

# K I M B E R L Y   B E L L I

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## EDUCATION

**Northeastern University**, Boston, MA May 2008  
**Doctor of Philosophy** in Interdisciplinary Engineering (civil engineering, computational electromagnetics and computer aided engineering). **Dissertation:** “Enhanced Analysis of Ground Penetrating Radar Bridge Deck Investigations Using Computational Modeling.” **Advisors:** Professors Sara Wadia-Fascetti and Carey Rappaport.

**Northeastern University**, Boston, MA August 2002  
**Master of Science** in Civil Engineering (emphasis in Structural Engineering).

**Worcester Polytechnic Institute**, Worcester, MA May 1997  
**Bachelor of Science** in Civil Engineering.

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## PROFESSIONAL EXPERIENCE

**Postdoctoral Research Associate** 2008 – present  
*Northeastern University* Boston, MA  
Research and programmatic support to Intelligent Diagnostics IGERT (**I**ntegrated **G**raduate **E**ducation and **R**esearch **T**raineeship) Doctoral Fellowship Program, and research to support the Gordon Center for Subsurface Sensing and Imaging Systems (Gordon-CenSSIS). Research areas: structural condition assessment for civil infrastructure, nondestructive evaluation, and computational electromagnetics.

**IGERT & GAANN Fellow, Graduate Research Assistant** 2000 – 2008  
*Northeastern University* Boston, MA  
Conducted research in intelligent diagnostics of structural systems using Ground Penetrating Radar (GPR) to assess the subsurface condition of reinforced concrete bridges (2001 – 2008), and supported E-mentoring activities for the CONNECTIONS program (2000 – 2005). Four years of support provided by the GAANN (**G**raduate **A**ssistance in **A**reas of **N**ational **N**eed) Doctoral Fellowship Program for Sensing, Identification, Diagnostics, & Rehabilitation of Structural systems and the Intelligent Diagnostics IGERT Doctoral Fellowship Program (2006 – 2008).

**Staff Engineer** Summer 2004  
*Infrasense, Inc.* Arlington, MA  
Analyzed GPR data for statewide highway condition survey of 3500 lane miles in Oklahoma.

**Project Engineer** 1998 – 2000  
*Raytheon Systems Company* Burlington, MA  
Assessed locations for placement of Digital Airport Surveillance Radars on various airport and military sites. Surveyed sites, analyzed radar coverage of candidate sites and prepared reports for site selection.

**Staff Engineer**, *CASE/LEA Engineers*, Boston, MA 1997 – 1998  
**Summer Intern**, *New England Design Associates*, Worcester, MA Summer 1996  
**Intern**, *Bechtel Corporation*, Boston, MA Jan–Jun 1995

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## RESEARCH SUPERVISION

Margery Hines. MS/PhD ECE. Margery is an IGERT Fellow conducting research in computational modeling of ground penetrating radar for the detection of underground tunnels and pipes. Joint supervision with S. Wadia-Fascetti and C. Rappaport since September 2009.

Christopher (Kit) Wright. MS/PhD CEE. Kit is an IGERT Fellow conducting research in structural condition assessment of civil infrastructure. Joint supervision with S. Wadia-Fascetti and C. Rappaport since September 2008.

*Research Supervision, continued*

Christopher Udall. BS ECE. Chris is an undergraduate working on comparisons between 2D, 2.5D, and 3D FDTD simulation of Ground Penetrating Radar testing of bridge decks. Joint supervision with C. Rappaport since September 2008.

## TEACHING, SERVICE &amp; OUTREACH ACTIVITIES

- Reviewer. IEEE International Geoscience and Remote Sensing Symposium (2007, 2008)
- Instructor for Introduction to the L<sup>A</sup>T<sub>E</sub>X Document Preparation System Workshop (2008, 2009)
- Mentor for Elizabeth Schroth-Nicho (CEE), who completed an undergraduate independent study in GPR simulation (Fall–Winter 2006)
- Mentor for Laura Carey (CEE), an undergraduate working in nondestructive evaluation as part of the Research Experience for Undergraduates (REU) Program & Gordon Scholar program. (Spring–Winter 2006)
- Instructor for CONNECTIONS Take-Apart Computers Seminar (2001)

