Orange Water and Sewer Authority
*Our community's trusted partner for clean water and environmental protection.*

# ADDENDA

## ADDENDUM #1

DATE: December 5, 2025

PROJECT: RFQ Mason Farm WWTP Bridge Rehabilitation

OWNER: Orange Water and Sewer Authority

TO: All Submitters

Attached are copies of Bridge inspection reports from 2021, 2016, and an emergency inspection report following Tropical Storm Chantal in 2025.

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N. C. DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
STRUCTURE MANAGEMENT UNIT

ATTENTION: _____

# Structure Safety Report

## Initial Inspection

**COUNTY:** ORANGE **STRUCTURE NUMBER:** OWASA **FREQUENCY:** _____

**FACILITY CARRIED:** ENTRANCE DRIVE TO MASON FARM WASTEWATER TREATMENT PLANT **MILE POST:** NA

**LOCATION:** 0.05 MILES SOUTH OF INTERSECTION WITH OLD MASON FARM ROAD

**FEATURE INTERSECTED:** MORGAN CREEK

**LATITUDE:** 35° 53' 55.34" N **LONGITUDE:** 79° 1' 32.85" W

**SUPERSTRUCTURE:** CONCRETE PRESTRESSED CORED SLABS W/ ASPHALT WEARING SURFACE

**SUBSTRUCTURE:** REINFORCED CONCRETE ABUTMENTS AND INTERIOR CONCRETE BENT FOOTING

**SPANS:** 2 @ 30'-0"

☐ FRACTURE CRITICAL ☐ TEMPORARY SHORING ☐ SCOUR CRITICAL ☐ SCOUR PLAN OF ACTION

**PRESENT CONDITION:** GOOD **INSPECTION DATE:** 6/16/2021

**POSTED SV:** NOT POSTED **POSTED TTST:** NOT POSTED

**OTHER SIGNS PRESENT:** NARROW BRIDGE



SOUTH APPROACH LOOKING NORTH

| SIGN NOTICE ISSUED FOR | | NUMBER REQUIRED |
|---|---|---|
| NO | WEIGHT LIMIT | 0 |
| NO | DELINEATORS | 0 |
| NO | NARROW BRIDGE | 0 |
| NO | ONE LANE BRIDGE | 0 |
| NO | LOW CLEARANCE | 0 |

**DIRECTION OF INSPECTION** S-N

6/24/2021

NORTH CAROLINA PROFESSIONAL SEAL 036215 ENGINEER ERIN B. KRAYER

DocuSigned by:
Erin B. Krayer
0F47E60768D7452...

WETHERILL ENGINEERING

Wetherill Engineering, Inc.
1223 Jones Franklin Road
Raleigh, North Carolina 27606
License No.: F-0377

| INSPECTED BY: | SIGNATURE | ASSISTED BY: |
|---|---|---|
| MARK WADE | M S Wade | GLEN KIKER |

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# National Bridge and NC Inspection Items

**Structure Number:** OWASA **Inspection Date:** 6/16/2021

**National Bridge Inventory Items**

| Item | | Grade Scale | Grade |
|---|---|---|---|
| Item 58: | Deck | 0-9, N | 7 |
| Item 59: | Superstructure | 0-9, N | 7 |
| Item 60: | Substructure | 0-9, N | 7 |
| Item 61: | Channel and Channel Protection | 0-9, N | 6 |
| Item 62: | Culvert | 0-9, N | N |
| Item 71: | Waterway Adequacy | 0-9, N | 7 |
| Item 72: | Approach Roadway Alignment | 0-9, N | 8 |

EVALUATION CODE: 0 - 2 CRITICAL, 3 & 4 POOR, 5 & 6 FAIR, 7 - 9 GOOD

**NC SMU Inspection Items**

| Item | Grade Scale | Grade |
|---|---|---|
| Deck Debris | G, F, P, OR C | G |
| Drainage System | G, F, P, OR C | |
| Utilities | G, F, P, OR C | G |
| Slope Protection | G, F, P, OR C | |
| Scour | G, F, P, OR C | G |
| Wingwall | G, F, P, OR C | G |
| Field Scour Evaluation | G, F, P, OR C | G |
| Drift | G, F, P, OR C | F |
| Fender System | G, F, P, OR C | |
| Movable Span Machinery | G, F, P, OR C | |
| Repsonse to Live Load | G, F, P, OR C | 8 |
| Estimated Remaining Life | G, F, P, OR C | 22 |

EVALUATION CODE: GOOD, FAIR POOR OR CRITICAL

Note: If NC SMU Item is not present, leave NC SMU item blank

**Inspection Information**

| Item | Grade Scale | Grade |
|---|---|---|
| Regulatory Sign Noticed Issued | YES/NO | N |
| Priority Maintenance Request Submitted | YES/NO | N |
| Inspection Time | Hours | 4 |
| Traffic Control Time | Hours | 0 |
| Snooper Time | Hours | 0 |
| Ladder Used | YES/NO | N |
| Bucket Truck Used | YES/NO | N |
| Boat Used | YES/NO | N |
| Other Equipment Used | YES/NO | N |

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# National Bridge and NC Inspection Item Details

**Structure Number:** OWASA **Inspection Date:** 6/16/2021

| Item Details | Deck - Item 58 | Grade 7 |
|---|---|---|
| WEARING SURFACE: | SPAN 1 WEARING SURFACE HAS 65 SQUARE FEET OF HAIRLINE TO 1/8" WIDE MAP CRACKING THROUGHOUT (SEE PHOTO). SPAN 2 WEARING SURFACE HAS 35 SQUARE FEET HAIRLINE TO 1/8" WIDE MAP CRACKING THROUGHOUT (SEE PHOTO). 1½" THICK ASPHALT WEARING SURFACE HAS BEEN ADDED OVER ORIGINAL REINFORCED CONCRETE WEARING SURFACE. ASPHALT CRACKED ALONG FILL FACE OF JOINT AT ABUTMENT 1 AND 2. | |
| DECK: | CONCRETE DECK IS NOT VISIBLE FOR INSPECTION SINCE INSTALLATION OF ASPHALT WEARING SURFACE. | |
| STEEL RAIL: | DAMAGE TO THE SOUTHEAST BOTTOM BRIDGE RIAL IS BENT OUT OF ALIGNMENT 7" TO THE EAST (SEE PHOTO). | |
| JOINT: | JOINTS HAVE BEEN SEALED AND ARE IN GOOD CONDITION. | |
| DECK DEBRIS: | MINOR DEBRIS ACCUMULATED IN DECK WEARING SURFACE CUT-OUTS FOR UTILITY SUPPORTS ALONG EAST FACE OF BRIDGE. | |

| Item Details | Superstructure - Item 59 | Grade 7 |
|---|---|---|
| CORED SLABS: | 5" X 1" DEEP SPALL IN CORED SLAB 2 IN SPAN 2, LOCATED 3.5' FROM ABUTMENT 2 (SEE PHOTO). NO CRACKS, SPALLS OR DELAMINATIONS FOUND ON EXTERIOR SIDES OF BRIDGE. | |

| Item Details | Substructure - Item 60 | Grade 7 |
|---|---|---|
| CAP: | STICKS AND OTHER DEBRIS HANG FROM BETWEEN TOP OF CAP AND BOTTOM OF CORED SLAB UNITS. A 9" X 5" DELAMINATION WITH A HAIRLINE X 7" LONG HORIZONTAL CRACK ON THE BOTTOM SOUTH FACE OF THE BENT CAP JUST ABOVE COLUMN 1 ON SPAN 2 SIDE (SEE PHOTO). | |
| ABUTMENT: | MINIMUM RANDOM MAP CRACKING PRESENT ON BREASTWALL OF ABUTMENT 1. | |
| WINGWALL: | NORTHWEST WINGWALL HAS 30 SQUARE FEET HAIRLINE MAP CRACKING (SEE PHOTO). HAIRLINE TO 3/32" WIDE VERTICAL CRACK ON SOUTHWEST WINGWALL. 5" X 19" DELAMINATED AREA ON NORTHWEST WINGWALL WITH MINOR SURFACE SPALLS. (SEE PHOTO) | |

| Item Details | Channel & Channel Protection - Item 60 | Grade 6 |
|---|---|---|
| | 20' LONG X 5' HIGH X 4' WIDE BANK SCOUR ALONG DOWNSTREAM SOUTH SIDE OF STREAM (SEE PHOTO). 12' LONG X 5' HIGH X 4' WIDE BANK SCOUR ALONG SOUTH SIDE OF STREAM AT WEST SIDE OF BRIDGE (SEE PHOTO). | |

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| | | |
|---|---|---|
| Item Details | Approach Roadway Alignment - Item 72 | Grade 8 |
| | BOTH NORTH AND SOUTH SIDE APPROACH ASPHALT WEARING SURFACE IS IN GOOD CONDITION, NO CRACKING EXCEPT AT JOINTS AND HAVE BEEN SEALED. | |
| Item Details | Slope Protection | Grade NA |
| | NO SLOPE PROTECTION PRESENT AT ABUTMENTS. | |
| Item Details | Drift | Grade F |
| | 18' LONG X 8' WIDE X 4' HIGH DRIFT LOCATED AT THE BASE OF BENT 1 (SEE PHOTO) | |
| Item Details | Utilities | Grade G |
| | 7" DIAMETER INSULATED DUCTILE IRON PIPE WAS REMOVED FROM UNDER THE BRIDGE AND THE ENDS CAPPED AT THE ABUTMENT WALLS. AN 8" DIAMETER DUCTILE IRON PIPE IS HUNG ALONG THE EAST SIDE OF THE BRIDGE. | |
| Item Details | Field Scour Evaluation | Grade G |
| | PER BRIDGE PLANS, BRIDGE IS SUPPORTED ON SPREAD FOOTING KEYED INTO SHALE. NO VISIBLE INDICATION OF SCOUR AROUND FOOTINGS. BED ELEVATIONS ARE ABOVE FOOTINGS. | |

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## BRIDGE INSPECTOR'S RECOMMENDATIONS FOR MAINTENANCE REPAIRS

Bridge: **NA** County: **ORANGE** Date: **6/16/2021**

**These Repairs Should Be Made Within Twelve Months From The Date Of This Inspection.**

| Function Code | Description of Function | Unit | Quanity | Remarks | Est. cost |
|---|---|---|---|---|---|
| | | 1 | LS | PATCH SPALL ON BOTTOM SURFACE OF CORED SLAB 2. WHERE PREVIOUS HANGER WAS ATTACHED, ADJACENT TO BEAM 3.5' FROM | |
| | | 20 | MHS | REMOVE DRIFT FROM BENT 1. | |
| | | 1 | LS | REPAIR BENT BOTTOM RAIL. | |
| | | 1 | LS | ADD RIP RAP TO SOUTH STREAM BANK WHERE SCOURING. | |

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# STANDARD STRUCTURE PHOTOS

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South Approach Looking North



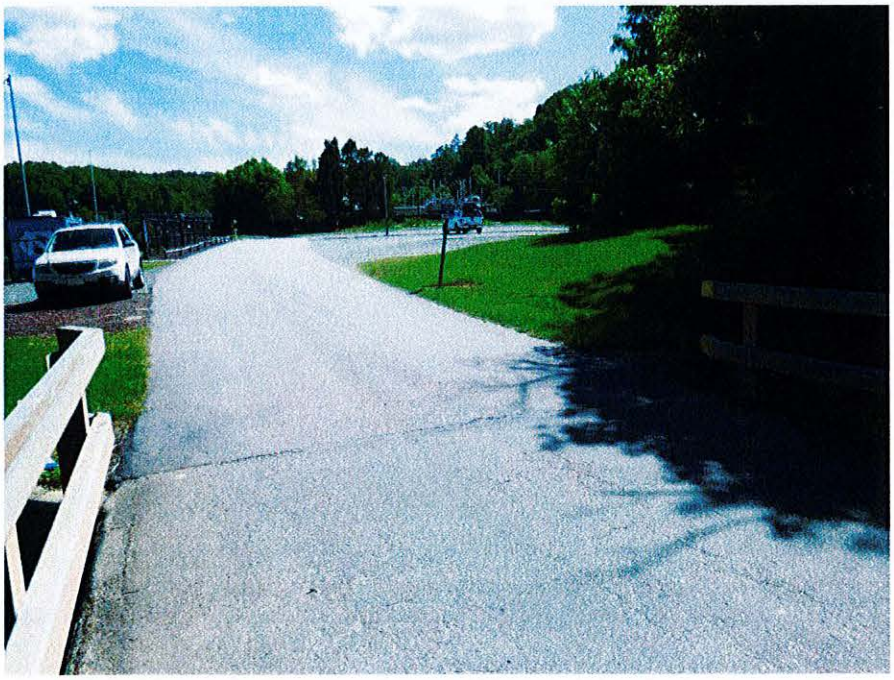
North Approach Looking South

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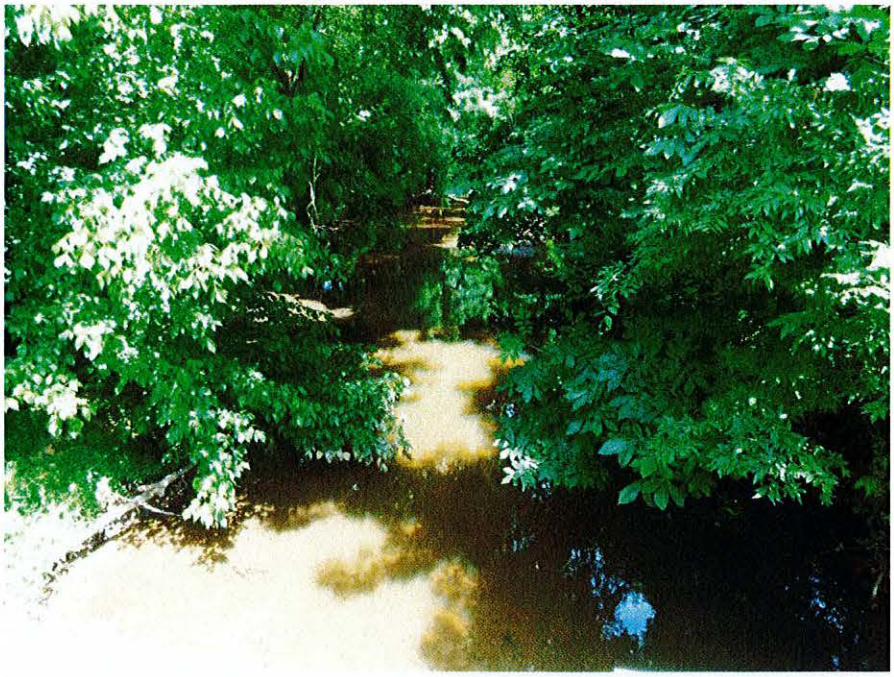
North Approach



South Approach

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Looking West Upstream



Looking East Downstream

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Narrow Bridge Sign at North Approach



Typical 2-Bar steel tube bridge railing, taken at southwest corner

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Bent 1 West side superstructure



Typical Wingwall, northwest wingwall shown

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Northwest wingwall



8" Diameter ductile iron waterline along east face of bridge, shown at End Bent 2

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Utility stub at Abutment 2, left side



Abutment 1

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Interior Bent 1, Span 2 side



Abutment 2

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Utility Bracket at Abutment 1, right side



Span 1 Superstructure, looking north

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Utility 7" diameter at Abutment 1



Looking downstream from under the bridge

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Looking upstream from under the bridge



Abutment 1 top of wearing surface

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Bent 1 joint and top of wearing surface



Abutment 2 top of wearing surface

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Guardrail attachment located at mid span at Span 1 on left side



West side bridge profile

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East side bridge profile

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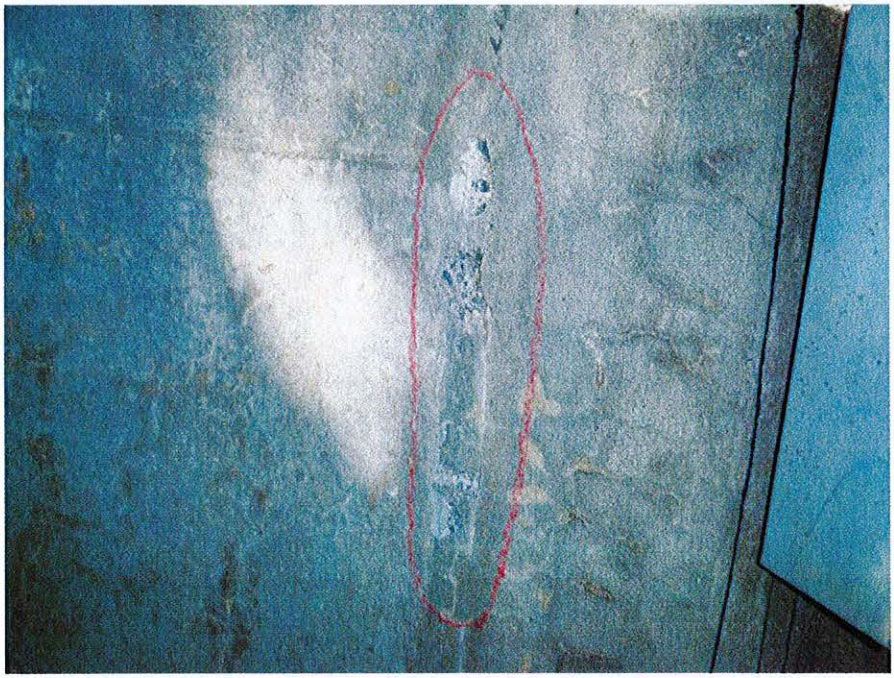
# CONDITION PHOTOS

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Damage to the southeast bottom bridge rail is bent out of alignment 7" to the east



5" x 19" delaminated area on northwest wingwall with surface spalls

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20' long x 5' high x 4' wide bank scour along downstream south side of stream



12' long x 5' high x 4' wide bank scour along south side of stream at west side of bridge

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9" x 5" delamination with a 7" long horizontal hairline crack at the bottom of cap near column 1, span 1 side



5" x 1" deep spall in cored slab 2 in span 2, located 3.5' from abutment 2

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Drift 18' long x 8' wide x 4' high at Bent 1



