environmental Engineering, Villanova University, Villanova, PA

2002 M.S., Mechanical Engineering, University of Minnesota, Minneapolis, MN

1995 B.S., Mechanical Engineering, Calvin College, Grand Rapids, MI

### **APPOINTMENTS**

- Assistant Professor, University of Minnesota – Duluth (2018 – Present)
- President and Owner, Crossroads Engineering Services, LLC (2014 – Present)
- Director of Engineering, Pipe Services Division (2013 – 2014), TRI-Environmental, Austin, TX
- Director of Engineering (2005-2007; 2008 - 2013), Plastics Pipe Institute, CPPA Division, Irving, TX
- Director of Engineering (2007-2008), Nova-Tech Engineering, Willmar, MN
- Director of Engineering (2002 - 2005), Prinsco, Inc., Prinsburg, MN
- Senior Design Engineer (2000 – 2002), The Toro Co., Commercial Division, Bloomington, MN
- Senior Test Engineer (1996 – 2000), The Toro Co., Consumer Division, Bloomington, MN
- Research Assistant (1996), University of Minnesota, Mech. and Env. Engr. Dep't, Minneapolis, MN
- Teaching Assistant (1996), University of Minnesota, Mech. and Env. Engr. Dep't, Minneapolis, MN
- Associate Engineer (1994), Ford Motor Company, Dearborn, MI

### **COURSES INSTRUCTED (PRIMARY)**

*University of Minnesota - Duluth, Duluth, MN:*

- CE 4115 – Design of Steel Structures
- ME 3222 – Controls and Kinematics Lab
- IE 3122 – Materials Engineering Lab

### **COURSES INSTRUCTED (AS GUEST LECTURER AND/OR SUBSTITUTE)**

*Villanova University, Villanova, PA:*

- CEE 8439 – Civil Engineering Materials (Grad.) – Lectured and developed exam problems
- CEE 2211 – Intro. to Transportation (Sophomores) – Lectured
- CEE 4224 – Transportation Facilities Design (Seniors) – Lectured and exam problems
- CEE 8206 – Construction Project Management (Grad.) – Lectured and exam problems
- CEE 7303 – Railway Engineering (Grad.) – Lectured and exam problems
- CEE 3807 – Soil Mechanics (Juniors) – Lectured
- CEE 7400 – Water Resources Engineering (Grad.) – Lectured and exam problems
- CEE 8103 – Geosynthetics (Grad.) – Lectured and exam problems

*McGill University, Montreal, Quebec:*

- Civil Engineering Materials Course – 2009 and 2011

*Drexel University, Philadelphia, PA:*

- Civil Engineering Materials Course – 2010

## **PROFESSIONAL ASSOCIATIONS**

- Transportation Research Board AFF70 (Culverts and Hydraulic Structures), Member
- Transportation Research Board AFS60 (Subsurface Drainage), Member
- Transportation Research Board AFS40 (Subsurface Soil Structure Interaction), Friend
- National Cooperative Highway Research Committee (NCHRP) – Contactor and panel member on various projects
- ASTM International Memberships and Appointments: F17 Membership Secretary (Plastic Piping Systems), F17.62 Secretary (Sewers), F17.40 Chair (Test Methods), D20 (Plastics), C13 (Concrete Pipe), E60 (Sustainability), D35 (Geosynthetics)
- AASHTO National Transportation Product Evaluation Program (NTPEP) Consultant
- AASHTO Subcommittee on Materials Technical Section 4b – Friend of Committee
- AASHTO Subcommittee on Bridges and Structures – Industry participant and consultant
- American Society of Civil Engineers (ASCE), 2002 to present
- American Society of Mechanical Engineers (ASME), 1995 to present
- Society of Plastics Engineers (SPE)

