

BSDMS Summary Report

15 Leipsic River at S.R. 9 at Leipsic, DE

Site Location:

Site ID: 15
Site Name: Leipsic River at S.R. 9 at Leipsic, DE
County: Kent
Nearest City: Leipsic
State: DE
Latitude: 391444
Longitude: 753105
USGS Station ID: 1483530
Route Number: 9
Route Class: State
Service Level: Mainline
Route Direction: NA
Highway Mile Point:
Stream Name: Leipsic River
River Mile:

Contact:
USGS
3600 West Broad Street Suite 606
Richmond, VA 23230
(804) 771-2427

Publication:
Hayes, Donald C., 1993, Site Selection and Collection of Bridge-Scour Data in Delaware, Maryland, and Virginia: U.S. Geological Survey Water-Resources Investigations Report 93-4017, 23 p.

Site Description:

This site is located at the State Route 9 bridge crossing the Leipsic River at Leipsic, Delaware, 5 miles north of Dover, Delaware. The arched bridge, 547 ft long and 29 ft wide, has 12 pile-bent piers. Three spans are over the water, with possibly four piers in the flow. The bridge deck rests on the pile caps. Each pile bent includes 5 piles spaced 6 ft apart on centers. The piles in the center bents (C2 and C3) have a 3-ft-diameter concrete collar extending several ft above and below the waterline for protection from ice. The Leipsic River is actually an estuary with tidal flows in both directions. Net downstream flow is probably a small percentage of tidal flow. Any extremely high water is probably associated with storms causing extremely high tides. Runoff would probably not contribute much flow. If the river rises above the tidal banks (several feet above normal high tide), a very wide floodplain would be inundated. It is unlikely that the bridge would be overtopped.

Elevation Reference

Datum: MSL

MSL (ft):

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Description of Reference Elevation:

BM 4038C 1984 -- assumed elevation 49.990 ft. Located on approach to bridge on left bank, downstream side, in concrete curb.

Stream Data

| | | | |
|---------------------------|-----------|---------------------------|-----------|
| Drainage Area (sq mi): | | Floodplain Width: | Unknown |
| Slope in Vicinity(ft/ft): | | Natural Levees: | Little |
| Flow Impact: | Straight | Apparent Incision: | Unknown |
| Channel Evolution | Unknown | Channel Boundary: | Alluvial |
| Armoring: | Unknown | Banks Tree Cover: | Low |
| Debris Frequency: | Rare | Sinuosity: | Sinuuous |
| Debris Effect: | None | Braiding: | None |
| Stream Size: | Medium | Anabranching: | None |
| Flow Habit: | Perennial | Bars: | Unknown |
| Bed Material: | Unknown | Stream Width Variability: | Equiwidth |
| Valley Setting: | None | | |

Roughness Data

Manning's n Values

| | Left Overbank | Channel | Right Overbank |
|---------|---------------|---------|----------------|
| High: | | | |
| Typical | | | |
| Low: | | | |

Bed Material

| Measurement Number | Yr | Mo | Dy | Sampler | D95 (mm) | D84 (mm) | D50 (mm) | D16 (mm) | SP | Shape | Cohesion |
|--------------------|------|----|----|---------|----------|----------|----------|----------|------|-------|--------------|
| 1 | 1992 | 8 | 18 | BMH-60 | 8 | 1.4 | 0.4 | 0.06 | 2.65 | | Non-Cohesive |

Bed Material Comments

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Measurement No: 1

Bridge Data

Structure No: 2-2B
Length(ft): 547
Width(ft): 29
Number of Spans: 13
Vertical Configuration: Unknown
Low Chord Elev (ft): 15.42
Upper Chord Elev (ft): 16.6
Overtopping Elev (ft):
Skew (degrees): 20
Guide Banks: None
Waterway Classification: Main
Year Built: 1950
Avg Daily Traffic:
Plans on File: Yes
Parallel Bridges No
Upstream/Downstream: N/A
Continuous Abutment: No
Distance Between Centerlines:
Distance Between Pier Faces:

Bridge Description:

The arched bridge, 547 ft long and 29 ft wide, has 12 pile-bent piers. Three spans over the water, with possible four piers in the flow. The bridge deck rests on the pile caps. Each pile bent includes 5 piles spaced 6 ft apart on centers. The piles in the center bents (C2 and C3) have a 3-ft-diameter concrete collar extending several ft above and below the waterline for protection from ice. It is unlikely that the bridge would be overtopped. Flow skew to the bridge (20 degrees maximum) varies during the

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tide cycle.

