Applicability of a Road Rating System to the City of Vancouver

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Table of Contents

List of Figures

List of Tables

EXECUTIVE SUMMARY

This report provides an evaluation of the applicability of a road rating system to the road construction practices of the City of Vancouver public works. A road rating system is a collection of best practices that can be utilized to achieve sustainable road construction. The primary objective of using a road rating system is to identify the level of sustainable measures within specific projects and gage success factors against other projects. There are many road rating systems available in the market today and most of them are based on the triple bottom line principle; which is environmental protection, economic growth and social development. This report will focus on five different road rating systems that can be classified in one of three categories: Greenroads, a rating system with third party recognition and awards; GreenLITES and INVEST, self-evaluation tools with non-recognized awards and I-LAST and STEED, self-evaluation tools without awards. The main advantage of adopting an award based rating system is that; it can be used to demonstrate the sustainable initiatives of an agency to the general public.

Although the main benefit of implementing a road rating system for the City of Vancouver is to analyze how sustainable current road construction practices are, adopting an award based rating system would also support one of the City's Engineering Strategic Plan objectives of leading the way on green issues. Greenroads is the one and only rating system which awards third party certification to an industry accepted standard. Achieving a level of certification in Greenroads, require a vast amount of information documented in all of their 11 project requirements. Satisfying these requirements does not look feasible for ongoing programs of small scale rehabilitation and reconstruction projects undertaken by the City. Even a pilot project assessment from Greenroads, which is a starting point, requires the submission of documents that are currently not generated at the City of Vancouver. Greenroads cannot provide a reasonable assessment unless these documents are provided. Therefore, moving forward with even a pilot project assessment from Greenroads is not feasible.

The other alternative option is to adopt an award based self-evaluation tool. INVEST and GreenLITES are the most prominent self-evaluation tools available in the market. These systems can be applied at the project development stage, however, there is also an application for

maintenance and operation work as well. In addition, due to the voluntary nature of these rating systems, it is possible to amend them to suit the City's requirements. Implementation of INVEST is much easier than GreenLITES because of the refined criteria and scorecard provided for small scale rehabilitation and reconstruction works, making it a good fit for the City. If GreenLITES was to be adopted, the criteria provided in their project development certification manual should be refined to select only applicable criteria and the scorecard has to be amended accordingly. To support the recommendation of the applicability of INVEST for the City of Vancouver, one of the typical grind and overlay projects was scored using INVEST and the findings showed that with little effort to prepare documented proof, this project has the potential to achieve a silver award. With additional person-hours dedicated to the preparation of documents, completing paperwork, forms and calculations, the grind and overlay project has the potential to achieve the Platinum award, the highest level of award available within INVEST. The detail scorecard is provided in the appendix.

The non-award based rating systems provide a list of most desirable sustainable practices that can be applied to a road construction project. I-LAST and STEED are the commonly available rating systems of this nature. These systems are developed for the continuous improvement of the sustainable initiatives within an agency. Careful investigation of these rating systems would also help the City to identify the possible sustainable best practices that are not considered in other rating systems.

As with any improvement and new initiative, implementation of any road rating systems requires additional resources and may have potential cost implications to the project or program. From the site surveys carried out among randomly selected City crews, it was observed that, although many sustainable practices are being considered at site level, they lack proper guidance, evaluation techniques and recording procedures. The success of the implementation of any rating system would require change initiatives to ensure staff involved at all levels drive the process to prepare proper documentation, analysis and auditing.

The ambitions and efforts of the City to become sustainable should not stop with achieving one of these awards. The City should focus on continuous improvements and ongoing investigations of the best sustainable practices should be incorporated to make construction as sustainable as

possible and always strive to reach the next level. Green Guides, currently being developed by the Transportation Association of Canada, is one of the tools that will require review and analysis as it could be applicable to the City of Vancouver road construction practices. Incorporation of these recommendations will provide great contributions towards the City of Vancouver's goal of being the Greenest City in the World by 2020.

Kamal Abdul (Green City Scholar) *Date: 31st July, 2012*

1. INTRODUCTION

"Sustainability" is commonly understood as developments that meet the needs of the present without compromising the ability of future generations to meet their own needs (UN, Brundtland Commission, 1987). Meanwhile, sustainability has to be balanced by the "triple bottom line" principle, which is based on environmental protection, economic growth and social development. But, these three principles do not directly address the actions need to be adopted by a transportation designer or contractor, to make a road development project sustainable.

It was a well-known fact that the transportation sector is one of the major polluter of the environment. Sustainable measures have to be introduced into the sector to reduce the harmful effect of the industry on the environment. The idea of green highway rating systems evolved from LEED (Leadership in Energy and Environmental Design) standard for green buildings. LEED was introduced in 1998 by the U.S. Green Building Council (USGBC), and it has successfully encompassed more than 7000 projects worldwide so far. Different organization adopted this idea to develop a similar rating system for the transportation sector as well. The first one to come-up with such an idea is Greenroads. Greenroads was developed based on a research project originated at the University of Washington. The research work on Greenroads began in 2007 and it was developed into a rating system by the University of Washington and CH2M HILL. The pilot version of Greenroads was first released in 2009 and the new version is available for the third party certification now.

Since the introduction of Greenroads, there are many other road rating systems also released and most of them are self-evaluation in nature. Some of the most prominent self-evaluation tools are INVEST Sustainable Highways Self-Evaluation Tool developed by the Federal Highway Administration, U.S Department of Transportation, I-LAST (Illinois – Livable And Sustainable Transportation Rating System) developed by the Sustainability Group of the Illinois Department of Transportation (IDOT), GreenLITES (Leadership in Transportation Environmental Sustainability) developed by the New York State Department of Transportation and STEED (Sustainable Transportation Engineering & Environmental Design) developed by LOCHNER INC. INVEST, I-LAST and STEED are voluntary in nature whereas GreenLITES was developed

primarily for the internal use at NYSDOT. These five sustainable road rating systems are compared in this report.

Apart from these, there are few other road ratings systems which are still in its development phase. Green Guide (Canadian Guide for Green Roads) being developed by the Transportation Association of Canada (TAC) is one of the important ones among them, as it's being developed in Canada. A consultant team of four, MMM Group, MRC, Enermodal Engineering and Ecoplans limited are working on the Green Guide and it's expected to be released in early winter 2013.

2. GREENROADS

2.1 INTRODUCTION

Greenroads is a voluntary third party rating system managed by the Greenroads Foundation based in Washington, USA. This is a road rating system that is already tested in its pilot project phase and issuing certification now. Version 0.95 of the Greenroads Rating system was jointly developed by the University of Washington and CH2M Hill in 2009. This has undergone several revisions and Version 1.5 is currently available. Greenroads is based on a performance matrix which can be used to score points. The total points a project score can be used to compare how sustainable the project is. Based on the total points scored, a project can be opted for certification as well.

The categories under which a project can be scored are divided into two as required and voluntary. The required activities are called the Project Requirements (PRs). There are 11 Project Requirements and it is compulsory to complete all the PRs if a project is to be certified by Greenroads. No points are allocated for completing these Project Requirements. Voluntary credits (VCs) are the optional category that can be used to score points. The VCs are classified under five major groups as Environment & Water (EW), Access & Equity (AE), Construction Activities (CA), Materials & Resources (MR), and Pavement Technologies (PT). Summary of the PRs and VCs are provided in table 01. Each of the categories is further divided into many Subcategories. These categories are assigned a point value from 1 to 5 and a total of 108 points can be scored if all the voluntary Credit requirements are satisfied. The client is given the opportunity to design maximum of two of his own credits for a total of 10 points under custom category. This makes the total credit that can be scored under the VCs to 118. The custom credits need to be approved by the Greenroads before it can be implemented. The different levels of certification issued by Greenroads and the point requirements are shown in figure 01.

