FINAL REPORT

PROJECT L2

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Understanding Relationships between the Built Environment, Physical Activity, Public Health, Urban Mobility & Traffic Congestion: A Graduate Curriculum

Dimitra Michalaka, Ph.D., The Citadel
William J. Davis, Ph.D., The Citadel
Daniel Bornstein, Ph.D., DBornstein Solutions, LLC
Kweku Brown, Ph.D., The Citadel

STRIDE | Southeastern Transportation Research, Innovation, Development and Education Center

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16. Abstract - The objective of this project was to develop a multidisciplinary graduate-level course addressing the intersection between public health, transportation, and the built environment. The methodology of this course focused on establishing basis of need for and potential benefits from the implementation of optimal solutions to the challenging dilemma of how the built environment impacts urban mobility, transportation infrastructure, network connectivity, sustainability, livability, and public health. Interconnections between the fields of physical activity, public health, public policy, and engineering planning and design will be identified. The goal is for students with diverse backgrounds in a variety of academic fields to be able to evaluate urban, suburban communities and neighborhoods to identify positive and adverse effects of the built environment on levels of physical activity and measures of public health, with an emphasis on adoption of polices and approaches for improving desirable outcomes supporting healthier communities. This course was developed in an effort to bring together content from physical activity, public health, civil engineering, transportation planning, and community design. Anticipated results of this graduate course are the education of professionals who will have the requisite skills, knowledge, and abilities to facilitate collaborative efforts across multiple disciplines to improve physical activity, public health, built environment, and traffic congestion outcomes.

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LIST OF AUTHORS

Co-Principal Investigators:

Dimitra Michalaka, Ph.D., P.E.
The Citadel, Civil & Environmental Engineering
Dimitra.Michalaka@citadel.edu
ORCID Number: 0000-0001-7001-0579

William J. Davis, Ph.D., P.E. (AL)
The Citadel, Civil & Environmental Engineering
davisj7@citadel.edu
ORCID Number: 0000-0002-3812-8654

Daniel Bornstein, Ph.D.
Founding Principal DBornstein Solutions LLC
dab@bornsteinsolutionsllc.com
ORCID Number: 0000-0001-9948-1876

Additional Researchers:

Kweku Brown, Ph.D., P.E.
The Citadel, Civil & Environmental Engineering
kbrown16@citadel.edu
ORCID Number: 0000-0001-6497-8479

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ABSTRACT

Evidence-based research from the public health profession has determined adverse factors associated with the built environment, transportation network, urban/suburban land use patterns, and travel mode choices are contributing to declining public health and rising healthcare costs in U.S. metropolitan areas. The objective of this project is to develop a multidisciplinary graduate-level course addressing the intersection between public health, transportation and the built environment. The methodology of this course will focus on establishing basis of need for and potential benefits from implementation of optimal solutions to the challenging dilemma of how the built environment impacts urban mobility, transportation infrastructure, network connectivity, sustainability, livability, and public health. Interconnections between the fields of physical activity, public health, public policy and engineering planning and design will be identified. The goal is for students with diverse backgrounds, in a variety of academic fields, to be able to evaluate urban, suburban communities, and neighborhoods to identify positive and adverse effects of the built environment on levels of physical activity and measures of public health, with an emphasis on adoption of polices and approaches for improving desirable outcomes supporting healthier communities. There is a widely recognized need in professional circles for physical activity, public health, and transportation professionals to work collaboratively. However, these three disparate fields have distinct methods and languages that often inhibit meaningful collaboration. This course was developed in an effort to bring together content from physical activity, public health, civil engineering, and transportation planning and community design. Anticipated results of this graduate course are education of professionals who will have requisite skills, knowledge, and abilities to facilitate collaborative efforts across multiple disciplines to improve physical activity, public health, built environment, and traffic congestion outcomes.

Keywords: Physical Activity, Public Health, Built Environment

EXECUTIVE SUMMARY

The purpose of this project was to develop a multidisciplinary graduate-level course to engage students in interconnected curriculum addressing the intersection between public health, physical activity, transportation engineering, and the built environment. The principal objectives of this project were to 1.) develop multidisciplinary graduate curriculum, 2.) create partnerships with similarly focused educational programs and institutions, 3.) recruit students from diverse academic majors to enroll and participate in the course, 4.) conduct a survey of similar course offerings at other colleges/universities, 5.) pilot test instructional materials in an initial course offering, 6.) assess student performance and feedback, and 7.) report on findings and make course materials available for use by others.

Development of instructional material focuses on establishing the basis of need and identifying potential benefits from implementation of optimal solutions to the challenging dilemma of how design of the built environment impacts urban mobility, transportation infrastructure, network connectivity, sustainability, livability, and public health. The project worked to establish the educational demand for cross-cutting multidisciplinary curriculum, although it was difficult to convince like-minded academic programs to move beyond a default academic silo approach to retaining exclusive control of course offerings and graduation requirements. Additionally, when actual course registration was limited to engineering students, instructional engagement was adjusted to best engage this particular disciplinary background and professional practice focus.

Instructional materials developed for this multidisciplinary graduate course and made available to other interested faculty and academic programs through this project include:

- Course syllabus with description, textbooks, goals, student learning objectives, basis of grades, course background, outline of instructional modules and list of course topics.
- 20-instructional modules (10-physical activity/ public health, 10-transportation/land use)
- 10-student assignments with resources and grading criteria
- 4-in-class quizzes for real-time, formative assessment (26-multiple choice questions)
- Midterm Examination (60-multiple choice, short answer questions, two essay questions)
- Final Project assignment and evaluation rubric for review by an expert panel
- Results from survey of similar courses taught at other colleges/universitates (n=18)

Adverse public health outcomes are a pervasive national problem extending across multiple professional fields. Creation of a crosscutting graduate course that engages students outside of their traditional academic silos will help facilitate collaboration across multiple disciplines to improve physical activity, public health, built environment, and traffic congestion outcomes. The chief goal is for students with diverse backgrounds, in a variety of academic programs, to be equipped to evaluate urban, suburban communities, and neighborhoods by identifying positive and adverse effects of the built environment on physical activity and assessing measures of public health, with an emphasis on adoption of polices and approaches for improving desirable outcomes supporting healthier communities.

1.0 INTRODUCTION

The objective of this project is to develop a multidisciplinary graduate course focusing on the intersection between public health, physical activity, transportation infrastructure, and the built environment especially considering the impacts of mobility benefits of short distance trips by means of active transportation modes. The course focuses on establishing basis of need and potential benefits from implementation of possible solutions to the challenging dilemma of built environment, urban mobility, transportation infrastructure networks, sustainability, livability, and community wellness. Interrelated linkages between the fields of public health, public policy and engineering planning and design are highlighted, emphasized and explored. Emerging technologies offered by connected vehicle technology, energy and sustainability concepts will be incorporated into the course curriculum. The chief goal is for students to be able to evaluate urban, suburban communities, and neighborhoods to identify positive and adverse effects of the built environment and transportation networks on levels of physical activity and measures of public health, with an emphasis on adoption of approaches for improving desirable outcomes so professionals can work to create more healthy communities and support desirable population-level (epidemiological) outcomes.

1.1 COURSE OBJECTIVES

Course objectives focusing on theoretical, conceptual and applied educational content; analytical methodologies, evaluations and assessments; and application of intellectual skills and proficiencies are summarized as follows:

1. Share knowledge of methods to assess relationships between physical activity, public health and the built environment, with specific emphasis on strengths and limitations of commonly adopted methods and outcomes.
2. Demonstrate knowledge of multiple perspectives on physical activity, public health and the built environment through the socio-ecological model, urban planning principles, transportation network operations, and corresponding public health outcomes.
3. Describe relationships between built environment components, including transportation, land use, community and economic development, urban design, and health issues related to physical activity, such as obesity, heart disease, diabetes, cancer, and mental health.
4. Develop a working knowledge of multiple methods used to assess the built environment, physical activity and the built environment's impact on physical activity and public health.
5. Prepare students to work collaboratively and effectively within their professional fields to improve a wide range of performance measures interrelated between public health and built environment.

1.2 PROJECT SCOPE

Target audiences anticipated for this type of graduate curriculum include students and practicing professionals from the following fields and programs:

- Traffic and Transportation Engineers
- Transportation Planners
- Urban, Regional, and City Planners
- Architects and Landscape Architects
- Public Administrators
- Environmental Sciences
- Public Health Professionals
- Recreation and Physical Activity Professions
- Non-Profit Organizations and Advocacy Groups
- Social Science and Social Services Professions

The work plan for preparing graduate course curriculum included the following tasks:

a. Conduct literature review on the topic and develop library of reference materials. An undergraduate student will participate as part of undergraduate research experience, no project deliverables will rely on this student's work, only intended to serve in a development capacity.

b. Develop course syllabus, with expanded course goals, learning objectives, reading requirements, and student engagement activities, including: assignments, projects, examinations, data sets, software, assessment criteria, evaluation rubrics, etc.

c. Conduct survey of STRIDE universities, and other programs, to understand how course curriculum covering transportation incorporates topics such as public health and physical activity. This survey was developed to survey existing course offerings and would also be helpful in informing researchers about the opportunities for further technology transfer within Region 4.

d. Develop instructional materials such as slide presentations, in-class and out-of-class activities, reading and writing assignments, physical educational models and others educational means.

e. Engage public health subject matter expert, Dr. John Vena, Professor and Founding Chair, Public Health Sciences, Medical University of South Carolina, for review and feedback on course curriculum and course materials.

f. Beta (Pilot) test the proposed course as part of The Citadel's new graduate certificate program on Public Health and the Built Environment. Project funding was used to beta (pilot) test the course curriculum. The course offering was team-taught by Dr. William Davis and Dr. Daniel Bornstein, who both serve as project Co PI's and who have worked collaboratively on strategic planning, curriculum content, and related physical activity, public health and transportation issues since 2014.

g. Conduct assessment of material effectiveness, taking into consideration student feedback, peer evaluations for revising and improving the developed syllabus, course lectures, and assignments. Use previously adopted structured criteria for assessing curricular and student learning elements during the Beta Test course offering to serve as a systematic method for improving course content and course materials that will be made available for use by others.

h. Develop and deliver a workshop or webinar as part of technology transfer to engage professional organizational groups in transportation, planning, and public health.

1.3 OVERVIEW OF SIMILAR COURSES

Similar courses and programs in this emergent field were recently developed and offered, most commonly within Public Health and City Planning graduate degree programs. Curriculum and content from these courses were evaluated to ensure comparative curriculum is included. It should be noted that although a survey of these courses was useful in providing insight and perspective into creation of the proposed course on Public Health and Transportation, none of the available courses were developed within an engineering program and therefore providing a transportation engineering perspective on these important multidisciplinary topics and emerging issues provides a unique course offering. A partial list of similar courses includes:

1. ENV H 538/URBDP 538: Public Health and Built Environment, Department of Urban Design and Planning and Dept. of Environmental & Occupational Health Services, University of Washington https://deohs.washington.edu/course-information
2. PLAN 581: Public Health and the Built Environment, Health & Community Design Lab, The University of British Columbia http://health-design.spph.ubc.ca/teaching/public-health-and-the-built-environment/
3. PBHL 550ES: Community Based Prevention Practices, Dornsife School of Public Health, Drexel Univ https://catalog.drexel.edu/search/?P=PBHL%20550ES
4. 602.751.86 The Built Environment: Influences and Challenges to Improving Population Health, Bloomberg School of Public Health, Johns Hopkins. http://jhsph.edu/courses/course/33113/2021/602.751.86/the-built-environment-influences-and-challenges-to
5. CP 6850, Built Environment and Public Health, College of Design, School of City and Regional Planning, Georgia Institute of Technology, https://serve-learn-sustain.gatech.edu/built-environment-and-public-health
6. UEP 224/PH 288, Public Health and Built Environment, Urban and Environmental Policy and Planning, Graduate School of Arts and Sciences, Tufts University https://sites.tufts.edu/MaryDavis/files/2017/01/PHBE-2016.pdf

2.0 LITERATURE REVIEW

Impact of the Built Environment: Transportation elements of the built environment, include aspects such as roads, intersections, sidewalks, and trails, often have a direct impact on public health outcomes (Sallis et al, 2012). The built environment influence various aspects of public health including, but not limited to: physical activity, obesity, cardiovascular diseases, diabetes, respiratory and pulmonary diseases, depression, anxiety, and social support. (Botchwey et al., 2009). Changes in transportation infrastructure that support active transportation, improve mobility and access to desired destinations, improve traffic safety, air quality, and consequently overall health. Roadways not including sidewalks or bike paths have been shown to reduce walking and biking for leisure and active commuting (Center for Disease Control, 2011). Community design is inextricably linked to the amount of physical activity in which local residents engage. National and state-level data show a clear link between a low level of non-motorized travel and a high level of obesity (Chen, Menifeild, 2017). Also, diabetic rates are highest among states with low levels of bicycling and walking. These relationships are in line with other results indicating a similar negative correlation between levels of bicycling/walking and corresponding levels of obesity and high blood pressure (Steele et al., 2010).

