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Final Report

Technology Transfer: Educational and Professional Training Modules on Green/ Sustainability Design and Rating Systems Workshop

(Project # 2016-011)

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Disclaimer

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Nomenclature

AASHTO	American Society of State Highway and Transportation Officials
ACEC	American Consulting Engineers Council
ASCE	American Society of Civil Engineers
BE^2ST	Building Environmentally and Economically Sustainable Transportation
CNU	Congress for the New Urbanism
FHWA	Federal Highway Administration
GreenLITES	Green Leadership in Transportation and Environmental Sustainability
IDOT	Illinois Department of Transportation
IJSG	Illinois Joint Sustainability Group
I-LAST	Illinois Livable and Sustainable Transportation
INVEST	Infrastructure Voluntary Evaluation Sustainability Tool
IRI	International Roughness Index
IRTBA	Illinois Road and Transportation Builders Association
ISI	Institute for Sustainable Infrastructure
LCCA	Life Cycle Cost Analysis
LEED	Leadership in Energy and Environmental Design
LEED-ND	Leadership in Energy and Environmental Design – Neighborhood Development
MEPDG	Mechanistic-Empirical Pavement Design Guide
MTO	Ontario Ministry of Transportation
NASTC	North American Sustainable Transportation Council
NRDC	Natural Resources Defense Council
NYSDOT	New York State Department of Transportation
PBT	Portland Bureau of Transportation
POSI	Portland + Oregon Sustainability Institute
ROI	Return on investment
SIP	Sustainability Implementation Plan
SSCRTC	Santa Cruz County Regional Transportation Commission
SRNL	Savannah River National Laboratory
STARS	Sustainable Transportation Analysis and Rating System
STRIDE	Southeastern Transportation Research, Innovation, Development and Education Center
TNM	Traffic Noise Model
TRB	Transportation Research Board
UAB	University of Alabama at Birmingham
UF	University of Florida
UN	United Nations
USGBC	United States Green Building Council
VMT	Vehicle miles traveled

Abstract:

The goal and focus of this proposed technology transfer project was to highlight and disseminate the results of STRIDE Research Project No. 2012-051S [Peters *et al*., 2015], thereby making the results of that project available to the technical community and the general public. A post-workshop survey was conducted to address what information had been learned from the workshop. Such information may be of help in developing new courses related to sustainability related to transportation and environmental systems.

This project developed workshop materials based on the results developed for Project No. 2012-051S, which involved the development of a graduate/advanced undergraduate course addressing "Sustainability Design and Rating Systems"; presented the results of the earlier project in a focused workshop highlighting the significant results and key points of the project course; and presented a seminar highlighting the significant points of the course and workshop. Additionally, a final report was developed and submitted to STRIDE at the conclusion of the project.

Various criteria were used in the transportation- and neighborhood-level rating systems. Criteria used involve:

Environmental sustainability:
- Water conservation;
- Energy conservation;
- Environmental/ecosystem protection;
- Climate change;
- Waste and materials management;
- Noise/light pollution; and
- Sustainable land use.

Economic sustainability:
- Innovation/design
- Operations and maintenance;
- Cost effectiveness;
- Affordability;
- Economy/jobs; and
- Transportation impact.

Social sustainability:
- Access;
- Safety;
- Equity/inclusion;
- Health/well-being;
- Culture/place-making;
- Food sustainability; and
- Indoor environment.

These criteria were addressed to some degree in the transportation and neighborhood development rating systems. No single rating system addressed all of the various criteria listed above.

Executive Summary:

This technology transfer project describes transportation and neighborhood-level rating systems. Related to this project, an advanced undergraduate/graduate course entitled ""Sustainable Design and Rating Systems" was developed and was taught during the fall semester of 2014 in the Department of Civil, Construction, and Environmental Engineering at the University of Alabama at Birmingham (UAB). A series of course modules were developed and introduced focusing on principles of sustainable transportation and livable streets, transportation planning and site design for sustainable transportation, transportation sustainability rating systems, brownfield/greyfield redevelopment principles, and sustainable design and ethics. The teaching modules and various homework assignments and exams can be accessed on the STRIDE website.

Various criteria have been used in the transportation and neighborhood-level rating systems. Transportation Sustainability Rating Systems reviewed included: Greenroads, GreenLITES (Green Leadership in Transportation and Environmental Sustainability), STARS (Sustainable Transportation Analysis and Rating System), BE^{2}ST (Building Environmentally and Economically Sustainable Transportation), GreenPave, I-LAST (Illinois Livable and Sustainable Transportation), INVEST (Infrastructure Voluntary Evaluation Sustainability Tool), and Envision. Neighborhood-Level Development Rating Systems reviewed included: Star Communities, One Planet Communities, Enterprise Green Communities, LEED-ND (Leadership in Energy and Environmental Design (LEED) for Neighborhood Development), Ecodistricts, and Green Star Communities.

These rating systems have been described. Criteria used involve:
Environmental sustainability: Water conservation; Energy conservation; Environmental/ ecosystem protection; Climate change; Waste and materials management; Noise/light pollution; and Sustainable land use.
Economic sustainability: Innovation/design; Operations and maintenance; Cost effectiveness; Affordability; Economy/jobs; and Transportation impact.
Social sustainability: Access; Safety; Equity/inclusion; Health/well-being; Culture/place-making; Food sustainability; and Indoor environment.

These criteria have been addressed to some degree in the transportation and neighborhood development rating systems. No single rating system addressed all of the various criteria listed above. The sustainability rating systems were described and presented in a workshop and two seminars.

The workshop and seminar highlighted the results of the course development addressing "Sustainability Design and Rating Systems"; the results of the pre- and post-workshop surveys were used to address perceptions associated with sustainability rating systems. Potential benefits of this technology transfer project involve better familiarizing the transportation officials and the general public with various transportation- and environmental-related aspects of sustainability rating systems.

Chapter 1: Background Information Related to Workshops and Webinars/Seminars

Webinars are seminars/workshops held via a web-based interface. Such approaches have become a popular vehicle for delivery of educational content [Mihai, 2014]. Webinars fulfill the function of bridging the gap between the traditional classroom and the e-learning platforms, in the absence of face-to-face contact, allowing teachers and attendees to communicate live. Participants can simultaneously communicate with each other; this enables participants to share both content-related and non-content-related contributions [Mihai, 2014]. The educator is present for the entire duration of the webinar and can have a real-time dialogue with the participants. This increases the motivation and attention levels, and helps diminish the sense of distance and isolation experienced in other e-learning techniques [Mihai, 2014; Salmon, 2000]. Mihai [2014] notes that the teachers of the webinar need to make more effort to capture the attention of the participants. It also accommodates the increased geographical spread of the target audience [Mihai, 2014]. Mihai [2014] concluded that teachers found e-learning techniques (such as webinars) are a convenient, flexible tool for both participants and teachers, and are especially useful for reaching participants in remote locations.

Forrest [2012] identified a number of public involvement/public outreach methods, including large-group public meetings, small-group public meetings, presentations to existing groups, availability sessions, tours and open houses, workshops, advisory groups, use of fact sheets and brochures and similar materials (including web-based downloadable documents), news stories and other media pieces, use of posters, and information repositories. For each of these methods, benefits and challenges were identified. Forrest [2012] has noted that small-group public meetings can be especially effective when numerous, diverse stakeholder groups are concerned about a particular issue. Such meetings can be held in any location that will accommodate and be acceptable to those who wish to attend.

In workshops, participants receive information and resources, and then work with the data (often assisted by technical experts in the field). Benefits identified for using workshops include [Forrest, 2012]:

- Workshops can generate meaningful and well-thought-out recommendations from stakeholders; these recommendations may include factors that professional staff members would not have thought of on their own; and
- The recommendations generated during workshops can achieve a high level of legitimacy.

Challenges associated with workshops include [Forrest, 2012]:

- Well-executed workshops are labor-intensive. Workshop sponsors must plan the session, recruit strong participants, prepare presentations, develop information for the participants to use, and provide facilitation/assistance during the sessions. A staff member must take detailed notes during the sessions so that important discussion points are not lost.
- Workshop objectives must be meaningful and achievable, and workshop recommendations must be taken seriously.
- Workshop participants should be drawn from all stakeholder groups if possible. It is important to accommodate diverse viewpoints, questions, and concerns.

For using workshops and webinars, Douglas *et al*. [2012] point out the power of using figures

and images. Where possible, local residents should also be engaged in these activities [Douglas *et al*., 2012].

Eikelboom and Janssen [2013] conducted a series of workshops combining expertise from both scientists and stakeholders dealing with an interactive mapping device. Pre-workshop and post-workshop questionnaires were completed by the participants. The questionnaires were used to evaluate five primary themes. Their statements revealed changes in expectations, knowledge, and opinions. Their investigation showed that interactive participation promotes stakeholder involvement and encouraged knowledge exchange and acceptance of workshop products. This study [Eikelboom and Janssen, 2013] also showed communication between science and society is valuable for research planning, consistent with the results of Opdam [2007].

Delgado [2016] points out that the true effectiveness of a webinar comes down to what it delivers and how "customers" can apply it to their needs and problems. The internet/web allows users to modify existing content, create new content, personalize their web experience, and build online education networks [Cruz, 2013]. Educational technology is a way for teachers to deliver content and research to students/users within the classroom. Cruz [2013] further points out that new innovation of technology is shaping the future of higher education and is influencing teaching methodologies.

At workshops, as the presenter describes the nature of various technology options, the workshop attendees can learn and assimilate the information obtained, and indicate their preference of the options presented [Wang *et al*., 2010].

The research described in this technology transfer project addressed the development and delivery of a workshop and a webinar related to STRIDE Project No. 2012-051S on "Development of Educational and Professional Training Modules on Green/Sustainability Design and Rating Systems for Neighborhood Development and Transportation".

Chapter 2: Objectives and Methodology

Project Objectives:

The goal and focus of this proposed technology transfer project is to highlight and disseminate the results of STRIDE Research Project No. 2012-051S [Peters *et al*., 2015], thereby making the results of that project available to the technical community and the general public. There are three primary objectives of this technology transfer project:

1. Develop workshop materials based on the results developed for Project No. 2012-051S, which involved the development of a graduate/advanced undergraduate course addressing "Sustainability Design and Rating Systems";
2. Present the results of the earlier project in a focused workshop highlighting the significant results and key points of the project course; and
3. Present a webinar highlighting the significant points of the course and workshop.

The scope of the developed course revolves around sustainability issues related to transportation and infrastructure. The course developed under STRIDE Research Project No. 2012-051S, provided both transportation and environmental perspectives focusing on principles of sustainable transportation and livable streets, transportation planning and site design for sustainable transportation, transportation sustainability rating systems, brownfield/greyfield development principles, and sustainable design and ethics. The graduate/ advanced undergraduate course covered the following topics:

- Introduction to Sustainability;
- Sustainable Transport;
- Livable Streets;
- Transportation Planning for Sustainability;
- Site Design for Sustainable Transportation;
- Sustainability Rating Systems – FHWA INVEST;
- Sustainability Rating Systems – LEED ND Introduction;
- Sustainability Rating Systems – LEED ND Smart Location and Linkage (SLL);
- Sustainability Rating Systems – LEED ND Neighborhood Pattern and Design (NPD);
- Sustainable Development Rating Systems (I and II)
- Sustainability at the University Campus level;
- Livable, Sustainable, and Smart Cities;
- Megacities;
- Urban Sprawl;
- Brownfield Redevelopment (I and II);
- Greenfield Redevelopment; and
- Urban Hydrology and Landscape Architecture.

In Project 2012-051S, the course modules included the lecture materials, allowing instructor/student interactions and discussions. The class time in the course lecture was 75 minutes; the class was offered twice a week during the semester.

Project Methodology:

The project methodology involved using the course materials developed in a condensed format, providing a summary of the materials covered in the course, for technical dissemination in a workshop to the technical community and the general public. Materials presented in the workshop will be provided to the workshop attendees as workshop handouts; additionally, the handout material will be provided to the workshop attendees in electronic format. The workshop will be presented to a live audience. The workshop is expected to last about 3 hours in length.

Following the workshop, the results were presented in a virtual mode via a seminar (expected to last ~1 hour). The results of the seminar has been made in an archival format accessible through STRIDE. The seminar has been made available to the seminar attendees. STRIDE advertised the seminar and had participants register for the seminar.

Research Tasks to be Performed in Technology Grant Application:

As highlighted above in the methodology, three primary research tasks will be performed in this technology transfer grant, as listed briefly below:

1. Develop workshop materials based on the results developed for Project No. 2012-051S, which involved the development of a graduate/advanced undergraduate course addressing "Sustainability Design and Rating Systems";
2. Present the results of the earlier project in a focused workshop highlighting the significant results and key points of the project course; and
3. Present a seminar highlighting the significant points of the course and workshop.

Additionally, a final report will be developed and submitted to STRIDE at the conclusion of the project.

Anticipated Results

The workshop and seminar highlighted the results of the course development addressing "Sustainability Design and Rating Systems"; the results of the pre- and post-workshop surveys were used to determine whether perceptions differ between educational professionals and the general public. The workshop presented a more extensive summary of the highlights of the graduate/advanced undergraduate course developed under STRIDE Project No. 2012-051S. The seminar presented a more focused (condensed) summary of the highlights that people will be able to access electronically; archives of the information and materials can be obtained through STRIDE. The results from both the workshop and seminar are described in this final report.

Chapter 3: Results and Discussion:

Workshop Results

Sustainability means different things to different people, as depicted in the figure illustrated on the following page. Sustainability is a big concept, like "justice" or "freedom". Concepts are easier to understand than to define. The UN World Commission on Environment and Development (Brundtland Commission) defined Sustainable Development as: "Meeting the needs of the present generation without compromising the ability of future generations to meet their own needs" [Report of the World Commission on Environment and Development, 1986]. Other meanings of sustainability are depicted in Figure 1.

Figure 1. Different meanings associated with the term "sustainability".

Other definitions of sustainability include [Center for Environmental Excellence by AASHTO Transportation and Sustainability Peer Exchange, 2009]:

- "An overarching conceptual framework that describes a desirable, healthy, and dynamic balance between human and natural systems."
- "A system of policies, beliefs, and best practices that will protect the diversity and richness of the planet's ecosystems, foster economic vitality and opportunity, and create a high quality of life for people."
- "A vision describing a future that anyone would want to inhabit."