## PROPOSALS AND GRANT FUNDING

*Nondestructive Testing to Identify Delaminations between HMA Layers*

**PI:** Michael Heitzman (National Center for Asphalt Technology, NCAT)  
**Sponsor:** Transportation Research Board, Strategic Highway Research Program  
**Co-PIs:** Nam Tran (NCAT)  
 Kenneth Maser (Infrasense, Inc.)  
**Team Members:** Buzz Powell (NCAT), Senior Engineer  
 Dennis Hiltunen (Univ. of Florida), Sub-Contractor to Infrasense  
**Kimberly Belli** (Northeastern Univ.), Sub-Contractor to Infrasense  
 Ray Brown (US Army ERDC), Sub-contractor  
 Stephen Holland (Iowa State Univ.), Sub-contractor  
**Duration:** 30 months (February 2009 – July 2011)

## PUBLICATIONS

*Refereed (Peer Reviewed) Articles in Journals (in print, in press, or accepted)*

- [1] **Belli, K.**, Rappaport, C., Zhan, H. and Wadia-Fascetti, S., “Effectiveness of 2D and 2.5D FDTD Ground Penetrating Radar Modeling for Bridge Deck Deterioration Evaluated by 3D FDTD,” *IEEE Transactions on Geoscience and Remote Sensing*, vol. 47, no. 4, pp. 3656–3663, Nov. 2009.
- [2] **Belli, K.**, Rappaport, C., and Wadia-Fascetti, S., “Forward Time Domain Ground Penetrating Radar Modeling of Scattering from Anomalies in the Presence of Steel Reinforcements,” *Research in Nondestructive Evaluation*, vol. 20, no. 4, Nov. 2009.
- [3] **Belli, K.**, Zhan, H., Wadia-Fascetti, S., and Rappaport, C., “Comparison of the Accuracy of 2D versus 3D FDTD Air-Coupled GPR Modeling of Bridge Deck Deterioration,” *Research in Nondestructive Evaluation*, vol. 20, no 2, May 2009.
- [4] **Belli, K.**, Wadia-Fascetti, S., and Rappaport, C., “Model Based Evaluation of Bridge Decks Using Ground Penetrating Radar,” *Computer-Aided Civil and Infrastructure Engineering*, vol. 23, no. 1, pp. 3–16, Jan. 2008.

*Refereed (Peer Reviewed) Articles in Edited Books*

- [1] **Belli, K.**, Wadia-Fascetti, S., and Rappaport, C., “Integrated Modeling Environment for Subsurface Sensing,” *Smart Structures*. Edited by C.-B. Yun & L. Bergman, Techno Press, pp. 125–136, 2004.

**Refereed (Peer Reviewed) Articles Currently in Review**

- [1] **Belli, K.**, Rappaport, C., and Wadia-Fascetti, S., “A Time Domain Equivalent Source Model of an Impulse GPR Antenna Based on Measured Radiation Fields.” Submitted August 2009 to *Research in Nondestructive Evaluation*.
- [2] **Belli, K.**, Wadia-Fascetti, S., and Rappaport, C., “Integrated Sensor and Media Modeling Environment Developed and Applied to Ground Penetrating Radar Investigation of Bridge Decks,” *ASCE Journal of Computing in Civil Engineering*. Originally submitted Aug. 2009 & revision submitted Oct. 2009.

**Refereed (Peer Reviewed) Conference Papers**

- [1] **Belli, K.**, Rappaport, C., Udall, C., Hines, M., and Wadia-Fascetti, S., “Use of 2D FDTD Simulation and the Determination of the GPR Travel Path Angle for Oblique B-Scans of 2D Geometries,” *IEEE Geoscience and Remote Sensing Symposium (IGARSS)*, Honolulu, HI, Jul. 2010. Accepted abstract.
- [2] Wright, C., Rappaport, C., **Belli, K.**, and Wadia-Fascetti, S., “Accurate Modeling of Ground-coupled Ground Penetrating Radar with 2-D FDTD Using Observed Calibration Measurements,” *Progress in Electromagnetics Research Symposium (PIERS)*, Cambridge, MA, Jul. 2010. Accepted abstract.
- [3] **Belli, K.**, Rappaport, C., Wadia-Fascetti, S., “Determination of GPR Antenna Models for 2-D Finite-difference Time Domain Simulation of Bridge Decks,” *Asian-Pacific Network of Centers for Research in Smart Structure Technology (ANCRiSST) Workshop on Advanced Smart Materials and Smart Structure Technology*, July 2009.
- [4] **Belli, K.**, Udall, C., Rappaport, C., and Wadia-Fascetti, S., “2-1/2 dimensional bistatic GPR propagation and scattering modeling of roadways and tunnels with projected 2D FDTD,” *IEEE Geoscience and Remote Sensing Symposium (IGARSS)*, July 2009.
- [5] Zhan, H., **Belli, K.**, Rappaport, C., and Wadia-Fascetti, S., “Effectiveness of 2D FDTD Ground Penetrating Radar Modeling for Bridge Deck Deterioration Evaluated by 3D FDTD,” *IEEE Geoscience and Remote Sensing Symposium (IGARSS) 2008 Proceedings*, July 2008.
- [6] **Belli, K.**, Wadia-Fascetti, S., and Rappaport, C., “Analysis of Simulated Variation in Dielectric Properties of Reinforced Concrete Systems,” *Applications of Advanced Technology in Transportation Conference 2006 Proceedings*, August 2006.
- [7] Wadia-Fascetti, S., Grivas, D., **Belli, K.**, and Lebeau, K., “Defect Diagnosis and Impact on Bridge Performance,” *The First International Conference on Bridge Maintenance, Safety and Management Proceedings*, Barcelona, Spain, July 2002.