Role of Transportation Planning: Transportation planning, policy, design and operations can help improve public health by providing transportation choices that support active lifestyles. Modal shift to active transportation modes, such as walking and biking, can also have a positive impact on congestion reduction and improvement of the quality of life. Several metropolitan organizations (MPOs) and states are working together (Raynault, Christopher, 2013) to incorporate public health related elements into the transportation planning process. Typically, urban planners who shape the built environment have little interaction with public health officials, which further perpetuates systemic urban problems and adverse health outcomes. To meet health requirements, build viable urban spaces, and promote walking and biking as rational transportation options, urban planning principles and site planning must be introduced so critical issues can be solved (Frank, 2014). Communities and city planners must provide residents with access to sidewalks and bike lanes. Sidewalks and bike paths must lead from high residential areas to commercial areas and places of employment for a large number of people to begin to compete as a viable transportation alternative. Having the community use these mobility options will lead to healthier lifestyles and less harmful emissions into the environment. Advances in active mobility can help combat heart disease, diabetes, obesity, and cardiovascular disease. Transportation networks comprise one of the single most influences on whether people will use different forms of transportation other than a single occupancy motor vehicle (Frank, 2014). Good transportation planning will result in more people walking, biking, using public transit, or carpooling, supporting reduced adverse impact on the environment and facilitating less adverse health outcomes in the community. A 2007 study of 67 counties in North Carolina determined that people living in areas with high active community environment, Active community environment (ACE) scores were more than twice as likely to walk and bike than counties with lower scores. The ACE score is based on the number of mixed land use

policies, implementation tools, and support of non-motorized transportation (Aytur et al., 2007). Transportation infrastructure and public transit have a considerable impact on quality of life within a community, including mental health. If residents are able to access entertainment areas, commercial areas, recreational areas, and work in a quick and effective manner, then, individuals in the community will ultimately live a happier life with less mental and physical health issues. The youth, elderly, and people with disabilities commonly do not have access to the same transportation options as a young to middle-aged adults and also must be accommodated (Frank, 2014). GIS can be used to provide solutions to where multimodal facilities are needed. Related infrastructure solutions and essential elements involve providing continuous sidewalks, ability to cross streets, proper lighting, and zoning that places commercial and recreational facilities close to residential areas, otherwise known as mixed land use (Frank, 2014).

Development Graduate Curriculum: Course curriculum on Public health and built environment available to students are generally taught under public health, environmental sciences and city planning academic programs. Based on an initial survey of courses and programs offered in this multidisciplinary field, no courses were identified that were developed or taught within an engineering degree program. As engineering programs provide education and curriculum instruction primarily focused on providing an analytical basis for design, construction and operation of the built environment, it seems as natural fit to include physical activity and public heath as performance outcomes for transportation infrastructure and measures of urban mobility. The potential to engage and inform students in other fields of public health, physical activity, city planning and public administration appears to provide great potential to help integrate parallel initiatives and move beyond previous silo-oriented work to address these serious infrastructure and societal issues.

Graduate degree and certificate programs in transportation engineering and intra-professional education where students work in teams, will benefit from including public health and built environment course and subject matter in the curriculum to help graduates to be better prepared to address these cross-cutting problems. The proposed course will supplement traditional curriculum subject matter and provide foundational content and instruction to be better prepared to address an emerging issue in many communities. Additionally, if this course is effective in drawing students from other graduate programs in related fields of public health, physical activity, city planning and public administration, integrating these often-disassociated fields has the potential of providing benefits beyond a single course though a better understanding of how to engage differing professions to address long-term improvements for worthy and compelling common cause.

3.0 METHODOLOGY

The objective of this project was to develop a graduate-level course focusing on the intersection between public health, physical activity, transportation infrastructure, and the built environment especially considering the impacts of mobility benefits of short distance trips by means of active transportation modes. The course focuses on establishing basis of need and potential benefits from implementation of possible solutions to the challenging dilemma of built environment, urban mobility, transportation infrastructure networks, sustainability, livability, and community wellness. Interrelated linkages between the fields of public health, public policy and engineering planning and design are highlighted, emphasized and explored. The objective was for students to be able to evaluate urban, suburban communities, and neighborhoods to identify positive and adverse effects of the built environment and transportation networks on levels of physical activity and measures of public health, with an emphasis on adoption of approaches for improving desirable outcomes resulting from professionals from various disciplinary fields working collaboratively to design more healthy communities and support desirable population-level (epidemiological) outcomes.

3.1 Relevance to STRIDE Theme of Congestion Mitigation

Active travel modes, including walking, biking and public transportation, have been shown to mitigate traffic congestion in urban areas and increase levels of physical activity, which support beneficial public health outcomes (premature death, mortality prevention, life expectancy, health related quality of life). The economic and social impact of physical inactivity on residents in the United States is staggering. Adverse effects of urban sprawl, segregation of land uses, and reliance on single occupancy automobiles for urban mobility are contributing factors to this pervasive problem. 72 percent of trips less than 3-miles and 60 percent of trips less than 2-miles are made by private vehicles (NHTS, 2009). More recently, a research study for the Bureau of Transportation Statistics focused on the number of daily trips taken in the United States. In 2021, 52% of all trips, including all modes of transportation, were less than three miles, with 28% of trips less than one mile (USDOT, 2021). Providing feasible alternative travel modes for shorter trip distances will serve to reduce demand on the roadway network and serve to mitigate congestion. Active travel modes requiring increased levels of physical activity are positively correlated with a subset of improved public health outcomes, as well as improved economic and social outcomes. The objective of this course was to provide students across multiple disciplines in transportation engineering, city planning, public health, physical activity, land scape architecture and public administration with foundational knowledge of the effects of transportation infrastructure on health as well as traffic congestion and will provide practical solutions to problems associated with planning, policy, and design for improving health and mitigating congestion. Specifically, the proposed course supports congestion mitigation as it relates to the components affecting congestion: 1.) travel demand vs. supply for

short distance trips, 2.) urban network operations and management, 3.) technology impacts on alternatives for short distance urban trips, and 4.) supportive land use and infrastructure elements.

3.2 Institutional Approvals and Collaborations

The graduate course (CVIL 642) was approved by Civil and Environmental Engineering Department, School of Engineering and Citadel college-wide Curriculum Committees. In addition, the South Carolina Commission on Higher Education officially approved the course and related courses to be provided within an affiliated graduate certificate program, which focuses on transportation, built environment, physical activity and public health. The course is one of four courses that graduate students from several Charleston-based graduate programs are able to complete to earn a Graduate Certificate in Built Environment and Public Health from The Citadel.

Considerable institutional coordination was focused on identifying and strategically attracting student enrollment streams for the proposed course and affiliated graduate certificate program. Prospective students would be generated from six graduate programs at four Charleston area institutions of higher education as follows:

1. Medical University of South Carolina, Master of Public Health Sciences
2. Clemson University, Master of Resilient Urban Design
3. College of Charleston, Master of Public Administration, Master of Science in Environmental Studies
4. The Citadel, Master of Science in Civil Engineering, Master of Science in Health Exercise and Sport Science

Course offerings for the Graduate Certificate in Built Environment and Public Health from The Citadel are summarized below, with course descriptions for Citadel courses. It should be noted that all graduate certificate candidates are required to complete at least two courses at The Citadel.

Required Course:

CIVL 642 Public Health, Physical Activity, and Design of the Built Environment - Multidisciplinary evaluation of cities, suburban communities and neighborhoods to identify positive and adverse effects of the built environment on levels of physical activity and measures of public health, with an emphasis on adoption of approaches for improving desirable outcomes. The course focuses on establishing basis of need and potential benefits from implementation of optimal solutions to the challenging dilemma of built environment, urban mobility, transportation infrastructure networks, economics, sustainability, livability, and community wellness. Interconnections between the fields of public health,

public policy and engineering design are identified. Students are equipped with proficiencies needed to create more healthy communities through an emphasis on physical activity.

At least one of the following courses at The Citadel:

CIVL 506 Geographic Information Systems - Instruction in Geographic Information Systems (GIS) focusing on data analysis and spatial application methods, for engineers, planners, scientists and related professions. Fundamental topics include spatial analysis, geostatistical analysis, 3-D analysis /display, and vector/raster data. Course focus is on gaining an essential knowledge of spatial data structures in GIS, geo-spatial data acquisition, geoprocessing, geostatistical methods; visualization, exploration of spatial data; network analysis, terrain mapping, and spatial analysis. The course includes an emphasis on land use evaluation methods and transportation network analysis.

CIVL 640 Urban Mobility Infrastructure Policy and Planning - Foundation for understanding transportation system relationships to cities and people and managing urban transportation systems, including: 1.) multi-faceted understanding of the historical, spatial, economic, social, and environmental factors affecting transportation issues, 2.) transportation and land use relationships, 3.) transportation as a tool of economic development and growth, 4.) transportation political influences and finance, and 5.) regional, state, federal governmental structure of committees, agencies and oversight.

Two courses can be transferred from the following list, or approved by the department head, from institutions in South Carolina, or beyond, that cover curriculum material required. The list below identifies institutions located within Charleston area:

Medical University of South Carolina (MUSC)
- BEHH 700 Social and Behavioral Sciences
- ENVH 700 Environmental Health Sciences

Clemson University
- CRP 8060 Urban and Regional Analysis
- CRP 8010 Planning Process and Legal Foundations
- CRP 8020 Site Planning & Infrastructure

College of Charleston
- PUBA 502 Applications in GIS
- PUBA 602 Public Policy
- PUBA 611 Urban Policy
- EVSS 601 Economic Theory for Policy Analysis
- EVSS 659 Environmental Statistics

3.2 Course Goals, Learning Objectives, and Course Topics

The syllabus for CIVL 642 Public Health, Physical Activity, and Design of the Built Environment is provided in Appendix B. The course textbook and supplemental reading materials are cited in Table 1. The course was established with educational materials aligning with course goals summarized in Table 2, student learning objectives listed in Table 3, and outline of instructional modules and course topics in Table 4.

TABLE 1. COURSE TEXTBOOK AND SUPPLEMENTAL READING FOR CIVL 642

Required Textbook

1. Physical Activity and Public Health Science, Editors Daniel Bornstein, Amy Eyler, Jay Maddock, Justin Moore, ISBN 9780826134585, Springer Publishing, New York, 2019.

Supplemental Reading

2. Foundations of Physical Activity and Public Health, Harold W. Kohl, III, Tinker D. Murray, ISBN 978-0-7360-8710-0, Human Kinetics Publishers, pp. 296, 2012.
3. The Built Environment and Public Health, Russell P. Lopez, ISBN 978-0-470-62003-8, John Wiley & Sons, pp. 432, 2012.
4. Numerous technical documents, references, methods, and data will be provided during the term, most of which will be posted on the course Learning Management System (LMS).

TABLE 2. COURSE GOALS FOR CIVL 642

1. Knowledge of methods to assess relationships between physical activity, public health and the built environment, with specific emphasis on strengths and limitations of commonly adopted methods and outcomes.
2. Demonstrate knowledge of multiple perspectives on physical activity, public health and the built environment through the socio-ecological model, urban planning principles, transportation network operations, and corresponding a subset of public health outcomes.
3. Describe relationships between built environment components, including transportation, land use, community and economic development, urban design, and health issues related to physical activity, such as obesity, heart disease, diabetes, cancer, and mental health.
4. Develop a working knowledge of multiple methods used to assess the built environment, physical activity and the built environment's impact on physical activity and public health.
5. Prepare students to work collaboratively and effectively across fields to improve a wide range of performance measures interrelated between public health, built environment, land use planning, and transportation engineering.