## **RECENT RESEARCH PROJECTS AND REPORTS**

- “Development of Precision and Bias Statement for the Un-Notched Constant Ligament Stress (UCLS) Test, ASTM F3181”, testing and data analysis to determine precision statistics for new UCLS test method, \$17,000 project funded by the PPI, Completed October 2017
- “Development of New AASHTO Standard for Steel Reinforced HDPE Composite Pipe”, August 2017
- “Testing and Analysis of New Steel Reinforced HDPE Composite Pipe”, January 2017
- “PPI Handbook for Corrugated HDPE Pipe”, selected as co-author and editor for development of new handbook for corrugated HDPE pipe, November 2016
- “Evaluation of Corrugated HDPE Pipes Manufactured with Recycled Materials for Commuter Railroad Applications”, Dissertation, Villanova University, October 14, 2016
- “Minnesota DOT Evaluation of Culverts under Shallow Cover”, Research project and report for the Minnesota Department of Transportation, November 2015
- “Evaluation of Polypropylene Pipe for New Jersey DOT”, Research project and report, October 2015
- “An overview and Analysis of the Stub Compression Test for AASHTO M294 Corrugated HDPE Pipe”, Presented at AASHTO Subcommittee on Materials 2015
- “Field Study of Corrugated HDPE Pipes Made with Recycled Content”, 3-year project starting in July 2013, \$600,000, NCHRP Project 4-39, Co-Principal Investigator
- “Assessing the Performance of Large Diameter Plastic Pipe Under Railroads”, conducted by Michael Pluimer (PPI) and Shawn Coombs (ADS), 2011, \$150,000, funded jointly by industry and the Plastics Pipe Institute
- “Constrained Soil Modulus Testing of Crushed Stone”, conducted by Tim Toliver (Advanced Pipe Services) and Michael Pluimer (PPI), 2010, \$30,000, funded by the Plastics Pipe Institute
- “Evaluating the Effects of Carbon Black in Corrugated HDPE Pipe”, conducted by Michael Pluimer and industry members, 2010 – present
- “Evaluating the Stress Crack Resistance of Corrugated HDPE Pipe”, conducted by Michael Pluimer and industry members, 2005 – 2008

**RECENT PUBLICATIONS, PRESENTATIONS AND LECTURES**

1. "NCHRP Report 870: Field Performance of Corrugated HDPE Pipes Manufactured with Recycled Content", published by the Transportation Research Board of the National Academies, Washington DC, October 2017 – Co-Principal Investigator and primary author
2. Modifications to "AASHTO M 294: Standard Specification for Corrugated Polyethylene Pipe, 300- to 1500-mm (12- to 60-in.) Diameter", published by the American Association of State Highway and Transportation Officials, Washington, DC (developed and balloted modifications to incorporate recycled materials into standard based on NCHRP research – adopted by AASHTO in 2018)
3. "AASHTO Committee on Pavements and Materials Presentation on NCHRP Project 4-39", Webinar, October 2017
4. "Performance of Corrugated HDPE Pipes Manufactured with Recycled Materials for Commuter Railroad Applications", paper and presentation to the Southern African Plastic Pipes Manufacturing Association (SAPPMA), Johannesburg, South Africa, September 2017
5. "NCHRP 04-39 Project Summary and Update", presentation of research and ballot to incorporate recycled materials into AASHTO M 294, AASHTO Subcommittee on Materials Technical Section 4b, Phoenix, AZ, August 2017
6. "Proposed Changes to AASHTO LRFD Section 12", presentation of proposed changes to AASHTO's LRFD Bridge Design Specification to incorporate recycled materials into corrugated HDPE pipes, AASHTO Subcommittee on Bridges and Structures, Technical Section T13 on Culverts, Spokane, WA, June 2017
7. "Service Life Assessment of Corrugated HDPE Pipe", presentation to the Ministry of Transportation of Quebec, May 2017
8. "Performance of Corrugated HDPE Pipes Manufactured with Recycled Content Underneath Commuter Railroads", paper and presentation at the Transportation Research Board Session 520, published in proceedings as a Practice-ready Paper, January 2017
9. "Incorporating Recycled Materials into Plastic Pipes", presentation to the ACPA Pipe School, University of Texas – Arlington, January 2017
10. "ASTM F3181: Standard Test Method for the Un-Notched Constant Ligament Stress (UCLS) Test for HDPE Materials Containing Post-Consumer Recycled HDPE", published by ASTM International, Conshohocken, PA, November 2016
11. "Evaluation of Corrugated HDPE Pipes Manufactured with Recycled Materials in Commuter Railroad Applications", Doctoral Dissertation, Proquest Publishing, Villanova University, October 2016
12. "Plastic Pipe Design Methodology", presentation to engineering firm, October 2016
13. "Recycled Materials for Corrugated HDPE Pipes", presentation to engineering firm, October 2016
14. "Predicting the Service Life of Corrugated HDPE and PP Pipes", Presentation, October 2016
15. "Evaluation of Corrugated HDPE Pipes Manufactured with Recycled Materials for Commuter Railroad Applications", Dissertation defense at Villanova University, October 2016
16. "Predicting the Service Life for Recycled PE Materials via the Un-notched Constant Ligament Stress (UCLS) Test", Presentation and paper, Plastics Pipes XVIII, Berlin, Germany, September 2016

