

Memorandum

*Flex your power!
Be energy efficient!*

To: LENA ASHLEY
OFFICE OF DESIGN NORTH
DESIGN BRANCH E-3
EUREKA

Date: May 21, 2013

File: 01-MEN-1-43.3/44.1
01-401100
Albion River Br. #10-0136
Bridge Rehabilitation

From: JEFF SIMS
Bridge Design Branch 1
Structure Design
Division of Engineering Services MS 9-4/8I

JP 5/21/2013

Subject: Feasibility Study Transmittal

Attached are two copies of the Feasibility Planning Study for the above referenced project as submitted to the Division of Engineering Services by your (Tom Phillips) initial Request Memo dated July 17, 2012.

The estimated construction costs, including 10% mobilization and 25% contingencies, for the Albion River Bridge replacement alternatives are as follows:

Bridge Rehab Alternative	Description	Estimated Cost	Annual Maintenance Cost
A	Rehab and upgrade rail	\$5,715,000	\$100,000
B	Rehab, widen & upgrade rail	\$20,083,000	\$150,000
C	Rehab as pedestrian bridge	\$5,349,000	\$100,000

The following table summarizes the projected total structure cost based on a variable escalation rate. The escalated structure cost is provided for informational purposes only and does not replace annual cost updates as required by Department policy.

Years Beyond Midpoint	Escalated Cost Alternative A	Escalated Cost Alternative B	Escalated Cost Alternative C
1	\$5,715,000	\$20,083,000	\$5,349,000
2	\$5,824,000	\$20,465,000	\$5,451,000
3	\$5,981,000	\$21,018,000	\$5,598,000
4	\$6,166,000	\$21,670,000	\$5,772,000
5	\$6,326,000	\$22,233,000	\$5,922,000

The escalated structure cost is provided for informational purposes only and does not replace annual cost updates as required by Department policy.

The metal tube railing shown on the plans is only a concept for the study. Caltrans does not currently have any bridge rails that can be attached to a timber deck and still meet the crash test criteria of AASHTO. The concept rail shown in the plans, with its attachment to a timber plank deck, will need to be crash tested before it can be incorporated on the bridge per AASHTO and Caltrans requirements.

The current bridge has a low load rating for permit loads (POOXX). The rehabilitation alternatives do not change this load rating. It was not considered feasible to strengthen all the main members of the superstructure and substructure.

The rehabilitation alternatives include earthquake retrofit. The concrete and timber towers are allowed to rock during the design seismic event.

The bridge site is subject to tsunami hazards. The source of the tsunami hazard may be due to local tsunami-generating activity occurring along the California coast, or from sources thousands of miles away across the Pacific Ocean. Tsunamis are most typically associated with offshore subduction zone earthquakes, but can also be caused by submarine landslides, volcanic activity, and other sources. The maximum tsunami wave height at this site is seventeen feet (1000 year event). The tsunami inundation zone extends between bents 10 and 27 at the bridge and runs up the river for about 1 ¾ miles. The wave velocity is assumed to be 23 ft/sec at the bridge site for both the forward run-up wave and the withdrawal. Bents 11 through 26 will be inundated by the tsunami wave. These bents are all on piles and should be okay for the erosion that can occur due to the wave velocity. These bents are also sufficiently strong to resist the drag forces of the high velocity water as it flows around them. However, historical data indicates that a majority of the damage during tsunamis has been from the impact of debris. Records from the 1964 tsunami at Crescent City indicate that substantial damage occurred as a result of debris impacting on structures. The debris included logs, automobiles, and baled lumber. The impact forces either destroyed the load-carrying capacity of walls, or caused bending or breaking of light columns. The fact that the bridge has such closely spaced timber bents in the tsunami inundation zone and that there is a campground and marina located just upstream make this bridge especially vulnerable to impact damage that could lead to collapse of a portion of the structure. A long span replacement bridge with no piers in the central half width of the tsunami inundation zone is recommended at this site to reduce the risk of impact damage from upstream debris (boats, automobiles, buildings, trees, boulders, etc).

The rehabilitation alternatives do not add appreciable service life to the bridge. Although the non-redundant, Fracture Critical steel truss span is being replaced in all alternatives, the majority of the bridge superstructure and substructure still consists of 70 year old structural timber that is nearing the end of its life. The estimated remaining life of the bridge components are as follows:

- 1) The new steel truss is estimated to have a service life of 25 years with a maintenance cost of \$1.25 million over the life of the structure to maintain the paint system at today's costs. At 25 years, the truss will require major rehabilitation which may include replacement of some secondary members or total replacement. The relatively short

service life is due to the harsh coastal environment in which the steel members are susceptible to extremely rapid corrosion and deterioration. Recoating the steel truss in this environment is difficult and will likely have a shorter service life than the original coating.

- 2) The timber connection life expectancy is 2 years. Nuts and bolts have historically required replacement every two years.
- 3) The estimated remaining life of the existing shear ring connectors in the existing bolted connections is 10 years. The internal shear rings (split ring and toothed ring connectors) in all existing timber connections cannot be accessed for inspection. They can only be accessed by dismantling the connection. Most of the connections have never been dismantled and the integrity of the internal shear rings is unknown. If these rehabilitation alternatives are carried forward, it is recommended that several connections be dismantled to examine the conditions of these shear rings to better determine their remaining life, or if replacement is required immediately (will increase the cost of the alternatives).
- 4) The expected remaining life of the existing timber is 20 years if currently identified timbers with rot are replaced as shown in the plans and all checks and splits are filled with caulk. It will be difficult and expensive to replace load bearing timber members without disrupting traffic when replacement is required.
- 5) The expected life of new timber is 40 years assuming splits and checks are inspected and sealed with caulk annually.

The total annual maintenance costs will remain at the current level of \$100,000 for Alternatives "A" and "C". This cost is based on the continuing need to replace nuts and bolts on the bolted connections as they experience section loss due to corrosion, caulking checks and splits in the timber members (\$50,000 annual cost), and also maintaining the paint system on the steel truss spans (\$50,000 annual cost).

The total annual maintenance cost for Alternative "B" is estimated at \$150,000.

The history of this bridge has been one of constant repair including replacement of timber connectors, steel connector plates, and portions of the steel truss. Structure Maintenance & Investigations Peer Review, in August 2007, unanimously reaffirmed replacement of the structure as the preferred engineering and most fiscally responsible alternative to ensure the safety and reliability of this critical link of the state highway system.

Due to the high maintenance cost, short life span, low load rating for permit vehicles, and tsunami hazard risk of the rehab alternatives "A" and "B", we also recommend replacement with a structure more suited to the environment.

LENA ASHLEY - Design North

5/21/13

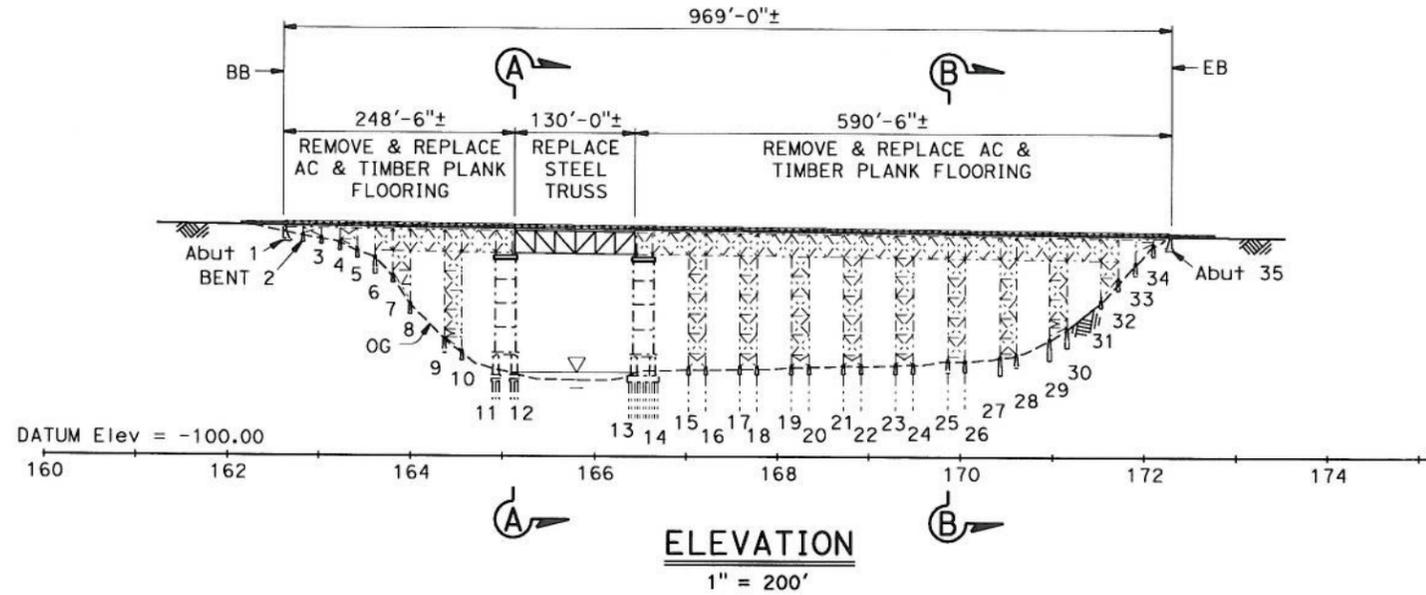
Page 4

If you have any questions, or if you need additional information, regarding this study, please contact Kevin Harper at (916) 227-8156 or Jeff Sims at (916) 227- 8497.