TABLE 3. STUDENT LEARNING OBJECTIVES FOR CIVL 642

Student Learning Objectives	Goal	Bloom's Taxonomy
1.) Describe fundamental concepts in public health	1	2, Comprehension
2.) Describe relationships between physical activity and specific health outcomes.	1	2, Comprehension
3.) Explain core concepts and methods of physical activity epidemiology.	1	2, Comprehension
4.) Illustrate behavioral and environmental factors known to influence physical activity behavior.	2	3, Application
5.) Choose appropriate physical activity measurement instruments based on desired outcomes.	2	3, Application
6.) Employ components of an existing physical activity strategic plan in designing a policy, system, or project level intervention.	2	3, Application
7.) Describe the process of land use planning, zoning and annexation that contribute to the phenomena of urban sprawl.	3	2, Comprehension
8.) Describe how active living by design principles can be used for urban land development projects.	3	2, Comprehension
9.) Explain factors and opportunities for retrofitting suburbia to achieve improved public health outcomes.	3	2, Comprehension
10.) Illustrate how transportation, land use and public health policies can be developed and implemented to address environmental justice issues within a community.	4	3, Application
11.) Describe fundamental elements of effective partnerships between health and transportation organizations focused on improving public health outcomes.	4	2, Comprehension
12.) Review the basis for application of health and transportation indicator measures and use data to compare and contrast differences between communities.	5	2, Comprehension
13.) Differentiate urban environments and community approaches for adopting elements of green modes of travel for improved public health outcomes.	5	4, Analysis

TABLE 4. OUTLINE OF CIVL 642 INSTRUCTIONAL MODULES AND COURSE TOPICS

1. Relationships Between Physical Activity and Health • Cardiorespiratory and Metabolic Health • Cancers • Mental Health • Overweight and Obesity • Musculoskeletal and Functional Health
2. Transportation and Health Partnerships for Targeted Populations • Active Transportation • Safety • Connectivity • Access and Equity • Health Performance Metrics • USDOT Indicator Data
3. Fundamentals of Public Health • Defining moments in public health • Core functions of public health • Outbreaks and Epidemics • Relationship between public health outcomes and infrastructure • Developing Policy & Environmental Interventions
4. Concepts of Transportation, Land use patterns, urban sprawl, & zoning • Process of land use plan, zoning, annexation, and urban sprawl • Evolution of new development concepts • Retrofitting suburbia • Environmental Justice
5. Concepts and Methods in Physical Activity Epidemiology • Epidemiologic Measures • Crude, Specific, and Standardized Rates • Research Design in Epidemiologic Studies • Evaluating Associations in Epidemiologic Studies • Models in Physical Activity Epidemiology • Inferring Cause in Epidemiologic Studies • Criteria for Causation
6. Green modes of travel (Part 1) • Mode choice and multimodal environments • Transit oriented development • Walking and walkable communities • Intro to Charleston elements of PA Plan

7. Establishing the Value of Physical Activity for individual stakeholders • Individual-level Physical Activity Behavior
8. Strategic Plans for Increasing Population-levels of physical activity • National Physical Activity Plan • WV State Physical Activity Plan • San Antonio Municipal PA Plan
9. Green modes of travel (Part 2) • Bike share programs • Bike facilities and network connections • Safe Routes to School, walking school buses
10. Establishing the Value of Physical Activity for organizational and community stakeholders • Environmental-level Correlates and Theories of Physical Activity behavior o Social-ecological Model • Physical Activity policy into practice
11. Building and Maintaining Effective Coalitions • Coalition Strategies, Vision and Mission • Case studies of local and state coalitions
12. Transportation Planning Process • Planning procedures, jurisdictional priorities, and policy decisions • Funding methods and revenue sources • Advocacy groups, prof. societies, policy influences • Understanding/navigating public policy process
13. Physical Activity Measurement • Measuring energy expenditure o Laboratory-based measures o Field-based measures • Objective vs. Subjective Measurement o Accelerometers and Pedometers o Direct Observation techniques o Self-Report Instruments o Surveillance in Populations
14. Federal guidelines for physical activity
15. Health Impact Assessments • CDC Healthy Community Design and HIA • Different Types of Health Assessments o Public Health Assessment o Health Risk Assessment o Cost Benefit Analysis • Environmental Impact Assessment

16. Sustainable Communities & mobility • Mixed-use developments, density & mode choice • Walkability, bikability and active living by design • Context Sensitive Solutions • Energy consumption & greenhouse gas emission
17. Health Impact Assessments • Case Studies & application of concepts to a Charleston-area physical location: o Charleston neighborhoods (North Morrison, at-risk, well established) o Local communities (Hanahan, Goose Cr., Ladson, Daniel Is., Park Cir.) • New developments (W. End, Cainhoy, Long Savannah, Nexton, Magnolia)
18. Quality of life, livability, active living • Designing Healthy Communities • Active Living Collaboratives in the US • Neighborhood-Based Differences in Physical Activity
19. Demographic and population influences • Trends in US Socio demographic data and transitions • The Effects of Socio-Demographics on Future Travel Demand • Demographics and transportation in US 2050
20. Multidisciplinary methods and metrics • Built environment, physical activity, and obesity: literature review • Healthy People 2020 • Measuring Policy and Environmental Change in Obesity Prevention

3.1.1 Support from Medical University of South Carolina

The Medical University of South Carolina (MUSC), Department of Public Health Science, Professor and Founding Chair, Dr. John R. Vena, played a significant role in development of this course as special advisor and public health subject matter expert. Dr. Vena was an enthusiastic supporter of course development and strategy to construct a curriculum that would attract enrollment of MUSC students, and other institutions, in the proposed graduate course and newly established graduate certificate program. Dr. Vena's perspective and depth of knowledge was invaluable based on his 38-years of experience in environmental epidemiology and stature as a pioneer in integration of biomarkers in epidemiology, analytic studies to investigate gene-environment interactions, and use of Geographical Information Systems in environmental epidemiologic research.

4.0 RESULTS

The course was offered Summer 2019 as the result of a multidisciplinary partnership including the fields of transportation engineering, health and human performance and public health by faculty at The Citadel and Medical University of South Carolina in Charleston, SC. From this collaboration a three-credit hour graduate course was created focusing on elements of the built environment, affiliated aspects of urban mobility and impacts on public health. The purpose of the course was to provide students in transportation engineering, city planning, public health, physical activity, land scape architecture, and public administration with foundational knowledge of the effects of transportation infrastructure, as well as traffic congestion, on health and to provide practical approaches to development of solutions for problems associated with planning, policy, and design in improving public health outcomes (premature death, mortality prevention, life expectancy, health related quality of life). Collaborating academic institutions and programs in Charleston, SC included: The Citadel and Medical University of South Carolina, with initial emerging partnerships with Clemson University, Urban Planning and College of Charleston, Public Administration, programs.

4.1 Student Recruiting and Enrollment

Through cooperation and encouragement from academic institutions including, Lowcountry Graduate Center, Clemson University, Medical University of South Carolina and College of Charleston, formative efforts to create and offer this graduate course were initiated in 2015. Although positive feedback and support was received for this multi-institutional course, administrative issues delayed offering this course until four years later with support from STRIDE grant providing the resources needed for the course to move forward. Unfortunately, during the transpiring four-year period, many of the previous leaders and contacts from other institutions experienced turnover and commitments to encourage students to register for the course waned. Master of Public Health Science students from Medical University of South Carolina were interested in enrolling, however, lack of a tuition exchange framework, prevented these student from registering. As a result, the course was only able to attract six students, all within The Citadel School of Engineering summarized in Table 5. Text from an example promotional flier focused on student recruitment is provided in Table 6, with additional course fliers for the graduate course and graduate certificate program are provided in Appendix B, under sections 8.2 and 8.3.

TABLE 5. SUMMARY OF CIVL 642 STUDENT ENROLLMENT

Student Category	Professional Affiliation
1.) MSCE degree candidate	civil engineering consulting firm
2.) MSCE degree candidate	civil engineering consulting firm
3.) MSCE degree candidate	civil engineering consulting firm
4.) MSCE degree candidate	civil engineering consulting firm
5.) Potential MSCE program student	City of Charleston, Traffic & Transportation
6.) Potential MSCE program student	Charleston Co., Transportation Development

TABLE 6. FRAMEWORK FOR CIVL 642 STUDENT RECRUITING

Who: Multidisciplinary partnership including the fields of transportation engineering, health and human performance and public health by faculty at The Citadel and Medical University of South Carolina in Charleston, SC.
What: Graduate level course focusing on elements of the built environment, affiliated aspects of urban mobility and impacts on public health. The course will provide students in transportation engineering, city planning, public health, physical activity, land scape architecture, and public administration with foundational knowledge of the effects of transportation infrastructure on health, as well as traffic congestion, providing practical approaches to solutions for problems associated with planning, policy, and design in improving public health outcomes and mitigating congestion.
When: Course material is currently under development and will be pilot-tested through a 3-credit hour course taught during Summer 2019.
Where: Collaborating institutions in Charleston, SC include: The Citadel and Medical Univ. of South Carolina, with additional emerging partnerships with Clemson University, Urban Planning and College of Charleston, Public Administration, programs.
Why: Active travel modes, including walking, biking and public transportation, have been shown to mitigate traffic congestion in urban areas and increase levels of physical activity, which support beneficial public health outcomes. The adverse economic and social impact of physical inactivity on residents in the United States is staggering. Negative effects of urban sprawl, segregation of land uses, and reliance on single occupancy automobiles for urban mobility are contributing factors to this pervasive problem. In 2021, 52% of all trips, including all modes of transportation, were less than three miles, with 28% of trips less than one mile. Providing feasible travel alternatives for shorter trip distances will reduce demand on the roadway network and serve to mitigate congestion. Active travel modes requiring increased levels of physical activity are positively correlated with improved public health outcomes, as well as improved economic and social outcomes.
Expected Benefits: Adverse public health outcomes are a pervasive national problem extending across multiple professional fields. Creation of a crosscutting graduate course engaging students outside of their traditional academic silos will help facilitate collaboration across multiple disciplines to improve physical activity, public health, built environment, and traffic congestion outcomes. The goal is for students with diverse backgrounds, in a variety of academic programs, to be equipped to evaluate urban, suburban communities, and neighborhoods by identifying positive and adverse effects of the built environment on physical activity and assessing measures of public health, with an emphasis on adoption of polices and approaches for improving desirable outcomes supporting healthier communities. Course materials and educational modules will be shared initially with STRIDE partner institutions, as well as other universities, along with assessment of learning outcomes and student perceptions from the pilot offering in Summer 2019.

4.2 Course Offering and Professors

The course was offered in a face-to-face delivery method using a learning management system and with support from community leaders, specifically Dr. John Vena, MUSC and City of Charleston Health and Wellness Advisory Committee. The three-credit hour graduate course was offered during the 2019 Summer Session I, a 7-week accelerated term, with course meetings twice a week from 5-8pm, scheduled to accommodate working professionals. Professor and Advisor credentials are summarized as follows:

Professor: Dr. William J. Davis, PE, Professor & Dept. Head, Civil Environmental, Construction Engineering at The Citadel. He previously served on a variety of national technical committees including: 1.) Transportation Research Board, Highway Capacity and Quality of Service, Subcommittee for Bicycles, 2.) Transportation Research Board, Committee on Bicycling (A3B07), 3.) American Society of Civil Engineers Intermodal Committee, 4.) Executive Committee, American Society of Civil Engineers, Urban Transportation Division, and 5.) Transportation Research Board, Sub Committee on Education and Awareness (A3A10). Additionally, he has worked on a variety of traffic operations, design safety, and maintenance research projects for the South Carolina Department of Transportation. Additionally, he has worked with institutions and governmental agencies throughout the state of South Carolina on urban mobility, transportation infrastructure, and land use issues.

Professor: Dr. Daniel Bornstein, (previously) Associate Professor, Dept. of Health and Human Performance at The Citadel. His primary area of research is on active living policy, systems, and environmental changes aimed at decreasing chronic disease prevalence and minimizing health disparities. He believes impacting policy, systems, and environments is best accomplished through effective policy advocacy, and providing scientific evidence that is of utmost interest to policy makers. He investigates ways in which population-levels of physical inactivity may negatively impact national security, in addition to public health. He led a series of studies in collaboration with the U.S. Army's Public Health Institute and the University of South Carolina looking at state-level trends in physical fitness and injuries of Army recruits. He was awarded funding to investigate associations among physical activity, sleep behavior, physical fitness, and academic performance among Citadel cadets. In addition to research in the area of physical activity and national security, he collaborates on research focused on validity and reliability of physical activity measurement, and physical activity promotion among specific populations. He previously taught a variety of undergraduate and graduate courses at The Citadel from exercise testing and prescription, to applied biomechanics, strength and conditioning, and research methods.

