



# Rasmus Enge Memorial Bridge Evaluation

## Task 1—Condition Assessment

Prepared for:  
City of Petersburg  
P.O. Box 329  
Petersburg, Alaska 99833

Prepared by:

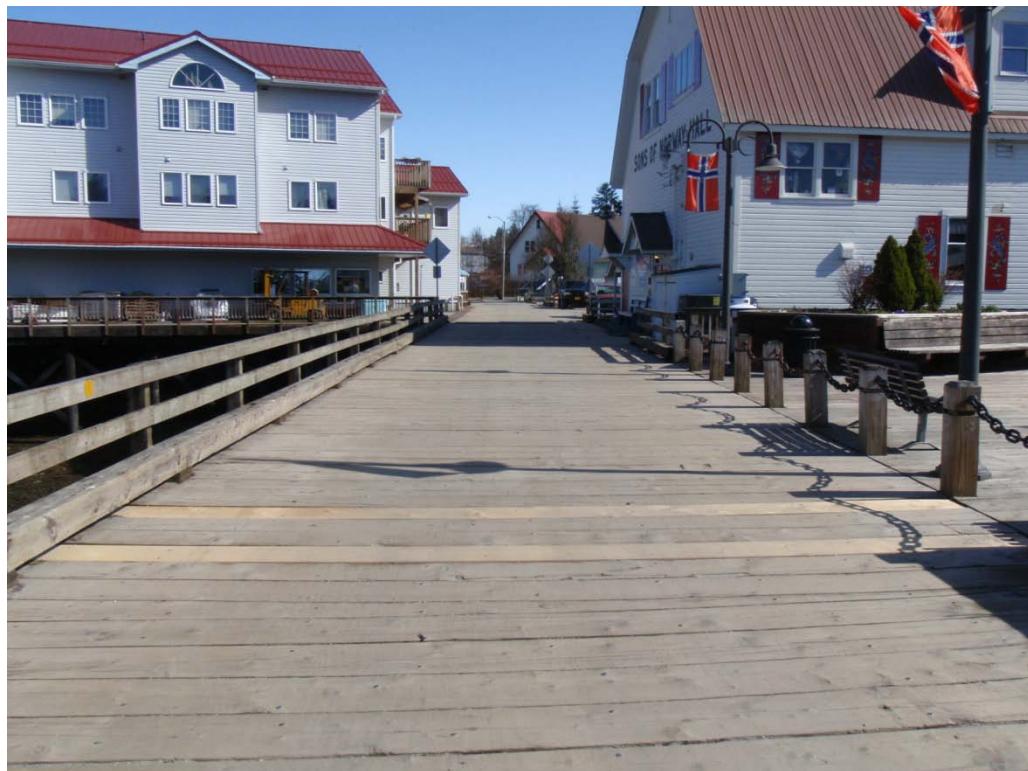
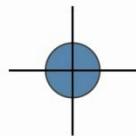


PND Engineers, Inc.  
9360 Glacier Highway, Suite 100  
Juneau, Alaska 99801  
PND No. 122023.01

APRIL 2012

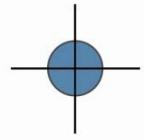
# Rasmus Enge Memorial Bridge

## Condition Assessment



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# Section 1

# Inspection Report

P | N | D



ENGINEERS, INC.

April 27, 2012

PND 122023.01

Mr. Chris Cotta  
Assistant Public Works Director  
P.O. Box 329  
303 S. 2<sup>nd</sup> Street  
Petersburg, Alaska 99833

Re: Rasmus Enge Memorial Bridge – Task 1 Condition Assessment

Dear Mr. Cotta:

The following report is a summary of the condition assessment performed by PND Engineers, Inc. (PND) for the sub-structure and utilities of the Rasmus Enge Memorial Bridge.

**Overview:**

According to AKDOT bridge inventory records, the Rasmus Enge Memorial Bridge was built in 1945 and reconstructed in 1976. It is a 20-ft wide by approximately 400-ft long timber structure supported by creosote treated timber piles and framed with creosote treated 12x12 pile caps, stringers of varying sizes, and untreated, 4x12 decking. Each pile cap is supported by three piles, and the pile caps are spaced approximately 10-ft on center. The pile caps are connected to each pile, and similarly, each stringer is connected to the pile cap with steel drift pins. Deck planks are attached to each stringer with 3/8-inch spikes. A cast-in-place concrete abutment exists at each end of the structure. Design drawings provided by the City of Petersburg indicate the abutments were designed and constructed in the late 1980's.

The decking was last replaced in approximately 2001, and in 2008, 4x12 longitudinal bracing was added to both sides of each span along the structure.

With regard to utilities, two insulated, jacketed sewer lines are supported by the bridge (one on each side), and several PVC electrical conduits are suspended beneath the structure.

**Inspection:**

PND inspected the Rasmus Enge Memorial Bridge on April 5<sup>th</sup> and 6<sup>th</sup>, 2012. A base map was developed from a City of Petersburg Mapping Department drawing. The layout and numbering scheme established by AKDOT was maintained. A visual inspection was performed, and representative photos were taken. In addition, microsecond timer readings were taken at each pile cap and for each pile in order to quantify the level of timber degradation. These readings are attached to this report.

**Observations:**

The overall condition of the structure is fair, but the condition of specific components varies from good to poor. General observations are as follows (see attachments for specific observations):

- Decking – General observations confirm the decking is in poor condition. Mechanical wear, rot, and excessive deflection from vehicle traffic all indicate it is at the end of its service life.
- Stringers – General observations indicate the condition of the stringers varies greatly from very good to poor. Stringers in good condition appear to have been installed within the last 10 years while the

stringers in poor condition likely vary in age and are either cracked or broken. The stringers in poor condition do not represent an immediate structural concern as it appears that over time, new, additional stringers have been installed adjacent to the original stringers. This is evident by the fact that the number and size of stringers varies from span to span along the bridge. In some instances, stringers are side-by-side across the full width of the pile cap.

- Pile Caps – The general condition of the pile caps is good. Most have surface mold/fungus on them, indicating the creosote treatment is losing its effectiveness and ability to prevent this early stage of degradation. Pile caps evaluated as being in poor condition have split ends where moisture has entered and begun the decay process. These pile caps were also believed to be salvaged material as evident by the presence of horizontal drift pin holes. While candidates for replacement, these pile caps do not present an immediate structural concern. Also, a significant amount of gravel has accumulated atop the pile caps. This holds moisture and promotes decay. The gravel should be removed and the pile caps retreated with wood preservative during the deck replacement work.
- Piles – The general condition of the piles varies from good to poor. Similar to the pile caps, many piles have surface mold/fungus on them, indicating the creosote treatment is losing its effectiveness and ability to prevent this early stage of degradation. In addition, the upper-half of many piles have no visible evidence of treatment as it seems to have migrated downward over time. The piles were not cored to verify the presence of treatment beneath the surface. Many piles have vertical checking/splits; most are minor, but some are of significant size. Fortunately, most all piles have a piece of tar paper covering the top of the pile which prevents access of water to this typically vulnerable area. Microsecond timer readings obtained generally indicate sound wood exists. Higher readings indicate a higher level of decay; however, the wood must be solid wood, without splits or cracks as these will also produce higher readings. Consequently, the readings obtained must be evaluated with respect to visible checking and/or splitting. While there are no immediate structural concerns, there are a couple piles that are recommended to be repaired or replaced.
- Bracing – Cross bracing is a very important structural component but a particularly vulnerable component of timber pile supported structures as they are exposed to floating debris that can cause substantial physical damage and they are submerged for long periods of time, like the piles but due to their smaller size, do not last as long as the piles. The existing cross bracing consists of ACZA treated 4x6 timbers, lap-spliced at mid-height on the middle support pile. Approximately 40% of the cross bracing needs to be replaced in order to maintain both the structural and operational stability of the structure. Cross bracing is currently provided on both sides of the support piles and thus is inherently redundant. Consequently, there is no immediate structural concern; however, cross bracing replacement should take place when the deck replacement work occurs. Existing, recently installed longitudinal bracing consists of creosote treated 4x12 timbers that are in very good condition.
- Utilities – The utilities supported by the structure appear to be in overall fair condition. Minor surface corrosion exists on most sewer pipe hangers on the upstream side of the bridge, while the hangers on the downstream side are in good condition as the galvanized coatings are holding up well. A broken hanger was observed near pile bent #26. Some areas of minor damage to the pipe jacketing and insulation were observed. Moderate corrosion exists on many of the unistrut supports for the electrical conduit under the bridge.

### Conclusions:

With some exceptions referenced above and mentioned in the detailed observations attached to this report, the overall condition of the Rasmus Enge Memorial Bridge sub-structure is fair. If the AKDOT bridge inventory records are accurate, then the structure built in 1945 was 31 years old when it was reconstructed in 1976, and the current structure is 36 years old. Many different variables factor into the life expectancy for a structure of this type. With relatively minor repair and/or replacement work, the sub-structure should



provide a remaining service life of approximately 10-15 years. The sub-structure should be monitored with regular inspections (every 5 years) in order to update the structure's condition.

The service life of new creosote stringers will likely exceed the remaining life of the sub-structure, while the service life of new decking (untreated) will be approximately 10 years. For this particular case, the untreated decking is likely warranted considering the volume of traffic that travels over the bridge and the resulting mechanical wear that occurs to the deck timbers. A treated deck with a wear surface is an option, but is only feasible if the supporting sub-structure is going to last beyond the expected service life mentioned above.

The support piles are the controlling factor in both the remaining service life of the Rasmus Enge Memorial Bridge as well as the options available for replacement. Currently, Alaska's permitting regulations will allow the use of creosote treated piles in the water for maintenance purposes (of docks), and although replacement is technically possible, the presence of an anadromous fish stream, coupled with the recent trend to strongly discourage the use of creosote treated piles in the water will likely preclude this option. If the structure could be proven to be a historical structure, that could be a favorable factor for an in-kind replacement, but the permitting process would still be a long, drawn-out affair that will likely have an unfavorable outcome.

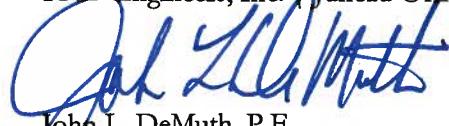
Task 2 for the evaluation of the Rasmus Enge Memorial Bridge involves a cost/benefit analysis of partial repair versus full replacement options. However, if permitting cannot be approved for partial repairs or any other use of creosote piles, then the only option remaining is full replacement with steel support piles at the end of the structure's service life.

With this in mind, PND recommends the City of Petersburg make the necessary repairs and/or replacements discussed in this report to ensure the structure is safe and performs according to the original design intent for the remaining service life expected for the timber support piles. The repair and/or replacement work will need to be designed, and preliminary design work should also begin for public consideration of potential replacement options. This will provide the City of Petersburg with the time necessary to choose the most favorable option and secure the funding required to accomplish the project. In addition, any replacement option could be done in phases depending upon available funding and any associated stipulations.

PND appreciates the opportunity we have had to assist you with this work, and we hope this information serves your needs. Should you have any questions, please feel free to contact us.

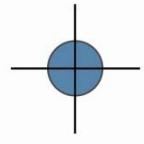
Sincerely,

PND Engineers, Inc. | Juneau Office



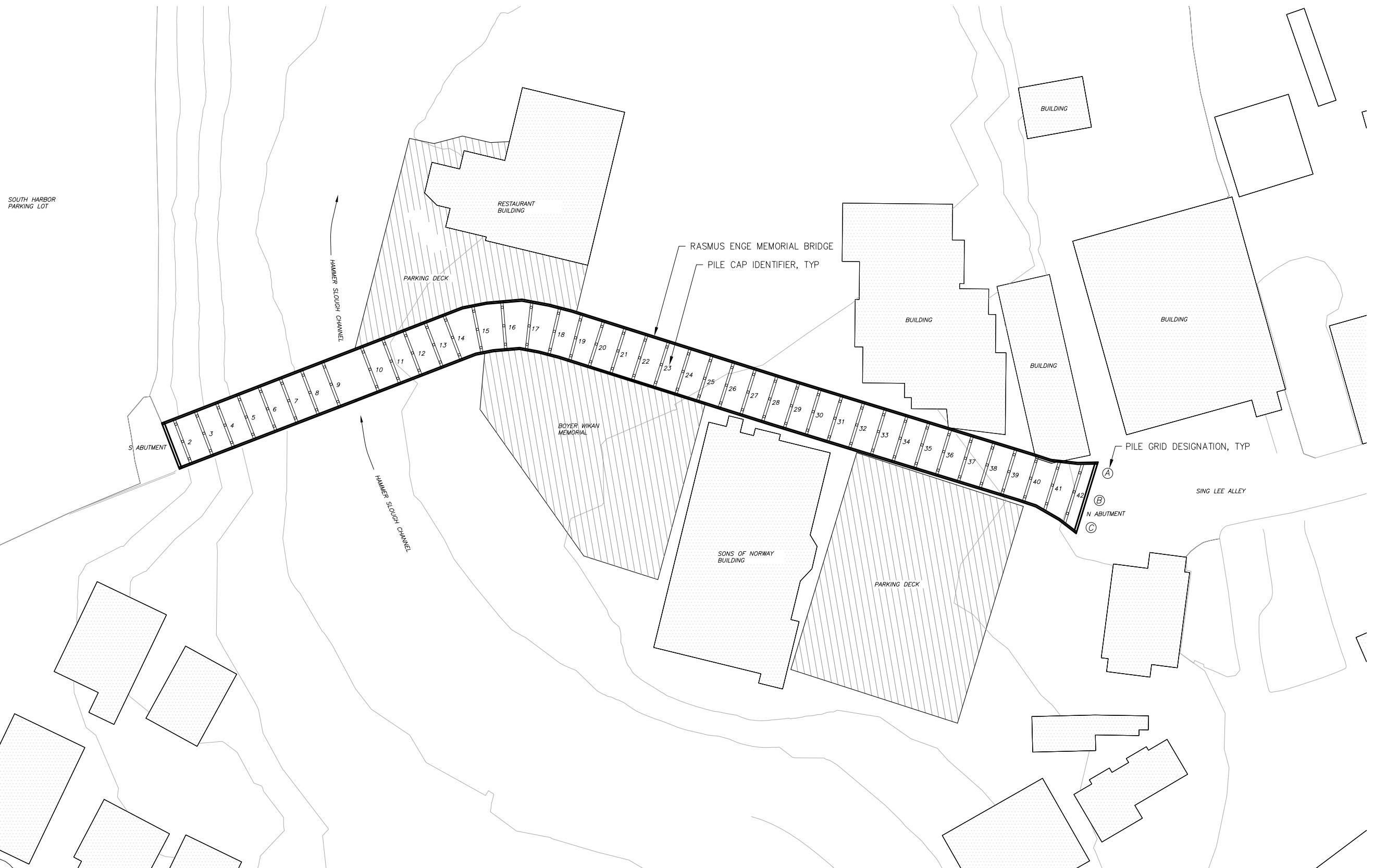
John L. DeMuth, P.E.  
Principal

Attachments



## Section 2

### Base Map



**PRELIMINARY NOT FOR CONSTRUCTION**

**REVISIONS**

REV.	DATE	DESCRIPTION	DWN.	CKD.	APP.

**PND**  
ENGINEERS, INC.

9360 Glacier Highway Ste 100  
Juneau, Alaska 99801  
Phone: 907-586-2093  
Fax: 907-586-2099  
www.pndengineers.com

DESIGN:  
DRAWN:

CHECKED:  
APPROVED:

SCALE:  
0

SCALE IN FEET  
20 40 FT.

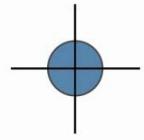
**PETERSBURG, ALASKA  
RASMUS ENGE MEMORIAL BRIDGE  
CONDITION ASSESSMENT**

**SHEET TITLE:  
EXISTING CONDITIONS  
SITE PLAN**

PND PROJECT NO.: 122023.01 DWG. FILE:

**1**

**SHEET  
1 OF 1**



## Section 3

### Field Notes



ENGINEERS, INC.

Date of Inspection: April 5-7th, 2012

PND Project #: 122023

Inspection Type: Substructure Special Inspection – Piles, Pile Caps, Bracing, Utilities/Supports

## Rasmus Enge Memorial Bridge - Condition Assessment

### Control/Orientation:

- NE (near end) is end toward Alaska Marine Highway Terminal.
- FE (far end) is end toward downtown Petersburg.
- US (upstream) is the right side of the structure
- DS (downstream) is the left side of the structure.
- Pile A is the DS (downstream) pile and Pile C is the US (upstream) pile.
- Abutment 1 is the abutment at NE of structure.
- Abutment 43 is the abutment at the FE of structure.

### Observations:

#### General:

- Surface fungus/mold on pile caps, piles and cross bracing.
- Creosote treatment not visible on upper half of many piles.
- Many cross braces split, broken and/or rotten.
- Light to moderate corrosion of steel utility mounting components/hardware.

#### Abutment 43:

- Concrete good condition.

#### Bent 2:

- Surface fungus/mold on pile cap.
- US end of pile cap split.
- Pile B not in full contact w/ pile cap (shim req'd).
- Electrical conduit partially melted – hole thru conduit; melted wire sheathing.

#### Bent 3:

- Surface fungus/mold on pile cap.
- FE lower left cross brace split.

#### Bent 4:

- Surface fungus/mold on pile cap.

#### Bent 5:

- Surface fungus/mold on cap.
- Pile A has deteriorated portion near bottom; deteriorated area approx. 5-in wide by 24-in long and extends approx. 3 inches into pile. Micro second timer readings adjacent to area indicate sound material.
- NE lower left cross brace split.
- FE lower right cross brace split.

**Bent 6:**

- Surface fungus/mold on pile cap.
- Pile A split at top.
- FE lower left cross brace split.

**Bent 7:**

- Surface fungus/mold on pile cap.

**Bent 8:**

- Surface fungus/mold on pile cap.
- FE upper center cross brace split.
- FE lower right cross brace split.

**Bent 9:**

- Surface fungus/mold on pile cap.
- Pile A with metal band around top of pile – pile top has multiple splits.
- Pile C has vertical split near top of pile.
- FE lower left cross brace split.

**Bent 10:**

- Surface fungus/mold on pile cap.
- Pile A has vertical split near top of pile.
- Pile B has vertical split near top of pile; not in complete bearing w/ cap (shims req'd).
- Pile C has hole 2-ft from mudline (approx. 3-in dia. by 11-in deep). Micro second timer readings adjacent to area indicate sound material.
- FE lower right cross brace broken/disconnected.

**Bent 11:**

- Surface fungus/mold on pile cap.
- NE lower right cross brace broken.
- FE lower left cross brace decayed/rotten.

**Bent 12:**

- Surface fungus/mold on pile cap.
- NE lower right cross brace decayed/rotten.
- FE cross brace split.

**Bent 13:**

- Surface fungus/mold on pile cap.
- Creosote treatment not visible on upper half of all piles.
- Pile C split at top.
- NE lower right cross brace decayed/rotten.

**Bent 14:**

- Surface fungus/mold on pile cap.
- Creosote treatment not visible on upper half of all piles.
- Pile B split at top
- NE lower right cross brace split at end.

**Bent 15:**

- Surface fungus/mold on pile cap.



- Creosote treatment not visible on upper half of all piles.
- Pile B split at top.
- NE lower left cross brace decayed/rotten.
- FE lower right cross brace split.

**Bent 16:**

- Surface fungus/mold on pile cap.
- Creosote treatment not visible on upper half of all piles.
- Pile B and C split at top.
- NE lower right cross brace split.
- FE center cross brace split.
- FE lower left cross brace is split.

**Bent 17:**

- Surface fungus/mold on pile cap.
- Creosote treatment not visible on upper half of all piles.
- Pile A split at top.

**Bent 18:**

- Surface fungus/mold on pile cap.
- Creosote treatment not visible on upper half of all piles.
- Pile A split at top.
- NE lower right cross brace decayed/rotten.
- FE lower left cross brace split.

**Bent 19:**

- Surface fungus/mold on pile cap.
- Creosote treatment not visible on upper half of all piles.
- NE lower right cross brace split.

**Bent 20:**

- Surface fungus/mold on pile cap.
- Creosote treatment not visible on upper half of all piles.
- Pile C split at top.
- NE lower left cross brace decayed/rotten.

**Bent 21:**

- Surface fungus/mold on pile cap.

**Bent 22:**

- Surface fungus/mold on pile cap.
- Pile A checking/split lower portion near mudline.

**Bent 23:**

- Surface fungus/mold on pile cap.
- FE cross brace split at Pile B.

**Bent 24:**

- Surface fungus/mold on pile cap.

**Bent 25:**

- Surface fungus/mold on pile cap.



- NE lower right cross brace decayed/rotten.
- FE lower left cross brace split.

**Bent 26:**

- Surface fungus/mold on pile cap.
- Pile C split at top.
- Corroded/broken utility support bracket (right side sewer).
- Minor physical damage to pipe outer jacketing (US side sewer) – 3 locations.

**Bent 27:**

- Surface fungus/mold on pile cap.

**Bent 28:**

- Surface fungus/mold on pile cap.
- NE lower right cross brace split.

**Bent 29:**

- NE lower right cross brace decayed/rotten.
- FE lower left cross brace split.

**Bent 30:**

- NE lower right cross brace decayed/rotten.

**Bent 31:**

- NE lower right cross brace decayed/rotten.
- FE lower right cross brace split.

**Bent 32:**

- Pile cap split at US end.
- NE cross brace at Pile B placed/drilled at edge of brace member.
- NE lower cross brace split.

**Bent 33:**

- Pile C split at top.
- NE cross brace connect 3ft from top of pile; poor angle; not braced well.

**Bent 34:**

- Pile B split at top.
- NE cross brace at Pile B split.
- NE lower right cross brace split.
- FE lower left cross brace split.

**Bent 35:**

- All piles with moderate splitting at top.
- FE lower cross brace split.

**Bent 36:**

- Pile A and C split at top.
- NE cross brace split/checking.

**Bent 37:**

- Pile A and B split at top.



**Bent 38:**

- Pile A split at top.
- Pile B broomed at top.
- Pile C not in contact w/ pile cap (shims req'd).

**Bent 39:**

- Pile cap has horizontal splitting/checking full length.
- Pile B split (large –  $\frac{3}{4}$ " width) full length and not in contact w/ pile cap (shims req'd).
- Pile C several splits (moderate) at top of pile.
- NE cross brace split/checking.
- FE lower cross brace split.

**Bent 40:**

- Surface fungus/mold on pile cap; pile cap salvaged as evidenced by presence of horizontal (previous) drift pin holes (i.e. older than other caps).
- Pile B and C split at top.
- FE lower left cross brace split.
- FE cross brace near horizontal; poor angle; not braced well.

**Bent 41:**

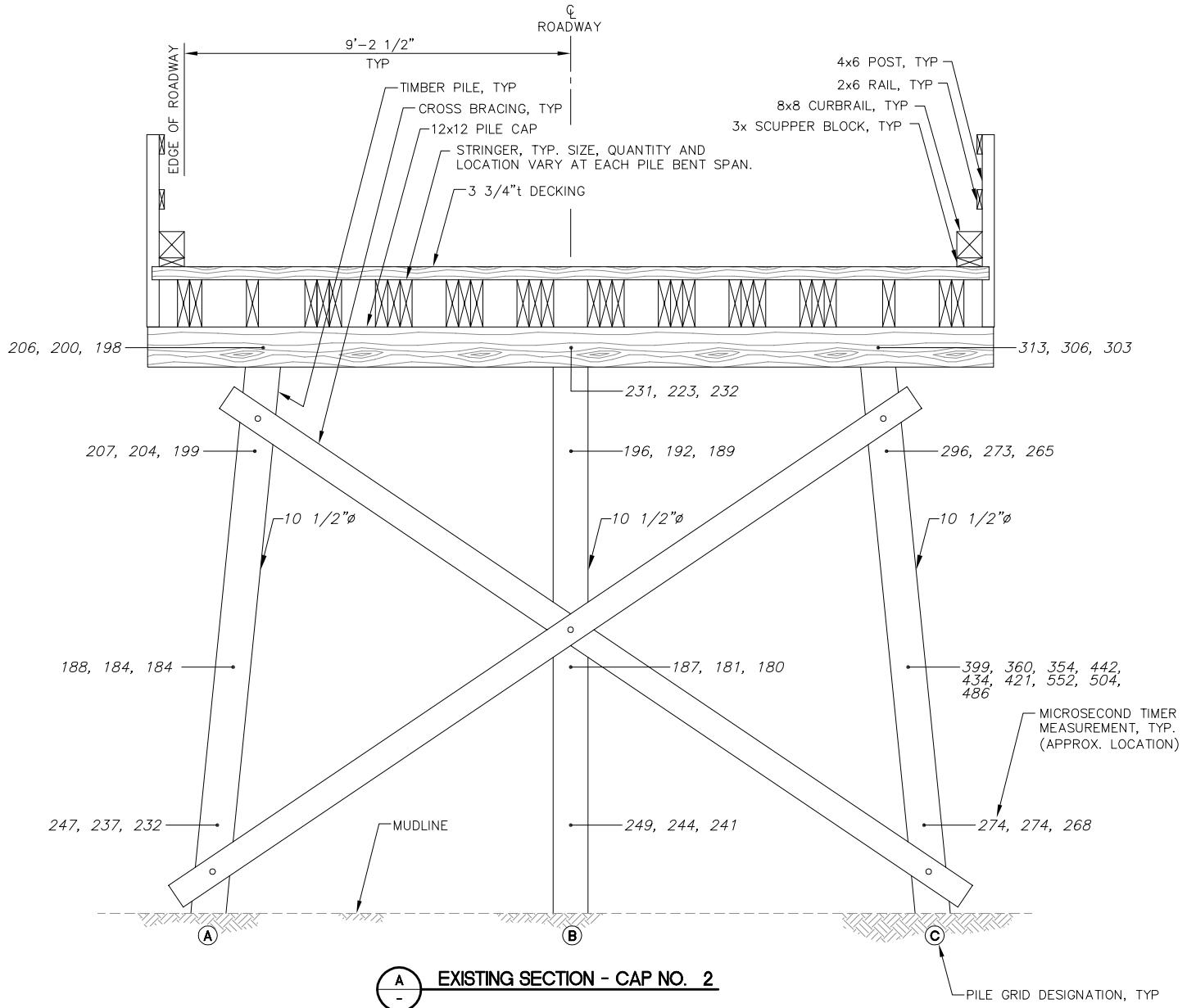
- Surface fungus/mold on pile cap; pile cap salvaged as evidenced by presence of horizontal (previous) drift pin holes (i.e. older than other caps).
- Pile cap hollow sounding.
- Pile A and C split at top.
- NE cross brace split.

