APPENDIX 10

CAROL DRIVE BRIDGE -
STRUCTURE ASSESSMENT &
GRANT APPLICATION

# Application #708 - Carol Drive Bridge

Routing in Progress: Field Staff Management Review (Step 5 of 9)

**Application Summary**

This form outlines all project details, including Scope of Work, all costs, and location worksheets.

| | |
|---|---|
| **Title:** | Carol Drive Bridge |
| **Cost:** | $1,300,000.00 |
| **Funding Sources:** | Federal - $975,000.00<br>State - $0.00<br>Local - $325,000.00 |
| **FEMA Obligation Data:** | Federal Number - < no value ><br>Date of Obligation Letter - < no value ><br>Project POP Date - < no value ><br>CATEX Comments - < no value ><br>Edit |
| **Related Links:** | View Letter of Intent |

**Workflow Summary**

| | |
|---|---|
| **Current Step:** | 5) Field Staff Management Review<br>Last Advanced on December 21, 2013 by Corrina Cavallo |
| **Submission:** | October 15, 2013 by System Admin |

**Grant**

**4085 Hurricane Sandy**
Hazard Mitigation Grant Program
Declared: October 30, 2012

**Applicant**

**Town Of East Fishkill**
Dutchess County
FIPS #: 027-21996-00
Type: Other
Physical/Mailing: 330 Route 376
Hopewell Junction, NY, 12533

**Project**

**F # S #708**
Carol Drive Bridge
PR Project
Project POP Deadline:
Eligible: $1,300,000.00
Federal: $975,000.00 (75%)

# History > Item History: Application #708 - Carol Drive Bridge

| Date/Time | Action By | Item | Action |
|---|---|---|---|
| Dec 21, 2013 9:30 PM | Corrina Cavallo | Application #708 - Carol Drive Bridge - 4085 (HMGP) / Town Of East Fishkill / Project F0-S708 - Carol Drive Bridge | Advanced from 4) QA/QC Review to 5) Field Staff Management Review |
| Dec 15, 2013 5:11 PM | Patrick Franz | Application #708 - Carol Drive Bridge - 4085 (HMGP) / Town Of East Fishkill / Project F0-S708 - Carol Drive Bridge | Advanced from 2) Initial Review to 4) QA/QC Review |
| Dec 12, 2013 2:14 PM | John Metzger | Application #708 - Carol Drive Bridge - 4085 (HMGP) / Town Of East Fishkill / Project F0-S708 - Carol Drive Bridge | Advanced from 1) Submit Completed Form To State to 2) Initial Review |
| Dec 12, 2013 2:13 PM | John Metzger | Application #708 - Carol Drive Bridge - 4085 (HMGP) / Town Of East Fishkill / Project F0-S708 - Carol Drive Bridge | Modified |
| Dec 12, 2013 2:13 PM | John Metzger | Application #708 - Carol Drive Bridge - 4085 (HMGP) / Town Of East Fishkill / Project F0-S708 - Carol Drive Bridge | Modified |
| Dec 12, 2013 2:07 PM | John Metzger | Application #708 - Carol Drive Bridge - 4085 (HMGP) / Town Of East Fishkill / Project F0-S708 - Carol Drive Bridge | Modified |
| Dec 12, 2013 2:01 PM | John Metzger | Application #708 - Carol Drive Bridge - 4085 (HMGP) / Town Of East Fishkill / Project F0-S708 - Carol Drive Bridge | Modified |
| Dec 12, 2013 1:47 PM | John Metzger | Application #708 - Carol Drive Bridge - 4085 (HMGP) / Town Of East Fishkill / Project F0-S708 - Carol Drive Bridge | Modified |
| Dec 12, 2013 1:40 PM | John Metzger | Application #708 - Carol Drive Bridge - 4085 (HMGP) / Town Of East Fishkill / Project F0-S708 - Carol Drive Bridge | Modified |
| Dec 5, 2013 9:27 AM | David Baird | Application #708 - Carol Drive Bridge - 4085 (HMGP) / Town Of East Fishkill / Project F0-S708 - Carol Drive Bridge | Note Added |
| Dec 5, 2013 9:27 AM | David Baird | Application #708 - Carol Drive Bridge - 4085 (HMGP) / Town Of East Fishkill / Project F0-S708 - Carol Drive Bridge | Returned from 5) Field Staff Management Review to 1) Submit Completed Form To State |
| Dec 3, 2013 10:45 AM | Corrina Cavallo | Application #708 - Carol Drive Bridge - 4085 (HMGP) / Town Of East Fishkill / Project F0-S708 - Carol Drive Bridge | Advanced from 4) QA/QC Review to 5) Field Staff Management Review |
| Nov 30, 2013 6:57 PM | Vicky Ngoie M.B.A | Application #708 - Carol Drive Bridge - 4085 (HMGP) / Town Of East Fishkill / Project F0-S708 - Carol Drive Bridge | Advanced from 3) Application and BCA Review to 4) QA/QC Review |
| Nov 1, 2013 2:47 PM | Gregory Suko | Application #708 - Carol Drive Bridge - 4085 (HMGP) / Town Of East Fishkill / Project F0-S708 - Carol Drive Bridge | Modified |
| Nov 1, 2013 2:27 PM | Bridget Stradford | Application #708 - Carol Drive Bridge - 4085 (HMGP) / Town Of East Fishkill / Project F0-S708 - Carol Drive Bridge | Advanced from 2) Initial Review to 3) Application and BCA Review |
| Oct 30, 2013 5:07 PM | John Metzger | Application #708 - Carol Drive Bridge - 4085 (HMGP) / Town Of East Fishkill / Project F0-S708 - Carol Drive Bridge | Advanced from 1) Submit Completed Form To State to 2) Initial Review |
| Oct 30, 2013 5:07 PM | John Metzger | Application #708 - Carol Drive Bridge - 4085 (HMGP) / Town Of East Fishkill / Project F0-S708 - Carol Drive Bridge | Modified |
| Oct 30, 2013 5:03 PM | John Metzger | Application #708 - Carol Drive Bridge - 4085 (HMGP) / Town Of East Fishkill / Project F0-S708 - Carol Drive Bridge | Modified |