Advisor, Public Health Subject Matter Expert: Dr. John Vena, Professor and Founding Chair, Dept. of Public Health Science, Medical University of South Carolina. He has over 38 years of experience in environmental epidemiology. From 1999-2003 he served as

NIH co-investigator on pioneering work to integrate biomarkers in epidemiology analytic studies to investigate gene-environment interactions, exposure assessments and use of Geographic Information Systems as an integral tool in epidemiologic research. He was PI of New York State Angler Cohort Study (NYSACs) 1991-2003, which investigated body burdens and effects of persistent environmental toxicants in the Great Lakes Ecosystem and exposure from Sport fish eating on risk of adverse reproductive and developmental outcomes and biomarkers of intermediate effects, including endocrine disruption and more recently cancer risks. As PI on numerous CDC and NIH-funded grants from NIEHS and NCI, he laid groundwork and served as co-investigator for several environmental epidemiology studies in Western NY and in South Carolina, undertaken by mentees. He has published extensively in the field of environmental and occupational epidemiology and his studies have included descriptive and analytic studies of air and water pollution, bladder cancer and drinking water contaminants, occupational exposures, health of municipal workers including firefighters and police officers, diet, electromagnetic fields and persistent environmental toxicants. He has published extensively in developmental epidemiology and cancer epidemiology including case-control studies of occupational and environmental risk factors. Throughout his career he has been a thought leader in providing formal mechanisms for structured interdisciplinary research initiatives, graduate training programs and junior faculty mentoring.

4.3 Course Materials

As stated, the course was offered in a face-to-face delivery method, during an accelerated 7-week summer term to accommodate working professionals. Classes met twice a week for 3-hours per meeting. Course materials and delivery of course materials were developed with this schedule and target audience in mind. Most meetings were comprised on two primary topics, one engineering focused, one focusing on public health. 20-course content subject matter areas were identified to provide an effective educational structure as course instructional modules. The course was comprised of 14-class meetings and included a separate final exam period. In additional to instructional materials covered during class periods, students gave in-class project presentations, listened to guest lecturers, and completed in-class quizzes/tests. A summary of course materials is summarized in Table 7.

TABLE 7. SUMMARY OF CIVL 642 COURSE MATERIALS

20 instructional modules (10-physical activity/ public health, 10-transportation/land use)
10-individual/group assignments
In-class midterm exam (60-multiple choice, short answer, 2-essay questions)
4-In-class quizzes (total 26 questions)
Final project submittals & presentation to an expert panel (final exam)

4.4 Instructional Modules

The course was organized into 20-instructional modules focusing on Physical Activity/Public Health, or Transportation/Land Use, as summarized in Table 8. Instructional materials were assimilated from a wide variety of technical sources and organizations including: (required and supplemental) course textbooks, technical publications, Centers for Disease Control and Prevention, Federal Highway Administration, Robert Wood Johnson Foundation-Active Living by Design, and professional organizations resources. Typically, two instructional modules were covered during each of the 3-hr class periods, optimally, a physical activity/public heath focused module by Dr. Daniel Bornstein, and a transportation/land use focused module by Dr. William J. Davis. 1-20 Instructional Modules developed and applied as the framework to support CIVL 642 course objectives are available at the following website: www.stride.ce.ufl.edu

TABLE 8. SUMMARY OF CIVL 642 INSTRUCTION MODULES BY FOCUS AREA

Physical Activity/Public Health focused	Transportation/Land Use focused
1. Public Health, Physical Activity & Design of the Built Environment	2. Transportation & Health Partnerships for Targeted Populations
3. Fundamentals of Public Health, Physical Activity & Public Health Milestones	4. Transportation, Land Use Patterns, Urban Sprawl & Zoning
5. Concepts and Methods in Physical Activity Epidemiology	6. Green Modes of Travel (Part 1)
7. Establishing the Value of Physical Activity for Individual Stakeholders	9. Green Modes of Travel (Part 2)
8. Strategic Plans for Increasing Population-levels of Physical Activity	11. Coalitions
10. Establishing the Value of Physical Activity for Community Stakeholders	12. Urban Transportation Planning Process
13. Physical Activity Measurement	16. Sustainable Communities & Mobility
14. Federal Guidelines for Physical Activity	17. Health Impact Assessments
15. Health Impact Assessments	18. Quality of Life, Livability, Active Living
20. Multidisciplinary Methods & Metrics	19. Demographic & Population Influences
Note: Module numbering correlates with course outline provided in Table 4, whereas the paired list reflects the alternating order in which the two focus areas were taught.	

4.5 Student Assignments

The course included 10 student assignments, conducted individually and in groups that were largely open-ended to engage students, covered topics including physical activity, chronic disease, exercise, obesity, active mobility, health risk factors, policy/program interventions, and project/built environment interventions. Assignments involved presenting findings in class, peer evaluations using rubrics, review of strengths/ weaknesses, class discussion and recognition of best cases. Student assignments developed and administered to support CIVL 642 course objectives are summarized in Table 9 and available at the following website: www.stride.ce.ufl.edu

TABLE 9. SUMMARY OF CIVL 642 STUDENT ASSIGNMENTS

No.	Type	Description
1.	Group	Prepare class briefing on: 1.) dose–response relationship between physical activity and chronic disease, 2.) physical activity and exercise, 3.) economic impact of physical inactivity and chronic disease
2.	Individual	Identify local mobility problem and active transportation solution
3.	Group	Analyze South Carolina data using Behavioral Risk Factor Surveillance System (BRFSS) https://www.cdc.gov/brfss/index.html
4.	Individual	Using Walk Score results, compare and contrast three areas in Charleston, SC www.walkscore.com
5.	Individual	Using National Physical Activity Plan, identify effective built environment example of local, state, regional, or national applications https://paamovewithus.org/national-physical-activity-plan/
6.	Individual	Prepare class briefing to identify effective implemented program or policy supporting the National Physical Activity Plan, Strategies & Tactics https://paamovewithus.org/national-physical-activity-plan/
7.	Individual	Prepare class briefing to provide technical evaluation of three articles involving physical activity, public health and/or active transportation
8.	Individual	Review & analyze Cato Institute multimedia program "The future of Public Transit" https://www.cato.org/multimedia/events/future-public-transit
9.	Individual	Review and analyze Idaho PBS program "Designing Healthy Communities: Dr. Richard Jackson," Season 2016, Episode 11 https://www.pbs.org/video/dialogue-designing-healthy-communities-dr-richard-jackson/
10.	Group	Outline of Final presentation to Expert Panel, City of Charleston Mayor's Health & Wellness Advisory Committee local agency, responsible for providing expertise on City policy decisions

4.6 Quizzes and Examinations

The courses included four in-class quizzes (26-questions), a mid-term examination (60-multiple choice, short answer, 2-essay questions) and Final Project submittal and presentation to an expert panel (final exam). In class quizzes were administered using Plickers, which uses multiple choice cards scanned with a cell phone application to provide formative real time assessment that anonymously displays student responses via bar charts so understanding of course concepts could be discussed in class as questions were posed and correct responses were identified. The mid-term exam was administered in class and comprised a comprehensive review of course concepts, instructional modules, student assignments, and reading assignments. The final exam was comprised as a small group (n=2) project submittal and presentation to an expert panel as summarized in Table 10. In-class quizzes and mid-term exam developed and administered to support CIVL 642 course objectives are available at the following website: www.stride.ce.ufl.edu

TABLE 10. OVERVIEW OF FINAL PROJECT SUBMITTAL AND EXPERT PANEL PRESENTATION, FINAL EXAM

1. **Final Project Assignment:** Student teams develop preliminary plan for integrating course concepts into Charleston-area community implementation including:
    - Submittal of Draft Outline of Implementation Plan (review by faculty)
    - Final Student Team Presentation (reviewed by expert panel)
    - Submittal of Project Implementation Plan (reviewed by faculty)
2. **Student Projects included:**
    - Implementation of People Plan Historic Charleston Peninsula
    - Implementation of Charleston area School to Parks Plan
    - Adoption of Design Principles for Active Buildings
3. **Composition of Expert Panel:** City of Charleston Mayor's Health & Wellness Advisory Committee responsible for providing expertise on City policy decisions.
4. **Basis of Evaluation:** Final Student Team Presentations were evaluated using a simple 1-5 Likert scale to score 1.) technical content, 2.) presentation effectiveness, and 3.) student response to questions.
5. **Role of Expert Panel:** 1.) Evaluate final student presentations, 2.) provide relevant technical and community feedback, 3.) recognize the best presenting student team, and 4.) provide context for fitting conclusion to graduate course.

4.7 Assessment of Student Performance

Course goals 1-5 were mapped to Bloom's Taxonomy and evaluated using course embedded indicators, aligned with course assignments, projects, quizzes, and exams. The Department assessment standard for graduate student performance is based on an achievement of an 80% score, averaged across all students participating in the course. If student performance of 80%, or above, is achieved, an embedded indicator is

determined to meet Department Standards. In the event student performance is below 80%, an embedded indicator is categorized as "Does Not Meet" and an improvement plan is developed by the professor with the purpose of improving performance in future course offerings. Results for CIVL 642 are summarized in Table 11 indicating four course goals met and one course goal did not meet Department assessment standards. Establishing an assessment process that is effective in identifying failures is an acceptable short-term outcome, in that the process is appropriately calibrated to identify targeted areas in which future improvements are needed. It should be noted for the overall course, students were successful in earning final grades of A or B. At the present time, the course has not been offered since the initial offering, due to a variety of reasons. Improvements to raising student performance aligned with Course Goal 1 would be implemented in future course offerings.

TABLE 11. SUMMARY OF COARSE GOAL ASSESSMENT USING EMBEDDED INDICATORS

Course Goal	Bloom's Taxonomy	Embedded Indicator	Student Performance	Program Outcome	Assessment Result
1	2, Comprehension	1-4 Quizzes	73.4	1-Depth of Knowledge	Does Not Meet
2	3, Application	Midterm exam	82.5	1-Depth of Knowledge	Meets
3	2, Comprehension	Assignment 6	94.4	2-Contemporary Issue	Meets
4	2, Comprehension	Assignment 5	80.8	4-Engineering Tools & Techniques	Meets
5	4, Analysis	Final Project	93.3	3-Design a Complex System or Process	Meets

List of Course Goals

1. Knowledge of methods to assess relationships between physical activity, public health and the built environment, with specific emphasis on strengths and limitations of commonly adopted methods and outcomes.
2. Demonstrate knowledge of multiple perspectives on physical activity, public health and the built environment through the socio-ecological model, urban planning principles, transportation network operations, and corresponding a subset of public health outcomes.
3. Describe relationships between built environment components, including transportation, land use, community and economic development, urban design, and health issues related to physical activity, such as obesity, heart disease, diabetes, cancer, and mental health.
4. Develop a working knowledge of multiple methods used to assess the built environment, physical activity and the built environment's impact on physical activity and public health.
5. Prepare students to work collaboratively and effectively across fields to improve a wide range of performance measures interrelated between public health, built environment, land use planning, and transportation engineering.

4.7 Student Feedback

Feedback from students was collected from a professor administered survey focused on achievement of course goals and institution-wide student evaluation of instruction. The Department Standard for student evaluation of instruction is attainment of an average Likert score of 4.0. If a Likert score is 4.0 or above, is achieved, student feedback is determined to meet Department Standards. In the event a Likert score is below 4.0, student feedback is categorized as "Does Not Meet" and an improvement plan is developed by the professor with the purpose of improving student feedback in future course offerings. Student feedback results for CIVL 642 are summarized in Tables 12 and 13. As indicated in Table 12, student feedback indicates improvements need to be made in educational engagement and delivery of instructional materials for course goals 2 and 5.

Student feedback summarized in Table 13, captured students' dissatisfaction with the 7-week summer term and difficulty to digest graduate course concepts during an accelerated academic term. Other student suggestions and feedback are expected in making an initial course offering, and necessary adjustments would be easily implemented in the next course offering. Negative feedback regarding effective professor communication, is believed to be the result of team teaching across different disciplines for which further improvements could be readily adopted in further course offerings. It should be noted that as the course consisted solely of engineering students, there was a missing dynamic that would have added to the course if public health, physical activity, public administration or city planning students would have participated in the course, as was initially intended in developing program and intuitional partnerships.