**Bent 42:**

- Surface fungus/mold on pile cap; pile cap salvaged as evidenced by presence of horizontal (previous) drift pin holes (i.e. older than other caps).
- Pile cap checking/splits extend 4ft +/- to middle of cap from US end.
- All piles split (moderate) at top.

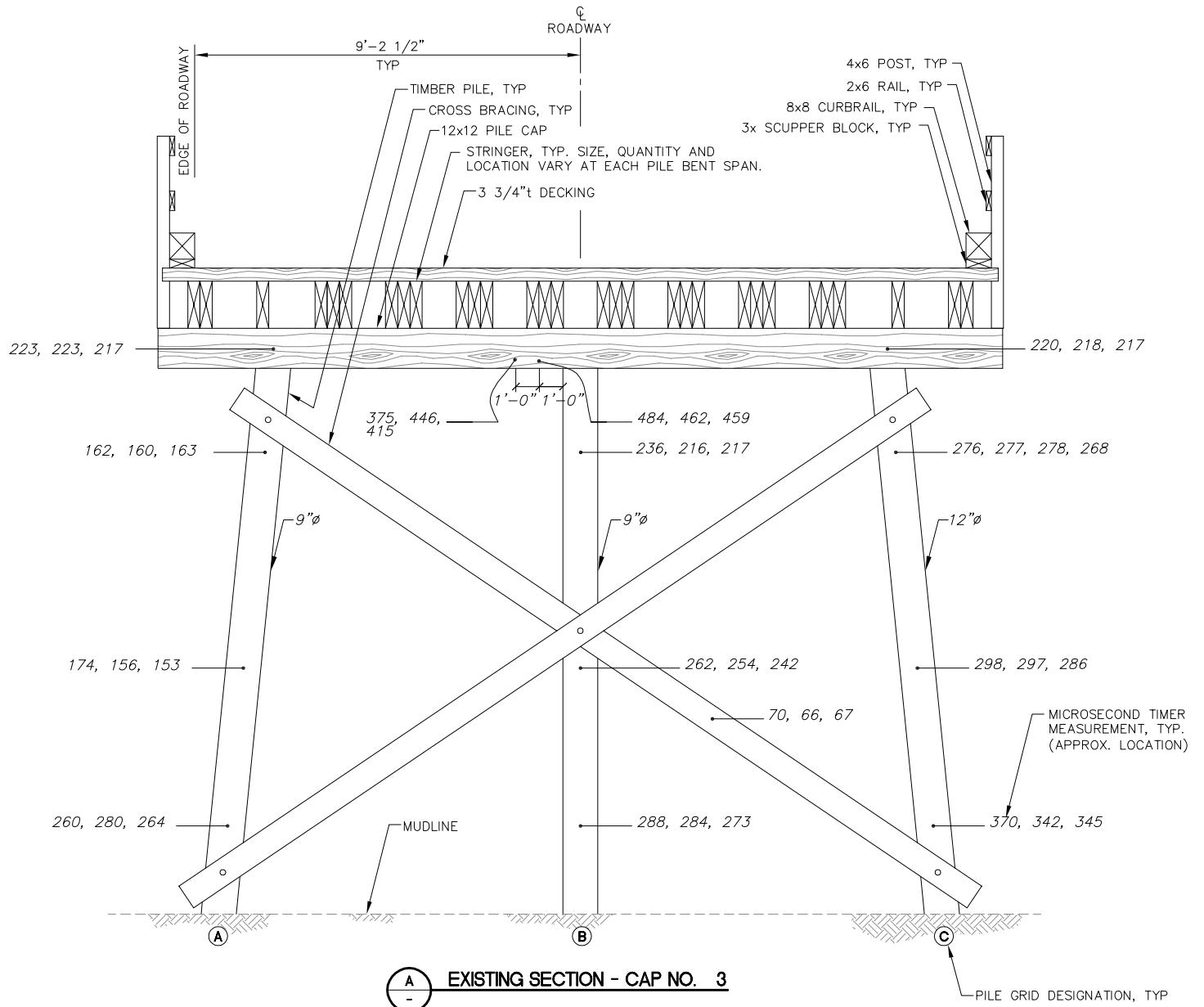
**Abutment 43:**

- Concrete minor cracking/spalling.
- Steel stringer connection angles w/ moderate corrosion.
- Significant accumulation of gravel (moisture retention) between stringers at abutment bearing area.



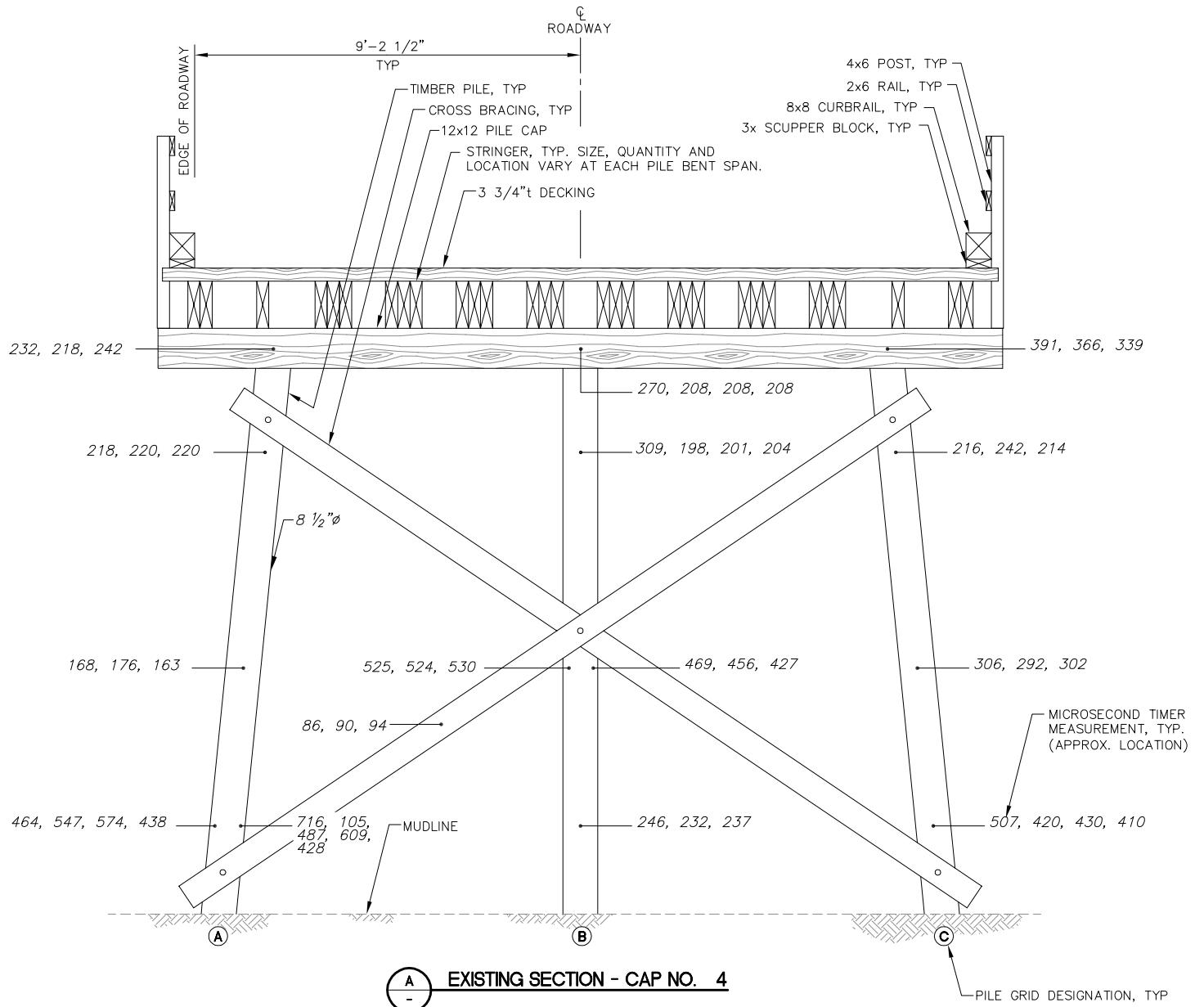
**NOTES:**

LARGE SPLIT THRU CENTER OF PILE CAP UPSTREAM SIDE, 4-FT LONG  
 4x6 CROSS BRACING SHOWS SMALL CHECKING, OVERALL GOOD CONDITION  
 PILE B NOT IN CONTACT WITH PILE CAP  
 UNISTRUTS ARE RUSTED  
 NOTE ALL CAPS WERE TESTED @ BOTTOM 1/2 OF CAP



**NOTES:**

PILE C SOUNDS SOFT @ MUDLINE  
 PILE B SOUNDS SOFT @ BOTTOM AND MUDLINE  
 UNISTRUTS ARE RUSTED  
 NOTE ALL CAPS WERE TESTED @ BOTTOM  $\frac{1}{2}$  OF CAP

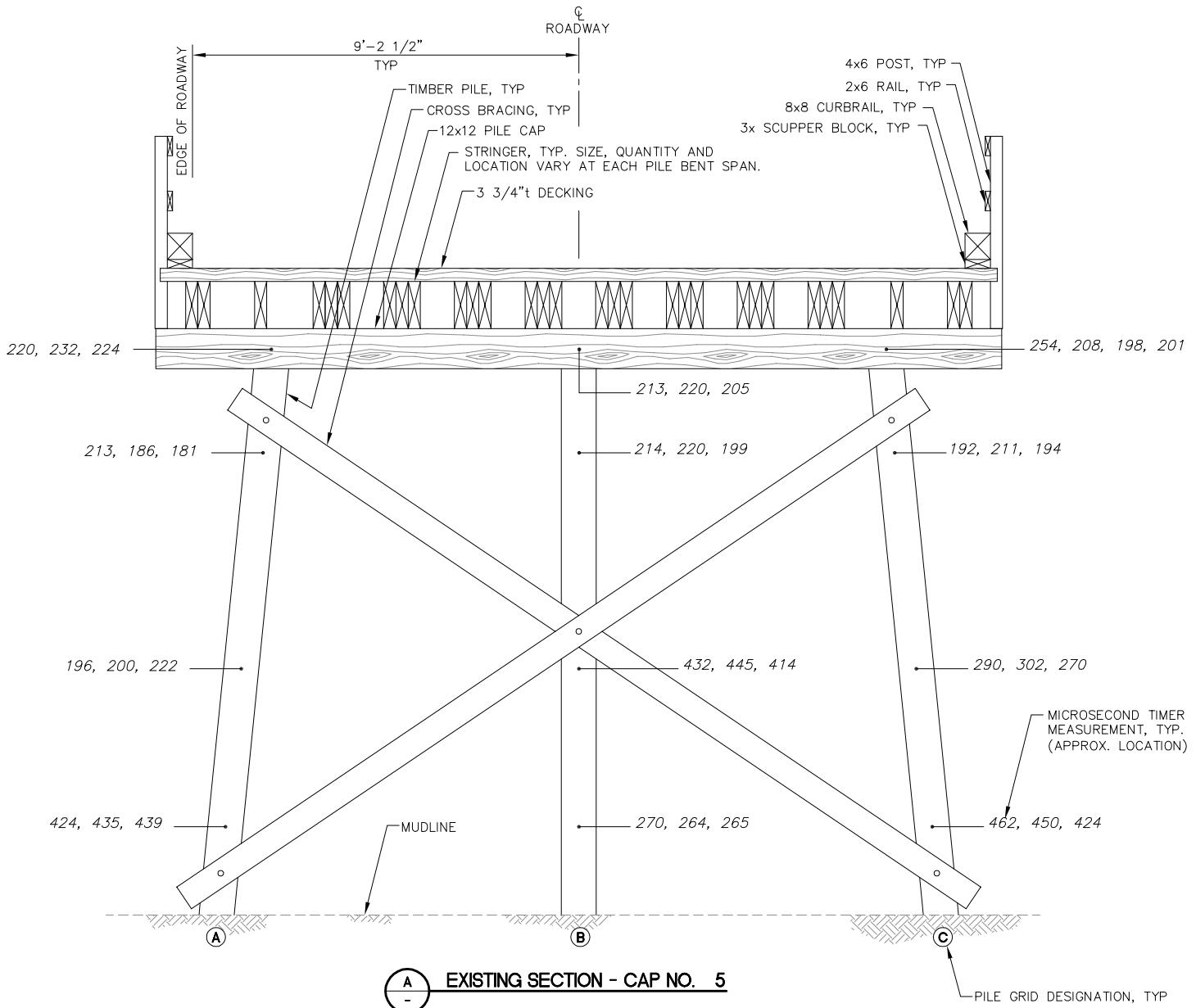


**NOTES:**

PILE C FEELS SOFT @ MUDLINE

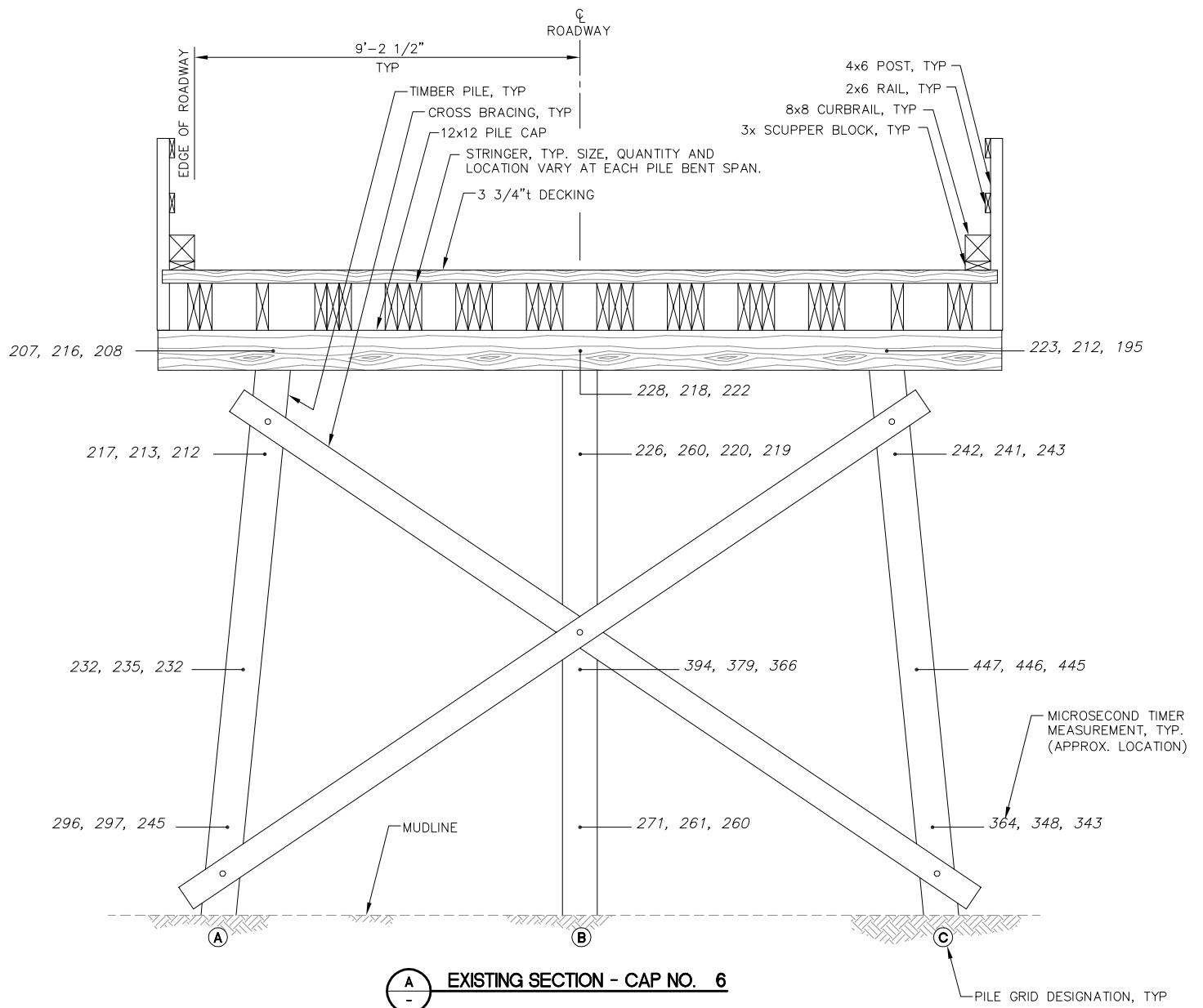
UNISTRUTS ARE RUSTED

NOTE ALL CAPS WERE TESTED @ BOTTOM 1/2 OF CAP



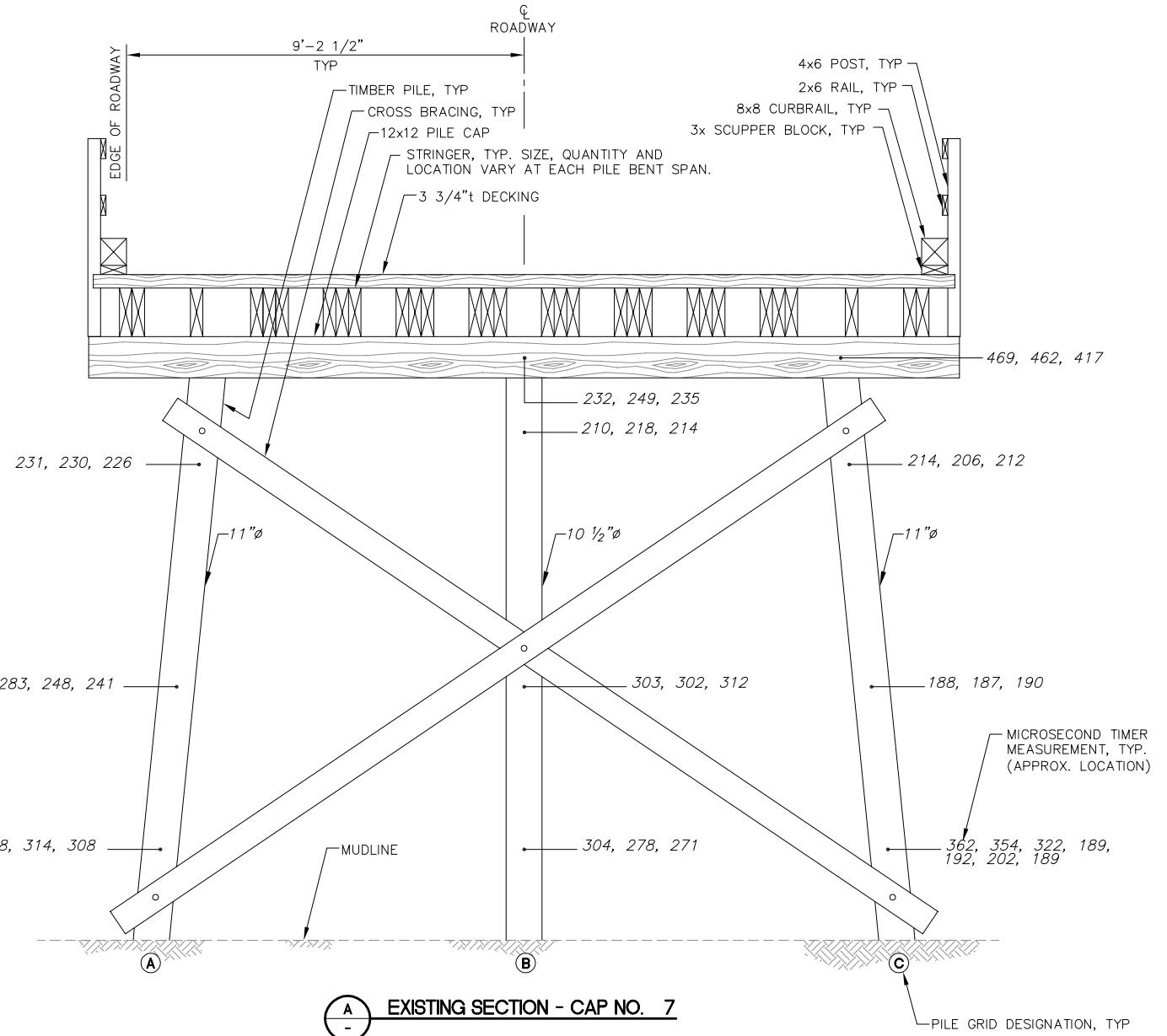
**NOTES:**

TOP OF PILE B IS SPLIT & HAS A NUMBER OF CHECKS  
CROSS BRACES ROTTEN @ LOW ENDS  
UNISTRUTS ARE RUSTED  
NOTE ALL CAPS WERE TESTED @ BOTTOM  $\frac{1}{2}$  OF CAP



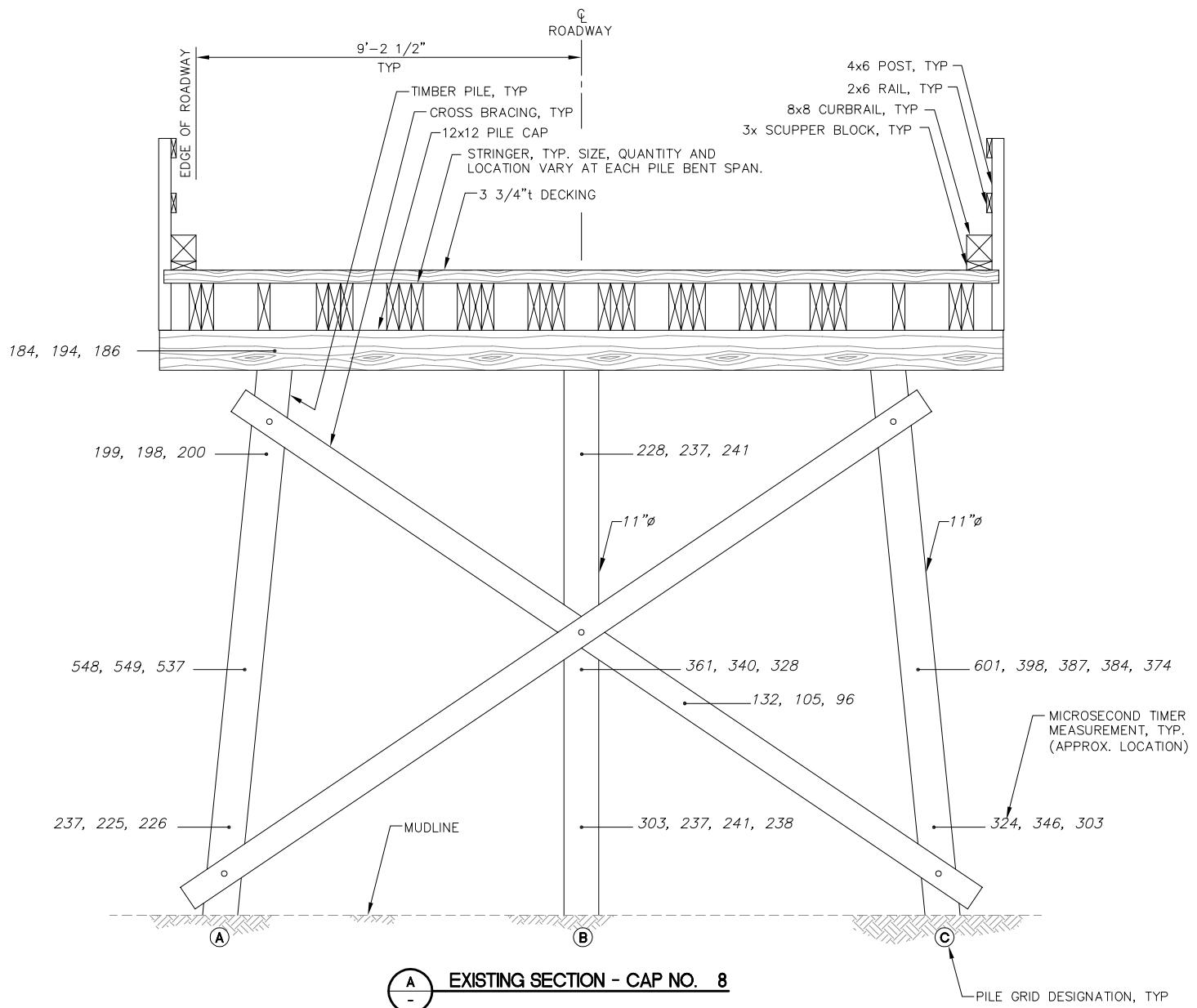
**NOTES:**

PILE C HAS LARGE BATTER TOWARD PILE B  
 PILE C = 12"Ø @ BOTTOM, 16" @ TOP  
 CROSS BRACE ROTTEN @ CONNECTION BOLT  
 LONGITUDINAL BRACE OK  
 UNISTRUTS ARE RUSTED  
 NOTE ALL CAPS WERE TESTED @ BOTTOM  $\frac{1}{2}$  OF CAP



