# RAPHAEL W. CROWLEY, PH.D., P.E.

Assistant Professor, University of North Florida, Jacksonville, FL
Courtesy Assistant Professor, University of Florida, Gainesville, FL
r.crowley@unf.edu; (315) 657-1082

## EDUCATION

**Ph.D.** *May 2008 – Dec. 2010*
Civil Engineering, University of Florida, Gainesville, FL
- Dissertation: Investigation of sediment erosion rates of rock, sand, and clay mixtures for predicting scour depth using enhanced erosion rate testing instruments

**M.S.** *Aug. 2005 – May 2008*
Coastal and Oceanographic Engineering, University of Florida, Gainesville, FL
- Thesis: Drag forces on pile groups

**B.S.** *Aug. 2000 – May 2004*
Civil and Environmental Engineering, Bucknell University, Lewisburg, PA

## EXPERIENCE

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| Assistant Professor<br>*Aug. 2014 – present* | Department of Construction Management<br>University of North Florida, Jacksonville, FL |
| Courtesy Assistant Professor<br>*May 2014 – present* | Department of Civil and Coastal Engineering<br>University of Florida, Gainesville, FL |
| Visiting Assistant Professor<br>*Aug. 2013 – Aug. 2014* | Department of Construction Management<br>University of North Florida, Jacksonville, FL |
| Postdoctoral Researcher & Adjunct<br>*Dec. 2010 – Aug. 2013* | Department of Civil and Coastal Engineering<br>University of Florida, Gainesville, FL |
| Research Assistant<br>*May 2005 – Dec. 2010* | Department of Civil and Coastal Engineering<br>University of Florida, Gainesville, FL |
| Research Assistant<br>*Jan. 2007 – Aug. 2007* | J. Sterling Jones Hydraulics Laboratory<br>FHWA Turner-Fairbank Highway Research Center, McLean, VA |
| Marine Engineer<br>*May 2004 – May 2005* | Marine and Waterborne Transportation Divisions<br>M.G. McLaren, P.C., West Nyack, NY |

## PUBLICATIONS

Peer-Reviewed Journal Articles

1. Crowley, R., Bloomquist, D., Konn, V.*, Faraone, Z., and Pasken, K. (2015, accepted). The large-scale soil box: a new device for testing the performance of buried pipe. *Geotechnical Testing Journal*, to be published in Vol. 39, No. 1, January 2016.

2. Li, Q., Crowley, R., Bloomquist, D., and Roque, R. (2014). The adhesive strength test (AST): a newly developed test for measuring sealant adhesive strength between joints of concrete pavement. *Journal of Materials in Civil Engineering*, DOI: 10.1061/(ASCE)MT.1943.5533.0001020.
3. Crowley, R., Robeck, C.*, and Thieke, R. J. (2014). Computer modeling of bed material shear stresses in piston-type erosion rate testing devices. *Journal of Hydraulic Engineering*, 140 (1), 24-34.
4. Chen, Y., Bloomquist, D., and Crowley, R. (2013). Cellulose fiber reinforced concrete fracture mechanisms and damage detection using acoustic emission. *Applied Mechanics and Materials*, 239-240, 3-9.
5. Chen, Y., Bloomquist, D., and Crowley, R. (2013). Moisture effects on cellulose fiber reinforced concrete properties. *Applied Mechanics and Materials*, 330, 77-81.
6. Bloomquist, D., Sheppard, D. M., Schofield, S., and Crowley R. (2012). The rotating erosion testing apparatus (RETA): a laboratory device for measuring erosion rates versus shear stresses of rock and cohesive materials. *Geotechnical Testing Journal*, 35 (4), 641-648.
7. Crowley, R., Bloomquist, D., Hayne, J.*, and Holst, C.* (2012). Estimations and measurements of shear stresses on bed materials in erosion rate testing devices. *Journal of Hydraulic Engineering*, 138 (11), 990-994.
8. Crowley, R., Bloomquist, D., Shah, F.*, and Holst, C.* (2012). The sediment erosion rate flume (SERF): a new testing device for measuring erosion rates and shear stresses. *Geotechnical Testing Journal*, 35 (4), 649-659.
9. Li, Q., Crowley, R., Bloomquist, D., and Roque, R. (2012). The creep testing apparatus (CRETA): a new testing device for measuring viscoelasticity of joint sealant. *Journal of Testing and Evaluation*, 40, (3), DOI: 10.1520/JTE104431.
10. Crago, R. and Crowley, R. (2005). Complementary relationships for near-instantaneous evapotranspiration." *Journal of Hydrology*, 300, (1-4), 199-211.
11. Crago, R., Hervol, N., and Crowley, R. (2005). A complementary evaporation approach to the scalar roughness length. *Water Resources Research*, 41 (6), W06017.1-W06017.6.