**Presentations: Oral († indicates presenting author)**

- [1] **Belli†, K.**, Rappaport, C., Wadia-Fascetti, S., “Determination of GPR Antenna Models for 2-D Finite-difference Time Domain Simulation of Bridge Decks,” *Asian-Pacific Network of Centers for Research in Smart Structure Technology (ANCRiSST) Workshop on Advanced Smart Materials and Smart Structure Technology*, July 2009.
- [2] **Belli, K.**, Udall, C., Rappaport†, C., and Wadia-Fascetti, S., “2-1/2 dimensional bistatic GPR propagation and scattering modeling of roadways and tunnels with projected 2D FDTD,” *IEEE Geoscience and Remote Sensing Symposium (IGARSS)*, July 2009.
- [3] **Belli†, K.**, Rappaport, C., and Wadia-Fascetti, S., “Characterization of a GPR Antenna for Excitation of a 2D Finite-Difference Time Domain Model of Reinforced Bridge Decks,” *Progress in Electromagnetics Research Symposium (PIERS)*, July 2008.
- [4] Zhan†, H., **Belli, K.**, Rappaport, C., and Wadia-Fascetti, S., “Validation of 2D FDTD Ground Penetrating Radar Modeling for Bridge Deck Evaluation by 3D FDTD,” *Progress in Electromagnetics Research Symposium (PIERS)*, July 2008.
- [5] **Belli†, K.**, Wadia-Fascetti, S., and Rappaport, C., “Analysis of Simulated Variation in Dielectric Properties of Reinforced Concrete Systems,” *Applications of Advanced Technology in Transportation Conference*, August 2006.

- [6] **Belli<sup>†</sup>, K.**, Wadia-Fascetti, S., and Rappaport, C., “Virtual Testbed Framework for Civil Infrastructure & Geotechnical Applications,” *CenSSIS Research and Industrial Collaboration Conference (RICC)*, November 2003.
- [7] **Belli<sup>†</sup>, K.**, “The Correlation of GPR Bridge Deck Assessment Data to Ground Truth,” *CenSSIS Research and Industrial Collaboration Conference (RICC)*, December 2002.

**Presentations: Conference & Workshop Posters (<sup>†</sup>indicates presenting author)**

- [1] **Belli<sup>†</sup>, K.**, Rappaport, C., and Wadia-Fascetti, S., “Forward Time Domain Ground Penetrating Radar Modeling of Scattering from Anomalies in The Presence of Steel Reinforcements,” *ADVANCE Interdisciplinary Networking in Sensing & Imaging Workshop* in conjunction with *CenSSIS Research and Industrial Collaboration Conference (RICC)*, October 2009.
- [2] Zhan<sup>†</sup>, H., **Belli, K.**, Rappaport, C., and Wadia-Fascetti, S., “Effectiveness of 2D FDTD Ground Penetrating Radar Modeling for Bridge Deck Deterioration Evaluated by 3D FDTD,” *IEEE Geoscience and Remote Sensing Symposium (IGARSS) 2008*, July 2009.

**Presentations: Northeastern University Event Posters (<sup>†</sup>indicates presenting author)**

10 posters at the *National Science Foundation Gordon-CenSSIS Site Visit*

9 posters at the *Gordon-CenSSIS Research and Industrial Collaboration Conference (RICC)*

2 posters at the *Northeastern University Research & Scholarship Exposition*

1 poster at the *Northeastern University Women in Science Exposition*

Select posters listed below.

