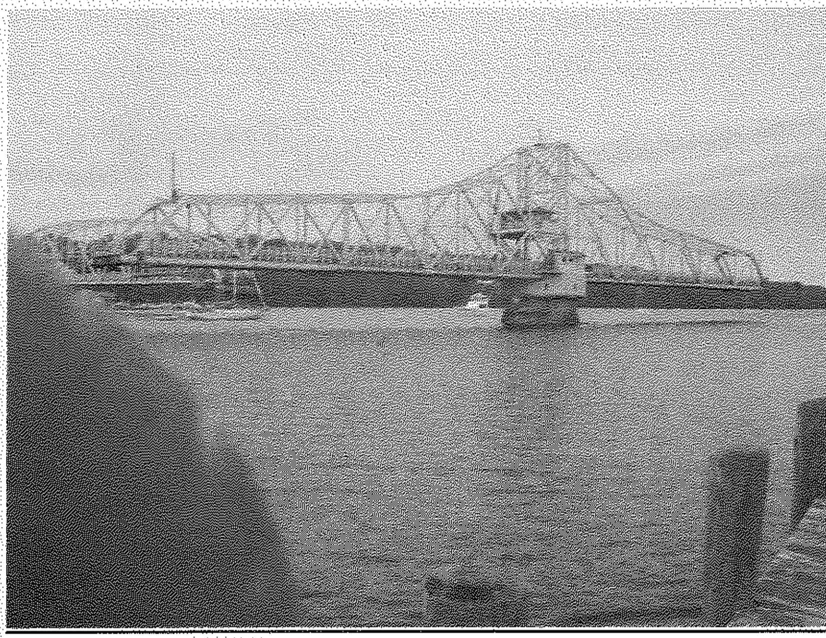
East Haddam Swing Bridge

Bridge No. 1138

Sidewalk Study Report



Connecticut Department of Transportation

Prepared by:

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CONSULTING ENGINEERS
76 Westbury Park Road
Watertown, Connecticut

October, 1999

Lichtenstein

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BRIDGES HIGHWAYS RAILROADS SITE ENGINEERING DAMS

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EXECUTIVE SUMMARY

This report will present the findings of a study that considered adding sidewalks to Bridge No. 1138, the East Haddam Swing Span. This bridge carries Route 82 over the Connecticut River. There is pedestrian traffic on the East Haddam bridge due to presence of the Goodspeed Opera House located near the east end of the bridge and the Camelot Boat tours at the west end of the bridge. Since there are no sidewalks along the bridge, 2 lanes of vehicular traffic currently share the narrow 24 feet 6 inches roadway with the pedestrian traffic. This study was performed to check the feasibility of adding a 5 foot sidewalk on each side of the bridge. No approach sidewalk is included in the study.

Three sidewalk structure types considered as part of the feasibility study are as follows:

1) Fiber Reinforced Plastic Sidewalk
2) Steel Grid Deck and Framing
3) Timber Sidewalk

Each option was considered for its effect on the structural rating of the truss members and floor system members and its relative merits and demerits. Within each option there are several alternative framing plans and member configurations that were not fully considered as their effect on the structure would be the same.

The results of the study indicate that the addition of sidewalks is feasible with little effect on the structural capacity of the bridge. Of the three options considered (fiber reinforced plastics, timber, steel), only the steel option required strengthening of truss members. Based on loading and economic considerations, the option that appears to offer the most reasonable solution is Option A: Fiber Reinforced Plastics. This option has a low estimated cost, will be highly corrosion resistant and its lightweight has little effect on the structure. Concerns that are common to all material types that will need to be addressed during design are, the installation of appropriate architectural adornments (pedestrian railings etc.) that will ensure aesthetic and historic compatibility with the existing bridge, and the installation of a system that will ensure that pedestrians are able to safely clear the swing span prior to an opening. This may include pedestrian traffic gates and cameras so that the sidewalks are clearly visible from the operator's house. Fiber Reinforced Plastics can be made in a number of different shapes and colors to closely match the style of the existing structure, thus mitigating historic concerns.

The recommended option is the addition of a Fiber Reinforced Plastic sidewalk and pedestrian rail supported on steel floor beams on each fascia of the bridge at a cost of $1,360,000. This cost is exclusive of approach work that will be necessary to provide sidewalks on both sides of both approaches.

Description of Existing Bridge

The East Haddam swing bridge was built in 1913 across the Connecticut River. The bridge carries two (2) lanes of Route 82 in an east/west direction while allowing navigation access of the Connecticut River in a 200 foot clear channel width in the west half of the swing span. The bridge has three (3) truss spans consisting of a 99 foot deck truss span, a 326 foot through truss fixed span and a 456 foot through truss swing span. The bridge roadway has a width of 24 feet 6 inches face to face of railings and an out to out deck width of 25 feet 11 3/8 inches.

The deck truss span consists of 2 riveted Warren trusses with vertical posts, spaced 15 feet center to center. The floor beams bear on the top of the top chord and cantilever outside the trusses to support the full width of the deck. Floor beams are located at 9 node points of the 10 panel truss, and the east end floor beam is supported directly by pier 1. The fixed through truss span consists of a pair of 18 panel, Pennsylvania type, riveted trusses with a 27 foot spacing center to center of trusses. The 32 floor beams of this span frame to the bottom chord, but have a spacing not congruent to the panel spacing of the trusses. The swing span consists of a through truss system with multiple eye bar members and riveted built-up members. The two trusses are also spaced at 27 feet center to center, and each half of the swing span has 10 truss panels. Like the fixed through truss span, the 42 floor beams are framed into the bottom chord members and do not connect at the node points of the trusses. The swing span trusses are supported on 2 transverse cross girders at the pivot pier. The cross girders transfer loads to a center pivot bearing through 6 foot long pintle girders over the center pivot bearing. Live load wedges exist under each end of each cross girder and at the ends of the swing span which are driven in place when the bridge is closed. When the wedges are withdrawn, the entire superstructure is supported at the center pivot bearing. The substructure consists of a reinforced concrete open stem west abutment, while the east abutment is reinforced concrete stub abutment. The piers are reinforced concrete stem walls and piers 2 and 3, which are in the river, are faced with stone masonry from the waterline down to the mud-line and are founded on wood piles.

Preliminary Sidewalk Type Study

Three schemes were studied on the basis of the choice of construction materials, namely, fiber reinforced plastic (FRP), steel, and timber. For the purposes of this study, the framing in all 3 schemes consist of a 5 foot wide sidewalk deck supported on a new sidewalk stringer-floor beam system framing into the existing bridge structure. The sidewalk floor beams in the deck truss span, in all 3 schemes, would be supported by the fascia stringer and the top chord of the deck truss as shown in the framing plan in Figure 6. In the through truss spans, the bottom chords at the existing floor beam framing locations would support the sidewalk floor beams. In addition to the stringer floor beam systems, other framing could be considered. Trusses, 5 feet± deep, could be used instead of stringers for longitudinal support, or innovative integral deck systems could be considered to increase span or minimize member installation. In considering a system to be chosen for framing of a sidewalk on this structure, mitigation of historic concerns and aesthetic impacts will be foremost concerns. The estimated costs and quantities are for work done on the bridge from abutment to abutment and do not include additional work that would be required at the approaches.

Option A - Fiber Reinforced Plastic Sidewalk

Fiber Reinforced Plastics are composite materials consisting of a plastic resin matrix reinforced by embedded fibrous material such as fiberglass. Such materials offer lightweight alternatives to more conventional construction materials and are fabricated in standard shapes or costume made sections. Pigments can be added to match almost all colors.

The deck in this scheme consists of a 1/8 inch thick FRP plate bonded to 2 inch deep FRP bearing bars spaced 2 inches center to center. The deck would be supported on 2 FRP stringers and steel floor beams. The rail and rail posts would also be of FRP in this alternative with post spacing of 2 feet. Steel shim plates would be required in all the spans to match the elevation of the sidewalk deck with the existing bridge deck. Refer to Figures 7 and 10 for a typical cross section of the proposed sidewalk with this scheme. The estimated cost of this option is $1,360,000. (See Appendix A)

The advantages of this option are that it is lightweight thus can be installed with no strengthening of truss members, is low cost when compared to the steel option, FRP are corrosion resistant and a color may be chosen that is harmonious with existing structure and surroundings.

Disadvantages are that maintenance and repair of these materials are more difficult because they are not readily available and maintenance personnel are not familiar with repair methods. Additionally, the flexibility of the material may limit the span length and require additional attachments when compared to the other options, and it is likely that historic concerns will require special treatments (i.e. decorations) to ensure compatibility with the historic structure.

Option B -Steel Grid Sidewalk

Steel framing with a concrete filled steel grid is an often-used system that offers rigidity for deflection, relative long life and ease of installation. This system is similar to what is currently in place on the structure.