TABLE 12. STUDENT FEEDBACK ON ACHIEVEMENT OF COURSE GOALS

Course Goal	Bloom's Taxonomy	Student Likert 1-5 Feedback on Achievement of Course Goals	Assessment Result
1	2, Comprehension	4.0	Meets
2	3, Application	3.8	Does Not Meet
3	2, Comprehension	4.5	Meets
4	2, Comprehension	4.2	Meets
5	4, Analysis	3.7	Does Not Meet

List of Course Goals

1. Knowledge of methods to assess relationships between physical activity, public health and the built environment, with specific emphasis on strengths and limitations of commonly adopted methods and outcomes.
2. Demonstrate knowledge of multiple perspectives on physical activity, public health and the built environment through the socio-ecological model, urban planning principles, transportation network operations, and corresponding a subset of public health outcomes.
3. Describe relationships between built environment components, including transportation, land use, community and economic development, urban design, and health issues related to physical activity, such as obesity, heart disease, diabetes, cancer, and mental health.
4. Develop a working knowledge of multiple methods used to assess the built environment, physical activity and the built environment's impact on physical activity and public health.
5. Prepare students to work collaboratively and effectively across fields to improve a wide range of performance measures interrelated between public health, built environment, land use planning, and transportation engineering.

TABLE 13. STUDENT FEEDBACK ON EFFECTIVENESS OF COURSE DELIVERY

Standard Student Evaluation of Instruction Survey Question	Student Likert 1-5 Feedback on Student Evaluation of Instruction Questions	Assessment Result
Assignments are related to goals specified in the syllabus	4.0	Meets
My professor communicated the subject matter effectively.	3.5	Does Not Meet
My professor makes good use of examples and illustrations	4.0	Meets
My professor effectively challenged me to think.	4.2	Meets
I would rate my professor as an excellent teacher.	4.2	Meets
What did you like most about this course? 1. The topics of the course were interesting and covered topics that are not part of undergraduate curriculum. Course allowed for flexibility in research topics. 2. Great topic that combines two different 'worlds' or backgrounds to meet a common goal.		
What did you like least about this course? 1. The compressed timeframe was very challenging especially with two professors from two different backgrounds. I felt like I was taking two separate classes that were attempting to be combined in a very short time period. 2. Summer semester is a little fast paced for a graduate level course however the professors did a pretty good job of not overloading outside course work.		
What Construction suggestions do you have? 1. I would suggest not teaching this course in a summer format (7-week class). This class should be taught in a regular semester. I felt overwhelmed by the amount of information in the class. I suggest trimming the material and focusing on a handful of "key concepts". 2. I felt that overall, the contents of the course were good. I would have liked for the course to have slightly more leaned towards engineering aspects and technical concepts, and less public health topics. The course could have easily been labeled a public health course.		

4.8 Survey of Colleges/Universities

A survey of STRIDE academic institutions, and others, was conducted to provide a baseline comparison of course content for similar undergraduate and graduate offerings in other programs. The survey was administered in 2020 and focused on gaining an understanding how programs at other colleges/universities are covering transportation engineering and incorporating topics such as public health and physical activity. The survey was distributed via email to 80 faculty from universities across North America, and beyond, where faculty have been engaged in teaching and providing educational curriculum covering transportation engineering, public health and related subjects. The

survey consisted of 21 questions and was estimated to take 10-15 minutes to complete. Participation in the survey was voluntary. A total of 18 responses were received from faculty affiliated with the following universities:

- The Citadel, Dept. of Civil & Environmental Engineering
- University of Toronto, St. George, Dept. of Geography and Planning
- University of Florida, Department of Urban and Regional Planning
- Univ. of Alabama at Birmingham, Civil, Construction & Environmental Engineering
- Auburn University, Civil & Environmental Engineering
- University of Wisconsin-Madison, Dept. of Planning & Landscape Architecture
- Georgia Institute of Technology, Civil & Environmental Engineering
- University of North Carolina, City Planning
- University of Washington, School of Public Health & College of Built Environments
- Benedict College, Computer Science, Physics & Engineering
- Utah State University, Civil & Environmental Engineering
- University of Florida, Transportation Engineering
- University of North Carolina Highway Safety Research Center
- Univ. of New Mexico, Dept. of Civil, Construction & Environmental Engineering
- Morgan State University, Transportation & Urban Infrastructure Studies
- University of Oklahoma, Regional & City Planning

The first three questions focused on participants' general information such as email, contact information, name of university, academic department and/ or program, and position. Question No. 4 asked how many courses in respective undergraduate programs are transportation engineering related. Answers varied from zero to eight for programs highly focused on transportation engineering. Figure 1 illustrates survey participant responses. It is worth noting that more than 55% of programs offer zero or one mandatory courses with foundational focus on transportation engineering at the undergraduate level.

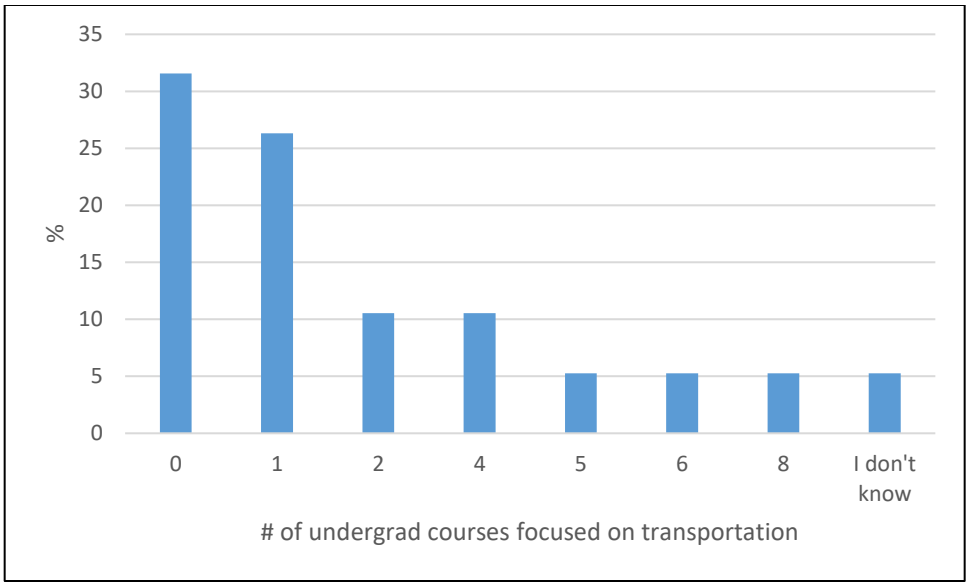

FIGURE 1: UNDERGRADUATE TRANSPORTATION COURSES OFFER BY SURVEY PARTICIPANTS

Survey participants were asked to identify graduate degree and certificate programs offered at the respective university. Table 14 summarizes responses for each category providing an overall profile of survey participants. Percentages do not add to 100% as categories are not exclusive and many universities participating in the survey offer multiple graduate degrees.

TABLE 14. SUMMARY OF GRADUATE PROGRAM OFFERINGS BY SURVEY PARTICIPANTS

Graduate Certificates	37%
MS	84%
PhD	74%

Next, participants were asked if their university offers a transportation oriented graduate program. 95% of responding universities offer transportation focused graduate programs. The next question asked how many regularly offered courses in the graduate curriculum are focused on transportation engineering? Answers varied from zero (16%) to over 20 (10.5%), with a majority of responses between two and eight courses (73.5%).

Survey participants were asked if the university offers graduate transportation engineering courses covering public health and physical activity concepts with results: yes-63.2%, no-31.6% and 5.2%-stating not known. If participants answered yes, they were prompted with more questions on administration and content for health and transportation courses. Survey participants provided graduate titles for courses covering transportation, public health and physical activity, and course descriptions in many instances. Responses are summarized as follows:

- CIVL 642, Public Health, Physical Activity, and Design of the Built Environment

- GGR1422H, The Geography of Urban Air Pollution, course examines current local to global issues of urban air pollution. Topics include understanding sources of air pollution, human health effects and study designs, stages of urban development and air pollution, mitigation approaches, global challenges and current air pollution issues by region. Measurement technologies and their applications, including low-cost sensors and regulatory grade instrumentation are explored. Students apply tools for spatial and temporal modelling of urban air pollution including dispersion modelling, spatial interpolation, remote sensing and land use regression modelling.
- CIV536H, Urban Activity, Air Pollution and Health, interdisciplinary course on challenge of air pollution with focus on urban areas. Interdependencies between transportation, air quality, and health are demonstrated. The city and the behavior of its inhabitants constitute the context for the following course topics: overview of air pollutants in urban areas, urban air quality monitoring networks, mobile source emissions, air pollution and meteorology, atmospheric dispersion, chemical processes specific to cities, personal mobility and exposure to traffic-related air pollution, epidemiology of air pollution.
- Active Transportation, explores all physically active modes of travel, with a specific focus on walking and bicycling. This course introduces students to principles and methods involved in active transportation planning, design, and operation. Topics covered include characteristics of bicyclists and pedestrians; bicycle/pedestrian facility design, traffic operations, and facility analysis; and active transportation data, planning, and policy. Students develop professional skills, apply course material, learn about resources, and gain basic understanding of bicycle and pedestrian planning, design, and operations through reading assignments, class lectures, discussions, field trips, assignments, homework, and a group project. This is a sustainability-related course offering.
- JPG1554H, Transportation and Urban Form, reduction of automobile dependence and congestion has been argued widely in recent years, and urban form has been identified as a major aspect influencing choice of travel mode. The combined imperatives of sustainability, healthier cities, and worsening congestion has prompted an increasingly rich body of research on the relationships between urban form, transport infrastructure, and travel patterns, and an array of new methodological approaches to research them. This course critically examines this research and examines planning strategies that seek to influence travel through coordinated transport investment and land use and design control. Both regional and neighborhood scale issues and strategies will be addressed. The geographic focus of the course will largely be metropolitan regions in Canada and the United States, but there will be opportunity to examine other national contexts.

- EXS5515H, Physical Activity and Health, GIS for Public Health, and a few others, etc. offered at undergraduate and graduate level, new courses re: active transport are anticipated to be offered in next few years.
- Air quality course for environmental health science and environmental engineering, students learn about emissions, air quality effect in transportation planning as well as transportation environmental system analysis, including emissions, energy, and mass transportation.
- Transportation Policy and Planning, includes bicycling, transit and walking.
- Transportation and Land Use, includes bicycling, transit and walking.
- Multimodal Transportation Planning
- Global Health and Transportation
- Transport and Built Environment
- Transportation and Health
- Sustainable Transportation Abroad
- Multimodal Transportation
- Health and Built Environment
- Highway and Traffic Engineering
- Transportation Safety
- RCPL 5979 Public Health and Built Environment
- RCPL 5463 Transportation and Land Development

Survey participants were asked to identify the types of students and academic majors taking transportation, public health and physical activity related courses of interest in this survey. Responses included: transportation engineering, city/urban planning, land scape architecture, architecture, public administration, public health, natural/health science, and others. In terms of the number of credit hours that courses of interest involve, responses were from one credit hour (7.7%) seminars, to 12-credit hours (7.7%), with the majority being three credit hours (one course, 69%). Most courses are offered annually, or bi-annually, with course enrollment varying from 5 to 30 students. In most universities, courses involving material that covers transportation and public health are elective courses (73%), with elective/required (13%) courses depending on specific program requirements. Course offerings are coordinated with other institutions and/or academic programs/departments for half of survey respondents (50%). Textbooks are required for 50% of courses and used to cover transportation, public health and physical activity curriculum concepts. Specific textbooks identified in the survey included:

- Physical Activity and Public Health Science, ISBN 9780826134585, Editors Daniel Bornstein, Amy Eyler, Jay Maddock, Justin Moore, 2019.
- The Geography of Urban Transportation, 4th Ed., ISBN 9781462529650, Genevieve Giuliano, Susan Hanson, 2017; supplemental readings on walking and bicycling.