**NOTES:**

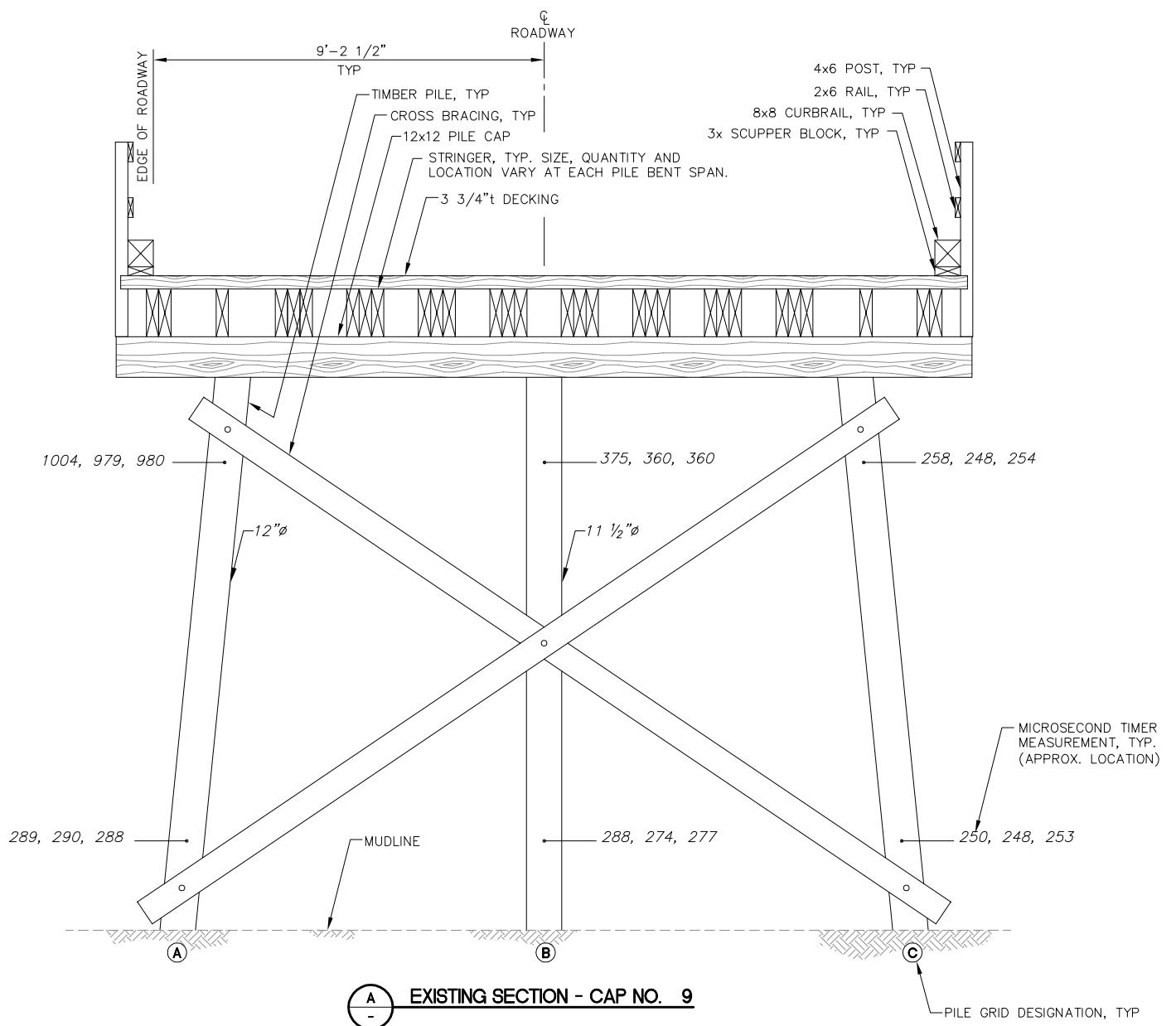
BRACING SPLIT @ ENDS  
CAP SURFACE FEELS SOFT  
PILE A HAS CHECKS @ TOP  
UNISTRUTS ARE RUSTED  
NOTE ALL CAPS WERE TESTED @ BOTTOM 1/2 OF CAP



**NOTES:**

UNISTRUTS ARE RUSTED

NOTE ALL CAPS WERE TESTED @ BOTTOM 1/2 OF CAP



**NOTES:**

BRACING, SPLIT, SOFT, SATURATED

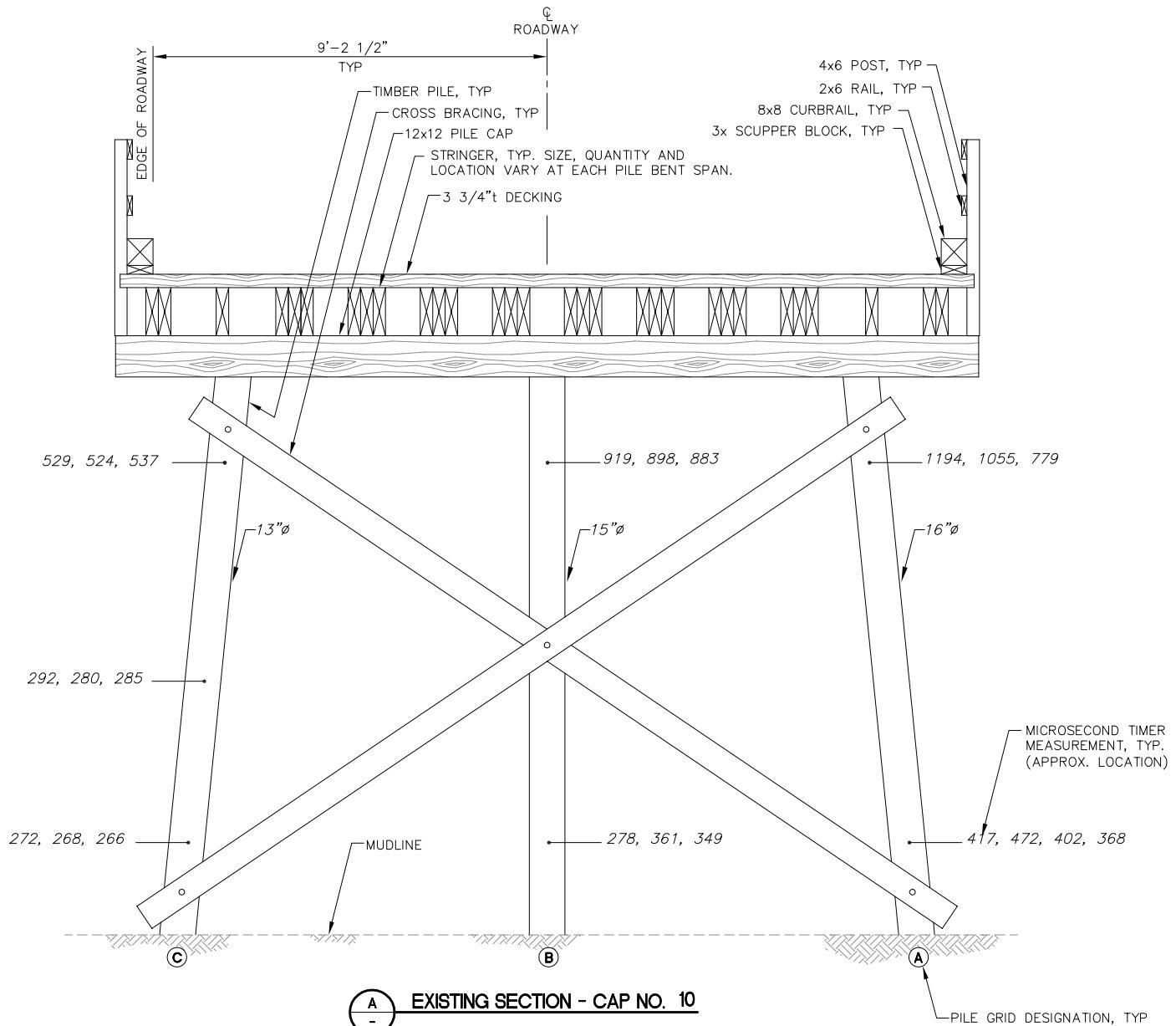
CAP IS SISTERED

PILE A= STEEL CLAMP @ TOP TO HOLD TOP OF PILE TOGETHER

PILE B= CHECKS @ TOP

UNISTRUTS ARE RUSTED

NOTE ALL CAPS WERE TESTED @ BOTTOM 1/2 OF CAP



**NOTES:**

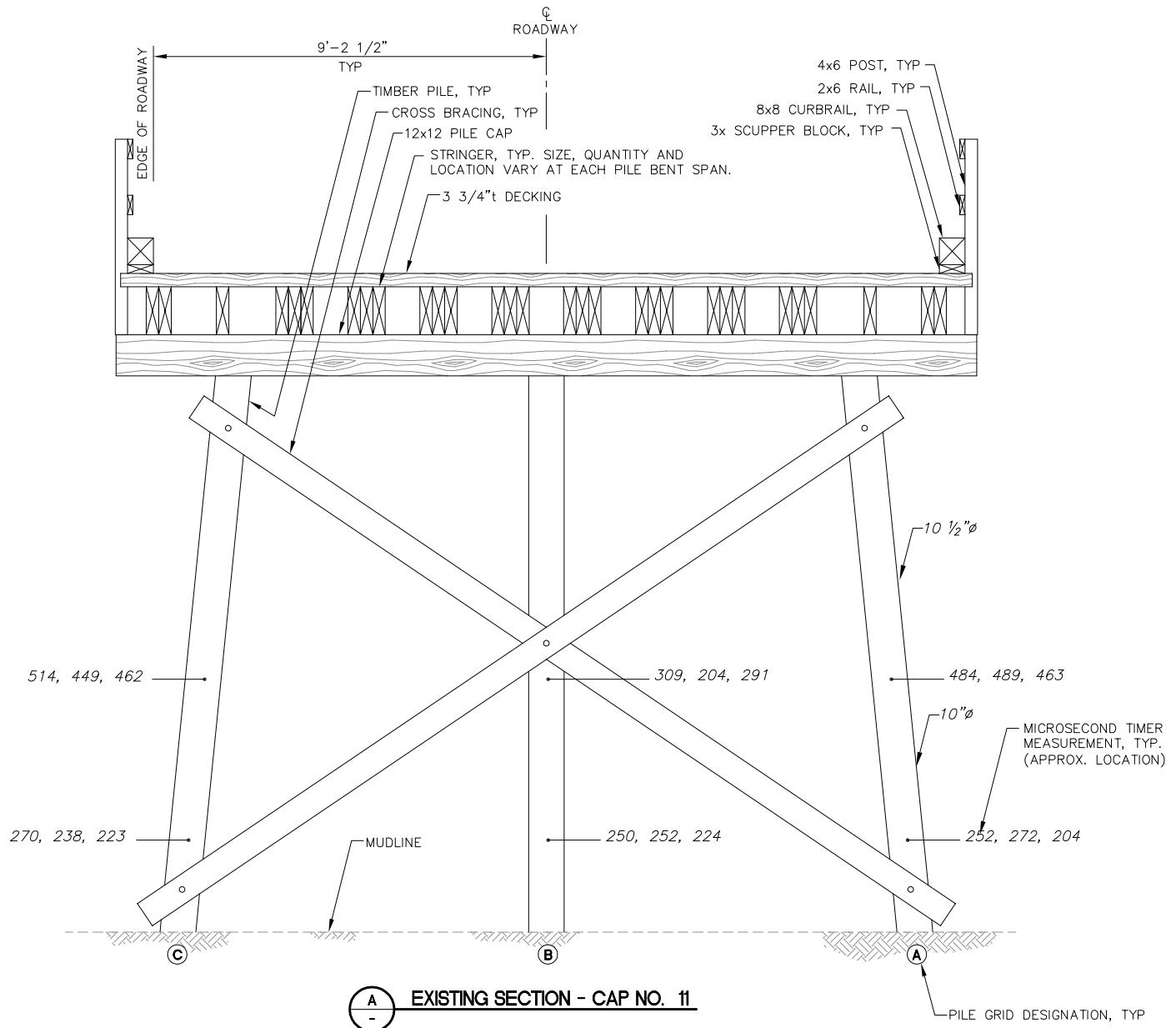
PILE A= CHECK @ TOP; CAP IS SISTERED

PILE B= LARGE SPLIT DEEP @ TOP 1' OF PILE OPEN ABOUT 1"

PILE C= LARGE CHECKS @ TOP SOUNDS SOFT;  
HAS MULTIPLE HOLES NEAR MUDLINE  
LARGE HOLE= 11" DEEP X 6" WIDE  
SMALLER HOLES= 1 1/2" DEEP 1" WIDE 3" LONG

UNISTRUTS ARE RUSTED

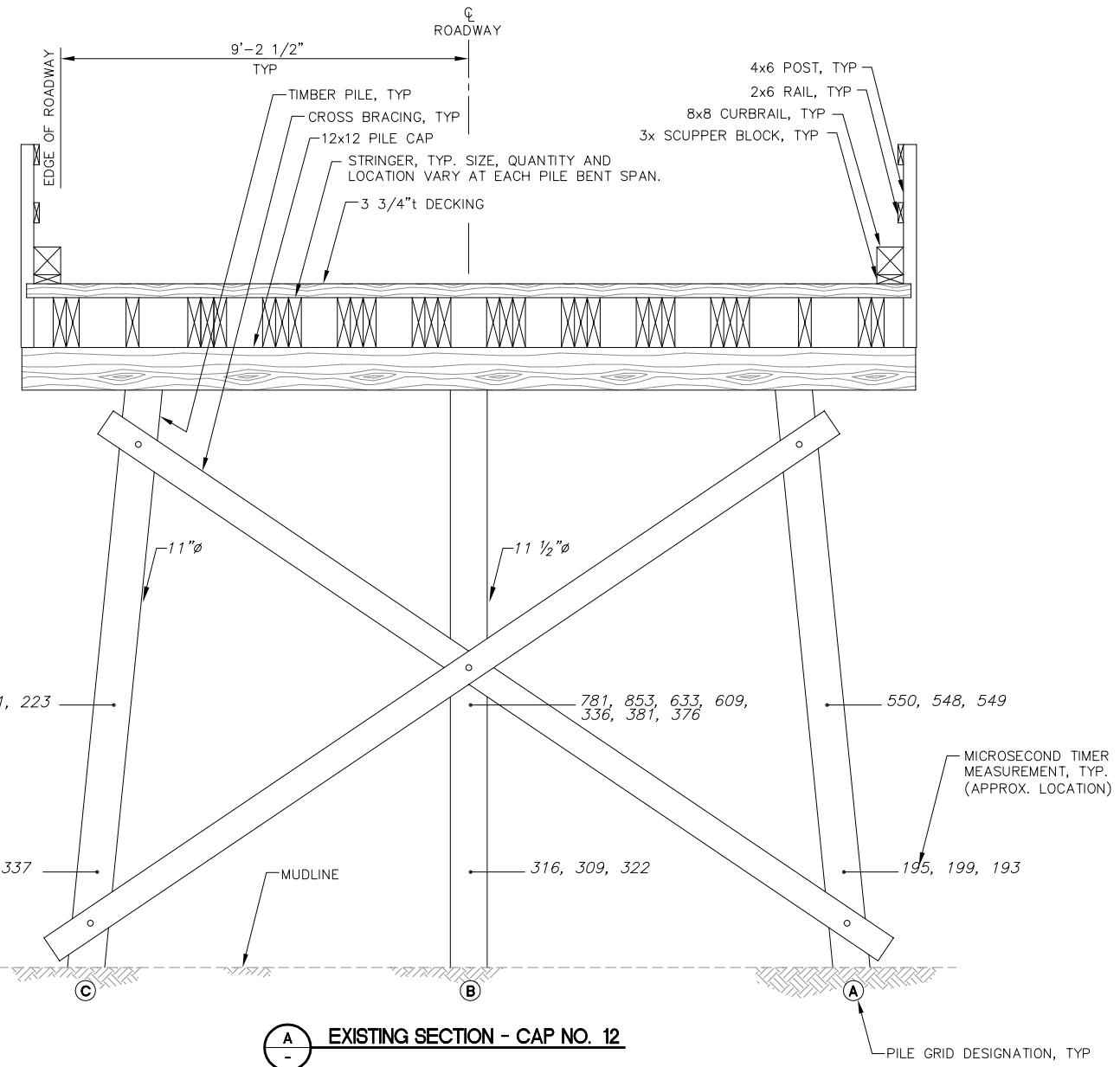
NOTE ALL CAPS WERE TESTED @ BOTTOM 1/2 OF CAP



**NOTES:**

UNISTRUTS ARE RUSTED

NOTE ALL CAPS WERE TESTED @ BOTTOM 1/2 OF CAP



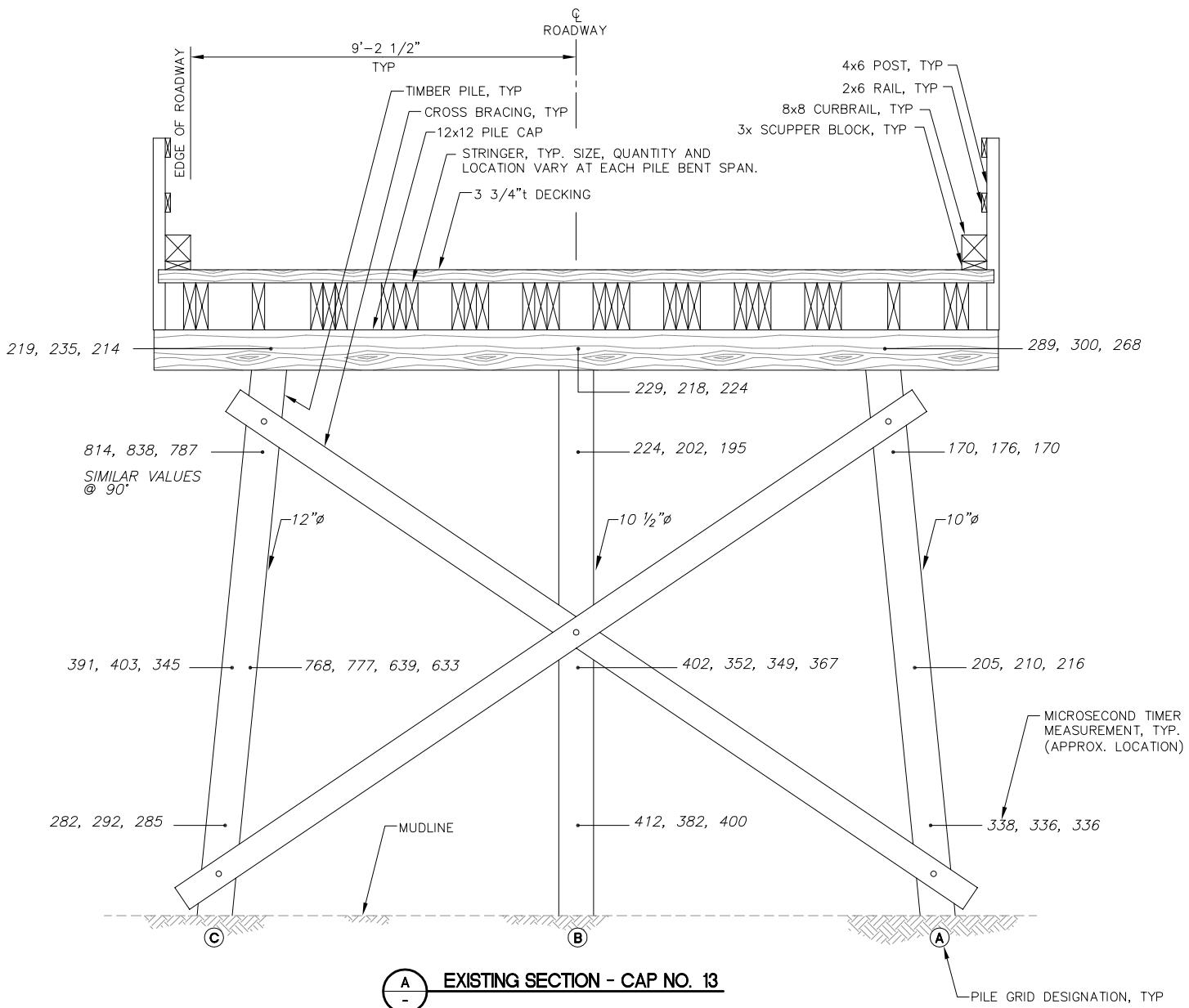
**NOTES:**

PILE B= VERY SOFT SURFACE CHECKS 2" OUTSIDE DELAM SIGNIFICANT CHECKS @ SURFACE, APPEARS TO HAVE AN INTERIOR CHECK/SPLIT IN ONE DIRECTION NEAR MID POINT OF PILE