Abutment Data

Left Station: 0
Right Station: 552
Left Skew (deg): 0
Right Skew (deg) 0
Left Abutment Length (ft): 29
Right Abutment Length (ft) 29
Left Abutment to Channel Bank (ft): 200
Right Abutment to Channel Bank (ft): 100
Left Abutment Protection:
Right Abutment Protection
Contracted Opening Type: Unknown
Embankment Skew (deg): 0
Embankment Slope (ft/ft): 1
Abutment Slope (ft/ft)
Wingwalls: No
Wingwall Angle (deg): 0

Pier Data

| Pier ID | Bridge Station(ft) | Alignment | Highway Station | PierType | # Of Piles | Pile Spacing(ft) |
|---------|--------------------|-----------|-----------------|----------|------------|------------------|
| C1 | 325 | 0 | 0 | Group | 5 | 6 |
| C2 | 255 | 0 | 0 | Group | 5 | 6 |
| C3 | 165 | 0 | 0 | Group | 5 | 6 |
| C4 | 95 | 0 | 0 | Group | 5 | 6 |

| Pier ID | Pier Width(ft) | Pier Shape | Shape Factor | Length(ft) | Protection | Foundation |
|---------|----------------|------------|--------------|------------|------------|------------|
|---------|----------------|------------|--------------|------------|------------|------------|

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| | | | | | |
|----|------|--------|----|-------|-------|
| C1 | 1.25 | Square | 27 | None | PILES |
| C2 | 1.25 | Square | 27 | Other | Piles |
| C3 | 1.25 | Square | 27 | Other | Piles |
| C4 | 1.25 | Square | 27 | None | Piles |

| Pier ID | Top Elevation(ft) | Bottom Elevation(ft) | Foot or Pile Cap Width(ft) | Cap Shape | File Tip Elevation(ft) |
|---------|-------------------|----------------------|----------------------------|-----------|------------------------|
| C1 | 16.6 | 13.42 | 2 | Square | -42 |
| C2 | 15.42 | 12.42 | 2 | Square | -42 |
| C3 | 15.42 | 12.42 | 2 | Square | -42 |
| C4 | 16.6 | 13.42 | 2 | Square | -42 |

Pier Description

Pier ID C1

This pile bent at the right edge of water includes 5 concrete piles (1.25 ft square) spaced 6 ft apart on centers. The bridge deck rests on the pile cap. Pile length of 55 ft is estimated from 1100 ft piles/4 piers/5 piles per pier.

Pier ID C2

Pile bent C2 includes 5 concrete piles (1.25 ft square) spaced 6 ft apart on centers. This pile bent has a 3-ft-diameter concrete collar extending several ft above and below the waterline (approximately to low-tide elevation) for protection from ice. The collar should not affect scour. NO pier coordinates exist for pier ID C2.

Pier ID C3

Pile bent C3 includes 5 concrete piles (1.25 ft square) spaced 6 ft apart on centers. This pile bent has a 3-ft-diameter concrete collar extending several ft above and below the waterline (approximately to low-tide elevation) for protection from ice. The collar should not affect scour. NO pier coordinates exist for pier ID C3.

Pier ID C4

This pile bent at the left edge of water includes 5 concrete piles (1.25 ft square) spaced 6 ft apart on centers. The bridge deck rests on the pile cap. Pile length of 55 ft is estimated from 1100 ft piles/4 piers/5 piles per pier. NO pier coordinates exist for pier ID C4.

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Pier Scour Data

| Pier ID | Date | Time | USOrDS |
|---------|----------|-------|----------|
| C2 | 11/28/88 | 16:00 | Upstream |
| C2 | 11/15/90 | 13:30 | Upstream |
| C2 | 12/2/90 | 13:00 | Upstream |
| C2 | 12/2/90 | 14:00 | Upstream |
| C2 | 12/4/90 | 15:00 | Upstream |
| C2 | 10/7/91 | 13:00 | Upstream |
| C2 | 6/10/92 | 9:30 | Upstream |
| C2 | 6/10/92 | 10:30 | Upstream |
| C2 | 6/10/92 | 11:30 | Upstream |
| C3 | 11/15/90 | 13:30 | Upstream |
| C3 | 6/10/92 | 10:30 | Upstream |

