ENCE489G Special Topics in Civil Engineering: Sustainability & Infrastructure SB 18 Study Abroad – Athens, Greece

3 credit Tech Elective & Study Abroad Course double count for Sustainability Minor Elective 3 credits count for full time status in Spring 2018 semester



Sustainable Niarxos Building, Olympic Stadium, Athens

Program Dates:

- UMCP workshops: March 7 & 14, 2018.
- Athens, Greece: March 16 25, 2018.

Program Director

Dr. Dimitrios Goulias, Associate Professor & Director Undergraduate Studies

Course Description

With the rapid world's population growth and the transition from rural to urban living over 50 percent of the population is now living in cities. By 2050, it is predicted that nearly 70 percent of the world's population (about six billion people) will be living in urban areas. Large cities represent only two percent of the world's surface area, yet are the economic drivers of the world's economy accounting for over 80 percent of the world's gross domestic product (GDP). With these staggering statistics the concepts and principles of "Sustainable Infrastructure" are vital for the survival of urban settlements and the development of healthy living conditions, along with economic prosperity. Thus, the concepts of "Sustainability" are in the forefront of planners, designers, engineers, environmentalist, citizens and users for achieving a functional, cost effective, resilient and healthy city for an improved urban experience. "Sustainability" include among other:

• **Infrastructure Components:** Green Infrastructure (green buildings, green roads, and other components); Energy Systems and Energy Conservation; Recycling and Waste Reduction; Water Network and Water Conservation; Monitoring Systems and Sensors; other.

Athens represents a challenging city due to the high concentration of Greek population (more than 40%) and government services, social challenges due to the significant migration, and the current economic challenges. Thus, the implementation of sustainability principles in the further development of infrastructure components is critical. The specific history and cultural heritage of the city provides unique challenges and complexity in such effort.

Theoretical Framework

This study abroad course will expose students to the theoretical principles, framework, and techniques required to address the development of sustainable infrastructure (i.e., highways, bridges, tunnels, dams, ports, airports) complex spatial systems encompassing mobility, environment, energy, and social well-being. The course will deal with the identification of a set of qualitative/quantitative indicators and methodologies. The course will first address with key faculty experts speakers from the US and Greece, the principles of technical, cultural and social approaches used in the design of sustainable infrastructure, including among other:

Topics (tentative)

- 1. Sustainability & Livability Principles
- 2. Resilience Principles, Strategies and Metrics
- 3. Sustainability & Infrastructure: Principles & Design
 - o Sustainability Requirements for Green Infrastructure (buildings, roads, airports, ports, other)
 - Economic Analysis Methods (present worth, equivalent annual cost)
 - Life Cycle Analysis Principles (design and performance period, initial, rehabilitation and operating/maintenance costs)
 - Environmental Analysis Fundamentals & Principles: Assessment Analysis (GHG Emissions, RCRA Hazardous Waste, Energy Analysis, Water Consumption, GWP –Global Warming Potential, Noise Analysis, other.
- 4. Environmentally Friendly Structures: Principles and Design of Green Buildings
 - Green Buildings Components
 - Energy Conservation: Alternative Energy Sources & Climate Control
 - Water Management
- 5. Sustainability Metrics & LEED
 - o Green Buildings
 - Urban neighborhoods
- 6. Principles & Design of Green Roadways & Sustainability Assessment/Metrics
 - o Infrastructure Condition Assessment: Methods and Ratings
 - Pavement Structural Design Principles & Methods
 - o Sustainable Rehabilitation Methods: Principles, Structural Analysis, Materials, Methods
 - o In-situ Recycling Principles & Methods (condition, materials and techniques)
 - Principles and Design of Permeable vs Impermeable Surfaces
 - o Ex-situ Recycled Materials and Alternative "Green" Materials
 - Hydrological concepts related to runoff in urban areas: permeable and impermeable surfaces and materials, contaminant control
 - o Design of permeable/ porous surfaces; Engineering Analysis and Design
- 7. Sustainability Assessment Analysis & Metrics
 - LCA & Environmental Assessment Analysis for Conventional & Sustainable Alternatives & Tools (Palate, BE²ST)
 - Highway Sustainability Analysis & Rating Methods (GreenRoads, GreenLite, BE²ST in Highways)
 - o Optimization Analysis of Sustainable Alternatives & Selection of Best Solution



Akropolis Museum, Olympic Infrastructure, Athens.

Case Studies & Design Projects

The study abroad students will be involved in the development of alternative solutions incorporating "sustainability" principles and analysis related to alternative city conditions and infrastructure complements. The alternative case studies will represent real case scenarios.

Site Visits (tentative)

Technical Site Visits

- Greek National Opera/ Niarchos Foundation, Sustainability site visit.
- Attiki Odos toll road site visit;
- Eleftherios Venizelos Athens International Airport site visit;
- Athens Metro site visit
- 2004 Olympic Infrastructure

Historic/cultural land marks Site Visits

Syntagma Square, Handrian's Arch, Plaka/Monastiraki/ Agora, Parthenon; 1869
Olympic Stadium; Acropolis Museum; Mount Licabettus.