PILE C= CHECKS @ SURFACE

UNISTRUTS ARE RUSTED

NOTE ALL CAPS WERE TESTED @ BOTTOM 1/2 OF CAP

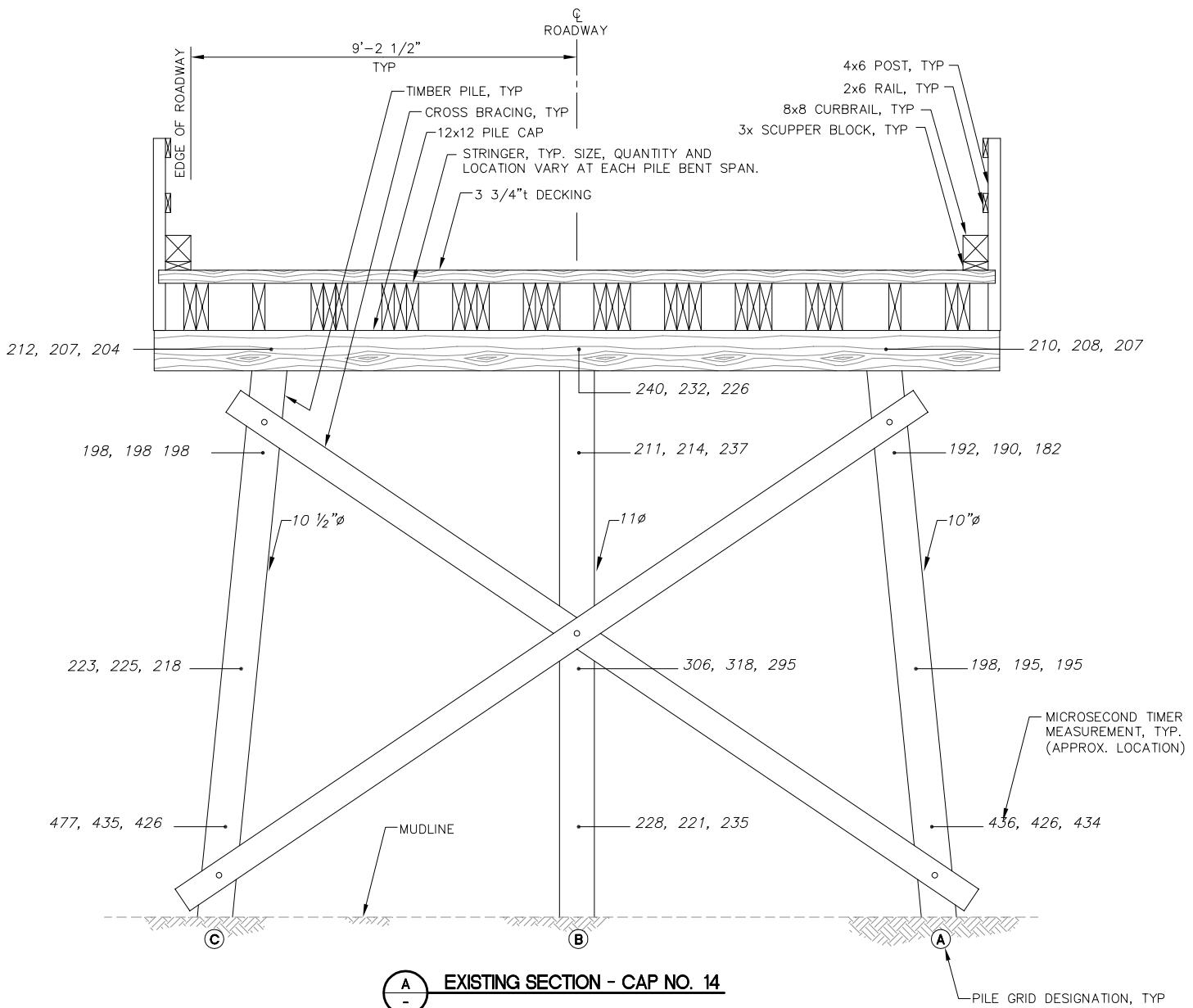


**NOTES:**

PILE C= LARGE CHECKS @ TOP; CHECK UP TO 3" DEEP @ TOP

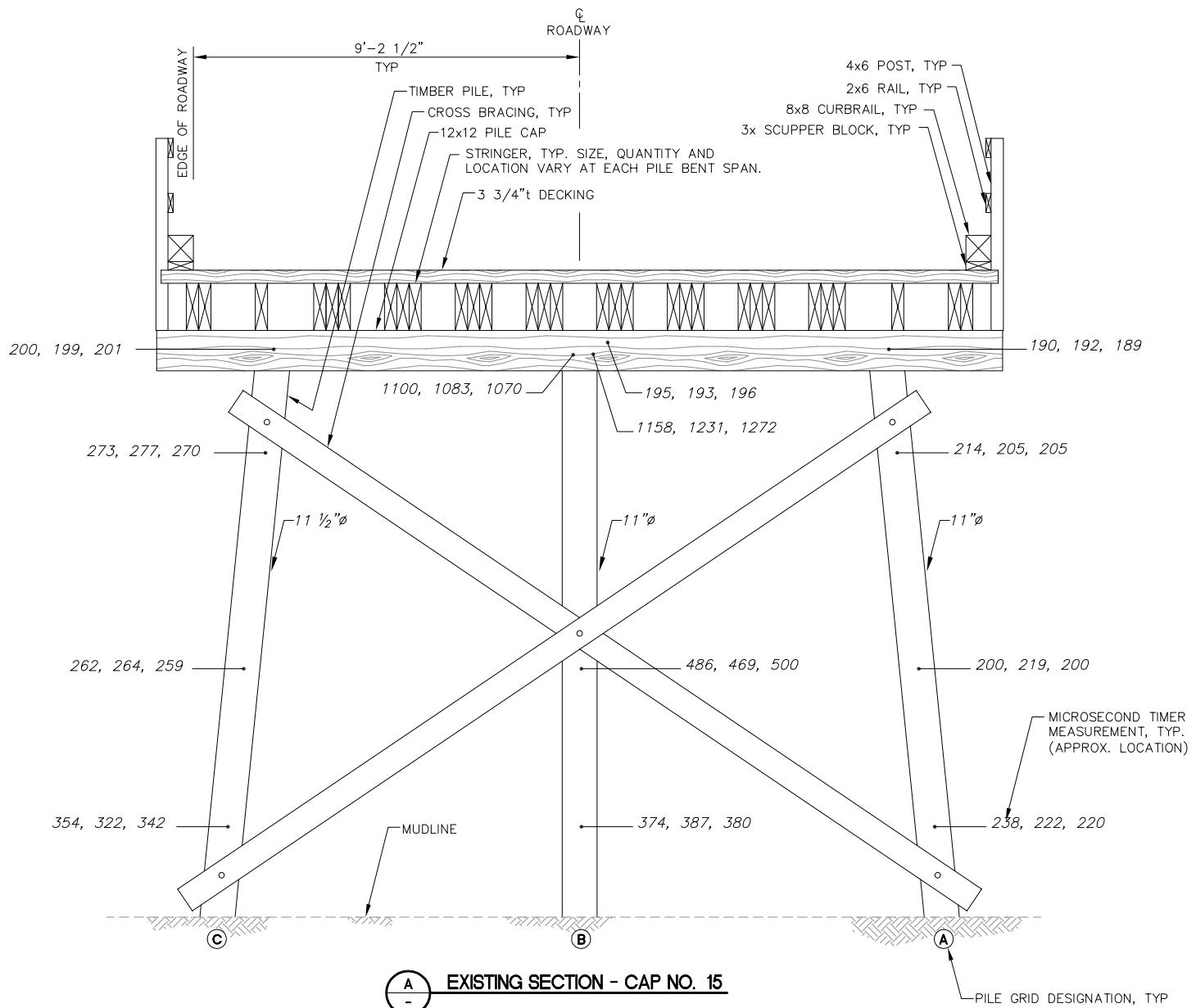
UNISTRUTS ARE RUSTED

NOTE ALL CAPS WERE TESTED @ BOTTOM 1/2 OF CAP



**NOTES:**

CAP HAS MINOR CHECKS ALONG BOTTOM OF MEMBER  
 PILE B HAS LARGE CHECK @ TOP; MISSING TAR PAPER  
 UNISTRUTS ARE RUSTED  
 NOTE ALL CAPS WERE TESTED @ BOTTOM 1/2 OF CAP

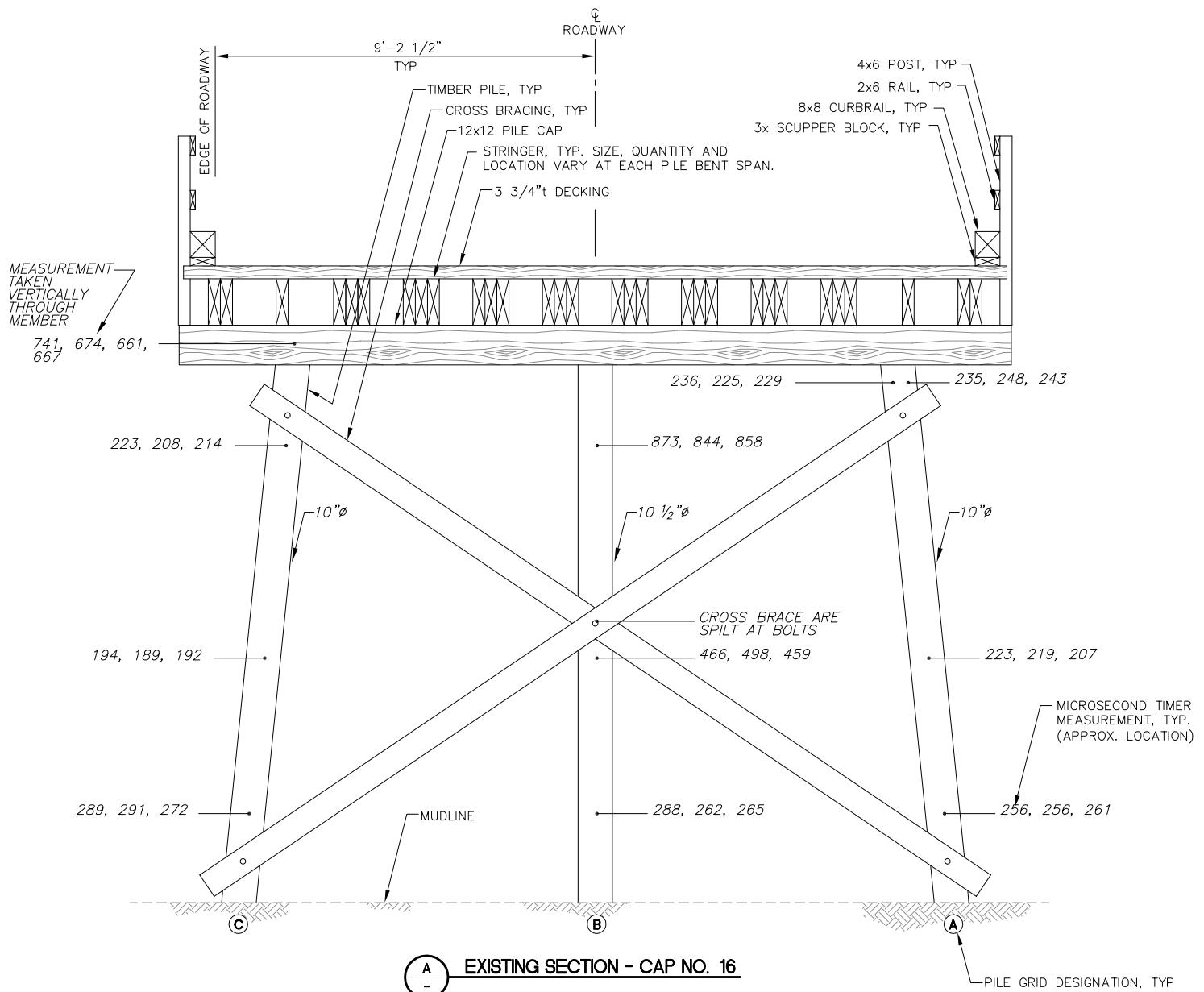


**NOTES:**

PILE C = SURFACE IS SOFT  
PILE B HAS LARGE SPLIT/ CHECKS @ TOP HALF OF PILE; CREOSOTE APPEARS GONE FROM SURFACE @ TOP HALF OF PILE, PILE NOT BEARING ON CAP (LOOSE)

UNISTRUTS ARE RUSTED

NOTE ALL CAPS WERE TESTED @ BOTTOM 1/2 OF CAP



**NOTES:**

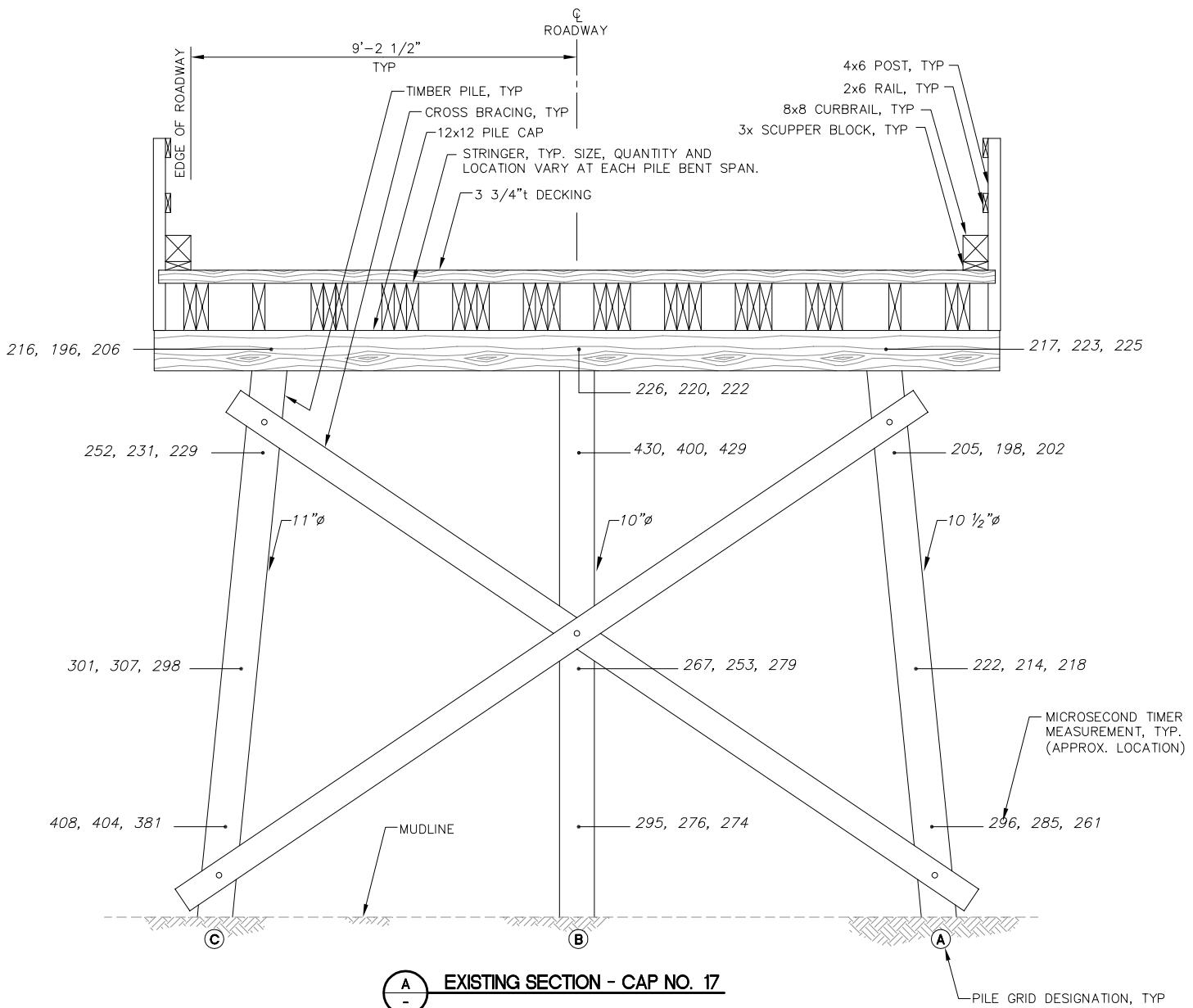
PILE C HAS SURFACE CHECKS/ SECTIONAL LOSS ON SURFACE; CHECKS @ TOP

CAP HAS LARGE AREA OF WHITE & RED STAINING NEAR PILE B ALMOST APPEARS BOLT RUST FROM BOLTS USED TO SISTER THE CAP ARE STAINING THE BOTTOM OF CAP

PILE B SOUNDS SOFT@ MID SECTION; TOP IS SPLIT/CHEKCED SIGNIFICANTLY

UNISTRUTS ARE RUSTED

NOTE ALL CAPS WERE TESTED @ BOTTOM 1/2 OF CAP



**NOTES:**

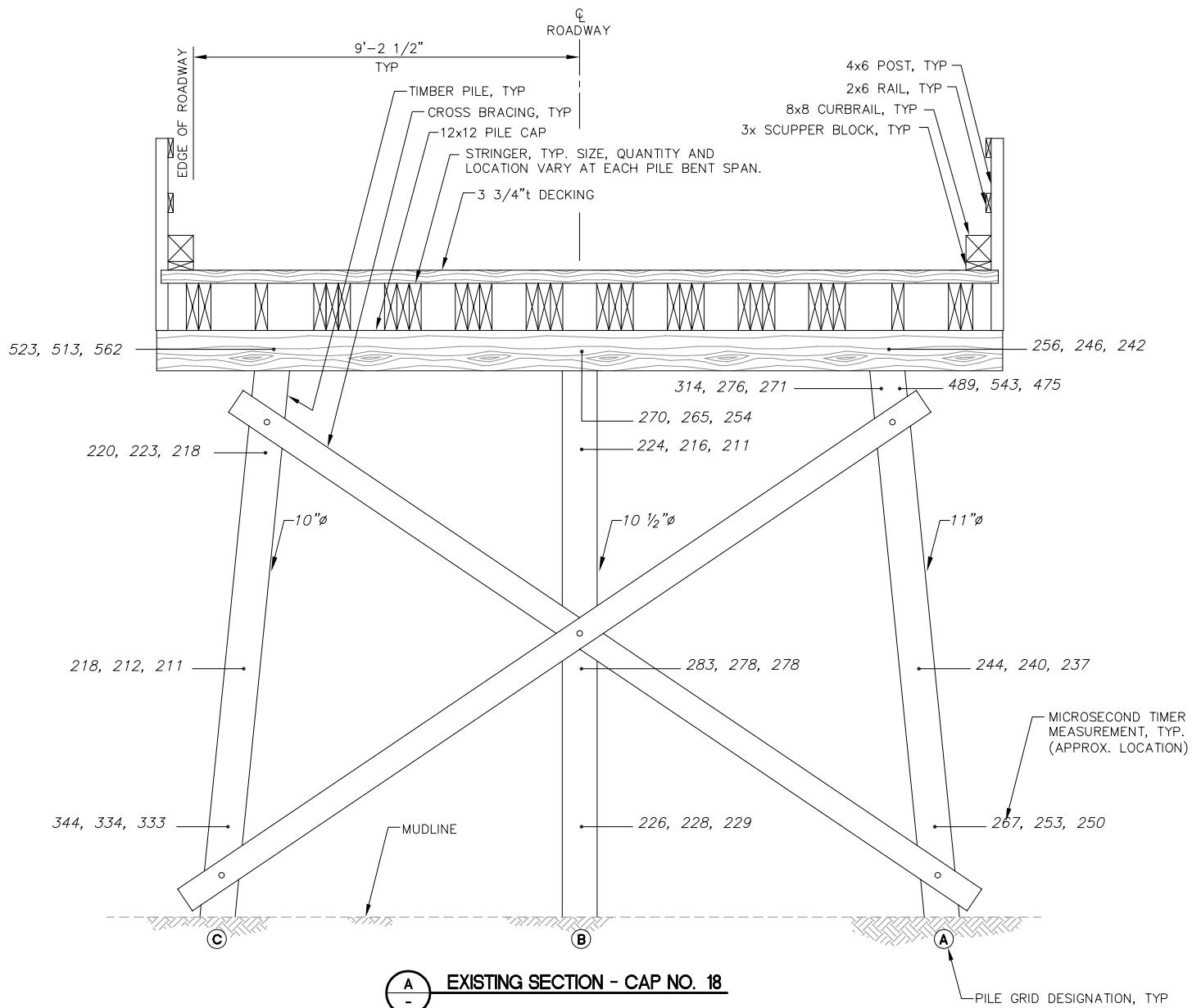
PILE A WAS SOFT @ BOTTOM; MINOR TO SIGNIFICANT CHECKS; HOLE @ EYE LEVEL 3" DEEP 6" LONG 2" WIDE

PILE B SMALL CHECKS @ TOP

PILE C CHECKED FULL LENGTH W/ SMALL CHECKS GREEN GROWTH OVER BLACK CREOSOTE

UNISTRUTS ARE RUSTED

NOTE ALL CAPS WERE TESTED @ BOTTOM 1/2 OF CAP



**NOTES:**

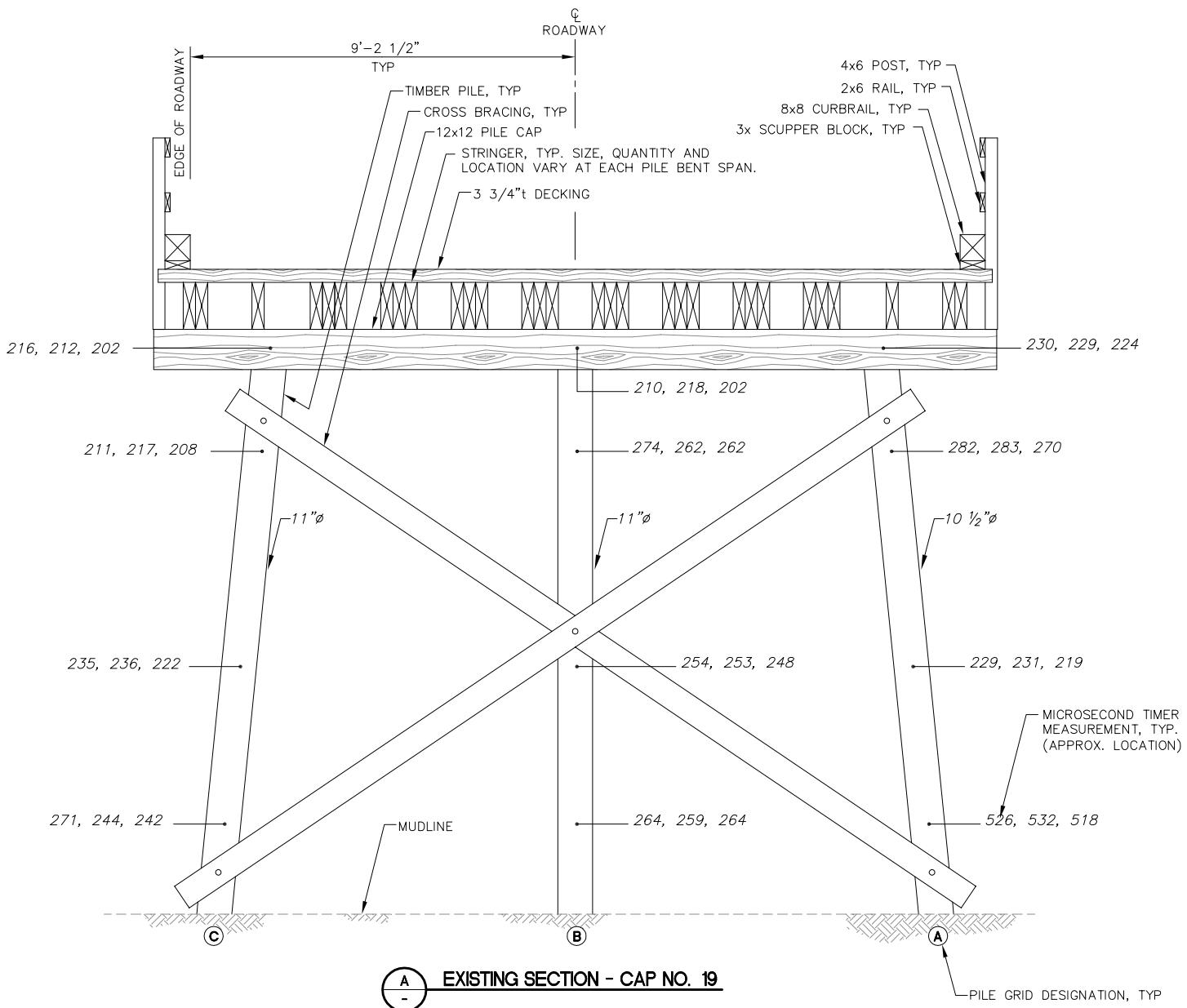
PILE A= GREEN GROWTH; BIG CHECKS @ TOP; CAP SHAKES WHEN VEHICLES PASS OVER; CAP IS SISTERED TESTED BOTTOM 1" OF CAP