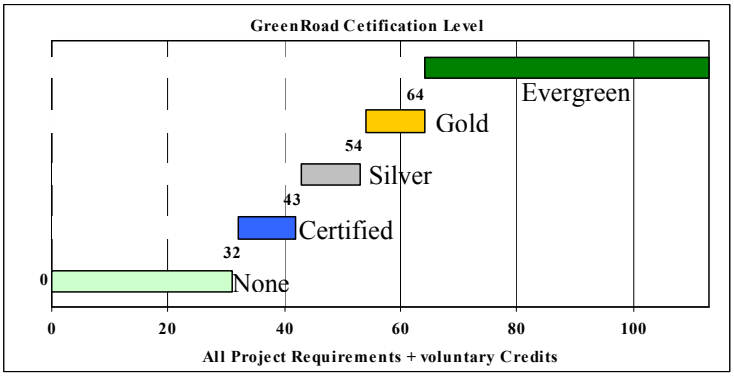
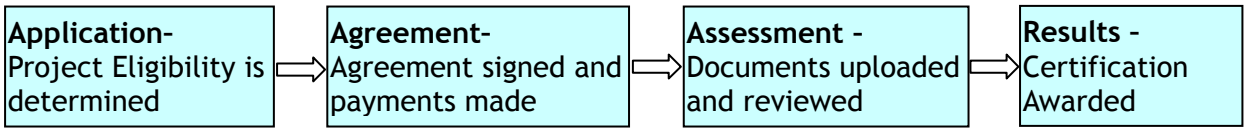


Figure 1 Greenroads Certification Level

Table 1 Greenroads Rating system credit summary (Source: Greenroads Manual)

No.	Title	Pts.	Description
Project Requirements (PR) – Mandatory for all projects			
PR-1	Environmental Review Process	Req	Complete a comprehensive environmental review
PR-2	Lifecycle Cost Analysis (LCCA)	Req	Perform LCCA for pavement section
PR-3	Lifecycle Inventory (LCI)	Req	Perform LCI of pavement section
PR-4	Quality Control Plan	Req	Have a formal contractor quality control plan
PR-5	Noise Mitigation Plan	Req	Have a construction noise mitigation plan
PR-6	Waste Management Plan	Req	Have a plan to divert C&D waste from landfill
PR-7	Pollution Prevention Plan	Req	Have a TESC/SWPPP
PR-8	Low Impact Development (LID)	Req	Complete a LID feasibility study
PR-9	Pavement Management System	Req	Have a pavement management system
PR-10	Site Maintenance Plan	Req	Have a roadside maintenance plan
PR-11	Educational Outreach	Req	Publicize sustainability information for project
Environment & Water (EW) – Up to 21 Points			
EW-1	Environmental Management System	2	ISO 14001 certification for general contractor
EW-2	Runff Flow Control	1-3	Reduce runoff quantity
EW-3	Runoff Quality	1-3	Treat stormwater to a higher level of quality
EW-4	Stormwater Cost Analysis	1	Conduct an LCCA for stormwater elements
EW-5	Site Vegetation	1-3	Use native low/no water vegetation
EW-6	Habitat Restoration	3	Restore habitat beyond what is required
EW-7	Ecological Connectivity	1-3	Connect habitat across roadways
EW-8	Light Pollution	3	Discourage light pollution
Access & Equity (AE) – Up to 30 Points			
AE-1	Safety Audit	1-2	Perform roadway safety audit
AE-2	Intelligent Transportation Systems (ITS)	2-5	Implement ITS solutions
AE-3	Context Sensitive Solutions	5	Plan for context sensitive solutions
AE-4	Traffic Emissions Reduction	5	Reduce emissions with quantifiable methods
AE-5	Pedestrian Access	1-2	Provide/improve pedestrian accessibility
AE-6	Bicycle Access	1-2	Provide/improve bicycle accessibility
AE-7	Transit Access	1-5	Provide/improve transit accessibility
AE-8	Scenic Views	1-2	Provide views of scenery or vistas
AE-9	Cultural Outreach	1-2	Promote art/culture/community values
Construction Activities (CA) – Up to 14 Points			
CA-1	Quality Management System	2	ISO 9001 certification for general contractor
CA-2	Environmental Training	1	Provide environmental training
CA-3	Site Recycling Plan	1	Have a plan to divert waste from landfill
CA-4	Fossil Fuel Reduction	1-2	Use alternative fuels in construction equipment
CA-5	Equipment Emissions Reduction	1-2	Meet EPA Tier 4 standards for non-road equip.
CA-6	Paving Emissions Reduction	1	Use pavers that meet NIOSH requirements
CA-7	Water Tracking	2	Develop data on water use in construction
CA-8	Contractor Warranty	3	Warranty on the constructed pavement
Materials & Resources (MR) – Up to 23 Points			
MR-1	Life Cycle Assessment (LCA)	2	Conduct a detailed LCA of the entire project
MR-2	Pavement Reuse	1-5	Reuse existing pavement sections
MR-3	Earthwork Balance	1	Use native soil rather than import fill
MR-4	Recycled Materials	1-5	Use recycled materials for new pavement
MR-5	Regional Materials	1-5	Use regional materials to reduce transportation
MR-6	Energy Efficiency	1-5	Improve energy efficiency of operational systems
Pavement Technologies (PT) – Up to 20 Points			
PT-1	Long-Life Pavement	5	Design pavements for long-life
PT-2	Permeable Pavement	3	Use permeable pavement as a LID technique
PT-3	Warm Mix Asphalt (WMA)	3	Use WMA in place of HMA
PT-4	Cool Pavement	5	Contribute less to urban heat island effect (UHI)
PT-5	Quiet Pavement	2-3	Use a quiet pavement to reduce noise
PT-6	Pavement Performance Tracking	1	Relate construction to performance data
Custom Credits (CC) – Available for all projects based on context and innovation, subject to approval			
CC-1	Custom Credit 1	1-5	Design a new voluntary credit
CC-2	Custom Credit 2	1-5	Design a new voluntary credit
	Greenroads Total Points:	**118**	

2.2 How does it Work



Initially a screening application is filled online and the project eligibility is determined by Greenroads. If the project is eligible, then an agreement is signed and the relevant payments are made. The entire process takes place online and the required documents need to be uploaded online as well. Greenroads will assign a reviewer for the project and the project team will be working closely with the reviewer. Once the construction is complete, all the required documents have to be submitted for the final review. Greenroads rating is issued once the evaluation of the documents is complete. Greenroads has the right to inspect or audit the project during and after the construction. The certification is valid for five years. The performance of the project has to be monitored continuously and a detail report on the performance has to be submitted to Greenroads every five years, if the certification has to be renewed. The owner can opt for voluntary annual reporting as well. The report may include the performance data including, but not limited to energy use, water use, traffic use, pavement and deck performance, environmental maintenance data, etc.

Greenroads can be applied to most of the transportation related projects including new road construction, improvement of the facilities, rehabilitation and reconstruction works, pathway and trail projects, etc. However road structures such as bridges, tunnels, walls, etc. are not explicitly included in Greenroads and it is not possible to apply Greenroads to activities performed as part of the site maintenance plan. There are three types of assessments available with Greenroads.

1. **A-Lined Assessment**

This is designed to identify the potential of a project to score points in each category and to provide suggestions of improvements required to increase the scoring chances. A-Lined assessment can be performed at any stage of a project.

2. Pilot Project Assessment

This is a less formal form of an assessment of a project. The pilot project assessment was mainly introduced to provide a learning experience to both client and Greenroads. This follows the same process of a certification and limited access to usage of the Greenroads logo can be gained. There are two types of assessment in this category and they are basic pilot project assessment and detail pilot project assessment. The differences between these two assessments are the number of documents reviewed and the fee structure. Basic pilot project assessment is recommended for projects that are already completed. Detail pilot project assessment can be best utilized for projects that are in its early design stage where certification is considered as an option.

3. Certification

Certification is a detailed review of a project for the purpose of issuing a Greenroad rating certificate.

2.3 Criteria behind Greenroads

The Greenroads rating system is based on the 7E sustainability criteria as shown in figure 02 below. This is a detail break down of the triple bottom line principle.