These definitions are central around sustainability's applicability to the triple bottom line of sustainability, involving environment, social, and economy aspects, as depicted in the figure below.

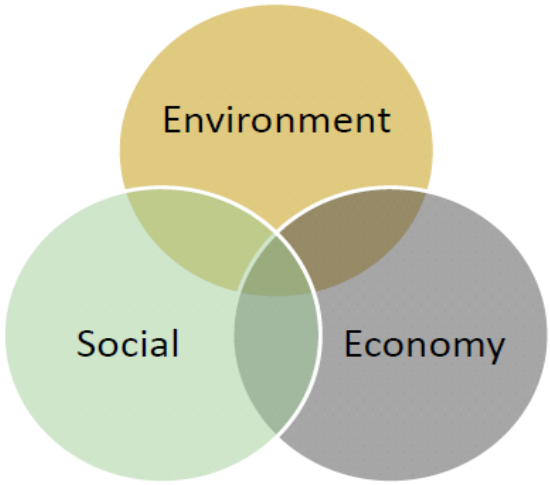

Figure 2. Triple Bottom Line of Sustainability.

These concepts are consistent with the American Society of Civil Engineers (ASCE) definition of sustainability. ASCE defines sustainability as: A set of **environmental, economic and social conditions** in which **all of society** has the capacity and opportunity to **maintain and improve** its quality of life indefinitely **without degrading** the quantity, quality or availability of natural, economic and social resources [ASCE, 2009].

Various indicators and metrics exist related to assessment of sustainability. As an example, for the case of sustainable transportation systems, indicators and metrics include:

- Transportation Related (VMT; public transit use; Freight tonnage-miles; traffic volumes; auto occupancy, etc.);
- Environmental Related (CO_2 emissions; fossil fuel consumption; noise level; per capita energy consumption aka E-index etc.);
- Safety Related (fatality and injury rates; crash-related costs; medical costs, etc.);
- Economic (population density, employment, etc.); and
- Social; Equity Related (accessibility and mobility, income inequality, quality of life, etc.).

Review of Course Development

Course objectives for the development of the advanced undergraduate/graduate course addressing sustainability design and rating systems included:

- Understand the role of transportation in sustainable development;
- Be able to identify planning, and design practices for implementing sustainable transportation systems;
- Be able to describe and differentiate between sustainable, livable, and smart cities;
- Be able to describe how brownfield and greyfield redevelopment/revitalization ties in with livable cities principles; and
- Be able to describe and apply the different rating systems.

The scope of the course revolves around sustainability issues related to transportation and infrastructure. Such issues are of great importance as global concerns about climate change, energy use, environmental impacts, and limits to financial resources for transportation infrastructure

require new and different approaches to planning, designing, constructing, operating, and maintaining transportation solutions and systems [CH2M Hill and Good Company, 2009].

For the scope of the course, the effort resulted in the development of educational resources that focus on new paradigms for transportation and community planning with noticeable societal, health, economic, and environmental benefits. The educational objectives and lectures/modules developed for the course reflect discussions and feedback received from the Southeast Transportation Research Innovation Development and Education Center led by the University of Florida (UF) and the Sustainable Smart Cities Research Center at the University of Alabama at Birmingham (UAB).

A 3-hour semester-long course on "Sustainable Design and Rating Systems" was developed and delivered on the UAB campus during the fall semester of 2014. The class had 19 enrolled students (8 undergraduate and 11 graduate students). The course was team-taught by transportation engineering and environmental engineering faculty members to address both transportation- and environmental-related aspects of sustainable design.

A series of course modules were developed and introduced focusing on principles of sustainable transportation and livable streets, transportation planning and site design for sustainable transportation, transportation sustainability rating systems, brownfield/greyfield redevelopment principles, and sustainable design and ethics. The course modules are listed below:

• Introduction to Sustainability; • Sustainable Transport; • Livable Streets; • Transportation Planning for Sustainability; • Site Design for Sustainable Transportation; • Sustainability Rating Systems – FHWA INVEST; • Sustainability Rating Systems – LEED ND Introduction; • Sustainability Rating Systems – LEED ND Smart Location and Linkage (SLL);	• Sustainability Rating Systems – LEED ND Neighborhood Pattern and Design (NPD); • Sustainable Development Rating Systems (I and II) • Sustainability at the University Campus level; • Livable, Sustainable, and Smart Cities; • Megacities; • Urban Sprawl; • Brownfield Redevelopment (I and II); • Greenfield Redevelopment; and • Urban Hydrology and Landscape Architecture.

These teaching modules and various homework assignments and exams are available on the STRIDE website (see Appendix A). Additional information related to the course on "Sustainable Design and Rating Systems" is provided in the earlier project's final report [Peters *et al.*, 2015], in the authors' ASEE conference proceedings paper [Sisiopiku *et al.*, 2015], and in a TRB conference poster presentation [Ramadan *et al.*, 2014].

Sustainability Rating Systems

A number of related research studies have been performed addressing sustainable transportation and rating systems. Samberg *et al*. [2011] identified that there is no internationally recognized standard for determining and evaluating sustainable transportation. Mapes and Wolch

[2010] note that until 2008, there was no comprehensive system in place to measure the sustainability of new community developments. Many projects tend to focus on features that increase community attractiveness to potential buyers, but fail to address attributes to enhance environmental- and socio-economic sustainability [Mapes and Wolch, 2010]. In another study, Litman and Burwell [2006] describe issues related to the sustainable transport definition, and evaluation and implementation of sustainable transportation.

Specific issues addressed have included the range of sustainability definitions, the range of issues under these definitions, the range of perspectives, criticisms of sustainability analysis, evaluation of sustainability, transportation impacts on sustainability, sustainable transportation decision making, equity, land use, automobile dependency, community livability, human health, and ecological integrity.

Examples of sustainability rating systems studied are listed below:

- Greenroads
- FHWA Infrastructure Voluntary Evaluation Sustainability Tool (INVEST)
- Ecodistricts
- One Planet Communities
- Leadership in Energy and Environmental Design – Neighbor-hood Development (LEED-ND) among others.

The sustainability rating systems for the transportation and neighborhood-level development systems considered in this technology transfer project are listed below:

Transportation sustainability rating systems:

• Greenroads	• Green Pave
• GreenLITES	• I-LAST
• STARS	• INVEST
• BE^{2}ST	• Envision

Neighborhood-level development rating systems:

• Star Communities	• LEED-ND
• OnePlanet Communities	• Ecodistricts
• Enterprise Green Communities	• Green Star Communities

The various sustainability rating systems are briefly described in the following section.

<u>Transportation Sustainability Rating Systems</u>:

- Greenroads

Developed by CH2M HILL and the University of Washington in 2009 [Greenroads, 2012], Greenroads stimulates sustainability in highway construction by awarding credits to projects that have successfully incorporated sustainable best practices. It provides a holistic means of considering and evaluating roadway sustainability for new construction, reconstruction and rehabilitation through a quantitative method that informs decision making [Greenroads, 2012]. It also addresses operations and maintenance through an Operations and Maintenance Plan, which is evaluated when the project is scored.

The criteria under the Greenroads sustainable rating system are broken down into two categories: required and voluntary. Each project must meet the 11 project requirements: Environmental Review Process, Lifecycle Cost Analysis, Lifecycle Inventory, Quality Control Plan, Noise Mitigation Plan, Waste Management Plan, Pollution Prevention Plan, Low Impact Development, Pavement Management System, Site Maintenance Plan, and Educational Outreach [Clevenger *et al*., 2013]. The majority of required criteria are derivatives of codes or laws; and do not present an additional burden to the project team. In addition, there are six voluntary credit categories. They include: Environment and Water (8 criteria), Access and Equity (9 criteria), Construction Activities (8 criteria), Materials and Resources (6 criteria), Pavement Technologies (6 criteria) and Custom Credits (2 criteria). All criteria are intended to inspire action towards a higher standard of construction sustainability using current technology and tools. After project requirements are fulfilled, voluntary credits are selected, documented, and submitted to Greenroads for a third party review [Greenroads, 2012]. Each credit is weighed by Greenroads on a scale of 1–5 depending on its potential to influence the sustainability of projects.

Four awards levels exist for the Greenroads system: Bronze (32–42 voluntary credit points), Silver (43–53 voluntary credit points), Gold (54–63 voluntary credit points) and Evergreen (64 upwards voluntary credit points). The tool may be used on highways and conceptually on bridges, tunnels and other structures associated with similar works. It is web based and can be used throughout the life cycle of the project [Greenroads, 2012; Clevenger *et al*., 2013].

- GreenLITES (Green Leadership in Transportation and Environmental Sustainability)

GreenLITES was developed by the New York State Department of Transportation (NYSDOT). GreenLITES assesses project performance in several key areas, while encouraging sustainability best practices [NYSDOT, 2012]. Projects are assessed under GreenLITES Design during conceptual and design phases. The system is grounded in the triple bottom line of sustainability: environment, economy, and equity. It includes five point categories: Sustainable Sites, Water Quality, Material and Resources, Energy and Atmosphere, and Innovation. A total of 175 credits exist across these five categories. There are four award levels: GreenLITES Certified, GreenLITES Silver, GreenLITES Gold and GreenLITES Evergreen awards [Clevenger *et al*., 2013]. GreenLITES is a mandatory tool for the NYSDOT on all highway projects. Additionally, the NYSDOT is developing a Pilot GreenLITES Regional Assessment Tool to rate projects using the triple bottom line [NYSDOT, 2012].

- STARS (Sustainable Transportation Analysis and Rating System)

STARS began in July 2008 when a dozen transportation and sustainability professionals discussed how to shift transportation from planning for modes to planning for multiple outcomes, thereby providing people with more and better choices while reducing energy use and climate pollution in a financially constrained era [NASTC, 2013]. STARS was developed by the Portland (OR) Bureau of Transportation, the North American Sustainable Transportation Council (NASTC) and the Santa Cruz County Regional Transportation Commission. STARS is designed to improve the Triple Bottom Line performance of transportation plans and projects [NASTC, SCCRTC, and PBT, undated]. STARS is a voluntary, national system for use by public agencies and private consultants to simplify alternative analysis and decision-making. STARS intends to improve

transportation outcomes by certifying and rewarding performance, much in the way LEED and the Living Building Challenge are improving building performance.

The Sustainable Transportation Analysis and Rating System (STARS) system is designed to help transportation professionals, elected officials, and citizens, improve a transportation project's short-term and long-term performance [NASTC, 2013]. Used effectively, the STARS Project credits in the STARS manual can help to:

- Develop consensus among professionals, decision-makers, businesses, and professionals around project goals, objectives, and strategies/alternatives;
- Show which project strategies help meet goals and objectives for providing people and businesses more and better travel and location options;
- Show which project strategies help meet goals and objectives for reducing energy use and greenhouse gas emissions;
- Show which project strategies may be particularly cost-effective; and
- Evaluate the performance of project strategies short-term (up to ten years) and long-term (preferably 20–25 years and 2050).

STARS-Project is the first component in a larger planning, evaluation, and rating system for transportation plans and projects [NASTC, 2013]. Two other components are currently available: STARS-Plan and the STARS Safety, Health and Equity Credit Tool.

There are three STARS manuals: STARS-Plan, STARS-Project and STARS for Safety, Health, and Equity. STARS-Plan and STARS-Project allow users to gain "credits" toward a rating in seven categories [NASTC, SCCRTC, and PBT, undated]:

- Integrated Process;
- Access and Mobility;
- Safety, Health, and Equity ;
- Climate and Energy;
- Ecological Function;
- Cost Effectiveness; and
- Economic Benefit.

STARS is an outcome-focused integrated planning framework for transportation plans and projects [NASTC, 2013]. Based on sustainability principles, STARS evaluates the impact of an investment over its full life. Since the use of a transportation project (e.g., the vehicles moving along it) often has more lasting consequences on a community than the construction phase, the decision of what to build is often more important than how it is constructed. This "upstream" approach to transportation projects distinguishes STARS from other rating systems that are centered on the design and construction phases.

Additionally, STARS is outcome-focused, encouraging users to set and achieve measurable objectives and targets [NASTC, 2013]. Rather than comply with a list of standards, STARS asks users to evaluate strategies to help them achieve economic, environmental and social outcomes – goals that have been set through an integrated process. Furthermore, STARS promotes improved "access" rather than simply mobility. That is, STARS encourages a mix of transportation and land use strategies to meet the needs of residents and businesses for access to goods, services,

information and places. This shift in focus enables users to conceive of solutions to transportation problems that might otherwise be overlooked with a traditional mobility focus.

- BE^{2}ST (Building Environmentally and Economically Sustainable Transportation)

BE^{2}ST-In-Highways is a sustainability rating system whose main focus is to quantify the sustainability impact of using recycled materials in pavements [Recycled Materials Resource Center, 2012]. BE^{2}ST was developed by the Recycled Materials Resource Center (RMRC) based at the College of Engineering at the University of Wisconsin. In scoring projects, the rating system utilizes Pavement Life-Cycle Assessment Tool for Environmental and Economic Effects PaLATE and the Life Cycle Cost Analysis (LCCA) RealCost software program. It also uses Mechanistic-Empirical Pavement Design Guide (MEPDG) to measure service life, Traffic Noise Model LookUp (TNM-Look) to assess traffic noise, and International Roughness Index (IRI) simulation to determine life of pavement. When implementing this rating system, project teams propose alternate design options to the reference design. Projects are evaluated based on nine sub-criterions: Greenhouse Gas Emission, Energy Use, Waste Reduction (including ex situ materials), Waste Reduction (recycling in situ materials), Water Consumption, Hazardous Waste, Life Cycle Cost, Traffic Noise, and Social Cost of Carbon Saving. Stakeholders have the option to assign weights to each sub-criterion based on their importance and potential to contribute to the project. Score percentages are presented in comparison to the reference design and prorated to an equivalent score in accordance with the weight for each sub-criterion. A percentage is calculated by dividing the actual score by maximum possible score according to the following levels: Bronze (50%), Silver (75%) and Gold (90%). The system is applicable to highway projects during the design phase, is entirely web-based, and offers third party verification as well as voluntary participation alternatives [Clevenger *et al*., 2013].