Conference Papers

1. Crowley, R. and Fuller, J.* (2015). Analysis of the Florida Department of Transportation (FDOT) asset maintenance program – approach and preliminary results. *7th Annual AMOTIA Conference, the Past, Present, and Future of Performance-Based Contracting*, Association for the Management and Operations of Transportation Infrastructure Assets, Ponte Vedra, FL, October 1-2.
2. Crowley, R. and Robeck, C.* (2014). Computational modeling of wave forces on bridge decks. *National Hydraulic Engineering Conference*, Iowa City, IA, August 19-22.
3. Crowley, R., Bloomquist, D., and Robeck, C.* (2012). Description of erosion rate testing devices and correlations between rock erosion rate and cohesion. *Proc. 6th International Conference on Scour and Erosion*, Paris, France, August 27-31, 48-56.
4. Li, Q., Crowley, R., Bloomquist, D., and Roque, R. (2012). Investigation of joint surface preparation effects on silicone sealant using a new testing procedure. *91st Annual TRB Meeting*, Transportation Research Board, Washington, D.C.

Technical Reports

1. Crowley, R. Bloomquist, D., and Sheppard, D.M. (2014). Investigation of erosion rates of field samples using FDOT's enhanced sediment erosion rate flume (SERF). *Final Report No. BDK75 977-53*, Florida Department of Transportation, Tallahassee, FL, January.
2. Crowley, R. and Bloomquist, D. (2014). Time-dependent load response of flexible pipe subjected to sustained loading. *Final Report No. BDK75 977-21*, Florida Department of Transportation, Tallahassee, FL, January.

3. Crowley, R., Bloomquist, D., Goff, V.*, and Connell, J.* (2013). Redesign of FDOT state material office (SMO) testing standards. *FDOT Final Report No. BDK75 977-69*, Florida Department of Transportation, Tallahassee, FL, March.
4. Crowley, R., Bloomquist, D., and Rogers, M.* (2013). Development of a smear-proof horizontal and vertical permeability probe. *FDOT Final Report No. BDK75 977-35*, Florida Department of Transportation, Tallahassee, FL, February.
5. Bloomquist, D., Li, Q., Crowley, R., Cottrell, W., and Ferguson, R. (2011). Development of a testing system for the analysis of transverse contraction joints in Portland cement concrete pavement. *FDOT Final Report No. BDK75 960-01*, Florida Department of Transportation, Tallahassee, FL, May.
6. Bloomquist, D. and Crowley, R. (2010). Enhancement of FDOT's SERF device and a study of erosion rates of rock, sand, and clay mixtures using FDOT's RETA and SERF equipment. *FDOT Report No. BDK75 977-09*, Florida Department of Transportation, Tallahassee, FL, October.