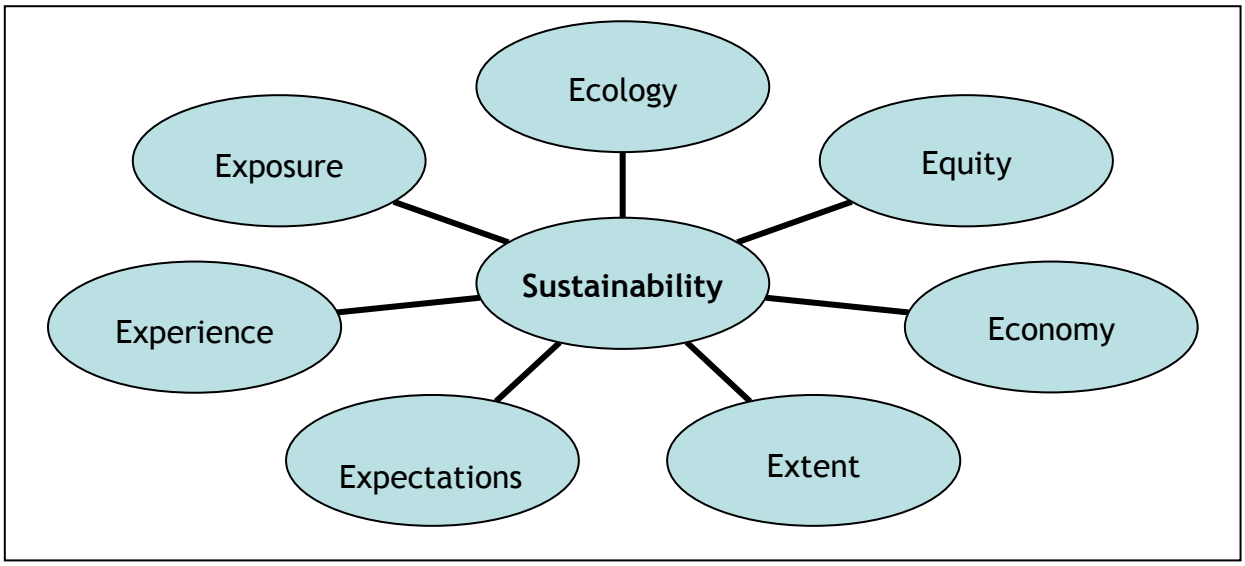


Figure 2 Sustainability Principles of Greenroads

2.4 BENEFITS OF GREENROADS

The sustainability benefits of Greenroads are well spelt and are divided into two groups as eco-centric benefits and anthropocentric benefits. It is also possible to map each PR and VC to its benefits. The following table 02 provides the summary of the benefits mentioned in the Greenroads manual.

Table 2 Sustainable benefits of Greenroads system

Eco-centric Benefits	Anthropocentric Benefits
Reduces raw materials use	Improve access
Reduces fossil fuel use	Improves mobility
Creates energy	Increases service life
Reduces water use	Improves human health & safety
Reduces air emissions	Improves local economies
Reduces greenhouse gases	Reduces first costs
Reduces water pollutions	Reduces lifecycle costs
Reduces solid waste	Improves accountability
Restores habitat	Increases awareness
Creates habitat	Increases aesthetics
Reduces manmade footprint	Creates new information

3. INVEST SUSTAINABLE HIGHWAYS SELF-EVALUATION TOOL

3.1 INTRODUCTION

This is a web-based voluntary self-evaluation tool that can be adopted by anyone to measure the sustainability of a road project. INVEST tool was developed by the Federal Highway Administration, U.S Department of Transportation and the beta version was released in falls 2010 with the name "Infrastructure Voluntary Evaluation Sustainability Tool" (INVEST). The current version, which is being used as a pilot project assessment tool, has undergone significant revision of its beta version. Version 1.0 of Invest tool is scheduled to be released in late 2012. INVEST list down the sustainable best practices that can be adopted in a transportation project. A project can be scored based on the extent of implementation of these best practices. The website also provides detailed scorecards. INVEST is based on the triple bottom line concept as outlined in the figure 03 below.

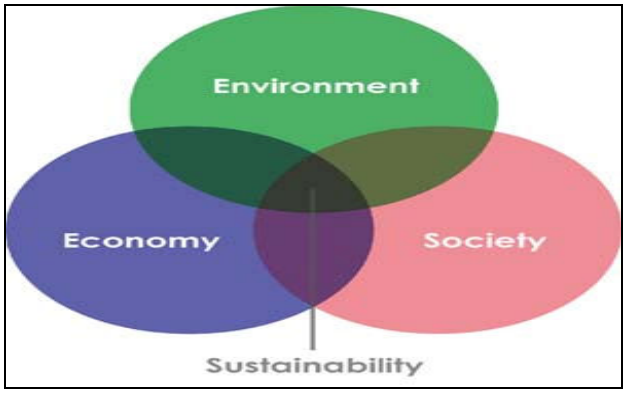


Figure 3 Triple Bottom Line Principle

Since it is not possible to directly measure sustainability based on the triple bottom line principle, INVEST spells out the criteria that can be used to measure sustainability of a project based on economy, environment and society. These criteria are called "Sustainability Best Practices". Each of these best practices is assigned a point value based on the impact it has on sustainability. The total points a project score can be used to compare different projects. However, this tool was not developed for the intention of comparing projects among transportation agencies. The table 03 summarizes the awards given to a project based on their scores. Since this is not a third party certification, awards can be considered only as an unofficial recognition by FHWA.

Table 3 Invest Awards

Award	Percentage of Score
None	<30%
Bronze	≥30%
Silver	≥40%
Gold	≥50%
Platinum	≥60%

3.2 THE STRUCTURE OF INVEST

The INVEST rating system contains different criteria and scorecard to analyze a project depending on its phase of development as mentioned below.

- System Planning
- Project Development
- Operation & Maintenance

System Planning and Operation & Maintenance are designed to be used within an agency program where as Project Development category can be applied to the development of a specific project. Since majority of the major work done by the City of Vancouver come under the project development category it will be elaborated in details here.

3.3 PROJECT DEVELOPMENT

Project Development category contains 30 criteria and they are summarized in the table 04. It is possible to map each criteria to the "triple bottom line principle" as well. There are two types of scorecards available under the project development category. The first step towards the evaluation of a project is to identify the right scorecard to be used. It is understood that all the criteria mentioned in the rating systems may not be suitable for all the projects. Therefore there is room provided to identify the relevant criteria applicable to a project and to evaluate the project based on those criteria only.

- Basic Scorecard (20 Criteria)

This is a filtered version of the extended scorecard. This is designed to be used for smaller projects such as small reconstruction and bridge replacement where the capacity is not increased, preservation projects, restoration projects, etc.

- Extended Scorecard (30 Criteria)

This scorecard is to be used for large highway and bridge projects such as new road construction projects, major reconstruction works where the capacity of the roadway or bridge is increased. This contains more criteria than the basic scorecard.

3.4 How to Score a Project

First of all, the type of scorecard to be used has to be selected based on the type of the project. Since it is not possible to implement all the criteria in the scorecard to a specific project, the relevant criteria have to be identified based on the phase and context of the project. Once the relevant criteria are identified, the self-evaluation tool can be used to score the project. The scorecard is available online and it is possible to modify the scorecard based on the relevant criteria as well.

3.5 Where to use INVEST and its benefits

INVEST is designed to be used for many purposed within system planning, project development and operation and maintenance of a transportation project. It is possible to use INVEST as a planning tool, decision-making tool or as an evaluation tool. Although the main benefit of INVEST is achieved through implementing it from the planning stage of a project, it is also possible to evaluate projects that are already completed or projects that are in its implementation stage. The primary benefit of using INVEST is the identification of the sustainability best practices considered in a project and the scale of their implementation. This also paves ways for broad participation of different groups within a project.

Table 4 PD criteria by Principle and scoring category (Source: Invest Manual)

No	Criteria	Triple Bottom Line Principle			Project Scorecard type	
		Environmental	Social	Economic	Basic	Extended
PD-1	Cost benefit analysis	♦	♦	♦	●	●
PD-2	Highway and Traffic safety		♦	♦	●	●
PD-3	Context sensitive project development	♦	♦	♦		●
PD-4	Lifecycle cost analyses	♦		♦	●	●
PD-5	Freight Mobility	♦		♦	●	●
PD-6	Educational outreach	♦	♦	♦	●	●
PD-7	Tracking environmental commitments	♦	♦		●	●
PD-8	Habitat restoration	♦			●	●
PD-9	Storm water	♦			●	●
PD-10	Ecological connectivity	♦	♦	♦	●	●
PD-11	Recycle & reuse materials	♦		♦	●	●
PD-12	Create renewable energy	♦		♦		●
PD-13	Site vegetation	♦		♦		●
PD-14	Pedestrian access	♦	♦	♦	●	●
PD-15	Bicycle access	♦	♦	♦	●	●
PD-16	Transit & HOV access	♦	♦	♦		●
PD-17	Historical, archaeological, and cultural preservation		♦		●	●
PD-18	Scenic, natural or recreational qualities		♦			●
PD-19	Low-emitting materials	♦	♦		●	●
PD-20	Energy efficient lighting	♦		♦	●	●
PD-21	ITS for systems operations	♦	♦	♦	●	●
PD-22	Long-life pavement design	♦		♦	●	●
PD-23	Reduced energy and emissions in pavement materials	♦	♦	♦		●
PD-24	Contractor's warranty	♦		♦		●
PD-25	Earthwork Balance	♦		♦		●
PD-26	Construction Environmental training	♦				●
PD-27	Construction equipment emission reduction	♦	♦		●	●
PD-28	Construction noise mitigation	♦	♦		●	●
PD-29	Construction quality control plan	♦		♦	●	●
PD-30	Construction waste management	♦		♦		●

4. I-LAST (Illinois – Livable & Sustainable Transportation Rating System)

4.1 Introduction

I-LAST is a voluntary rating system developed jointly by the Sustainability Group of the Illinois Department of Transportation (IDOT), the American Council of Engineering Companies–Illinois (ACEC-Illinois) and the Illinois Road and Transportation Builders Association (IRTBA). I-LAST guide contains a list of potential sustainable practices that can be incorporated into a highway project and a scorecard to evaluate the sustainability of the project. The intent, rationale and measures of effectiveness of each sustainable practice are elaborated in detail in the guide as well. The first version (V 1.01) was released in January 2010 and no revisions were introduced since its first release. I-LAST identifies the following as the main objectives for implementing the guide for a highway project.