- [1] Ganguli<sup>†</sup>, A., Abramo, D., **Belli, K.**, Wadia-Fascetti, S., and Rappaport, C., “Fusion of Electromagnetic and Mechanical Wave Data for Concrete Structure Diagnosis,” *CenSSIS Research and Industrial Collaboration Conference (RICC)*, October 2009.
- [2] Wright<sup>†</sup>, C., Rappaport, C., Wadia-Fascetti, S., **Belli, K.**, and Maser, K., “Capturing Ground Penetrating Radar Excitation Signals for Realistic FDTD Simulations,” *CenSSIS Research and Industrial Collaboration Conference (RICC)*, October 2009.
- [3] Udall<sup>†</sup>, C., **Belli, K.**, Zhan, H., Rappaport, C., and Wadia-Fascetti, S., “Effectiveness of 2D and 2.5D FDTD Ground Penetrating Radar Modeling for Bridge Deck Deterioration Evaluated by 3D FDTD,” *National Science Foundation Year 9 Site Visit*, April 2009 and *CenSSIS Research and Industrial Collaboration Conference (RICC)*, October 2008. C. Udall was the winner of the Best Poster in the TestBED category at the RICC.
- [4] **Belli<sup>†</sup>, K.**, Rappaport, C., and Wadia-Fascetti, S., “Characterization of a GPR Antenna for Excitation of a 2D FDTD Model of Reinforced Bridge Decks,” *National Science Foundation Year 8 Site Visit*, April 2008.
- [5] **Belli<sup>†</sup>, K.**, Zhan, H., Wadia-Fascetti, S., and Rappaport, C., “Comparison of the Accuracy of 2D versus 3D FDTD Air-Coupled GPR Modeling of Bridge Deck Deterioration,” *CenSSIS Research and Industrial Collaboration Conference (RICC)*, October 2007.
- [6] **Belli<sup>†</sup>, K.**, Wadia-Fascetti, S., and Rappaport, C., “Forward Time Domain GPR Modeling of Bridge Decks for Detecting Deterioration,” *National Science Foundation Year 7 Site Visit*, April 2007 and *Northeastern Research & Scholarship Expo*, March 2007, and *CenSSIS Research and Industrial Collaboration Conference (RICC)*, October 2006.
- [7] **Belli<sup>†</sup>, K.**, Wadia-Fascetti, S., and Rappaport, C., “Analysis of Simulated Variation in Dielectric Properties of Reinforced Concrete Systems,” *National Science Foundation Year 6 Site Visit*, April 2006, and *Women in Science Expo*, April 2006, and *Northeastern Research & Scholarship Expo*, March 2006 (Winner ‘Outstanding Graduate Student Research Award’), and *CenSSIS Research and Industrial Collaboration Conference (RICC)*, October 2005.
- [8] **Belli<sup>†</sup>, K.**, Wadia-Fascetti, S., and Rappaport, C., “Integrated Modeling for Subsurface Sensing of Civil Infrastructure,” *National Science Foundation Year 5 Site Visit*, April 2005 and *CenSSIS Research and Industrial Collaboration Conference (RICC)*, October 2004.

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## WORKSHOP PARTICIPATION

- ADVANCE Interdisciplinary Networking in Sensing & Imaging Systems, Boston, MA, October 26–28, 2009.
- Gordon-CenSSIS Research and Industrial Collaboration Conferences, Boston, MA, 2002–2009
- Gordon-CenSSIS Site Visits Years 1-9, Boston, MA, 2001–2009
- NATO Advanced Study Institute “Multisensor Data and Information Processing for Rapid and Robust Situation and Threat Assessment,” Albena, Bulgaria, May 16–27, 2005.

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## HONORS & AWARDS

- **Phi Kappa Phi** honor society membership (Awarded 2008)
- **IGERT Fellowship** in Intelligent Diagnostics (2006 – 2008)
- **GAANN Fellowship** in Sensing, Identification, Diagnostics & Rehabilitation of Structural Systems (2004 – 2006)
- **Outstanding Graduate Student Research Award** at NU Research & Scholarship Expo (March 2006)
- **National Science Foundation Travel Grant** to NATO Advance Study Institute (May 2005)
- **Alpha Psi Omega** dramatic honor fraternity membership (Fall 1999)
- **Crimson & Grey Recognition Award** for contribution & dedication to WPI and the enrichment of student life (April 1997)

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## SOCIETY MEMBERSHIPS

- American Society of Civil Engineers (ASCE)
- American Society for Nondestructive Testing (ASNT)
- Institute of Electrical and Electronics Engineers (IEEE)