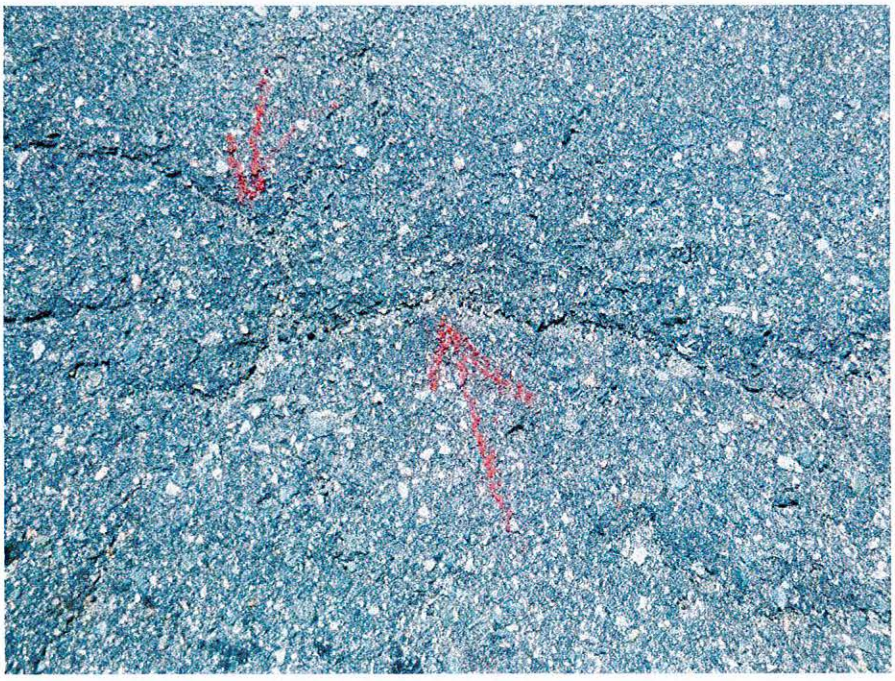
Northwest wingwall has 30 sq. ft. of hairline map cracking

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Hairline to 3/32" wide vertical crack on southwest wingwall near rail post



Span 1 wearing surface has 65 sq. ft. hairline to 1/8" wide map cracking

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Span 2 wearing surface has 35 sq. ft. hairline to 1/8" wide map cracking

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# STREAM BED SOUNDINGS

(SEE NEXT SHEET FOR PROFILE SKETCH)

BR. INSP. WORKSHEET (1/1/90)
Revised 10/9/1998

Bridge #: OWASA COUNTY ORANGE DATE 6-16-2021 BY: MSW/RGK

RECORD SOUNDINGS FROM TOP OF RAIL. OTHER LOCATION IF NEEDED: TOP OF RAIL

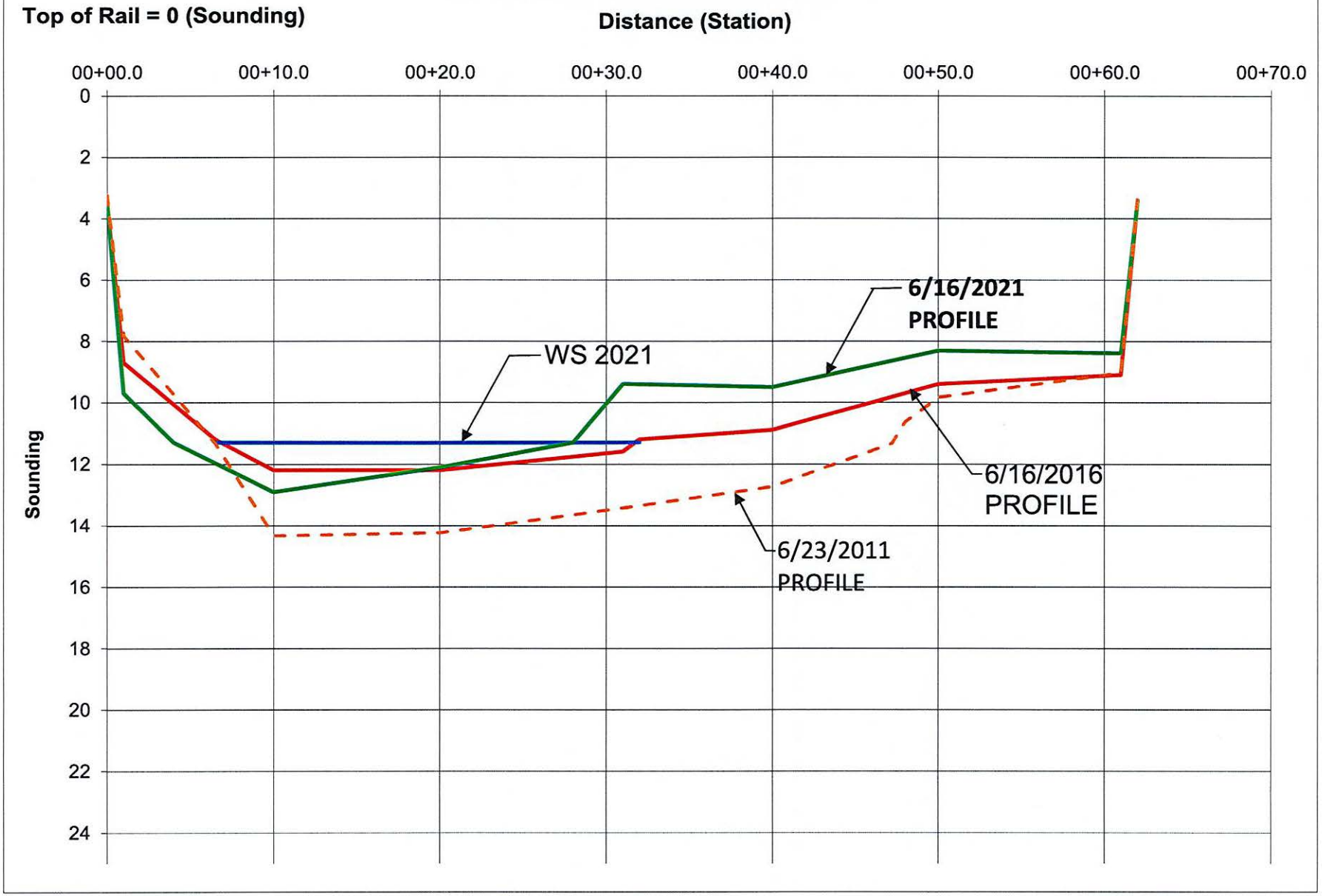
DISTANCE HIGHWATER MARK TO TOP OF CURB: _____ LOCATION H. W. MARK: _____

NOTE: Draft a Stream Bed Profile sketch and record soundings at the stream face of abutments, C/L of piers, WE, WS, and major contour changes on the downstream side. Record soundings at the stream face abutments and C/L piers on the upstream side.

| DOWNSTREAM | | | UPSTREAM | | |
|---|---|---|---|---|---|
| DISTANCE (Station) | SOUNDING | DESCRIPTION | DISTANCE (Station) | SOUNDING | DESCRIPTION |
| 00+06.5 | 11.3 | WS & WE | | | |
| 00+32.0 | 11.3 | WS & WE | | | |
| 00+00.0 | 3.40 | TOP OF WING | 00+00.0 | 3.43 | TOP OF WING |
| 00+01.0 | 9.70 | FACE OF WING | 00+01.0 | 10.90 | FACE OF CAP |
| 00+04.0 | 11.30 | WS & WE | 00+04.5 | 11.10 | WS & WE |
| 00+10.0 | 12.90 | BED | 00+31.0 | 10.60 | CENTERLINE BENT |
| 00+20.0 | 12.10 | | 00+33.8 | 11.10 | WS & WE |
| 00+28.0 | 11.30 | WS & WE | 00+61.0 | 8.20 | FACE OF CAP |
| 00+31.0 | 9.40 | CENTERLINE BENT | | | |
| 00+40.0 | 9.50 | GROUNDLINE | | | |
| 00+50.0 | 8.30 | GROUNDLINE | | | |
| 00+61.0 | 8.40 | FACE OF WING | | | |
| 00+62.0 | 3.40 | TOP OF WING | | | |
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Bridge #: **OWASA** County: **ORANGE** Date: **6/16/2021** By: **MSW/RGK**

## STREAMBED PROFILE (Downstream)






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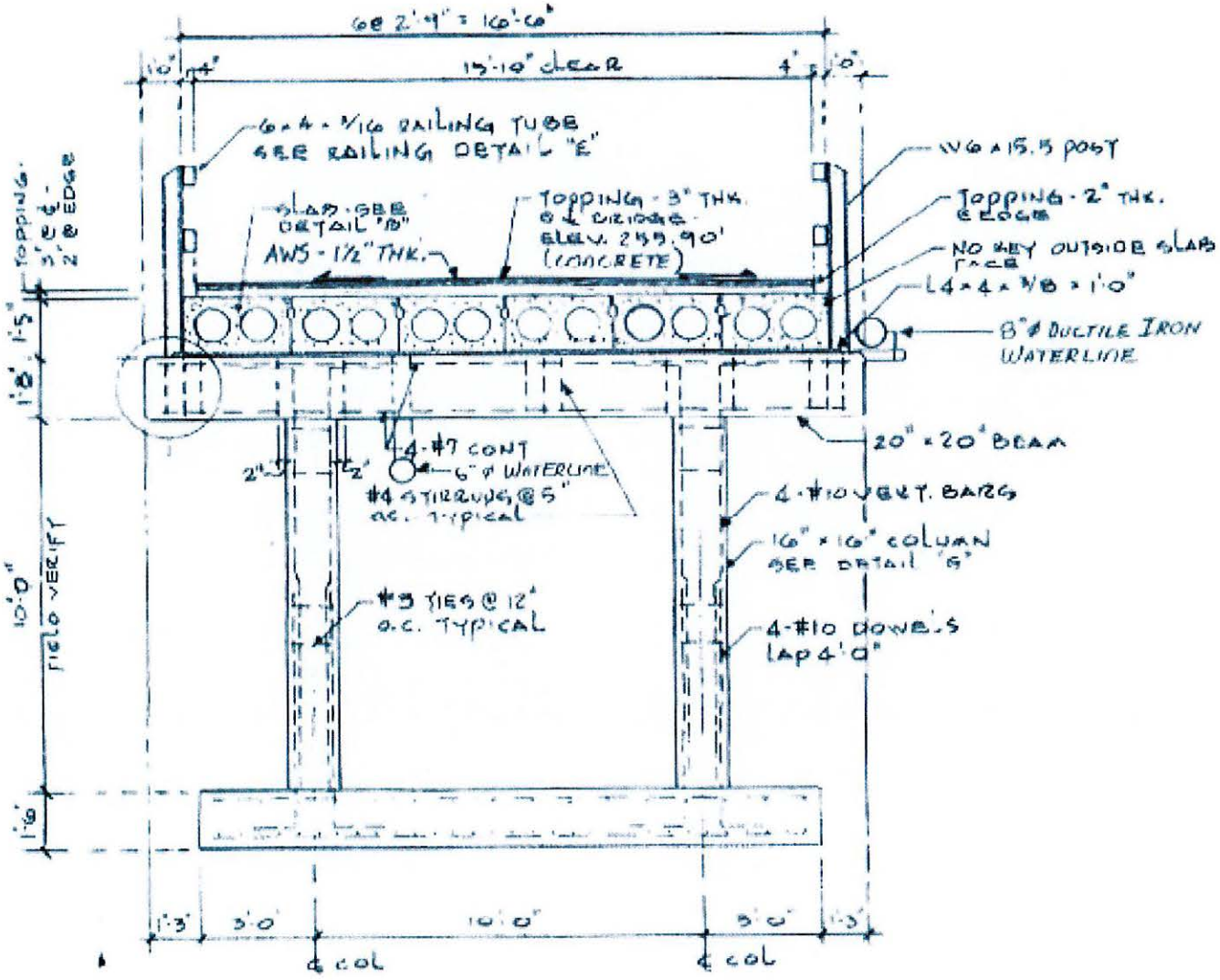
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TRANSPORTATION PLANNING/DESIGN - BRIDGE/STRUCTURE DESIGN
CIVIL/SITE DESIGN - GIS/GPS - CONSTRUCTION OBSERVATION

1223 Jones Franklin Rd.
Raleigh, N.C. 27606
Bus: 919 851 8077
Fax: 919 851 8107
License No. F-0377

LOCATION: CHAPEL HILL
COUNTY: ORANGE
INSPECTION DATE: 6/16/2021
DRAWN BY: EBK CHECKED BY: DDH

# OWASA




## TYPICAL SECTION

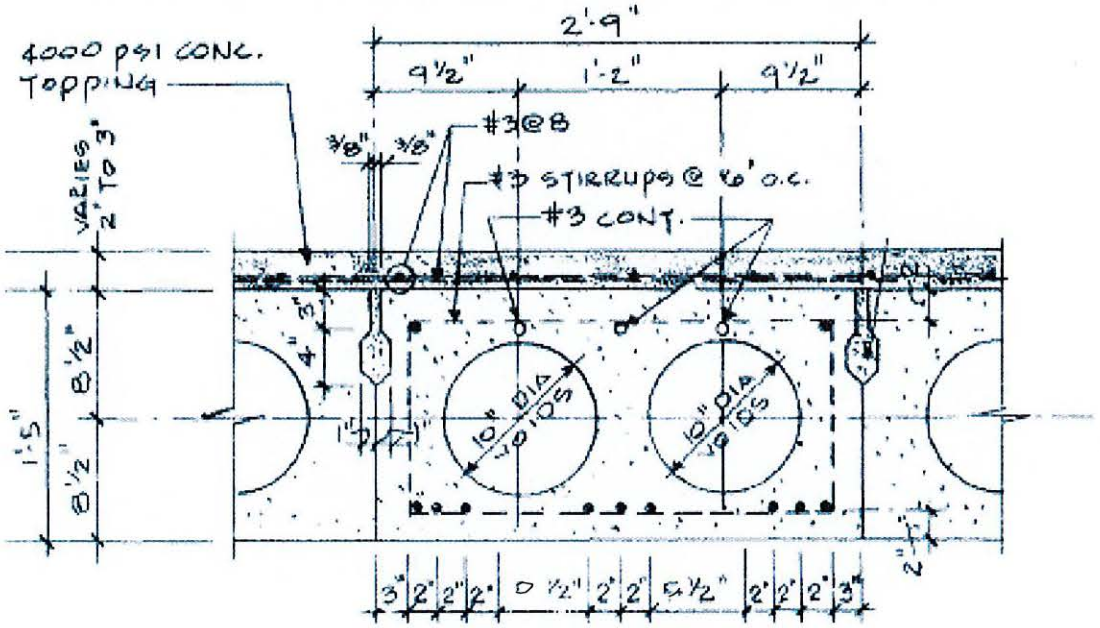
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LOCATION: CHAPEL HILL
COUNTY: ORANGE
INSPECTION DATE: 6/16/2021
DRAWN BY: EBK CHECKED BY: DDH

# OWASA - MASON FARM WASTERWATER TREATMENT PLANT




## DETAIL "B"
## CORED SLAB UNIT

7/16" Ø 270 ksi., 7 WIRE STRANDS
11 STRANDS BOTTOM, 2 STRANDS TOP
fc' = 5,000 psi

| | |
|---|---|
| NUMBER OF SPANS | 2 |
| BRIDGE LENGTH (FILL FACE TO FILL FACE) | 60'-0" |
| SPAN 'A' - LENGTH | 30'-0" |
| SPAN 'B' - LENGTH | 30'-0" |
| BEARING TO BEARING LENGTH (TYPICAL) | 29'-11½" |
| NUMBER OF CORED SLAB UNITS | 6 |
| BRIDGE WIDTH (OUT TO OUT) | 16'-6" |
| BRIDGE WIDTH (CLEAR ROADWAY) | 15'-10" |

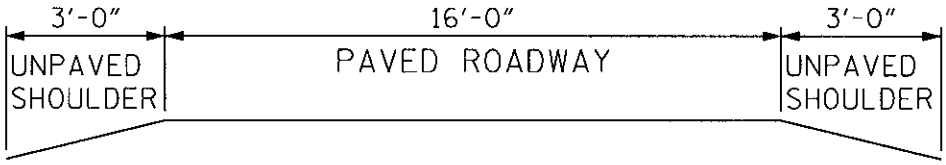
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CIVIL/SITE DESIGN - GIS/GPS - CONSTRUCTION OBSERVATION
559 Jones Franklin Rd. Suite 164
Raleigh, N.C. 27606
Bus: 919 851 8077
Fax: 919 851 8107
License No. F-0377

LOCATION: CHAPEL HILL
COUNTY: ORANGE
INSPECTION DATE: 6/23/2021
DRAWN BY: EBK CHECKED BY: DDH

# OWASA - MASON FARM WASTERWATER TREATMENT PLANT




MEASUREMENTS TAKEN 25' SOUTH OF BRIDGE

## APPROACH ROADWAY

(LOOKING NORTH)