- GreenPave

The Ontario Ministry of Transportation (MTO) recently reinforced its commitment to sustainability by releasing a Sustainability Implementation Plan (SIP) that reflects the collective responsibility to optimize infrastructure design, capacity, and investment. In an effort to bring awareness of "green" initiatives to designers, the Ontario Ministry of Transportation (MTO) was inspired to create a user-friendly and quantifiable system to promote sustainable pavement technologies for the design, construction, rehabilitation, reconstruction, and preservation of pavements. This led to the development of a green pavement rating system for MTO known as GreenPave [Chan *et al*., 2013].

- I-LAST (Illinois Livable and Sustainable Transportation)

I-LAST was developed from a collaborative effort involving the Illinois Department of Transportation (IDOT), the American Consulting Engineers Council (ACEC), and the Illinois Road and Transportation Builders Association (IRTBA). The aim of I-LAST is to encourage sustainable practices in highway construction and to evaluate sustainability using simple methods. The system is voluntary, paper-based, applicable to highways and employs self-assessment. Participation is voluntary and the system consists of a guidebook that allows the project team to review criteria, select which ones are applicable, and score them. I-LAST can be used throughout the conceptual phase (Phase I: Planning), design (Phase II: Final Design) and during future construction (Phase III). Eight major categories exist under this rating system: Planning, Design,

Environmental, Water Quality, Transportation, Lighting, Materials, and Innovation. In combination, all categories have 153 sustainable criteria that fall into 17 broader criteria headings [IDOT and IJSG, 2010]. The system employs self-scoring using a hierarchy methodology where 1–3 points are awarded per criteria. There are no calculations, just a yes/no award by the self-evaluator. A maximum of 233 points can be gained across the 153 sustainable best practices [Clevenger *et al*., 2013].

- INVEST (Infrastructure Voluntary Evaluation Sustainability Tool)

INVEST was developed by the Federal Highway Administration (FHWA) with the help of CH2M Hill and launched in 2012 [FHWA, 2012b]. It was designed to be user friendly and uses a free, web-based interface. It is broken down according to the project phases: systems planning, project development, and operations and maintenance [FHWA, 2012a]. The system provides scorecards for Paving, Basic Rural, Basic Urban, Extended Rural, Extended Urban, and Custom [Clevenger *et al.*, 2013]. Criteria under the INVEST rating system are defined according to sustainable best practices. They fall under one of three headings: project delivery and system planning and processes (17 criteria), project development (20 or 29 criteria depending on whether basic or extended scorecard is used), and operations and maintenance (14 criteria). The criteria in project development are weighted based on their relative sustainable impact. Based on the answers provided, a project is awarded a score for each criterion and an overall score is tallied to rate the entire project. The project is awarded a Bronze, Silver, Gold and Platinum based on the overall score. Due to the lack of a third party evaluator, this award serves as unofficial recognition by the FHWA [FHWA, 2012a].

- Envision

Envision was developed by the Zofnass Program for Sustainable Infrastructure at the Harvard Graduate School of Design and the Institute for Sustainable Infrastructure (ISI). Envision can be used to rate infrastructure works associated with water storage and treatment, energy generation, landscaping, transportation, and information systems. The program encourages the use of life cycle analysis in planning, designing, construction and operation to improve sustainability performance. Design team and owners are recognized for their efforts to incorporate sustainable practices throughout infrastructure project life cycle. There are 60 credits possible distributed over five categories [ISI, 2012]: Quality of Life, Leadership, Resource Allocation, Natural World and Climate, and Risk. Quality of Life embodies social aspects of sustainability such as appropriateness of project, it's holistically effect on the community, and whether it improves the community's mobility or access to facilities. Envision is a two- stage assessment tool: Stage 1 is a Self-Assessment Checklist, and Stage 2 entails Third Party Verification and Public Recognition. Four Envision certifications exist: Acknowledgement of Merit, Silver Award (8% minimum in each category), Gold Award (15% minimum in each category) and Platinum Award (20% minimum in each category) [ISI, 2012; Clevenger *et al*., 2013].

The review revealed that many similarities exists between these systems. Specifically, each rating system evaluates items related to consumption and management of water, energy, and materials. Differences lie primarily in differences in process and implementation requirements, as well as how weights are assigned among rating criteria [Clevenger *et al*., 2013].

Comparison of Various Sustainability Rating Systems

The review revealed that many similarities exist between these systems. Specifically, each rating system evaluates consumption and management of water, energy, and materials. Differences lie primarily in process and implementation requirements, as well as how weights are assigned among rating criteria. Only Envision, GreenLITES, Greenroads, and INVEST are applicable to the construction phase; and only Envision, GreenLITES, and INVEST include operations and maintenance phases of a project. Envision is the only system applicable to many different type projects. The other rating systems are only applicable to highway projects.

Clevenger *et al*. [2013] note that the total points achievable for Envision, GreenLITES, Greenroads, I-LAST and INVEST are 708, 290,118, 233, and 576, respectively.

Neighborhood-Level Development Rating Systems:

- Star Communities

The STAR Communities framework, which integrates economic, environmental, and social aspects of sustainability, provides communities with a menu-based system to customize their approach based on local conditions and priorities. Communities can pursue the most important or relevant objectives, addressing regional variability and differing priorities along the way. The rating system is organized by goals, objectives, and evaluation measures; this design is intended to align with local government processes and standard practice. The structure features a set of components that reflect public sector mechanisms that are proven effective in advancing change.

STAR Communities provides a robust set of programs and services to meet diverse community needs. STAR Communities can be used as a standalone framework for local sustainability, and it is also a management tool and certification program. The STAR Community Rating System supports best practices that move the needle on community-level conditions and outcomes [STAR Communities, 2017a]. The Leading STAR Community indicators include 21 metrics based on the proven STAR Community Rating System. The indicators include: drinking water quality; safe wastewater management; housing and transportation costs; transportation mode split; transportation safety; climate adaptation and vulnerability assessment; greenhouse gas emissions; renewable electrical energy supply; total solid waste; 3rd grade reading proficiency; high school graduation rated and graduation rate equity; environmental justice and risk exposure; equity access and proximity to foundational community assets; businesses; employment; median household income; living wages; food security and assistance; access to healthful food; violent crime rate; and designated green infrastructure (including built environment climate, energy education, arts, community equity, empowerment economy, jobs, health, and safety natural systems) [STAR Communities, Sustainability Tools for Assessing and Rating Communities, 2017b,c].

Developed in partnership with the Urban Sustainability Directors Network, the Leading Indicators are organized into an online platform where U.S. cities and counties can annually report key sustainability metrics. Communities of all sizes and experience can use the Leading Indicators to benchmark annual performance and compare their progress with participating communities.

STAR Community certification allows communities to measure and baseline their sustainability performance against the national standards and benchmarks in the STAR Community Rating System. U.S cities and counties of all sizes and resource levels have achieved

certification under the rating system. There is no minimum or maximum community size for pursuing certification, however the city or county government must be the primary applicant. On average, the certification process takes a community a year from start to finish. Communities begin by aligning their existing programs, policies, and plans with the STAR Community Rating System using project management tools and resources provided by STAR. Then they gather data on the evaluation measures of their choice from the rating system and enter the data into STAR's online data entry and reporting platform. Because the rating system measures community-wide sustainability, data and information on programs will need to be provided by a variety of different governmental departments and agencies, as well as from community stakeholders and civic partners.

- One Planet Communities

One Planet Communities is a voluntary program, and it is not a certification program. One Planet Communities base their work around the following 10 principles of the One Planet Living framework [One Planet Communities: Greener Developments, 2015]:

- Health and Happiness: Encouraging active, sociable, meaningful lives to promote good health and well-being
- Equity and Local Economy: Creating bioregional economies that support equity and diverse local employment and international fair trade
- Culture and Community: Respecting and reviving local identity, wisdom and culture; encouraging the involvement of people in shaping their community and creating a new culture of sustainability
- Land Use and Wildlife: Protecting and restoring biodiversity and creating natural habitats through good land use
- Sustainable Water: Using water efficiently in buildings, farming, and manufacturing. Designing to avoid local issues such as flooding, drought, and water course pollution
- Local and Sustainable Food: Supporting sustainable and humane farming; promoting access to healthy, low-impact, local, seasonal, and organic diets; and reducing food waste
- Sustainable Materials: Using safe and sustainable products, including those with low embodied energy, sourced locally, made from renewable or waste resources
- Sustainable Transport: Reducing the need to travel, and encouraging low- and zero-carbon modes of transport to reduce emissions
- Zero Waste: Reducing waste, reusing where possible, and ultimately sending zero waste to landfill
- Zero Carbon: Making buildings energy efficient and delivering all energy with renewable technologies

- Enterprise Green Communities

The criteria's holistic approach to green building and development promotes [Enterprise Community Partners, 2017]:

- Better ways to plan neighborhoods and build homes;
- Resource conservation;

- Energy efficiency;
- Efficient operation of homes and entire buildings; and
- Healthy living environment.

- LEED-ND (Leadership in Energy and Environmental Design (LEED) for Neighborhood Development)

Leadership in Energy and Environmental Design (LEED) for Neighborhood Development (LEED-ND), is a United States-based rating system that integrates the principles of smart growth, new urbanism, and green buildings, into a national system for neighborhood design. It is a rating system used to create communities that are sustainable, smart and socially equitable [USGBC, 2017]. LEED certification provides independent, third-party verification that a development's location and design meet accepted high levels of environmentally responsible, sustainable development. LEED for Neighborhood Development prerequisites and credits are awarded in the following categories [USGBC, 2017; USGBC, NRDC, and CNU, 2011]: Smart Location and Linkage (where to build), Neighborhood Pattern and Design (what to build), and Green Infrastructure and Buildings (how to manage environmental impacts). Details regarding the prerequisites and credits as well as the maximum number of points that can be earned for each credit in this rating system, are provided in the document "LEED for Neighborhood Development Credits, Prerequisites and Points" [USGBC, 2017] and in the document entitled "A Citizen's Guide to LEED for Neighborhood Development: How to Tell if Development is Smart and Green" [USGBC, NRDC, and CNU, 2011].

LEED for Neighborhood Development (LEED-ND) was engineered to inspire and help create better, more sustainable, well-connected neighborhoods [USGBC, 2014]. It looks beyond the scale of buildings to consider entire communities. LEED-ND applies to neighborhoods and parts of neighborhoods. But a neighborhood is more than territory within a boundary drawn on a map. At best, it is a place with its own unique character and function, where people can live, work, shop, and interact with their neighbors. The most sustainable neighborhoods tend to exhibit high levels of walkability, a sense of place, social cohesion and stability, and neighborhood resiliency amidst changing economic and sociopolitical conditions [USGBC, NRDC, and CNU, 2011].

- Ecodistricts

An ecodistrict associates the terms "district" and "eco" to denote ecological. It designates an urban planning aiming to integrate objectives of "sustainable development" and reduce the ecological footprint of the project. This notion insists on the consideration of the whole environmental issues by attributing them ambitious levels of requirements.

Applying the principles of sustainability to existing cities, communities and neighborhoods will require transforming the urban fabric, one district at a time. Energy, water and waste systems all optimize at a scale bigger than a single building. Originated by the City of Portland and the Portland Sustainability Institute [POSI, 2017], the EcoDistricts term refers to a conceptual framework for planning, designing, implementing, and maintaining sustainable solutions at a district level. EcoDistricts applies to geographically defined areas, such as neighborhoods, institutional campuses, or employment districts within which flows of energy, water, nutrients, resources, information, financial capital, and cultural resources are localized, integrated, and synergized.

A city neighborhood or district can be seen as an urban ecology, made up of hardware systems (buildings, streets, sidewalks, parks and pipes) and software systems (flows of energy, people, food, resources, financial and social capital, services, and information) that function together as a whole system [Ecodistricts: Developing sustainable systems at scales that makes sense – SERA Architect, 2014]. Building on this notion, an EcoDistrict seeks to enhance this urban ecology, improving performance of both the hard and soft systems.

Another key finding is that different systems optimize at different scales As an example, stormwater collection and reuse systems might function best when shared by property owners within a several block radius of each other, or within a distinct watershed. Likewise, energy-efficient central-mechanical plants that provide thermal energy (heating and/or cooling) will more likely be most economical when scaled to serve a cluster of high-performing buildings rather than just one [Ecodistricts: Developing sustainable systems at scales that makes sense – SERA Architect, 2014]. The value of the EcoDistrict model is that it allows large-scale development to attain high performance through long-term investments, greatly reducing operation costs, resource consumption, and environmental impacts, over time at both the building and district scale.

At the heart of the EcoDistricts protocol are 6 priorities that include a set of 6 goals containing 22 objective categories that are used to scope and define a district's sustainability agenda [EcoDistricts Protocol Priorities for Sustainable Development, undated]. The six priorites include: place, prosperity, connectivity, living infrastructure, health and wellbeing, and resource restoration.

- Green Star Communities

The criteria are grouped into the following categories: integrative design; location and neighborhood fabric; site improvements; water conservation; energy efficiency; materials; healthy living environment; and operations, maintenance, and resident engagement.

Chapter 4: Discussion and Comparison of the Sustainability Ratings Systems

Table 1 provides a summary of transportation system and neighborhood-level development sustainability rating systems. The various sustainability rating systems were briefly described in the preceding section. To better understand the different rating systems, Tables 2 and 3 were developed to compare and contrast the criteria used in each of the rating systems. These tables consider both transportation and neighborhood-level development systems based on the same categories of criteria and identify similarities and differences among the criteria used for evaluating and quantifying the sustainability of a project, program, etc. Table 4 provides a summary of criteria used in sustainability rating systems (adapted from Brodie *et al*., 2013b). In these tables, the factors and criteria considered are indicated by areas that are shaded in color.

Table 1. Summary of Transportation System and Neighborhood-Level Development Sustainability Rating Systems.

