Case Study: I-95 Section GIR - Rain Garden Maintenance

Megan Farnsworth, EIT
Case Study: I-95 Section GIR - Rain Garden Maintenance

1. I-95 Section GIR Background
2. GR2 Maintenance Inventory
3. Forebay Maintenance
4. Lessons Learned
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I-95 Section GIR Background

I-95 Girard Avenue Interchange Reconstruction (GIR)

3 miles of I-95 Highway (Race Street to Allegheny Avenue)
Multi-phase project (2000-present)
70+ SMP devices throughout project at completion
University Monitoring Program for SMPs since 2016
  • Temple University
  • Villanova University
I-95 Section GIR Background

GIR SMP Maintenance

GR2&3: Complete
- Temple University contracted landscapers
- Monitor manpower
- Recommend design changes

GR4: Construction
- Applied lessons learned from GR2
- Will continue monitoring

GR5&6: In Design
- Applied lessons learned from GR2&3
- Apply lessons from GR4 as constructed
- Long-term maintenance plan for PennDOT
I-95 Section GIR Background

Active GIR SMPs

SMP A
SMPs C,D,&G
SMPs E&F
SMP H
SMPs I&J
SMP P01

I-95 Section GIR - Rain Garden Maintenance

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I-95 Section GIR Background

I-95 – Phase GR2 Aerial View

[Image of aerial view with labeled locations: Delaware Ave, SMP P01, Shackamaxon St, SMP H, SMPs I&J, SMPs E&F, SMPs C,D,&G, SB I-95 NB, NB I-95 SB]

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Vegetation - 225 cubic yards
- Mow lawns
- Remove weeds
- Trim overgrown vegetation
- SMP A – “Minimal Maintenance Routine”

Trash - 146 x 42-gallon bags
- Collect trash
- Needles

Manpower - 1416 man hours
- Inspect after storm events
- Spring/summer → 2 trips per month
- Fall/winter → 1 trip per month
Manpower Observations

Overall Observations

- 1-2 days/month
- Year 2 – scheduling issues

Low Maintenance Requirements

- SMP A – “Minimal Maintenance Routine”
- SMP H – less attention on interior
- SMP I&J – poor performance

High Maintenance Requirements

- SMPs E&F – complaints
  - Tedious maintenance
  - More visits
- SMPs C,D,&G – public presentation
  - Tours
  - Publications

<table>
<thead>
<tr>
<th>Site</th>
<th>Total (2yrs)</th>
<th>Avg per month</th>
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</thead>
<tbody>
<tr>
<td>A</td>
<td>238 hrs</td>
<td>9.9 hrs</td>
</tr>
<tr>
<td>CDG</td>
<td>446 hrs</td>
<td>18.6 hrs</td>
</tr>
<tr>
<td>EF</td>
<td>420 hrs</td>
<td>17.5 hrs</td>
</tr>
<tr>
<td>H</td>
<td>207 hrs</td>
<td>8.6 hrs</td>
</tr>
<tr>
<td>IJ</td>
<td>105 hrs</td>
<td>4.4 hrs</td>
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</tbody>
</table>
GR2 Maintenance Inventory

Manpower per Month

Annual Total
- A: 138 hrs
- CDG: 269 hrs
- EF: 346 hrs
- H: 118 hrs
- IJ: 88 hrs

Monthly Total

July-17: 27 hrs
Aug-17: 43 hrs
Sept-17: 51 hrs
Oct-17: 80 hrs
Nov-17: 41 hrs
Dec-17: 36 hrs
Jan-18: 45 hrs
Feb-18: 96 hrs
Mar-18: 102 hrs
Apr-18: 169 hrs
May-18: 141 hrs
June-18: 130 hrs

July-18: 66 hrs
Aug-18: 4 hrs
Sept-18: 2 hrs
Oct-18: 17 hrs
Nov-18: 10 hrs
Dec-18: 33 hrs
Jan-19: 71 hrs
Feb-19: 92 hrs
Mar-19: 83 hrs
Apr-19: 29 hrs
May-19: 0 hrs
June-19: 50 hrs

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Overall Observations

- SMPs I&J low → poor performance
- SMPs C,D,&G and SMPs E&F highest in vegetation and manpower