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# *RATING SUMMARY SHEET*

| | | | | | |
|---|---|---|---|---|---|
| **STRUCTURE NO:** | **OWASA** | **COMPILED BY:** | **EBK** | **DATE:** | **6/23/2021** |
| **COUNTY:** | **ORANGE** | **CHECKED BY:** | **DDH** | **DATE:** | **6/24/2021** |

| MEMBER | 17" PRESTRESSED CONCRETE CORED SLAB UNIT | | | | | |
|---|---|---|---|---|---|---|
| Span Length | 30'-0" | | | | | |
| Beam Spacing C=Cont | 2'-9" | | | | | |
| HS 20 Inventory Rating | 34.0 | | | | | |
| HS 20 Operating Rating | 39.0 | | | | | |
| SNSH 13.5 | 50.0 | | | | | |
| SNGARBS2 20 | 55.0 | | | | | |
| SNAGRIS2 22 | 40.0 | | | | | |
| SNCOTTS3 27.25 | 48.0 | | | | | |
| SNAGGRS4 34.925 | 48.0 | | | | | |
| SNS5A 35.55 | 51.0 | | | | | |
| SNS6A 39.95 | 52.0 | | | | | |
| SNS7B 42 | 54.0 | | | | | |
| TNAGRIT3 33 | 52.0 | | | | | |
| TNT4A 33.075 | 61.0 | | | | | |
| TNAGRIT4 43 | 62.0 | | | | | |
| TNAGT5A 45 | 59.0 | | | | | |
| TNAGTGB 45 | 59.0 | | | | | |
| TNT6A 41.6 | 61.0 | | | | | |
| TNT7A 42 | 59.0 | | | | | |
| TNT7B | 58.0 | | | | | |

| | |
|---|---|
| **DESIGN LOADING** | **UNKNOWN** |
| **INVENTORY** | **HS 20** |
| **OPERATING** | **HS 34** |
| **T7 RATING (A or B)** | **58 TONS** |
| **OVERLOAD BRIDGE ONLY** | **YES** [ ] **NO** [X] |

| | | |
|---|---|---|
| **CALCULATED POSTING:** | **SV** NONE Tons | **TTST** NONE Tons |
| **CONTROLLING MEMBER:** | **CORED SLAB** | |
| **EXISTING POSTING:** | **NOT POSTED** | **NOT POSTED** |
| **RECOMMENDED POSTING:** | **NONE REQ'D** | **NONE REQ'D** |

**REASON FOR POSTING CHANGE:** _____

**COMMENTS:** _____

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*Wetherill Engineering, Inc.*
**1223 Jones Franklin Rd.**
**Raleigh, NC 27606**
**(919) 851-8077 * (919) 851-8107 (Fax)**

**SUBJECT** Cored Slab
**BRIDGE** Mason Farm
**PREPARED BY** EBK
**CHECKED BY** JAD

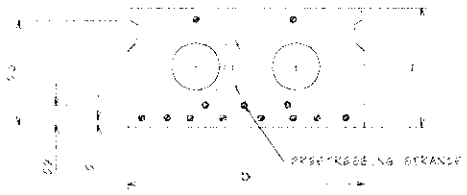
**PROJECT** OWASA
**COUNTY** Orange
**STATION**
**SHEET** 1 **of** 10

# Prestress Concrete Cored Slab

References:
1. AASHTO, Manual for Condition Evaluation of Bridges, 2000
2. AASHTO, Standard Specification for Highway Bridges, 2000

*Basic Units*

$ksi := 1000 \cdot psi_*$
$kip := 1000 \cdot lbf_*$
$ton := 2 \cdot kip_*$



***Input Data***

**Strand Locations** (Measured From the Bottom) **-Remove a strand if strand damaged in the middle third of the girder.**
d1 d2 d3 d4 d5 d6 d7 d8 ...dn

$d := (2 \ \ 2 \ \ 2 \ \ 2 \ \ 2 \ \ 2 \ \ 2 \ \ 2 \ \ 15 \ \ 15) \cdot in$

***Section Properties***
*(Superstructure)*

$\gamma := 0.4$ — Ultimate stress factor 0.4 S.R. or 0.28 for L.R.

$b := 33 \cdot in$ — Width of slab section

$h := 17 \cdot in$ — Height of slab section

$A_{strand} := 0.1152 \cdot in^2$ — Area of Single 7/16" strand

$D := 10 \cdot in$ — Diameter of core

***Material Properties***
*(Superstructure)*

$f_c := 5 \cdot ksi$ — Concrete strength

$F_{s'} := 270 \cdot ksi$ — Prestressing strand strength

$\gamma_c := 150 \cdot \frac{lbf}{ft^3}$ — Specific weight of concrete

***Geometric Properties***
*(Superstructure)*

$Width := 16.50 \cdot ft$ — Width of bridge

$N_L := 1$ — Number of Lanes

$Span := 29.9583 \cdot ft$ — BRG to BRG span length

$units := 6$ — Number of prestress concrete units

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**SUBJECT** Cored Slab
**BRIDGE** Mason Farm
**PREPARED BY** EBK
**CHECKED BY** JAD

**PROJECT** OWASA
**COUNTY** Orange
**STATION**
**SHEET** 2 **of** 10

## Prestress Concrete Cored Slab

***Intermediate Calculations***
*(Superstructure)*

Area of concrete $A_c := b \cdot h - 2 \cdot \left( D^2 \cdot \frac{\pi}{4} \right)$ $A_c = 403.92 \cdot in^2$

Depth of deck $d_d := \frac{h - D}{2}$ $d_d = 3.5 \cdot in$

Equivalent rectangular stress distribution factor $\beta 1$ is dependent on the concrete strength.

$$\beta_1 := if\left[ f_c < 4 \cdot ksi, .85, .85 - .05 \cdot \left( \frac{f_c - 4 \cdot ksi}{1 \cdot ksi} \right) \right] \qquad \beta_1 = 0.8$$ *AASHTO (8.16.2.7)*

*Number of strands* strands := cols(d) strands = 11

*Equivalent strand location*

d = | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | ... | ·in Strand locations

n := cols(d) n = 11 Number of strands

$d_{sec} := h - \frac{\sum d}{n}$ $d_{sec} = 12.636 \cdot in$ Centroid of strands from top

$e := \frac{h}{2} - d_{sec}$ $e = -4.136 \cdot in$ Centroid of strands from center

***Prestress Reinforcement Calculation***
*(Superstructure)*

$b = 33 \cdot in$ $A_{strand} = 0.115 \cdot in^2$ $\rho := \frac{strands \cdot A_{strand}}{b \cdot d_{sec}}$ $\rho = 0.00304$

***Average Ultimate Stress Calculation***
*(Superstructure)*

*AASHTO(9.1.2)*

$\gamma = 0.4$ Ultimate Stress factor for LR strands

$\beta_1 = 0.8$ Equivalent Rectangular block factor

$F_{s'} = 270 \cdot ksi$ Nominal Strand Stress

$f_c = 5 \cdot ksi$ Compressive strength of concrete

$$F_{su'} := F_{s'} \cdot \left( 1 - \frac{\gamma}{\beta_1} \cdot \frac{\rho \cdot F_{s'}}{f_c} \right) \qquad F_{su'} = 247.847 \cdot ksi$$ Average stress at Ultimate Load *AASHTO (9.17.4.1)*

***Moment Capacity Checks***
*(Superstructure)*

Check1 must be less then Limit1

$Check_1 := \rho \cdot \frac{F_{su'}}{f_c}$ $Limit_1 := 0.36 \cdot \beta_1$ $Check_1 = 0.151$ $Limit_1 = 0.288$ OK *AASHTO (9.18.1)*

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## Prestress Concrete Cored Slab

***Locate Neutral Axis*** *(Superstructure)*

$A_{st} := A_{strand} \cdot strands_*$ $\quad A_{st} = 1.267 \cdot in^2$ Area of all strands

If Neutral axis is less then $d_d = 3.5 \cdot in$ then the compression block lies within the deck.

$$a := \frac{A_{st} \cdot F_{su'}}{f_c \cdot b \cdot .85} \qquad a = 2.239 \cdot in$$

$d_d = 3.5 \cdot in$

$$A_{pf} := \frac{.85 \cdot f_c \cdot (b - 2 \cdot D) \cdot \left(\frac{h}{2} - \frac{D}{2}\right)}{F_{su'}} \qquad A_{pf} = 0.78 \cdot in^2$$ *AASHTO (9.17.2)*

$A_{pw} := A_{st} - A_{pf}$ $\quad A_{pw} = 0.487 \cdot in^2$

$$a_2 := \frac{A_{pw} \cdot F_{su'}}{.85 \cdot (b - 2 \cdot D) \cdot f_c} \qquad a_2 = 2.185 \cdot in$$

***Moment Capacity Calculation*** *(Superstructure)*

$\phi := 1.0$ Strength Capacity Reduction factor for prestressed concrete members *AASHTO (9.14)*

$A_{st} = 1.267 \cdot in^2$ Area of all strands

$F_{su'} = 247.847 \cdot ksi$ Average Stress at Ultimate Load

$d_{sec} = 12.636 \cdot in$ Centroid of strands from top of Cord Slab

$f_c = 5 \cdot ksi$ Compressive strength of concrete

*AASHTO (EQ 9-13)*

$\rho = 0.003$ Prestress reinforcement ratio

$$\phi M_{n1} := \phi \cdot \left[A_{st} \cdot F_{su'} \cdot d_{sec} \cdot \left(1 - 0.6 \cdot \rho \cdot \frac{F_{su'}}{f_c}\right)\right] \qquad \phi M_{n1} = 300.836 \cdot kip \cdot ft$$

$$\phi M_{n2} := \phi \cdot \left[A_{pw} \cdot F_{su'} \cdot \left(d_{sec} - \frac{a_2}{2}\right) + .85 \cdot f_c \cdot (b - 2 \cdot D) \cdot \left(d_{sec} - \frac{a_2}{2}\right) \cdot d_d\right] \qquad \phi M_{n2} = 302.139 \cdot kip \cdot ft$$

$\phi M_n := if\left(a < d_d, \phi M_{n1}, \phi M_{n1}\right)$

$\phi M_n = 300.836 \cdot kip \cdot ft$

Moment Capacity of Prestress Concrete Cored Slab
Design Flexural Strength

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## Prestress Concrete Cored Slab

***Dead load Calculation***

### *Composite Dead Load Table*

| | | |
|---|---|---|
| AWS | 50 | lb/ft |
| Concrete Wearing Surface | 88 | lb/ft |
| Utilities | 11 | lb/ft |
| Side Walk Weight | 0 | lb/ft |
| Rail Weight | 14 | lb/ft |
| Other | 0 | lb/ft |
| **Total** | **163** | **lb/ft** |

### *Non Composite Dead Load Table*

| | | |
|---|---|---|
| SIP Forms | 0 | lb/ft |
| Slab Weight | 0 | lb/ft |
| Beam Weight | 421 | lb/ft |
| Diaphram Weight | 7.5 | lb/ft |
| Other | 0 | lb/ft |
| **Total** | **428.5** | **lb/ft** |

$Com_D := Com_DL \cdot \frac{lbf}{ft}$ $\quad Non_com_D := Non_com_DL \cdot \frac{lbf}{ft}$ $\quad w_D := (Com_D + Non_com_D)$

$Com_D = 0.163 \cdot \frac{kip}{ft}$ $\quad Non_com_D = 0.428 \cdot \frac{kip}{ft}$ $\quad w_D = 0.591 \cdot \frac{kip}{ft}$

***Dead Load Moment Channel***

$M_{DL_C} := \frac{Com_D \cdot Span^2}{8}$ $\quad M_{DL_C} = 18.287 \cdot kip \cdot ft$ Composite dead load moment

$M_{DL_NC} := \frac{Non_com_D \cdot Span^2}{8}$ $\quad M_{DL_NC} = 48.072 \cdot kip \cdot ft$ Non composite dead load

$M_{DL} := M_{DL_C} + M_{DL_NC}$ $\quad M_{DL} = 66.359 \cdot kip \cdot ft$ Total dead load

***Live Load Distribution Factor***

*AASHTO(3.23.4.3)*

$S := b$ $\quad S = 33 \cdot in$

$L := Span$ $\quad L = 29.958 \cdot ft$

$K := .8$ Rectangle With Void

$C := K \cdot \left( \frac{units \cdot b}{L} \right)$ $\quad C = 0.441$

$D_1 := if\left[ C < 5, \left(5.75 - 0.5 \cdot N_L\right) + 0.7 \cdot N_L \cdot (1 - 0.2 \cdot C)^2, \left(5.75 - 0.5 \cdot N_L\right) \right] \cdot ft$

$D_1 = 5.832 \cdot ft$

$DF := \frac{S}{D_1} \cdot \frac{1}{2}$ $\quad DF = 0.236$ Distribution Factor

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## Prestress Concrete Cored Slab

### *Impact Factor*

$$I := \frac{50 \cdot ft}{Span + 125 \cdot ft} \qquad I = 0.323$$

*AASHTO (3.8.2.1) EQ3-1*

The impact factor need not exceed .3

$$I := if(I > .3, .3, I) \qquad I = 0.3$$

### *Section Modules*

$area_1 := b \cdot h$ $\quad distance_1 := \frac{h}{2}$ $\quad Inertia_1 := \frac{b \cdot h^3}{12}$ $\quad Inertia_1 = 13510.75 \cdot in^4$

$area_2 := -\frac{\pi \cdot D^2}{2}$ $\quad distance_2 := \frac{h}{2}$ $\quad Inertia_2 := \frac{-2 \cdot \pi \cdot D^4}{64}$ $\quad Inertia_2 = -981.748 \cdot in^4$

$area_1 + area_2 = 403.92 \cdot in^2$ $\quad S_x := \frac{Inertia_1 + Inertia_2}{\frac{h}{2}}$ * $\quad S_x = 1474 \cdot in^3$ Section modules

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## Prestress Concrete Cored Slab

Strength Reduction Factor Based on Condition at Time of Inspection

$Eff_{slab} := 92\%$ *

***Rating Factors***

Inventory: $A_{i1} := 1.3$* $A_{i2} := 2.17$*

Operating $A_{o1} := 1.3$* $A_{o2} := 1.3$*

***Cracking Moment***

Composite reaction

$$reaction := w_D \cdot \frac{Span}{2} \qquad reaction = 8.86 \cdot kip$$

Non-Composite reaction

$$non_comp_reaction := Non_com_D \cdot \frac{Span}{2} \qquad non_comp_reaction = 6.419 \cdot kip$$

Dead Load Moment

$Loss := 12\%$ Assumed losses

$$P := \left[0.75 \cdot F_s \cdot (1 - Loss)\right] \cdot A_{strand} \cdot strands \qquad P = 225.815 \cdot kip$$

*AASHTO(9.18.2)*

$$f_{pe} := \frac{P}{A_c} + \frac{-P \cdot e}{S_x}$$

$$CR_{moment} := \left[\left(7.5 \cdot \sqrt{\frac{f_c}{psi}} \cdot psi + f_{pe}\right) \cdot S_x\right] - \left[M_{DL_NC} \cdot \left(\frac{S_x}{S_x} - 1\right)\right]$$

$1.2 \cdot CR_{moment} = 253.981 \cdot kip \cdot ft$ $\phi M_n = 300.836 \cdot kip \cdot ft$

---

**Maximum Strength**

$$C := Eff_{slab} \cdot \phi M_n \qquad C = 276.769 \cdot kip \cdot ft$$

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## Prestress Concrete Cored Slab

### *Sample Calculation (HS)*

$Truck_{HS} := 20 \cdot ton$

***Live Load Moment Calculation Utilizing the Live Load Moment Tables***

Lengths L1 and L2, the moments M1 and M2, and shear S1 and S2 were taken from the Tables ***Maximum Moment /End Reaction Simple Span*** and are interpolated to arrive at the correct live load moment on the span considered.

*Note: The following moment calculations are for the HS truck loading only.*

$Span = 29.958 \cdot ft$

$L_{x1} := 29 \cdot ft$ $L_{x2} := 30 \cdot ft$

$M_1 := 267.0 \cdot kip \cdot ft$ $M_2 := 282.1 \cdot kip \cdot ft$

***Live load Moment***

$$M_{LL} := M_1 + \frac{M_2 - M_1}{L_{x2} - L_{x1}} \cdot (Span - L_{x1})$$

$M_{LL} = 281.47 \cdot kip \cdot ft$ HS Live load Moment

CALCULATING STRESSES

$\phi r := 0.90$

$e := d_{sec} - \frac{h}{2}$ $e = 4.136 \cdot in$ $E_c := 4286$ $E_s := 28500$

$F_{d.B} := \frac{-M_{DL}}{S_x}$ $F_{d.T} := \frac{M_{DL}}{S_x}$ $F_{d.B} = -0.54 \cdot ksi$ $F_{d.T} = 0.54 \cdot ksi$

$F_{p.B} := \frac{P}{A_c} + \frac{P \cdot e}{S_x}$ $F_{p.T} := \frac{P}{A_c} - \frac{P \cdot e}{S_x}$ $F_{p.B} = 1.193 \cdot ksi$ $F_{p.T} = -0.075 \cdot ksi$

$F_{l.B} := \frac{-DF\, M_{LL} \cdot (1 + I)}{S_x}$ $F_{l.T} := \frac{DF\, M_{LL} \cdot (1 + I)}{S_x}$ $F_{l.B} = -702.328 \cdot psi$ $F_{l.T} = 702.328 \cdot psi$

$$F_{l.BS} := -\left[\frac{E_s}{E_c} \cdot \left[F_{l.B} + \frac{(F_{l.T} - F_{l.B}) \cdot 2 \cdot in}{h}\right]\right]$$

$F_{l.BS} = 3571.307 \cdot psi$

$F_{y'} := .9 \cdot F_{s'}$ $F_{y'} = 243000 \cdot psi$

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CALCULATING RF FACTORS

Inventory RF Factors

$$RF_{INV.T} := \frac{\left(-6\cdot\sqrt{\frac{f_c}{psi}}\cdot psi\right) - \left(F_{d.B} + F_{p.B}\right)}{F_{l.B}}$$

$RF_{INV.T} = 1.533$
Concrete Tension

$$RF_{INV.C1} := \left[\frac{0.6\cdot f_c - \left(F_{d.T} + F_{p.T}\right)}{F_{l.T}}\right]$$

$RF_{INV.C1} = 3.609$
Concrete Compresion

$$RF_{INV.C2} := \left[\frac{0.4\cdot f_c - 0.5\left(F_{d.T} + F_{p.T}\right)}{F_{l.T}}\right]$$

$RF_{INV.C2} = 2.516$
Concrete Compresion

$$RF_{INV.P} := \left[\frac{0.8F_{y'} - .75\cdot F_{s''}\cdot(1 - Loss)}{F_{l.BS}}\right]$$

$RF_{INV.P} = 4.536$
Presstressing steel Tension

$$RF_{INV.M} := \frac{C - A_{i1}\cdot M_{DL}}{A_{i2}\cdot(1 + I)\cdot M_{LL}\cdot DF}$$

$RF_{INV.M} = 1.018$
Moment Capacity
*(AASHTO 6-1a)*

$$RF_i := \min\left(RF_{INV.T}, RF_{INV.C1}, RF_{INV.C2}, RF_{INV.P}, RF_{INV.M}\right)$$