- Minimize impacts on environmental resources
- Minimize consumption of material resources
- Minimize energy consumption
- Preserve or enhance the historic, scenic and aesthetic context of a highway project
- Integrate highway projects into the community in a way that helps to preserve and enhance community life
- Encourage community involvement in the transportation planning process
- Encourage integration of non-motorized means of transportation into a highway project
- Find a balance between what is important:
    - To the transportation function of the facility
    - To the community
    - To the natural environment
    - Economy
- Encourage the use of new and innovative approaches in achieving these goals.

4.2 How does it work

I-LAST guide contains 153 sustainable best practices divided into eight categories as shown below.

- Planning
- Design
- Environmental
- Water quality
- Transportation
- Lighting
- Materials
- Innovation

Since the guide contains a wide range of sustainable practices, the relevant practices that are applicable to a specific project have to be identified first. The applicable sustainable practices vary from project to project and it depends on the type and phase of a project. This guide also contains a relatively simple scorecard which can be used to evaluate a project. Each sustainable practice identified as applicable to a project, is evaluated by giving a point value based on the extent of their application in the project. I-Last guide does not have an award system and this is not suitable for maintenance and operation work as well.

5. GreenLITES (Leadership in Transportation Environmental Sustainability)

5.1 Introduction

GreenLITES is a self-certification program developed by the New York State Department of Transportation, primarily for the internal use. The idea behind GreenLITES was to measure the performance of a road project, recognize best practices and improve where necessary. Although this has been developed for the internal use at NYSDOT, it is possible for other agencies also to voluntarily apply this rating system to assess their projects as well. GreenLITES program has been developed based on the following philosophies.

- Protect and enhance the environment
- Conserve energy and natural resources
- Preserve or enhance the historic, scenic, and aesthetic project setting characteristics
- Encourage public involvement in the transportation planning process
- Integrate smart growth and other sound land-use practices
- Encourage new and innovative approaches to sustainable design

NYSDOT made it compulsory to perform a GreenLITES assessment for all the projects submitted for approval after September 25, 2008. A GreenLITES scorecard is included with the plan, specification and estimates, when a project goes for approval at NYSDOT. The submittal procedure and auditing procedures are clearly mentioned in the online guide. GreenLITES have two types of certification programs as follows.

1. Project design certification program
2. Operation certification program

5.2 Project Design Certification Program

All new road construction works and rehabilitation and reconstruction of transportation networks can be evaluated under this program. The applicable criteria may differ from project to project and the relevant criteria have to be identified based on the type of the project. Under this program, projects are scored based on their design and an initial award is issued before the project goes for implementation. The GreenLITES design certification program guide was initially released in September 2008. It was revised twice and the current version (V 2.1.0) was released in April 2010. Project designs are assessed based on the following principles.

- Sustainable Sites
  - Alignment Selection
  - Context Sensitive Solutions
  - Land Use/Community Planning
  - Protect, Enhance, or Restore Wildlife Habitat
  - Protect, Plant, or Mitigate for Removal of Trees and Plant Communities
- Energy and Atmosphere
  - Improve Traffic Flow
  - Reduce Electrical Consumption
  - Reduce Petroleum Consumption
  - Improve Bicycle and Pedestrian Facilities
  - Noise Abatement
  - Stray Light Reduction
- Innovation/Unlisted
- Material and Resources
  - Reuse of Materials
  - Recycled Content
  - Locally Provided Material
  - Bio-Engineering Techniques
  - Hazardous Material Minimization
- Water Quality
  - Storm water management (volume and quality).
  - Reduce runoff and associated pollutants by treating storm water runoff through BMPs

These categories are further subdivided into many sub-categories and this makes the scoring of a project easier. Each of these sub-categories is assigned a maximum point value and it is mentioned in the scorecard as well. Each project is scored based on the level of the consideration of the sustainable best practices in their design. When the rating system is used outside

NYSDOT, the relevant criteria have to be selected based on the type of the project. The following table 05 summarized the levels of certification that can be awarded to a project based on the score.

Table 5 GreenLITES Awards

Award	Point Range
None	0 – 14
Certified	15 – 29
Silver	30 – 44
Gold	45 – 59
Evergreen	60 & up

5.3 Operation Certification Program

The main aim of the operation certification program is to improve the transportation facility in a sustainable way by minimizing the environmental impacts of the operation. Operation certification program, which was introduced in October 2009, is still in its pilot stage. The draft version of the OCP manual is available online. The scoring methodology is similar to the project design certification program. The certification level is determined by comparing the total points scored by the project to the total points available for each certification category. The OCP is developed based on the following principles.

- Protect and enhance the environment
- Conserve energy and natural resources in all aspects of the work including the facilities
- Participate in new and innovative approaches to sustainable operations and maintenance
- Support a sustainable fleet and alternative fuel use
- Improve access to public sites and protect historic resources
- Support multi-modal transportation and smart growth
- Preserve and enhance scenic and aesthetic roadside characteristics

The scorecard is divided into sixteen categories as shown below. Each of these categories is subdivided further into many sub-categories like in the project design certification scorecard. This simplifies the scoring of a project. The scorecard is available online.

- Bridge
- Pavement
- Drainage
- Signal and lighting (Traffic and safety)
- Snow and ice
- Facilities
- Intelligent transport system
- Roadside environmental
- Guide rails and fencing
- Marking
- Signs
- Fleet administration
- Walls and rock slopes
- Communication technology and emergency preparedness
- Multimodal and ADA
- Others

It is understood that sustainability is based on the triple bottom line principle and the selection of a criteria has to be checked against the financial feasibility, social impact and environmental benefits. Therefore, different options must be considered and carefully evaluated before the final decision to implement it. The percentage of points required for the achievement of a certification level is similar to the project design certification program (Table 05).

6. STEED (Sustainable Transportation Engineering and Environmental Design)

6.1 Introduction

STEED is a voluntary self-evaluation tool developed by H.W Lochner Inc, a national transportation consulting firm, based in Chicago. This was initially developed in 2008 and revised in 2010. STEED version 2.1 is currently available for use. One of the unique features of STEED is that, it does not provide certification levels like other rating systems. The aim of STEED is to make the project as sustainable as possible based on the triple bottom line principle. This is designed to identify and incorporate sustainable options at four different stages of the project namely planning, environmental, design and construction. This approach helps to keep the flow of information about the sustainability options considered when the project is handed over from one department to another. This also makes it possible to track when and where the decisions on sustainability options were changed.

6.2 How does it work

Since the triple bottom line principle does not provide a measuring tool for sustainability, STEED subdivides each principle of the triple bottom line concept into seven sub-categories (Table 06). These sub-categories contain a total of 153 clear objectives, which can be directly implemented at the project level to achieve sustainability.

The STEED manual comes with a scorecard and selecting an element from the scorecard adds one point to the project. A total of 153 points can be scored for a project. It's required to provide a brief description about each element selected on how it's planned to be achieved.

Table 6 STEED Scoring Categories

Environmental Quality		Social Quality		Economic Viability	
Air Quality	8	Aesthetics & Livability	10	Life-Cycle Considerations	5
Biodiversity	8	Cultural & Historic	5	Construction Duration	7
Energy	8	Equity	6	Freight Mobility	8
Environmental cleanup	8	Land & Geology	7	Innovative Use of	9
Light & Noise	11	Land use/ Transportation,	5	Modal connectivity	6
Material & Resources	10	Public Involvement	6	Operation & Maintenance	6
Water Resources	9	Safety & Security	7	User Economic Impacts	4
Subtotal	**62**	**Subtotal**	**46**	**Subtotal**	**45**

7. Comparison of Different Road Rating Systems

7.1 General comparison

The five most prominent road rating systems identified were compared based on their launched date, country of origin, certification levels available in the road rating system, applicable fees if any, governing bodies, stages of the road construction for which the rating system can be applied, total and minimum points, etc. Table 07 provides the summary of the general comparison. The major similarity of all these rating systems is that they all are developed in the USA. No prominent road rating system from any other country is available so far. Greenroads has assessed more than 120 projects including the projects analyzed during its research stage and this is the one and only rating system which offers 3rd party certification. INVEST is a voluntary self-assessment tool with un-official recognition and I-LAST and STEED do not provide any certification. GreenLITES provided certification for internal usage at NYSDOT only.