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| Oct 30, 2013 1:35 PM | John Metzger | Application #708 - Carol Drive Bridge - 4085 (HMGP) / Town Of East Fishkill / Project F0-S708 - Carol Drive Bridge | Modified |
| Oct 30, 2013 1:15 PM | John Metzger | Application #708 - Carol Drive Bridge - 4085 (HMGP) / Town Of East Fishkill / Project F0-S708 - Carol Drive Bridge | Modified |
| Oct 30, 2013 1:14 PM | John Metzger | Application #708 - Carol Drive Bridge - 4085 (HMGP) / Town Of East Fishkill / Project F0-S708 - Carol Drive Bridge | Modified |
| Oct 30, 2013 1:14 PM | John Metzger | Application #708 - Carol Drive Bridge - 4085 (HMGP) / Town Of East Fishkill / Project F0-S708 - Carol Drive Bridge | Modified |
| Oct 30, 2013 1:13 PM | John Metzger | Application #708 - Carol Drive Bridge - 4085 (HMGP) / Town Of East Fishkill / Project F0-S708 - Carol Drive Bridge | Modified |
| Oct 30, 2013 1:08 PM | John Metzger | Application #708 - Carol Drive Bridge - 4085 (HMGP) / Town Of East Fishkill / Project F0-S708 - Carol Drive Bridge | Modified |
| Oct 30, 2013 12:27 PM | John Metzger | Application #708 - Carol Drive Bridge - 4085 (HMGP) / Town Of East Fishkill / Project F0-S708 - Carol Drive Bridge | Modified |
| Oct 30, 2013 12:26 PM | John Metzger | Application #708 - Carol Drive Bridge - 4085 (HMGP) / Town Of East Fishkill / Project F0-S708 - Carol Drive Bridge | Modified |
| Oct 30, 2013 12:16 PM | John Metzger | Application #708 - Carol Drive Bridge - 4085 (HMGP) / Town Of East Fishkill / Project F0-S708 - Carol Drive Bridge | Modified |
| Oct 30, 2013 12:15 PM | John Metzger | Application #708 - Carol Drive Bridge - 4085 (HMGP) / Town Of East Fishkill / Project F0-S708 - Carol Drive Bridge | Modified |
| Oct 30, 2013 10:25 AM | John Metzger | Application #708 - Carol Drive Bridge - 4085 (HMGP) / Town Of East Fishkill / Project F0-S708 - Carol Drive Bridge | Modified |
| Oct 30, 2013 10:14 AM | John Metzger | Application #708 - Carol Drive Bridge - 4085 (HMGP) / Town Of East Fishkill / Project F0-S708 - Carol Drive Bridge | Modified |
| Oct 30, 2013 9:43 AM | John Metzger | Application #708 - Carol Drive Bridge - 4085 (HMGP) / Town Of East Fishkill / Project F0-S708 - Carol Drive Bridge | Modified |
| Oct 29, 2013 3:56 PM | John Metzger | Application #708 - Carol Drive Bridge - 4085 (HMGP) / Town Of East Fishkill / Project F0-S708 - Carol Drive Bridge | Modified |
| Oct 29, 2013 3:55 PM | John Metzger | Application #708 - Carol Drive Bridge - 4085 (HMGP) / Town Of East Fishkill / Project F0-S708 - Carol Drive Bridge | Modified |
| Oct 29, 2013 3:07 PM | John Metzger | Application #708 - Carol Drive Bridge - 4085 (HMGP) / Town Of East Fishkill / Project F0-S708 - Carol Drive Bridge | Note Added |
| Oct 29, 2013 12:29 PM | John Metzger | Application #708 - Carol Drive Bridge - 4085 (HMGP) / Town Of East Fishkill / Project F0-S708 - Carol Drive Bridge | Modified |
| Oct 29, 2013 10:38 AM | John Metzger | Application #708 - Carol Drive Bridge - 4085 (HMGP) / Town Of East Fishkill / Project F0-S708 - Carol Drive Bridge | Modified |
| Oct 29, 2013 10:38 AM | John Metzger | Application #708 - Carol Drive Bridge - 4085 (HMGP) / Town Of East Fishkill / Project F0-S708 - Carol Drive Bridge | Modified |
| Oct 29, 2013 10:38 AM | John Metzger | Application #708 - Carol Drive Bridge - 4085 (HMGP) / Town Of East Fishkill / Project F0-S708 - Carol Drive Bridge | Modified |
| Oct 29, 2013 10:34 AM | John Metzger | Application #708 - Carol Drive Bridge - 4085 (HMGP) / Town Of East Fishkill / Project F0-S708 - Carol Drive Bridge | Modified |