$RF_i = 1.018$

Operating RF Factors

$$RF_{OPR.M} := \frac{C - A_{o1}\cdot M_{DL}}{A_{o2}\cdot(1 + I)M_{LL}\cdot DF}$$

$RF_{OPR.M} = 1.699$
Moment Capacity

$$RF_{OPR.P} := \left[\frac{0.9F_{y'} - .75\cdot F_{s''}\cdot(1 - Loss)}{F_{l.BS}}\right]$$

$RF_{OPR.P} = 11.34$
Presstressing steel Tension

$$RF_o := \min\left(RF_{OPR.P}, RF_{OPR.M}\right)*$$

$RF_o = 1.699$

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## Prestress Concrete Cored Slab

### *Summary (superstructure)*

***Intermediate Calculations***
*(Superstructure)*

$\phi M_n = 300.836 \cdot kip \cdot ft$ Ultimate Moment Capacity of Prestress Concrete Channel

$Span = 29.958 \cdot ft$ Span Length BRG to BRG

*Note: These numbers will be used in the following Table .*

$w_D = 0.591 \cdot \frac{kip}{ft}$ Uniform Dead Load

$DF = 0.236$ Live Load Distribution Factor

$Eff_{slab} = 0.92$ Strength Reduction Factor for P/C Based on Bridge Condition at Time of Inspection

$I = 0.3$ Impact Factor

***Rating HS Summary***
*(Superstructure)*

$RF_i = 1.018$

$RF_o = 1.699$

*Note: The ratings shown are for the HS loading, and may not be the limiting case..*

$RF_i \cdot Truck_{HS} = 20.352 \cdot ton$

$RF_o \cdot Truck_{HS} = 33.973 \cdot ton$

Data passed

$$R1 := \frac{-\left[\left(-6 \cdot \sqrt{\frac{f_c}{psi}} \cdot psi\right) - \left(F_{d.B} + F_{p.B}\right)\right]}{ksi} \qquad R1 = 1.077$$

$$R2 := \frac{0.6 \cdot f_c - \left(F_{d.T} + F_{p.T}\right)}{ksi} \qquad R2 = 2.534$$

$$R3 := \frac{0.4 \cdot f_c - 0.5\left(F_{d.T} + F_{p.T}\right)}{ksi} \qquad R3 = 1.767$$

$$S_x := \frac{S_x}{in^3} \qquad S_x = 1474$$

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**Coreslab Rating Input Data:**

| | |
|---|---|
| **Ultimate Moment Capacity (ft.-kips)** | 300.836 |
| **Span Length (ft.)** | 29.958 |
| **Uniform Dead Load (kip/ft.)** | 0.592 |
| **Live Load Distribution Factor** | 0.2358 |
| **Strength Reduction Factor** | 0.92 |
| **Impact Factor** | 1.300 |

**Moment Capactiy :** 190.50 ft.-kips

**CORED SLAB RATING SUMMARY**

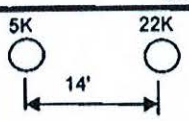
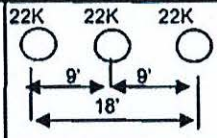
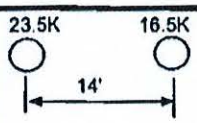
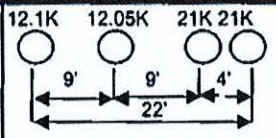
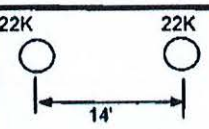
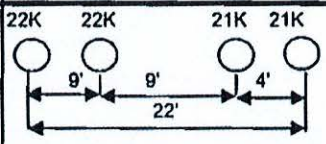
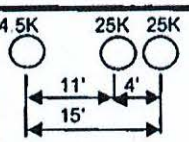
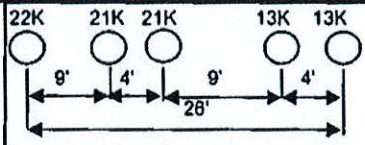
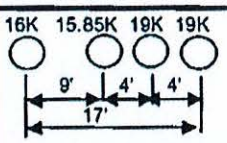
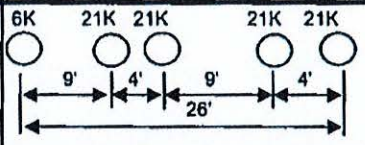
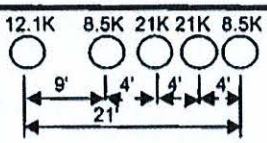
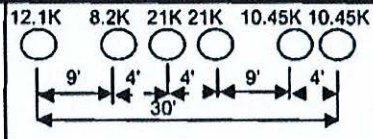
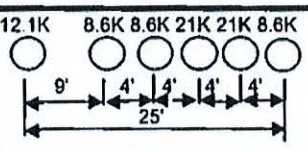
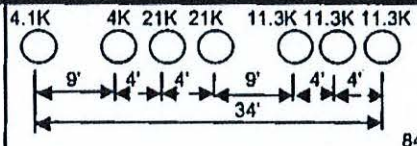
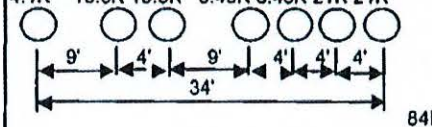
Span Input (ft.): 29.9583

| Loading: Truck type | Truck Wt. (tons) | Live Load Moment : (kip-ft) | RF inv. | RF oper. | Cored slab Rating: Inventory (tons) | Operating (tons) |
|---|---|---|---|---|---|---|
| HS 20 | 20 | 281.47 | 1.02 | 1.70 | 20.4 | 34.0 |
| SNSH | 13.5 | 167.51 | 1.71 | 2.85 | 23.1 | 38.5 |
| SNGARBS2 | 20 | 195.20 | 1.47 | 2.45 | 29.3 | 49.0 |
| SNAGRIS2 | 22 | 193.57 | 1.48 | 2.47 | 32.6 | 54.3 |
| SNCOTTS3 | 27.25 | 333.52 | 0.86 | 1.43 | 23.4 | 39.1 |
| SNAGGRS4 | 34.925 | 353.33 | 0.81 | 1.35 | 28.3 | 47.3 |
| SNS5A | 35.55 | 359.98 | 0.80 | 1.33 | 28.3 | 47.2 |
| SNS6A | 39.95 | 379.59 | 0.75 | 1.26 | 30.1 | 50.3 |
| SNS7B | 42 | 395.13 | 0.72 | 1.21 | 30.4 | 50.8 |
| TNAGRIT3 | 33 | 296.30 | 0.97 | 1.61 | 31.9 | 53.2 |
| TNT4A | 33.075 | 308.61 | 0.93 | 1.55 | 30.7 | 51.2 |
| TNAGRIT4 | 43 | 340.02 | 0.84 | 1.41 | 36.2 | 60.5 |
| TNAGRT5A | 45 | 351.48 | 0.81 | 1.36 | 36.7 | 61.2 |
| TNAGRT5B | 45 | 369.64 | 0.77 | 1.29 | 34.9 | 58.2 |
| TNT6A | 41.6 | 342.53 | 0.84 | 1.40 | 34.8 | 58.1 |
| TNT7A | 42 | 332.29 | 0.86 | 1.44 | 36.2 | 60.4 |
| TNT7B | 42 | 348.43 | 0.82 | 1.37 | 34.5 | 57.6 |

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# NORTH CAROLINA LEGAL LOADS

## ALL BRIDGES EXCEPT THOSE CARRYING INTERSTATE TRAFFIC

| SINGLE VEHICLE (SV) | | | TRUCK TRACTOR SEMI-TRAILER (TTST) | | |
|---|---|---|---|---|---|
| REF. # | SCHEMATIC | | REF. # | SCHEMATIC | |
| SNSH |   | 27K 13.5 TON | TNAGRIT3 |   | 66K 33 Ton |
| SNGARBS2 |   | 40K 20 TON | TNT4A |   | 66.15K 33.075 TON |
| SNAGRIS2 |   | 44K 22 Ton | TNAGRIT4 |   | 86K 43 TON |
| SNCOTTS3 |   | 54.5K 27.25 TON | TNAGT5A |   | 90K 45 TON |
| SNAGGRS4 |   | 69.85K 34.925 TON | TNAGT5B |   | 90K 45 TON |
| SNS5A |   | 71.1K 35.55 TON | TNT6A |   | 83.2K 41.6 TON |
| SNS6A |   | 79.9K 39.95 TON | TNT7A |   | 84K 42 TON |
| SNS7B |   | 84K 42 TON | TNT7B |   | 84K 42 TON |

**Note: Includes 10% Tolerance where applicable.**

Revised 10/25/2005
Revised Vehicle Names 11/15/2007
Revised 7/31/2008
Revised Vehicle Names 6/12/2009
Revised Vehicle Names 1/12/2011

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WETHERILL ENGINEERING
1223 Jones Franklin Road, Suite 100
Raleigh, North Carolina 27606
Phone: 919-851-8077 • Fax: 919-851-8107

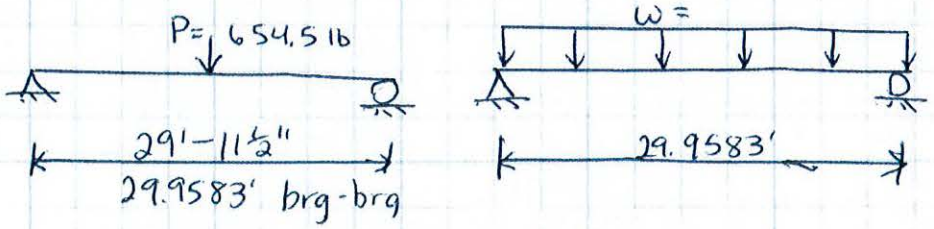
1209 Floral Parkway
Wilmington, North Carolina 28403
Phone: 910-799-5682 • Fax: 910-799-5684

SUBJECT Bridge Rating - Loads PROJECT OWASA
LOCATION Mason Farm Wastewater Treatment
PREPARED BY EBK DATE 6-23-21 STATION
CHECKED BY DDH DATE 6-24-21 SHEET 1 OF 2

## Dead Loads

- (6) Cored Slab Units (1'-5" h x 2'-9" w)
  $6[(1.417' * 2.75') - 2(0.417')^2\pi]\,150\ pcf = 2.525\ K/ft$

- Diaphragm @ Midspan
  $6 * 0.667' [2(0.417')^2\pi] * 150\ pcf = 0.6545\ k$ @ midspan

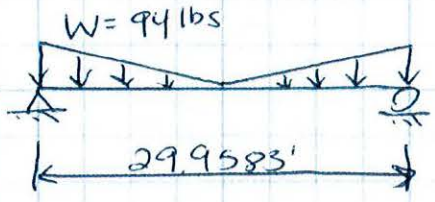



Eqv. Moment $\Rightarrow \frac{Pl}{4} = \frac{wl^2}{8}$

$w = \frac{2P}{l} = \frac{2(0.6545k)}{29.9583'} = 0.044\ K/ft \rightarrow 0.045\ K/ft$

- Wearing Surface (assume ½" camber in cored slab)




Eqv. Moment $\Rightarrow \frac{Wl}{12} = \frac{wl^2}{8}$

$w = \frac{2}{3}\frac{W}{l} = 2/3\ \frac{(94\ lbs)}{29.9583'} = 2.092\ lb/ft^2$

$WS = (15'-10")(31.25\ lb/ft^2 + 2.09\ lb/ft^2) = 0.528\ K/ft \rightarrow 0.53\ K/ft$ of bridge

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1223 Jones Franklin Road, Suite 100
**Raleigh**, North Carolina 27606
Phone: 919-851-8077 • Fax: 919-851-8107

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**Wilmington**, North Carolina 28403
Phone: 910-799-5682 • Fax: 910-799-5684

SUBJECT Bridge Rating - Loads PROJECT OWASA
LOCATION Mason Farm Wastewater Treatment
PREPARED BY EBK DATE 6-23-21 STATION
CHECKED BY DDH DATE 6-24-21 SHEET 2 OF 2

- Railing
  - (2) 6x4x3/16 tubes ~32.2ft ⇒ 2 * 11.98 lb/ft * 32.2ft = 772 lb/side
  - (6) x W6x15.5 post ~ 5'-1" ⇒ 6 * 15.5 lb/ft * 5.083' = 473 lb/side

  1245 lb/side
  x 2 side
  2,490 lbs
  ÷ 29.9583'
  83 lb/ft

- AWS ~ 1½" thick
  (15'-10")(1½")(150 lb/ft³) = 0.297 k/ft
  → 0.30 k/ft

- Utilities
  - 8" ϕ D.I. Waterline @ 59.8 lb/ft
  - Supports say 7.5% → 4.5 lb/ft
    64.3 lb/ft / 6 units = 11 lb/ft

~~- 6" ϕ D.I Waterline @ 38.5 lb/ft~~
~~- Supports & Insulation say 7.5% = 3 lb/ft~~
6" Removed

# Invoice

Oltrin Solutions
P.O. Box 1195
Hamlet, NC 28345
(910) 582-5650

Page: 1
Number: 0000102078
Date: 2/11/2022
Customer: 1114-02
Sales Order: 0000113381

***ACH/Wire is our preferred payment method.***
***Please contact ar@trinitymfg.com for details.***

| Sold To | Ship To |
|---|---|
| OWASA - Corporate<br>400 Jones Ferry Rd<br>PO Box 366<br>Carrboro, NC 27510-2001 USA | OWASA - Mason Farm<br>170 Old Mason Farm Rd<br>Chapel Hill, NC 27517-4431 USA |

| Customer P.O. | Ship Via | F.O.B | Terms |
|---|---|---|---|
| 2022-011 | HNF | | Net 30 |

| Quantity | UOM | Item | Description | Price | Amount |
|---|---|---|---|---|---|
| 11.9100 | DT | 305004 | 50% Commercial Caustic - Truck | $770.0000 | 9,170.70 |
| | | | **Net Weight:** 47,059 LB | | |
| | | | **Na2O:** 38.47 | | |
| | | | **DT:** 11.91 | | |
| | | | ***DT Formula:*** $\frac{47{,}059 * 38.47}{76 * 2000}$ | | |
| | | | **Extended Amount:** 9,170.70 | | |
| | | | ***Formula:*** *11.91 * 770.0000* | | |
| | | | LAST ITEM | | |

0000106385

| | |
|---|---|
| Subtotal | 9,170.70 |
| Freight | 0.00 |
| Sales Tax | 687.80 |
| Trade Discount | 0.00 |
| Payment/Credit Amount | 0.00 |
| **Balance** | $ 9,858.50 |

## TERMS and CONDITIONS of SALE

### GENERAL SALES POLICY

By submitting, either by telephone, electronic submission or in writing, any order will indicate your agreement to the following terms. Any terms other than the following will be unacceptable.

### TERMS OF PAYMENT

Unless further credit is granted, payment in full is due 30 Days after the date of the invoice. Past due balances shall be subject to a service charge of 1 1/2% per month (18% per annum), but in no event more than the maximum amount permitted by law.

### WARRANTY

Oltrin Solutions ("SELLER") warrants this product, conforms to the chemical description on the label and is reasonably fit for the purpose stated on the label when used in strict accordance with the directions therein. Seller makes no other express or implied warranty of merchantability or fitness for a particular purpose, and Seller makes absolutely no other warranties, express or implied. Seller's liability for default, breach or failure under this label shall be limited to the amount of the purchase price. Seller shall have no liabililty for consequential damages. Buyer shall indemnify and hold Seller harmless from any and all liability, actions, and claims, and damages arising out of Buyers negligence or misuse of this product.