Invited Presentations

1. Crowley, R., Zimmerman, A., and Hudyma, N. (2015). Application of microbial induced calcite precipitation to stabilize Florida high-organic matter soils for roadway construction. Florida Department of Transportation Geotechnical Research in Progress (GRIP) Meeting, Gainesville, FL, August 21.
2. Tibbets, C.*, Mohseni, A., and Crowley, R. (2015). Field testing and calibration of the vertical insitu permeameter. Florida Department of Transportation Geotechnical Research in Progress (GRIP) Meeting, Gainesville, FL, August 20.
3. Tibbets, C.*, Mohseni, A., and Crowley, R. (2014). Field testing and calibration of the vertical insitu permeameter. Florida Department of Transportation Geotechnical Research in Progress (GRIP) Meeting, Gainesville, FL, August 1.
4. Crowley, R. (2013). Simulated overburden load on buried pipe. Florida Department of Transportation Pipe Advisory Group (PAG) Meeting, Gainesville, FL, October 30.
5. Crowley, R., Bloomquist, D., and Sheppard, D.M. (2013). Investigation of erosion rates of field samples using FDOT's enhanced sediment erosion rate flume (SERF). Florida Department of Transportation Annual Geotechnical Research in Progress (GRIP) Meeting, Gainesville, FL, August 8.
6. Rodgers, M.*, Crowley, R., and Bloomquist, D. (2013). Design of a smear-proof vertical and horizontal in-situ permeability probe. Florida Department of Transportation Annual Geotechnical Research in Progress (GRIP) Meeting, Gainesville, FL, August 8.
7. Crowley, R., Bloomquist, D., and Sheppard, D.M. (2012). Investigation of erosion rates of field samples using FDOT's enhanced sediment erosion rate flume (SERF). Florida Department of Transportation Annual Geotechnical Research in Progress (GRIP) Meeting, Gainesville, FL, August 17.
8. Rodgers, M.*, Crowley, R., and Bloomquist, D. (2012). Design of a smear-proof vertical and horizontal in-situ permeability probe. Florida Department of Transportation Annual Geotechnical Research in Progress (GRIP) Meeting, Gainesville, FL, August 17.
9. Crowley, R., Bloomquist, D., and Sheppard, D.M. (2011). Investigation of erosion rates of field samples using FDOT's enhanced sediment erosion rate flume (SERF). Florida Department of Transportation Annual Geotechnical Research in Progress (GRIP) Meeting, Gainesville, FL, July 29.
10. Rodgers, M.*, Crowley, R., and Bloomquist, D. (2011). Design of a smear-proof vertical and horizontal in-situ permeability probe. Florida Department of Transportation Annual Geotechnical Research in Progress (GRIP) Meeting, Gainesville, FL, July 29.
11. Crowley, R., Bloomquist, D., and Sheppard, D.M. (2010). Enhancement of FDOT's SERF Device and a study of rock, clay, and sand mixtures using FDOT's RETA and SERF instruments. Florida Department of Transportation Annual Geotechnical Research in Progress (GRIP) Meeting, Gainesville, FL, August 13.

12. Crowley, R., Bloomquist, D., and Sheppard, D.M. (2009). Enhancement of FDOT's SERF Device and a study of rock, clay, and sand mixtures using FDOT's RETA and SERF instruments. Florida Department of Transportation Annual Geotechnical Research in Progress (GRIP) Meeting, Gainesville, FL, August 14.

Submitted Publications

1. Crowley, R., Robeck, C.*, and Dompe, P. A computational analysis of bridges subjected to monochromatic wave attack. Submitted to *Journal of Bridge Engineering* August 2015.

* Indicates Student Advisee/Supervisee Co-Author

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**EXTERNALLY-FUNDED RESEARCH**

Active Projects

1. PI, Crowley, R. and Zimmerman, A. (U. of Florida) (preliminarily accepted, awaiting task work order release). Application of microbial induced calcite precipitation to stabilize Florida high-organic matter soils for roadway construction. $210,339, Florida Department of Transportation, Tallahassee, FL.
2. Co-PI, Lambert, D. and Crowley, R. (2015). Maritime management plan development, planning, evaluation, and meeting facilitation for Duval County. $66,667, Northeast Florida Regional Council, Jacksonville, FL.
3. PI, Crowley, R., ElSafty, A., and Brown, C. (2015). Analysis, comparison, and contrast of two primary maintenance contracting techniques used by the Florida Department of Transportation. FDOT Project No. BDV34 977-04, $85,125, Florida Department of Transportation, Tallahassee, FL.
4. Collaborator, Genex Systems, LLC et al. (2014). Provide non-personal technical support services for the FHWA Hazard Mitigation (HM) team. FHWA Contract No. DTFH6114D00007, $9,900,000, Federal Highway Administration, Washington, D.C.
5. Collaborator, Agrawal, A. et al. (2014). Provide non-personal technical support services for the FHWA Hazard Mitigation (HM) team. FHWA Contract No. DTFH6114D00010, $9,900,000, Federal Highway Administration, Washington, D.C.
6. Co-PI, Mohseni, A. (U of Florida) and Crowley, R. (2014). Field testing and calibration of the vertical insitu permeameter (VIP). FDOT Contract No. BDV31 977-23, $74,243, Florida Department of Transportation, Tallahassee, FL.