Attachments

- c: ETaddese, Project Liaison Engineer MS 9-5/11G
- EKurani, Bridge Design Office Chief MS 9-4/11G
- MAmini, Technical Liaison Engineer MS 9-1/5C FM2
- JChavez, Structure Aesthetics Branch Chief MS 9-3/1H
- PWhitfield, Structure Maintenance & Investigations MS 9-1/9I
- KWall, HA21 Program Coordinator MS 9-1/9I
- JBabcock, Structure Construction MS 9-2/11H
- RBibbens, Geotechnical Services MS 5
- SNG, Structure Hydraulics & Hydrology MS 9-1/2I

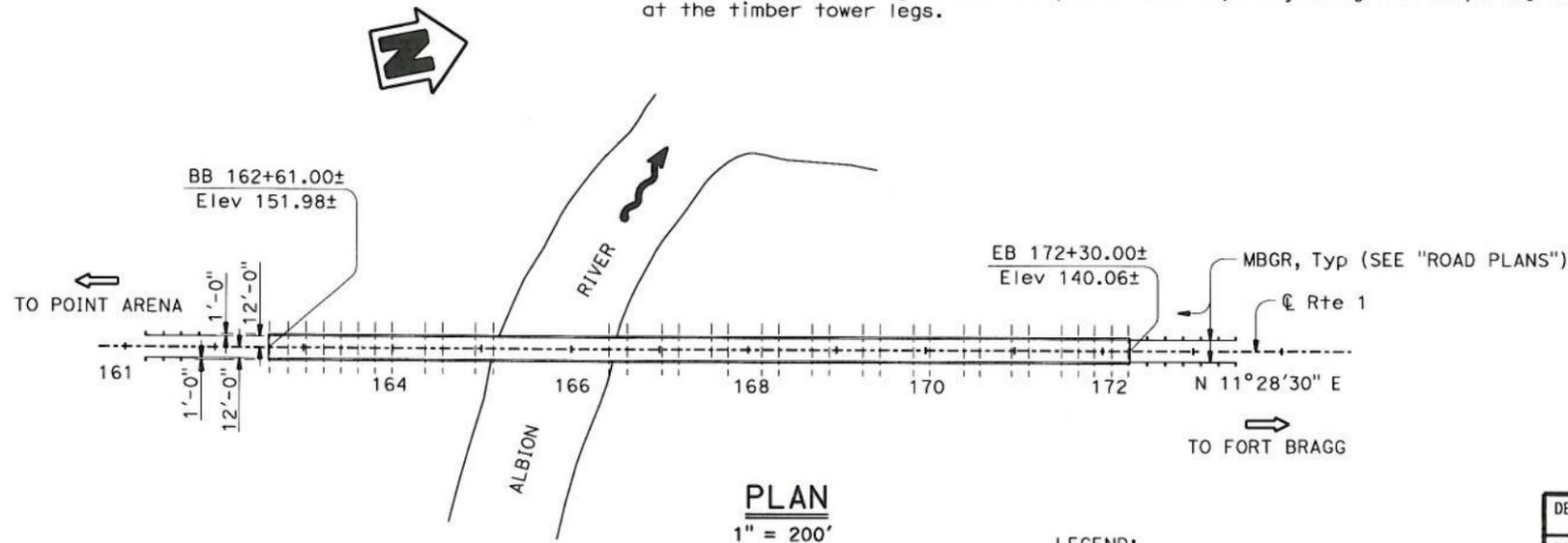
DIST	COUNTY	ROUTE	POST MILE
01	Men	1	43.74



NOTES:

- One lane traffic control across the bridge is assumed during the replacement of the timber deck planks, AC wearing surface and barrier rail.
- Total bridge closure assumed at night to remove and replace whole width sections of the two layer plank deck. Sixty (60) linear feet of bridge deck is assumed to be replaced during each night closure.
- Existing AC wearing surface and barrier rails assumed to be removed over entire bridge length prior to starting work on deck plank replacement. The traffic lane shall have temporary deck plates in place prior to allowing traffic on the existing plank flooring.
- Place a heavy mop coat of hot asphalt on top of the sub floor and then place top planking while the asphalt is still plastic.
- Top and sub floor planks may be of random lengths with a maximum of one joint per run. Joints to occur at centerline of stringer. Joints to be staggered so that joints in adjacent planks do not occur at the same stringer or one directly above another. Minimum plank length is 6 feet.
- AC wearing surface is not to be placed until all plank flooring has been replaced.
- For the assumed construction sequence of the steel truss span replacement, see "NEW TRUSS CONSTRUCTION SEQUENCE" detail.
- Replacement of existing timber sill plates will require jacking and temporary supports at the timber tower legs.

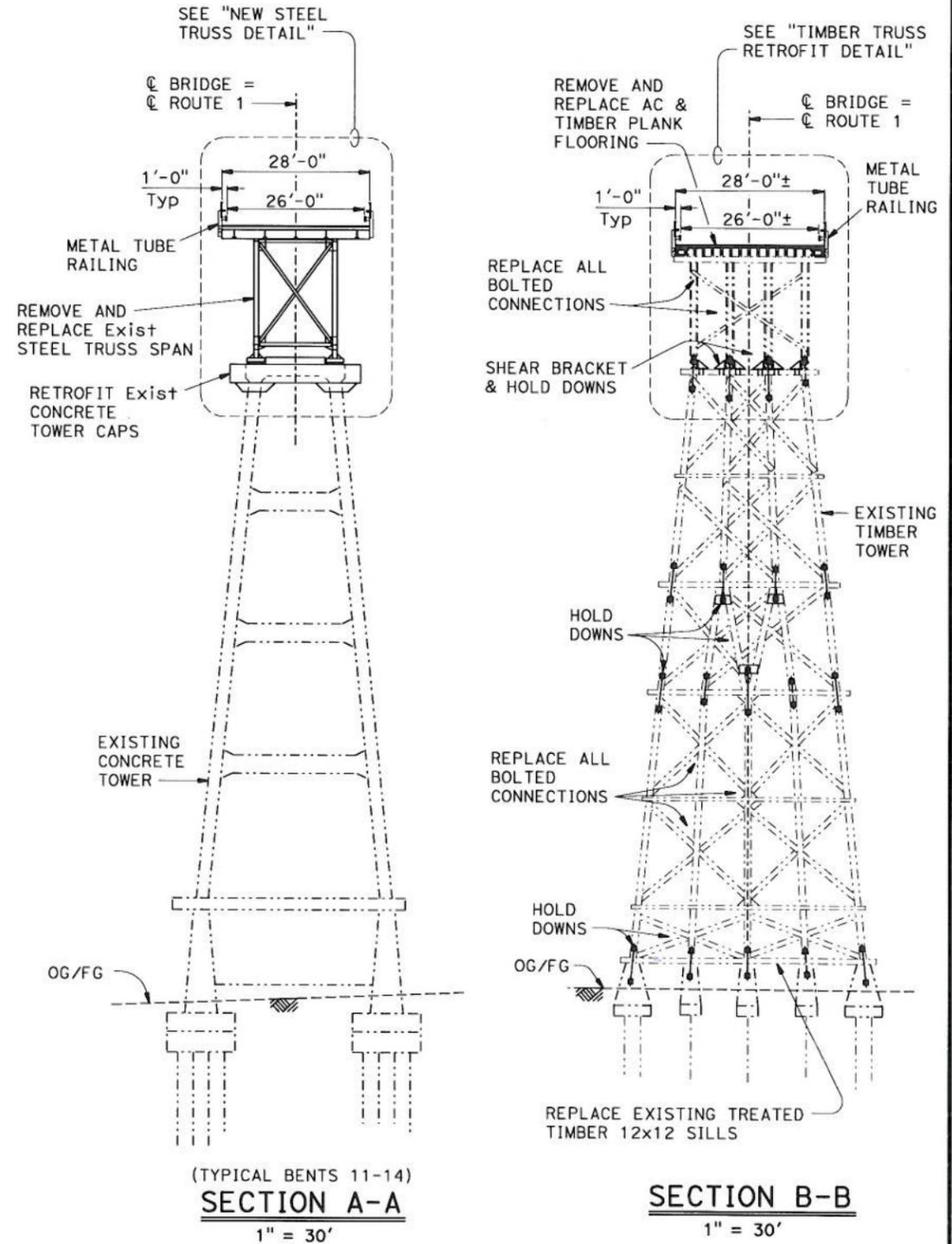
DATE OF ESTIMATE	05-17-2013
STR. DEPTH	
LENGTH	969 FT
WIDTH	28 FT
AREA	27,132 SQ FT
COST/SQ FT INCLUDING 10% MOBILIZATION & 25% CONTINGENCY	\$211 /SQ FT
TOTAL COST	\$5,715,000 ⁰⁰



PLAN
1" = 200'

LEGEND:

----- Indicates existing structure



(TYPICAL BENTS 11-14)
SECTION A-A
1" = 30'

SECTION B-B
1" = 30'

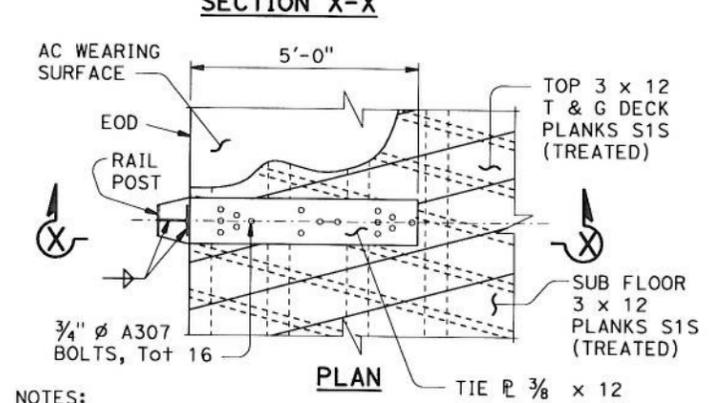
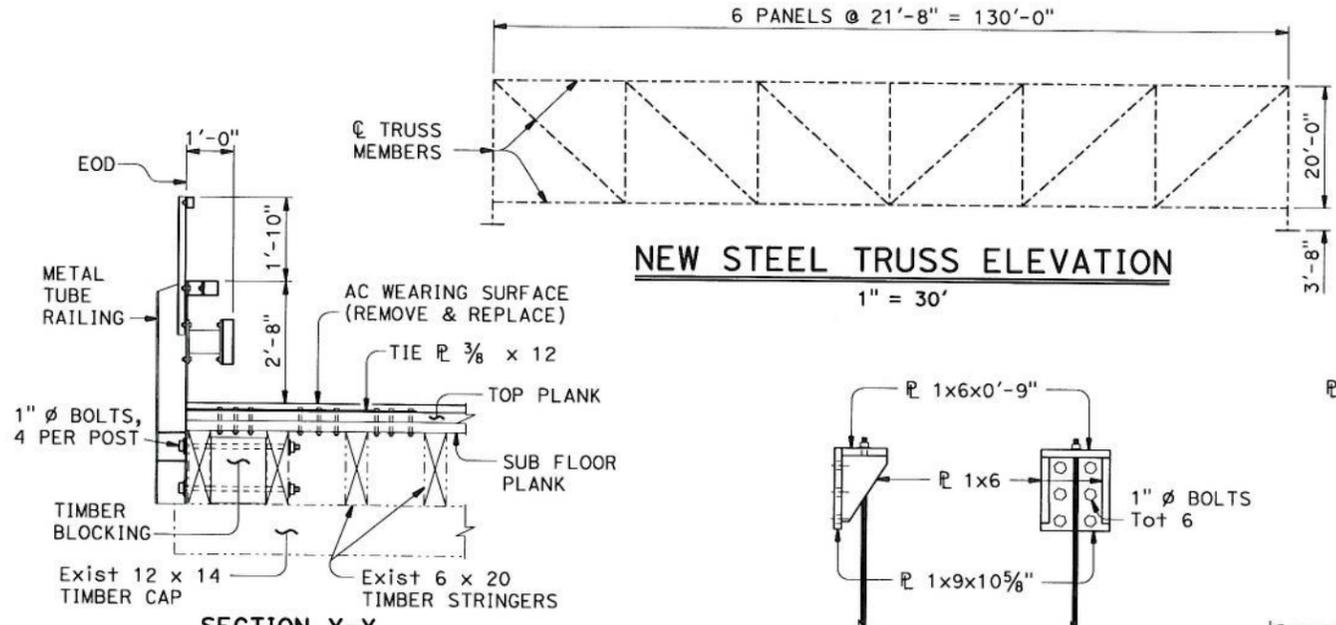
ALT A - REHAB (SHEET 1 OF 2)