The deck in this scheme would consist of a 2 inch deep open steel grid deck filled with concrete with a 6 inch spacing of main bars. The deck would be supported on 2 steel stringers and steel floor beams. The rail and rail posts would be tubular steel sections in this alternative with post spacing of 5 feet. Steel shim plates would be required in all the spans to match the elevation of the sidewalk deck with the existing bridge deck. Refer to Figures 8 and 11 for a typical cross section of the proposed sidewalk with this alternative. The estimated cost of this option is $2,070,000. (See Appendix A)

Advantages of this option are that the system is in common use, is relatively easy to repair, is similar to the system currently on the bridge and is compatible with the historic nature of the structure. Furthermore, architectural treatments to enhance the aesthetics of the sidewalk can be easily added and are readily available.

Disadvantages include the high cost and weight. The heavy added weight of this option makes strengthening of truss members in the deck truss necessary and reduces the rating of other truss members throughout the structure.

Option C -Timber Sidewalk

Timber is a lightweight construction material that can be sawn rectangular shapes or can be glulaminated members with custom cross sections. Generally this material is readily and can be repaired and maintained easily. Colors are limited and the aesthetic affect may not be compatible with the historic nature of this structure.

The deck in this scheme would consist of 2 inch X 6 inch sawn lumber (pressure treated, southern pine). The deck would be supported on 2 timber stringers (pressure treated, southern pine) and steel floor beams. The rail and rail posts would be tubular steel sections in this alternative with post spacing of 5 feet. Steel shim plates would be required in all the spans to match the elevation of the sidewalk deck with the existing bridge deck. Refer to Figures 8 and 12 for a typical cross section of the proposed sidewalk with this alternative. The estimated cost of this option is $1,330,000. (See Appendix A)

Advantages of this system are its low cost, lightweight, ease of repair and several options of framing members are possible that may not be as easy with the other materials. Glulaminated timber members can be made in many shapes and sizes. Additionally, architectural treatments can be easily fabricated and installed.

Disadvantages include a life cycle that is approximately half that of steel and FRP, and aesthetically wood may not be compatible with this steel structure.

Effect of Proposed Sidewalk on Existing Bridge Rating

Tables 1, 2, and 3 give the weight of the proposed sidewalk, for the 3 alternatives, per linear foot of the deck truss span, fixed through truss span, and the swing through truss span respectively. As can be noted, the option with the FRP is the lightest while the option of steel sidewalk is the heaviest. The live load of 85 psf is the same for all the 3 alternatives. Tables of the weights of the various options and summary of the effect on the rating is included in Appendix B.

Summary:

Option A - Fiber Reinforced Plastics

No strengthening of truss members, floor beams or stringers is required

Option B – Steel and Concrete Filled Steel Grid Deck

Truss Members U4U5 and U5U6 in the deck truss span would require strengthening the ratings of other members including Truss Member L0L1 in the thru truss span and L10L10' in the swing truss span are near the lower limit, No strengthening of floor beams or stringers is required

Option C – Timber

No strengthening of truss members, floor beams or stringers is required

Deck Truss Span

The proposed sidewalk would increase the stresses in the fascia stringers, the floor beams, and the deck trusses directly and via the floor beam.

a) Fascia Stringer

The controlling rating for the fascia stringer would drop from the existing 81.9 tons (based upon bending, no sidewalk) to 51.8 tons based upon shear for the heaviest option B. Thus, no strengthening of the fascia stringers appears to be required under any of the options.

b) Floor beams

The existing rating for the floor beams, without a sidewalk, is 60.1 tons and is based upon bending of an as-inspected section of floor beam 4 at midspan. Since the sidewalks would load only the cantilevered portion of the floor beam, the heaviest Option B would result in a floor beam rating of 52.9 tons. Thus, no strengthening of the floor beams appears to be required under any of the options.

c) Deck truss

The rating for the deck truss, controlled by members U4U5 and U5U6, would drop from the existing 38.5 tons to 34.9 tons for the heaviest option B, thus requiring minimum strengthening. A scheme for proposed strengthening of members U4U5 and U5U6 for Option B is shown in Figure 13. The rating of the aforementioned strengthened members would be 37 tons. For options A and C, the controlling rating would be 36 tons requiring no strengthening.

Fixed Through Truss Span

The proposed sidewalk would stress only the trusses. The existing truss rating, controlled by bottom chord member L0L1, would drop from 40.2 tons to 36.4 tons for the heaviest sidewalk option B. Thus, no strengthening of the fixed through trusses appears to be required under any of the three options.

Swing Through Truss Span

The proposed sidewalk would load only the trusses. The existing truss rating, governed by bottom chord member L10L10' with bridge in closed position, would drop from 43.9 tons to 39.2 tons for the heaviest sidewalk option B. Thus, all three options would require no strengthening of the swing span trusses.

A summary of the bridge rating due to the proposed sidewalk is given in Appendix B Table 4.

Summary and Conclusions

In summary, analyses have shown that all three options studied are possible and that only Option B, steel with concrete filled grid deck, would require strengthening of the existing bridge. Option B will require minor strengthening of members U4U5 and U5U6 of the deck truss. The cost of Option A (FRP) and Option C (timber) are essentially the same, approximately $1,360,000 and $1,330,000 and the cost of Option B (steel) is $2,070,000. Based on cost, Option B is the least desirable. Considering life cycle, FRP is twice that of timber, and the fact that color can be matched with the existing, Option A, is the most desirable.

Appendix A

Estimates

Proposed Sidewalk on East Haddam Swing Bridge
East Haddam, Connecticut

Lichtenstein Project No. 1940 25-Oct-99

Option A - Fiber Reinforced Plastic Sidewalk

	QUANTITY	UNIT	UNIT PRICE	TOTAL
FRP deck	8,810	SF	$35.00	$308,350.00
FRP stringers	3,524	LF	$45.00	$158,580.00
FRP rail and rail posts	3,524	LF	$65.00	$229,060.00
Structural steel	32,040	LB	$7.50	$240,300.00
Rivet Removal	850	EA	$30.00	$25,500.00
Furnish & Install Surveillance Cameras and Monitor	1	LS	$15,440.00	$15,440.00
Install Conduit for Cameras	1,100	LF	$4.00	$4,400.00
Lights for Sidewalk	50	EA	$800.00	$40,000.00
Conduit for Lights	1,800	LF	$4.00	$7,200.00
Furnish and Install Pedestrian Traffic Gates	4	EA	$9,000.00	$36,000.00
			SUBTOTAL =	$1,064,830.00
			MOBILIZATION @ 5% =	$53,241.50
			ENGINEERING COSTS @ 6% =	$63,889.80
			SUBTOTAL =	$1,181,961.30
			CONTINGENCIES @ 15% =	$177,294.20
			TOTAL =	$1,359,255.50
			SAY	**$1,360,000.00**

Proposed Sidewalk on East Haddam Swing Bridge
East Haddam, Connecticut

Lichtenstein Project No. 1940 25-Oct-99

Option B - Steel Grid Sidewalk

	QUANTITY	UNIT	UNIT PRICE	TOTAL
Steel grid deck	8,810	SF	$24.00	$211,440.00
Structural steel (new)	101,010	LB	$7.50	$757,575.00
Structural steel (strengthening)	225	LB	$15.00	$3,375.00
Steel rail and rail posts	3,524	LF	$150.00	$528,600.00
Rivet removal	460	EA	$30.00	$13,800.00
Furnish & Install Surveillance Cameras and Monitor	1	LS	$15,440.00	$15,440.00
Install Conduit for Cameras	1,100	LF	$4.00	$4,400.00
Lights for Sidewalk	50	EA	$800.00	$40,000.00
Conduit for Lights	1,800	LF	$4.00	$7,200.00
Furnish and Install Pedestrian Traffic Gates	4	EA	$9,000.00	$36,000.00
			SUBTOTAL =	$1,617,830.00
			MOBILIZATION @ 5% =	$80,891.50
			ENGINEERING COSTS @ 6% =	$97,069.80
			SUBTOTAL =	$1,795,791.30
			CONTINGENCIES @ 15% =	$269,368.70
			TOTAL =	$2,065,160.00
			SAY	**$2,070,000.00**

Proposed Sidewalk on East Haddam Swing Bridge
East Haddam, Connecticut

Lichtenstein Project No. 1940 25-Oct-99

Option C - Timber Sidewalk

	QUANTITY	UNIT	UNIT PRICE	TOTAL
Timber deck	8,810	SF	$12.00	$105,720.00
Timber stringers	12,275	BF	$4.50	$55,237.50
Steel rail & rail posts	3,524	LF	$150.00	$528,600.00
Structural steel	30,100	LB	$7.50	$225,750.00
Rivet Removal	850	EA	$30.00	$25,500.00
Furnish & Install Surveillance Cameras and Monitor	1	LS	$15,440.00	$15,440.00
Install Conduit for Cameras	1,100	LF	$4.00	$4,400.00
Lights for Sidewalk	50	EA	$800.00	$40,000.00
Conduit for Lights	1,800	LF	$4.00	$7,200.00
Furnish and Install Pedestrian Traffic Gates	4	EA	$9,000.00	$36,000.00

