TriDurLE

National Center for Transportation Infrastructure Durability & Life-Extension

Annual Performance Indicators Report for University Transportation Centers

October 1, 2019 – September 20, 2020

Submitted by

National Center for
Transportation Infrastructure Durability & Life-Extension

Prepared for

Office of the Assistant Secretary for Research & Technology (OST-R)
U.S. Department of Transportation

Alabama A&M University
Case Western Reserve University
Florida Atlantic University
Missouri University of Science & Technology
South Dakota State University
Tennessee State University
Texas A&M University
University of Colorado Denver
University of Mississippi
University of Utah
Washington State University

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1. PROGRAM INFORMATION

USDOT National University Transportation Center

Annual Performance Indicators Report

Submitted to	U.S. Department of Transportation Office of the Assistant Secretary for Research and Technology (OST-R)
Grant Number:	69A3551947137
Project Title:	National Center for Transportation Infrastructure Durability & Life-Extension (TriDurLE)
Center Director:	Xianming Shi, Ph.D., P.E. Associate Professor Department of Civil and Environmental Engineering Washington State University Pullman, WA 99163 xianming.shi@wsu.edu | 509-335-7088
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Project/Grant Period:	July 1, 2019 - September 30, 2023
Reporting Period Start Date:	April 1, 2020
Reporting Period End Date:	September 30, 2020
Report Term or Frequency:	**Annual Performance Indicators Report**
Signature of Submitting Official:	

2. PROGRAM-WIDE INDICATORS

University Transportation Centers Program Performance Indicators

UTC Name	Transportation Infrastructure Durability & Life Extension
University	Lead University: Washington State University (WSU) Consortium Member Universities: • Alabama A&M University (AAMU) • Case Western Reserve University (CWRU) • Florida Atlantic University (FAU) • Missouri University of Science & Technology (MST) • South Dakota State University (SDSU) • University of Utah (UU) • University of Mississippi (UM) • Tennessee State University (TSU) • University of Colorado Denver (UCD) • Texas A&M University (TAMU)
Grant #	69A3551947137
Reporting Period	October 1, 2019 to September 30, 2020

Performance Indicators	WSU	AAMU	CWRU	FAU	MST	SDSU	TSU	TAMU	UCD	UM	UU
Indicator #1 **Number of transportation-related courses offered during the reporting period that were taught by faculty and/or teaching assistants who were associated with the UTC**											
Undergraduate	6	3	4	1	4	0	0	3	0	1	4
Graduate	4	0	0	1	6	2	0	2	5	0	3
Indicator #2 **Number of students participating in transportation research projects during the reporting period funded by this grant**											
Undergraduate	2	0	0	0	2	0	0	1	0	0	0
Graduate	7	0	4	2	11	2	1	2	2	0	0
Indicator #3 **Number of transportation-related advanced degree programs that utilize grant funds during the reporting period to support graduate students**											
Master's level	3	0	0	1	1	2	0	1	0	0	0
Doctoral level	3	0	0	1	1	0	0	0	2	0	0
Indicator #4 **Number of students supported by this grant during the reporting period**											
Undergraduate	2	0	0	0	1	0	0	0	0	0	0
Master's	3	0	0	1	1	1	0	1	0	0	0
Doctoral	3	0	4	1	5	0	0	0	2	0	0
Indicator #5 **Number of degrees awarded during the reporting period to students supported by this grant**											
Undergraduate	0	0	0	0	0	0	0	0	0	0	0
Master's	0	0	0	0	0	0	0	0	0	0	0
Doctoral	0	0	0	0	0	0	0	0	0	0	0
Indicator #6 **Number and total dollar value of research projects selected for funding during the reporting period using UTC grant funds (Federal and/or Recipient) that you consider to be applied research and advanced research**											
Number of applied research projects	2	0	4	0	6	1	0	1	0	0	2

Dollar value of applied research projects	$220K	0	$21	0	$336,636	$114,104	0	$210,000	0	-	$260,358
Number of advanced research projects	2	1	0	2	2	0	0	0	0	0	0
Dollar value of advanced research projects	50,000	$61,778	0	$99,999	$145,912	0	0	0	0	-	0

3. UTC-SPECIFIC INDICATORS

3.1. Alabama A&M

Part II – UTC-Specific Performance Indicators	
UTC Name	National Center for Transportation Infrastructure Durability & Life-Extension (TriDurLE)
University	**Alabama A&M University**
Grant #	69A3551947137
Reporting Period	**July 1, 2019 to September 30, 2020**

Category	**Description of indicator**	**Metric**
Research Capability	Research results published in: Journal of Geotechnical and Geoenvironmental Engineering, ASCE Journal of Bridge Engineering, ASCE International Journal of Geomechanics, ASCE Journal of Engineering Reports.	•Number of refereed journal publications (11) 1. Ashour, M., Allaa Eldin, A., and Arab, M. "Laterally Loaded Battered Piles in Sandy Soils." Journal of Geotechnical and Geoenvironmental Engineering, ASCE, ISSN 1090-0241. 2. Ashour, M., Ibrahiem, A., and Boskovic, S. "Pile Cap Interaction with Bridge Foundations under Lateral Loads." Journal of Bridge Engineering, ASCE, 24(6). 3. Ashour, M., and Ibrahiem, A. "Response of piles in multilayers of soil under uplift forces." International Journal of Geomechanics, ASCE, 20(6): 04020056. 4. Ashour, M., Abbas, A., El-Tahrany, A ., and Allaa Eldin, A. "Modelling the behavior of inundated collapsible soils." Engineering Reports, John Wiley & Sons, Ltd, DOI: 10.1002/eng2.12156. •Number of presentations (0) •Number of technical research reports published (0)
Leadership	Member, *American society of Civil Engineering, ASCE.* *Member of the Seismic and Lateral Loads Committee, Deep foundation Institute.*	•Editorship (0) •Fellowship (1) •Organizing committee member or subcommittee chair of conference or workshop (0) •Number of professional committees or affiliated centers (1)
Education and Workforce Development	Teaching the following graduate course related to transportation	•Transportation related courses offered by faculty (1)

	infrastructure: CE508 (Advance Deep Foundation Design) Supported 0 undergraduate student in TriDurLE funded projects	•Number of students participating in TriDurLE funded projects (0) •Number of transportation related degree programs with students funded by TriDurLE (0)
Technology Transfer	Invited presentations	•Presentations given at professional and academic meeting (0) •Number of professionals in the audience (0)
Collaboration	Reviewer of 5 papers in peer review journals (Journal of Computer and Geotechnics, Journal of Geotechnical and Geoenvironmental Engineering, ASCE, Journal of Bridge Engineering, ASCE, International Journal of Geomechanics, ASCE	•Number of collaborative partners (0) •Number of international collaboration (0).