DESIGNED BY	Kevin Harper	DATE	12/5/12
DRAWN BY	Bob Huddleston	DATE	12/20/12
CHECKED BY	<i>[Signature]</i>	DATE	4/16/13
APPROVED	<i>[Signature]</i>	DATE	4/16/13

STRUCTURE DESIGN BRANCH
1

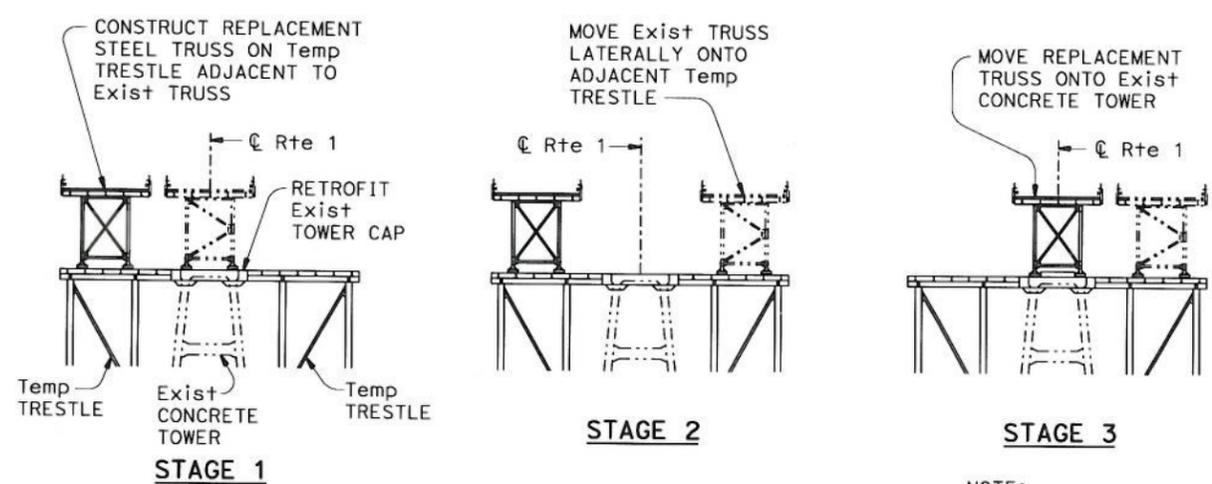
PLANNING STUDY	
ALBION RIVER BR (RETROFIT)	
BRIDGE NO. 10-0136	UNIT: 3576
SCALE: as shown	PROJECT NO. & PHASE: 01000001540

DIST	COUNTY	ROUTE	POST MILE
01	Men	1	43.74

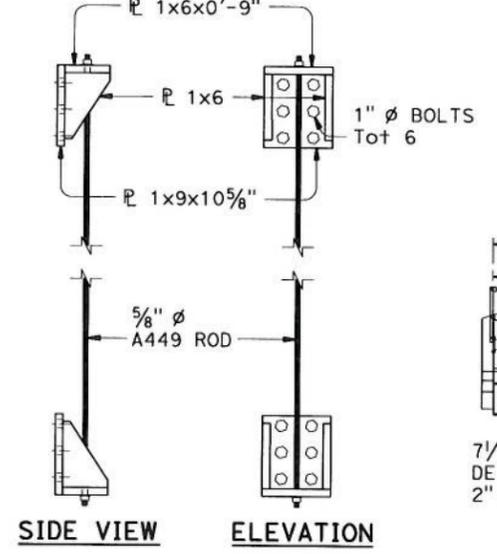


- NOTES:
- Deck planks (top & subfloor) to be removed and replaced.
 - Attach each plank to each stringer with 3/8"x6" TimberLok heavy duty wood screws.
 - Tube rails not shown in "PLAN".

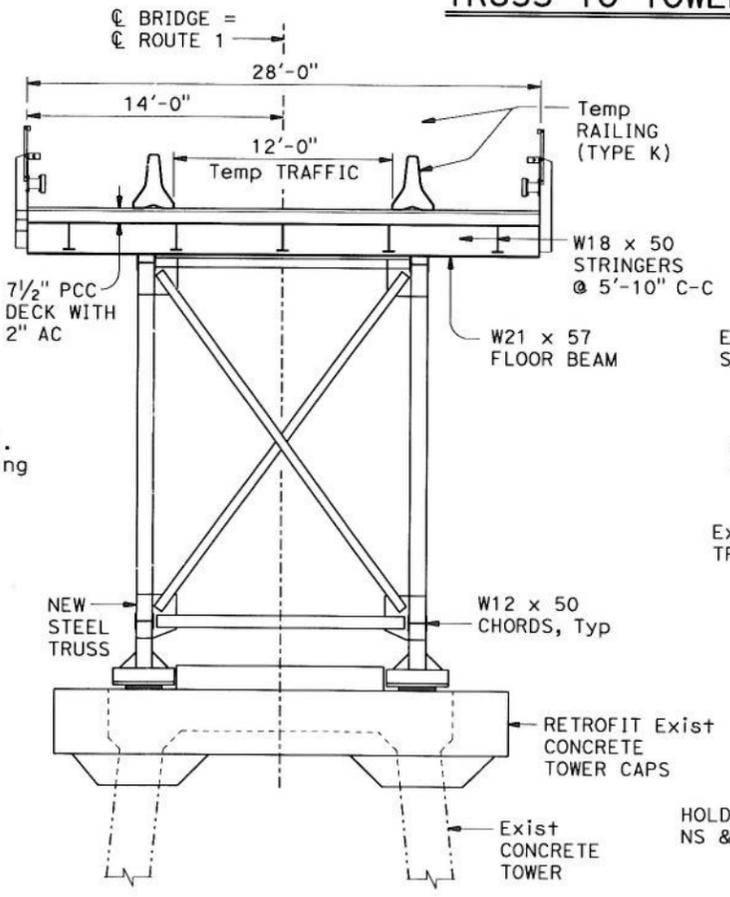
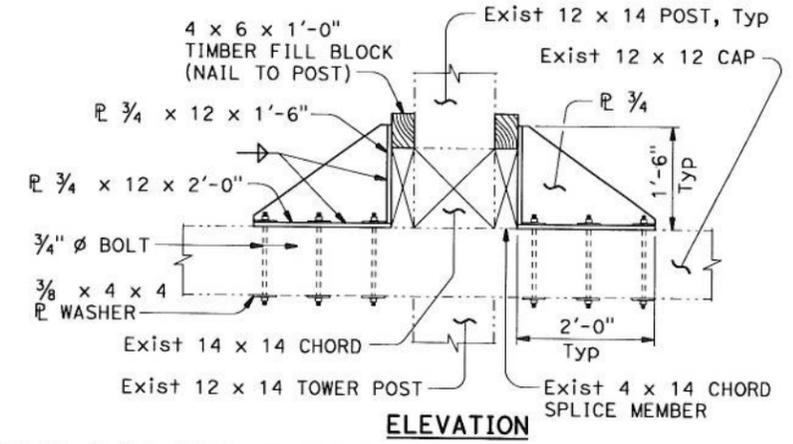
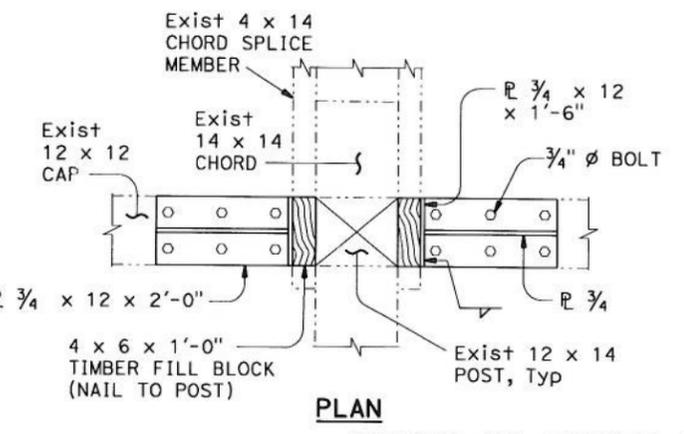
METAL TUBE RAILING AND TIMBER DECK
1/4" = 1'-0"



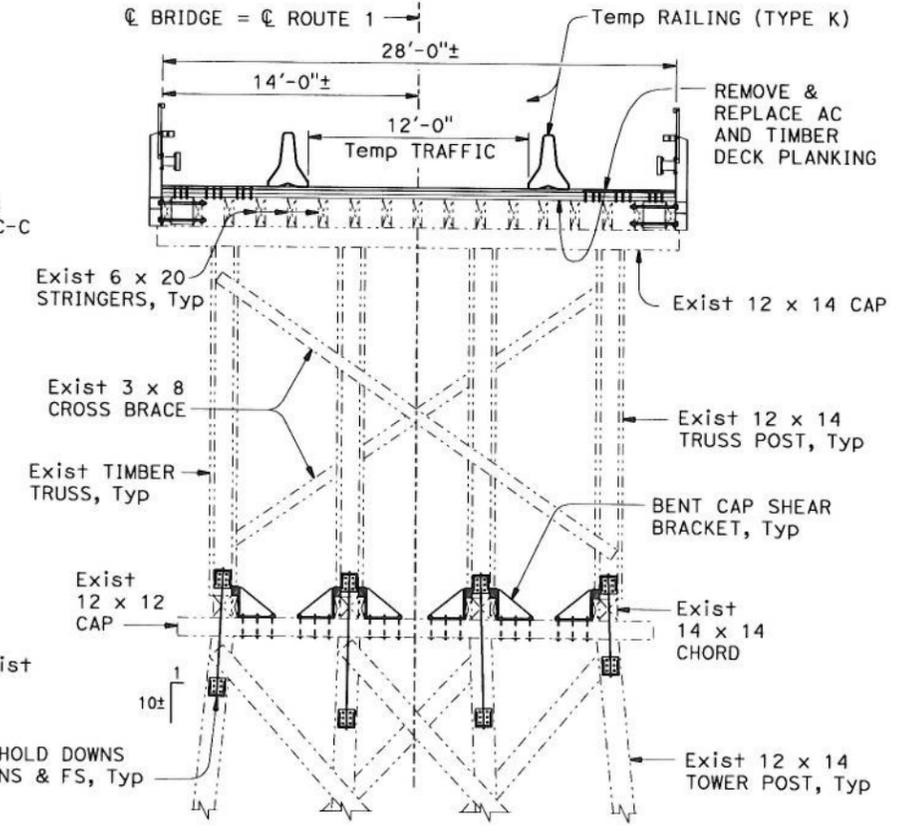
NEW TRUSS CONSTRUCTION SEQUENCE
NO SCALE