Completed Projects

1. Collaborator, Crowley, R., Sheppard, D.M. (Intera, Inc.), and Bloomquist, D. (Geohazards, Inc.) (2014). Scour testing for the McMicken Dam. $8,000, Intera, Inc., Gainesville, FL.
2. Collaborator, Glagola, C. and Rilko, W. (2012-2013). Performance based quality assurance/quality control (QA/QC) acceptance procedures for in-place soil testing. FDOT Contract No. BDK75 977-72, $248,695, Florida Department of Transportation, Tallahassee, FL.
3. PI, Crowley, R., Bloomquist, D., and Sheppard, D.M. (2011-2013). Investigation of erosion rates of field samples using FDOT's enhanced sediment erosion rate flume (SERF). FDOT Contract No. BDK75 977-53, $168,263, Florida Department of Transportation, Tallahassee, FL.
4. PI, Crowley, R. and Bloomquist, D. (2009-2013). Time-dependent load response of flexible pipe subjected to sustained loading. FDOT Contract No. BDK75 977-21, $453,555, Florida Department of Transportation, Tallahassee, FL.
5. Collaborator, Sheppard, D.M. (Intera, Inc., 2013). Scour testing of Hudson River sediment for the Tappan Zee Bridge replacement. $8,000, Intera, Inc., Gainesville, FL.
6. PI, Crowley, R. and Bloomquist, D. (2012-2013). Redesign of FDOT state material office testing standards. FDOT Contract No. BDK75 977-69, $27,675, Florida Department of Transportation, Tallahassee, FL.

7. PI, Crowley, R. and Bloomquist, D. (2010-2012). Development of a smear-proof horizontal and vertical permeability probe. FDOT Contract No. BDK75 977-35, $53,280, Florida Department of Transportation, Tallahassee, FL.

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**AWARDS AND RECOGNITIONS**

1. Nominated by Department Chair for UNF Undergraduate Teaching Award, Fall 2015
2. UNF BCN Department Award of Excellence for ABET Accreditation, Fall 2015
3. UNF Office of Research and Sponsored Programs (ORSP) Award of Excellence, Spring 2015
4. Nominated by Dean of college for Outstanding International Leadership Award, Spring 2015

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**TEACHING EXPERIENCE**

University of North Florida

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| 1. | BCN 3611C: Construction Cost Estimating | Fall 2015, Summer 2015, Fall 2014 |
| 2. | BCN 4709: Construction Management Capstone | Fall 2015, Spring 2015 |
| 3. | BCN 4612: Advanced Construction Estimating | Spring 2015, Spring 2014 |
| 4. | BCN 4990: Maritime Construction | Spring 2015, Spring 2014 |
| 5. | BCN 3782: Introduction to Construction Computing | Fall 2014, Spring 2014, Fall 2013 |
| 6. | BCN 4990: Shipbuilding | Summer 2014 at U. Catabria, Santander, Spain |
| 7. | BCN 4753: Construction Administration and Economics | Fall 2013 |
| 8. | BCN 4871C: Commercial Construction | Fall 2013 |

University of Florida

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| 1. | CGN 3421: Computer and Numerical Methods for Civil Engineers | Spring 2013, Fall 2012 |
| 2. | EOC 6430: Coastal Structures Spring 2013 | Spring 2012, Spring 2011 |
| 3. | CGN 3710: Instrumentation and Experimentation | Summer 2011, Fall 2011 |

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**STUDENT THESES**

1. Robeck, C. (2014). Computational modeling of advanced mechanisms for bridge failure in response to fluid forces. M.S. Thesis, University of Florida, Gainesville, FL.
2. Konn, V. (2013). Response of flexible pipe subjected to increasing overburden stress. M.S. Thesis, University of Florida, Gainesville, FL.
3. Tebow, M. (2011). Field analysis of variable width Portland cement concrete pavement joints. High Honors Thesis, University of Florida, Gainesville, FL.
4. Shah, F. D. (2009). Development and testing of uniform synthetic limestone samples for the calibration of equipment used to determine erosion rates. High Honors Thesis, University of Florida, Gainesville, FL.