Field Trip

• Hydra, Poros, Aigina

Instructors University of Maryland

Department of Civil and Environmental Engineering.

• Dr. Dimitrios Goulias, Associate Professor. (Program Director).

University of the Aegean

Department of Shipping Trade & Transport

• Dr. Amalia Polydoropoulou, Professor.

University of Piraeus

Department of International and European Studies

• Dr. John Paravantis, Assistant Professor.

Course Schedule (tentative)

UMCP Sustainability & Infrastructure Workshops

- -March 7, 2018: Intro to Infrastructure Sustainability; Sustainability Concepts & Rating Systems; Site data collection & Analysis techniques, LCA, Environmental Assessment; Sustainability Metrics;
- -March 14, 2018: Technical Assessment of Sustainable Alternatives; Introduction to Design projects, data collection techniques & design/analysis tools. Design projects development planning.

Pre-departure meeting/ orientation and travel information.

-March 16, 2018: Departure from US.

Athens, Greece

- -March 17, 2018: Arrival in Athens, Airport transfer to lodging. On-site orientation, Welcome Reception.
- -March 18, 2018: Athens Site Visits. Design projects & Logistics.
- -March 19, 2018: Lectures in Infrastructure & Sustainability Design projects & Logistics. Technical Site Visits: Olympics Infrastructure
- -March 20, 2018: Lectures/Workshop in Infrastructure & Sustainability; Sustainability Technical Site Visit Greek National Opera/ Niarchos Foundation
- -March 21, 2018: Workshop in Infrastructure & Sustainability; Design projects. Technical Site Visit: Athens Metro.
- -March 22, 2018: Workshop in Infrastructure & Sustainability with participating faculty; Technical Site Visits: Eleftherios Venizelios Athens Airport.
- -March 23, 2018: Presentation of Design Projects, Course Assessment Technical Site Visit: Attiki Odos toll road.

-March 24, 2018: Field Trip

Concluding Remarks & Farewell Dinner.

-March 25, 2018: Airport Transfer & Return to the US.



1869 Panathenaic Olympic Stadium, Aegina Island, Irodou Theater, Athens

Course Location & Access

Students will be housed at a hotel in Athens and will be using lecture rooms.

Learning Objectives

Students in this course will:

- gain knowledge on the principles and techniques for the design of sustainable infrastructure components;
- be exposed to the complex and multi-disciplinary analysis required for such projects and account for the physical characteristics of the space, the historic and cultural identity of cities, as well as the environmental aspects;
- be exposed to and learn of the set of qualitative and quantitative indicators used in the design of "green infrastructure;"
- apply principles and techniques on case studies.

Learning Outcomes

By the end of the course, students should have attained competency (ABET) in the following areas:

- participatory decision making within a team;
- creating design alternatives based on community needs assessment, and cultural identity;
- creating and analyzing multiple design alternatives;
- determining appropriate techniques and methods to be used in solving societal needs mingled with engineering and environmental principles;
- determining metrics for design projects.

Proposed Texts.

None. Readings or other resource materials will be provided by the participating faculty.

Course Prerequisites.

None. The course is open to any major, undergraduate and graduate students, as well as non UMD students.

Participation.

The students will be working in teams to conduct their design projects. Students are expected to: i) attend all of the lecture and site visit sessions associated with this course; ii) actively participate in the design project developed by each team.

Program Assessment

1. Program & Team Participation (15%)

This component will assess the interest, participation and interaction of each student in the different phases of this study abroad course (lectures, project design of case studies, site visits).

Throughout the program, the faculty will assess through one to one interaction and discussions the following: student knowledge of the principles of developing green infrastructure design alternatives; their ability to recognize the complex and multi-disciplinary analysis required for such projects; their knowledge and ability to identify the set of qualitative and quantitative indicators for the design of "green infrastructure."

Participants will be asked to select one of the technical /cultural site visits included in the program, prepare explanatory material and present their findings and explanation to the rest of the team during the actual visit.

2. Design Project Report & Presentation (70%)

Each student and team will be assessed based on the level of performance in regards to the following list of outcomes:

- participatory decision making within a team;
- ability to create and administer design alternatives based on community needs assessment, and cultural identity;
- ability to create and analyze multiple design alternatives;
- ability to determine appropriate techniques and methods to be used in solving societal needs mingled with engineering and environmental principles;
- ability to define evaluation metrics for the design project.
- 3. Reflection Summary (15%)

At the conclusion of the program <u>a "Reflection" summary</u> will be prepared from each student which will highlight:

- cultural immersion experience pinpointing both social and professional differences between US and GR;
- Details and impressions from a technical /cultural visit site of choice.

Academic Integrity

Students will be reminded of the academic integrity expectations and the Honor Code.