- NOTES:
- All plates shall be Grade 50 steel.
 - All nuts shall have a thread locking system.
- HOLD DOWN DETAIL**
1/2" = 1'-0"



NEW STEEL TRUSS DETAIL
1" = 10'



TIMBER TRUSS RETROFIT DETAIL
1" = 10'

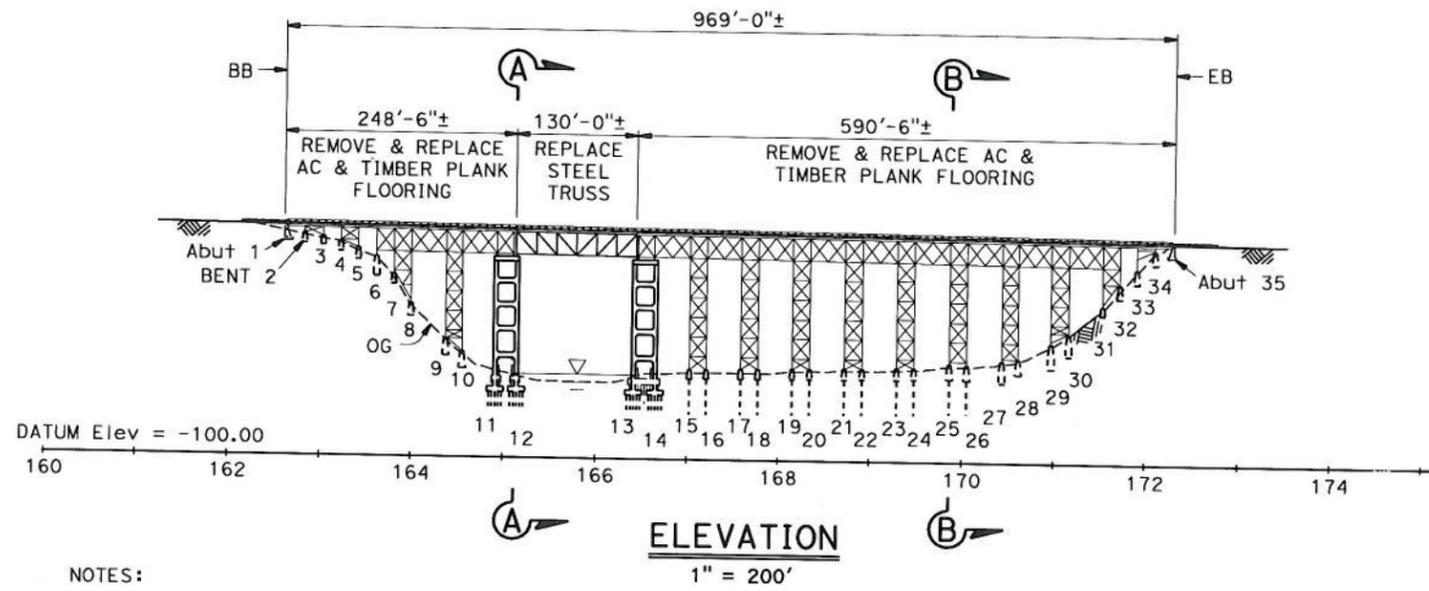
LEGEND:
----- Indicates existing structure

NOTE:
Route 1 shall not be closed for longer than 24 hours during Stage 2 and Stage 3 construction.

DESIGNED BY	Kevin Harper	DATE	12/5/12
DRAWN BY	Bob Huddleston	DATE	1/7/13
CHECKED BY	<i>[Signature]</i>	DATE	4/16/13
APPROVED	<i>[Signature]</i>	DATE	4/16/13

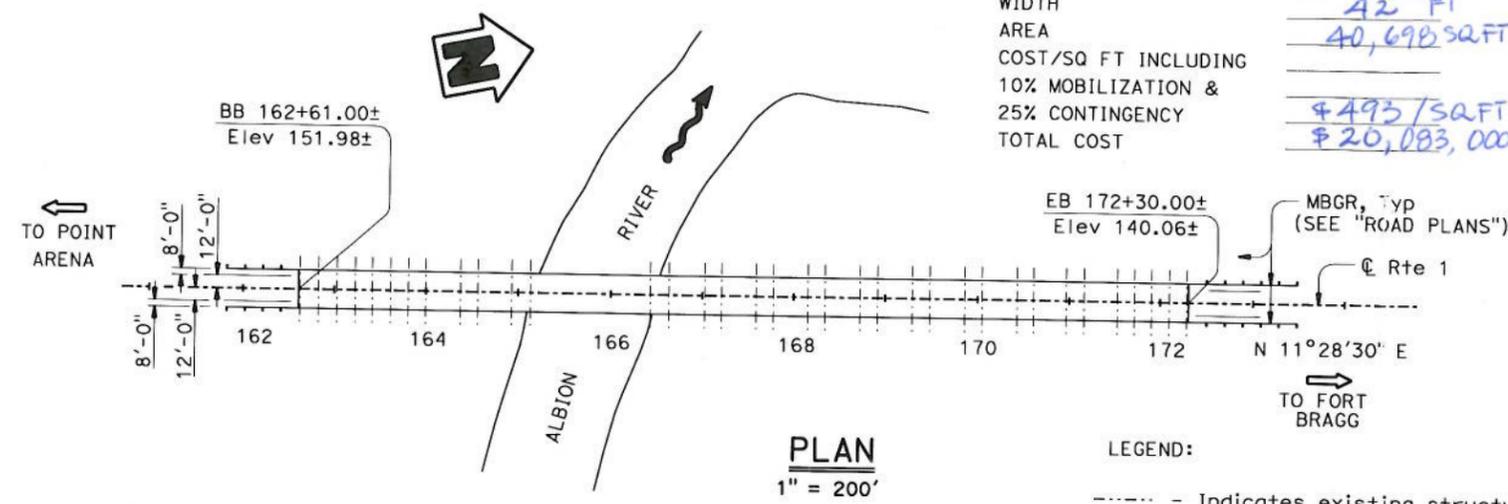
ALT A - REHAB (SHEET 2 OF 2)	
STRUCTURE DESIGN BRANCH	PLANNING STUDY
1	ALBION RIVER BR (RETROFIT)
BRIDGE NO. 10-0136	UNIT: 3576
SCALE: as shown	PROJECT NO. & PHASE: 0100001540

DIST	COUNTY	ROUTE	POST MILE
01	Men	1	43.74

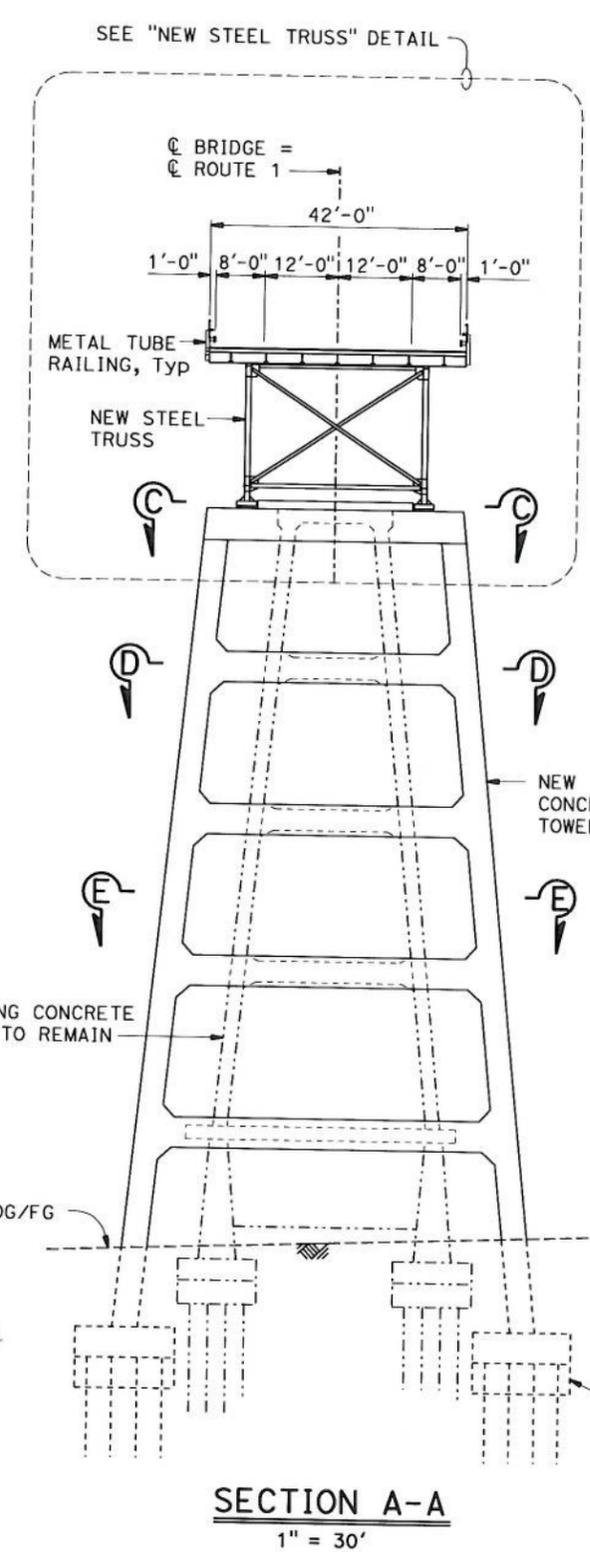


NOTES:

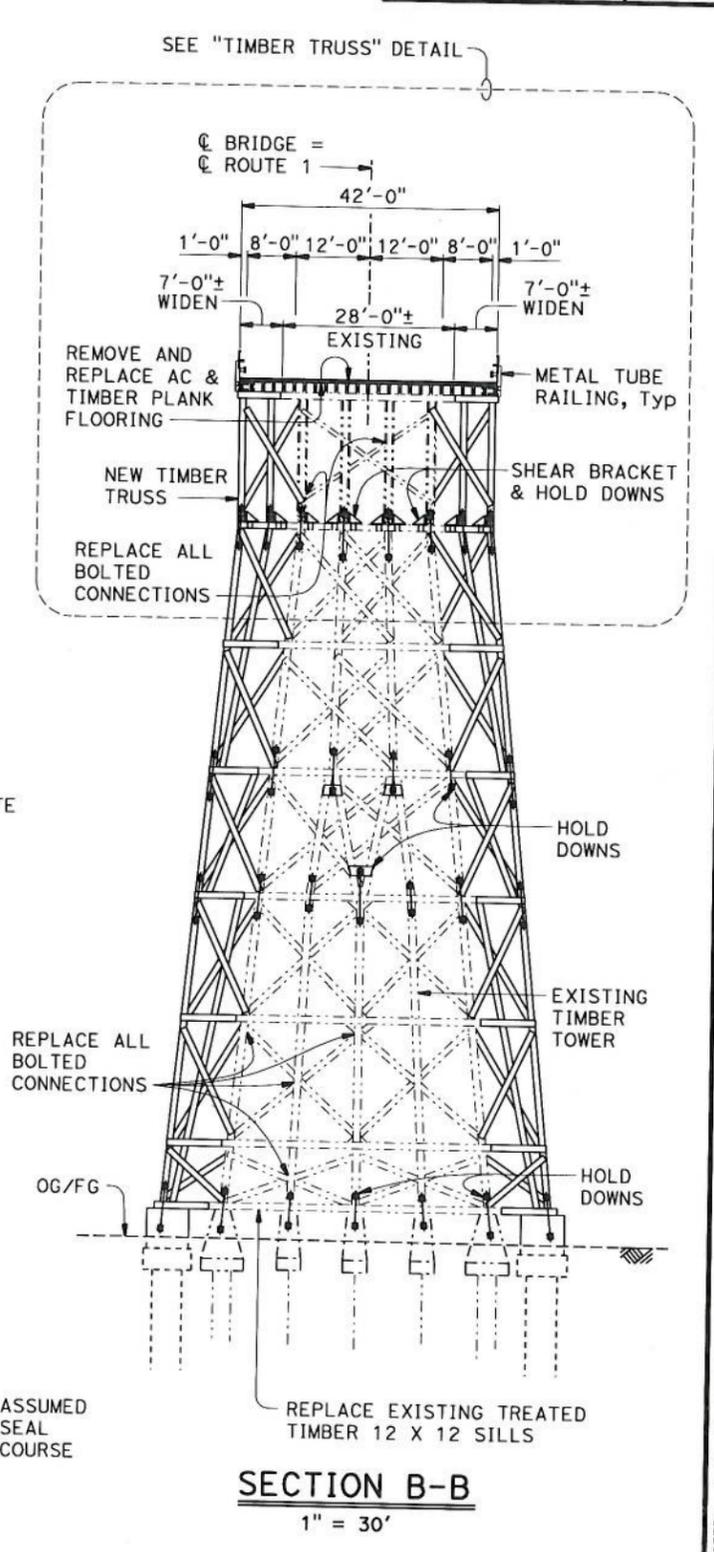
- One lane traffic control across the bridge is assumed during the replacement of the timber deck planks, AC wearing surface and barrier rail.
- Total bridge closure assumed at night to remove and replace whole width sections of the two layer plank deck. Sixty (60) linear feet of bridge deck is assumed to be replaced during each night closure.
- Existing AC wearing surface and barrier rails assumed to be removed over entire bridge length prior to starting work on deck plank replacement. The traffic lane shall have temporary deck plates in place prior to allowing traffic on the existing plank flooring.
- Place a heavy mop coat of hot asphalt on top of the sub floor and then place top planking while the asphalt is still plastic.
- Top and sub floor planks may be of random lengths with a maximum of one joint per run. Joints to occur at centerline of stringer. Joints to be staggered so that joints in adjacent planks do not occur at the same stringer or one directly above another. Minimum plank length is 6 feet.
- AC wearing surface is not to be placed until all plank flooring has been replaced.
- For the assumed construction sequence of the steel truss span replacement, see "NEW TRUSS CONSTRUCTION SEQUENCE" detail.
- Replacement of existing timber sill plates will require jacking and temporary supports at the timber tower legs.
- Structure Excavation (Type A) (cofferdam with seal course) assumed at Bents 11 through 14.
- Structure Excavation (Type D) assumed at Bents 15 through 28.
- All supports assumed to be founded on Class 140 Piles.



DATE OF ESTIMATE	05-17-2013
STR. DEPTH	
LENGTH	969 FT
WIDTH	42 FT
AREA	40,698 SQFT
COST/SQ FT INCLUDING 10% MOBILIZATION & 25% CONTINGENCY	\$493/SQFT
TOTAL COST	\$20,083,000



SECTION A-A
1" = 30'



SECTION B-B
1" = 30'

ALT B - RETROFIT & WIDEN (SHEET 1 OF 2)

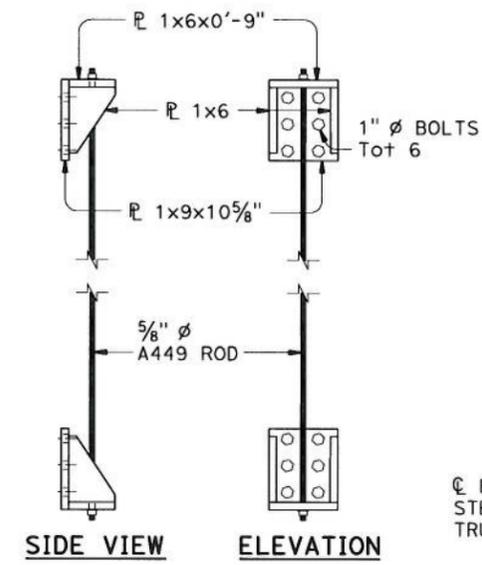
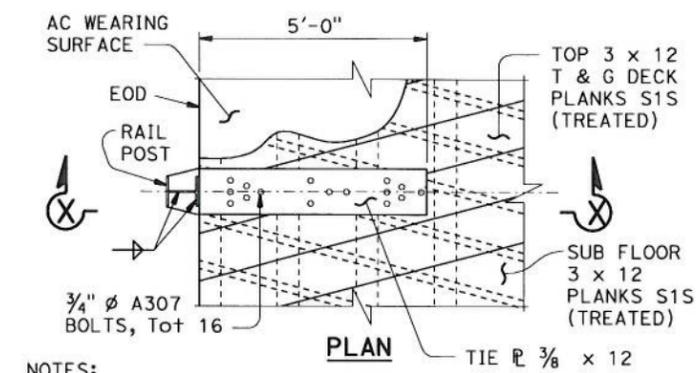
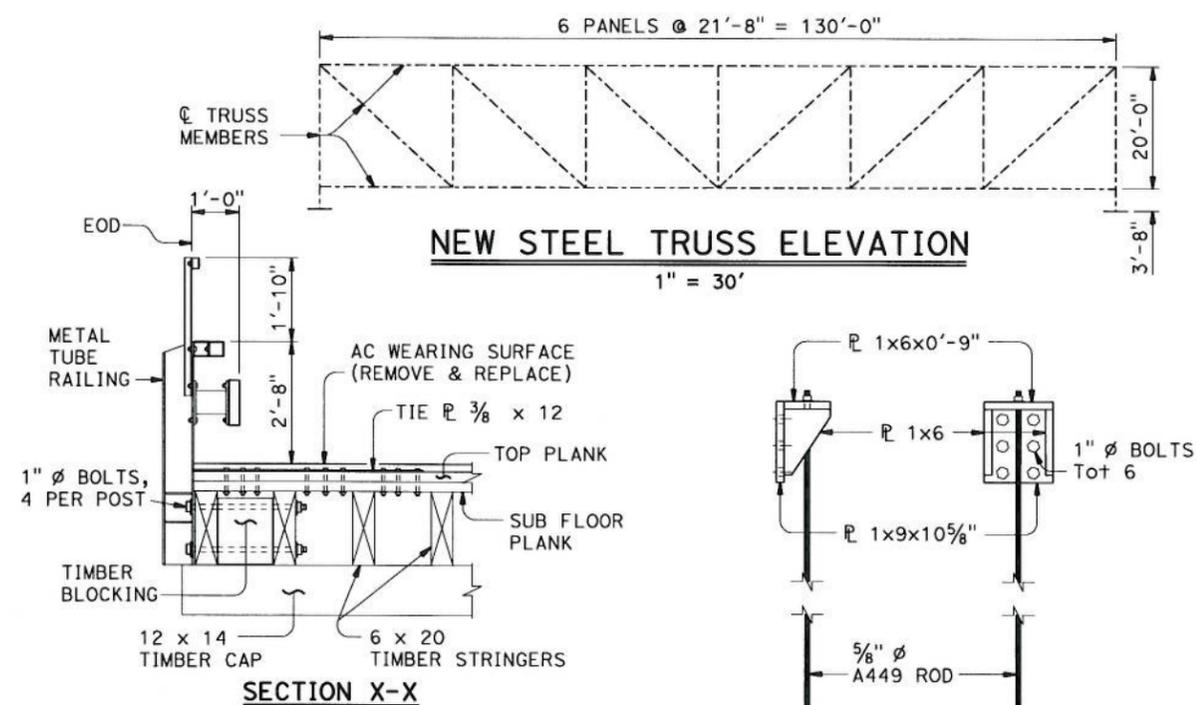
DESIGNED BY	Kevin Harper	DATE	12/5/12
DRAWN BY	Bob Huddleston	DATE	12/31/12
CHECKED BY	[Signature]	DATE	4/16/13
APPROVED	[Signature]	DATE	4/16/13