The importance given to each category of the sustainable solution varies from one rating system to another. Comparison of the weighting of different systems is summarized in figure 04 below. Greenroads was not included in the comparison because of the mandatory project requirement in the rating system which does not contain any point value. As can be seen from the figure, weightings between the criteria vary considerably between the road rating tools. The variation may be due to the voluntary nature of these systems. There is no recognized body which controls the development of a rating system. This clearly indicates that the certification from one rating system cannot be compared with another one.

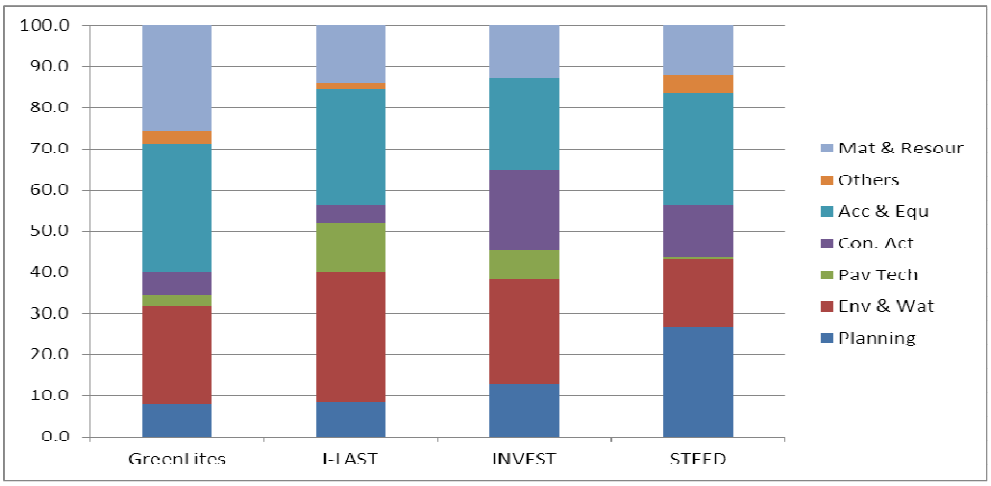


Figure 4 Comparison of Point allocations for different sustainability criteria

Table 7 General Comparison of the Road Rating Systems

Criteria	Greenroads	GreenLITES	I-LAST	INVEST	STEED
Launched Date	2009	2010	2010	2010	2008
Country of Origin	USA	USA	USA	USA	USA
Website	www.greenroads.org	www.dot.ny.gov/programs/greenlites	http://www.dot.state.il.us/green/documents/I-LASTGuidebook.pdf	www.sustainablehighways.org	N/A
Certification Levels	Certified / Silver / Gold / Evergreen	Certified / Silver / Gold / Evergreen	N/A	Bronze / Silver / Gold / Platinum	N/A
Fee	-$5000* (Contract Price (million) /10) *-Minimum $5000*	N/A	Free	Free	Free
Number of projects	-120 Including Research -04 Certified	N/A	N/A	N/A	N/A
Third Party valuation	Yes	Yes, Internal for NYSDOT only	No	No	No
Certification Labeling	Greenroads	GreenLITES	N/A	INVEST	STEED
Update Process	-Annually voluntary -Every five years Mandatory	N/A	N/A	Voluntary	N/A
Governance	Greenroads Foundation	NYSDOT	Illinois DOT	Federal Highway Administration, US Department of Transportation	H.W Lochner Inc.
Stage of Use	Project Development	-Project Design -Operation	Project Development	-Planning -Project Development -Operation & Maintenance	-Planning -Project Development -Operation & Maintenance
Total Points	118	70	213	-System Planning - 160 -Project Development - 85/117 -Operation & Maintenance - 150	153
Minimum Point Requirement	27%	33%	N/A	30%	N/A
Information	All the information available in the website	All the information available online	Download the manual online	All the information available in the website	Email: Demich, Gary gdemich@hwlochner.com

7.2 ADVANTAGES AND DISADVANTAGES OF THE DIFFERENT RATING SYSTEMS

The following table 08 summarized the pros and cons of each of the rating systems considered in the research.

Table 8 Advantages and disadvantages of road rating systems

Advantages	Disadvantages
Greenroads	
• 3rd Party certification available • A well-established rating system • Have assessed more than 120 projects so far • Have started issuing certification	• Very difficult to obtain certification because of the mandatory project requirements • No provisions provided to select only the relevant criteria based on the type of project • Not applicable for planning or operation and maintenance stage • Cannot compare uncertified projects based on the scores only as the project requirements does not contain any point value
INVEST	
• Free self-evaluation tool • Can be applied for planning and operation and maintenance stages as well • Provides refined criteria for small scale projects • Provides a different scorecard for small projects under project development category • No mandatory project requirements	• No 3rd party certification available • As this is a self-evaluation tool, implementation requires additional effort from the internal staff of the organization • No room provided in the scorecard for innovation or unlisted items
GreenLITES	
• Free self-evaluation tool • Has very good structured guideline on how to be implemented within an agency • Applicable for Project Design and operation • The scorecard provides room for innovations and unlisted items • No mandatory project requirements • The scorecard provides detailed breakdown of each category compared to INVEST, making scoring much easier	• Primarily developed for the internal use within NYSDOT and No 3rd party certification available • Does not provide a refined scorecard for small projects. • Less importance is given for pavement technology and construction activities including quality control

I-LAST	
• Voluntary self-evaluation tool • Flexible in the selection of the criteria based on the type of project	• No 3rd party recognition available • Does not have an award system • Can't compare projects based on the score due to the flexibility in the selection of criteria • Not applicable for planning or operation and maintenance stage • Not revised since its first release in 2010
STEED	
• Voluntary self-evaluation tool • Sustainable practices are identified and implemented through all four stages of the project • Requirement of a one page summary on how to achieve the selected criteria provides a better understanding about the objectives to the relevant parties	• No 3rd party recognition available • Does not have an award system • Less importance is given to pavement technology • The criteria are based on a broader perspective and do not look into to the finer details. This makes the comparison of projects difficult based on the score.

8. SITE SURVEY

A site survey was conducted among the site staff of the Streets Operations Branch. Twenty five crew members were selected randomly and they were asked to fill out a one page questionnaire. The objective of this survey was to introduce the Green City Action Plan 2020 among the crew members, to understand the work procedures and the level of sustainability practices at the sites, to get an understanding of the knowledge on sustainability among the site staff and their willingness to incorporate new practices to make the road construction sustainable.

It was observed that, the crew members, at least at the foremen level are willing to adopt sustainable best practices in their work procedures. But most of them were concerned about the increase in workload in terms of the documentation. It was also observed that they lacked the guidance when it comes to the implementation of sustainable practices and there was no documented proof available on site to quantify the outcome of the incorporation of any sustainable practice. The foreman was solely responsible for the quality of the work and no quality audits were done by a designated quality control staff. And most importantly, no crew members were provided with an environmental training so far. The results of the survey are provided in the figure 05 below.