3.2. Case Western Reserve University

Part II – UTC-Specific Performance Indicators	
UTC Name	National Center for Transportation Infrastructure Durability & Life-Extension (TriDurLE)
University	**Case Western Reserve University**
Grant #	69A3551947137
Reporting Period	**July 1, 2019 to September 30, 2020**

Category	**Description of indicator**	**Metric**
Research Capability	Research results published in: *Construction & Building Materials, Transportation Research Record, Journal of Energy Engineering, Bulletin of Engineering Geology and the Environment, Fuel, Optik, etc.* Research results presented at: 99th TRB Annual Meeting	•Number of refereed journal publications (11) 5. Hu, J,Y, Zhang, X.J. Guo, Y. Zhang, LQ, Yu, X. (2020). Comparative Evaluation of Moisture Susceptibility of Modified/Foamed Asphalt Binders Combined with Different Types of Aggregates Using Surface Free Energy Approach, Construction & Building Materials, accepted 6. Dong, SY and Yu, X. (2020). Microstructure-Based Random FEM Model for the Freezing Effects in Soils and Cold Region Retaining Walls, Transportation Research Record, in production 7. Hu, J.Y. and Yu, X. (2020). Adaptive greenhouse with thermochromic material: performance evaluation in cold regions, Journal of Energy Engineering, in production 8. Zhang, L., Shi, B., Zhu, H.H, Yu, X., Wei, GQ (2020). A Machine learning method for inclinometer lateral deflection calculation based on distributed strain sensing technology, Bulletin of Engineering Geology, and the Environment, https://doi.org/10.1007/s10064-020-01749-3 9. Rucker G.R., Zhang LQ, Yu, X. (2020), Molecular Dynamics Investigation on n-Alkane-Air/Water Interfaces, Fuel, Volume 267, 1 May 2020, 117252, https://doi.org/10.1016/j.fuel.2020.117252 10. Hu,J and Yu, X (2020). Electromagnetic simulation on optical performance of thermochromic film: Influences of particle size, shape, concentration, and film substrate, Optik, 164307 11. Hu,J and Yu, X (2020). Simulation of optical properties of thermochromic film: Influences of particle configuration and geometry, Optik 202, 163635, 1 12. Hu,J and Yu, X. (2020). Performance evaluation of solar-responsive asphalt mixture with thermochromic materials and nano-TiO2 scatterers,

		Construction and Building Materials 247, 118605, 2020 •Number of presentations (8) •Number of technical research reports published (0)
Leadership	Xiong (Bill) Yu • Editorial Board Member *Journal of Testing and Evaluation* *Journal of Advancement in Civil Engineering Materials* *Geotechnical Testing Journal* *Journal of Advance in Civil Engineering Materials* *Journal of Infrastructure Preservation & Resilience* • Technical Committees *Immediate past Chair, ASCE Geo-Institute Committee on Engineering Geology and Site Characterization* *ASCE Geo-Institute Committee on Geophysical Engineering* *ASCE Committee on Pavement Engineering* *ASCE G-I Task Force on Sustainability and Climate Change* *IEEE Intelligent Transportation System Society* *IEEE Instrument and Measurement Society* *TRB AFP60 Committee on Unsaturated Soils* *TRB AFP40 Climatic Effects on Infrastructure Committee* Yue Li • Editor board *Section Editor, Journal of Structural Engineering, ASCE* *Associate Editor, Journal of Structural Engineering, ASCE* *Associate Editor, Journal of Performance of Constructed Facilities, ASCE* *Editorial Board, Structural Safety* *Editorial Board, Journal of Sustainable and Resilient Infrastructure* • Committees service *Chair of Technical Council on Life-Cycle Performance, Safety, Reliability and Risk of Structural*	•Editorship (10) •Fellowship (1) •Organizing committee member or subcommittee chair of conference or workshop (3) •Number of professional committees or affiliated centers (9)

	Systems, Task Group 3 (TG3): Risk Assessment of Structural Infrastructure Facilities and Risk-Based Decision Making (2018 - 2022)	
Education and Workforce Development	Teaching the following Ph.D level courses related to transportation infrastructure: • Pavement Analyses and Design (Xiong Bill Yu) • Intelligent Infrastructure System (Xiong (Bill) Yu) • Probabilistic analysis (Yue Li) Supported 4 Ph.D. students and 0 undergraduate student in TriDurLE funded projects	•Transportation related courses offered by faculty (1) •Number of students participating in TriDurLE funded projects (2) •Number of transportation related degree programs with students funded by TriDurLE (1)
Technology Transfer	Invited presentations by First International Conference on Mirobial Biotechnology in Construction Materials and Geotechnical Engineering, WSU TriDurLE, etc. Plus 8 other presentations.	•Presentations given at professional and academic meeting (11) •Number of professionals in the audience (500)
Collaboration		•Number of collaborative partners (0) •Number of international collaboration (0). •Number of Center personnel involved (0)

3.3. South Dakota State University

Part II – UTC-Specific Performance Indicators	
UTC Name	National Center for Transportation Infrastructure Durability & Life-Extension (TriDurLE)
University	**South Dakota State University**
Grant #	69A3551947137
Reporting Period	**July 1, 2019 to September 30, 2020**

Category	**Description of indicator**	**Metric**
Research Capability	Research results published in: ACI Materials Journal, ACI Structural Journal Research results presented at: The 2020 ASCE Congress	•Number of refereed journal publications (2) 1. Tuhin, I.A., and Tazarv, M. (2020). "Stress-Strain Relationship for Polyurea Confined Circular Concrete Columns under Static Loads," ACI Materials Journal, Vol. 117, No. 4, pp. 81-94. 2. Tazarv, M., and Saiidi, M.S. (2020). "Analysis and Design of NiTi Superelastic SMA-Reinforced ECC Bridge Columns," ACI Structural Journal, Special Issue, SP-341-6, pp. 105-130. •Number of presentations (1) •Number of technical research reports published (0)
Leadership	Editor-in-Chief: Co-Editor, Special Issue: Organizing committee: Co-Moderator: 2020 ASCE Congress, St. Louis, MO, April 5 • Member of the American Society of Civil Engineers (M.ASCE). • Member of the American Concrete Institute (ACI). • Young Member of the TRB AFF50 Seismic Committee (2015-2021). • Member of the SEI ASCE Seismic Effect Committee (2015-2021). • Member of the ACI	•Editorship (0) •Fellowship (0) •Organizing committee member or subcommittee chair of conference or workshop (1) •Number of professional committees or affiliated centers (7)

	Committee 341, Earthquake-Resistant Concrete Bridges. • Associate Member of ASCE 7-22 Main Committee. • Associate Member of ASCE 7-22 Seismic Subcommittee.	
Education and Workforce Development	Teaching the following MS/PhD level courses related to transportation infrastructure: CEE 759 (Structural Dynamics, 7 students) and EM 741 (Finite Element Analysis, 5 students). Supported 0 Postdoctoral Associate, 0 Ph.D. students and 1 MS student, and 0 undergraduate student in TriDurLE funded projects	•Transportation related courses offered by faculty (2) •Number of students participating in TriDurLE funded projects (1) •Number of transportation related degree programs with students funded by TriDurLE (1)
Technology Transfer	Invited presentations by: The 2019 South Dakota County Convention, The 34th Annual North Central Regional Local Road Conference, Transportation Learning Network, The 2019 International Accelerated Bridge Construction Conference, The 2020 ASCE Congress, ACI Spring 2020 Convention, TriDurLE, ASCE South Dakota Eastern Branch	•Presentations given at professional and academic meeting (8) •Number of professionals in the audience (400)
Collaboration	A collaboration between Civil Engineering and Computer Science at SDSU.	•Number of collaborative partners (2) •Number of international collaboration (0). •Number of Center personnel involved (1): Dr. Mostafa Tazarv