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| Oct 29, 2013 10:23 AM | John Metzger | Application #708 - Carol Drive Bridge - 4085 (HMGP) / Town Of East Fishkill / Project F0-S708 - Carol Drive Bridge | Modified |
| Oct 29, 2013 10:22 AM | John Metzger | Application #708 - Carol Drive Bridge - 4085 (HMGP) / Town Of East Fishkill / Project F0-S708 - Carol Drive Bridge | Modified |
| Oct 29, 2013 10:21 AM | John Metzger | Application #708 - Carol Drive Bridge - 4085 (HMGP) / Town Of East Fishkill / Project F0-S708 - Carol Drive Bridge | Modified |
| Oct 29, 2013 9:35 AM | John Metzger | Application #708 - Carol Drive Bridge - 4085 (HMGP) / Town Of East Fishkill / Project F0-S708 - Carol Drive Bridge | Modified |
| Oct 28, 2013 4:15 PM | John Metzger | Application #708 - Carol Drive Bridge - 4085 (HMGP) / Town Of East Fishkill / Project F0-S708 - Carol Drive Bridge | Modified |
| Oct 28, 2013 4:14 PM | John Metzger | Application #708 - Carol Drive Bridge - 4085 (HMGP) / Town Of East Fishkill / Project F0-S708 - Carol Drive Bridge | Modified |
| Oct 28, 2013 4:08 PM | John Metzger | Application #708 - Carol Drive Bridge - 4085 (HMGP) / Town Of East Fishkill / Project F0-S708 - Carol Drive Bridge | Modified |
| Oct 28, 2013 3:23 PM | John Metzger | Application #708 - Carol Drive Bridge - 4085 (HMGP) / Town Of East Fishkill / Project F0-S708 - Carol Drive Bridge | Modified |
| Oct 28, 2013 3:17 PM | John Metzger | Application #708 - Carol Drive Bridge - 4085 (HMGP) / Town Of East Fishkill / Project F0-S708 - Carol Drive Bridge | Modified |
| Oct 28, 2013 1:58 PM | John Metzger | Application #708 - Carol Drive Bridge - 4085 (HMGP) / Town Of East Fishkill / Project F0-S708 - Carol Drive Bridge | Modified |
| Oct 28, 2013 1:51 PM | John Metzger | Application #708 - Carol Drive Bridge - 4085 (HMGP) / Town Of East Fishkill / Project F0-S708 - Carol Drive Bridge | Modified |
| Oct 28, 2013 12:06 PM | John Metzger | Application #708 - Carol Drive Bridge - 4085 (HMGP) / Town Of East Fishkill / Project F0-S708 - Carol Drive Bridge | Modified |
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| Oct 28, 2013 12:03 PM | John Metzger | Application #708 - Carol Drive Bridge - 4085 (HMGP) / Town Of East Fishkill / Project F0-S708 - Carol Drive Bridge | Modified |
| Oct 28, 2013 11:41 AM | John Metzger | Application #708 - Carol Drive Bridge - 4085 (HMGP) / Town Of East Fishkill / Project F0-S708 - Carol Drive Bridge | Note Added |
| Oct 28, 2013 11:35 AM | John Metzger | Application #708 - Carol Drive Bridge - 4085 (HMGP) / Town Of East Fishkill / Project F0-S708 - Carol Drive Bridge | Modified |
| Oct 28, 2013 11:32 AM | John Metzger | Application #708 - Carol Drive Bridge - 4085 (HMGP) / Town Of East Fishkill / Project F0-S708 - Carol Drive Bridge | Modified |
| Oct 28, 2013 11:28 AM | John Metzger | Application #708 - Carol Drive Bridge - 4085 (HMGP) / Town Of East Fishkill / Project F0-S708 - Carol Drive Bridge | Modified |
| Oct 28, 2013 11:06 AM | John Metzger | Application #708 - Carol Drive Bridge - 4085 (HMGP) / Town Of East Fishkill / Project F0-S708 - Carol Drive Bridge | Modified |
| Oct 28, 2013 11:02 AM | John Metzger | Application #708 - Carol Drive Bridge - 4085 (HMGP) / Town Of East Fishkill / Project F0-S708 - Carol Drive Bridge | Modified |
| Oct 28, 2013 10:52 AM | John Metzger | Application #708 - Carol Drive Bridge - 4085 (HMGP) / Town Of East Fishkill / Project F0-S708 - Carol Drive Bridge | Modified |

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|---|---|---|---|
| Oct 15, 2013 12:51 PM | System Admin | Application #708 - Carol Drive Bridge - 4085 (HMGP) / Town Of East Fishkill / Project F0-S708 - Carol Drive Bridge | Created |

Carol Drive Bridge

# Structure Assessment

Prepared for: Town of East Fishkill

Date: September, 2013


HVEA
ENGINEERS

Table of Contents

## I. Administrative Data

| | |
|---|---|
| Structure Number: | 2262780 (NYSDOT Bridge Identification Number) |
| Route Carried: | Carol Drive |
| Feature Crossed: | Fishkill Creek |
| Roadway Classification: | Local Road |
| Design/Posted Speed: | 30 mph |
| AADT (current/year): | 699/2008 (from 2011 NYSDOT Biennial Inspection) |
| Inventory Rating HS: | HS 19.8 (as-designed) |
| | HS 13.2 (as-built) |

Construction / Reconstruction / Repair History:

Originally built in 1986;

Scour repair done to end abutment, 2007;

There is no history of other significant repair work.

## II. Physical Description of Structure:

The bridge is a 3 span structure with span lengths of 19'-6", 26'-0" and 19'-6" (from west to east). It carries two travel lanes, with a curb to curb width of 24'-0" and an out-to-out width of 26'-0". The bridge has no skew.

The Superstructure consists of laminated timber deck, oriented longitudinally. It is surfaced with an asphalt wearing course. The railing system is timber, with a timber curb.

The abutments are comprised of timber pile and lagging stemwalls and wingwalls, with a 12"x12" timber pile cap serving as a bridge seat. The piers are timber pile bents with a 12"x12" timber pier cap, and timber diagonal bracing. The fascia piles are designed battered 12V on 1H.

## III. Field Inspection & Physical Evaluation

The physical inspection employs FHWA National Bridge Inventory [NBI] rating factors. These factors are defined as follows:

| Code | Description |
|---|---|
| N | NOT APPLICABLE |
| 9 | EXCELLENT CONDITION |
| 8 | VERY GOOD CONDITION - no problems noted. |
| 7 | GOOD CONDITION - some minor problems. |
| 6 | SATISFACTORY CONDITION - structural elements show some minor deterioration. |
| 5 | FAIR CONDITION - all primary structural elements are sound but may have minor section loss, cracking, spalling or scour. |
| 4 | POOR CONDITION - advanced section loss, deterioration, spalling or scour. |
| 2 | CRITICAL CONDITION - advanced deterioration of primary structural elements. Fatigue cracks in steel or shear cracks in concrete may be present or scour may have removed substructure support. Unless closely monitored it may be necessary to close the bridge until corrective action is taken. |
| 1 | "IMMINENT" FAILURE CONDITION - major deterioration or section loss present in critical structural components or obvious vertical or horizontal movement affecting structure stability. Bridge is closed to traffic but corrective action may put it back in light service. |
| 0 | FAILED CONDITION - out of service; beyond corrective action. |

Superstructure:

Wearing Surface: 4

The asphalt wearing surface displays reflective cracking at all four joint locations, and several other areas of distress. The wearing course has been patched above the joints.

Timber Deck: 5/6

The longitudinal laminated timber deck shows signs of water infiltration. The underside is stained, indicating considerable leakage. Icicles were observed at a few locations during a January 2013 site visit. The Town indicated that a waterproofing membrane was installed when the bridge was constructed; the condition of the underside of the deck suggests that the membrane may be failing.

The timber railing appears sound.

Substructure:

Abutments:

East Abutment: 5
West Abutment: 5

The timber pile and lagging abutments are in fair condition. There is scour visible at the abutment stem, and rot is evident in the west abutment right wingwall piles above the tieback elevation.

Piers:

Cap Beam: 4

The cap beams are stained by water infiltration. A lap joint in the 12x12 timber cap beam results in an as-built load rating of HS13.2. This lap joint is not included in the original design calculations or on the plans; the plans specify a continuous 12x12 timber member.

Piles: 5

The piles are unremarkable. The lateral bracing is functioning as designed. All of the piles were installed in a nearly vertical orientation, however the plans specify a 1 on 12 batter of the outboard piles. The absence of this batter leads to increased stress on the lateral bracing.