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**UNIVERSITY AND DEPARTMENT SERVICE**

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| 1. | Chair of Search Committee for 2 tenure-track positions in BCN | Fall 2015 – present |
| 2. | Adjunct Affairs Committee | Fall 2014 – present |
| 3. | Faculty advisor for student chapter DBIA | Fall 2014 – present |
| 4. | Chair of Search Committee for instructor position in BCN | Fall 2014 – Spring 2015 |
| 5. | Maritime Construction Subcommittee of Dean's Leadership Council | Fall 2014 |
| 6. | CCEC Enrollment Committee | Fall 2013 – Fall 2014 |
| 7. | Led ten students on study abroad program in in Santander, Spain at University of Cantabria; taught course at U. Cantabria in collaboration with their faculty (Summer 2014). | |

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**PROFESSIONAL AFFILIATIONS**

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| 1. | Design-Build Institute of America (DBIA), Member | 2014 – present |
| 2. | Florida Board of Professional Engineers, P.E, License No. 75403 | 2013 – present |
| 3. | American Society of Civil Engineers (ASCE), Member | 2012 – present |
| 4. | Coasts, Oceans, Ports, and Rivers Institute (COPRI), Member | 2012 – present |
| 5. | Associate Editor and Reviewer for *International Journal of Sediment Research* | 2014 – present |
| 6. | Reviewer for several additional journals including | |
| | a. *Engineering Structures* | |
| | b. *Open Engineering* | |
| | c. *Canadian Journal of Civil Engineering* | |
| | d. *Journal of Bridge Engineerin*g | |
| | e. *Central European Journal of Engineering* | |
| | f. *Journal of Civil Engineering and Architecture*. | |
| 7. | CFD Collaborative Research Group with Argonne National Laboratories' (ANL) Transportation Research and Computing Center (TRACC) & Federal Highway Administration's (FHWA) J. Sterling Jones Hydraulics Lab at the Turner-Fairbank Highway Research Center (TFHRC) (2011 – 2015). | |

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## TEACHING STATEMENT

As shown on my vita, I have extensive teaching experience in a number of different topics. On the geotechnical side, my graduate-level course in *Coastal Structures* that I redeveloped at the University of Florida (UF) involved the study of retaining walls and rubble mound structures. I taught MATLAB in my entry-level *Computer and Numerical Methods* course. In *Instrumentation and Experimentation*, topics included load cells, strain gauges (and associated bridge circuits), pressure transducers, flowmeters, linear variable differential transformers (LVDTs), and basic electrical engineering concepts. More recently, I have taught construction courses in topics such as estimating, maritime construction, construction administration, and building information modeling (BIM).

I believe I have demonstrated the ability to successfully teach almost anything. More specifically, I would be happy teaching courses in any of the following geotechnical topics:

- Soil mechanics
- Retaining walls
- Shallow foundations
- Deep foundations
- Rubble mound structures
- Geosynthetics

Additionally, if needed, I am always happy to teach outside of these two topics. I love teaching entry-level courses. Topics could include MATLAB, LabVIEW, instrumentation, statics, dynamics, or even fluid mechanics. As you may note, I have had much success recently teaching courses in construction management. While construction management is not my primary field of interest by any stretch of the imagination, I believe this speaks to my versatility as an educator.

To me, the topic that I teach is less important to me than having the opportunity to work with talented students so that I can help them succeed. First and foremost, I want my students to be successful. To me, success is more than making high grades in technical courses because these skills will only take them so far. I want my students to effectively communicate. I encourage these skills by requiring regular oral presentations and written professional reports. Additionally, I use many "real world" examples in my classes. For example, the final project for my *Coastal Structures* course three years ago was to redesign Cedar Key, FL's city marina. More recently, I have revamped our construction management capstone course to include a real-world project whereby students are judged by experts from industry.

Beyond this, I want my students to feel comfortable with me, and I want to be able to help them outside of the classroom when they most need it. For example, last spring a student came into my office and laid his heart on the line. Apparently, this student just had the worst two weeks of his life. His significant other had received her second DUI in six months and was sitting in jail; he found out she was pregnant after she was booked; he got evicted from his apartment; he moved in with his father; his father beat him up (again – apparently this happens regularly; his face was all welted over); and he couldn't hold it together anymore – a heady situation for any 26 year old trying to get his life together. He trusted me, believed that I would help him, and needed someone to look up to. I did the best I could for him under the circumstances – called some friends who are attorneys to help with the legal trouble, recommended he see a university counselor, etc. Really, this is my goal – to help my students.