- Metropolitan Transport and Land Use: Planning for Place and Plexus, 1st Ed., ISBN-978-1138924260, David Levinson, Kevin Krizek, 2018, with supplemental materials.
- FHWA Course on Bicycle and Pedestrian Transportation, FHWA-RD-99-198, 2006; other Pedestrian & Bicycle Info. Center publications integrated into courses.
- Sustainable Transportation Systems Engineering: Evaluation & Implementation, 1st Ed., ISBN 9780071800129, Francis Vanek, Largus Angenent, et al. 2014
- Making Healthy Places, 1st Ed., ISBN: 9781597267274, Andrew Dannenberg, Howard Frumkin, Richard Jackson, 2011.

Other useful resources that were provided as instructional materials to assist in teaching the courses of interest included:

- Foundations of Physical Activity and Public Health, 2nd Ed., ISBN 97807360871003, Harold Kohl, III, Tinker Murray, 2020.
- The Built Environment & Public Health, ISBN 9780470620038, Russell Lopez, 2012.
- Center for Advancing Research in Transportation Emissions, Energy, and Health (CARTEEH) a tier-one University Transportation Center. https://www.carteeh.org/
- Health Effects Institute, research organization providing high-quality science on the health effects of air pollution, https://www.healtheffects.org/
- Centers for Disease Control and Prevention, https://www.cdc.gov/
- World Health Organization, https://www.who.int/
- Pedestrian & Bicycle Information Center, https://www.pedbikeinfo.org/
- Use of various air quality sensors, numerous peer-reviewed articles updated each year from public health and urban planning literature.
- Sakai; academic literature database engine, Univ. of North Carolina.
- Summon; GIS and statistical analysis labs
- Odum Institute for Research in Social Science, Univ. of North Carolina, https://odum.unc.edu/ hosts data and offers short courses on quantitative and qualitative research design and analysis.
- Federal Highway Administration (FHWA)
- American Association of State Highway and Transportation Officials (AASHTO)
- Institute of Transportation Engineers (ITE)

Survey participants were asked to use a 0-5 Likert Scale (0 not covered, 5 well covered) to indicate to what extend transportation and public health topics are included in the courses of interest. Topics are listed in Table 15 and graphically represented in Figure 2 to identify which topics are covered most and which are not. 1-20 topic numbers, listed in Table 15, are shown along the y-axis and ranked from the most covered to the least covered. The blue portion of the graph reflects percentages of participants who responded with Likert scores of 4 or 5 for a specific topic (well covered). The orange portion of the graph reflects percentages of participants who responded with Likert

scores of 2 or 3 (sometimes covered). The green portion of the graph reflects percentages of participants who responded with Likert scores of 0 or 1 (not covered).

TABLE 15. SUMMARY OF TRANSPORTATION AND PUBLIC HEALTH COURSE TOPICS BY SURVEY PARTICIPANTS

ID #	Topic Description
1	Fundamental elements of the transportation planning process
2	Concepts of transportation, land use, urban sprawl and zoning
3	Application of sustainability concepts in transportation and community mobility
4	Urban environments and community approaches for adopting elements of green modes of travel for improved public health outcomes
5	Demographic and population influence on mobility and public health
6	Application of Active living by design principles for urban development projects
7	Behavioral and environmental factors influencing physical activity behavior
8	How transportation, land use, public health policies influence environmental justice
9	Factors and opportunities for retrofitting suburbia to achieve improved public health outcomes
10	Basis for application of health and transportation indicator measures and use of data to compare and contrast differences between communities
11	Relationships between physical activity and specific health outcomes
12	Physical activity strategic planning to design a policy, system, or project level intervention
13	Multidisciplinary methods and metrics in measuring change
14	Fundamental concepts of public health
15	Establishing value of Physical Activity for organizational/community stakeholders
16	Context and basis for applying Health Impact Assessments
17	Concepts and methods of physical activity epidemiology
18	Physical activity measurement instruments based on desired outcomes
19	Fundamental elements of effective partnerships between health and transportation organizations focused on improving public health outcomes
20	Federal guidelines for physical activity and physical activity measurement

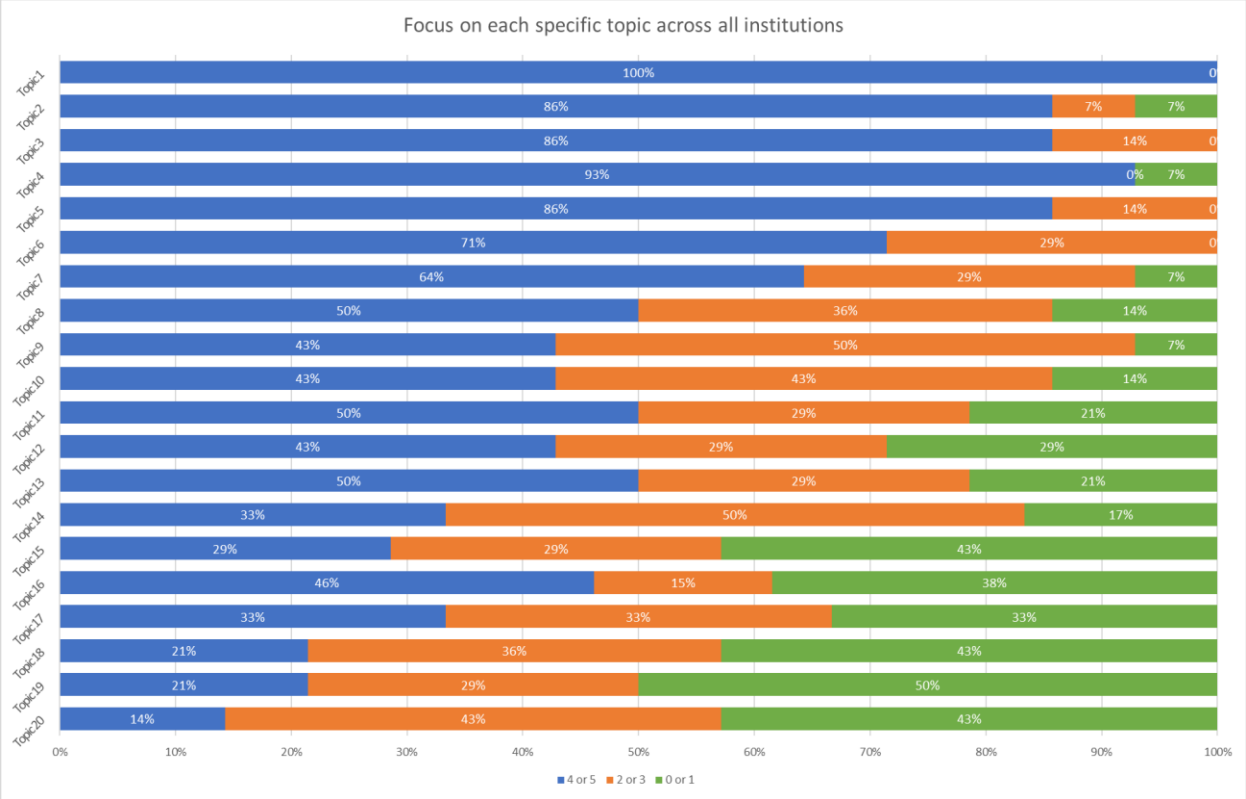

FIGURE 2: TRANSPORTATION AND PUBLIC HEALTH TOPIC COVERAGE IN SURVEY COURSES

Survey participants were also asked if there are any topics not identified in Table 15 that are covered in the courses of interest. Additional course topics include:

- Air pollution and health
- Air Pollution Exposure Modeling, Urban Heat Island
- Design fundamentals for ped/bike injury prevention, school transportation, trail design; speed management, public engagement, systems perspectives, connection to transit, equity
- Emissions, traffic and health, noise impact on health and practices
- Injury, air pollution, mental health, social capital, architecture and health, healthy food access, healthy housing, gentrification, developer's perspective on healthy development
- Health Impact Assessment
- Design for active transportation
- Universal design, what ADA accessibility means and how to design for 8-year-olds and 80-year-olds within the built environment, bike and ped audits

Survey participants were asked to report topics not identified in table 15 and not covered in courses of interest, that should be covered in a course of this type. Additional suggested topics include:

- Transportation and air pollution

- Air Pollution Impacts on Public Health
- Funding and financing active travel projects/policies, legal issues and liability, health and transportation data sharing and privacy protection, communicating/ framing engineering projects using a public health lens, agriculture, health impacts and transportation
- More on transportation equity
- Participatory justice

Survey respondents indicated for faculty to effectively cover transportation, public health and physical activity, the following methods of instruction were listed as most effective: PowerPoint notes/slide presentations, videos/podcasts, guest lecturers, group assignments, student presentations, community real-world projects assignments, case study analysis, discussions, expert panel presentations, health impact assessment, student research projects (e.g., policy critique, literature review, data analysis, health impact analysis, etc.), student data collection and process, in-class activities, observations of behavior, and observations of problem areas and identification of redesign options.

5.0 CONCLUSION

The need for multidisciplinary graduate-level curriculum that addresses the intersection between public health, transportation and the built environment was addressed through creation and offering of CIVL 642, Public Health, Physical Activity, and Design of the Built Environment during the 2019 Summer I term at The Citadel in Charleston, SC. Work on this project and course offering helped establish a need for graduate programs to provide students with diverse backgrounds, in a variety of academic fields, curriculum that provides instruction materials to identify and evaluate positive and adverse effects of the built environment on levels of physical activity and measures of public health. Students pursuing graduate degrees in interconnected fields of physical activity, public health, public policy, city planning, transportation engineering, and civil engineering design need to gain a common understanding of how to contribute to adoption of built environment polices and approaches for improving desirable outcomes supporting healthier communities. Students need to develop depth of knowledge and practical skills to establish the basis of need and potential benefits from implementation of optimal solutions to the challenging dilemma of how balance often competing demands of the built environment, urban mobility, transportation infrastructure, network connectivity, sustainability, livability, and public health.

5.1 Project and Course Successes

Completion of this project, creation of institutional materials, coordination with other institutions and programs, recruiting of students, and offering of CIVL 642, Public Health, Physical Activity, and Design of the Built Environment to graduate students in civil engineering, resulted in the following strategically important course successes:

- The project resulted in creation of graduate course materials that are available to other institutions that include: recruiting materials, course syllabus, 5-course goals, 13-student learning objectives, 20-instructional modules, 10-student assignments, quizzes, midterm exam, final project, course assessment, and evaluation of student feedback.
- The project allowed engagement of the knowledge and perspective of community leaders who served on City of Charleston Mayor's Health & Wellness Advisory Committee who provided input on course materials and served on an expert panel for student final project presentations.
- The project included administration of an insightful survey of transportation engineering and public heath undergraduate and graduate courses that included input and feedback from 18 respondents.
- The course largely achieved course goals, student learning objectives, and provided evidence of desired student performance for demonstrating an understanding of instructional materials, assignments, in class quizzes, midterm exam, and final project.

- The course incorporated use of real-world data, projects, programs, and policies to provide effective learning experiences, to reflect inherit complexities in this multidisciplinary field, and to engage professional community who are addressing similar issues through their work.
- The project effectively leveraged STRIDE Center and USDOT UTC resources to offer a new graduate course to a select group of engineering students, and pilot test effectiveness of course materials.

Project findings and dissemination of results was accomplished through the following activities:

- Podcast: William Davis, Daniel Bornstein, "ITE Talks Transportation Podcast Series, Institute of Transportation Engineers, Episode 21, Transportation and Health with The Citadel's Jeff Davis and Dan Bornstein," https://www.spreaker.com/user/ite-talks-transportation/the-citadel-3, 953 downloads, #activetransportation, #health, #livability, #transportation, Feb. 2018.
- Conference Presentation: "Transportation Engineering and Public Health: Updates on Science, Interventions and Practice," Georgia Section, Institute of Transportation Engineers, 2018 Summer Seminar, Daniel Bornstein, William J. Davis, St. Simons Island, GA, July 18, 2018.
- Book Chapter: Physical Activity and Public Health Science, ISBN 9780826134585, William J. Davis coauthored Chapter 18, Physical Activity in Urban Settings, Springer Publishing, New York, 2019.
- Panel Discussion Session: "How to Teach Active Living to Future Practitioners and Researchers," Active Living Research Conference, William J. Davis, Morgan Hughey, Charleston, SC, Feb. 20, 2019.
- Public Health Week: Participation in Global and National Public Health Week, Medical University of South Carolina, promoting Citadel Public Health & Built Environment Graduate Certificate program and graduate course offering, Charleston, SC, April 1, 2019.
- Webinar: "Creation of Graduate Curriculum Explaining Relationships Between Public Health, Physical Activity, Urban Mobility & The Built Environment," Southeastern Transportation Research, Innovation, Development and Education Center (STRIDE), University Transportation Center, USDOT, Office of Research & Technology, University of Florida, William J. Davis, Daniel Bornstein, July 8, 2020.