17. "Long-term Performance of Corrugated HDPE Pipes Manufactured with Recycled Materials for Commuter Railroad Applications", Presentation and paper, Plastics Pipes XVIII, Berlin, Germany, September 2016
18. "A Review and Summary of NCHRP Project 4-39: Field Performance of Corrugated HDPE Pipes Manufactured with Recycled Materials", Presentation at AASHTO Subcommittee on Materials Meeting, Greenville, SC, August 2016
19. "NCHRP Project 4-39 Research Project Summary", Presentation for the Plastics Pipe Institute Annual Meeting, May 2016
20. "AASHTO M294 Flattening Test", Webinar for AASHTO Subcommittee on Materials, April 2016
21. "Corrugated HDPE Pipe – History and Chemistry", Lecture at ASCE Pipelines Conference, August 2015
22. "Performance of Corrugated HDPE Pipe Regarding Fatigue Loading Under Commuter Railroads", ASCE Pipelines Conference, August 2015
23. "Fatigue Assessment of Corrugated HDPE Pipes Manufactured with Recycled Content Under Railroads", Plastic Pipes XVII, Chicago, IL September 2014
24. "Plastic Materials and Testing for Civil Engineering", lecture at Villanova University, Civil and Environmental Engineering Graduate Geosynthetics Class, February 2014
25. "Plastic Pipes for Civil Engineering Applications", lecture at Villanova University, Civil and Environmental Engineering Materials Class, October 2013
26. "Design and Installation of Corrugated HDPE Pipe", presented to Minnesota Geotechnical Society, Duluth, MN, May 2013
27. "Corrugated HDPE Pipe for Culverts and Storm Drains", presented to Civil Engineering class at McGill University, Quebec, April 2013
28. "The Evolution of Corrugated HDPE Pipe in the United States", published and presented at Plastic Pipes XVI, Barcelona, Spain, September 2012
29. "Post-Installation Inspection and Quality Control of Plastic Pipes", lecture at Villanova University CEE 8206, Construction Project Management class, Villanova, PA October 2012
30. "Proposed Changes to AASHTO M294", presented to AASHTO Subcommittee on Materials, Biloxi, MS August 2012
31. "Corrugated HDPE Pipe for Railroad Applications", lecture at Villanova University CEE 7300 Class on Railway Engineering, Villanova, PA June 2012
32. "Corrugated HDPE Pipe NTPEP Workplan", presented at the AASHTO National Transportation Product Evaluation Program Annual Meeting, Indianapolis, IN May 2012
33. "Bioplastics Potential in Pipe", presented at the Bio-Plastek Conference in Baltimore, MD March 2012
34. "Plastic Pipe Industry Perspective on Post-Installation Inspection of Pipes", presented at the Transportation Research Board, Washington, DC, January 2012
35. "An Assessment of Corrugated HDPE Pipe Under Railroads", presented at China Plastic Pipe Association conference, Beijing, China, November 2011
36. "Corrugated HDPE Pipe for Highway Drainage", a lecture given to Villanova University, CEE 8439 Civil Engineering Materials, September 2011
37. "The Evolution of Plastics Pipes", a presentation given as a guest speaker at the 75th Annual Illinois Association of Highway Engineers Convention, Normal, IL September 2011