The asphalt wearing surface is settled and potholed above the piers, indicating movement of the superstructure at the pier locations, either from expansion/contraction or rot of the ends of the glue laminated deck. The plans detail the installation of steel straps to tie the deck spans together above the piers.

**IV. Commentary:**

Timber is a viable material for construction of roadway bridges. It is relatively inexpensive, easy to work with, and requires a limited array of tools and equipment during construction. Timber has a reasonably high strength to weight ratio, and it can withstand momentary overloads without plastic deformation or reduction in long term capacity or durability. However, it has limitations, including limited durability under certain site conditions.

The chief vulnerability of timber is decay, generally caused by fungus. Brown rot is a notable type of decay organism that is commonly found in timber bridge structures. It can significantly reduce load carrying capacity of bridge structural members prior to exhibiting visual signs of deterioration. Moisture content is the best indicator of the vulnerability of wood to decay. It is important to keep the moisture content of wood below the threshold level of approximately 22% to 24%. Moisture content beyond this level presents a sustainable environment for a variety of fungal organisms.

Most modern timber bridges are treated with a preservative to prevent decay. All of the timber elements of the Carol Drive bridge were treated in this manner. However, when the moisture content of treated wood repeatedly rises and falls, the wood fibers swell and contract, causing the preservative to be pumped from within and pushed out to the exterior of the member, leaving behind unprotected wood fibers. These fibers are then vulnerably to decay.

The Carol Drive bridge is susceptible to a loss of preservative function, particularly in the piles at the elevation of ordinary high water. Here, the piles cycle between submerged and dry, resulting in wildly varying moisture content. Unfortunately, the

decay can start at the inside and progress outward, showing no signs of deterioration until significant damage has occurred.

The laminated deck members are also vulnerable to decay. However, the waterproofing membrane will provide substantial protection against loss of wood preservative. The staining of the underside of the deck indicates that the membrane may be failing, but it likely protected the timber members for a long period post construction, and decay in these members can likely be prevented with remedial action.

In addition to vulnerable nature of the timber construction, the joint in the cap beam at the west abutment and at pier 1 represent an as-built defect that affects the load carrying capacity of the bridge. This joint can be retrofitted to support the design load, but until that occurs, the loads on the structure should be limited as discussed in Section VI, Recommendations.

## V. Conclusions:

Properly treated and maintained timber bridges can be expected to provide a design life of 50 years or more. However, the Carol Road bridge has vulnerabilities, particularly with the substructures, that cannot be moderated with good maintenance.

Bridges crossing water can be constructed with timber superstructures, however, timber piles in these environments can be vulnerable to decay. In fact, the NYSDOT guidance for timber bridge construction recommends concrete substructures:

> "For the majority of cases, the use of a concrete substructure is encouraged. Since the vast majority of timber structures will cross water, the soil interface zone will be subjected to continuous cycles of wetting and drying and should be considered a hostile area for wood.
>
> Timber sheeting and timber piles with lagging walls, either tied or untied, are the typical types of timber substructure construction. Constructability, first cost and life-cycle costs are factors that must be considered prior to selecting a type of substructure.
>
> Timber piling can also be used, but the use of these piles in a zone of wetting and drying cycles is undesirable. Areas likely to contain marine borers and other types of wood destroying fungi should also be avoided. Wood pile bents can be protected to some degree by using protective sleeves in the trouble area. Timber piling installed in an area where it has been constantly wet is often found to be in

good condition after many years of service. Prior to reusing existing timber piles, a test pit should be dug to gain access to evaluate their condition."[1]

The bridge is also hydraulically vulnerable. Scour has necessitated remedial work at one abutment, where a concrete scour curb was poured in front of the stem, and a concrete block extension was installed to lengthen one of the wingwalls. The stream banks feature many trees with exposed roots, indicating a widening of the steam bed. This transformation could eventually challenge the stability of the abutments, although the banks do not appear to be in immediate jeopardy near the bridge.

The piles are vulnerable to impact by debris during storm events. Large floating objects can deliver a severe blow to unarmored pile bents Further, the absence of battered piles will cause a higher stress on the lateral pile bracing. The bolted connection of the lateral bracing to the piles is also a concern, as several of these connections occur in areas near the waterline where decay is more likely to be present.

## VI. Recommendations:

*Actions to prevent catastrophic failure (in order of importance):*

Investigate pile decay

Non-destructive testing can be done to determine the occurrence of decay of the piles at the waterline. This testing should be done in advance of permitting repetitive truck loads or overweight vehicles.

Deteriorated piles can be repaired by jacketing with concrete, fiber reinforced polymer sleeves, or epoxy injection.

Recommended Load Posting

NYSDOT provides guidance for safe load capacity (SLC) and load posting of highway bridges. The condition of the cap beam described in Section III of this report yields a HOR = 26.3 Tons and a SLC of 22.4 Tons. According to NYSDOT's guidance, a load posting of **22 tons** is indicated[2]. This posting should remain in effect until the following two conditions are met:

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[1] NYSDOT Bridge Manual, 2008, Section 10

[2] NYSDOT Engineering Instruction 05-034 indicates that "primary members with extensive section loss" should have a SLC of 70% of HOR (H Operating Rating). Floor system members are categorized as 85% of H Operating Rating. The conclusion employs 85% of H Operating Rating. This is unconservative, but it is deemed appropriate because the guidance incorporates multiple other conservative elements.

1. The lap joints in the cap beam are remediated. An engineered retrofit of this condition is required so that the cap beams can perform as-designed.
2. Pile decay is investigated and remediated if it is present. In situ repair of decayed timber piles has been done on several demonstration projects, with results published by the FHWA and the American Society of Civil Engineers. The methods utilize differing construction techniques, from epoxy and glass fiber wraps to concrete encasement. An engineered solution at the Carol Drive Bridge would be needed.

Scour Protection

The bridge is vulnerable to scour at the abutments. Scour has been remediated at the east abutment through addition of a scour apron, and the original bank protection at the west abutment is functioning as designed. Still, widening of the stream channel continues to occur, and the scour protection at the bridge is limited to light stone fill. Medium stone ($D_{50}$>12") would be better suited for this purpose.

Pier Protection

The piers are vulnerable to collision with debris or large floating objects during periods of high flow or storm events. Installation of a debris deflector or similar pier protection would mitigate this risk. An appropriate installation would be a V shaped array of piles where the V is pointed upstream and is therefore able to shed debris away from the bridge pier.

