Incorporating Sustainable Practices and Water Quality into Roadway Design

May 24, 2017
Overview

What is Sustainable Roadway Design?

Planning Tools

Complete Streets

LID
- What is LID
- Application for Public/Urban Infrastructure
- Challenges
- Keys to Success
Sustainable Roadways

- Environmentally Friendly
- Improvement of Water and Air Quality
- Safer Neighborhoods
- Pedestrian Friendly
- Promotes Economic Development
- Meets Needs of Tomorrow
- Involves Stakeholders
- Reduces Cost of Life Cycle
Planning Tools

RATING SYSTEMS
• LEED - Facility
• Envision - Infrastructure

BENEFITS
• Best Practices
• Standard for Planners/Designers
• Measurable Results
• Public Relations
Envision's critical role in infrastructure sustainability

Envision is an easy to use, flexible resource development and maintenance of sustainability provides value at every step of the process stages throughout operations.

The Envision sustainable infrastructure rating comprehensive framework of 60 sustainability full range of environmental, social, and economic...
To foster improvements in Economic, Social and Environmental aspects of projects.
Complete Streets
What is Low Impact Development?

Also known as:

- Green Infrastructure (GI)
- Environmentally Sensitive Design (ESD)
- Water Sensitive Urban Design (WSUD)
What is Low Impact Development?

Generally accepted Definition/Concepts:

• “Systems and practices that use or mimic natural processes to infiltrate, store, evapotranspirate, or reuse stormwater or runoff on the site where it is generated”

• Focus on maintaining or replicating the pre-development hydrologic regime (both quantity and quality)

• Focus on use of micro-scale controls that are distributed throughout the site, versus at the “end of pipe”
Common Forms

Disconnection of Impervious Surfaces

Bioretention

Rain Gardens

Bioswales

Vegetated Buffers / Strips

Green Roofs

Porous Paving

Rainwater Harvesting
LID Design Components

1. **Quantity Control**
   - Peak Flow Attenuation
   - Runoff Volume Reduction

2. **Quality Control**
   - Sedimentation
   - Floatation
   - Filtration
   - Biological Processes

3. **Pollutant Removal**
   - TSS
   - Nutrients
   - Bacteria
Bioretention Design

- Inlet from Roadway or Parking Area (Grass, Vegetated, or Stone-Lined Swale)
- Mulch Layer
- Temporary Ponding Area
- Native Plantings
- Overflow Inlet
- Optional Stone Weir (Overflow Spillway)
- Optional Geotextile (Sides Only)
- Peastone Separator
- INfiltration
- BIOTREMATION SOIL
- GRAVEL BED
- NATIVE SOIL
- Optional Underdrain
- Outflow
Basic Design Concepts

- 2–3” Mulch, Compost, or Landscape Rock
- 6–12” Ponding Water
- 2–4’ Engineered Planting Soil
- Filter Fabric
- 6”–1’ Gravel
Basic Design Concepts
Challenges

- High Intensity Rainfall
- Dual Function Performance
- Poor Soils
- Poor Construction Practices
- Poor Design Practices
- Lack of Available Space
- Poor O&M Practices
- Vegetation Failure
- BMP Failure

Vegetation Failure

BMP Failure

High Intensity Rainfall

Dual Function Performance

Poor Soils

Poor Construction Practices

Poor Design Practices

Lack of Available Space

Poor O&M Practices

Vegetation Failure

BMP Failure
Keys to Success

- Constructible
- Durable
- Maintainable
- Compatible
- Visible
- Context Sensitive
Case Studies
Merritt Road, Rowlett
BIORETENTION BED
PLANTINGS
(SEE SHEET BE-1)