Year	Rating System	Description	Application
Transportation Systems			
2007	**Greenroads:** Developed by the University of Washington and CH2MHILL.	Third-party rating system used across the country and abroad. Roadway design and construction projects that meet a set of required criteria are then scored on their sustainable attributes that surpass current standards.	Roadway design and construction
2008	**GreenLITES** Developed by NYSDOT and modeled on USGBC LEED and Greenroads.	Self-certification program used to integrate NYSDOT sustainability principles into choices for all projects and practices. Scoring is based on a set of criteria and certification levels are determined.	All projects and practices at the DOT level
2008	**STARS** Developed by the North American Sustainable Transportation Council based on LEED and Living Building Challenge.	Performance-based system with an emphasis on planning and development. The pilot scoring system evaluates the full life cycle of transportation projects using both required and additional credits.	Planning transportation projects and programming
2009	**Saga Sustainability Database** Developed by the Sustainable Aviation Guidance Alliance.	Comprehensive and searchable catelog of sustainability practices used by airports in an Excel and web database.	Airports
2010	**BE^{4}ST-in-Highways** Developed in part by the University of Wisconsin-Madison.	Software-supported methodology to quantify benefits of sustainable highway construction. Evaluates and rates life cycle performance of highway design and construction projects using mandatory screening.	Life cycle performance of highway design and construction projects
2010	**Greenpave** Developed by the Ontario Ministry of Transportation in Ontario, Canada.	Rating system used by contracters and consultants of the Ministry to promote sustainable pavement design and construction practices..	Pavement projects
2010	**I-LAST** Developed by Illinois DOT and state American Council of Engineering Companies and modeled on GreenLITES.	Performance metric system used to provide a relative rating of sustainable improvements for highway projects. An extensive collection of guidelines and specifications is used for a pre-project and post- project assessment of sustainability.	Highway projects
2012	**INVEST** Developed by the Federal Highway Administration.	Web-based tool to assist transportation agencies meet individual sustainability goals. Rates three phases of projects (i.e. planning, development, operations and maintenance) based on criteria developed.	Life cycle of tranportation projects
2012	**envISion** In development by Institute for Sustainable Infrastructure.	Self-assessment tool in development to advance improvements in performance and resilience of the wide range of physical infrastructure. Rating is determined by meeting a minimum number of points in each category.	All infrastructure projects
2012	**Green Guides for Roads** In development by the Transportation Association of Canada.	Self-evaluation tool intended to support decision-making based on sustainability objectives.	Roadway and highway projects
	DuboCalc Developed by Dutch Ministry of Infrastructure and Environment.	Quantifies sustainability over the lifecycle of a project so that environmental performance is used as design principle during the bid process of projects.	Transportation infrastructure projects
Neighborhood-Level Development			
2008	**STAR Community Index** Developed by Local Governments for Sustainability USA.	A framework to assess the triple bottom line of sustain-ability for communities through a rating system with online support tools.	Community development
2008	**One Planet Communities** Developed by BioRegional (UK).	Five-step process (including planning and review) to support solutions for sustainable living based on ten basic principles.	Neighborhood-scale development (design, construction, and management)
2008; Updated 2011	**Enterprise Green Communities** Developed by Enterprise Community Partners.	Certification system that guides the development of affordable housing with green practices and accounts for residents well-being.	Development of affordable housing
2009	**LEED-ND** Developed by USGBC LEED.	Evaluates sustainable development based on principles of smart growth, urbanism and sustainable construction using a credits system for certification.	Neighborhood-scale planning and development
2010	**EcoDistricts Initiative** Developed by the Portland Sustainability Institute.	Approach to creating sustainable neighborhoods by removing implementation barriers and establishing a focus on the social component of sustainability.	Neighborhood-scale with focus on engagement and governance
2012	**TOD Rating Systems** Development by Northeastern University and the CTOD.	Quantifies "high-quality" transit –oriented projects and neighborhoods to establish a basis for public sector support in TOD.	Transit-related projects and neighborhoods
2012	**Green Star Communities** Developed by the Green Building Council Australia.	Rating system that uses a framework of guiding principles to evaluate sustainability practices at all stages of development.	All stages of community development (e.g. policy making, implementation, monitoring)

This table considers both transportation and neighbor-hood-level development systems Various rating systems developed are listed in the table, including: Greenroads, GreenLITES, STARS, Saga Sustainability Database, Greenpave, One Planet Communities, Leadership in Energy & Environmental Design (LEED)-Neighborhood Development.

Table 2. Criteria Comparison Table for Transportation Rating Systems.

		Transportation							
	Criteria Categories	Greenroads	GreenLITES	STARS	BE^2ST	Green Pave	I-LAST	INVEST	EnvISIon
Environmental Sustainability	Water Conservation	■	■	■	■		■	■	■
	Energy Conservation	■	■	■	■	■	■	■	■
	Environmental/Ecosystem Protection	■	■	■			■	■	■
	Climate Change		■	■	■	■			■
	Waste and Materials Management	■	■	■	■	■		■	■
	Noise/Light Pollution	■	■		■	■	■	■	■
	Sustainable Land Use	■	■				■	■	■
Economic Sustainability	Innovation/ Design		■	■		■	■	■	■
	Operations and Maintenance	■		■				■	■
	Cost Effectiveness	■		■	■			■	■
	Affordability	■		■	■				■
	Economy/Jobs								
	Transportation Impact	■	■	■	■	■	■	■	■
Social Sustainability	Access	■						■	■
	Safety	■						■	
	Equity/Inclusion	■		■	■				■
	Health/Well-being								
	Culture/Place-making	■		■	■				■
	Food Sustainability								
	Indoor Environment								

This table addresses transportation rating systems in terms of environmental, economic, and social sustainability. Specific attention is noted for each of the criteria categories (water conservation through indoor environment).

Table 3. Criteria Comparison Table for Neighborhood-Level Development Rating Systems.

		Neighborhood Development					
	Criteria Categories	STAR Communities	OnePlanet Communities	Enterprise Green Communities	LEED-ND	Ecodistricts	Green Star Communities
Environmental Sustainability	Water Conservation	■	■	■	■	■	■
	Energy Conservation	■		■	■	■	■
	Environmental/Ecosystem Protection	■	■	■	■	■	■
	Climate Change	■	■		■		■
	Waste and Materials Management						
	Noise/Light Pollution	■	■			■	■
	Sustainable Land Use	■	■		■	■	■
Economic Sustainability	Innovation/ Design						
	Operations and Maintenance	■		■	■		■
	Cost Effectiveness						
	Affordability	■	■		■	■	■
	Economy/Jobs	■			■	■	■
	Transportation Impact						
Social Sustainability	Access	■		■	■	■	■
	Safety						
	Equity/Inclusion	■	■				■
	Health/Well-being	■	■		■	■	■
	Culture/Place-making	■	■		■		■
	Food Sustainability	■	■	■	■		■
	Indoor Environment	■		■			

This table addresses neighborhood-level development rating systems in terms of environmental, economic, and social sustainability. Specific attention is noted for each of the criteria categories (water conservation through indoor environment).

Table 4. Summary of Criteria in Sustainability Rating Systems [adapted from Brodie *et al*., 2013b].

This table provides a comparison of the various sustainability rating systems. None of the rating systems address all the factors (water conservation through food sustainability).

The various rating systems are listed at the top of the table and if the criteria within the system are related to the general categories, this is indicated with a shaded box. The general categories are also separated into one of three types of sustainability: environmental, economic, or social. The categories were assigned a type of sustainability that was applicable but it must be noted that some of the categories may fit into more than one of the three types of sustainability.

Additional information comparing the various sustainability rating systems related to this project are provided in several publications and conferences proceedings written by the project coauthors [Brodie *et al*., 2013a,b].

Chapter 5: Discussion of Sustainability Rating Systems

Sustainability rating systems are at various levels of development and implementation. Over time, they have built upon each other and incorporated components of prior systems. Although several transportation rating systems are well known and used in practice, many of the neighborhood-level systems are in the pilot stage. More recent systems in transportation are increasingly comprehensive and context sensitive.

Reviewing various rating systems revealed that sustainability is defined differently among them. The definition of sustainability ranges from "Reduce, Reuse, Recycle," to consideration for future generations, to balancing human and natural needs, to the "triple bottom line."

The review revealed that there is a heavy focus on environmental aspects of sustainability and often social and economic considerations are missing from transportation rating systems. Neighborhood-level development rating systems generally include social factors. All systems are based on industry best practices in sustainability. Systems award points based on some minimum set of criteria that is influenced by best practices. Criteria vary among systems; however, there is some overlap. This comparison is depicted graphically in Tables 2 and 3. For example, all but one of the systems have criteria related to energy conservation.

Although, the rating processes of all the systems are based on the criteria derived from best practices, the process of rating projects and programs varies. Several systems, including Greenroads, require select criteria to be met for each level of certification or for certification in general. The classification for certification levels is also derived differently across systems. The differences in the systems make some more or less applicable in different contexts. Tables 2 and 3 can be useful in identifying which types of criteria are evaluated in each system and help an agency, company, etc., in determining which system would be most applicable based on their sustainability goals.

The review also showed that rating systems take two different approaches to evaluating improvements: Project-based or Systems-based. Transportation systems typically had a focus on projects. Systems designed for rating road construction were very project-based; however, some transportation rating systems did incorporate land use considerations. Generally, neighborhood development systems have a holistic approach, evaluating sustainability at a systems level and including transportation components. For example, a project may be rated very high on many criteria but low in environmental protection and still receive a gold rating. If this project is in the vicinity of a wetland and vulnerable species, is it still deserving of a gold rating? These complications are not necessarily accounted in the rating systems.

Chapter 6: Summary and Conclusions

Reviewing the range of rating systems reveals some of the comparisons discussed in the previous section. Specifically, these differences and similarities are highlighted in Tables 2 and 3. As mentioned previously, most systems focus on environmental impacts such as water and energy conservation, climate change, and other ecological concerns. The two categories of rating systems, transportation and neighborhood-level development, do however, have some clear differences. For instance, Food Sustainability and Health/Well-being are not included in any of the transportation-based systems.

Additional areas of human impacts that may be considered social sustainability are also absent in many transportation rating systems. Equity/Inclusion was included in several systems with a focus on inclusionary participation and criteria relating to Economy/Jobs was not included in any of the transportation systems. Still, where some of the transportation systems focus, the neighborhood-level development systems tend to overlook. Areas like, waste management and cost-effectiveness are not clearly accounted for in any of the neighborhood-level systems. Innovation and design is another area missing in the neighborhood-level systems. Transportation systems include this area to encourage and spur creative solutions to sustainability issues.

The lack of it (innovative solutions) at the neighborhood development level is curious as one would see value in encouraging innovative solutions, especially within the development community. The area of *safety* was only included in two of the transportation systems and in none of the neighborhood-level systems. An area where the two types of systems overlap but do not necessarily cover are Sustainable Land Use and Transportation Impact. The land use transportation interaction is commonly accepted; however, in these rating systems, it is not commonly included. While most systems have some measure of sustainable land use, neighborhood-level systems do not incorporate the area of Transportation Impact. Most do have criteria in the area of Access but do not explicitly focus on Transportation Impact.

Various criteria were used in the transportation and neighborhood-level rating systems. Criteria used involve:

<u>Environmental sustainability</u>:
- Water conservation;
- Energy conservation;
- Environmental/ecosystem protection;
- Climate change;
- Waste and materials management;
- Noise/light pollution; and
- Sustainable land use.

<u>Economic sustainability</u>:
- Innovation/design
- Operations and maintenance;
- Cost effectiveness;
- Affordability;
- Economy/jobs; and
- Transportation impact.

<u>Social sustainability</u>:

- Access;
- Safety;
- Equity/inclusion;
- Health/well-being;
- Culture/place-making;
- Food sustainability; and
- Indoor environment.

These criteria were addressed to some degree in the transportation and neighborhood development rating systems. No single rating system addressed all of the various criteria listed above.

In conclusion, there is a range of rating systems that can be applied to transportation and neighborhood development projects. These systems all are used to quantify or provide a measure of sustainability for the finished project; however, this is done in a variety of different ways accounting for a variety of criteria. Some systems are specific to certain types of projects while others are more comprehensive. All the systems, however, are based on best practices in sustainability. Because of their differences, but also because of their fundamental similarities, one might conclude that these systems are most useful for identifying, streamlining, simplifying and enabling sustainable practices and not only in rating and evaluating the sustainability of projects.

Results from the Workshop

A workshop was presented on the UAB campus on March 24th in the Business and Engineering Complex. A copy of the workshop agenda is provided in Appendix B. Appendix C contains a listing of the workshop participants. A total of 23 people attended the workshop. The workshop can be accessed through the STRIDE website.

A post-workshop survey was distributed toward the conclusion of the workshop for the workshop participants to complete. A copy of the post-workshop survey is provided in Appendix D. A summary of the feedback provided by the workshop participants on the essay-type questions is provided in Table 5. The feedback provided in the post-workshop survey is provided in Appendix E.

Table 5. Comments Provided on Post-Workshop Survey.

Question 6: Based on what you have learned in this presentation, what were your highlights?
• "The 'grading system' is very in depth but necessary and there is more to sustainability than meets the eye"; • "LEED as it relates to public transit"; • "The collaboration efforts and grant funding used to open the minds of students and professionals to sustainability"; • "There are various inconsistent rating systems for sustainability"; • "Understanding definitions of sustainable programs"; • Extensiveness of rating systems"; • "Learning what exactly it takes for a building to be certified as environmentally friendly"; • The in-depth description of LEED Neighborhood Development";

- "I never realized how much more went into efficiency/sustainability. This presentation showed just how in-depth one can go into this topic";
- LEED program; Smart Location Linkage; Planet Community"; and
- "I found the idea behind the sustainability class amd I truly consider taking it if it were offered".

Question 7: Was the presentation better, worse, or about what you expected?

- "Better";
- "About what I expected";
- "This presentation was better than expected; the handouts and jump drives are great for reviewing";
- "Worse. Design was in the title of the flyer, but not covered";
- "Better";
- "Better";
- "About what I expected";
- "No prior expectation";
- "It was good";
- "Better than what I was expecting";
- "Better";
- "About what I expected";
- "There were a lot on the PowerPoint slides"; and
- "Much better".

Question 8: What did you learn?

- "How sustainability is rated and the framework for it";
- "I learned how important public transit's role is to sustainability";
- "Lots";
- "I learned about sustainability rating systems and applications";
- "Different evaluation programs for sustainability";
- "Sustainability is closer to reality than I thought";
- "Learning what exactly it takes for a building to be certified as environmentally friendly";
- I learned about the various sustainability rating systems";
- "A lot";
- "The many different rating systems and how/why points are awarded";
- "Various rating systems to determine sustainability";
- "Vital information about the LEED program"; and
- "I found out more information about sustainability".

Information obtained from the post-workshop surveys are described below. Table 6 indicates the organizations represented that attended the workshop.

Table 6. Organizations Participating in the Sustainability Ratings Systems Workshop.