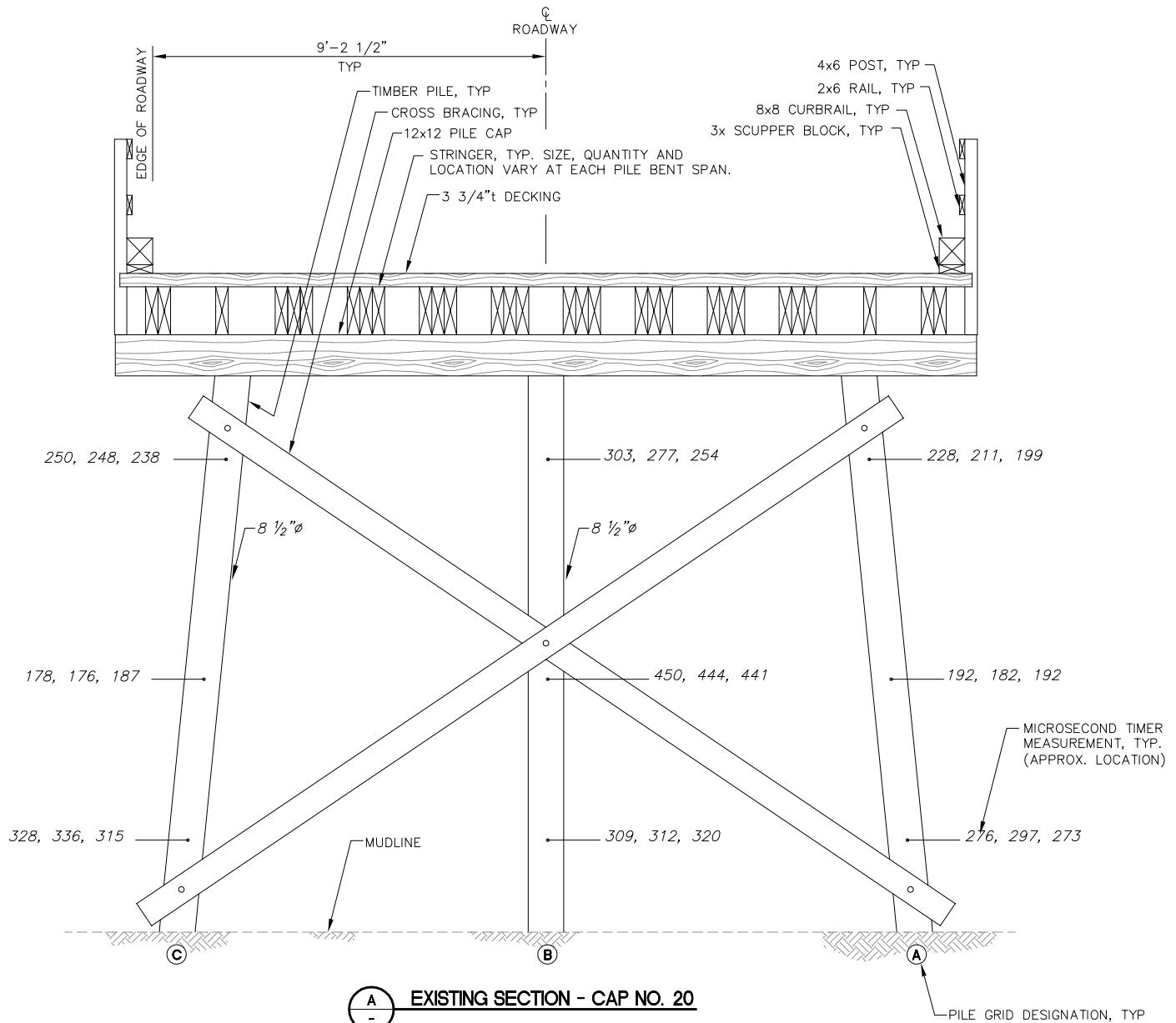
PILE B= SURFACE CHECKS, MINOR PILE DAMAGE @ MID HEIGHT OF PILE

PILE C= CAP HAS STAIN & DAMAGE TO UNDER SIDE

UNISTRUTS ARE RUSTED

NOTE ALL CAPS WERE TESTED @ BOTTOM 1/2 OF CAP





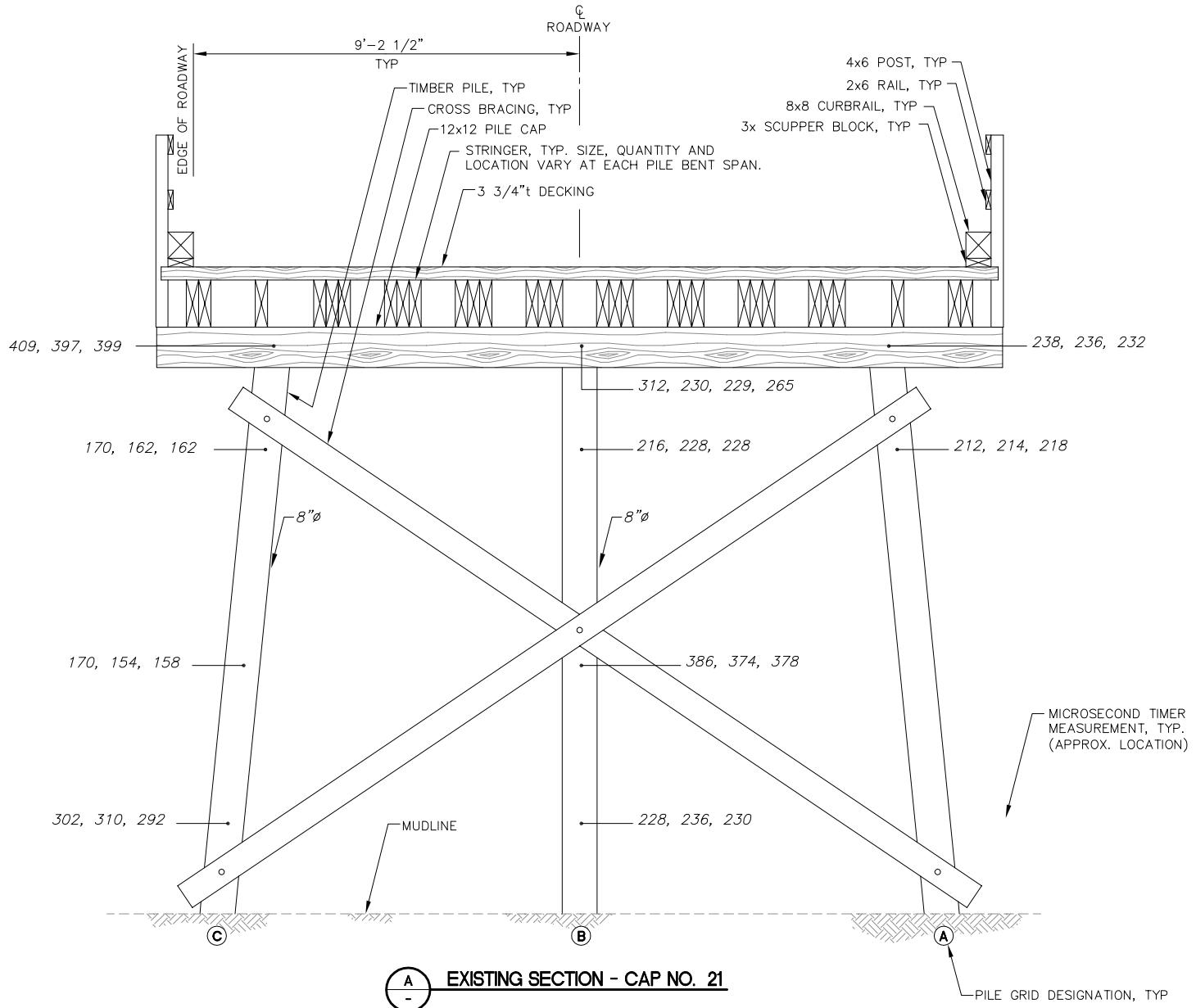
**NOTES:**

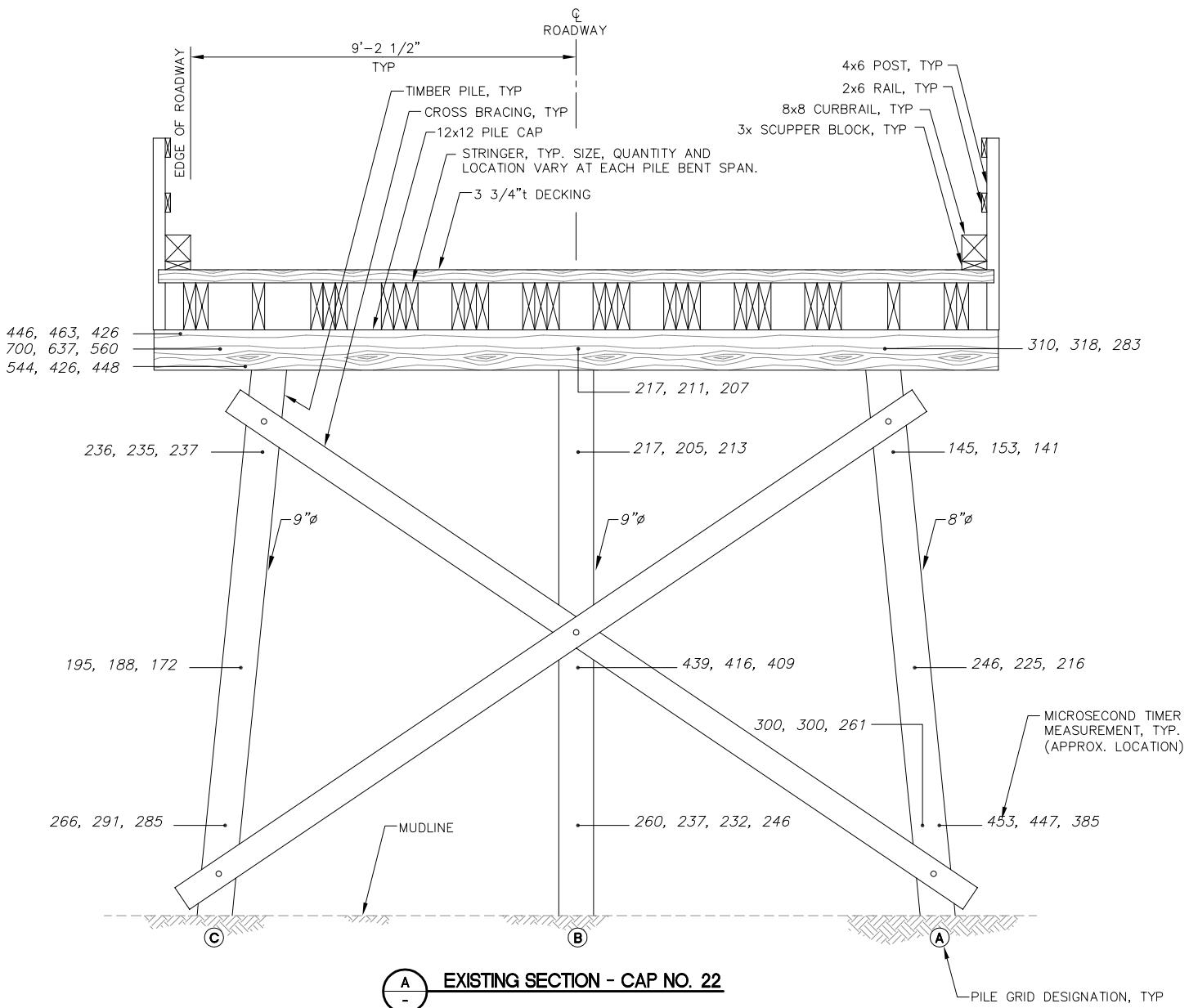
PILE A FEELS SOFT @ BOTTOM; SISTERED PILE CAP; CAP APPEARS TO HAVE STAINING ON BOTTOM NEAR CHECKS; SISTER SPACER BLOCK BETWEEN BOLT & SISTER BEAM IS SPLIT & FALLING APART

PILE C HAS A LARGE CHECK @ TOP

UNISTRUTS ARE RUSTED

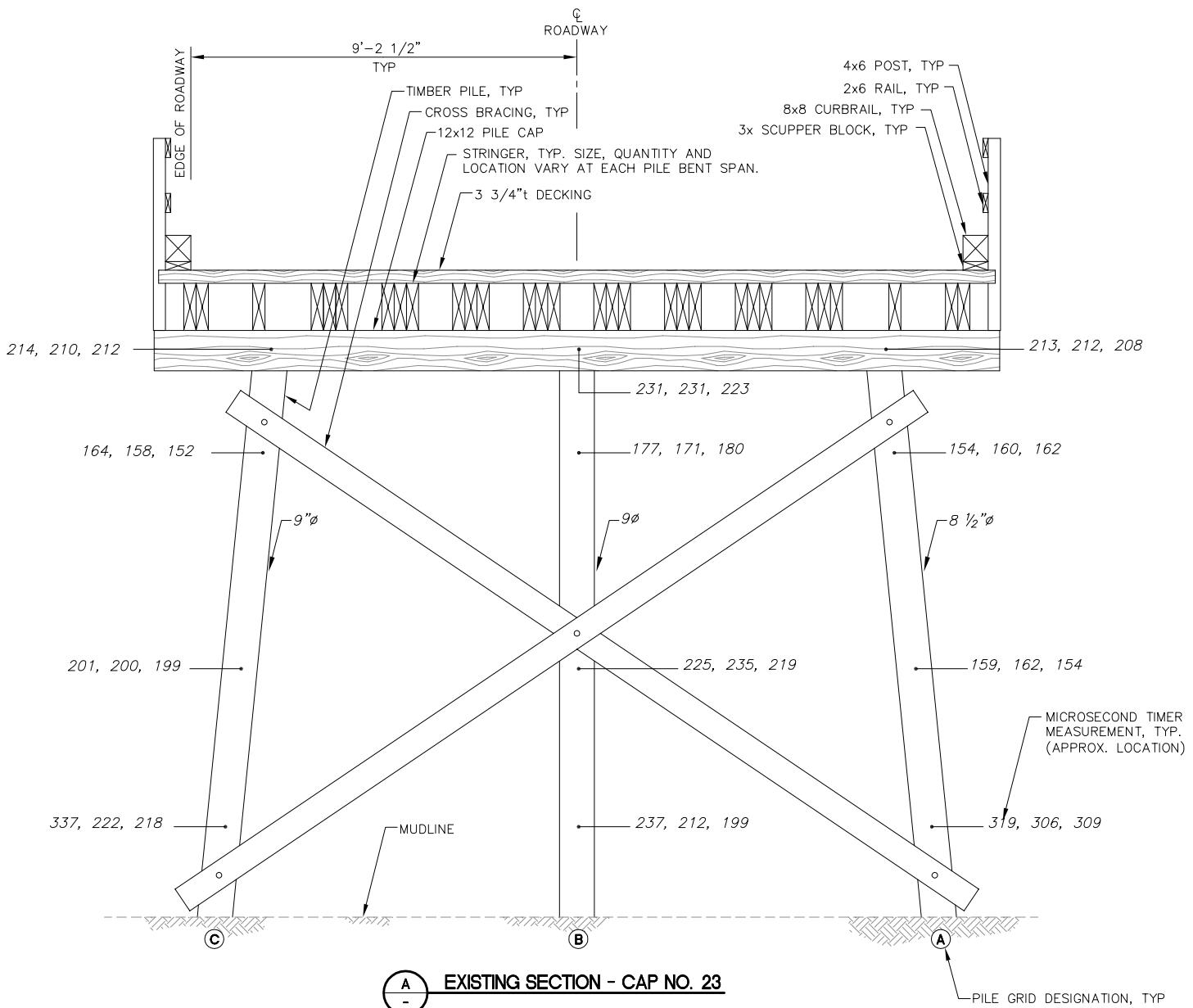
NOTE ALL CAPS WERE TESTED @ BOTTOM 1/2 OF CAP

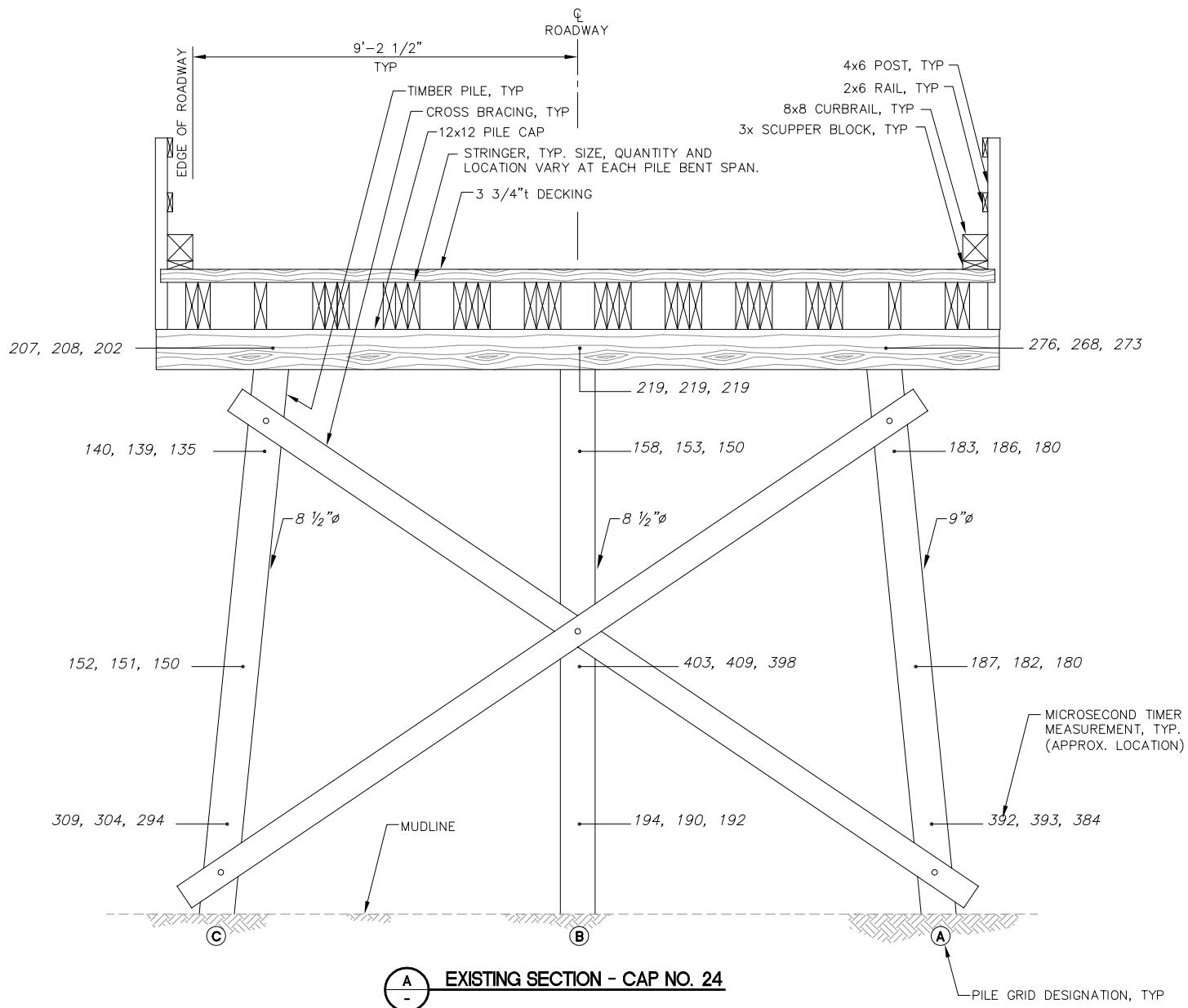




**NOTES:**

LARGE CHECK @ BOTTOM OF PILE A  
UNISTRUTS ARE RUSTED  
NOTE ALL CAPS WERE TESTED @ BOTTOM 1/2 OF CAP

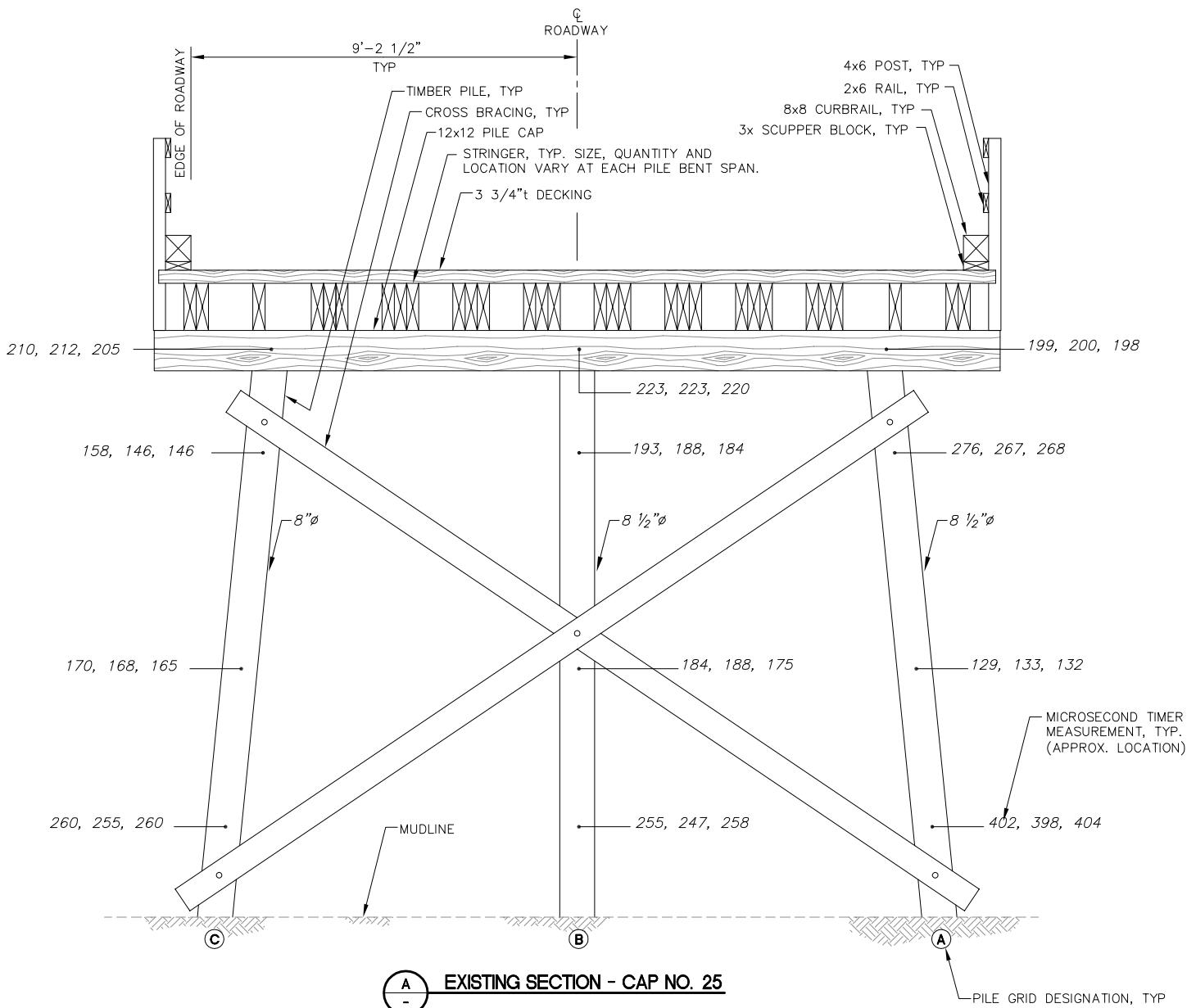




**NOTES:**

UNISTRUTS ARE RUSTED

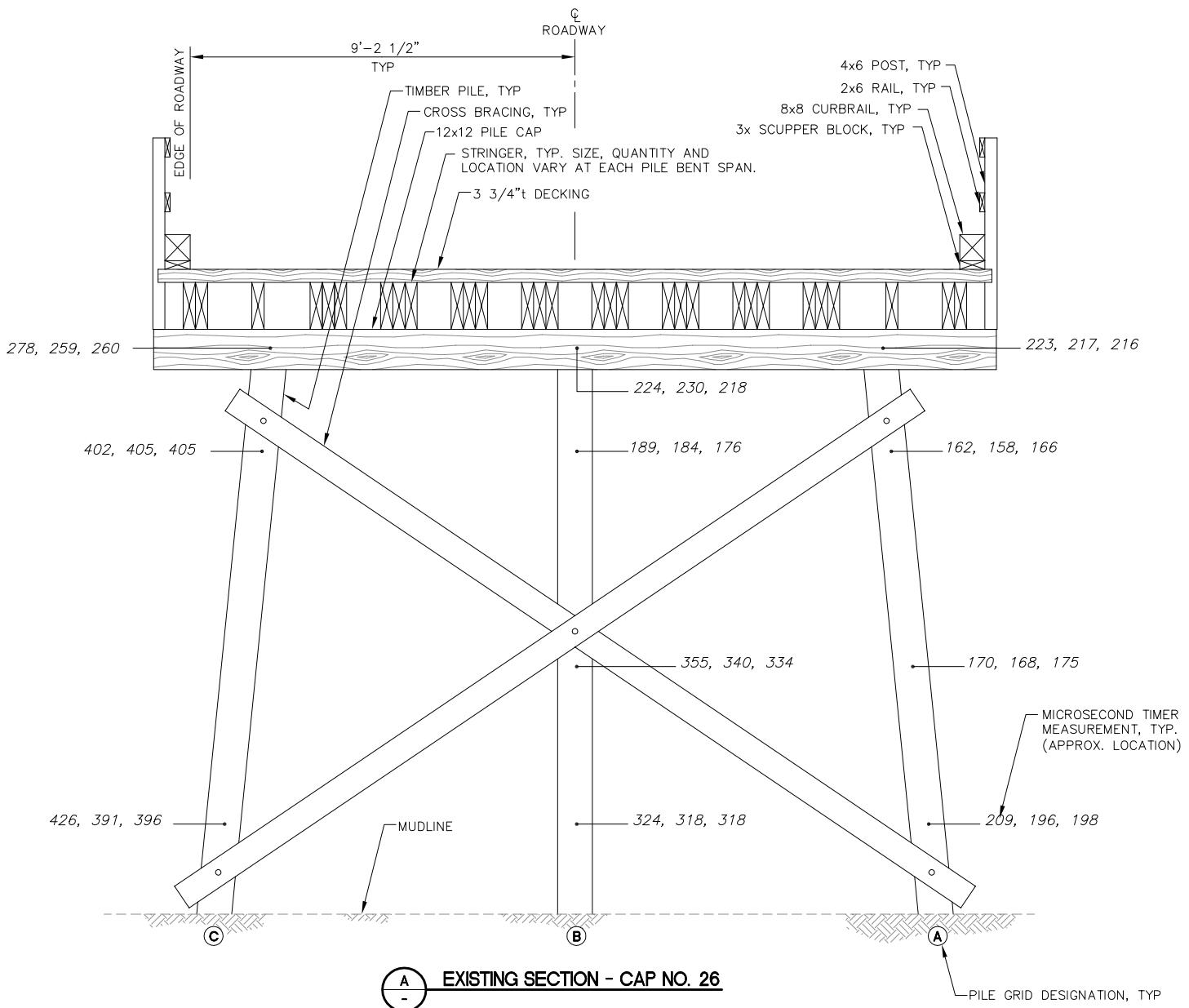
NOTE ALL CAPS WERE TESTED @ BOTTOM 1/2 OF CAP