ORANGE WATER
AND SEWER AUTHORITY

ATTENTION: *Vishnu Gangadharan, PE, PMP*
*Engineering Manager - Capital Projects*

# BRIDGE INSPECTION REPORT

| | | | | | |
|---|---|---|---|---|---|
| MUNICIPALITY/ LOCATION | *CHAPEL HILL* | TYPE OF INSPECTION: | *ROUTINE* | | |
| COUNTY | *ORANGE* | BRIDGE NUMBER | *N/A* | INSPECTION CYCLE | *N/A* |
| ROUTE | *ENTRANCE DRIVE TO MASON FARM WASTEWATER TREATMENT PLANT* | | | | |
| ACROSS | *MORGAN CREEK* | M. P. | *N/A* | | |
| LOCATION | *0.05 MILES SOUTH OF INTERSECTION WITH OLD MASON FARM RD.* | | | | |
| SUPERSTRUCTURE | *CONC. PRESTRESSED CORED SLABS W/ ASPHALT WEARING SURFACE* | | | | |
| SUBSTRUCTURE | *REINFORCED CONC. ABUTMENTS AND INTERIOR CONC. BENT FOOTING* | | | | |
| SPANS | *2 SPANS @ 30'-0"* | | | | |
| PRESENT CONDITION | *GOOD* | INVENTORY RATING | *HS-20* | | |
| INSPECTION DATE | *6/16/2016* | OPERATING RATING | *HS-34* | | |
| PRESENT POSTING | *NOT POSTED* | PROPOSED POSTING | *NONE* | | |
| COMPUTER UPDATE | *N/A* | ANALYSIS DATE | *6/21/2016* | | |
| POSTING LETTER DATE | *N/A* | OTHER SIGNS PRESENT | *NARROW BRIDGE* | | |
| GPS COORDINATES | *35° 54' 44.3" N / 79° 01' 24.4" W* | | | | |



LOOKING NORTH

SPECIAL PERMIT

| SIGN NOTICE ISSUED FOR | | NUMBER REQUIRED |
|---|---|---|
| *NO* | WEIGHT LIMIT | |
| *NO* | SPECIAL PERMIT | |
| *NO* | DELINEATORS | |
| *NO* | NARROW BRIDGE | |
| *NO* | ONE LANE BRIDGE | |
| *NO* | LOW CLEARANCE | |

NORTH CAROLINA PROFESSIONAL SEAL 043110 ENGINEER RAFAEL ASENCIO
6-22-16

WETHERILL ENGINEERING
1223 Jones Franklin Road
Raleigh, North Carolina 27606
Phone: (919) 851-8077 Fax: (919) 851-8107
Firm License No. F-0377

BRIDGE I & A FORM 1 ( 90 ) A

# BRIDGE INSPECTION RECORD AND SUMMARY

REV. 5-30-97

INSPECTION TYPE: ROUTINE — INSPECTION DATE: 6/16/2016

BRIDGE NO.: OWASA — COUNTY: ORANGE — ROUTE: PLANT ENTRANCE — OVER: MORGAN CREEK

STRUCTURE TYPE: CONCRETE PRESTRESSED CORED SLABS W/ AWS — YEAR BUILT: 1976

LENGTH: 60'-0" — ROUTE ORIENTATION: N TO S — FOR SPAN: 1 & 2 OF: 2 SPANS

EVALUATION CODE: (0 - 2) CRITICAL, (3 & 4) POOR, (5 & 6) FAIR, (7 - 9) GOOD

| INSPECTION ITEM | | | GRADE |
|---|---|---|---|
| DECK ITEMS | | | |
| 1 WEARING SURFACE | | | 7 |
| 2 DECK | a. CONCRETE | | N/A |
| NO. OF EA. | b. TIMBER | | |
| TYPE SPN. | c. STEEL PLANK | | |
| GRADE | d. OPEN GRID | | |
| RATES | | | |
| SI & A ITEM | | | |
| 58 | | | |
| 3 RAILING | a. CONCRETE | | |
| | b. TIMBER | | |
| | c. ALUMINUM | | |
| | d. STEEL | | 7 |
| 4 CURBS - WHEELGUARDS - PARAPETS - MEDIANS | | | |
| 5 WALKWAYS (ON OR ATTACHED TO STRUCTURE) | | | |
| 6 DECK EXP. | a. STEEL PL. OR FINGER PL. | | |
| JTS. OR | b. MISC. PREFAB DEVICES | | |
| DEVICES | c. COMPRESSION SEALS | | |
| NO. OF | d. STANDARD JOINTS | | |
| EACH | e. OPEN JOINTS | | 7 |
| 7 DECK DEBRIS ( INCLUDE EXCESS SAND / GRAVEL ) | | | 7 |

| SUPER STR. ( FM. 1 (90) B TRUSS ) ITEM 59 | |
|---|---|
| 10 LONGITUDINAL BEAMS OR GIRDERS | 7 |
| 11 LONGITUDINAL JOIST OR STRINGERS | |
| 12 INT. DIAP'S, X-FRAMES, BRACING, & CONN'S | |
| 13 END DIAP'S, CURTAIN WALLS, & CONN'S | |
| 14 FLOOR BEAMS AND CONNECTIONS | |
| 15 BEARINGS ASSEMBLIES ( INCLUDE MISALIGN ) | |
| 16 DRAINAGE SYSTEMS ( ON STRUCTURES ) | |
| 17 MOVABLE SPAN MACHINERY | |

| SUB STR ITEMS, ITEM 60 ( INCLUDE SCOUR ) | | |
|---|---|---|
| 35 TIM. | a. ABUT. & INT. BENT CAPS & RISERS | |
| SUB | b. PILES, POST, SILLS, & BRACING | |
| STR. | c. BULKHEADS, WING'S, & TIE BACKS | |
| 36 CONC. & | a. ABUT. & INT. BENT CAPS | 7 |
| MAS. | b. ABUT. & BENT COL'S & BREASTWALLS | 7 |
| SUB | c. ABUT. & INT. BENT PILES | |
| STR | d. BACKWALLS - WING'S - RETAIN. WALLS | 7 |
| | e. ABUT. AND BENT FOOTINGS & SILLS | N/A |
| 37 STEEL | a ABUT. & INT. BENT CAPS & RISERS | |
| SUB. STR. | b. PILES AND BRACING AND BULKHEADS | |
| 38 FOUNDATION PILES TYPE MATERIAL | | |
| 39 SLOPE PROT., RIP - RAP ( INCLUDE DRAINAGE ) | | |
| 40 FENDER SYSTEMS | | |
| 41 DRIFT | | 6 |

| ITEM 61 | | GRADE |
|---|---|---|
| 45 CHANNEL | a. WATERWAY | 7 |
| & | b. ALIGNMENT | 7 |
| CHANNEL | c. SCOUR | 6 |
| PROT. | d. SLOPE PROT., RIP - RAP, | N/A |
| | DIKES, ETC. | |
| 50 APPROACH ROADWAY CONDITION | | 7 |
| 51 APPROACH SLABS | | |
| 52 PAINT SYSTEMS | CODE | |
| 53 UTILITIES | | 7 |
| 54 RESPONSE TO LIVE LOAD | | 8 |
| 55 ESTIMATED REMAINING LIFE | YEARS | 22 |
| | | |
| 60 REGULATORY SIGN NOTICE ISSUED | | N |
| 61 PROMPT - ACTION NOTICE ISSUED | | N |
| 62 PRESENTLY POSTED | | N |
| 63 TOT. FIELD INSP. TIME ( INCLUDE WRITE UP )(M/H) | | 10 |
| 64 TOTAL SNOOPER INSP. TIME (HRS) | | |
| 65 TOTAL TRAFFIC CONTROL TIME (M/H) | | |

| 70 SI&A GENERAL CONDITION RATINGS | | |
|---|---|---|
| a. DECK | ITEM 58 | 7 |
| b. SUPERSTRUCTURE | ITEM 59 | 7 |
| c SUBSTRUCTURE | ITEM 60 | 7 |
| d. CHANNEL & CHANNEL PROT. | ITEM 61 | 7 |

| 71 SI& A FIELD APPRAISAL RATINGS | |
|---|---|
| a. WATERWAY ADAQUACY | 7 |
| b. APPR. RDWY. ALIGNMENT | 7 |
| | |
| 72 FIELD SCOUR EVALUATION | - G - |

| USE OF INSP. ACCESSIBILITY EQUIPMENT | | |
|---|---|---|
| SNOOPER ( CODE P, S, 4 or N ) | | |
| LADDER | Y/N | N |
| OVERSIDE LADDER | Y/N | N |
| BUCKET TRUCK | Y/N | N |
| BOAT | Y/N | N |
| OTHER | Y/N | N |

SPECIAL INSPECTION REQUESTED FOR :

NOTE:

80 INSPECTED BY : RAFAEL ASENCIO, PE

81 REVIEWED BY : JOHN T. DIFFEE, PE

| Bridge I & A Form 1 (82) H<br>Revised 6/4/97<br>STATE OF NORTH CAROLINA<br>DEPT. OF TRANSPORTATION<br>DIVISION OF HIGHWAYS<br>Prepared for:<br>Orange Water and Sewer Authority | **FIELD INSPECTION REPORT**<br><br>**BRIDGE INSPECTION & ANALYSIS** | Bridge No. OWASA<br><br>Route MASON FARM WASTEWATER TREATMENT PLANT ENTRANCE<br>County ORANGE |
|---|---|---|

TEAM LEADER: RAFAEL ASENCIO, PE DATE: 6/16/2016

ASSISTED BY: JIM PENDERGRAFT

| ITEM NO. | DESCRIPTION |
|---|---|
| 1. WEARING SURFACE (7) GOOD | 1½" THICK ASPHALT WEARING SURFACE HAS BEEN ADDED OVER ORIGINAL REINFORCED CONCRETE WEARING SURFACE. ASPHALT CRACKED ALONG FILL FACE OF JOINT AT ABUTMENT 1 AND 2, ALL CRACK LOCATIONS HAVE BEEN SEALED AND ARE SOUND AT THIS TIME. |
| 2a. CONCRETE DECK (N/A) | ORIGINAL CONCRETE DECK IS NOT VISIBLE FOR INSPECTION SINCE INSTALLATION OF ASPHALT WEARING SURFACE. |
| 3d. STEEL RAILING (7) GOOD | DAMAGE TO THE SOUTHEAST BOTTOM BRIDGE RAIL TERMINUS. (SEE PHOTO) |
| 6e. OPEN JOINT (7) GOOD | JOINTS HAVE BEEN SEALED AND ARE IN GOOD CONDITION. |
| 7. DECK DEBRIS (7) GOOD | MINOR DEBRIS ACCUMULATED IN DECK WEARING SURFACE CUT-OUTS FOR UTILITY SUPPORTS ALONG EAST FACE OF BRIDGE. |
| 10. LONGITUD. BEAMS OR GIRDERS (7) GOOD | NO CRACKS, SPALLS OR DELAMINATIONS FOUND ON EXTERIOR SIDES OF BRIDGE, A SMALL SPALL FOUND WHERE THE UTILITY HANGERS HAVE BEEN REMOVED ON BEAM 2. (SEE PHOTO) |
| 36a. ABUT. & INT. BENT CAPS (7) GOOD | STICKS AND OTHER DEBRIS HANG FROM BETWEEN TOP OF CAP AND BOTTOM OF CORED SLAB UNITS. A HAIRLINE x 7" LONG HORIZONTAL CRACK WITH ADJACENT DELAMINATION ON THE SOUTH FACE OF THE BENT CAP JUST ABOVE COLUMN 1. (SEE PHOTO) |
| 36b. ABUT. & INT. BENT COL'S. & BREASTWALLS (7) GOOD | MINIMUM RANDOM MAP CRACKING PRESENT ON BREASTWALL OF ABUTMENT 1. |
| 36d. BACKWALLS, WINGS (7) GOOD | HAIRLINE TO 3/32" WIDE VERTICAL CRACK ON SOUTHWEST WINGWALL. 5" X 19" DELAMINATED AREA ON NORTHWEST WINGWALL WITH MINOR SURFACE SPALLS. (SEE PHOTO) A GAS TEST IS PRESENT AT THE END OF THE NORTHEAST WINGWALL. NORTHWEST WINGWALL SURFACE HAS MAP CRACKING. |
| 41. DRIFT (6) FAIR | MINOR DEBRIS ACCUMULATED AT WATER SURFACE AGAINST COLUMN 1 AND SOME DEBRIS ACCUMULATION WAS NOTED ON THE TOP OF THE CAP ENDS. (SEE PHOTO) |
| 45c. CHANNEL SCOUR (6) FAIR | STREAM BANK UNDERMINING TYPICAL ALONG THE SOUTH STREAM. (SEE PHOTO) |

| Bridge I & A Form 1 (82) H<br>Revised 6/4/97 | **FIELD INSPECTION REPORT**<br>(CONTINUED) | Bridge No.: OWSA<br>County: ORANGE<br>Date: 6/16/2016<br>By: RAFAEL ASENCIO, PE |
|---|---|---|

| ITEM NO. | DESCRIPTION |
|---|---|
| 45d. CHANNEL SLOPE PROT. RIP-RAP (N/A) | NO SLOPE PROTECTION PRESENT AT ABUTMENTS. |
| 50. APPROACH ROADWAY (7) GOOD | BOTH NORTH AND SOUTH SIDE APPROACH ASPHALT WEARING SURFACE IS IN GOOD CONDITION, NO CRACKING EXCEPT AT JOINTS AND HAVE BEEN SEALED. |
| 54. UTILITIES (7) GOOD | 6" DIAMETER INSULATED DUCTILE IRON PIPE WAS REMOVED FROM UNDER THE BRIDGE AND THE ENDS CAPPED AT THE ABUTMENT WALLS. AN 8" DIAMETER DUCTILE IRON PIPE IS HUNG ALONG THE EAST SIDE OF THE BRIDGE. |
| 54. FIELD SCOUR EVALUATION (CODE: -8-) | PER BRIDGE PLANS, BRIDGE IS SUPPORTED ON SPREAD FOOTING KEYED INTO SHALE. NO VISIBLE INDICATION OF SCOUR AROUND FOOTINGS. BED ELEVATIONS ARE ABOVE FOOTINGS. |

## BRIDGE INSPECTOR'S RECOMMENDATIONS FOR MAINTENANCE REPAIRS

Bridge: OWASA County: ORANGE Date: 6/16/2016

**These Repairs Should Be Made Within Twelve Months From The Date Of This Inspectio**

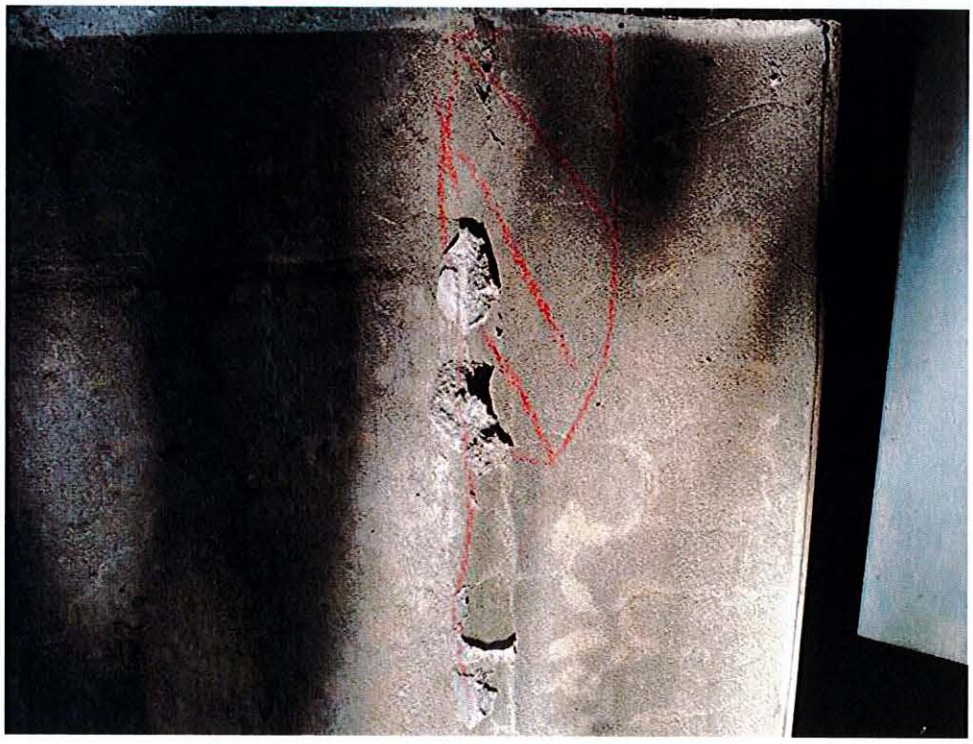
| Function Code | Description of Function | Unit | Quantity | Remarks | |
|---|---|---|---|---|---|
| | | 1 | LS | PATCH SPALL ON BOTTOM SURFACE OF BEAM 2, WHERE PREVIOUS HANGER WAS ATTACHED, ADJACENT TO BEAM 3.5 FT. FROM ABUTMENT 2.<br>*[BRUSH SPALL WITH CLEAN WIRE BRUSH TO REMOVE LOSS MATERIAL AND CONTAMINANTS; PRIME SURFACE WITH A BONDING AGENT COMPATIBLE WITH REPAIR MORTAR PER MANUFACTURERS INSTRUCTIONS; APPLY A REPAIR MORTAR SUITABLE FOR OVERHEAD WORK (SUCH AS SIKA REPAIR 223) TO PATCH SPALL.]* | |

***THIS INFORMATION SHALL BE CONSIDERED AND SHOULD NOT BE PROVIDED TO CONTRACTORS***

# CONDITION PHOTOS



DAMAGE TO THE SOUTHEAST BOTTOM BRIDGE RAIL TERMINUS



5" X 19" DELAMINATED AREA ON NORTHWEST WINGWALL WITH SURFACE SPALLS



UNDERMINING OF BANK ALONG DOWSTREAM SOUTH SIDE OF STREAM



9" X 5" DELAMINATION WITH A 7" LONG HORIZONTAL HAIRLINE CRACK AT BOTTOM OF CAP NEAR COLUMN 1




5" X 1" DEEP SPALL LOCATED AT CORED SLAB 2, 3 1/2" FEET FROM ABUTMENT 2

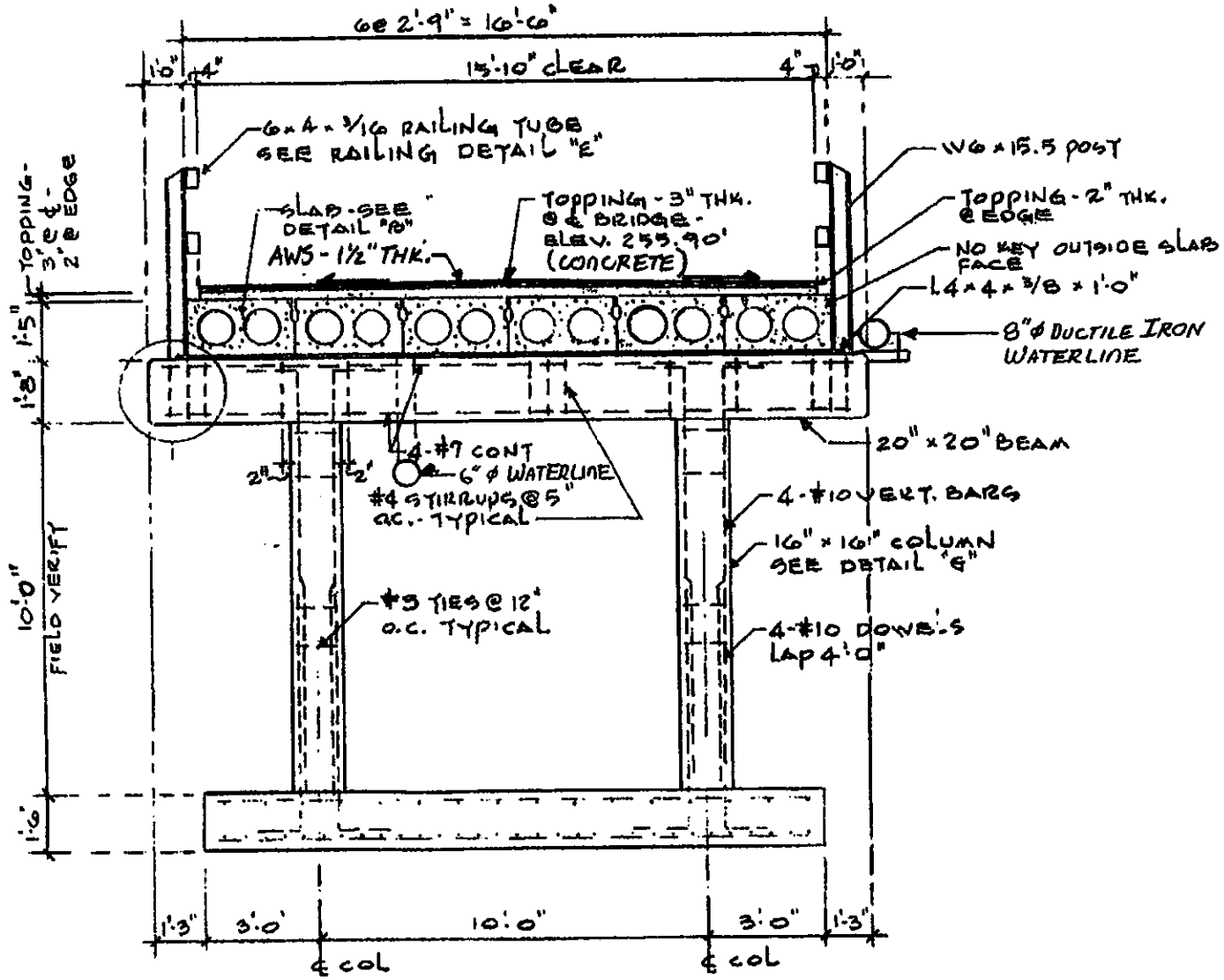


6 FOOT WIDE DEBRIS PILE LOCATED ON THE WEST END OF THE BENT CAP

WETHERILL ENGINEERING
TRANSPORTATION PLANNING/DESIGN - BRIDGE/STRUCTURE DESIGN
CIVIL/SITE DESIGN - GIS/GPS - CONSTRUCTION OBSERVATION
1223 Jones Franklin Rd.
Raleigh, N.C. 27606
Bus: 919 851 8077
Fax: 919 851 8107
License No. F-0377