SUBTOTAL = $1,043,847.50

MOBILIZATION @ 5% = $52,192.38
ENGINEERING COSTS @ 6% = $62,630.85

SUBTOTAL = $1,158,670.73

CONTINGENCIES @ 15% = $173,800.61

TOTAL = $1,332,471.33

SAY $1,330,000.00

Appendix B

Summary of Loads and Ratings

Table 1 - Weight of Each Proposed Sidewalk on Deck Truss Span

	Option A (plf)	Option B (plf)	Option C (plf)
Deck	24.0	163.0	31.5
Stringer	18.5	36.0	32.8
Floorbeam	64.5	35.8	64.5
Steel shims	6.5	1.1	1.9
Rail & rail posts	14.1	82.9	69.4
Total dead load (est)	128	319	200

plf = pounds per linear foot

Table 2 - Weight of Each Proposed Sidewalk on Fixed Through Truss Span

	Option A (plf)	Option B (plf)	Option C (plf)
Deck	24.0	163.0	31.5
Stringer	17.6	48.0	22.5
Floorbeam	10.6	5.5	10.6
Steel shims	1.0	1.0	0.5
Rail & rail posts	14.1	82.9	69.4
Total dead load (est)	68	301	135

plf = pounds per linear foot

Table 3 - Weight of Each Proposed Sidewalk on Swing Through Truss Span

	Option A (plf)	Option B (plf)	Option C (plf)
Deck	24.0	163.0	31.5
Stringer	17.6	48.0	22.5
Floorbeam	10.8	5.9	10.8
Steel shims	0.5	2.1	0.6
Rail & rail posts	14.1	82.9	69.4
Total dead load (est)	68	302	135

plf = pounds per linear foot

Table 4 - Summary Sheet of Bridge Rating due to Proposed Sidewalk

Member	RF_I	RT_I	RF_O	RT_O
Interior stringer *	1.34	48.2	2.24	80.6
Deck Truss Span				
Fascia stringer	1.44	51.8	2.41	86.6
Floorbeam	1.47	52.9	2.46	88.4
Truss (U4U5, U5U6), Option B	0.97	34.9	1.62	58.3
Option C	1.01	36.4	1.69	60.7
Thru Truss Span				
Floorbeam*	1.21	44.0	2.02	73.0
Truss (L0L1)	1.01	36.4	1.69	60.7
Swing Truss Span				
Floorbeam*	1.50	54.0	2.50	90.2
Truss (L10L10')	1.09	39.2	1.82	65.5

Notes :

a) I = Inventory, O = Operating, RF = Rating Factor, RT = Rating Ton

b) * = Sidewalk does not affect load rating

c) Unless specified, ratings based upon the heaviest Option B

Appendix C

Sketches

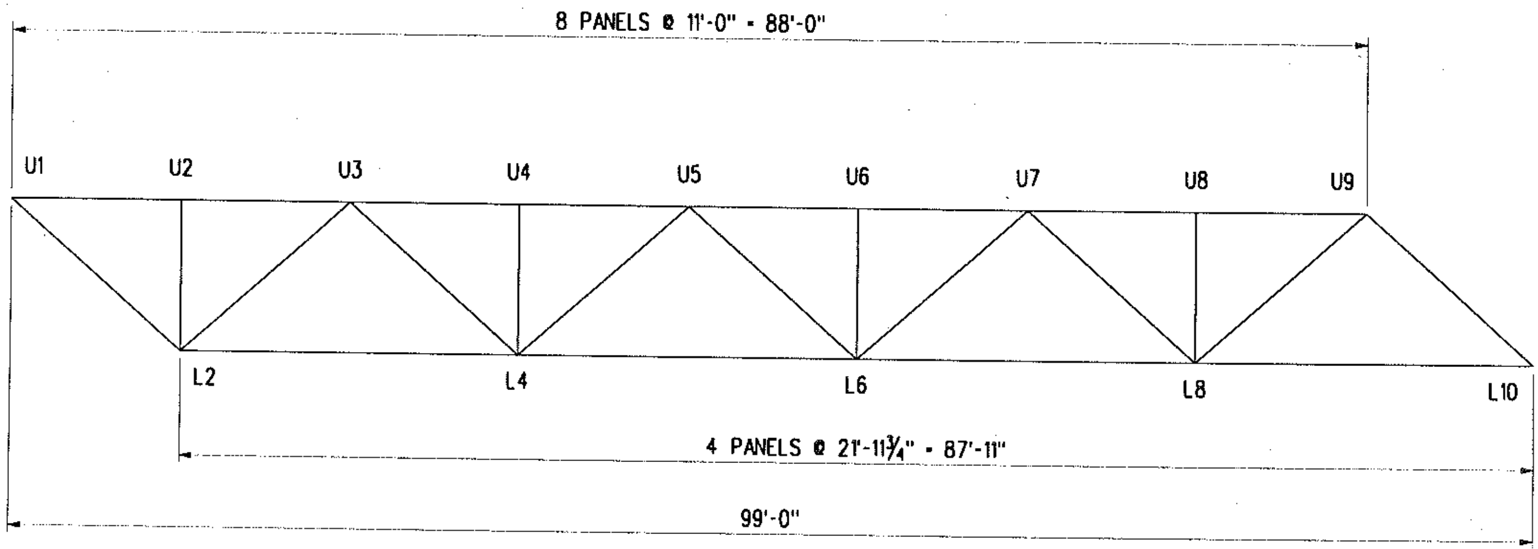

FIGURE 1
ELEVATION - SPAN 1

A.G. LICHTENSTEIN & ASSOCIATES, INC.
CONSULTING ENGINEERS
Lichtenstein
BRIDGES HIGHWAYS RAILWAYS HISTORIC STRUCTURES DAMS

ROUTE 82 OVER THE CONNECTICUT RIVER EAST HADDAM, CONNECTICUT		
FIGURE 1		
ENGINEER: A.G. LICHTENSTEIN & ASSOCIATES, INC.		
DESIGNER: AS	DRAFTER: CD	CHECKER: EAR
PROJECT NO. 1940	DATE: 09/07/99	

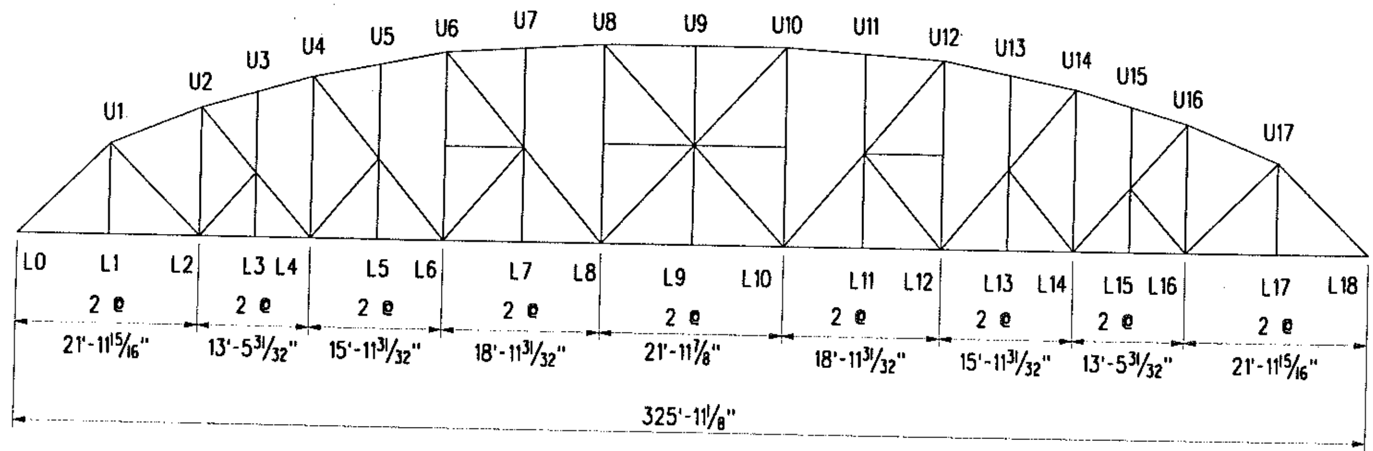

FIGURE 2
ELEVATION - SPAN 2

A.G. LICHTENSTEIN & ASSOCIATES, INC.
CONSULTING ENGINEERS
Lichtenstein
BRIDGES HIGHWAYS RAILWAYS HISTORIC STRUCTURES DAMS