STRUCTURE DESIGN BRANCH
1

PLANNING STUDY	
ALBION RIVER BR (WIDEN)	
BRIDGE NO. 10-0136	UNIT: 3576
SCALE: as shown	PROJECT NO. & PHASE: 01000001540

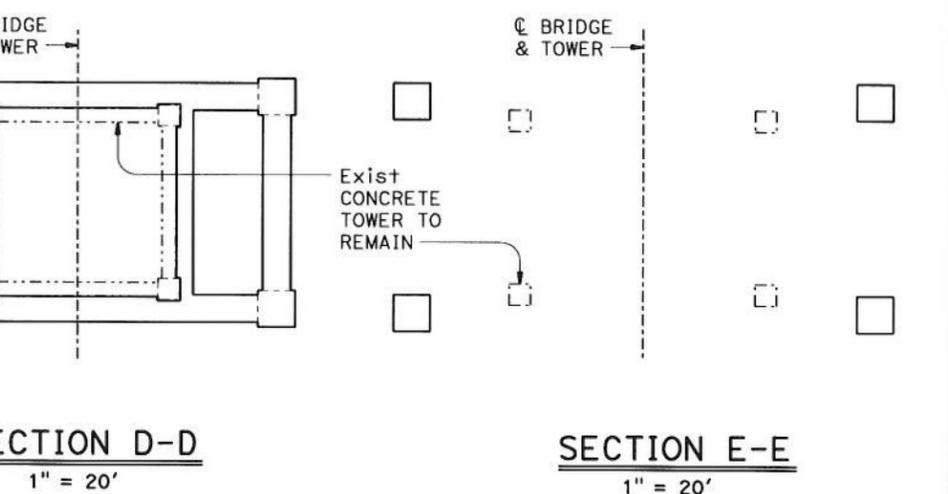
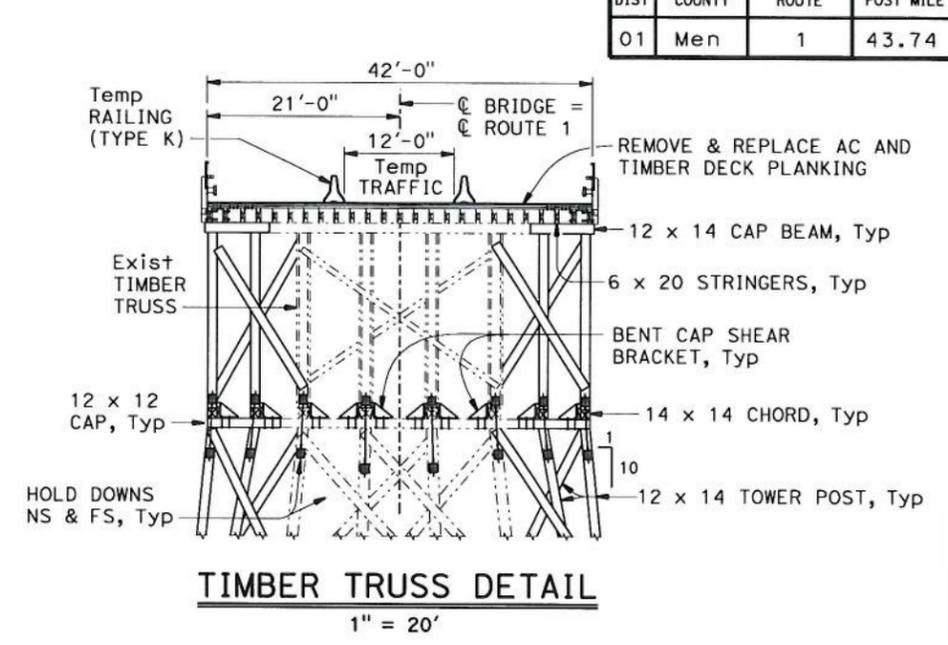
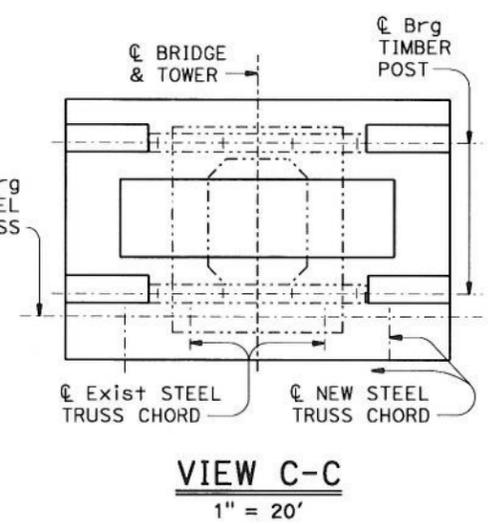
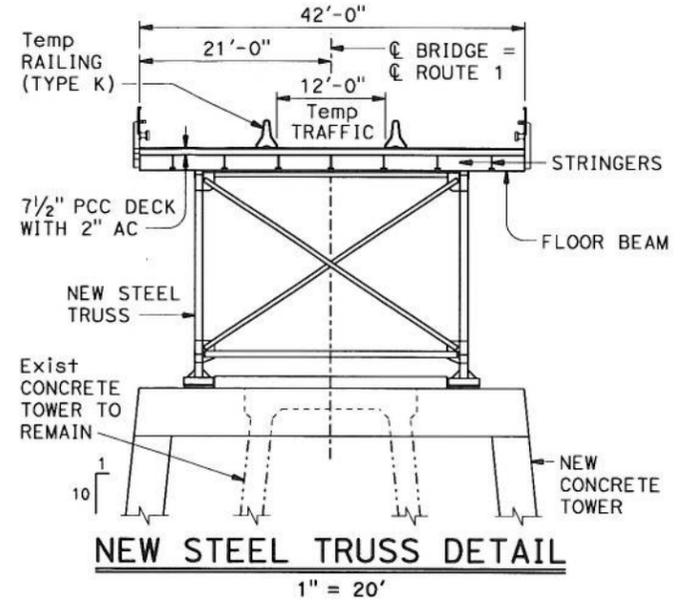
LEGEND:
----- Indicates existing structure

DIST	COUNTY	ROUTE	POST MILE
01	Men	1	43.74



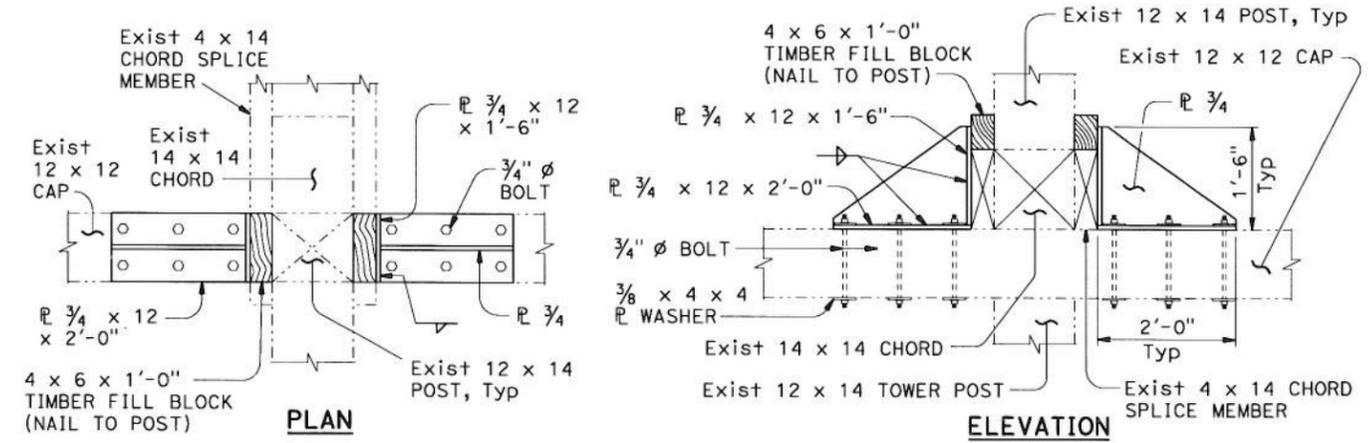
NOTES:
 1. All plates shall be Grade 50 steel.
 2. All nuts shall have a thread locking system.

HOLD DOWN DETAIL
 1/2" = 1'-0"



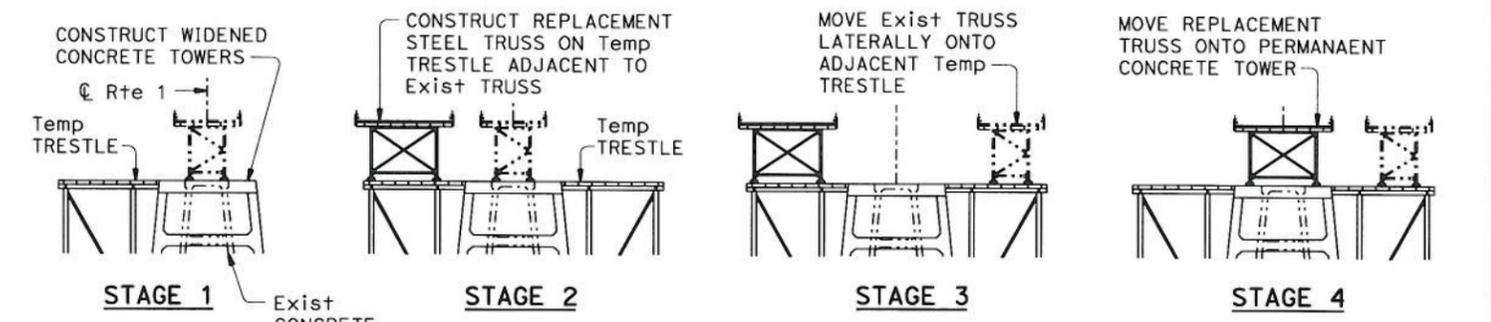
NOTES:
 1. Existing deck planks (top & subfloor) to be removed and replaced.
 2. Attach each plank to each stringer with 5/8"x6" TimberLok heavy duty wood screws.
 3. Tube rails not shown in "PLAN".

METAL TUBE RAILING AND TIMBER DECK
 1/4" = 1'-0"



TRUSS TO TOWER BENT CAP SHEAR BRACKET
 3/8" = 1'-0"

LEGEND:
 - - - - - Indicates existing structure

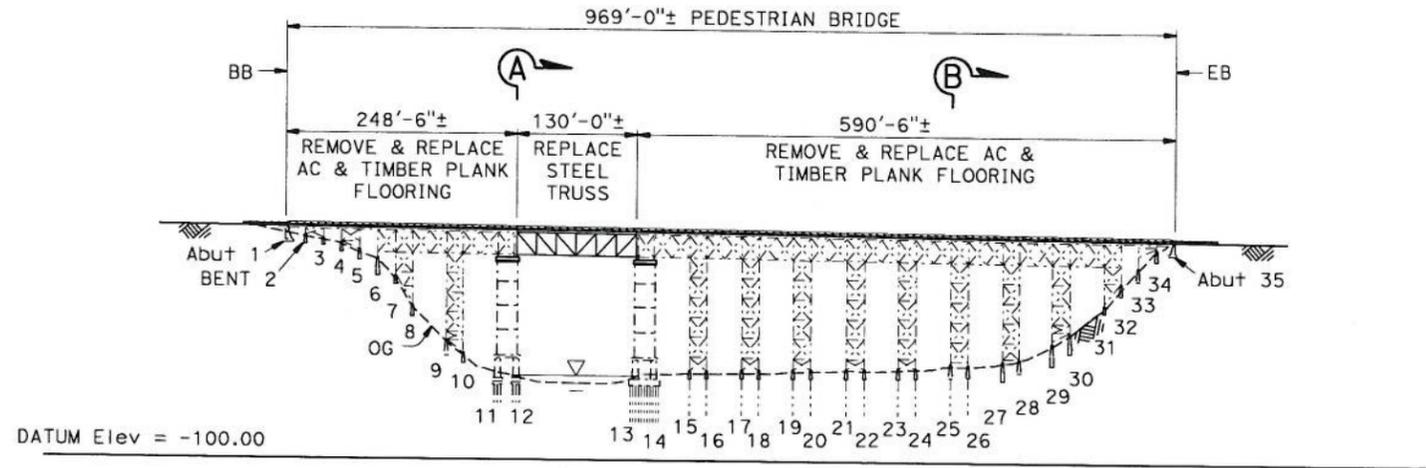


NEW TRUSS CONSTRUCTION SEQUENCE
 NO SCALE

NOTE:
 Route 1 shall not be closed for longer than 24 hours during Stage 3 and Stage 4 construction.