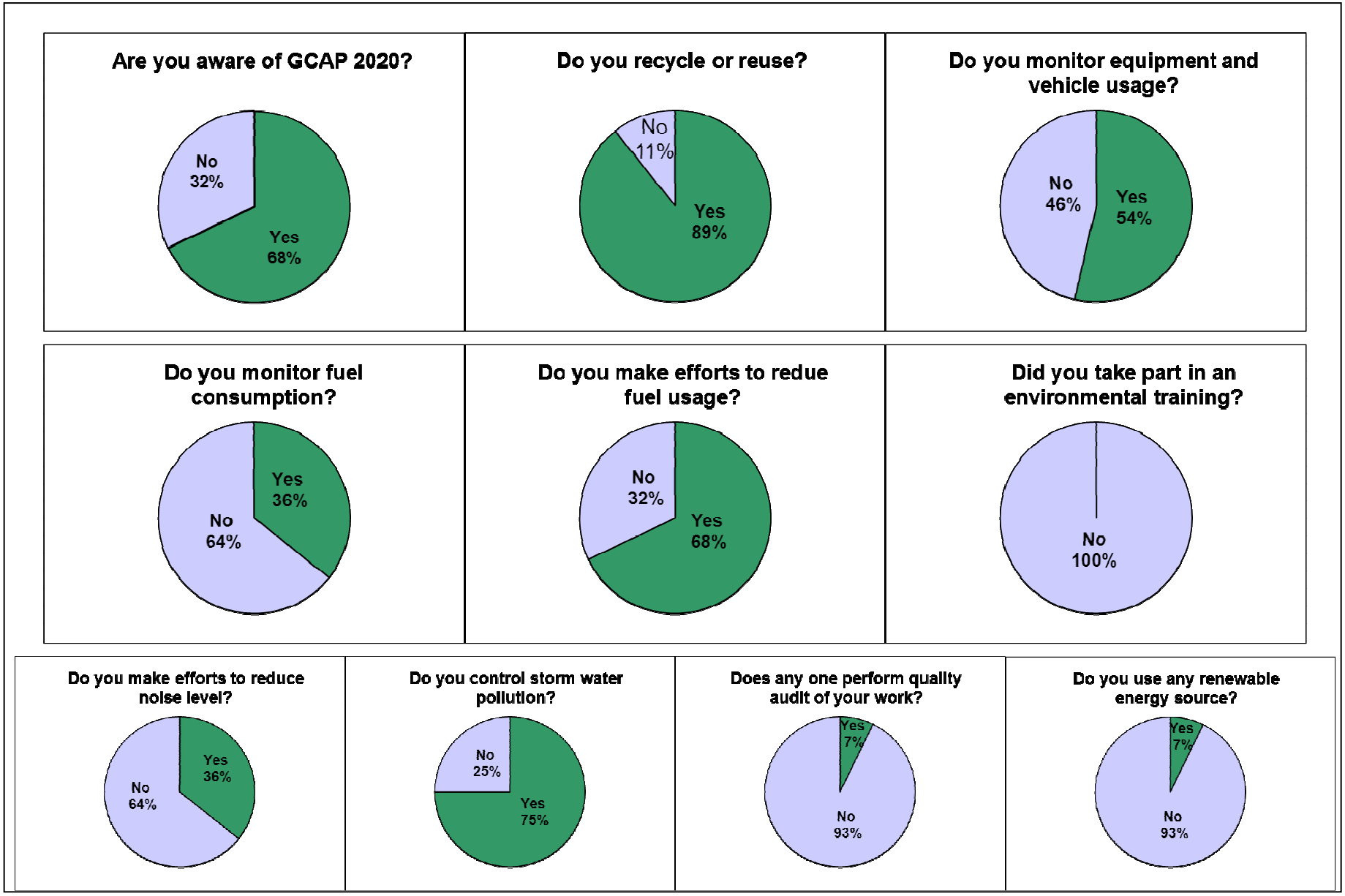


Figure 5 Results of the Site Survey

9. RECOMMENDATIONS

9.1 INTRODUCTION

The primary idea behind the implementation of a road rating system for the City of Vancouver's road construction work is to inform the City how sustainable their construction practice is. This also gives the City an opportunity to lead the way on green issues. If a recognized award system based on a road rating system can be implemented, it will demonstrate the public, how the city is advancing its sustainable practices towards becoming the Greenest City by 2020. The identified road rating systems can be classified into four groups as shown in the figure 06 below. The suitability of each of this rating system for the City of Vancouver and the recommendations to be adopted to implement these rating systems are explained in detail under the relevant categories.

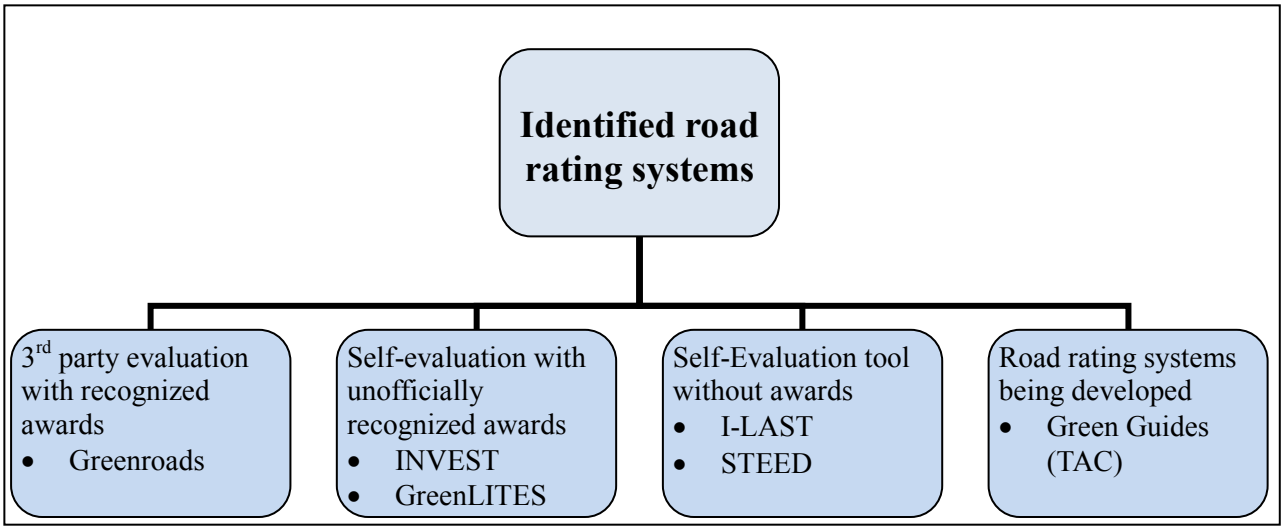


Figure 6 Classification of road rating systems

9.2 3RD PARTY EVALUATION WITH RECOGNIZED AWARDS

Greenroads is the one and only rating system available so far which provides 3rd party certification. It is not possible for the City to go for this rating system because of the 11 compulsory project requirements. The COV doesn't have all the required documentation to satisfy most of the project requirements. It is also not feasible to prepare all the required

documentation and implement the procedures at the site due to the small scale of the project undertaken by the city, which is rehabilitative in nature in most of the cases.

The other option is to go for a pilot project evaluation or an A-Lined assessment from Greenroads. Pilot project evaluation is a less formal way of assessment and it informs the client the ability of a project to score as it is and the necessary improvements required to achieve a certification level with Greenroads. This is also done by reviewing documents such as plans and specifications, quality control plan, environmental review documents, mix design documents, design reports, geotechnical report, etc. It doesn't look possible for the city to go for this assessment as well, as most of the required documents are not available. When the necessary documents are not submitted, the Greenroads won't be in a position to analyze the project properly or to develop recommendations. The pilot project summary report done for the Mill and Overlay project at the Minnesota Department of Transportation can be considered as an example of what score the City will get if it opt for a pilot project assessment. The Minisota Department of Transportation also had very few documents like the City of Vancouver and they scored only 15 out of 118 and satisfied only 02 PR's out of 11. The pilot project report is available online at Greenroads website.

The purpose of an A-Lined assessment is also to identify the potential of a project to obtain certification in Greenroads and to develop recommendations for improvements. This is a less expensive form of assessment than the pilot project assessment where only few documents are reviewed. As it can be seen clearly, the projects of the City of Vancouver do not have the potential to obtain certification from Greenroads. Hence it is not required to go for an A-Lined assessment, as the primary objective of the A-Lined assessment is to inform the client how to increase the chances of scoring to obtain certification. Besides, the criteria and detail requirements of Greenroads is available online for reference.

9.3 SELF-EVALUATION WITH UNOFFICIALLY RECOGNIZED AWARDS

There are two prominent rating systems available under this category and they are INVEST and GreenLITES. Both of these rating systems are free to try and voluntary in nature. These two rating systems also have a separate category of criteria for maintenance and operation work as well. Because of the voluntary nature of these rating systems, the user has the flexibility to amend the scorecard to best suit his needs.

Although it is possible to use both of these rating systems for the City of Vancouver, implementing INVEST is much easier. INVEST provides a basic scorecard which contains only the relevant criteria for small scale projects which are rehabilitation or reconstruction in nature. If GreenLITES to be implemented, the scorecard has to be amended by selecting only the relevant criteria. This would require careful evaluation of the criteria and changes in the award system as well. The City can use one of this tool for its internal recognition as well. It is recommended to introduce an incentive system where the most sustainable project based on the rating system would be recognized during the City Awards.