ROUTE 82 OVER THE CONNECTICUT RIVER EAST HADDAM, CONNECTICUT		
FIGURE 2		
ENGINEER: A.G. LICHTENSTEIN & ASSOCIATES, INC.		
DESIGNER: AS	DRAFTER: CD	CHECKER: EAR
PROJECT NO. 1940	DATE: 09/07/99	

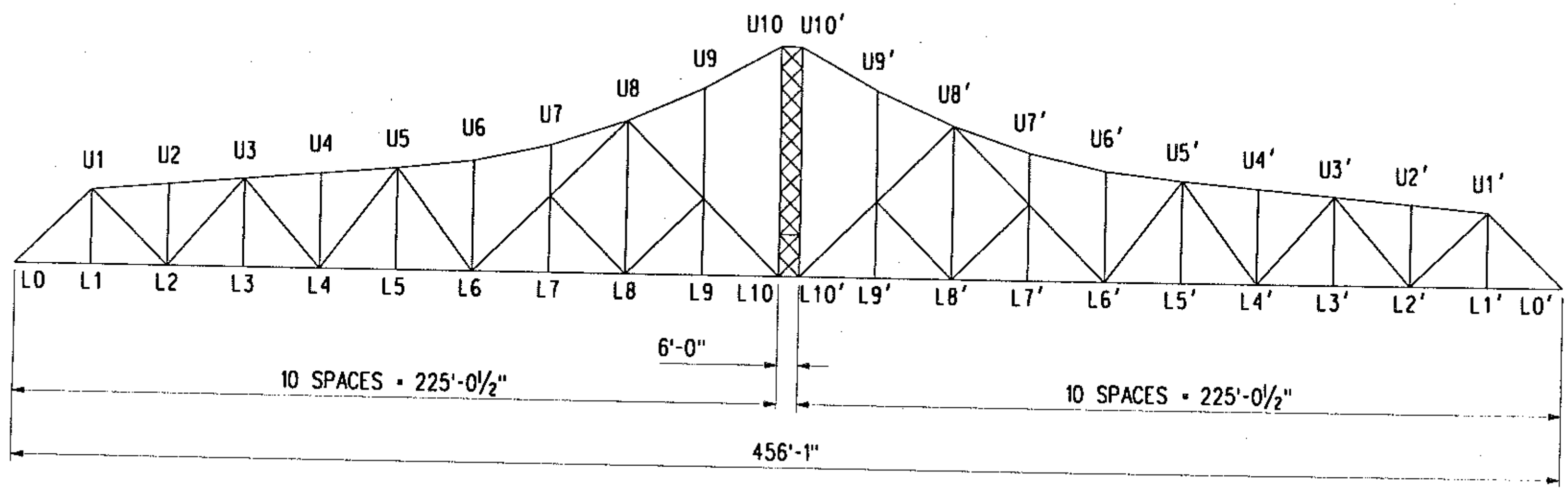

FIGURE 3
ELEVATION - SPAN 3

A.G. LICHTENSTEIN & ASSOCIATES, INC.
CONSULTING ENGINEERS
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BRIDGES HIGHWAYS RAILWAYS HISTORIC STRUCTURES DAMS

ROUTE 82 OVER THE CONNECTICUT RIVER EAST HADDAM, CONNECTICUT		
FIGURE 3		
ENGINEER: A.G. LICHTENSTEIN & ASSOCIATES, INC.		
DESIGNER: AS	DRAFTER: CO	CHECKER: EAR
PROJECT NO. 1940		DATE: 09/07/99

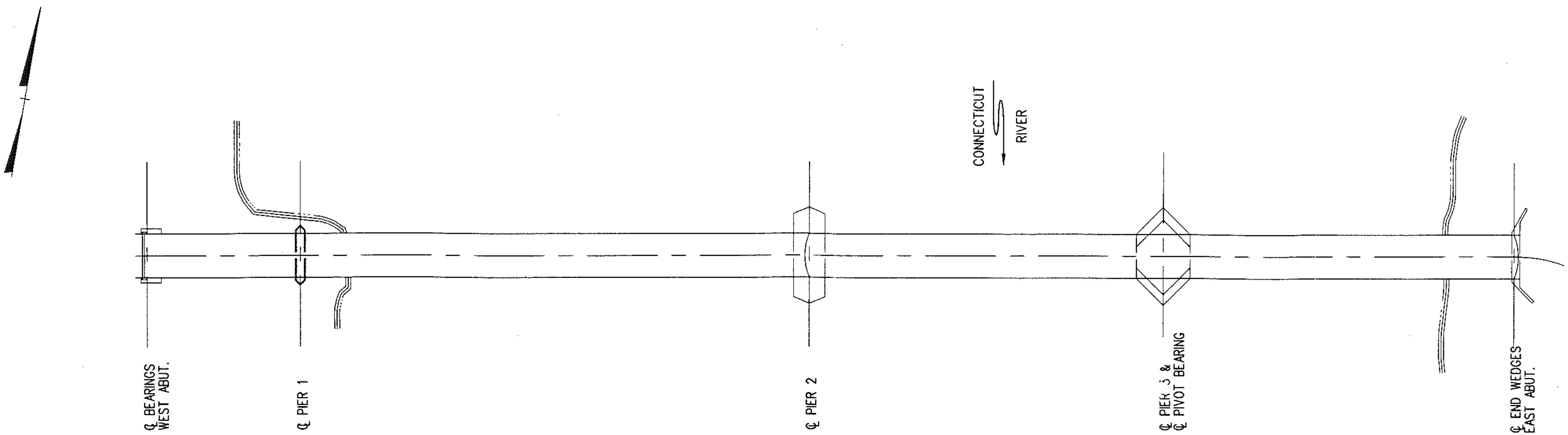

FIGURE 4
PLAN VIEW

A.G. LICHTENSTEIN & ASSOCIATES, INC.
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ROUTE 82
OVER
THE CONNECTICUT RIVER
EAST HADDAM, CONNECTICUT

FIGURE 4

ENGINEER: A.G. LICHTENSTEIN & ASSOCIATES, INC.