| Pier ID | Scour Depth | Accuracy (ft) | Side Slope (ft/ft) | TopWidth (ft) | Apprch Vel (ft/s) | Apprch Depth(ft) | Effective Pier Width | Skew to Flow(deg) |
|---------|-------------|---------------|--------------------|---------------|-------------------|------------------|----------------------|-------------------|
| C2 | 0.5 | 1 | 20 | 20 | 1.82 | 15.4 | 1.25 | 0 |
| C2 | 0.8 | 1 | 6 | 10 | 2.22 | 17.3 | 1.25 | 0 |
| C2 | 1 | 1 | 7.5 | 15 | 1.33 | 15.7 | 1.25 | 0 |
| C2 | 0.8 | 1 | 8 | 13 | 2.18 | 13.9 | 1.25 | 0 |
| C2 | 1 | 1 | 7.5 | 15 | 1.42 | 15.5 | 1.25 | 0 |
| C2 | 0.5 | 1 | 20 | 20 | 1.6 | 15.2 | 1.25 | 0 |
| C2 | 0.6 | 1 | 16 | 52 | 1.65 | 15 | 1.25 | 0 |
| C2 | 0.7 | 1 | 10 | 14 | 1.62 | 13.9 | 1.25 | 0 |
| C2 | 0.5 | 1 | 10 | 10 | 1.52 | 12.3 | 1.25 | 0 |
| C3 | 0.3 | 1 | 8.5 | 5 | 1.74 | 13.2 | 1.25 | 0 |
| C3 | 0.9 | 1 | 6 | 11 | 1.72 | 16.2 | 1.25 | 0 |

| PierID | Sediment Transport | Bed Material | BedForm | Trough (ft) | Crest (ft) | Sigma | Debris Effects |
|--------|--------------------|--------------|---------|-------------|------------|-------|----------------|
| C2 | Unknown | Unknown | Unknown | | | 5.05 | Unknown |
| C2 | Unknown | Unknown | Unknown | | | 5.05 | Unknown |
| C2 | Unknown | Unknown | Unknown | | | 5.05 | Unknown |
| C2 | Unknown | Unknown | Unknown | | | 5.05 | Unknown |
| C2 | Unknown | Unknown | Unknown | | | 5.05 | Unknown |
| C2 | Unknown | Unknown | Unknown | | | 5.05 | Unknown |
| C2 | Unknown | Unknown | Unknown | | | 5.05 | Unknown |
| C2 | Unknown | Unknown | Unknown | | | 5.05 | Unknown |

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| | | | | | |
|----|---------|---------|---------|------|---------|
| C2 | Unknown | Unknown | Unknown | 5.05 | Unknown |
| C3 | Unknown | Unknown | Unknown | 5.05 | Unknown |
| C3 | Unknown | Unknown | Unknown | 5.05 | Unknown |

| PierID | D95 (mm) | D84 (mm) | D50 (mm) | D16 (mm) |
|--------|----------|----------|----------|----------|
| C2 | 8 | 1.4 | 0.4 | 0.055 |
| C2 | 8 | 1.4 | 0.4 | 0.055 |
| C2 | 8 | 1.4 | 0.4 | 0.055 |
| C2 | 8 | 1.4 | 0.4 | 0.055 |
| C2 | 8 | 1.4 | 0.4 | 0.055 |
| C2 | 8 | 1.4 | 0.4 | 0.055 |
| C2 | 8 | 1.4 | 0.4 | 0.055 |
| C2 | 8 | 1.4 | 0.4 | 0.055 |
| C2 | 8 | 1.4 | 0.4 | 0.055 |
| C3 | 8 | 1.4 | 0.4 | 0.055 |
| C3 | 8 | 1.4 | 0.4 | 0.055 |

Pier Scour Comments

Pier ID C2 **Time:** 16:00 **US/DS:** Upstream

Accuracy of local scour estimate is probably 1 foot. Estimate is maximum scour for this cross section only and may not represent the maximum local scour at the pier.

Pier ID C2 **Time:** 13:30 **US/DS:** Upstream

Pier ID C2 **Time:** 13:00 **US/DS:** Upstream

Pier ID C2 **Time:** 14:00 **US/DS:** Upstream

Pier ID C2 **Time:** 15:00 **US/DS:** Upstream

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| | | | | | |
|---------|----|-------|-------|--------|----------|
| Pier ID | C2 | Time: | 13:00 | US/DS: | Upstream |
| Pier ID | C2 | Time: | 9:30 | US/DS: | Upstream |
| Pier ID | C2 | Time: | 10:30 | US/DS: | Upstream |
| Pier ID | C2 | Time: | 11:30 | US/DS: | Upstream |
| Pier ID | C3 | Time: | 13:30 | US/DS: | Upstream |
| Pier ID | C3 | Time: | 10:30 | US/DS: | Upstream |

Abutment Scour

Contraction Scour

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Stage and Discharge Data

| Peak Discharge | | | | | Flow (cfs) | Qacc | Peak Stage | | | | | Stage (ft) | Water Temp (C) | Return Period(yr) |
|----------------|----|----|----|----|---------------|------|------------|----|----|----|----|---------------|-------------------|----------------------|
| year | mo | dy | hr | mi | | | year | mo | dy | hr | mi | | | |

Hydrograph

| Hydrograph Number | Year | Month | Day | Hr | Min | Sec | Stage(ft) | Discharge (cfs) |
|----------------------|------|-------|-----|----|-----|-----|-----------|--------------------|
|----------------------|------|-------|-----|----|-----|-----|-----------|--------------------|

Supporting Files