Organization	Number Attending	% of Total Respondents
City of Birmingham	4	17.391
City of Alabaster	1	4.348
University of Alabama at Birmingham	3	13.043
University of Alabama at Birmingham	12	52.174
Birmingham-Jefferson County Transit Authority (BJCTA)	3	13.043
Total Respondents	23	100

The percentage organizational attendance at the workshop is provided in pie-chart format in the following figure. Approximately 65% of the workshop participants were from academia (UAB), and about 35% were city governments.

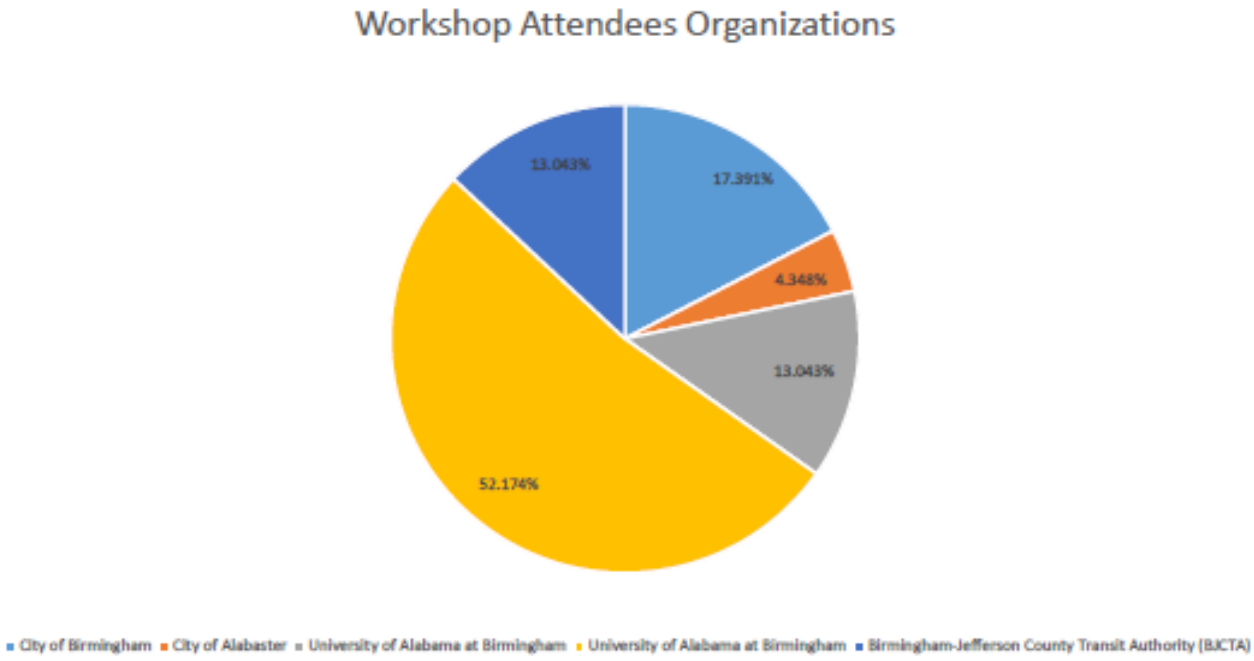

Figure 3. Percentage Organizational Attendance at the Workshop.

Table 7 indicates the job titles of people who attended the workshop.

Table 7. People Participating in the Sustainability Ratings Systems Workshop, Classified by Job Title.

Job Title	% of Total Respondents
capital projects/urban designer/historic preservation manager/ senior planner	17.391
city engineer	4.348
faculty	13.043
students	52.174
city planner/contract administrator	13.043
Total Respondents	100

The percentage people attending the workshop (classified by job title) is provided in pie-chart format in the following figure. Approximately 65% of the workshop participants were from academia (faculty and students), and about 35% were city government employees.

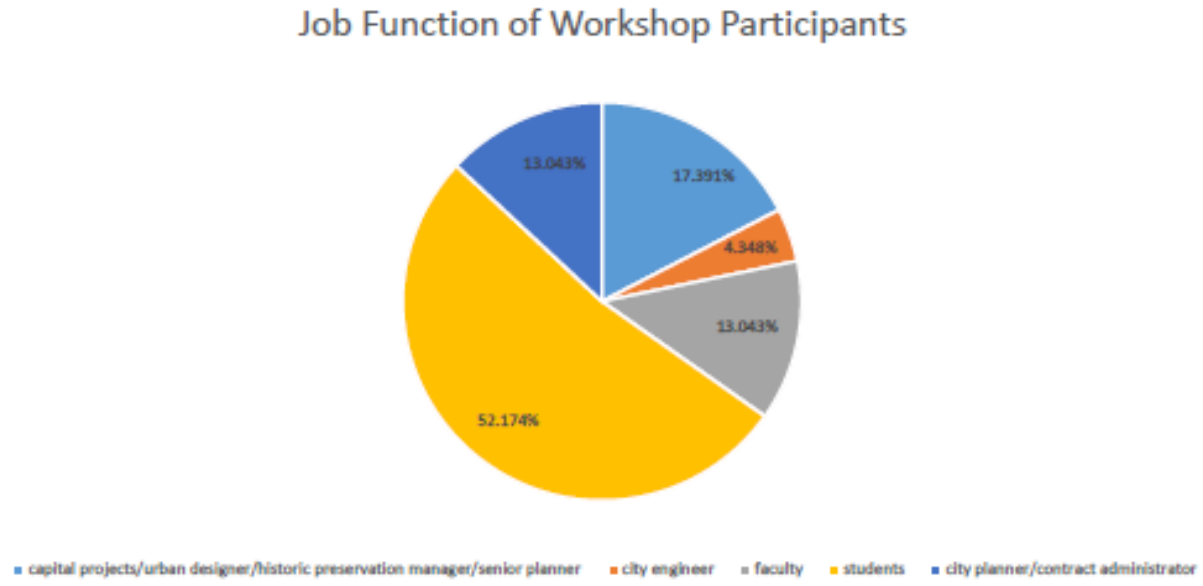

Figure 4. Percentage of People Attending the Workshop, Classified by Job Title.

Feedback provided by the workshop attendees to the post-workshop survey is summarized below.

Table 8. Feedback Provided by Workshop Participants to Post-Workshop Survey.

Question Respondent Rating (1 to 5):	1a	1b	1c	1d	2	3a	3b	3c	3d	3e	4	5	9	10
No.1	4	4	5	5	5	5	5	5	5	5	5	4	5	4
No.2	4	4	5	5	5	3	5	5	5	3	4	4	4	4
No.3	5	5	5	5	5	N/A	5	N/A	5	N/A	5	5	5	5
No.4	5	5	5	5	4	5	5	5	5	5	5	5	4	5
No.5	3	1	3	1	2	N/A	1	N/A	2	N/A	1	1	1	1
No.6	5	5	5	5	4	N/A	4	4	4	4	4	5	4	4
No.7	4	4	5	5	4	2	2	2	5	4	3	4	4	4
No.8	5	3	5	2	4	4	3	3	4	3	4	5	3	4
No.9	5	5	5	5	5	5	4	N/A	5	N/A	4	4	5	4
No.10	5	5	5	5	5	4					5	5	5	5
No.11	4	4	4	4	5	5			5		4	4	5	5
No.12	5	4	4	4	4	3	2	4	4	3	5	5	3	5
No.13	5	5	5	5	4	5			4		4	5	4	5
No.14	5	5	5	5	4	3	2	3	5	4	3	4	3	4
No.15	5	3	5	5	3		5				4	4	4	4
No.16	5	5	5	5	5	5	5	5	4	3	5	5	5	4
No.17	5	3	4	3	3	4	3	3	5		4	3	4	5
Sum	79	70	80	74	71	53	51	39	67	34	69	72	68	72
Mean	4.647	4.118	4.706	4.353	4.176	4.077	3.643	3.900	4.467	3.778	4.059	4.235	4.000	4.235
Median	5	4	5	5	4	4	4	4	5	4	4	4	4	4
Mode	5	5	5	5	5	5	5	5	5	3	4	5	4	4
Variance	0.368	1.235	0.346	1.493	0.779	1.077	2.093	1.211	0.695	0.694	1.059	1.066	1.125	0.941
Standard Deviation	0.606	1.111	0.588	1.222	0.883	1.038	1.447	1.101	0.834	0.833	1.029	1.033	1.061	0.970

Table Notes:
High Values:
Low Values:

As indicated in Table 8 above, the workshop attendees were quite pleased with the material presented in the workshop and the presentation itself; the median response was generally either a "4" or a "5".

Seminar Presentations

Seminar presentations were given at the University of Florida (in conjunction with STRIDE) on June 2nd, and at the Savannah River National Laboratory (SRNL) on May 11th. The announcements for these two seminars is provided in Appendices F and G. The seminar presented at the University of Florida can be accessed through the STRIDE website. The seminars presented highlights from the workshop.

Chapter 7: Recommendations, Suggested Research, and Benefits of the Research

Sustainability rating systems are at various levels of development and implementation. A workshop on sustainability rating systems was presented on the UAB campus. Seminar presentations were given at the University of Florida (in conjunction with STRIDE) and at the Savannah River National Laboratory (SRNL).

There is a range of rating systems that can be applied to transportation and neighborhood development projects. These systems all are used to quantify or provide a measure of sustainability for the finished project; however, this is done in a variety of different ways accounting for a variety of criteria. Some systems are specific to certain types of projects while others are more comprehensive. All the systems, however, are based on best practices in sustainability. Because of their differences, but also because of their fundamental similarities, one might conclude that these systems are most useful for identifying, streamlining, simplifying and enabling sustainable practices and not only in rating and evaluating the sustainability of projects. Criteria were addressed to some degree in the transportation and neighborhood development rating systems. No single rating system addressed all of the various criteria listed above.

Several research and implementation recommendations are put forth to further facilitate using sustainability rating systems. These recommendations are briefly addressed below:

1. Although several publications have addressed use of several sustainability rating systems [Clevenger *et al*., 2013; Samberg *et al*., 2011; Litman and Burwell, 2006; etc.], the various sustainability rating systems need to be critically compared and contrasted, to identify the pros and cons of each rating system.
2. Additional workshops, seminars, and webinars should be presented to state Department of Transportations (DOTs), municipal/regional planning commissions, city government officials, to better integration of sustainability practices in planning operations.

The workshop and seminar highlighted the results of the course development addressing "Sustainability Design and Rating Systems"; the results of the pre- and post-workshop surveys were used to address perceptions associated with sustainability rating systems. Potential benefits of this technology transfer project involve better familiarizing the transportation officials and the general public with various transportation- and environmental-related aspects of sustainability rating systems.

References Cited:

American Society of Civil Engineers (ASCE), 2009. Policy Statement 418 – "The Role of the Civil Engineer in Sustainable Development"; Available at: http://www.asce.org/issues-and-advocacy/public-policy/public-policy-statement-418-the-role-of-the-civilo-engineer-insustainable-development/.

Brodie, S., A. Ingles, Z. Colville, A. Amekudzi, R.W. Peters, and V. Sisiopiku, 2013a. "Review of Sustainability Rating Systems for Transportation and Neighborhood-Level Developments", pp.337–354 in ***Green Streets, Highways and Development 2013: Advancing the Practice***; A.A. Amekudzi, S.L. Otto, D.J. Carlson, and M.A. Bomar, Editors, ASCE Transportation & Development Institute (T&DI) Conference, American Society of Civil Engineers, New York, NY; Paper presented at the ASCE T&DI Conference, Austin, Texas, (November 3–6).

Brodie, S., A. Ingles, Z. Colville, A. Amekudzi, R.W. Peters, and V. Sisiopiku, 2013b. "Sustainability Evaluation of Transportation Systems and Neighborhood-Level Developments", Poster presented at the STRIDE Student Poster Competition at the 92nd Annual Meeting of the Transportation Research Board (TRB) conference, held in Washington, D.C., (January 13–17).

Center for Environmental Excellence by AASHTO Transportation and Sustainability Peer Exchange, 2009. 'Transportation and Sustainability Best Practices Background", Sustainability Peer Exchange – Center for Environmental Excellence by American Society of State Highway and Transportation Officials (AASHTO), (May 27–29).

CH2M HILL and Good Company. 2009. ***Transportation and Sustainability Best Practices Background***. Presented at AASHTO Transportation and Sustainability Peer Exchange, May 27-29, 2009. Available at: http://environment.transportation.org/pdf/sustainability_peer_exchange/AASHTO_SustPeerExh_BriefingPaper.pdf.

Chan, S., B. Bennett, and T. Kazmierowski, 2013. "Implementation of Ontario's Pavement Sustainability Rating System – GreenPave", ***Proc. 2013 Airfield & Highway Pavement Conference***, Los Angeles, California, (June 9–12). Available at: https://doi.org/10.1061/9780784413005.0.

Clevenger, C.M., M.E. Ozbek, and S. Simpson, 2013. "Review of Sustainability Rating Systems Used for Infrastructure Projects", ***Proc. 49th ASC (Associated Schools of Construction) Annual Internat. Conf.***, San Luis Obispo, CA, (June).

Cruz, A.M., 2013. "Educational Technology for Teaching and Learning", ***Cuadernos de Educación y Desarrollo***, Available at: http://atlante.eumed.net.

Delgado, R., 2016. "What's the ROI Value of Webinars?", ***Latest B2B News***, (January 8).

Douglas, E.M., P.H. Kirshen, M. Paolisso, C. Watson, J. Wiggin, A. Enrici, and M. Ruth, 2012. "Coastal Flooding, Climate Change and Environmental Justice: Identifying Obstacles and Incentives for Adaptation in Two Metropolitan Boston Massachusetts Communities", ***Mitig. Adapt. Strateg. Glob. Change***, ***17***: 537–562, doi: 10.1007/s11027-011-9340-8.

Ecodistricts: Developing Sustainable Systems at Sales that Makes Sense – SERA Architect, 2014. "Ecodistricts: Developing Sustainable Systems at Scales that Makes Sense", Available at: http://seradesign.com/2014/03/ecodistricts-developing-sustainable-systems-at-scales-that-makes-sense.

EcoDistricts Protocol Priorities for Sustainable Development, undated. "At the Heart of the EcoDistricts Protocol Are 6 Priorities", Available at: https://ecodistricts.org/get-started/the-ecodistricts-protocol/priorities/

Eikelboom, B.T., and R. Janssen, 2013. "Interactive Spatial Tools for the Design of Regional Adaptation Strategies", ***J. Environ. Manage.***, ***127***: 56–59, S10–S14.