On a more day-to-day less dramatic level, I use my classroom exposure with students to recruit for my research group – both at the undergraduate and graduate level. Over the years, I have attracted approximately 50 research assistants in this capacity. I believe this helps students, and getting students involved in research early in their careers is essential. I started research early in my career (just after my 2$^{nd}$ year of college). I learned more doing research than I did in all my undergraduate courses combined, and this experience helped to launch my career. I want to give students similar opportunities because I believe that research helps students more than anything else.

**RESEARCH STATEMENT**

As mentioned in my cover letter, bridge scour has always been the backbone of my research program although I retain interests in many other topics. The following is a specific discussion of some topics that I believe would be part of my research group:

Bridge Scour

Scour is the leading cause of bridge failure in this country and causes more failures than all other modes of bridge failure combined. I often work with FHWA, particularly Kornel Kerenyi of FHWA's J. Sterling Jones hydraulics laboratory on scour problems. Additionally, I also often collaborate with the soil and computational modelers from Argonne National Laboratories' (ANL) Transportation Research and Computing Center (TRACC). One of the major research topics that we often discuss is bridge scour, soil erosion, and sediment transport in the context of hydraulic structures.

In a recent conversation, Kornel told me that he had taken over for Arneson as the coordinator of Hydraulic Engineering Circular No. 18 (the design guideline for scour) and that he wished to revamp the specification to include a more physics-based approach. Of particular interest to him is soil layering. A reliable insitu test needs to be developed to accurate describe bed materials' erosion rates. On the cohesive and rock scour side, FHWA has been made a major push in the last five years to correlate erosion rates to "traditional" geotechnical properties. I presented a paper on this topic at the *International Conference on Scour and Erosion* in 2012, and in short, much more work is needed.

I am also working to develop a sustainable, cost effective scour mitigation technique for existing structures. I believe geomicrobial soil improvement (specifically MICP) may be the answer, and I recently won an award from the Florida Department of Transportation (FDOT) to study this technology. While in the short-term, the scope of this project is limited to MICP application in Florida organic soils, I hope to attract future NSF funding for a broader study. In the meantime, I have acted as a consultant for developing scour curves for two high-profile projects in the past couple years – the Tappan Zee Bridge's replacement and the McMicken Dam.

Traditional Geotechnical Topics

Outside of bridge scour, I have been developing a probe to measure insitu orientation-dependent soil permeability for the past five years. There is an enormous need for such a device for retention pond design. Currently, I have a follow-up project ongoing to assess the effectiveness of the current FDOT instrument. As a postdoc at UF, I assisted on a project that was aimed at finding an effective replacement for the nuclear density gauge. While several "solutions" are commercially available, we found that they are mostly ineffective. I want to develop a technique with no moving parts (an apparatus similar to a GPR). Last fall, I finished a project involving buried pipe performance whereby field-scale pipes were tested in a large-scale soil box. Follow-up work is needed on the computational side so that long-term performance can be more accurately computed. One of my graduate students and I developed a preliminary model in LS-DYNA, but more funding would be required to extend this work further. Finally, I developed a method by which highway geotechnical testing can be partially automated. Long-term cost savings associated with this method would be enormous; and it would be beneficial to implement such a system on a DOT-scale. This is the sort of topic that I believe your DOT might be immediately interested in funding.

Hydraulic Research

I understand that your position is in geotechnical engineering. That said, I have research interests in hydraulic engineering, and I have made significant progress in recent years. As such, I would hope to continue my work in this field, regardless of your position's title.

My research in hydraulics is focused on complex computational modeling using high-end commercially available software. While my research group has modeled many hydraulic events – grate drainage, an offshore windmill, three erosion rate testing devices, etc. – my real passion in computational modeling is wave forcing on coastal structures. For example, during the summer of 2014, I presented a paper at the *National Hydraulic Engineering Conference* that provided a possible explanation for slamming forces on a bridge. Much more follow-up work is needed in this field because currently there is a schism among researchers about whether or not the slamming force actually exists.

This sort of hydraulic modeling could be directly tied to geotechnical engineering because there has been a push in recent years to develop a fluid-soil-structure interaction technique that could be used to describe forcing on oil platforms and windmills.