DESIGNER: AS | DRAFTER: CD | CHECKER: EAR

PROJECT NO. 1940 | DATE: 09/07/99

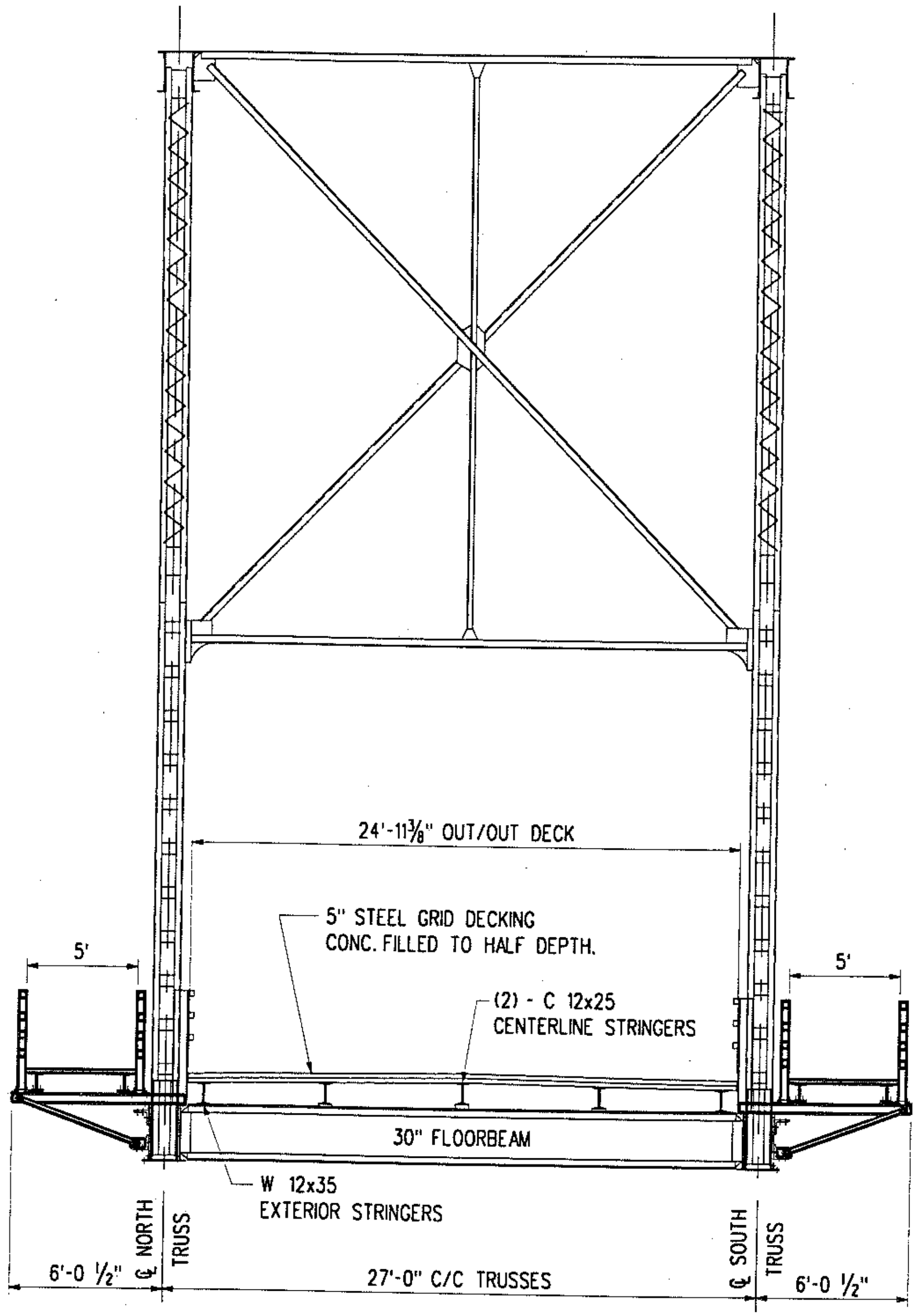

FIGURE 5
TYPICAL CROSS SECTION THROUGH TRUSSES

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Lichtenstein
BRIDGES HIGHWAYS RAILWAYS HISTORIC STRUCTURES DAMS

ROUTE 82
OVER
THE CONNECTICUT RIVER
EAST HADDAM, CONNECTICUT

FIGURE 5

ENGINEER: A.G. LICHTENSTEIN & ASSOCIATES, INC.

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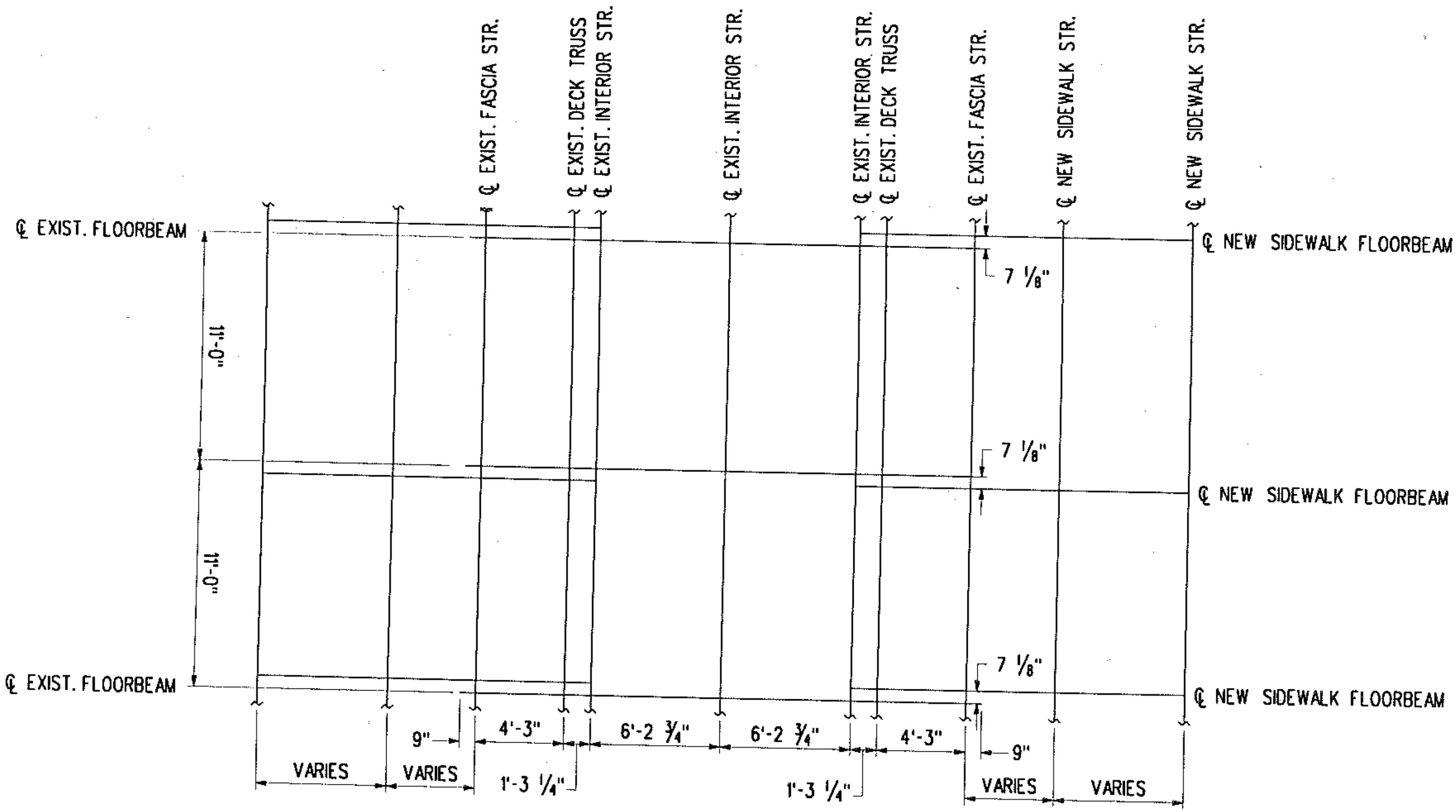
PROJECT NO. 1940	DATE: 09/07/99	