5.2 Broader Impacts

Broader impacts of teaching this course included engagement of academic institutions of higher learning and academic programs in the Charleston are with whom the course offering was coordinated including:

- Clemson University, Graduate Studies in Architecture + Health

- Clemson University, Planning, Development and Preservation
- Clemson University, College of Health, Education, and Human Development
- Clemson University, City and Regional Planning
- Clemson university, College of Engineering, Computing and Applied Sciences
- Clemson University, Parks, Recreation, and Tourism Management
- Clemson University, Master of Resilient Urban Design
- Medical University of South Carolina, Public Health Sciences
- College of Charleston, Master of Public Administration
- College of Charleston, Master of Science in Environmental Studies
- The Citadel, Master of Science in Civil Engineering
- The Citadel, Master of Science in Health Exercise and Sport Science

Furthermore, lasting broader impacts were reflected in graduate students who completed the course and continued the careers in the engineering profession with the following outcomes:

- Three students who completed the course work as practicing civil engineers and stated they would use educational material from this course to better design projects they are currently working on and future projects to better accomplish site development, physical activity, and public health objectives through design of built environment projects in which their consulting firm performs.
- One student who completed the course works as a practicing transportation engineer and stated he is currently using educational material from this course to better design roadway improvement projects in the Charleston area and to engage other engineers in his office and broader profession to better adhere to best practices and guiding principles.
- Two students work in positions of authority with local government transportation engineering agencies (City of Charleston Dept. of Traffic & Transportation, and Charleston County, Transportation Development Dept.). These students immediately used principles from the course to improve existing projects and programs that they were jointly working on and created an alliance to use principles on a broader basis to make transportation network improvements that would lead to better public health and mobility outcomes for the community.

5.3 Course Deficiencies/Limitations

Completion of this project and offering of CIVL 642, Public Health, Physical Activity, and Design of the Built Environment resulted in the following deficiencies and limitations:

- Student enrollment for course was only comprised of civil engineering students, which limited public health, physical activity, and other majors in bringing the breadth of perspective needed to compliment course instruction and student engagement dynamic.

- One of five course goals was not met by evidence of student performance as provided from a course embedded indicator aligned with results of in-class quizzes (n=26 questions).
- Some constructive and negative student feedback was received related to dissatisfaction of the short 7-week summer term and needed improvement in delivery of course materials by professors.
- This course has not been offered since Summer 2019, due to low enrollment of transportation engineering students in the MSCE program and lack of interest from other graduate programs and academic institutions.
- This project was not effective in using this course as a catalyst for establishing an ongoing graduate certificate program in Built Environment and Public Health.

5.4 Future Improvements

Improvements for future offerings of CIVL 642, Public Health, Physical Activity, and Design of the Built Environment should incorporate the following improvements:

- Reinvigorate dialog with other graduate programs and academic institutions to further advance dialog, input, interest and participation in this multidisciplinary graduate course offering.
- Work proactively and strategically Improve diversity of students from other academic programs to including: transportation engineering, public health, physical activity, public administration and city planning students.
- Improve delivery of course instructional materials to address assessment deficiencies and constructive/negative student feedback.
- Create more robust partnerships with local community to better engage students in initiatives by governments, nonprofit organizations, agencies or other initiatives working on built environment and public health projects, programs and policies.
- Work proactively and strategically to engage professional societies in promotion of course to professionals.
- Continue to promote viability of future course offerings to partner institutions, specifically targeting: College of Charleston, Master of Public Administration; Medical University of South Carolina, Master of Public Health; and Clemson University, Master of Urban Resilience Design programs.
- Creation institutional partnerships is crucial to the viability and effectiveness of this type of academic approach that extends across multiple disciplines, academic units and institutional boundaries. The major target institutions for this curricular program are all in competition with each other. Understanding and trust that is forged to move forward with this type cross-cutting curriculum experience a very short shelf life. As launching of the course was delayed by a few years, the fluid nature of academic leadership led to initial trust gained and commitments offered, diminishing as new individuals moved forward into leadership positions.

6.0 RECOMMENDATIONS

Through competition of this project, creation of institutional materials, coordination with other institutions and programs, recruiting of students, and offering of CIVL 642, Public Health, Physical Activity, and Design of the Built Environment, the following recommendations were identified:

- Graduate and undergraduate programs should work to include multidisciplinary course offerings that provide students with foundational knowledge on the effects of transportation infrastructure, as well as traffic congestion, on health and to provide practical approaches to development of solutions for problems associated with planning, policy, and design in improving public health outcomes (premature death, mortality prevention, life expectancy, health related quality of life).
- Development of multidisciplinary course offerings to meet this need, facilitating faculty and administrations are advised to work within the consequential understanding and constraints that academic programs are frequently siloed into individual disciplinary areas with their own curriculum and coordination can be inherently difficult and temporal.
- Coordination of multidisciplinary course offerings should be pursued with the understanding that the duration (aka shelf life) of academic partnerships is inherently short lived, with turnover in faculty and administrators, enhancement of program offerings to meet the everchanging needs of society, influence of assessment and accreditation, and evolving strategic initiatives of academic institutions.
- Attraction of diverse students from differing majors and perspectives is an essential element in offering effective multidisciplinary curriculum and courses.
- The importance of mutually beneficially tuition exchange agreements is imperative and constitutes an essential element if student enrollment streams are intended to extend across multiple academic institutions.
- The benefits of investigating online course delivery methods for a multidisciplinary course offering that could best accommodate working professionals and traditional graduate students may be an effective strategic means to attract the diversity of student majors and perspectives needed to create desired synergistic student dynamic for optimal learning of course concepts and instructional material.
- In the event a similar focused multidisciplinary course is offered, it is recommended that course goals, learning objectives, assignments, quizzes, exams and final project would be more effective for student outcomes if offered during a more traditional 10-15 week academic term, rather than an accelerated 7-week term used for CIVL 642.

7.0 REFERENCE LIST

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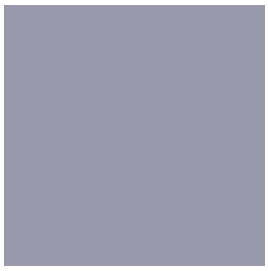
8.0 APPENDICES

8.1 Appendix A – Acronyms, abbreviations, etc.

AASHTO	American Association of State Highway and Transportation Officials
ALbD	Active Living by Design
APHA	American Public Health Association
ASCE	American Society of Civil Engineers
Bloom's	classification system to define and distinguish levels of human cognition
CARTEEH	Center for Advancing Research in Transp. Emissions, Energy, & Health
CDC	Centers for Disease Control and Prevention
CIVL	Citadel Civil Engineering course designation
EI	Embedded Indicators
FHWA	Federal highway Administration
GIS	Geographic Information System
HIA	Health Impact Assessment
ITE	Institute of Transportation Engineers
LDRS	Citadel Leadership course designation
Likert	psychometric scale used in multiple choice surveys and questionnaires
LMS	Learning Management System
MPH	Masters of Public Health
MSCE	Master of Science in Civil Engineering
MUSC	Medical University of South Carolina
NCI	National Cancer Institute
NHTS	National Household Travel Survey
NIH	National Institutes of Health
NIEHS	National Institute of Environmental Health Sciences
PBIC	Pedestrian & Bicycle Information Center
Plickers	free, accessible, web-based platform, educational assessment tool
PMGT	Citadel Project Management course designation
RWJ	Robert Wood Johnson Foundation
STRIDE	Southeast. Transportation Research, Innovation, Development & Education
USDOT	United States Department of Transportation
UTC	University Transportation Center
WHO	World Health Organization

8.2 Appendix B – Course Promotional Flier



Public Health, Physical Activity & Design of the Built Environment (CIVL 642)

The Citadel School of Engineering

Course Objectives:

1. Apply methods to assess relationships between physical activity, public health & the built environment, including review of commonly adopted policies and practices.
2. Develop new perspectives on physical activity, public health and the built environment through the socio-ecological model, urban planning principles, transportation network design, and public health outcomes.
3. Recognize relationships between built environment elements including land use, transportation, economic development, and urban design affecting public health including physical activity, heart disease, diabetes, cancer, and mental health.
4. Evaluate data and analytical methods used to assess the built environment and quantify impacts on physical activity and public health outcomes.
5. Prepare students to work collaboratively through their professional fields to improve physical activity, public health, and built environment policies and outcomes.

Course Description Multidisciplinary evaluation of cities, communities and neighborhoods to identify positive and adverse effects of the built environment on levels of physical activity and measures of public health, with an emphasis on adoption of approaches for improving desirable outcomes. The course focuses on establishing a basis of need and potential benefits from implementation of optimal solutions to the challenging dilemma of built environment, urban mobility, transportation infrastructure, economics, sustainability, livability, and community wellness. Interconnections between the fields of public health, public policy and transportation engineering design are identified. Students are equipped with proficiencies needed to create more healthy communities through an emphasis on physical activity.

Course Topics

1. Fundamentals of public health
2. Relationships between physical activity and health
3. Concepts and methods in physical activity epidemiology
4. Behavioral aspects of physical activity
5. Physical activity measurement
6. Strategic Plans for increasing population-level physical activity
7. Federal guidelines for physical activity
8. Land use patterns, urban sprawl, and zoning
9. Transportation and health partnerships
10. Green modes of travel
11. Quality of life, livability, active living
12. Transportation planning Process
13. Sustainable communities and mobility
14. Health Impact Assessments
15. Demographic and population influences

Course & Registration Information

Credit Hrs:	3 hours
Professors:	William Davis, Ph.D., P.E., Civil & Environmental Engineering Daniel Bornstein, Ph.D., Health Education & Sports Science
Term:	Summer I, May 9 - June 23, 2016
Time:	Tuesday, Thursday, 5-8pm
Location:	TBD (Lowcounty Graduate College or Citadel campus)

1.) Certificate Program Info: http://www.citadel.edu/root/cee-graduate-programs/environmental-public-health

2.) Admission Requirements: http://www.citadel.edu/root/cee-graduate-programs/master-of-science-civil-engineering

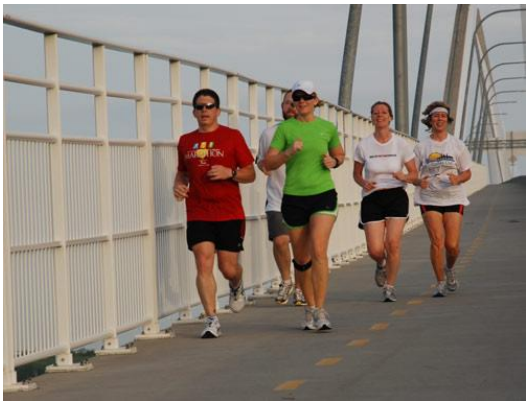
3.) Admission Info: http://www.citadel.edu/root/graduatecollege-current-students/courses/summer-2016/how-do-i-take-a-summer-school-course-at-the-citadel

4.) Online Application (submit by April 15 for Summer courses): http://www.citadel.edu/root/graduatecollege-apply

5.) Course Registration Info: http://www.citadel.edu/courses/summer-i-2016-evening-graduate-course-offerings.php

8.3 Appendix B – Graduate Certificate Promotional Flier

Public Health & The Built Environment



NEW Graduate Certificate Program
School of Engineering, The Citadel

Program Description: The Public Health and the Built Environment certificate focuses on infrastructure and land use supportive of improved public health, and addresses cutting-edge interdisciplinary issues including:

- physical activity
- health impact assessment
- infrastructure policies
- urban mobility
- city/urban planning
- built environment design

Certificate Requirements: Students complete four courses from a list of approved electives from The Citadel, or other participating academic institutions. At least two courses must be taken at The Citadel, including a required course in Public Health, Physical Activity, and Design of The Built Environment.




Targeted professions and graduate programs include:

- Public Health Professionals
- Urban/Regional/City Planners
- Architects/Landscape Architects
- Public Administrators
- Traffic/Transportation Engineers
- Transportation Planners
- Environmental Sciences
- Non Profit Orgs, Board/Staff

Program Mission: To provide students with a uniquely informative perspective and understanding of interdisciplinary data, methods, objectives and outcomes in the fields of transportation engineering, city planning, public health, physical activity, public administration, and infrastructure decision making.