Enterprise Community Partners, 2017. "Green Communities", Available at: http://www.enterprisecommunity.org/solutions-and-innovation/green-communities.

Federal Highway Association (FHWA), 2012a. "Infrastructure Voluntary Evaluation Sustainability Tool (INVEST)", (WWW document). URL https://www.sustainablehighways.org/1/home.html.

Federal Highway Association (FHWA), 2012b. "Infrastructure Voluntary Evaluation Sustainability Tool (INVEST)"; Webcast Launch (WWW document). URL: http://mp125118.cdn.mediaplatform.com/125118/wc/mp/4000/5592/5599/18858/Archive/default.htm?ivt= %7B6d0eccff-4ff1-bba1-c102-d80de1a4a7f5%7D.

Forrest, C.J., 2012. "Environmental Public Involvement and Outreach: Tools and Commentary", ***Environ. Qual. Manage.***, 1–19, doi: 10.1002/tqem.21313.

Greenroads, 2011. "Greenroads Abridged Manual v1.5, (WWW document). URL http://www.greenroads.org/366/download-the-manual.html.

Illinois Department of Transportation (IDOT), and Illinois Joint Sustainability Group (IJSG), 2010. "I-Last – Illinois Livable and Sustainable Transportation Rating System and Guide", (WWW document). URL http://www.dot.state.il.us/green/documents/I-LASTGuidebook.pdf.

Institute for Sustainable infrastructure (ISI), 2012. "Institute for Sustainable Infrastructure: Envision Rating System", Available at: http://www.sustainableinfrastructure.org/index.cfm.

Litman, T., and D. Burwell, 2006. "Issues in Sustainable Transportation", ***J. Global Environ. Issues***, ***6*** (4): 331–347. Available at: https://pdfs.semanticscholar.org/e0f8/24d0e3de6cf819387921a154e0e27740d0d5.pdf

Mapes, J., and J. Wolch, 2010. 'Living Green': The Promise and Pitfalls of New Sustainable Communities, ***J. Urban Design***, ***16*** (1): 105–126.

Mihai, A., 2014. "The Virtual Classroom: Teaching European Studies through Webinars", ***European Political Science***, ***13***: 4–11, doi: 10.1057/eps.2013.31.

New York State Department of Transportation (NYSDOT), 2012. "New York State Department of Transportation", (WWW document). URL https://www.dot.ny.gov/programs/greenlites.

North American Sustainable Transportation Council (NASTC), Santa Cruz County Regional Transportation Commission (SCCRTC), and the City of Portland Bureau of Transportation (PBT), undated. "STARS (Sustainable Transportation Analysis and Rating System)". Available at: http://transportationcouncil.org/wp-content/.../STARS-Fact-Sheet-3-Logos-ph-gd-kr.pdf

North American Sustainable Transportation Council (NASTC), 2013. "Sustainable Transportation Analysis and Rating System (STARS): Pilot Project Application Manual Version 1.2", (May). Available at: http://transportationcouncil.org/wp-content/uploads/.../STARS-Project-1.2-Introduction.pdf.

One Planet Communities: Greener Developments, 2015. "One Planet Communities: Greener Developments — The Green Spotlight"; Available at: http://www.thegreenspotlight.com/2015/07/one-planet-communities/

Opdam, P., 2007. "Learning Science from Practice", ***Landscape Ecology***, ***25***: 821–823.

Peters, R.W., V.P. Sisiopiku, and A. Amekudzi-Kennedy, 2015. STRIDE Final Report: "Development of Educational and professional Training Modules on Green/Sustainability Design and Rating Systems for Neighborhood Development and Transportation", Final report submitted to the Southeastern Transportation Research, Innovation, Development and Education Center, Gainesville, Florida, (June).

Portland + Oregon Sustainability Institute (POSI), 2017. "Sustainable Communities online for a More Sustainable Future"; Available at: http://www.sustainable.org/creating-community/building-partnerships/108-portland--oregon-sustainability-institute.

Ramadan, O.E., V.P. Sisiopiku, and R.W. Peters, 2014. "Sustainability Design and Rating Systems for Transportation: A Synthesis of Practice", Poster Presented at the Transportation Research Board (TRB) Annual Meeting, Washington, D.C.

Recycled Materials Resource Center, 2012. "BE^{2}ST-in-HighwaysTM (Building Environmentally and Economically Sustainable Transportation-Infrastructure-Highways)", University of Wisconsin, Madison, WI.

Report of the World Commission on Environment and Development, 1986. **"**Our Common Future, Chapter 2: Towards Sustainable Development", ***Development and International Co-operation*: *Environment***, Official Records of the General Assembly, Forty-second Session, Supplement No. 25, (A/42/25).

Salmon, G., 2000. ***E-Moderating*: *The Key to Teaching and Learning Online***, Kogan Page, London, United Kingdom.

Samberg, S., A. Bassok, and S. Holman, 2011. "Method for Evaluation of Sustainable Transportation", ***Transportation Research Record*: *Journal of the Transportation Research Board***, ***2242*** (1): 1–8.

Sisiopiku, V., R.W. Peters, and O.E. Ramadan, 2015. "Introducing Sustainability into the Civil Engineering Curriculum", ***Proc.* 112th *ASEE Annual Conference and Exposition***, Paper No.14100, American Society of Engineering Education, Seattle, WA, (June 14–17).

STAR Communities Rating Systems, 2017a; Process and Timeline, Available at: http://www.starcommunities.org/certification/process -timeline/.

STAR Communities, Sustainability Tools for Assessing and Rating Communities, 2017b. STAR Communities – Set Goals, Measure Progress, Improve Your Community, Available at: http://www.starcommunities.org.

STAR Communities, Sustainability Tools for Assessing and Rating Communities, 2017c. "STAR Community Rating System, Version 2.0", Available at: www.starcommunities.org/get-started/download/.

U.S. Green Building Council (USGBC), Natural Resources Defense Council (NRDC), and the Congress for the New Urbanism (CNU), 2011. "A Citizen's Guide to LEED for Neighborhood Development: How to Tell if Development is Smart and Green", (May). Available at: https://www.nrdc.org/sites/default/files/citizens_guide_LEED-ND.pdf.

U.S. Green Building Council (USGBC), 2014. "Getting to know LEED: Neighborhood Development", (January). Available at: http://www.usgbc.org/articles/getting-know-leed-neighborhood-development.

U.S. Green Building Council (USGBC), 2017. "LEED for Neighborhood Development Credits, Prerequisites and Points", (April). Available at: http://www.usgbc.org/articles/leed-nd-credits-and-points.

Wang, N., Y.-C. Chang, and C. Nunn, 2010. "Lifecycle Assessment for Sustainable Design Options of a Commercial Building in Shanghai", ***Building and Environment*, *45***: 1415–1421, doi: 10.1016/j.buildenv.2009.12.004.

Appendix A. Materials Related to Project on the STRIDE website.

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

People | Research | Education | Workforce Development

Educational Training Modules on Green/Sustainability Design & Ratings System for Neighborhood Development & Transportation (STRIDE Project # 2012-095S)

Dr. Robert W. Peters and Dr. Virginia P. Sisiopiku of the University of Alabama at Birmingham and Ph.D. student Ossama Ramadan have developed Sustainability Design and Rating Systems course modules for undergraduate and graduate students. Dr. Adjo Amekudzi of Georgia Tech contributed to the effort. The development of these modules were made possible thanks to a grant from the STRIDE Center. This course is protected by the U.S. Copyright Law.

COURSE MATERIALS

- Syllabus [download]
- Guest Lecturer on Urban and Landscape Hydrology [download]
- Guest Lecturer on Sustainablility [download]
- Class Project [download]

MODULES	HOMEWORK
1 – Introduction to Sustainability [download]	No. 1 [download]
2 – Sustainable Transportation [download]	No. 2 [download]
3 – Liveable Streets [download]	No. 3 [download]
4 – Transportation Planning for Sustainability [download]	No. 4 [download]
5 – Site Design for Sustainable Transportation [download]	No. 5 [download]
6a – Sustainability Rating Systems (FHWA INVEST) Part I [download]	No. 6 [download]
6b – Sustainability Rating Systems (FHWA INVEST) Part II	No. 7 [download]

[download]

7 – Sustainability Rating Systems (LEED ND Introduction) [download]

8 – Sustainability Rating Systems for Neighborhoods (LEED ND SLL) [download]

9 – Sustainability Rating Systems for Neighborhoods (LEED ND NPD) [download]

10 – Liveable, Sustainable, Smart Cities [download]

11 – Megacities [download]

12 – Brownfield Redevelopment [download]

13 – Greyfield Redevelopment [download]

14 – Sustainable Design and Rating Systems (Overview) [download]

15 – Review of Sustainability Rating Systems [download]

ASSESSMENT

To request quizes and exams for this course, contact Dr. Rober Peters or Dr. Virginia Sisiopiku or the STRIDE Research Coordinator at iaviles@ce.ufl.edu.

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Appendix B. Sustainability Design and Rating Systems Workshop Agenda.

STRIDE Southeastern Transportation Research, Innovation, Development and Education Center

UAB SUSTAINABLE SMART CITIES RESEARCH CENTER
Knowledge that will change your world

Sustainability Design and Rating Systems Workshop
March 24, 2017

Agenda

1. Check-in/Registration
2. Introduction/welcome
3. Project goals, objectives, and tasks
4. Project introduction/overview
5. Sustainability discussion
6. Project methodology
7. Break/refreshments
8. Project/Course objectives
9. Course development and implementation
10. Course modules
11. Sustainability rating systems [Greenroads, Infrastructure Voluntary Evaluation Sustainability Tool (INVEST), Ecodistricts, One Planet Communities, LEED-Neighborhood Development]
12. Discussion and Concluding Remarks
13. Questions and Answers (Q&A)
14. Adjournment

Appendix C. Attendees/Participants at the Sustainability Design and Rating Systems Workshop.

Attendees/Participants removed for privacy reasons.

Attendees/Participants removed for privacy reasons.

Appendix D. Sustainability Design and Rating Systems Post-Workshop Survey.

UNIVERSITY OF ALABAMA AT BIRMINGHAM

SUSTAINABILIITY RATING SYSTEMS PRESENTATION EXIT SURVEY EVALUATION FORM

MARCH 24, 2017

1. Educational/Learning Objective(s): Please rate your educational satisfaction with the overall presentation based on the following scoring system:

   1= Ineffective 5= Very Effective

   A. This presentation increased my knowledge of sustainability rating systems

   1 2 3 4 5

   B. This presentation enhanced my knowledge of overall sustainability

   1 2 3 4 5

   C. This presentation provided key points on sustainability rating systems

   1 2 3 4 5

   D. This presentation has increased my awareness of sustainability practices

   1 2 3 4 5

2. How did this presentation meet your above educational/learning objectives?

   Minimally 1 2 3 4 5 Completely

3. Was the presented information relevant to your needs (Circle One)

Academic	N/A	Limited	1	2	3	4	5	Very Beneficial
Professional	N/A	Limited	1	2	3	4	5	Very Beneficial
Research	N/A	Limited	1	2	3	4	5	Very Beneficial
General Knowledge	N/A	Limited	1	2	3	4	5	Very Beneficial
Other	N/A	Limited	1	2	3	4	5	Very Beneficial

4. To what degree was the appropriateness of the presentation to your needs?

   Poor 1 2 3 4 5 Excellent

5. What is your overall evaluation of this presentation?

   Poor 1 2 3 4 5 Excellent

6. Based on what you have learned in this presentation, what were your highlights?

7. Was the presentation better, worst or about what you expected?

8. What did you learn?

9. How useful did you find the information presented?

   Minimally 1 2 3 4 5 Completely

10. Overall, how satisfied were you with the presentation?

    Minimally 1 2 3 4 5 Completely

We appreciate your valuable time and participation in this presentation. Thank You!

Appendix E. Feedback Provided in the Post-Workshop Survey.

UNIVERSITY OF ALABAMA AT BIRMINGHAM

SUSTAINABILIITY RATING SYSTEMS PRESENTATION EXIT SURVEY EVALUATION FORM

MARCH 24, 2017

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   1= Ineffective 5= Very Effective

   A. This presentation increased my knowledge of sustainability rating systems
   1 2 3 (4) 5

   B. This presentation enhanced my knowledge of overall sustainability
   1 2 3 (4) 5

   C. This presentation provided key points on sustainability rating systems
   1 2 3 4 (5)

   D. This presentation has increased my awareness of sustainability practices
   1 2 3 4 (5)

2. How did this presentation meet your above educational/learning objectives?
   Minimally 1 2 3 4 (5) Completely

3. Was the presented information relevant to your needs (Circle One)

Academic	N/A	Limited	1	2	3	4	(5)	Very Beneficial
Professional	N/A	Limited	1	2	3	4	(5)	Very Beneficial
Research	N/A	Limited	1	2	3	4	(5)	Very Beneficial
General Knowledge	N/A	Limited	1	2	3	4	(5)	Very Beneficial
Other	N/A	Limited	1	2	3	4	(5)	Very Beneficial

4. To what degree was the appropriateness of the presentation to your needs?
   Poor 1 2 3 4 (5) Excellent

5. What is your overall evaluation of this presentation?
   Poor 1 2 3 (4) 5 Excellent

6. Based on what you have learned in this presentation, what were your highlights?
   the "grading system" is very in depth but necessary and there is more to sustainability than meets the eye

7. Was the presentation better, worst or about what you expected?
   better

8. What did you learn?
   how sustainability is rated & the framework for it

9. How useful did you find the information presented?
   Minimally 1 2 3 4 (5) Completely

10. Overall, how satisfied were you with the presentation?
    Minimally 1 2 3 (4) 5 Completely

We appreciate your valuable time and participation in this presentation. Thank You!