LOCATION: CHAPEL HILL
COUNTY: ORANGE
INSPECTION DATE: 6/16/2016
DRAWN BY: JCP CHECKED BY: JTD

# OWSA



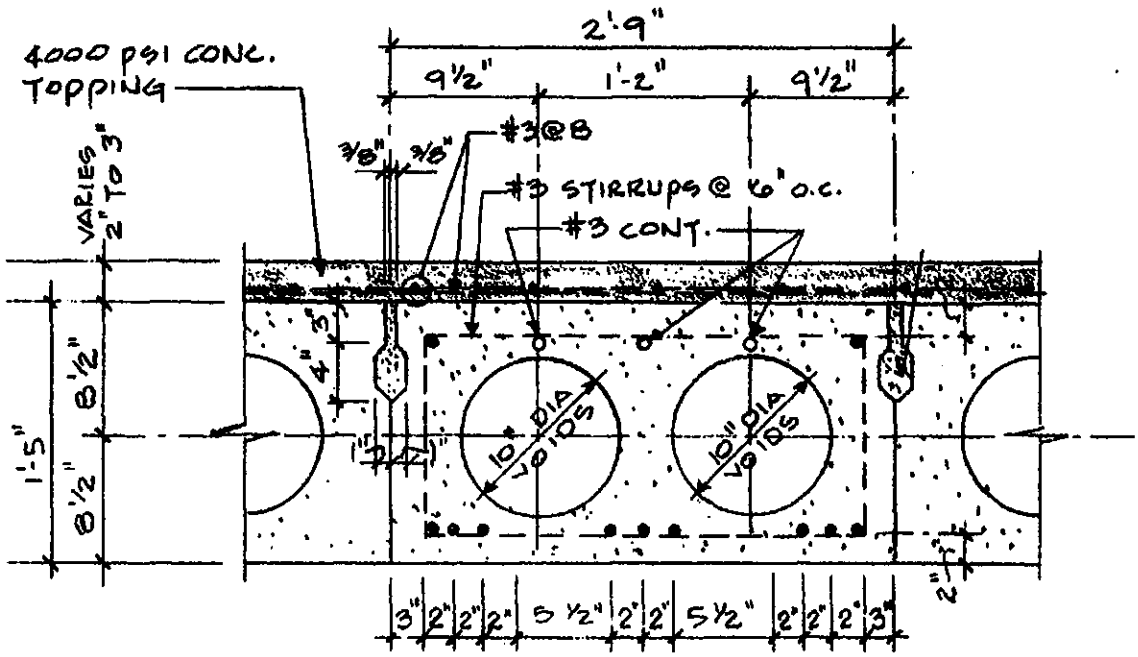

## TYPICAL SECTION

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# OWASA - MASON FARM WASTERWATER TREATMENT PLANT




## CORED SLAB UNIT

7/16" Ø 270 ksi., 7 WIRE STRANDS
11 STRANDS BOTTOM, 2 STRANDS TOP
fc' = 5,000 psi

| | |
|---|---|
| NUMBER OF SPANS | 2 |
| BRIDGE LENGTH (FILL FACE TO FILL FACE) | 62'-0" |
| SPAN 'A' - LENGTH | 31'-0" |
| SPAN 'B' - LENGTH | 31'-0" |
| BEARING TO BEARING LENGTH (TYPICAL) | 29'-11½" |
| NUMBER OF CORED SLAB UNITS | 6 |
| BRIDGE WIDTH (OUT TO OUT) | 16'-6" |
| BRIDGE WIDTH (CLEAR ROADWAY) | 15'-10" |

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# STREAM BED SOUNDINGS

(SEE NEXT SHEET FOR PROFILE SKETCH)

BR. INSP. WORKSHEET (1/1/90)
Revised 10/9/1998

Bridge #: OWASA COUNTY ORANGE DATE 6-16-16 BY: RA

RECORD SOUNDINGS FROM TOP OF RAIL. OTHER LOCATION IF NEEDED: TOP OF RAIL

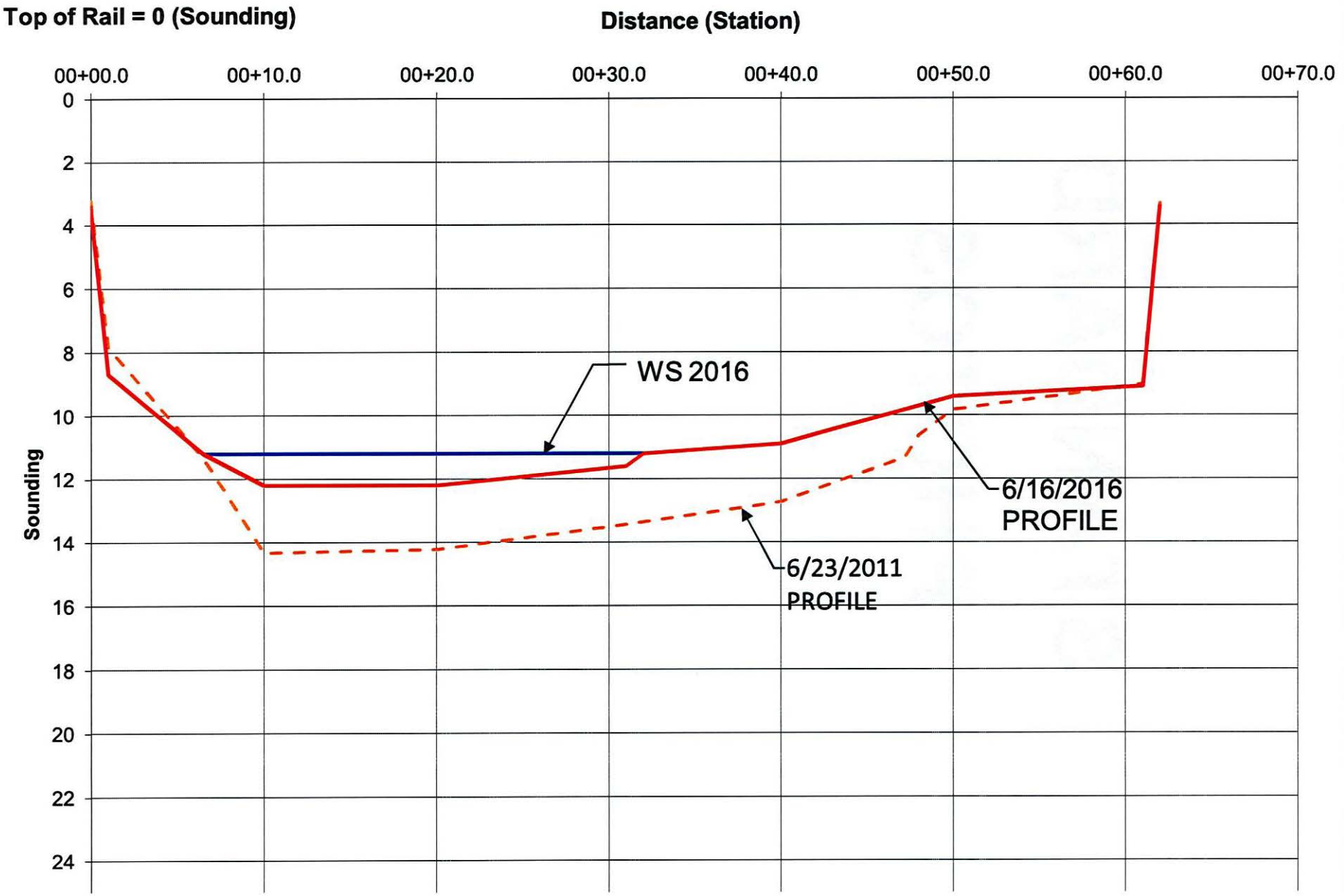
DISTANCE HIGHWATER MARK TO TOP OF CURB: _____ LOCATION H. W. MARK: _____

NOTE:Draft a Stream Bed Profile sketch and record soundings at the stream face of abutments, C/L of piers, WE, WS, and major contour changes on the downstream side. Record soundings at the stream face abutments and C/L piers on the upstream side.

| DOWNSTREAM | | | UPSTREAM | | |
|---|---|---|---|---|---|
| DISTANCE (Station) | SOUNDING | DESCRIPTION | DISTANCE (Station) | SOUNDING | DESCRIPTION |
| 00+06.5 | 11.2 | **WS & WE** | | | |
| 00+32.0 | 11.2 | **WS & WE** | | | |
| 00+00.0 | 3.40 | TOP OF WING | 00+00.0 | 3.43 | TOP OF WING |
| 00+01.0 | 8.70 | FACE OF WING | 00+01.0 | 10.10 | FACE OF CAP |
| 00+06.5 | 11.20 | WS & WE | 00+04.5 | 11.10 | WS & WE |
| 00+10.0 | 12.20 | | 00+31.0 | 11.10 | CENTERLINE BENT |
| 00+20.0 | 12.20 | | 00+33.8 | 11.10 | WS & WE |
| 00+31.0 | 11.60 | CENTERLINE BENT | 00+61.0 | 8.90 | FACE OF CAP |
| 00+32.0 | 11.20 | WS & WE | | | |
| 00+40.0 | 10.90 | | | | |
| 00+50.0 | 9.40 | GROUNDLINE | | | |
| 00+61.0 | 9.10 | FACE OF CAP | | | |
| 00+62.0 | 3.43 | TOP OF WING | | | |
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Bridge #: **OWASA** County: **ORANGE** Date: **6/16/2016** By: **RA**

## STREAMBED PROFILE (Downstream)



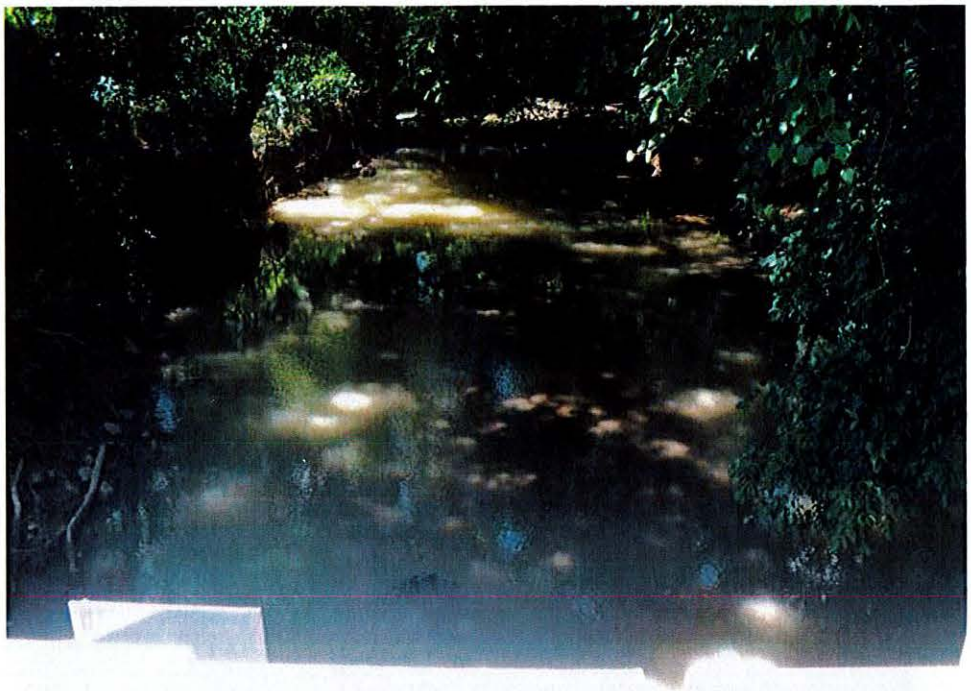
# STANDARD PHOTOS



SOUTH APPROACH LOOKING NORTH



NORTH APPROACH LOOKING SOUTH



LOOKING WEST UPSTREAM



LOOKING EAST DOWNSTREAM




NARROW BRIDGE SIGN AT SOUTH APPROACH



TYPICAL 2-BAR STEEL TUBE BRIDGE RAILING



TYPICAL WINGWALL (NORTHEAST WINGWALL SHOWN)



8" DIAMETER DUCTILE IRON WATERLINE ALONG EAST FACE OF BRIDGE



ABUTMENT 2



INTERIOR BENT 1



UTILITY SUPPORT CONNECTION FOR EXTERIOR 8" DIA. WATERLINE W/ANCHOR ROD BETWEEN JOINT OF CORED SLAB 1



SEALED JOINT AT ABUTMENT 1



SEALED JOINT AT BENT



SEALED JOINT AT ABUTMENT 2



GUARDRAIL ATTACHMENT LOCATED AT MID SPAN OF SPAN 2, WEST END



NORTHWEST WINGWALL



WEST SIDE BRIDGE PROFILE, LOOKING NORTH



UTILITY STUB



ABUTMENT 1



EAST SIDE BRIDGE PROFILE, LOOKING SOUTH

# LOAD RATING

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SUBJECT Cored Slab
BRIDGE Mason Farm
PREPARED BY RA
CHECKED BY JAD

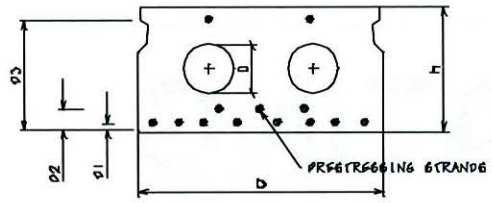
PROJECT OWASA
COUNTY Oranage
STATION
SHEET 1 of 10

# Prestress Concrete Cored Slab

References:
1. AASHTO, Manual for Condition Evaluation of Bridges, 2000
2. AASHTO, Standard Specification for Highway Bridges, 2000

*Basic Units*

$ksi := 1000 \cdot psi$
$kip := 1000 \cdot lbf$
$ton := 2 \cdot kip$




## Input Data

**Strand Locations** (Measured From the Bottom) **-Remove a strand if strand damaged in the middle third of the girder.**

d1 d2 d3 d4 d5 d6 d7 d8 ...dn

$d := (2\ \ 2\ \ 2\ \ 2\ \ 2\ \ 2\ \ 2\ \ 2\ \ 15\ \ 15) \cdot in$

### Section Properties
*(Superstructure)*

$\gamma := 0.4$ — Ultimate stress factor 0.4 S.R. or 0.28 for L.R.

$b := 33 \cdot in$ — Width of slab section

$h := 17 \cdot in$ — Height of slab section

$A_{strand} := 0.1152 \cdot in^2$ — Area of Single 7/16" strand

$D := 10 \cdot in$ — Diameter of core

### Material Properties
*(Superstructure)*

$f_c := 5 \cdot ksi$ — Concrete strength

$F_{s'} := 270 \cdot ksi$ — Prestressing strand strength

$\gamma_c := 150 \cdot \frac{lbf}{ft^3}$ — Specific weight of concrete

### Geometric Properties
*(Superstructure)*

$Width := 16.50 \cdot ft$ — Width of bridge

$N_L := 1$ — Number of Lanes

$Span := 29.9583 \cdot ft$ — BRG to BRG span length

$units := 6$ — Number of prestress concrete units

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# Prestress Concrete Cored Slab

## Intermediate Calculations
*(Superstructure)*

Area of concrete $A_c := b \cdot h - 2 \cdot \left( D^2 \cdot \frac{\pi}{4} \right)$ $A_c = 403.92 \cdot in^2$

Depth of deck $d_d := \frac{h - D}{2}$ $d_d = 3.5 \cdot in$

Equivalent rectangular stress distribution factor β1 is dependent on the concrete strength.

