Improving Sustainability in Stormwater Infrastructure

Tom LaRue, PE
Regional Engineer – Southern California
America's Overall Grade

2017 Infrastructure Report Card
Sustainability: the ability to be maintained at a certain rate or level
Efforts in Sustainability

• Energy Efficiency
• Water efficiency
• Green Design
• Environmentally Innovative Projects

- California Waterboards Guidelines
Obstacles for Efforts in Sustainability

- Energy Efficiency
- Technological
- Political
- Financial
Obstacles for Efforts in Sustainability

• Water Efficiency
• Technical (hydromod)
• Financial
• Success?
Obstacles for Efforts in Sustainability

• Green Design
• Time
• Personal Habits
Obstacles for Efforts in Sustainability

• Environmentally Innovative
• Practical?
• Scalable?

https://www.ads-pipe.com/
Our Efforts in Sustainability

RECYCLE

REDUCE

REUSE
HOW LONG DOES IT TAKE TO DECOMPOSE?

- Banana peel: 2 to 10 days
- Sugar cane waste: 1 to 2 months
- Paper bags: 2 to 5 months
- Cotton: 1 to 5 months
- Orange peel: within 6 months
- Rope: 3 to 14 months
- Thread: 3 to 14 months
- Milk cartons: around 5 years
- Cigarette: 1 to 12 years
- Nylon clothing: 30 to 40 years
- Leather shoes: 25 to 40 years
- Aluminium cans: 80 to 100 years
- Diapers: 500 to 800 years
- Plastic bags: 15 to 1000 years
- Glass bottles: Does not decompose
- Plastic bottles: Does not decompose

Source: http://societyb.com/issues/strange-trash-facts/
Our Efforts in Sustainability

Mega Green (HDPE)
ASTM F2648
DSPS
Private

N-12 (HDPE)
ASTM F2306
AASHTO M294
DOT 520/608
Public

A GREEN NEW PIPE
Green Line POLYMERS

255 million pounds post-consumer plastic + 170 million pounds post-industrial plastic

High performing pipe

ASTM INTERNATIONAL
Helping our world work better

70%
24%
37%
57%

FY 2005 FY 2017

Virgin Recycled

https://www.ads-pipe.com/
5,774 kWh
685 Gal
98MM Btu’s
Recycling Process
Recycled HDPE Bales → Recycled HDPE Flake → Recycled HDPE Pellets

Virgin HDPE Pellets → Carbon Black Pellets
Is 75-100 year service life attainable for Public Storm Sewer & Culverts utilizing portions of recycled HDPE?
NCHRP Research Efforts
Institutional Field Study
~$10,000,000
11 Years of Data Gathered

The Answer: Yes
Field Test Installation

3-Year Evaluation Under Heavy Rail Loads

- Virgin and PCR 750 mm (30 in.) diameter pipes with bell and spigot watertight joint
- 0.6 m (2.0 ft.) of cover to bottom of tie
- Pipes instrumented with strain gages and extensometers
A 30-inch pipe manufactured with recycled materials was installed underneath an active commuter railroad to evaluate performance relative to fatigue loading.

Research concluded that fatigue due to live loading is not a concern for either virgin or recycled pipes.
A GREEN NEW PIPE - AASHTO M294 Revisions

• Recycled = Virgin
  • Same cell classification, NCLS criteria, structural properties, pipe stiffness, etc.

• Recycled > Virgin:
  • Average UCLS failure time must exceed a minimum calculated value to ensure that service life exceeds 100 years
  • Minimum OIT of 20 minutes (ensures resistance to Stage III chemical failure)
  • Elongation at break must exceed 150% (redundant contaminant test)
Standard Practice for Service Life Determination

Standard Recommended Practice for Service Life Determination of Corrugated HDPE Pipes Manufactured with Recycled Materials

AASHTO Designation: M xxx-yy¹
Technical Section: No., Name
Release: Group n (Month yyyy)

- Details procedure for determining the service life of corrugated HDPE pipes manufactured with recycled materials
- Provides equations to determine the minimum UCLS requirements to ensure service life at given conditions

American Association of State Highway and Transportation Officials
444 North Capitol Street N.W., Suite 249
Washington, D.C. 20001

https://www.ads-pipe.com/
Highlights of Research

AASHTO Specifications

• Recommendations were made by the research team to include recycled materials into AASHTO M294
• Criteria were included to ensure 100-year service life for these pipes
• A new AASHTO Standard Recommended Practice was developed to detail the procedure to determine the service life of corrugated HDPE pipes manufactured with recycled materials

https://www.ads-pipe.com/
Recycled HDPE Pipe Applications

- **Agricultural Drainage Pipe**
  - ASTM F667

- **Private Storm Drainage Pipe**
  - ASTM F2648

- **Public Storm Sewer / Culvert Pipe**
  - ASTM F2306-R
  - AASHTO M294-R
Chapter 4  Construction Details

Section 64  Plastic Pipe

4-6401  General

This section provides guidelines for inspecting plastic pipe and slotted plastic pipe for work specified under Section 64, “Plastic Pipe,” of the Standard Specifications. Plastic pipe must be either Type C or Type S corrugated polyethylene pipe, or corrugated polyvinyl chloride (PVC) pipe with smooth interior. Slotted plastic pipe must be polyethylene.
Closing Infrastructure Gap

- Infrastructure Needs
- ASCE Grand Challenge
- Available Funding

Time

$
<table>
<thead>
<tr>
<th>Pipe Diameter in. (mm)</th>
<th>Closed Competition</th>
<th>Open Competition</th>
<th>% Savings from Open Competition</th>
</tr>
</thead>
<tbody>
<tr>
<td>18” (450)</td>
<td>$67.75</td>
<td>$43.44</td>
<td>36%</td>
</tr>
<tr>
<td>24” (600)</td>
<td>$74.19</td>
<td>$44.63</td>
<td>40%</td>
</tr>
<tr>
<td>30” (750)</td>
<td>$103.66</td>
<td>$58.01</td>
<td>44%</td>
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<tr>
<td>36” (900)</td>
<td>$124.76</td>
<td>$75.93</td>
<td>39%</td>
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<tr>
<td>42” (1050)</td>
<td>$205.41</td>
<td>$89.04</td>
<td>57%</td>
</tr>
<tr>
<td>48” (1200)</td>
<td>$239.99</td>
<td>$108.60</td>
<td>55%</td>
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<tr>
<td>54” (1350)</td>
<td>$209.11</td>
<td>$146.95</td>
<td>30%</td>
</tr>
<tr>
<td>60” (1500)</td>
<td>$245.35</td>
<td>$152.80</td>
<td>38%</td>
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</tbody>
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Average Cost ($/foot) for Closed and Open Competition, and Percent Savings Identified for Open Over Closed Competition, On Average.

Source: BCC Research.

<table>
<thead>
<tr>
<th>Simulated 1-Mile Install of 24” (600 mm) Pipe</th>
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<tbody>
<tr>
<td>Closed Competition</td>
</tr>
<tr>
<td>-------------------</td>
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<tr>
<td>$391,746</td>
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Thank You!

Tom LaRue, P.E.
Southern California Regional Engineer
(602) 245-6850
Thomas.LaRue@ads-pipe.com