UNIVERSITY OF ALABAMA AT BIRMINGHAM

SUSTAINABILIITY RATING SYSTEMS PRESENTATION EXIT SURVEY EVALUATION FORM

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   A. This presentation increased my knowledge of sustainability rating systems
   1 2 3 (4) 5

   B. This presentation enhanced my knowledge of overall sustainability
   1 2 3 (4) 5

   C. This presentation provided key points on sustainability rating systems
   1 2 3 4 (5)

   D. This presentation has increased my awareness of sustainability practices
   1 2 3 4 (5)

2. How did this presentation meet your above educational/learning objectives?
   Minimally 1 2 3 4 (5) Completely

3. Was the presented information relevant to your needs (Circle One)

Academic	N/A	Limited	1	2	(3)	4	5	Very Beneficial
Professional	N/A	Limited	1	2	3	4	(5)	Very Beneficial
Research	N/A	Limited	1	2	3	4	(5)	Very Beneficial
General Knowledge	N/A	Limited	1	2	3	4	(5)	Very Beneficial
Other	N/A	Limited	1	2	(3)	4	5	Very Beneficial

4. To what degree was the appropriateness of the presentation to your needs?
   Poor 1 2 3 (4) 5 Excellent

5. What is your overall evaluation of this presentation?
   Poor 1 2 3 (4) 5 Excellent

6. Based on what you have learned in this presentation, what were your highlights?

7. Was the presentation better, worst or about what you expected?

8. What did you learn? I learned how important public transit's role is to sustainability

9. How useful did you find the information presented?
   Minimally 1 2 3 (4) 5 Completely

10. Overall, how satisfied were you with the presentation?
    Minimally 1 2 3 (4) 5 Completely

We appreciate your valuable time and participation in this presentation. Thank You!

UNIVERSITY OF ALABAMA AT BIRMINGHAM

SUSTAINABILIITY RATING SYSTEMS PRESENTATION EXIT SURVEY EVALUATION FORM

MARCH 24, 2017

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   1= Ineffective 5= Very Effective

   A. This presentation increased my knowledge of sustainability rating systems
   1 2 3 4 (5)

   B. This presentation enhanced my knowledge of overall sustainability
   1 2 3 4 (5)

   C. This presentation provided key points on sustainability rating systems
   1 2 3 4 (5)

   D. This presentation has increased my awareness of sustainability practices
   1 2 3 4 (5)

2. How did this presentation meet your above educational/learning objectives?
   Minimally 1 2 3 4 (5) Completely

3. Was the presented information relevant to your needs (Circle One)

Academic	(N/A)	Limited	1	2	3	4	5	Very Beneficial
Professional	N/A	Limited	1	2	3	4	(5)	Very Beneficial
Research	(N/A)	Limited	1	2	3	4	5	Very Beneficial
General Knowledge	N/A	Limited	1	2	3	4	(5)	Very Beneficial
Other	(N/A)	Limited	1	2	3	4	5	Very Beneficial

4. To what degree was the appropriateness of the presentation to your needs?
   Poor 1 2 3 4 (5) Excellent

5. What is your overall evaluation of this presentation?
   Poor 1 2 3 4 (5) Excellent

6. Based on what you have learned in this presentation, what were your highlights?

   Leed as it pertains to public transit

7. Was the presentation better, worst or about what you expected?

8. What did you learn?

   Lots

9. How useful did you find the information presented?
   Minimally 1 2 3 4 (5) Completely

10. Overall, how satisfied were you with the presentation?
    Minimally 1 2 3 4 (5) Completely

We appreciate your valuable time and participation in this presentation. Thank You!

UNIVERSITY OF ALABAMA AT BIRMINGHAM

SUSTAINABILIITY RATING SYSTEMS PRESENTATION EXIT SURVEY EVALUATION FORM

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1. Educational/Learning Objective(s): Please rate your educational satisfaction with the overall presentation based on the following scoring system:

   1= Ineffective 5= Very Effective

   A. This presentation increased my knowledge of sustainability rating systems
   1 2 3 4 (5)

   B. This presentation enhanced my knowledge of overall sustainability
   1 2 3 4 (5)

   C. This presentation provided key points on sustainability rating systems
   1 2 3 4 (5)

   D. This presentation has increased my awareness of sustainability practices
   1 2 3 4 (5)

2. How did this presentation meet your above educational/learning objectives?
   Minimally 1 2 3 (4) 5 Completely

3. Was the presented information relevant to your needs (Circle One)

Academic	N/A	Limited	1	2	3	4	(5)	Very Beneficial
Professional	N/A	Limited	1	2	3	4	(5)	Very Beneficial
Research	N/A	Limited	1	2	3	4	(5)	Very Beneficial
General Knowledge	N/A	Limited	1	2	3	4	(5)	Very Beneficial
Other	N/A	Limited	1	2	3	4	(5)	Very Beneficial

4. To what degree was the appropriateness of the presentation to your needs?
   Poor 1 2 3 4 (5) Excellent

5. What is your overall evaluation of this presentation?
   Poor 1 2 3 4 (5) Excellent

6. Based on what you have learned in this presentation, what were your highlights?
   The collaboration efforts and grant funding used to open the minds of students and professionals to sustainability.

7. Was the presentation better, worst or about what you expected?
   This presentation was better than expected, the handa and jumpdrives are great for reviewing.

8. What did you learn?
   I learned about sustainability rating systems & Application.

9. How useful did you find the information presented?
   Minimally 1 2 3 (4) 5 Completely

10. Overall, how satisfied were you with the presentation?
    Minimally 1 2 3 4 (5) Completely

We appreciate your valuable time and participation in this presentation. Thank You!

UNIVERSITY OF ALABAMA AT BIRMINGHAM

SUSTAINABILIITY RATING SYSTEMS PRESENTATION EXIT SURVEY EVALUATION FORM

MARCH 24, 2017

1. Educational/Learning Objective(s): Please rate your educational satisfaction with the overall presentation based on the following scoring system:

   1= Ineffective 5= Very Effective

   A. This presentation increased my knowledge of sustainability rating systems
   1 2 (3) 4 5

   B. This presentation enhanced my knowledge of overall sustainability
   (1) 2 3 4 5

   C. This presentation provided key points on sustainability rating systems
   1 2 (3) 4 5

   D. This presentation has increased my awareness of sustainability practices
   (1) 2 3 4 5

2. How did this presentation meet your above educational/learning objectives?
   Minimally 1 (2) 3 4 5 Completely

3. Was the presented information relevant to your needs (Circle One)

Academic	(N/A)	Limited	1	2	3	4	5	Very Beneficial
Professional	N/A	Limited	(1)	2	3	4	5	Very Beneficial
Research	(N/A)	Limited	1	2	3	4	5	Very Beneficial
General Knowledge	N/A	Limited	1	(2)	3	4	5	Very Beneficial
Other	(N/A)	Limited	1	2	3	4	5	Very Beneficial

4. To what degree was the appropriateness of the presentation to your needs?
   Poor (1) 2 3 4 5 Excellent

5. What is your overall evaluation of this presentation?
   Poor (1) 2 3 4 5 Excellent

6. Based on what you have learned in this presentation, what were your highlights?
   There are various inconsistent rating systems for sustainability.

7. Was the presentation better, worst or about what you expected?
   Worse. Design was in the title of the flyer, but not covered.

8. What did you learn?
   See 6

9. How useful did you find the information presented?
   Minimally (1) 2 3 4 5 Completely

10. Overall, how satisfied were you with the presentation?
    Minimally (1) 2 3 4 5 Completely

We appreciate your valuable time and participation in this presentation. Thank You!

UNIVERSITY OF ALABAMA AT BIRMINGHAM

SUSTAINABILIITY RATING SYSTEMS PRESENTATION EXIT SURVEY EVALUATION FORM

MARCH 24, 2017

1. Educational/Learning Objective(s): Please rate your educational satisfaction with the overall presentation based on the following scoring system:

   1= Ineffective 5= Very Effective

   A. This presentation increased my knowledge of sustainability rating systems
   1 2 3 4 (5)

   B. This presentation enhanced my knowledge of overall sustainability
   1 2 3 4 (5)

   C. This presentation provided key points on sustainability rating systems
   1 2 3 4 (5)

   D. This presentation has increased my awareness of sustainability practices
   1 2 3 4 (5)

2. How did this presentation meet your above educational/learning objectives?
   Minimally 1 2 3 (4) 5 Completely

3. Was the presented information relevant to your needs (Circle One)

Academic	(N/A)	Limited	1	2	3	4	5	Very Beneficial
Professional	N/A	Limited	1	2	3	(4)	5	Very Beneficial
Research	N/A	Limited	1	2	3	(4)	5	Very Beneficial
General Knowledge	N/A	Limited	1	2	3	(4)	5	Very Beneficial
Other	N/A	Limited	1	2	3	(4)	5	Very Beneficial

4. To what degree was the appropriateness of the presentation to your needs?
   Poor 1 2 3 (4) 5 Excellent

5. What is your overall evaluation of this presentation?
   Poor 1 2 3 4 (5) Excellent

6. Based on what you have learned in this presentation, what were your highlights?
   UNDERSTANDING DEFINITIONS OF SUSTAINABLE PROGRAMS

7. Was the presentation better, worst or about what you expected?
   BETTER

8. What did you learn?
   DIFFERENT EVALUATION PROGRAMS FOR SUSTAINABILITY

9. How useful did you find the information presented?
   Minimally 1 2 3 (4) 5 Completely

10. Overall, how satisfied were you with the presentation?
    Minimally 1 2 3 (4) 5 Completely

We appreciate your valuable time and participation in this presentation. Thank You!

UNIVERSITY OF ALABAMA AT BIRMINGHAM

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   1 2 3 (4) 5

   B. This presentation enhanced my knowledge of overall sustainability
   1 2 3 (4) 5

   C. This presentation provided key points on sustainability rating systems
   1 2 3 4 (5)

   D. This presentation has increased my awareness of sustainability practices
   1 2 3 4 (5)

2. How did this presentation meet your above educational/learning objectives?
   Minimally 1 2 3 (4) 5 Completely

3. Was the presented information relevant to your needs (Circle One)

Academic	N/A	Limited	1	(2)	3	4	5	Very Beneficial
Professional	N/A	Limited	1	(2)	3	4	5	Very Beneficial
Research	N/A	Limited	1	(2)	3	4	5	Very Beneficial
General Knowledge	N/A	Limited	1	2	3	4	(5)	Very Beneficial
Other	N/A	Limited	1	2	3	(4)	5	Very Beneficial

4. To what degree was the appropriateness of the presentation to your needs?
   Poor 1 2 (3) 4 5 Excellent

5. What is your overall evaluation of this presentation?
   Poor 1 2 3 (4) 5 Excellent

6. Based on what you have learned in this presentation, what were your highlights?
   Extensiveness of rating systems

7. Was the presentation better, worst or about what you expected?
   Better

8. What did you learn?
   Sustainability is closer to reality than I thought

9. How useful did you find the information presented?
   Minimally 1 2 3 (4) 5 Completely

10. Overall, how satisfied were you with the presentation?
    Minimally 1 2 3 (4) 5 Completely

We appreciate your valuable time and participation in this presentation. Thank You!

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   1 2 3 4 (5)

   B. This presentation enhanced my knowledge of overall sustainability
   1 2 (3) 4 5

   C. This presentation provided key points on sustainability rating systems
   1 2 3 4 (5)

   D. This presentation has increased my awareness of sustainability practices
   1 (2) 3 4 5

2. How did this presentation meet your above educational/learning objectives?
   Minimally 1 2 3 (4) 5 Completely

3. Was the presented information relevant to your needs (Circle One)

Academic	N/A	Limited	1	2	3	(4)	5	Very Beneficial
Professional	N/A	Limited	1	2	(3)	4	5	Very Beneficial
Research	N/A	Limited	1	2	(3)	4	5	Very Beneficial
General Knowledge	N/A	Limited	1	2	3	(4)	5	Very Beneficial
Other	N/A	Limited	1	2	(3)	4	5	Very Beneficial

4. To what degree was the appropriateness of the presentation to your needs?
   Poor 1 2 3 (4) 5 Excellent

5. What is your overall evaluation of this presentation?
   Poor 1 2 3 4 (5) Excellent

6. Based on what you have learned in this presentation, what were your highlights?
   Learning what exactly it takes for a building to be certified as environmentally friendly

7. Was the presentation better, worst or about what you expected?
   About what I expected.

8. What did you learn?
   Same as #6

9. How useful did you find the information presented?
   Minimally 1 2 (3) 4 5 Completely

10. Overall, how satisfied were you with the presentation?
    Minimally 1 2 3 (4) 5 Completely

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   1 2 3 4 (5)

   B. This presentation enhanced my knowledge of overall sustainability
   1 2 3 4 (5)

   C. This presentation provided key points on sustainability rating systems
   1 2 3 4 (5)

   D. This presentation has increased my awareness of sustainability practices
   1 2 3 4 (5)

2. How did this presentation meet your above educational/learning objectives?
   Minimally 1 2 3 4 (5) Completely

3. Was the presented information relevant to your needs (Circle One)

Academic	N/A	Limited	1	2	3	4	(5)	Very Beneficial
Professional	N/A	Limited	1	2	3	(4)	5	Very Beneficial
Research	(N/A)	Limited	1	2	3	4	5	Very Beneficial
General Knowledge	N/A	Limited	1	2	3	4	(5)	Very Beneficial
Other	(N/A)	Limited	1	2	3	4	5	Very Beneficial

4. To what degree was the appropriateness of the presentation to your needs?
   Poor 1 2 3 (4) 5 Excellent

5. What is your overall evaluation of this presentation?
   Poor 1 2 3 (4) 5 Excellent

6. Based on what you have learned in this presentation, what were your highlights?

7. Was the presentation better, worst or about what you expected?
   – No prior expectation

8. What did you learn?
   I learned about all of the various sustainability rating systems.

9. How useful did you find the information presented?
   Minimally 1 2 3 4 (5) Completely

10. Overall, how satisfied were you with the presentation?
    Minimally 1 2 3 (4) 5 Completely

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UNIVERSITY OF ALABAMA AT BIRMINGHAM

SUSTAINABILIITY RATING SYSTEMS PRESENTATION EXIT SURVEY EVALUATION FORM

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   1 2 3 4 (5)

   B. This presentation enhanced my knowledge of overall sustainability
   1 2 3 4 (5)

   C. This presentation provided key points on sustainability rating systems
   1 2 3 4 (5)

   D. This presentation has increased my awareness of sustainability practices
   1 2 3 4 (5)

2. How did this presentation meet your above educational/learning objectives?
   Minimally 1 2 3 4 (5) Completely

3. Was the presented information relevant to your needs (Circle One)

Academic	N/A	Limited	1	2	3	(4)	5	Very Beneficial
Professional	N/A	Limited	1	2	3	4	5	Very Beneficial
Research	N/A	Limited	1	2	3	4	5	Very Beneficial
General Knowledge	N/A	Limited	1	2	3	4	5	Very Beneficial
Other	N/A	Limited	1	2	3	4	5	Very Beneficial

4. To what degree was the appropriateness of the presentation to your needs?
   Poor 1 2 3 4 5 (Excellent)

5. What is your overall evaluation of this presentation?
   Poor 1 2 3 4 5 (Excellent)

6. Based on what you have learned in this presentation, what were your highlights?

7. Was the presentation better, worst or about what you expected?

8. What did you learn?

9. How useful did you find the information presented?
   Minimally 1 2 3 4 (5) Completely

10. Overall, how satisfied were you with the presentation?
    Minimally 1 2 3 4 (5) Completely

We appreciate your valuable time and participation in this presentation. Thank You!