$\beta_1 := if\left[ f_c < 4 \cdot ksi, .85, .85 - .05 \cdot \left( \frac{f_c - 4 \cdot ksi}{1 \cdot ksi} \right) \right]$ $\beta_1 = 0.8$ *AASHTO (8.16.2.7)*

*Number of strands* strands := cols(d) strands = 11

*Equivalent strand location*

d = | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | ... | ·in Strand locations

n := cols(d) n = 11 Number of strands

$d_{sec} := h - \frac{\sum d}{n}$ $d_{sec} = 12.636 \cdot in$ Centroid of strands from top

$e := \frac{h}{2} - d_{sec}$ $e = -4.136 \cdot in$ Centroid of strands from center

## Prestress Reinforcement Calculation
*(Superstructure)*

$b = 33 \cdot in$ $A_{strand} = 0.115 \cdot in^2$ $\rho := \frac{strands \cdot A_{strand}}{b \cdot d_{sec}}$ $\rho = 0.00304$

## Average Ultimate Stress Calculation
*(Superstructure)*

*AASHTO(9.1.2)*

$\gamma = 0.4$ Ultimate Stress factor for LR strands

$\beta_1 = 0.8$ Equivalent Rectangular block factor

$F_{s'} = 270 \cdot ksi$ Nominal Strand Stress

$f_c = 5 \cdot ksi$ Compressive strength of concrete

$F_{su'} := F_{s'} \cdot \left( 1 - \frac{\gamma}{\beta_1} \cdot \frac{\rho \cdot F_{s'}}{f_c} \right)$ $F_{su'} = 247.847 \cdot ksi$ Average stress at Ultimate Load *AASHTO (9.17.4.1)*

## Moment Capacity Checks
*(Superstructure)*

Check1 must be less then Limit1

$Check_1 := \rho \cdot \frac{F_{su'}}{f_c}$ $Limit_1 := 0.36 \cdot \beta_1$ $Check_1 = 0.151$ $Limit_1 = 0.288$ OK *AASHTO (9.18.1)*

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## Prestress Concrete Cored Slab

***Locate Neutral Axis*** *(Superstructure)*

$A_{st} := A_{strand} \cdot strands$ $A_{st} = 1.267 \cdot in^2$ Area of all strands

If Neutral axis is less then $d_d = 3.5 \cdot in$ then the compression block lies within the deck.

$$a := \frac{A_{st} \cdot F_{su'}}{f_c \cdot b \cdot .85} \qquad a = 2.239 \cdot in$$

$d_d = 3.5 \cdot in$

$$A_{pf} := \frac{.85 \cdot f_c \cdot (b - 2 \cdot D) \cdot \left(\frac{h}{2} - \frac{D}{2}\right)}{F_{su'}} \qquad A_{pf} = 0.78 \cdot in^2$$ *AASHTO (9.17.2)*

$A_{pw} := A_{st} - A_{pf}$ $A_{pw} = 0.487 \cdot in^2$

$$a_2 := \frac{A_{pw} \cdot F_{su'}}{.85 \cdot (b - 2 \cdot D) \cdot f_c} \qquad a_2 = 2.185 \cdot in$$

***Moment Capacity Calculation***
*(Superstructure)*

$\phi := 1.0$ Strength Capacity Reduction factor for prestressed concrete members *AASHTO (9.14)*

$A_{st} = 1.267 \cdot in^2$ Area of all strands

$F_{su'} = 247.847 \cdot ksi$ Average Stress at Ultimate Load

$d_{sec} = 12.636 \cdot in$ Centroid of strands from top of Cord Slab

$f_c = 5 \cdot ksi$ Compressive strength of concrete

$\rho = 0.003$ Prestress reinforcement ratio *AASHTO (EQ 9-13)*

$$\phi M_{n1} := \phi \cdot \left[ A_{st} \cdot F_{su'} \cdot d_{sec} \cdot \left(1 - 0.6 \cdot \rho \cdot \frac{F_{su'}}{f_c}\right)\right] \qquad \phi M_{n1} = 300.836 \cdot kip \cdot ft$$

$$\phi M_{n2} := \phi \cdot \left[ A_{pw} \cdot F_{su'} \cdot \left(d_{sec} - \frac{a_2}{2}\right) + .85 \cdot f_c \cdot (b - 2 \cdot D) \cdot \left(d_{sec} - \frac{a_2}{2}\right) \cdot d_d \right] \qquad \phi M_{n2} = 302.139 \cdot kip \cdot ft$$

$\phi M_n := if\left(a < d_d, \phi M_{n1}, \phi M_{n1}\right)$

$\phi M_n = 300.836 \cdot kip \cdot ft$

Moment Capacity of Prestress Concrete Cored Slab
Design Flexural Strength

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# Prestress Concrete Cored Slab

## Dead load Calculation

**Composite Dead Load Table**

| | | |
|---|---|---|
| AWS | 50 | lb/ft |
| Concrete Wearing Surface | 88 | lb/ft |
| Utilities | 11 | lb/ft |
| Side Walk Weight | 0 | lb/ft |
| Rail Weight | 14 | lb/ft |
| Other | 0 | lb/ft |
| Total | 163 | lb/ft |

**Non Composite Dead Load Table**

| | | |
|---|---|---|
| SIP Forms | 0 | lb/ft |
| Slab Weight | 0 | lb/ft |
| Beam Weight | 421 | lb/ft |
| Diaphram Weight | 7.5 | lb/ft |
| Other | 0 | lb/ft |
| Total | 428.5 | lb/ft |

$Com_D := Com_DL \cdot \frac{lbf}{ft}$ $\quad Com_D = 0.163 \cdot \frac{kip}{ft}$

$Non_com_D := Non_com_DL \cdot \frac{lbf}{ft}$ $\quad Non_com_D = 0.428 \cdot \frac{kip}{ft}$

$w_D := (Com_D + Non_com_D)$ $\quad w_D = 0.591 \cdot \frac{kip}{ft}$

## Dead Load Moment Channel

$M_{DL_C} := \frac{Com_D \cdot Span^2}{8}$ $\quad M_{DL_C} = 18.287 \cdot kip \cdot ft$ Composite dead load moment

$M_{DL_NC} := \frac{Non_com_D \cdot Span^2}{8}$ $\quad M_{DL_NC} = 48.072 \cdot kip \cdot ft$ Non composite dead load

$M_{DL} := M_{DL_C} + M_{DL_NC}$ $\quad M_{DL} = 66.359 \cdot kip \cdot ft$ Total dead load

## Live Load Distribution Factor

AASHTO(3.23.4.3)

$S := b$ $\quad S = 33 \cdot in$

$L := Span$ $\quad L = 29.958 \cdot ft$

$K := .8$ Rectangle With Void

$C := K \cdot \left(\frac{units \cdot b}{L}\right)$ $\quad C = 0.441$

$D_1 := if\left[C < 5, \left(5.75 - 0.5 \cdot N_L\right) + 0.7 \cdot N_L \cdot (1 - 0.2 \cdot C)^2, \left(5.75 - 0.5 \cdot N_L\right)\right] \cdot ft$

$D_1 = 5.832 \cdot ft$

$DF := \frac{S}{D_1} \cdot \frac{1}{2}$ $\quad DF = 0.236$ Distribution Factor

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SUBJECT Cored Slab
BRIDGE Mason Farm
PREPARED BY RA
CHECKED BY JAD

PROJECT OWASA
COUNTY Oranage
STATION
SHEET 5 of 10

## Prestress Concrete Cored Slab

### *Impact Factor*

$$I := \frac{50 \cdot ft}{Span + 125 \cdot ft} \qquad I = 0.323$$

AASHTO (3.8.2.1) EQ 3-1

The impact factor need not exceed .3

$$I := if(I > .3, .3, I) \qquad I = 0.3$$

### *Section Modules*

$area_1 := b \cdot h$ $\quad distance_1 := \frac{h}{2}$ $\quad Inertia_1 := \frac{b \cdot h^3}{12}$ $\quad Inertia_1 = 13510.75 \cdot in^4$

$area_2 := -\frac{\pi \cdot D^2}{2}$ $\quad distance_2 := \frac{h}{2}$ $\quad Inertia_2 := \frac{-2 \cdot \pi \cdot D^4}{64}$ $\quad Inertia_2 = -981.748 \cdot in^4$

$area_1 + area_2 = 403.92 \cdot in^2$ $\quad S_x := \frac{Inertia_1 + Inertia_2}{\frac{h}{2}}$ * $\quad S_x = 1474 \cdot in^3$ Section modules

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## Prestress Concrete Cored Slab

Strength Reduction Factor Based on Condition at Time of Inspection

$Eff_{slab} := 93\%$ *

### *Rating Factors*

Inventory: $A_{i1} := 1.3$* $A_{i2} := 2.17$*

Operating $A_{o1} := 1.3$* $A_{o2} := 1.3$*

### *Cracking Moment*

Composite reaction

$$reaction := w_D \cdot \frac{Span}{2} \qquad reaction = 8.86 \cdot kip$$

Non-Composite reaction

$$non_comp_reaction := Non_com_D \cdot \frac{Span}{2} \qquad non_comp_reaction = 6.419 \cdot kip$$

Dead Load Moment

$Loss := 12\%$ Assumed losses

$$P := \left[0.75 \cdot F_{s'} \cdot (1 - Loss)\right] \cdot A_{strand} \cdot strands \qquad P = 225.815 \cdot kip$$

AASHTO(9.18.2)

$$f_{pe} := \frac{P}{A_c} + \frac{-P \cdot e}{S_x}$$

$$CR_{moment} := \left[\left(7.5 \cdot \sqrt{\frac{f_c}{psi}} \cdot psi + f_{pe}\right) \cdot S_x\right] - \left[M_{DL_NC} \cdot \left(\frac{S_x}{S_x} - 1\right)\right]$$

$1.2 \cdot CR_{moment} = 253.981 \cdot kip \cdot ft$ $\phi M_n = 300.836 \cdot kip \cdot ft$

---

### Maximum Strength

$$C := Eff_{slab} \cdot \phi M_n \qquad C = 279.777 \cdot kip \cdot ft$$

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## Prestress Concrete Cored Slab

### *Sample Calculation (HS)*

$Truck_{HS} := 20 \cdot ton$

***Live Load Moment Calculation Utilizing the Live Load Moment Tables***

Lengths L1 and L2, the moments M1 and M2, and shear S1 and S2 were taken from the Tables ***Maximum Moment /End Reaction Simple Span*** and are interpolated to arrive at the correct live load moment on the span considered.

*Note: The following moment calculations are for the HS truck loading only.*

$Span = 29.958 \cdot ft$

$L_{x1} := 29 \cdot ft$ $\quad L_{x2} := 30 \cdot ft$

$M_1 := 267.0 \cdot kip \cdot ft$ $\quad M_2 := 282.1 \cdot kip \cdot ft$

***Live load Moment***

$$M_{LL} := M_1 + \frac{M_2 - M_1}{L_{x2} - L_{x1}} \cdot (Span - L_{x1})$$

$M_{LL} = 281.47 \cdot kip \cdot ft$ HS Live load Moment

CALCULATING STRESSES

$\phi r := 0.90$

$$e := d_{sec} - \frac{h}{2} \qquad e = 4.136 \cdot in \qquad E_c := 4286 \qquad E_s := 28500$$

$$F_{d.B} := \frac{-M_{DL}}{S_x} \qquad F_{d.T} := \frac{M_{DL}}{S_x} \qquad F_{d.B} = -0.54 \cdot ksi \qquad F_{d.T} = 0.54 \cdot ksi$$

$$F_{p.B} := \frac{P}{A_c} + \frac{P \cdot e}{S_x} \qquad F_{p.T} := \frac{P}{A_c} - \frac{P \cdot e}{S_x} \qquad F_{p.B} = 1.193 \cdot ksi \qquad F_{p.T} = -0.075 \cdot ksi$$

$$F_{l.B} := \frac{-DF\, M_{LL} \cdot (1 + I)}{S_x} \qquad F_{l.T} := \frac{DF\, M_{LL} \cdot (1 + I)}{S_x} \qquad F_{l.B} = -702.328 \cdot psi \qquad F_{l.T} = 702.328 \cdot psi$$

$$F_{l.BS} := -\left[\frac{E_s}{E_c} \cdot \left[F_{l.B} + \frac{(F_{l.T} - F_{l.B}) \cdot 2 \cdot in}{h}\right]\right] \qquad F_{l.BS} = 3571.307 \cdot psi$$

$F_{y'} := .9 \cdot F_{s'}$ $\quad F_{y'} = 243000 \cdot psi$

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## CALCULATING RF FACTORS

### Inventory RF Factors

$$RF_{INV.T} := \frac{\left(-6 \cdot \sqrt{\frac{f_c}{psi}} \cdot psi\right) - \left(F_{d.B} + F_{p.B}\right)}{F_{l.B}}$$

$RF_{INV.T} = 1.533$

Concrete Tension

$$RF_{INV.C1} := \left[\frac{0.6 \cdot f_c - \left(F_{d.T} + F_{p.T}\right)}{F_{l.T}}\right]$$

$RF_{INV.C1} = 3.609$

Concrete Compresion

$$RF_{INV.C2} := \left[\frac{0.4 \cdot f_c - 0.5\left(F_{d.T} + F_{p.T}\right)}{F_{l.T}}\right]$$

$RF_{INV.C2} = 2.516$

Concrete Compresion

$$RF_{INV.P} := \left[\frac{0.8F_{y'} - .75 \cdot F_{s'} \cdot (1 - Loss)}{F_{l.BS}}\right]$$

$RF_{INV.P} = 4.536$

Presstressing steel Tension

$$RF_{INV.M} := \frac{C - A_{i1} \cdot M_{DL}}{A_{i2} \cdot (1 + I) \cdot M_{LL} \cdot DF}$$

$RF_{INV.M} = 1.034$

Moment Capacity

*(AASHTO 6-1a)*

$$RF_i := \min\left(RF_{INV.T}, RF_{INV.C1}, RF_{INV.C2}, RF_{INV.P}, RF_{INV.M}\right)$$

$RF_i = 1.034$

### Operating RF Factors

$$RF_{OPR.M} := \frac{C - A_{o1} \cdot M_{DL}}{A_{o2} \cdot (1 + I) M_{LL} \cdot DF}$$

$RF_{OPR.M} = 1.725$

Moment Capacity

$$RF_{OPR.P} := \left[\frac{0.9F_{y'} - .75 \cdot F_{s'} \cdot (1 - Loss)}{F_{l.BS}}\right]$$

$RF_{OPR.P} = 11.34$

Presstressing steel Tension

$$RF_o := \min\left(RF_{OPR.P}, RF_{OPR.M}\right)$$

$RF_o = 1.725$

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## Prestress Concrete Cored Slab

### *Summary (superstructure)*

***Intermediate Calculations***
***(Superstructure)***

$\phi M_n = 300.836 \cdot kip \cdot ft$ Ultimate Moment Capacity of Prestress Concrete Channel

$Span = 29.958 \cdot ft$ Span Length BRG to BRG

$w_D = 0.591 \cdot \frac{kip}{ft}$ Uniform Dead Load

*Note: These numbers will be used in the following Table .*

$DF = 0.236$ Live Load Distribution Factor

$Eff_{slab} = 0.93$ Strength Reduction Factor for P/C Based on Bridge Condition at Time of Inspection

$I = 0.3$ Impact Factor

***Rating HS Summary***
***(Superstructure)***

$RF_i = 1.034$

$RF_o = 1.725$

*Note: The ratings shown are for the HS loading, and may not be the limiting case..*

$RF_i \cdot Truck_{HS} = 20.674 \cdot ton$

$RF_o \cdot Truck_{HS} = 34.509 \cdot ton$

Data passed

$$R1 := \frac{-\left[\left(-6 \cdot \sqrt{\frac{f_c}{psi}} \cdot psi\right) - \left(F_{d.B} + F_{p.B}\right)\right]}{ksi} \qquad R1 = 1.077$$

$$S_x := \frac{S_x}{in^3} \qquad S_x = 1474$$

$$R2 := \frac{0.6 \cdot f_c - \left(F_{d.T} + F_{p.T}\right)}{ksi} \qquad R2 = 2.534$$

$$R3 := \frac{0.4 \cdot f_c - 0.5\left(F_{d.T} + F_{p.T}\right)}{ksi} \qquad R3 = 1.767$$

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SUBJECT Cored Slab
BRIDGE Mason Farm
PREPARED BY RA
CHECKED BY JAD

PROJECT OWASA
COUNTY Oranage
STATION


**Coreslab Rating Input Data:**

| | | |
|---|---|---|
| **Ultimate Moment Capacity (ft.-kips)** | | 300.836 |
| **Span Length (ft.)** | | 29.958 |
| **Uniform Dead Load (kip/ft.)** | | 0.592 |
| **Live Load Distribution Factor** | | 0.2358 |
| **Strength Reduction Factor** | | 0.93 |
| **Impact Factor** | | 1.300 |
| **Moment Capactly :** | 193.51 ft.-kips | |

**CORED SLAB RATING SUMMARY**

Span Input (ft.): 29.9583

| Loading: Truck type | Truck Wt. (tons) | Live Load Moment : (kip-ft) | RF inv. | RF oper. | Cored slab Rating: Inventory (tons) | Operating (tons) |
|---|---|---|---|---|---|---|
| HS 20 | 20 | 281.47 | 1.03 | 1.73 | 20.7 | 34.5 |
| SNSH | 13.5 | 167.51 | 1.74 | 2.90 | 23.4 | 39.1 |
| SNGARBS2 | 20 | 195.20 | 1.49 | 2.49 | 29.8 | 49.8 |
| SNAGRIS2 | 22 | 193.57 | 1.50 | 2.51 | 33.1 | 55.2 |
| SNCOTTS3 | 27.25 | 333.52 | 0.87 | 1.46 | 23.8 | 39.7 |
| SNAGGRS4 | 34.925 | 353.33 | 0.82 | 1.37 | 28.8 | 48.0 |
| SNS5A | 35.55 | 359.98 | 0.81 | 1.35 | 28.7 | 48.0 |
| SNS6A | 39.95 | 379.59 | 0.77 | 1.28 | 30.6 | 51.1 |
| SNS7B | 42 | 395.13 | 0.74 | 1.23 | 30.9 | 51.6 |
| TNAGRIT3 | 33 | 296.30 | 0.98 | 1.64 | 32.4 | 54.1 |
| TNT4A | 33.075 | 308.61 | 0.94 | 1.57 | 31.2 | 52.1 |
| TNAGRIT4 | 43 | 340.02 | 0.86 | 1.43 | 36.8 | 61.4 |
| TNAGRT5A | 45 | 351.48 | 0.83 | 1.38 | 37.3 | 62.2 |
| TNAGRT5B | 45 | 369.64 | 0.79 | 1.31 | 35.4 | 59.1 |
| TNT6A | 41.6 | 342.53 | 0.85 | 1.42 | 35.3 | 59.0 |
| TNT7A | 42 | 332.29 | 0.88 | 1.46 | 36.8 | 61.4 |
| TNT7B | 42 | 348.43 | 0.84 | 1.39 | 35.1 | 58.5 |