3.4. University of Colorado Denver

Part II – UTC-Specific Performance Indicators	
UTC Name	National Center for Transportation Infrastructure Durability & Life-Extension (TriDurLE)
University	**University of Colorado Denver**
Grant #	69A3551947137
Reporting Period	**July 1, 2019 to September 30, 2020**

Category	**Description of indicator**	**Metric**
Research Capability	Research results published in: PCI Journal, American Concrete Institute Special Publication, Structures and Buildings, Research results presented at: Bridge Engineering Institute Conference, Transportation Research Board, ASCE International Conference on Transportation & Development	•Number of refereed journal publications 1. Kim, Y.J. and Siriwardanage, T. 2020. New LRFD-based prestressed concrete bulb-tee girders in Colorado, PCI Journal, Prestressed Concrete Institute (PCI), 65(3), 53-63 2. Nickle, R.W., and Kim, Y.J. 2020. Design of FRP-prestressed concrete bridge girders, ACI Special Publication on Design and Evaluation of Concrete Bridges (ACI-SP-340), American Concrete Institute (ACI), 233-246 3. Ji, Y., and Kim, Y.J. 2020. Load effects and associated forces for bridges subjected to light rail transit, Structures and Buildings, Institution of Civil Engineers, ICE, 173(8), 568-584 •Number of presentations (3) 1. Wang, J., Bumadian, I., and Kim, Y.J. 2019. Behavior of Corroded Steel Beams Strengthened with CFRP Sheets, Bridge Engineering Institute Conference in 2019 (BEI-2019), Honolulu, HI. 2. Coppola, N. and Marshall, W. Planimetric Spatial Data & the Provision of Sidewalk Infrastructure in Cities. *Transportation Research Board*; Washington, D.C.; Jan. 2020. 3. Coppola, N. and Marshall, W. An Evaluation of Sidewalk Availability and Width. ASCE International Conference on Transportation & Development; Seattle, WA; May 2020. •Number of technical research reports published (0)
Leadership	Associate Editor of *Advances in Structural Engineering*; Editorial	•Editorship (3)

	Board Member of *Journal of Infrastructure Preservation and Resilience* and International Journal of Concrete Structures and Materials Editor, Advances in concrete bridges: design, construction, evaluation, and rehabilitation, American Concrete Institute (ACI), ISBN: 978-1-64195-078-7 Fellow, American Concrete Institute (ACI) Director of the Transportation Research Center at the University of Colorado Denver Conference committee, Chair: Bridge Engineering Institute Conference 2019 (BEI-2019), Honolulu, HI, 2019 International Scientific Committee of the 9th Asia-Pacific Young Researchers and Graduates Symposium (YRGS 2019), Shanghai, China, 2019 International Scientific Committee of the 7th Asia Pacific Conference on FRP in Structures (APFIS 2019), Surfers Paradise, Australia, 2019 International Scientific Committee of the 14th International Symposium on Fiber-Reinforced Polymer Reinforcement of Concrete Structures (FRPRCS-14), Belfest, UK, 2019 Moderator: Prestressed Concrete with Conventional and Nonconventional Materials, Part 1, American Concrete Institute (ACI) Fall, Cincinnati, OH, 2019 Moderator: Prestressed Concrete with Conventional and Nonconventional Materials, Part 2, American Concrete Institute (ACI)	•Fellowship (1) •Organizing committee member or subcommittee chair of conference or workshop (6) •Number of professional committees or affiliated centers (16)

	Fall, Cincinnati, OH, 2019 Professional Committee: President, Bridge Engineering Institute, An International Technical Society: 2017 – present Chair, ACI-440I (FRP-prestressed Concrete): 2013 – present Voting member: American Concrete Institute Committee 345 (ACI-345: Repair and Maintenance of Concrete Bridges) Voting member: American Concrete Institute Committee 440 (ACI-440: Fiber Reinforced Polymer Reinforcement) Voting member: American Concrete Institute Committee 440L (ACI-440L: FRP Durability) Voting member: American Concrete Institute Committee 440K (ACI-440K: FRP Material Characteristics) Voting member: American Concrete Institute Committee 440I (ACI-440I: FRP-prestressed Concrete) Voting member: American Concrete Institute Committee 440H (ACI-440H: FRP-reinforced Concrete) Voting member: American Concrete Institute Committee 440F (ACI-440H: FRP-repair-strengthening) Voting member: American Concrete Institute Committee 342 (ACI-342:Evaluation of Concrete Bridges and Bridge Elements) Associate member: American Concrete Institute Committee 343	

	(ACI-343:Concrete Bridge Design) Associate member: American Concrete Institute Committee 377 (ACI-377: Performance-Based Structural Integrity & Resilience of Concrete Structure) Research Coordinator and Member of the National Research Council, Transportation Research Board Committee on Transportation Issues in Major Cities (ABE30) (April 2012 - 2020) Paper Review Coordinating Team and Member of the National Research Council, Transportation Research Board Committee on Transportation Demand Management (ABE50) (April 2011 - 2020) Faculty Advisor, Institute of Transportation Engineers (ITE) University of Colorado Denver Student Chapter (2009 - present) Co-Faculty Advisor, Women's Transportation Seminar (WTS) University of Colorado Denver Student Chapter (2015 – present)	
Education and Workforce Development	Infrastructure Rehabilitation; Design of Prestressed Concrete; Sustainable Transportation Systems; Transportation System Safety; Introduction to GIS Supported 2 Ph.D. students and 0 undergraduate student in TriDurLE funded projects	Transportation related courses offered by faculty (5) Number of students participating in TriDurLE funded projects (2) Number of transportation related degree programs with students funded by TriDurLE (2)
Technology Transfer	Invited presentations by FRP in New Construction: From Prestressed Concrete to Pultruded Sections, the 11th Conference on Application Technology of FRP in Infrastructure (FRP 11), Shanghai, China, Sept. 21, 2019 (Keynote speaker)	Presentations given at professional and academic meeting (3) Number of professionals in the audience (500+100 = 600)

	2 presentations	
Collaboration	Yongcheng Ji, Northeast Forestry University, China City and City of Denver - Walk Denver - Colorado Cross-Disability Coalition - Colorado Public Interest Research Group (CoPIRG) Foundation - Groundwork Denver Community/Environmental Organization - Bike Denver - Bicycle Colorado - All In Denver Affordable Housing Organization - American Heart Association	Number of collaborative partners (10) Number of international collaboration (1). Number of Center personnel involved (3): Dr. Jimmy Kim, Dr. Wesley Marshall, and Dr. Arun Karunanithi