UNIVERSITY OF ALABAMA AT BIRMINGHAM

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   1 2 3 (4) 5

   B. This presentation enhanced my knowledge of overall sustainability
   1 2 3 (4) 5

   C. This presentation provided key points on sustainability rating systems
   1 2 3 (4) 5

   D. This presentation has increased my awareness of sustainability practices
   1 2 3 (4) 5

2. How did this presentation meet your above educational/learning objectives?
   Minimally 1 2 3 4 (5) Completely

3. Was the presented information relevant to your needs (Circle One)

Academic	N/A	Limited	1	2	3	4	(5)	Very Beneficial
Professional	N/A	Limited	1	2	3	4	5	Very Beneficial
Research	N/A	Limited	1	2	3	4	5	Very Beneficial
General Knowledge	N/A	Limited	1	2	3	4	(5)	Very Beneficial
Other	N/A	Limited	1	2	3	4	5	Very Beneficial

4. To what degree was the appropriateness of the presentation to your needs?
   Poor 1 2 3 (4) 5 Excellent

5. What is your overall evaluation of this presentation?
   Poor 1 2 3 (4) 5 Excellent

6. Based on what you have learned in this presentation, what were your highlights?

7. Was the presentation better, worst or about what you expected?
   It was good

8. What did you learn?
   a lot, I can't

9. How useful did you find the information presented?
   Minimally 1 2 3 4 (5) Completely

10. Overall, how satisfied were you with the presentation?
    Minimally 1 2 3 4 (5) Completely

We appreciate your valuable time and participation in this presentation. Thank You!

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   1 2 3 4 (5)

   B. This presentation enhanced my knowledge of overall sustainability
   1 2 3 (4) 5

   C. This presentation provided key points on sustainability rating systems
   1 2 3 (4) 5

   D. This presentation has increased my awareness of sustainability practices
   1 2 3 (4) 5

2. How did this presentation meet your above educational/learning objectives?
   Minimally 1 2 3 (4) 5 Completely

3. Was the presented information relevant to your needs (Circle One)

Academic	N/A	Limited	1	2	(3)	4	5	Very Beneficial
Professional	N/A	Limited	1	(2)	3	4	5	Very Beneficial
Research	N/A	Limited	1	2	3	(4)	5	Very Beneficial
General Knowledge	N/A	Limited	1	2	3	(4)	5	Very Beneficial
Other	N/A	Limited	1	2	(3)	4	5	Very Beneficial

4. To what degree was the appropriateness of the presentation to your needs?
   Poor 1 2 3 4 5 (Excellent)

5. What is your overall evaluation of this presentation?
   Poor 1 2 3 4 (5) Excellent

6. Based on what you have learned in this presentation, what were your highlights?

7. Was the presentation better, worst or about what you expected?
   better than what I was expecting

8. What did you learn?

9. How useful did you find the information presented?
   Minimally 1 2 (3) 4 5 Completely

10. Overall, how satisfied were you with the presentation?
    Minimally 1 2 3 4 (5) Completely

We appreciate your valuable time and participation in this presentation. Thank You!

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   B. This presentation enhanced my knowledge of overall sustainability
   1 2 3 4 (5)

   C. This presentation provided key points on sustainability rating systems
   1 2 3 4 (5)

   D. This presentation has increased my awareness of sustainability practices
   1 2 3 4 (5)

2. How did this presentation meet your above educational/learning objectives?
   Minimally 1 2 3 (4) 5 Completely

3. Was the presented information relevant to your needs (Circle One)

Academic	N/A	Limited	1	2	3	4	(5)	Very Beneficial
Professional	N/A	Limited	1	2	3	4	5	Very Beneficial
Research	N/A	Limited	1	2	3	4	5	Very Beneficial
General Knowledge	N/A	Limited	1	2	3	(4)	5	Very Beneficial
Other	N/A	Limited	1	2	3	4	5	Very Beneficial

4. To what degree was the appropriateness of the presentation to your needs?
   Poor 1 2 3 (4) 5 Excellent

5. What is your overall evaluation of this presentation?
   Poor 1 2 3 4 (5) Excellent

6. Based on what you have learned in this presentation, what were your highlights?
   The indepth description of LEED Neighborhood Development.

7. Was the presentation better, worst or about what you expected?
   Better

8. What did you learn?
   The many different rating systems and how/why points are awarded.

9. How useful did you find the information presented?
   Minimally 1 2 3 (4) 5 Completely

10. Overall, how satisfied were you with the presentation?
    Minimally 1 2 3 4 (5) Completely

We appreciate your valuable time and participation in this presentation. Thank You!

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   1 2 3 4 (5)

   C. This presentation provided key points on sustainability rating systems
   1 2 3 4 (5)

   D. This presentation has increased my awareness of sustainability practices
   1 2 3 4 (5)

2. How did this presentation meet your above educational/learning objectives?
   Minimally 1 2 3 (4) 5 Completely

3. Was the presented information relevant to your needs (Circle One)

Academic	N/A	Limited	1	2	(3)	4	5	Very Beneficial
Professional	N/A	Limited	1	(2)	3	4	5	Very Beneficial
Research	N/A	Limited	1	2	(3)	4	5	Very Beneficial
General Knowledge	N/A	Limited	1	2	3	4	(5)	Very Beneficial
Other	N/A	Limited	1	2	3	(4)	5	Very Beneficial

4. To what degree was the appropriateness of the presentation to your needs?
   Poor 1 2 (3) 4 5 Excellent

5. What is your overall evaluation of this presentation?
   Poor 1 2 3 (4) 5 Excellent

6. Based on what you have learned in this presentation, what were your highlights?
   I never realized how much went in to efficiency/sustainability. This presentation showed just how in depth one can go into this topic.

7. Was the presentation better, worst or about what you expected?
   About what I expected

8. What did you learn?
   Various rating systems to determine sustainability

9. How useful did you find the information presented?
   Minimally 1 2 (3) 4 5 Completely

10. Overall, how satisfied were you with the presentation?
    Minimally 1 2 3 (4) 5 Completely

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   B. This presentation enhanced my knowledge of overall sustainability
   1 2 (3) 4 5

   C. This presentation provided key points on sustainability rating systems
   1 2 3 4 (5)

   D. This presentation has increased my awareness of sustainability practices
   1 2 3 4 (5)

2. How did this presentation meet your above educational/learning objectives?
   Minimally 1 2 (3) 4 5 Completely

3. Was the presented information relevant to your needs (Circle One)

Academic	N/A	Limited	1	2	3	4	5	Very Beneficial
Professional	N/A	Limited	1	2	3	4	(5)	Very Beneficial
Research	N/A	Limited	1	2	3	4	5	Very Beneficial
General Knowledge	N/A	Limited	1	2	3	4	5	Very Beneficial
Other	N/A	Limited	1	2	3	4	5	Very Beneficial

4. To what degree was the appropriateness of the presentation to your needs?
   Poor 1 2 3 (4) 5 Excellent

5. What is your overall evaluation of this presentation?
   Poor 1 2 3 (4) 5 Excellent

6. Based on what you have learned in this presentation, what were your highlights?

7. Was the presentation better, worst or about what you expected?

8. What did you learn?

9. How useful did you find the information presented?
   Minimally 1 2 3 (4) 5 Completely

10. Overall, how satisfied were you with the presentation?
    Minimally 1 2 3 (4) 5 Completely

We appreciate your valuable time and participation in this presentation. Thank You!

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   1 2 3 4 (5)

   B. This presentation enhanced my knowledge of overall sustainability
   1 2 3 4 (5)

   C. This presentation provided key points on sustainability rating systems
   1 2 3 4 (5)

   D. This presentation has increased my awareness of sustainability practices
   1 2 3 4 (5)

2. How did this presentation meet your above educational/learning objectives?
   Minimally 1 2 3 4 5 (Completely)

3. Was the presented information relevant to your needs (Circle One)

Academic	N/A	Limited	1	2	3	4	(5)	Very Beneficial
Professional	N/A	Limited	1	2	3	4	(5)	Very Beneficial
Research	N/A	Limited	1	2	3	4	(5)	Very Beneficial
General Knowledge	N/A	Limited	1	2	3	(4)	5	Very Beneficial
Other	N/A	Limited	1	2	(3)	4	5	Very Beneficial

4. To what degree was the appropriateness of the presentation to your needs?
   Poor 1 2 3 4 (5) Excellent

5. What is your overall evaluation of this presentation?
   Poor 1 2 3 4 (5) Excellent

6. Based on what you have learned in this presentation, what were your highlights?
   LEED program SLL
   Planet communities

7. Was the presentation better, worst or about what you expected?
   There were alot of words on the Powerpoint slide.

8. What did you learn? Vital information about the LEED program

9. How useful did you find the information presented?
   Minimally 1 2 3 4 (5) Completely

10. Overall, how satisfied were you with the presentation?
    Minimally 1 2 3 (4) 5 Completely

We appreciate your valuable time and participation in this presentation. Thank You!

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   B. This presentation enhanced my knowledge of overall sustainability
   1 2 (3) 4 5

   C. This presentation provided key points on sustainability rating systems
   1 2 3 (4) 5

   D. This presentation has increased my awareness of sustainability practices
   1 2 (3) 4 5

2. How did this presentation meet your above educational/learning objectives?
   Minimally 1 2 (3) 4 5 Completely

3. Was the presented information relevant to your needs (Circle One)

Academic	N/A	Limited	1	2	3	(4)	5	Very Beneficial
Professional	N/A	Limited	1	2	(3)	4	5	Very Beneficial
Research	N/A	Limited	1	2	(3)	4	5	Very Beneficial
General Knowledge	N/A	Limited	1	2	3	4	(5)	Very Beneficial
Other	N/A	Limited	1	2	3	4	(5)	Very Beneficial

4. To what degree was the appropriateness of the presentation to your needs?
   Poor 1 2 3 (4) 5 Excellent

5. What is your overall evaluation of this presentation?
   Poor 1 2 (3) 4 5 Excellent

6. Based on what you have learned in this presentation, what were your highlights?
   I found the idea behind the sustainability class and I would consider taking it if it were offered

7. Was the presentation better, worst or about what you expected?
   much better

8. What did you learn?
   I found out more information about sustainability

9. How useful did you find the information presented?
   Minimally 1 2 3 (4) 5 Completely

10. Overall, how satisfied were you with the presentation?
    Minimally 1 2 3 4 (5) Completely

We appreciate your valuable time and participation in this presentation. Thank You!

Appendix F. STRIDE-Funded Research Summer Seminar Announcement.

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

UF University of Florida Transportation Institute
Transportation Technology Transfer (T2) Center
UNIVERSITY of FLORIDA

STRIDE-Funded Research Summer Seminar June 2, 2017

Researchers will be showcasing products from various STRIDE-funded projects.

When: Friday, June 2, 2017

Where: Emerson Alumni Hall, President's Ballroom A, UF Campus, Gainesville, FL

Time: 8 am to 5 pm

Cost: FREE! However, there will be a $75 charge, if you are interested in receiving 6 PDHs.

A Continental breakfast and lunch will be provided, including morning and afternoon breaks

Registration Link:
https://xms.dce.ufl.edu/reg/groups/ft/course.aspx?c=9814&ug=23

Seminar Agenda [view]

Topics to be presented

Using Interactive Virtual Presence to Help Parents Install Child Restraints Correctly
David C. Schwebel, Ph.D., Professor of Psychology & Associate Dean, University of Alabama at Birmingham

Training Modules on Green/Sustainability Design and Rating Systems
Robert W. Peters, Ph.D., P.E., Professor of Environmental Engineering Department of Civil, Construction, & Environmental Engineering, University of Alabama at Birmingham

Bike&Place: A New Tool for Designing Active, Place-Making Transportation Networks
Brian J. Morton, Ph.D., Senior Research Associate, Center for Urban & Regional Studies, University of North Carolina at Chapel Hill

GIS-based Instructional Tool for Crash-Prediction Methods
Ilir Bejleri, Ph.D. Associate Professor, Department of Urban & Regional Planning and Siva Srinivasan, Ph.D., Associate Professor, Department of Civil Engineering, University of Florida

Statewide Training of SafetyAnalyst in Florida
Priyanka Alluri, Ph.D., P.E., Assistant Professor, Florida International University

Evaluation of Traffic Control Options in Work Zones
Ossama Ramadan, Ph.D., Research Associate, University of Alabama at Birmingham

School Siting and School Transportation Impacts
Ruth Steiner, Ph.D., Professor, Department of Urban & Regional Planning, University of Florida

To view the abstracts and presenter biographies, click here.

For more information, contact Ines Aviles-Spadoni, STRIDE Research Coordinator at iaviles@ce.ufl.edu.

Southeastern Transportation Research, Innovation, Development and Education Center (STRIDE)
University of Florida
365 Weil Hall
PO Box 116580
Gainesville, FL 32611
352.294.7803
iaviles@ce.ufl.edu
http://www.stride.ce.ufl.edu/

Appendix G. Seminar Announcement at Savannah River National Laboratory.

SRNL Environmental Sciences & Biotechnology Group

SEMINAR

Green Sustainability Rating System

Robert W. Peters, Ph.D., P.E.
Professor of Environmental Engineering
Department of Civil, Construction, and Environmental Engineering
University of Alabama at Birmingham

May 11, 2017
10:00-11:00 AM
Aiken County Technology Laboratory (ACTL) Bldg. 999-W
Room 332, Conference Room

For More Information, Please Contact:
Robin Brigmon, Environmental Sciences Biotechnology Group
Direct Telephone: 803 819-8405
R03.brigmon@srnl.doe.gov

Dr. Peter's Seminar Abstract and Bio are attached.