Green Streets and Porous Pavement:
Lessons for Sustainability, Success
and Savings

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Presentation Overview

- Porous Street Design Concepts
  - Porous Concrete
  - Porous Pavers
- Maintenance Cost Assessment
- Bellingham Case Studies
  - Northshore Road Rehabilitation
    - Design Concept
    - LID/Traditional cost comparison
    - Maintenance cost assessment
  - Meador Kansas Ellis Corridor Improvement
    - Design Concept
    - LID/Traditional cost comparison
    - Maintenance cost assessment
- Repair
- Summary
Porous Surface Design Concepts

- **Porous Concrete Specifications**
  - Specific concrete design – uniform aggregate
  - Latex hardener added, no other admixtures
  - PCAPave used to size roadway section
  - Costs – 50 – 80% more than traditional concrete subject to section design

- **Porous Concrete Uses**
  - Sidewalk
  - Pathway
  - Bike Lanes
  - Low-volume roadways

Porous Street Design Concepts

- **Porous Pavers Specifications**
  - Same as standard pavers
  - Placed similarly to traditional pavers
  - Interlocking style recommended
  - Costs – 3-5 times more than traditional concrete/asphalt subject to section design

- **Porous Paver Uses**
  - Sidewalks/public plazas
  - Pathway with edge restraints
  - Parking lanes
Additional Technologies/Technical Thoughts

- Regional Use Considerations
  - Freeze/thaw concerns
  - Thermal cycles
  - Vegetation growth

- Other surface types
  - Glass/rock with polymer
  - Gravel retention cells
  - Grass cells ‘Grasscrete’

Detention Maintenance Activities

- Clearing/vegetation control
  - Ponds – yearly
  - Pipes/vaults – every 3 years
Porous Maintenance Activities

- Twice yearly vacuum
  - Purpose built equipment
  - Dry weather required
  - Predictable scheduling
- 5-Year Restoration
  - Pressure wash with vacuum
  - Vacuum truck accessory

Maintenance Cost Evaluation

- Job tickets for facilities maintenance
- Evaluated against serviced roadway area
- Results are $/lf/year for facilities
- LID and traditional facilities
Northshore Roadway Improvements

- Roadway rehabilitation – stringent stormwater requirements.
- Before:
- After:

- Traditional stormwater system vs LID Options?

Street Design Section
Capital Cost Comparisons - Stormwater

- **Option 1:** Buy waterfront property for new facilities
  - If you have to ask, you can't afford it…

- **Option 2:** 100% Impervious – treatment vaults
  - Piped system and treatment vaults (11,000 cf required)
  - 20 (8x12) vaults x $30,000 each (installed) = $600,000
  - Piped system = $203,000
  - Total = $803,000

- **Option 3:** 38% Porous Replacement (Sidewalks/bike lanes)
  - Impervious area reduction, stormwater infiltration, piped system back-up
  - 3125 SY installed x $23.00/sy (additional cost for porous) = $71,900
  - Piped system and porous underdrain = $282,400
  - Total = $354,300

**Construction savings = $448,700**

Maintenance Cost Comparisons

- **Yearly Maintenance Costs**
  - Detention Pipes - $0.70/lf of arterial roadway
  - Porous Bikelanes/Sidewalks – $1.28/lf of arterial roadway

- **Porous Restoration (5 year cycle) = $1.25/lf**

- **20 Year Maintenance Costs**
  - Detention Pipes - $30,800
  - Porous Bikelanes/Sidewalks - $56,320+$11,000 = $67,320

- **Total 20-Year Project Costs**
  - Detention Pipes - $833,800
  - Porous Bikelanes/Sidewalks - $421,620

**Porous design = 49% less over 20 years**
Meador Kansas Ellis Trail

- Corridor improvement/pedestrian bridge project
- Before: 
- After:

- Traditional stormwater system vs LID Options?

Street Design Section
Capital Cost Comparisons - Stormwater

- **Option 1: 100% Impervious – detention requirement**
  - Piped system and treatment/detention vaults (11,000 cf required)
  - 300 lf 48” PVC pipe x $210/lf (installed) = $63,000
  - Piping improvements = $65,000
  - Total = $128,000

- **Option 2: 65% Porous (Sidewalks/Paver Parking)**
  - Impervious area reduction, stormwater infiltration, piped system back-up
  - 800 SY installed x$23.00/yd (more) = $18,400
  - Piping improvements = $11,200
  - Total = $29,600
  - **Construction savings = $98,400**

Maintenance Cost Comparisons

- **Yearly Maintenance Costs**
  - Detention Pipes - $0.70/lf of arterial roadway
  - Porous Bikelanes/Sidewalks – $0.13/lf of arterial roadway*

- **20 Year Maintenance Costs**
  - Detention Pipes - $70,000
  - Porous Bikelanes/Sidewalks - $13,000 + $19,643 = $32,643
  - **Porous design = 53% less over 20 years**

- **Total 20-Year Project Costs**
  - Detention Pipes - $198,000
  - Porous Bikelanes/Sidewalks - $42,243
  - **Porous design = 69% less over 20 years**

*Porous data for this street design is limited to 1 year of data – restoration data is pro-rated from Northshore data.
Surface Repair

- New residential water connection
- Added to sidewalk repair contract – available year round
- Similar costs to traditional sidewalk
- Easier to repair than a detention structure

Summary

- Porous surfaces in streetscapes are proven in both design and construction
- Regulation driving implementation
- Installation is becoming standardized - contractors and inspectors knowledge base is expanding
- Supports all street infrastructure
- Maintenance costs should go down with increased efficiencies
Questions?
Thanks for your time!

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