However, to implement any of the rating systems successfully, the City needs to implement certain recording procedures, do some analysis and create documented guidelines. The following table 08 summarizes the requirements needed to be adopted to implement INVEST successfully. It was observed that, by implementing INVEST Pilot Test Version, a typical grind and overlay project of the City of Vancouver can score up to 33 points with little effort to prepare documented proof. This is only one point less from a Silver Award. But if all the highlighted items in table 08 can be implemented the same project has the potential to score up to 53 points which is good enough to achieve the Platinum Award from INVEST. The detailed scorecard is provided in Appendix.

Table 8 Requirements to adopt INVEST successfully

Records
• Habitat restoration activities which show the impact of the project on habitats and how it's restored • Recycled and reused materials on site • List of the implemented ITS applications and photographs of proof • Usage of construction and non-construction equipment, hours of operation and fuel consumption
Analysis
• Cost Benefit Analysis • Life Cycle Cost Analysis of pavement structures • Analysis of the purpose of providing improved pedestrian and bicycle access, how it fits with the land use and public feedbacks on the proposal • Expected energy savings of using energy efficient lights • Calculation of total paved surface using long lasting pavements
Documents
• Pavement design report • Formal quality control Plan • Noise mitigation plan
Actions
• Conduct road safety audit regularly and provide documented proof of the audit • Create public awareness programs about the projects and create a website for public opinions • Track environmental compliance and maintain records of the commitments • Develop general guidelines on how to control storm water pollution • Provide environmental training for site staff

It is understood that, it is not possible to implement all the suggested actions at once. Since the goal of the City is to become the Greenest City by 2020, it is possible to incorporate most of these with the time in hand. Most of these documents have to be created only once and they can be used for other projects as well due to the typical nature of the projects.

The main objective of the city is to become as sustainable as possible. Therefore, the efforts of implementing sustainable practices should not stop with the achievement of an award from a rating system. The city should target the continuous improvements. Different rating systems

should be investigated and efforts should be taken to implement whatever the sustainable practices possible. With the innovation of new technologies and input from the clients, the rating systems also keep on changing. Therefore the newer versions of the rating system should be used for evaluation once they become available.

9.4 SELF-EVALUATION WITHOUT AWARDS

STEED and I-LAST are the two rating systems which fall under this category. The idea behind the development of these rating systems is the continuous improvement of projects by the incorporation of as many sustainable practices as possible. For City of Vancouver, to lead the way on green issues, it needs to adopt an award based rating system which would demonstrate the public the City's initiatives towards GCAP 2020. But, as mentioned earlier, the ultimate objective of the City has to be to become as sustainable as possible. Therefore, while implementing an award based rating system like INVEST, the non-award based rating systems also should be analyzed to identify the best sustainable practices available.

Green Guides is an important road rating system that needed to be looked forward to. This is a self-evaluation tool being developed by the Transportation Association of Canada (TAC). Green Guide is important for the City of Vancouver as its being developed in Canada. Many other cities, the City of Toronto, City of Winnipeg, City of Calgary, City of Edmonton, City of Hamilton and City of Ottawa are sponsoring this project. The pros and cons of the existing road rating system are considered in the development of Green Guides and it is expected to be released in winter 2013. While implementing a self-evaluation tool for the City of Vancouver, it is highly encouraged to look forward for the release of Green Guides, evaluate it and consider adopting the recommended sustainable practices.

10. CONCLUSION

Road construction is considered to be one of the major polluters of the environment. The types of pollution caused by road construction and maintenance work vary from air pollution, water pollution, habitat destruction, noise pollution, etc. However, if the possible environmental impacts of a project can be identified in its early stages, preventive measures can be adopted. Making the road construction practices sustainable, would play an important role in achieving the Vancouver's goal of being the Greenest City in the world by 2020. Sustainable road rating system is a tool that can be used to identify the sustainable best practices in road construction. Implementing an award based rating system would also help the city to demonstrate the public of its actions to be the leader in Green initiatives.

There are many road rating systems available in the market today. These rating systems can be classified as rating systems with 3rd party evaluation, self-assessment tools with non-recognized certification and self-assessment tool without certification. Greenroads is the one and only tool available so far, which provides 3rd party certification. But, going for a certification or a pilot project assessment from Greenroads does not seem possible because of the lack of written documents available in the City of Vancouver. INVEST and GreenLITES are the prominent voluntary self-assessment tools, which provide non recognized awards. Since INVEST provides separate criteria and scorecard for small scale rehabilitation projects, adopting invest is easier than GreenLITES. If GreenLITES need to be adopted, the criteria and scorecard for the project design certification program has to be refined to match the rehabilitation project in consideration.

Although the application of an award based rating system would inform the City how sustainable their road construction is, the efforts should not stop there. The main aim has to be to incorporate as many sustainable practices as possible. This can be achieved with the careful investigation of the available road rating systems. The non-award based self-evaluation tools can be utilized for this purpose. With the innovation of the technology, these road rating systems are continually updated and new road rating systems are developed. The City needs to adopt a practice to look for this new rating system and try to implement the possible new sustainable practices. Green Guides, being developed by the Transportation Association of Canada, is one of the rating systems that need to be looked forward to.

REFERENCES

- Greenroads Manual (www.greenroads.com)
- www.sustainablehighways.org
- www.dot.ny.gov/programs/greenlites
- STEED booklet (Sustainable Transportation Engineering & Environmental Design)
- I-LAST guidebook (Illinois Livable and Sustainable Transportation Rating system and Guide)

APPENDIX

INVEST SCORECARD FOR A TYPICAL GRIND AND OVERLAY PROJECT AT THE CITY OF VANCOUVER

FHWA
Sustainable Highways Self-Evaluation Tool
Pilot Project Version - Basic Scorecard

Project Development Criteria

Criterion	Title	Score		
PD-1	Cost Benefit Analysis		0	02
PD-2	Highway and Traffic Safety		0	02
PD-4	Lifecycle Cost Analysis		0	01
PD-5	Freight Mobility	03	0	
PD-6	Educational Outreach		0	02
PD-7	Tracking Environmental Commitments		0	04
PD-8	Habitat Restoration	03	0	
PD-9	Stormwater	03	0	03
PD-10	Ecological Connectivity		0	
PD-11	Recycle & Reuse Materials	06	0	
PD-14	Pedestrian Access	02	0	
PD-15	Bicycle Access	02	0	
PD-17	Historical, Archaeological, and Cultural Preservation	02	0	
PD-19	Low-Emitting Materials	02	0	
PD-20	Energy Efficient Lighting	05	0	
PD-21	ITS for System Operations	03	0	
PD-22	Long-Life Pavement Design	04	0	
PD-27	Construction Equipment Emission Reduction		0	01
PD-28	Construction Noise Mitigation		0	01
PD-29	Construction Quality Control Plan		0	04
	Project Development Score	34	0	54

	Number of Points Required for Each Level Basic Scorecard
Total # Points	85
BRONZE (30%)	26
SILVER (40%)	34
GOLD (50%)	43
PLATINUM (60%)	51

- Score with little effort

- Potential Score with more effort

Pilot Project Version, April 2011

Note - some criteria are not included in the basic scorecard, so criterion numbers may not be sequential.

Summary of Criteria
Page 1 of 5

FHWA
Sustainable Highways Self-Evaluation Tool
Pilot Project Version - Basic Scorecard

Project Development					Tally	0
Criterion	Title	Requirements	Point Basis	Available Points	Obtained Points	Total Score
PD-1	Cost Benefit Analysis	Using the principles of cost benefit analysis, ensure that users benefits, including environmental and social benefits, exceed full life-cycle costs, including estimates of environmental and social costs.	Conduct a cost benefit analysis for the project that shows the net present value of expected user benefits exceeds life-cycle costs.	3	02	02
Range: 3 Points						
PD-2	Highway and Traffic Safety	Safeguard human health by incorporating science-based quantitative safety analysis processes within project development that will reduce serious injuries and fatalities within the project footprint.	Complete road safety audits (RSA) in accordance with FHWA's Road Safety Audit Guidelines.	4	02	02
Range: 4 -10 Points			Include the use of predictive methods for evaluation of quantitative safety effects.	+5		
			Perform an evaluation of the safety effectiveness of the project using statistically reliable approaches.	+1		
PD-4	Lifecycle Cost Analysis	Inform the decision-making process for the project through lifecycle cost analyses of key project features.	Perform a lifecycle cost analysis of all pavement structure alternatives considered.	+1	01	01
Range: 1-3 Points			Perform a lifecycle cost analysis of all stormwater utilities.	+1		
			Perform a lifecycle cost analysis of all of the project's other main features.	+1		
PD-5	Freight Mobility	Decrease the impacts from freight movements. *Points for features are cumulative if roadways have more than one feature, however this criterion shall not exceed seven (7) points.*	No-idling policy and signage; OR Construct new rest area or rest stop or expand existing rest area or rest stop.	+1	01	03
Range: 1-7 Points			Safety improvements specifically for freight; OR physical or otherwise constructed grade or alignment adjustments for truck safety and mobility.	+2		
			Construct a new dedicated truck delivery parking areas or repurpose an existing parking area to be truck-only; OR Automated Weigh-In-Motion stations.	+3	02	
			Virtual Weigh-In-Motion stations; OR construct a new electrified rest stop or electrify an existing rest stop.	+4		
			Construct a new or convert an existing mixed-traffic lane to a truck-only lane.	+5		