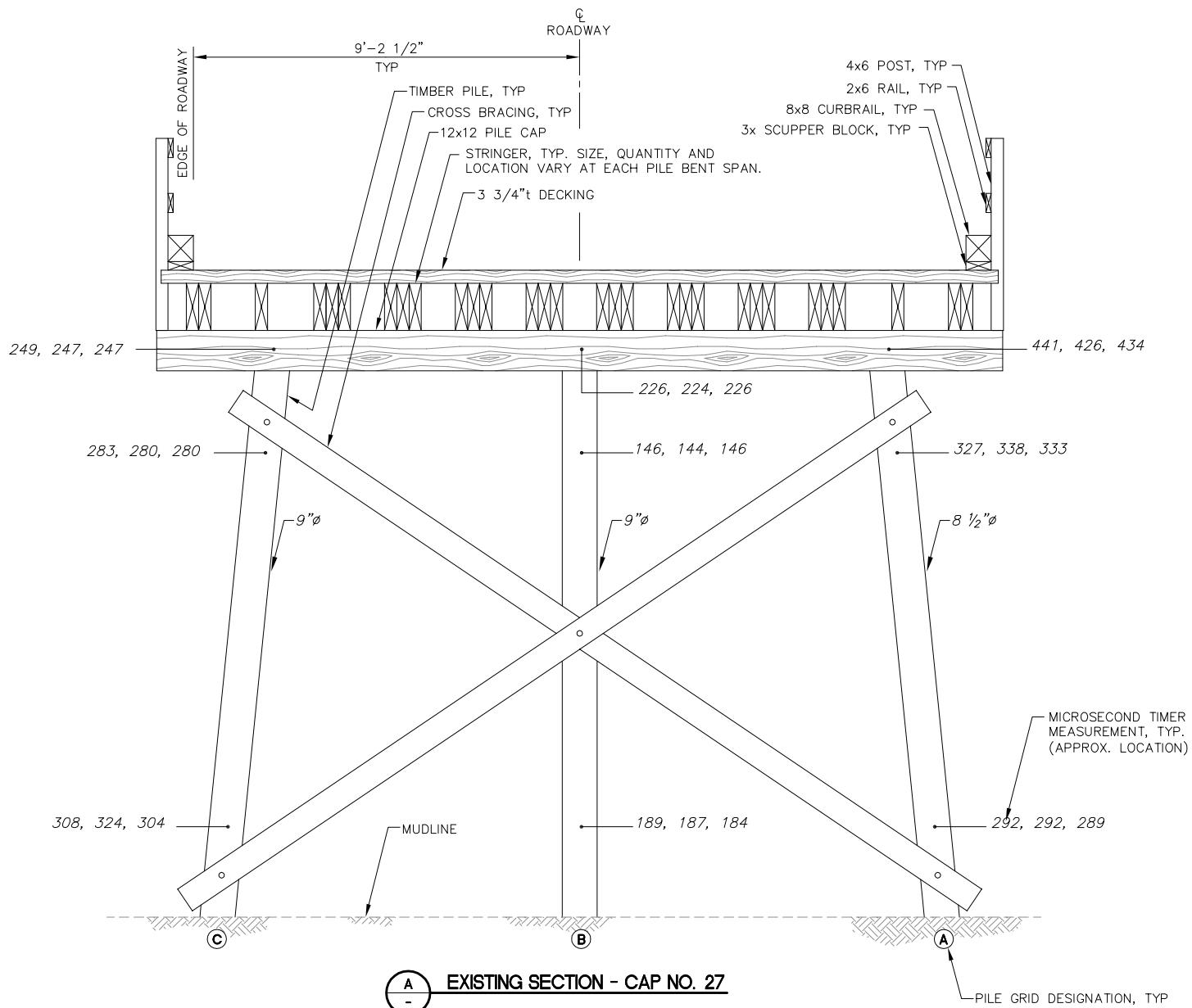


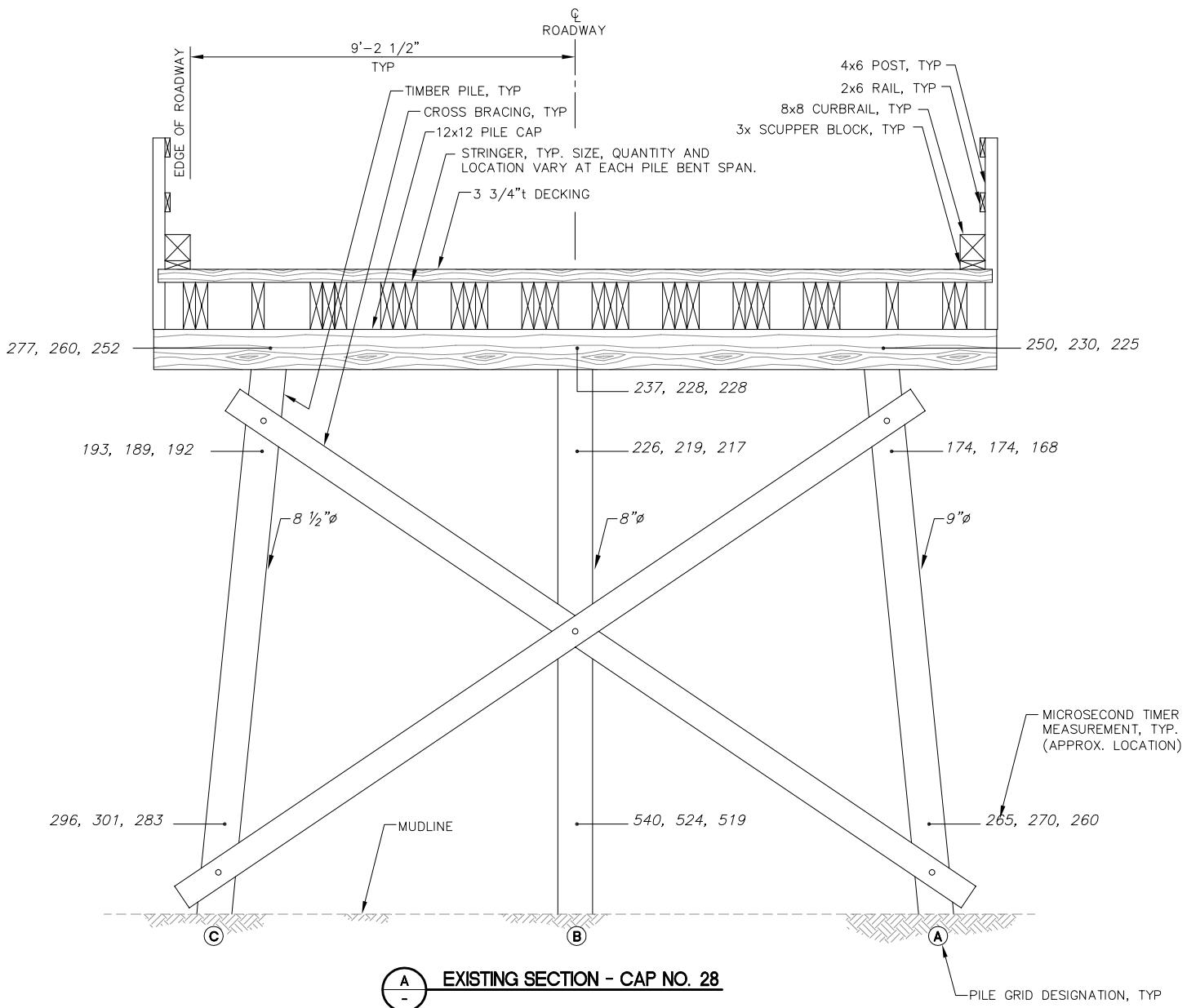
**NOTES:**

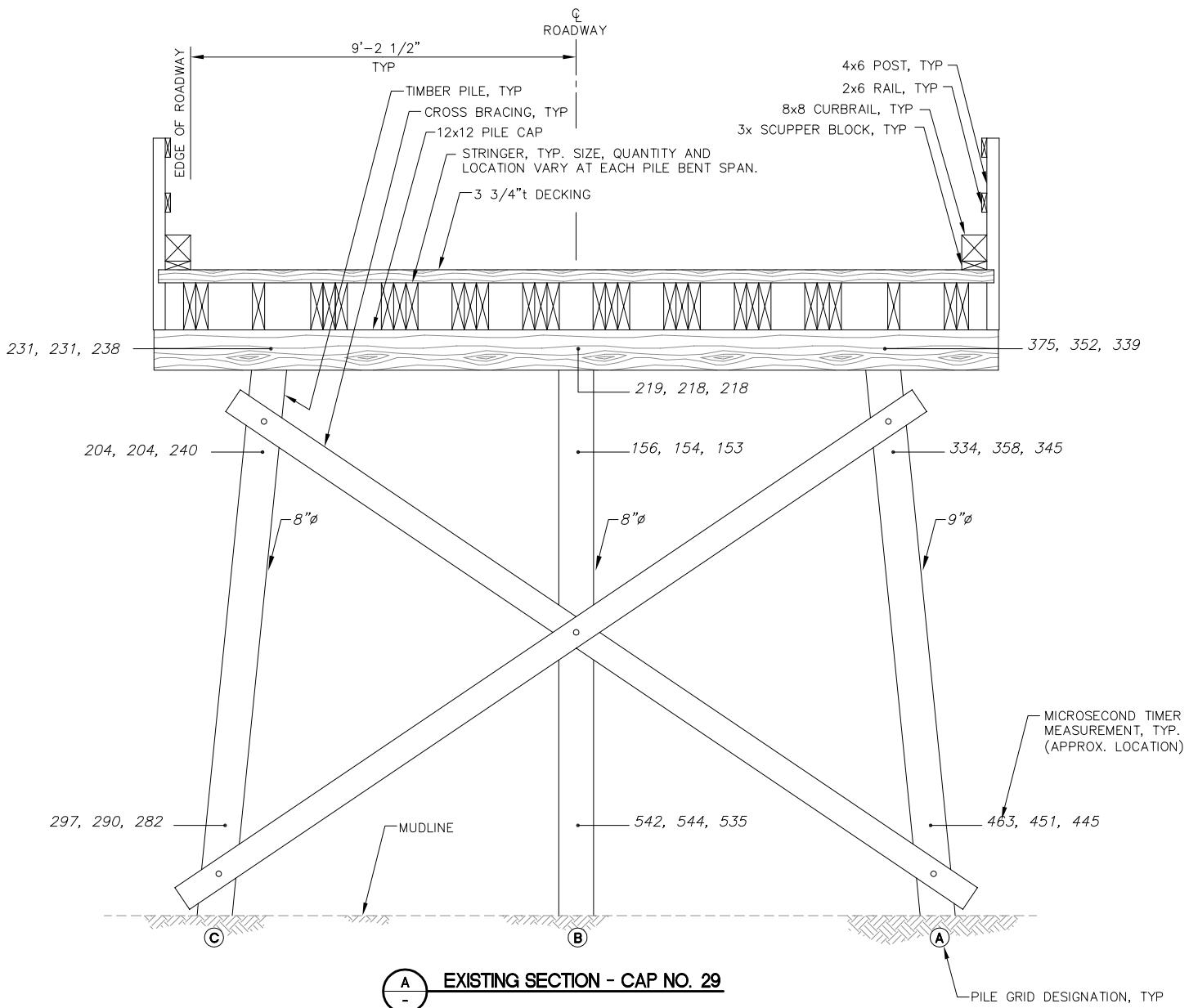
UNISTRUTS ARE RUSTED

NOTE ALL CAPS WERE TESTED @ BOTTOM 1/2 OF CAP







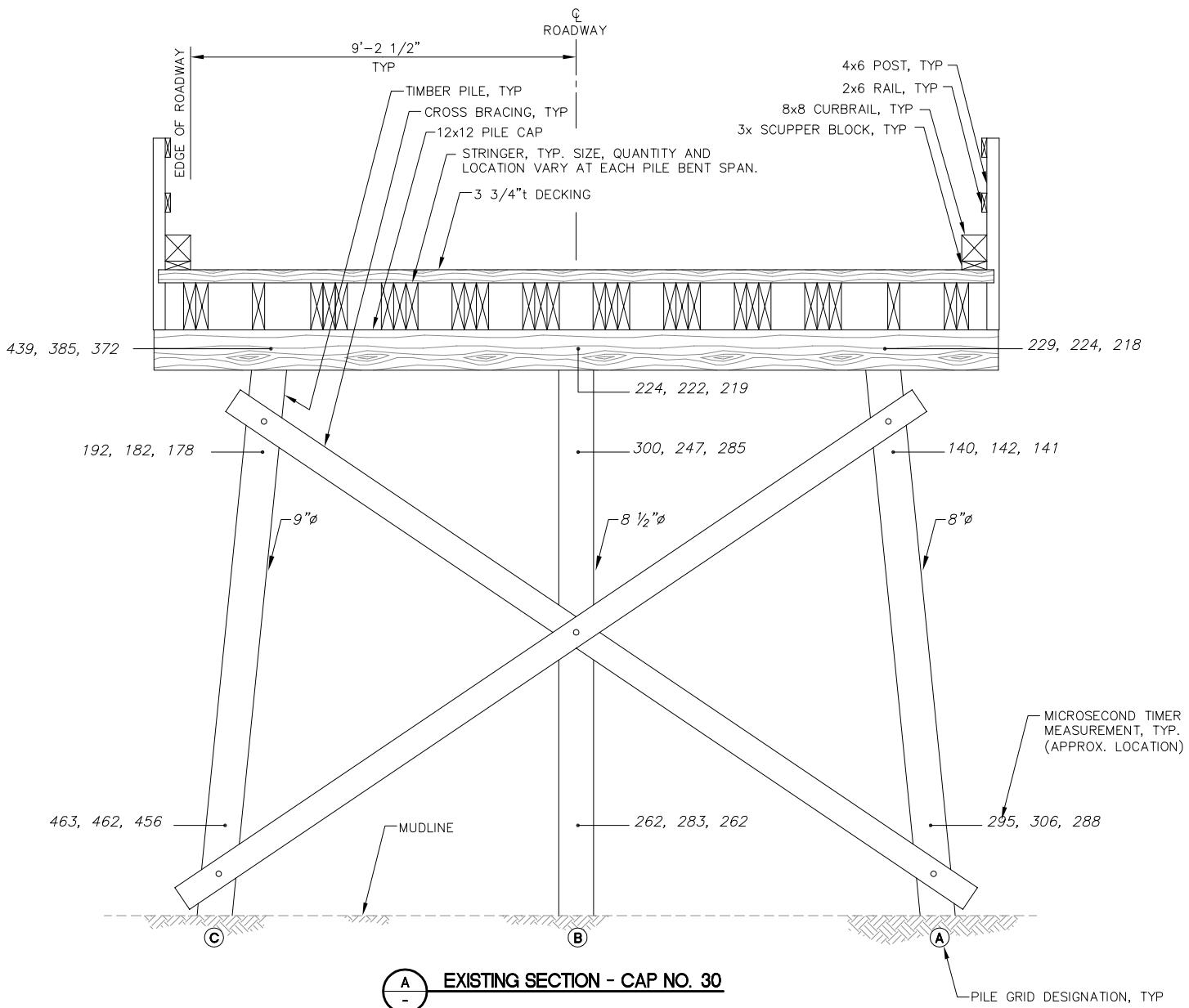


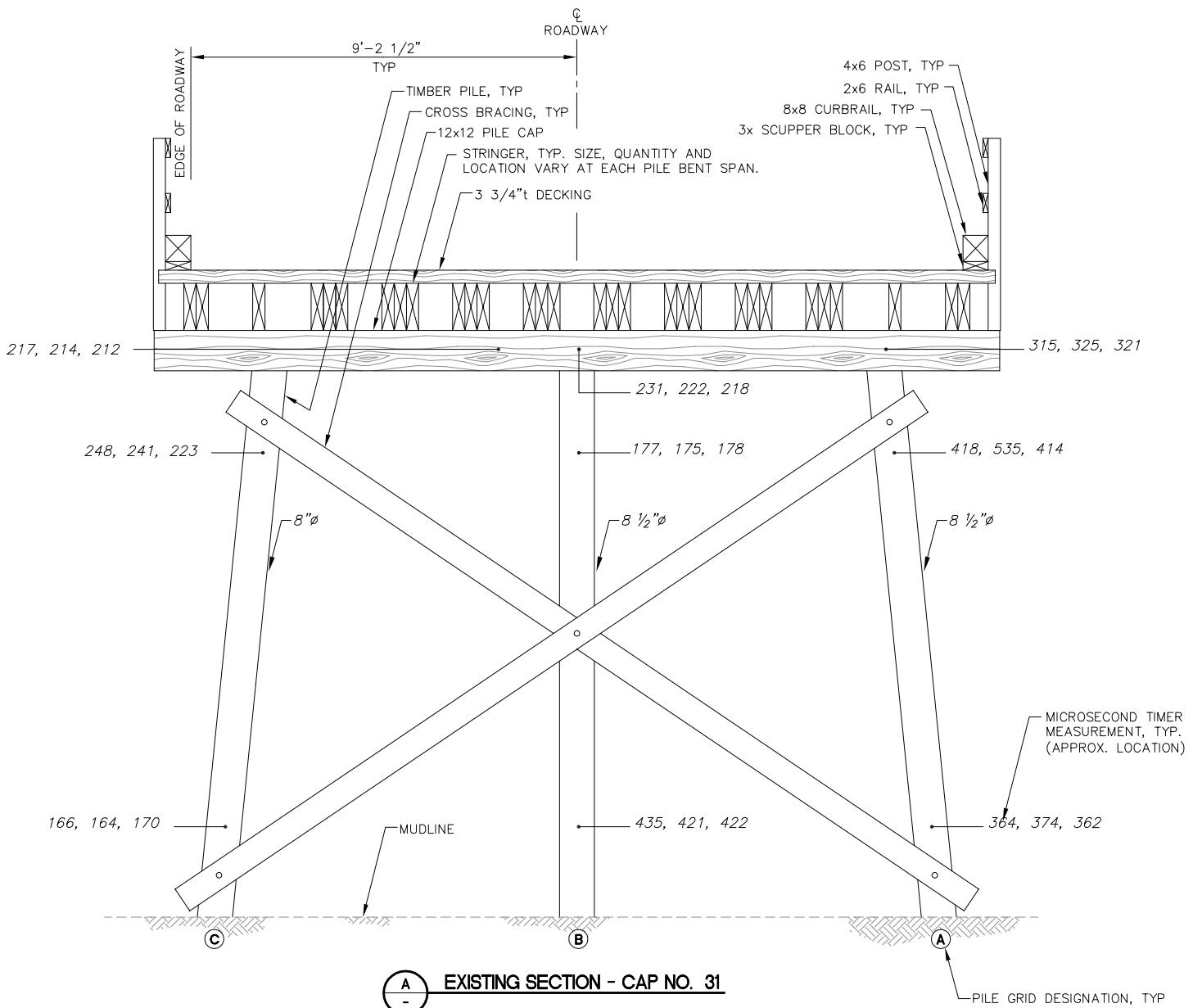
**NOTES:**

CAP OFF CENTER FROM PILES C & B

UNISTRUTS ARE RUSTED

NOTE ALL CAPS WERE TESTED @ BOTTOM 1/2 OF CAP



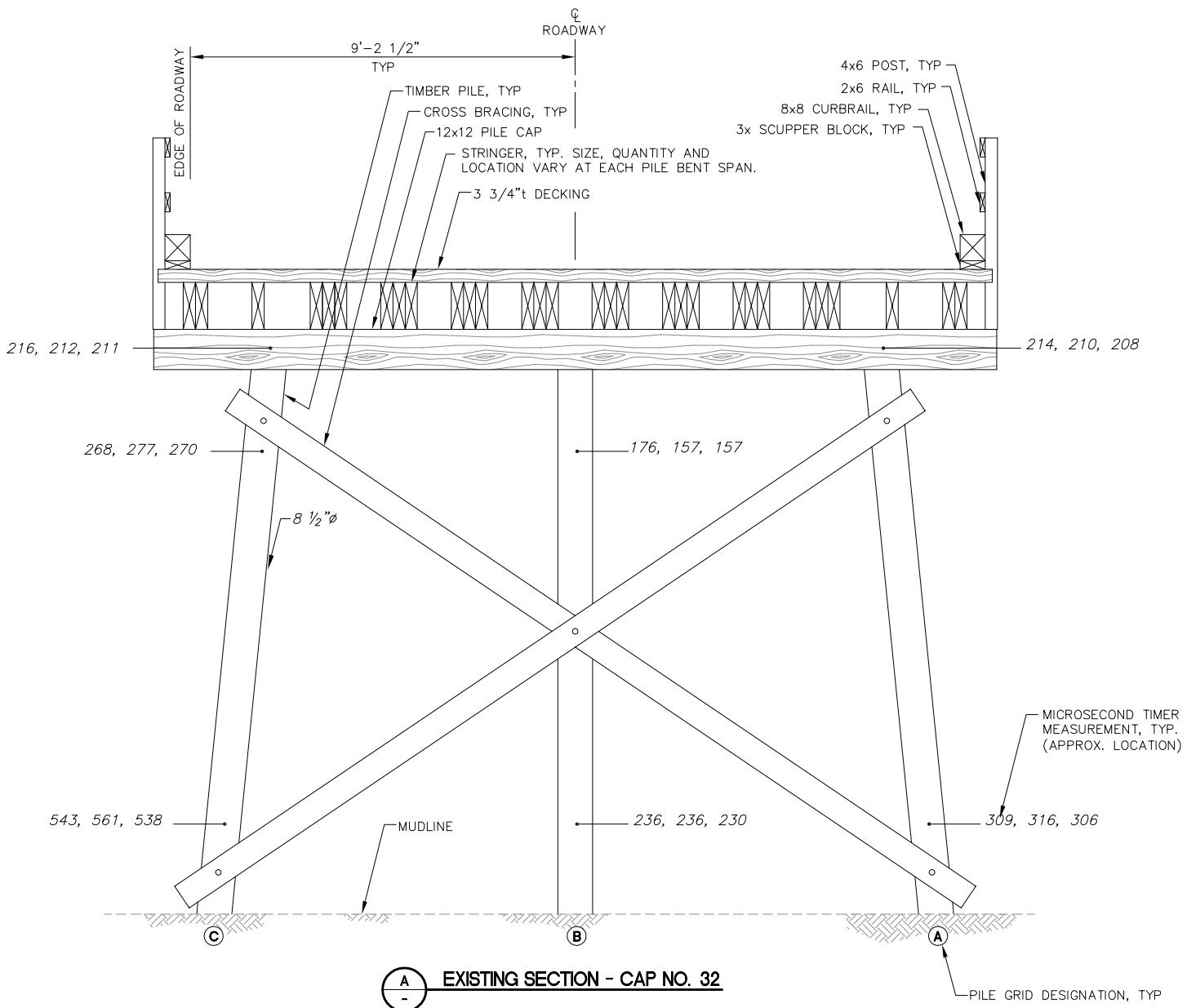


**NOTES:**

B CAP IS OFF SET FROM CENTER OF PILE

UNISTRUTS ARE RUSTED

NOTE ALL CAPS WERE TESTED @ BOTTOM 1/2 OF CAP

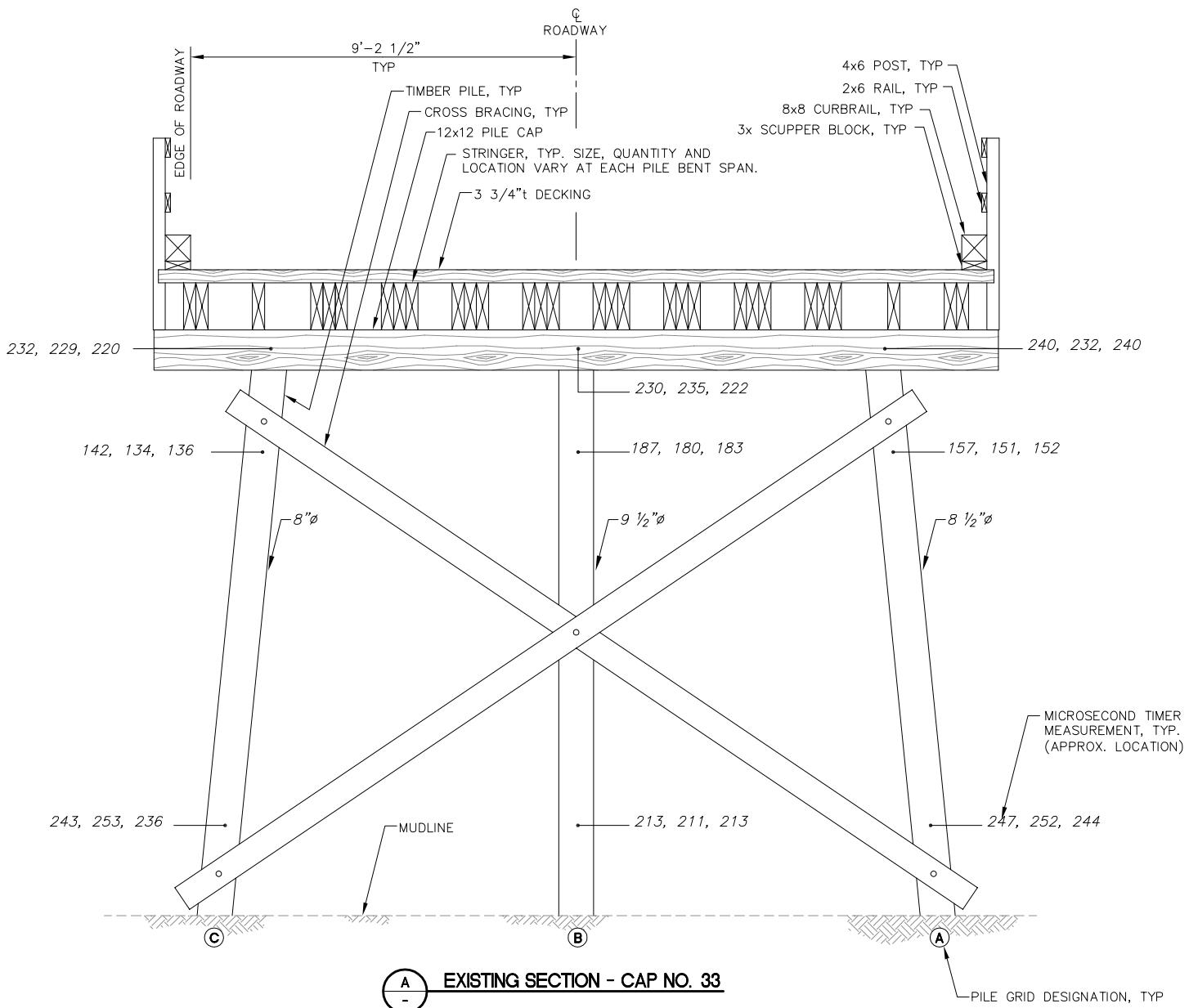


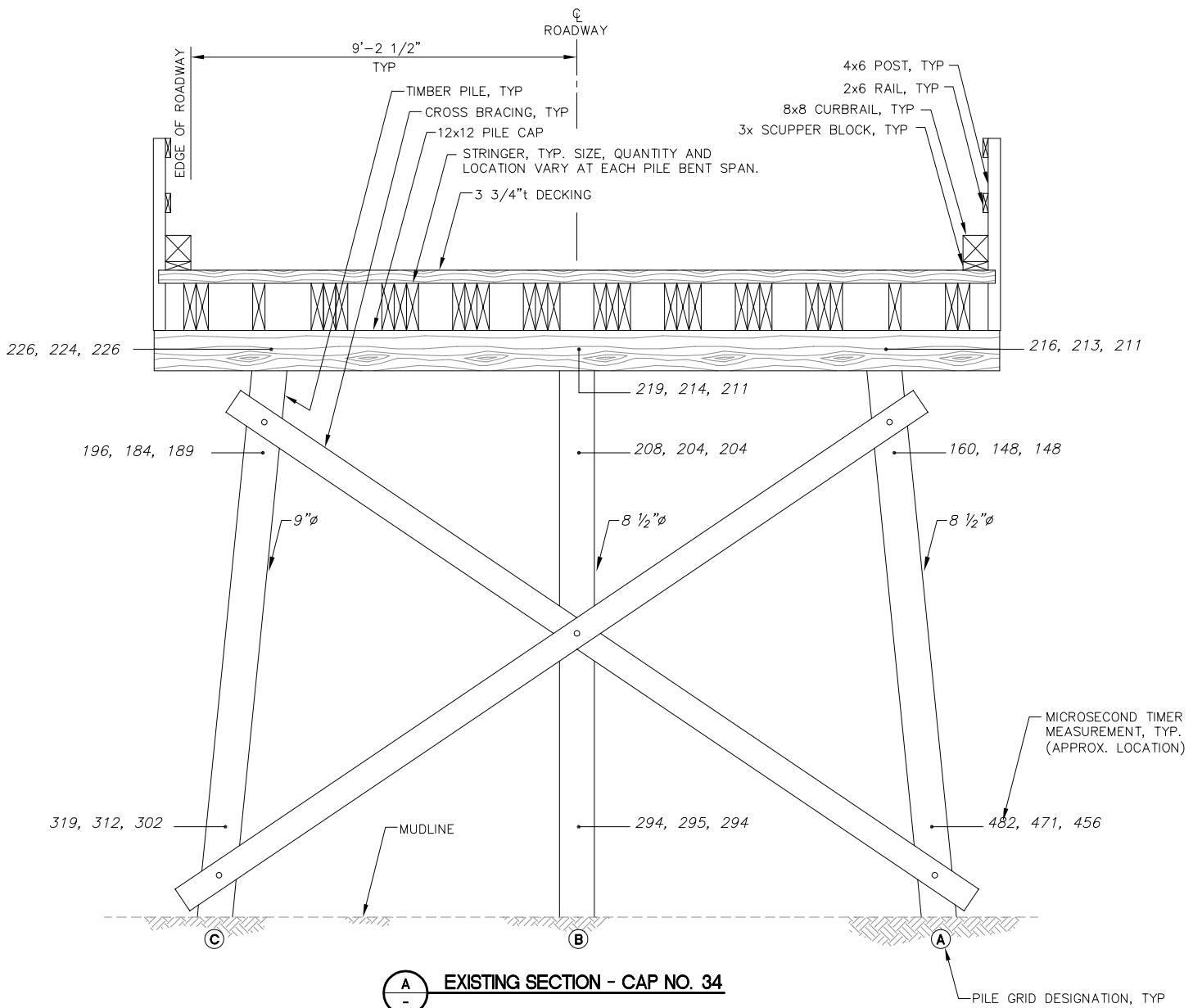
**NOTES:**

LONGITUDINAL BRACING STARTS

UNISTRUTS ARE RUSTED

NOTE ALL CAPS WERE TESTED @ BOTTOM 1/2 OF CAP





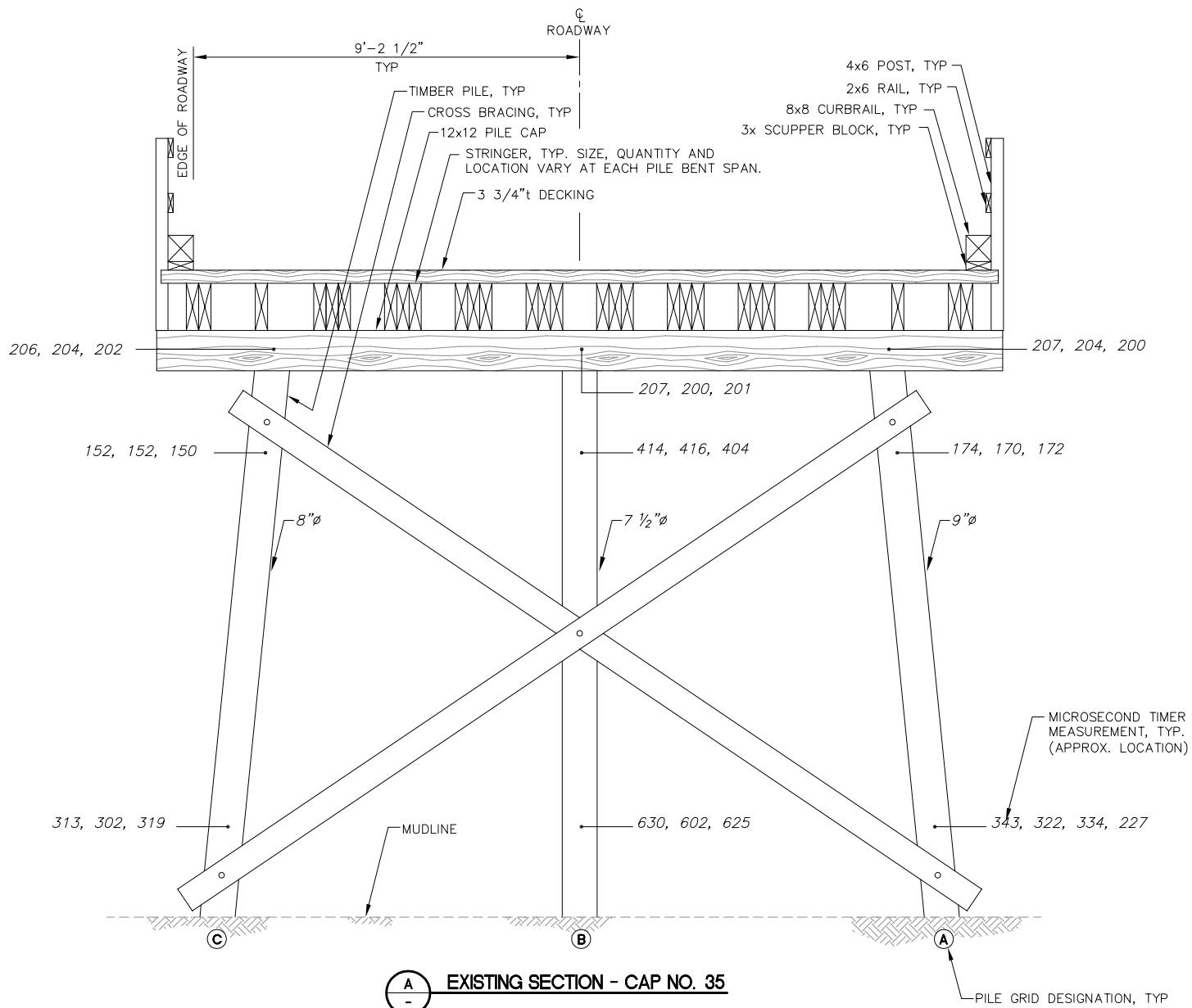
**NOTES:**

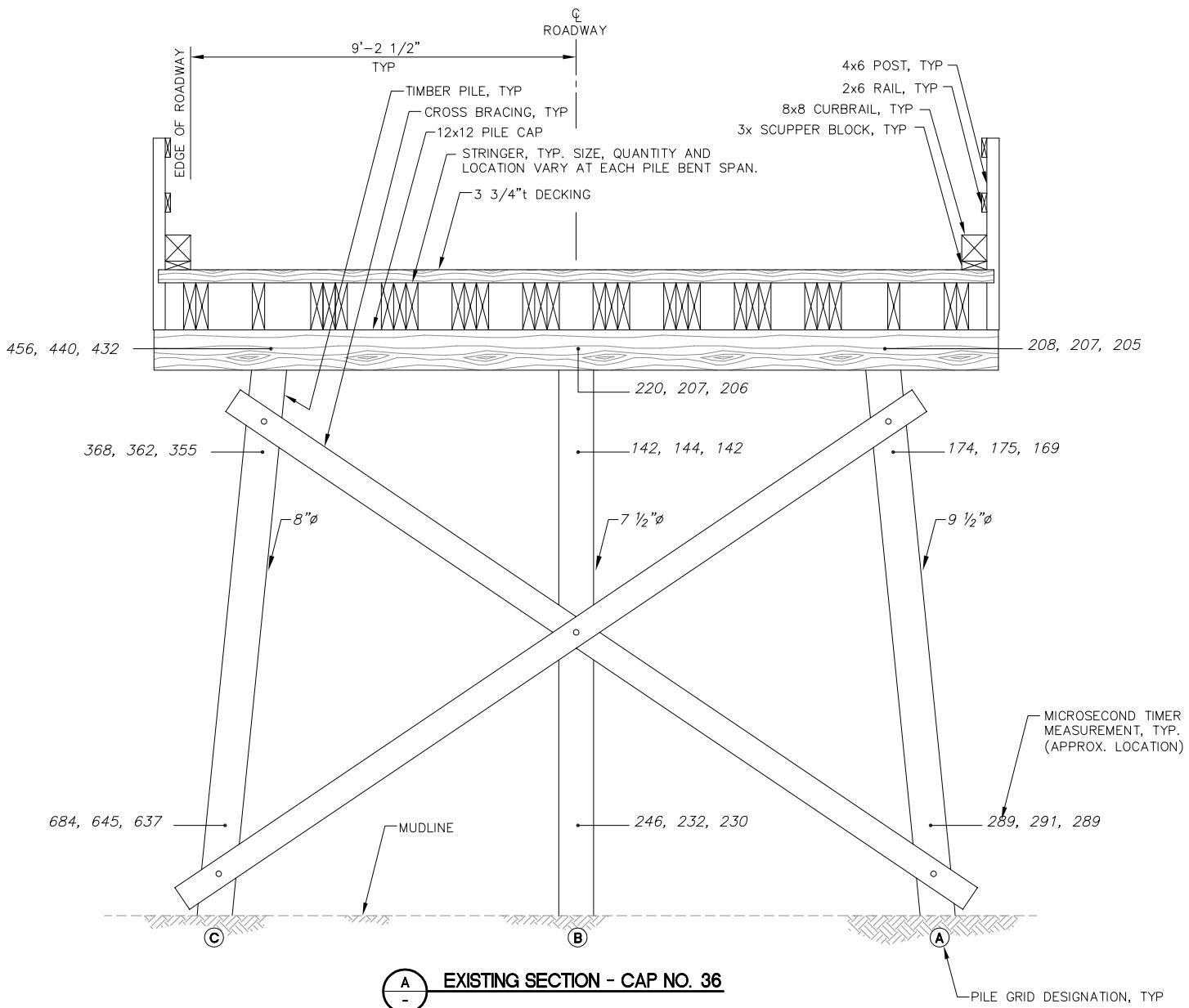
PILE B= SMALL CHECKS @ TOP

PILE A= CHECK @ TOP 3 1/2'