3.5. Missouri University of Science & Technology

Part II – UTC-Specific Performance Indicators	
UTC Name	National Center for Transportation Infrastructure Durability & Life-Extension (TriDurLE)
University	**Missouri University of Science and Technology (S&T)**
Grant #	69A3551947137
Reporting Period	**July 1, 2019 to September 30, 2020**

Category	**Description of indicator**	**Metric**
1. Research Capability	Research results published in: *Journal of Materials in Civil Engineering, Journal of Transportation Engineering, Part A: Systems, Transportation Research Part C: Emerging Technologies, International Journal of Geomechanics, Transportation Research Record etc.* Research results presented at: 99th TRB Annual Meeting, GeoCongress 2020, 9th International Conference on Structural Health Monitoring of Intelligent Infrastructure, 7th Asia-Pacific Conference on Unsaturated Soils, etc.	•Number of refereed journal publications (27) Please check the attached *Publications* file. •Number of conference papers (19) •Number of presentations (22) •Number of technical research reports published (3)
2. Leadership	• Associate Editor, the International Journal of Transportation Science and Technology. • Associate Editor, ASCE Journal of Cold Regions Engineering • Associate Editor, Advances in Civil Engineering • Associate Editor, ASCE Journal of Transportation Engineering Part B: Pavements, since 2017 • Associate Editor, ASCE Journal of Materials in Civil Engineering, since 2009 • Guest Editor, Special Issue on "Green and Smart Pavement Materials and Technologies",	•Editorship (6) •Organizing committee member or subcommittee chair of conference or workshop (2) •Number of professional committees or affiliated centers (8)

	ASCE Journal of Transportation Engineering Part B: Pavements, 2020 • Committee Member, TRB ADB20 • Committee Member, TRB AFP60 • Committee Member, TRB AFP50 • Committee Member, TRB AFS20 • Committee Member, TRB AFP70 • Chair, ASCE Geo-Institute Shallow Foundation Committee • Voting Member, TC106 Unsaturated Soils, International Society for Soil Mechanics and Geotechnical Engineering (ISSMGE) • Chair, ASCE Live Webinar Subcommittee Member, ASCE Geo-Institute Unsaturated Soil Mechanics Committee • Chair, Scientific Committee, 5th International Conference on Transportation Infrastructure and Materials, 2021. • Session Chair, technical session, and Student Posters Sessions, and organizing committee member, 9th International Conference on Structural Health Monitoring of Intelligent Infrastructure, August 4-7, 2019	
3. Education and Workforce Development	Teaching the following Ph.D level courses related to transportation infrastructure: CE5001 Base courses in Pavements, 8 students CE5116 Pavement Design, 32 students CE5513 Traffic Engineering, 61 students	•Transportation related courses offered by faculty (6) •Number of students participating in TriDurLE funded projects (7) •Number of transportation related degree programs with students funded by TriDurLE (2)

	CE5515 Advanced Traffic Operation and Capacity Analysis, 59 students CE6716 Soil stabilization, 12 students CE6001 Special Topics on Unsaturated Soil Mechanics, 23 students Supported 1 undergraduate student, 1 MS student, and 5 Ph.D. students in TriDurLE funded projects	
4. Technology Transfer	• Keynote presentation, 7th Asia-Pacific Conference on Unsaturated Soils, August 23~25, 2019, Nagoya Japan • Keynote presentation, 4th International Conference on Transportation Soil Engineering in Cold Regions, 20 –23 May, 2019, St. Petersburg, Russia • X. Zhang, Keynote Speaker, GEO-Omaha 2020, 37th Annual Geotechnical Conference, Omaha, NE • Invited webinar by TRB Standing Committee on Maintenance and Operations Management AKR10. Attracted 600+ registrants. • Other invited presentations	•Presentations given at professional and academic meeting (22) •Number of professionals in the audience (2860)
5. Collaboration	• S&T hosted 11 visiting scholars from Dalian University of Technology, Chang'An university, China University of Geosciences, Changsha University of Science and Technology, Guangdong University of Technology, etc. • UTC projects matched with MoDOT, CODOT, and industries	•Number of collaborative partners (9) •Number of international collaboration (11). •Number of Center personnel involved (3): Drs. Jenny Liu, X. Zhang, and XB Hu

3.6. University of Utah

Part II – UTC-Specific Performance Indicators	
UTC Name	National Center for Transportation Infrastructure Durability & Life-Extension (TriDurLE)
University	**University of Utah**
Grant #	69A3551947137
Reporting Period	**July 1, 2019 to September 30, 2020**

Category	**Description of indicator**	**Metric**
1. Research Capability	Research results published in: *Journal of Materials in Civil Engineering, Concrete International, Construction and Building Materials, Fuel, Journal of Infrastructure Preservation & Resilience, Nanomaterials, Composite Structures, Engineering Structures, and Construction and Building Materials.* Research results presented at: 99th TRB Annual Meeting, ACI 2019 Fall Convention, 4th International Conference on Transportation Infrastructure & Materials, ASCE Structures Congress, 17th World Conference on Earthquake Engineering,	Number of refereed journal publications (8) 1. Asib, ASM., Romero, P., and Safdazadeh, F: "*An equivalence between methods of aging for determining the low-temperature performance of hot-mix asphalt concrete mixtures containing reclaimed asphalt pavement.*" Journal of Construction and Building Materials, Elsevier Volume 223 Pp 198-209 (2019). 2. Gao, Y., Romero, P. Zhang, H., Huang, M., and Lai, F.: "*Unsaturated polyester resin concrete: A review*." Journal of Construction and Building Materials, Elsevier Volume 228 Article 116709 (2019) 3. Kim, H., Han, D., Kim, K., and Romero, P. "*Performance Assessment of Repair Material for Deteriorated Concrete Slabs Using Chemically Bonded Cement*". Article 117468 Journal of Construction and Building Materials Volume 237, Elsevier (March 2020) 4. Moran, D.A., Pantelides, C.P., and Reaveley, L.D. (2019). "Mohr-Coulomb model for rectangular and square FRP-confined concrete." *Composite Structures*, 209, 889-904. 5. Wang, Y., Ibarra, L., and Pantelides, C.P. (2019). "Collapse capacity of reinforced concrete skewed bridges retrofitted with buckling-restrained braces." *Engineering Structures*, 184, 99-114. 6. Wu, R.Y., and Pantelides, C.P. (2019). "Seismic evaluation of repaired multi-column bridge bent using static and dynamic analysis." *Construction and Building Materials*, 208, 792-807. 7. Upadhyay, A., Pantelides, C.P., and Ibarra, L. (2019). "Residual drift mitigation for bridges retrofitted with buckling restrained braces or self-centering energy dissipation devices." *Engineering Structures*, 199, 109663. 8. Wang, Y., Ibarra, L., and Pantelides, C.P. (2020). "Effect of incidence angle on the seismic performance of skewed