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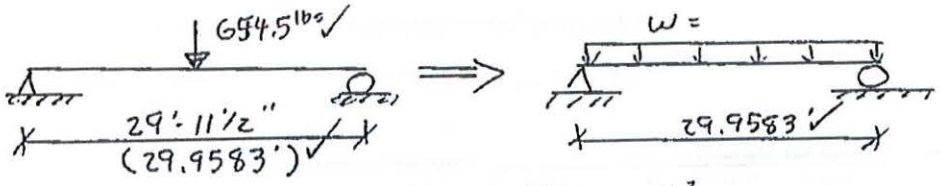
SUBJECT BRIDGE RATING LOADS PROJECT OWSA
LOCATION MASON FARM WASTE TREATMENT
PREPARED BY JTD DATE 6-16-11 STATION
CHECKED BY JND DATE 6-20-11 SHEET 1 OF

G-22-16 LOADS NO CHANGE
JAD

## DEAD LOADS

- 6 - CORED SLAB UNITS (1'-5" h × 2'-9")
  $6\left[(1'\text{-}5'')(2'\text{-}9'') - 2(5'')^2\pi\right] \times 150^{lbs}/_{ft} = 2.525^{K}/_{ft}$

- DIAPHRAGM @ MID-SPAN
  $6 \times {}^{8''}/_{12^{in}/ft}\left[2(5'')^2\pi\right] \times 150^{lbs}/_{ft} = 0.6545^{Kips}$ @ MIDSPAN

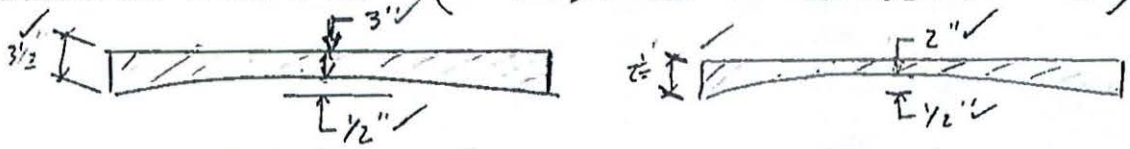


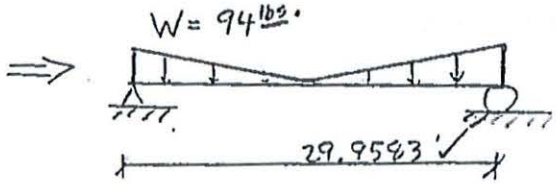

EQV. MOMENT $\Rightarrow \frac{Pl}{4} = \frac{wl^2}{8}$

$w = \frac{2P}{l} = \frac{2(0.6545^{K})}{29.9583'} = 0.044^{K}/_{ft}$

$\longrightarrow$ SAY $0.045^{K}/_{ft}$

- WEARING SURFACE: ($\rightarrow$ ASSUME ½" CAMBER IN CSO)




EQV. MOMENT $\Rightarrow \frac{Wl}{12} = \frac{wl^2}{8}$

$w = \frac{2}{3}\frac{W}{l} = \frac{2}{3}\frac{(94^{lbs})}{29.9583'} = 2.092^{lbs}/_{ft} =$

$WS = (15'\text{-}10'')(31.25^{lbs}/_{ft^2} + 2.09^{lbs}/_{ft^2}) = 0.528^{Kips}/_{ft}$

$\longrightarrow$ SAY $0.53^{K}/_{ft}$ of BRIDGE

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SUBJECT BRIDGE RATING LOADS PROJECT OWSA
LOCATION MASON FARM WASTE TREATMENT
PREPARED BY JTD DATE 6-16-11 STATION
CHECKED BY JAD DATE 6-20-11 SHEET 2 OF

JAD 6-22-11

- RAILING
  - 2 - 6x4x3/16 TUBES ~ 32.2 ft => 2 × 11.98 lbs/ft × 32.2 ft = 772 lbs/SIDE
  - 6 × WG 15.5 ~ 5'-1" => 6 × 15.5 lbs/ft × 5.083' = 473 lbs/SIDE

1245 lbs
× 2 SIDES
2,490 lbs
÷ 29.958'
83 lbs/ft.

ADDED 6-2

- 1½ AWS
  (15'-10")(1½")(150 lbs/ft³) = 0.297 k/ft of BRIDGE
  SAY 0.30 k/ft

- UTILITIES
  - 8" ø D.I WATERLINE @ 59.8 lbs/ft
  - SUPPORTS SAY 7.5% => 4.5 lbs/ft
    64.3 lbs/ft
  - 6" ø D.I WATERLINE @ 38.5 lbs/ft
  - SUPPORTS & INSULATION, SAY 7½% = 3 lbs/ft
    41.5 lbs/ft → 0

6" ø DI REMOVED

TOTAL : 0.11 k/ft.
-SAY

64.3 lbs/ft / 6 UNITS = 11 lbs/ft

# NORTH CAROLINA LEGAL LOADS

## ALL BRIDGES EXCEPT THOSE CARRYING INTERSTATE TRAFFIC

| SINGLE VEHICLE (SV) | | TRUCK TRACTOR SEMI-TRAILER (TTST) | |
|---|---|---|---|
| REF. # | SCHEMATIC | REF. # | SCHEMATIC |
| SNSH | 5K 22K — 14' — 27K 13.5 TON | TNAGRIT3 | 22K 22K 22K — 9' 9' — 18' — 66K 33 Ton |
| SNGARBS2 | 23.5K 16.5K — 14' — 40K 20 TON | TNT4A | 12.1K 12.05K 21K 21K — 9' 9' 4' — 22' — 66.15K 33.075 TON |
| SNAGRIS2 | 22K 22K — 14' — 44K 22 Ton | TNAGRIT4 | 22K 22K 21K 21K — 9' 9' 4' — 22' — 86K 43 TON |
| SNCOTTS3 | 4.5K 25K 25K — 11' 4' — 15' — 54.5K 27.25 TON | TNAGT5A | 22K 21K 21K 13K 13K — 9' 4' 9' 4' — 28' — 90K 45 TON |
| SNAGGRS4 | 16K 15.85K 19K 19K — 9' 4' 4' — 17' — 69.85K 34.925 TON | TNAGT5B | 6K 21K 21K 21K 21K — 9' 4' 9' 4' — 26' — 90K 45 TON |
| SNS5A | 12.1K 8.5K 21K 21K 8.5K — 9' 4' 4' 4' — 21' — 71.1K 35.55 TON | TNT6A | 12.1K 8.2K 21K 21K 10.45K 10.45K — 9' 4' 4' 9' 4' — 30' — 83.2K 41.6 TON |
| SNS6A | 12.1K 8.6K 8.6K 21K 21K 8.6K — 9' 4' 4' 4' 4' — 25' — 79.9K 39.95 TON | TNT7A | 4.1K 4K 21K 21K 11.3K 11.3K 11.3K — 9' 4' 4' 9' 4' 4' — 34' — 84K 42 TON |
| SNS7B | 7.6K 8.6K 8.6K 21K 21K 8.6K 8.6K — 9' 4' 4' 4' 4' 4' — 29' — 84K 42 TON | TNT7B | 4.1K 10.5K 10.5K 8.45K 8.45K 21K 21K — 9' 4' 9' 4' 4' 4' — 34' — 84K 42 TON |

**Note: Includes 10% Tolerance where applicable.**

Revised 10/25/2005
Revised Vehicle Names 11/15/2007
Revised 7/31/2008
Revised Vehicle Names 6/12/2009
Revised Vehicle Names 1/12/2011

# *RATING SUMMARY SHEET (BEFORE REPAIRS)*

| STRUCTURE NO: | OWASA | | COMPILED BY: | RA | DATE: | 6/20/2016 |
|---|---|---|---|---|---|---|
| COUNTY: | ORANGE | | CHECKED BY: | JAD | DATE: | 6/22/2016 |

| MEMBER | 17" PRESTRESSED CONCRETE CORED SLAB UNIT | | | | | |
|---|---|---|---|---|---|---|
| Span Length | 30'-0" | | | | | |
| Beam Spacing C=Cont | 2'-9" | | | | | |
| HS 20 Inventory Rating | 34 | | | | | |
| HS 20 Operating Rating | 39 | | | | | |
| SNSH 13.5 | 50 | | | | | |
| SNGARBS2 20 | 55 | | | | | |
| SNAGRIS2 22 | 40 | | | | | |
| SNCOTTS3 27.25 | 48 | | | | | |
| SNAGGRS4 34.925 | 48 | | | | | |
| SNS5A 35.55 | 51 | | | | | |
| SNS6A 39.95 | 52 | | | | | |
| SNS7B 42 | 54 | | | | | |
| TNAGRIT3 33 | 52 | | | | | |
| TNT4A 33.075 | 61 | | | | | |
| TNAGRIT4 43 | 62 | | | | | |
| TNAGRT5A 45 | 59 | | | | | |
| TNAGRT5B 45 | 59 | | | | | |
| TNT6A 41.6 | 61 | | | | | |
| TNT7A 42 | 59 | | | | | |
| TNT7B 42 | 58 | | | | | |

| | |
|---|---|
| DESIGN LOADING | UNKNOWN |
| INVENTORY RATING | HS-20 |
| OPERATING RATING | HS-34 |
| NT7 RATING (A or B) | 58 Tons |
| OVERLOAD BRIDGE ONLY HS OPERATING DROPPED 3 TONS OR MORE | YES [ ] NO [X] |

| CALCULATED POSTING: | SV – | TTST – |
|---|---|---|
| CONTROLLING MEMBER: | – | |
| EXISTING POSTING: | NOT POSTED | |
| RECOMMENDED POSTING: | NONE | |

**REASON FOR POSTING CHANGE:** _____

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704-919-1880
www.wetherilleng.com

# OWASA EMERGENCY
# BRIDGE INSPECTION



**JULY 17, 2025**

**PREPARED FOR:**

OWASA

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## Executive Summary

This report consists of bridge inspection findings and observations for OWASA Wastewater Treatment Plant bridge located on Old Mason Farm Rd in Chapel Hill, North Carolina. The inspection was conducted on July 10, 2025, by Matthew Robertson (Team Leader) and Schuyler Daugherty, (Team Member), to assess the overall condition of the bridge. A follow up inspection was performed on July 17, 2025, by Matthew Robertson and Schuyler Daughtery due to receded water levels. The primary focus was to conduct a hands-on and visual inspection of the bridge structural elements and components which had been impacted by recent storm events.

The following report includes a summary of existing conditions and findings. Additionally, standard structure and condition photos and a channel profile have been included.

## Existing Conditions

The bridge carries Old Mason Farm Rd over Morgan Creek. The bridge consists of (2) 30’-0” spans with concrete prestressed cored slabs on reinforced concrete abutments and interior concrete bents. The bridge overall length is 60’-0” with an out-to-out width of 16’-6” and clear roadway width of 15’-10” measured between rails.

At the time of inspection, the weather was 80°F and cloudy. Waders were used to access portions of the bridge superstructure and substructure. Refer to the Standard Structure Photos section for general views of the bridge and site conditions.

## Findings

The bridge was inventoried from South to North. Observed general conditions and deficiencies were documented and photographed at the time of inspection and included below.

Drift accumulation was found to be throughout the length of the East bridge rail up to 18” deep, at the Southeast wingwall with an area up to 15’ long x 15’ wide x 5’ deep, at the Southwest wingwall (removal in progress) with timber debris up to 12” in diameter x 12’ long, at the upstream end of Bent 1, with an area up to 14’ long x 12’ wide x up to 8” deep with timber debris reaching up to 8” in diameter and along the downstream side adjacent to the sports field at the Southeast approach. Sediment accumulation was observed to be on the West side of Span 2 for the full length up to 2’ deep.

Scour was observed to be at the South approach Behind the Southeast wingwall, with an area of up to 6’ long x 4’ wide x 5” deep, at the North approach at the East side with an area up to 20’ long x 10’ wide x 2” inches deep, and beginning 4 feet North of Bent 1 at the East end, with an area up to 7’ long x 10’ wide x 4 feet deep.

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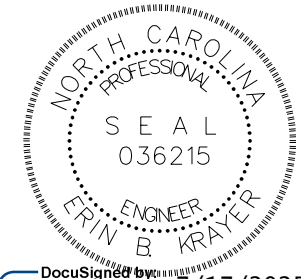
Areas of erosion were observed to be at the Southwest wingwall on the stream face, with an area 15’ long x 7’ wide x 6’ deep.

Evaluation

The following repairs are recommended to improve the current condition of the bridge:

- Clean and remove drift and sediment accumulation
- Fill scour holes and areas with applicable fill material
- Fill area of erosion at Southwest wingwall and implement erosion control measures

Should you have questions or concerns regarding the information presented herein, please feel free to contact me at 704-919-1880 or ekrayer@wetherilleng.com.




DocuSigned by:
Erin B. Krayer
13BA44097B65467...
7/17/2025

Respectfully Submitted,
**WETHERILL ENGINEERING, INC.**

Erin B. Krayer, PE
Vice President of Operations

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Charlotte, North Carolina 28277
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# STANDARD STRUCTURE PHOTOS

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Photo 1 – South Approach Looking North



Photo 2 – South Approach Looking South

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Photo 3 – North Approach Looking North



Photo 4 – North Approach Looking South

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Photo 5 – West Profile



Photo 6 – East Profile

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Photo 7 – Looking West (Upstream) from Bridge



Photo 8 – Looking East (Downstream) from Bridge

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Photo 9 – Looking West (Upstream) from under Span 1



Photo 10 – Looking East (Downstream) from under Span 1

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Photo 11 – End Bent 1 looking South



Photo 12 – End Bent 2 looking North

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Photo 13 – West Rail



Photo 14 – East Rail

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# CONDITION PHOTOS

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Photo 15 – Drift accumulation along East rail up to 18 inches deep throughout length of bridge



Photo 16 – Behind Southeast wingwall adjacent to South approach, area of scour up to 6 feet long x 4 feet wide x 5 inches deep

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Photo 17 – North approach at East side area of scour up to 20 feet long x 10 feet wide x 2 inches deep, similar at West side



Photo 18 – Scour hole beginning 4 feet North of Bent 1 at East end up to 7 feet long x 10 feet wide x 4 feet deep

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Photo 19 – Drift accumulation at Southeast wingwall up to 15 feet long x 15 feet wide x 5 feet deep **7-10-2025**



Photo 20 – Drift pile at Southeast corner (removal in progress) **7-17-2025**

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Photo 21 – Southeast wingwall on stream face, area of erosion 15 feet long x 7 feet wide x 6 feet deep



Photo 22 – Drift accumulation at Southwest wingwall up to 12 inches in diameter x 12 feet long

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Photo 23 – Sediment accumulation at West side of Span 2 up to 2 feet deep full length of span



Photo 24 – Upstream end of Bent 1, drift accumulation 14 feet long x 12 feet wide x 6 feet deep and up to 8 inches in diameter

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Photo 25 – Drift along downstream fencing up to 4 feet deep



Photo 26 – Average water depth under Span 2 East side (4 feet 2 inches) **7-10-2025**

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Photo 27 – Average water depth at Bent 1 Pile 1 (2 feet 2 inches) **7-10-2025**



Photo 28 – Average water depth at Bent 1 Pile 1 (10 inches) **7-17-2025**

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Photo 29 – Average water depth at Bent 1 Pile 2 (2 feet 2 inches) **7-10-2025**



Photo 30 – Average water depth at Bent 1 Pile 2 (6 inches) **7-17-2025**

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Photo 31 – Average water depth at End Bent 1 upstream (2 feet 2 inches) **7-10-2025**



Photo 32 – Average water depth at End Bent 1 upstream (1 foot) **7-17-2025**

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Photo 33 – Average water depth at End Bent 1 downstream (1 foot 11 inches) **7-10-2025**



Photo 34 – Average water depth at End Bent 1 downstream (1 foot) **7-17-2025**

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# STREAM BED SOUNDINGS

**(SEE NEXT SHEET FOR PROFILE SKETCH)**

BR. INSP. WORKSHEET (1/1/90)
Revised 10/9/1998

Bridge #: **0WASA** COUNTY **ORANGE** DATE **7-17-2025** BY: **MWR/SMD**

RECORD SOUNDINGS FROM TOP OF RAIL. OTHER LOCATION IF NEEDED: **TOP OF RAIL**

DISTANCE HIGHWATER MARK TO TOP OF CURB: **1'** LOCATION H. W. MARK: **1 FOOT ABOVE CURB**

NOTE:Draft a Stream Bed Profile sketch and record soundings at the stream face of abutments, C/L of piers, WE, WS, and major contour changes on the downstream side. Record soundings at the stream face abutments and C/L piers on the upstream side.

| DOWNSTREAM | | | UPSTREAM | | |
|---|---|---|---|---|---|
| **DISTANCE (Station)** | **SOUNDING** | **DESCRIPTION** | **DISTANCE (Station)** | **SOUNDING** | **DESCRIPTION** |
| 00+01.1 | 10.5 | **WS & WE** | 00+01.1 | 10.5 | **WS & WE** |
| 00+44.0 | 10.5 | **WS & WE** | 00+32.0 | 10.5 | **WS & WE** |
| 00+00.0 | 3.40 | TOP OF WING | | | |
| 00+01.0 | 11.50 | FACE OF WING | 00+01.0 | 11.42 | FACE OF WING |
| 00+04.0 | 11.50 | BED | 00+04.0 | 11.75 | BED |
| 00+10.0 | 11.25 | BED | 00+10.0 | 11.42 | BED |
| 00+20.0 | 11.50 | BED | 00+20.0 | 11.00 | BED |
| 00+28.0 | 11.00 | BED | 00+28.0 | 11.08 | BED |
| 00+31.0 | 11.08 | BENT 1 | 00+31.0 | 11.50 | BENT 1 |
| 00+40.0 | 12.42 | BED | 00+40.0 | 5.20 | BED |
| 00+50.0 | 8.10 | GROUND | 00+50.0 | 6.6 | GROUND |
| 00+61.0 | 8.30 | FACE OF WING | 00+61.0 | 8.1 | FACE OF WING |
| 00+62.0 | 3.4 | TOP OF WING | | | |
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Bridge #: **OWASA** County: **ORANGE** Date: **7/17/2025** By: **MWR/SMD**

## STREAMBED PROFILE (Downstream)