UNISTRUTS ARE RUSTED

NOTE ALL CAPS WERE TESTED @ BOTTOM 1/2 OF CAP





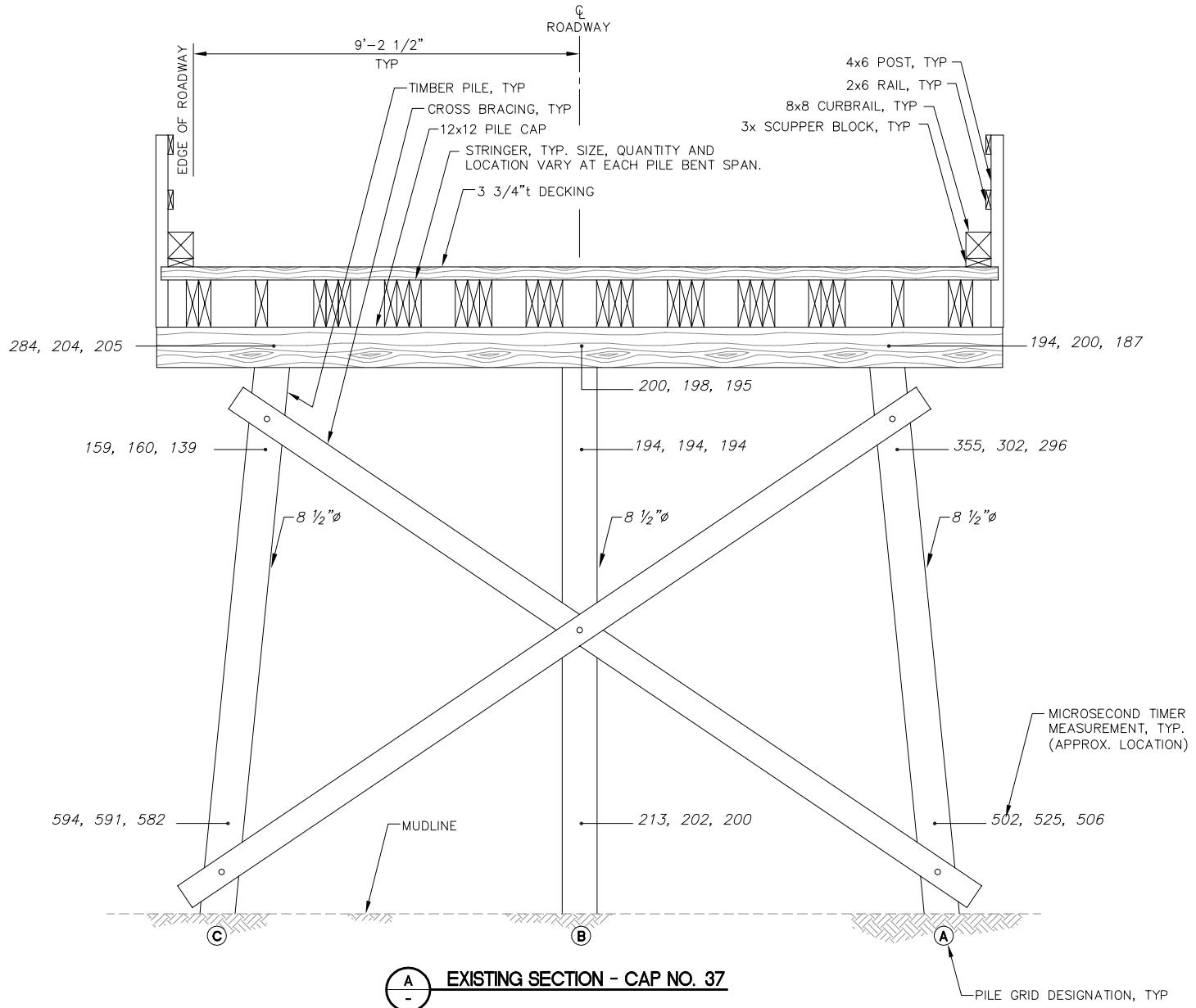
**NOTES:**

PILE B= DAMAGE @ TOP OF PILE

PILE A= LARGE CHECKS THROUGH OUT

UNISTRUTS ARE RUSTED

NOTE ALL CAPS WERE TESTED @ BOTTOM 1/2 OF CAP

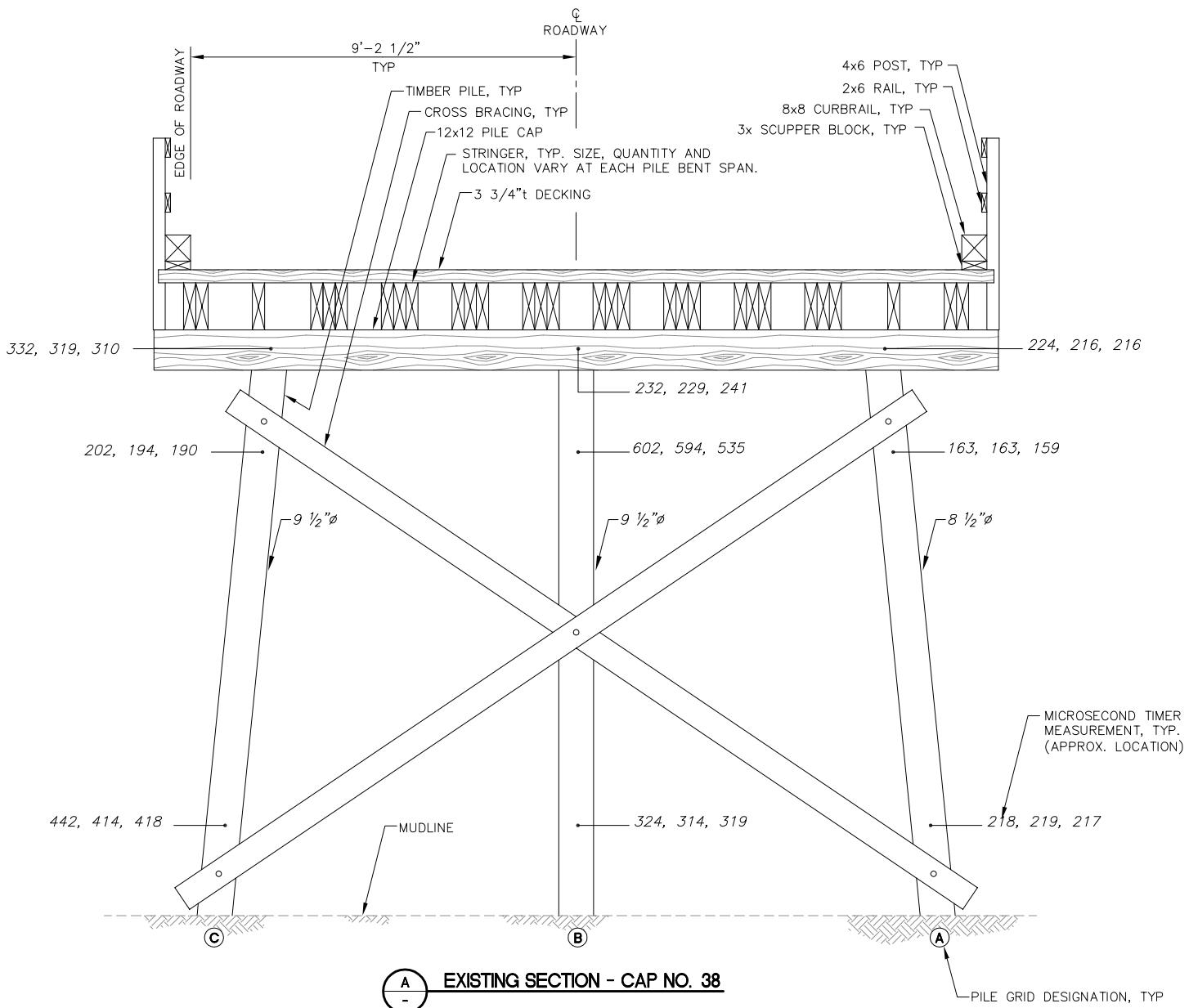


**NOTES:**

PILE A= LARGE CHECK @ TOP

UNISTRUTS ARE RUSTED

NOTE ALL CAPS WERE TESTED @ BOTTOM 1/2 OF CAP

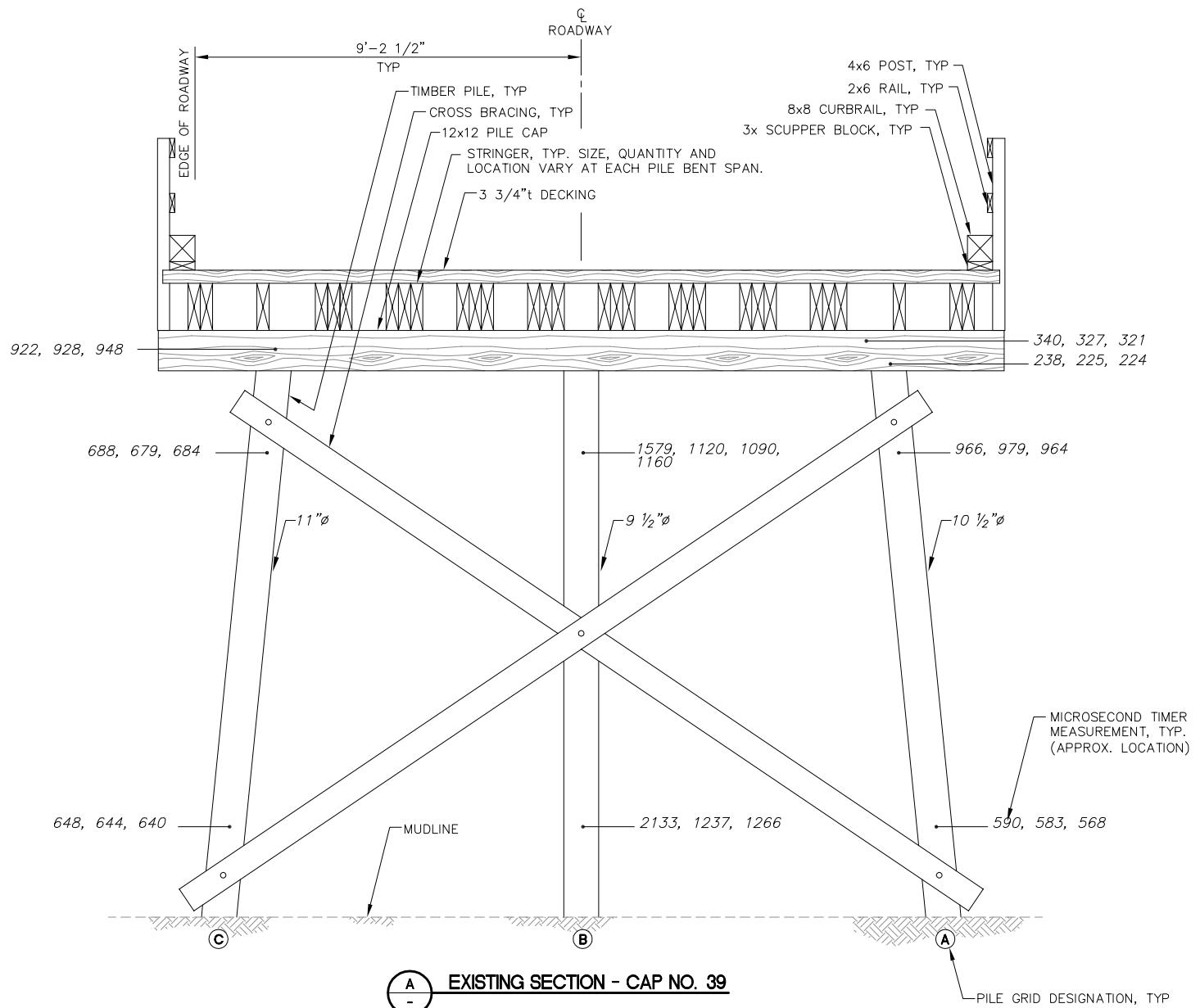


**NOTES:**

PILE B= END DAMAGE WITH SURFACE SHAKES@ TOP OF PILE

UNISTRUTS ARE RUSTED

NOTE ALL CAPS WERE TESTED @ BOTTOM 1/2 OF CAP



**NOTES:**

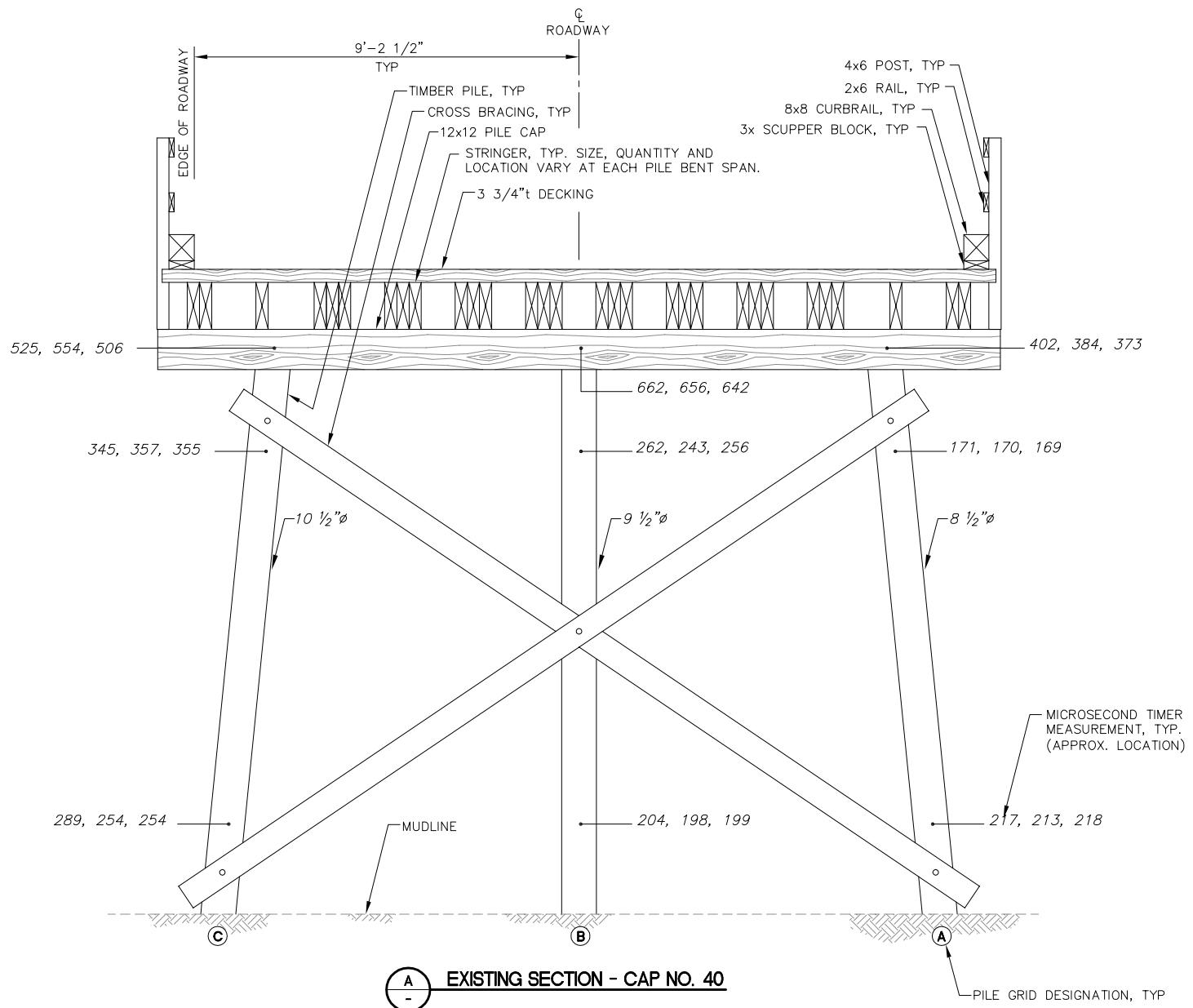
PILE C= LARGE CHECKS

PILE B= LARGE SPLIT OPEN 1 1/2X3" DEEP; CAP DEFLECTED @ TOP OF PILE, PILE CAP DOES NOT BEAR ON PILE

PILE A= LARGE CHECKS AND DAMAGE, PILE NOT FULLY BEARING ON PILE CAP

UNISTRUTS ARE RUSTED

NOTE ALL CAPS WERE TESTED @ BOTTOM 1/2 OF CAP



**NOTES:**

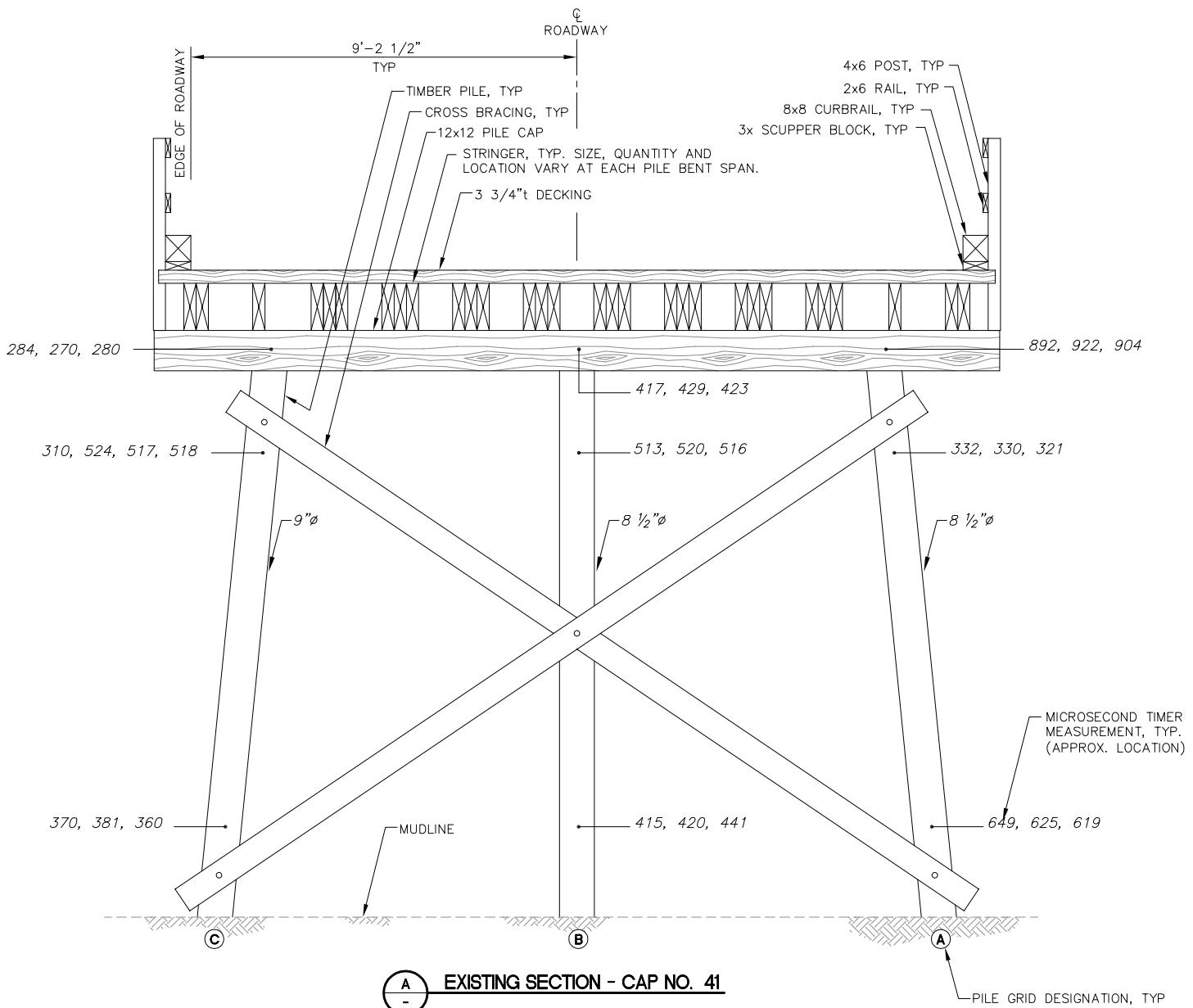
PILE C IS COVERED IN DIRT

PILE B IS CHECKED @ SURFACE

CAP IS COMPRESSED & SIDES ARE BULGING

UNISTRUTS ARE RUSTED

NOTE ALL CAPS WERE TESTED @ BOTTOM 1/2 OF CAP



**NOTES:**

PILE C= LONG CHECK, BUT DOES NOT GO ALL THE WAY THROUGH; PILE CAP HAS MOSS & PLANT GROWTH ON IT

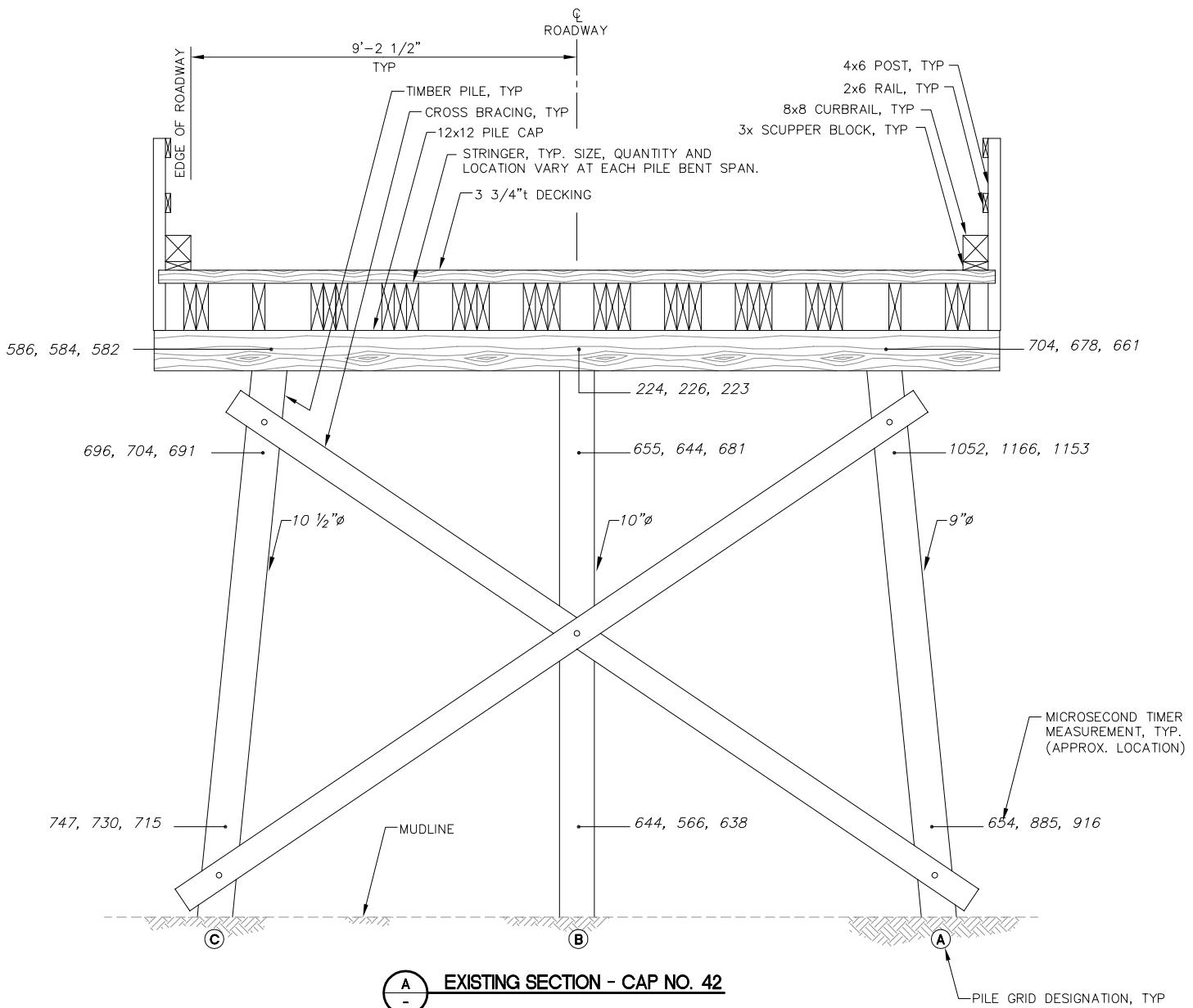
PILE B= SPLIT @ BOTTOM

PILE A= SOUNDS HOLLOW W/ LONG CHECKS @ BOTTOM

CAP HAS LARGE SPLIT OVER PILE A TO ABOUT B

UNISTRUTS ARE RUSTED

NOTE ALL CAPS WERE TESTED @ BOTTOM 1/2 OF CAP



**NOTES:**

PILE C HAS MULTIPLE LARGE SPLITS

PILE B HAS SPLIT @ TOP

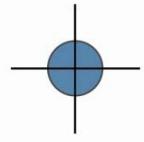
CROSS-BRACE HAS SMALL MINOR SPLITS

PILE A LARGE SPLIT @ TOP

CAP HAS SPLIT THROUGH CENTER TO PILE B, DAMAGE TO PILE CAP @ OVERHANG NEAR PILE A

UNISTRUTS ARE RUSTED

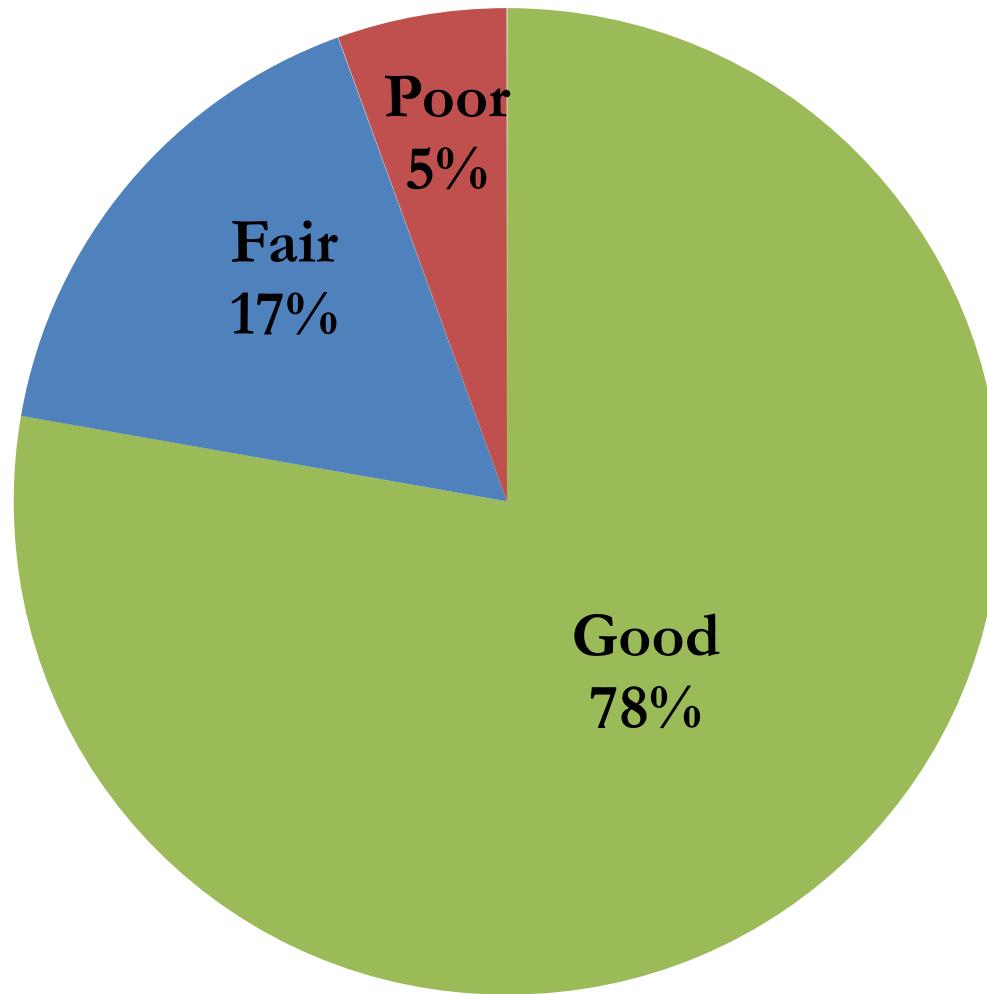
NOTE ALL CAPS WERE TESTED @ BOTTOM 1/2 OF CAP



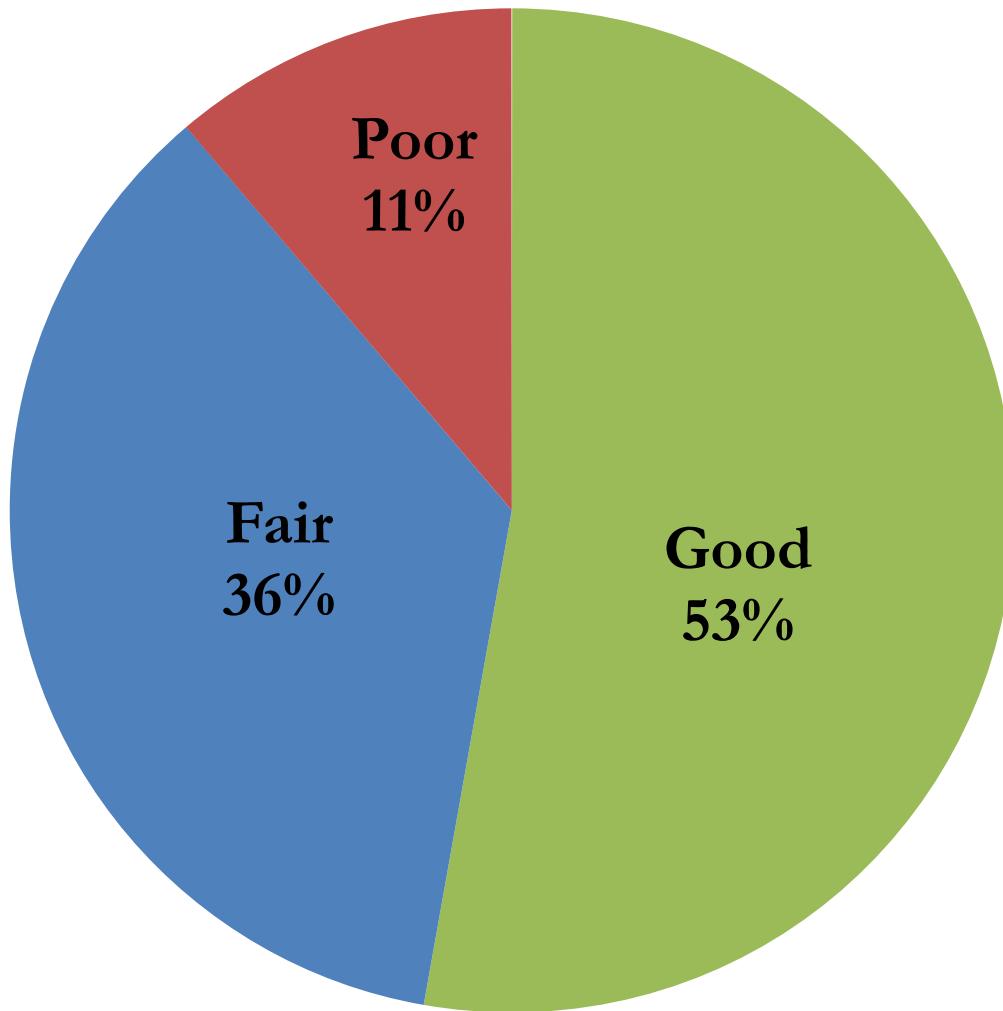
## Section 4

### Microsecond Timer Data

## Pile Cap Condition



## Pile Conditions



Test Location			Top of Pile				Middle of Pile				Bottom of Pile							
Bent	Member	Pile Size (in)	Standard value	Test #1	Test #2	Test #3	Average	Test #1	Test #2	Test #3	Average	Test #1	Test #2	Test #3	Average	Highest Average	Condition Category	
2	Pile A	10.5	203	207	204	199	203	188	184	184	185	247	237	232	239	239	GOOD	
	Pile B	10.5	203	196	192	189	192	187	181	180	183	247	244	241	244	244	GOOD	
	Pile C	10.5	203	296	273	265	278	399	360	354	371	274	274	268	272	507	FAIR	
								442	434	421	432							
								532	504	486	507							
	Pile Cap	Cap Size (in)	Standard value	Test #1	Test #2	Test #3	Average	Highest Average	Condition Category									
3	At Pile A	12	232	206	200	198	201	307	GOOD									
	At Pile B	12	232	231	223	232	229											
	At Pile C	12	232	313	306	303	307											
	Pile A	9	174	163	160	162	162	174	156	153	161	260	280	264	268	268	GOOD	
	Pile B	9	174	236	216	217	223	262	254	242	253	288	284	273	282	282	FAIR	
	Pile C	12	232	276	277	278	277	298	297	286	294	370	342	345	352	352	GOOD	
4	Pile Cap	Cap Size (in)	Standard value	Test #1	Test #2	Test #3	Average	Highest Average	Condition Category									
	At Pile A	12	232	223	223	217	221	468	FAIR									
	At Pile B	12	232	484	462	459	468											
	At Pile C	12	232	220	218	217	218											
	Pile A	9	174	218	220	220	219	168	176	163	169	464	547	574	528	528	FAIR	
	Pile B	11	212	198	201	204	201	525	524	530	526	246	232	237	238	526	FAIR	
5	Pile C	11	212	216	242	214	224	469	456	427	451							
	Pile Cap	Cap Size (in)	Standard value	Test #1	Test #2	Test #3	Average	Highest Average	Condition Category									
	At Pile A	12	232	218	220	220	219	363	GOOD									
	At Pile B	12	232	208	208	208	208											
	At Pile C	12	232	391	360	339	363											



















Test Location			Top of Pile				Middle of Pile				Bottom of Pile								
Bent	Member	Pile Size (in)	Standard value	Test #1	Test #2	Test #3	Average	Test #1	Test #2	Test #3	Average	Test #1	Test #2	Test #3	Average	Highest Average	Condition Category		
41	Pile A	8.5	164	332	330	321	328					649	625	619	631	631	POOR		
	Pile B	8.5	164	513	520	516	516					415	420	441	425	516	FAIR		
	Pile C	9	174	524	517	518	520					370	381	360	370	520	FAIR		
	Pile Cap	Cap Size (in)	Standard value	Test #1	Test #2	Test #3	Average	Highest Average	Condition Category										