		bridges retrofitted with buckling-restrained braces." *Engineering Structures*, 211, 110411. •Number of presentations (2) 1. ASM, Asib; Romero, P., and Safazadeh, F.: *A long-term field study on Low Temperature Cracking Performance of Asphalt Pavements using the Bending Beam Rheometer*. Paper 20-03620 Presented at the 99th TRB Annual Meeting 2. Safazadeh, F., Romero, P. ASM, Asib; and VanFrank, K.*: Methods to evaluate Intermediate Temperature Properties of Asphalt Mixtures by the Semi-Circular Bend Test*. Paper 20-00404. Presented at the 99th TRB Annual Meeting •Number of technical research reports published (1) Romero, P., and VanFrank, K.: *Balanced Asphalt Concrete Mix Performance in Utah, Phase III: Evaluation of Field Materials Using BBR and SCB-I-FIT Tests*. Report UT-19.15, Utah Department of Transportation, 2019
2. Leadership	Reviewer • *Journal of the Transportation Research Board* • *ASCE Journal of Materials in Civil Engineering* • *Journal of Construction and Building Materials* • *Journal of Road Materials and Pavement Design* • *ASCE Journal of Structural Engineering* • *ASCE Journal of Bridge Engineering* • *Engineering Structures* • *Composite Structures* • *Construction and Building Materials* • *ASCE Journal of Composites for Construction* • *Earthquake Spectra*	•Editorship (1) •Fellowship (1) •Organizing committee member or subcommittee chair of conference or workshop (1) 2020 Utah Asphalt Conference •Number of professional committees or affiliated centers (0)
3. Education and Workforce Development	Teaching the following Ph.D level courses related to transportation infrastructure: 1. CVEEN 3510: Civil Engineering Materials (35 students)	•Transportation related courses offered by faculty (7) •Number of students participating in TriDurLE funded projects (0)

	2. CVEEN 5220/6220: Concrete Design II (15 students) 3. CVEEN 5500: Materials Sustainability (26 students) 4. CVEEN 5570: Pavement Design (21 students) 5. CVEEN 6570: Advanced Pavement Design (3 students) 6. CVEEN 7250: Structural Earthquake Engineering (9 students) 7. CVEEN 7235: Bridge Design (12 students) Supported 0 Postdoctoral Associate, 0 Ph.D. students and 0 undergraduate student in TriDurLE funded projects	•Number of transportation related degree programs with students funded by TriDurLE (0)
4. Technology Transfer	Invited presentations by .	•Presentations given at professional and academic meeting (0) •Number of professionals in the audience (0)
5. Collaboration	Hosted a visiting scholar from Chang'An University. Utah Department of Transportation (UDOT): in-kind support for TriDurLE research; University of Utah: facility utilization.	•Number of collaborative partners (0) •Number of international collaboration (1). •Number of Center personnel involved (1): Dr. Pedro Romero

3.7. Washington State University

Part II – UTC-Specific Performance Indicators	
UTC Name	National Center for Transportation Infrastructure Durability & Life-Extension (TriDurLE)
University	**Washington State University**
Grant #	69A3551947137 PI X. Shi
Reporting Period	**July 1, 2019 to September 30, 2020**

Category	Description of indicator	Metric
2. Research Capability	Research results published in: *Journal of Materials in Civil Engineering, Concrete International, Construction and Building Materials, Fuel, Journal of Infrastructure Preservation & Resilience, Nanomaterials, etc.* Research results presented at: 99th TRB Annual Meeting, ACI 2019 Fall Convention, 4th International Conference on Transportation Infrastructure & Materials, etc.	•Number of refereed journal publications (11) 1. He, J., Shi, X. Accelerated Laboratory Assessment of Discrete Sacrificial Anodes for Rehabilitation of Salt Contaminated Reinforced Concrete, *ASCE Journal of Materials in Civil Engineering*, 2020, 32(11), DOI: 10.1061/(ASCE)MT.1943-5533.0003374. 2. Nazari, M.H., Shihab, M., Havens, E.A., Shi, X. Mechanism of Corrosion Protection in Chloride Solution by an Apple-Based Green Inhibitor: Experimental and Theoretical Studies. *Journal of Infrastructure Preservation and Resilience,* 2020, 1, 7, DOI: 10.1186/s43065-020-00007-w. 3. Shi, X. Foreword from the Editor-in-Chief: The Inaugural Issue of Journal of Infrastructure Preservation and Resilience. *Journal of Infrastructure Preservation and Resilience,* 2020, (1), 1, DOI: 10.1186/s43065-020-00006-x. 4. Xu, G., Shi, X. Fly Ash Geopolymer Pervious Concrete: A Study of Durability Performance under Cold-Climate Conditions. *Concrete International*, 2020, 42(1), 37-41. 5. Li, Z., Shi, X. Graphene Oxide Modified, Clinker-Free Cementitious Paste with Principally Alkali-Activated Fly Ash. *Fuel*, 2020, 269, DOI: 10.1016/j.fuel.2020.117418. 6. Zhu, J., Zhang, K., Liu, K., Shi, X. Adhesion Characteristics of Graphene Oxide Modified Asphalt Unveiled by Surface Free Energy and AFM-Scanned Micro-Morphology. *Construction and Building Materials*, 2020, 244, DOI: 10.1016/j.conbuildmat.2020.118404. 7. Wu, J., Diao, B., Cao, Y., Zhong, J., Shi X. Chloride Concentration Distributions in Fatigue Damaged RC Beams Revealed by Energy-Dispersive X-ray Spectroscopy. *Construction and Building Materials*, 2020, 234, DOI: 10.1016/j.conbuildmat.2019.117396. 8. Du, S., Jiang, Y., Zhong, J., Ge, Y., Shi, X. Surface Abrasion Resistance of High-Volume Fly Ash Concrete

		Modified by Graphene Oxide: Macro- and Micro-Perspectives. *Construction and Building Materials*, 2020, 237, DOI: 10.1016/j.conbuildmat.2019.117686. 9. Du, S., Wu, J., Alshareedah, O., Shi, X. Nanotechnology in Cement-based Materials: A Review of Durability, Modeling, and Advanced Characterization. *Nanomaterials*, 2019, 9(9), 1213. DOI: 10.3390/nano9091213. 10. He, J., Gray, K., Norris, A., Ewing, A. C., Jurgerson, J., Shi, X. Use of Biological Additives in Pavements: A Review of Opportunities and Challenges. *ASCE Journal of Transportation Engineering, Part B: Pavements*, 2020, 146(3), DOI: 10.1061/JPEODX.0000188. 11. Du, S., Tang, Z., Zhong, J., Ge, Y., Shi, X. Effect of Admixing Graphene Oxide on Abrasion Resistance of Ordinary Portland Cement Concrete. *AIP Advances*, 9, 105110 (2019), DOI: 10.1063/1.5124388. •Number of presentations (15) •Number of technical research reports published (0)
13. Leadership	Editor-in-Chief of *Journal of Infrastructure Preservation & Resilience*; Association Editor of *Journal of Nondestructive Evaluation*; Editorial Board of *International Journal of Transportation Science and Technology*. Co-Editor, Special Issue: Intelligent Concrete, New Functionalities and Nanotechnology, *Frontiers in Materials* journal Fellow, *ASCE,* since July 2020 Organizing committee, 2019 *International Conference on Transportation Infrastructure and Materials*, July 2-4, 2019, Jinan, China. Co-Moderator, ACI Special Session on *Durability, Service Life, and Long-Term Integrity of Concrete Materials, Bridges, and Structures* to be held in Oct. 17-21, 2021, Atlanta, GA. • Full Member, Sigma Xi, The	•Editorship (7) •Fellowship (1) •Organizing committee member or subcommittee chair of conference or workshop (2) •Number of professional committees or affiliated centers (9)