*Actions to extend the life of the bridge:*

Prevent water infiltration to superstructure

Replace the waterproofing membrane and asphalt wearing surface, and examine the condition of the joints. Field observations indicate that the steel plates above the transverse joints may be failing; these plates should be examined and potentially replaced. Arresting water infiltration to the superstructure could extend the life of the deck spans an additional 25 years or more, assuming the timbers are currently unaffected by decay.

# Attachment A

Location Map

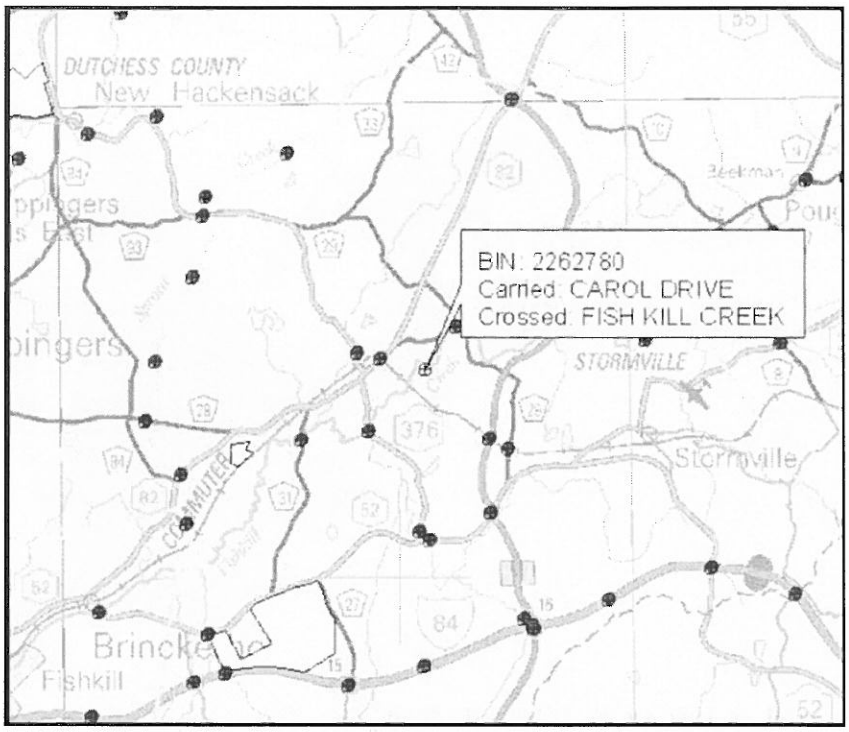