Course Requirements

Complete two courses from The Citadel

Required Course:

CIVL 642	Public Health, Physical Activity, & Design of The Built Environment

At least one of the following courses:

CIVL 506	Geographic Information Systems
CIVL 640	Urban Mobility Infrastructure Policy & Planning

Two courses from participating institutions:

Medical University of South Carolina

BEHH 700	Social and Behavioral Sciences
ENVH 700	Environmental Health Sciences

Clemson University

CRP 8060	Urban and Regional Analysis
CRP 8010	Planning Process & Legal Foundations
CRP 8020	Site Planning & Infrastructure

College of Charleston

PUBA 502	Applications in GIS
PUBA 602	Public Policy
PUBA 611	Urban Policy
EVSS 601	Economic Theory for Policy Analysis
EVSS 659	Environmental Statistics

Citadel Faculty

William J. Davis, Ph.D., P.E.

Professor, Civil & Environmental Engineering - urban land use, mobility policy, public transit systems, transportation infrastructure planning /design, comprehensive plans/funding

Daniel S. Bornstein, Ph.D.

Asst. Professor, Health Exercise & Sport Science - Physical activity, public health, policy, systems, environmental factors, Project Coordinator, U.S. National Physical Activity Plan

Dimitra Michalaka, Ph.D.

Asst. Professor, Civil & Environmental Engineering - Urban mobility systems, capacity analysis, congestion pricing, transportation demand management, traffic simulation, traffic operations

For more information contact:

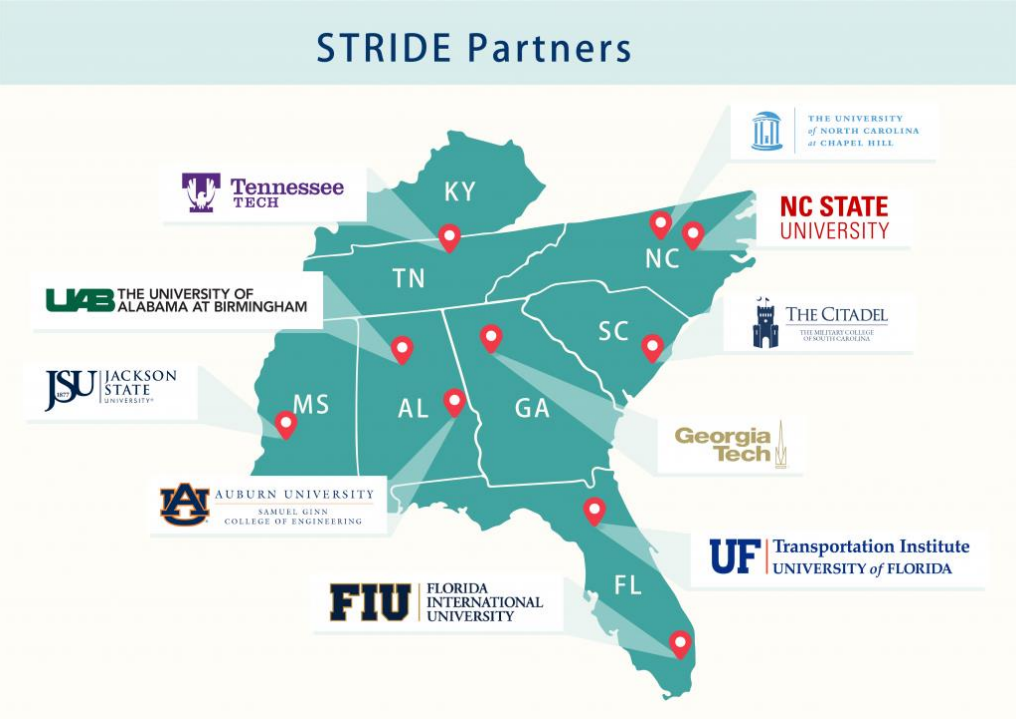
Dr. William J. Davis, 843-953-7687
jeff.davis@citadel.edu

8.4 Appendix B – Questionnaire for Survey of Colleges/Universities

Understanding Relationships between the Built Environment, Physical Activity, Public Health, Urban Mobility, and Traffic Congestion: Graduate Curriculum

Civil & Environmental Engineering, and Health & Human Performance
The Citadel, Charleston, SC
May 2020

Survey of universities regarding incorporation of public health and physical activity content into transportation engineering course curriculum.



Through the Southeastern Transportation Research, Innovation, Development & Education Center (STRIDE), housed at University of Florida, collaborating researchers at The Citadel are working to gain a collective perspective on how transportation engineering curriculum incorporates instructional content related to public health and physical activity. For this purpose, faculty from universities across North America, and beyond, are being surveyed to develop a broad understating of course offerings, course goals and course content.

This survey should take 10 to 15 minutes to complete. Participation is voluntary. Respondents must be at least 18 years of age and be affiliated with the university offering the transportation engineering curriculum of interest. Submitted data will be secure and only study researchers will be allowed to review responses. A list of participating universities will be included in the final report; however, responses will not be associated with anyone's name, or university. Participant privacy will be protected. For those completing survey responses, it is inferred that individuals consent with criteria and stipulations contained herein and would like to freely volunteer as a participant for this research study.

I. The following questions pertain to your university

1) Please provide your email/contact information?

2) Please provide the name or your university and identify your academic Dept./Program?

3) Please provide your title / position?

4) What graduate degrees are offered?
   - Graduate Certificates
   - MS
   - PhD
   - Other

5) Does your university offer a transportation oriented graduate program?
   - Yes
   - No

6) How many regularly offered courses in your graduate curriculum are focused on transportation engineering?

7) Does your university offer graduate transportation engineering courses covering public health and physical activity concepts?
   - Yes
   - No

II. If yes, please respond to the following questions pertaining to course administration.

8) Please provide titles of graduate transportation engineering courses covering public health and physical activity, and corresponding course descriptions:

9) Can you identify students who take transportation, public health and physical activity related courses of interest?
   - Transportation Engineering
   - City/Urban Planning
   - Architecture
   - Land Scape Architecture
   - Public Administration
   - Public Health
   - Natural/Health Science
   - Other

10) How many credit hours do the courses of interest involve?

11) How frequently are courses of interest offered?

12) How many students take course offerings in a typical calendar year?

13) Are courses of interest offered as required or elective courses?
    Required
    Elective

14) Are course offerings coordinated with other institutions and/or academic programs/departments?

III. The following questions pertain to course content.

15) For courses of interest, is a textbook used to cover transportation, public health and physical activity curriculum concepts?
    Yes
    No

16) Please provide textbook tittles and/or other resources used in course instruction?

17) Please identify useful resources provided as instructional materials to assist in teaching the courses of interest.

18) Please use a 0-5 Likert Scale (0 not covered, 5 well covered) to indicate how the following topics are included in the courses of interest:
    1) Relationships between physical activity and specific health outcomes.
    2) Fundamental elements of effective partnerships between health and transportation organizations focused on improving public health outcomes.
    3) Fundamental concepts of public health.
    4) Concepts of transportation, land use, urban sprawl and zoning.
    5) Concepts and methods of physical activity epidemiology.
    6) Urban environments and community approaches for adopting elements of green modes of travel for improved public health outcomes.
    7) Establishing value of Physical Activity for organizational/community stakeholders.
    8) Physical activity strategic planning to design a policy, system, or project level intervention.
    9) Fundamental elements of the transportation planning process
    10) Federal guidelines for physical activity and physical activity measurement
    11) Application of sustainability concepts in transportation and community mobility
    12) Context and basis for applying Health Impact Assessments
    13) Application of Active living by design principles for urban development projects.
    14) Demographic and population influences on mobility and public health
    15) Multidisciplinary methods and metrics in measuring change

16) Behavioral and environmental factors influencing physical activity behavior.
17) Physical activity measurement instruments based on desired outcomes.
18) How transportation, land use & public health policies influence environmental justice.
19) Factors & opportunities for retrofitting suburbia to achieve improved public health outcomes.
20) Basis for application of health and transportation indicator measures and use of data to compare and contrast differences between communities.

19) Please list topics not identified above that are covered in your courses.

20) Please list topics not identified above and not covered in your course, which you believe should be covered in a course of this type.

IV. The following questions pertain to course instruction and instructor credentials.

21) To effectively cover transportation, public health and physical activity, the following methods of instruction (please select all that apply.)

PowerPoint notes/slide presentations
Videos/podcasts
Guest lecturers
Group assignments
Student presentations
Community real world projects assignments
Case study analysis
Other

22) Please summarize the academic background and credentials of individuals teaching courses of interest.

8.5 Appendix C – Summary of Accomplishments

Date	Type of Accomplishment	Detailed Description
2/20/2018	Conference Presentation	William Davis, Daniel Bornstein, "ITE Talks Transportation Podcast Series, Institute of Transportation Engineers, Episode 21, Transportation and Health with The Citadel's Jeff Davis and Dan Bornstein," https://www.spreaker.com/user/ite-talks-transportation/the-citadel-3, 953 downloads.
7/18/2018	Conference Presentation	William Davis, Daniel Bornstein, "Transportation Engineering and Public Health: Updates on Science, Interventions and Practice," Georgia Section, Institute of Transportation Engineers, 2018 Summer Seminar, St. Simons Island, GA.
8/15/2018	Student Accomplishment or Award	Cadet Steven Pollard, recipient of Harry McCullough Mims Scholarship for exceptional aptitude and outstanding student achievement in transportation engineering, The Citadel
1/16/2019	Publication	Dan Bornstein Editor Physical Activity and Public Health Science, ISBN 9780826134585, Springer Publishing, New York; William Davis coauthored Chapter 18, Physical Activity in Urban Settings
2/20/2019	Conference Presentation	William Davis, "How do we teach active living to future practitioners and researchers?" Plenary Panel Session Presentation Active Living Research, 2019 Annual Conference, Charleston, SC.
4/1/2019	Other	William Davis, "Citadel Public Health & Built Environment Graduate Certificate program and graduate course offering," Global and National Public Health Week, Medical University of South Carolina, Charleston, SC
8/15/2019	Student Accomplishment or Award	Cadet Robert Davidson, recipient of Harry McCullough Mims Scholarship for exceptional aptitude and outstanding student achievement in transportation engineering, The Citadel
10/3/2019	Conference Presentation	Dimitra Michalaka, "Assessing Potential of Bike Share Networks and Active Transportation to Improve Urban

		Mobility, Physical Activity and Public Health," 3rd Annual C2M2 Conference, Clemson, SC
12/5/2019	Student Accomplishment or Award	Cadet Joseph Martinez, recipient of Gilbert H. Rowe Transportation Engineering Scholarship, S.C Institute of Transportation Engineers
12/5/2019	Faculty Accomplishment or Award	Dimitra Michalaka, elected to serve as South Carolina Section Representative to Southern District 5, Institute of Transportation, Executive Committee, Board of Directors
1/10/2020	Other	Dimitra Michalaka, "Assessing potential of bike share networks and active transportation to improve urban mobility, physical activity and public health outcomes in SC," ASCE Eastern Branch Meeting
7/8/2020	Faculty Accomplishment or Award	William Davis, Daniel Bornstein, "Creation of graduate curriculum explaining relationships between Public Health, Physical Activity, Urban Mobility and The Built Environment" webinar available at: https://www.youtube.com/watch?v=Z3GV0IIc3bQ&t=3s
6/11/2020	Student Accomplishment or Award	Cadet Robert O'Neal, recipient of Harry McCullough Mims Scholarship for exceptional aptitude and outstanding student achievement in transportation engineering, The Citadel
4/18/2021	Faculty Accomplishment or Award	Dimitra Michalaka, PE, received the 2021 Outstanding Faculty Service Award by The Citadel Faculty Excellence Committee and The Citadel Provost.
3/29/2022	Faculty Accomplishment or Award	Dr. Dimitra Michalaka, PE, received the 2022 Excellence in Transportation Engineering Award, District 5, Institute of Transportation Engineers, presented during an awards ceremony, 69th Annual Meeting, Southern District, Institute of Transportation Engineers, Louisville, KY. The award recognizes an individual who contributed outstandingly to education of future leaders in the transportation engineering field and to their local Section or the Southern District ITE.