FRAMING PLAN OF
PROPOSED SIDEWALK IN DECK TRUSS SPAN

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ROUTE 82
OVER
THE CONNECTICUT RIVER
EAST HADDAM, CONNECTICUT

FIGURE 6

ENGINEER: A.G. LICHTENSTEIN & ASSOCIATES, INC.		
DESIGNER: AS	DRAFTER: CD	CHECKER: EAR
PROJECT NO. 1940		DATE: 09/07/99

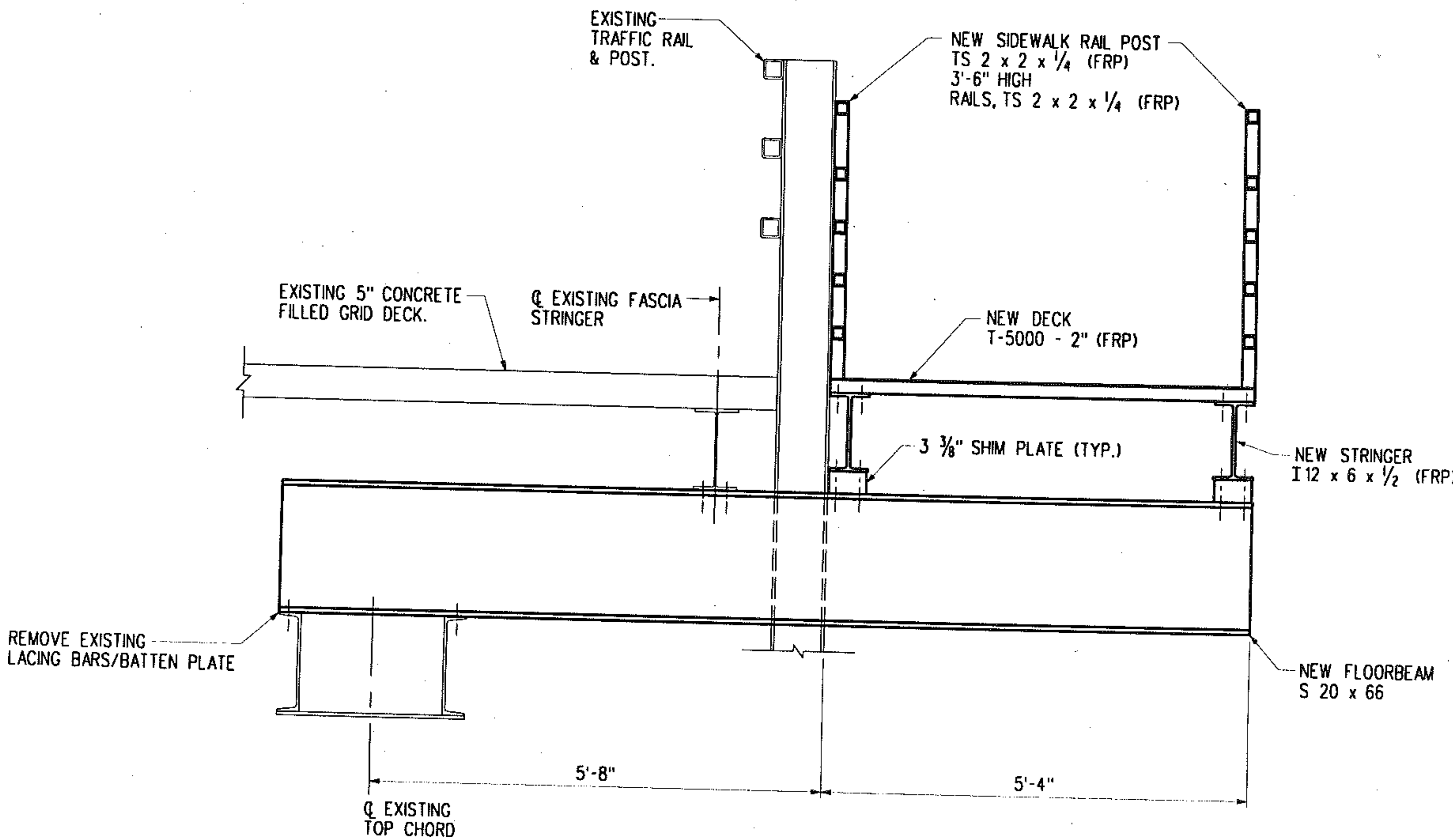

FIGURE 7 - OPTION A
DECK TRUSS SPAN

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BRIDGES HIGHWAYS RAILWAYS HISTORIC STRUCTURES DAMS

ROUTE 82 OVER THE CONNECTICUT RIVER EAST HADDAM, CONNECTICUT		
FIGURE 7 – OPTION A		
ENGINEER: A.G. LICHTENSTEIN & ASSOCIATES, INC.		
DESIGNER: AS	DRAFTER: CD	CHECKER: EAR
PROJECT NO. 1940		DATE: 09/07/99

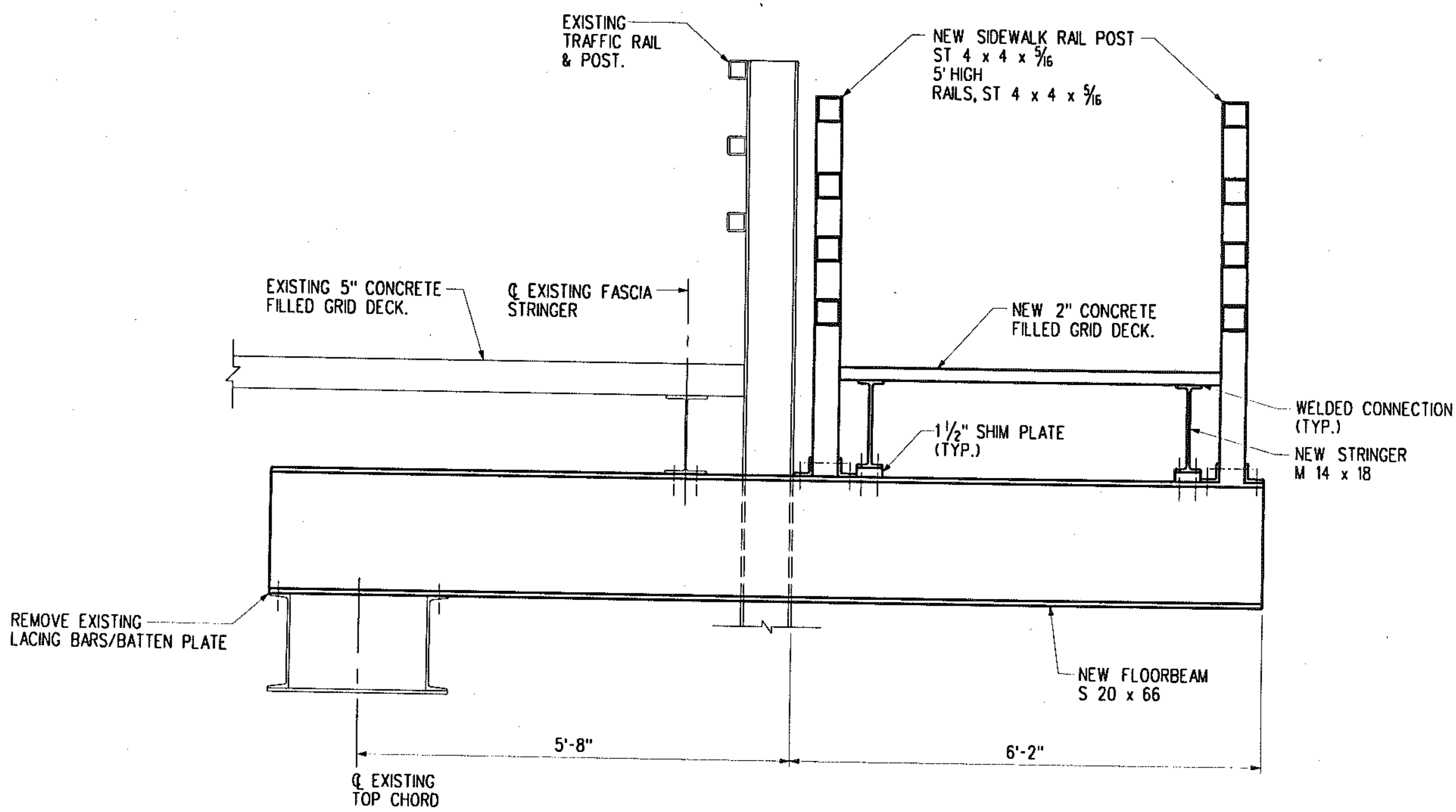

FIGURE 8 - OPTION B

DECK TRUSS SPAN

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ROUTE 82 OVER THE CONNECTICUT RIVER EAST HADDAM, CONNECTICUT		
FIGURE 8 - OPTION B		
ENGINEER: A.G. LICHTENSTEIN & ASSOCIATES, INC.		
DESIGNER: AS	DRAFTER: CD	CHECKER: EAR
PROJECT NO. 1940	DATE: 09/07/99	