Figure 1: Regional Location Map

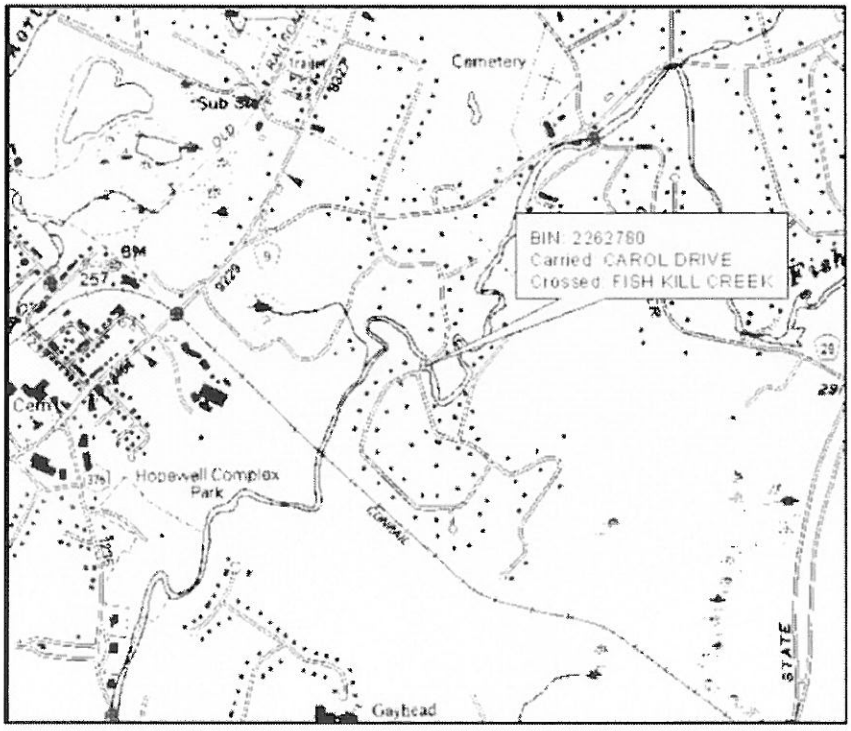


Figure 2: Location Map

# Attachment B

Structure Photos

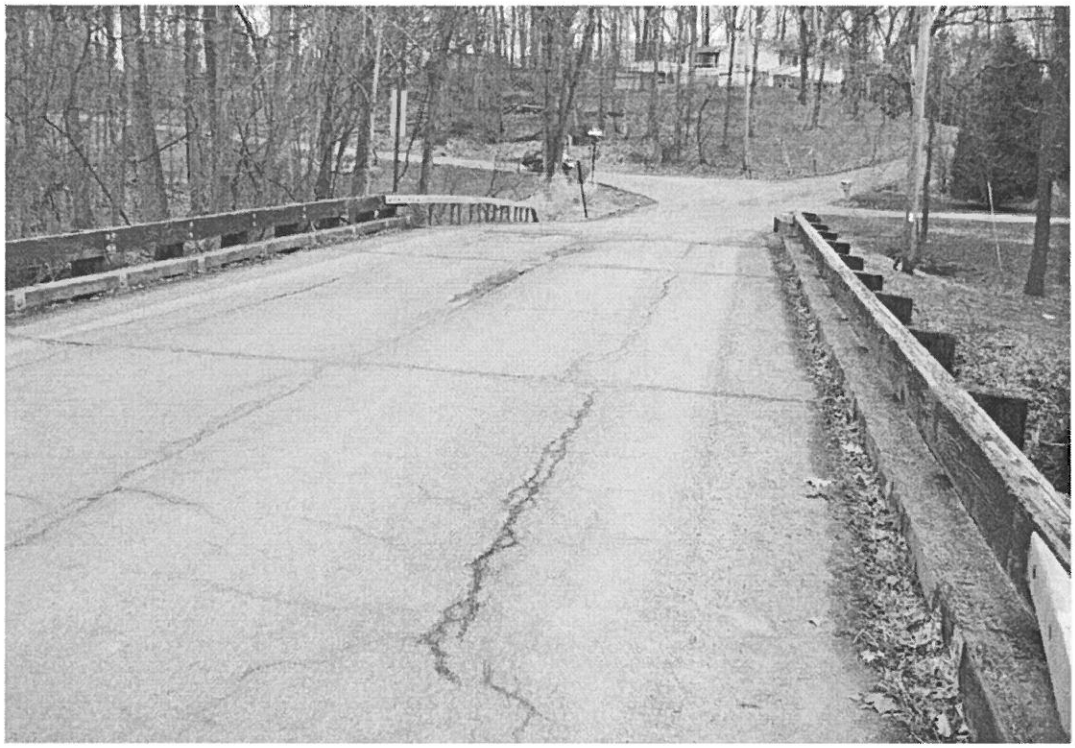

Photo 1: On Bridge looking West

Photo 2: Crack in Asphalt at Pier

Photo 3: Bridge Elevation looking South

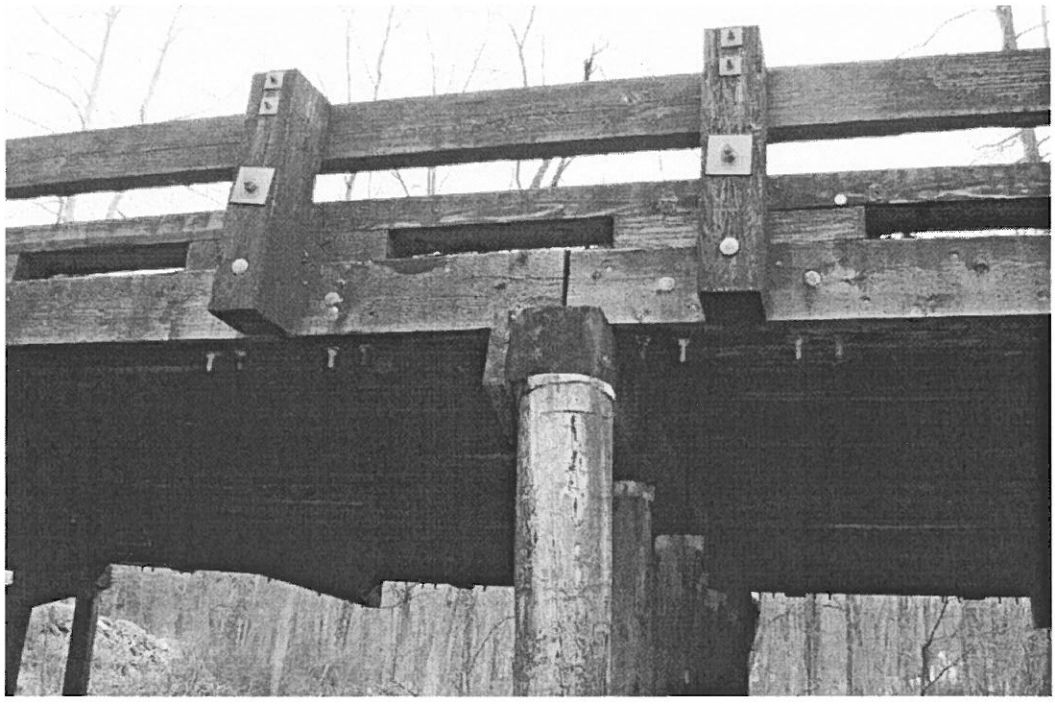

Photo 4: End of Pier

Photo 5: SW Wingwall Pile with rot at top

Photo 6: Pier 1 Cap Beam Splice

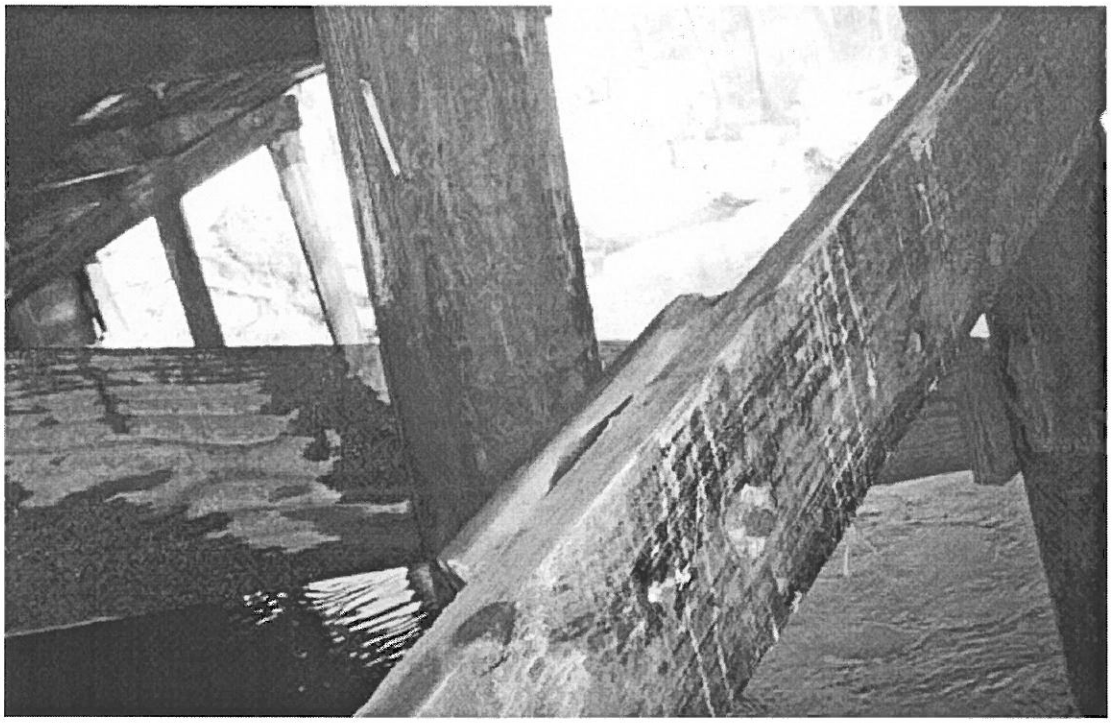

Photo 7: Wood Pile Pier Cross Bracing

Photo 8: West Abutment Cap Beam Splice off Pile

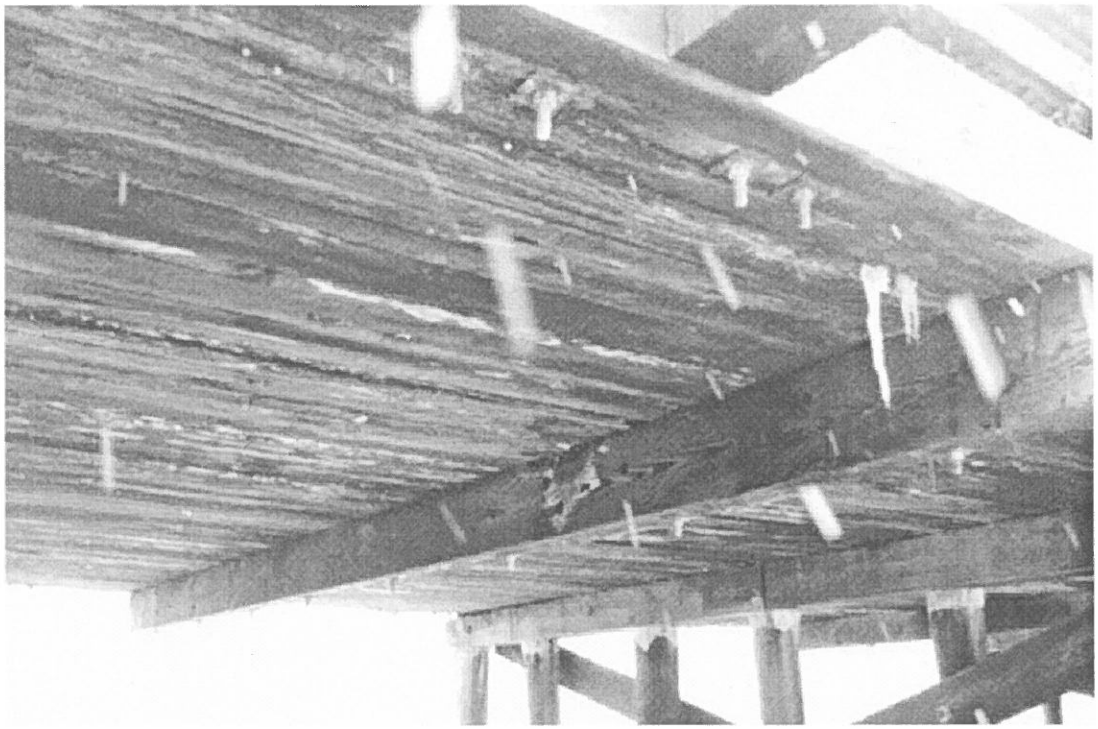

Photo 9:

Photo 10: Debris in steam under bridge between West Abutment and Pier 1


Photo 11: West Abutment Cap Beam Splice off Pile

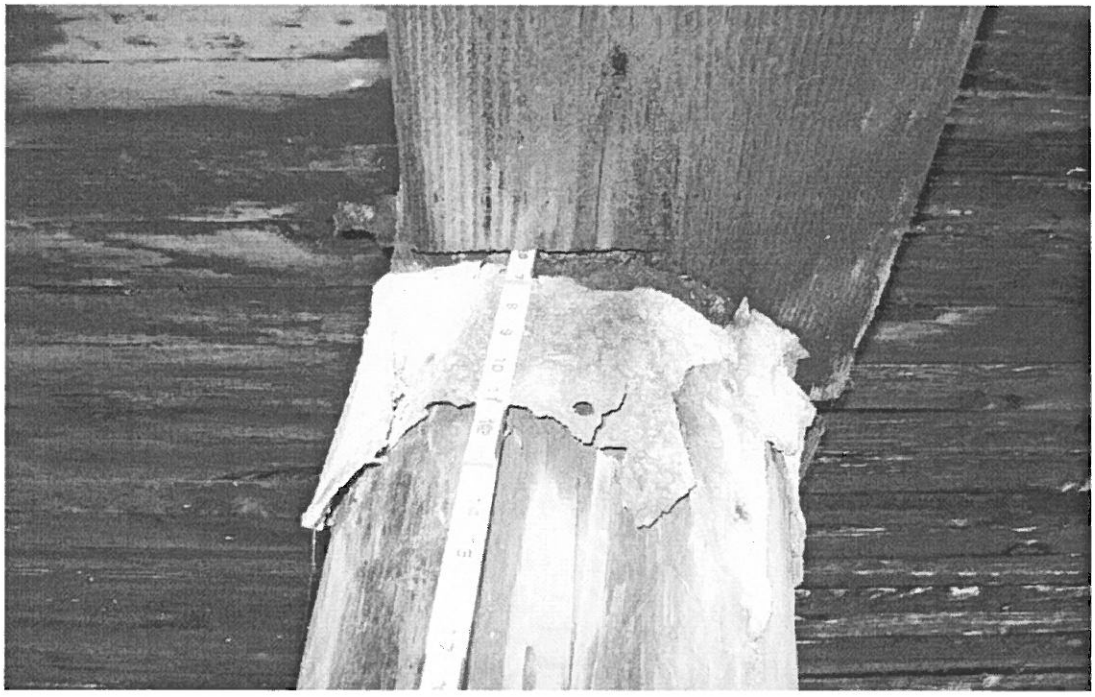

Photo 12: Looking up at Pier 1 Cap Beam, CL of Splice off Pile

Photo 13: East Abutment looking South

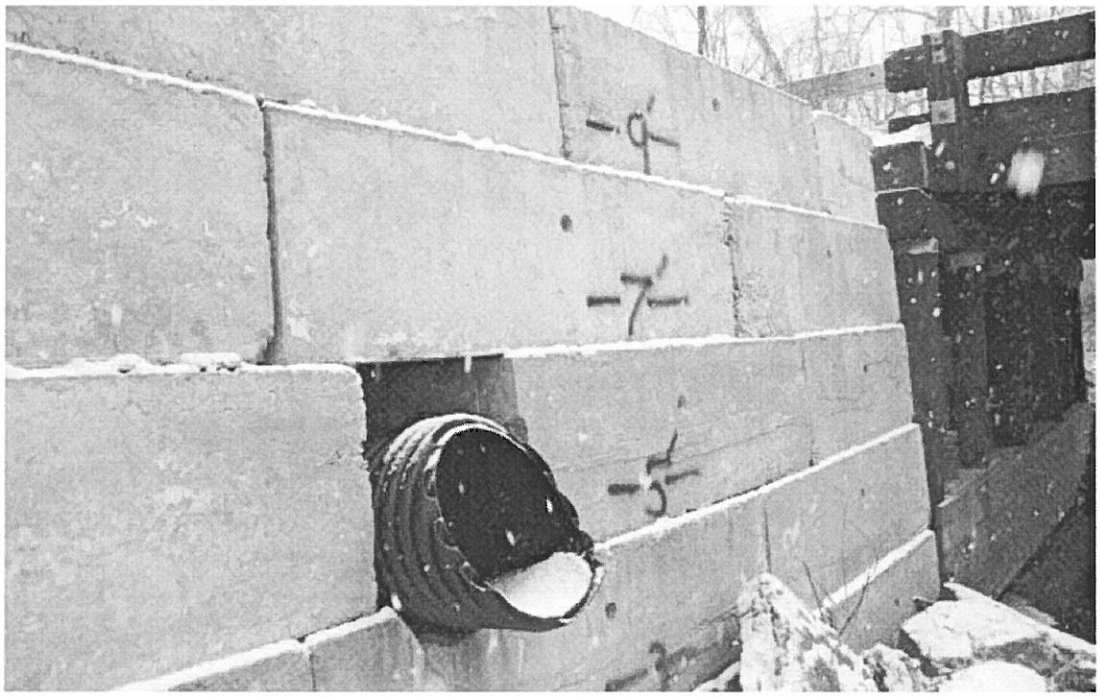

Photo 14: NE Wing wall constructed from Concrete "Mafia" Blocks

# Attachment C

## Load Posting Calculations

# Operating Load Rating to determine if Bridge Should be Load Posted

Town: East Fishkill, New York
Bridge: Carol Drive over the Fishkill Creek
BIN: 2262780

Ref:
1. AASHTO Manual for Bridge Evaluation 2nd Edition
2. NYSDOT EI 05-034 (Bridge Load Posting Guidelines)
3. 2005 NDS (National Design Specification for Wood Construction)

Load Rating Method: ASD

**Operating** Load Rating for shear in 12" x 12"cap beam at Pier #1
Due to Notch in cap beam at cap beam splice location and CL of spice not located on pile take shear at reduced cross section of notch.

Rating Vehicle = H-20 Truck (for posting use H Truck not HS truck)

**Calculate Shear Capacity of Cap beam at Notch**
Area = Reduced area due to Notch = (b=6", d=12") = 72 in^2

Fv = Allowable Shear stress = 170 psi (for Douglas Fir-Larch from NDS Table 4D)
Factor for operating rating = 1.33
Load Duration Factor = $C_D$ = 1.6 for impact load from Truck
Fv' = Fv x 1.33 x 1.6 = 362 psi

Capacity in shear = **C** = 2/3 x Fv' x Area = 2/3 x 362 x 72 = **17,376 lbs**

**Loads on Cap Beam**

Span 1 =19'  Span 2 = 25'
Trib Area on Cap Beam = 22'
2.08' = 1/2 clear span of cap beam

Dead Loads
Cap Beam = 50 lbs/ft
Floor = 1.0' x1.0' x 22' x 50 lbs/ft^3 = 1100 lbs/ft
Asphalt Surface = 0.25' x 1' x 22' x 150 lbs/ft^3 = 825 lbs/ft
Total = 1975 lbs/ft
$V_{dead}$ = 1975 lbs/ft x 2.08' = 4108 lbs

Live Loads (H-20 Truck)
(3.67' deck width wheel load is dis. over)
16,000 lbs / 3.67' = 4360 lbs/ft
11/25 x 4000 lbs / 3.67' = 480 lbs/ft
Total = 4840 lbs/ft
$V_{live}$= 4840 lbs/ft x 2.08' =10,067 lbs