	At Pile A	12	232	892	922	904	906												
	At Pile B	12	232	417	429	423	423												
	At Pile C	12	232	284	270	280	278												
Test Location			Top of Pile				Middle of Pile				Bottom of Pile								
Bent	Member	Pile Size (in)	Standard value	Test #1	Test #2	Test #3	Average	Test #1	Test #2	Test #3	Average	Test #1	Test #2	Test #3	Average	Highest Average	Condition Category		
42	Pile A	9	174	1052	1166	1153	1124					654	885	916	818	1124	POOR		
	Pile B	10	193	655	644	681	660					644	566	638	616	660	FAIR		
	Pile C	10.5	203	696	704	691	697					747	730	715	731	731	POOR		
	Pile Cap	Cap Size (in)	Standard value	Test #1	Test #2	Test #3	Average	Highest Average	Condition Category										
	At Pile A	12	232	704	678	661	681												
	At Pile B	12	232	229	226	223	226												
	At Pile C	12	232	586	584	582	584												

General Notes:

- 1 The standard Value is calculated by  $222\mu\text{m}/11.5"$ . This is the estimated value for timber in good condition with 1.5" of penetration with an oil-borne preservative.
- 2 Timber in good condition is timber with a Highest Average micro second value less than 1.5 times the standard value.
- 3 Timber in fair condition is timber with a Highest Average micro second value between 1.5 times the standard value and 3 times the standard value.
- 4 Timber in poor condition is timber with a Highest Average micro second value greater than 3 times the standard value.
- 5 "NA" indicated members that were not accessible due to location or covered by other members.
- 6 Timber pile sizes were measured at eye level at each pile. The pile diameter decreased from the mudline to the pile cap.

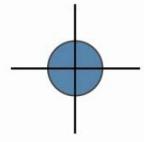
Total Number of Members In Each Condition Category

Pile Cap Conditions

	Good	Fair	Poor
Total	28	6	2

Pile Conditions

	Good	Fair	Poor
Total	66	45	14



## Section 5

# Photographs



Topside view of structure (from NE).



US profile at NE.



DS profile at NE.



Topside of structure looking North (in vicinity of Boyer Wikan Memorial)



Topside view of structure (from FE).



Topside of structure looking South (in vicinity of parking area at FE).



Topside of structure looking South (in vicinity of Boyer Wikan Memorial).



Load rating signage at FE.



Microsecond timer operation.



Microsecond timer operation.



US profile of structure/utility pipe near FE abutment.



Typical surface growth on piles and pile caps.



Typical condition of piles. DS side looking toward NE abutment.



Typical pile w/ surface growth and no visible sign of creosote treatment on upper half of pile.



Typical surface growth/mold found on pile.



Pile C at Bent #9 w/ metal band at top of pile.



Damaged Pile A at Bent #5.



Pile B at Bent #2 not in contact w/pile cap.



Pile B at Bent #15 split top w/no visible treatment.



Typical piles w/o visible treatment on upper half.



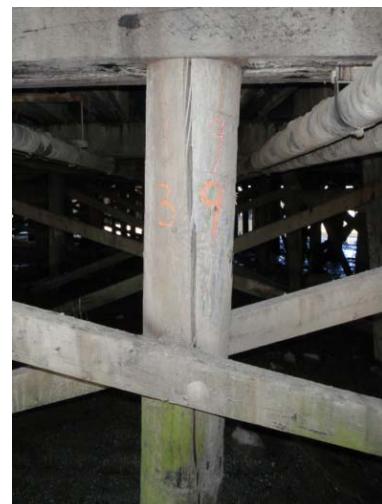
Hole in Pile C at Bent #10.



Hole in Pile C at Bent #10 (hammer inside pile).



Moderate split in Pile C at Bent #20.



Moderate split in Pile B at Bent #39.



Moderate splits in Pile B at Bent #39.



Moderate split in Pile B at Bent #42.



Typical surface fungus and mold growth.



Split US end of pile cap at Bent #2.



Typical surface fungus and mold growth.



Crushing pile cap at Bent #40, pile B.



Typical surface fungus and mold growth.



Rot/decay at DS end of pile cap at Bent #42.



Typical rotten cross bracing end at pile connection.



Rotten/broken cross bracing at Bent #10.



Typical rotten/broken cross bracing at pile connection.



Bent #32 cross bracing connection at center pile.



Typical condition of DS insulated utility pipe.



Typical condition of US insulated utility pipe.  
Hangers w/ minor corrosion and minor surface growth on pipe jacketing.



Utilities at NE abutment.



Utilities at FE abutment.



Melted conduit/wiring by NE abutment.



Damaged insulation/jacketing on US utility pipe between Bents #9 and #10.



Corroded and broken pipe hanger near Bent #26.



Typical corrosion of electrical conduit support.



Typical corrosion of electrical conduit support.



Typical corrosion of electrical conduit support.



Broken/disconnected conduit hangers.