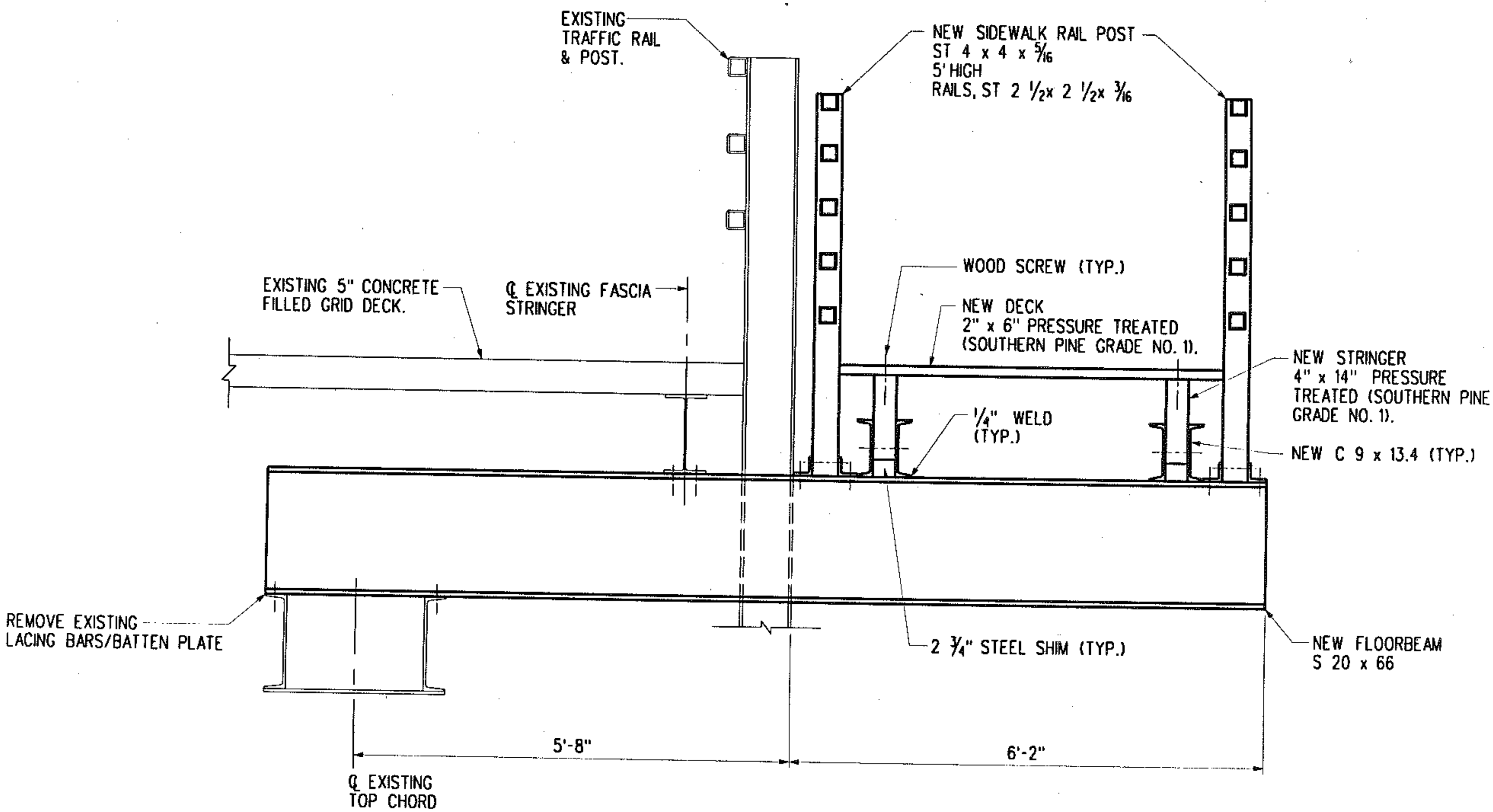

FIGURE 9 - OPTION C

DECK TRUSS SPAN

A.G. LICHTENSTEIN & ASSOCIATES, INC. CONSULTING ENGINEERS Lichtenstein BRIDGES HIGHWAYS RAILWAYS HISTORIC STRUCTURES DAMS	ROUTE 82 OVER THE CONNECTICUT RIVER EAST HADDAM, CONNECTICUT
	FIGURE 9 – OPTION C
	ENGINEER: A.G. LICHTENSTEIN & ASSOCIATES, INC.
	DESIGNER: AS / DRAFTER: CD / CHECKER: EAR
	PROJECT NO. 1940 / DATE: 09/07/99

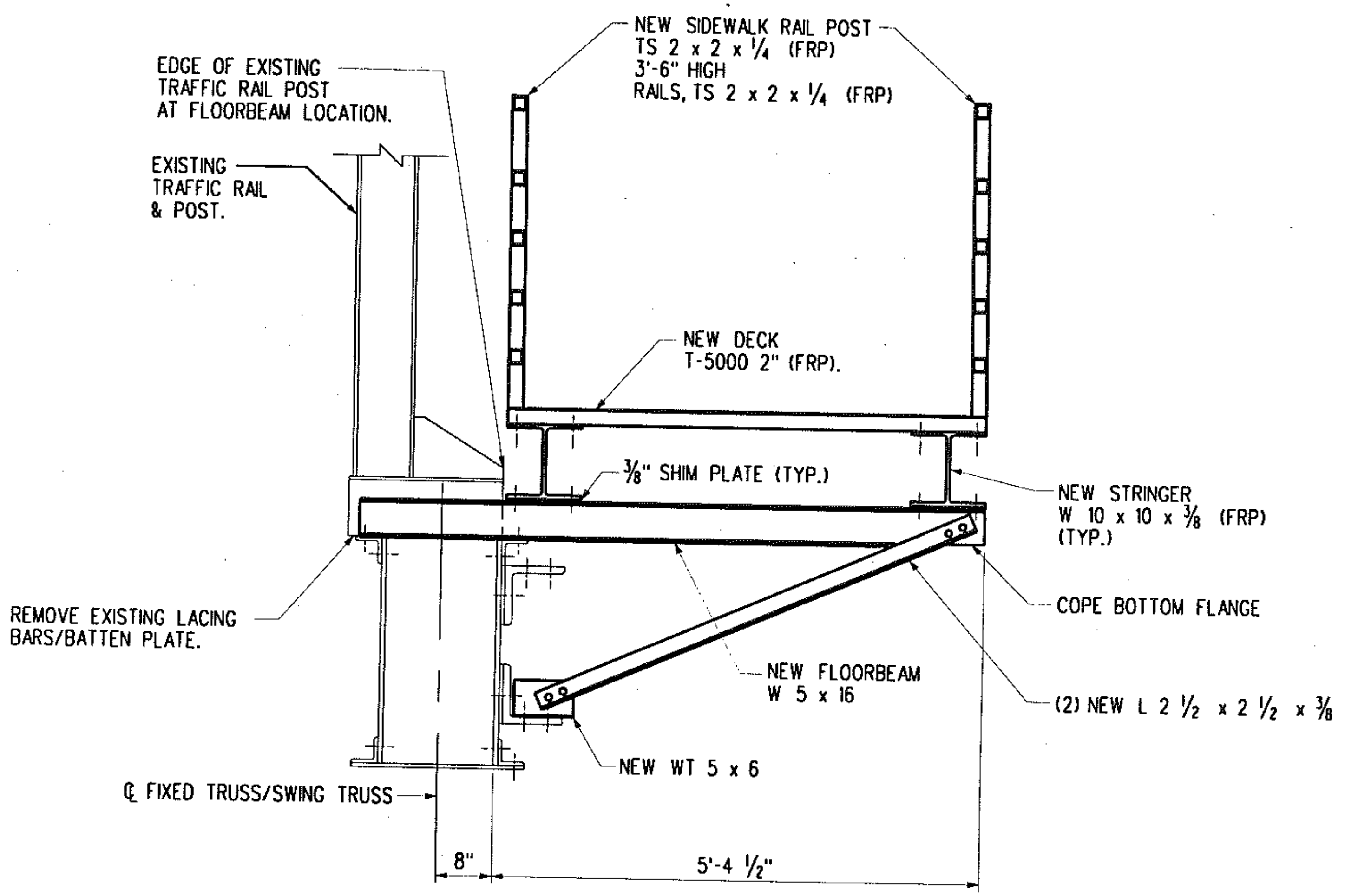

FIGURE 10 - OPTION A
THRU & SWING TRUSS SPAN

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Lichtenstein
BRIDGES HIGHWAYS RAILWAYS HISTORIC STRUCTURES DAMS