	Scientific Research Honor Society, Sept. 2020 – Present • Member, American Association for the Advancement of Science (AAAS), May 2020 – Present • Affiliated Faculty, Center for Bioplastics and Biocomposites: A National Science Foundation I/UCRC, 2019-Present • Affiliated Faculty, WSU Center for Environmental Research, Education, and Outreach, 2014-Present • Affiliated Faculty, WSU Composite Materials & Engineering Center, 2014-Present • ASCE Construction Institute (CI) Bituminous Materials Committee, Control Member since 2016 • TRB *Standing Committee on Durability of Concrete* (AFN30 and now AKM 70), Member, 2016-2022. • TRB *Standing Committee on Resource Conservation and Recovery* (ADC60 and now AMS20), Member, 2016-2021. • American Concrete Institute (ACI), Committee 236 (Material Science of Concrete), Committee 222 (Corrosion of Metals in Concrete), and Committee 201 (Durability of Concrete), Associate member, since 2009	
14. Education and Workforce Development	Teaching the following Ph.D level courses related to transportation infrastructure: CE508 (Concrete Durability), 8 students Supported 1 Postdoctoral Associate, 2 Ph.D. students and 0 undergraduate student in TriDurLE funded projects	•Transportation related courses offered by faculty (1) •Number of students participating in TriDurLE funded projects (2) •Number of transportation related degree programs with students funded by TriDurLE (1)

15. Technology Transfer	Invited presentations by Tianjin University, Changsha University of Science and Technology, Idaho Transportation Department, Sun Yet-Sen University, South China University of Technology, 1st Sino-US Symposium on Advances in Civil Infrastructure Intelligence and Sustainability, and 4th International Conference on Transportation Infrastructure & Materials. Plus 8 other presentations.	•Presentations given at professional and academic meeting (15) •Number of professionals in the audience (1050)
16. Collaboration	Hosted two visiting scholars from University of Jinan, Chang'An University, Yunan University, Harbin Institute of Technology, and Southwest Jiaotong University, resp. The Washington State Department of Transportation (WSDOT): in-kind support for TriDurLE research; University of Idaho: facility utilization. Journal of Infrastructure Preservation & Resilience and Bridge Engineering Institute, both provide outreach platform.	•Number of collaborative partners (9) •Number of international collaboration (5). •Number of Center personnel involved (2): Dr. Xianming Shi, Ms. Cheryl Reed

University	**Washington State University**
Grant #	**3815-5662 PI Muhunthan**
Reporting Period	**July 1, 2019 to September 30, 2020**

Category	**Description of indicator**	**Metric**
Research Capability	Research results published in: *Journal of Materials in Civil Engineering, Construction and Building Materials, Transportation Geotechn Journal of Cleaner Production, Jour. Transp. Engrg., Part B: Pavements*	•Number of refereed journal publications 1. Li, X., Zhang, K., Bahadori, A., and Muhunthan, B. (2020). Modification of asphalt materials to resist studded-tire wear on pavements., *Jour. Materials. Civil Engrg.,* ASCE. DOI 10.1061/(ASCE) MT.1943-5533.0003067. 2. Li, R., Bahadori, A., Xin, J., Zhang, K., Muhunthan, B., and Zhang, J. (2020). Characteristics of bioepoxy based on waste cooking oil and lignin and its effects on asphalt binder. *Construction and Building Materials*, doi.org/10.1016/j.conbuildmat.2020.118926.

		3. Lim, J., Bahadori, A., Wen, H., Littleton, K., Corely, K., Muhunthan, B. (2020). Feasibility of 9.5-mm Stone Matrix Asphalt (SMA) For Thin Lift Overlay in Washington State., *Jour. Matl. Civil Engrg*, ASCE (accepted). 4. Wang, J., Wen, H., Muhunthan, B. (2020). Development of test methods to characterize the Shrinkage Properties of cementitiously stabilized materials. Transportation Geotechnics. https://doi.org/10.1016/j.trgeo.2020.100405 5. Wu, S., Tahiri, O., Shen, S., Zhang, W., Muhunthan, B. (2020). Environmental impact evaluation and long-term rutting resistance performance of warm mix asphalt technologies. *Journal of Cleaner Production*; https://doi.org/10.1016/j.jclepro.2020.123938 6. Wang, J., Li, X., Wen, H., Muhunthan, B. (2020). Shrinkage cracking model for cementitiously stabilized layers for use in the Mechanistic-Empirical Pavement Design Guide. *Transportation Geotechnics*. https://doi.org/10.1016/j.trgeo.2020.100386 7. Amarasiri, S., and Muhunthan, B. (2020). Evaluating effectiveness of pavement preventive maintenance treatments in mitigating longitudinal cracks in Wet Freeze Climate Zones. Jour. Transp. Engrg., Part B: Pavements, ASCE., DOI: 10.1061/JPEODX.0000158. •Number of technical research reports published (0)
Leadership	Fellow, ASCE Since 2008 Editorial Board of *International Journal of Geomechanics, ASCE* Chair, Civil and Environmental Engineering Department, WSU	•Editorial Board (1) •Fellowship (1) Department Lead (1)
Education and Workforce Development	Teaching the following Ph.D level courses related to transportation infrastructure: CE 317 (Geotechnical Engineering CE 425/525 (Soil and Site Improvement) Supported 1 Ph.D. student in TriDurLE funded projects Coordinated offering of CE 400 – Highway Materials CE 322- Transportation Engineering	•Transportation related courses offered by faculty and colleagues (4) •Number of students participating in TriDurLE funded projects (1) •Number of transportation related degree programs with students funded by TriDurLE (1)

Technology Transfer	Invited presentations at Changsha University of Science and Technology, Sun Yet-Sen University, South China University of Technology, 1st Sino-US Symposium on Advances in Civil Infrastructure Intelligence and Sustainability, and 4th International Conference on Transportation Infrastructure & Materials. Jilin University	•Presentations given at professional and academic meeting (5) •Number of professionals in the audience (600)
Collaboration		

University	**Washington State University**
Grant #	69A3551947137 PIs Motter and Phillips
Reporting Period	**July 1, 2019 to September 30, 2020**