38. "Proposed Changes to AASHTO Standards", presented at the AASHTO Subcommittee on Materials Meeting, Burlington, VT, August 2011
39. "A Service Life Assessment of Corrugated HDPE Drainage Pipe", paper published in the Journal of ASTM International, Volume 8, No. 6, July 2011
40. "A Summary of Changes to AASHTO Standards", presented at AASHTO's National Transportation Product Evaluation Program annual meeting, San Antonio, April 2011
41. "Evaluation of the Performance of Large Diameter Corrugated HDPE Pipe Underneath Railroads", presented at AMI's Sewerage and Drainage Pipes Conference, Dusseldorf, Germany February 2011
42. "A Summary of PPI's Research on Corrugated HDPE Pipes Under Railroads", presented at Transportation Research Board AFF70, Subcommittee on Culverts, Washington, DC January 2011
43. "Corrugated HDPE Pipe Seminar", University of New Brunswick, New Brunswick, Canada, January 2011
44. "Corrugated HDPE Pipe Seminar", presented to the City of Halifax water commission, Halifax, Nova Scotia, January 2011
45. "Service Life of Corrugated HDPE Pipe", published and presented at Plastics Pipes XV Conference, Vancouver, British Columbia September 2010
46. "Corrugated HDPE Pipe for Highway Drainage", Villanova University, CEE 4224, Transportation Facilities Design, September 2010
47. "Performance of Corrugated Pipe Under Railroads", published and presented at ASCE Pipelines Conference, Keystone, CO August 2010
48. "Plastic Pipe and Engineering", guest lecturer at Calvin College Engineering Department, Grand Rapids, MI March 2010
49. "Service Life of Corrugated Pipe – A Summary of Recent Results From the FDOT Protocol", presentation at the Transportation Research Board, Washington, DC January 2010
50. "Corrugated HDPE Pipe History and Performance", guest lecturer at McGill University, Civil Engineering Department, Dr. M. Saeed Mirza's class, November 2009
51. "A Service Life Assessment of Corrugated HDPE Pipe", presented at ASTM Symposium on Plastic Pipe and Fittings, Atlanta, GA, November 2009
52. "Service Life of Corrugated HDPE Pipe", presented at INFRA Conference in Mont Tremblant, Quebec November 2009
53. "Discussion on 100-Year Service Life of Plastic Pipe", presentation at Pennsylvania DOT, Harrisburg, PA September 2009
54. "Colorado DOT Pipe Policy", presentation to the Colorado Department of Transportation, Denver, CO August 2009
55. "Installation Guidelines for Thermoplastic Pipe", presentation to the City of Columbus, Columbus, OH May 2009
56. "Corrugated HDPE Pipe Design and Performance", guest lecturer at Dr. Grace Hsuan's Civil Engineering graduate class, Drexel University, Philadelphia, PA March 2009
57. "Corrugated HDPE Pipe Design, Performance, and Service Life", guest speaker at Colorado DOT Hydraulic Engineers Annual Conference, Crested Butte, CO, September 2008
58. "Comparison of IT and OIT Testing in Polymers", presentation to the Eastern States Consortium, March 2007

59. "CPPA Design Seminar – Structural Considerations of Corrugated HDPE Pipe", half-day presentation at Raleigh, NC, September 2006
60. "Corrugated HDPE Pipe Seminar", guest lecturer at the New York Highway School, Ithaca College, Ithaca, NY June 2006
61. "Establishing 100-Year Service Life for Corrugated HDPE Pipe", published and presented in ASCE Pipelines Journal, Chicago, IL August 2006
62. "Corrugated Pipe Design Seminar", lecture to the American Council of Engineering Companies, Duluth, MN January 2006
63. "Installation of Corrugated HDPE Pipe", half day seminar in Orlando, FL December 2005