ROUTE 82
OVER
THE CONNECTICUT RIVER
EAST HADDAM, CONNECTICUT

FIGURE 10 – OPTION A

ENGINEER: A.G. LICHTENSTEIN & ASSOCIATES, INC.		
DESIGNER: AS	DRAFTER: CO	CHECKER: EAR
PROJECT NO. 1940	DATE: 09/07/99	

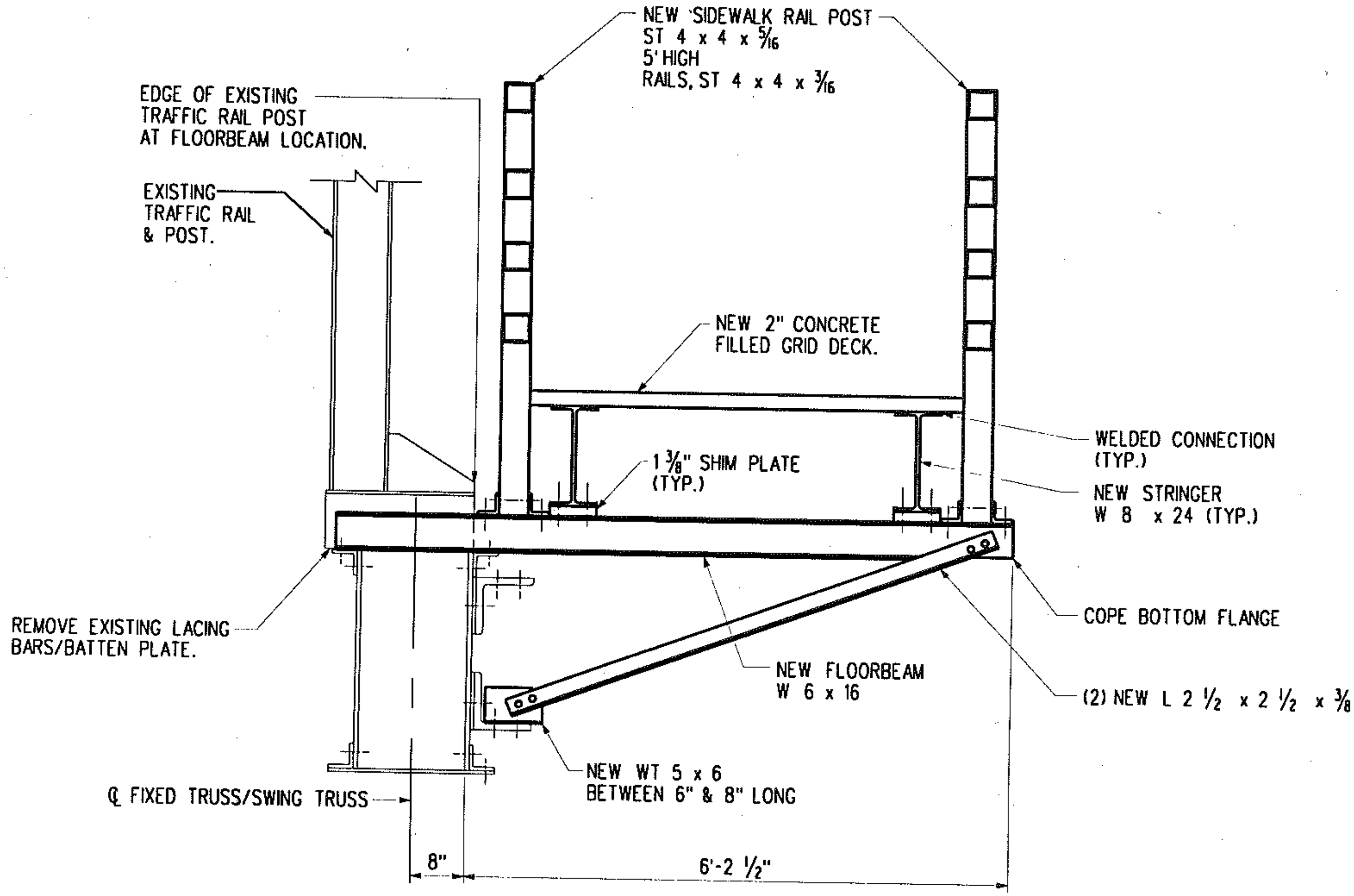

FIGURE 11 - OPTION B
THRU & SWING TRUSS SPAN

ROUTE 82 OVER THE CONNECTICUT RIVER EAST HADDAM, CONNECTICUT		
FIGURE 11 - OPTION B		
ENGINEER: A.G. LICHTENSTEIN & ASSOCIATES, INC.		
DESIGNER: AS	DRAFTER: CD	CHECKER: EAR
PROJECT NO. 1940	DATE: 09/07/99	

A.G. LICHTENSTEIN & ASSOCIATES, INC.
CONSULTING ENGINEERS
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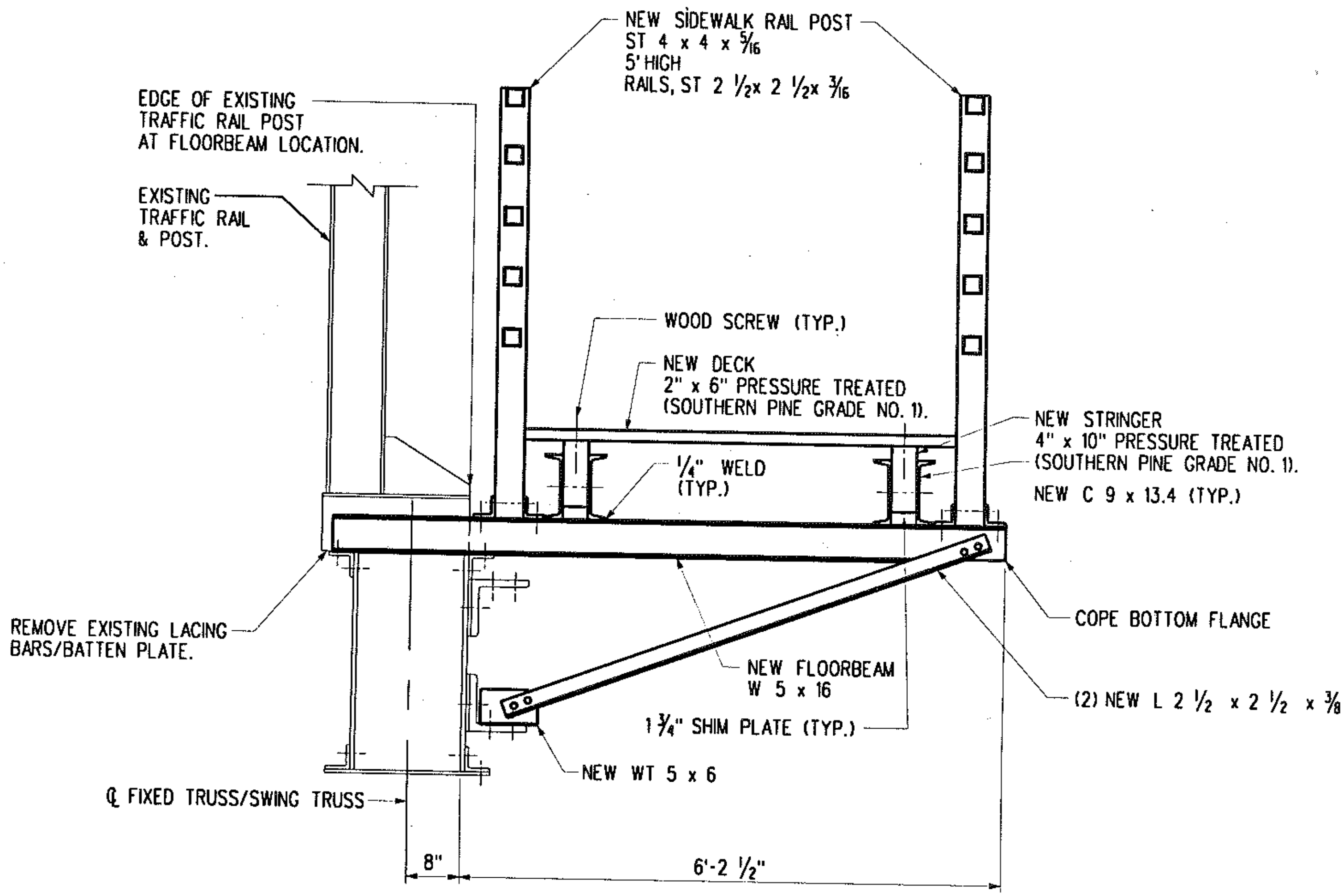

FIGURE 12 - OPTION C

THRU & SWING TRUSS SPAN

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BRIDGES HIGHWAYS RAILWAYS HISTORIC STRUCTURES DAMS

ROUTE 82 OVER THE CONNECTICUT RIVER EAST HADDAM, CONNECTICUT		
FIGURE 12 - OPTION C		
ENGINEER: A.G. LICHTENSTEIN & ASSOCIATES, INC.		
DESIGNER: AS	DRAFTER: CD	CHECKER: EAR
PROJECT NO. 1940		DATE: 09/07/99

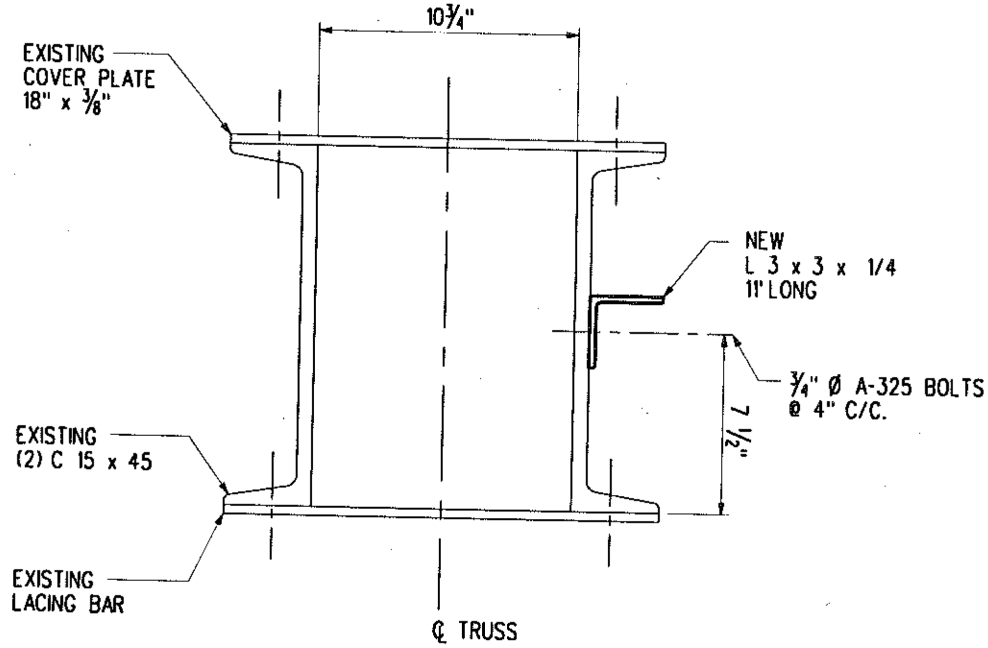

FIGURE 13
PROPOSED STRENGTHENING OF MEMBERS U4U5 & U5U6 IN DECK TRUSS FOR OPTION B

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ROUTE 82 OVER THE CONNECTICUT RIVER EAST HADDAM, CONNECTICUT		
FIGURE 13		
ENGINEER: A.G. LICHTENSTEIN & ASSOCIATES, INC.		
DESIGNER: AS	DRAFTER: CD	CHECKER: EAR
PROJECT NO. 1940		DATE: 09/07/99