Category	**Description of indicator**	**Metric**
3. Research Capability		
Leadership	Motter Assistant Editor of *The Masonry Society Journal* • Affiliated Faculty, WSU Composite Materials & Engineering Center, 2014-Present • Voting Member, American Concrete Institute (ACI) Committee 318-W: Structural Concrete Building Code - Wind Provisions • Secretary and Voting Member, American Concrete Institute (ACI) Committee 374: Performance-Based Seismic Design of Reinforced Concrete Buildings Phillips • Affiliated Faculty, WSU Composite Materials & Engineering Center, 2014-	•Editorship (1) •Number of professional committees or affiliated centers (3) • Number of professional committees of affiliated centers (2)

	Present • Member, American Institute of Steel Construction Partners in Education Committee	
Education and Workforce Development	Motter Teaching the following Ph.D level courses related to transportation infrastructure: CE534 (Prestressed Concrete and Bridge Design), 10 students Motter & Phillips Supported 0 Postdoctoral Associate, 2 M.S. students and 2 undergraduate students in TriDurLE funded projects	•Transportation related courses offered by faculty (1) •Number of students participating in TriDurLE funded projects (4)
Technology Transfer	Motter & Phillips Invited presentations by Washington Department of Transportation	•Presentations given at professional and academic meeting (1) •Number of professionals in the audience (50)
Collaboration	Motter & Phillips Collaborate with three faculty at the University of Washington	•Number of collaborative partners (3) •Number of Center personnel involved (2): Dr. Christopher Motter, Dr. Adam Phillips
University	**Washington State University**	
Grant #	69A3551947137 **PI J. Y. Lee**	
Reporting Period	**July 1, 2019 to September 30, 2020**	
Category	**Description of indicator**	**Metric**
Research Capability	Research results published in: *Structural Safety, Earthquake Spectra*	•Number of refereed journal publications (1) 17. Ghasemi, S.H. and **Lee, J.Y.** (2020). "Reliability-based indicator for post-earthquake traffic flow capacity of a highway bridge." *Structural Safety*. In press. •Number of presentations (0) •Number of technical research reports published (0)
Leadership	• ASCE 7-22 Minimum Design Loads and Associated Criteria for Buildings and Other Structures, Historian and Voting Member of Load	•Number of professional committees or affiliated centers (4)

	Combinations Subcommittee • Task leader in ASCE 7-22 Load Combinations Subcommittee • Member, ASCE Infrastructure Resilience Division (IRD) • Member, ASCE Task Group 2 Reliability-Based Structural System Performance Indicator (TG2)	
Education and Workforce Development	Teaching the following Ph.D level courses related to transportation infrastructure: CE405/505 (Decision-Making for Sustainable and Resilient Civil Infrastructure), 39 students Supported 0 Postdoctoral Associate, 1 Ph.D. students and 0 undergraduate student in TriDurLE funded projects	•Transportation related courses offered by faculty (1) •Number of students participating in TriDurLE funded projects (1) •Number of transportation related degree programs with students funded by TriDurLE (1)
Technology Transfer	None	
Collaboration	Cast Western Reserve University	

University	**Washington State University**
Grant #	69A3551947137 PI **Pizhong Qiao**
Reporting Period	**July 1, 2019 to September 30, 2020**

Category	**Description of indicator**	**Metric**
4. Research Capability	Research results published in: *Journal of Testing and Evaluation, Thin-walled Structures, Construction and Building Materials, Journal of Engineering Mechanics, International Journal of Damage Mechanics, Journal of Materials in Civil Engineering, Composites-Part B, Cold Regions Science and Technology, Composite Structures, etc.*	•Number of refereed journal publications (10) 18. Pathirana S and Qiao PZ (2020). "Elastic local buckling of periodic sinusoidal corrugated composite panels subjected to in-plane shear," Thin-walled Structures, 157: 107134 (11 pages). (December 2020) https://doi.org/10.1016/j.tws.2020.107134 19. Zhou, ZD and Qiao, PZ (2020). "Direct Tension Test for Characterization of Tensile Behavior of Ultra High Performance Concrete," Journal of Testing and Evaluation, 48(4): 2730–2749 (July/August 2020). https://doi.org/10.1520/JTE20170644 20. Dong YJ, Su C, Qiao, PZ, and Sun LZ (2020). "Microstructural crack segmentation of three-dimensional concrete images based on deep convolutional neural networks," Construction and Building Materials, 253: 119185 (12 pages) (April 21, 2020). https://doi.org/10.1016/j.conbuildmat.2020.119185 21. Liu DX, Qiao PZ, Zhou ZD and Sun LZ. (2020). "Microstructural

		Origins of Wave Modulus of Elasticity of Concrete," Journal of Engineering Mechanics, 146(5): 04020028. DOI: 10.1061/(ASCE)EM.1943-7889.0001758 22. Dong YJ, Su C, Qiao, PZ, and Sun LZ (2020). "A thermal-hydraulic-mechanical coupling model for freezing process simulation of cementitious materials with entrained air voids," Construction and Building Materials, 243: 118253 (11 pages) (January 30, 2020). https://doi.org/10.1016/j.conbuildmat.2020.118253. 23. Luo Q, Liu DX, Qiao PZ, Zhou ZD, Zhao YL, and Sun LZ (2020). "Micro-CT-based micromechanics and numerical homogenization for effective elastic property of ultra-high performance concrete," International Journal of Damage Mechanics, 29(1): 45-66. DOI: 10.1177/1056789519848475.. 24. Zhou ZD and Qiao PZ (2019). Prediction of Restrained Shrinkage Cracking of Shotcrete Rings Using Fracture Mechanics-based Approach. ASCE Journal of Materials in Civil Engineering, 31(10): 04019214 (12 pages). (Oct. 1, 2019) 10.1061/(ASCE)MT.1943-5533.0002852. 25. Zhou ZD, Xie RF, Qiao PZ and Lu LJ. (2019). On the modeling of tensile behavior of ultra-high performance concrete with freezing-thawing actions. Composites Part B, 174: 106983 (15 pages) (Oct. 1, 2019). 10.1016/j.compositesb.2019.106983. 26. Zhou ZD and Qiao PZ. (2019). Durability of air-entrained shotcrete exposed to cyclic freezing and thawing effect. Cold Regions Science and Technology, 164: 102778 (August 2019). https://doi.org/10.1016/j.coldregions.2019.05.004. 27. Pathirana S and Qiao PZ (2019). "Local Buckling Analysis of Periodic Sinusoidal Corrugated Composite Panels under Uniaxial Compression," Composite Structures, 220: 148-157. (July 2019) 10.1016/j.compstruct.2019.03.050. •Number of presentations (0) •Number of technical research reports published (0)
28. Leadership	Associate Editor of *Structural Health Monitoring-International Journal*, Associate Editor of *ASCE Journal of Engineering Mechanics*, Associate Editor of *ASCE Journal of Aerospace Engineering*, editorial board member of *Int. J. of Damage Mechanics*, editorial board member of *Disaster Advances*, editorial board member of *Structural Monitoring and*	•Editorship (7) •Fellowship (2) •Organizing committee member or subcommittee chair of conference or workshop (0) •Number of professional committees or affiliated centers (2)