Rating Factor = **RF** = $(C - V_{dead}) / V_{live}$ = (17,376 - 4108) / 10,067 = **1.318 ( H-26.3 = HOR)**

From NYSDOT EI 05-034 Table 2
**SLC** = 0.85 x HOR = 0.85 x 26.3 = **22.4**
Eff Span = 25 + 19 = 44'
From Table 1, H Equivalent Load for 44' = H23 > SLC so Load Post
From Table 3 Load Post for = **22 Tons**

# Attachment D

HS Inventory Load Rating Calculations of

As-built Bridge Condition

## Inventory Load Rating of As-built Condition

Town: East Fishkill, New York
Bridge: Carol Drive over the Fishkill Creek
BIN: 2262780

Ref: 1. AASHTO Manual for Bridge Evaluation 2nd Edition
2. 2005 NDS (National Design Specification for Wood Construction)

Load Rating Method: ASD

**Inventory** Load Rating (Shear in 12" x 12"cap beam at Pier #1 controls)
Due to Notch in cap beam at cap beam splice location and CL of spice not located on pile take shear at reduced cross section of notch.

Rating Vehicle = HS-20 Truck

**Calculate Shear Capacity of Cap beam at Notch**
Area = Reduced area due to Notch = (b=6", d=12") = 72 in^2

Fv = Allowable Shear stress = 170 psi (for Douglas Fir-Larch from NDS Table 4D)
Factor for inventory rating = 1.00
Load Duration Factor = $C_D$ = 1.6 for impact load from Truck
Fv' = Fv x 1.00 x 1.6 = 272 psi

Capacity in shear = **C** = 2/3 x Fv' x Area = 2/3 x 272 x 72 = **13,056 lbs**

**Loads on Cap Beam**

Span 1 =19' Span 2 = 25'
Trib Area on Cap Beam = 22'
2.08' = 1/2 clear span of cap beam

Dead Loads
Cap Beam = 50 lbs/ft
Floor = 1.0' x1.0' x 22' x 50 lbs/ft^3 = 1100 lbs/ft
Asphalt Surface = 0.25' x 1' x 22' x 150 lbs/ft^3 = 825 lbs/ft
Total = 1975 lbs/ft
$V_{dead}$ = 1975 lbs/ft x 2.08' = 4108 lbs

Live Loads (HS-20 Truck)
(3.67' deck width wheel load is dis. over)
16,000 lbs / 3.67' = 4360 lbs/ft
11/25 x 16000 lbs / 3.67' = 1918 lbs/ft
5/19 x 4000 lbs / 3.67' = 287 lbs/ft
Total = 6565 lbs/ft
$V_{live}$= 6565 lbs/ft x 2.08' =13,655 lbs

Rating Factor = **RF** = $(C - V_{dead}) / V_{live}$ = (13,056 - 4108) / 13,655 = **0.66 (HS-13.2)**