ALT B - WIDEN & RETROFIT (SHEET 2 OF 2)			
DESIGNED BY	Kevin Harper	DATE	12/5/12
DRAWN BY	Bob Huddleston	DATE	1/9/13
CHECKED BY	<i>[Signature]</i>	DATE	4/16/13
APPROVED	<i>[Signature]</i>	DATE	4/16/13
STRUCTURE DESIGN BRANCH 1		PLANNING STUDY	
		ALBION RIVER BR (WIDEN)	
		BRIDGE NO. 10-0136	UNIT: 3576
SCALE: as shown		PROJECT NO. & PHASE: 01000001540	

DIST	COUNTY	ROUTE	POST MILE
01	Men	1	43.74

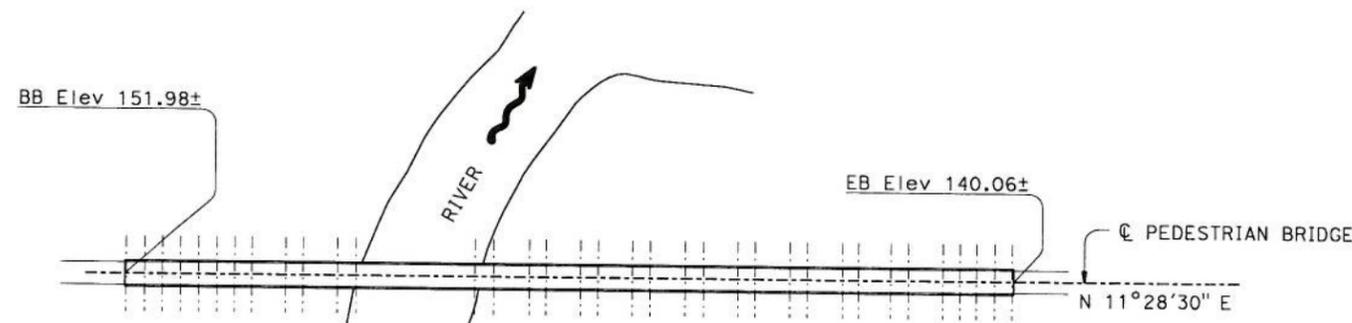


ELEVATION
1" = 200'

NOTES:

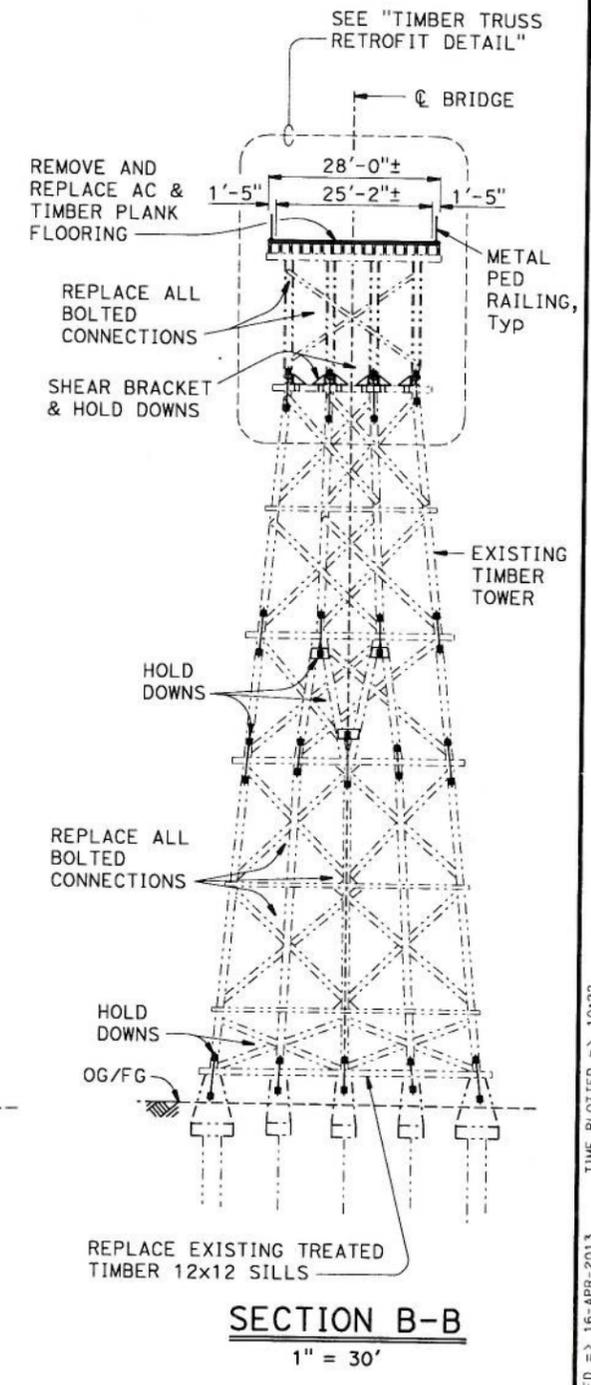
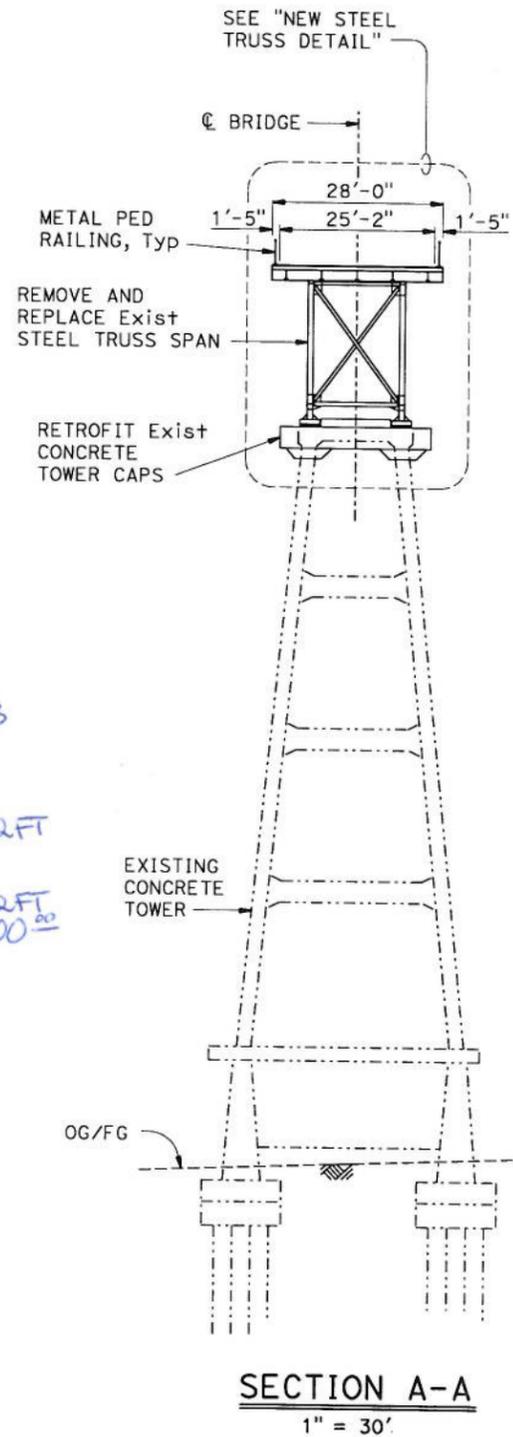
1. New Rte 1 Albion River Bridge not shown.
2. No traffic is assumed to be on the existing bridge during construction. (Route 1 has been realigned to new bridge.)
3. Top and sub floor planks may be of random lengths with a maximum of one joint per run. Joints to occur at centerline of stringer. Joints to be staggered so that joints in adjacent planks do not occur at the same stringer or one directly above another. Minimum plank length is 6 feet.
4. Place a heavy mop coat of hot asphalt on top of the sub floor and then place top planking while the asphalt is still plastic.
5. Replacement of existing timber sill plates will require jacking and temporary supports (dead load only) of the timber tower legs.

DATE OF ESTIMATE	05-17-2013
STR. DEPTH	
LENGTH	969 FT
WIDTH	28 FT
AREA	27,132 SQFT
COST/SQ FT INCLUDING 10% MOBILIZATION & 25% CONTINGENCY	\$197/SQFT
TOTAL COST	\$5,349,000 ²⁰



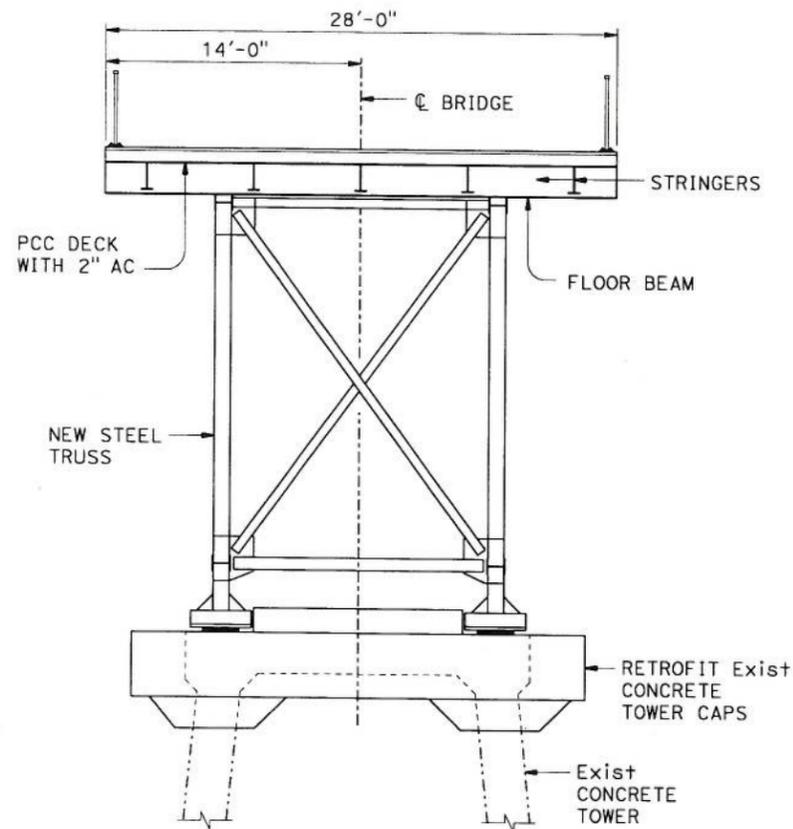
PLAN
1" = 200'