NB-side vs SB-side of Highway

- Year 1 → SB-side higher totals
- Sunlight impacts growth
- Continue studying

Fenced vs Open to Public

- Similar totals
- Year 1 – SMPs E&F (fenced)
- Year 2 – SMPs C,D,&G (open to public)

GR2 Maintenance Inventory

<table>
<thead>
<tr>
<th>Site</th>
<th>Total (2yrs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>48.0 yds</td>
</tr>
<tr>
<td>CDG</td>
<td>53.0 yds</td>
</tr>
<tr>
<td>EF</td>
<td>58.0 yds</td>
</tr>
<tr>
<td>H</td>
<td>46.5 yds</td>
</tr>
<tr>
<td>IJ</td>
<td>19.0 yds</td>
</tr>
</tbody>
</table>
GR2 Maintenance Inventory
Vegetation Debris Collected per Month

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GR2 Maintenance Inventory

Trash Collection Observations

Overall Observations

- SMPs C,D,&G highest total
- SMPs H,I,&J next to construction of private developments

NB-side vs SB-side of Highway

- Study in GR3&4
  - SB-side → Residential
  - NB-side → Along Delaware Ave

Fenced vs Open to Public

- Fenced → less trash
- SMP C,D,&G had additional collection by neighbors

<table>
<thead>
<tr>
<th>Site</th>
<th>Total (2yrs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>28.1 bags</td>
</tr>
<tr>
<td>CD&amp;G</td>
<td>64.8 bags</td>
</tr>
<tr>
<td>E&amp;F</td>
<td>24.6 bags</td>
</tr>
<tr>
<td>H</td>
<td>15.1 bags</td>
</tr>
<tr>
<td>I&amp;J</td>
<td>13.6 bags</td>
</tr>
</tbody>
</table>
GR2 Maintenance Inventory

Trash Collected per Month

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Forebay Maintenance

Forebay Background

GR2 – SMPs w/o forebays

Design → Riprap
  • Reduce velocity

Observations
  • Erosion present
  • Sediment buildup
  • Cigarettes

GR3&4 – SMPs w/ forebays

Design → Paver forebay
  • Pre-treatment
  • Reduce velocity

Observations
  • Easier maintenance
  • Reduce erosion
Improper Construction
- Clogging during construction
- Reduced infiltration capacity

Mulch Erosion
- Unanticipated sediment transport
- Covers infiltrating area

Invasive Weeds
- Tedious maintenance
- Could impact paver placement
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Lessons Learned
Public Reaction to SMPs

- Community Interaction
- Wildlife
- Public Interest
- Complaints about Overgrowth
- Homeless “Camp” Storage
- Vandalization
Lessons Learned

Fenced SMPs

<table>
<thead>
<tr>
<th>Positives</th>
<th>Negatives</th>
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</thead>
<tbody>
<tr>
<td>– Reduces trash</td>
<td>– No public access</td>
</tr>
<tr>
<td>• Blocks debris blown by</td>
<td>• More complaints with bordering</td>
</tr>
<tr>
<td>wind</td>
<td>properties</td>
</tr>
<tr>
<td>• No pedestrian traffic</td>
<td>• Public cannot be involved</td>
</tr>
<tr>
<td>– Reduces vandalization &amp;</td>
<td>– More difficult maintenance</td>
</tr>
<tr>
<td>trespassing</td>
<td>• Vegetation growth through fence</td>
</tr>
<tr>
<td>• Steep embankment (SMPs</td>
<td>• Cannot mow perimeter</td>
</tr>
<tr>
<td>E,F,&amp;H)</td>
<td></td>
</tr>
<tr>
<td>• Neighboring properties</td>
<td></td>
</tr>
</tbody>
</table>

03/01/2019 08/05/2019

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Lessons Learned

SMPs E & F Vegetation

SMP E
Receives Highway Runoff

SMP F
Temporary Bypass

Comparable vegetation growth
Lessons Learned

Summary

SMP Maintenance

- Monthly visits, more frequent in summer
- Little variation between functioning SMPs
- Can’t avoid trash cleanup

Forebay Design

- Reduces erosion
- Pre-treatment avoids clogging SMP (cigarettes)
- Room for improvement to reduce maintenance

Future Studies

- Maintenance trends
- Long term performance of forebays
- Community outreach
Questions?

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