FHWA
Sustainable Highways Self-Evaluation Tool
Pilot Project Version - Basic Scorecard

Project Development					Tally	0
Criterion	Title	Requirements	Point Basis	Available Points	Obtained Points	Total Score
PD-6	Educational Outreach	Increase public, agency, and stakeholder awareness of roadway sustainability activities.	Incorporate a comprehensive public educational outreach program that promotes and educates the public about sustainability into the planning, design, construction and operational phases of the roadway project.	2	02	02
Range: 2 Points						
PD-7	Tracking Environmental Commitments	Ensure environmental commitments made by the project are completed, and documented in accordance with all applicable laws, regulations and issued permits.	Utilize a comprehensive environmental compliance tracking system for the project, beginning in project development, to identify how environmental commitments will be identified, tracked, fulfilled and verified throughout design and construction.	+3	02	04
Range: 3 - 5 Points			The principal project constructor has a documented environmental management system that meets or exceed the standard set forth by ISO 14001:2004 and is in use on the project to track environmental commitments.	+2	02	
PD-8	Habitat Restoration	Offset the loss and alteration of natural (stream and terrestrial) habitat caused by road construction. Restore and protect natural habitat beyond regulatory requirements.	For projects required to mitigate habitat impacts, restore and/or preserve more area by at least an additional 5% beyond what is required.	3	03	03
Range: 3 Points			For projects not required to mitigate habitat impacts, implement a habitat restoration effort.	or 3		
PD-9	Stormwater	Improve stormwater quality from the impacts of the project and control flow to minimize their erosive effects on receiving waters using management methods and practices that reduce the impacts associated with development.	Treat 80% or more of the managed runoff for sediments (or more) for an area greater than the target impervious surface area.	+1-3	02	03
Range: 1-9 Points			Implement flow control measures for 80% or more of the managed runoff for sediments (or more) for an area greater than the target impervious surface area.	+1-3	02	
			Implement effective water quality BMPs and/or Infiltration /LID.	+1-2	01	
			Project is located within an urban boundary as defined by local planning department.	+1	01	
PD-10	Ecological Connectivity	Provide or improve wildlife, amphibian, and aquatic species passage access and mobility across roadway facility boundaries.	Conduct a site-specific ecological assessment and replace in-kind, retrofit, or upgrade any and all existing culverts and wildlife fencing structures deemed structurally deficient, damaged, obsolete, insufficiently sized, or otherwise inadequate.	2		0
Range: 2 or 3 Points			Conduct a site-specific ecological assessment and install new dedicated or multi-use wildlife crossing structures and protective fencing.	or 3		

FHWA
Sustainable Highways Self-Evaluation Tool
Pilot Project Version - Basic Scorecard

Project Development					Tally	0
Criterion	**Title**	**Requirements**	**Point Basis**	**Available Points**	**Obtained Points**	**Total Score**
PD-11	Recycle & Reuse Materials	Reduce lifecycle impacts from extraction and production of virgin materials. *Points for features can be earned for both recycling and reusing, however this criterion shall not exceed eight (8) points.*	Recycle: Pavement binder materials only. 1 point for every 10% recycled up to 50%	+1-5	04	06
Range: 1-8 Points			Recycle: HMA or PCC pavement materials only. 1 point for every 10% recycled up to 50%	+1-5		
			Recycle: All pavement materials.1 point for every 10% recycled above 20% to maximum 60%	+1-5		
			Recycle: All project materials. 1 point for every 10% recycled above 20% to maximum 60%	+1-5		
			Reuse: All pavement materials. 1 point for every 10% used above 50% to maximum 90%	+1-5		
			Reuse: All structural materials. 1 point for every 10% used above 50% to maximum 90%	+1-5		
			Reuse: All project materials. 1 point for every 10% used above 50% to maximum 90%	+1-5	02	
PD-14	Pedestrian Access	Promote walkable and wheelable (wheelchairs, strollers, scooters) communities by providing pedestrian facilities within the project footprint.	Implement operations or technologies for pedestrian facilities.	1	02	02
Range: 1 or 2 Points			Implement physical or constructed changes to the roadway structure, dimensions or form that provide pedestrian access within the right of way.	or 2		
PD-15	Bicycle Access	Promote bicycling in communities by providing dedicated cycling facilities within the project footprint.	Implement new (or improve existing) operations or technologies for bicycle facilities.	1	02	02
Range: 1 or 2 Points			Implement new (or improve existing) physical or constructed changes to the roadway structure, dimensions, or form that provide safe and convenient such as bicycle lanes or other bikeways.	or 2		
PD-17	Historical, Archaeological, and Cultural Preservation	Respect and preserve cultural and historic assets, and/or feature National Scenic Byways Program (NSBP) historic, archaeological, or cultural intrinsic qualities in a roadway.	The project location is officially recognized because of it's significant historical, cultural and/or archaeological features. An effort has been made to minimize adverse effects on the project location and the project protects, preserves and/or enhances historic, archaeological or cultural resources.	2	02	02
Range: 2 Points						
PD-19	Low-Emitting Materials	Reduce human exposure to hazardous airborne compounds from construction materials.	Do not use cutback asphalt and all paints and coatings must comply with GS-11.	2	02	02
Range: 2 Points						
PD-20	Energy Efficient Lighting	Reduce lifetime energy consumption of lighting systems for roadways.	Install energy efficient lighting systems that are compliant with all safety requirements applicable to the roadway project. 1 point awarded for each 10% of reduced energy to a maximum of 50%.	1-5	04	04
Range: 1-5 Points						

FHWA
Sustainable Highways Self-Evaluation Tool
Pilot Project Version - Basic Scorecard

Project Development					Tally	0
Criterion	Title	Requirements	Point Basis	Available Points	Obtained Points	Total Score
PD-21	ITS for System Operations	Meet economic and social needs and improve mobility without adding capacity, or improve the efficiency of transportation systems.	Points awarded for installing ITS applications in the following categories: surveillance, traffic control, lane management, information dissemination, enforcement, ramp control, warning systems, road weather management, traveler information, electronic payment/pricing, traffic incident management, emergency management, information management, response and treatment. Points depend on number of applications used and number of categories per Requirements.	1-5	03	03
Range: 1-5 Points						
PD-22	Long-Life Pavement Design	Minimize life cycle costs by promoting design of long-lasting design pavement structures.	Design at least 75% of the total new or reconstructed pavement surface area for regularly trafficked lanes of pavement to meet long-life pavement design criteria and the pavement must be designed in accordance with a formally recognized, adopted and documented design procedure.	5	03	03
Range: 5 Points						
PD-27	Construction Equipment Emission Reduction	Reduce air emissions from nonroad construction equipment.	At least 50% of the nonroad construction equipment fleet operating hours for the project are accomplished on equipment either an engine that meets EPA Tier 3/Interim Tier 4 standards or have diesel retrofit devices for after-treatment pollution control verified by either the EPA or the California Air Resources Board.	1	01	01
Range: 1 or 2 Points			At least 75% of the nonroad construction equipment fleet operating hours for the project are accomplished on equipment either an engine that meets EPA Tier 3/Interim Tier 4 standards or have diesel retrofit devices for after-treatment pollution control verified by either the EPA or the California Air Resources Board.	or 2		
PD-28	Construction Noise Mitigation	Reduce or eliminate annoyance or disturbance to surrounding neighborhoods and environments from road construction noise and improve human health.	Establish, implement, and maintain a formal Noise Mitigation Plan (NMP) during construction for the prime contractor.	1	01	01
Range: 1-2 Points			The project is an urban project greater than $100M in construction value.	+1		
PD-29	Construction Quality Control Plan	The prime contractor will establish, implement, and maintain a formal construction Quality Control Plan (QCP).	Establish, implement, and maintain a formal Quality Control Plan during roadway construction.	5	04	04
Range: 5 Points						