6" OVERFLOW
PIPE @ 10'
SPACING

3" AGED HARDWOOD
BARK MULCH SHREDDED 2X

GABION
LEVEL
SPREADER

12" FILTERED MEDIA OR
APPROVED EQUAL WITH MINIMUM
INFILTRATION RATE OF 100" PER
HOUR
6" PEAGRavel

ATLANTIS DOUBLE MODULE RAIN TANK
WITH 80Z NON-WOVEN GEOTEXTILE
ENVELOPE
CLEAN SAND
CONTACT CONSTRUCTION ECOSERVICES
FOR PROPER FABRIC SPECIFICATION
45 MIL EPDM IMPERMEABLE LINER
18" TO 24" RCP OUTLET
3" CRUSHED LIMESTONE

3' 2' 3' 3' 2' 3' 2'
24"x12" Gabion Forebay Level Spreader

Vegetated Swale Flow

Turf Reinforced Matting

Atlantis Double Module Rain Tank with 800 Nonwoven Geotextile Envelope. Contact ECOSERVICES for Proper Fabric Specification.

3" Crushed Limestone

6" Overflow Inlet

5 LF 18" RCP with Pipe Boot Connection to Rain Tank

45mil EPDM Impermeable Liner

5" Pea Gravel

12" Filtered Media or Approved Equal Min. Infiltration Rate of 100" per Hour

Bioretention Plantings (see sheet BE-1)

6" Overflow Pipe @ 10' Spacing

3" Aged Hardwood Bark Mulch Shredded 2x
Existing South Lamar
Concerns

Drainage
- Storm drain lines undersized
- Too few inlets

Deteriorated pavement

Lack of pedestrian amenities
Standard Roadway

Safe and Convenient for **CAR** Traffic Only

- Wide Divided Roadway
- Split Green Space
- Small Sidewalks Close to Road
LID Roadway Layout

CONSERVE RESOURCES & FUNCTION

Site Specific Benefits

Green Space Buffer Zone

Reduces Costs

UN DIVIDED AND OFFSET ROADWAY
MAXIMIZE THE QUALITY OF RUNOFF

Bioretention Basins

IMPROVE STORM WATER QUALITY

Pollutant Removal

Vegetated Depression

Filters Water Before Collected
Project Costs

- Bio-retention cells
- LED lighting
- Less infrastructure
- Reduced maintenance costs
- Avoid high maintenance items - pavers
- Durable pavement section
## Project Costs

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<tr>
<th>TOTAL CONSTRUCTION COST</th>
<th>STANDARD DESIGN</th>
<th>LOW IMPACT DESIGN</th>
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<tbody>
<tr>
<td>CIVIL ITEMS</td>
<td>$6,480,604</td>
<td>$6,200,478</td>
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<tr>
<td>LANDSCAPING ITEMS</td>
<td>$1,488,412</td>
<td>$1,161,017</td>
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<td><strong>TOTAL INITIAL COST</strong></td>
<td><strong>$7,969,016</strong></td>
<td><strong>$7,361,495</strong></td>
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### LIFE CYCLE FACTORS

INITIAL COST, ANNUAL PAVEMENT REPAIR COSTS, LANDSCAPING MAINTENANCE, LIGHTING MAINTENANCE, DESIGN LIFE

<table>
<thead>
<tr>
<th>LIFE CYCLE COST</th>
<th>COST PER YEAR</th>
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<tr>
<td>STANDARD DESIGN</td>
<td>$323,180</td>
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<tr>
<td>LOW IMPACT DESIGN</td>
<td>$267,716</td>
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Clean Water State Revolving Fund (CWSRF) Loan Program

Below market interest rate loans
James Garner Street – City of Norman - Complete Street
James Garner Street – City of Norman - Complete Street
James Garner Street – City of Norman - Complete Street
Questions
Freese and Nichols, Inc.
6303 N Portland Ave
Suite 100
Oklahoma City, OK 73112
405-607-7060

Todd Buckingham, P.E.,
ENV SP
 tcb@freese.com
 817-735-7517

Justin Oswald, P.E., CFM
jto@freese.com
 817-735-7506