LEGEND:
----- Indicates existing structure



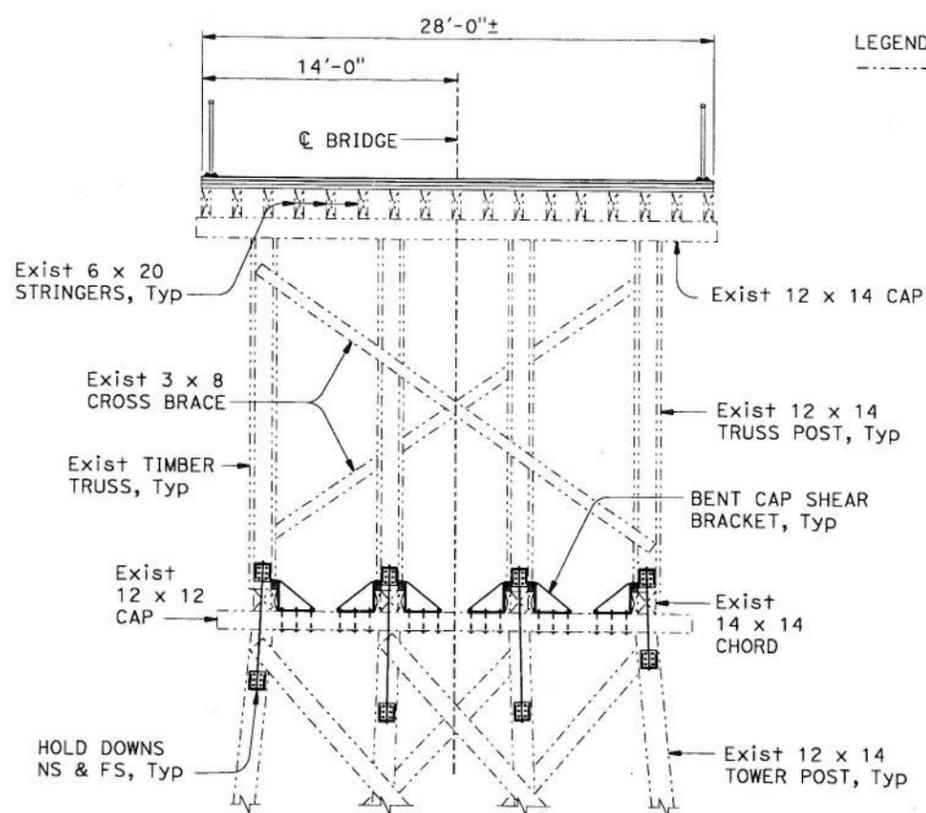
ALT C - REHAB FOR PED BRIDGE (SHEET 1 OF 2)			
DESIGNED BY Kevin Harper	DATE 12/5/12	STRUCTURE DESIGN BRANCH 1	PLANNING STUDY ALBION RIVER BR (RETROFIT)
DRAWN BY Bob Huddleston	DATE 1/14/13		
CHECKED BY [Signature]	DATE 4/16/13		
APPROVED [Signature]	DATE 4/19/13		
BRIDGE NO. 10-0136		UNIT: 3576	
SCALE: as shown		PROJECT NO. & PHASE: 0100001540	
CONTRACT NO.: 01-401104			

DIST	COUNTY	ROUTE	POST MILE
01	Men	1	43.74



NEW STEEL TRUSS DETAIL

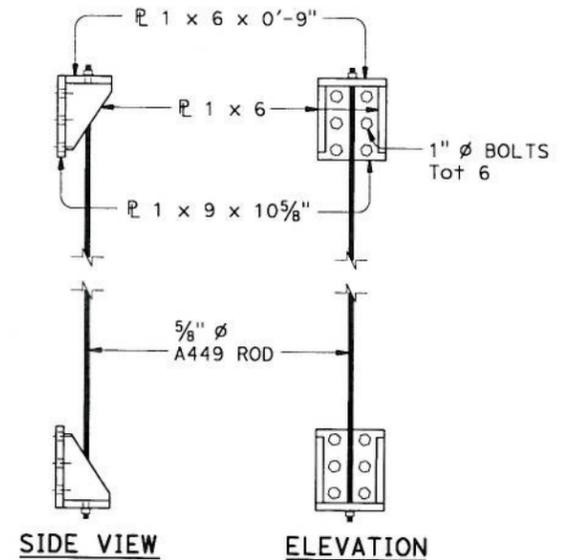
1" = 10'



TIMBER TRUSS RETROFIT DETAIL

1" = 10'

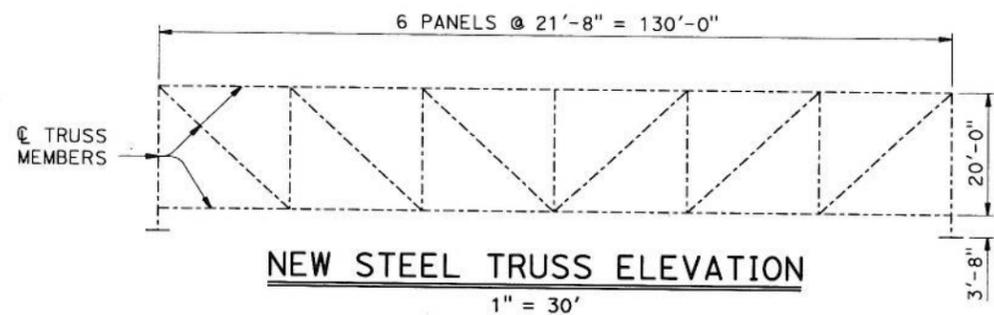
LEGEND:
----- Indicates existing structure



HOLD DOWN DETAIL

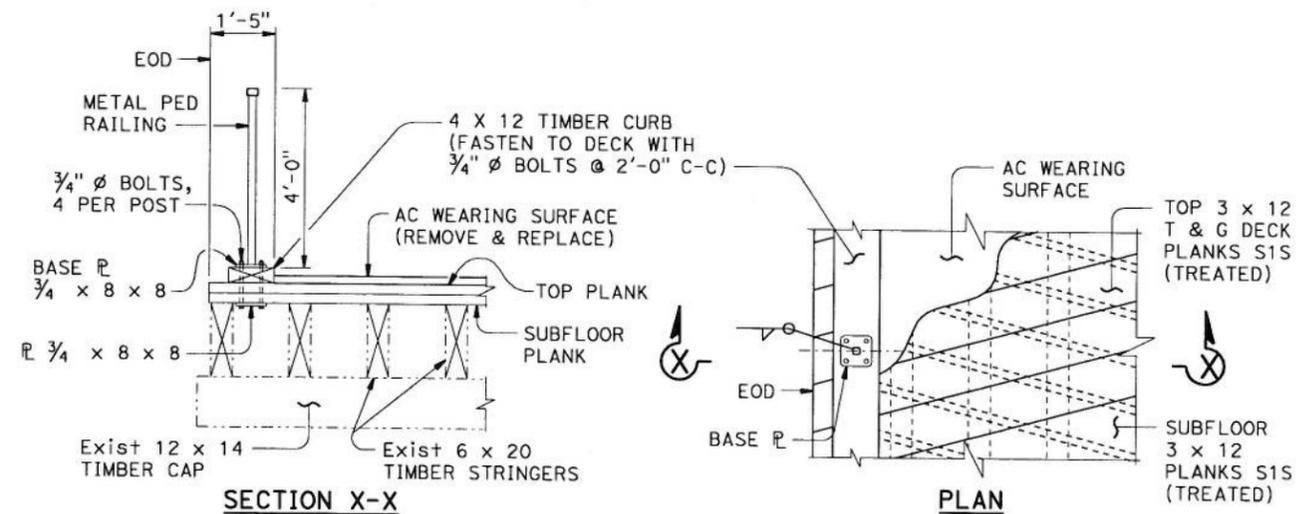
1/2" = 1'-0"

NOTES:
1. All plates shall be Grade 50 steel.
2. All nuts shall have a thread locking system.



NEW STEEL TRUSS ELEVATION

1" = 30'

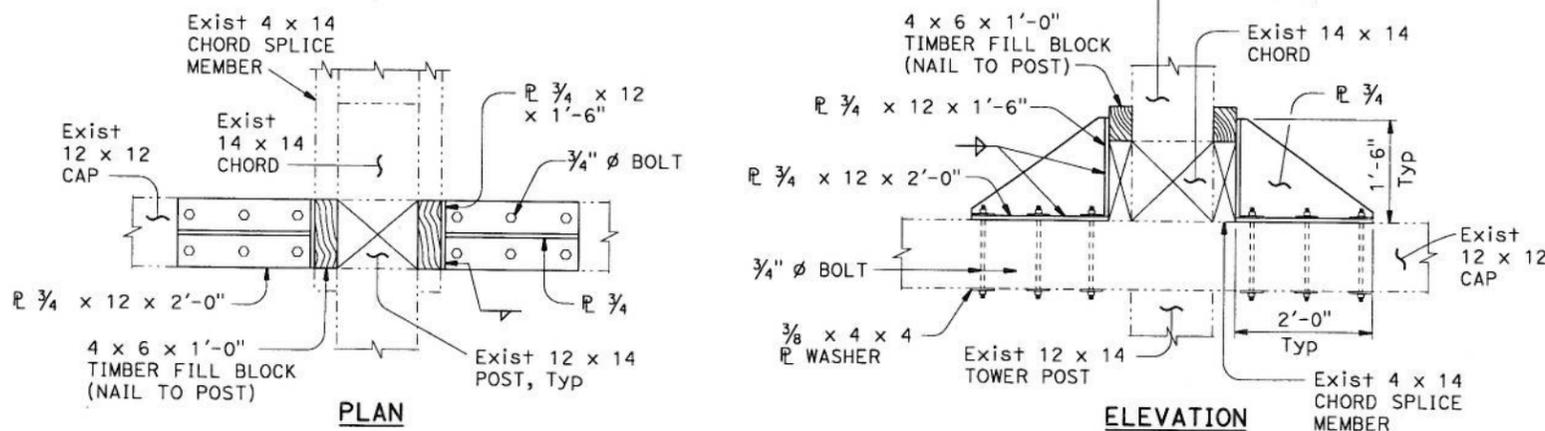


SECTION X-X

NOTES:
1. Deck planks (top & subfloor) to be removed and replaced.
2. Attach each plank to stringer with 5/8" x 6" TimberLok heavy duty wood screws.
3. Tube rails not shown in "PLAN".

METAL PEDESTRIAN RAILING & TIMBER DECK

1/4" = 1'-0"



PLAN

ELEVATION

TRUSS TO TOWER BENT CAP SHEAR BRACKET

3/8" = 1'-0"

ALT C - REHAB FOR PED BRIDGE (SHEET 2 OF 2)

DESIGNED BY	Kevin Harper	DATE	12/5/12
DRAWN BY	Bob Huddleston	DATE	1/14/13
CHECKED BY	<i>[Signature]</i>	DATE	4/10/13
APPROVED	<i>[Signature]</i>	DATE	4/16/13

STRUCTURE DESIGN BRANCH
1

PLANNING STUDY	
ALBION RIVER BR (RETROFIT)	
BRIDGE NO. 10-0136	UNIT: 3576
SCALE: as shown	PROJECT NO. & PHASE: 01000001540