	Maintenance, Guest Editor (2019 and 2020) of *Materials – "Structural Health Monitoring for Civil Engineering Materials"*. Fellow, *ASCE* Fellow, *Engineering Mechanics Institute (EMI), ASCE* Technical committee, *Stability, Engineering Mechanics Institute, ASCE*. Technical committee, *Advanced Materials and Structures, Aerospace Division, ASCE*.	
29. Education and Workforce Development	Teaching the following Ph.D level courses related to transportation infrastructure: CE533 (Advanced Reinforced Concrete Design), 14 students; CE532 (Finite Elements), 30 students; CE514 (Advanced Mechanics of Materials), 13 students Supported 1 Ph.D. students and 0 undergraduate student in TriDurLE funded projects	•Transportation related courses offered by faculty (3) •Number of students participating in TriDurLE funded projects (1) •Number of transportation related degree programs with students funded by TriDurLE (1)
30. Technology Transfer		•Presentations given at professional and academic meeting (0) •Number of professionals in the audience (0)
31. Collaboration	The Washington State Department of Transportation (WSDOT): in-kind support for TriDurLE research.	•Number of collaborative partners (2) •Number of international collaboration (1).

3.8. Florida Atlantic University

Part II – UTC-Specific Performance Indicators	
UTC Name	National Center for Transportation Infrastructure Durability & Life-Extension (TriDurLE)
University	**Florida Atlantic University**
Grant #	69A3551947137
Reporting Period	**July 1, 2019 to September 30, 2020**

Category	**Description of indicator**	**Metric**
Research Capability	Research results published in: Corrosion/2020 conference and submitted a report to FDOT (available at https://trid.trb.org/view/1724757)	Conference publication (1) Number of technical research reports published (1)
Leadership	• Member, Acoustical Society of America, May 2020 – Present • Member, IEEE, May 2020 – Present • Member, National Association of Corrosion Engineers (NACE), Vice chair of TEG053X • American Concrete Institute (ACI) • Electrochemical Society (ECS)	•Number of professional societies (5)
Education and Workforce Development	Teaching an Undergraduate/Graduate level course related to transportation infrastructure: Marine materials and corrosion (one chapter on Concrete durability and Corrosion of the reinforcing steel embedded in concrete) Supported: 1 MS student and 1 PhD student in TriDurLE funded projects, registered in FAU Ocean Engineering programs (MS and PhD),	•Transportation related courses offered by faculty (1) •Number of students participating in TriDurLE funded projects (2) •Number of transportation related degree programs with students funded by TriDurLE (2)
Technology Transfer	Invited presentations by Florida Department of Transportation	Presentations given at professional and academic meeting (2)

Collaboration	The Florida Department of Transportation (FDOT): in-kind support for TriDurLE research	•Number of Center personnel involved (2): Dr. Presuel-Moreno, Dr. Beaujean

3.9. Texas A&M University

Part II – UTC-Specific Performance Indicators	
UTC Name	National Center for Transportation Infrastructure Durability & Life-Extension (TriDurLE)
University	**Texas A&M University**
Grant #	69A3551947137
Reporting Period	**July 1, 2019 to September 30, 2020**

Category	**Description of indicator**	**Metric**
Research Capability	Research results presented at: 99th TRB Annual Meeting, 1. Kim, Jinho*, and Dan G. Zollinger, "Effects of Shape and Bond Strength on Adhesive Failure of Joint Sealants" Transportation Research Board 99th Annual Meeting Transportation Research Board, 2020. 2. Fujie Zhou, Sheng Hu, and Dave Newcomb, "Development of a performance-related framework for production quality control with ideal cracking and rutting tests" Construction and Building Materials, Volume 261, 20 November 2020.	•Number of refereed journal publications (1) •Number of presentations (1) •Number of technical research reports published (0)
Leadership	Associate Editor – Journal of Transportation Engineering, Part B: Pavements CVEN 343/622 Course Coordinator; CVEN 418/612 Course Coordinator; Co-coordinator for CVEN 342	•Editorship (1) •Fellowship (0) •Organizing committee member or subcommittee chair of conference or workshop (0) •Number of professional committees or affiliated centers (2)
Education and Workforce Development	Teaching the following Ph.D level courses related to transportation infrastructure: CVEN 342 Materials of Construction, 50 students	•Transportation related courses offered by faculty (1) •Number of students participating in TriDurLE funded projects (2)

	CVEN 343 Concrete Malts for CE/CVEN 622 Properties of Concrete, 20 students Supported 1 graduate student in TriDurLE funded projects	•Number of transportation related degree programs with students funded by TriDurLE (1)
Technology Transfer	Invited presentations by. ACPA 56TH ANNUAL MEETING; New Orleans, LA "Early Aged Slab Behavior and Cracking"	•Presentations given at professional and academic meeting (1) •Number of professionals in the audience (30)
Collaboration	The Texas Department of Transportation (WSDOT): in-kind support for TriDurLE.	•Number of collaborative partners (1) •Number of international collaboration (1). •Number of Center personnel involved (0)

3.10. Tennessee State University

Part II – UTC-Specific Performance Indicators		
UTC Name	National Center for Transportation Infrastructure Durability & Life-Extension (TriDurLE)	
University	**Tennessee State University**	
Grant #	69A3551947137	
Reporting Period	**July 1, 2019 to September 30, 2020**	
Category	**Description of indicator**	**Metric**
Research Capability		•Number of refereed journal publications (0) •Number of presentations (0) •Number of technical research reports published (0)
Leadership	Organizing Committee, 2021 TDOT Innovation to Implementation Forum, since 2019 Music City Professionals National Society of Black Engineers, Treasurer, since 2019 National Society of Black Engineers Transportation Special Interest Group Member, since 2018 Metro Nashville Public Schools STEAM Advisory Committee, since 2018 Tennessee Department of Education STEM Advisory Council, since 2020	•Editorship (0) •Fellowship (0) •Organizing committee member or subcommittee chair of conference or workshop (1) •Number of professional committees or affiliated centers (2)
Education and Workforce Development	Teaching the following undergraduate level courses related to structures, CVEN/AREN 3410 Structural Analysis 18 students 0 Postdoctoral Associate, 0 Ph.D. students, 1 master student and 0 undergraduate student in TriDurLE funded projects	•Transportation related courses offered by faculty (1) •Number of students participating in TriDurLE funded projects but not funded (1) •Number of transportation related degree programs with students funded by TriDurLE (0)

Technology Transfer		•Presentations given at professional and academic meeting (0) •Number of professionals in the audience (0)
Collaboration	Working with Vanderbilt University and University of Tennessee Memphis to organize the TDOT Innovation to Implementation Forum	•Number of collaborative partners (2) •Number of international collaboration (0). •Number of Center personnel involved (1): Dr. Armwood-Gordon